



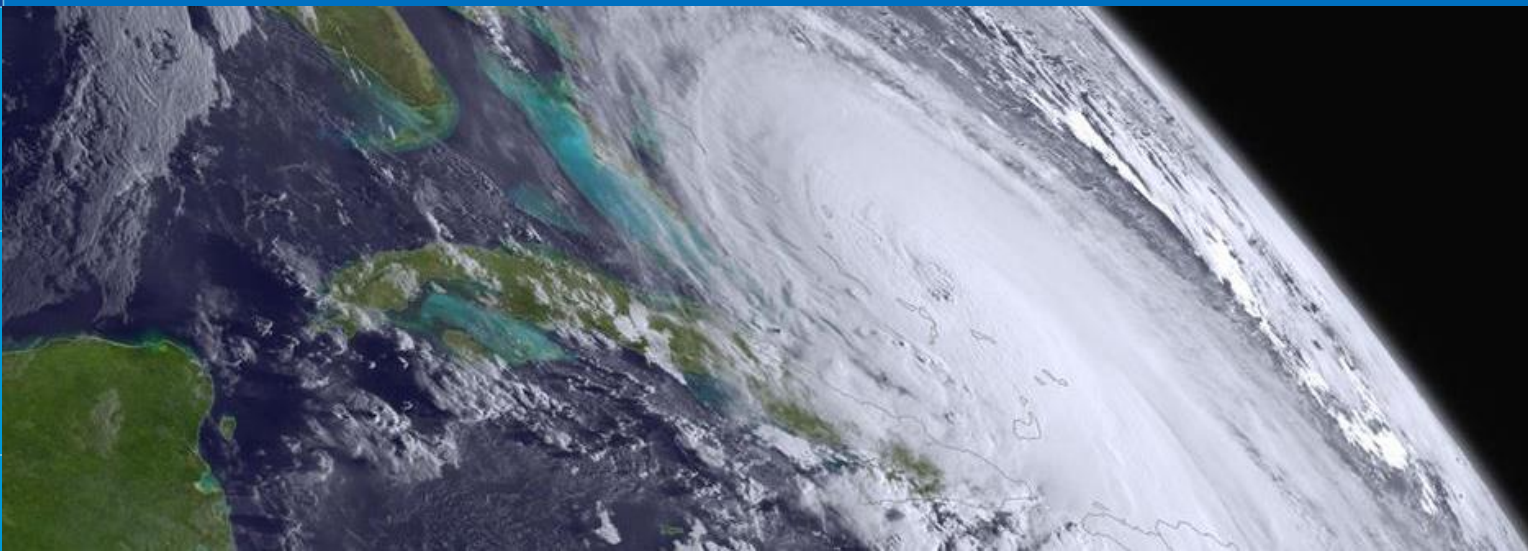
NOAA

Satellite and
Information
Service

March 26, 2019

NESDIS Update to the Committee on Earth Science and Applications from Space

Stephen Volz, Ph.D., Assistant Administrator for Satellites and
Information Services, National Oceanic and Atmospheric
Administration





Outline

- Our Charter
- NOAA Leadership
- NESDIS 2018 accomplishments
- 2019 Direction and Context
- NESDIS Plans for 2020 and Beyond
 - Organization, Architecture, Investigations
- Challenges for the Future



A Paradigm and a Challenge

From the 2017 National Academies Decadal Survey

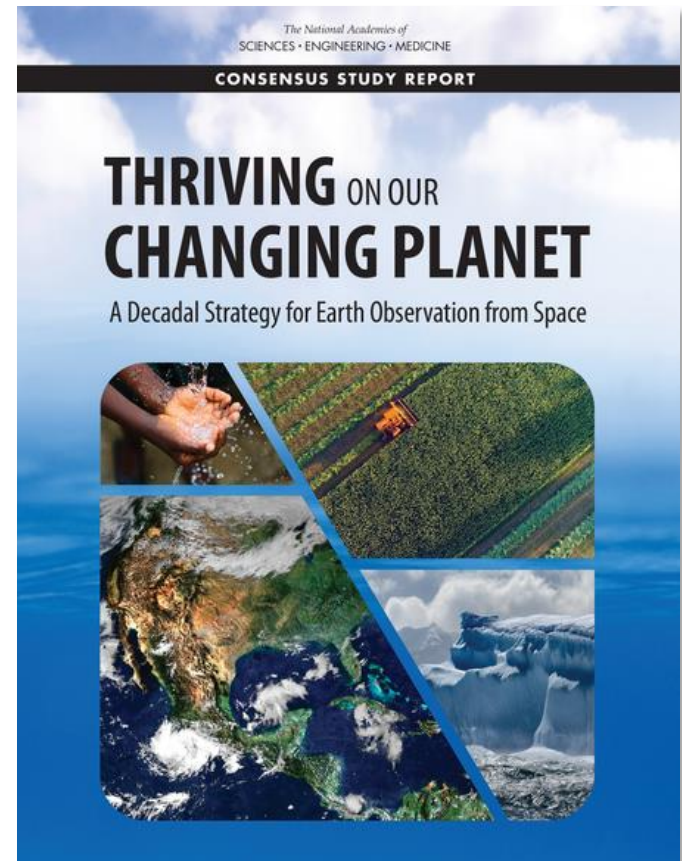


Earth Science and Applications Paradigm for the Coming Decade

Earth science and derived Earth information have become an integral component of our daily lives, our business successes, and society's capacity to thrive. Extending this societal progress requires that we focus on understanding and reliably predicting the many ways our planet is changing.

Decadal Community Challenge

Pursue increasingly ambitious objectives and innovative solutions that enhance and accelerate the science/applications value of space-based Earth observation and analysis to the nation and to the world in a way that delivers great value, even when resources are constrained, and ensures that further investment will pay substantial dividends.



NOAA HEADQUARTERS ORGANIZATION



CORPORATE FUNCTIONS

Deputy Assistant
Secretary for International
Fisheries
Andrew Lawler

Military Liaisons

U.S. Coast Guard Liaison
CAPT Kurt Zegowitz,
NOAA Corps

Liaison to the
Oceanographer
of the Navy
CDR Jason Mansour,
NOAA Corps

Assistant Secretary of Commerce for Environmental Observation and Prediction,
Performing the duties of Under Secretary of Commerce for Oceans and Atmosphere

Dr. Neil Jacobs

Assistant Secretary of Commerce for
Oceans and Atmosphere and
Deputy NOAA Administrator
RDML Timothy Gallaudet,
Ph.D., USN Ret.

Chief Scientist
Craig McLean (A)

Deputy Under Secretary for Operations
Benjamin Friedman

Chief of Staff
Stuart Levenbach

Policy
Kevin Wheeler

Deputy Chief of Staff
Michael Weiss

Senior Policy Advisors
Taylor Jordan
Brandon Eisner
Erik Noble

Communications
Julie Roberts
International Affairs
Elizabeth McLanahan

Legislative &
Intergovernmental Affairs
Wendy Lewis

Education
Louisa Koch

Decision Coordination &
Executive Secretariat
Kelly Quickle

General Counsel
John Luce

Acquisition & Grants
Jeffrey Thomas

Chief Administration
Officer
Deirdre Jones (A)

Chief Financial Officer
Mark Seiler

CIO/HP Computing &
Communications
Zach Goldstein

Office of Human
Capital Services
Kimberlyn Bauhs

Office of Inclusion &
Civil Rights
Kenneth M. Bailey

LINE OFFICES

NMFS

Assistant Administrator
National Marine Fisheries
Service
Chris Oliver

Deputy Assistant
Administrator for Operations
Paul Doremus

Deputy Assistant
Administrator
for Regulatory Programs
Sam Rauch

Director of Scientific
Programs & Chief
Science Advisor
Dr. Cisco Werner

NOS

Assistant Administrator
National Ocean Service
Nicole LeBoeuf (A)

Deputy Assistant
Administrator
John Armor (A)

NESDIS

Assistant Administrator
National Environmental
Satellite, Data &
Information Service
Dr. Stephen Volz

Deputy Assistant
Administrator
Mark S. Paese

OAR

Assistant Administrator
Oceanic & Atmospheric
Research
Craig McLean

Deputy Assistant
Administrator
for Laboratories &
Cooperative Institutes
Dr. Gary Matlock

Deputy Assistant
Administrator
for Programs
& Administration
Ko Barrett

NWS

Assistant Administrator
National Weather Service
Dr. Louis Uccellini

Deputy Assistant
Administrator
Mary Erickson

OMAO

Director Office of Marine &
Aviation Operations
& Director NOAA Corps
RDAM Michael Silah

Deputy Director for
Operations and Deputy
Director, NOAA Corps
RDML Nancy Hann

Deputy Assistant
Administrator for Programs
and Administration
Gary Reisner

Key: (A) = Acting Last updated 03/11/19



NOAASatellite and Information Service Organizational Chart



HEADQUARTERS

Stephen Volz

Assistant Administrator for
Satellite & Information Services

Mark S. Paese

Deputy Assistant Administrator for
Satellite & Information Services

Vacant

Deputy Assistant Administrator, Systems

Cherish Johnson

Chief Financial Officer/
Chief Administrative Officer

Kelly Turner

Chief of Staff

Irene Parker

Chief Information Officer

Karen St. Germain

Chief of System Architecture
& Advanced Planning

Charles Wooldridge

International &
Interagency Affairs Chief

Kevin O'Connell

Chief of Space Commerce



SATELLITE
OPERATIONS
& ACQUISITIONS

Steven Petersen

Chief of Satellite
Ground Services

Vanessa Griffin

Chief of Satellite and
Product Operations

Harry Okanek

Center for Satellite
Applications and Research

Pam Sullivan

GOES-R Series
Program Chief

Greg Mandt

Joint Polar Satellite System
(JPSS) Program Chief

Elayed Talaat

Chief of Projects,
Planning & Analysis



ENVIRONMENTAL
DATA &
INFORMATION

**New in
the last
Year**

Mary Wohlgenuth

National Centers for
Environmental Information





2018 NESDIS Accomplishments

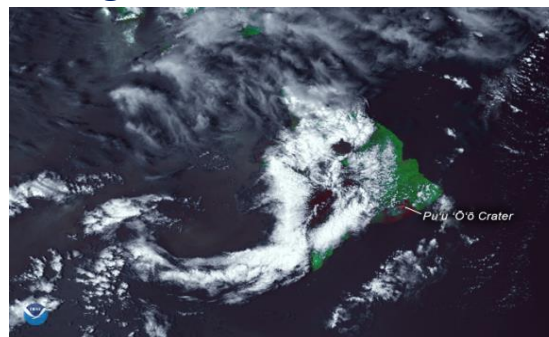
- **Advanced geostationary and polar-orbiting satellites**
 - Launched GOES-17, the second satellite in the Geostationary Operational Environmental Satellites-R (GOES-R) Series
 - Operationalized NOAA-20, the first of the Joint Polar Satellite System (JPSS) series
 - Supported the launch of EUMETSAT's Metop-C satellite, hosting three Earth observing NOAA instruments
- **Developed a critical architecture analysis tool that reshapes the process of how NOAA determines future space segment architectures**
 - NOAA Satellite Observing Systems Architecture (NSOSA) study
- **Initiated critical IT systems innovations to inform next generation ground system designs**
 - Secure Ingest Pilot program
 - Multiple Cloud processing investigations



GOES-17 successfully launched into orbit from Cape Canaveral, Florida on March 1, 2018



NOAA-20 captures plumes of smoke from the Camp Fire in Northern California



Eruption of Hawaii's Kilauea Volcano captured by NOAA-20



Hurricane Michael barreling toward the Florida Panhandle captured by GOES East

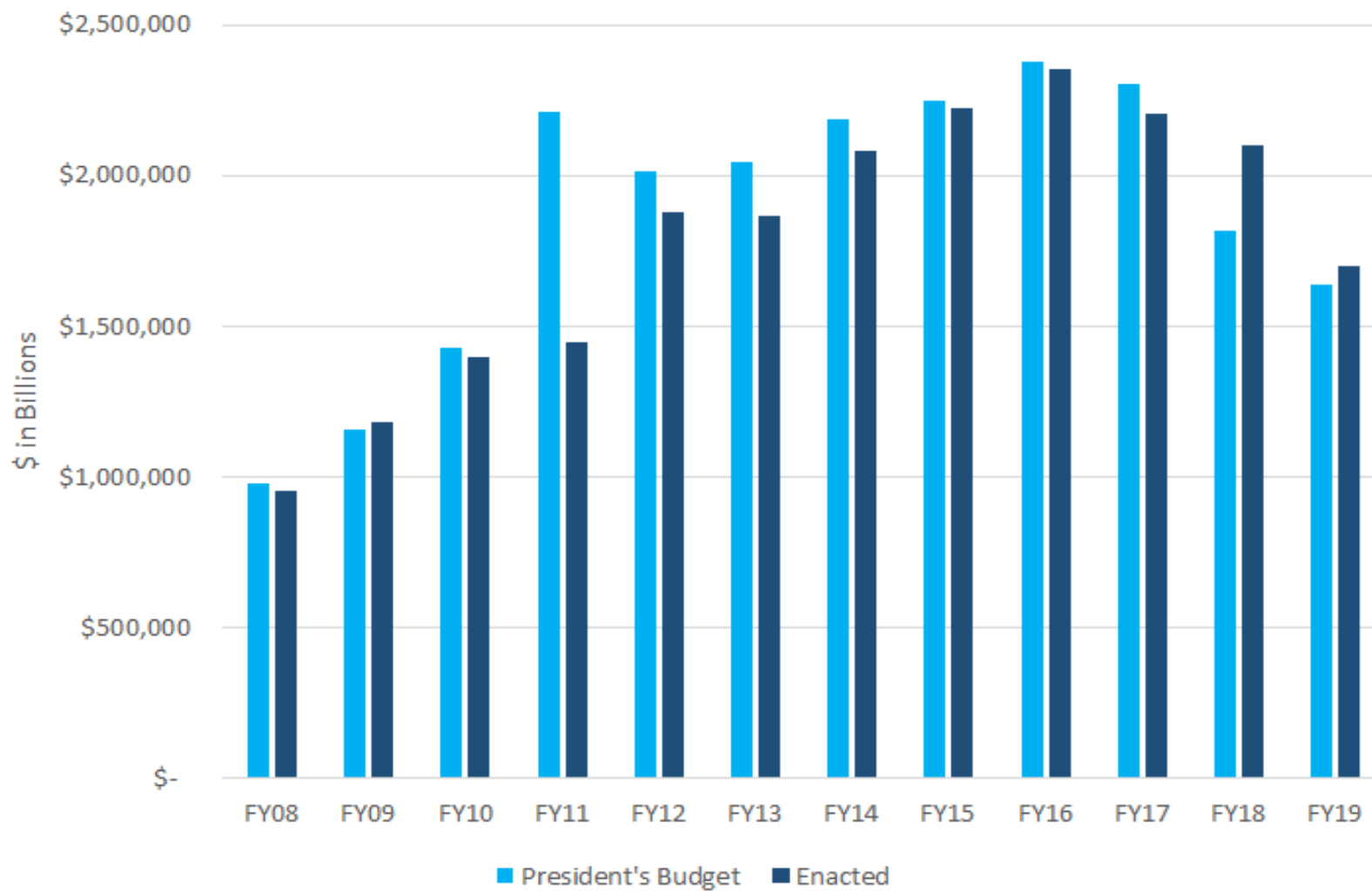


National Integrated Drought Information System (NIDIS) Reauthorization Act of 2018

- The Reauthorization was concluded in January 2019 (during the shutdown)
- The NIDIS Act included several notable amendments to the Weather Research and Forecasting Innovation Act of 2017:
 - ...analyze, test, and procure future data sources and satellite architectures identified in NSOSA study that perform quantitative assessments to value future data sources and architectures.
 - ...partner with commercial, academic sectors, non-governmental, not-for-profit and other Federal agencies to reduce the impact of extreme weather.
 - ...[provided] additional forms of transactional authority for R&D agreements of future data sources and satellite systems for when a CRADA or grant, procurement contract or cooperative agreement is not adequate
 - ...commercial Data Weather Pilot (CWDP) reauthorized and extended
 - ...establishes the Earth Prediction Innovation Center (EPIC) to advance weather modeling skill via a new community capacity function

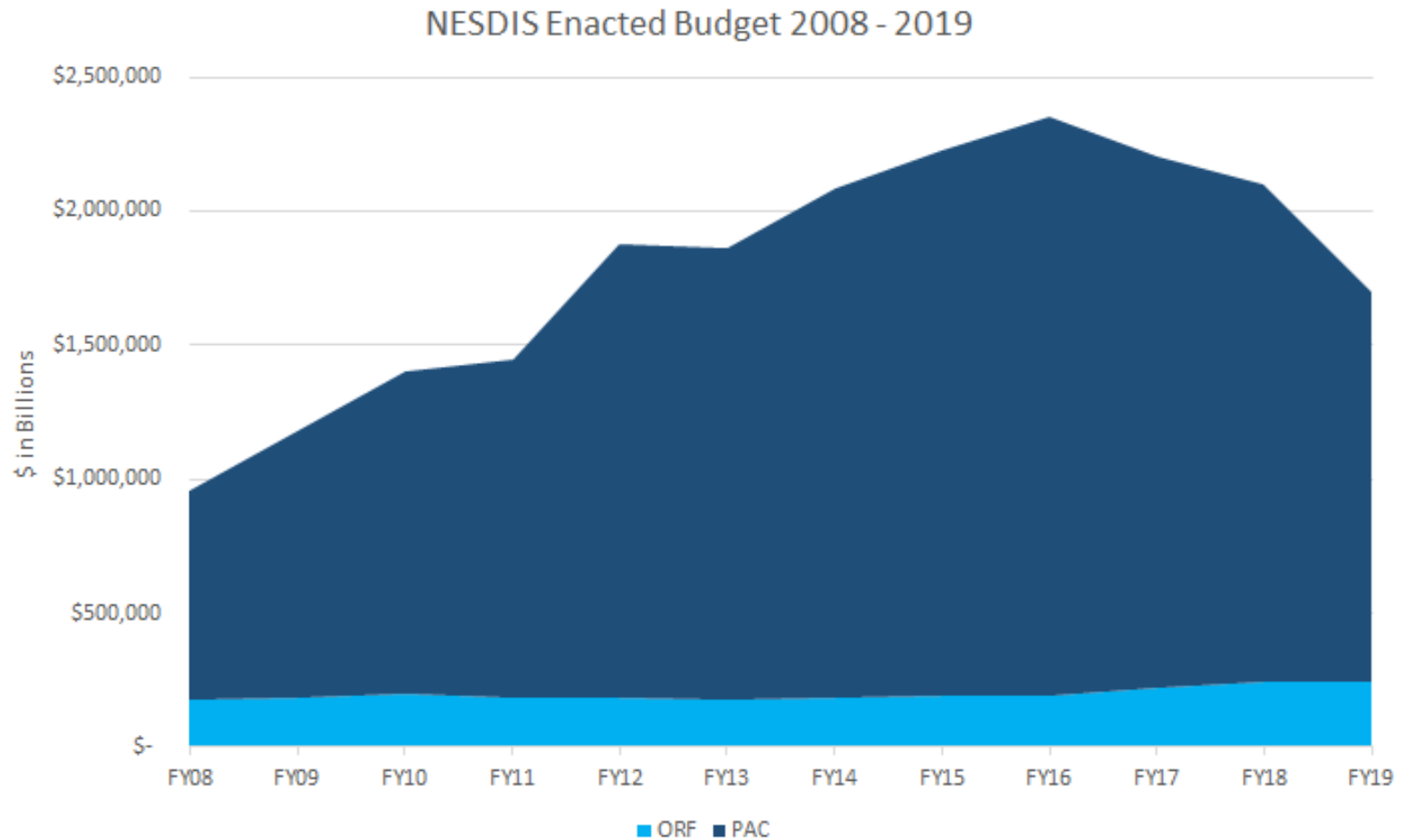


NESDIS Budget Trends





NESDIS Budget Trends





Ensure America's Leadership in Observations & Modeling

- **The weather & environmental data landscape is changing.**
 - We are experiencing a rapid expansion of data providers.
 - There is an increasing user demand for data to support more and more diverse applications.
 - Observing technologies are being developed faster than our historical approach to mission development effectively adapt.
- **NESDIS must evolve to a structure that:**
 - Utilizes an efficient combination of observing assets by
 - Building on the essential value of benchmark NOAA assets,
 - Applying new data sources & services (e.g., commercial hosts & data buys), where cost-effective, and
 - Expanding domestic & international partnerships
 - Includes a flexible budget and acquisition approach that can more quickly leverage science & technology innovation and opportunities
 - Aligns staff and resources to more efficiently and effectively acquire systems and data that meet NOAA's mission



Evolving Our Architecture

Current Architecture

Next Generation Architecture

Size of Satellites

Large, Expensive Satellite Systems with scattered small satellites

Mix of small/medium/large sats providing core capabilities, enhanced use of research & partner obs, individual instruments on commercial hosts

Design

Optimized Around Missions

Optimized Around Observations

Data Sources

Government Owned Assets

Combination of gov't owned assets & data buys

Partnerships

3-4 key government partners;
no commercial partners

~8 key government partners;
~3 commercial partner opportunities

Ground

Ingests USG and some partner data

Expanded to ingest multiple new data sources, including commercial

All data processed internally; no cloud

Process data internally & in the cloud

Proposed NESDIS Budget Structure



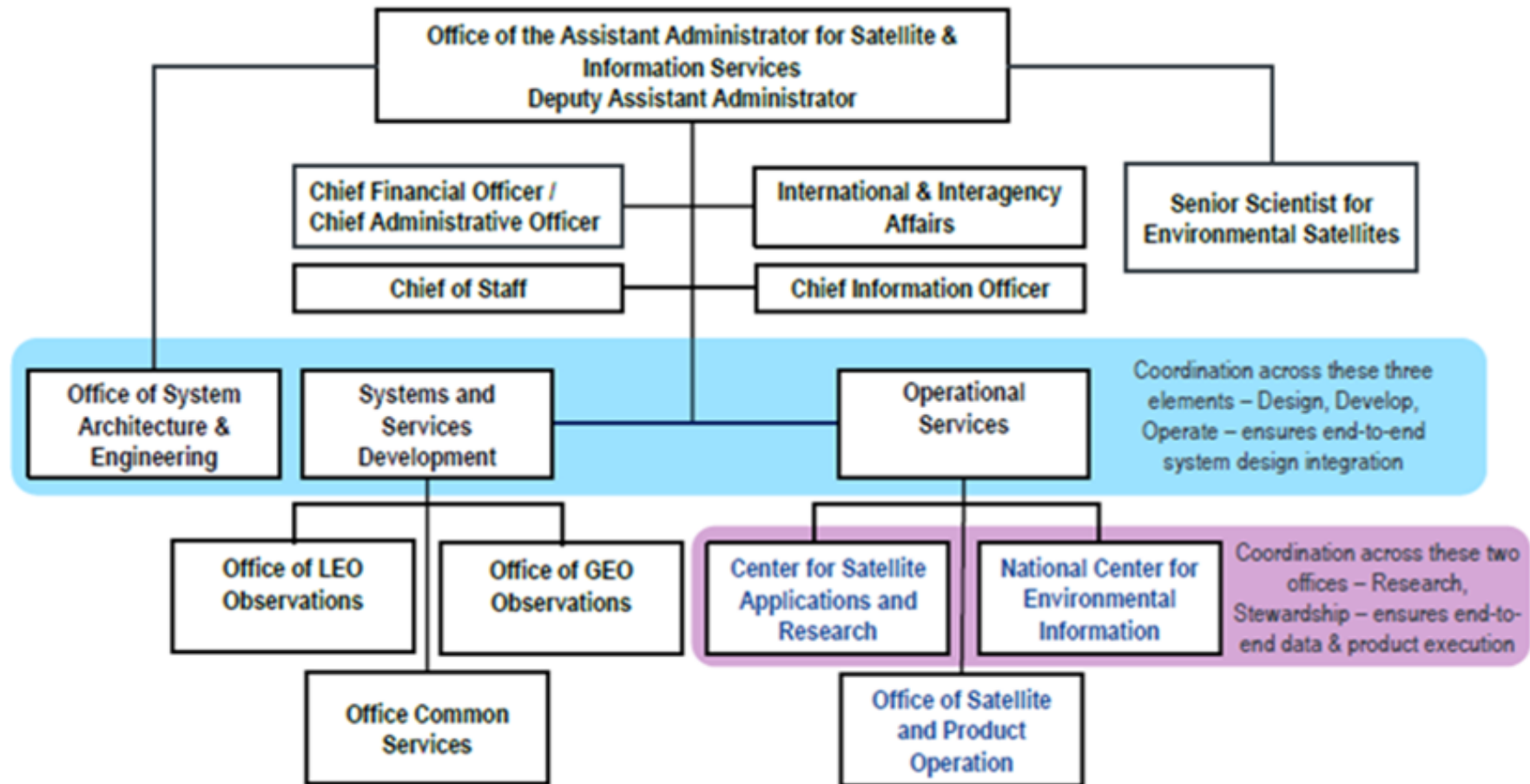
FY 2019 PAC Subactivities	FY 2020 PAC Subactivities
Geostationary Systems – R (GOES-R)	Geostationary Systems – R (GOES-R)
Joint Polar Satellite System (JPSS)	Polar Weather Satellites (PWS)
Polar Follow On (PFO)	
Cooperative Data and Rescue Services (CDARS)	Cooperative Data and Rescue Services (CDARS)
Space Weather Follow On (SWFO)	Space Weather Follow On (SWFO)
COSMIC 2/GNSS RO	Low Earth Orbit (LEO)
Satellite Ground Services (SGS) – split*	
Projects, Planning and Analysis (OPPA) – split*	
Satellite Ground Services (SGS) – split*	Geostationary Earth Orbit (GEO)
Projects, Planning and Analysis (OPPA) – split*	
System Architecture and Advanced Planning (SAAP)	Systems/Services Architecture & Engineering (SAE)
Commercial Weather Data Pilot (CWDP)	
Satellite Ground Services (SGS) – split*	
Projects, Planning and Analysis (OPPA) – split*	
Satellite CDA Facility	Satellite CDA Facility

* Satellite Ground Services (SGS) and Project, Planning, & Analysis (PPA) Subactivities are split across LEO, GEO, & SAE in PAC, & OSPO in ORF

- Maintain Subactivities for current major programs
- Build future architecture within Portfolios
- Continue to adhere to, track, and report on the life cycle costs for major programs
- Provide visibility through Quarterly briefings & Annual Satellite Report



Proposed NESDIS Organizational Chart



Architecture Planning



Recent Accomplishments

- Weather Act reauthorization signed into law; directs NOAA to implement NSOSA findings, gives NESDIS additional transaction authority and authorizes CWDP through FY23 (Jan 2019)
- Updated availability analysis for current GEO and LEO constellations (Dec 2018)
- Completed assessment of JPSS-2 rideshare RFI responses and made site visits to companies with viable responses (Nov 2018)
- Initiated LEO Sounder SmallSat Integrated Product Team; team has developed charter and is meeting regularly (Oct 2018)

Upcoming Major Milestones

- JPSS-2 Flight Planning Board decision on NOAA rideshare slots (Q3 FY 19)
- Initiate RFPs for industry support of next gen pre-phase A activities (Q4 FY 19)

Strategic Challenges

- Apply NSOSA methodology to future trades and analysis to inform space segment architecture decisions
- Augment technical analyses with economic and societal impact assessments of future observing system capabilities



New Capabilities Possible and Under Consideration

LEO

- Next generation & additional sounders, including microsatellites
- Higher density GNSS-RO
- Interagency weather observations

GEO

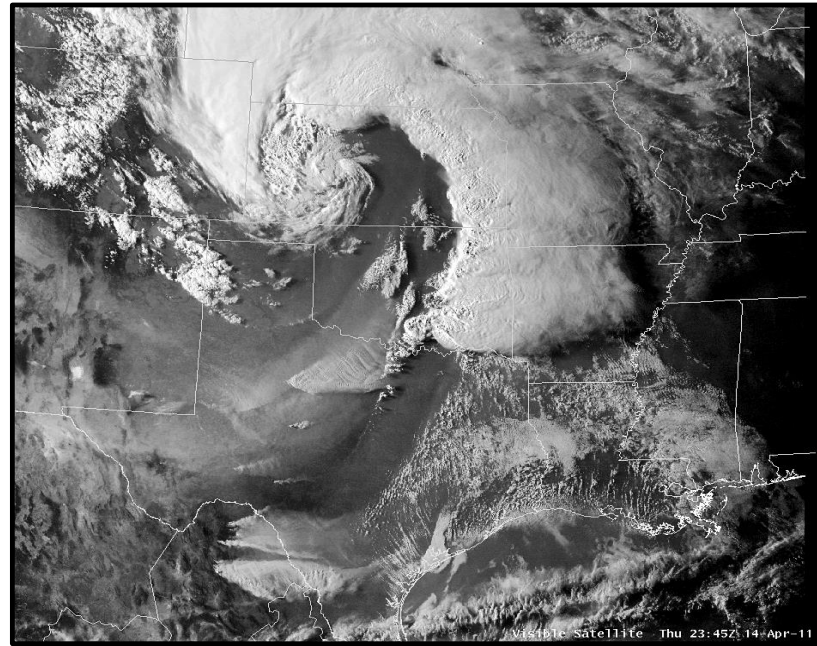
- Diverse quality imaging from three locations (east, west, center)
- Includes mixture of qualities, taskable update rates, and spectrum content (including hyperspectral)
- Higher quality lightning mapper in center

Space Weather

- Operational and improved on-Earth-Sun-Axis solar observation
- Off-axis solar observation and situ space weather

Tundra Orbit

- Extension of real-time imagery collection at high Latitudes
- Extend GEO belt to Alaska and all arctic



NOAA Space Innovation in FY2020



Ensuring continuity of critical environmental data, while expanding NOAA's U.S. space commerce and partner engagement:

Joint Venture Partnership

- NOAA will leverage other governmental agencies and the commercial sector to - at a lower cost to NOAA - develop and demonstrate evolving capabilities, which will speed transition of research capabilities into operational use (esp LEO).

Geostationary and Extended Orbits

- NOAA is evaluating architecture options to ensure long-term continuity of the geostationary observing mission following GOES-R. NESDIS will initiate a series of industry studies, analyses, & flight demonstrations to optimize ways to meet NOAA's future geostationary requirements.

Commercial Data Purchase

- NESDIS will execute a cost effective and the first operational commercial data buy of Global Navigation Satellite System (GNSS) Radio Occultation (RO) data and support the continued development of an infrastructure and capability to import, transfer, process, and store external data from commercial partners securely into operational use.

Additional FY2020 Investments



Cooperative Data and Rescue Services (CDARS)

- NESDIS will complete installation of Southwest USA Medium Earth Orbiting Local User Terminal (MEOLUT) ground station in New Mexico, supporting the transition to the next generation GPS-based Search and Rescue system
- Support launch of Argos A-DCS instrument as a *hosted payload* to low Earth orbit on a commercial spacecraft by late 2021

Space Weather Follow On (SWFO)

- Develop the spacecraft and Solar Wind Instrument Suite (SWIS) for the SWFO Earth-Sun Lagrange point 1 (L1) mission. Continue development of compact coronagraphs (CCOR) to provide Coronal Mass Ejection (CME) imaging
- Meet timelines necessary to maintain 2024 NASA Interstellar Mapping & Acceleration Probe (IMAP) ride-share opportunity

Metop-Second Generation (Metop-SG)

- NOAA will continue to leverage its partnership with EUMETSAT for Metop-SG satellite data by completing development of the Metop-SG science algorithms used to create data products, and ground infrastructure required for Metop-SG data ingest/processing/distribution. This will more than double the data flowing to NOAA from EUMETSAT

FY 2020 NESDIS Summary

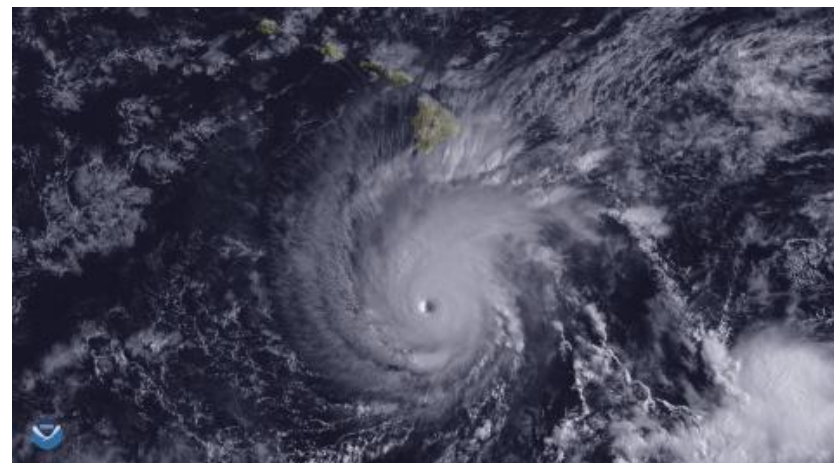


FY 2020 Budget Request provides \$1,472.7 million for NESDIS, which supports:

- A restructure to the Subactivities to align with our future architecture and observing system implementation.
- Continued development of the NOAA satellite geostationary (GOES-R Series) and polar (PWS) constellations that provide vital forecast information for significant weather events.
- Satellite operations and the development and distribution of products & information based on both NOAA data and data from multiple partners.
- Development of NOAA's future satellite capabilities, as well as positioning NOAA to take advantage of opportunities to procure observational data from commercial vendors.



Multiple Tropical Cyclones in the Northern Hemisphere – Oct 3 (NOAA-20)



Hurricane Lane Approaches Hawaii – Aug 22 (GOES-15)



Hot Issues for NESDIS



- Defining and financing the next generation satellite observing system
- Maintaining and growing commercial and international partnerships to deliver a resilient and high-performing observing system
- Reliable secure Ingest of partner data
- Exploiting IT advances in data analytics, and efficient movement to the cloud
- Incorporating AI into weather forecasts and data products
- Develop robust methodology to estimate economic and societal impact assessments for future observing system options





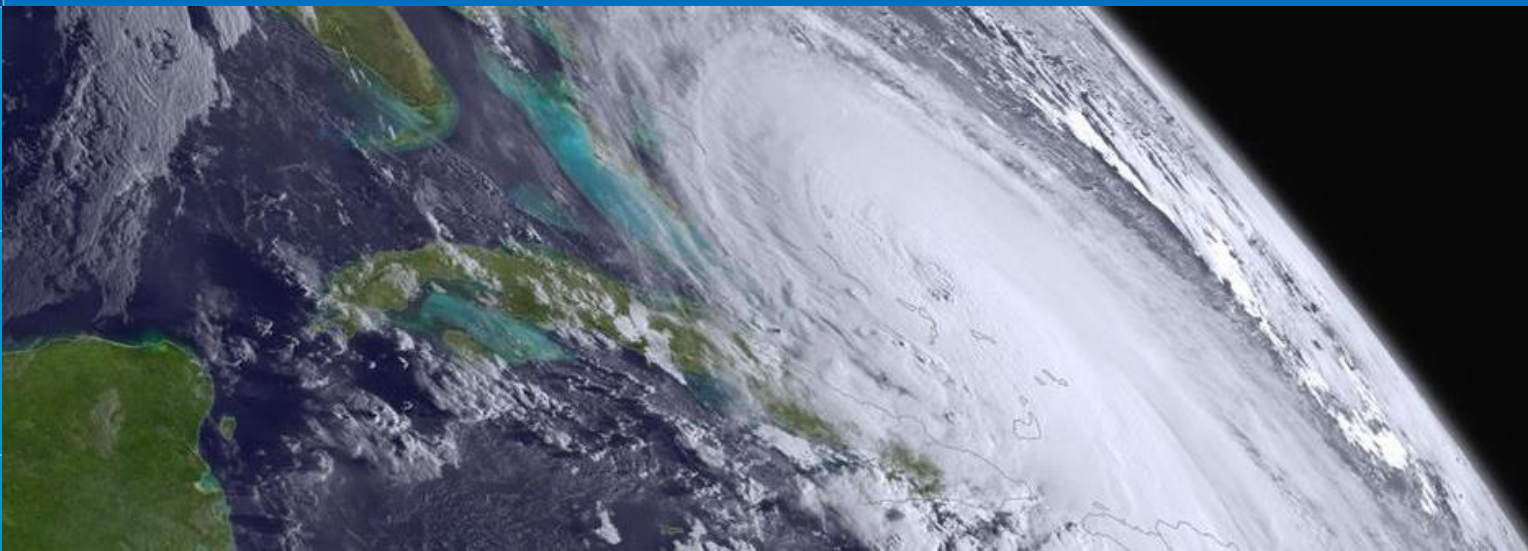
NOAA

**Satellite and
Information
Service**

March 26, 2019

THANK YOU

Stephen Volz, Ph.D., Assistant Administrator for Satellites and Information Services, National Oceanic and Atmospheric Administration



Socioeconomic Value of Earth Observations and Data



NESDIS had a Socioeconomic Benefits workshop earlier in March and key components include:

- Conduct an inventory of user surveys or engagement. Determine if existing surveys can be modified to collect additional data to support socio-economic analysis and identify existing data sets that can be used to support impact analysis or socio-economic analysis
- Conduct demonstrations, using SETT framework, for possible other areas such as HABs, hurricanes, floods which are high visibility and would involve multiple NOAA line offices
- Develop a strategy and roadmap for socio-economic benefit assessments to support NSOSA program justifications
- Evaluate options for establishment of a NESDIS Socioeconomic Benefit Program with roles and responsibilities mapped to resources



Radio Frequency Interference Issues

- World Radiocommunication Conference (WRC-19): FCC has proposed radio frequency protection levels that do not protect JPSS Advanced Technology Microwave Sounder (ATMS) data and will adversely impact numerical weather prediction forecast models worldwide
 - The impact will be felt equally on EUMETSAT sounders, which provide equally essential soundings to NOAA for our NWP
 - Loss of this critical sounding data will cause an estimated 30% degradation in forecast error to operational numerical weather prediction models
 - Anticipate interference impact to be 85% of data that is used for forecast models
- Ligado Networks
 - Interfered with NOAA GOES satellite operations at 1675-1680 MHz, impacting satellite data products used in weather forecasting
 - Global Positioning System (GPS) concerns that Ligado transmissions will cause harmful interference to civil and military GPS receivers



Radio Occultation Data Acquisition



NOAA's plan to meet its radio occultation (RO) data requirements involves actively working with other agencies, the international community, and the commercial sector to source data sets needed to meet the National Weather Service numerical weather prediction (NWP) modelling requirements. NOAA is also assessing the feasibility of RO payloads as part of future NOAA satellite constellations



- Continue to leverage data from U.S. and international partners from current missions (now through end of mission)
 - Taiwan COSMIC-1
 - EUMETSAT Metop-A and Metop-B
 - NASA GRACE-B
 - German TerraSAR-X
 - Korea KOMPSAT-5
 - Spain PAZ
 - U.S.-German GRACE-Follow on
 - EUMETSAT Metop-C
- Through the **Commercial Weather Data Pilot (CWDP)** work with U.S. commercial sector to acquire data to determine its suitability for operational use, and purchase it for operations as commercial capability matures
- Leverage data from U.S. and international partners from future missions
 - 2019- Taiwan-U.S. COSMIC-2 (equatorial only)
 - 2020- EUMETSAT Metop Second Generation
 - 2020 - U.S.-EUMETSAT Jason CS
- Explore placing RO sensors on future NOAA and international partner polar-orbiting satellites (2022 through 2036)



IT and Cloud Computing Services



Recent Accomplishments

- Steering Committee approved project Terms of Reference (TOR) and project teams began project execution on project A, C, D (Nov 2018)
- Developed project TOR and project plans with success criteria for feasibility areas A, C, and D (Oct 2018)
- Established Cloud Steering Committee made up of executive leadership to provide oversight and guidance to the project teams (Oct 2018)



Upcoming Major Milestones

- Coordinate a strategy for Feasibility Area A with NIST (Dec 2018 - Apr 2019)
- Feasibility areas C and D will confirm if cloud architecture is portable to Azure from Amazon Web Services (May 2019)
- Feasibility area E pilot project will be kicked off this month (expected completion Aug 2019)

Strategic Challenges

- Proactively developing operational concepts and managing the migration of existing systems and services to commercial cloud(s) in time to influence new development or major technology refresh efforts
- Gain a more comprehensive understanding of pilot impact due to the shut-down

Feasibility Areas	Description	Duration
A. Security in the Commercial Cloud	Develop NESDIS methodology for how security process will function at their current level within the commercial cloud	8 Months Start: Q1 FY 19
B. Cloud Consolidation of Mission Services	Demonstrate the feasibility of consolidating all NESDIS mission services using cloud-enabled tools	11 Months Start: Q4 FY 19
C. Command Data Ingest and on-boarding	Demonstrate that common ingest is feasible for all NESDIS business functions through enhanced cloud interoperability	17 Months Start: Q1 FY 19
D. Cloud-Optimized Algorithms and Production	Demonstrate optimized methodology for algorithm development and product generation in the cloud and meet current JPSS/GOES performance requirement	15 Months Start: Q1 FY 19
E. Data Access in the Commercial Cloud	Demonstrations of common distribution approaches and data visualization tools to enhance collaboration in the cloud environment	6 Months Start: Q2 FY 19

Other Programs and Initiatives



Cooperative Data and Rescue Services (CDARS)

- Supports space-based components of Argos Advanced Data Collection System (Argos A-DCS)
- Supports the Search and Rescue Satellite Aided Tracking (SARSAT) program

Office of Space Commerce (OSC) and Commercial Regulatory Affairs (CRSRA)

- OSC: Advocates for commercial space industry
- CRSRA: Regulatory authority and enforcement of commercial satellites with ability to view Earth Both of these offices play an important role for the larger space industry.
 - Actively working on updating CRSRA regulations
 - The Secretary of Commerce has proposed to transfer these offices from NOAA to the Department in an effort to meet the Administration's desire to prioritize management of the space industry.

Commercial Weather Data Pilot

- Demonstrates the viability of integrating commercial data into the NOAA operations data stream
- Enables the commercial sector to establish and sustain capabilities to meet NOAA's ongoing operational needs.

Jason -2 & -3 Satellites

- Launched in June 2008 and January 2016, respectively
- Partnership between EUMETSAT and the French Space Agency (CNES), and NOAA
- Maintain satellite altimetry observations of global sea surface height.

Commercial Partnerships



In an effort to align with the Administration's commercial space expansion, NESDIS has released a number of Requests for Information (RFI) and Requests for Proposals (RFP). NESDIS has also recently awarded contracts to support delivery of NOAA's critical mission to the Nation:

- **July 31:** Released an RFI for JPSS-2 rideshare. Closed on August 30.
- **August 9:** Released an RFI for expressions of interest in collaborative R&D on innovative approaches for exploiting environmental data. Closed on September 24.
- **September 17:** Awarded contracts to GeoOptics, PlanetIQ, and Spire Global as part of the Commercial Weather Data Pilot (CWDP) Round 2.
- **September 27:** Awarded a contract to Thales USA, Inc. to design, build, install, and check out a Medium Earth Orbiting Local User Terminal (MEOLUT) ground station in New Mexico.
- **November 7:** Awarded a contract to the Hosted Payload Solutions mission delivery order to General Atomics of Englewood, Colorado. This contract will support launch of the Argos A-DCS instrument as a hosted payload to low Earth orbit on a commercial spacecraft by late 2021.

Commercial Partnerships



In an effort to align with the Administration's commercial space expansion, NESDIS has released a number of Requests for Information (RFI) and Requests for Proposals (RFP). NESDIS has also recently awarded contracts to support delivery of NOAA's critical mission to the Nation:

- **NOV 2018:** NOAA received first data from GeoOptics as part of the second round of the Commercial Weather Data Pilot (other vendors scheduled for later in FY 2019)
- **NOV 2018 - Present:** Finalizing selection of JPSS-2 commercial rideshare payload - Final decision planned for April 2019
- **NOV 2018:** Awarded a contract to the Hosted Payload Solutions mission delivery order to General Atomics of Englewood, Colorado. This contract will support launch of the Argos A-DCS instrument as a hosted payload to low Earth orbit on a commercial spacecraft by late 2021.
- **DEC 2018:** Participated in Dcode Space 2.0 accelerator program that focused on identifying and bringing emerging and innovative space sector technologies to the Federal government. The technologies spanned communications, advanced materials, and data fusion. The purpose of the program is to help small companies bridge the gap between their capabilities and government customers.
- Released an RFI in August 2018 to interested industry companies and non-government groups to enter into a Cooperative Research and Development Agreement (CRADA) to explore improving existing, or generating new satellite-based products and services. The RFI closed in September and we received positive feedback and are currently evaluating, **TBR**.





Benefits of Proposed Budget Structure



FEATURE

BENEFIT

RESULT

Observations managed as Portfolios, with more PAC Subactivities organized by observation

Risks are evaluated and mitigated across a set of similar observations

- Manage program costs while improving forecast quality
- Fewer schedule delays
- Lower risk of observational gaps

Budget/Personnel structure supporting a diverse combo of assets

Able to leverage partner investments
Able to integrate commercial obs into operations

- Forecast improvements via the expansion & enhancement of our data products
- Lower-cost NOAA architecture
- Improves overall system resiliency

3-4 Yr. Budget/Acq. Cycle, but with 3 Partner & Comm. Obs Line Items

May invest in science & technology innovations in near-real time

- Ability to expand public/private partnerships
- Increases incentives for private innovation
- Ground infrastructure ready to securely ingest new data

Natural satellite development cycles with like-observations combined by Subactivity

More efficient management of small budget cuts or CRs
Allows program development trades across elements & FYs

- Fewer anomaly requests & reprogramming for small issues
- Compatible with multi-year flat budget
- Lower Life Cycle Costs

Detailed Program data at the Line Item level

Maintains transparency into Program and Project Costs

- Quarterly briefings & Congressional Justifications provide oversight bodies with detailed cost, schedule, technical data