



NOAA

NOAA's Approach to Observing System Requirements Management

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Prepared for U.S. IOOS Advisory Committee

February 11, 2020

*NOAA's vision is to achieve and sustain an observing system portfolio
which is mission-effective, integrated, adaptable, and affordable*





Outline



1. NOAA's Requirements governance



2. NOAA's requirements Portfolio Management



3. NOAA's overview of requirement capabilities



4. Current NOAA Requirements for marine obs/ services

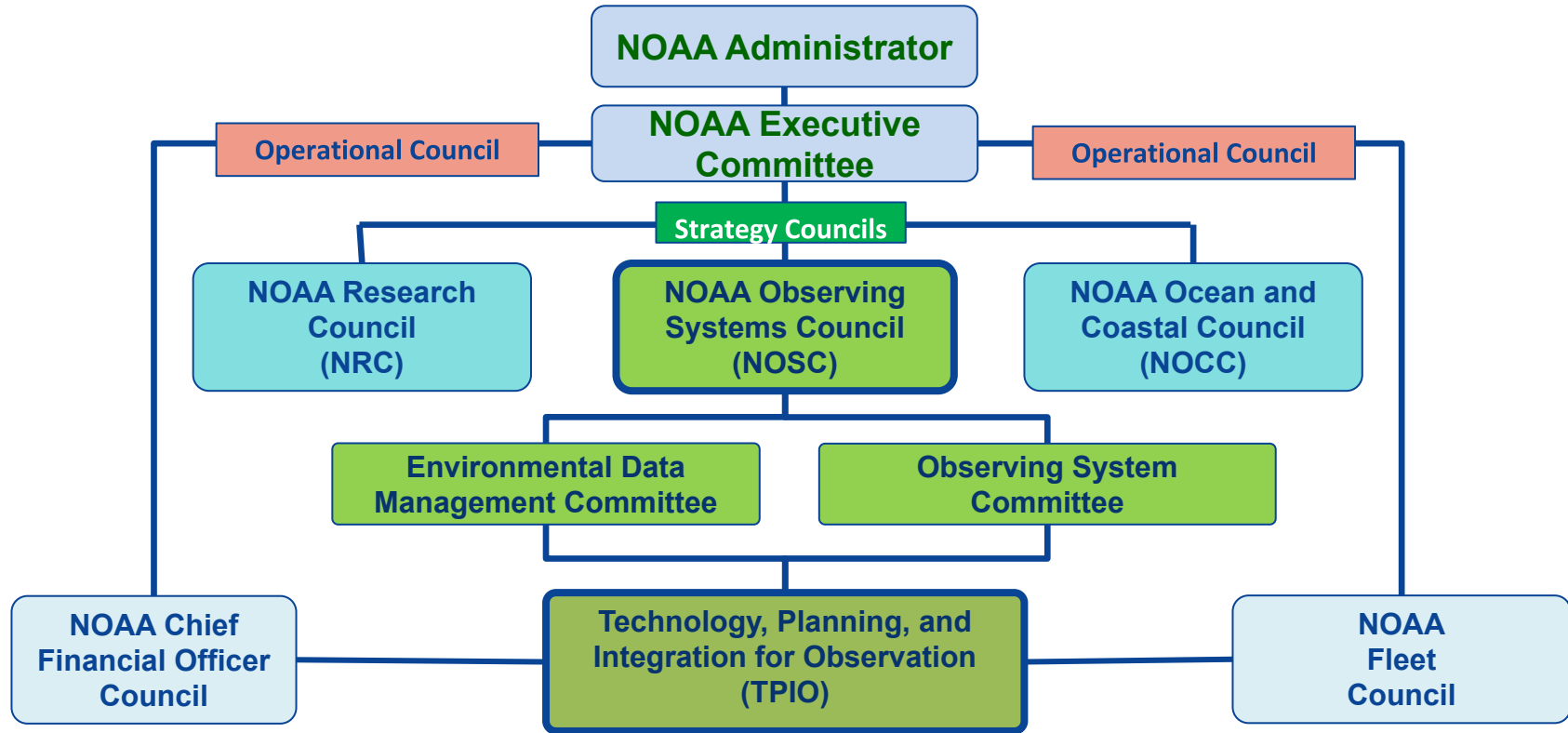


5. Opportunities to support NOAA's marine obs/ services





NOAA's Requirements Governance





Who Manages NOAA's requirements?



The Technology, Planning and Integration for Observation (TPIO) is the division that provides direct analytical, technical and decision support to the NOAA Observing Systems Council (NOSC).



TPIO helps provide the **actionable business intelligence** so NOAA leadership can make more informed decisions on how to better:



- Manage observing system investments through an integrated architecture.
- Maximize impact for investments in observing capabilities across NOAA's missions while minimizing costs.
- Minimize impacts to mission-services from budget reductions.

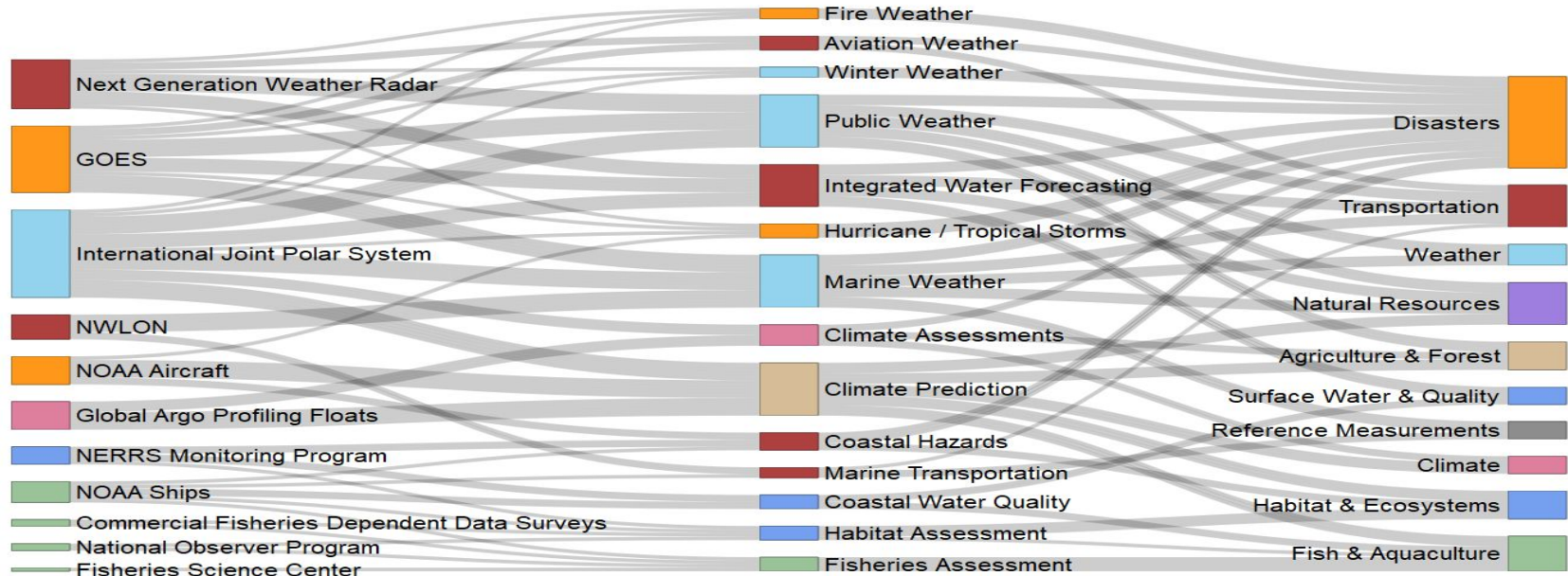


NOAA's Complex & Large Portfolio

190+ systems owned, operated or leveraged by 6 Line Offices

\$2.7B of \$5B Annual budget

1525 user observation requirements, 1200+ products and services



NOAA's Mission Service Areas (MSAs)

WEATHER READY NATION (WRN)

National Weather Service

1. **Aviation Weather & Volcanic Ash** (WRN-AWX)
2. **Fire Weather** (WRN-FWX)
3. **Hydrology & Water Resources** (WRN-IWF)
4. **Marine Weather & Coastal Events** (WRN-MWX)
5. **Hurricane/Tropical Storms** (WRN-HUR)
6. **Routine Weather** (WRN-RWX)
7. **Severe Weather** (WRN-SEV)
8. **Space Weather** (WRN-SWX)
9. **Tsunami** (WRN-TSU)
10. **Winter Weather** (WRN-WWX)

11. Science, Services and Stewardship

HEALTHY OCEANS (HO)

National Marine Fisheries Service

1. **Ecosystem Monitoring, Assessment & Forecast** (HO-ECO)
2. **Fisheries Monitoring, Assessment & Forecast** (HO-FMA)
3. **Habitat Monitoring & Assessment** (HO-HAB)
4. **Protected Species Monitoring** (HO-PSM)

5. Science, Services and Stewardship

RESILIENT COASTS (RC)

National Ocean Service

1. **Coastal Water Quality** (RC-CWQ)
2. **Marine Transportation** (RC-MTS)
3. **Planning & Management** (RC-PAM)
4. **Resilience to Coastal Hazards & Climate Change** (RC-RCC)

5. Science, Services and Stewardship

CLIMATE (CLI)

Office of Oceanic and Atmospheric Research

1. **Assessments of Climate Changes & Its Impacts** (CLI-ACC)
2. **Climate Mitigation & Adaptation Strategies** (CLI-CMA)
3. **Climate Science & Improved Understanding** (CLI-SIU)

4. Climate Prediction and Projections (CLI_CPP)

The National Environmental Satellite, Data, and Information Service (NESDIS)
and NOAA's Office of Marine and Aviation Operations (OMAO)





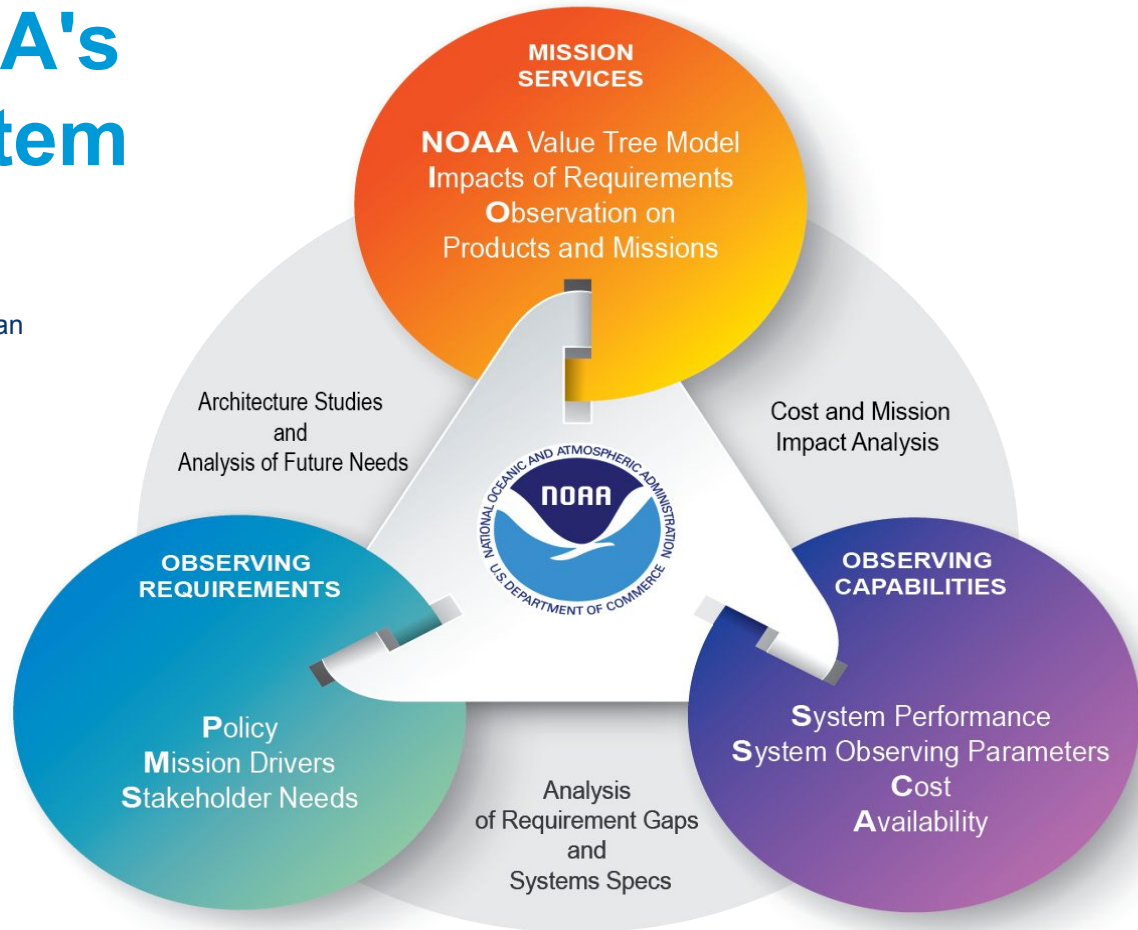
Managing NOAA's Observing System Portfolio

Vision: NOAA's vision is to achieve and sustain an observing system portfolio that is

mission-effective, integrated, adaptable, and affordable.

- Superior Service and Reputation
- Adaptability
- Cost-Effectiveness, Affordability & Sustainability
- Integration
- Global Context and Commitments (*Data Sharing*)
- In-House Expertise
- ***Well-governed, Understood & Trusted***

Reference: [NAO 212-16](#): ***Policy on NOAA Observing Systems Portfolio Management***





NOAA User Observation Requirements



Mission Requirements

NOAA responsibilities resulting from one or more requirements drivers. Should be understandable, outcome-oriented, concise, and actionable, and should identify the need but not prescribe specific solutions.



Business Requirements

Describe why the organization is undertaking the project. They state benefits that customers expect to receive from the products and services.



User Observation Requirements

System-independent, validated user needs of environmental parameters, with their associated attributes, required to produce specific products and services to meet mission objectives.



Observing System Requirements

The building blocks developers use to build the system. Traditional "shall" statements that describe what the system "shall do." System requirements are classified as either functional or supplemental.



Sensor Requirements

The technical specification for a sensor attached to the observing system

Observing System Budget Requirements

Budget of project to build an observing system

◀ N O A A R E Q U I R E M E N T S ▶





NOAA User Observation Requirements



Requirement	Threshold (T) Objective (O)	Priority	Geographic Coverage	Vertical Resolution	Horizontal Resolution	Measurement Accuracy	Sampling Interval
Lightning	T	1	Global	na	4 km	30%	10 sec
	O		Global		4 km	1%	1 sec
Ocean Temperature: Upper Ocean	T	1	Global Ocean	10 m	300 km	0.01 K	24 Day
	O		Global Ocean	1 m	1 km	0.0001 K	1 day

Priority Levels

- 1 Mission Critical:** Cannot meet operational mission objectives without this data. Not having these data will prevent performance of mission or preclude satisfactory mission accomplishment. **Only Priority 1s go through NOSC review and validation**
- 2 Mission Optimal:** Data not critical but would provide significant improvement to operational capability
- 3 Mission Enhancing:** Needed to enhance state of knowledge / assess potential for operational capability

Validation Level

Direct Validation Documentation
Associated

SME Consensus Documentation
Not Validated

Attribute Not Applicable



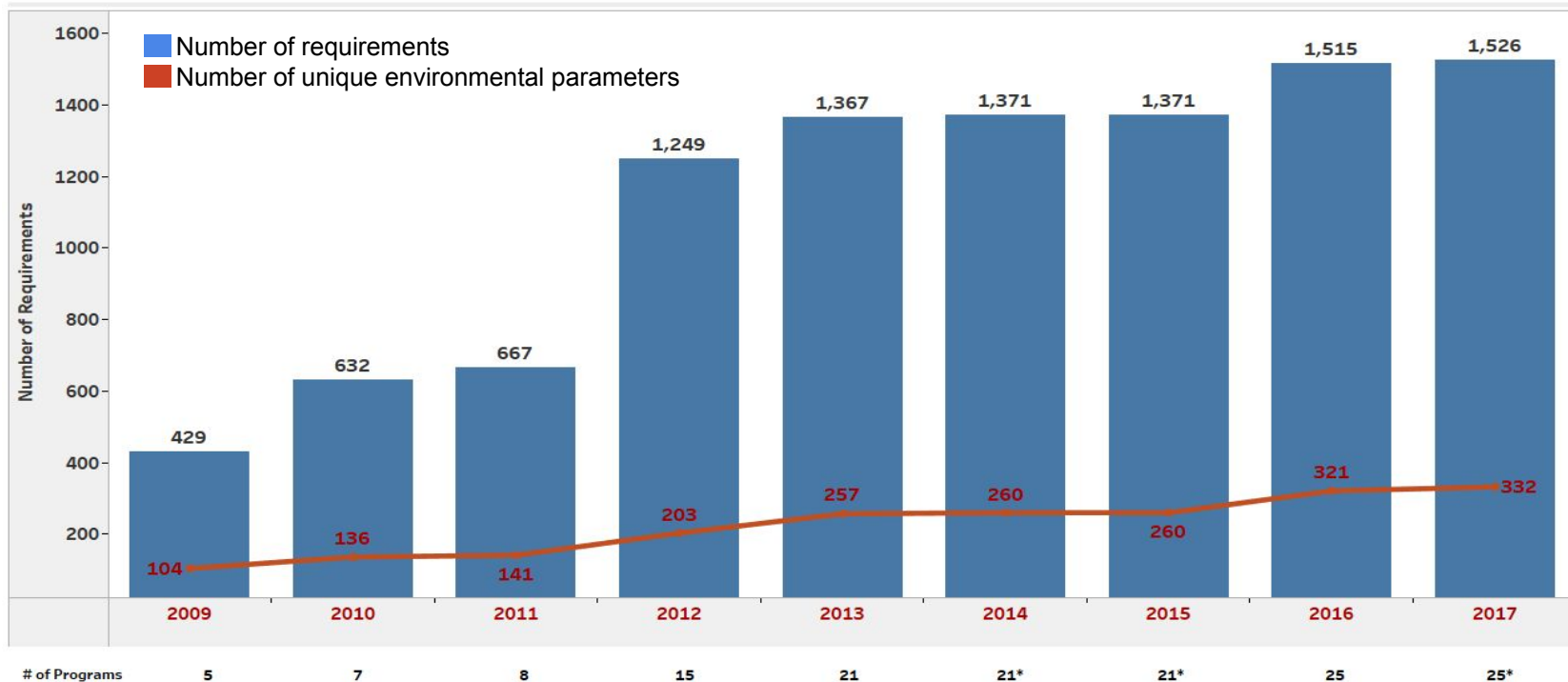


Evolution of Observation Requirements



NOAA Observation Requirements: **Growth by Year**

1,526 Total Requirements





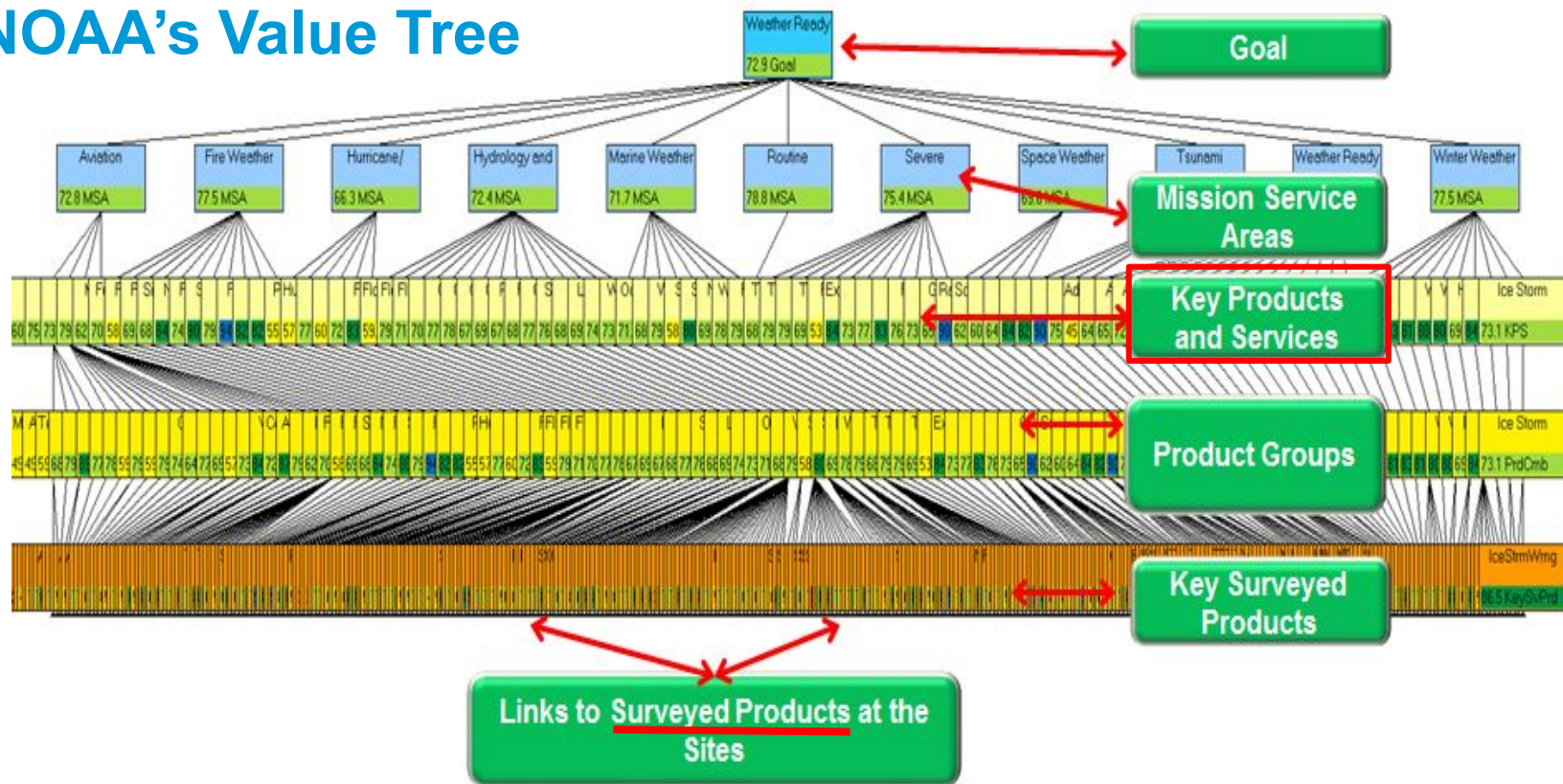
NOAA Observing Systems Integrated Analysis (NOSIA)

- Analytic framework consisting of a model, tools, and methodologies, all designed to analyze the capability, cost, overall impact, and value of NOAA observing system architectures
- NOSIA analyses/assessments can inform a variety of efforts including:
 - Management decisions affecting NOAA's observing systems portfolio
 - Decision-making on budget proposal development for observing systems





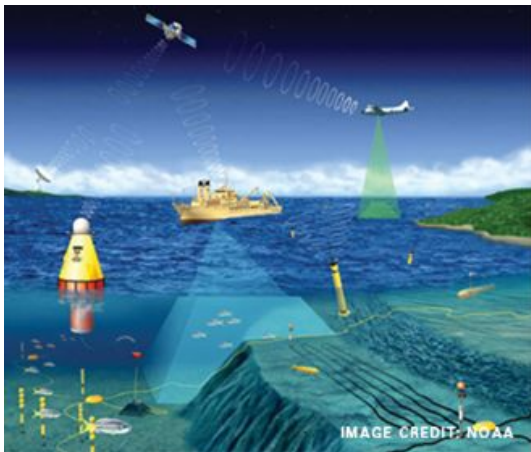
NOAA's Value Tree



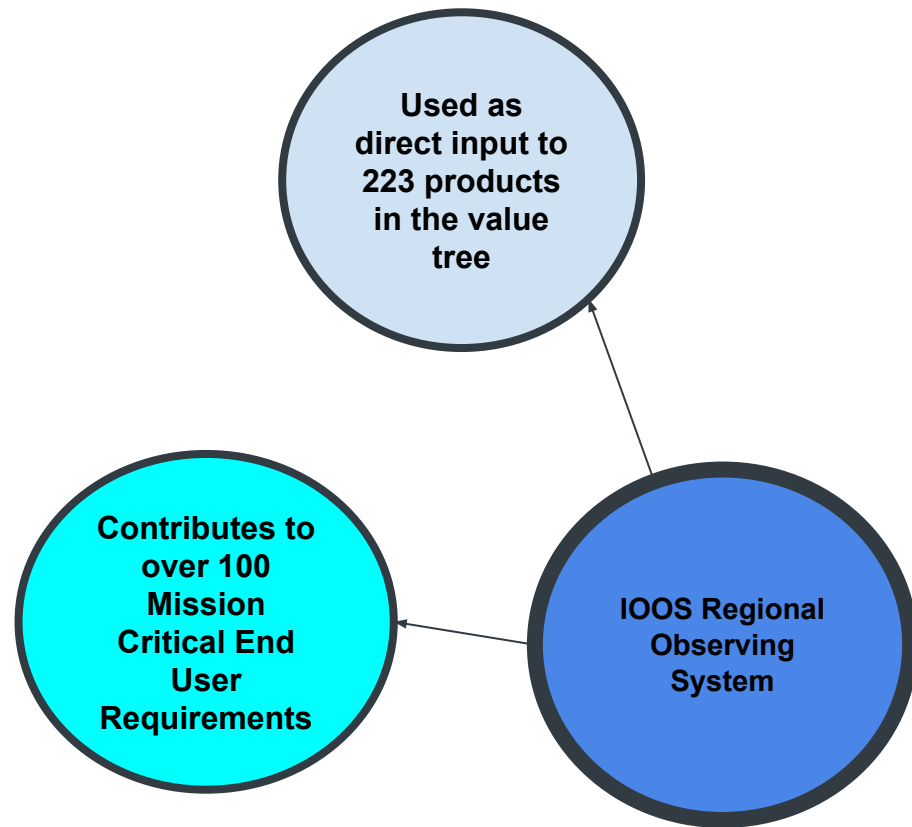
- Models Relationships (Products and Data Sources)
- Determine Impact of Portfolio Capabilities on Missions, Goals, Top Node (NOAA)



IOOS Capabilities - Support to NOAA



IOOS is an important source of requirements, especially for the regional associations. IOOS is on the "front lines" of ocean observing. Identifying new user needs and ensuring that they are captured and considered is critical.





Near Future IOOS Opportunities

- IOOS could be instrumental in developing a requirements-based acquisition strategy for UxS capabilities.
- Recently refreshed the "integrated water and prediction" end user requirements which represented a cross-NOAA assessment of needs to support a variety of products and services.
- Working with the NOAA Water Initiative Observations Team to perform a series of gap analysis assessments to help identify high priority requirements.

NOAA Unmanned Systems Strategy Maximizing Value for Science-based Mission Support



NOAA Integrated Water Prediction and Information Mission Service Area Observational User Requirements Document

September 25, 2017

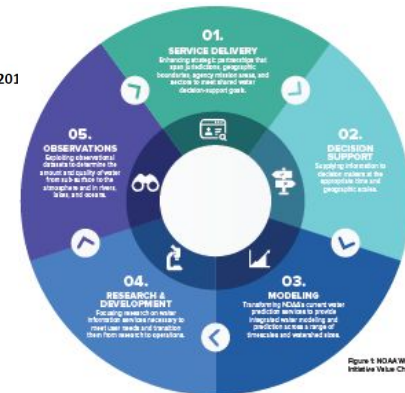


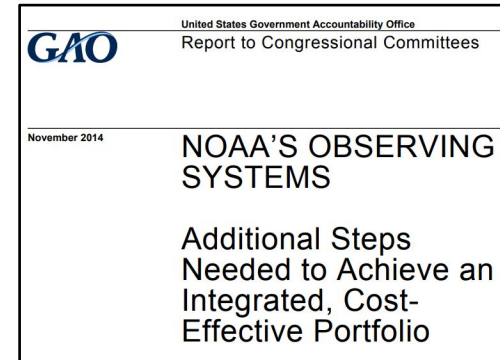
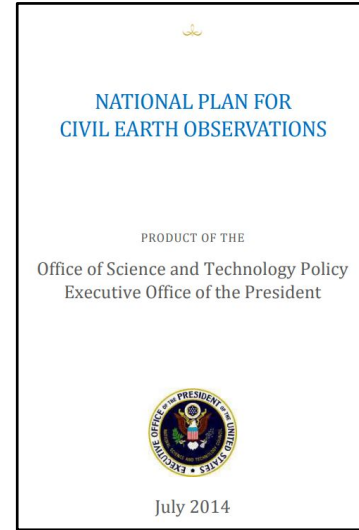
Figure 1: NOAA Water Initiative Value Chain





Recent Portfolio Analysis

- NESDIS Satellite Observing System Architecture Study (NSOSA, 2018)
- NESDIS Core Organizational Analysis (2017)
- Fleet Recapitalization and Acquisition Planning (OMAO, 2016)
- National Plan for Civil Earth Observation (OSTP, 2014, 2017)
- GAO Report 15-96 (2014), NOAA's Observing Systems – Additional Steps Needed to Achieve an Integrated, Cost-Effective Portfolio



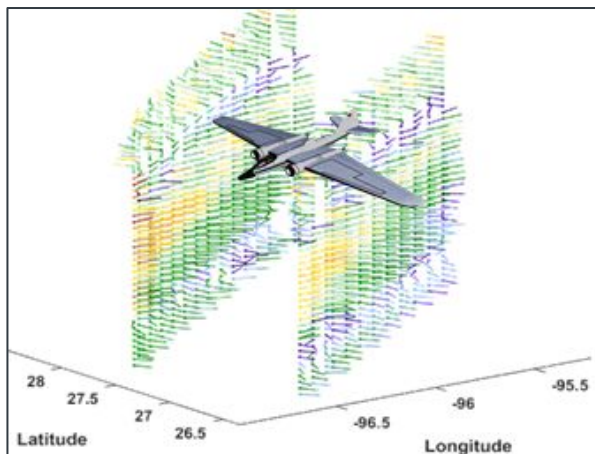


Inform Decisions to Focus Emerging Technologies

NOSIA + ETW = A Call to Private Industry



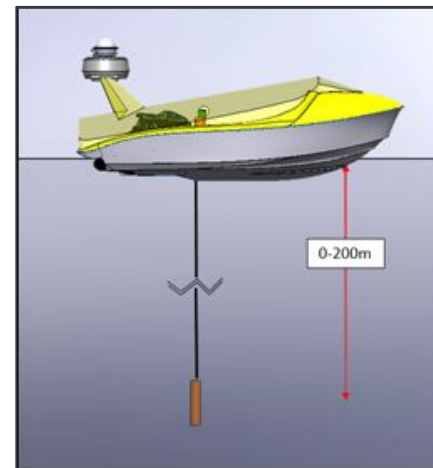
Private companies who made the best case were given the **spotlight** to present their solution at the **NOAA's Emerging Technologies Workshop** before an audience of 300 - 400 NOAA scientists & experts.



Airborne GroAWL Wind Speed and Direction Profiles (June 2016)



Credit: Sébastien de Halleux



GROOV Arrangement with CDT profiler





Key takeaway messages



- IOOS has an opportunity to show how they are meeting NOAA's needs. We want to make sure that IOOS and their partners capabilities, services, and products are accurately represented
- NOAA's portfolio management approach can show you:
 - Where IOOS assets are used
 - What the needs for marine data
 - Answers for business questions
- While not perfect, NOAA's analytical capabilities have opportunities to continue to improve our data to further answer your questions





Thank you

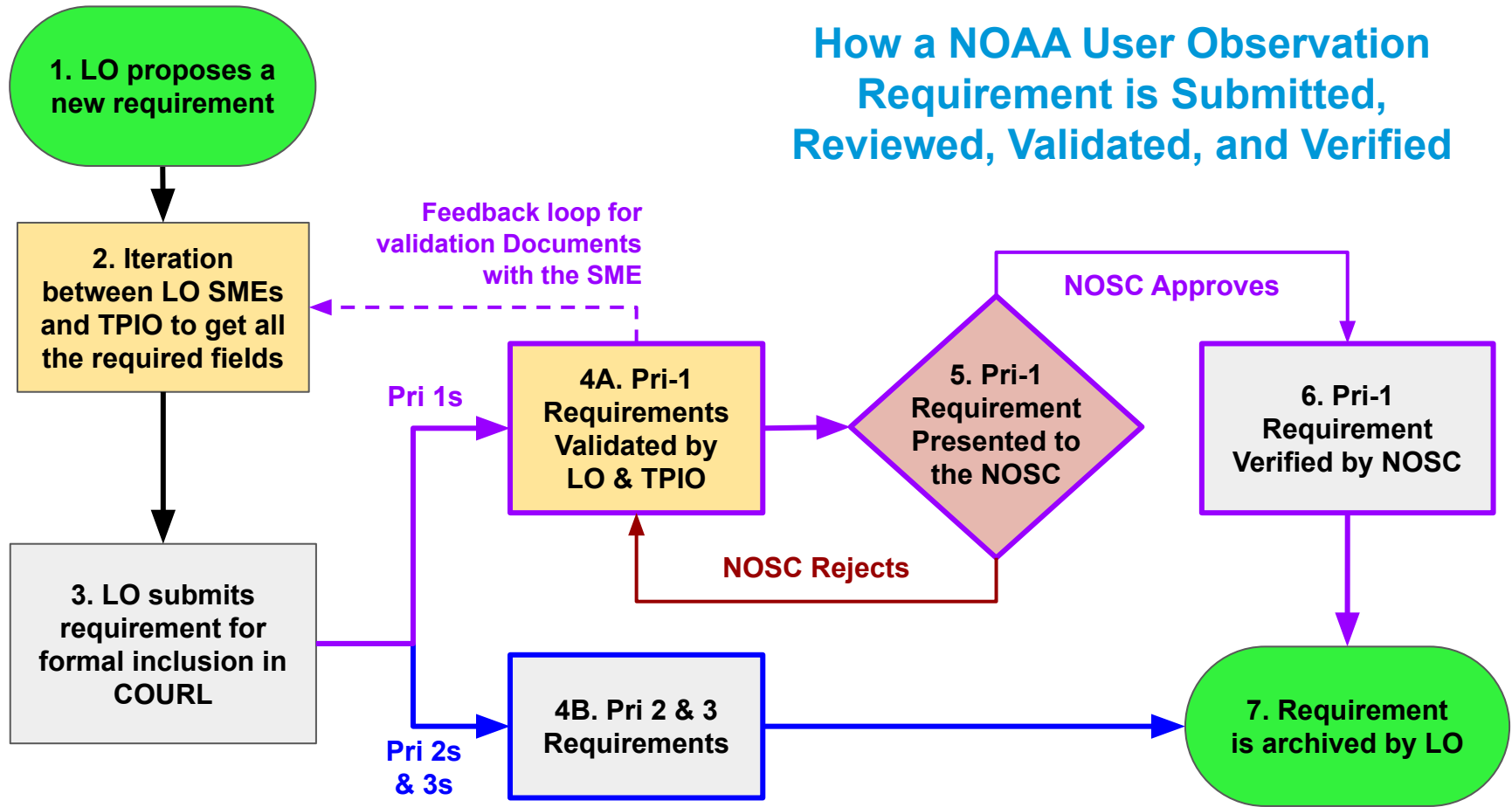




Back-up slides



How a NOAA User Observation Requirement is Submitted, Reviewed, Validated, and Verified






User Observing Requirements & Capabilities







TPIO has developed a “**gap analysis tool**” that assesses the performance gap between user needs and current observing capabilities for five key attributes that exist in both foundational datasets.




CasRT Color Legend

 **More than fully-satisfied requirement attribute**

  **Fully-satisfied**

  **Partially-satisfied**

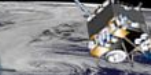
 **Unsatisfied requirement attribute**



Parameter → <u>Observing Systems</u>	Geo Coverage	Horizontal Resolution	Measure Accuracy	Sampling Frequency	RGAScore
Sea Surface Temperature	EEZ US	1 km	0.5 Kelvin	1 hour	
Soumi National Polar-Orbiting Partnership Satellite	Global Ocean	0.75 km	0.1 K	12 hrs	90
Polar-Orbiting Operational Environmental Satellite	Global Ocean	1 km	0.5 K	12 hrs	88
Global Ocean Observing System Ocean Ref Stations	Global Ocean	3530 km	0.002 K	5 min	67
Geostationary Operational Environmental Satellite N/O/P	Global Ocean	6 km	0.6 K	1 hour	79



Technology,
Planning, and
Integration for
Observations



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Earth Observation Requirements Evaluation System (EORES)

HOME



LOG IN

... to begin using EORES!

- [Report](#) a problem/enhancement request

Welcome to the EORES Application!

The purpose of EORES is to:

- Collect • Store • Visualize • Analyze • Report •

Utilizing data within and across the following entities:

- Earth Observation Requirements (EOR)
- Earth Observing Systems (EOS)
- Value Tree Information (VTI)

Employing an enterprise system providing capabilities which are:

- ★ Online Accessible ★ Responsive ★ User-Friendly ★

FOIA

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Information Quality

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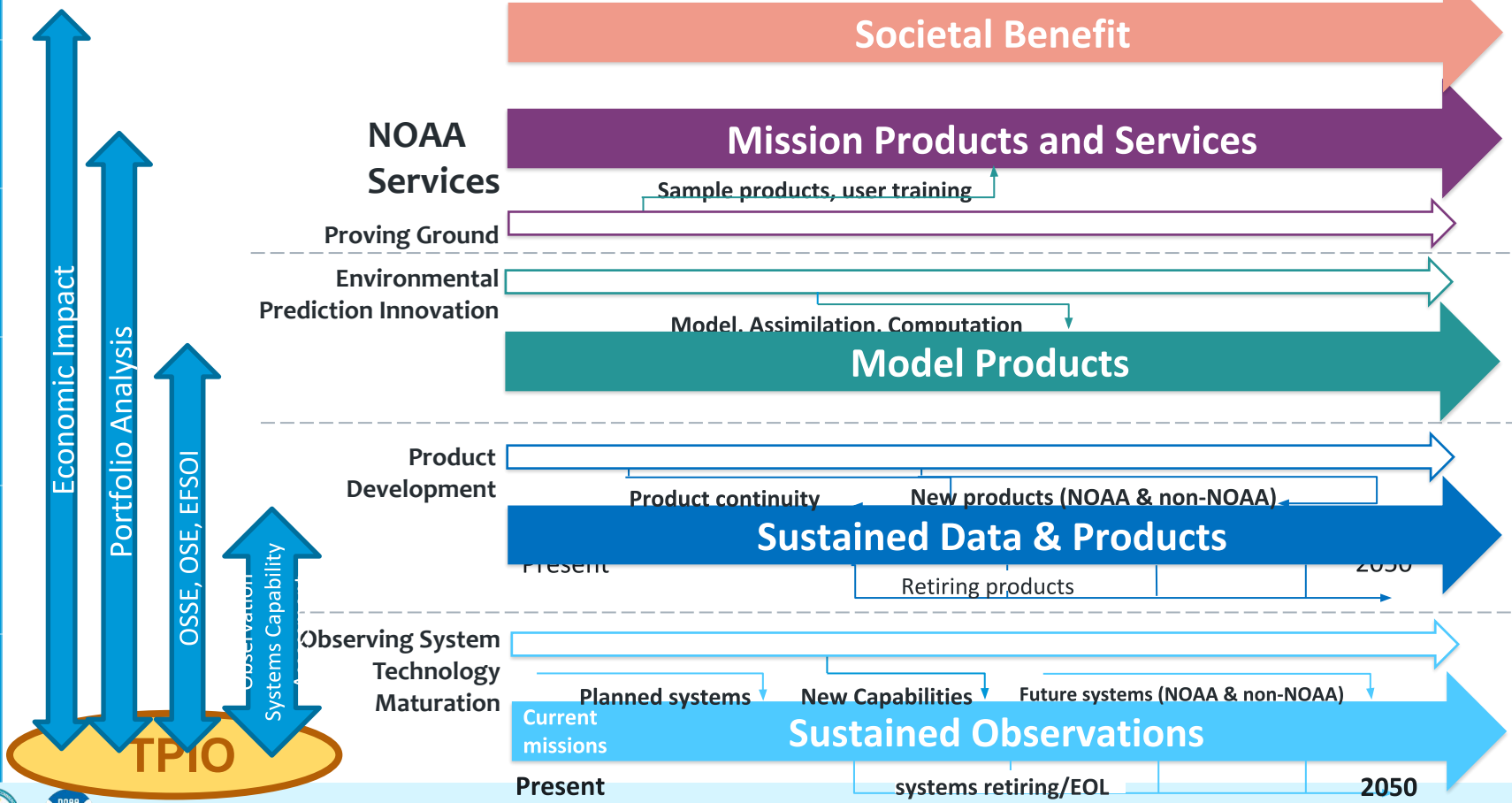
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System Architecture Portfolio Management





Decision Support using NOSIA



- NOSIA also provides decision support for analysis of observing system architecture impacts, and demonstrate the relevance of products and observing systems to each major aspect of NOAA's core mission
- NOSIA can be used to answer questions such as:
 - *How much would product performance decline if each input is removed?*
 - *How well is each product performing?*
 - *How well does each input meet the needs of the product?*



Earth Observation Requirements Evaluation System (EORES)

- Custom-built web application and relational database, developed by NOAA and USGS, to house information about:
 - User Observation Requirements
 - Observing Systems
 - Mission Value Tree
- EORES enables a suite of analysis tools to provide visibility into gap analysis, trade studies, impact analysis, and visualizations of the data