US IOOS®

Carl Gouldman
Deputy Director, US IOOS

IOOS | EYES ON THE OCEAN™

Renewable Natural Resources Foundation

12.07.16 | Carl Gouldman, Deputy Director

IOOS | EYES ON THE OCEAN

U.S. Integrated Ocean Observing System

- Partnership of 17 federal agencies
- Scientific, technical, and procedural standards to establish a national ocean, coastal, and Great Lakes observing system.
- 11 Regional Associations, the Alliance for Coastal Technologies (ACT) and the Southeastern University Research Association (SURA) to build this observing network.

From National to Global

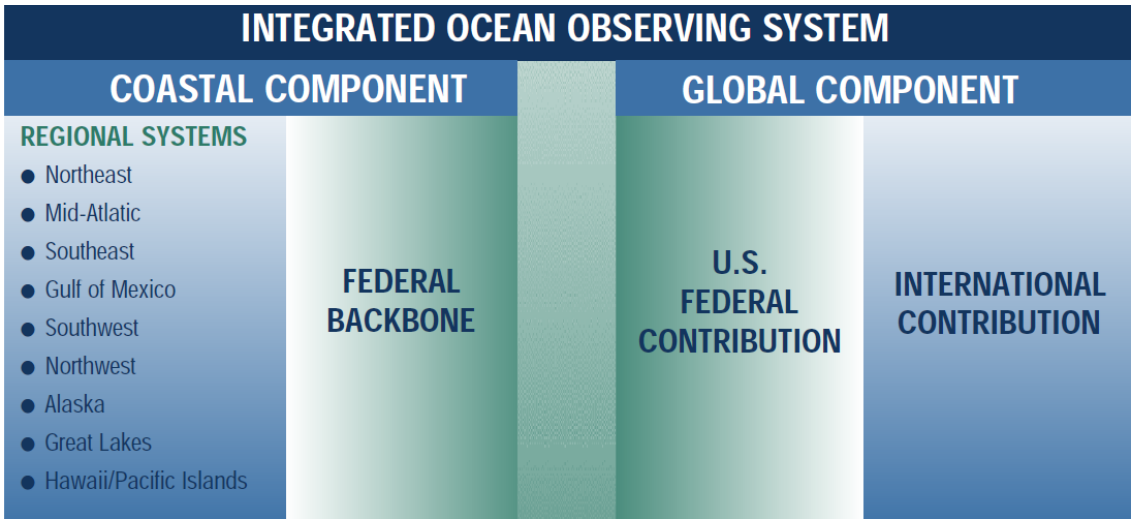
IOOS
Integrated Ocean Observing System

The Global Ocean Observing System
GOOS

GEO GROUP ON EARTH OBSERVATIONS

U.S. IOOS®: Program Overview

Policy Neutral, Stakeholder driven, Scientifically based



ICOOS Act - P.L. No 111-11, March 2009

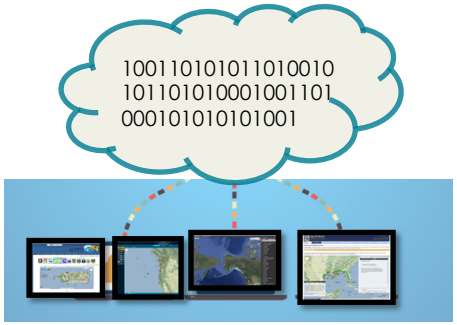
Mission Areas:

- Improve predictions of **climate** change and **weather**, and their effects on coastal communities and the nation
- Improve the safety and efficiency of **maritime operations**
- More effectively mitigate the effects of natural **hazards**
- Improve national and homeland **security**
- Reduce **public health** risks
- More effectively protect and restore healthy coastal **ecosystems**
- Enable the **sustained use** of ocean and coastal resources.

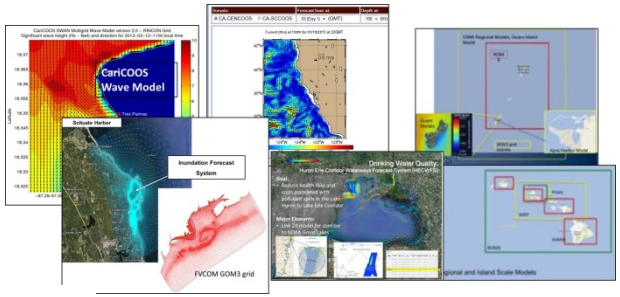
IOOS Regions

11 Regions

Observations



Data Access



Models

Who

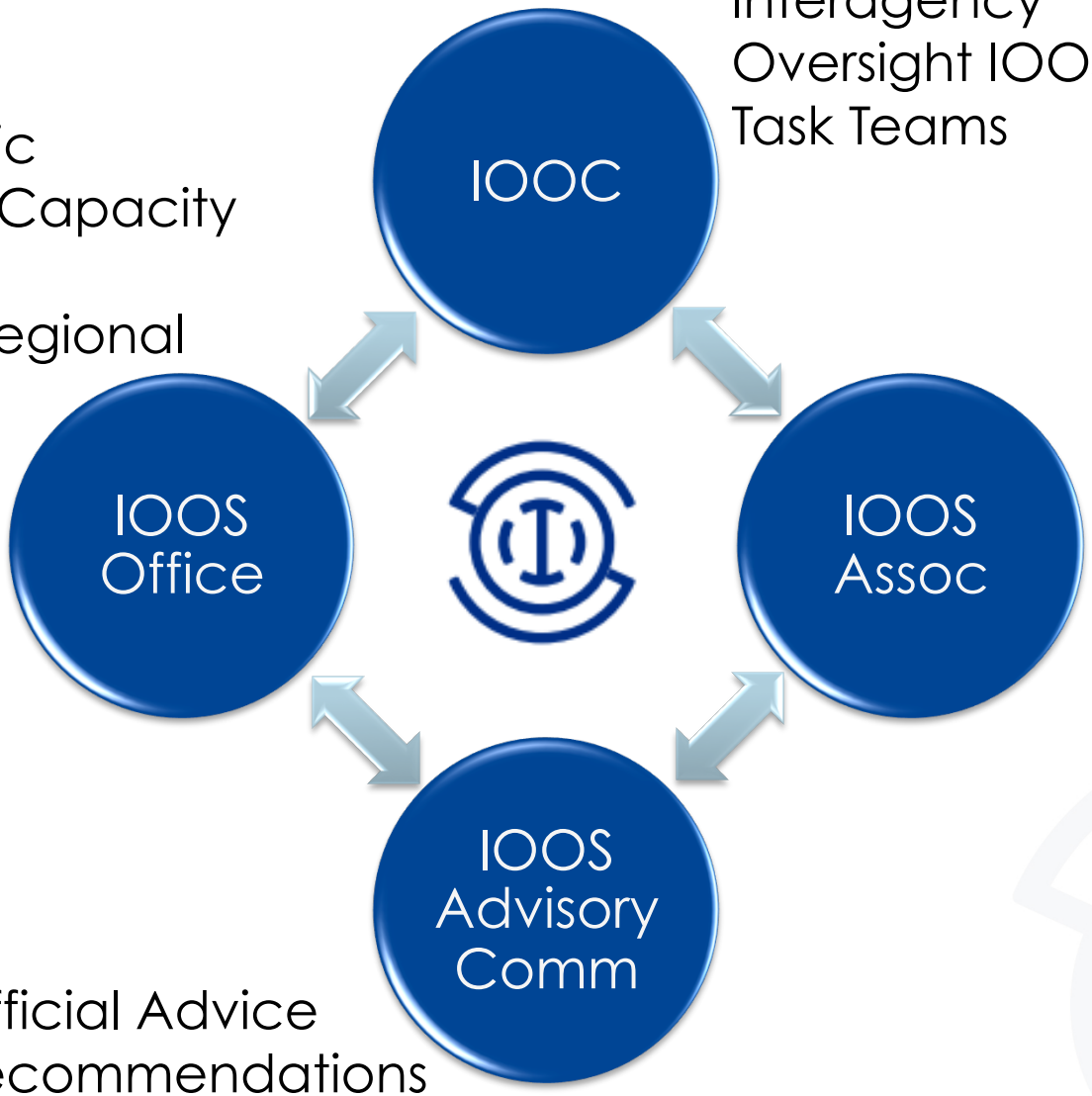
- State, Local, Tribal Government
- Profit & non profit industries
- Academia

Education
Outreach

Produce | Integrate | Communicate


AOOS
NANOOS
CENCOOS
SCCOOS
PacIOOS
GLOS
NERACOOS
MARACOOS
SECOORA
GCOOS
CariCOOS

IOOS is a Team Sport



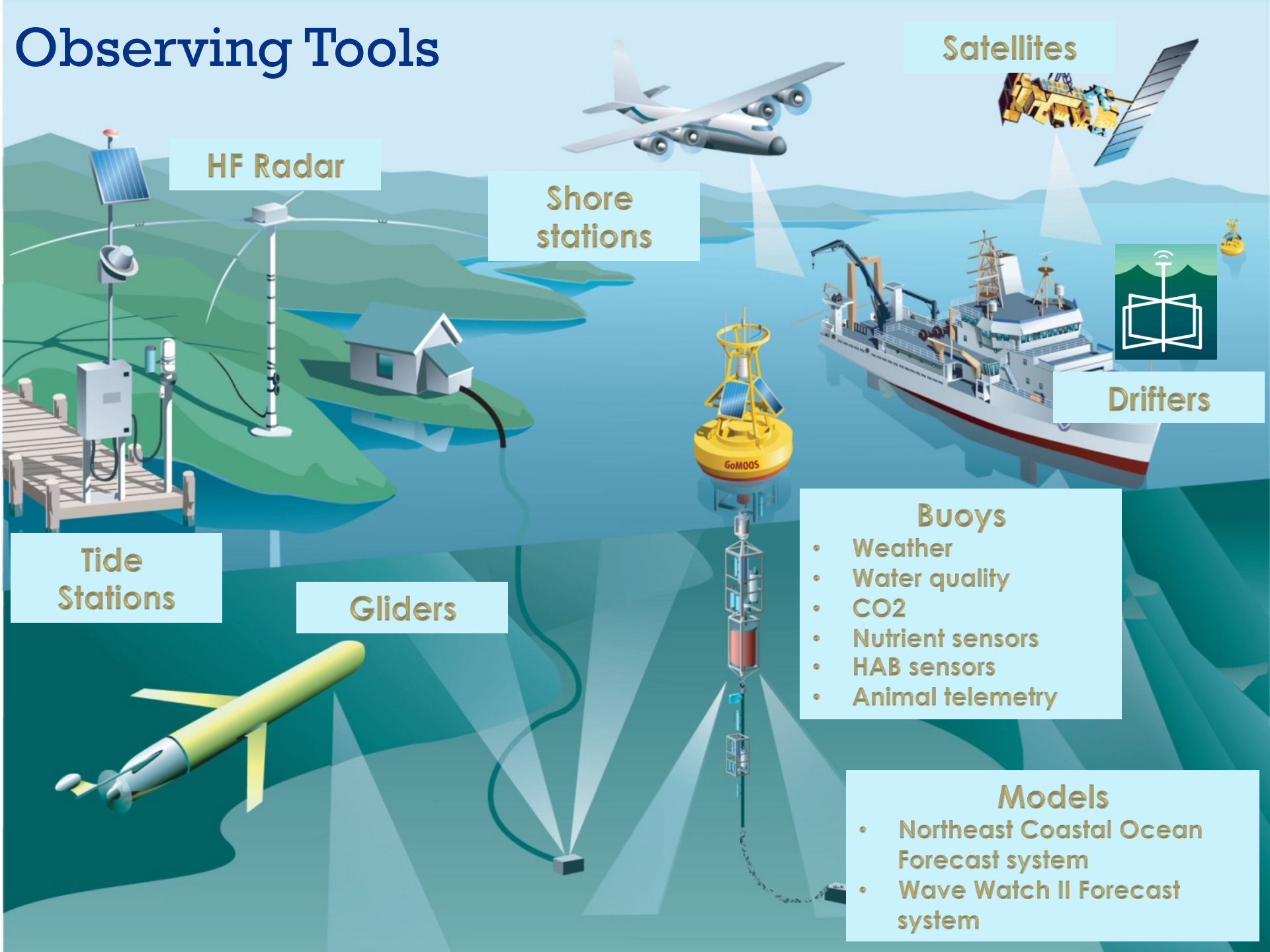
Interagency
Oversight IOOS
Task Teams

Programmatic
Operational Capacity
Partnerships
Champion Regional

Congress
OMB
Sponsor Events
RA Coordination

Official Advice
Recommendations

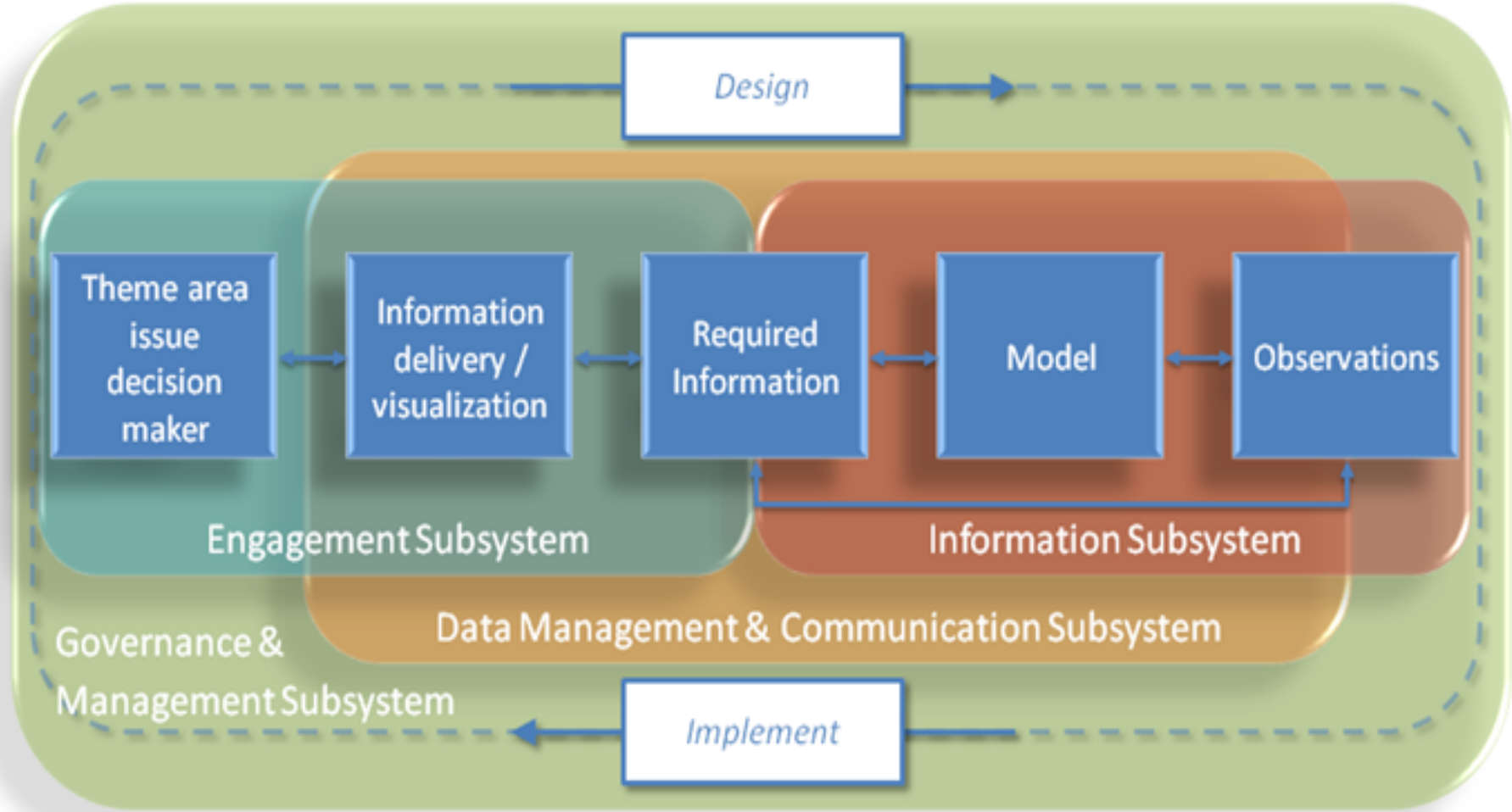
Observing Tools



Challenges

- Legacy observing systems to meet singular/specific mission needs.
- Lack of interoperability and common access to data
- Pockets of highly specialized observing, science, and data analysis
- Sparse data and modeling coverage in some geographies

Approach & System Design



Produce | Integrate | Communicate

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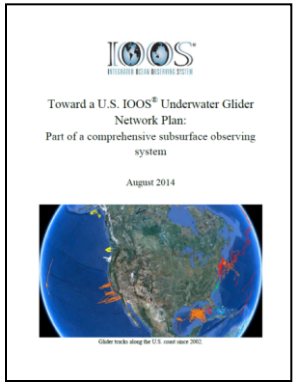
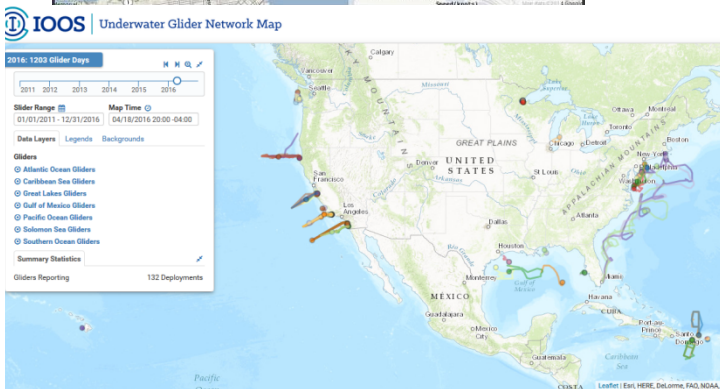
IOOS: Advancing Communities past Challenges

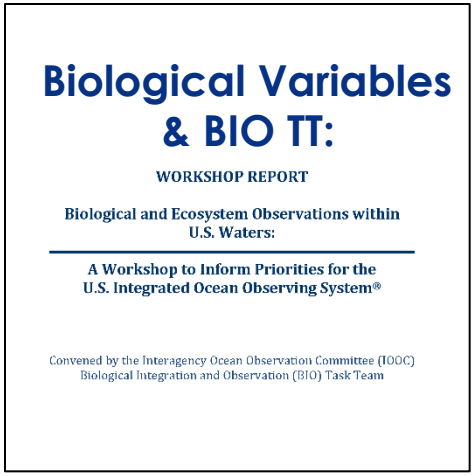
HF Radar:

Gliders:



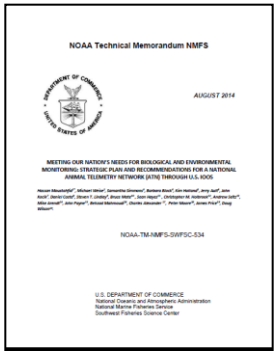


Biological Variables & BIO TT:



Wave Measurements:

Animal Telemetry:



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IOOS Data is BIG data

Petabytes
of
Open Data

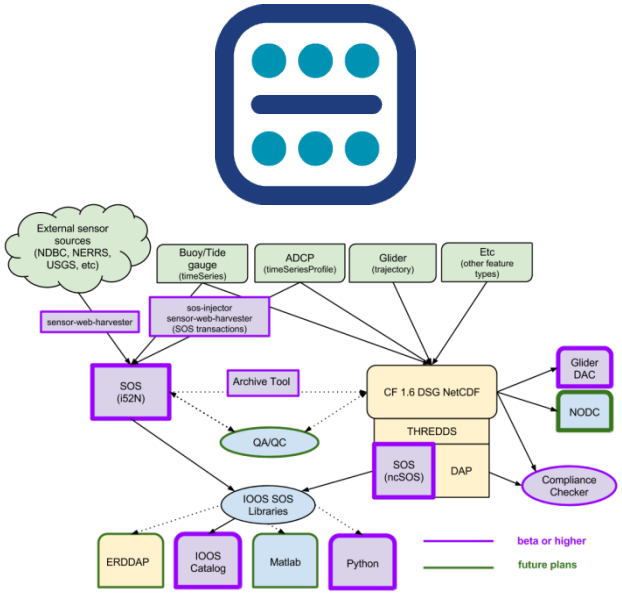
32,000
stations

119,515
sensors

37
national sensor networks

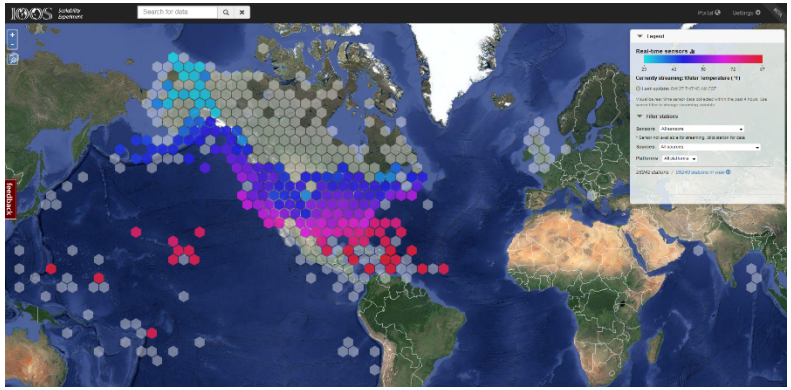
42,000,000
sensor observations
Per week

Access to Data

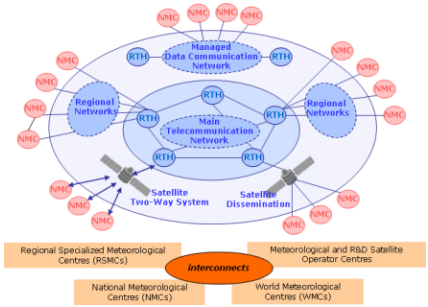


Standards

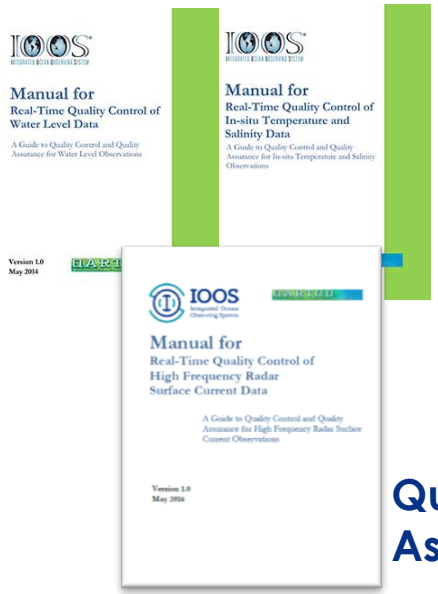
Access on 1 page: loos.us



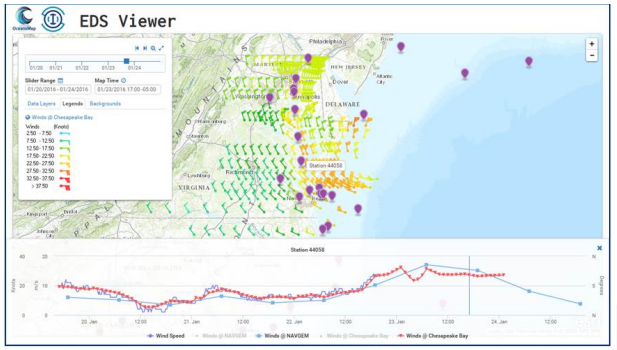
2 week cache of real-time observations



Global Telecommunications System (GTS)



Quality Assurance



Blizzard 2016: CBOFS winds at 1/23 17:00 EST. Time-series of model output and buoy observations (1/20 - 1/23)

Access to model output

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IOOS Regional Certification

Integrated Coastal and Ocean Observation System Act of 2009 (ICOOS Act)

- Formal recognition of IOOS Regional Associations
- Extends **civil liability** coverage for data use
- Establish minimum criteria for how a RICE operates
- Adherence to data management best practices
- Enhance delivery and quality of data and information

Credible – recognize NOAA's responsibility for ensuring data quality and assumption of liability risk

Reasonable – develop program guidelines in accordance with RA capabilities as supported by IOOS Program funding

PacIOOS
PACIFIC ISLANDS OCEAN OBSERVING SYSTEM

great lakes observing system

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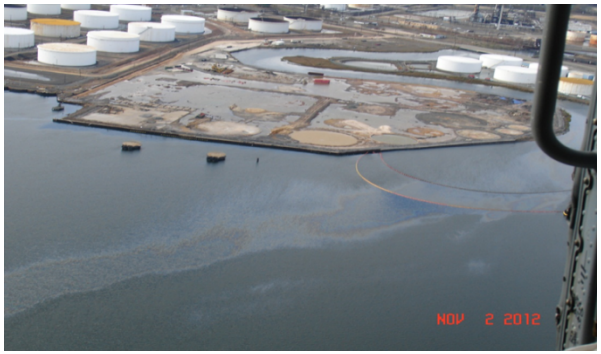
Applications and Needs

Post Storm: Response, Recovery, Long-term Planning

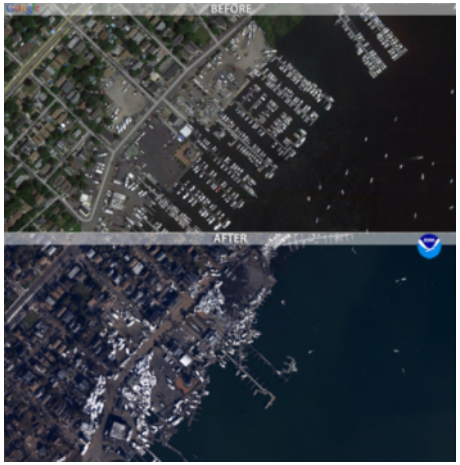
Navigation Response Team

Shoreline Imagery

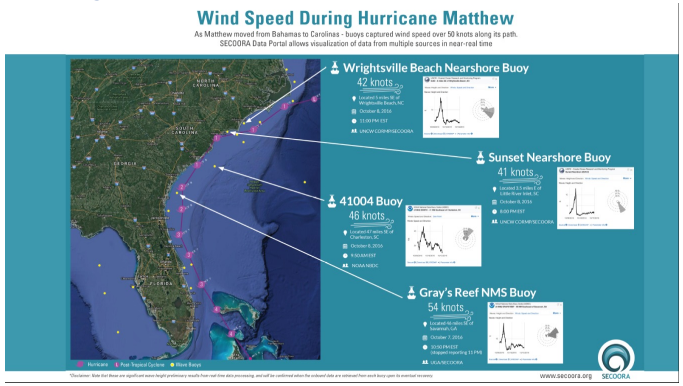
Oil Spill Response

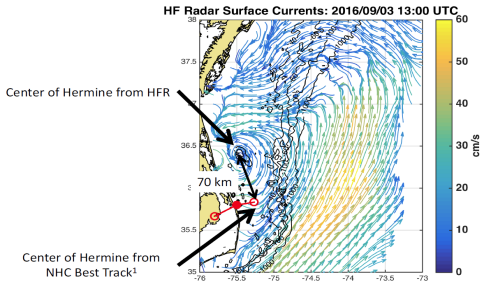


Marine Debris



Analysis of the Storm





[1] http://www.nhc.noaa.gov/gis/archive_besttrack_results.php?id=al09&year=2016&name=Hurricane%20HERMINE

Promoting Resilience

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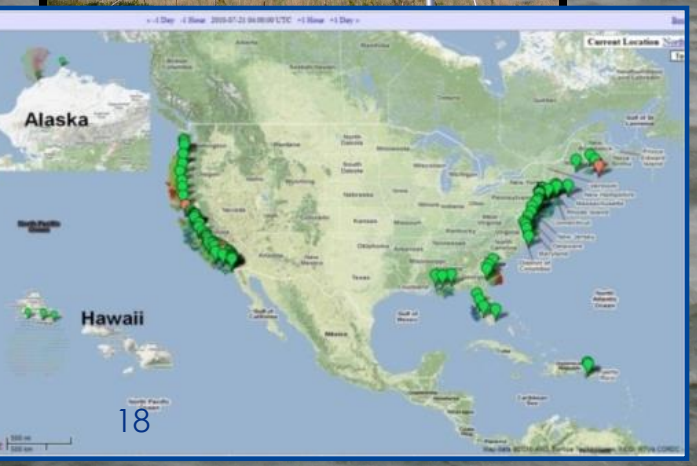
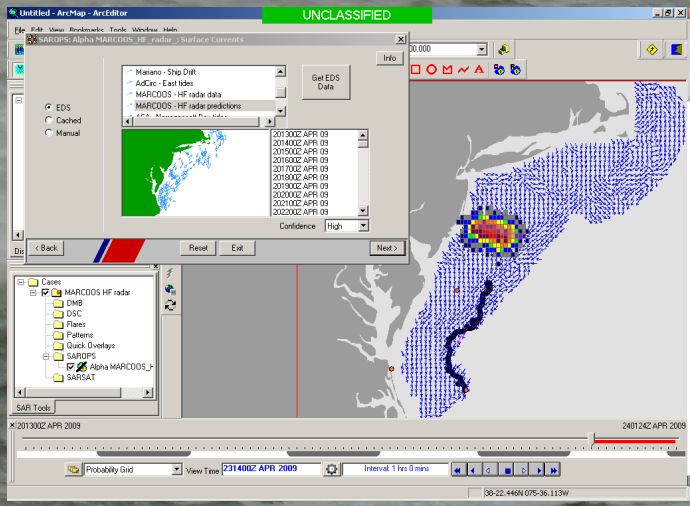
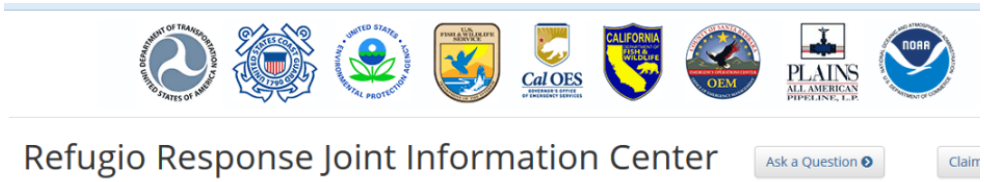
Saving Lives – supporting the US Coast Guard – Search and Rescue



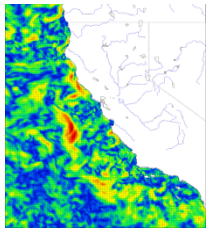


Public Good - Refugio State Beach Oil Spill – May 2015

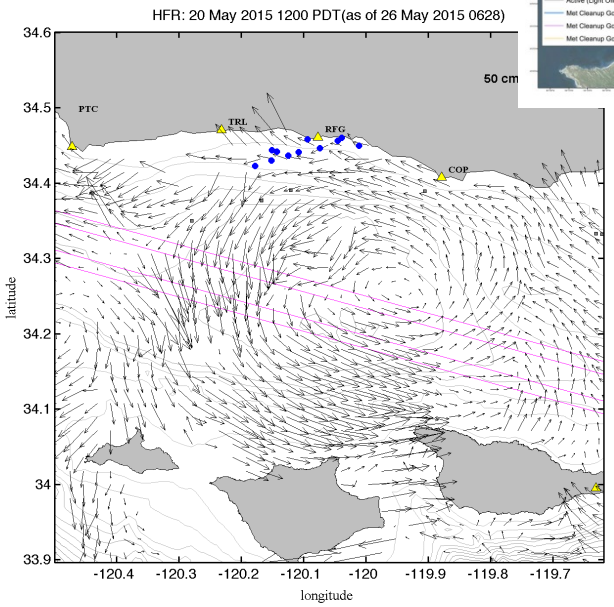


Gliders

HR Radar

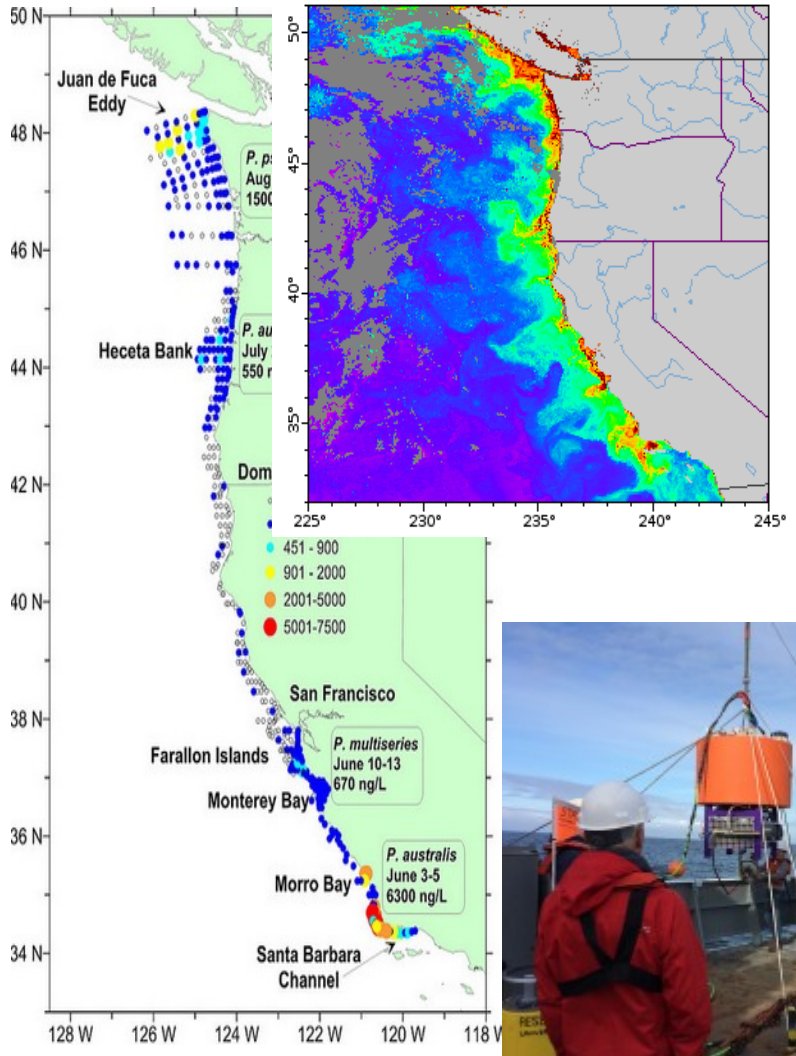


Modeling

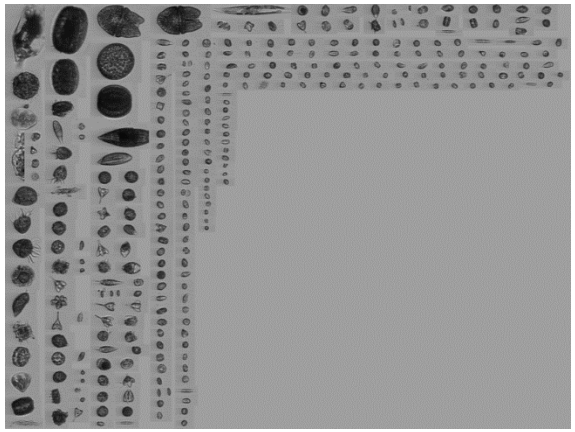


IOOS Regional Assets support national mission: supporting gliders, surface currents from HF radar, and regional models

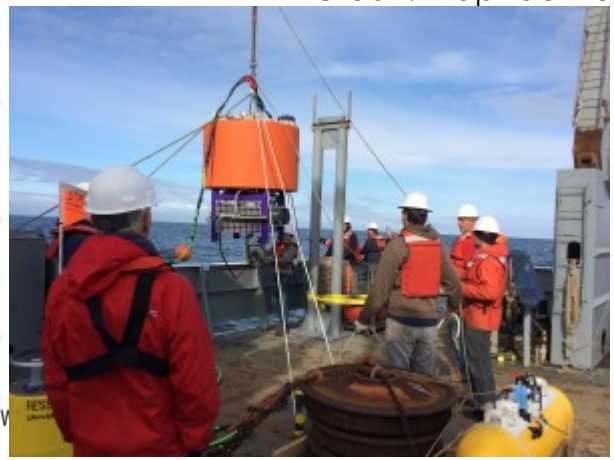
Public Good: Ocean Observing and Public Health



Harmful Algal Bloom Monitoring



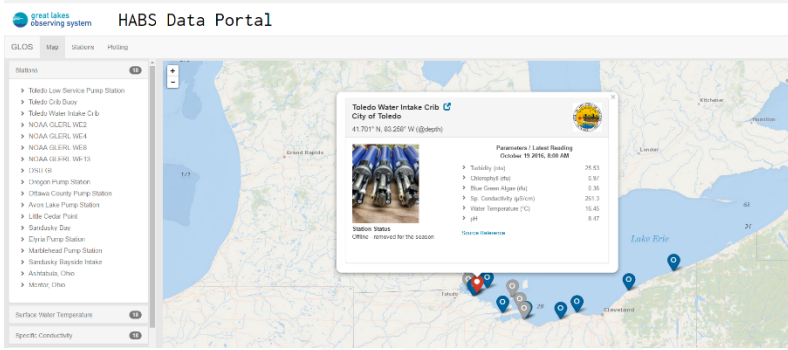
Output imagery from the IFCB, October 11 SF Bay Deployment. Credit: Raphael Kudela



Deployment of PNW ESP, May 2016. Credit: Stephanie Moore

Improved forecasts to mitigate and respond to human health hazards, caused by harmful algal blooms and pathogens :

- Improved reporting of real-time meteorological and oceanographic conditions;
- Improving reporting of water quality parameters; and
- Creating better trajectory models.



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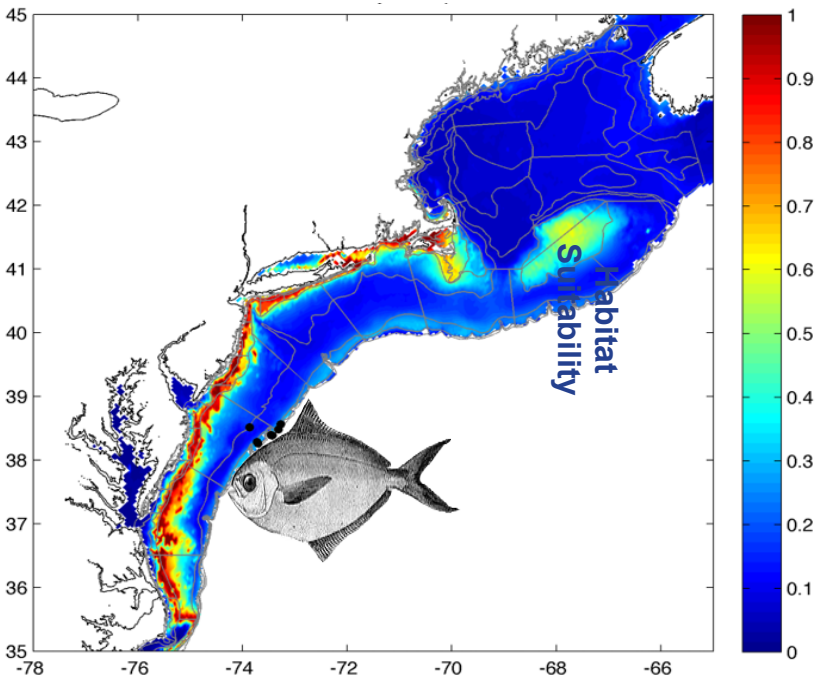
Economy: Supporting Fisheries



Mid Atlantic Fishery Manamgeent Council (MAFMC) :

- Butterfish fishery **incidental fishery** since 2002.
- 2014 is the first year of a small directed fishery, landings limit of **3,200 mt valued at $4.7 million.**
- 2015-2017 limits raised to **21,408 mt, potential value $31.7 million**

"The lesson learned is that going forward, this approach to fisheries stock assessments work has to be done before fisheries are shut down, and economic losses are unnecessarily sustained, due to data poor management ... The return on investment is spectacular: 1,000 – 1!"

- Greg DiDomenico, Garden State Seafood Association Executive Director and MARACOOS User Council Member

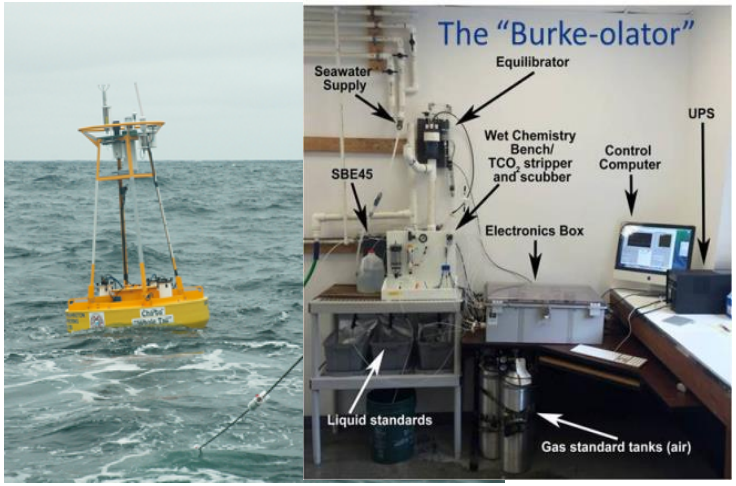
MARACOOS Ocean Information for a Changing World
RUTGERS THE STATE UNIVERSITY OF NEW JERSEY
NOAA
USF UNIVERSITY OF SOUTH FLORIDA
GARDEN STATE SEAFOOD ASSOCIATION
IOOS | EYES ON THE OCEAN

Economy: Shellfish Industry

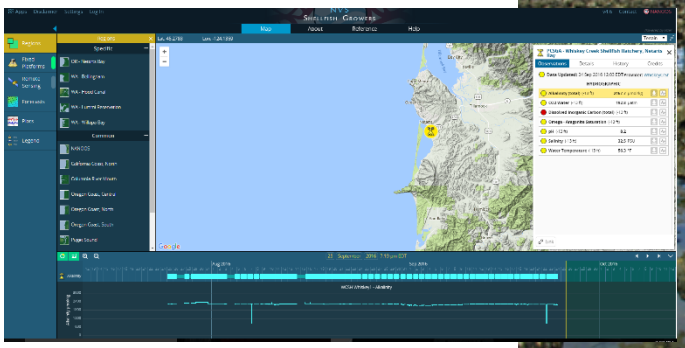
Shellfish industry:

- $111 million on West Coast
- At risk from ocean acidification

Real-time data informs industry management decisions



CeNCOOS

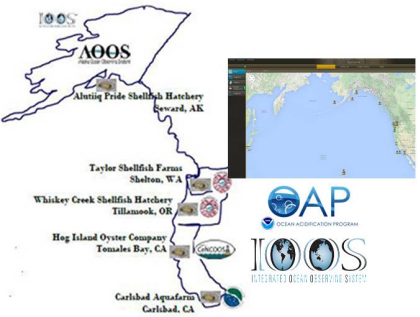


NANOOS

Ocean Technology Transition

Fostering the transition of advanced observing technologies to operations mode.

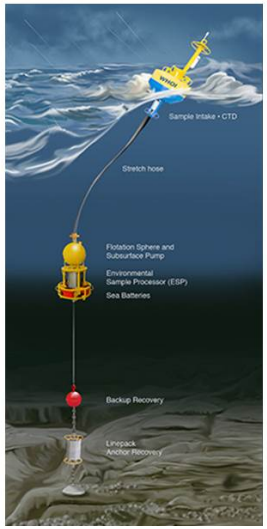
West Coast Ocean Acidification



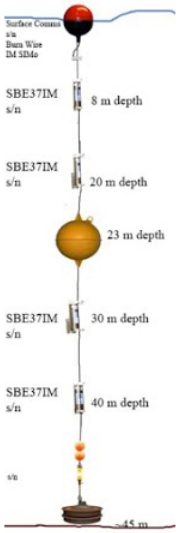
The "Burk-o-lator" – developing low cost OA sensors

Imaging Flow CytoBot in SF Bay – Industry

Harmful Algal Bloom
Gulf of Maine
North west United States



Operational Nutrient Observatory for the Northeastern United States – Industry Partner: WetLabs



Detecting Arctic Freeze Up Real-Time

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Functional Components

Alliance for Coastal Technologies (ACT)

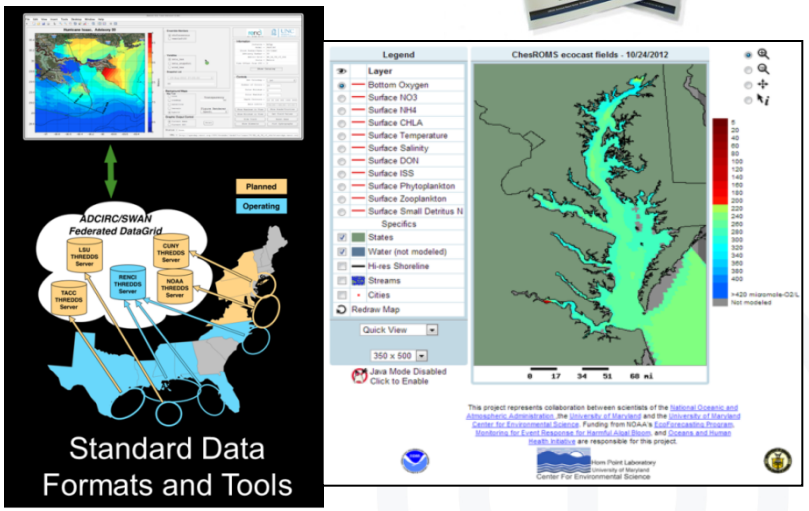
Technology Evaluations, Technical capacity building, and information clearinghouse

Nutrient Sensor Challenge

(FY2015/2016)

Coastal & Ocean Modeling Testbed (COMT)

Testing model skill, transition to operations, and applied science for hypoxia, inundation, and ocean forecasts



Marine Biodiversity Observation Network (MBON)

Interagency support:
$15M from NASA, NOAA (IOOS and OER), and BOEM for 5 years (FY14-18)
$2M from Shell to launch Arctic MBON

Demo projects are:
- Integrating existing monitoring
- Filling spatial, taxonomic gaps
- Monitoring "microbes to whales," "in-situ to satellites"
- Exploring technology applications
- Addressing data management
- Building MBON for the Nation
- Creating global MBON (with GEO, GOOS)
- Connecting with the Animal Telemetry Network

Credit: MBARI

MBON Technology Applications

New technologies and methods will lower the cost of observing while increasing space and time and space resolution.

MBON is:

- Refining eDNA methods - large, multi-institution partnership
- Leveraging OAR 'omics work with MBON funds and in-kind (corals, ESP)
- Evaluating technologies for MBON: genomics, acoustics, bio-optical informatics and images, animal tagging, ESP

	Microbes /Phyto	Zooplankton	Fish	Top Predators	Benthos, habitat forming
Optics/ Imaging	X	X	X Benthic		X
Acoustics		X active	X active	X Tags, passive	X active
Genomics	X	X	X	X	X
Platforms with samplers	AUVs, floats, moorings	AUVs, moorings	AUVs, moorings	AUVs, moorings, tags	AUVs, moorings
Data and visualization	X	X	X	X	X

Sustaining MBON

- MBON observes marine life – how it's changing, how it affects us.
- MBON is establishing long-term species status and trends and merging that with environmental information.
- MBON informs understanding of impacts from climate, ocean acidification, and human activity to species we depend upon.
- MBON directly supports:
  - Understanding biological impacts from ocean acidification, climate change
  - Management of National Marine Sanctuaries and marine protected areas
  - Protection of shallow and deep-water corals
  - Ecosystem-based science and management, including Integrated Ecosystem Assessments

Private and federal funding is needed to sustain MBON.

Economy: U.S. Ocean Enterprise

THE OCEAN ENTERPRISE

A study of US business activity in ocean measurement, observation and forecasting

IOOS Integrated Ocean Observing System

NOAA

Prepared by
ERISS Corporation
The Maritime Alliance
February, 2016

ERISS

THE MARITIME ALLIANCE

Study focus

Public, Private, Non-Profit, Research, Academia

Information, Services, Infrastructure

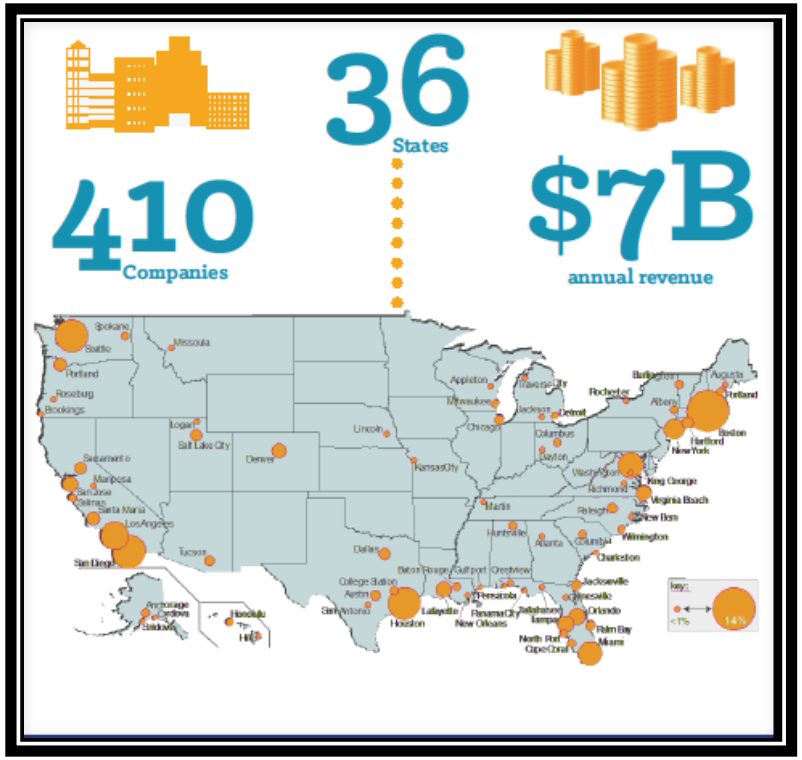
ISSUES: Oceans – Ecosystems – Climate

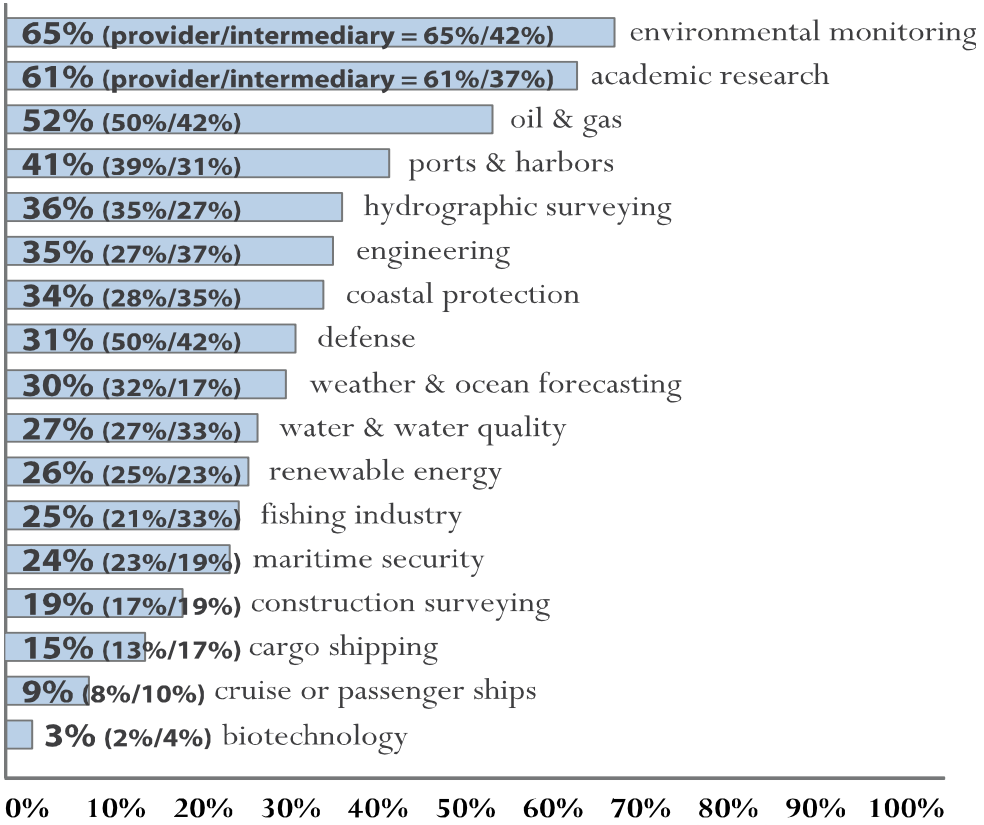
PROVIDERS
observations

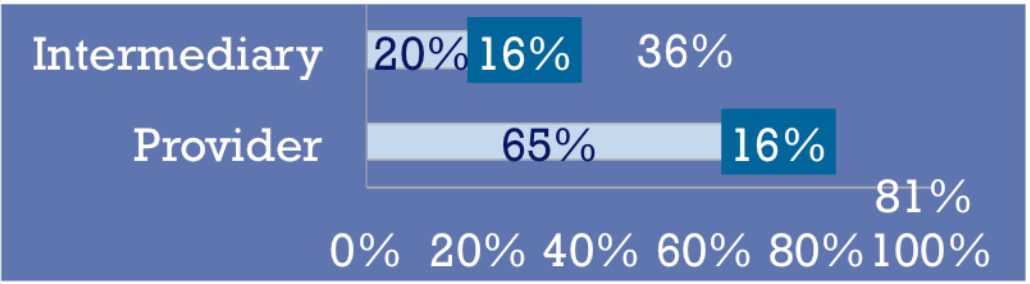
INTERMEDIARIES
value-added products

END USERS
emergency managers, developers, city planners, private sector

Ocean Enterprise - Results







- **Generally optimistic**
- **Majority expect to grow**
- **Providers: anticipate growth**
- **Intermediaries: staying the same or uncertain**

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Questions

Enables decision making

Fosters Advances in Science and Technology

https://ioos.noaa.gov

https://www.facebook.com/usioosgov

@usioosgov

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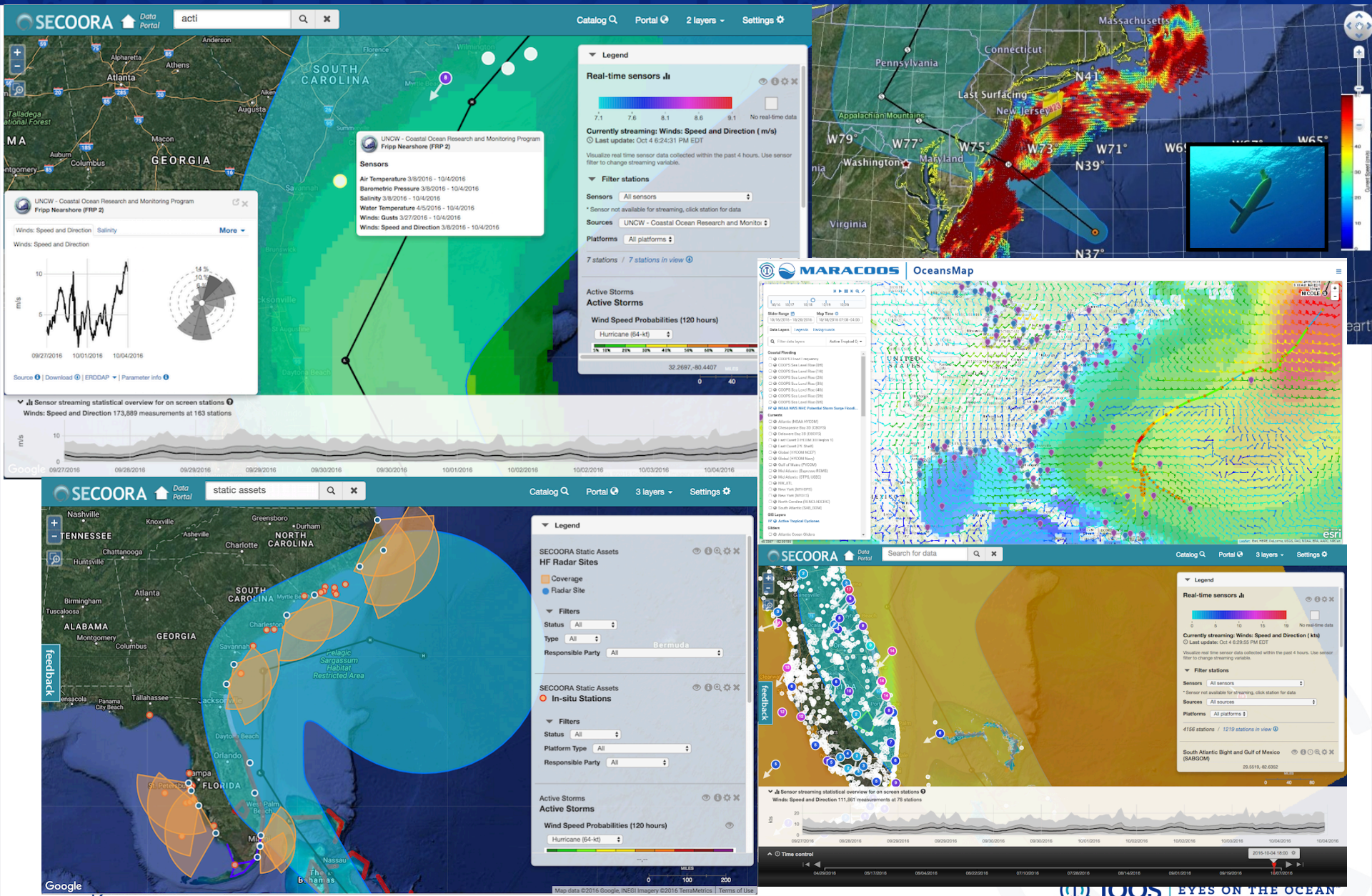
Challenges and Approaches

RNRF Charge:

Case studies highlighting the use of data and innovative technologies to answer questions and facilitate informed responses to environmental issues.

- What unique challenges were faced in collecting, storing and accessing relevant, high quality data? What approaches were key to success?
- Is data readily available for this need? What information would be valuable to have?
- What data science/ analytical techniques were applied?
- How have partnerships facilitated data access and improved technological and analytical capabilities?
- How is this application being used as a decision-making tool for on-the-ground action?

Public Good: Supporting Hurricane Response



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U.S IOOS By The Numbers

17
Federal Partners
Providing a Federal Backbone for IOOS

11
Regional Associations
Observing Assets and Data Feeds

1
Alliance for Coastal Technologies
A partnership supporting sensor evaluation and verification

1
Coastal Ocean Modeling Testbed
COMT - a conduit for research models to transition to operations

1
Marine Biodiversity Observing Network
MBON integrates marine biodiversity and ecosystem data

697
National Platforms
Buoys, Water level guages, Coastal and Estuary stations at the National level

254
Regional Platforms
Buoys, Water level guages, Coastal and Estuary stations at the Regional level

9
Ocean Technology Transition Projects
OTT supports transition of marine sensors to operations

15
Animal Telemetry Projects
Providing data on animal responses to the ocean and environment

140
HF-Radar Installations
High-Frequency Radar measures speed & direction of ocean currents

41,820
Glider Days
1 Glider in the water collecting data for 1 day

8
QARTOD Manuals
Realtime Oceanographic Quality Assurance

>15,000
Datasets
Oceanographic Datasets available in the IOOS Catalog

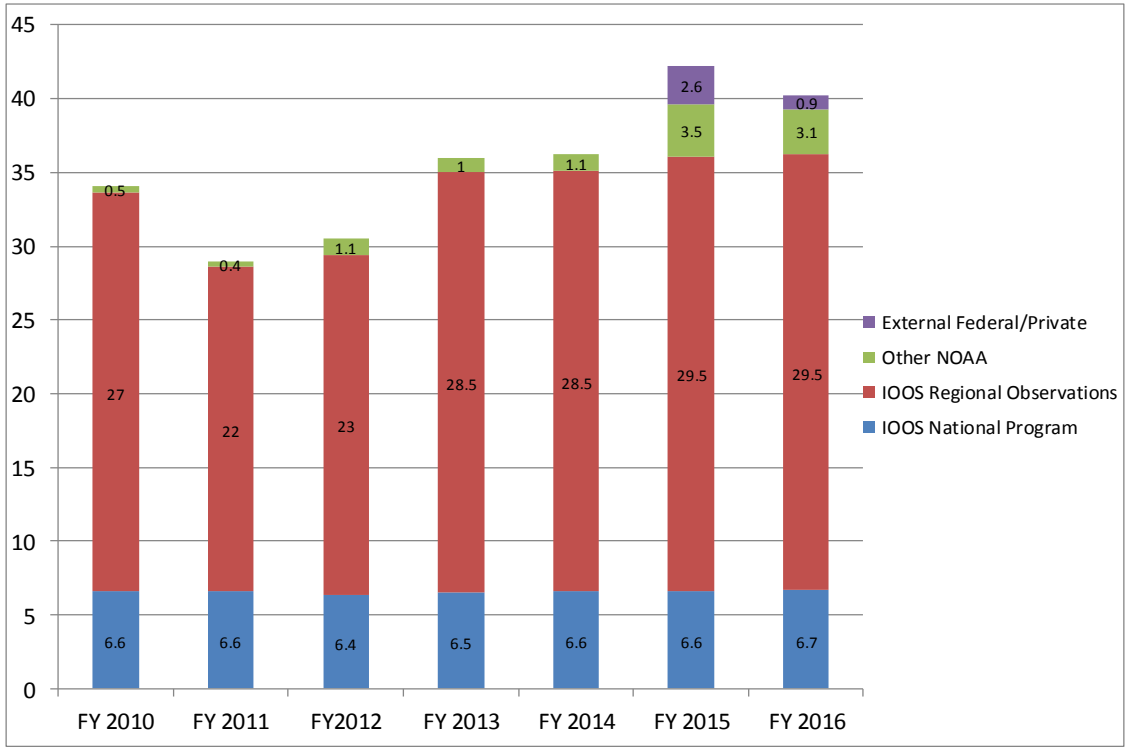
42
Servers
Top-level domains hosting data access

1
IOOS
Integrated Ocean Observing System

Programmatic - 2016

Budget History FY10-FY16

$ in M



IOOS Office Primary Roles:

Provide Programmatic Leadership

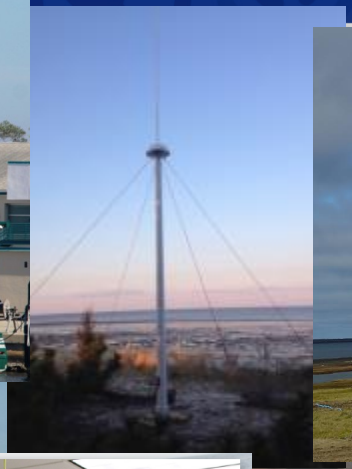
Foster Operational Capability

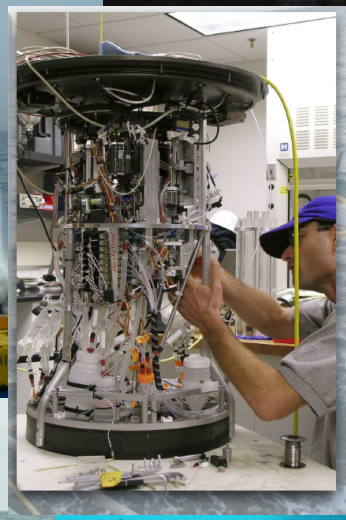
Forge Robust Partnerships

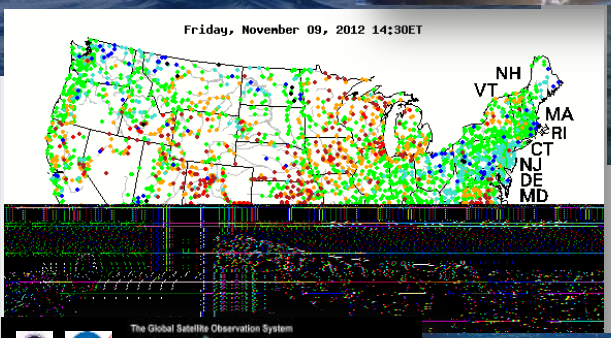
Champion Regional and Stakeholder Interests

Tools of the Trade

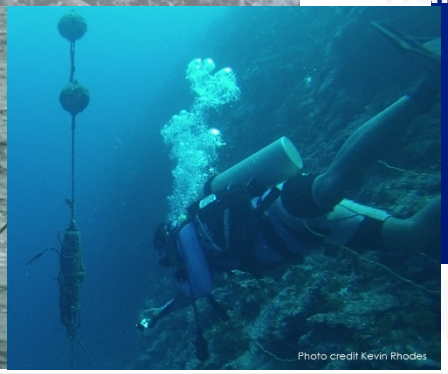
R/V Weatherbird II







Harry B Bigelow



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