



NOAA's Approach to Data Integration and Standards within the U.S. Integrated Ocean Observing System (IOOS)

**University Consortium for Geographic Information Science
2008 Winter Meeting
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IOOS

INTEGRATED OCEAN OBSERVING SYSTEM™

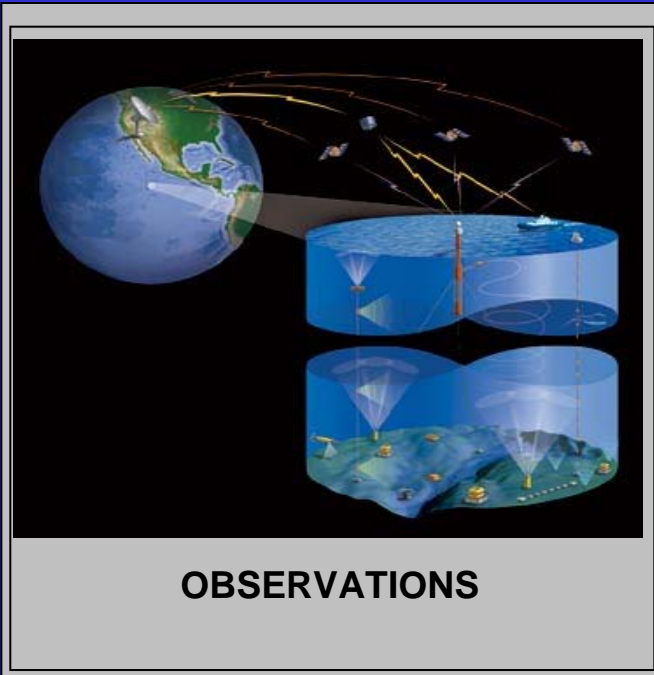


Outline



- U.S. Integrated Ocean Observing System (IOOS)
- The U.S. IOOS Challenge
- NOAA' Support of the U.S. IOOS
- National Approach to U.S. IOOS Standards
- International Approach to ocean observations (*in situ*) data management and exchange
- Summary

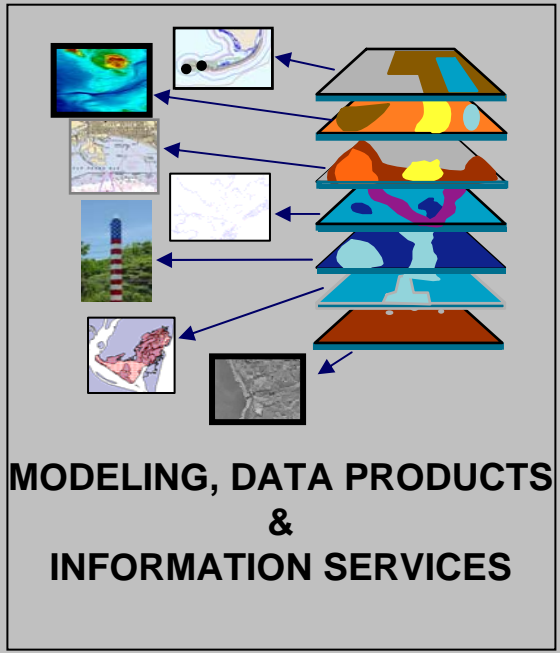
The IOOS is a coordinated national and international system of systems that is comprised of observations and data transmission, data management and communications (DMAC), and data analysis and modeling that routinely and continuously acquires and disseminates quality controlled data and information on past, present and future states of the oceans and Great Lakes. It is a multi-disciplinary system that provides data in forms and rates required by decision makers.



Platforms, sensors, sampling devices, and measurement techniques



Metadata, Data Discovery, data Transport standards & Protocols, archive, data security



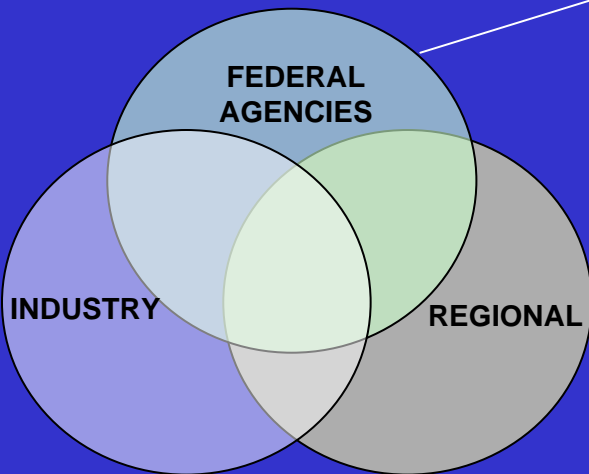
Data assimilation, Observing System Simulation Experiments, Decision support tools



U.S. IOOS: A National Endeavor



U.S. IOOS





The IOOS Challenge: Data Integration



Societal Challenges

The global climate is not well understood

Coastal populations are at risk from weather, climate & natural hazards

Our ocean, coastal and Great Lakes ecosystems are complex; many are at risk

Expanding the Marine Transportation System

Information Needs

Characterize the state of the global climate system and its variability

Improved models (e.g., hurricane intensity, coastal inundation, and harmful algal bloom model)

Improved ecosystem assessments

Updated management approaches

Improved access to data, and scientific information

IOOS Core Variables

Temperature
Salinity
Sea Level
Surface currents
Ocean color
 Bathymetry
 Surface waves
 Ice distribution
 Contaminants
 Dissolved nutrients
 Fish species
 Fish abundance
 Zooplankton species
 Optical properties
 Heat flux
 Bottom character
 Pathogens
 Dissolved O₂
 Phytoplankton species
 Zooplankton abundance

NOAA Decision - Support Tools

Hurricane Intensity Model

Coastal Inundation Model

Harmful Algal Bloom Model

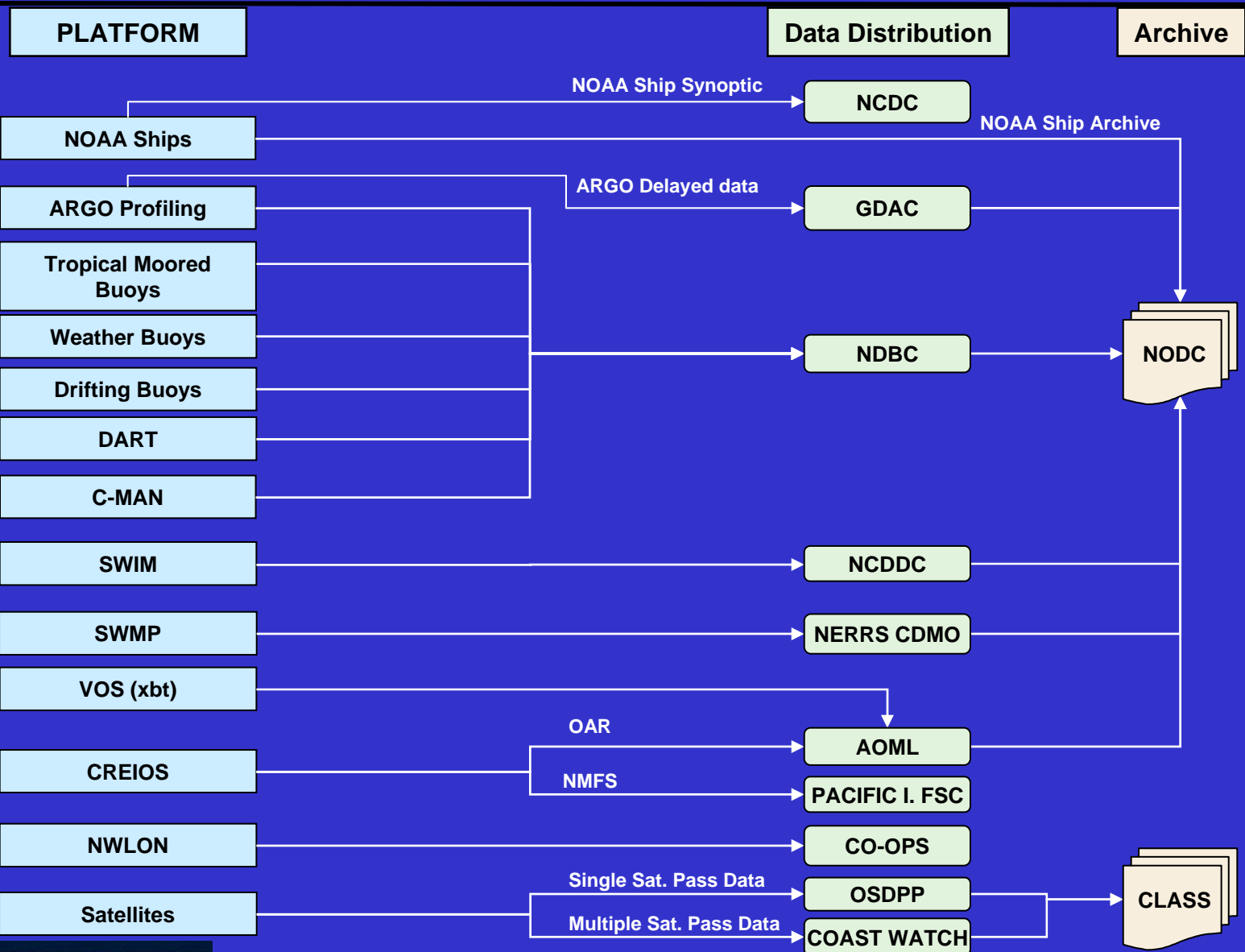
Integrated Ecosystem Assessment

Integration

Long-term data series, coordinated in space and time

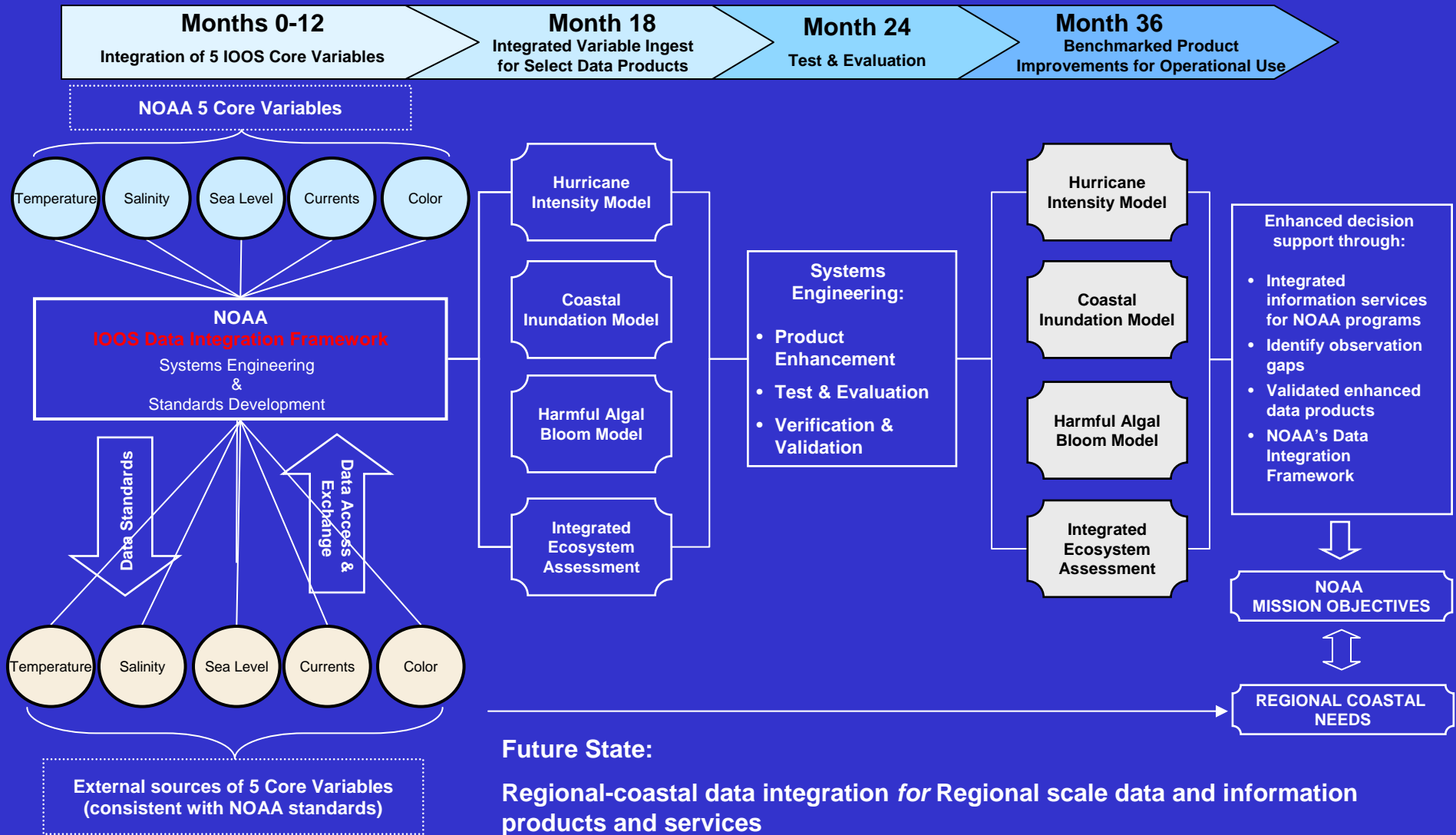


Data Integration Challenge - Temperature (Example)





NOAA's Approach to Supporting National IOOS: The Data Integration Framework (DIF)





NOAA's DIF Approach



- Cross-NOAA expertise is leveraged to design, develop, and implement the DIF
 - Represent data providers, data users (customers), and other data management experts.
 - Working groups are formed to execute specific development tasks (e.g. data standards and CONOPS)

Integrated Products Team

Chair, Charles Alexander – NOAA IOOS Program

National Weather Service

Dan Henderson	Walter Smith
Hendrik Tolman	Steve Baig
Chung Wu	Bill Burnett

National Env. Satellite Data & Informtn. Service

Ken Casey	Kent Hughes
Julie Bosch	Ken McDonald*

National Marine Fisheries Service

Roy Mendelssohn	Jim Sargent
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National Ocean Service

Katie Fisher	John Ulmer
Daniel Martin	Andrea Hardy
Rebecca Love	Shelley Tomlinson
Whitley Saumweber	Rich Patchen
Hugh Johnson*	Jack Harlan (IOOS Pgm)*
Josh Pederson	Anne Ball (CSC/Ocean.US)*

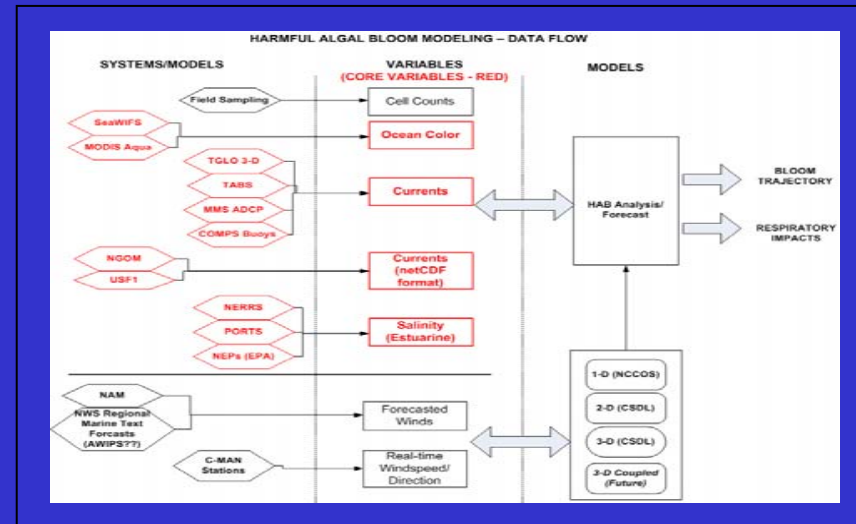
Oceanic and Atmospheric Research

Steve Hankin	Mike Johnson*
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*ex-officio (non-voting) members

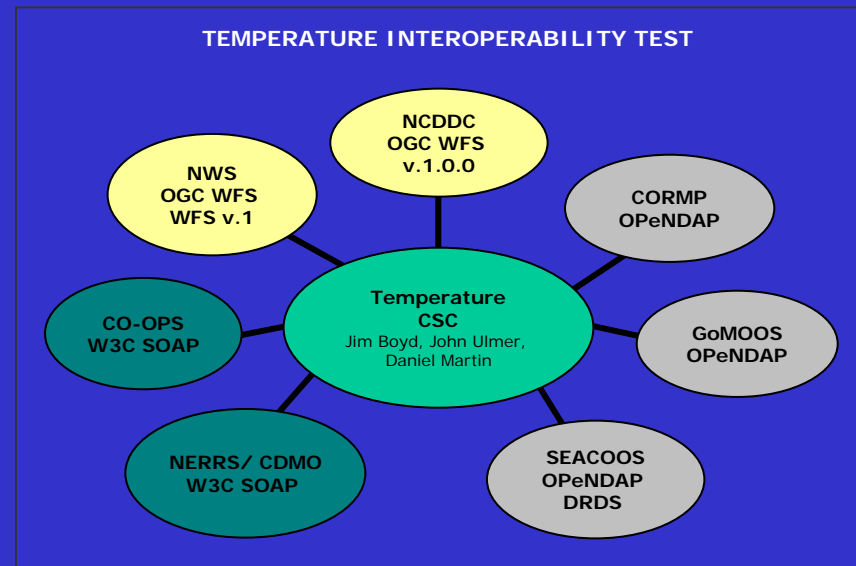
Characterizing the Current State

- Defined DIF requirements determined from several rounds of “customer” meetings.
 - Based on these requirements completed systems engineering data flow analyses for four targeted NOAA decision-support tools
- Five, cross-NOAA Interoperability Tests:
 - Consistent findings across various tests:
 - Lack of standards impedes data integration and access across the agency
 - Documented critical data management challenges to design effective solutions for integration



Implementing Solutions

- Completed project plan, requirements, and “as-is” baseline condition documents based on findings
- Transitioning from planning to execution



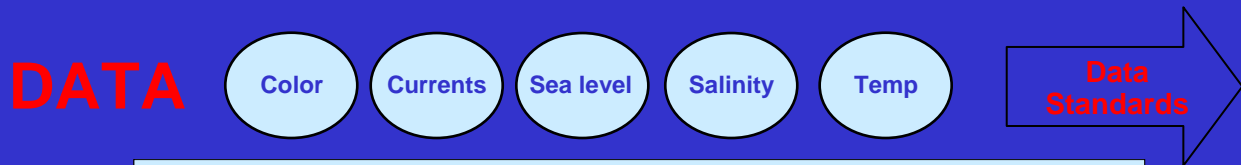
* Colors reference server type (WFS, OPeNDAP, etc.)



The Complexity of Standards



Common Data Sharing Infrastructure To facilitate unified access to distributed data



DIF STANDARDS: FUNCTIONAL CATEGORIES

		Data Discovery	Data Transport & Access	Metadata	Uniform on-line Browse	Data Archive	IT Security	QC/QA
D A T A T Y P E S	Grids		X	X			X	X
	Scattered Points							
	Trajectories							
	Time Series		X	X			X	X
	Moving sensor		X	X				
	Profiles		X	X			X	X
	Geospatial Mapping data							
	Metadata		X	X			X	X



NOAA DIF Execution in 2008



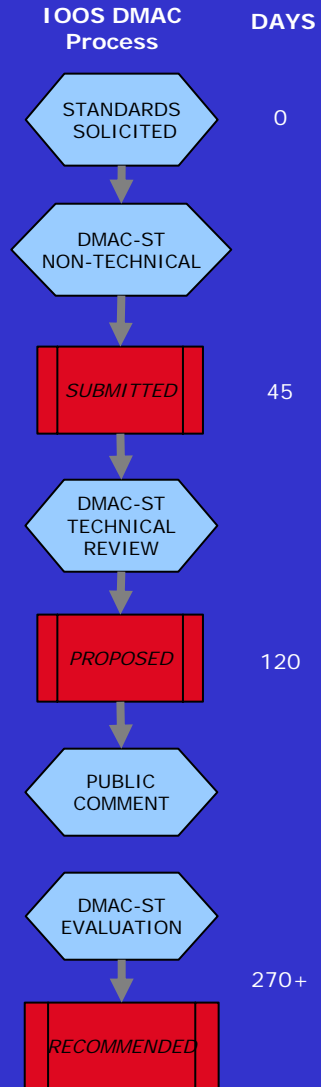
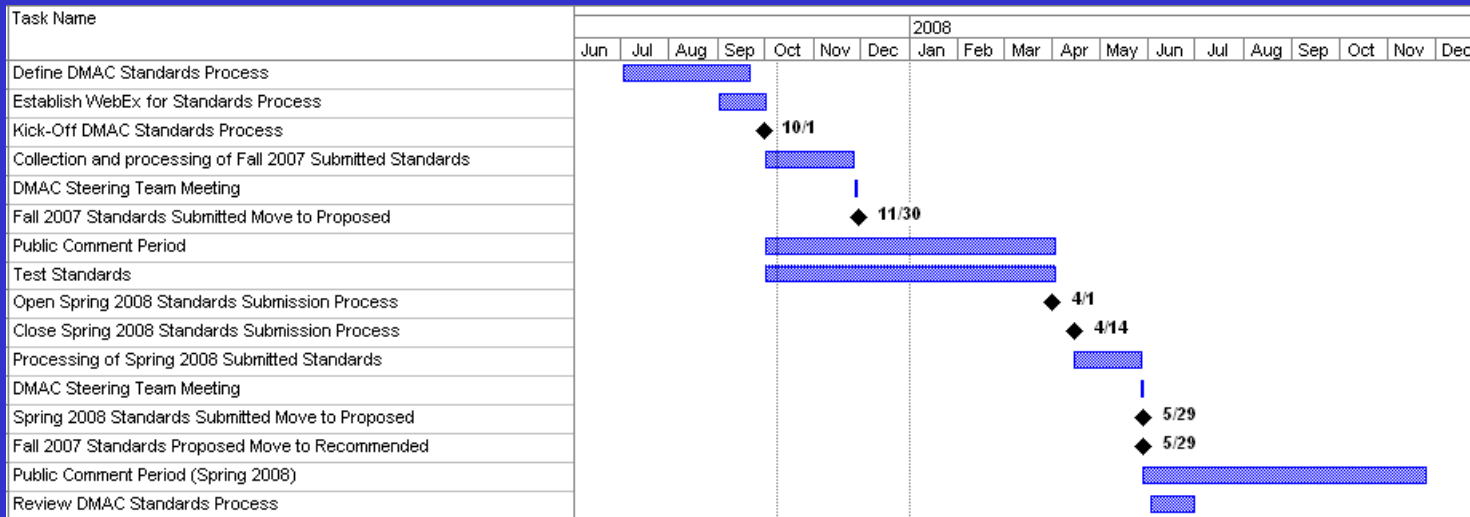
- Data Standards Identification and Development
 - Data content standard for 5 IOOS variables and associated encodings
 - Transport standards: OGC WFS, WCS and WMS
- Data provider implementation – CO-OPS, NDBC, CoastWatch
 - Data content and transport standards for 5 variables implemented
- “Customer” implementation
 - Currents for HABs for Eastern Gulf
 - Investigate feasibilities for candidate implementations for CI, IEAs



U.S. IOOS Data Standards Process



Implementing U.S. IOOS DMAC Process



- Process is executed through the DMAC Steering Team (ST) with membership drawn from government, academia, industry, public, and non-profit communities.
- DMAC ST is supported by community based Expert Teams, community engagement Caucuses, and Working Groups
- Process has never been exercised due to resource limitations
- NOAA IOOS Program provided detail to the process, established the web-enabled tools to execute the process, will oversee this national standards process, and will improve the process based on lessons learned



IODE/ JCOMM Forum on Oceanographic Data Management and Exchange Standards



- “The objective of this series of meetings is to get broad agreement and commitment to adopt a few standards related to ocean data management and exchange, thereby assembling not only the agreed conditions by which we operate, but in fact enact these agreements in our respective organizations.”
- First Session of the Forum was held 21-25 January 2008 at the IOC Project Office for IODE in Oostende, Belgium.
- The U.S., through NOAA, was a co-sponsor of the event.
- Participants included experts across the global marine ocean data community.
- Several parameters (temperature, salinity, sea level, currents) and functional areas (Vocabularies, Metadata, Quality Control) discussed align with those being addressed by the NOAA IOOS DIF.
- Consensus outcomes included:
 - The U.S. DMAC Standards Process will be emulated and executed through the appropriate JCOMM/ IODE working groups;
 - Consensus reached on recommendation of preliminary standards for specific uses
 - » A single page document with the recommendations is forthcoming



Summary

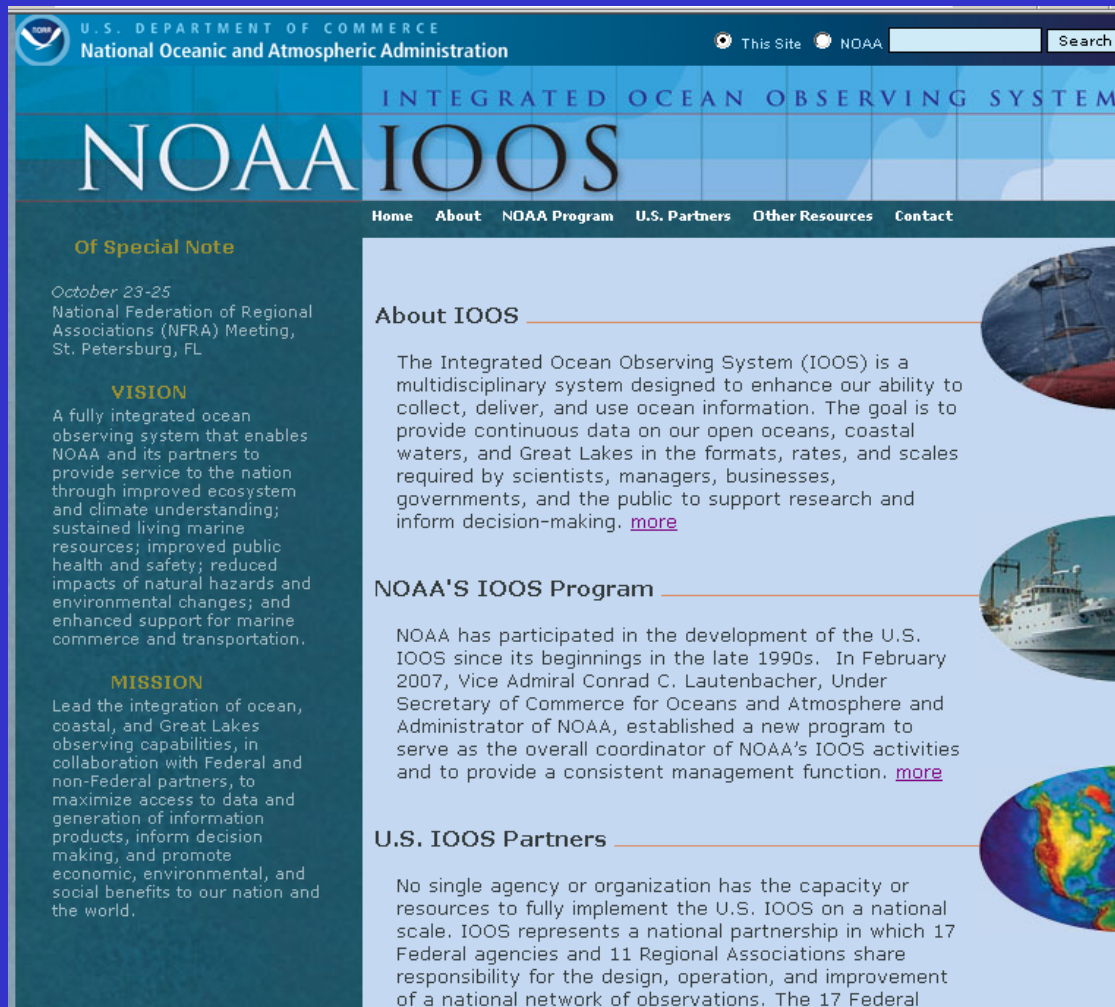


- NOAA's Approach to data integration and standards within IOOS is three-fold:
 - Within NOAA we are working to identify a set of data management standards that will contribute to a data integration framework that will enable integration of oceanographic data.
 - On a national level:
 - » NOAA IOOS DIF will be flexible and extensible to be of value to the broader U.S. IOOS community.
 - » We are participating in the U.S. IOOS DMAC standards process, both by submitting those standards identified for the DIF to the U.S. IOOS DMAC standards process, and by supporting the operation and execution of this process.
 - Internationally, we are participating in intergovernmental forums working to establish internationally accepted standards for ocean data management and exchange.



QUESTIONS???

www.ioos.noaa.gov



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

INTEGRATED OCEAN OBSERVING SYSTEM

NOAA IOOS

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Of Special Note

October 23-25
National Federation of Regional Associations (NFRA) Meeting, St. Petersburg, FL

VISION
A fully integrated ocean observing system that enables NOAA and its partners to provide service to the nation through improved ecosystem and climate understanding; sustained living marine resources; improved public health and safety; reduced impacts of natural hazards and environmental changes; and enhanced support for marine commerce and transportation.

MISSION
Lead the integration of ocean, coastal, and Great Lakes observing capabilities, in collaboration with Federal and non-Federal partners, to maximize access to data and generation of information products, inform decision making, and promote economic, environmental, and social benefits to our nation and the world.

About IOOS

The Integrated Ocean Observing System (IOOS) is a multidisciplinary system designed to enhance our ability to collect, deliver, and use ocean information. The goal is to provide continuous data on our open oceans, coastal waters, and Great Lakes in the formats, rates, and scales required by scientists, managers, businesses, governments, and the public to support research and inform decision-making. [more](#)

NOAA'S IOOS Program

NOAA has participated in the development of the U.S. IOOS since its beginnings in the late 1990s. In February 2007, Vice Admiral Conrad C. Lautenbacher, Under Secretary of Commerce for Oceans and Atmosphere and Administrator of NOAA, established a new program to serve as the overall coordinator of NOAA's IOOS activities and to provide a consistent management function. [more](#)

U.S. IOOS Partners

No single agency or organization has the capacity or resources to fully implement the U.S. IOOS on a national scale. IOOS represents a national partnership in which 17 Federal agencies and 11 Regional Associations share responsibility for the design, operation, and improvement of a national network of observations. The 17 Federal



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