



IOOS: Our Eyes on the Oceans, Coasts and Great Lakes

Zdenka Willis, Director
NOAA IOOS Program

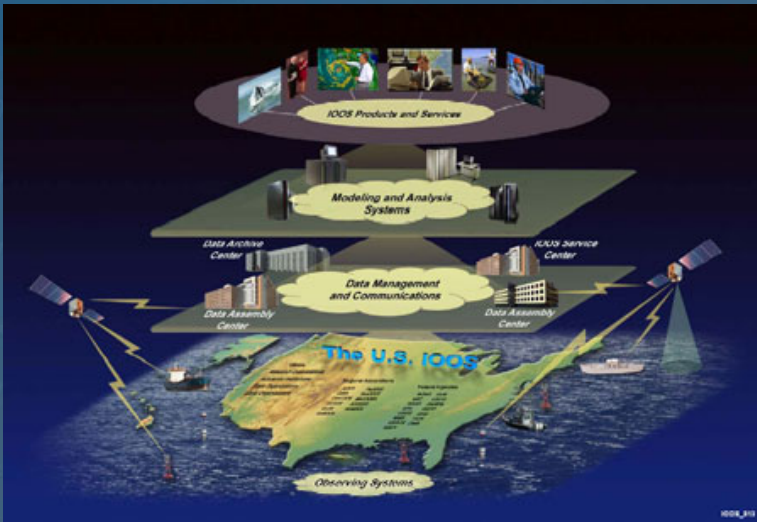
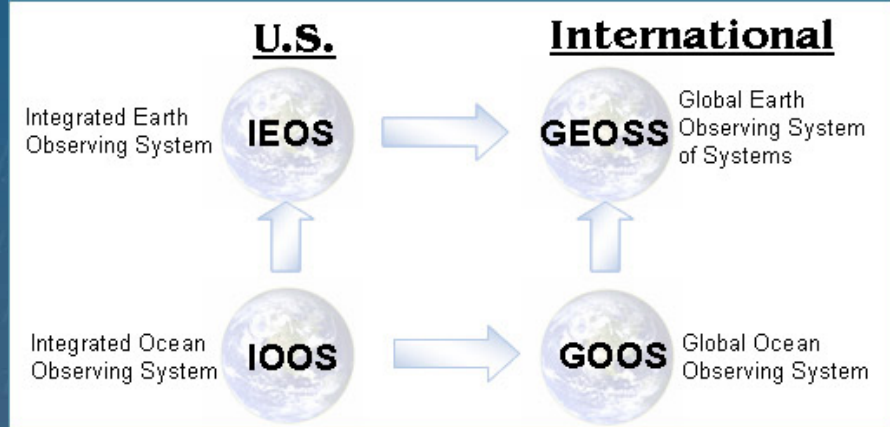
Brown Bag Seminar
July 17, 2008



US IOOS- Background

IOOS Development Plan defines:

- 1) Global Component
- 2) Coastal Component
- 17 Federal Agencies
- 11 Regional Associations



3 subsystems: Observing, Data Management and Communication, Modeling and Analysis;
 2 cross cuts: Research and Development: Education

Regional Associations



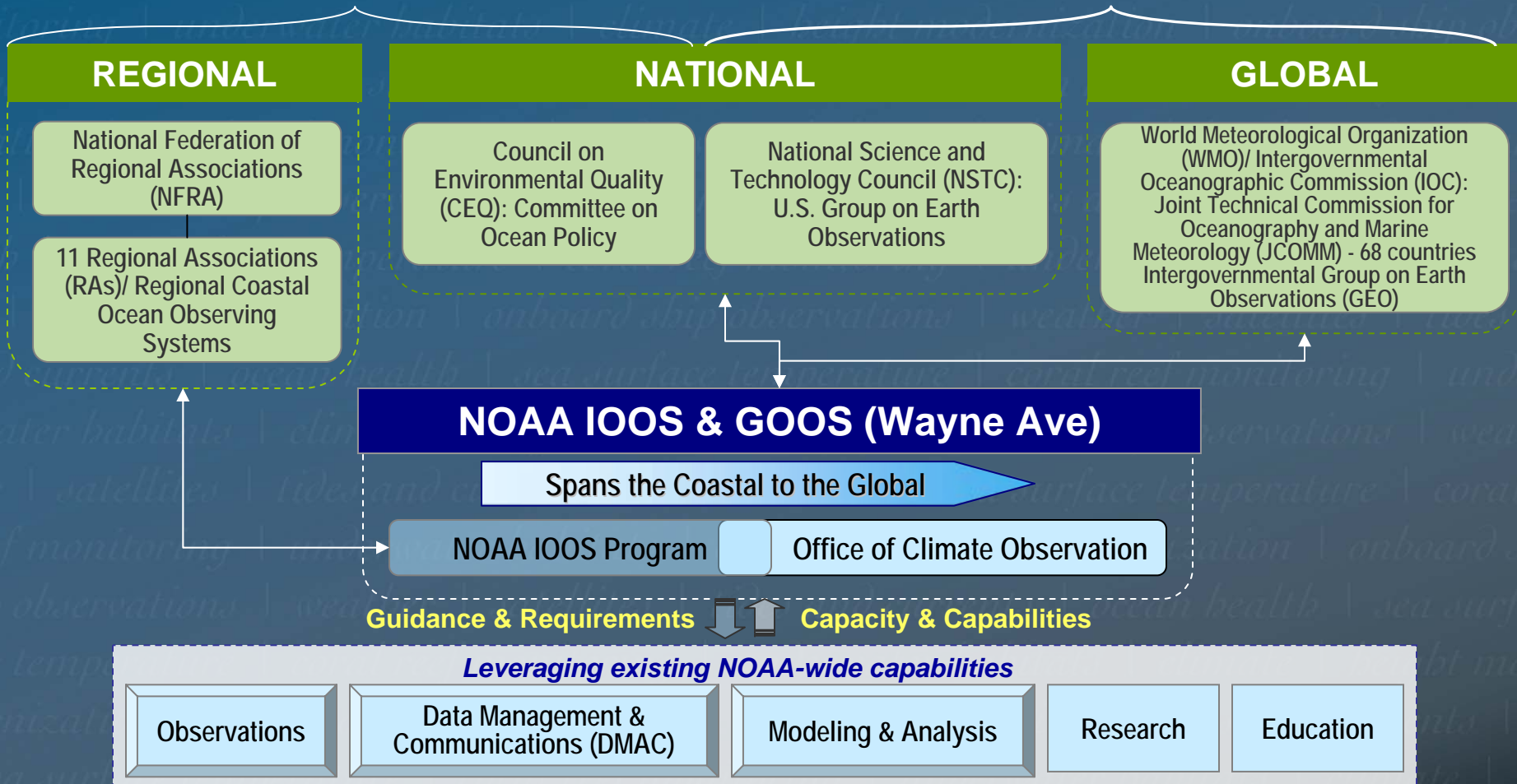
- **Is modernizing the way NOAA collects, shares, and uses ocean information**
- **Is increasing data interoperability and efficiency of operations across NOAA and the eleven IOOS regions and to our federal partners in the future**
- **Is expediting access to data for improved decision making**
- ❖ **To achieve these objectives, the Program focuses its contributions in two main areas:**
 - 1. Developing the IOOS Data Integration Framework (NOAA DIF-to-National DMAC)**
 - 2. Managing the regional IOOS partnership**



U.S. IOOS Structure (NOAA)

COASTAL COMPONENT (Regional and Federal)

GLOBAL COMPONENT





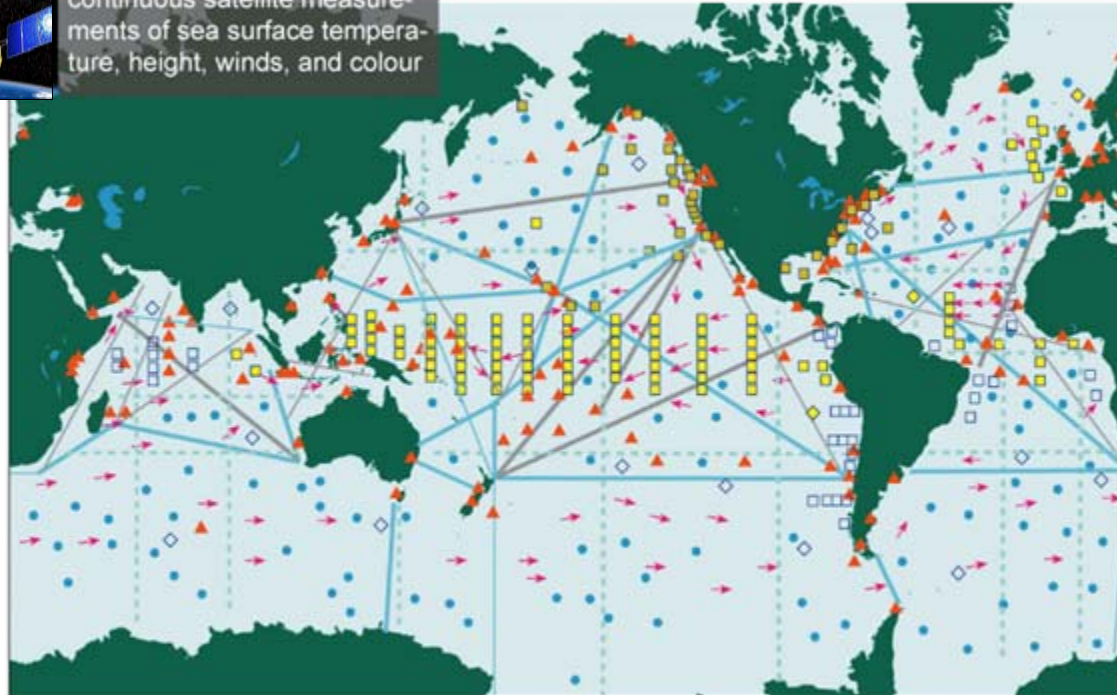
Initial Global Ocean Observing System for Climate Status against the GCOS Implementation Plan and JCOMM targets

Total *in situ* networks **60%**

February 2008



continuous satellite measurements of sea surface temperature, height, winds, and colour



87% Surface measurements from volunteer ships (VOSclim)

200 ships in pilot project



100% Global drifting surface buoy array

5° resolution array: 1250 floats



62% Tide gauge network (GCOS subset of GLOSS core network)

170 real-time reporting gauges



81% XBT sub-surface temperature section network

51 lines occupied



100% Profiling float network (Argo)

3° resolution array: 3000 floats



43% Repeat hydrography and carbon inventory

Full ocean survey in 10 years

Reference time series **24%**

58 sites



48% Global reference mooring network

29 moorings planned



79% Global tropical moored buoy network

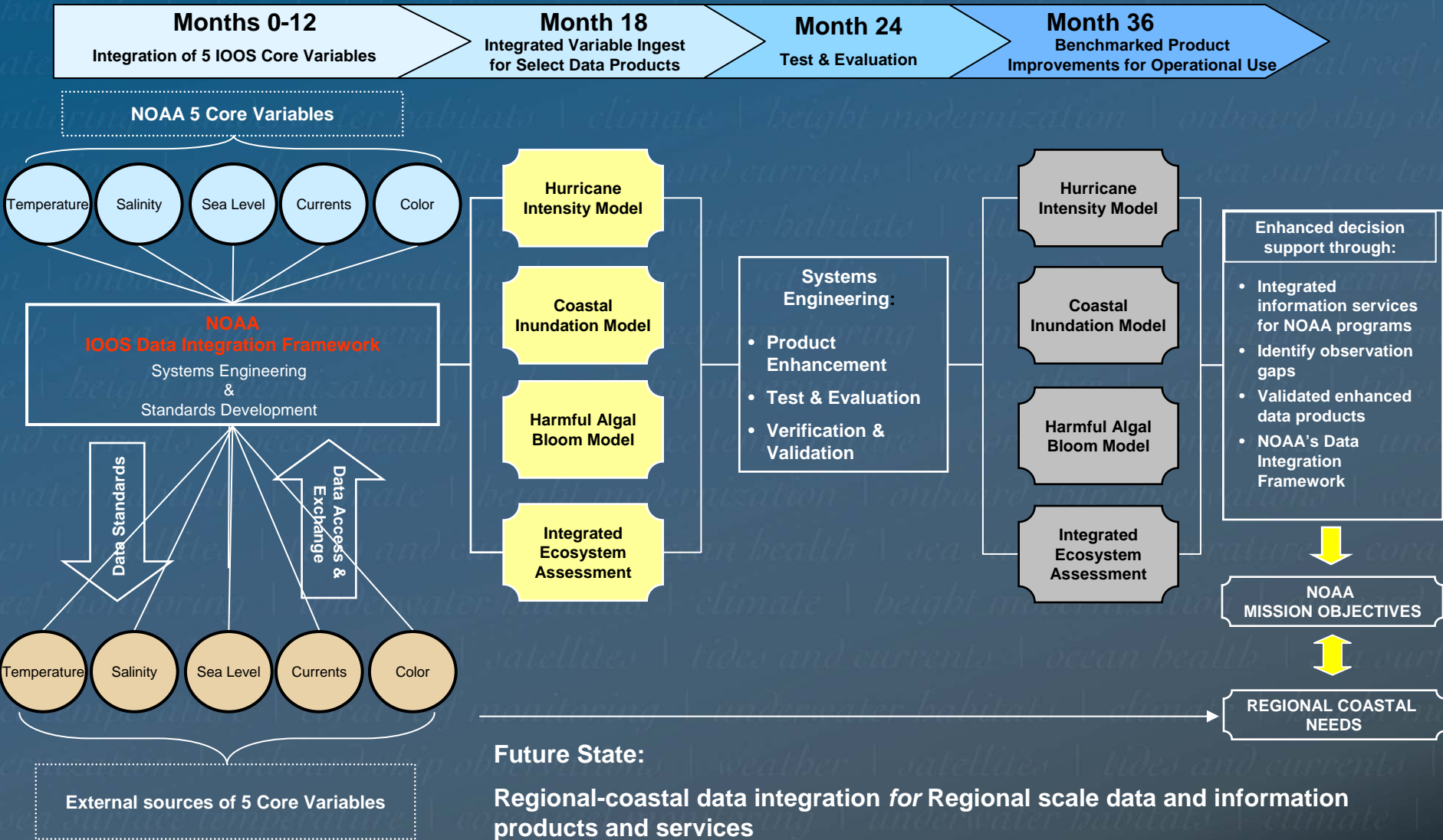
119 moorings planned



I N T E G R A T E D O C E A N O B S E R V I N G S Y S T E M

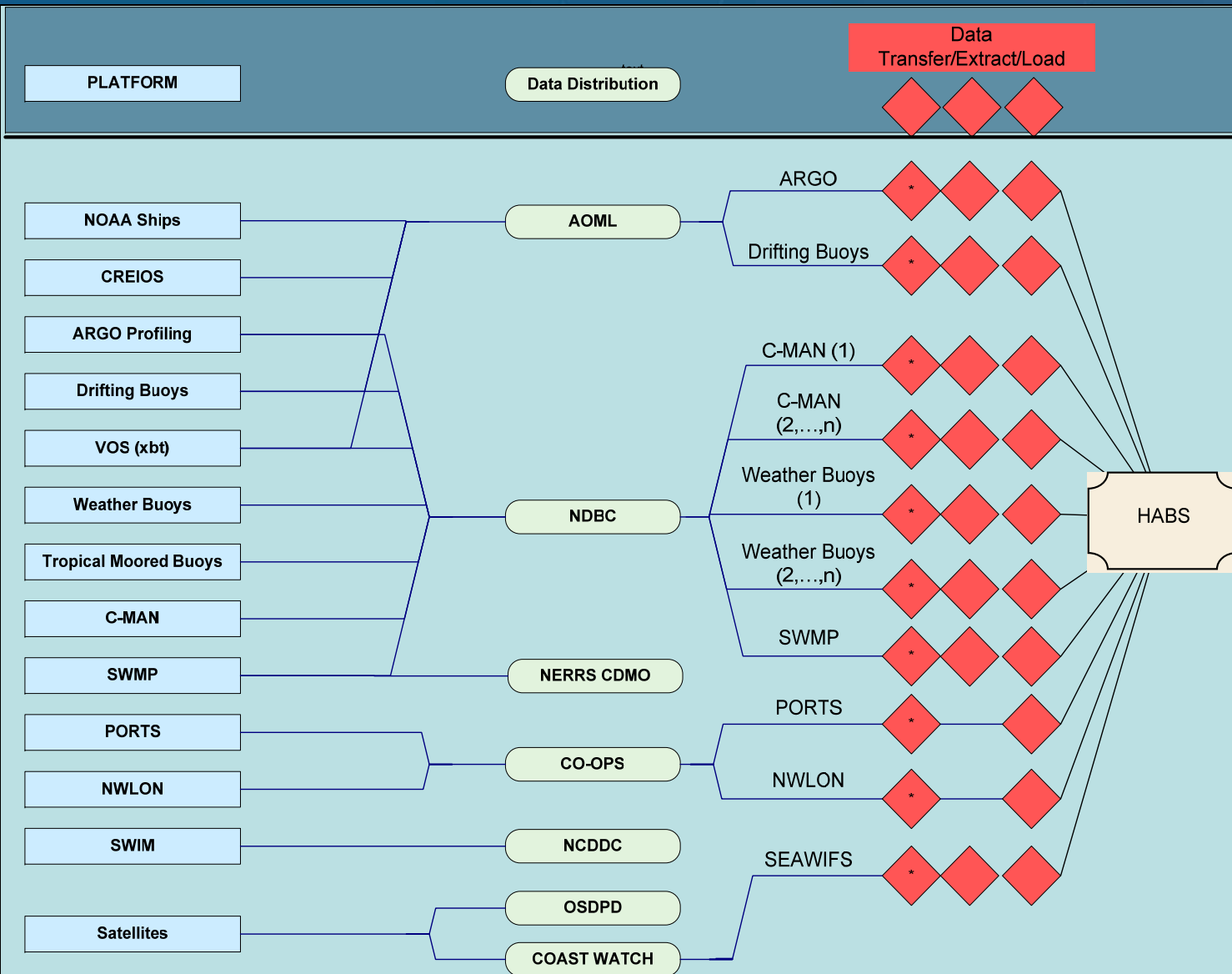


Data Integration Framework (DIF)





Integration Problem: Multiple, Unique, Independent



- 10 distinct data requests
- 10 individual algorithms to convert data to model format
- 10 different load functions to ingest data
- Any change by the data provider requires a down-stream change to all the algorithms

- Inefficient (Only requested data, not all available data)
- Costly processing (Labor hours)
- Time consuming
- Highlights stovepipe data management



DIF Coordination

Functional Requirements (completed)

- NESDIS/NCDDC
- NOS/CSC
- NWS/NDBC
- NMFS/SWFSC
- NESDIS/NGDC
- NWS/NCEP
- OAR/PMEL
- NOS/CO-OPS

Harmful Algal Blooms

- NOS/NCCOS
- NOS/CO-OPS
- NWS/NDBC

Coastal Inundation

- NWS/TPC
- NOS/CO-OPS

Data Standards (completed)

- NESDIS/NCDDC
- NESDIS/NGDC
- OAR/PMEL
- NOS/CSC

Integrated Products Team

Chair, Charles Alexander – NOAA IOOS Program

National Weather Service

Dan Henderson	Walter Smith	Bill Burnett
Hendrik Tolman	Steve Baig	Avichel Mehra

National Environmental Satellite Data & Information Service

Ken Casey	Kent Hughes	Paul Digiacomio
Julie Bosch	Ken McDonald*	Jennifer Frye
Ted Habermann		

National Marine Fisheries Service

Roy Mendelssohn	Jim Sargent
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National Ocean Service

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

Oceanic and Atmospheric Research

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

Design (being formed)

- NOS
- NESDIS
- NMFS
- NWS
- CSC

CONOPS (completed)

- NESDIS/ORA
- NMFS/SWFSC
- NWS/NDBC
- NOS/CSDL
- NOS/CSC
- NWS/NCEP
- NWS/EMC

Metadata

- NESDIS/NGDC
- NESDIS/NCDDC

Web Services and Data Encodings

Jeff de La Beaujardiere – IOOS Program Office (Chair)

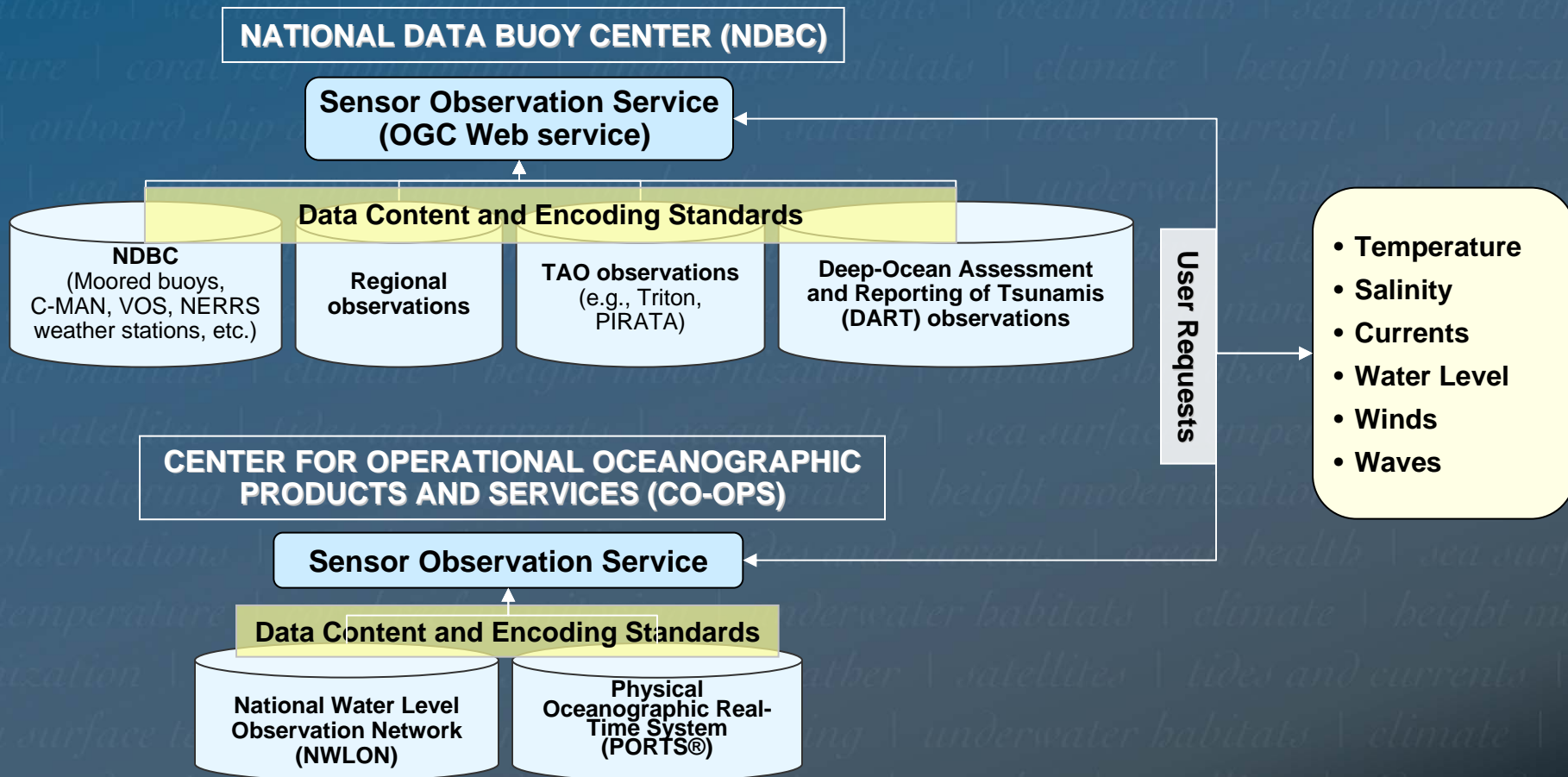
- Steve Hankin – OAR/PMEL
- Rich Patchen – NOS/CSDL
- Julie Bosch – NESDIS/NCDDC
- John Ulmer – NOS/CSC
- Daniel Martin – NOS/CSC
- Ted Haberman – NESDIS/NGDC
- Bill Burnett – NWS/NDBC
- Roy Mendelssohn – NMFS/SWFSC
- Paul Daisey – Image Matters
- Charlton Galvarino - SECOORA
- Ken Casey – NESDIS/NODC
- John Cartwright – NESDIS/NGDC
- Tess Brandon – NESDIS/NODC
- Andrea Hardy – NOS/CO-OPS
- Darrell Duncan – NWS/NDBC
- Luis Bermudez - SURA
- Eric Bridger - GOMOOS
- Eoin Howlett – MARCOOS
- Jeremy Cothran - SECOORA



DIF Implementation

Developing the IOOS Data Integration Framework

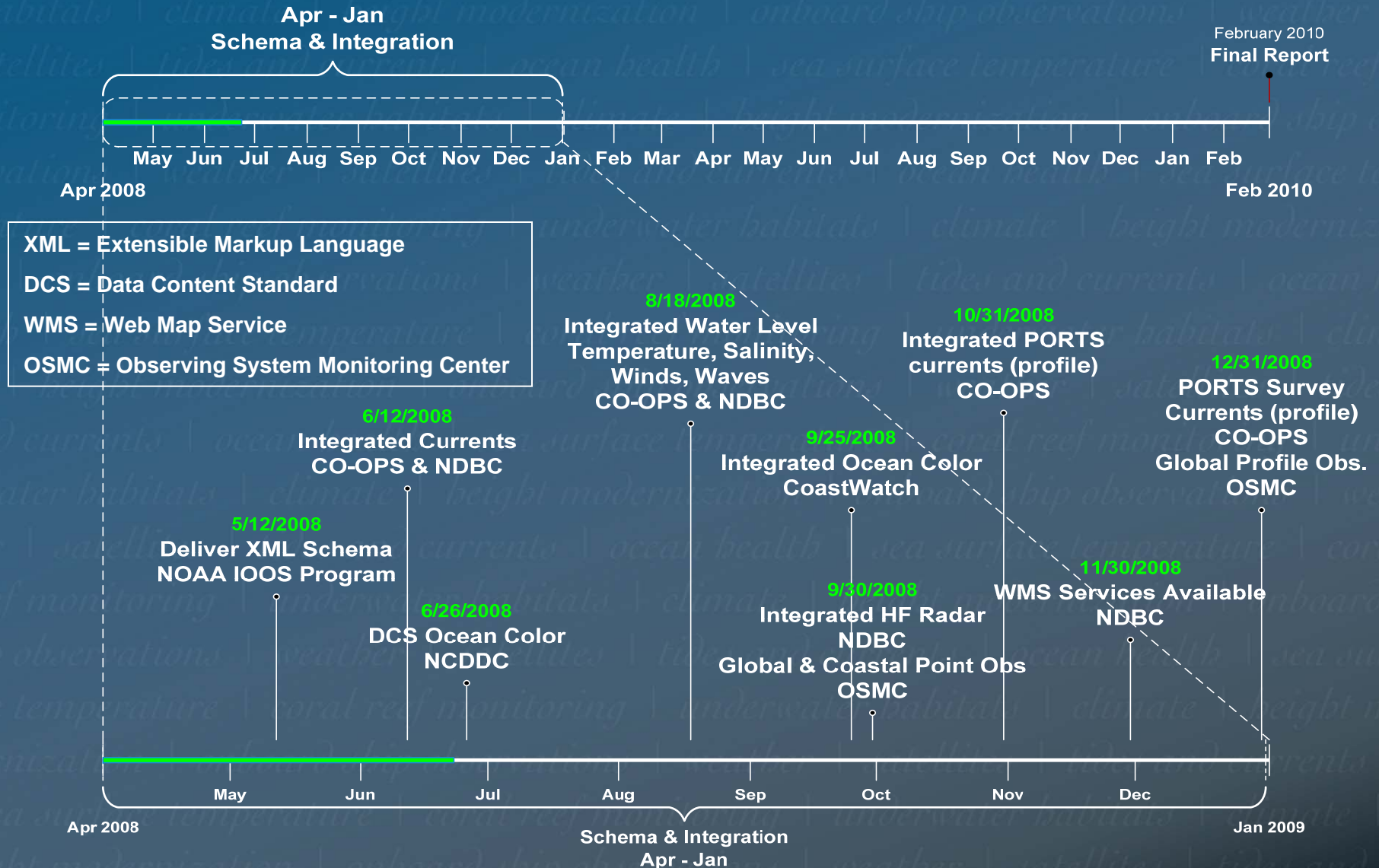
IOOS DIF implemented at major data providers, enabling delivery of interoperable NOAA data from multiple observing systems





DIF Implementation Schedule

Developing the IOOS Data Integration Framework





Coastal Inundation

Developing the IOOS Data Integration Framework

- **Enhancements to SLOSH model display program**
 - Integration of water level information with storm surge output
 - For real time SLOSH model runs
- **Partners –**
 - NWS MDL, NWS TPC
 - NOS CO-OPS
 - Selected WFOs and (possibly) emergency managers
- **Kick off meeting held June 25; monthly coordination concalls**
- **Key tasks –**
 - **Modify SLOSH display program to accept water level observation and products in DIF formats/ NAVD88 datum**
 - **Enhance SLOSH display with water level data layers**
 - **Determine value of integrated data available in consistent formats**



Harmful Algal Bloom Forecast System

Developing the IOOS Data Integration Framework

- **“Phase 1”**
 - Integration of surface currents data from NDBC and CO-OPS into HAB-FS Bulletin software (CSC)
 - To be completed by end of Sept. 08 (FY08)
- **Partners**
 - CO-OPS
 - NCCOS - CCMA
 - CSC (through end of FY08; CO-OPS will absorb these responsibilities)
- **“Phase 1” SOW being implemented now**
- **“Phase 2” – remaining currents (HF Radar, Modeled currents, profiles); winds, ocean color; under discussions with HABs partners to assess FY09 plan and SOW**
- **Key tasks for Phase 1 –**
 - Write ingest script; parse data as needed; convert to Google Map layer; integrate with other data layers in bulletin generation software
 - Test, refine on CO-OPS development server; move functionality to CO-OPS beta tier
 - Beta test and evaluate new data stream by HABs analysts; refine as necessary**



IOOS Data Ingest: IEA Enhancement

Developing the IOOS Data Integration Framework

Develop services transportable to all regions & priority activities

- Virtual Data Assembly Center (vDAC) for access, integration, visualization, analysis, distribution
- ERDDAP (Data Access Program) for downloading distributed data in formats of users choice
- Protect data stream and compliant with IT security standards

IOOS CA Current Pilot Project – operational successes to date

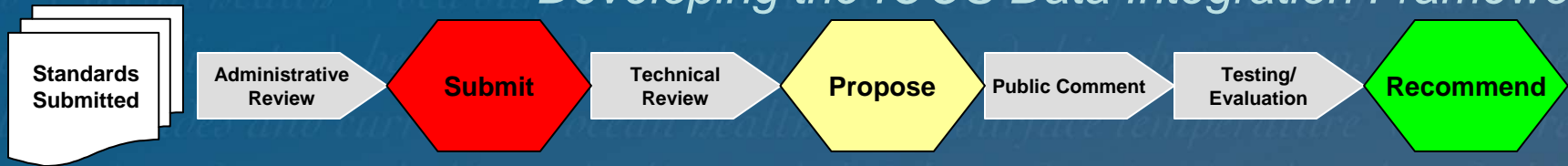
- Nearly 400 data sets available through IOOS THREDDS catalog
- Integrated and served with non-NOAA sources
- Operational for ecological analyses and IEA development
- Part of publicly-accessible DIF services

Goal — services for a ‘dynamic’ IEA for the CA Current LME, but applicable to other NOAA Priority Areas



US IOOS DMAC Standards

Developing the IOOS Data Integration Framework



- Strong DIF-DMAC connection; Interagency buy-in critical to successful development of national DMAC
- Interagency and non-Federal, community-based process
 - Approach to ‘(1) adopt, (2) adapt, (3) build new’
 - Multiple standards per variable increases complexity
- 1 Oct 2007, DMAC Steering Team: Re-initiated and resourced by NOAA
 - Developed web-based, collaborative tools
 - 270 day review process; 2 formal cycles per year
- **STATUS:** 12 standards “submitted”; 4 “proposed”; none achieved “recommended” status yet

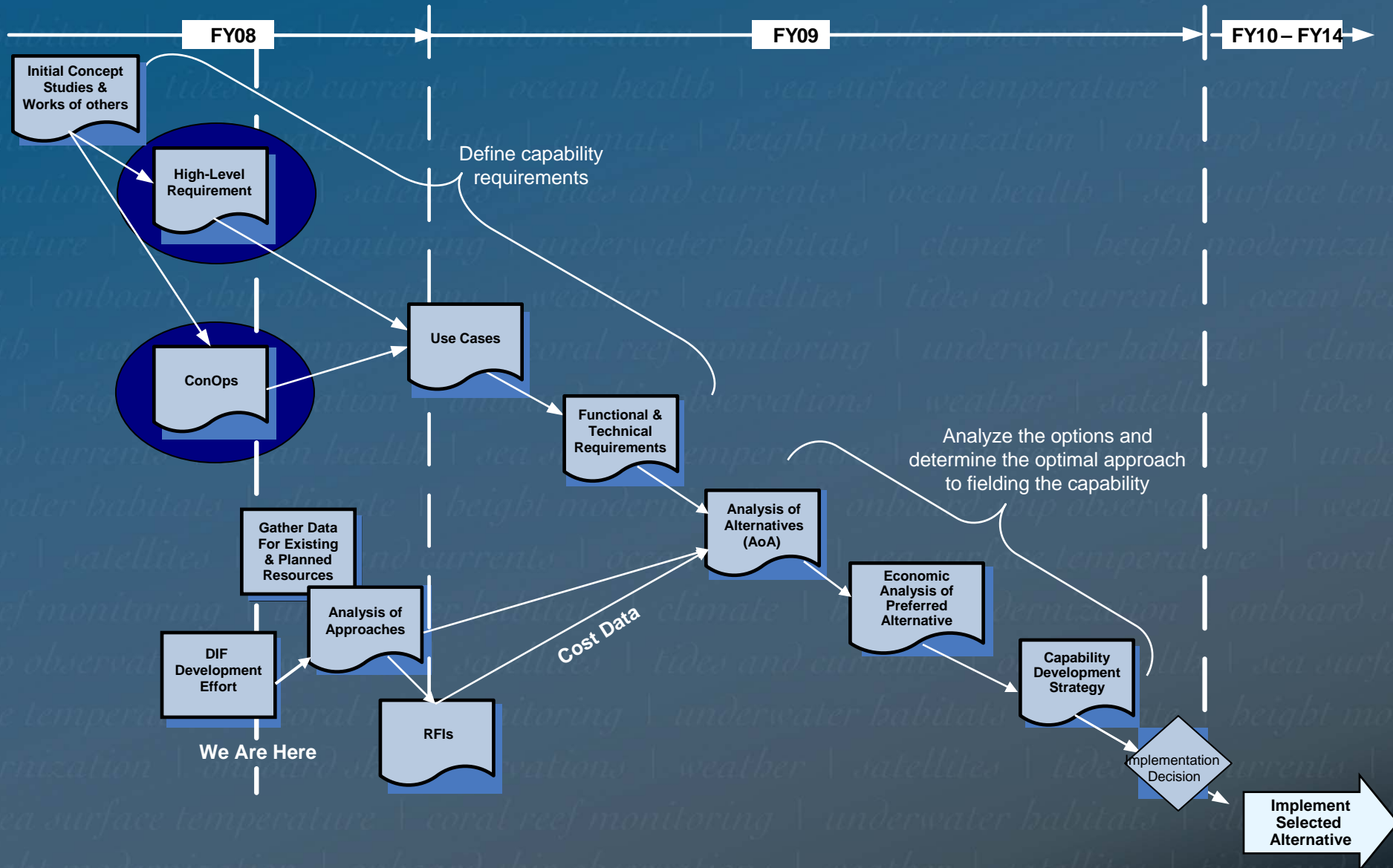


<http://ioosdmac.fedworx.org>



Pathway to a National DMAC

Developing the National IOOS Data Integration Framework



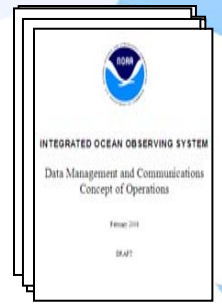
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NOAA Management & Organizations

Target	Desired Support
NOSC	Coordination across NOAA
Management	Funding, policy and direction
CIO	Technical and policy issues (NOAA common infrastructure)
Acquisition Office	Guidance, assistance and lessons learned
Misc	Buy in & acquisition approach feedback

High Level Requirements Document Concept of Operations



2



Federal Working Groups and Agencies

To obtain

- Present/ future requirements
- Perspective on DMAC scope, data, and services
- Verification of data collection links to products

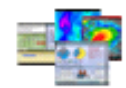
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Non-Federal Stakeholders



NFRA & Regional and Other Partners

- Align with current initiatives
- Obtain buy-in

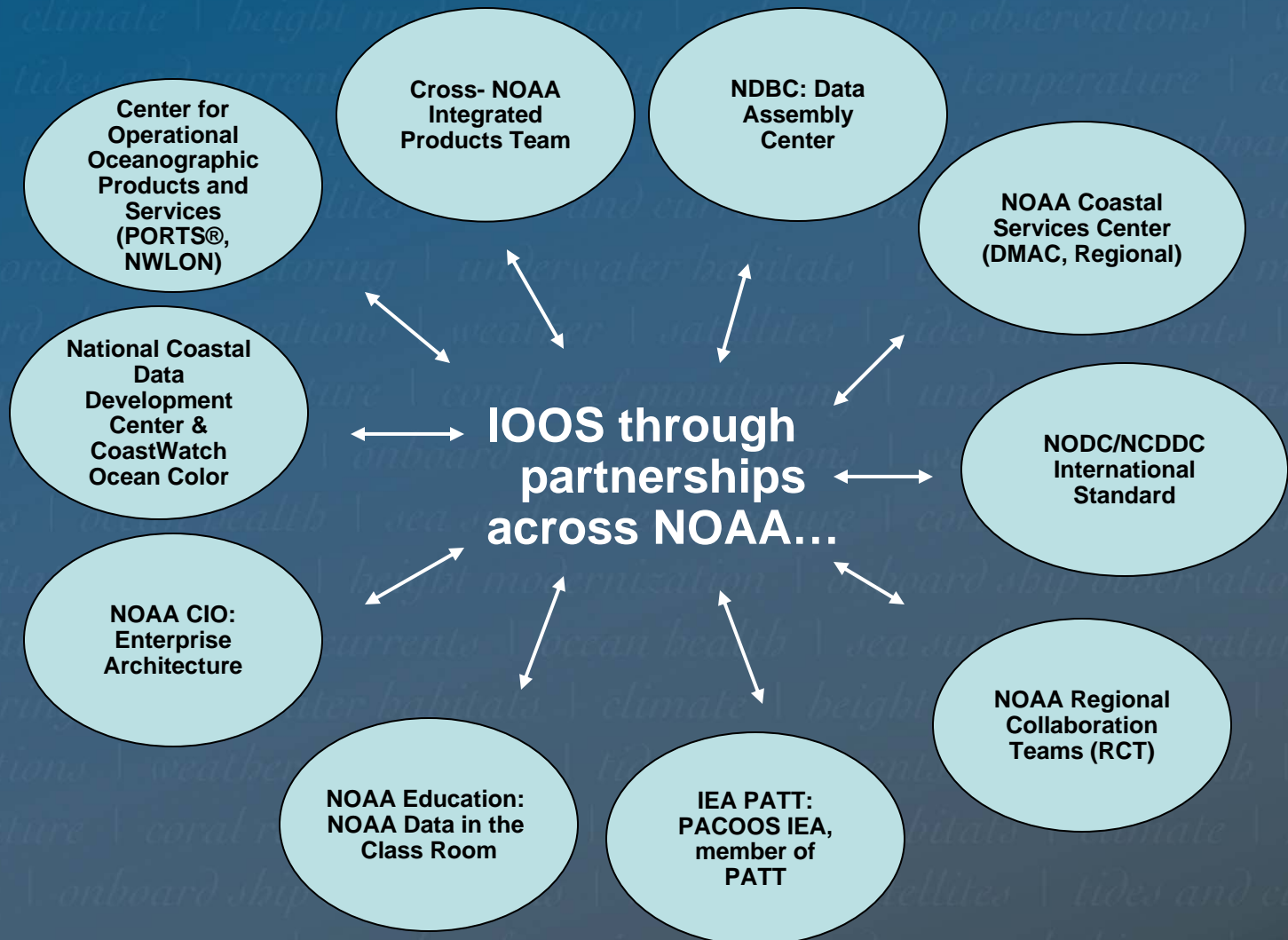


Industry

- Obtain comments on ConOps
- Solicit funding estimates (RFI)



Data and Program Integration



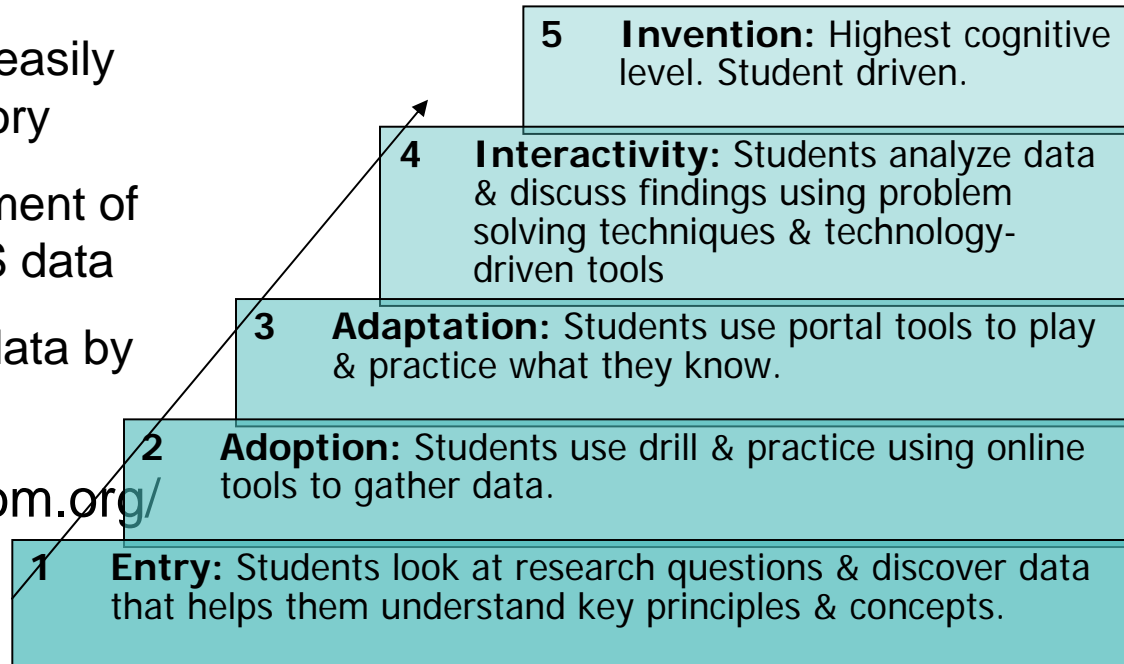


NOAA DATA EDUCATION PROJECT (NODE)

- Partnership between the National Estuarine Research Reserve System, the National Marine Sanctuaries Program, National Oceanographic Data Center (NODC), and Office of Education (OED)
- Demonstrate how data can be easily integrated to tell a compelling story
- Provide a test-bed for development of educational applications of IOOS data
- Analyze the usability of IOOS data by the non-scientific public
- <http://www.dataintheclassroom.org/>

Modules with lesson plans & activities on: water quality, sea level rise & El Nino

Leveled Scales of Interaction





Status of IOOS Regional Efforts

Managing the Regional IOOS Partnership

- Implemented active regional management to ensure accountability and strong connection to NOAA DIF and NOAA mission
- Provide primary POC and conduit from regions to other NOAA Programs and Federal agencies
- Regions meet NOAA and National missions through...
 - Strong connections to stakeholders and data users → 475 partnerships documented
 - Regional implementation of the DIF
 - Observing, DMAC, modeling, and product development capacity; Products transitioned to other regions and NOAA operations





Regional Products to Meet NOAA Missions

Managing the Regional IOOS Partnership

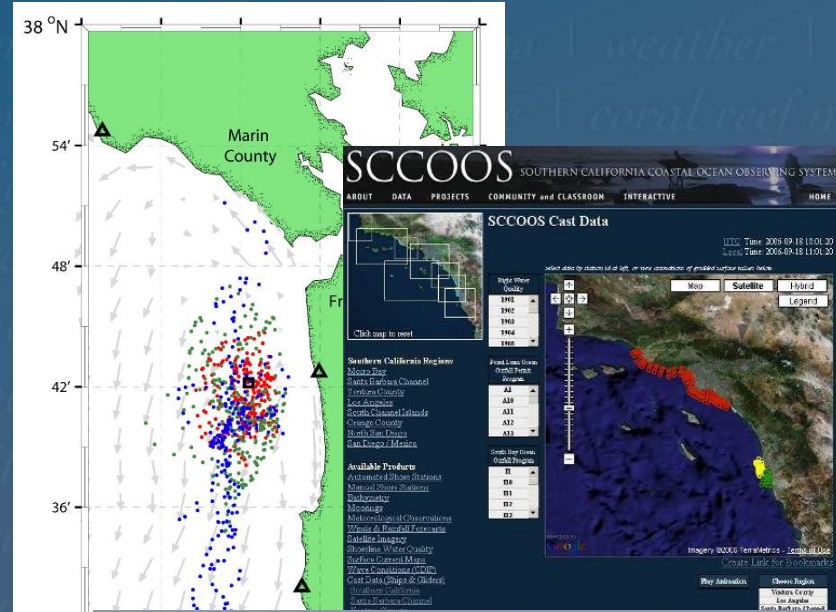
- **Oil spill tracking:** CeNCOOS spill trajectories and real-time surface current maps within hours of M/V Cosco Busan spill
- **Marine Weather Observations and Forecasts:** “Carolinas Coast”, developed by NOAA NWS and SECOORA, is a one-stop shop for marine weather. Expanding to Southeastern portal in Aug. ‘08
- **Marine Transportation:** Ports and Harbor Modeling in 3 Regions; Customized website for the entrance to the Los Angeles and Long Beach Harbor and San Pedro Channel
- **Atmospheric Modeling:** MACOORA improved local weather forecast model and severe weather alerts, incorporating R/T oceanographic data (transitioned to NWS WFO Mt Holly)
- **Harmful Algal Blooms:** NERACOOS observing assets support pre-operational, near real time nowcasts in Gulf of Maine
- **Aquaculture:** NANOOS-NEERS partnership provides real-time water quality information to support shellfish grower industry



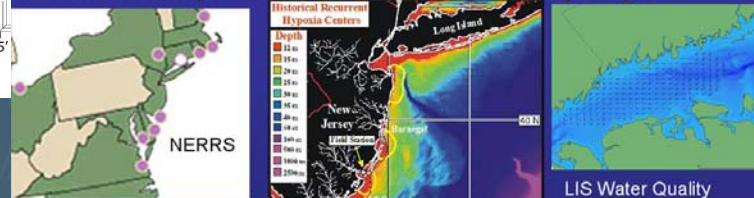
Regional Products to Meet National Missions

Managing the Regional IOOS Partnership

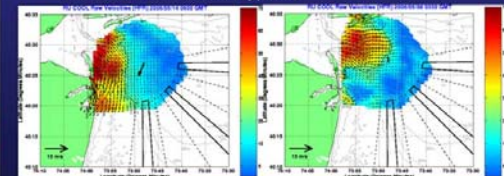
- Fisheries-Climate
 - SCCOOS- 50 years of CalCOFI data from SIO-NMFS web accessible in '09
- Water Quality
 - SCCOOS: The Hyperion Treatment Plant Diversion
 - MACOORA: Delaware River Basin NMQWM Pilot Study
 - CeNCOOS: Projected effluent trajectories
 - SECOORA: Surface currents monitoring to mitigate impacts of dredged material on nearby reefs
- Instrument Testing and Validation
 - Alliance for Coastal Technologies



MARCOOS Regional Support for Water Quality Projects



NJ Coast Recurrent Hypoxia



Monmouth County Health

Delaware River Basin NWQMN Pilot Study





Maximizing Benefit of non-NOAA Investments

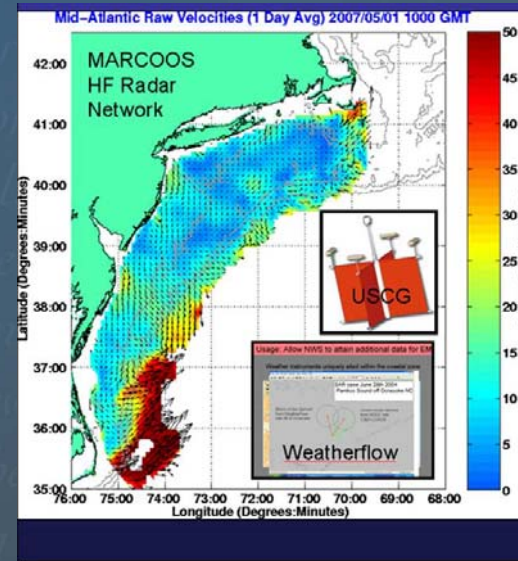
Managing the Regional IOOS Partnership

California Seafloor Mapping

- California planned major seafloor mapping investment
- Data could not support hydrographic mission unless processed to NOAA Office of Coast Survey quality standards
- IOOS Program guided NOAA-state partnership
- Data collected to NOAA standards and areas added to close NOAA gaps

High Frequency Radar (HFR)

- Significant non-federal investment
- Surface current data to serve NOAA mission and national needs
- Implemented national HFR servers and data management system





IOOS is a Team sport

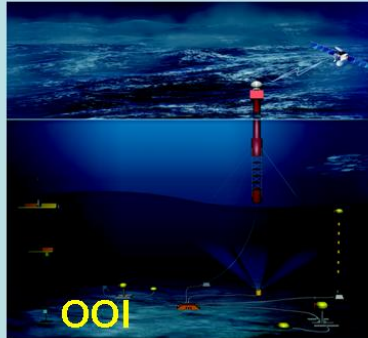
- **NOAA, EPA, and USGS: National Water Quality Monitoring Network**
- **NOAA, USGS, Census of Marine Life: Sharing data standards with Ocean Biogeographic Information System**
- **Marine Protected Areas Federal Advisory Committee (MPA FACA) formed Ocean Observing Systems Team**
 - National MPA Center, EPA, NOAA
- **ORRAP has formed a sub panel on Ocean Observing**
- **HSRP FACA includes IOOS activities oversight**
- **Regions look to NOAA for national IOOS development guidance**
- **Oceans and Human Health Initiative – working to support their observations and DMAC needs**
- **Connection to GEOSS through participation on two US-GEO Working Groups**



IOOS and OOI complement each other

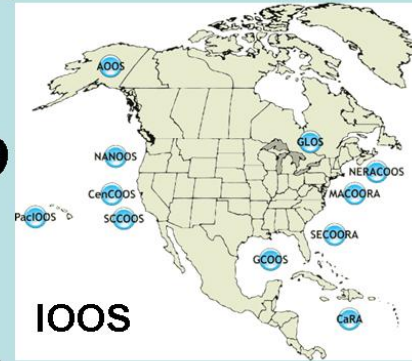
The National Test-beds

Process Understanding
New Technologies



OOI

**A WELL
SAMPLED
OCEAN**



IOOS

Sustained Regional Context
Societal Impact

Globally Aggregated Uses

Forward Deployed Uses

Information Mining Uses



GEOS

Poles –
Climate Change

Industrialized
Nations

Developing
Nations



Defense



Homeland Security



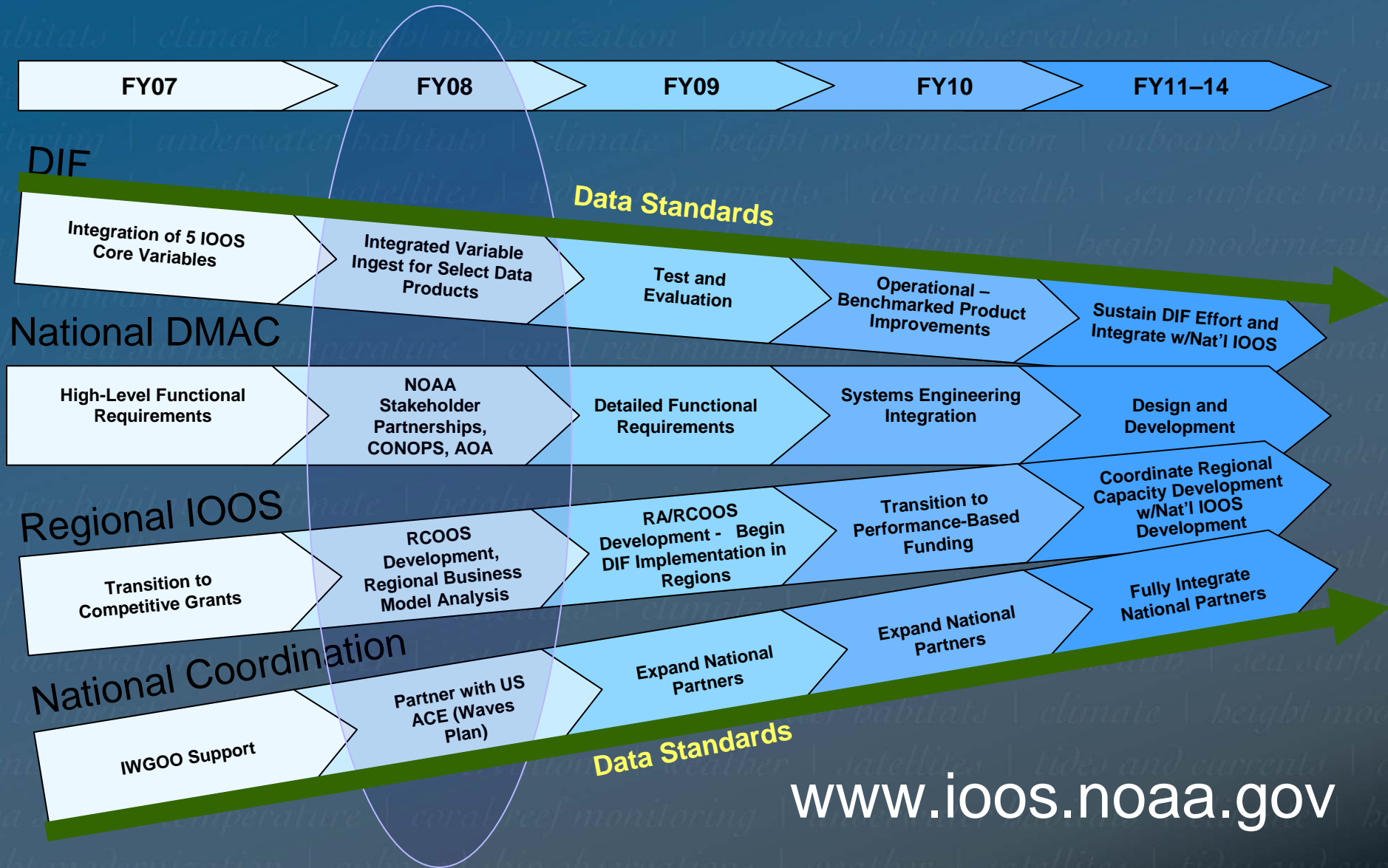
Glider Operations- MACOORA

<http://rucool.marine.rutgers.edu/atlantic/>





Evolution of IOOS



www.ioos.noaa.gov

