Integrated Ocean Observing System (IOOS)

NOAA’s Approach to Build an Initial Operating Capability

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Assistant Administrator NOAA’s National Ocean Service
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Outline

• Purpose
• Issue
• Output
  – IOOS Program Office
  – Data Integration Framework
• Tasks, Schedule, & Cost Estimate
• Next Steps
Purpose

• To present NOAA’s approach to build an initial operating capability for IOOS.
Issue

- NOAA recently increased its leadership in IOOS by assigning Mr. Dunnigan, Assistant Administrator for NOAA’s National Ocean Service (NOS), responsibility for NOAA’s internal implementation of IOOS activities.
- Mr. Dunnigan formed a task team to develop a plan to identify specific actions NOAA can take that are fundamental to IOOS development and that NOAA can implement within a 36 month timeframe.
- The approach includes establishing a NOAA IOOS Program Office within NOS and an initial data integration framework.
- On December 01, 2006, Mr. Dunnigan presented NOAA’s Approach to Build an Initial Operating Capability to VADM Lautenbacher and the senior NOAA Executive team.
- VADM Lautenbacher requested NEP/NEC concurrence on the approach presented by Mr. Dunnigan.
- The desired result of the virtual NEP/NEC briefing is formal concurrence on NOAA’s approach to build an initial operating capability for IOOS.
NOAA’s IOOS Opportunity

**IOOS Definition:**
Coordinated national and international network of observations and data transmission, data management and communication (DMAC), and data analyses and modeling that systematically and efficiently acquires and disseminates data and information on past, present and future states of the oceans and the U.S. coastal waters to the head of the tide. (IOOS Development Plan)

**NOAA’s IOOS Way Forward**

**Organize for Success**
- Establish a NOAA IOOS Program Office
  - Function: Lead and manage NOAA’s IOOS efforts
  - Responsibility: Execute NOAA’s IOOS efforts; establish requirements; conduct system acquisition; support external collaboration

**Integrate Data**
- Lead Data Integration Framework – Initial Operating Capability
  - Integrate priority IOOS core variables and deliver to end users and models
Organize for Success

**NOAA IOOS Program Office**

- **NOAA Administrator**
- **NOS Assistant Administrator**
- **IOOS Interagency & International Liaison (Dr. Spinrad)**
- **NOAA IOOS Office Director**

**Interagency Connections**

- Interagency Committee on Ocean Science and Resource Management Integration (ICOSRMI)
- Joint Subcommittee on Ocean Science and Technology (JSOST)
- Interagency Working Group on Ocean Observations (IWGOO)
- Ocean.US

**Organize for Success**

Leveraging existing NOAA-wide capabilities

**Bureaus**

- NDBC
- NCEP
- CSDL
- CSC
- OST
- NGDC
- NODC
- OCO
## IOOS Program Office Functions

<table>
<thead>
<tr>
<th>Major Project Management</th>
<th>Program Planning &amp; Analysis</th>
<th>Program Execution</th>
<th>Communication &amp; Outreach</th>
</tr>
</thead>
</table>
| • CERTIFIED Project Manager Required | • Establish IOOS Sub-Goal within Mission Support Goal  
  – Needed to achieve strategic direction for IOOS | • Budget Execution | • Regional Associations  
  • Regional Coastal Ocean Observing Systems |
| • Build NOAA Data Integration Framework  
  – Manage NOAA IOOS Project | • Define Program elements | • Annual Operating and Implementation Plans/IOOS Development Plan | • Internal & External Outreach  
  – Ocean.US  
  – Regional Associations  
  – Staff IWGOO |
| • KDP Process | • Define 100% requirements | • Research Transition | • Education  
  • Integrated Systems Engineering  
  – Develop Initial Capabilities  
    - Level One documentation  
  – Requirements acceptance  
  – Define & scope project  
  – Initiate and manage RFP | |
## Integrate Data

<table>
<thead>
<tr>
<th>Problem</th>
<th>Need</th>
<th>Core Variables</th>
<th>Decision Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global climate system not well understood</td>
<td>• Characterize the state of the global climate system and its variability</td>
<td>Temperature, Salinity, Sea Level, Surface currents, Ocean color</td>
<td>Hurricane Intensity Model</td>
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<tr>
<td>Coastal populations at risk, including coastal hazards and coastal development and urbanization</td>
<td>• Improved models (e.g., coastal inundation, hurricane intensity, and harmful algal bloom model)</td>
<td>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</td>
<td>Coastal Inundation Model, Harmful Algal Bloom Model</td>
</tr>
<tr>
<td>Ocean, coastal, and Great Lakes ecosystems at risk, including the hydrological and biogeochemical cycles, and ecosystem health and productivity</td>
<td>• Improved ecosystem assessments and models • Updated management approaches • Improved access to data, and scientific information</td>
<td></td>
<td>Integrated Ecosystem Assessment</td>
</tr>
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**Integration**

Long-term data series, coordinated in space and time
Core Variable Integration Problem: Temperature (Example)

PLATFORM
- NOAA Ships
- ARGO Profiling
- Tropical Moored Buoys
- Weather Buoys
- Drifting Buoys
- DART
- C-MAN
- SWIM
- SWMP
- VOS (xbt)
- CREIOS
- NWLON
- Satellites

Data Distribution
- NOAA Ship Synoptic
  - NCDC
  - NOAA Ship Archive
- ARGO Delayed data
  - GDAC
- NOAA Ship Synoptic
- NDBC
- NOAA Ship Synoptic
- NCDDC
- NOAA Ship Synoptic
- NERRS CDMO
- NOAA Ship Synoptic
- OAR
- NOAA Ship Synoptic
- AOML
- NOAA Ship Synoptic
- NMFS
- NOAA Ship Synoptic
- PACIFIC I. FSC
- NOAA Ship Synoptic
- CO-OPS
- NOAA Ship Synoptic
- OSDPP
- NOAA Ship Synoptic
- COAST WATCH
- NOAA Ship Synoptic
- CLASS

Archive
Decision Tools: Integrated Core Variables for Models

Process Flow

Evaluate NOAA models that impact highest-priority problems

Integrate variables needed to achieve benchmarked improvements

Quantify progress toward defined modeling improvements

Identify additional source(s) of error within model

Identify remaining IOOS core variables needed to reduce error

Select next set of priority core variables based on impacts to NOAA products

CORE VARIABLES

NOAA MODELS

Current State

MODELING IMPROVEMENTS (future state)

- Temperature
  - Hurricane Intensity Model
  - Non real-time and interpolated temperature data used to inform model
  - Integration of real-time, temperature = increased accuracy of hurricane intensity predictions

- Sea Level
  - Coastal Inundation Model
  - Sea level data (various sources and formats) integrated on site-by-site basis for use in model
  - Expedited development of coastal inundation forecasts for Southeast and Gulf

- Surface currents
  - Ocean Color
  - Salinity
  - Harmful Algal Bloom Model
  - Wind data and marine forecasts used as proxy to determine currents
  - Improved bloom trajectory forecast
  - Enable development of national HAB forecast with integrated currents

- Temperature
  - Salinity
  - Ocean Color
  - Surface currents
  - Sea level
  - Integrated Ecosystem Assessment
  - NOAA compiles and integrates suite of data required for each assessment
  - Assess current conditions
  - Forecast ecological health based on existing management strategies
  - Evaluate impacts of alternate management strategies

None?
Solution: Data Integration Framework – Initial Operating Capability

**Months 0-12**
Integration of 5 Core Variables

**Month 18**
Integrated variable ingest for following products

**Month 24**
Test & Evaluation

**Month 36**
Benchmarked product improvements for operational use

**NOAA 5 Core Variables**
- Temperature
- Salinity
- Sea Level
- Currents
- Color

**PRIORITY 1**
Systems Engineer Standards

**NOAA IOOS Integrated Data Framework**

**External sources of 5 Core Variables**
(consistent with NOAA standards)

**Systems Engineering:**
- Product Enhancement
- Test & Evaluation
- Verification & Validation

**Enhanced decision support through:**
- Integrated information services for NOAA programs
- Identify observation gaps
- Validated enhanced data products
- NOAA’s Data Integration Framework

**NOAA MISSION OBJECTIVES**
## Tasks, Schedule & Cost Estimate

### Cost Estimate Derivation:
- Program Office costs were determined based on current NIOT funding levels and additional FTEs for a total of 18.
- Data Integration Framework FY07 cost derived from cost estimates in the Lockheed Martin and Raytheon Conceptual Designs and the NOAA/Navy Demonstration Project.
- Data Integration Framework FY08 & 09 cost based on NOAA FY08 Budget request for DMAC activities.

### Cost Estimate

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<th></th>
<th>FY07</th>
<th>FY08</th>
<th>FY09</th>
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<td>NOAA IOOS Program Office</td>
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<td>4M</td>
<td>4M</td>
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<td>Data Integration Framework</td>
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<td>2.5M</td>
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### Tasks, Schedule & Cost Estimate

<table>
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<tr>
<th>Task Name</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
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<td>Qtr 1</td>
<td>Qtr 2</td>
<td>Qtr 3</td>
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- Establish IOOS Program Office
- Hire Program Office Director
- Finalize Program Office functions, roles, and responsibilities
- Recruit staff (Certified Project Manager, additional FTEs, and contractors)
- Initiate public NOAA IOOS web site development
- Communication and outreach (NOAA IOOS, cross agency, OceanUS, regional outreach)
- Establish Initial Data Integration Framework
  - Establish level one requirements (scope, cost, schedule, and success measures)
  - Define and distribute standards for 5 core variables
  - Integrate 5 NOAA core variables
  - Integrate 5 external core variables
  - Integrated variable ingest into selected NOAA model predictions and products
  - Model and data product evaluation, verification, and validation
  - Benchmark improvements to selected model predictions and products for operational use
Next Steps

- Recruit SES IOOS Program Office Director
- Move existing NOS IOOS staff (5 people) into NOAA IOOS Program Office
- Recruit certified project manager
- Continue preparation of Senate responses
- Initiate data management and integration activities
- Establish IOOS in the PPBES program structure – Mission Support Goal, IOOS Subgoal