The U.S. Integrated Ocean Observing System

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NOAA National Data Buoy Center

GCOOS Education and Outreach Council: formation meeting
November 29, 2004
Outline

• What is the Global Ocean Observing System?
• What is the Ocean.US Enterprise?
• What is the U.S. Integrated Ocean Observing System (IOOS)?
• What is the status of the IOOS?
The Global Ocean Observing System
Global Ocean Observing System (GOOS)

- GOOS is an end-to-end system of observations, data management, and production and delivery of products/services.

- GOOS is being coordinated by U.N. agencies with the participation of some 100 ocean nations.

- Together with the World Weather Watch, Global Atmospheric Watch, Global Climate Observing System and Global Terrestrial Observing System, GOOS is a an element of the Global Earth Observing System of Systems
The GOOS Modules

The Global Ocean Observing System (GOOS) has been designed and is being implemented in two modules:

- A **global module** designed to monitor, predict, and understand marine surface conditions and climate variability; and

- A **coastal module** designed to sustain healthy marine ecosystems, ensure human health, promote safe and efficient marine transportation, enhance national security, and predict and mitigate against coastal hazards.
The Ocean.US Enterprise
The U.S. Commission on Ocean Policy Report recommends

- Implement an Integrated Ocean Observing System
- Implement ecosystem–based management
- Strengthen regional approach
National Oceanographic Partnership Program Executive

NOAA Administrator
Secretary of the Navy
Director, National Science Foundation
Administrator, National Aeronautics and Space Administration
Deputy Secretary, Department of Energy
Administrator, Environmental Protection Agency
Commandant, United States Coast Guard
Director, United States Geological Survey
Director, Defense Advanced Research Projects Agency
Director, Minerals Management Service
Director, Office of Science and Technology Policy
Director, Office of Management and Budget
Ten–Year Strategic Plan for the NOPP

- Achieve & sustain an Integrated Ocean Observing System (IOOS)
- Promote lifelong ocean education
- Modernize ocean infrastructure & enhance technology development
- Foster interagency partnerships to increase & apply scientific knowledge
At the request of the U.S. Congress, the federal agencies of the NOPP are planning and developing a U.S. Integrated Ocean Observing System focused on:

- Detecting and Forecasting Oceanic Components of Climate Variability
- Facilitating Safe and Efficient Marine Operations
- Ensuring National Security
- Managing Marine Resources
- Preserving and Restoring Healthy Marine Ecosystems
- Mitigating Natural Hazards
- Ensuring Public Health
The National Office for Integrated and Sustained Ocean Observing and Prediction
http://www.ocean.us

Dr. Jack Kaye
Chair, Executive Committee

Thomas Malone
Director, Ocean.US Office
Functions of Ocean.US

Plan & Coordinate

- Develop & maintain strategic plan
- Ensure incorporation of elements into an integrated system
- Recommend enhancements
- Recommend R&D priorities
- Promote collaboration among participating NOPP Agencies & Regional Associations
- Report regularly to the EXCOM which
  - Provides policy guidance, ensures sustained agency support, & approves implementing documents
The U.S. Integrated Ocean Observing System
U.S. IOOS
Two Interdependent Components

Global Ocean Climate Component
GOOS/GCOS

Coastal Ocean Component

Regional Observing Systems

National Backbone

Resolution

Low

High

H Isl

GoA

NW

C Cal

S Cal

GLs

NE

MAB

SE

Go Mex

Caribbean
Coastal Component

Regional COOSs
- Operated by Regional Associations
- Involve private & public sectors
- Inform Federal Agencies of user needs
- Enhance the backbone based on user needs
- Incorporate Sub–regional systems

National Backbone
- Operated by Federal Agencies
- EEZ & Great Lakes
- Core variables required by regions & Federal Agencies
- Networks of sentinel & reference stations
- Standards/Protocols
Status of the IOOS: the Development Plan
1st Annual IOOS Development Plan

- **Part I – Structure and Governance**
  - Vision & IOOS design principles
  - Planning ↔ Implementing Bodies & Process

- **Part II – Building the Initial IOOS (FY 05 – 06)**
  - Integrate existing observing subsystem assets across agencies
  - Data management & communications
  - Coordinated regional development

- **Part III – Improving the IOOS (FY 07 – 14)**
  - Enhance the initial IOOS
  - R&D priorities
Part I
IOOS Governance

NORLC
Establish Policies & Procedures
Federal Agencies Develop & Operate the
Global Component & National Backbone
Interagency Working Group

Executive Committee
Approve Plans
Provide Resources

OceanUS
Plan & Coordinate

ORAP
Advise

USGSC
User Input & Performance

NFRA
Represent & Coordinate
RAs
Develop & Operate RCOOSs
Four Stages of IOOS Elements

1. Research
   New Knowledge & Technologies

2. Pilot Projects
   Demonstrate Feasibility
   (community acceptance; standards & protocols)

3. Pre-Operational Projects
   Proof of Concept
   (value added, cost-effective)

4. Operational System
   (routine, sustained)
Part II: The Initial IOOS
FY 05 – 06 Highest Priorities

- DMAC
- Establish RAs & the NFRA
- Coordinated Development of Global & Coastal Components
Part III – Enhancement Categories

• **Global Ocean – Climate Component**

• **DMAC**

• **Regional Coastal Ocean Observing Systems**

• **National Backbone Operational Observing Subsystem**
  
  – Increase density of measurements
  – Incorporate additional sensors

• **Education**
Part III – Enhancement Categories
Research & Pilot Projects

• **Product–Driven (end–to–end systems)**
  - Surface current maps
  - Near shore bathy-topography maps

• **Target Specific Elements of the IOOS**
  - Modeling – Close gap between operational models for
    - marine meteorology & physical oceanography &
    - those that require biological & chemical data
  - Benthic habitat mapping
  - *In situ* sensors for biological & chemical variables
  - Glider technologies
  - Improve spectral, spatial & temporal resolution of space–based remote sensing of coastal systems
The IOOS Global Component

- Part of an intergovernmental, cooperative system

- Designed to observe and predict global, ocean-influenced phenomena (such as El Niños, extreme weather, or global warming)

- Nearing operational, sustained status.
Global Ocean-Climate Component
Requirements for *In Situ* Observations

- **Full implementation**
  - Argo
  - Water level network
  - Global ocean time series observatories

- **Successful completion**
  - GODAE

- **Optimize the global network of observations**

- **Enhance ocean time series observatories**
  - key biological & chemical sensors
### Initial Ocean Observing System Milestones including international contributions

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**Operational GPS/DORIS Stations**

**Number of buoys**

**Number of moorings**

**High resolution and frequently repeated lines occupied**

**Number of floats**

**Number of flux moorings**

**Moorings with climate sensors**

**Number of flux sites/lines, One inventory per 10 years**

**Days at sea (NOAA contribution)**

**Product evaluation and feedback loops implemented**

**System % Complete**
Status of the Tropical Moored Buoy Network

80% complete
International CLIVAR/CO$_2$ Lines

Black = proposed US lines; Black&White = committed international lines; Gray = additional lines proposed for CLIVAR

Background: NCAR Model, Anthropogenic CO$_2$ for 2005

Joint NSF-NOAA program began June 2003

May 2004 P2

September 2003 A20 A22 A16N June 2003
Coastal Module: National Backbone
Core Variables

- **Physical**
  - Sea surface winds
  - Sea surface waves
  - Sea surface currents
  - Sea level
  - Stream flows
  - Temperature, Salinity
  - High Res Bathymetry
  - Ice distribution

- **Chemical**
  - Dissolved inorganic nutrients
  - Contaminants
  - Dissolved oxygen

- **Biological**
  - Fish species, abundance
  - Zooplankton species, abundance
  - Phytoplankton species, biomass (ocean color)
  - Pathogens

- **Multidisciplinary**
  - Optical properties
  - Bottom character/Benthic habitats
Coastal Component
The Initial IOOS

• Extend the global ocean component to the shoreline with higher resolution for
  - improved regional weather & climate predictions,
  - more efficient and safer marine operations in coastal waters,
  - more accurate forecasts of natural hazards & their effects, &
  - improved homeland security.

• Develop an integrated approach to water quality monitoring & living resource assessments through more timely provision of
  - Surface & interior fields
    - nutrients & dissolved oxygen
    - phytoplankton biomass (Chl) & macrozooplankton abundance
  - Extent and condition of benthic habitats;
  - Abundance and distribution of living marine resources (including protected species); &
  - Land-sea freshwater flows & associated transports of sediments, nutrients & contaminants.
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Thank you

http://www.ocean.us

http://ocean.tamu.edu/GOOS/goos.html