The U.S. Integrated Ocean Observing System (IOOS) and its local component, the Gulf of Mexico Coastal Ocean Observing System

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GCOOS-RA
Board of Directors
Meeting September 5, 2007
Houston, TX
Topics

• The U.S. IOOS
• NOAA's IOOS Initiative
• GCOOS Status and Plans
The Global Ocean Observing System
GOOS

• Two Interdependent Modules
  ➢ Global Ocean
  ➢ Coastal

• Global Module
  ➢ Planning began in late 1980’s
  ➢ Implementation plan completed in late 1990’s
  ➢ Implementation underway

• Coastal Module
  ➢ Planning began in late 1990’s
  ➢ Implementation strategy approved in 2004

www.ioc-goos.org/
1998 – Congress Called for
Integrated Ocean Observing System (IOOS)

Routinely Provide Data/Info Required for
Rapid Detection & Timely Prediction of State Changes

- Improve the safety & efficiency of marine operations
- Improve national/homeland security
- Improve forecasts of natural hazards and mitigate their effects more effectively
- Improve predictions of climate change & their effects
- Minimize public health risks
- Protect & restore healthy marine & estuarine ecosystems more effectively
- Sustain living marine resources

1 System, 7 Societal Goals
Ocean.US
The National Office for Integrated & Sustained Ocean Observations

• Established in 2000 by National Oceanographic Partnership Program
• In July 2007 the IWGOO charged Ocean.US to:
  ➢ Focus on planning and coordination of national IOOS across agencies and non-federal partners
  ➢ Coordinate efforts of Regional Associations with Federal IOOS efforts
  ➢ Coordinate through IWGOO national IOOS efforts consistent with global efforts of GOOS and GEOSS
  ➢ Assist IWGOO with planning implementation, and oversight of the RAs
  ➢ Promote Federal, Regional, and State collaboration by functioning as the portal for information
  ➢ Help IWGOO to ensure participation of all appropriate parties in IOOS
  ➢ Assist IWGOO in assessing and measuring socioeconomic benefits of IOOS
  ➢ Work with Federal Agencies and RAs to recommend needed R&D enhancements
  ➢ Prepare annual reports on IOOS status including short- and long-term priorities for implementation

• 2002 National IOOS Workshop
  ➢ ~100 data providers & users from government agencies, academia, industry & NGOs
  ➢ Begin the process of specifying Observing System Requirements & System Architecture

Committee on Ocean Policy
Chair CEQ
(Cabinet Level)

Interagency Committee on
Ocean Science &
Resource Management
Integration (ICOSRMI)
Co-Chairs: OSTP & CEQ

ORAP

JSOST
IWGOO

SIMOR

Ocean.US

NSC PCC
Global Environment
First Development Plan

Completed by Ocean.US

December 2004

Approved at Cabinet level by the Interagency Committee on Ocean Science & Resource Management (ICOSRMI)

January 2006

www.ocean.us
The First IOOS Development Plan

- Guidelines for IOOS Design, Implementation & Governance
- IOOS Architecture
- Recommends initial building blocks of the IOOS
- Initial Priorities on 5 Areas

www.ocean.us
“End-to-End”, Multi Disciplinary, Multi Purpose System Efficiently Links 3 Subsystems

Satellites
- Metadata standards
- Data discovery
- Data transport
- Online browse
- Data archival

Aircraft
- Currents & Waves
- Water level
- Coastal inundation
- Waterborne pathogens
- Population Dynamics
- Ecosystem Dynamics

Fixed Platforms
- DMAC

Ships
- Observation/Data Telemetry

Drifters & Floats

AUVs

Decision Support Tools
- Climate
- Natural Hazards
- Marine Services
- Security
- Public Health
- Ecosystem Health
- Resources
U.S. IOOS

Two Interdependent Components

Global Ocean Climate Component
GOOS/GCOS

Coastal Ocean Component

Regional Observing Systems

National Backbone

Low Resolution

High Resolution

H Isl

NW

C Cal

S Cal

GoA

GLs

NE

MAB

SE

GoMex

Caribbean

Cal

Mex

S
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
Global Ocean Component – Remote Sensing

• Sustain Continuity of Space–Based Observations
  ➢ Water level & sea surface temperature, currents, waves, ocean color

• Enhance Space–Based Observations
  ➢ Sea surface salinity
Global Ocean Component – *In Situ* Observations

- **Full implementation**
  - Argo profiling float array
  - Water level network
  - Tropical buoy arrays
  - Surface drifter array
  - VOS lines

  [*> 55% implemented*]

- **Transition successful elements of GODAE to an operational mode**

- **Enhance ocean time series observatories**
  - key biological & chemical sensors
Establish Regional Associations to build RCOOSs by

- Engaging user groups from private & public sectors in their regions
- Implementing national standards & protocols
- Informing Federal Agencies of user needs
- Enhancing the backbone based on user needs
  - Incorporate existing sub–regional observing systems
  - Increase resolution of the NB
  - Increase # of variables measured

Develop Regional Coastal Ocean Observing Systems
Focused on the EEZ, Great Lakes & Estuaries

11 RAs Have Been Funded To Initiate this Process
National Federation of Regional Associations Created in 2005

- Represent the collective interests of RAs at the federal level
- Provide mechanism for communications/collaboration between federal agencies & RAs
- Enable interoperability through coordinated development of RCOOSs & the NB
- Facilitate exchange of information on best practices
- Influence design & implementation of the National Backbone
- Contribute to building the National Backbone
- Ensure RA participation in developing/adopting national standards & protocols
  - Measurements & data telemetry
  - Data management & communications
  - Modeling & analysis
- Promote
  - Data & Information exchange
  - R&D
  - Capacity Building

http://www.ocean.us/nfra
Criteria for Initiating Phased Implementation of the National Backbone

- Observing subsystem assets must provide data streams that are
  - Sustainable, reliable, routine, & quality controlled
- Data streams to be integrated are currently available
- Integration will improve assessments &/or predictions that
  - Have major socio-economic benefits
  - Address 2 or more of the 7 societal goals
  - Demonstrate success sooner than later
Integrated Ocean Observing System (IOOS)

NOAA’s Approach to Building an Initial Operating Capability
# NOAA’s IOOS Plan

## Organize for Success

- Establish NOAA IOOS Program Office
  - Lead and manage NOAA’s IOOS efforts
- Support external collaboration
  - Identify and encourage similar data integration, test and evaluation approach by partners

## Integrate Data

- Develop an Integrated Data Framework as the Initial Operating Capability
  - Integrate priority IOOS core variables and deliver to end users and models
  - Quantify product improvements

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### NOAA IOOS Definition:

The U.S. Integrated Ocean Observing System (IOOS) is a coordinated network of people and technology that work together to generate and disseminate continuous data on our coastal waters, Great Lakes, and oceans. IOOS is our nation’s ocean contribution to an international effort called the Global Earth Observation System of Systems (GEOSS), which is designed to continuously and comprehensively monitor Earth and transmit observations globally. IOOS supports both a coastal and global component of ocean observing.
NOAA’s IOOS Program Office: Purpose & Functions

NOAA IOOS Activities

- NOAA Administrator
- NOS Assistant Administrator
- OAR Assistant Administrator
- IOOS Program Office Director
- IOOS Project Management
- Program Operations

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

Regional Coastal Component

- Observations
- Data Management & Communications
- Modeling & Analysis

Leveraging existing NOAA-wide capabilities
The IOOS Challenge: Data Integration

**Societal Challenges**

- Global climate not well understood
- Coastal populations at risk
- Ocean, coastal, and Great Lakes ecosystems at risk

**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 $O_2$
- Phytoplankton species
- Zooplankton abundance

**Decision Tools**

- Hurricane Intensity Model
- Coastal Inundation Model
- Harmful Algal Bloom Model
- Integrated Ecosystem Assessment

**Integration**

Long-term data series, coordinated in space and time
NOAA’s Initial Operating Capability: Integrated Data Framework

Integration of 5 IOOS Core Variables

- Temperature
- Salinity
- Sea Level
- Currents
- Color

NOAA 5 Core Variables

NOAA IOOS Integrated Data Framework

- Systems Engineering
- Standards Development

Data Standards

Data Access & Exchange

Integrated Variable Ingest for Select Data Products

- Hurricane Intensity Model
- Coastal Inundation Model
- Harmful Algal Bloom Model
- Integrated Ecosystem Assessment

Test & Evaluation

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

Benchmarked Product Improvements for Operational Use

- Hurricane Intensity Model
- Coastal Inundation Model
- Harmful Algal Bloom Model
- Integrated Ecosystem Assessment

Enhanced decision support through:

- Integrated information services for NOAA programs
- Identify observation gaps
- Validated enhanced data products
- NOAA’s Data Integration Framework

Future State:

- Regional-coastal data integration for
- Regional scale data and information products and services

NOAA MISSION OBJECTIVES

REGIONAL COASTAL NEEDS

External sources of 5 Core Variables (consistent with NOAA standards)
NOAA Coastal Services Center is funding competitive proposals to support Regional Coastal Ocean Observing Systems

- First Call for Proposals was in January 2007; the second was in June 2007. Projects are sought to:
  - 1. Further integrate and develop Regional Coastal Ocean Observing Systems,
  - 2. Improve Data Management and Communication capabilities, and
  - 3. Develop new products and services needed by stakeholders.
Summary

• NOAA is advancing IOOS through improved organization, management, and focus
  – The process for establishing a NOAA IOOS Program Office is underway
  – The NOAA IOOS Program Office is building an Initial Operating Capability (IOC) for IOOS
  – The IOC will be tested, evaluated, and benchmarked for success

• NOAA continues to coordinate larger U.S. IOOS efforts with federal and international partners through participation in inter-agency forums

• NOAA continues to support development of the regional component of IOOS to enable a fully configured and scalable U.S. IOOS

• NOAA is generally supportive of efforts to authorize IOOS
Status and Plans for the Gulf of Mexico Coastal Ocean Observing System (GCOOS)

a Component of the U.S. Integrated Ocean Observing System's Coastal Component
Outline

• Status of GCOOS-Regional Association
• Development of stakeholder priorities
• Integration of observing system elements
• Building new sub-systems
• Status of potential pilot projects
Overview of Status of GCOOS Regional Association

Resolution & Mission Statement adopted in January 2003

Formal Memorandum of Agreement establishing Regional Association for governance signed in January 2005; currently 71 signatories

Member of the National Federation of Regional Associations (NFRA)

Operational structure complete as of April 2006

Development of formal proposal process January 2007
Parties to GCOOS MoA

- **Stephanie Bailenson**, Florida Department of Environmental Protection
- **Peter Betzer**, University of South Florida
- **Kevin M. Bice**, Radiance Technologies, Inc.
- **Jerry Boatman**, Planning Systems, Inc.
- **Joseph N. Boyer**, Florida International University
- **Otis B. Brown**, University of Miami - Rosenstiel School
- **Lisa Campbell**, Individual
- **Kendall L. Carder**, Individual
- **Michael Dagg**, Individual
- **William Dentel**, Aquatek Corporation
- **Manhar Dhanak**, SeaTech, Florida Atlantic University
- **Richard E. Dodge**, Nova Southeastern University Oceanographic Center
- **Richard Eckenrod**, Tampa Bay Estuary Program
- **James W. Feeney**, Horizon Marine
- **George Forristall**, Forristall Ocean Engineering, Inc.
- **Yoku Furukawa**, Individual
- **Norman Guinasso**, Texas Automated Buoy System (TABS); GERG
- **Thomas P. Harding**, PAR Governments
- **Robert Hetland**, Individual
- **Roger R. Hoffman**, The Boeing Company
- **Patrick Hogan**, Naval Research Laboratory
- **Matthew Howard**, Individual
- **Stephan Howden**, Individual
- **Ann Jochens**, Individual
- **Björn Kjerfve**, Individual
- **Harvey Knoll**, Texas A&M University - Corpus Christi
- **Christopher Lindsey-Curran**, Society for Underwater Technology
- **Steven E. Lohrenz**, The University of Southern Mississippi
- **Greg Lorenzetti**, Titan Partners
- **Mark Luther**, Tampa Bay PORTS
- **John MacLeod**, Evans Hamilton, Inc.
- **Kumar Mahadevan**, Mote Marine Laboratory Inc.
- **Robert “Buzz” Martin**, Texas General Land Office
- **Thomas McGee**, Gulf of Mexico Hydrates Research Consortium, University of Mississippi
- **Christopher McPherson**, Ocean Design, Inc.
- **Gil McRae**, Fish & Wildlife Conservation Commission (Florida)
- **Douglas Meffert**, Tulane/Xavier Center for Bioenvironmental Research & LEAG
- **Clifford R. Merz**, Dialytics, Inc.
- **Dong-Ha Min**, Individual
- **Christopher N. K. Mooers**, Individual
- **Frank Muller-Karger**, Individual
- **Worth D. Nowlin, Jr.**, Individual
- **James J. O’Brien**, COAPS, Florida State University
- **Chris C. Oynes**, Minerals Management Service GoM Region
- **Henry J. Pierce, Jr.**, Tellus Applied Sciences, Inc.
- **Nancy Rabalais**, LUMCON
- **Sammy Ray**, DermoWatch
- **Mitchell Roffer**, Roffer’s Ocean Fishing Forecasting Service
- **Donald A. Roman**, Individual
- **Kerry St. Pe**, Barataria-Terrebonne National Estuary Program
- **Glen T. Shen**, Individual
- **Y. Peter Sheng**, University of Florida
- **W. H. Buzz Sierke, Jr.**, Individual
- **Steve J. Smith**, ChevronTexaco Energy Technology Company
- **Mike Spranger**, Florida Sea Grant Program
- **Robert Stickney**, Texas Sea Grant College Program
- **Robert Stickney**, Texas A&M University, Department of Oceanography
- **LaDon Swann**, Mississippi-Alabama Sea Grant Consortium
- **Joseph W. Swaykos**, Center of Higher Learning, University of Southern Mississippi
- **David Szabo**, Woods Hole Group, Inc.
- **James Titlow**, WeatherFlow Inc.
- **Raymond F. Toll, Jr.**, Science Applications International Corporation
- **Neil Trenaman**, RD Instruments
- **Jan van Smirren**, Fugro GEOS
- **Jyotika I. Virmani**, Florida COOS Consortium
- **Michael J. Vogel**, Shell International E&P Inc.
- **Sharon Walker, J. L. Scott Marine Education Center & Aquarium
- **William W. Walker**, Mississippi Department of Marine Resources
- **Larry Warrenfeltz**, Florida Institute for Human and Machine Cognition
- **Robert H. Weisberg**, Individual
## Demographics

<table>
<thead>
<tr>
<th>Breakdown of Parties by STATE</th>
<th>Breakdown of Parties by SECTOR</th>
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<tbody>
<tr>
<td><strong>FLORIDA</strong> - 25</td>
<td>Voting Party - Academic - 18</td>
</tr>
<tr>
<td><strong>ALABAMA</strong> - 3</td>
<td>Voting Party - Government - 12</td>
</tr>
<tr>
<td><strong>MISSISSIPPI</strong> - 10</td>
<td>Voting Party - Private Sector - 24</td>
</tr>
<tr>
<td><strong>LOUISIANA</strong> - 5</td>
<td>Voting Party - A / G - 1</td>
</tr>
<tr>
<td><strong>TEXAS</strong> - 17</td>
<td>Individual - Academic - 15</td>
</tr>
<tr>
<td><strong>OTHER STATES</strong> - 11</td>
<td>Individual - Government - 0</td>
</tr>
<tr>
<td>Virginia</td>
<td>Individual - Private Sector - 0</td>
</tr>
<tr>
<td>Maine</td>
<td>Individual - A / G - 1</td>
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<tr>
<td>California</td>
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<td>New York</td>
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<tr>
<td>Washington</td>
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<tr>
<td>District of Columbia</td>
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Status of GCOOS Business Plan

• Draft Business Plan for the GCOOS-RA is posted to web for comments
• Plan will include
  – Development strategy
  – Investment strategy
  – Near-term priorities for enhancements
• Cost estimates
• Estimates of economic benefits
Status of GCOOS Communications Strategy

- Focus is on web-based communications: inreach, outreach, capacity building
- Oral and written presentations in appropriate venues
- Standard GCOOS presentation being developed for briefing at other venues
- Web-delivered newsletter
GCOOS Education and Outreach Coordinator

- Funds for first year of support were transferred to the University of Southern Mississippi in January 2007; transfer underway for second year.
- Coordinator in place April 2007
- Expected to work closely with Education and Outreach Coordinator for the Gulf of Mexico Alliance, located in neighboring Alabama
- Additional support has been provided in two successful proposals
Stakeholder Priorities Are Key

• We are working to:
  – identify observations and products needed by users
  – estimate economic benefits of these needs
  – prioritize these needs
  – plan and initiate pilot projects to enable these needs to be met

• Mechanisms used:
  – Workshops & Meetings with Stakeholders
  – Task Team on Public Health
  – Development of Observing System Plan
  – Development of a Business Plan
Workshop Objectives:

• Obtain agreement on a short list of recommended products of highest priority to these industry sectors.
• Identify users for these priority products.
• Obtain guidance regarding what observations are needed to produce these products.
• Discuss which products are for common use, and so likely produced at government expense, and which are niche products, best produced by the private sector.

• To identify, with priorities, measurements and products needed to better predict and mitigate effects of storm surge and inundation in the southeastern U.S. and Gulf of Mexico.

• To suggest a few high priority pilot projects that might be undertaken soon to advance the development of the higher priority measurements and products.

• To provide estimates of annual economic benefits of the identified measurements and products as feasible.
Harmful Algal Blooms Workshop: GCOOS Role in Detection, Monitoring, and Prediction
13-15 April, 2004, St Petersburg, FL

Objectives:
• Review HAB data and information needs of state agencies, coastal zone managers, and scientists in the Gulf
• Assess current capabilities of HAB observing system and related efforts in Gulf
• Formulate a plan to improve capabilities
Harmful Algal Blooms Workshop

• Formal presentations and breakout sessions focused on needs and priorities.

• Agreement on needs for observations, model development, common standards and protocols, research and development.

• NOAA Coastal Services Center published a workshop report, "Action plan for harmful algal blooms and the Gulf of Mexico Coastal Ocean Observing System: Results from a regional workshop" (NOAA/CSC/20516-PUB).

• The EPA Gulf of Mexico Program prepared a document giving needed enhancements and budgets following the workshop.

• Using that information, Tom Malone prepared a draft plan for a HAB observing system for the Gulf of Mexico.

• Rick Stumpf (NOAA) also has prepared a plan for requirements for HABs forecasting.
Development of HABs Observing System Plan for the Gulf of Mexico

• Bart Bibler (FL Dept. of Health), Steven Wolfe (Gulf of Mexico Alliance), and Worth Nowlin (GCOOS) are working with a broad team to develop a HABs Observing System Plan for the Gulf.

• We are using telephone discussions to begin.

• Background documents are under preparation to be tabled at the annual Regional IOOS Meeting on October 23-25, 2007 in St. Petersburg, FL.

• A Steering Committee for a HABs Observing System Development Workshop has been selected.

• The workshop is scheduled for November 14-16, 2007 in New Orleans.
Future Focused Stakeholder Workshops

• **Fisheries**—Commercial, recreational, and regulatory. Seeking assistance from the Gulf of Mexico Fishery Management Council, Gulf States Marine Fisheries Commission, and NOAA Southeast Fisheries Research Center, and state fishery agencies.

• **Maritime transportation** elements—including tanker traffic, container ships, cruise ships, shipping agents, port authorities, pilots, LNG carriers, intercoastal waterway traffic, and commercial transportation of people.

• **Recreational boating**—including marina operators, power squadrons, yacht clubs, marina operators, and retailers.

• **Urban planners/developers**
Public Health

• High level of activities on public health have resulted in recommendations
  – IOOS Public Health Workshop, Jan. 2006
  – The Gulf of Mexico Alliance
• Standing *GCOOS Task Team on Public Health* has been created
• Terms of Reference call for Team to advise GCOOS Board regarding priority measurements and products
Integration of Existing Sub-systems

Goal: Bringing new extant real-time data sets to the NOAA National Data Buoy Center (NDBC) for quality control and open distribution.
Projects to funded to begin January 2008 in response to NOAA's January 2007 Call for Proposals:

• Development of a GCOOS Data Portal as the first step toward a GCOOS Operations Center.
• Standardization of Local Data Network Nodes in the GCOOS-RA
Building New Sub-systems 2

Possible Partnership on a Homeland Security Center of Excellence

• For study of natural disasters, coastal infrastructure, and emergency management
• Major partners are University of Washington and Texas A&M University
• This would provide continuing support to identify and assess products and services needed for improved resilience to inundation
Building New Sub-systems 3

Proposals in response to NOAA FY 2008 Call for Proposals for Regional Integrated Ocean Observing System Development

• To be submitted in November 2007
• Topics for proposed projects now being considered by organizational structure of the GCOOS Regional Association
Develop proven forecast capability for three-dimensional circulation in the Gulf of Mexico

-- Prospectus for this initiative prepared and placed on web for comments
-- Comments received and incorporated into revised plan
-- Initial funding ($1.3M) promised in 2008 from petroleum joint industry project (RPSEA)
-- Possible additional $300K from industry
-- Seeking additional support from NOAA and MMS
Status of Pilot Projects 1

• Water quality measurements for human pathogens (Bart Bibler)
  – Florida system well established
  – Moving to make data openly available
  – Other states will be encouraged to participate

• Improving forecasts of hurricane severity (Cort Cooper)
  – Assessment of existing activities completed
  – Letters of support for long-term research projects
  – Seeking self-contained meteorological instrumentation for ships and platforms
Status of Pilot Projects 2

- Pilot GCOOS Operations Center
  - Community comments received and incorporated
  - Data Portal project to be funded as initial thrust

- Instrument tankers for various measurements across Gulf

- Produce probability maps of bottom hazards and maps of hydrocarbon seeps

- Develop a Gulf measurements and products archive
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