U.S. Integrated Ocean Observing System (IOOS) Data Management and Communications (DMAC) – Strategy and Status

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IOOS Implementation

- Organize by regions
- Reach consensus on initial set of interoperability enabling DMAC standards and protocols
- Implement in phases
  - "Operationally"-proven first, then for:
    - Pre-Operational
    - Pilot demonstrations, and
    - Developmental targets
- Realign investments within current programs
- Seek new investment and capacity building resources
Background

• Mar 2002 - Airlie House National Conference, VA
• Apr 2002  - IOOS DMAC Steering Committee Seated
• Apr 2003 - National Summit of Regional Associations, Wash DC
• Oct 2003 – Interoperability Forum, Wash DC
• Mar 2003 – National Ocean Education Workshop, Charleston SC
• Aug 2004 – 1st IOOS Implementation Conference, Wash DC
• Sep 2004 – President’s Commission on Ocean Policy Report
• Nov 2004 – Public review of DMAC Plan
• Dec 2004 – IOOS Development Plan submitted to the NORLC
• Feb 2005 – IOOS DMAC Steering Team to be seated
• Mar 2005 – IOOS DMAC Plan (ed 1) target publish date

A consensus-building approach
IOOS

Two Interdependent Components

Global Ocean Climate Component

GOOS/GCOS

Coastal Ocean Component

National Backbone

Regional Coastal Observing Systems
Character of National (Backbone) and Regional Coastal Observing Systems

**National Backbone**
- Largely federal (U.S. Agencies)
- Satellite remote sensing
- Monitoring & fixed-site stations
- Linkage to global component
- DMAC standards & protocols
- Fewer variables

**Regional Coastal Systems**
- Largely non-federal (may be federally funded)
- Regional priorities & needs
- Greater resolution
- DMAC standards & protocols
- More variables
The Global Component
GTSPP, ARGO, Satellites, VOS, others

IOOS is the U.S. contribution to GOOS and the Oceans & Coasts component of the GEOSS
IOOS Coastal and Ocean Observing Systems are Quite Diverse

- Scientific research driven (to understand)
- Legally mandated (to comply)
- Exploratory (to discover)
- Operational (to predict and economize)
- Monitoring (to establish baselines & detect change)
- Ad hoc (Unpredictable but useful)
...competing characteristics ruled out the most straightforward solutions for IOOS
No simple data standard can be designed that all ocean data providers will utilize.

1. Heterogeneous data

2. Loosely federated organizations

3. Large, distributed holdings
No management structure exists to enforce adoption of a complex, data management solution.

1. Heterogeneous data

2. Loosely federated organizations

3. Large, distributed holdings
Data cannot be centrally managed at a single location

1. Heterogeneous data
2. Loosely federated organizations
3. Large, distributed holdings
Many Variables - The IOOS Core Set

• Physical*
  - Salinity, temperature, air-sea heat flux
  - Sea and water level, water depth (Shore line)
  - Surface waves (height, direction, freq), currents & sea ice

• Chemical
  - Contaminants & dissolved nutrients
  - Dissolved oxygen

• Biological
  - Fish species & abundance
  - Chlorophyll, ocean color & phytoplankton abundance/species
  - Zooplankton abundance/species
  - Pathogens

• Interdisciplinary
  - Optical properties (Atmospheric & in-water)
  - Bottom character and benthic habitats

* By extension includes standard surface met observations for marine buoys
The Governance Challenge

- Many observing system activities involved
- Many federal, state and even independent players
- Different funding paths, different program missions
- Cost implications (and transfer) are concerns
- Effective governance based on data management and communications (DMAC) plan key to success
- Ocean.US Office established to coordinate, and DMAC to lead data management planning
IOOS Governance Framework

Federal Agencies (NORLC)
- Agency Head Level
- Establish Policies & Procedures
- Develop & Implement National Backbone
  - Fund Regional Associations
  - Fund required R&D

Ocean.US Executive Committee
Approves Plans
Provide Resources
Advises NORLC

Ocean.US
Advises, Plans, Integrates, Recommends

OceanUS
*

NFRA*
Represents & Coordinates
RAs
Develop & Operate RCOOSs

ORAP (Advisory)

KEY
Federal
Non-Federal
FACA

NFRA=National Federal of Regional Associations
Note

• The NORLC and Ocean.US were established by the U.S. Congress as “inter-agency” activities, and without a dedicated budget. Consensus-building and coordination occupy a great deal of our time.

• The IOOS Data Management and Communications (DMAC) Plan provides a framework - but not a prescriptive solution - for achieving interoperability among the independent, heterogeneous systems, large and small components of IOOS
U.S. Federal Agency Consensus Priorities

• Make more effective use of and sustain existing operational observing systems capabilities

• Implement DMAC-based management across disciplines, across agencies and across global-to-local scales - interoperable

• Establish Regional Associations to improve regional needs focus and more effectively manage regional coastal ocean observing systems

• Effect global & coastal components integration

• Enhance capabilities by expanding present operational capabilities and accelerating R&D transition
Essential Goals Underlying DMAC Plan Recommendations

- Web Services
- Data discovery employing comprehensive searches
- Data exploration using standard browsers
- Machine-to-machine data transport “with meaning,” supporting common applications and regardless of data location
The DMAC Plan does not yet address

- “Telemetry” (sensor to server)
- Data assembly
- Quality Control
- Data provenance (and versioning)
- Security
- International linkages

The DMAC Plan will not address

- The observing subsystem (sensors)
- Modeling and analysis
The greatest challenges are in the area of community behavior, not technology.
Identifiable DMAC and FWIS Intersections

• Both represent overarching approaches to meet user data/information exchange needs
• Both seek to build on most successful of existing/emerging enterprises/programs
• Both target evolving present capabilities in response to user needs and technology opportunities
• Both seeking to put in place effective coordination mechanisms
Key DMAC Standards Areas

- **Metadata**
  - Core vocabulary
  - Minimum content (FGDC view compliant)
  - Extensions to core
  - Metadata + data required on publishing to IOOS
- **Data discovery and metadata management**
- **Data exploration (beyond standard browsers)**
- **Data transport** -
  - Gridded
  - Non-gridded
  - Geospatial and serial
- **Data archival** - complementing existing centers
# Metadata Is a Key First Step

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<th>DMAC</th>
<th>FWIS</th>
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Other Standards Areas Likely Similar

- **Metadata**
  - Core vocabulary
  - Minimum content (FGDC view compliant)
  - Extensions to core
  - Metadata + data required on publishing to IOOS
- **Data discovery and metadata management**
- **Data exploration (beyond standard browsers)**
- **Data transport -**
  - Gridded
  - Non-gridded
  - Geospatial
  - Serial
- **Data archival - complementing existing centers**
Where Does DMAC Stand?

• Regional Associations formed and funded (effective 2005)
• Regional Associations testing DMAC Plan recommendations implementation testing OPeNDAP, NetCDF, OGC Web Services, and regional aggregation services (http://www.SEACOOS.org)
• Cross agency integration pilots funded and underway (Water and tide levels: NOAA and USGS)
• NOAA NDBC on-line as first IOOS DMAC data assembly center. Also serving as gateway to GTS for non-federal IOOS observing systems
• First exploratory commercial interoperability contracts let (Boeing and Northrup Grumman)
• DMAC Steering Committee formed to guide further standards development
Where Does DMAC stand? (cont’d)

• Expert working groups identified as immediate priorities
  ➢ Metadata (formed and initially funded) to deal with key vocabulary, core content, standards approval process
  ➢ Data access and transport (2Q 2005) to deal especially with missing components of OPeNDAP/NetCDF, Open Geospatial Consortium (GIS) service issues

• Expert working groups being discussed
  ➢ Quality control, provenance and versioning
  ➢ Security - Services and data

• Multi-year IOOS Development Program Plan (2005-12) submitted to agencies (Jan 2005)