

# Navigation Data Integration Framework

**Clint Padgett**

Chief, Spatial Data Branch

Operations Division

Mobile District

Mobile District

**SPATIAL DATA**

OP-J

**RSM IPR Workshop**

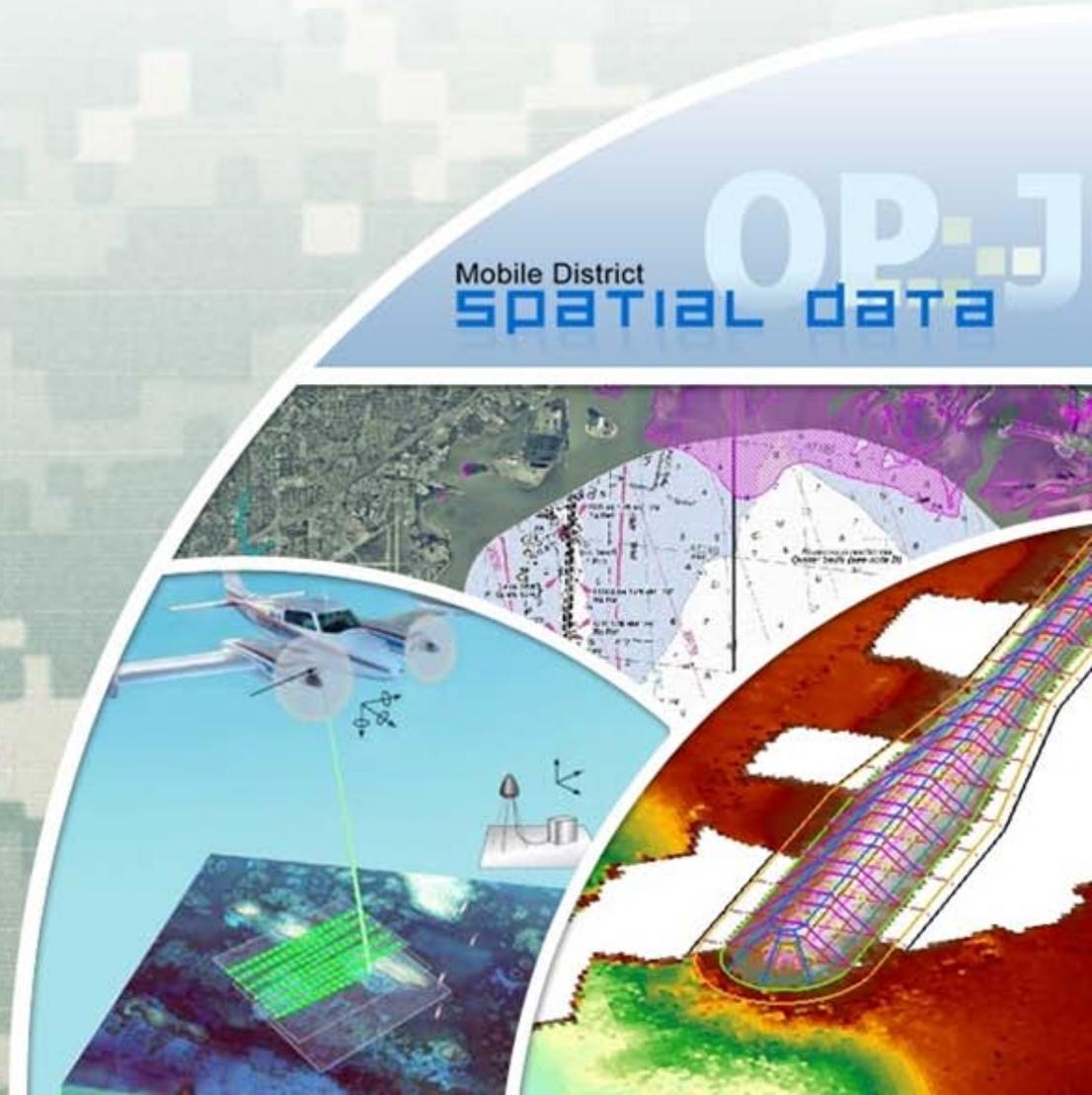
**Vicksburg, MS**

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**US Army Corps of Engineers**  
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# Contributors:

**Lead – W. Jeff Lillycrop**  
**ERDC CHL Technical Director, Navigation**

**James T. Stinson**  
ERDC ITL Computer Scientist

**Robert M. Wallace**  
ERDC ITL Chief, Computational Science & Engineering Division



# Presentation Outline

**CERB Recap (Jun 09)**

**NOAA-IOOS Experience**

**Approach & Examples**

**Plan**



# Coastal Working Group Survey

## 26 Data Use Questions

Office Symbol	Division	District	1. What types of coastal projects do you have? (i.e. shoreline protection, beach nourishment, shallow draft harbors, deep draft harbors, recreation, environmental restoration, etc.)
LRC, LRB	Great Lakes and Ohio River Division	Buffalo, Chicago	shoreline protection, beach nourishment, shallow draft harbors, deep draft harbors, recreation, environmental restoration, confined disposal facilities, navigation channels dredging projects
LRE		Detroit	Shore protection, Re-hab of Navigation Structures (Shallow and Deep Draft, Sediment Transport Studies, Dredged Sediment Placement Studies, Inner Harbor Wave Analyses, FEMA Flood Elevation Determination, Lawsuit Defense Studies
NAE	North Atlantic Division	New England	Shoreline protection and inundation prevention, coastal structure repair, beach nourishment, shallow draft harbors, deep draft harbors, recreation, environmental restoration, confined disposal facilities, navigation channels dredging projects
NAN		New York	shoreline protection (storm damage reduction), beach nourishment, shallow draft harbors, deep draft harbors, ecosystem restoration, intracoastal waterways, breakwaters, coastal inlets
NAP		Philadelphia	Hurricane and Storm Damage Reduction projects (including 10 beach nourishment projects), coastal structures (seawalls, jetties, revetments), shallow draft navigation, submerged breakwaters, environmental restoration
NAB		Baltimore	Shoreline Protection; Beach Nourishment; Shallow draft navigation, environmental restoration, Sand bypassing
NAO		Norfolk	Storm damage reduction, ecosystem restoration, beach nourishment, shallow and deep draft navigation projects
SAW	South Atlantic Division	Wilmington	Shoreline protection, beach nourishment, deep draft harbors, shallow draft channels, and environmental restoration.
SAW		Charleston	Shoreline protection, beach nourishment, deep draft harbors, shallow draft channels, and environmental restoration.
SAS		Savannah	Deep Draft Navigation Harbors, Beach Renourishment, Environmental Mitigation/Restoration, Dredged Material Disposal Areas, Shallow Draft Waterways, Flood Damage Reduction
SAJ-EN		Jacksonville	All of the above.
SAJ-PD		Jacksonville	all of the above, mainly shore protection with beach nourishment. hard structures used to a lesser extent. current construction of hard structures is to maintain beach fill in place. Navigation projects include both deep and shallow draft navigation and Intra Coastal Waterway. Navigation: deep draft harbors at 5 major cities and various shallow draft projects as well as the Gulf and Atlantic Intra Coastal Waterways
SAM		Mobile	Shoreline protection, beach nourishment, deep draft navigation harbor, restoration.
MVN	Mississippi Valley Division	New Orleans	Beneficial Use, Marsh restoration and protection, shoreline protection, Freshwater and sediment diversions, deep draft navigation channels, locks, gates, barrier island restoration, hydrologic restoration, sediment trapping, sand mining, sand management
SWG	Southwestern Division	Galveston	Coastal projects in SWG include coastal storm damage reduction, ecosystem restoration, deep-draft and shallow-draft navigation, and flood risk management. The coastal storm damage reduction project also takes into consideration a recreation aspect.
SPL	South Pacific Division	Los Angeles	All of the above including shoreline protection, storm damage reduction, navigation, recreation, ecosystem restoration.
SPN		San Francisco	Shore Protection, Flood Control, Shallow Draft Harbor, Deep Draft Harbors, Environmental Restoration
NWP	Northwestern Division	Portland	Deep draft and shallow draft navigation channels, rubblemound jetty navigation entrances, small local harbors, riverine and estuary pile-dike systems, shoreline erosion and protection, open water dredged material disposal sites, environmental restoration, shoreline/coastal flooding
NWS		Seattle	Shallow draft harbors, deep draft harbors, environmental restoration, beach nourishment
POA	Pacific Ocean Division	Alaska	shore protection, deep draft navigation, shallow draft harbor, flood damage reduction
POH		Hawaii	shoreline protection, beach nourishment, shallow draft harbors, deep draft harbors

2 Summary Spreadsheets Compiling Input from 21 Coastal Districts

Office Symbol	Division	District	Beach Profiles		
			Sources of Data	Problems Encountered	Related Data Needs
LRC, LRB	Great Lakes and Ohio River Division	Buffalo, Chicago	SHOALS in-house surveys contract	SHOALS - inconsistent coverage due to turbidity and breaking waves	
LRE		Detroit	Contractors. D&M	Inconsistent datum	Denser coverage around harbor
NAE	North Atlantic Division	New England	SHOALS/CHARTS in-house surveys contract	SHOALS/Charts - inconsistent coverage due to turbidity and breaking waves	
NAN		New York	In house (survey Branch) Contract Engineering Staff Local University	timeliness of data collection increasing costs difficulty in getting immediate post-storm profiles (for model calibration)	LIDAR vs. short profiles
NAP		Philadelphia	Contractor, in-house non-Federal sponsor (DE)	environmental windows (not completing profiles) accuracy in surf zone	technologies that develop accuracy surveying the surf zone
NAB		Baltimore	A-E	Control issues on occasion	
NAO		Norfolk	Local sponsor, Local Universities		
SAW		South Atlantic Division	Wilmington	Annual monitoring 2 projects.	
SAW	South Atlantic Division	Charleston	University State of South Carolina contractor	incorrect equipment setup	
SAS		Savannah	Construction Contractor Surveys	Reliability due to potential conflict of interest	
SAJ-EN		Jacksonville	In-House Survey Crews	Due to the large tidal range, it is difficult to get both hydrographic and topographic surveys during a reasonable time frame.	
SAJ-PD		Jacksonville	AE's, In-house	none	
SAM	Mobile	Lidar, In-house Bathymetric Survey, State databases		Inconsistent vertical datums. Issues with post processing.	
MVN	Mississippi Valley Division	New Orleans			
SWG	Southwestern Division	Galveston			
SPL	South Pacific Division	Los Angeles	hydrographic and nearshore surveys Old Corps and BEB records Old County records BEACON/SANDAG Organization of Local Gov't	datum conversions, accuracy not geo-referenced ambiguous alignment and zero location inconsistent datums (vertical) and local datums	Data to Produce Accurate Beach Profiles. long-term records that are geo-referenced need frequent enough capture seasonal and long-term trend Comparing historic beach profiles with current profiles and LIDAR
SPN		San Francisco	Survey Contractors NOAA Coast & Geodetic Survey USGS Surveys In-house staff	Datums Variability in survey techniques or assumptions Poor understanding of the true accuracy of various survey techniques	Datums; transect reference point Risk and Uncertainty Lidar capable software and computer power
NWP	Northwestern Division	Portland	in-house crew, contractor State governments, local agencies photogrammetric methods, lidar	some datum and control issues ground control setup expensive	more regional coverage needed after storms Post-storm monitoring surveys of erosional hotspots
NWS		Seattle	District WA Dept. Ecology	Data is unavailable without requesting	
POA	Pacific Ocean Division	Alaska	Contract surveyor	survey control. vertical datum changed relative to survey due glacial rebound and/or sea level rise	new monuments and tide gaging to update old monuments
POH		Hawaii	A/E Contracts	Cost is extremely high in remote locations. Datum issues.	In-house resources and tools would be beneficial.

# Synopsis of District Needs

CERB 2009

- **Data is required to execute our missions**
- We have **requirements for a wide range of data types** – temporal, spatial, financial, real-time, legacy, biological, chemical, physical, environmental, economic...
- **Corps collects / produces a lot of data that is indispensable to us, our stakeholders, and the public**
- Corps **relies on other agencies** for much data: other Fed (USGS, NOAA, others), coastal States (TX, LA, MS, AL, FL, CA, OR, WA, all), NGO's, and Universities
- There are **national & regional issues** that **require data partnerships to adequately address**
- **Need a sustainable framework** to discover, access, and use data



# Presentation Outline

Jun 09 CERB Recap

## IOOS Experience

Approach & Examples

Plan



# IOOS DIF Development Approach

Start Small

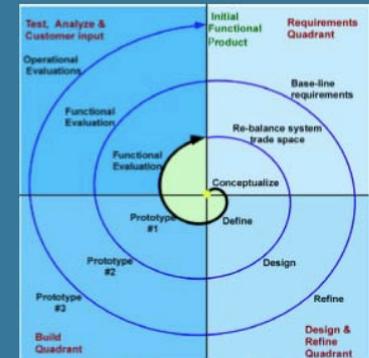
Be Specific

Don't duplicate data

Maximize value / impact

## Data Integration Framework (DIF)

- First spiral of IOOS development
- Standardize on small number of services & encodings
- Implement at selected provider & customer sites
- Start with several core variables
  - Currents
  - Temperature
  - Salinity
  - Water Level
  - Winds
  - Waves
  - Ocean Color (chlorophyll)



(Graphic by i3 Aerospace Technologies Pty Ltd  
– used with permission)

IOOS  
• Evaluate in FY 2010



# Digital Coast



- Distributed architecture
- Many contributors
- Access to the Public

## Decision Support

- Habitat Priority Planner
- Nonpoint-Source Pollution and Erosion Comparison Tool
- Impervious Surface Analysis Tool
- CanVis Visual Simulation Tool
- Multipurpose Marine Cadastre

## Informational

- Storm Mapping Tutorial
- Storm Data Resource Guide

## Data Access and Visualization

- Hurricane Evacuation Zones Mapping Tool
- Legislative Atlas
- Historical Hurricane Tracks IMS
- Hazard Assessment Tool

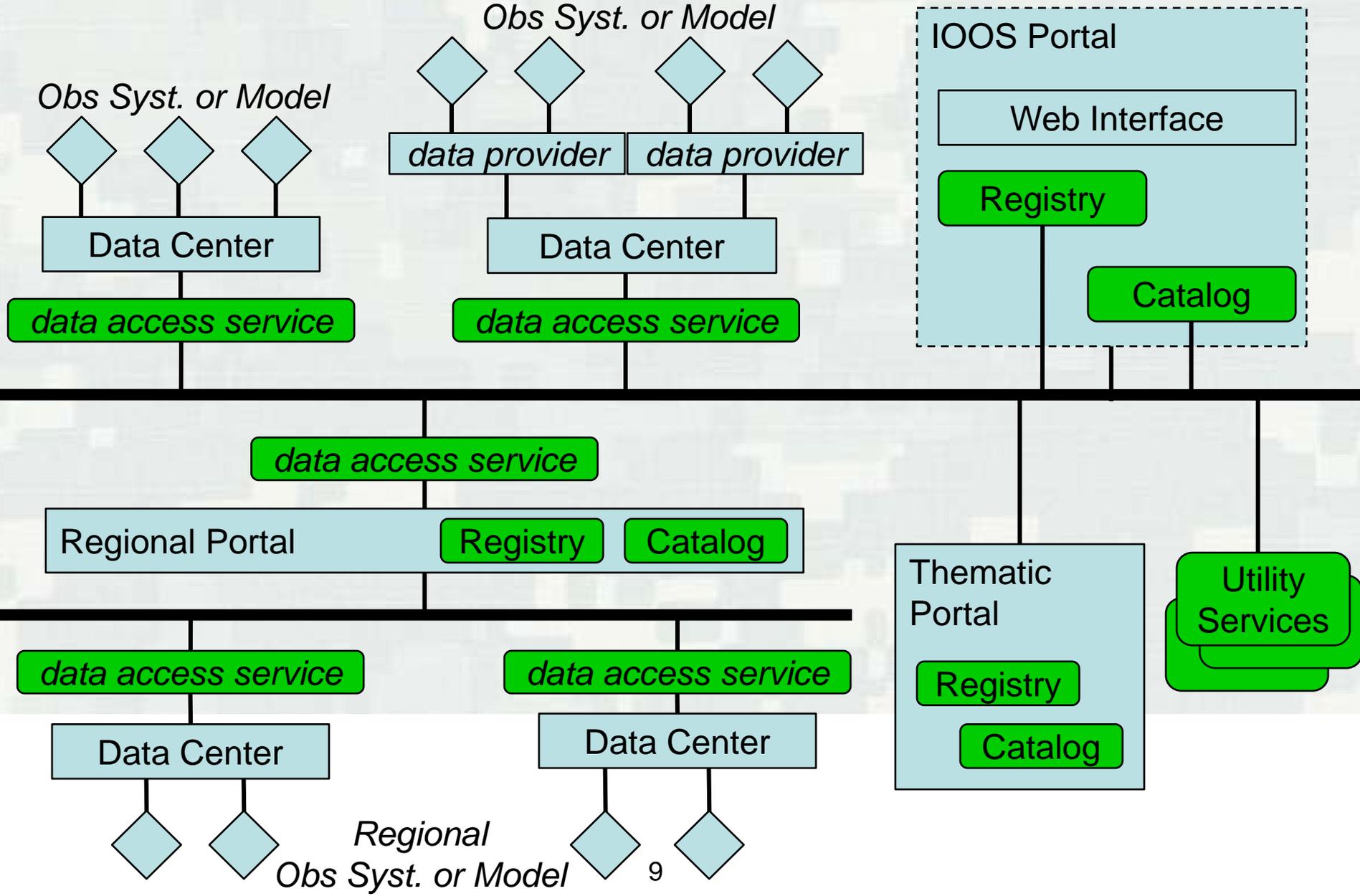
## Data Handling Tools

- Lidar Data Handler
- Chart Reprojector
- Electronic Navigational Chart Handler
- Nautical Chart Viewer

**Data – Tools - Training**



# Service-Oriented Architecture



# IOOS Web Services and Data Standards

## Data Type

## Web Service

## Standard

In-situ data (buoys, piers, towed sensors)

Sensor Observation Service (SOS)

XML based on OGC Observations and Measurements (O&M)

Gridded data (model outputs, satellite)

OpenDAP and/or Web Coverage Service (WCS)

NetCDF using Climate and Forecast (CF) conventions

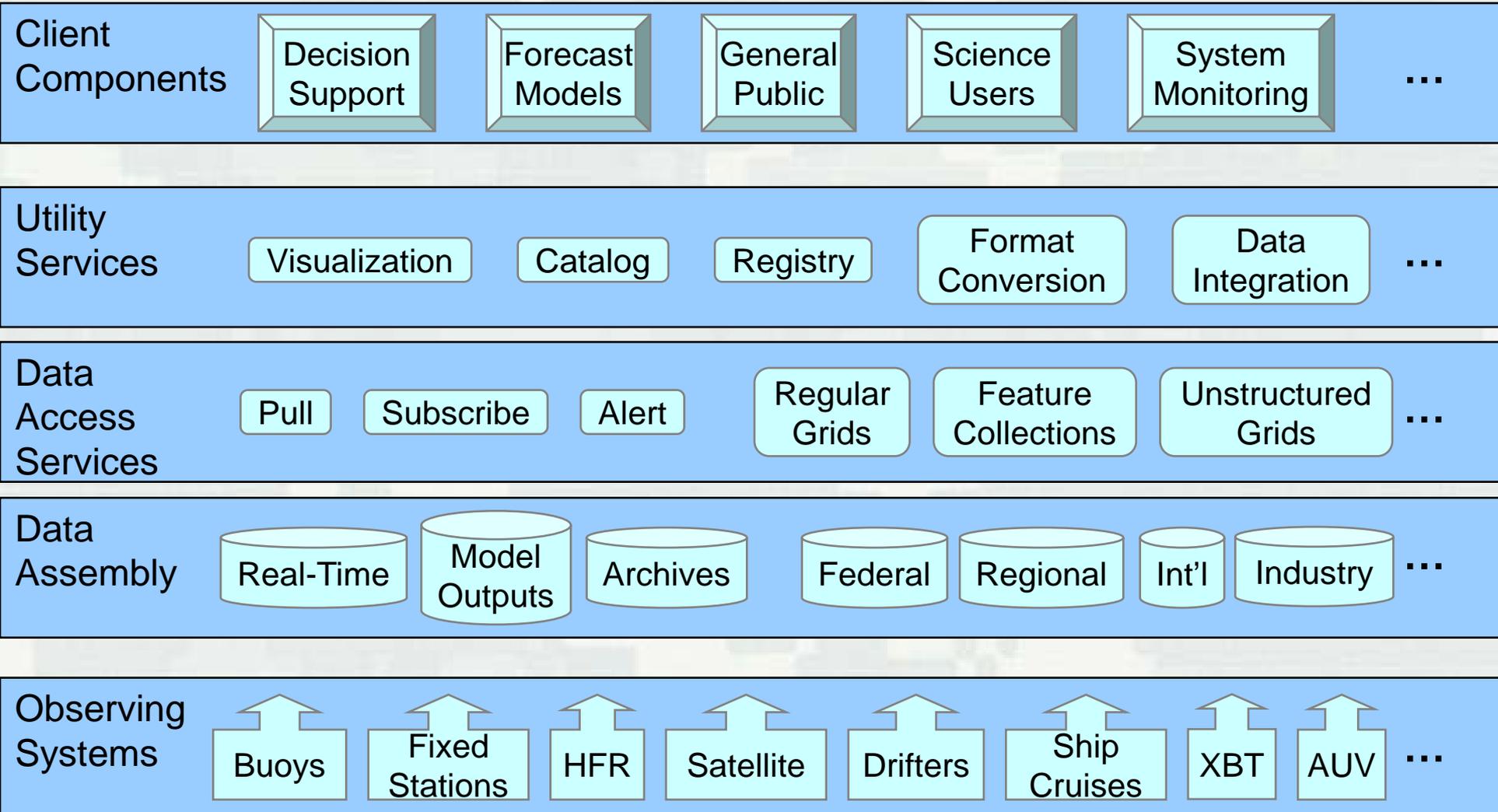
Images of data

Web Map Service (WMS)

TIFF, PNG etc.  
-possibly with standardized styles



# IOOS Data Management and Communication



# Presentation Outline

Jun 09 CERB Recap

IOOS Experience

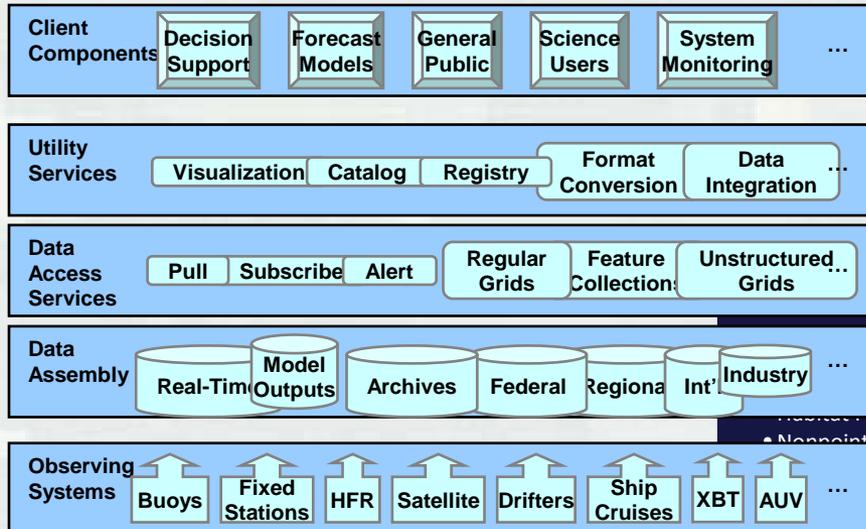
## Approach & Examples

Plan



# Approach

USACE Develop a comprehensive design



- Support
- Priority Planner
- Nonpoint Source Pollution and Comparison Tool
- Surface Analysis Tool
- Qual Simulation Tool
- Multipurpose Marine Cadastre
- Informational
- Storm Mapping Tutorial
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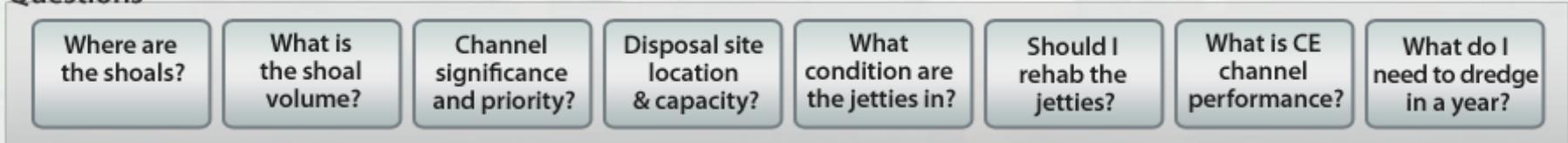
# Mission Critical Decisions

- 
- **When to Dredge?**
  - **Where to Dredge?**
  - **Where to Place Material?**
  - **Are there Alternatives to Dredging?**
  - **What is the Dredge Availability?**

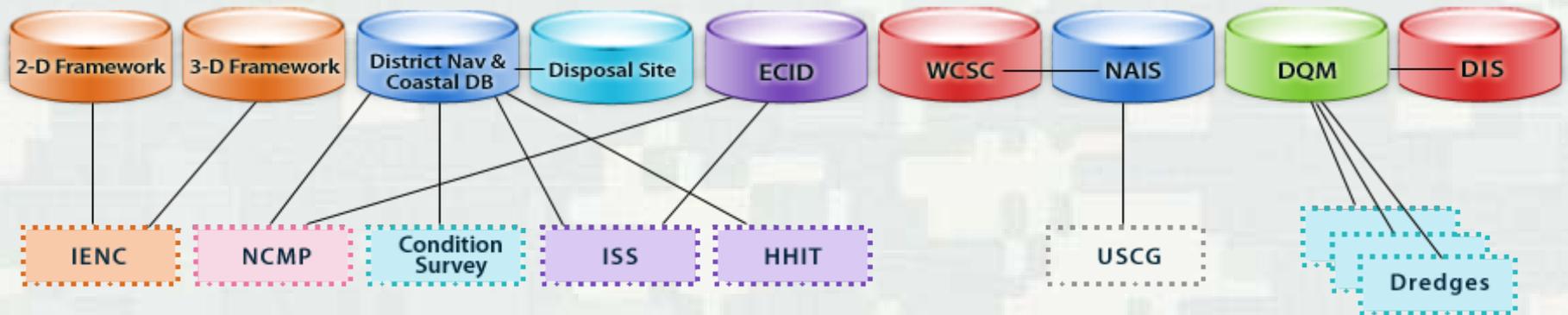
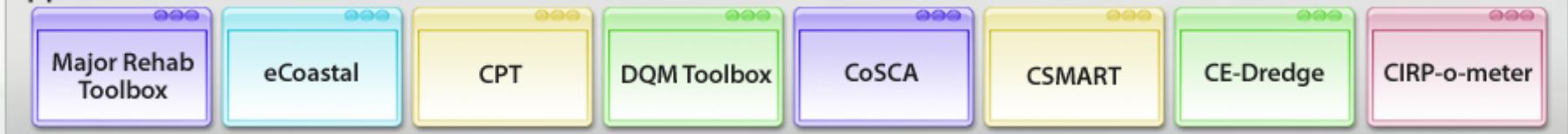


# Integrated Coastal Navigation Programs

## Questions



## Applications



# Integrated Coastal Navigation Programs

## Questions

Where are the shoals?

What is the shoal volume?

Channel significance and priority?

Disposal site location & capacity?

What condition are the jetties in?

Should I rehab the jetties?

What is CE channel performance?

What do I need to dredge in a year?

## Applications

Major Rehab Toolbox

eCoastal

CPT

DQM Toolbox

CoSCA

CSMART

CE-Dredge

CIRP-o-meter

2-D Framework

3-D Framework

District Nav & Coastal DB

Disposal Site

ECID

WCSC

NAIS

DQM

DIS

IENC

NCMP

Condition Survey

ISS

HHIT

USCG

Dredges



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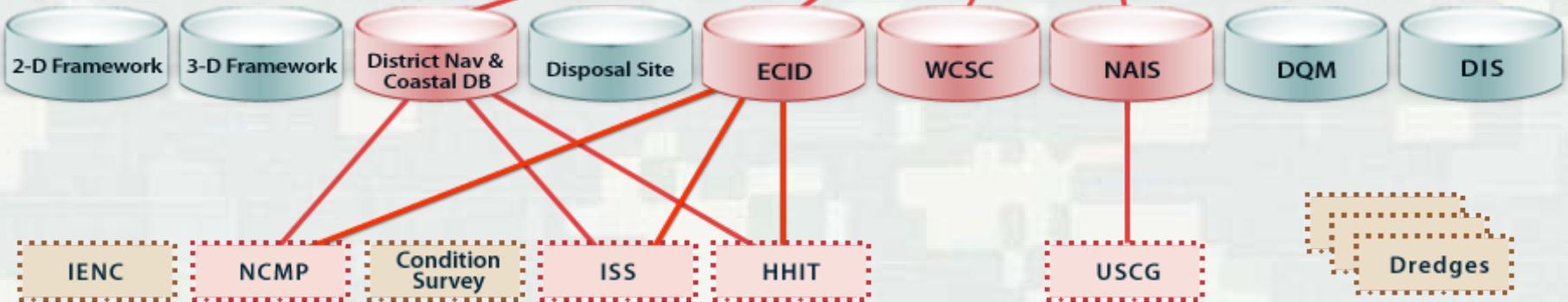
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Approach

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## Plan



# Proposal

Detailed DIF Design  
Include a pilot project  
Complete in 2 years

2-year program

1. Define requirements
2. Define interactions
3. ID existing parts & resources
4. Develop detailed design
5. Prototype (alpha) Year 1

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6. Assess Prototype
7. Final Design
8. Implement prototype
9. Products: Detailed Design and Prototype Year 2



# Approach

## Team

Develop and Design an operational prototype Data Integration Framework

IOOS (Fed)  
IWG-OCM (Fed)  
Digital Coast (NOAA)  
USGS

ACE-IT  
CECI

Karl Brown, SWG  
Heather Schlosser, SPL  
Tom Smith, POH  
Heidi Moritz, NWP  
, LRE  
Dave Lichy, IWR  
Clint Padgett, SAM  
Carl Dyess, SAM

Rory Sutton, SAD  
Monica Chasten, NAP  
William Rogers, NAD  
John Tavolaro, NAN

James Stinson, ERDC  
Eddie Wiggins, ERDC  
Molly Reif, ERDC  
Ned Mitchell, ERDC  
Mark Graves, ERDC  
CorpsMap, ERDC  
Jennifer Wozencraft, JALBTCX

Nancy Blyler, HQ  
Jeff McKee, HQ



# Summary

## **Proposal:**

- Develop a detailed data integration framework design
- Includes a pilot project
- Two-years
- Creates a Corps-wide Team

## **Proposal does:**

- Leverages on-going efforts
- Produces a design to tie them together
- Uses lessons from IOOS

## **Proposal does NOT:**

- Duplicate on-going efforts
- Create new applications or tools
- Create new databases



# Question/Comments?



**Clint.Padgett@us.army.mil**  
**<http://spatialdata.sam.usace.army.mil>**



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