

# Navigation RD&T

# ERDC

Engineer Research and  
Development Center

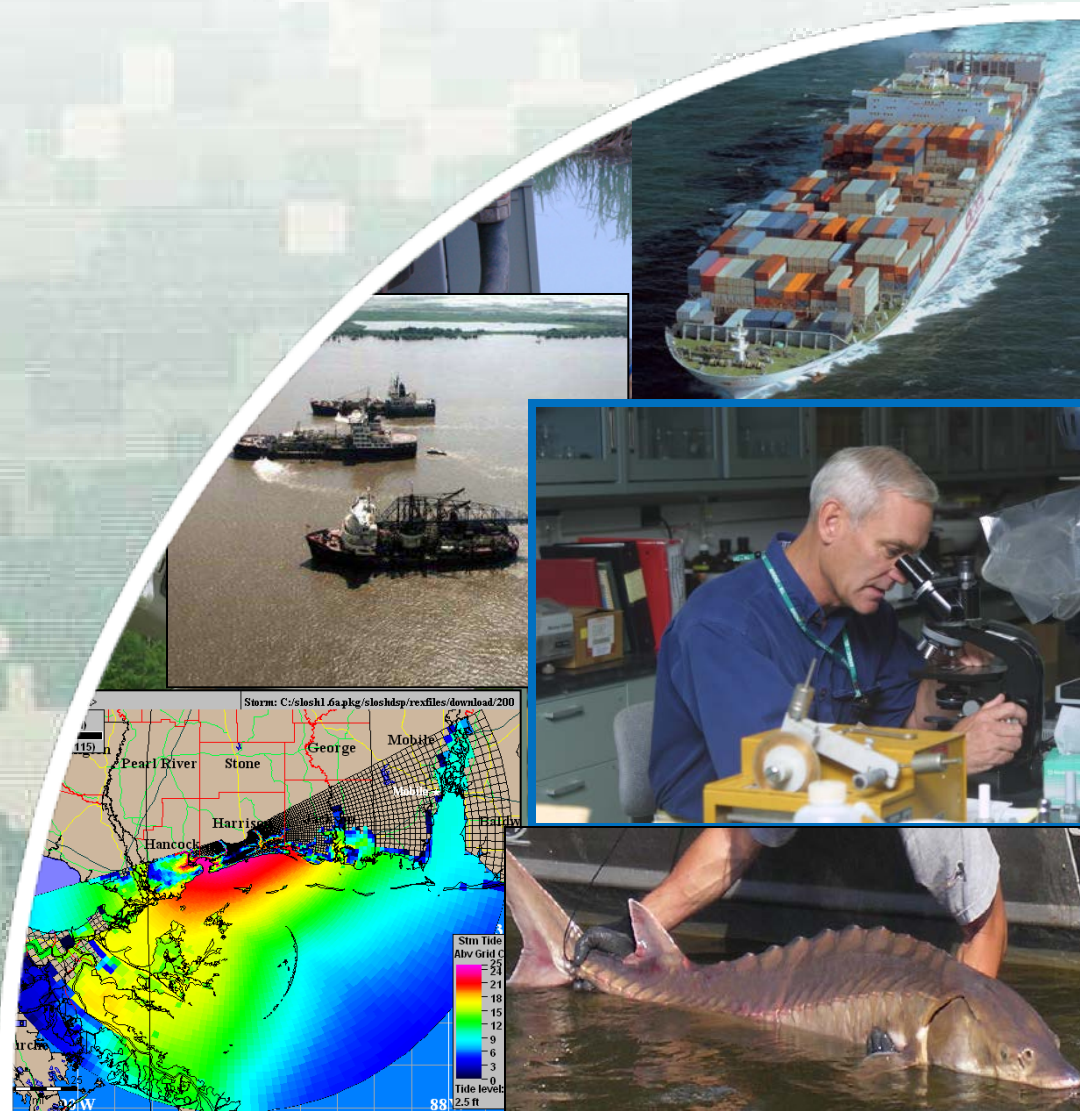
**Jeff Lillycrop**  
Technical Director

*Advancing Science and Technology  
in Support of Sustainable Solutions to  
America's Water Resources Needs*

20 Aug 2013  
RSM Annual Meeting



US Army Corps of Engineers  
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# CW R&D at a Glance

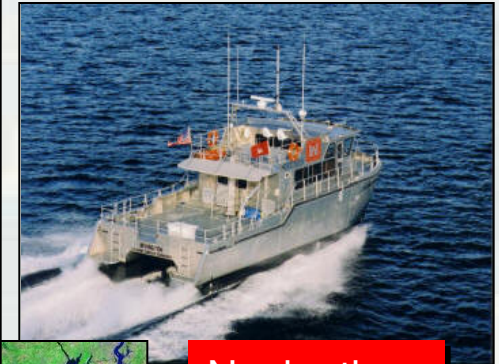
## USACE Business Areas

- **Navigation** and Hydropower
- **Flood and Coastal**, Water Supply, Emergency Management
- **Environment** - Restoration, Regulation, Stewardship

- **FY13 Business Lines**



Infrastructure



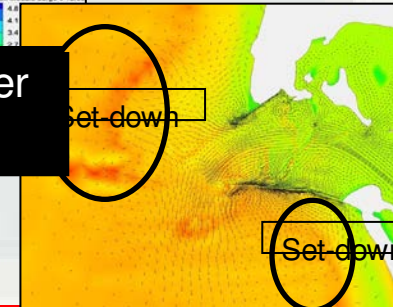
Navigation



Integrated Water Resources



Environment



Flood & Coastal



# CW RD&T Technology Transfer

## Summary of FY12 Products

**CW  
RD&T**

38 Wiki Pages

55 Webinars

161 Tech Reports and Tech Notes

207 Conferences & Workshops

66 Software Releases

58 Journal Articles

61 Hosted Workshops

45 DOTS requests / 18 Districts

45 WOTS requests / 20 Districts

105 Federal Agencies Collaborations

92 State & Stakeholder Collaborations

79 University Collaborations

4 Guidance Documents

1 Patent

**ERDC**

# Corps Navigation Mission

Provide safe, reliable, efficient, effective and environmentally sustainable waterborne transportation systems for movement of commerce, national security needs, and recreation.



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*Innovative solutions for a safer, better world*

# USACE Navigation Assets

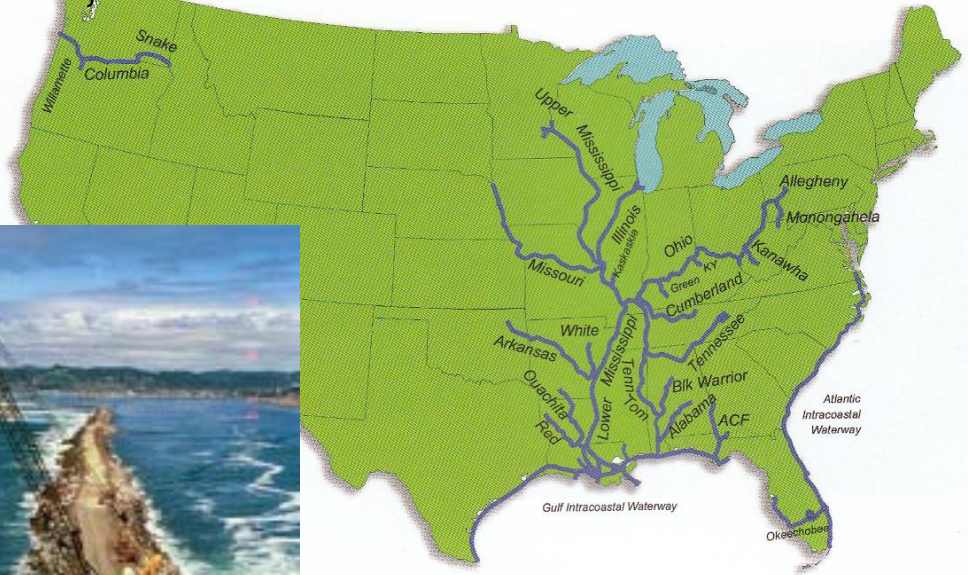
## COASTAL NAVIGATION

1067 Navigation Projects  
19 lock chambers  
13,000 miles of channels  
929 navigation structures  
844 bridges

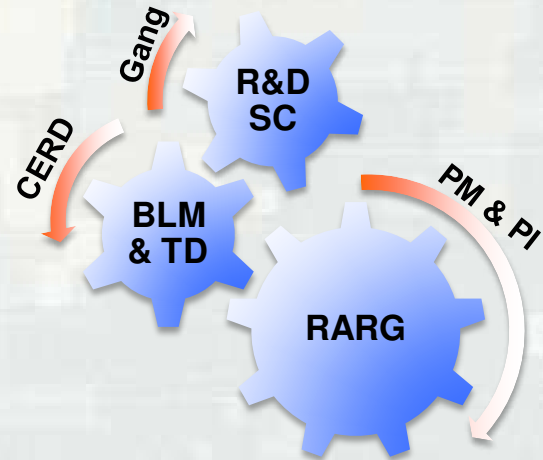
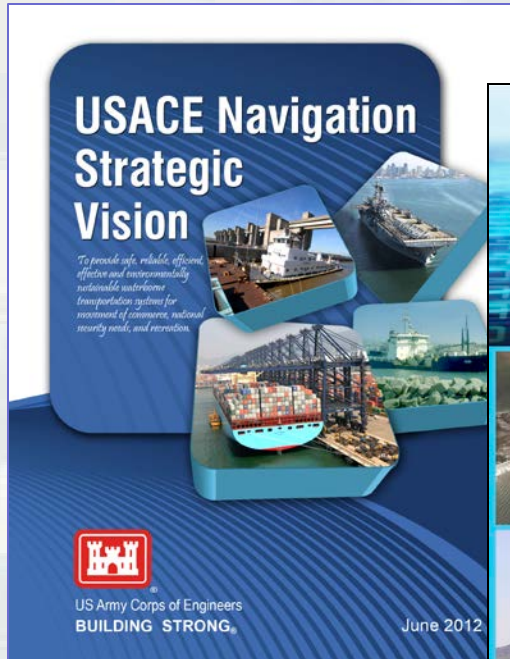


## INLAND NAVIGATION

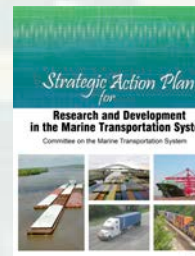
27 Inland River Systems  
207 lock chambers @ 171 lock sites  
12,000 miles of inland river channels



# Navigation RD&T Guiding Documents



USACE Campaign Plan				
What will YOU do to make USACE GREAT?				
<b>USACE Vision</b> A world of engineering that is safe, reliable, efficient, effective and environmentally sustainable waterways transportation systems for movement of commerce, national security needs, and recreation.	<b>USACE Mission</b> Provide the Army's primary service, support and engineering expertise to the Department of Defense and the Nation.	<b>USACE Values</b> Integrity, Innovation, Teamwork, and Customer Focus.	<b>Goal 1</b> Increase the number of employees who are certified in the Army's Professional Development Program (PDP).	<b>Goal 2</b> Increase the number of employees who are certified in the Army's Leadership Development Program (LDP).
<b>Goal 3</b> Increase the number of employees who are certified in the Army's Technical Development Program (TDP).	<b>Goal 4</b> Increase the number of employees who are certified in the Army's Safety Development Program (SDP).	<b>Goal 5</b> Increase the number of employees who are certified in the Army's Environmental Development Program (EDP).	<b>Goal 6</b> Increase the number of employees who are certified in the Army's Quality Development Program (QDP).	<b>Goal 7</b> Increase the number of employees who are certified in the Army's Diversity Development Program (DDP).



# Navigation RD&T Strategic Needs & Priorities

FY13

- Extend the useful life of existing navigation infrastructure
- Operate and manage national waterborne transportation assets as an integrated system
- Optimize and prioritize channel availability for commercial freight movement
- Engineering with nature to enhance ecosystem and project processes, benefits and services
- Implement eNavigation throughout the National MTS
- Deliver sound engineering and scientific solutions to align with the Planning Modernization initiative



# Navigation RD&T Portfolio

## Dredging Operations and Environmental Research

Dr. Todd Bridges

## Coastal Inlets Research Program

Dr. Julie Rosati

## Navigation Structures

## Navigation Systems

Mr. Eddie Wiggins

## Regional Sediment Management

Ms. Linda Lillycrop

## Monitoring Completed Navigation Projects

Dr. Lyn Hales

## Dredging Operations Technical Support

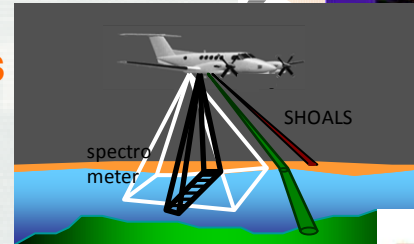
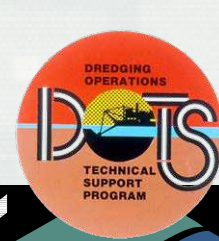
Ms. Cynthia Banks

## Inland Electronic Navigation Charts

Dr. Bob Mann / Ms. Denise LaDue

## National Coastal Mapping Program

Ms. Jennifer Wozencraft







Engineer Research and  
Development Center

# Dredging Operations Environmental Research (DOER)

Dr. Todd S. Bridges, ST  
Senior Research Scientist,  
Environmental Science



US Army Corps  
of Engineers®



# Beneficial Use of Dredged Material

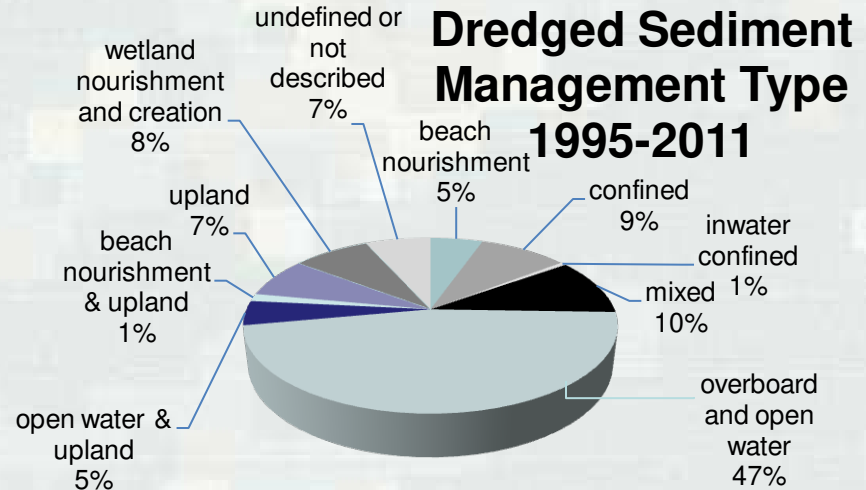
John Childs

## Problem

- ▶ Corps generates/ manages ~250E6+ cy of DM each yr
- ▶ BU is necessary for sustainability of Nav. program
- ▶ IWR tracks DM management, but not beneficial use
- ▶ Funding is limited and incentives are needed for BU

## Objective

- Increase BU
- Track DM Management and BU
- Technology transfer across Districts
- Identify feasible and cost effective management controls and engineering controls to allow for BU
- Identify BU incentives



## Approach

- Bring together previous and current research into Guidelines
- Quantify environmental (and social) benefits
- Occupy RSM and EWN
- BU is a primary goal of the National Dredging Team

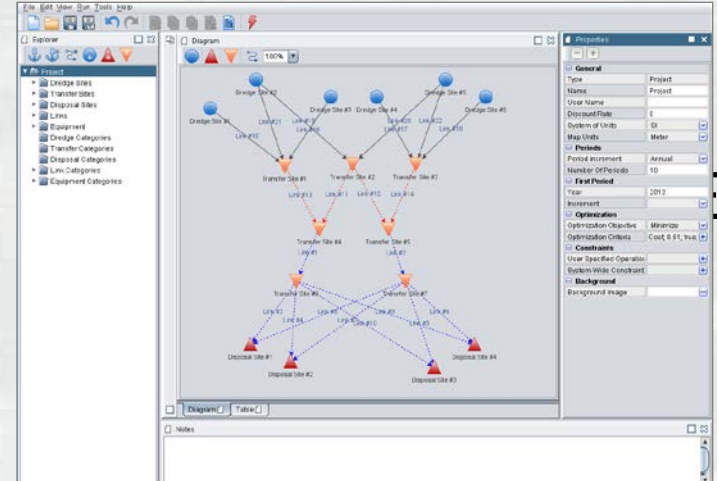


# Dredged Material Disposal Management

Linkov & Bates

## ■ Problem

- ▶ Multi-objective dredging planning & sediment management is complex
- ▶ Existing optimization software was archaic, limited, and hard to use



## Objective

- Improved user interface
- Improved multi-objective optimization functions
- GIS & decision support
- Open source software that is easy to maintain

## Approach

- Three modules (GIS, Optimization, Decisions)
- Visual, customizable, interactive user interface
- Java code built on open source optimization tools



# Engineering With Nature

Thomas J. Fredette

## ■ Problem

- USACE faces multiple challenges that affect delivery of safe and reliable navigation projects. These include:
  - Time and costs required to implement and operate projects increasing due to inter-agency coordination and consultation, regulatory compliance issues, market pressures, etc.
  - USACE infrastructure and operations are viewed by many stakeholders as being in conflict with environmental and social interests.
  - Environmental expectations and regulatory requirements for projects continue to steadily increase.
  - The effective budget for the USACE has been decreasing.



## Objective

- Document, demonstrate, and monitor EWN sites.
- Highlight how these infrastructure development efforts provide economic, environmental, and social benefits – in a sustainable way – producing a “triple win”.
- Enable greater support by and collaboration with our partners and stakeholders by illustrating case studies that use natural processes to achieve a broad range of project objectives.
- Support and advance the USACE Environmental Operating Principles and Civil Works Strategic Plan.

## Approach

- Conduct technical data/literature search to identify existing projects.
- Survey USACE Districts to identify and document existing projects and their benefits.
- Develop an Interactive Geographic Site Database.
- Evaluate identified projects and develop technical approaches for improving implementation and performance.



# Coastal Inlets Research Program



**Julie Dean Rosati**

Program Manager

**Jeff McKee**

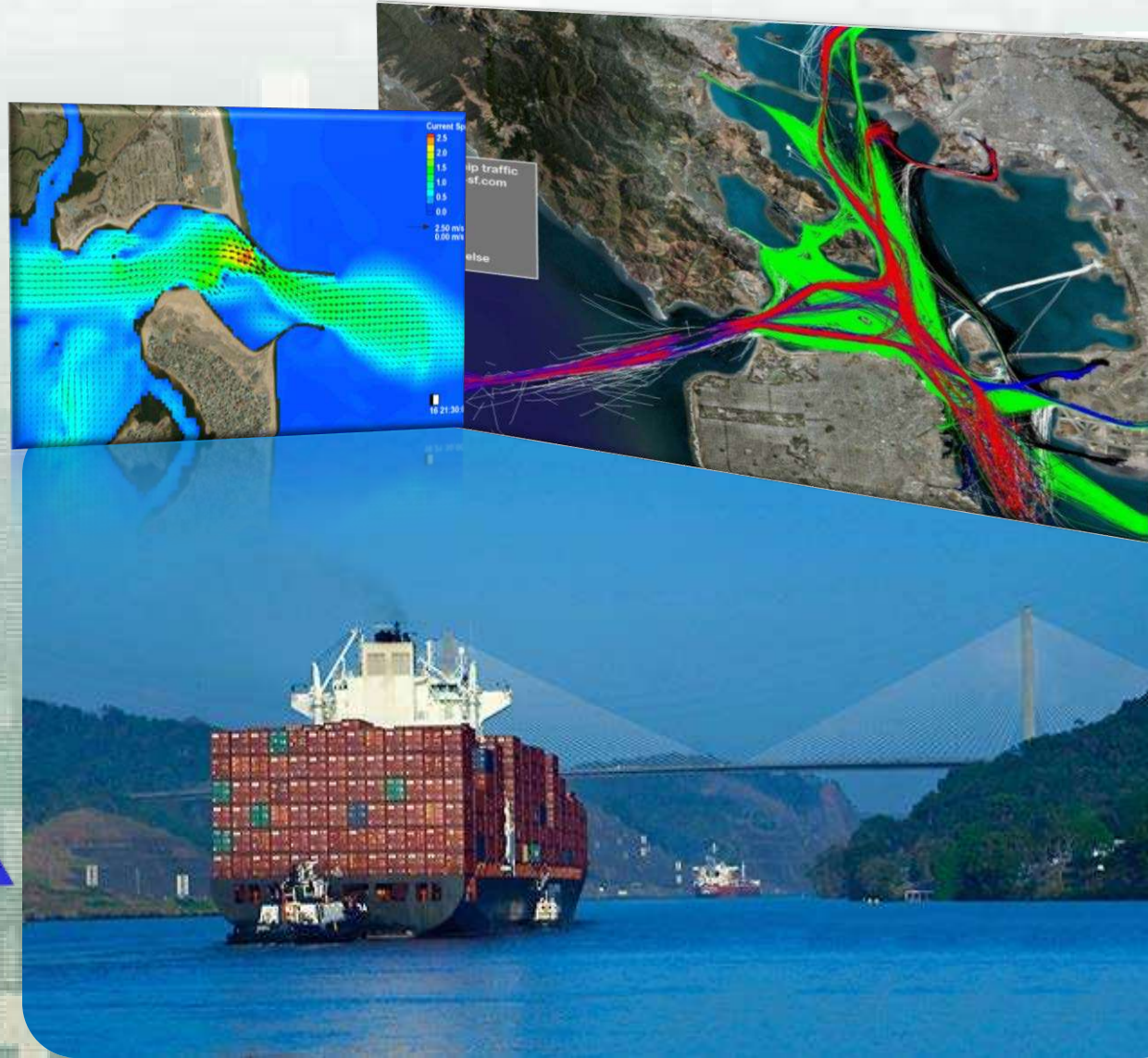
HQ Navigation  
Business Line Manager

**Jeff Lillycrop**

Technical Director

**Eddie Wiggins**

Associate Technical Director



US Army Corps of Engineers

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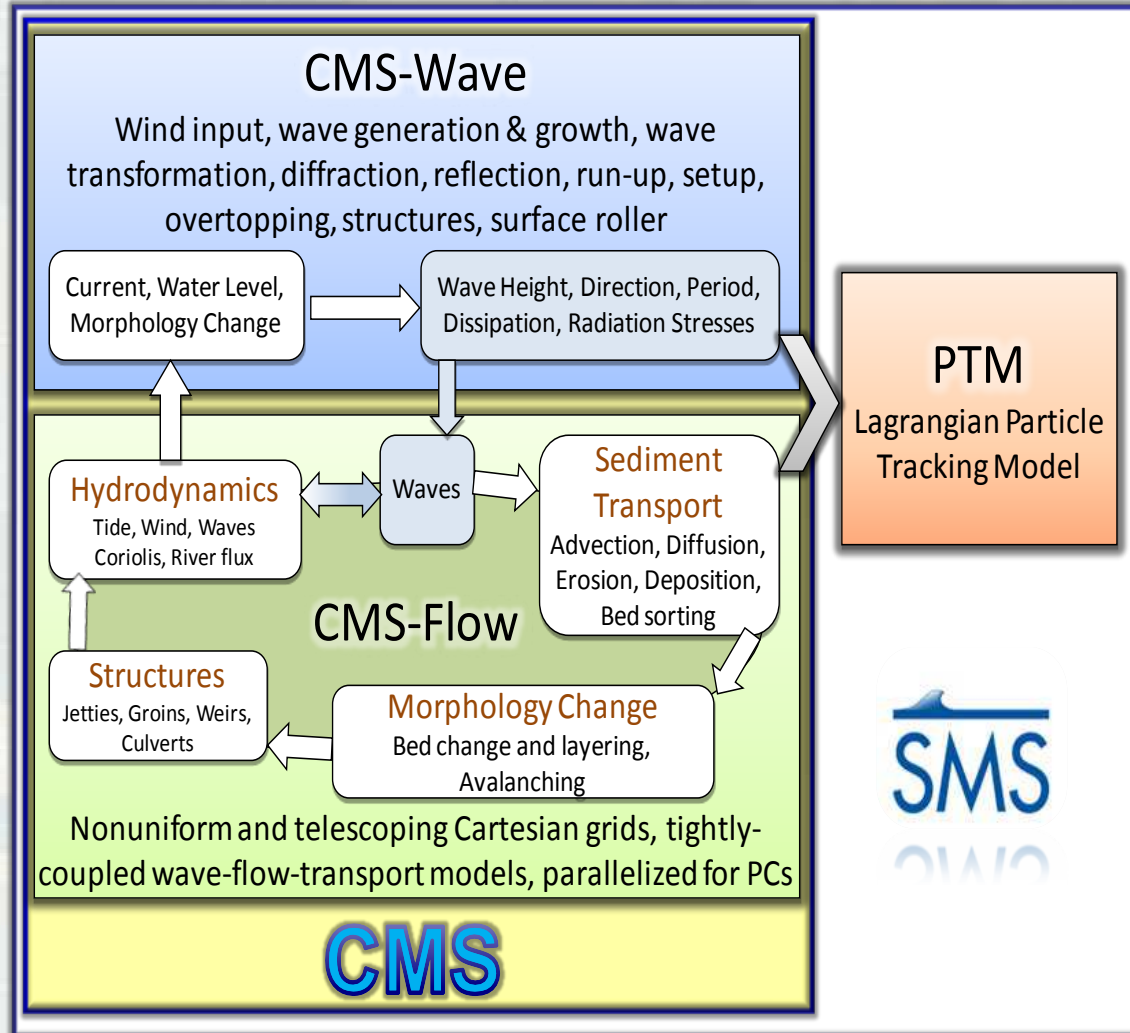
# Coastal Modeling System

## What is the CMS?

Integrated wave, current, and sediment transport model in the SMS

### Includes:

- Application specific solvers
  - Implicit:  $\Delta t \sim 10$  min
  - Explicit  $\Delta t \sim 1$  sec for transport
- Multiple-sized sed. transport
- Grid options
  - Non-uniform and
  - Telescoping Cart. grids
  - Flexibility and efficiency
- Parallelization on PC's
- FVM - Conservative



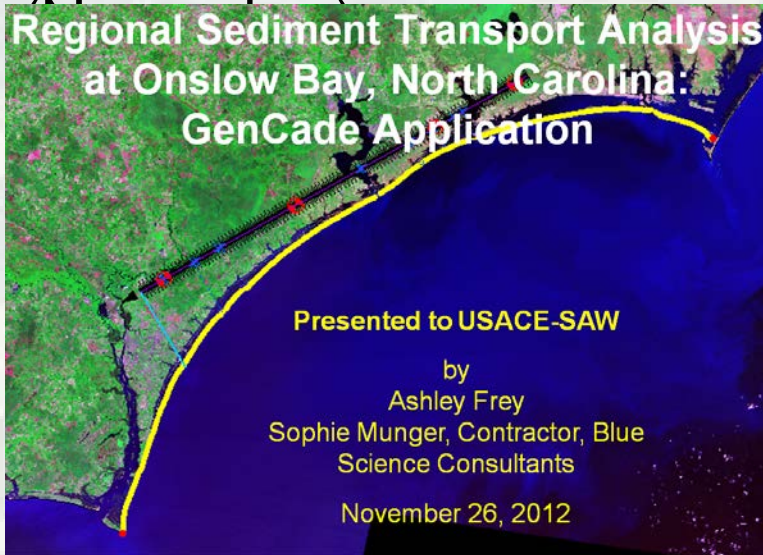
# GenCade – Tech-Transfer & District Interaction



## Webinars

Introduction to GenCade Webinar  
(October, 6 hours)

Onslow Bay Webinar to SAW



Coastal Inlets Research Program

1

## GenCade

Webinar occurred 16-18 June 2012

Agenda	Files
<p>16 October 2012 - Day 1</p> <ul style="list-style-type: none"> <li>• <a href="#">Welcome</a></li> <li>• <a href="#">Introduction to GenCade</a></li> <li>• <a href="#">Introduction to GenCade in the SMS</a></li> <li>• <a href="#">Helpful Hints</a></li> <li>• <a href="#">GenCade Applications</a></li> <li>• Completed Project Demo</li> <li>• Simple Case Demo</li> </ul>	<p>Click <u>underlined</u> links on the agenda to access presentation material, CMS User's Guide, and data files.</p> <ul style="list-style-type: none"> <li>• <a href="#">GenCade Executable</a></li> <li>• SMS 11.1 Beta (Full Installation)                             <ul style="list-style-type: none"> <li>◦ <a href="#">32-bit Installer</a></li> <li>◦ <a href="#">64-bit Installer</a></li> </ul> </li> <li>• <a href="#">Day 1 material</a></li> <li>• <a href="#">Day 2 material</a></li> <li>• <a href="#">Day 3 material</a></li> </ul>
<p>17 October 2012 - Day 2</p> <ul style="list-style-type: none"> <li>• Simple Case Demo (continued)</li> <li>• <a href="#">Inlets and Beach Fills Case</a></li> <li>• Complex Case (start)</li> </ul>	<p><b>Webinar Audio/Video Files</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Day 1 (~100 MB)</a></li> <li>• <a href="#">Day 2 (~113 MB)</a></li> <li>• <a href="#">Day 3 (~ 75 MB)</a></li> </ul>
<p>18 October 2012 - Day 3</p> <ul style="list-style-type: none"> <li>• Complex Case (continued)</li> <li>• <a href="#">Future Capabilities</a></li> <li>• <a href="#">Wave Conversion Tool</a></li> </ul>	





# Nearshore Berms

## RSM Leveraged

The Nearshore  
Berm Calculator

### NEARSHORE BERM CALCULATOR

Login
Background
Definitions
References
Contacts
Calculation

Save Cross Section

Save Plan View

**Units**

Permitted Placement Boundaries

Placement Site Profile

Placement Site Hydrodynamics

Placement Material

Dredge/Placement Method

Navigational and Environmental Limits

**LEGEND**  
Dredge Draft Safety Clearance: █

**RESULTS**  
 $D_{50B}$ : 0.18 mm  
 $D_{50}$ : 0.20 mm  
 $d_{inner}$ : -20.00 ft  
 $d_{Outer}$ : -35.00 ft  
**Berm Volume**: 562,140 yd<sup>3</sup>  
**Elevation of Berm Crest**: -6.04 ft  
**Berm Crest Width**: 100.00 ft





# Sediment Budget Calculator

## Auto-populate R's and L's

Enter minimum, maximum, and increment for the Right- and Left-directed longshore sand transport rates at the Right and Left boundaries of the budget region (see figure above). By clicking "Populate" these values will be entered into the input table below. To populate an example data set, click on Populate Sample.

Min: 100000      Max: 500000      Increment: 50000

Populate

Populate Sample

Which shoreline is downdrift OR of less certain volume change?       Units:

R1 minimum	<input type="text" value="100000"/>	R1 maximum	<input type="text" value="500000"/>	increment	<input type="text" value="50000"/>
R2 minimum	<input type="text" value="100000"/>	R2 maximum	<input type="text" value="500000"/>	increment	<input type="text" value="50000"/>
L1 minimum	<input type="text" value="-100000"/>	L1 maximum	<input type="text" value="-500000"/>	increment	<input type="text" value="-50000"/>
L2 minimum	<input type="text" value="-100000"/>	L2 maximum	<input type="text" value="-500000"/>	increment	<input type="text" value="-50000"/>
V change, Left	<input type="text" value="-100000"/>	Right	<input type="text" value="-300000"/>	gross	<input type="text" value="250000"/>

Fraction of incident transport impounded at left (J1) and right (J2) jetties (0= transparent jetty, 1= impermeable jetty)

J1:       J2:

Local inlet-induced transport from left (m1) and right (m2) shorelines (expressed as a percentage of R1 and L2, respectively):

M1:       M2:

Mechanical transfer of sand from the inlet to the left (DL) and right (DR) shorelines, respectively:

DL:       DR:

Mechanical transport of sand from left shoreline to right shoreline (DB; positive if left to right, negative if right to left) or placement offshore (Do):

DB:       DO:

Transport of sand into inlet from upland sources

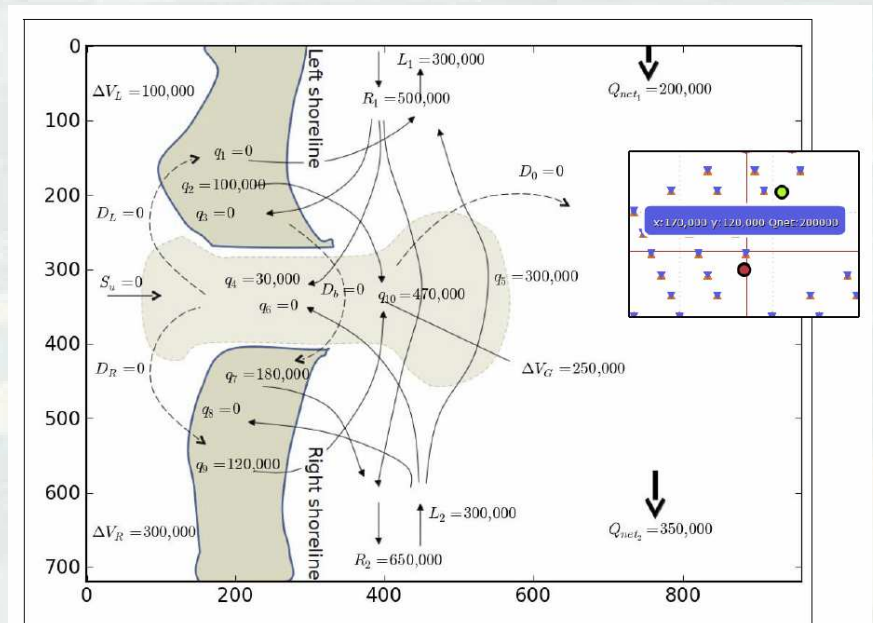
SU:

Calculate

(scroll down to view calculated chart)

An online web-tool that applies the Bodge Method of formulating an inlet and adjacent beach sediment budget through developing a Family of Solutions that satisfy user-defined constraints

Webinar in July with 11 attendees from Districts



# National Coastal Mapping Program

**Jennifer M. Wozencraft**

Director, Joint Airborne Lidar Bathymetry Technical Center of Expertise



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Joint Airborne Lidar Bathymetry  
Technical Center of Expertise

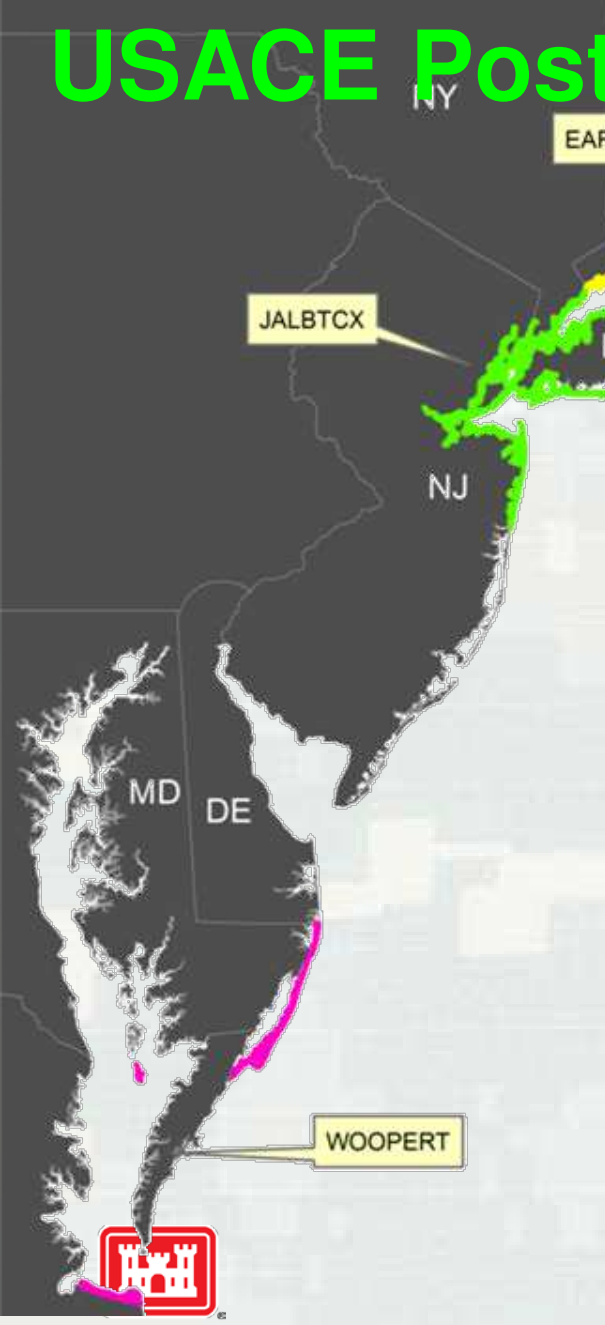
# National Coastal Mapping Program



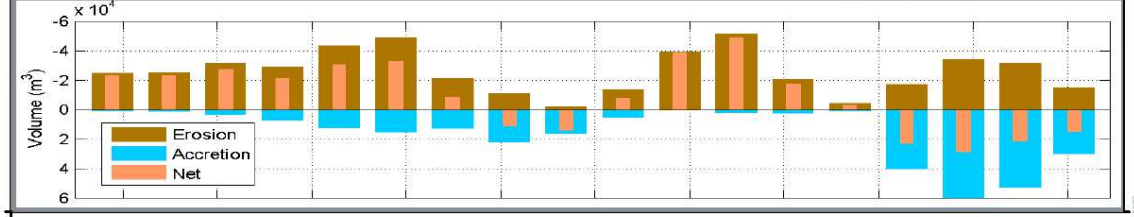
Seabrook, NH, 2011 federal navigation project and backbay marsh

# USACE Post-Sandy Lidar

JALBTCX was also tasked by North Atlantic Division with comparing the pre-event datasets from the USACE National Coastal Mapping Program with the post-event lidar data.



CORPS OF ENGINEERS  
-73 0352



Horizontal Coordinate System:  
GCS North American 1983  
Datum: North American 1983  
Distance Units: Degree  
Vertical Datum:  
Elevation differences are shown in meters.

The information depicted on this map represents a comparison of survey data collected by JALBTCX after Superstorm Sandy in late October 2012. The data and comparison are preliminary.

Comparison data sources: NY State Department of Environmental Conservation 2012 LIDAR and JALBTCX 2010 LIDAR.

2012 Aerial Photography data source: NOAA Hurricane Sandy Response Imagery

U.S. ARMY  
Corps of Engineers  
District: CEAA

DISCLAIMER

NATIONAL COASTAL MAPPING PROGRAM  
Post-Superstorm Sandy  
Elevation Differences and Volume  
Long Island 06 and Long  
Island 07: 600212

Sheet Reference  
Number 1 of 1

# National Coastal Mapping Program

## Coastal engineering indices

2004-2010 shoreline change rate index



2010 dune height index



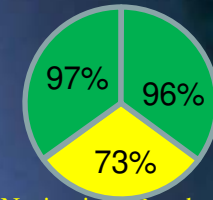
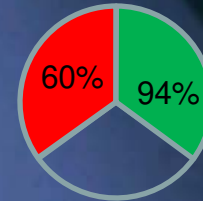
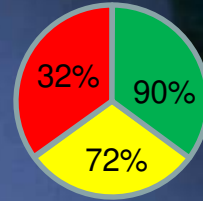
2010 beach width index



Combined geomorphology index

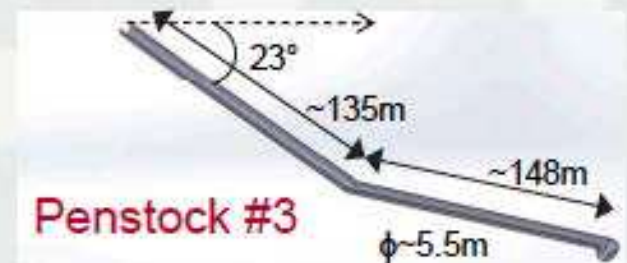


Geomorphology	Dune height Beach width Shoreline change
Inlets	Ebb shoal volume change Structure dimensions relative to design Navigability
Environment	Dune vegetation density Wetland density Submerged aquatic vegetation density
Human use	Impervious surface density



# FY13 Product Development

- 11/8/2012 Site Visit, Carter's Lake, Penstock #3
- Challenges
  - ▶ Little / no light
  - ▶ Water / slippery surface in center
  - ▶ No surface features
  - ▶ Curved & inclined floor
  - ▶  $\text{Fe}_2\text{O}_3$  dust



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# USACE Regional Sediment Management Program (RSM)

**Linda Lillycrop**  
Program Manager

**Jim Walker**  
HQ, Proponent  
Navigation Business Line Manager

**Jeff Lillycrop**  
Technical Director, Navigation

**Eddie Wiggins**  
Associate Technical Director, Navigation

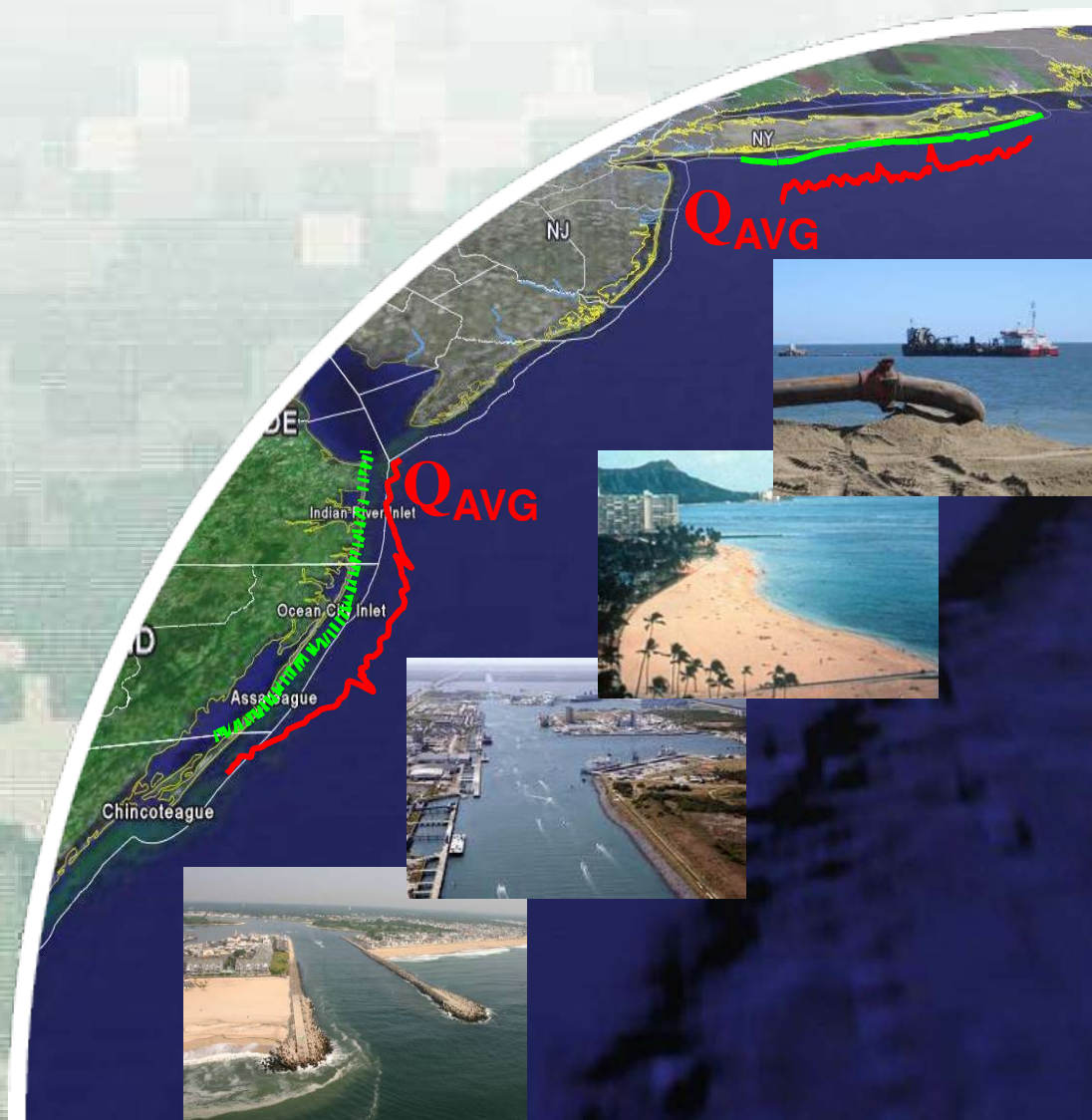
**Navigation RARG  
Meeting  
Vicksburg, MS  
3-5 April 2012**



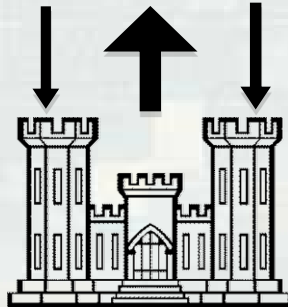
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# Regional Sediment Management



## Districts

### Navigation/Dredging



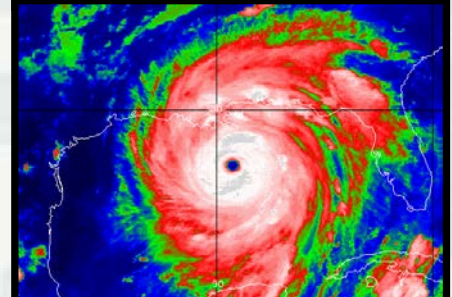
### Flood Risk Management



### Environmental Restoration



### Emergency Response





# RSM Products FY12 & FY13 - FY17

RSM.USACE.ARMY.MIL

RSM Technical Notes,  
Reports, Manuals, Conference Papers

**US Army Corps of Engineers**

**REGIONAL SEDIMENT MANAGEMENT**

**RSM**

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*Proudly serving the Armed Forces and the Nation now and in the future.*

Home | Tools & Databases | Workshops & Meetings | Initiatives | Publications | Related Sites | About RSM

### Regional Sediment Management (RSM) Program

Managing sediment to benefit a region potentially saves money, allows use of natural processes to solve engineering problems, and improves the environment. As a management method, RSM:

- Includes the entire environment, from the watershed to the sea
- Accounts for the effect of human activities on sediment erosion as well as its transport in streams, lakes, bays, and oceans
- Protects and enhances the nation's natural resources while balancing national security and economic needs

The Corps of Engineers holds in trust and manages lands and waterways across the U.S. Using regional sediment management concepts will significantly improve the Corps' mission accomplishment. The Corps' engineers and scientists develop new technologies through research to make management decisions more accurate and efficient. Simultaneously, they evaluate RSM concepts through projects that highlight and improve sediment management activities.

#### What's New?

- [Navigation Research, Development and Technology Strategic Needs and Priorities Document, v1.0](#)
- District Project Templates:
  - [Fact Sheets](#)
  - [Quarterly Reports](#)
- SBAS for ArcGIS 10
  - [Addin \(zip\)](#)
  - [User's Guide \(pdf\)](#)

Updated March 2012

US Army US Army Corps of Engineers



Bi-Monthly  
RSM Conference Calls  
Webinars

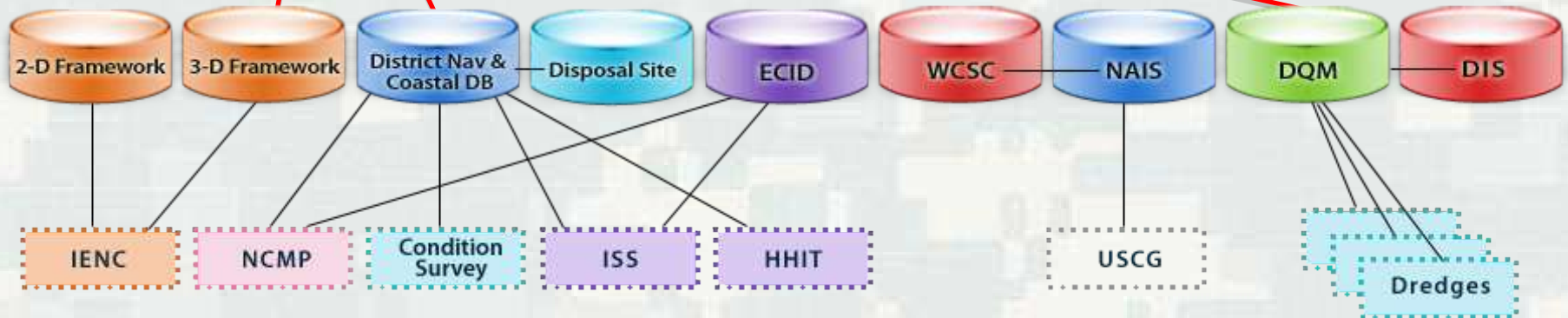


# Navigation Data Integration Framework

## Questions



## Applications



# Questions?



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