

# Coastal Inlets Research Program



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Program Manager

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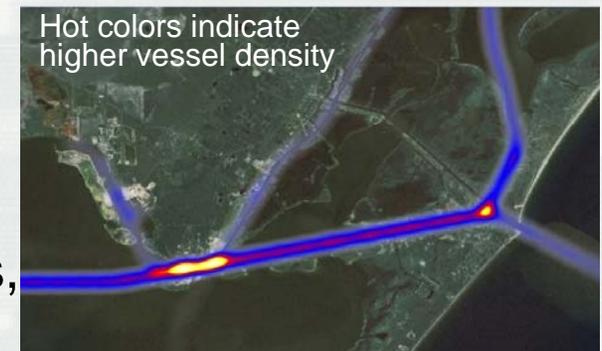
Associate Technical  
Director



US Army Corps of Engineers  
**BUILDING STRONG**<sup>®</sup>



- Conduct **R&D to reduce O&M costs** at coastal navigation projects
  - Include inlets, entrances, ports, marinas, harbors, navigation structures, channels and adjacent beaches.
- Develop **tools to support O&M practice**
  - Provide Districts tools for PCs to evaluate inlets, channels, structures, adjacent beaches, dredging and placement within regional systems.



Heat map of vessel transit patterns

- **Transfer technology** and products
  - Guidance documents, Workshops, models and tools, Web site, Wiki-pages, PC software, Web portals, Mobile device apps, video clips.





## Program Management and Technology Transfer

*Julie Rosati, Mitch Brown*

**Coastal  
Modeling  
System (CMS)**  
*Alex Sanchez  
Honghai Li*

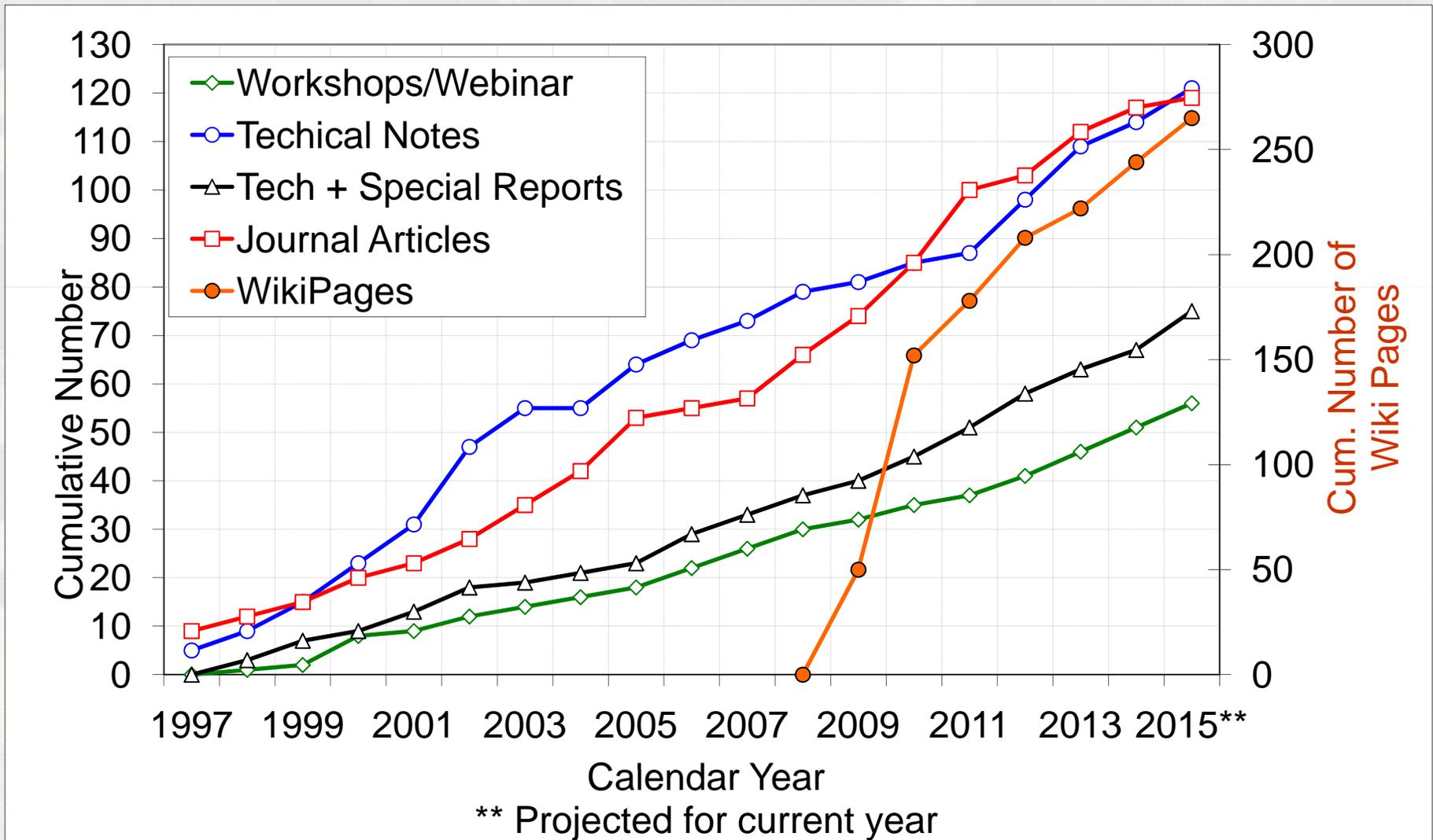


**Coastal  
Navigation  
Portfolio  
Management**  
*Ned Mitchell*

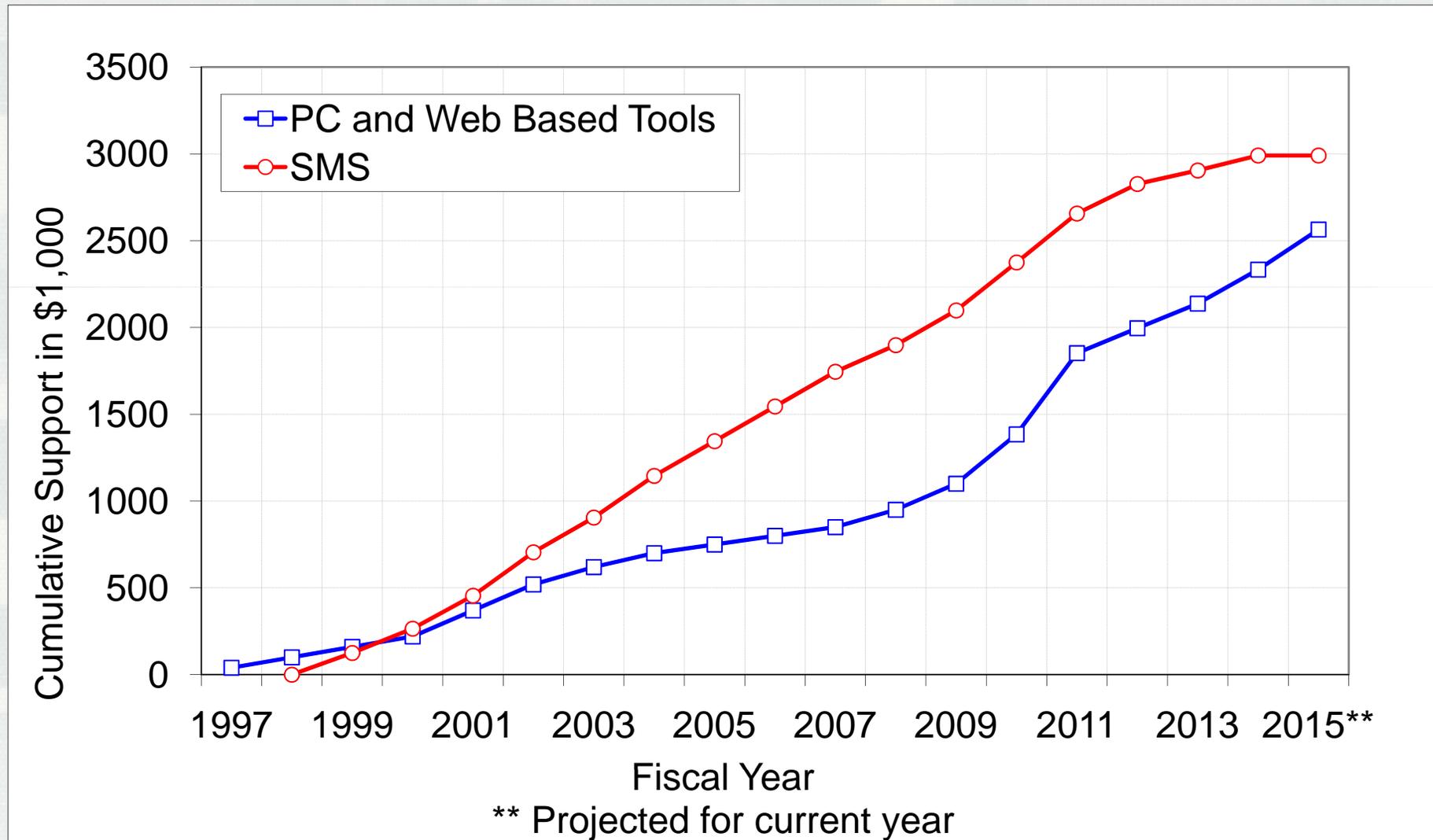
**Geomorphic  
Evolution**  
*Cheryl Pollock  
Katie Brutsché*

**Inlet  
Engineering  
Toolbox**  
*Ashley Frey*

**Waves at  
Navigation  
Structures**  
*Lihwa Lin  
Zeki Demirbilek*



# CIRP Investments: SMS, PC, and Web Tools





## Coastal

The United States is experiencing a rapid evolution of coastal inlet navigation waterways. This evolution is driven by environmental

## Coastal Inlets

- Vital coastal infrastructure
- Closely linked to the economy
- Central to national security
- Recreational and environmental

## The Coastal Inlet

Because of their proximity to the coast, inlets are often the first to be affected by sea level rise. Inlets are also the most vulnerable to change in the hydrologic cycles of inlet



Products

- CMS
- SMS
- Bouss 2D
- CPT
- CSMART
- GenCade
- IIAB (Section 211)
- Inlet Reservoir Model
- RMAP
- Sediment Budget Tools
- Shoaling Toolbox
- WaveNet
- CIRP Portal
- US Depth of Closure Info

CIRP

- Contact Information
- Fact Sheets
- CMS Subscription List
- Related Links
- Visitor Information
- FAQs

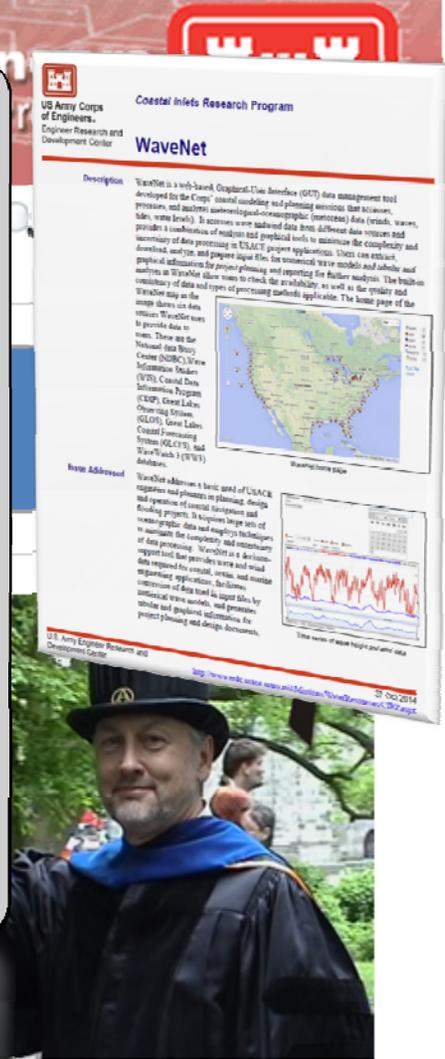
Program (CIRP)

... numerous scales of geomorphic adjustment, the physical processes of inlets are poorly understood. It is difficult to predict infilling of navigation channels, long-term stability, short- and long-term migration trends and effects on adjacent beaches, and estuary.

... advances the state of knowledge and develops engineering

CIRP Program

- CMS Work Unit
- CNPM Work Unit
- IET Work Unit
- Waves Work Unit
- Bouss2d
- CMS-Wave
- Particle Tracking Model
- TideNet Web Service
- WaveNet Web Service

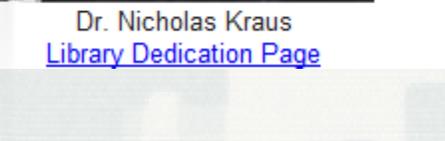


Coastal Inlets Research Program  
WaveNet

Description: WaveNet is a web-based Coastal Inlet Interface (CII) data management tool developed for the Corps' coastal modeling and planning services. It allows users to view, download, and process data from different data sources and provides a combination of real-time and historical data to maintain the complexity and accuracy of data processing in USACE project applications. Users can enhance their data processing capabilities by using WaveNet's data management and analysis tools. WaveNet also allows users to check the availability, as well as the quality and consistency of data and types of processing methods applicable. The home page of the program shows an overview of the program and provides data to users. There are the National Data Policy Center (NDPC), Wave Information System (WIS), Coastal Data Information Program (CDIP), Great Lakes Operating System (GLOS), Great Lakes Coastal Forecasting System (GLCS), and WaveWatch 3 (WV3) datasets.

WaveNet addresses a basic need of USACE engineers and planners in planning, design and operation of coastal navigation and dredging projects. It supports large sets of geographic data and complex hydrodynamic data processing. WaveNet is a service-oriented architecture that provides users and model developers with the ability to integrate and monitor information from multiple sources. It allows for the integration of data from multiple sources and provides a user-friendly interface for data management and processing. The program is designed to be user-friendly and easy to use.

U.S. Army Engineer Research and Development Center  
http://www.wave-net.usace.army.mil/About/AboutWaveNet2014.asp  
31 Oct 2014



# Technology Transfer, Nov98 - Apr15

## ***16 Years of Tech Transfer Activities***

Since RARG 2014:

**3 On-Site Training Sessions  
(1 CIRP-DOTS; 1 KEI; 1 CIRP-RSM)**

**2 Webinars**

**Oct 2014, Apr 2015 eNewsletters**

Program  
Management  
and Technology  
Transfer

Oct 2014	Coastal Inlet Breaching	Webinar
Nov 2014	Galveston District	CIRP –DOTS: CMS & SMS training
Jan 2015	Resilience of Coastal Dunes	Webinar
Jan 2015	Korean Environmental Institute	CMS & SMS training
Mar 2015	Jacksonville, FL	CIRP-RSM: Tools for Regional Sediment Management

## Program Management and Technology Transfer

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*Alex Sanchez  
Honghai Li*

### Geomorphic Evolution

*Cheryl Pollock  
Katie Brutsché*

### Inlet Engineering Toolbox

*Ashley Frey*

### Coastal Navigation Portfolio Management

*Ned Mitchell*

### Waves at Navigation Structures

*Lihwa Lin  
Zeki Demirbilek*



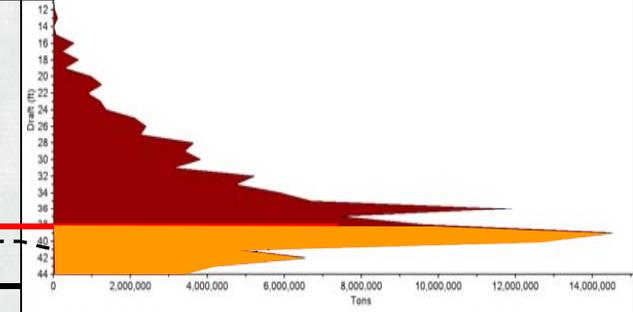
Coastal  
Navigation  
Portfolio  
Management

**Focus:** develop **decision-support tools** that provide the USACE with **objective, consistent performance metrics** for inventory of coastal channels, structures, and other navigation assets.

## Channel Portfolio Tool (CPT):

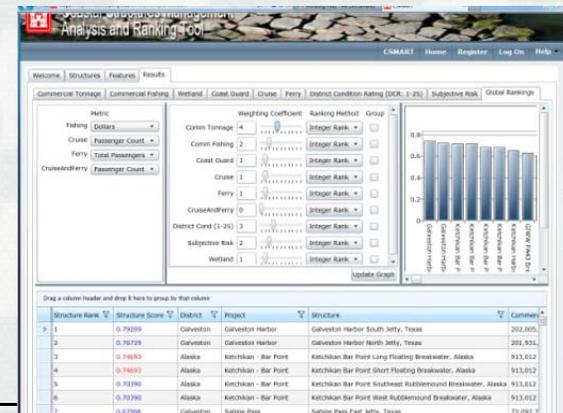
Web-based application that **relates navigable depths to cargo** most vulnerable to shoaling.

<https://cpt.usace.army.mil>



**Coastal Structures Management, Analysis, and Ranking Tool (CSMART):** Web-based application that **prioritizes coastal structures** according to user-specified criteria and weightings on metrics such as condition rating, commercial tonnage, fish landings, and cruise and ferry passengers.

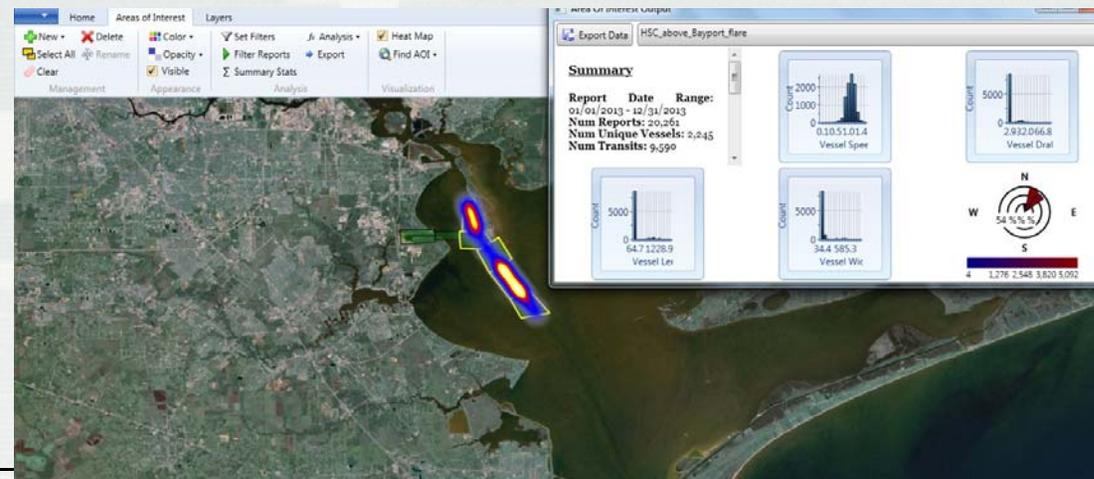
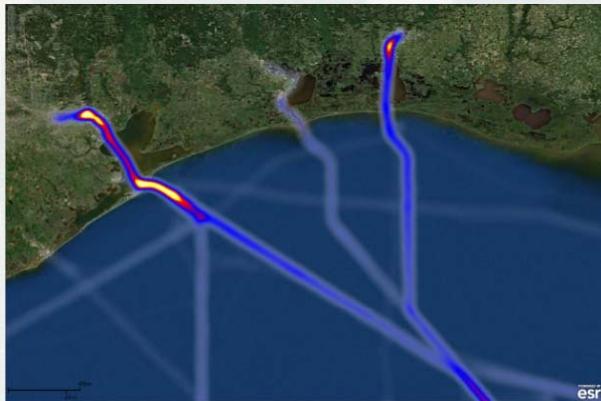
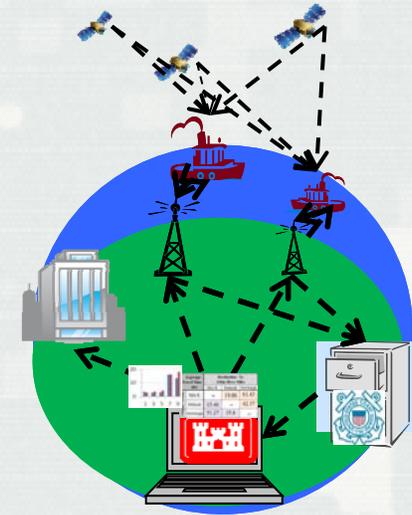
<https://cpt.usace.army.mil/Silverlight/CSMART>



Coastal  
Navigation  
Portfolio  
Management

## Automatic Identification System Analysis Package (AISAP)

- Access and analyze large amounts of **archived spatial-temporal AIS data** - archived vessel movement data from USCG for coastal & inland waters.
- Analysis capabilities include **traffic density patterns, fleet characteristics, average transit speeds, travel times, dwell times, and tidal dependency.**



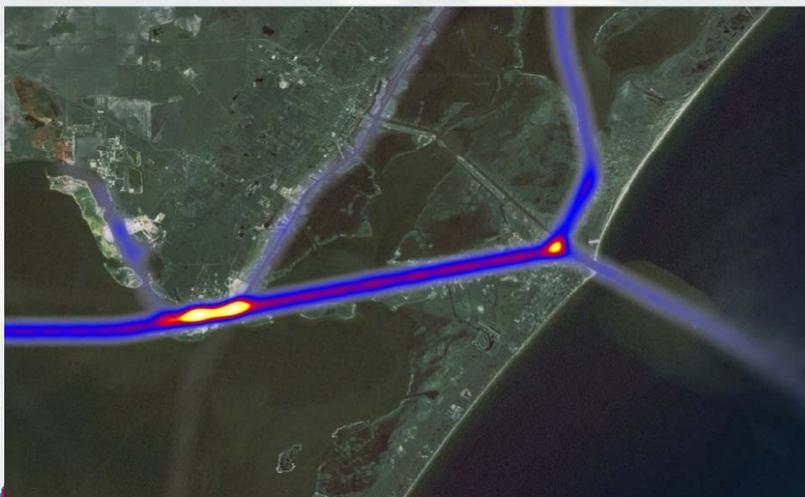
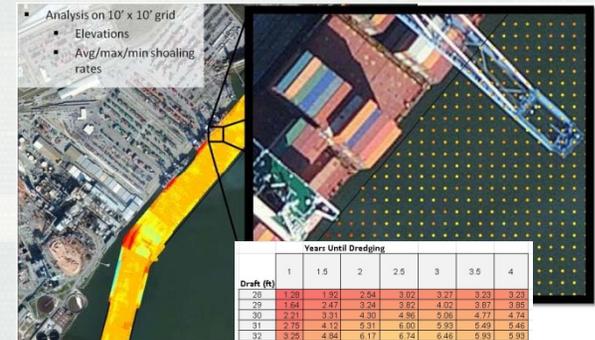
Coastal  
Navigation  
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Management

### CPT:

- Supporting Asset Management with integration of e-Hydro output and Corps Shoaling Analysis Tool (CSAT) forecasts into CPT architecture.
- ✓ Inclusion of FY09-FY13 navigation budget data.

### CSMART:

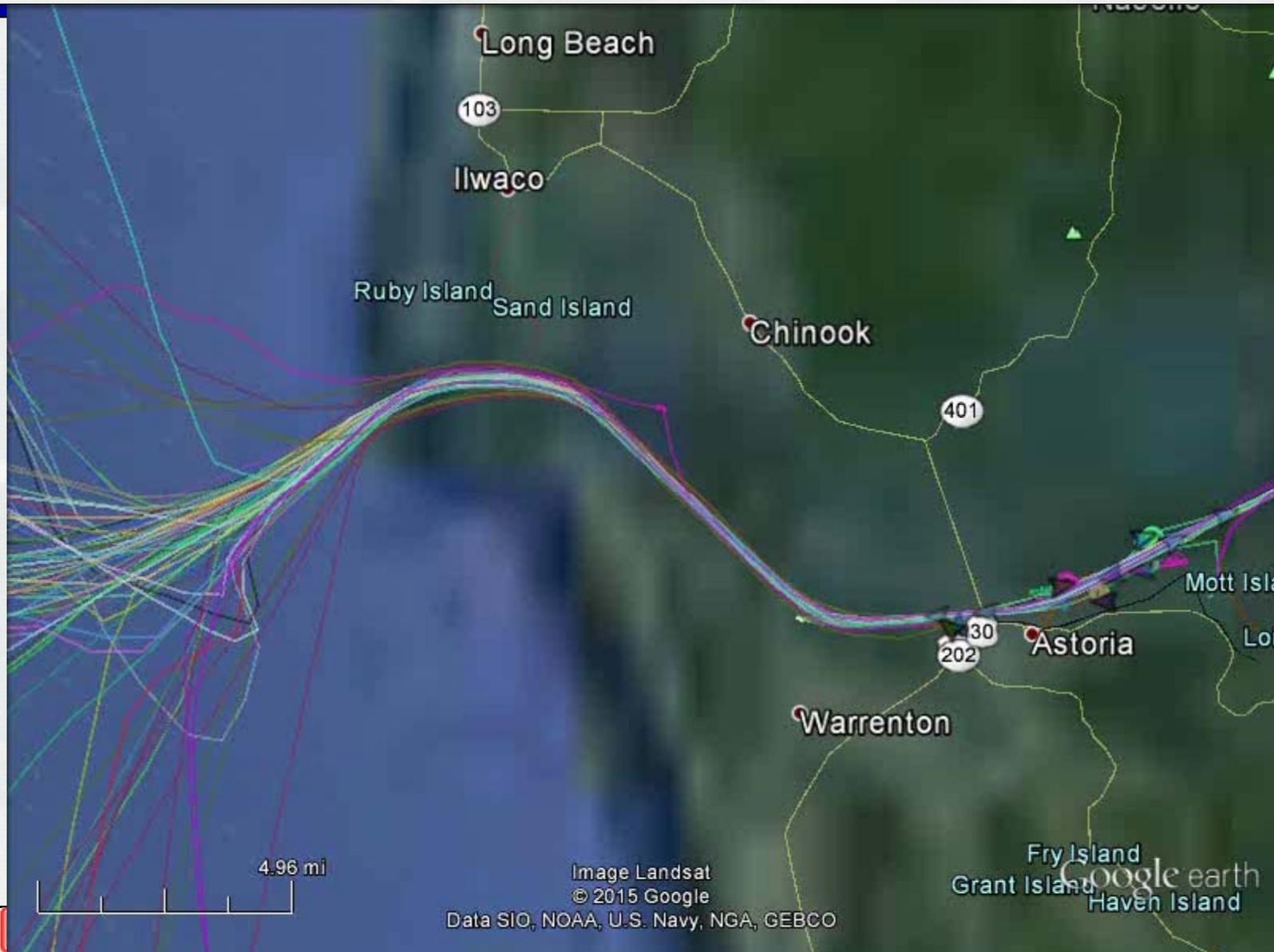
- ✓ CSMART query saver.
- ✓ Wetlands data, USCG installations.
- ✓ Dynamic interface for easier sensitivity analysis of weightings (FY13 reimbursable with Asset Mgmt.)



### AISAP:

- ✓ JP: Waterway Performance Monitoring via Automatic Identification System Data (Mitchell and Scully, 2014)
- ✓ Methodology for quantifying tidal influence on vessel transits
- Similar approach for waves, winds, currents

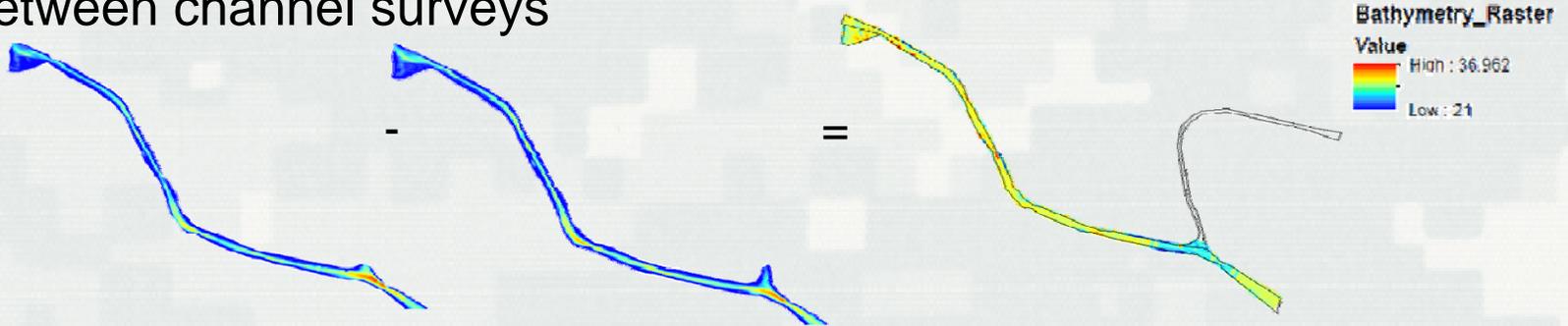
# AISAP: 5 days of Vessel Traffic at the Mouth of Columbia River, WA/OR



# CPT, eHydro & Corps' Shoaling Analysis Tool (CSAT) – Supporting Asset Management

Coastal Navigation Portfolio Management

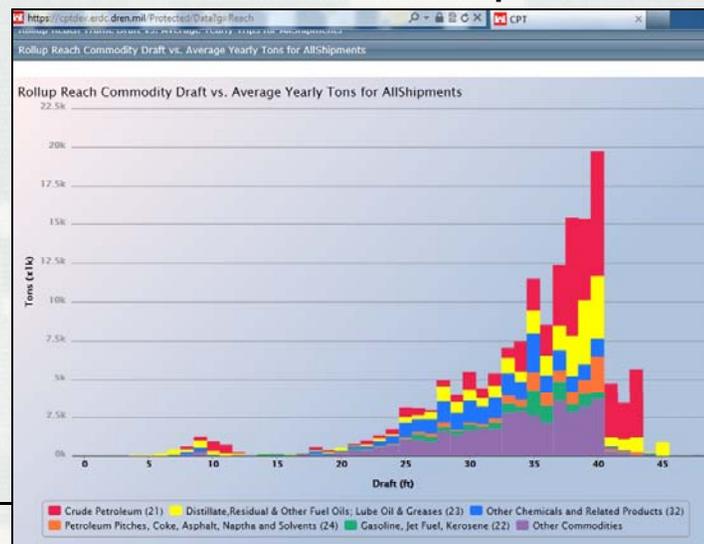
1. eHydro + 3D Channel Framework: Calculate shoaling rates between channel surveys



2. CSAT+Dredging History: Calculate infilling rates as function of time and depth

Target Elev, ft (MLLW)	Dredge Cut, ft (MLLW)	Quantity (CY) at different future times to reach specified depth						
		Now	6 mos.	12 mos.	18 mos.	24 mos.	30 mos.	36 mos.
-45	-47	312,962	1,527,520	3,795,422	6,661,576	9,912,000	13,381,110	16,874,650
-44	-46	312,962	1,527,520	3,795,422	6,661,576	9,912,000	13,381,110	16,874,650
-43	-45	312,962	1,527,520	3,795,422	6,661,576	9,912,000	13,381,110	16,874,650
-42	-44	180,540	977,219	2,872,732	5,496,566	8,567,152	11,903,859	15,304,755
-41	-43	48,118	426,918	1,950,042	4,331,555	7,222,303	10,426,608	13,734,860
-40	-42	27,629	248,849	1,377,110	3,445,803	6,112,310	9,147,867	12,329,802
-39	-41	7,140	70,779	804,178	2,559,651	5,002,317	7,869,126	10,924,743
-38	-40	4,214	40,268	533,256	1,965,286	4,145,992	6,808,288	9,707,811
-37	-39	1,287	9,757	262,333	1,370,920	3,289,668	5,747,450	8,490,879
-36	-38	724	5,673	160,583	1,008,025	2,668,627	4,910,082	7,474,515
-35	-37	160	1,589	58,832	641,129	2,047,587	4,072,715	6,458,151
-34	-36	80	895	34,177	445,102	1,610,423	3,424,647	5,831,585
-33	-35	0	201	9,523	249,075	1,173,259	2,776,579	4,805,020
-32	-34	0	103	5,598	164,495	889,617	2,283,336	4,137,170
-31	-33	-	6	1,673	79,915	605,975	1,790,093	3,469,321
-30	-32	-	3	1,065	51,076	440,680	1,435,445	2,935,180
-29	-31	-	-	457	22,237	275,386	1,080,797	2,401,040
-28	-30	-	-	281	14,037	195,155	841,539	1,991,483
-27	-29	-	-	105	5,838	114,924	602,281	1,581,926
-26	-28	-	-	54	3,922	80,042	453,954	1,282,898
-25	-27	-	-	3	2,007	45,160	305,627	983,870
-24	-26	-	-	1	1,356	31,075	225,913	775,127

3. CPT: tonnage & commodities transiting as a function of depth



4. Work Packages: dredging requirements to maximize tonnage & minimize expenditures

## Program Management and Technology Transfer

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Navigation  
Portfolio  
Management

*Ned Mitchell*

Geomorphic  
Evolution

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Inlet  
Engineering  
Toolbox

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**Waves at  
Navigation  
Structures**

*Lihwa Lin  
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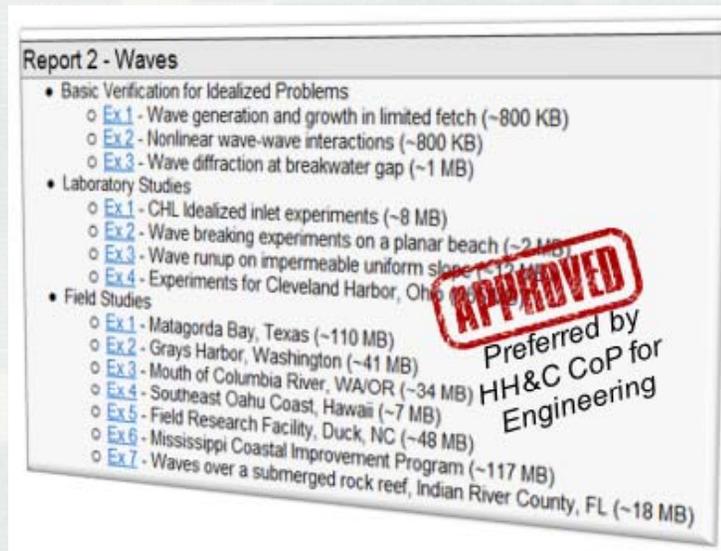
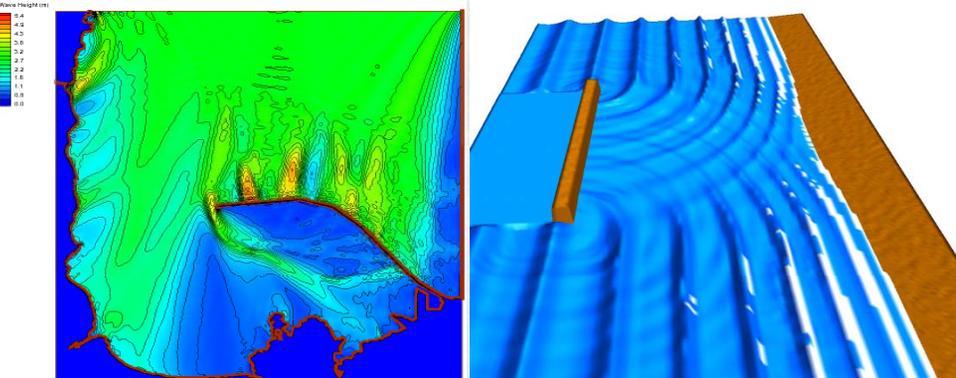
Waves at  
Navigation  
Structures

**Focus:** to **advance wave predictive capability** in support of USACE missions for coastal inlets, navigation, structures, ports/harbors/marinas, and adjacent beaches, reefs and wetlands.

## CMS-Wave:

Spectral wave propagation model including diffraction, reflection, run-up, setup, overtopping, wave generation, structures (breakwaters, jetties, groins, etc.), nested grids; integrated with CMS-Flow

Verification & Validation Cases (14)

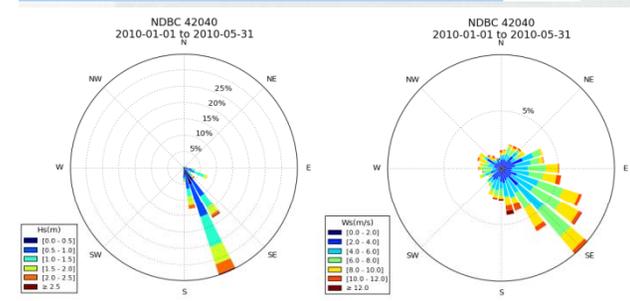
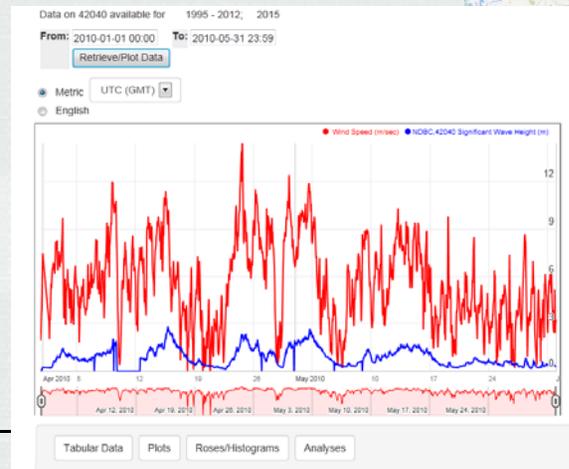
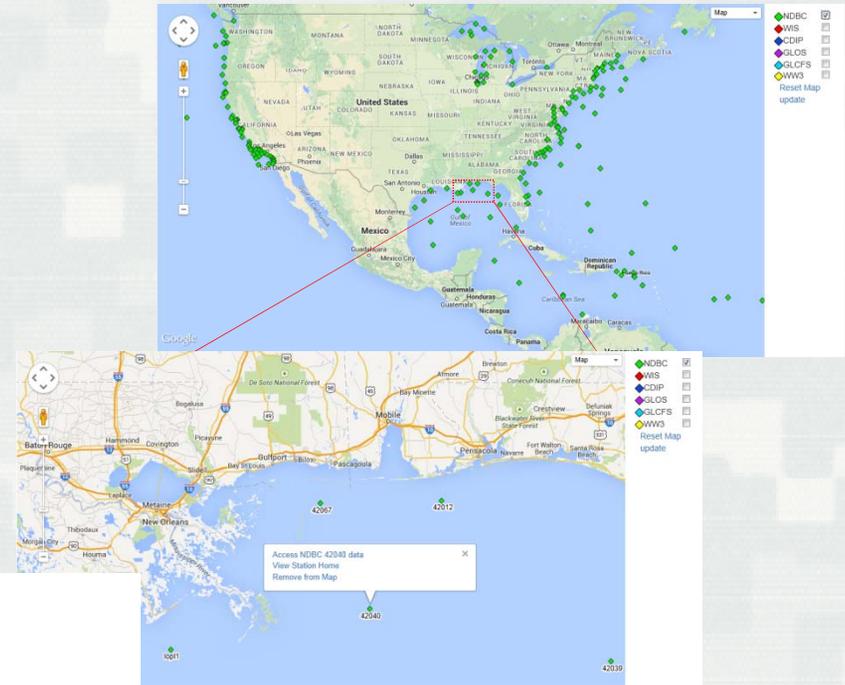


**Bouss-2D:** Phase-resolving shallow-water, nonlinear wave model for ports/harbors/marinas, navigation, fluid-structure interaction, vessel-generated waves.

Waves at Navigation Structures

### WaveNet: Web-based interactive GUI with Google Map

- **Purpose:** Access, analyze, plot, and format wave and wind data for projects and models
- **Data Sources:** NDBC, WIS, CDIP, WW3, GLCFS, GLOS
- **Future Additions:** CPT and AIS coupling



# Waves at Navigation Structures

## FY14 Project Applications & Reimbursables

Waves at  
Navigation  
Structures

- POH: Kikiaola Harbor, HI  
Faleasao Harbor, Samoa  
Kaanapali Beach, Maui, HI 
- SPN: Half Moon Bay, CA
- SWG: West Galveston Bay, TX 
- LRB: Braddock Bay, NY  
Oswego Harbor, NY
- NAO: Tangier Island, VA
- SAJ: Cape Canaveral, FL
- LRE: Sand Island, WI  
Duluth Harbor, MN  
Stamp Sand, WI  
Traverse City, MI
- NWP: Port Orford, OR

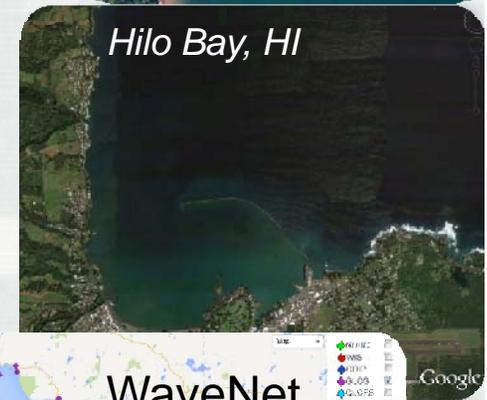
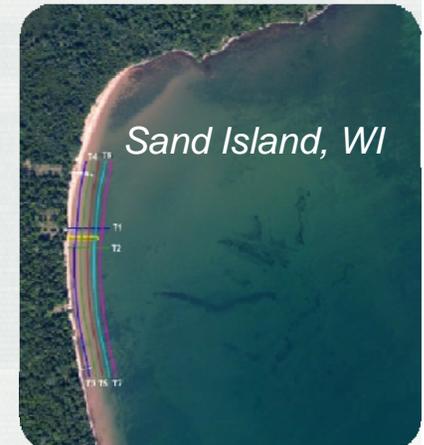


# Waves at Navigation Structures

## *FY15 Plans*

### Waves at Navigation Structures

- R&D
  - Enhancements to CMS-Wave
  - Pre- and post-processing capabilities
  - Complete WaveNet and TideNet
- Tech Transfer
  - Conduct District training for wave model applications
  - Complete publications (3 TRs, 2 CHETNs, 2 JPs)
  - Conduct WaveNet webinar
- Support Districts in project studies
  - POH (2), SPN (1), LRE (1), LRB (1)



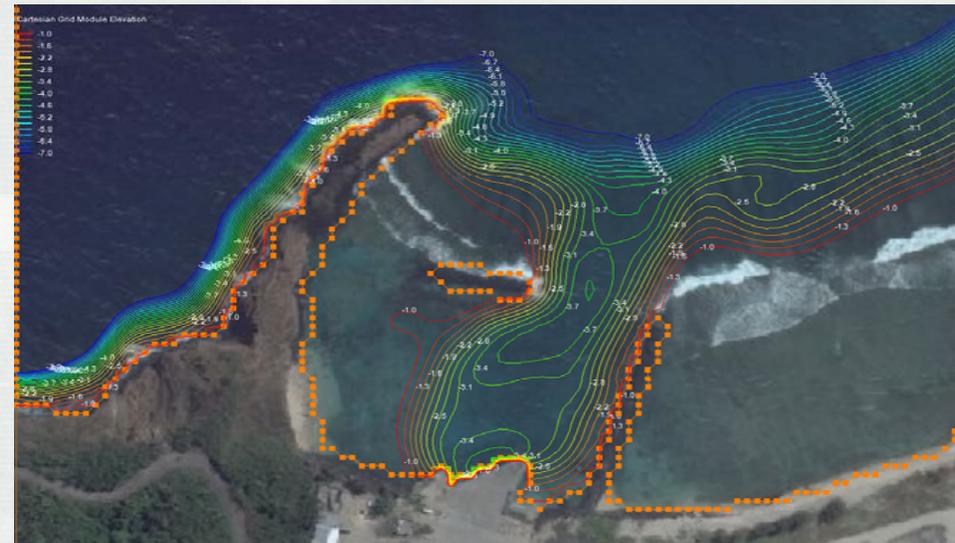
# Example of Support to District Navigation Projects: *Faleasao Harbor, Samoa*

Waves at  
Navigation  
Structures

**Purpose:**  
Evaluate improvements to  
navigation and infrastructure

## Tasks completed:

- Developed design wave estimates for harbor protection structures and safe operational condition at the entrance and interior harbor
- Evaluated three alternatives for infrastructure modifications
- Sized infrastructure modifications to minimize navigation risk
- Deepened and widened channel and mooring basin to allow larger vessels access the harbor



## Program Management and Technology Transfer

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### Coastal Modeling System (CMS)

*Alex Sanchez  
Honghai Li*

### Geomorphic Evolution

*Cheryl Pollock  
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### Inlet Engineering Toolbox

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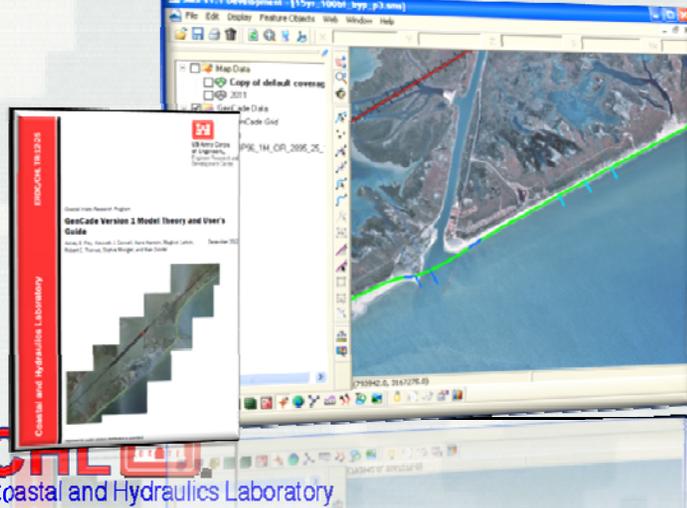
## Inlet Engineering Toolbox

**Focus:** develop desktop PC and web-based tools to assess how engineering actions affect coastal inlets, navigation channels, and adjacent beaches

### GenCade

- A 1-line model for shoreline change, sand transport, and inlet sand sharing
- Based on GENESIS (project scale) and Cascade (regional scale)
- TRs and previous webinar audio/video and slides on CIRP website

GenCade at Sargent Beach, TX



### Inlet Reservoir Model

- PC-based, time-dependent sand sharing model for inlet morphologic evolution



### GenCade-SBAS Connection

- Calculated transport rates and volumetric change from GenCade can be imported to the **S**ediment **B**udget **A**nalysis **S**ystem (SBAS) and utilized to create a sediment budget



## Inlet Engineering Toolbox

### GenCade Documented Guidance and Applications

- Published TR on GenCade recommendations and requirements
- Published 2 CHETNs on comparison of 1-line models
- Published PIANC CP on GenCade-SBAS application at Onslow Bay
- Completed GenCade Quick-Start Guide SR (published in FY15; SR-15-1)

### Natural and Constructed Dunes

- Foredune state of response TR (completed in FY14; published in FY15)



### Resilience

- JP accepted, in revision; defines concept of resilience, develops methodology, and provides a way to quantify engineering, environmental, and community resilience

**Shoreline Change Modeling Using One-Line Models: General Model Comparison and Literature Review**  
by Robert C. Thomas and Ashley E. Frey

**Shoreline Change Modeling Using One-Line Models: Application and Comparison of GenCade, Unibest, and Litpack**  
by Kimberly E. Townsend, Robert C. Thomas, and Ashley E. Frey

**EVALUATED BENCHMARK CASES:** The category of abundant coastal dunes developed for the standardized benchmark cases was the straight dune. The purpose of the straight dune cases is to provide an unambiguous foundation to test the most fundamental processes and the impact of coastal structures within Unibest, Litpack, and GenCade. The cases tested include the following:

- Case 1: Straight dune, sea structure
- Case 2: Straight dune, single pole
- Case 3: Straight dune, detached breakwater
- Case 4: Straight dune, T-pier
- Case 5: Straight dune, seawall
- Case 6: Straight dune, break sill

**DEVELOPING A REGIONAL SEDIMENT BUDGET WITH GENCADE AND THE SEDIMENT BUDGET ANALYSIS SYSTEM**  
by Ashley E. Frey and Emily Peterson

**ABSTRACT:** GenCade is a beach-resilient shoreline change and sand transport model. See applied to Onslow Bay, North Carolina, USA, to improve the understanding of the regional sediment system and provide a comprehensive sediment budget for the entire shoreline. The use of GenCade and the Sediment Budget Analysis System (SBAS) in this study was the first time these two models were used together in a regional sediment budget analysis. The results of this study are presented in a report available on the GenCade website.

**ERDC/CHL SR-14-6**

**Coastal and Hydraulics Laboratory**

**Quantitative Research Program Recommendations and GenCade Simulations**  
Ashley E. Frey, David B. King, and Stephen Hill

**ERDC/CHL SR-15-1**

**Coastal and Hydraulics Laboratory**

**GenCade Version 1 Quick-Start Guide: How to Start a Successful GenCade Project**  
Dorcas Murgu and Ashley E. Frey

**Development of a Metric for Coastal Resilience**

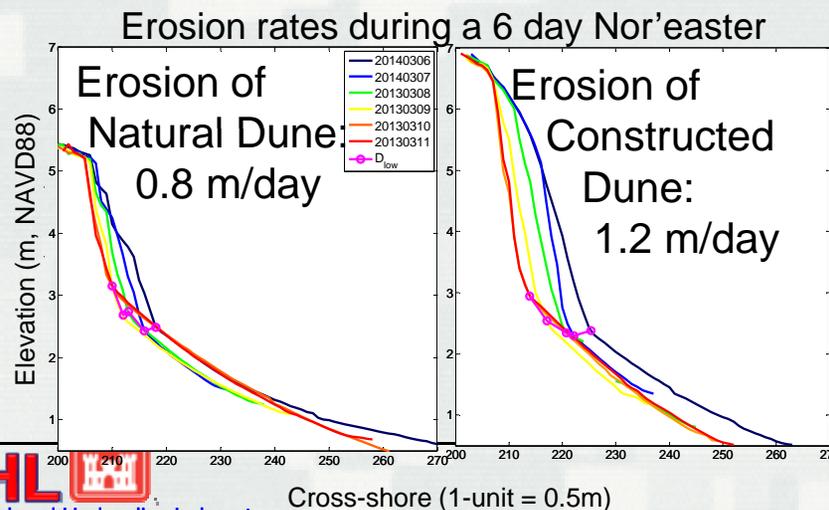
**ABSTRACT:** There is a need to develop metrics of coastal resilience to evaluate the ability of coastal systems to resist, absorb, and recover from disturbances. This report provides a methodology for developing such metrics. The methodology involves the identification of key components of coastal resilience, the development of a metric to quantify these components, and the validation of the metric using case studies.



**Inlet Engineering Toolbox**

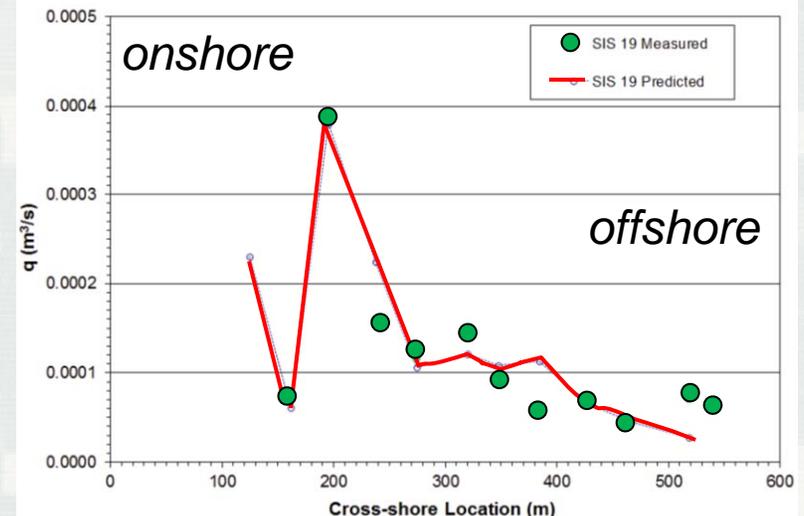
### Investigation of Short- and Long-Term Dune Recovery Processes

- Understand best practices for dune construction for long-term health and stability through comparison of natural accreting, natural eroding, and constructed dunes
  - Bi-weekly lidar
  - Analysis of long-term morphology change
  - TR describing results



### Longshore Sediment Transport Equation

- Develop reliable, physics-based, cross-shore distribution desktop formula for calculating LST to field engineers
- JP describing validated equation



Cross-shore distribution of longshore transport at the FRF

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# Inlet Geomorphology Evolution

PIs: Cheryl E. Pollock and Dr. Katherine E. Brutsché

## Geomorphic Evolution

**Focus:** Develop tools and databases for operation & management of federal navigation channels and coastal projects **considering temporal & spatial scales much greater than dredging cycles, planning timelines, and the dimensions of the navigation channel.**

- **Sediment and morphologic evolution in & around inlets**
- **Nearshore Placement guidance**
- **Collaborating with the best people at Districts to target projects of opportunity**
  - **Working closely with Engineers, Planners, Project Managers, Geotech, GIS Specialists, and Regulators in Districts**
  - **Considering a full range *perspective* on the *needs* within Districts**



# Inlet Geomorphology Evolution

## FY14 Accomplishments

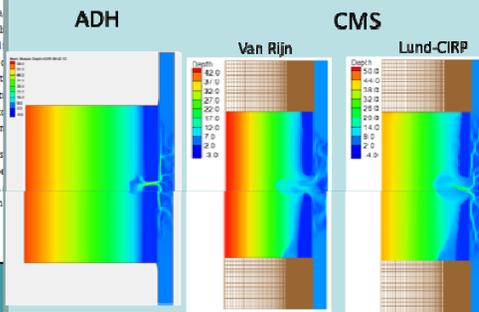
### CMS Morphology Modeling Validation of Empirical Relationships for Tidal Inlets

#### Introduction

The U.S. Army Corps of Engineers (USACE) Coastal Inlets Research Program (CIRP) has developed the Coastal Modeling System (CMS) as an applied numerical hydrodynamic and morphologic model capable of running on a desktop PC, and designed to analyze the physical processes in coastal navigation environments. Coastal tidal inlets are important to the USACE because they are commonly located at the confluence of a navigation project with the open coast, and of which...

There are capacity to m a tidal inlet, a general sense, generate the b gravitational falling of the c generate the t fills up an est sediment into derived sedi Tidal pris and interde changing, or, determine an

### ADH and CMS comparison – 10 yr



## Long-term Morphologic Modeling of Inlets (w/CMS WU)

**SAGA: Sediment Analysis GeoApp**  
Regional Sediment Management & Coastal Inlets Research Programs  
U.S. Army Engineer Research & Development Center  
Coastal & Hydraulics Laboratory

**Objective**  
The Regional Sediment Management (RSM) Program and the Coastal Inlets Research Program (CIRP) have joined efforts to develop a USACE-wide internet accessible for all states and other stakeholders with an emphasis for use in sediment management.

**Value of Enterprise Database**  
Comprehensive regional assessments of resources facilitate interagency collaboration. Ready access to an essential asset & decision right analyze data (ongoing process)

**Potential Users**  
All of USACE (Inlet and Coastal Inlets)

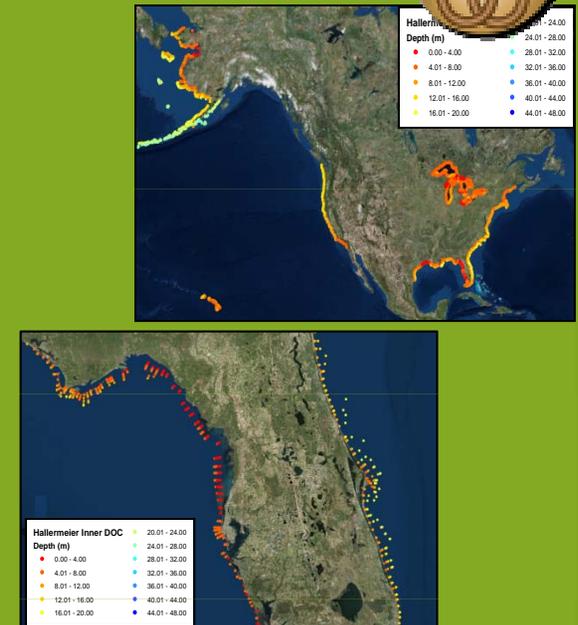
**SAGA Web-App**  
Web-enabled and will be hosted on C3-Design. Connected to the Navigation Data Integration Repository (NDIR)

**Display and Analysis Tools**  
Population, stream, distribution, trends, and other maps

**SAGA Application**

POC: Tampa M. Bick

## SAGA Web Application and Poster



## Depth of Closure Database and Maps

# Inlet Geomorphology Evolution FY15 Activities

Poster

**US Army Corps of Engineers®  
Jacksonville District**

**Egmont Key Field Monitoring for Turbidity and PAR\***

**US Army Corps of Engineers®**

**Evaluating Sediment Mobility for Siting Nearshore Berms**  
by Brian C. McFall, S. Jarrell Smith, Cheryl E. Pollock, James Rosati III, Katherine E. Bruschi

**PURPOSE.** This Coastal and Hydraulics Engineering Technical Note (CHETN) describes two methods to quickly assess sediment mobility relative to depth as a function of local waves and current. This information is valuable for preliminary or reconnaissance engineering studies to evaluate the potential mobility of sediment grain sizes and volumes placed in the form of a

**Nearshore Berm Sediment Mobility CHETN**

**US Army Corps of Engineers®**

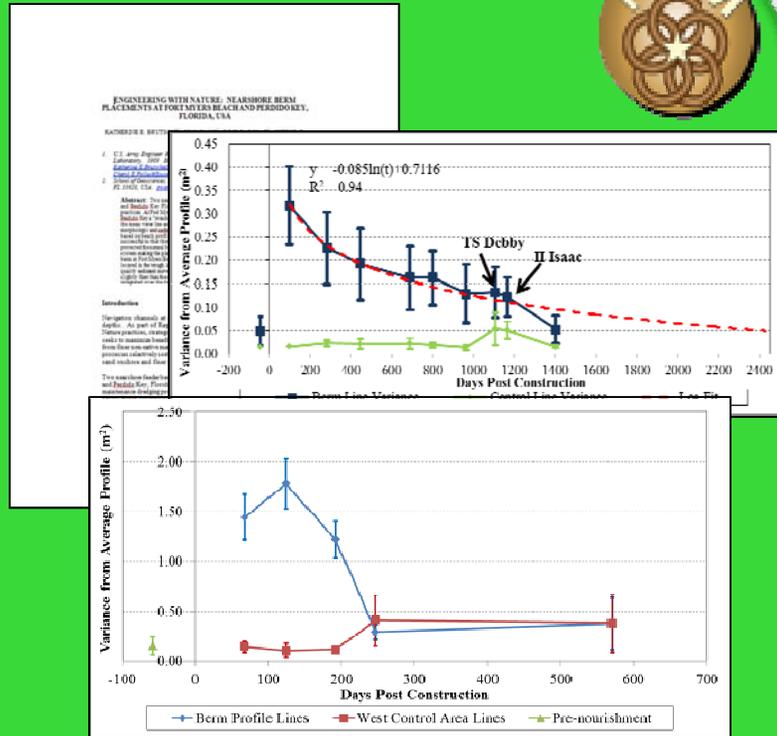
**Calculating Depth of Closure Using WIS Hindcast Data**  
by Katherine E. Bruschi, James Rosati III, and Cheryl E. Pollock

**PURPOSE.** In this Coastal and Hydraulics Engineering Technical Note (CHETN) a depth of closure using all of the Wave Information Study (WIS) Hindcast buoys along the United States coasts analysis and web-based tool is presented. The results summarized in this CHETN are a part of a larger effort to provide depth of closure data as a publicly available interactive web tool. The theoretical boundaries of wave initiated sediment motion for the United States using a simplified method that does not require numerical modeling of waves to give a better understanding of where sediment may be beneficially placed in the littoral zone. The tool provides users with the ability to rapidly locate potential depths of sediment placement based on different calculated zones, including depths of closure, for an area. This tool will be useful for any coastal engineering analysis that requires an understanding of the seaward extent of sediment transport in a region.

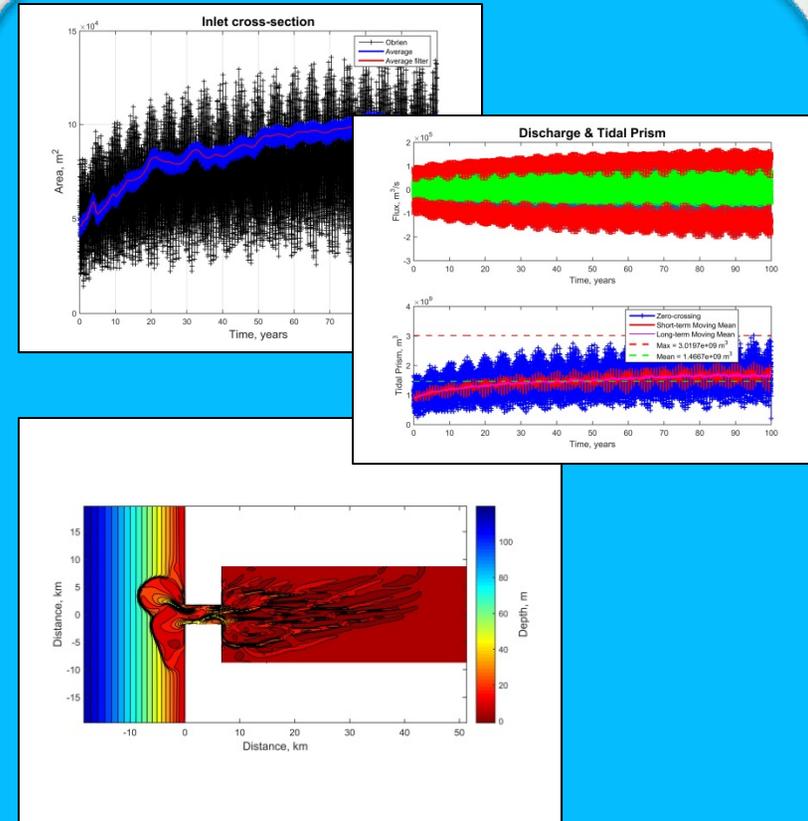
**DOC CHETN and Database**

# Inlet Geomorphology Evolution

## FY15 Activities



**Conf Paper: Strategic Berm Placement at Ft. Myers Beach, FL**



**Long Term Inlet Morphology Change Modeling**

## Program Management and Technology Transfer

*Julie Rosati, Mitch Brown*

### Coastal Modeling System (CMS)

*Alex Sanchez  
Honghai Li*

### Geomorphic Evolution

*Cheryl Pollock  
Katie Brutsché*

### Inlet Engineering Toolbox

*Ashley Frey*

### Coastal Navigation Portfolio Management

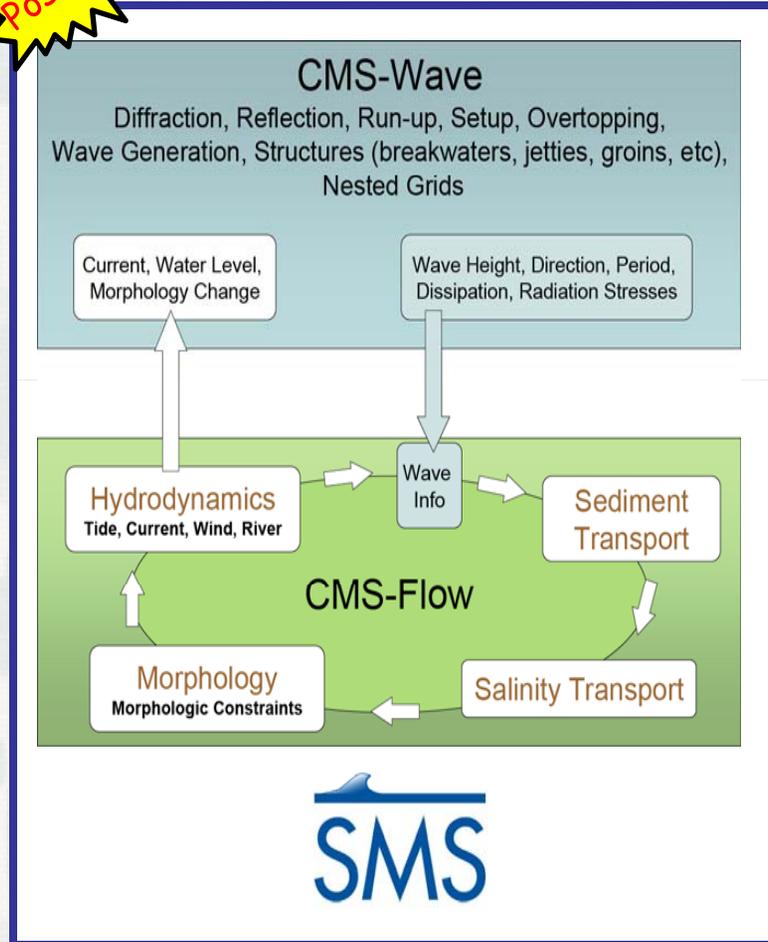
*Ned Mitchell*

### Waves at Navigation Structures

*Lihwa Lin  
Zeki Demirbilek*



Poster!



## What is the CMS?

- **Integrated wave, current, sediment transport, and morphology change model** in the Surface-water Modeling System (SMS).

## Why CMS?

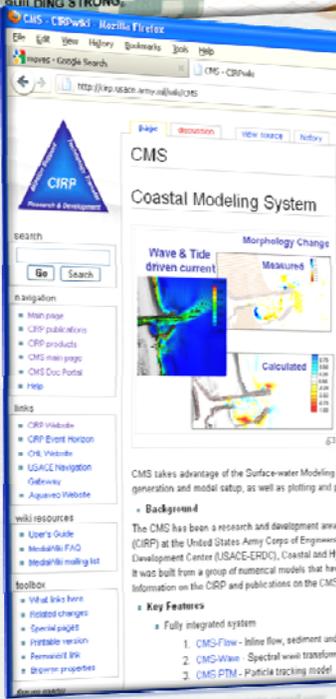
- Operational at 14 Districts and A/E firms
- Verified with analytical solutions
- Validated with lab experiments, real applications
- Robust and user-friendly
- Practice-oriented: *1 year simulation ~ 1-3 days on PC*

## Types of Applications

- **Channels:** Deepening, widening, lengthening, realigning
- **Jetties:** Lengthening, raising, rehabbing
- **O&M:** Placement areas – berms, wetlands
- **Processes:** *Navigability* – waves and currents; *Environmental* – circulation, sediment transport

**Coastal Modeling System**  
*Overview, background and capabilities*

Alex Sánchez  
Research Hydraulic Engineer  
Coastal and Hydraulics Laboratory  
Engineer Research and Development Center  
May 20, 2010



US Army Corps of Engineers  
**EMULATING STRONG**

CMS - CRPWiki Mozilla Firefox

search

Navigation

- Home page
- CIRP publications
- CIRP products
- CMS main page
- CMS Doc Portal
- Help

links

- CIRP Website
- CIRP Event Horizon
- CHL Website
- USACE Navigation Gateway
- Aguayo Website

wiki resources

- User's Guide
- Modeling FAQ
- Modeling mailing list

toolbox

- What links here
- Recent changes
- Special pages
- Printable version
- Permanent link
- Display properties

CMS takes advantage of the Surface-water Modeling generation and model setup, as well as plotting and

**Background**

The CMS has been a research and development area (CIRP) at the United States Army Corps of Engineers Development Center (USACE-ERDC), Coastal and H. It was built from a group of numerical models that have information on the CIRP and publications on the CMS

**Key Features**

- Fully integrated system
  - CMS-Flow - In-line flow, sediment and
  - CMS-Wave - Spectral-wave transform
  - CMS-PTM - Particle tracking model

Exporting the bottom friction dataset:

Exporting to a bottom roughness (friction) dataset is useful for creating different project alternatives or when providing friction datasets for different bottom roughness datasets (such as from Manning's n) to Bottom Friction Coefficient and Bed. It is also useful for storing multiple runs with different project alternatives.

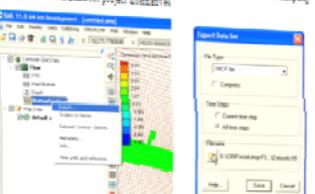


Figure 5.1.2. Manning's n contours after modifying the area under all three bridges.

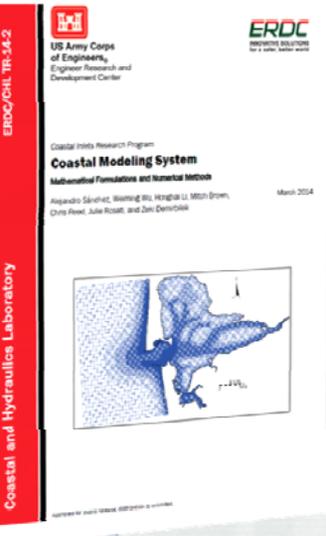
**Additional Bottom Friction Cards**

Additional bottom friction cards are available for setting bottom friction to a constant for the whole grid. These cards are useful for running sensitivity analysis for a wide range of values in cases which can be approximated with a single constant bottom friction value.

Table 5.1.2. Advanced Cards to set bottom friction dataset to a constant value

Card	Argument	Default	Units	Description	Card Number
bottomfriction_constant	value	0.00	1/s	Specifies constant value assigned to friction dataset. Defaults are relative to Manning's n.	5.1.2
bottomfriction_constant	value	0.00	1/s	Specifies constant value assigned to friction dataset. Defaults are relative to Manning's n.	5.1.2
bottomfriction_constant	value	0.00	1/s	Specifies constant value assigned to friction dataset. Defaults are relative to Manning's n.	5.1.2

5.1.2 Wall Friction



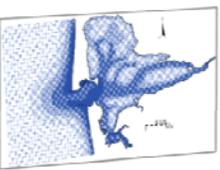
ERDC/CHL TR-54-2

US Army Corps of Engineers  
Engineer Research and Development Center

Coastal Inlets Research Program  
**Coastal Modeling System**  
Multidimensional Formulations and Numerical Methods

Alexandro Sánchez, Heung-Il Hwang, Li-Min Drom, Chris Reed, Julia Rosati, and Zeki Demirebilek

March 2014



Coastal and Hydraulics Laboratory

## Availability

- Comes with SMS installation package
- CIRP website (under Products)
- CMS is **Free** and interface is inexpensive
- POCs: Alejandro Sanchez, Lihwa Lin, Mitchell Brown, Honghai Li, Zeki Demirebilek

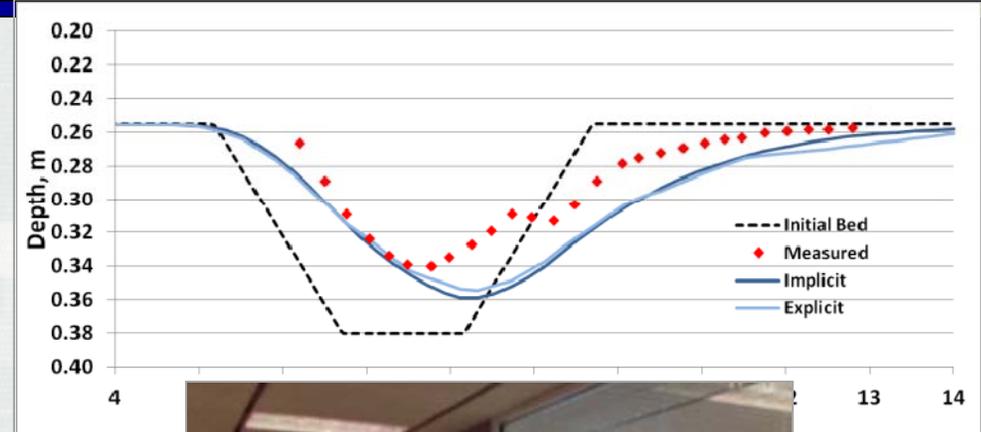
## Documentation

- TRs, CHETNs and journal papers  
<http://cirp.usace.army.mil/pubs/>
- CIRP Wiki <http://cirp.usace.army.mil/wiki/CMS>
- **New technical reports and updated users' guide** available

## Training and Support

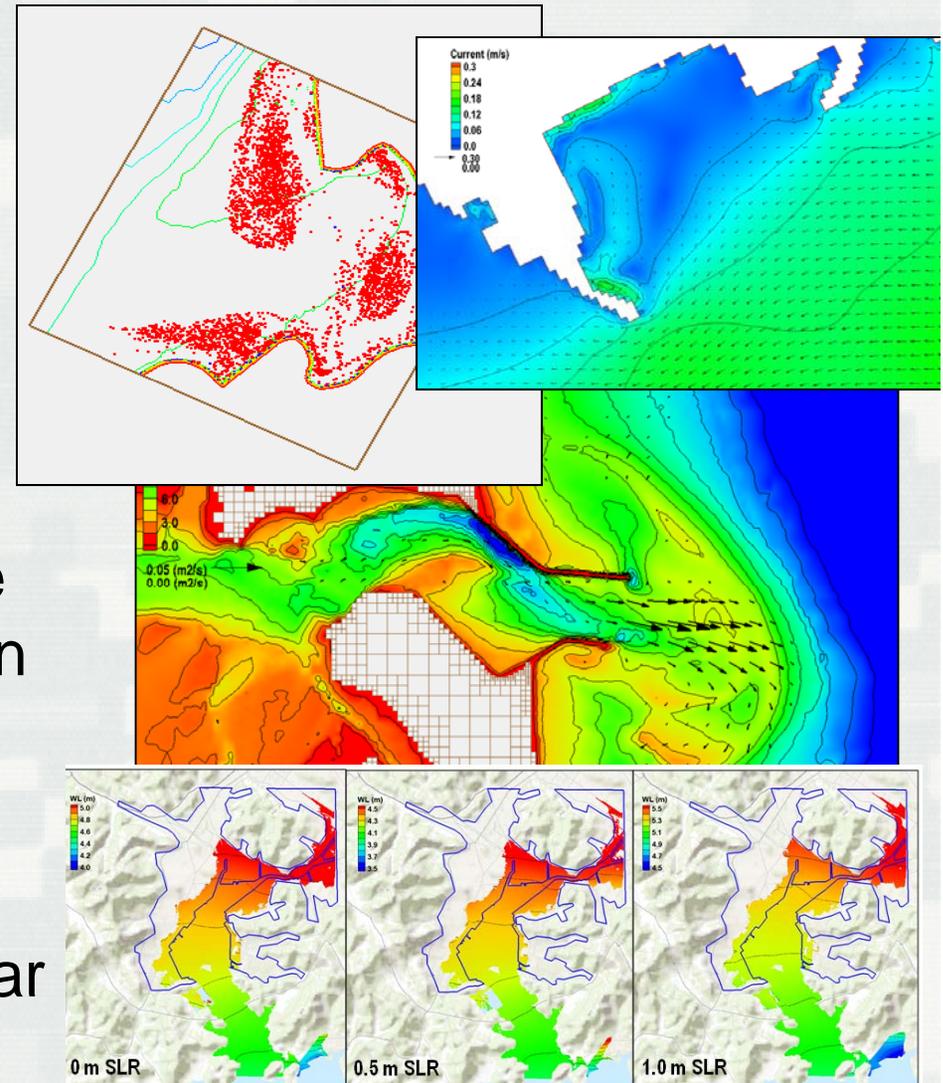
- Workshops <http://cirp.usace.army.mil/workshops/>
- Webinars <http://cirp.usace.army.mil/webinars/>
- On-site Training

- Publications (TNs, CHETNs, journal papers, conference papers)
- DOTS training for SWG
- Release of SMS 11.2
  - Dynamic dialogs
- Release of CMS 4.1
  - Many new features
- Web-based time series analysis tool
  - Prepared routines and posted on CIRP Wiki (data filtering, tidal harmonic, spectral, principal component analysis)





- NAE: Merrimack Bay/Inlet Modeling Study
- 
 ■ RSM Study: Port Orford Oregon Regional Sediment Model
- Pilot study on vulnerability assessment model of climate change: application to Korean coast
- Wave, hydrodynamic, and PTM modeling in support of the lateral expansion of Poplar Island

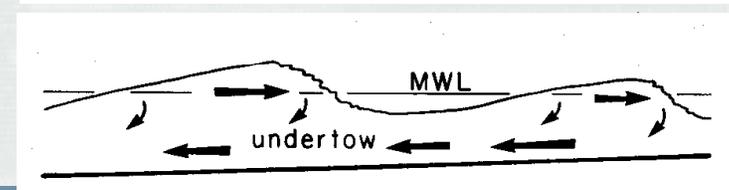
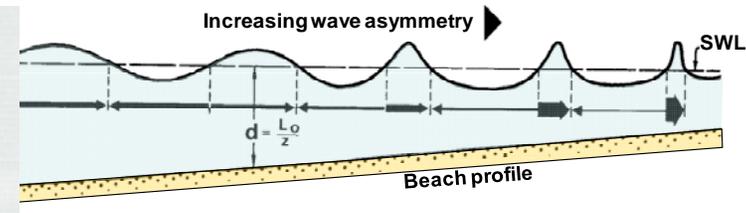
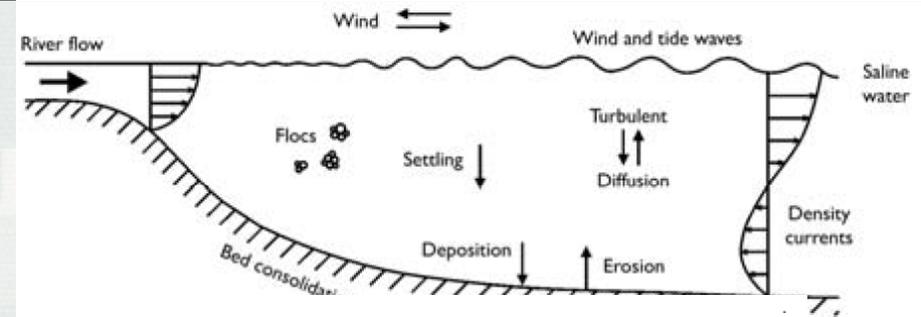


## Features/updates

- Sediment mapping
- Dredging module
- Temperature module
- Explicit telescoping grid
- Parallelization for HPC

## R&D

- Long-term morphology change
- Automated model calibration and uncertainty analysis
- Cross-shore sediment transport
- Sea level change impacts to navigation projects
- Bed-load dispersion
- Grid quality indicators



What do you need to better manage inlets & adjacent beaches\*?

*\*Including: entrances, ports, marinas, harbors, navigation structures, & channels*

How can CIRP  
better support your  
projects?



What tools,  
technology transfer  
media and guidance  
do you need?

What advances in coastal inlet and adjacent beach knowledge  
are needed?