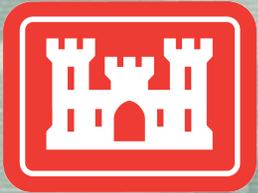


Navigation Infrastructure Research and Development

Jackie S. Pettway

Engineer Research and Development Center
Coastal and Hydraulics Laboratory



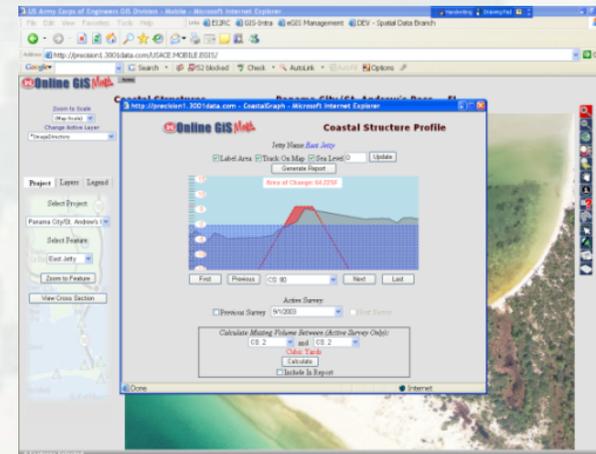
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Research and Development Objectives

Enable sustainable water resources infrastructure through development and application of state-of-the-art technology and innovative management approaches.

Meet marine transportation, hydropower and infrastructure challenges through research that incorporates engineering, economic, and environmental solutions.



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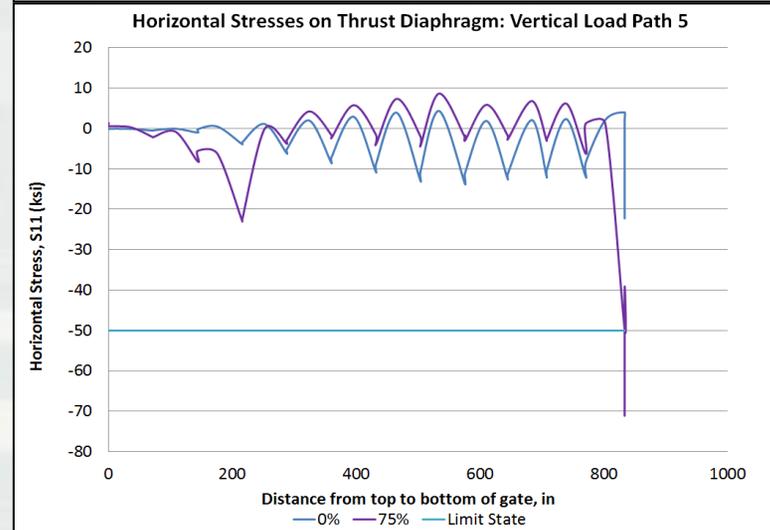
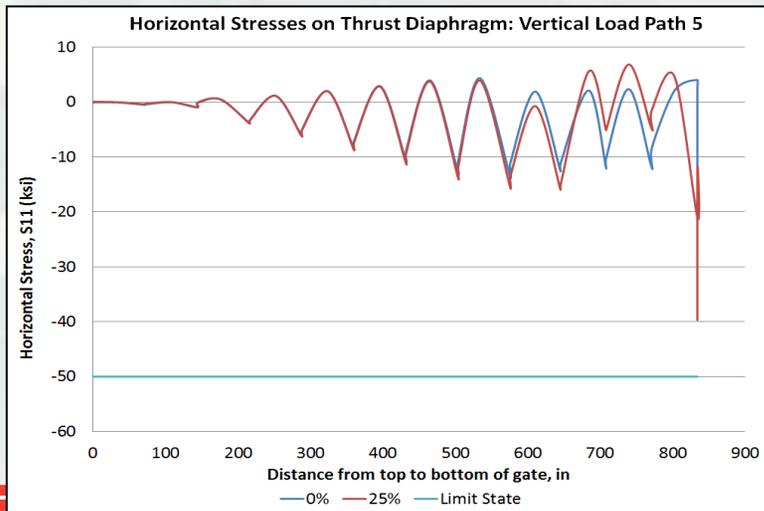
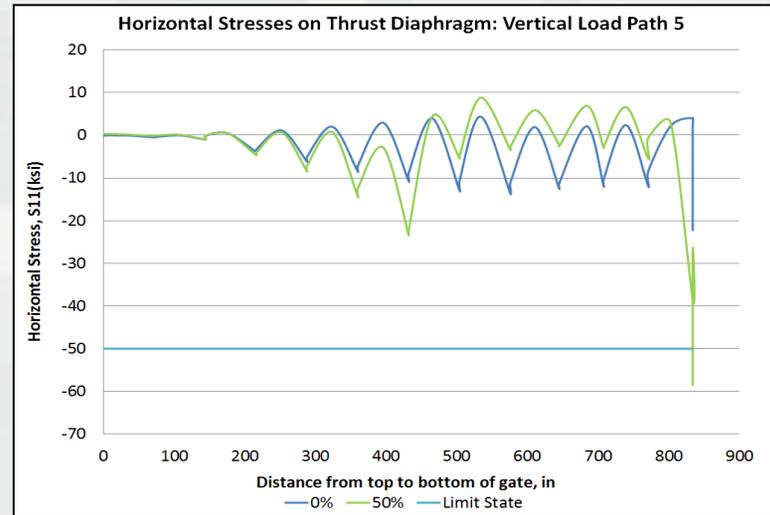
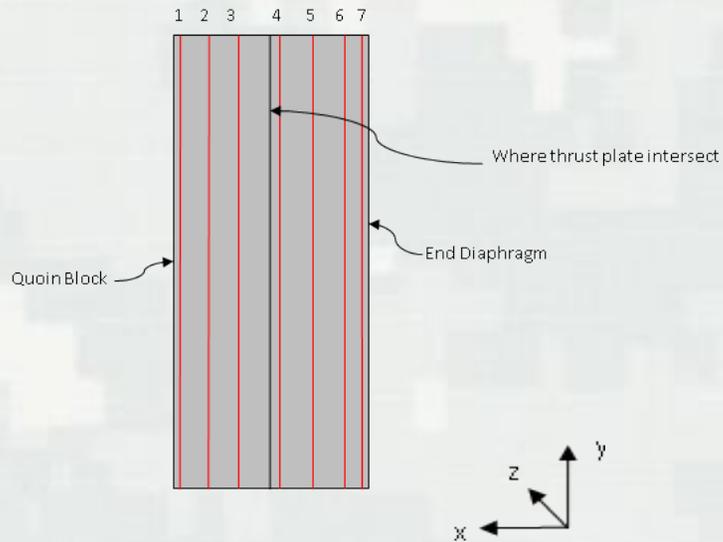
Pintle Socket Redesign

Problem Description

- ▶ Pintle rib cracks
- ▶ Broken bolts
- ▶ Thrust diaphragm – out of plane distortion
- ▶ Increase or relaxation of diagonal prestressing
- ▶ Bottom web fully fracture
- ▶ US Flange cracking



Horizontal Stress: Thrust Diaphragm Path 5

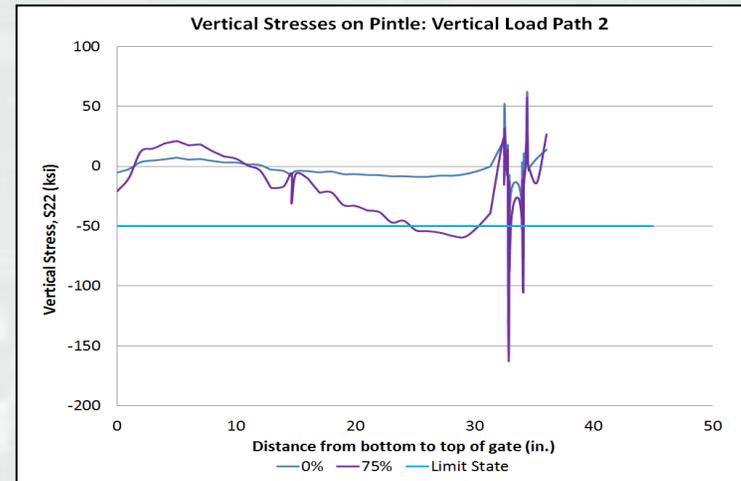
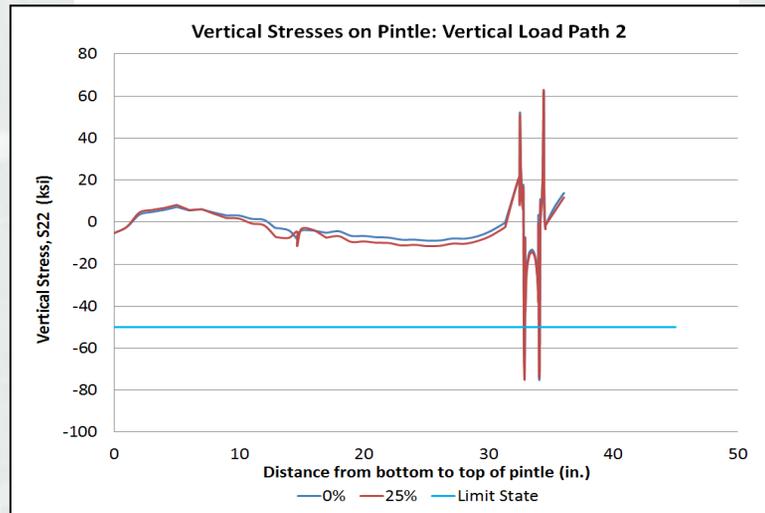
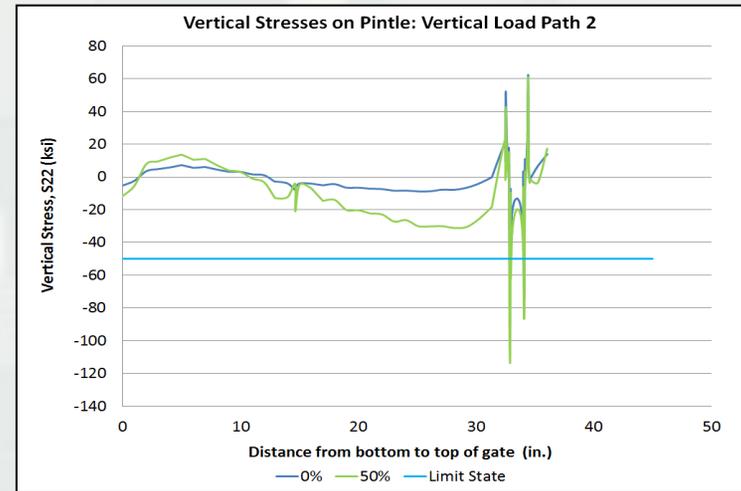
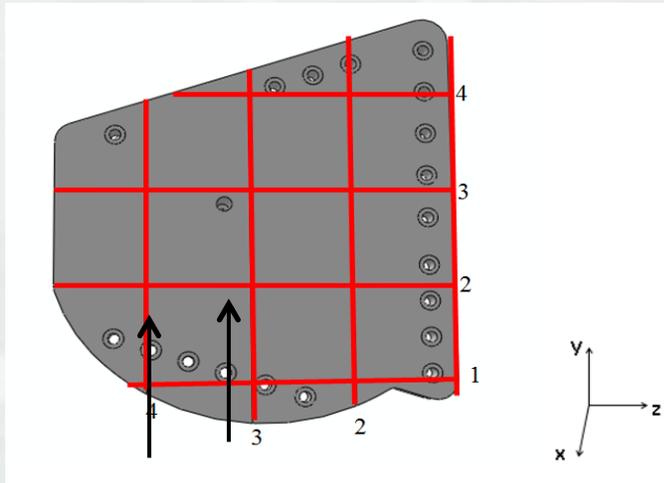


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Vertical Stresses on Pintle: Vertical Load Path 2



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Evaluation of Emerging Filler Materials for Miter and Quoin Blocks

- Background/Problem:
 - ▶ Unified Facility Guide Specifications UFGS 35 20 16.33 "Miter Gates" Outdated.
 - ▶ The epoxy filler specified in the guide specification is no longer available.



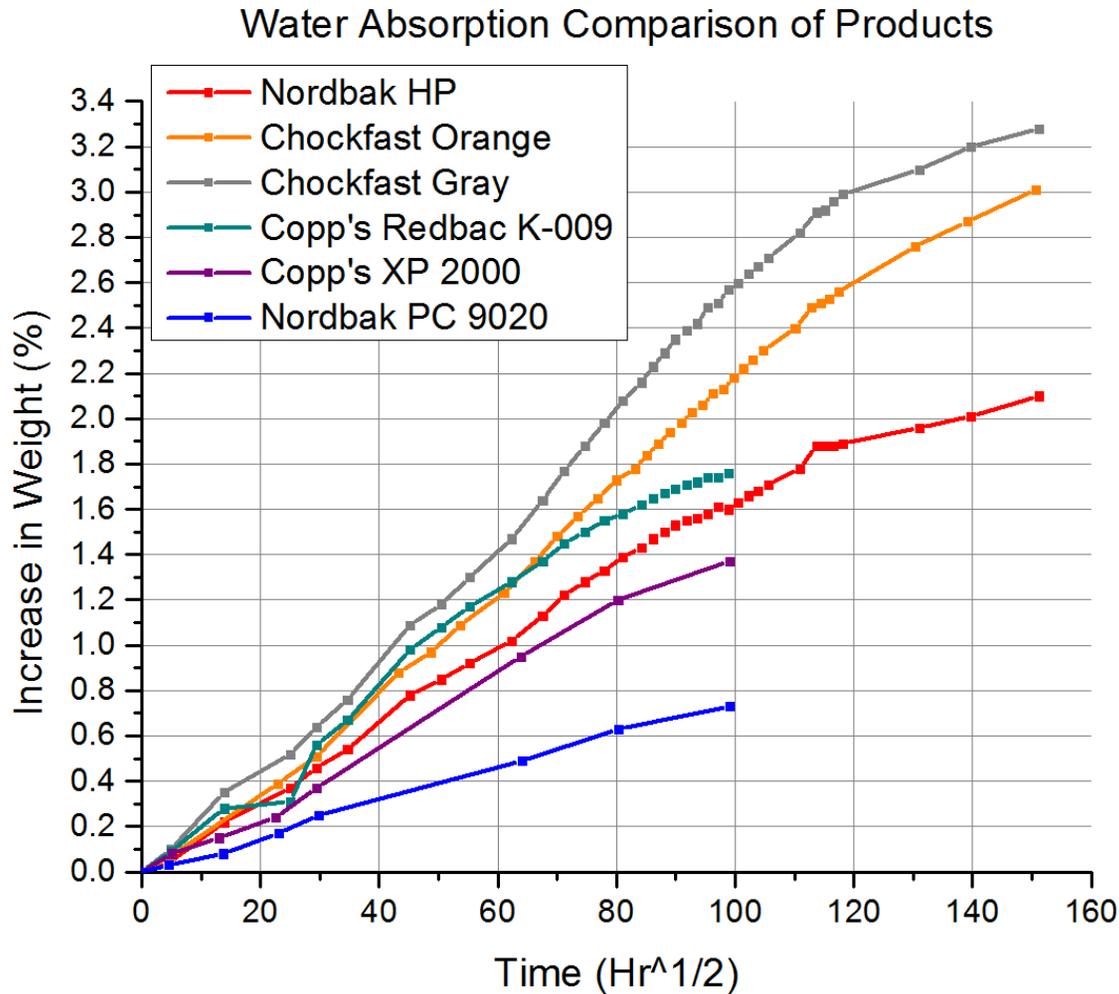
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FY15 Product Development (2/3)

Water Absorption/Immersion



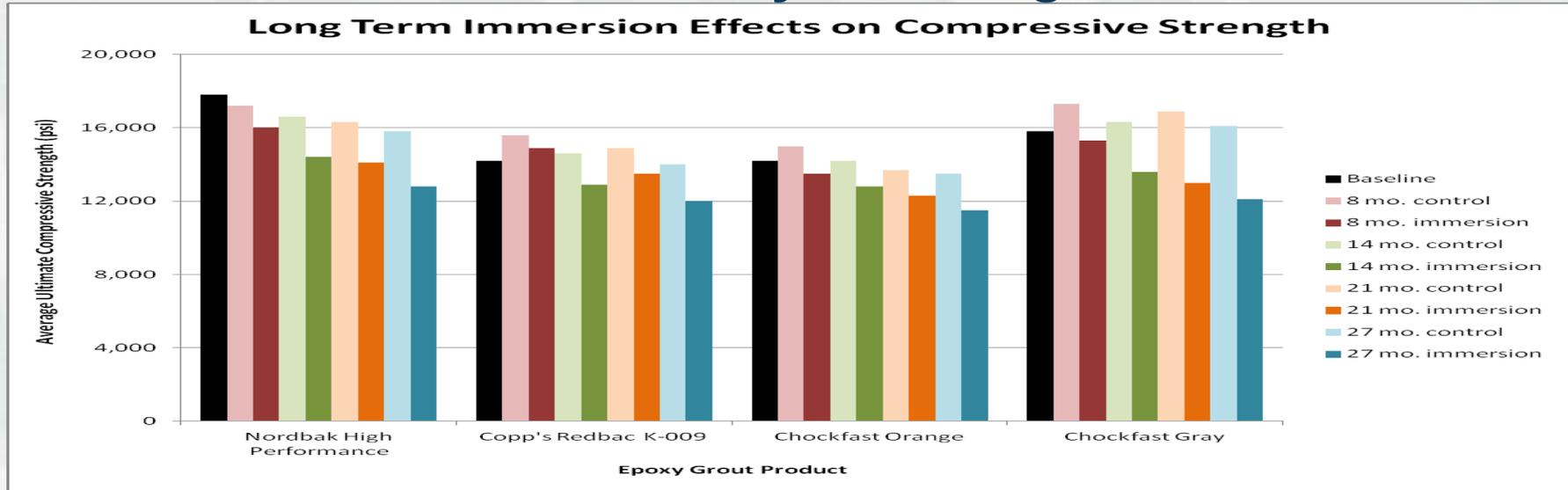
- Curve fitting data to determine Diffusion Coefficients.

- Using Fickian Diffusion Models to predict time to saturation.

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FY15 Product Development (3/3)

Durability Modeling

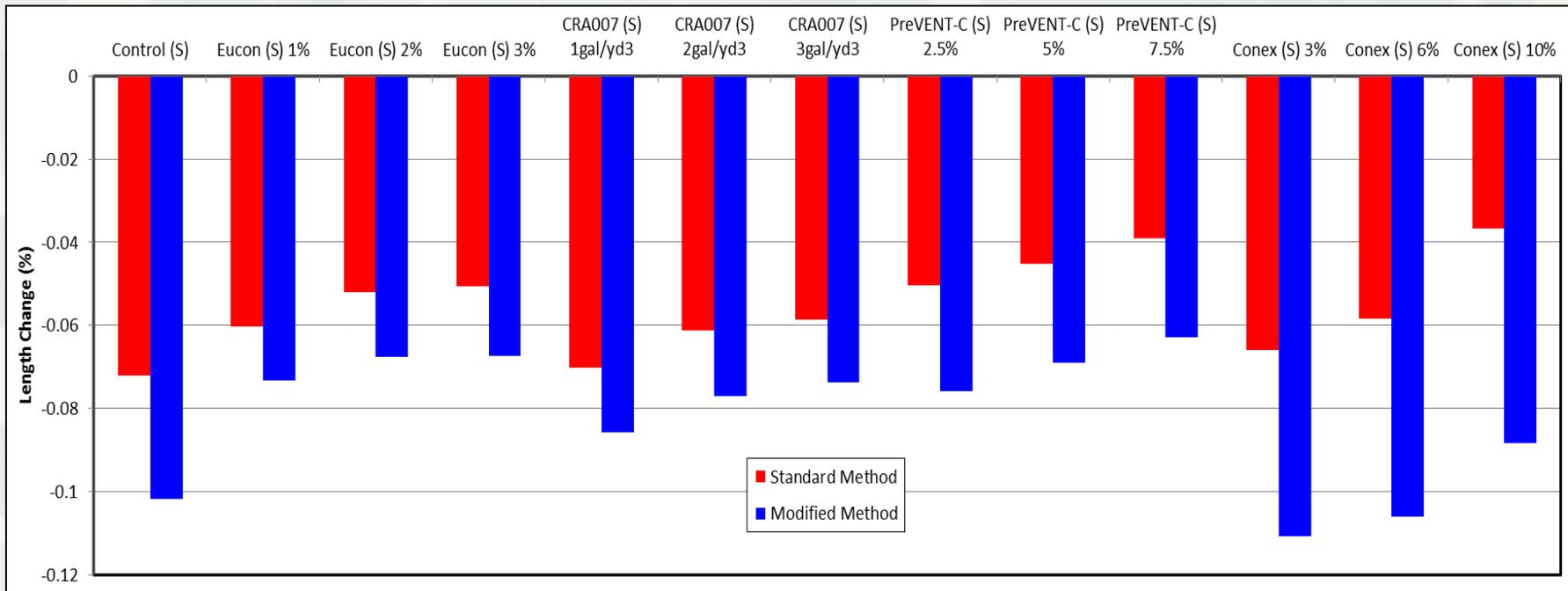


Sample	Average Compressive Strength after 8 mo. cure (psi)	Average Compressive Strength after 8 mo. Immersion (psi)	Difference @ 8 mo. from control (psi)	% Reduction @ 8 mo. from control	Difference @ 8 mo. from baseline (psi)	% Reduction @ 8 mo. from baseline	Average Compressive Strength after 14 mo. cure (psi)	Average Compressive Strength after 14 mo. Immersion (psi)	Difference @ 14 mo. from control (psi)	% Reduction @ 14 mo. from control	Difference @ 14 mo. from baseline	% Reduction @ 14 mo. from baseline
Nordbak High Performance	17,200	16,000	1,200	7%	1800	10%	16,600	14,400	2,200	13%	3,400	19%
Copp's Redbac K-009	15,600	14,900	700	4%	-700.00	-5%	14,600	12,900	1,700	12%	1,300	9%
Chockfast Orange	15,000	13,500	1,500	10%	700	5%	14,200	12,800	1,400	10%	1,400	10%
Chockfast Gray	17,300	15,300	2,000	12%	500	3%	16,300	13,600	2,700	17%	2,200	14%

Sample	Average Compressive Strength after 21 mo. cure (psi)	Average Compressive Strength after 21 mo. Immersion (psi)	Difference @ 21 mo. from control (psi)	% Reduction @ 21 mo. from control	Difference @ 21 mo. from baseline	% Reduction @ 21 mo. from baseline	Average Compressive Strength after 27 mo. cure (psi)	Average Compressive Strength after 27 mo. Immersion (psi)	Difference @ 27 mo. from control (psi)	% Reduction @ 27 mo. from control	Difference @ 27 mo. from baseline	% Reduction @ 27 mo. from baseline
Nordbak High Performance	16,300	14,100	2,200	13%	3700	21%	15,800	12,800	3,000	19%	5,000	28%
Copp's Redbac K-009	14,900	13,500	1,400	9%	700.00	5%	14,000	12,000	2,000	14%	2,200	15%
Chockfast Orange	13,700	12,300	1,400	10%	1900	13%	13,500	11,500	2,000	15%	2,700	19%
Chockfast Gray	16,900	13,000	3,900	23%	2800	18%	16,100	12,100	4,000	25%	3,700	23%

Shrinkage Reduction Studies – Mortars

- Shrinkage reduction reported by manufacturers of shrinkage reducing and compensating admixtures not achieved.
- Curing regime has impact on shrinkage even with SRAs.
- SRAs are not end-all-be-all but can improve performance.



Testing completed at start of FY15.



Test Slabs Configuration and Testing

- Concrete slabs (4' x4' x6") fabricated to perform simulated horizontal concrete repairs.
- Bonding conditions studied for control and PreVENT-C.
- Instrumented for strain measurements and mapping cracks.

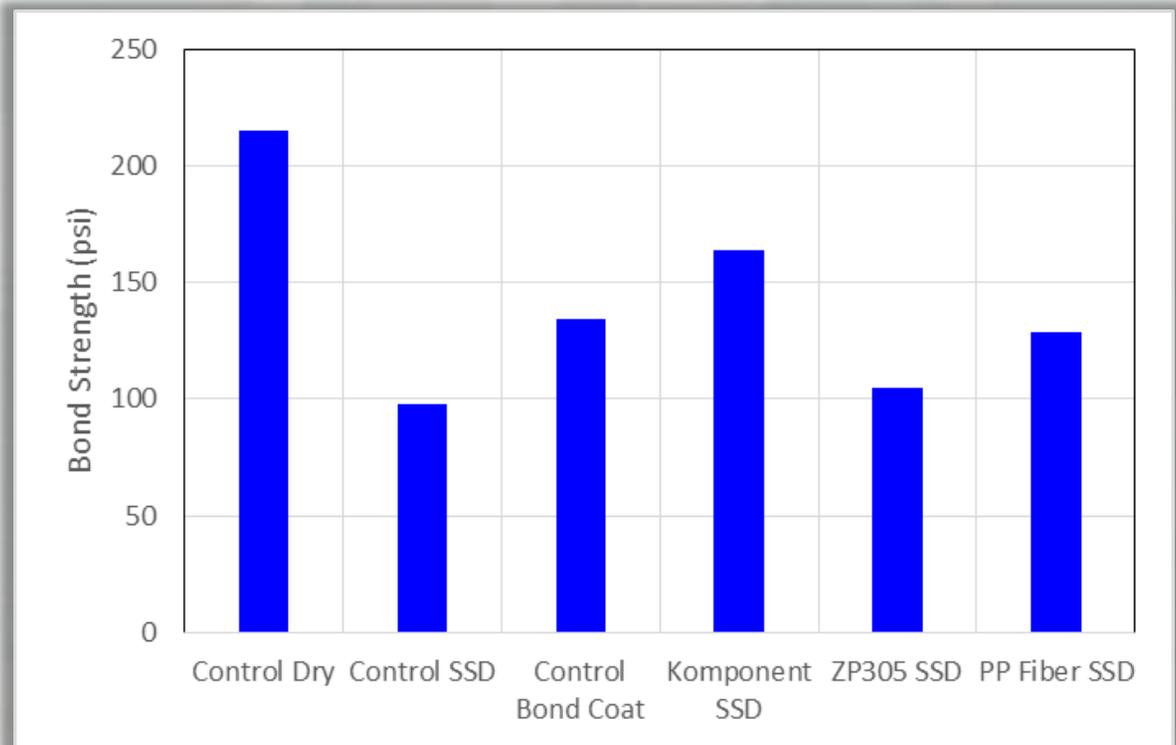


Placement of simulated repairs on test slabs.

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Results from Test Slabs

- Bond strength measurements made using direct tensile tests of cores from slabs to characterize influence of surface prep and material composition on strength.



Dry and bond coated surfaces promoted improved bond.

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Instrument Development

- Particle Imaging Camera System (PICS)
- SedFlume
- Remote Transmission Units (RTU)
- Autonomous Surface Survey Vehicle (ASSV)
- Survey Hexacopter (Photogrammetry)
- Microbot for confined spaces



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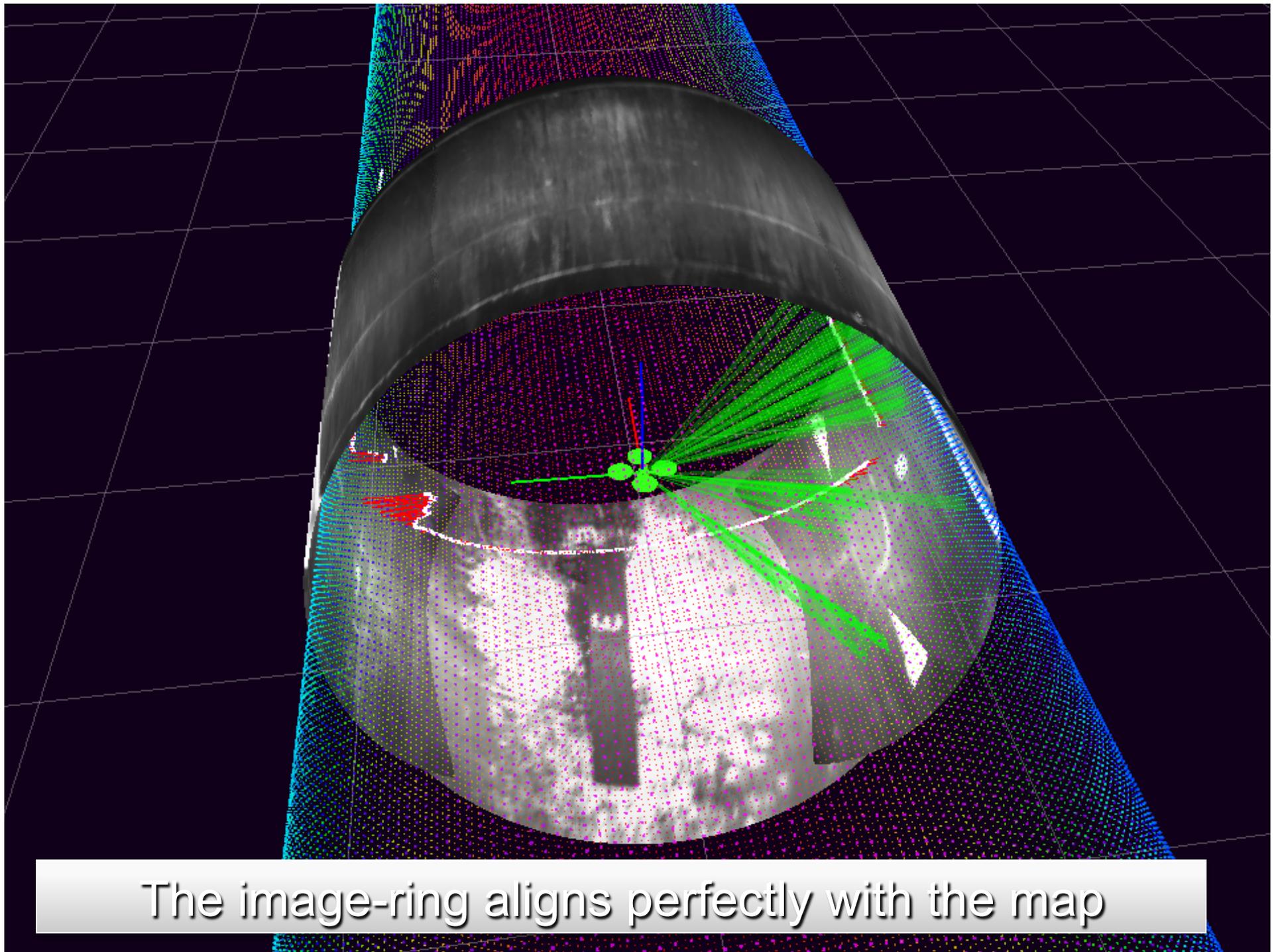
Autonomous Surface Survey Vessel



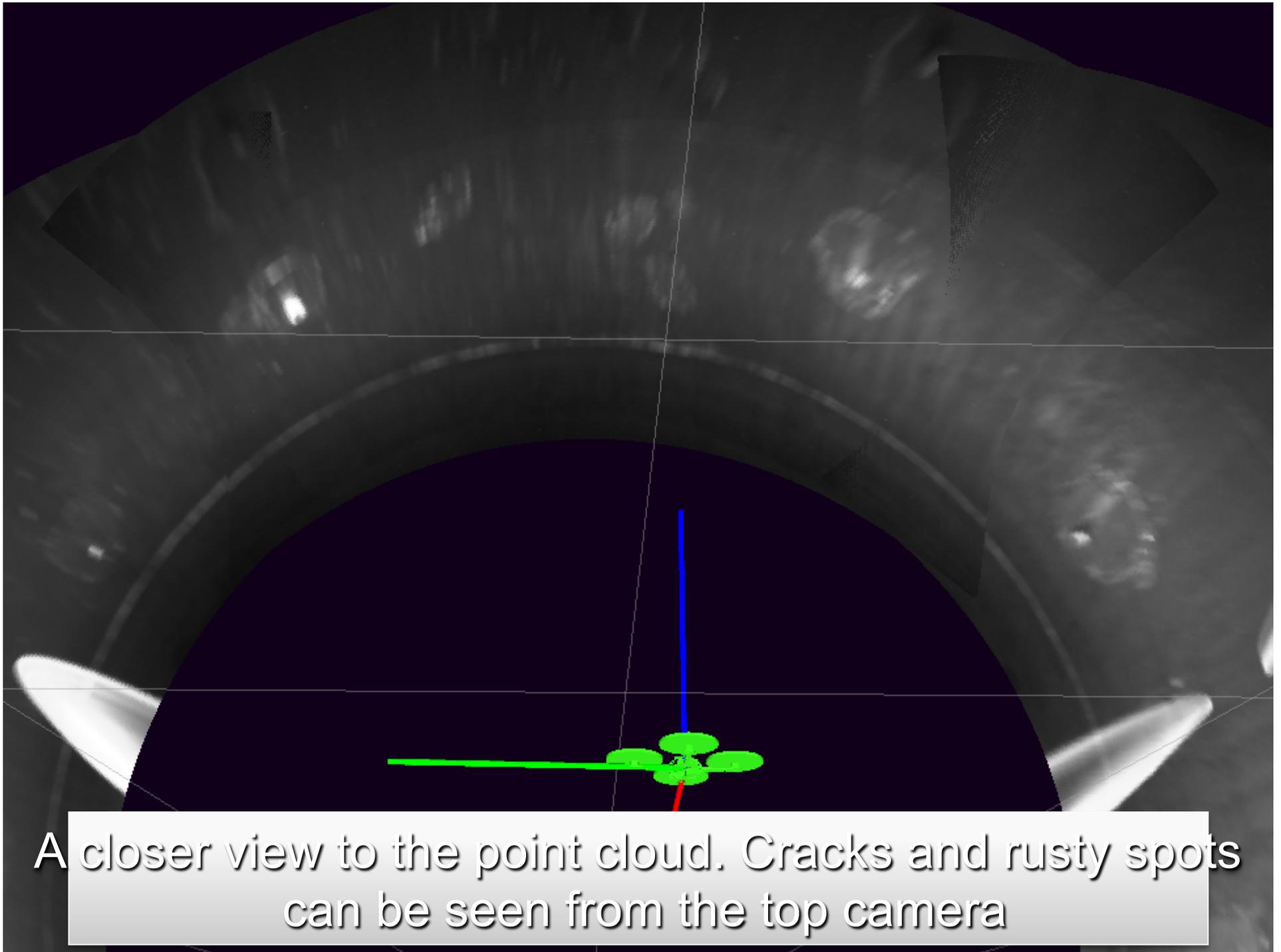
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The image-ring aligns perfectly with the map

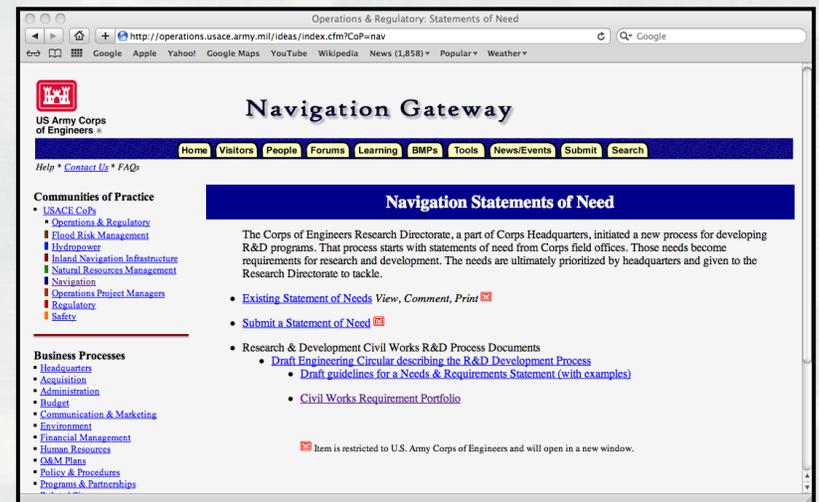


A closer view to the point cloud. Cracks and rusty spots can be seen from the top camera

Statements of Need

how it all begins

- Title
- Need that Drives Requirement
- Extent of Need Across USACE
- Requirement
- Consequences if Requirement Not Met
- Product Recommendation
- Originator



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Navigation Gateway

Operations & Regulatory: Navigation Gateway

http://operations.usace.army.mil/navigation.cfm

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Navigation Gateway

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Communities of Practice

- USACE CoPs
 - Operations & Regulatory
 - Asset Management
 - Flood Risk Management
 - Hydropower
 - Inland Navigation Infrastructure
 - Natural Resources Management
 - Navigation
 - Operations Project Managers
 - Regulatory
 - Safety
 - Civil Works Environment

Business Processes

- Headquarters
- Acquisition
- Administration
- Budget
- Communication & Marketing
- Environment
- Financial Management
- Human Resources
- PMP & PgMP
- Policy & Procedures
- Programs & Partnerships
- Related Sites
- Research & Development
- Safety, Security & Risk Management
- Teams
- Tools/AIS

Navigation Notes

Welcome to the Navigation Community

The USACE Navigation Mission:
To provide safe, reliable, efficient, effective and environmentally sustainable waterborne transportation systems for movement of commerce, national security needs, and recreation.

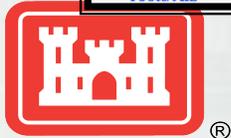
- Navigation R&D Statements of Need
- Contracts – Dredging - Good Enough to Share

Quick Links

- Coastal Inlets Research Program (CIRP)
- Coastal Working Group
- Dredging Operations and Environmental Research (DOER)
- Dredging Operations Technical Support (DOTS)
- eCoastal
- Joint Airborne LiDAR and Bathymetry Technical Center of Expertise (JALTCBX)

Navigation Newsletters

- eNews
 - About the eNews
 - Volume 18
 - Volume 17
 - See All Issues
 - Subscribe to eNews



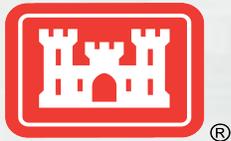
<http://operations.usace.army.mil/navigation.cfm>

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Questions/Discussion



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