

Improved Channel Evaluation using Automatic Identification System and Hydrographic Survey Data

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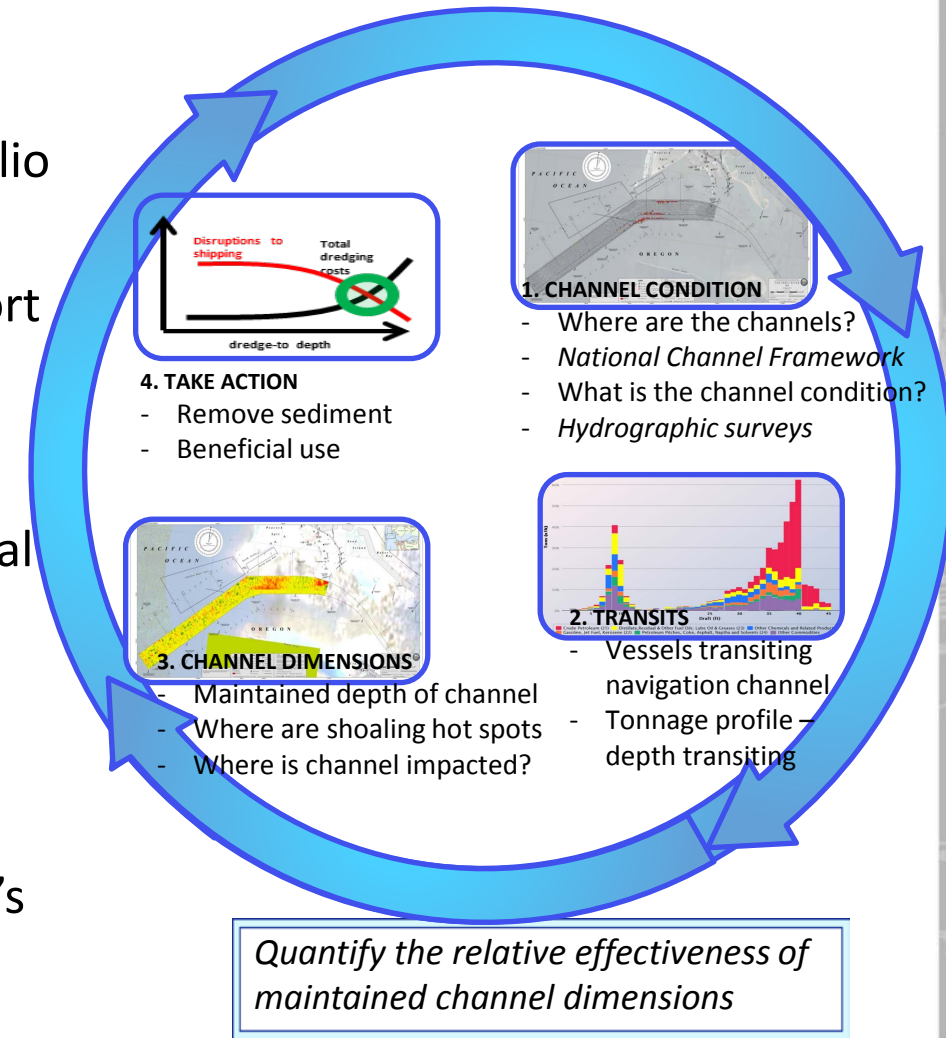
USACE Navigation Mission

- **Background:**

- USACE maintains a vast, aging navigation infrastructure portfolio that is critical to national well-being.
- Navigation projects facilitate marine transportation and support global supply chains.

- **Action:**

- Leverage existing data, user-friendly tools, and robust analytical approaches to develop objective, quantitative, and systems based approaches for management of the Corps' large coastal navigation project portfolio.
- Nation-wide, **enterprise** datasets
 - **Automatic Identification System (AIS)** identified mid 2000's as key to improving understanding and management.
 - Hydrographic surveys processed through **eHydro** and **channel shoaling rates using Corps Shoaling Analysis Tool**

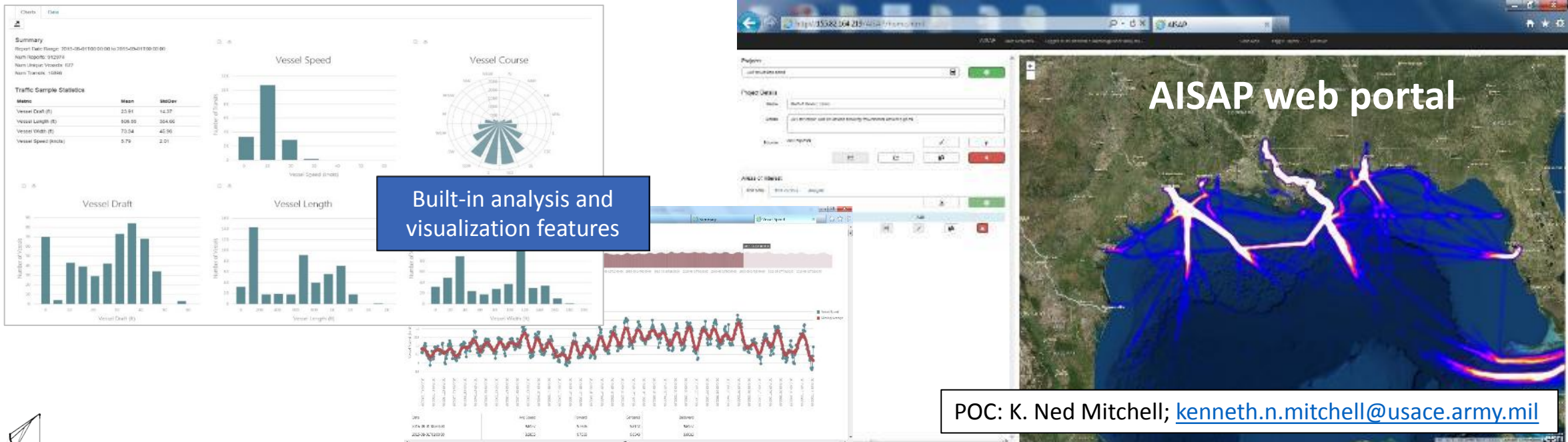


AIS Analysis Package (AISAP)

- Builds on the USCG-USACE data sharing agreement (2012)
- Strategic tool provides analysis and visualization capabilities for archival AIS data
- Serves diverse navigation stakeholders:
 - Gives Corps project managers insight into project use
 - Allows Corps planners to investigate key navigation metrics
 - Communicates “When”, “Where”, “How many” of corps project users



USCG-USACE
Interagency Security Agreement



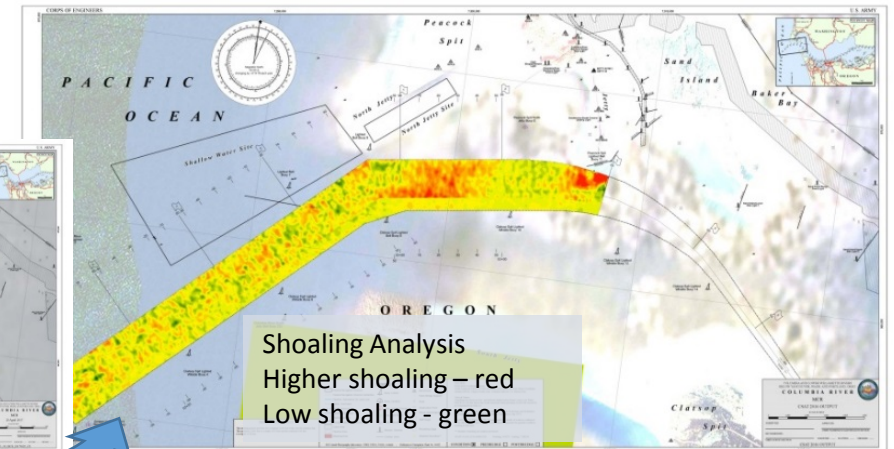
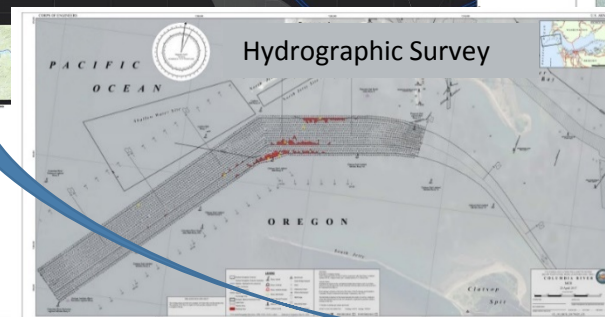
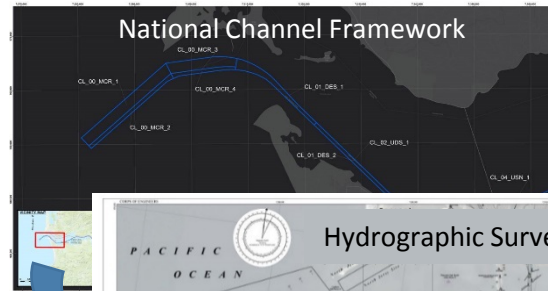
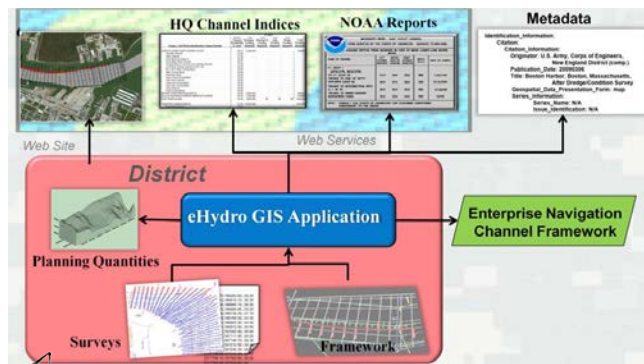
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Enterprise Hydrographic Datasets: eHydro & CSAT

■ eHydro: Application and Reporting Process

- *What is the present channel condition?*
- Geo-process hydrosurveys using automated GIS scripts
- Reports/Products generated
 - Channel Condition/Availability Reports
- Coastal districts using eHydro
 - National Channel Framework
 - Uploading surveys



• CSAT: Corps Shoaling Analysis Tool

- *What will the channels look like in the future?*
- estimates shoaling rates using hydrographic surveys within the boundary of the National Channel Framework.
- CSAT uses the historical shoaling rates to predict future dredging volumes at various channel depth intervals.

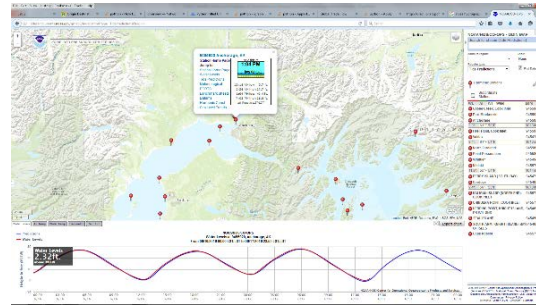
Incorporating Maintenance: Underkeel Clearance

- Can we estimate how much depth was available during a transit?

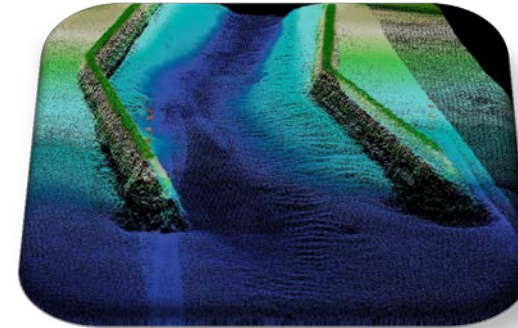
AIS Vessel Details



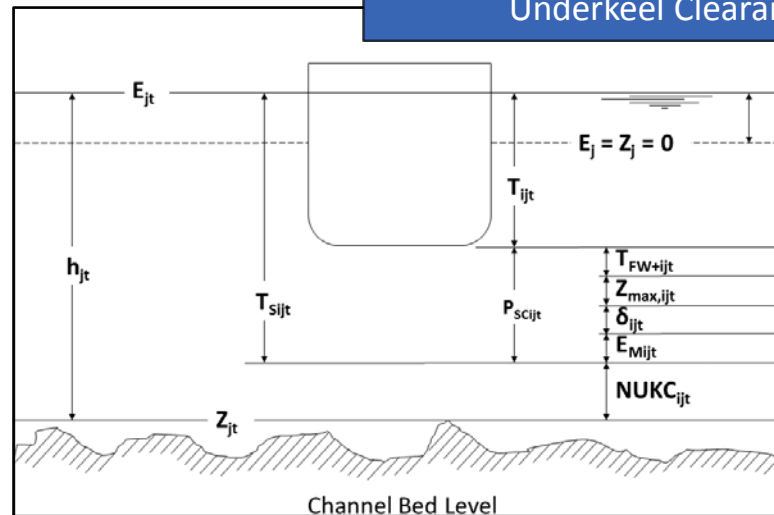
Water Level



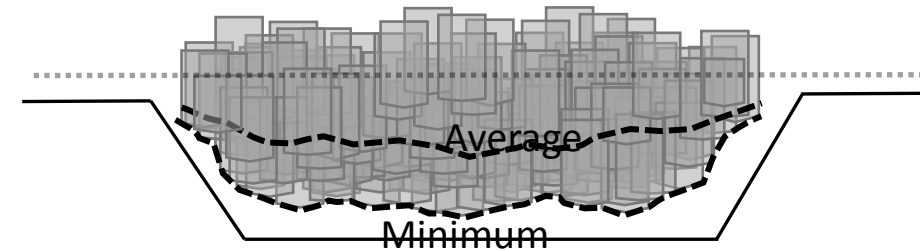
Bathymetric Evolution



Underkeel Clearance



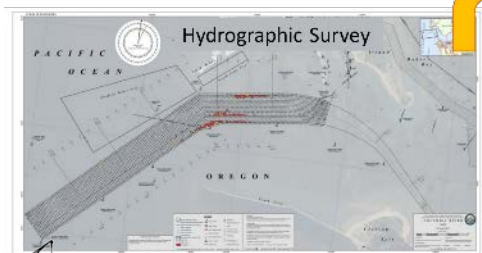
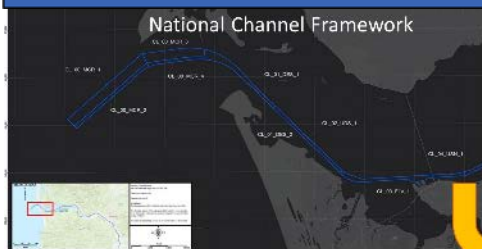
Underkeel Clearance Time stack



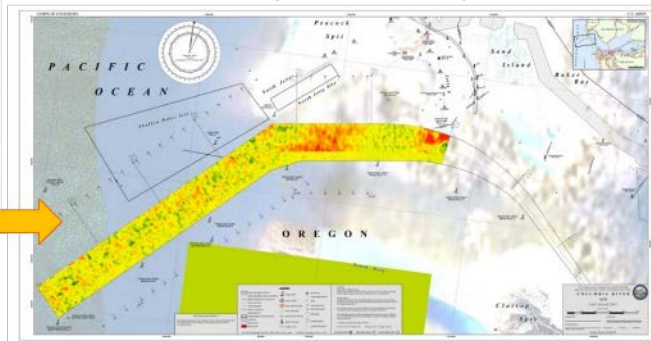
Resolving Length and Beam: Modeling Vessels

- Draft is no longer the only vessel dimension of concern.
- AIS has sufficient detail to resolve vessel hulls.
- Treat AIS data like the spatio-temporal record of a physical object.
- Contingent on managing AIS data quality
 - Validating vessel particulars
 - AIS draft provides conservative keel location

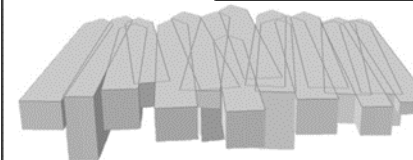
Develop Bathymetric Shoaling Rates



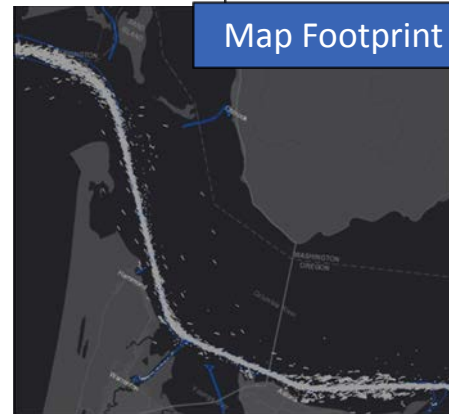
Shoaling Rate – CSAT Output



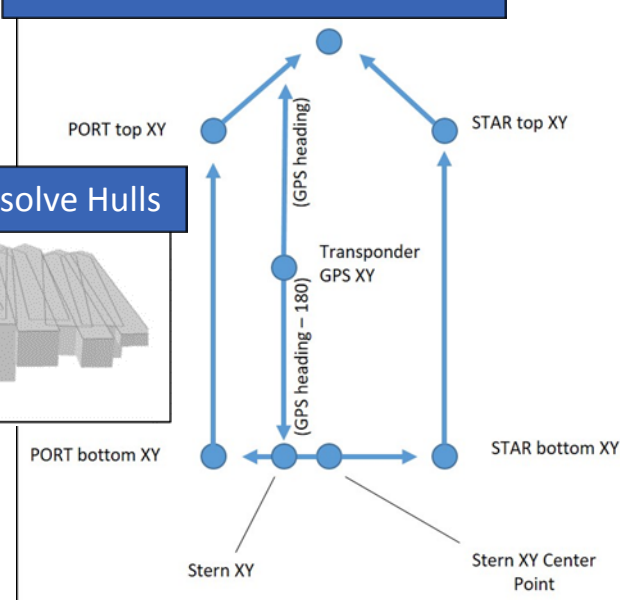
Resolve Hulls



Map Footprint



AIS contains Vessel Particulars



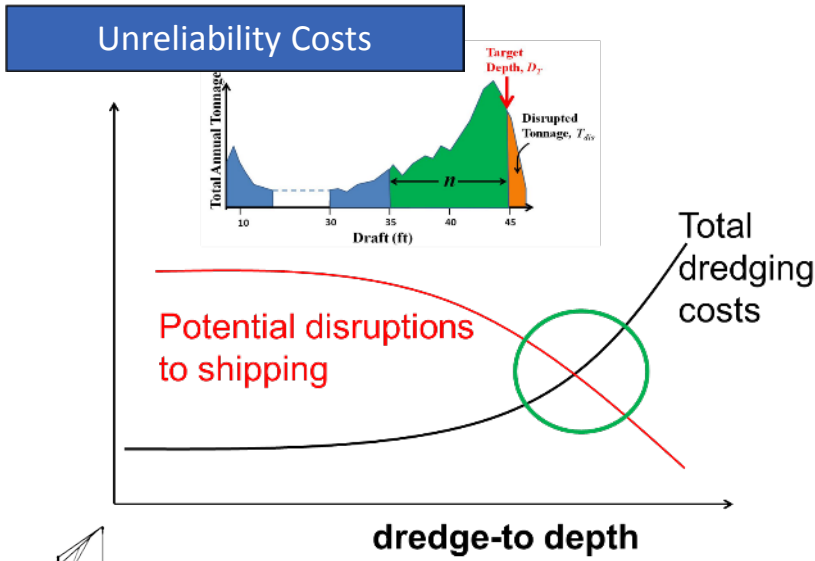
Result is Vessel Operating Picture



Img. Ref: OMC International

Measuring and Managing Reliability

- A transit is reliable if it has “enough” clearance in transit.
- The sequence of transited shoals and the available clearance can be tracked.
- A transit is “unreliable” if not “enough” clearance, “reliable” otherwise.
- A project’s reliability is the reliable fraction of all transits.
- Assess the potential impacts to commodity flows based on dredging decisions vs. unreliability costs.

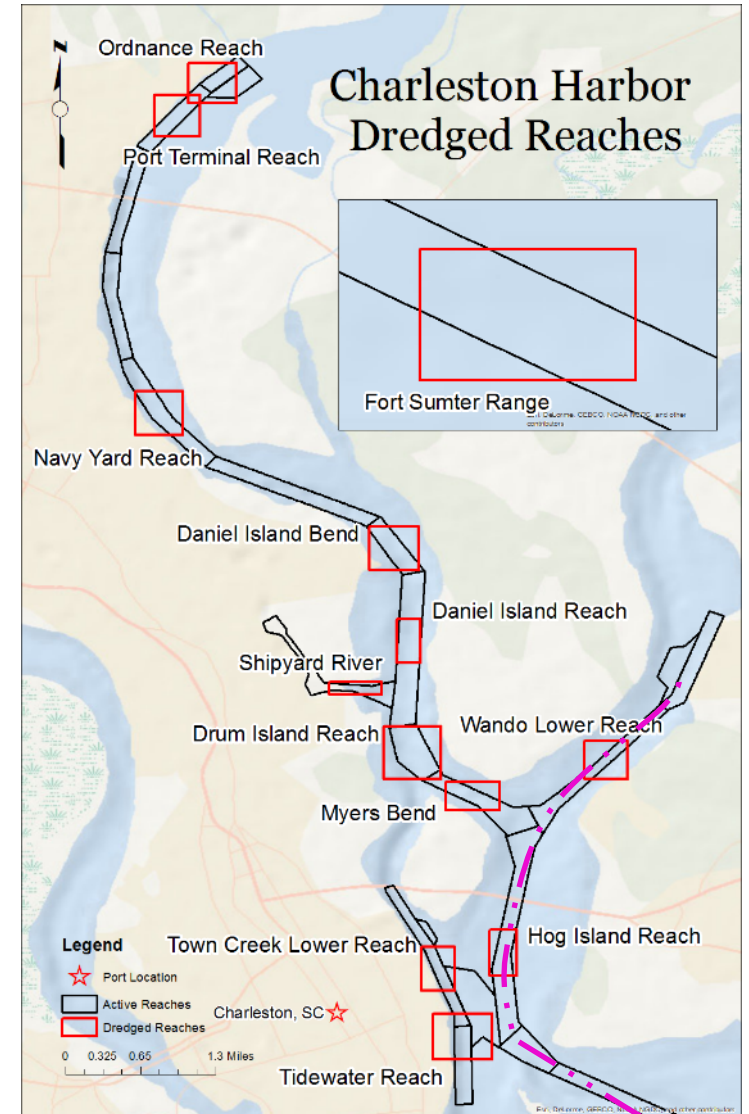


Target Elev. ft (MLLV)	Years between Dredging Events			
	1	1.5	2	2.5
45	16.16	21.71	25.15	27.35
44	16.46	22.52	26.36	28.78
43	16.71	23.30	27.58	30.27
42	15.94	22.60	27.11	29.91
41	15.75	22.73	27.65	30.68
40	15.19	22.14	27.33	30.56
39	14.48	21.32	26.71	30.12
38	13.14	19.42	24.65	28.12
37	11.96	17.76	22.82	26.35
36	10.51	15.64	20.28	23.69
35	9.82	13.30	17.39	20.57
34	7.28	10.87	14.28	17.05
33	5.93	8.86	11.69	14.11
32	4.88	7.31	9.66	11.75
31	4.13	6.19	8.20	10.04
30	3.31	4.87	6.59	8.11
29	2.47	3.70	4.92	6.08
28	1.92	2.88	3.83	4.75

Target Elev. ft (MLLV)	Years between Dredging Events			
	1	1.5	2	2.5
45	13.95	16.09	16.65	15.60
44	14.81	17.62	17.71	17.14
43	15.72	19.42	19.68	18.96
42	10.22	19.58	20.24	19.49
41	15.29	20.96	21.76	20.94
40	14.86	20.22	22.38	21.69
39	14.27	20.27	22.86	22.35
38	13.01	18.70	21.74	21.68
37	11.99	17.30	20.80	21.22
36	10.48	15.35	18.07	19.74
35	9.91	13.14	16.54	17.79
34	7.28	10.78	13.74	15.14
33	5.93	8.82	11.39	12.68
32	4.88	7.29	9.47	10.93
31	4.13	6.19	8.08	9.23
30	3.31	4.96	6.53	7.79
29	2.47	3.70	4.89	5.91
28	1.92	2.88	3.82	4.65

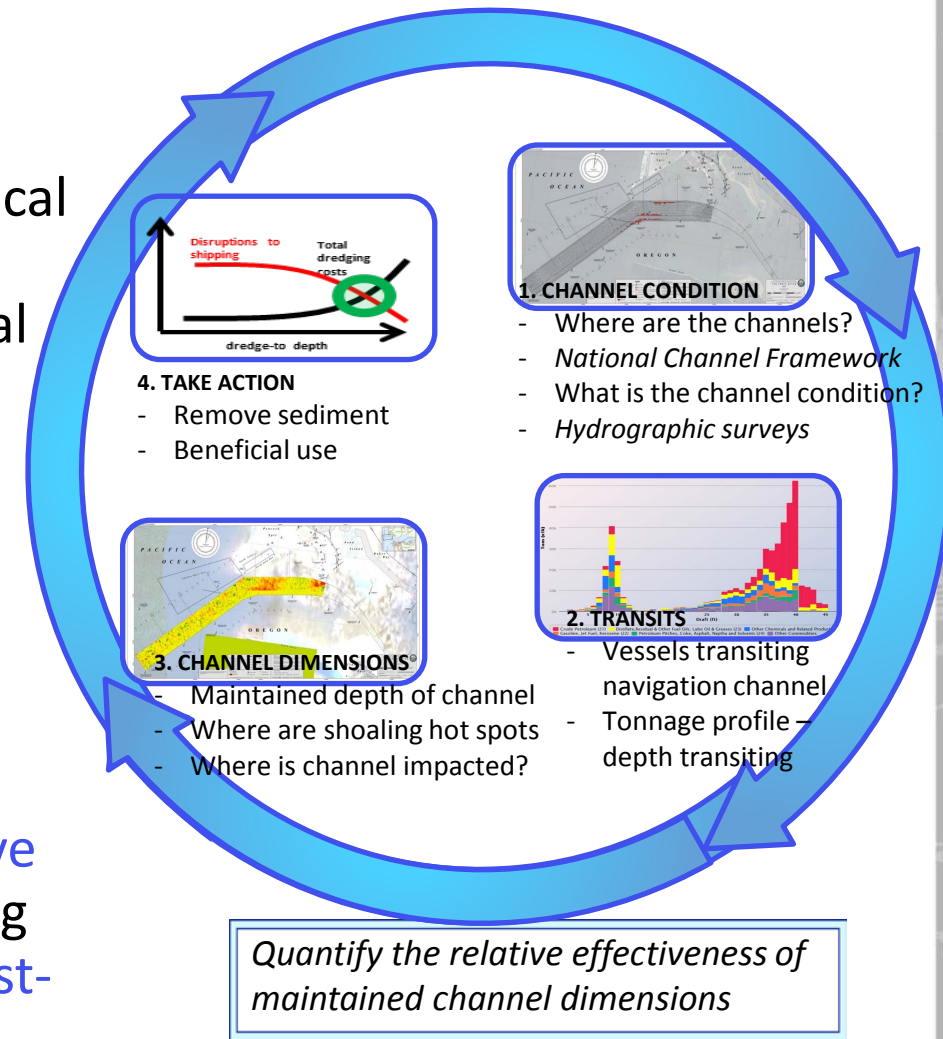
Target Elev. ft (MLLV)	Years between Dredging Events			
	1	1.5	2	2.5
45	9.44	8.44	7.09	6.23
44	10.95	10.00	8.84	7.99
43	13.62	12.27	9.82	8.21
42	13.16	13.35	10.73	8.79
41	13.96	15.40	12.45	9.91
40	13.80	16.34	13.69	10.76
39	13.59	17.31	15.19	11.74
38	12.56	16.54	15.39	12.04
37	11.69	15.89	15.88	12.61
36	10.35	14.39	15.18	12.46
35	8.88	12.58	14.11	12.07
34	7.26	10.45	12.13	10.88
33	5.93	8.66	10.43	9.68
32	4.88	7.21	8.86	8.90
31	4.13	6.16	7.72	8.02
30	3.31	4.96	6.31	6.84
29	2.47	3.70	4.79	5.38
28	1.92	2.88	3.71	4.32

Target Elev. ft (MLLV)	Years between Dredging Events			
	1	1.5	2	2.5
45	12.81	13.29	13.86	13.61
44	14.44	15.54	13.76	12.15
43	14.26	16.32	14.67	12.81
42	14.64	17.98	16.48	14.18
41	14.38	18.49	17.59	15.11
40	13.97	18.99	18.79	16.11
39	12.81	17.71	18.46	15.14
38	11.79	16.67	16.36	14.23
37	10.42	14.92	17.00	15.79
36	8.90	12.89	15.40	14.79
35	7.27	10.63	13.00	12.96
34	5.93	8.75	10.96	11.40
33	4.88	7.26	9.20	9.20
32	4.13	6.16	7.72	8.02



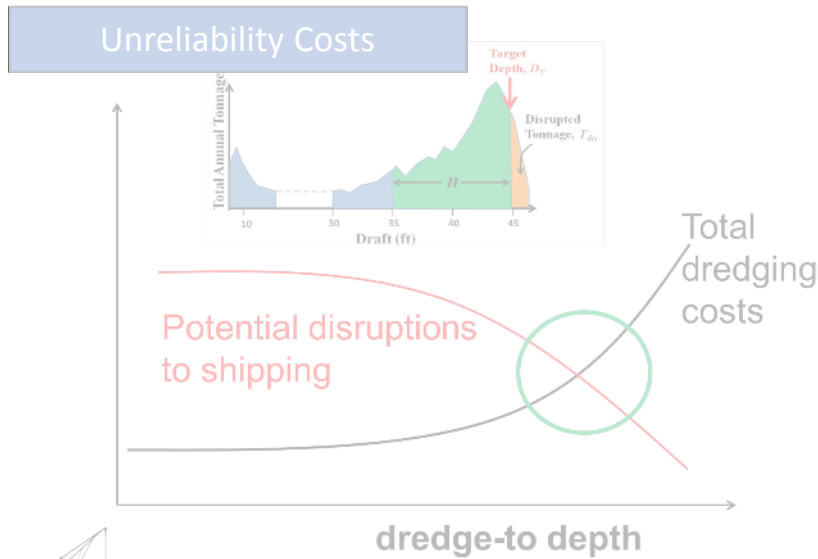
Summary

- USACE is working to improve waterway management using a data driven approach
- Leverage existing data, user-friendly tools, and robust analytical approaches to develop objective, quantitative, and systems based approaches for management of the Corps' large coastal navigation project portfolio.
- Nation-wide, **enterprise** datasets
 - Automatic Identification System (AIS)
 - Hydrographic surveys processed through **eHydro** and **channel shoaling rates using Corps Shoaling Analysis Tool**
- The goal is to **objectively** and **consistently** quantify the **relative effectiveness** of maintained channel dimensions in supporting the Navigation mission requirement for **safe, reliable, and cost-effective** marine transportation.



Thank you!

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Target Elev. ft (MLLW)	Years between Dredging Events							
	1	1.5	2	2.5	3	3.5	4	4
45	16.16	21.71	25.15	27.35	29.03	30.70	31.17	
44	16.46	22.02	26.36	28.76	30.64	32.47	35.10	
43	16.71	23.30	27.56	30.27	32.32	34.34	37.34	
42	15.94	22.00	27.11	29.91	32.00	34.03	37.04	
41	15.75	22.73	27.65	30.68	32.92	35.04	38.17	
40	15.19	22.14	27.53	30.56	32.89	35.07	38.28	
39	14.48	21.32	26.71	30.12	32.52	34.73	37.57	
38	13.14	16.42	24.65	26.12	30.47	32.60	35.57	
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36	10.51	10.64	20.28	23.69	25.96	27.69	30.47	
35	8.82	13.30	17.89	20.57	22.71	24.44	26.72	
34	7.28	10.87	14.28	17.05	19.02	20.54	22.45	
33	5.89	8.86	11.69	14.11	15.89	17.25	18.84	
32	4.88	7.31	9.66	11.75	13.36	14.77	15.95	
31	4.13	6.56	8.20	10.04	11.53	12.85	13.96	
30	3.31	4.87	6.59	8.11	9.39	10.38	11.40	
29	2.47	3.70	4.92	6.08	7.10	7.91	8.71	
28	1.92	2.88	3.83	4.75	5.58	6.27	6.92	

Target Elev. ft (MLLW)	Years between Dredging Events							
	1	1.5	2	2.5	3	3.5	4	4
45	13.02	16.09	18.02	19.02	19.21	19.25	19.15	
44	13.81	17.62	17.71	17.14	16.70	16.77	17.68	
43	15.72	19.42	19.68	18.96	18.45	18.43	19.47	
42	16.22	19.58	20.24	19.49	18.91	18.82	19.85	
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40	14.86	20.27	22.38	21.68	20.90	20.68	21.75	
39	14.27	20.27	22.86	22.35	21.48	21.19	22.26	
38	13.01	16.70	21.74	21.68	20.84	20.51	21.50	
37	11.89	17.30	20.80	21.22	20.40	20.02	20.98	
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35	8.91	13.14	16.54	17.79	17.42	17.05	17.77	
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32	4.88	7.29	9.47	10.93	11.57	11.25	11.67	
31	4.13	6.18	8.08	9.29	10.14	10.14	10.59	
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38	12.56	16.54	15.39	12.64	9.80	8.83	9.03	
37	11.65	15.89	15.08	12.61	10.14	9.02	9.07	
36	10.95	14.39	15.16	12.46	9.97	8.74	8.73	
35	8.88	12.50	14.11	12.07	9.59	8.26	8.16	
34	7.26	10.45	12.13	10.88	8.75	7.47	7.33	
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41	14.64	17.98	16.48	14.18	12.81	12.21	12.65	
40	14.38	18.49	17.59	15.11	13.52	12.80	13.22	
39	15.97	18.88	18.79	16.11	14.23	13.57	13.72	
38	12.81	17.71	16.48	15.15	14.14	13.18	13.51	
37	11.79	16.67	15.30	14.42	14.23	13.15	13.42	
36	10.42	14.92	14.00	13.70	13.73	12.58	12.78	
35	8.90	12.89	13.40	14.79	12.91	11.70	11.83	
34	7.27	10.83	13.00	12.95	11.54	10.42	10.47	
33	6.93	8.75	10.99	11.40	10.39	9.33	9.36	
32	4.85	7.25	9.20	9.90	9.29	8.40	8.32	

Dredging Cost & Depth

