

# ERDC and e-Nav Data Use



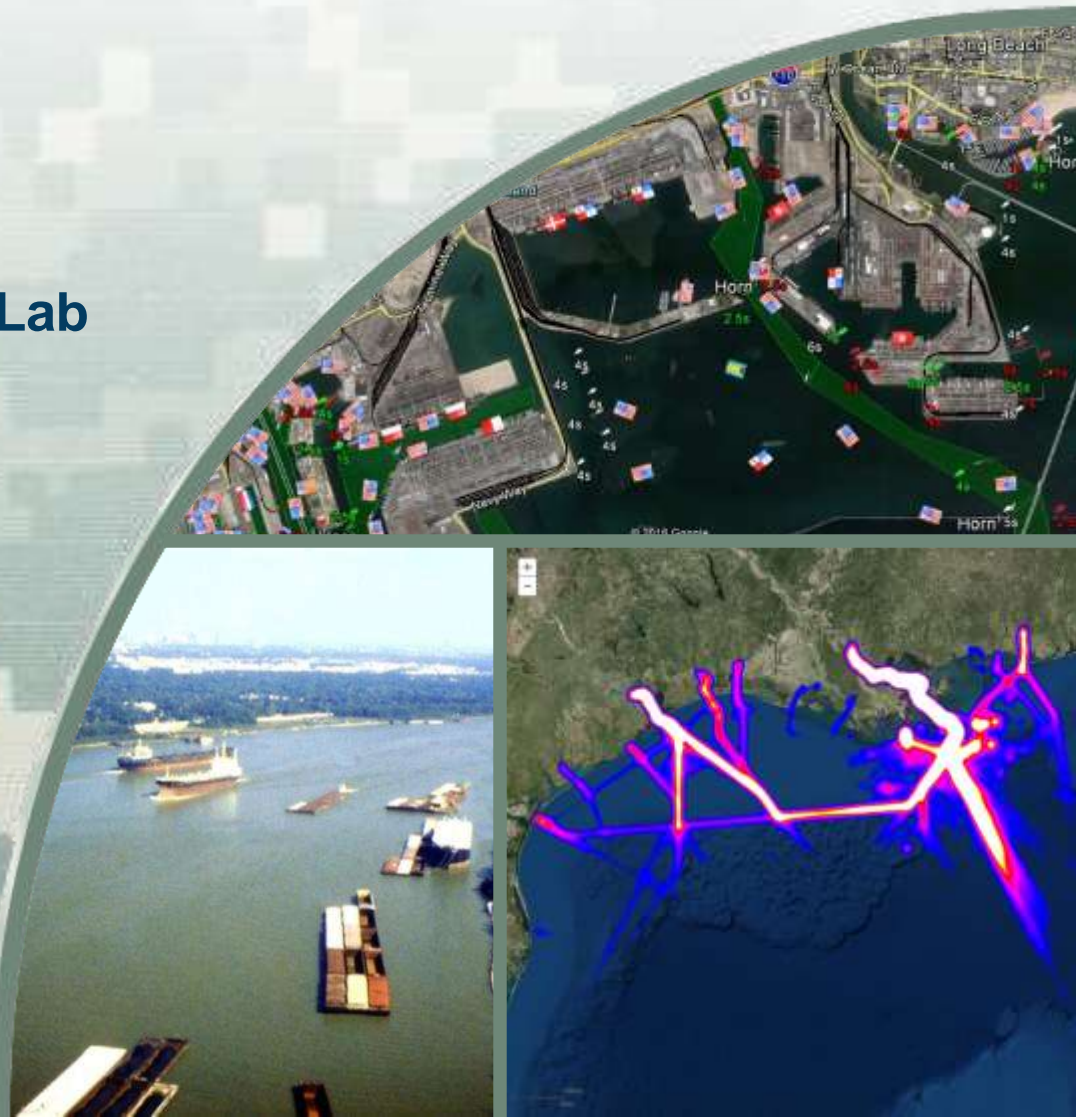
**Ned Mitchell, PhD**

Research Civil Engineer  
ERDC Coastal and Hydraulics Lab  
Vicksburg, Miss.

AAPA Harbors and Navigation  
30 MAR 2016



US Army Corps  
of Engineers®



# Traditional ERDC Harbors and Navigation Support

- Waterways Experiment Station (WES) – physical models to better understand the physics of proposed and existing USACE Navigation projects.



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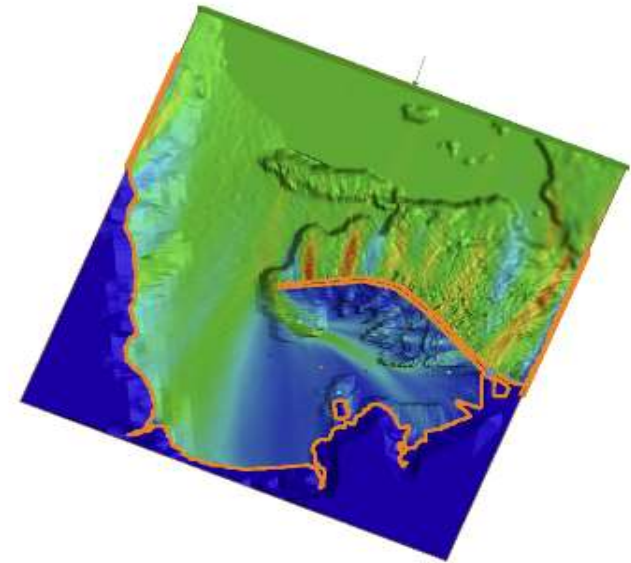
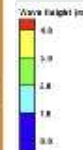
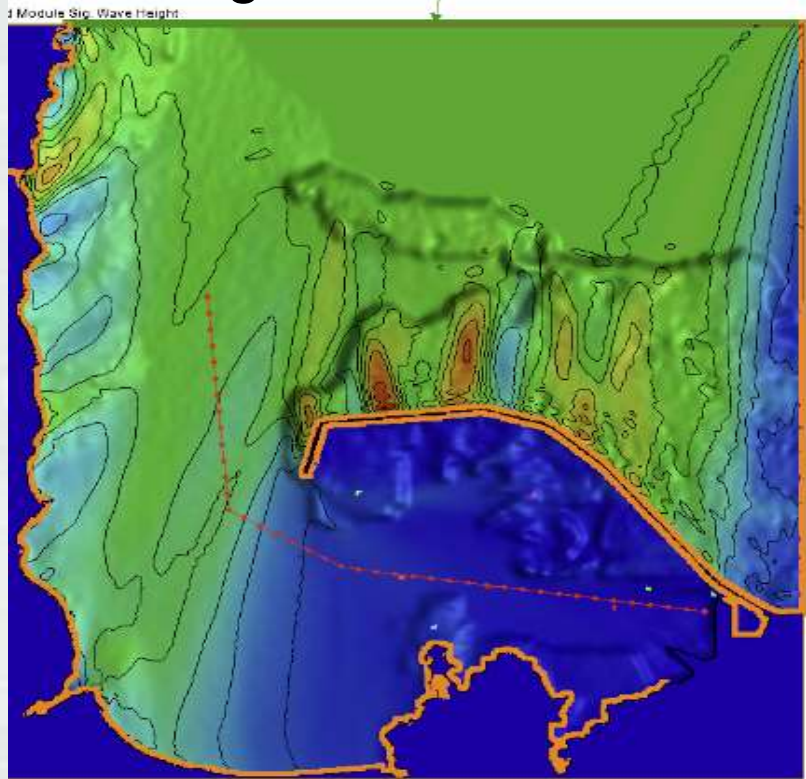
**ERDC**

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# Traditional ERDC Harbors and Navigation Support

- Numerical modeling to support harbor expansion studies, proposed modifications, safety considerations, etc. to improve navigation.



# Traditional ERDC Harbors and Navigation Support

- Ship simulator to assess mariner safety considerations
- Used to evaluate modifications to channels, new structures, operational procedures, changes to aids-to-navigation (AtoNs), and more.
- Allows comparison between multiple proposals.
- Allows optimization of channel dimensions.

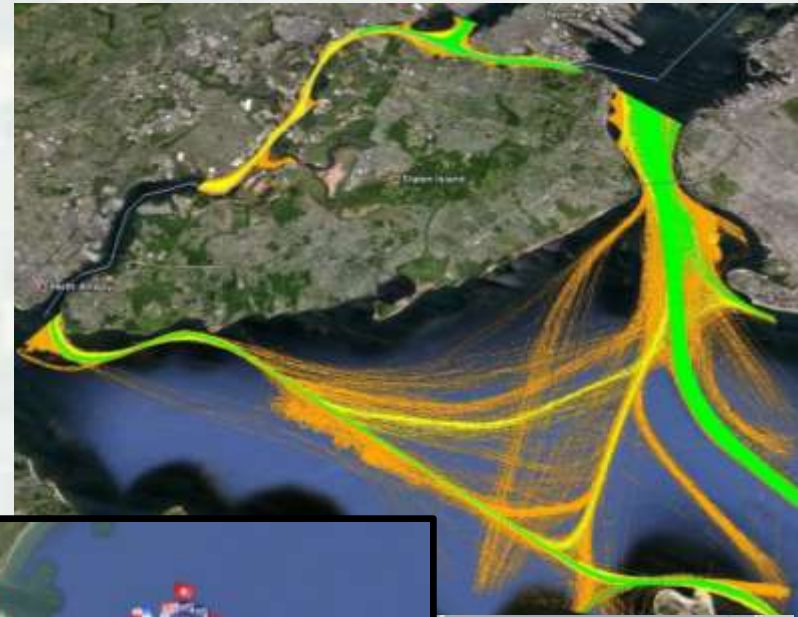




# Recent Data Availability Advances

- Ubiquitous GPS capabilities
- Data sharing, cloud computing, web services, etc.
- Big Data analytics, crowd sourcing, etc.

**Recognition and support from Leadership of the importance of systems-based approaches to how the Corps manages the vast Civil Works portfolio.**



# e-Navigation: Definitions

*“e-Navigation is the **harmonised collection, integration, exchange, presentation and analysis of maritime information** onboard and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment”*

*MSC85/26/Add.1 annex 20*

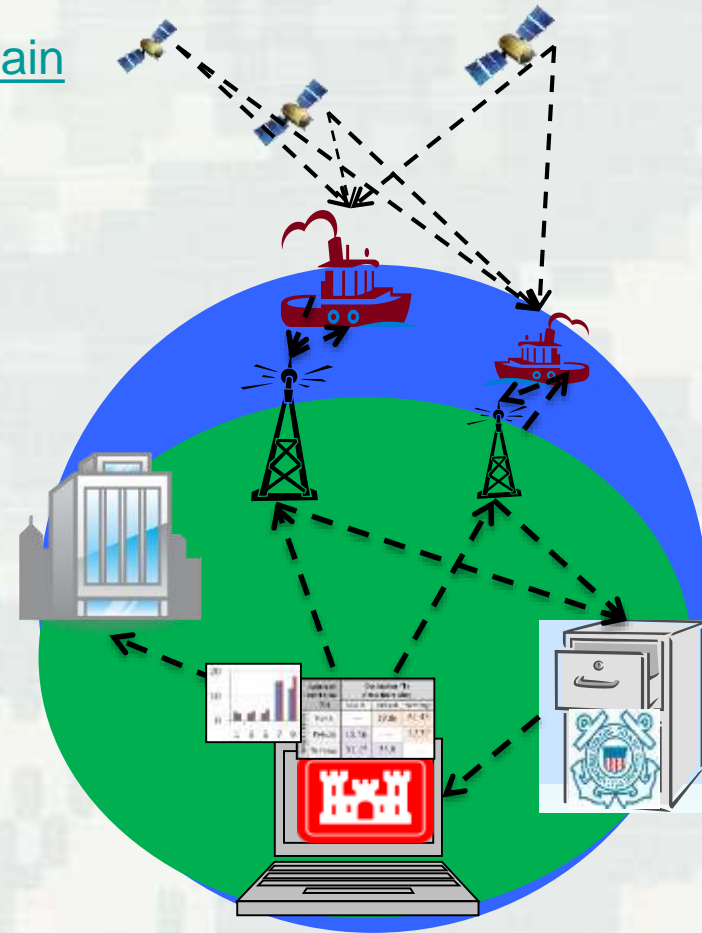
*“a framework that enables the **transfer of data between and among ships and shore facilities**, and that integrates and transforms that data into **decision and action information.**”*

*U.S. CMTS e-Navigation Strategic Action Plan (2012)*



# US Coast Guard's Nationwide Automatic Identification System (NAIS)

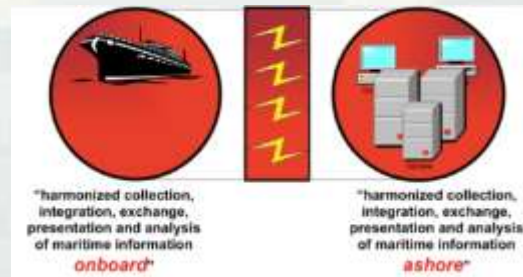
- <http://www.navcen.uscg.gov/?pageName=NAISmain>
- Information included in AIS:
  - Vessel identification
  - Location (longitude and latitude)
  - Time stamp
  - Heading
  - Speed
  - Vessel characteristics
- Discrete data points
  - Transmission frequency of 6 secs.
- Vessels act as passive probes



# The role of e-Navigation in addressing infrastructure challenges

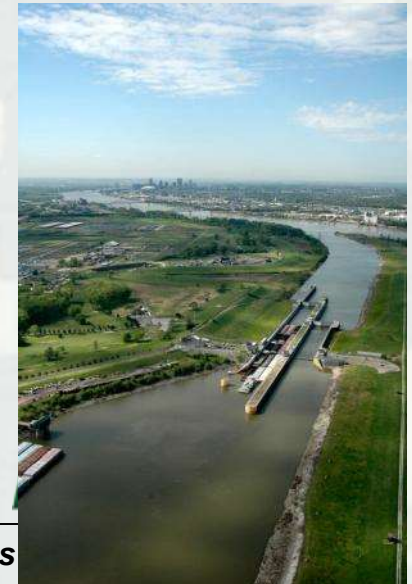
- Use e-Navigation concepts to improve navigation:

- ▶ Safety
- ▶ Efficiency
- ▶ Infrastructure reliability



- Waterways infrastructure reliability

- ▶ Address challenges of aging infrastructure and limited budget
- ▶ Focus on increased, timely, accurate, useful delivery of navigation information
- ▶ Recognition of shared value of information across mission areas





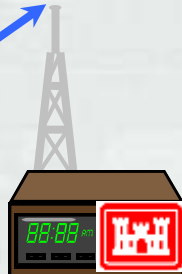
# Lock Operations Management Application (LOMA)



USCG  
AIS data capabilities:  
AIS archive,  
validation, etc.



AIS aboard vessels



Internal applications:  
• LPMS/LOSAT  
• CPT  
• Other apps

Internal and external  
Navigation data sources:  
• Met/hydro  
• Commodity  
• Voyage plans  
• Other

AIS  
Service  
Manager

Data  
Storage

Internal/  
External  
web access  
  
Web  
Services:  
XML, RSS,  
etc.

Lock Operator  
GUI



Industry

Public

Other Gov't  
agencies



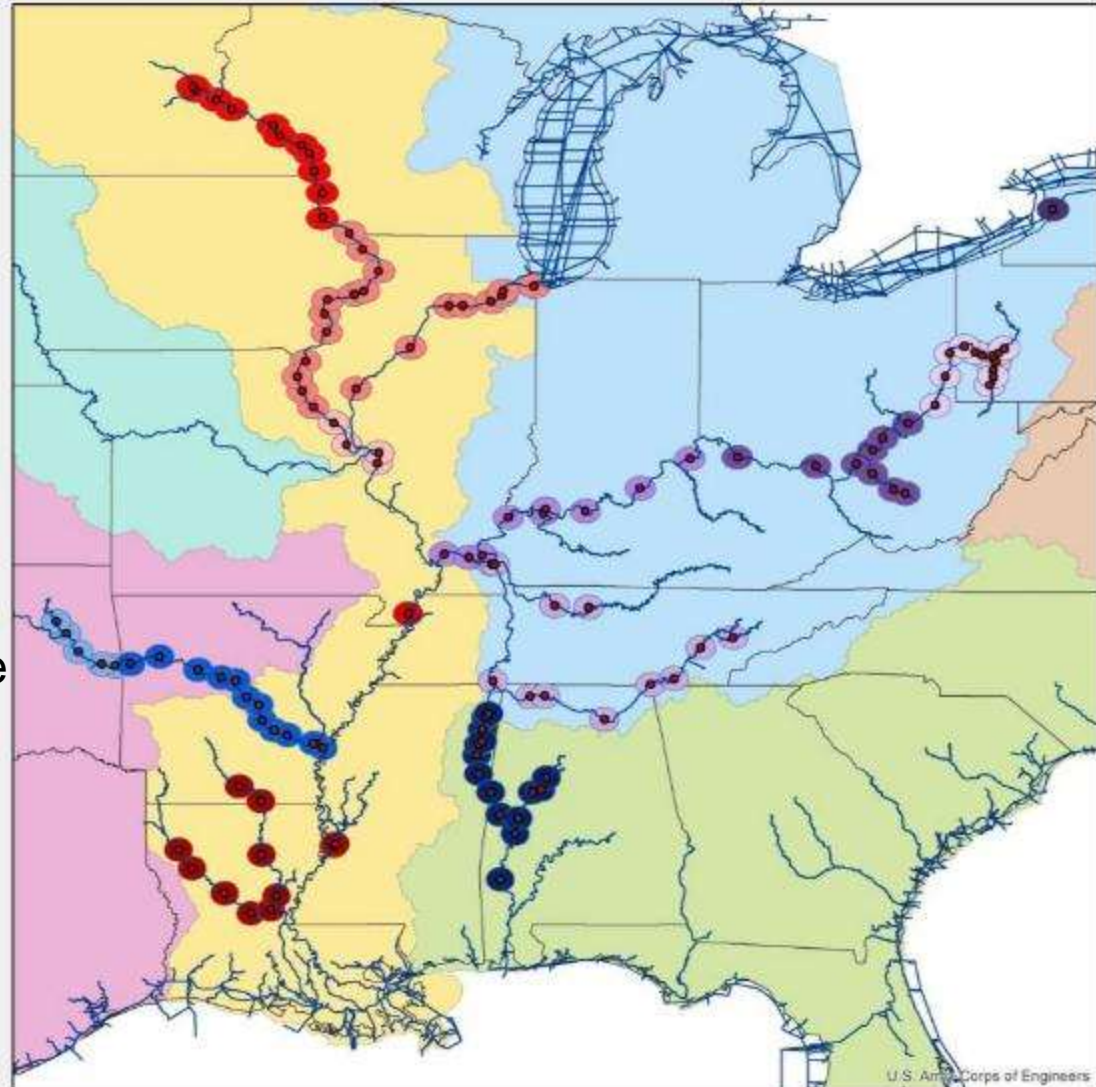
# LOMA AIS Coverage (nominal – 12nm)



- LOMA coverage: 3878 river miles
- 32% of USACE-maintained (12,000 miles)
- 50% of IENC coverage (7700 miles)
- Working on more detailed, accurate coverage analysis
  - System performance
  - Additional coverage priorities



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# Present LOMA Capabilities

- Lock operator situational display
- AIS vessel information
- Zone Management
- Playback capability

Lock Operations Management Application (LOMA) v1.0.340

LPMS Support Logout (tetreault)

US Army Corps of Engineers

Live Plotter Playback Plotter Zone Configuration Zone Reports Gadgets

Connected

### Target Information

Name	M/V WALLY ROLLER
MMSI	367143710
Callsign	WDD4358
Latitude	038°16'41"N
Longitude	085°47'44"W
SOG	0.4 kts
Heading	Not available
COG	100.9°
Nav Status	Under Way Engine
Operating Mode	Autonomous
Rate Of Turn	Not available
Length	164.00 ft
Beam	65.60 ft
Type of Ship	Vessel - Fishing
Type of Cargo	N/A
CargoType	30
IMO Number	0
Draught	0.00 ft
Nav Sensor	GPS
DTE Status	Available
Nationality	United States of America
LockETA	7/2/2013 8:30:56 AM
Lock	McAlpine Lock & Dam
Mile	607
PreviousMile	608
River	Ohio River
Time since last update	00:00:00

Notifications

038°15'54"N 085°51'12"W



# Virtual Aids to Navigation

Lock Operations Management Application (LOMA) v1.1.44  
LPMS Support Contact Logout (mfwink)

US Army Corps of Engineers

Live Plotter Playback Plotter Zone Configuration Zone Reports Gadgets

Target Information	
Name	WK
MMSI	993683000
Latitude	035°05'57"N
Longitude	090°10'32"W
AtoN Type	Starboard hand Mark
Position Accuracy	High
Type of electronic position fixing device	Surveyed
Dimension A	0
Dimension B	0
Dimension C	0
Dimension D	0
Off Position	On position
RAIM	RAIM not in use
Virtual AtoN Assigned	Virtual AtoN Autonomous and continuous mode
Nationality	Not found
Mile	727
River	Mississippi River Mouth of Ohio River to Baton Rouge LA
Time since last update	00:00:27

Name: WK  
Mile: 727  
Time since last update: 00:00:27

5mi  
5km

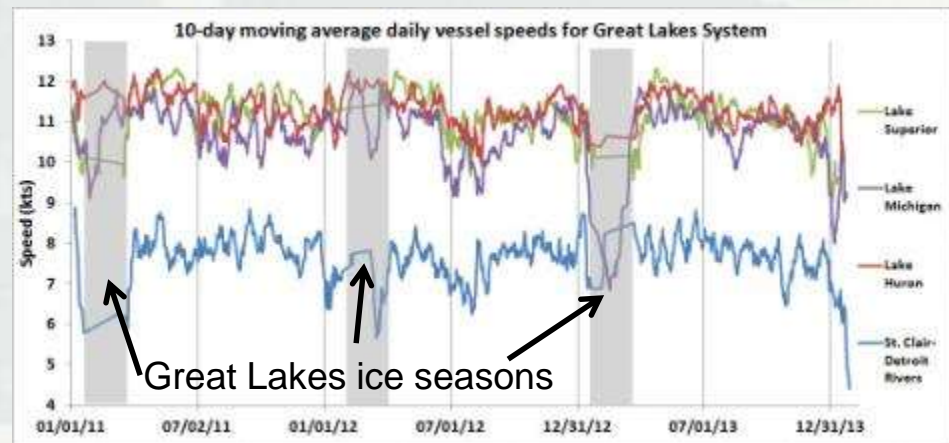
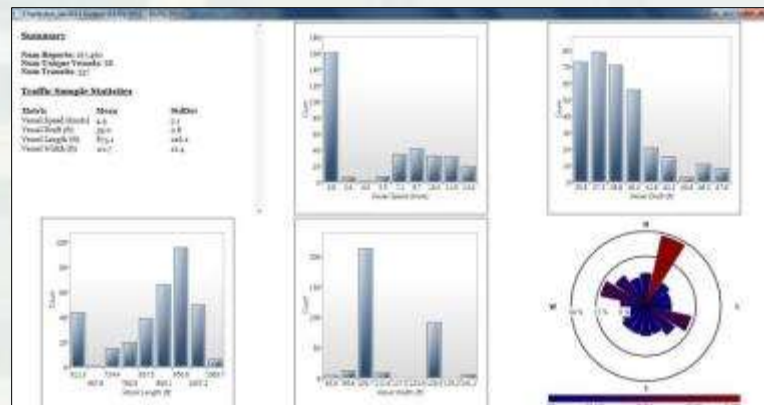
Notifications 035°05'57"N 090°10'26"W

Gadgets

Targets in Vbg-UST MVD\_TestLock Status SMART Gate - Demo

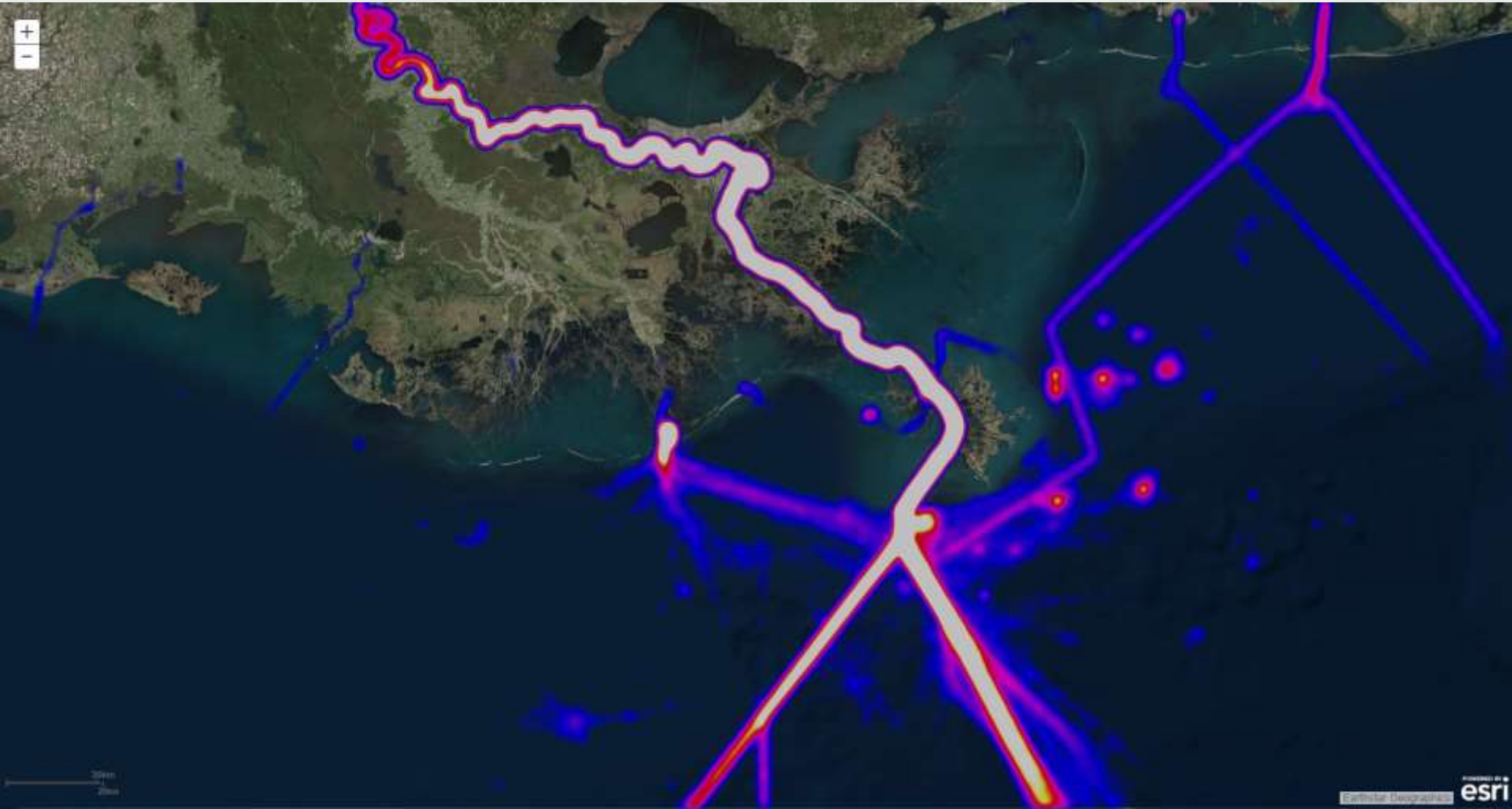
# Performance Monitoring via Archival AIS

- Analysis provides performance baselines
- Conditions can be monitored going forward
- Analyses are scalable across time and space, so single channels can be monitored for a few hours, or entire coasts can be monitored for years.





# Automatic Identification System Analysis Package (AISAP)





# AISAP Query Page

Browser address bar: <http://155.82.164.219/AISAP/home.html>

Page Title: AISAP

Navigation: Data Requests | Logged in as: kenneth.n.mitchell@usace.army.mil | Base Map | Toggle Layers | Measure

### Query Tool

Center the map on the region you wish to query. When you have the map where you want it, click the 'Draw Box' button draw your bounding box. Fill in all remaining fields and click 'Submit Request' to send your request to the Corps for processing. An email will be sent to the provided email address when the request is finished.

**Email**

**Start Time**

**End Time**

**Upper Left Lat**

**Upper Left Lon**

**Lower Right Lat**

**Lower Right Lon**

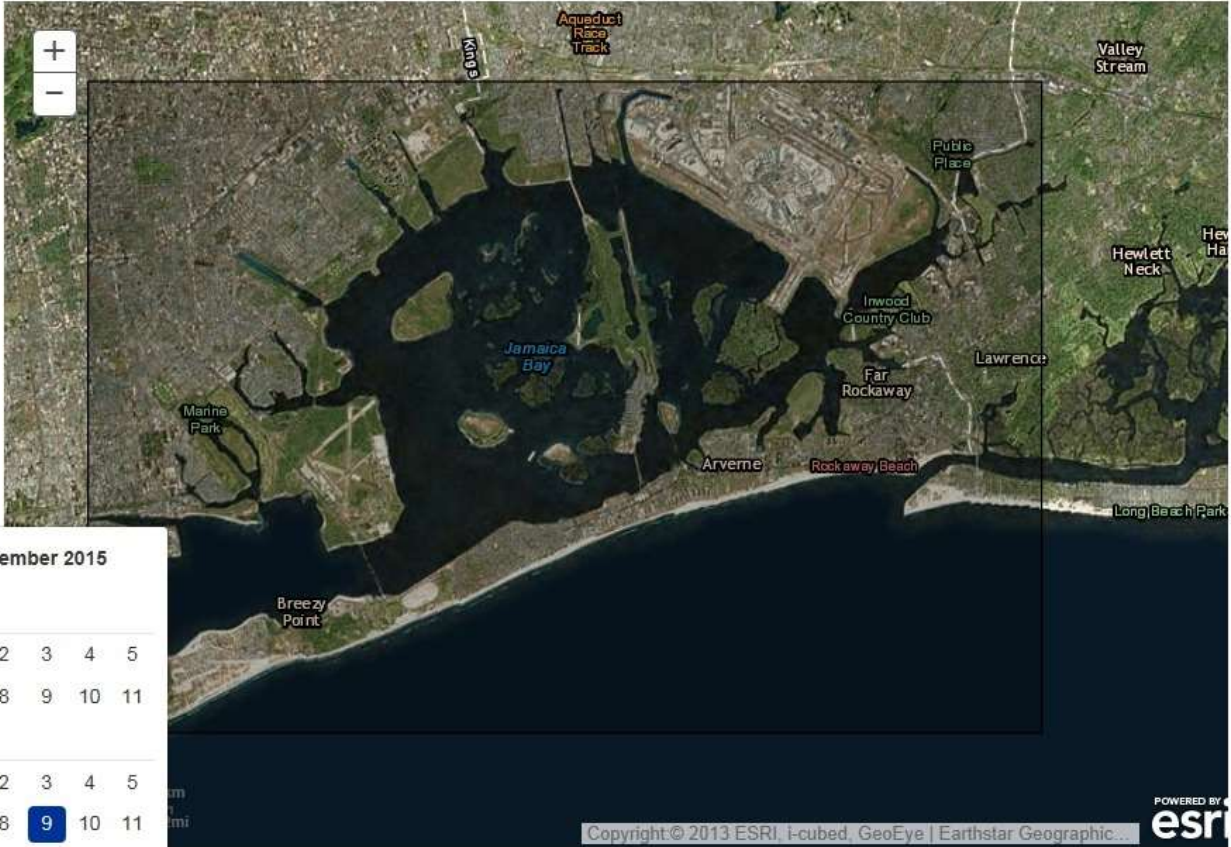
1 November 2015

AM

12	1	2	3	4	5
6	7	8	9	10	11

PM

12	1	2	3	4	5
6	7	8	9	10	11



Map labels: Jamaica Bay, Arverne, Rockaway Beach, Inwood Country Club, Far Rockaway, Lawrence, Hewlett Neck, Valley Stream, Breezy Point, Manne Park, Aqueduct Reservoir, Public Place, Long Beach Park.

Map controls: +, -

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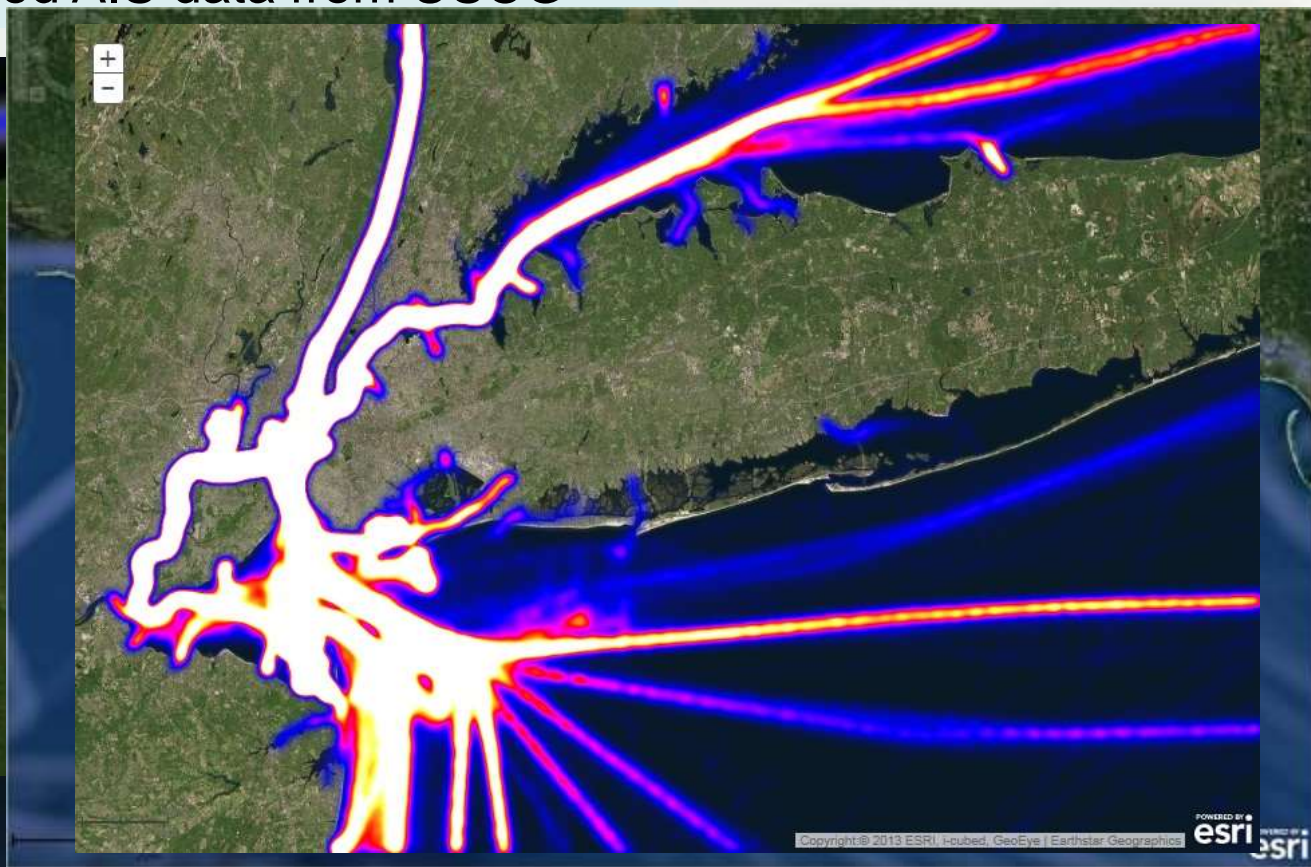
# AISAP Data Cache

Over 1B vessel position reports and counting

40k+ unique vessels (30k+ with full dimensions/type/flag info)

11k query requests and growing

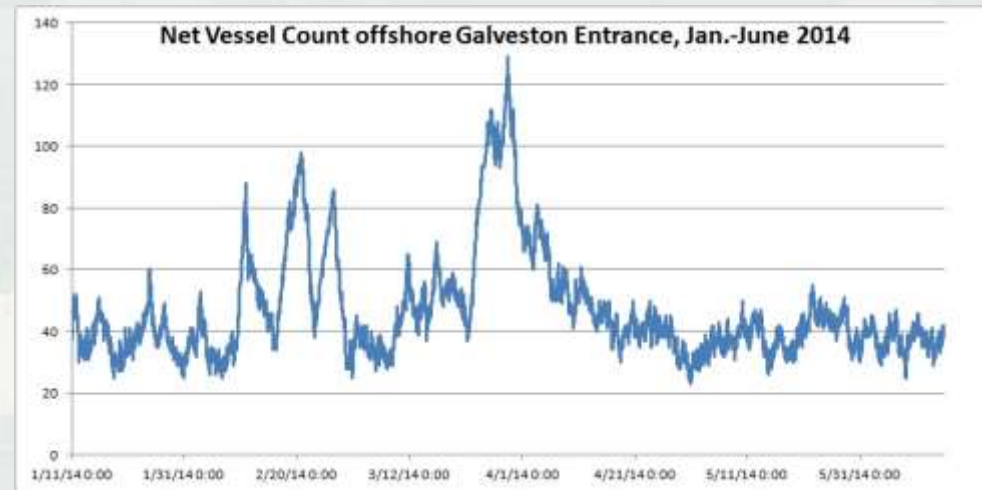
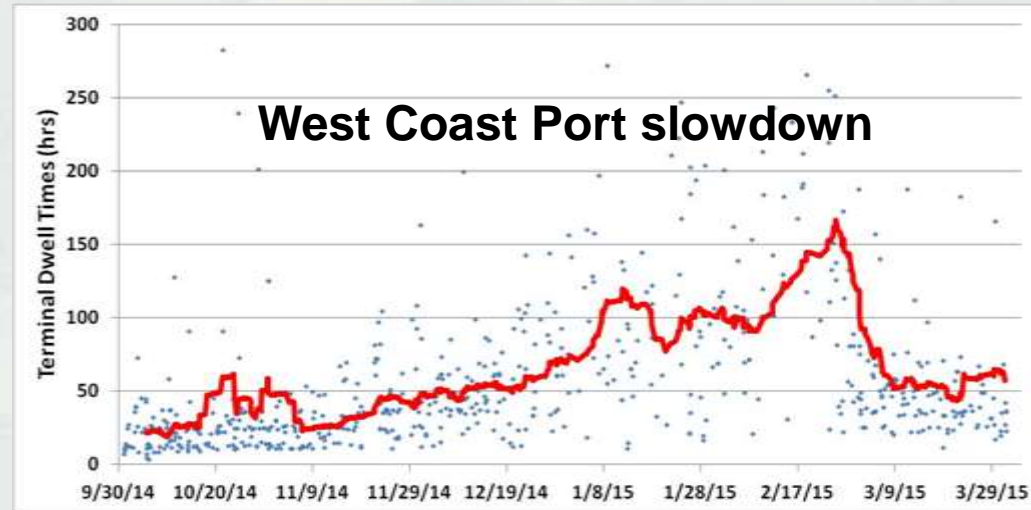
At least 3 years of archived AIS data from USCG





# Potential Applications

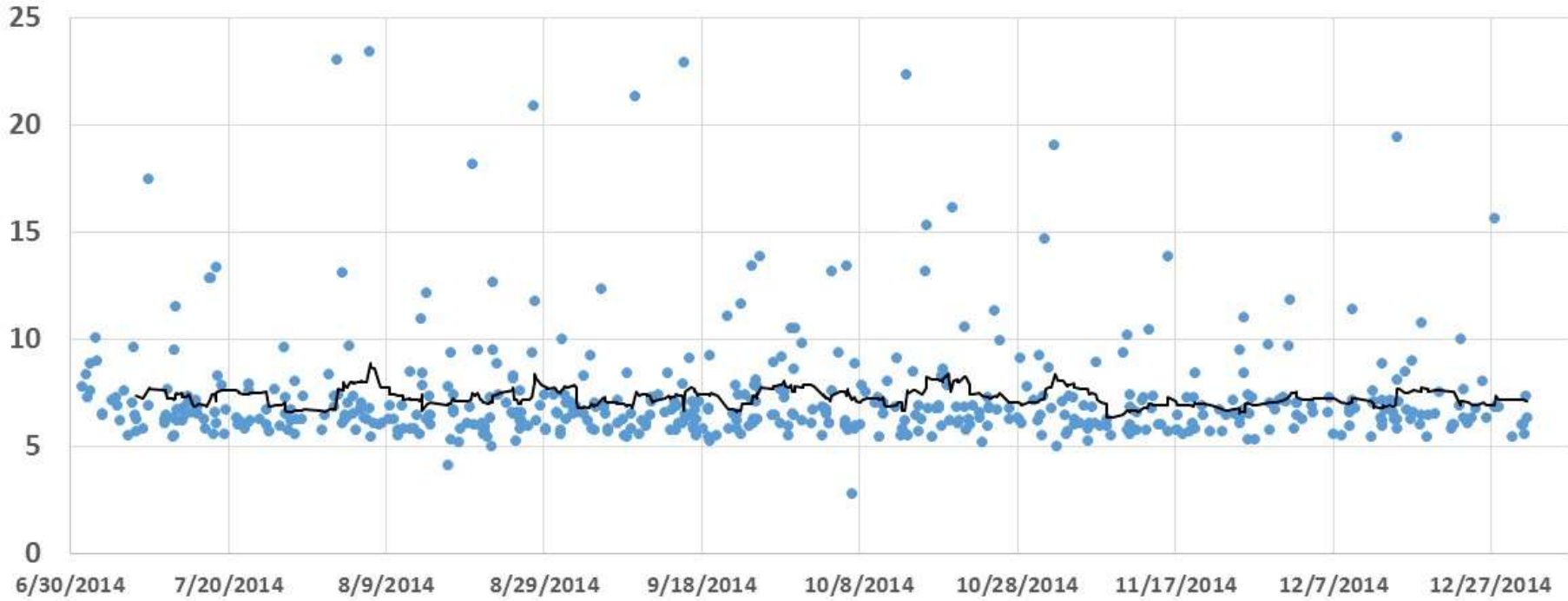
- Travel Times and Dwell Times
- Port System Performance Monitoring and Resiliency assessments
- Vessel Transit counts
- Speed analysis ~ Wake-induced wave energy for shoreline erosion studies
- Vessel tracks/speeds pre/post dredging
- Asian carp studies (CAWS)
- Impacts of invasive aquatic vegetation





# Transit Times through Federal Channels

Columbia River - Astoria to Portland Travel Times (hrs)

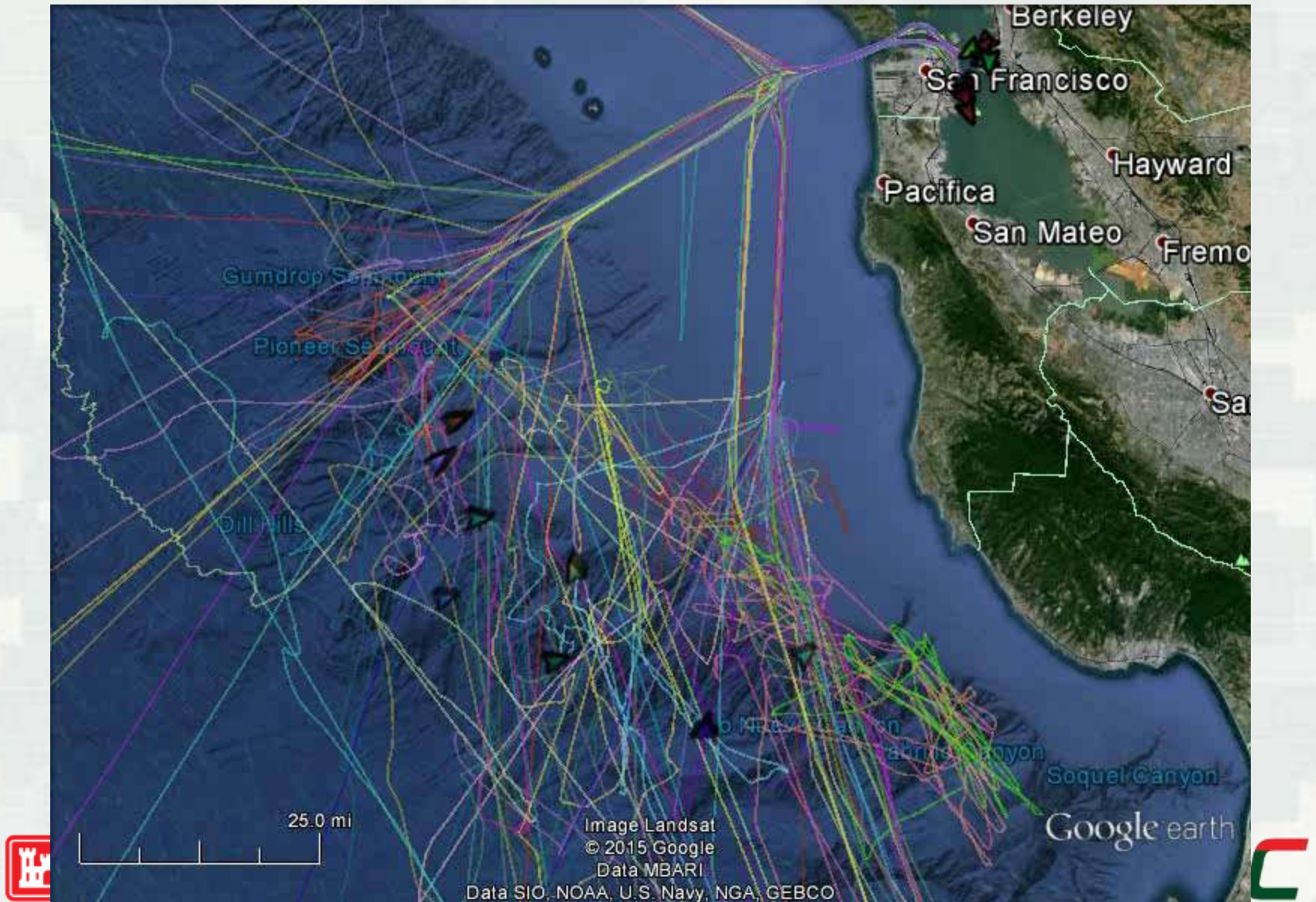


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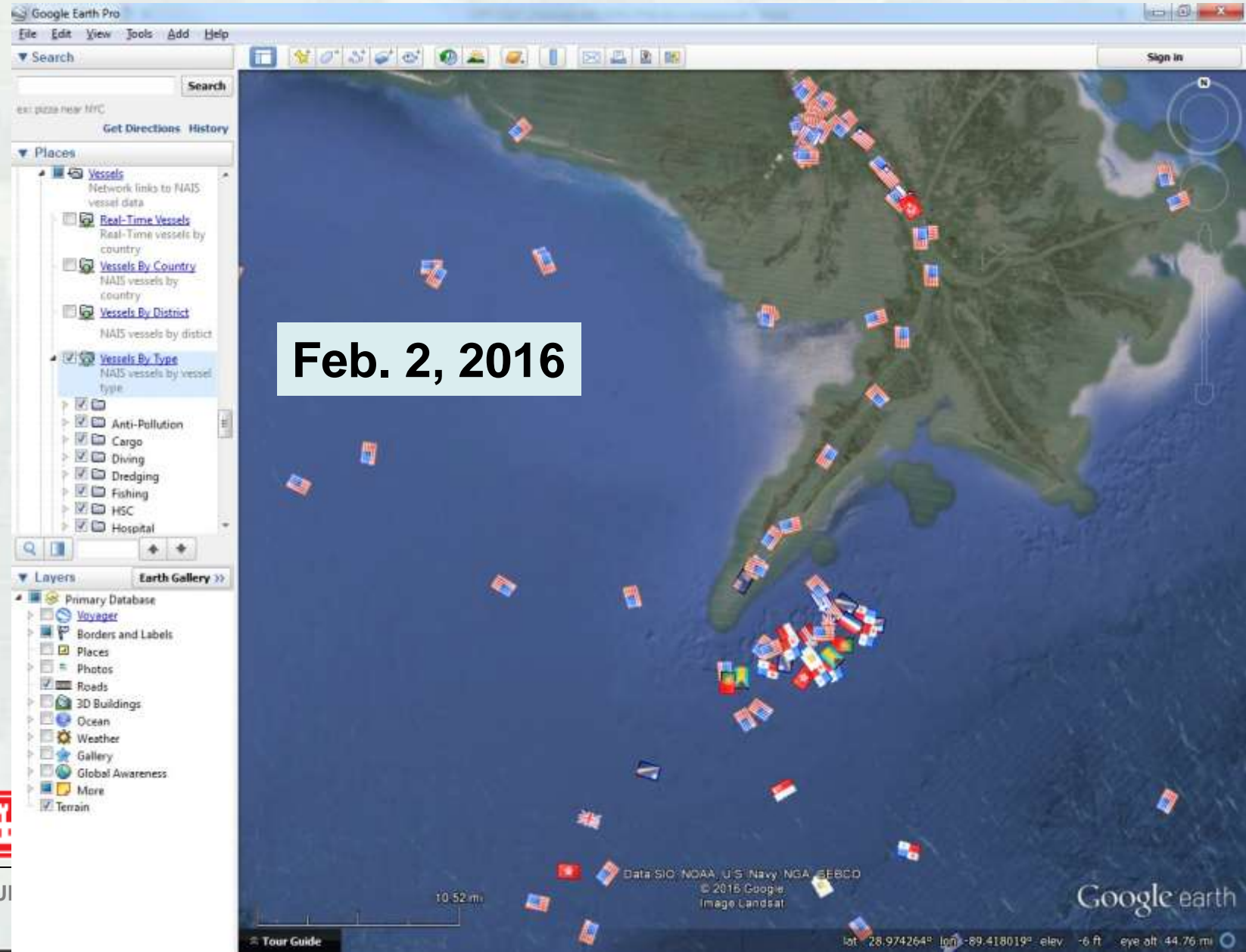
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# West Coast Port Slowdown: Oakland





# AIS for Monitoring Southwest Pass



Feb. 2, 2016

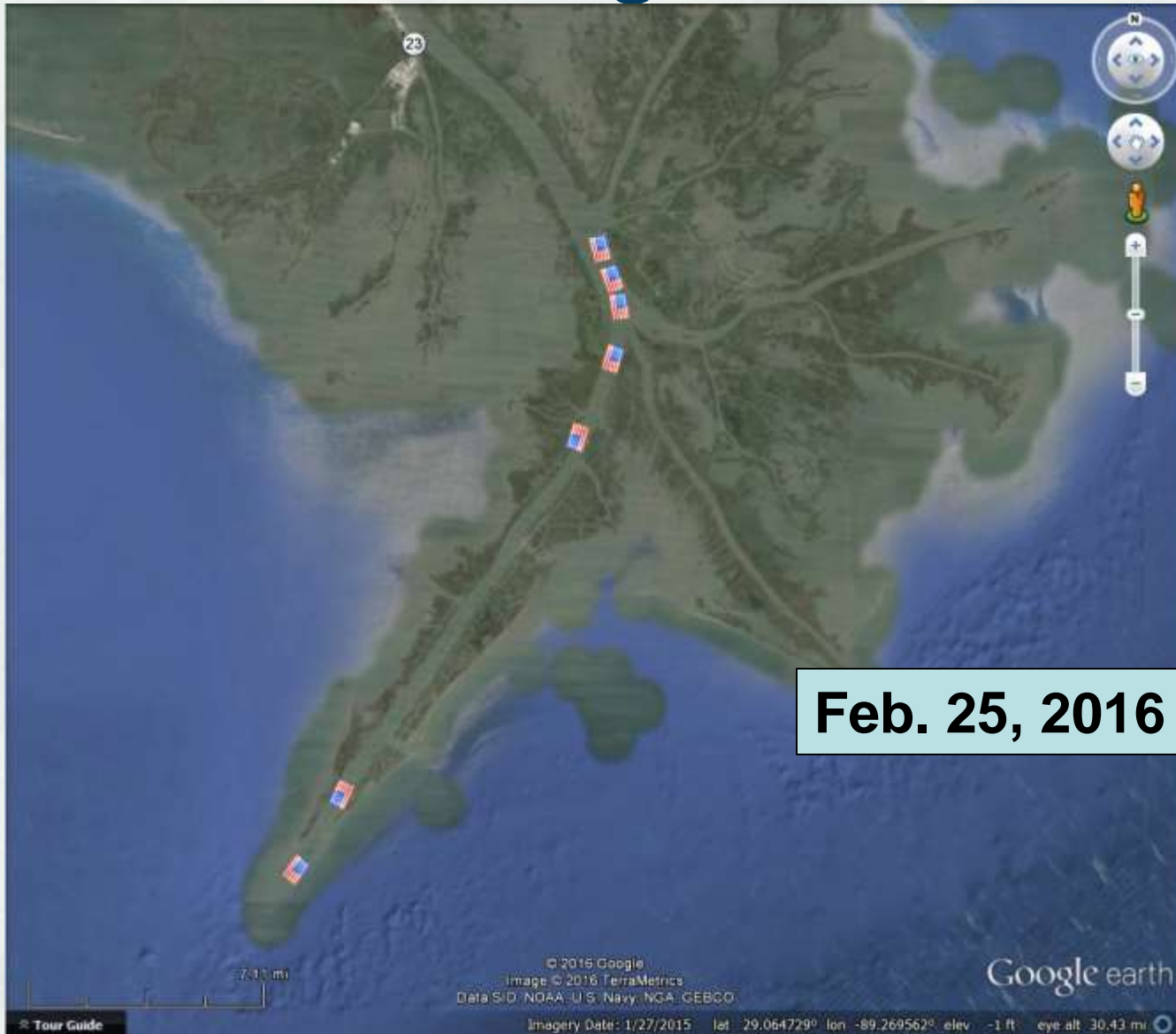


BUI



world

# AIS for Monitoring Southwest Pass



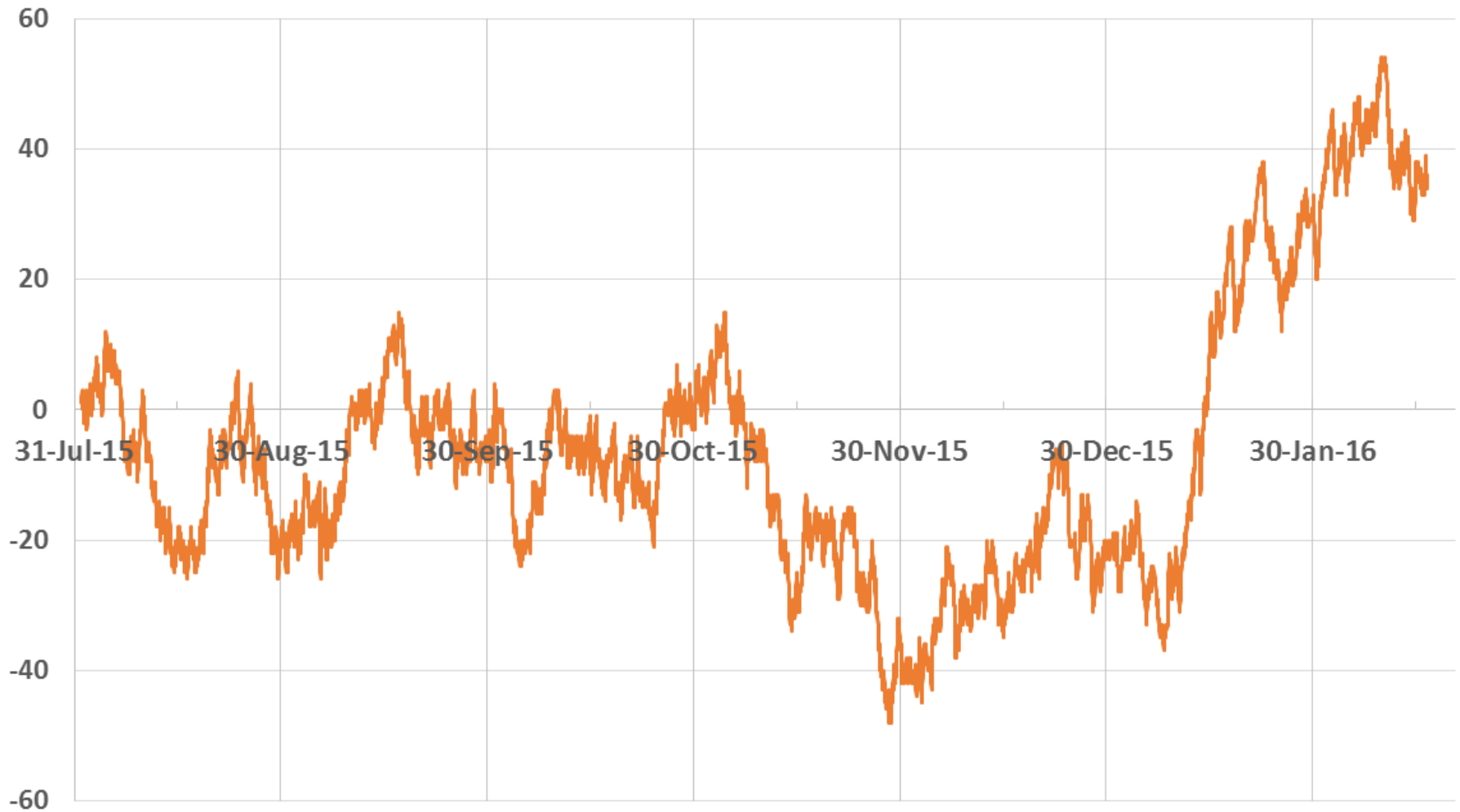
Feb. 25, 2016





# AIS for Monitoring Southwest Pass

Net In/Out Vessel Count via Southwest Pass (relative to 1 AUG 2015 12:00:00 AM)



# AIS for Monitoring Southwest Pass



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24.8 mi

Image Landsat  
© 2016 Google  
Image © 2016 TerraMetrics  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

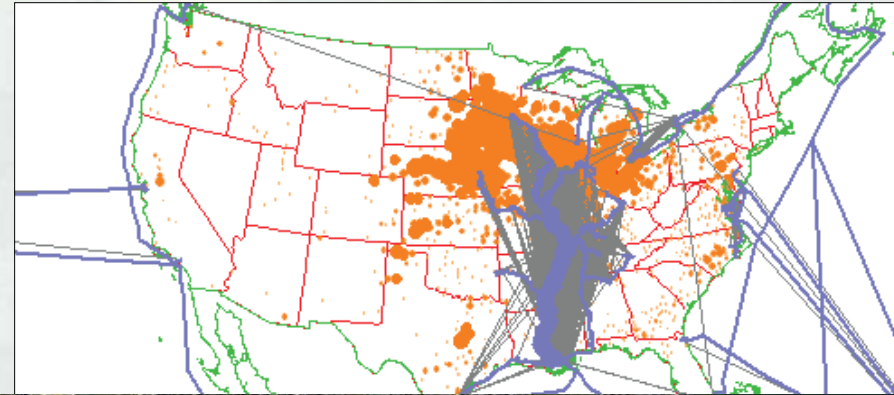


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# Towards Freight Fluidity Analysis

- Ultimately we seek a means of evaluating the performance of entire intermodal freight supply chains.
- Data from across the spectrum help inform this process.
- Opportunity to merge AIS and GPS probe datasets with traditional reported data to provide a more complete picture of intermodal freight fluidity.





# ERDC and e-Nav Data Use

## Questions?

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601-634-2022



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