

# AIS History and Future Improvements in Waterway Management

**Brandan Scully, PE**  
USACE Charleston District

**Kenneth Ned Mitchell, PhD**  
US Army Engineer Research and Development Center  
Coastal and Hydraulics Laboratory  
Vicksburg, Miss.  
on detail to USACE-HQ

June 26<sup>th</sup>, 2012



®

US Army Corps of Engineers  
**BUILDING STRONG**®



# Report Documentation Page

Form Approved  
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

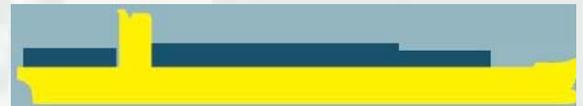
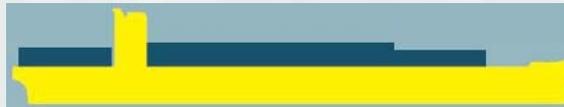
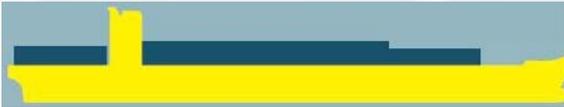
1. REPORT DATE <b>26 JUN 2012</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-2012 to 00-00-2012</b>	
4. TITLE AND SUBTITLE <b>AIS History and Future Improvements in Waterway Management</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>U.S. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, 3909 Halls Ferry Road, Vicksburg, MS, 39180</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>presented at the Transportation Research Board (TRB-MTS) Conference held in Washington, DC 26-28 June, 2012</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>20</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

# WHAT IS AIS?

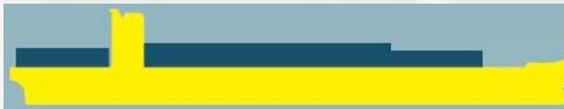
- Primarily for safety and maritime domain awareness
- Time-stamped position
- Vessel identifying information
- Vessel type classification
- Vessel dimensions
- Vessel “behavioral” information



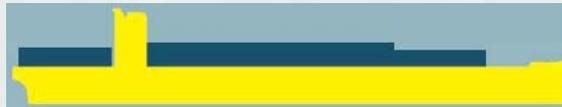
# AIS IN REAL TIME



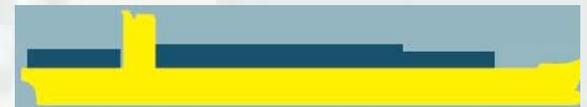
# AGGREGATE AIS RECORD



$X_{T0}, Y_{T0}; \{P_{T0}\}$



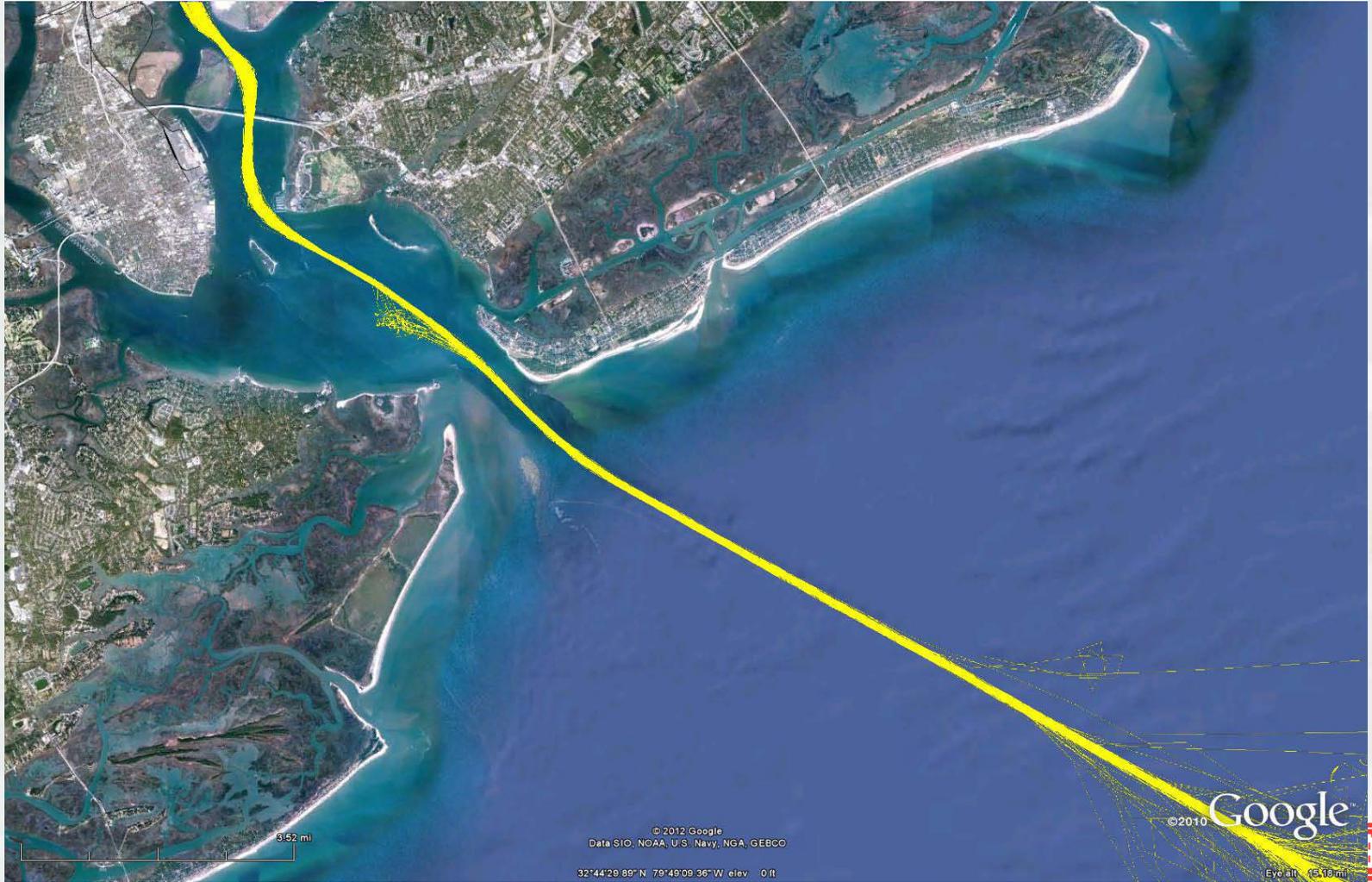
$X_{T1}, Y_{T1}; \{P_{T1}\}$



$X_{T2}, Y_{T2}; \{P_{T2}\}$

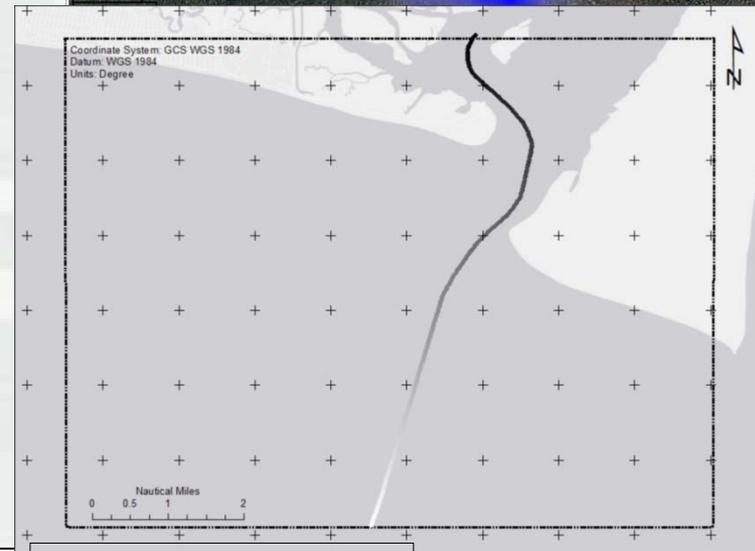
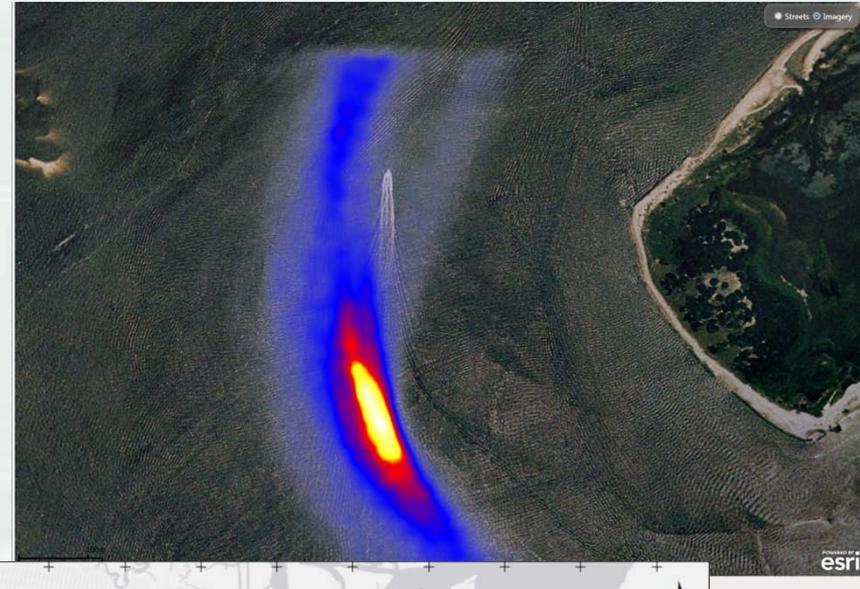


# WHAT DOES IT MEAN?



# Aggregate AIS Record

- Automatic Identification System (AIS) essentially provides a remote sensing technology for:
  - ▶ Quantifying vessel interactions with navigation projects
  - ▶ Assessing system-level dynamics (project-to-project vessel movements)
  - ▶ Real-time monitoring of navigable conditions in USACE projects



Source: Scully, 2012

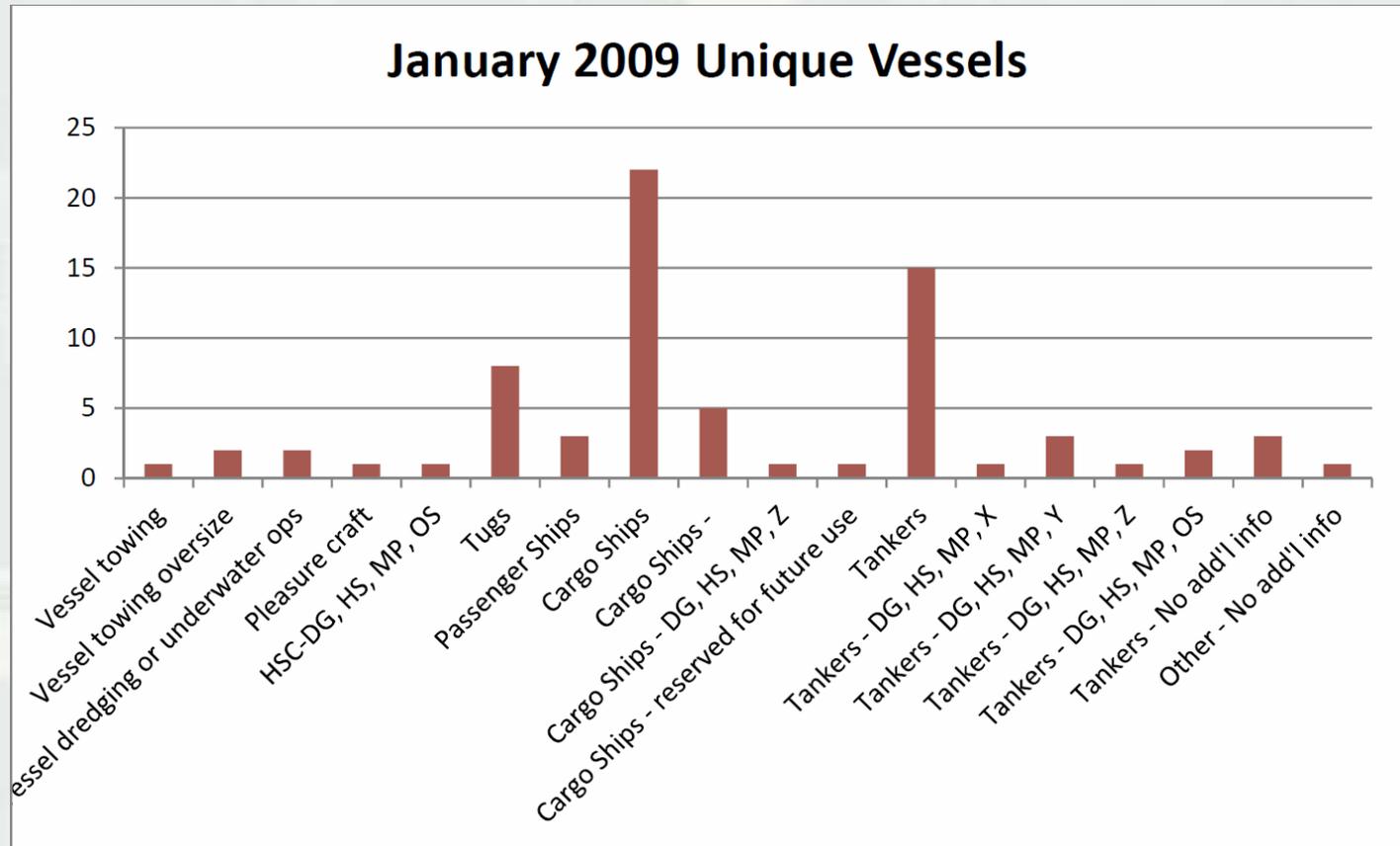
**BUILDING STRONG®**

# BASIC IMPLEMENTATION

- User Profiles
- Decision Support
- Vessel Transit Data Collection



# User Profiles

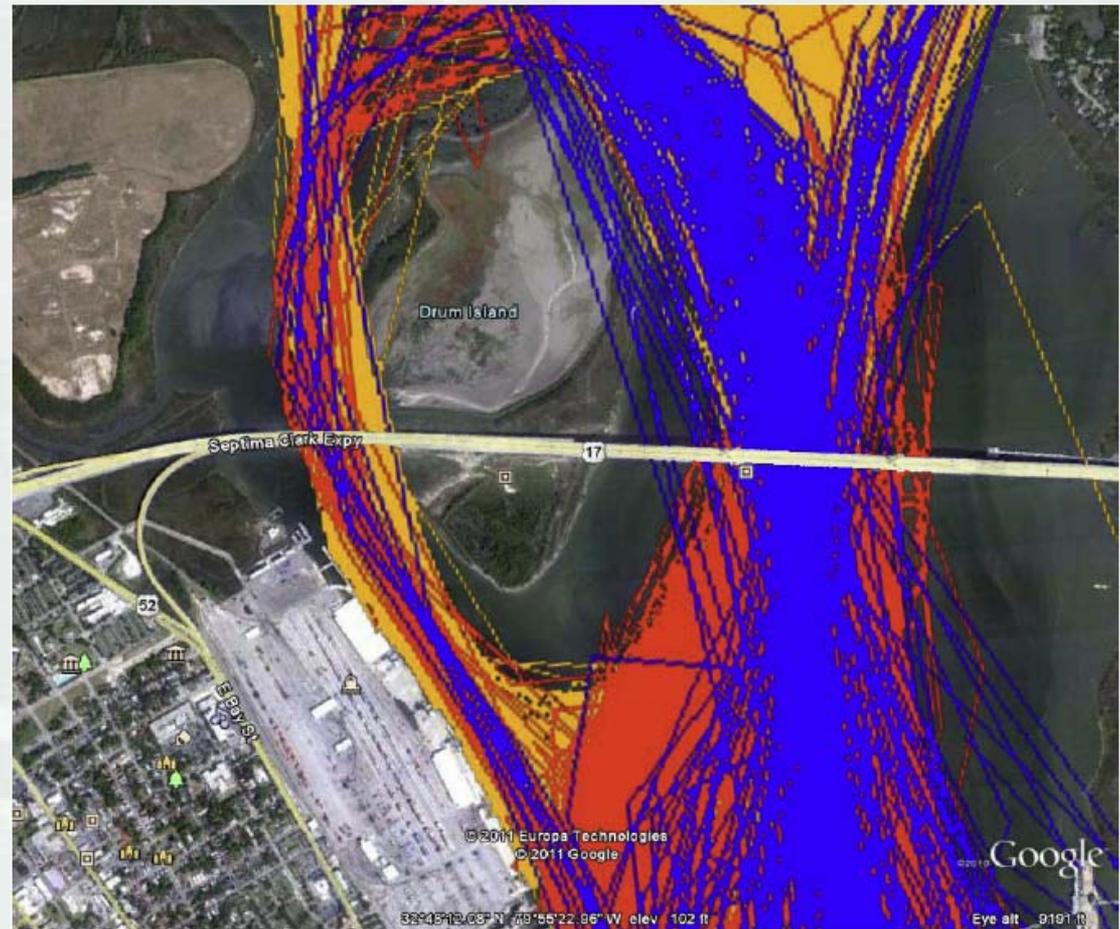


- Size
- Type
- Activity
- Reach-Level

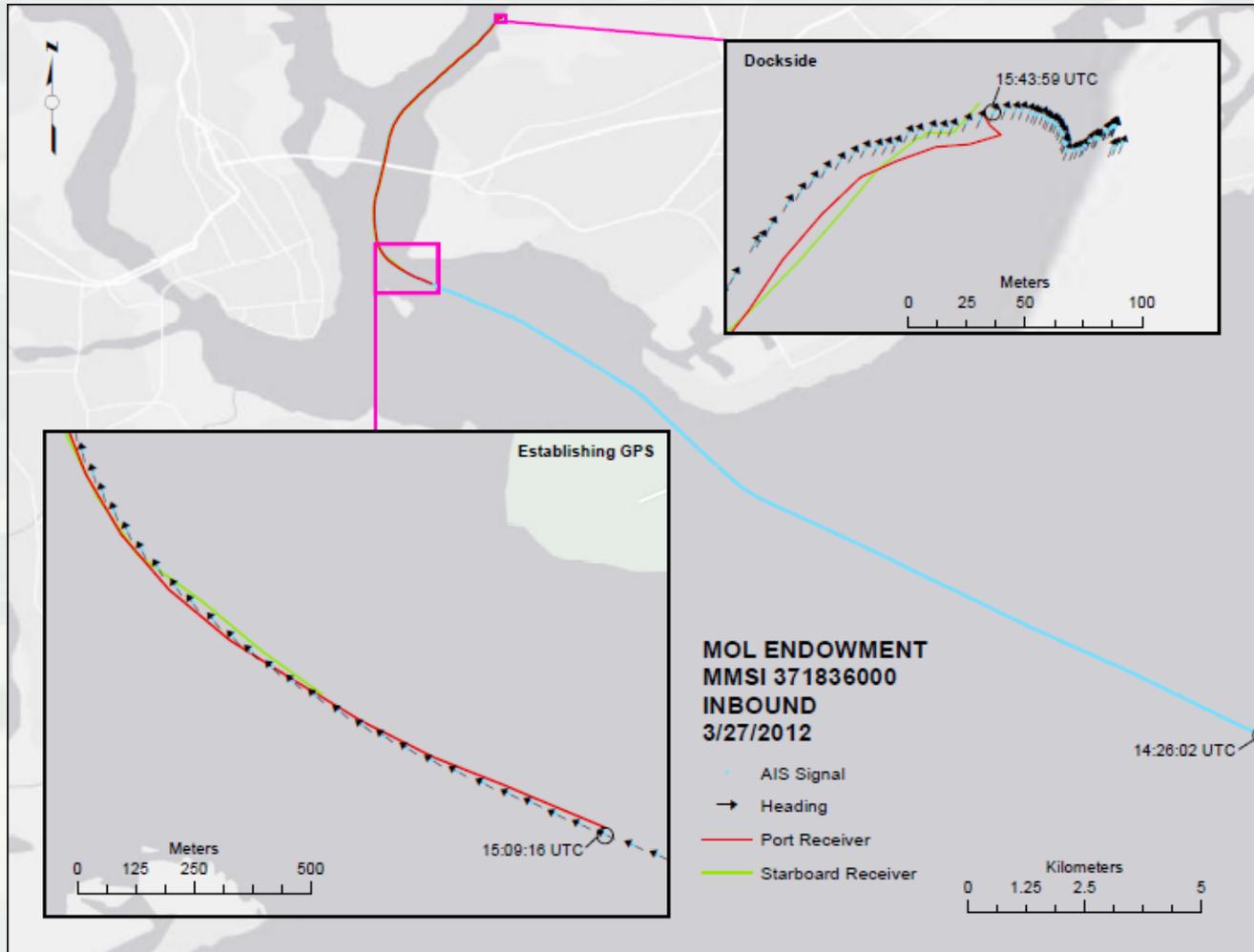


# Decision Support

- Suitability
- Interactions
- Potential Hazards
- Potential Damage



# Vessel Transit Data Collection



- Similar Data
- Less Processing
- More Detail
- Cheaper



# Vessel Transit Data Collection

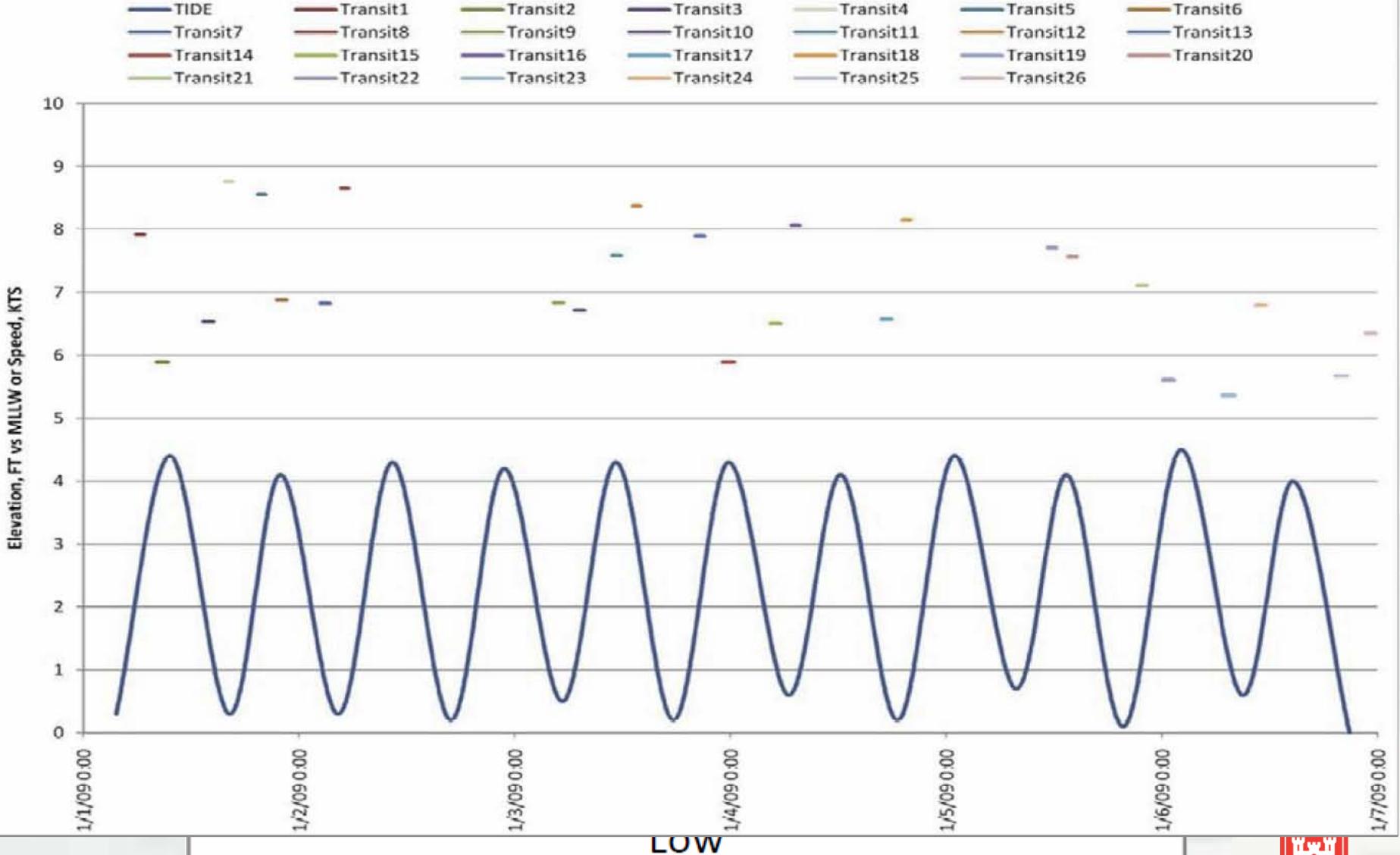
- Channel Obstruction
- Event Verification



# COMPLEX APPLICATIONS

- When are vessels in the channel?
- Tide corrected comparisons
- Detailed vessel comparisons
- How are traffic patterns changing?
- How do conditions affect vessels?
- Are navigation features working?





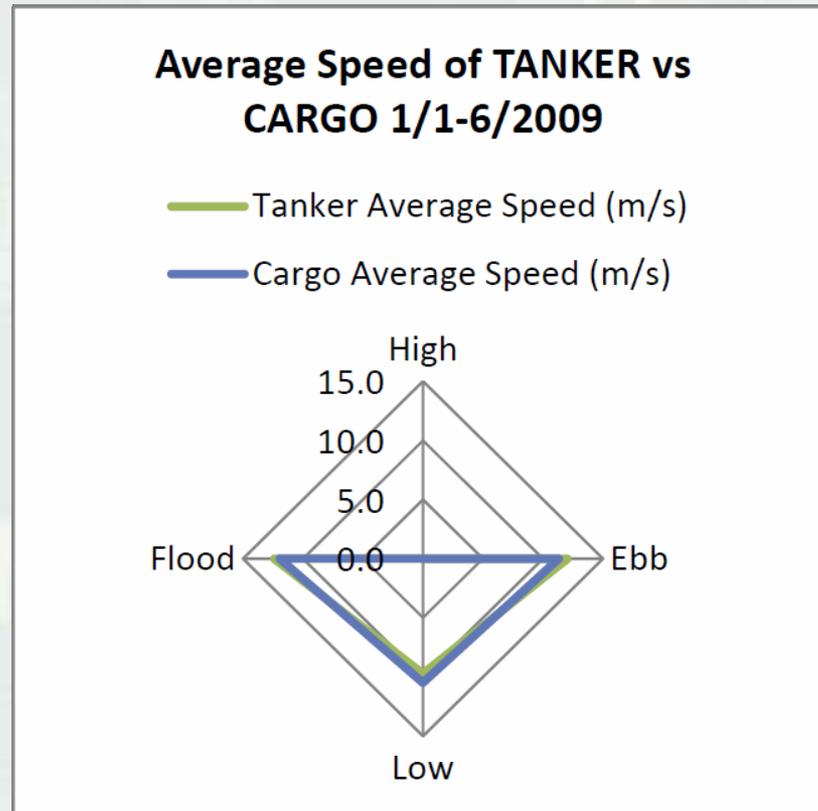
LOW



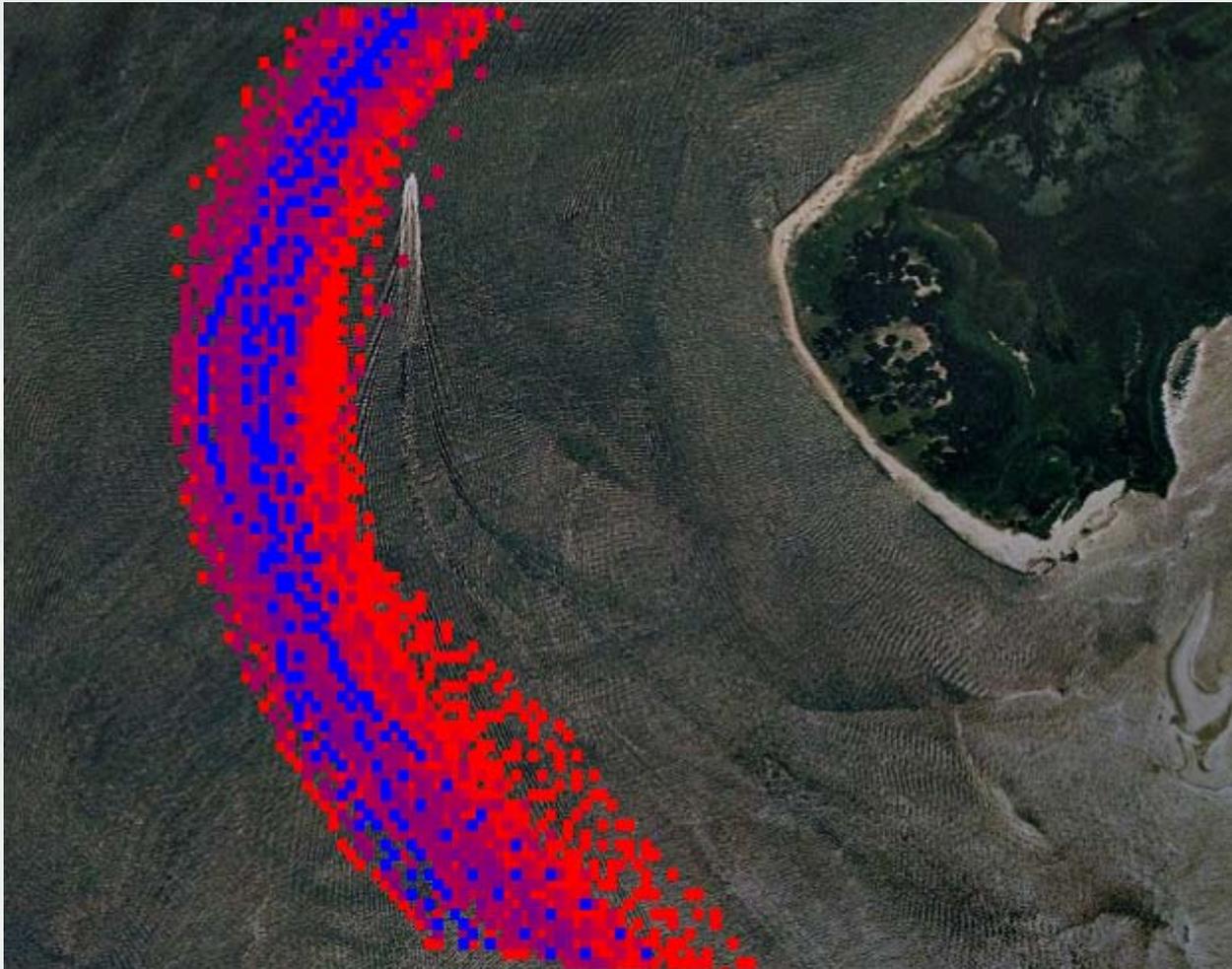
# Detailed Vessel Comparisons



# Detailed Vessel Comparisons



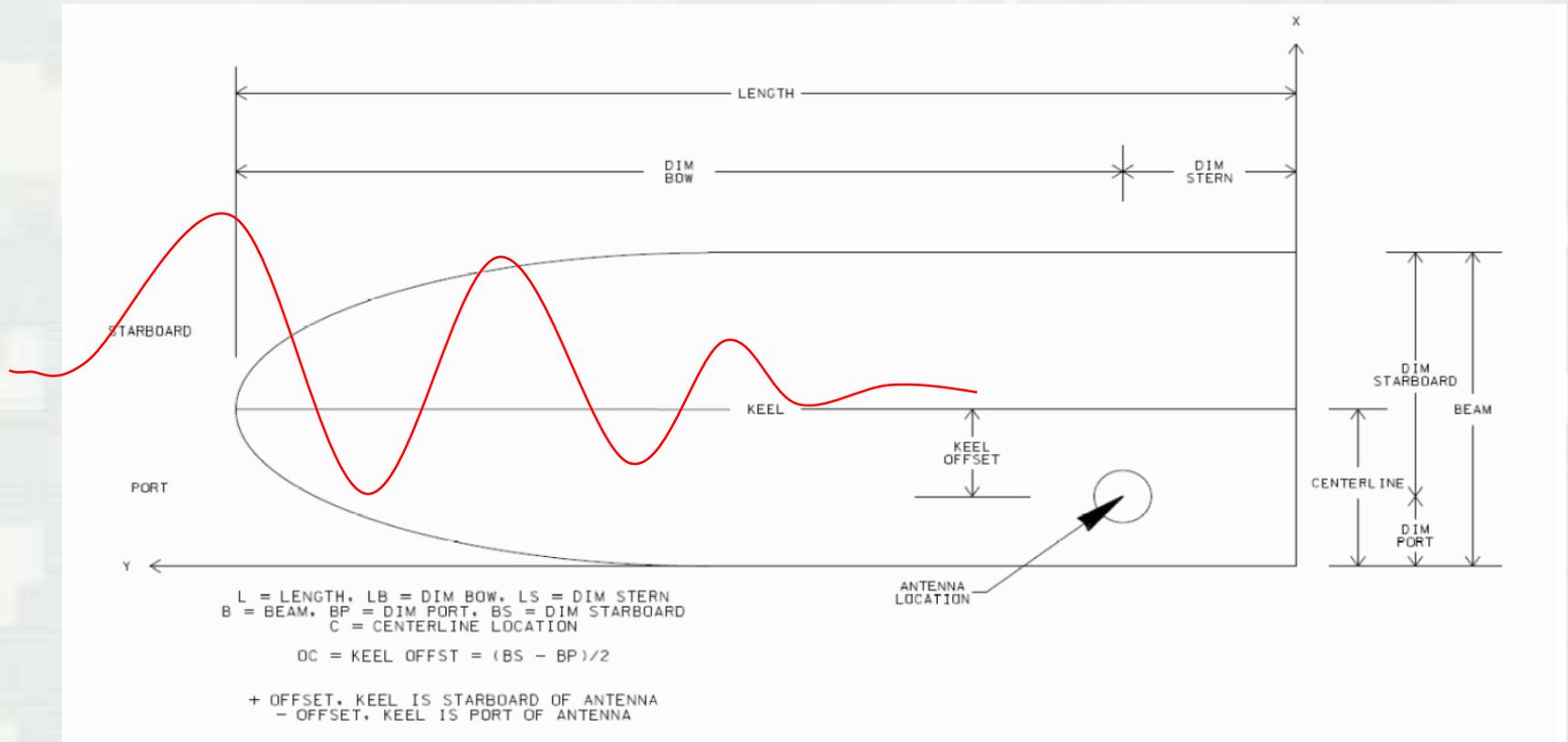
# Changing Traffic Patterns



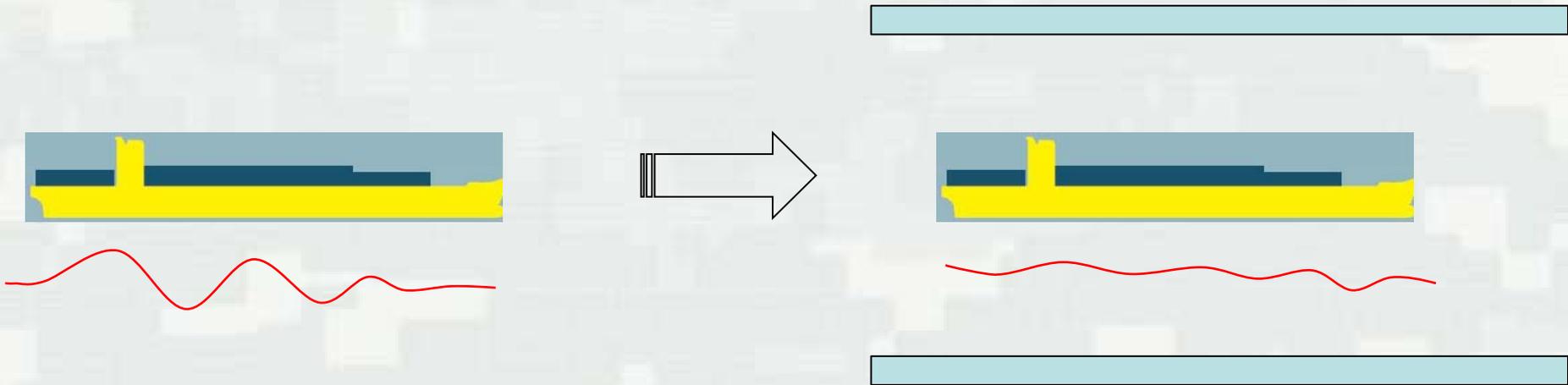
- Density plot changes over time represent response to changes in channel conditions.



# Vessel Response



# Feature Performance



# Optimize System Performance

- System inputs include decision variables (things we control) as well as natural forcings that we don't control
- Also must account for real-world constraints, capacities, schedules, etc.
- Optimization techniques reveal the best combination of decisions to ensure the highest possible:
  - ▶ engineering performance
  - ▶ environmental benefits
  - ▶ system reliability



# AIS History and Future Improvements in Waterway Management

## Questions?

Brandan Scully

[Brandan.m.scully@usace.army.mil](mailto:Brandan.m.scully@usace.army.mil)

Dr. Kenneth Ned Mitchell

[Kenneth.n.mitchell@usace.army.mil](mailto:Kenneth.n.mitchell@usace.army.mil)

USACE-HQ: (202)-761-0259

