AIS History and Future Improvements in Waterway Management

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US Army Corps of Engineers
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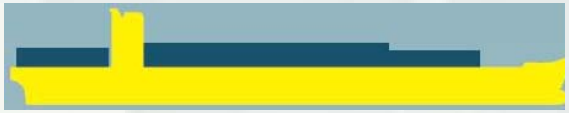
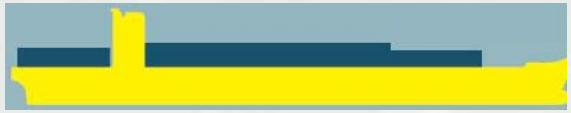
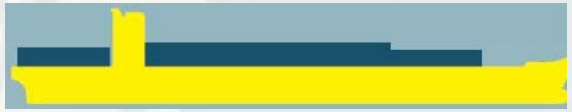
WHAT IS AIS?

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

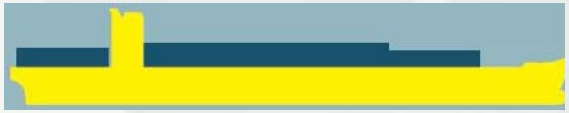
AIS IN REAL TIME



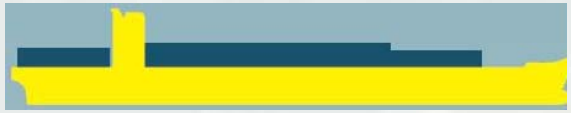




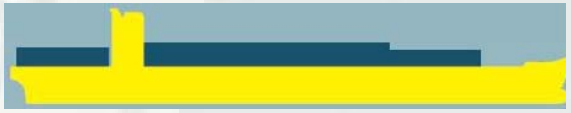
AGGREGATE AIS RECORD



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



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

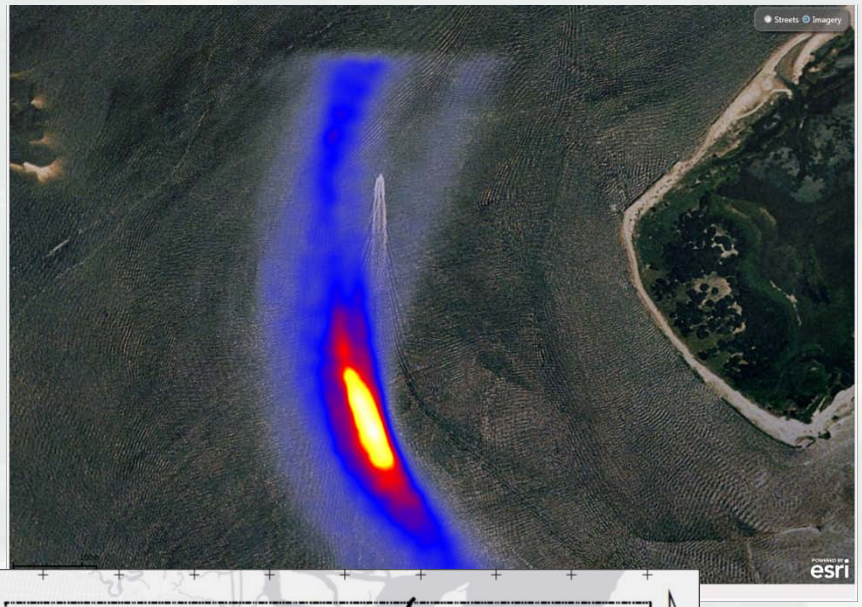


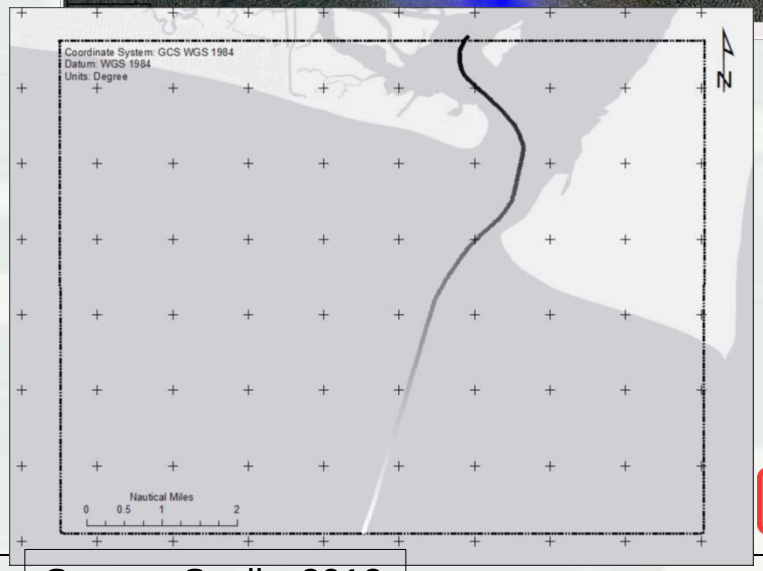
$X_{T2}, Y_{T2}; \{P_{T2}\}$

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



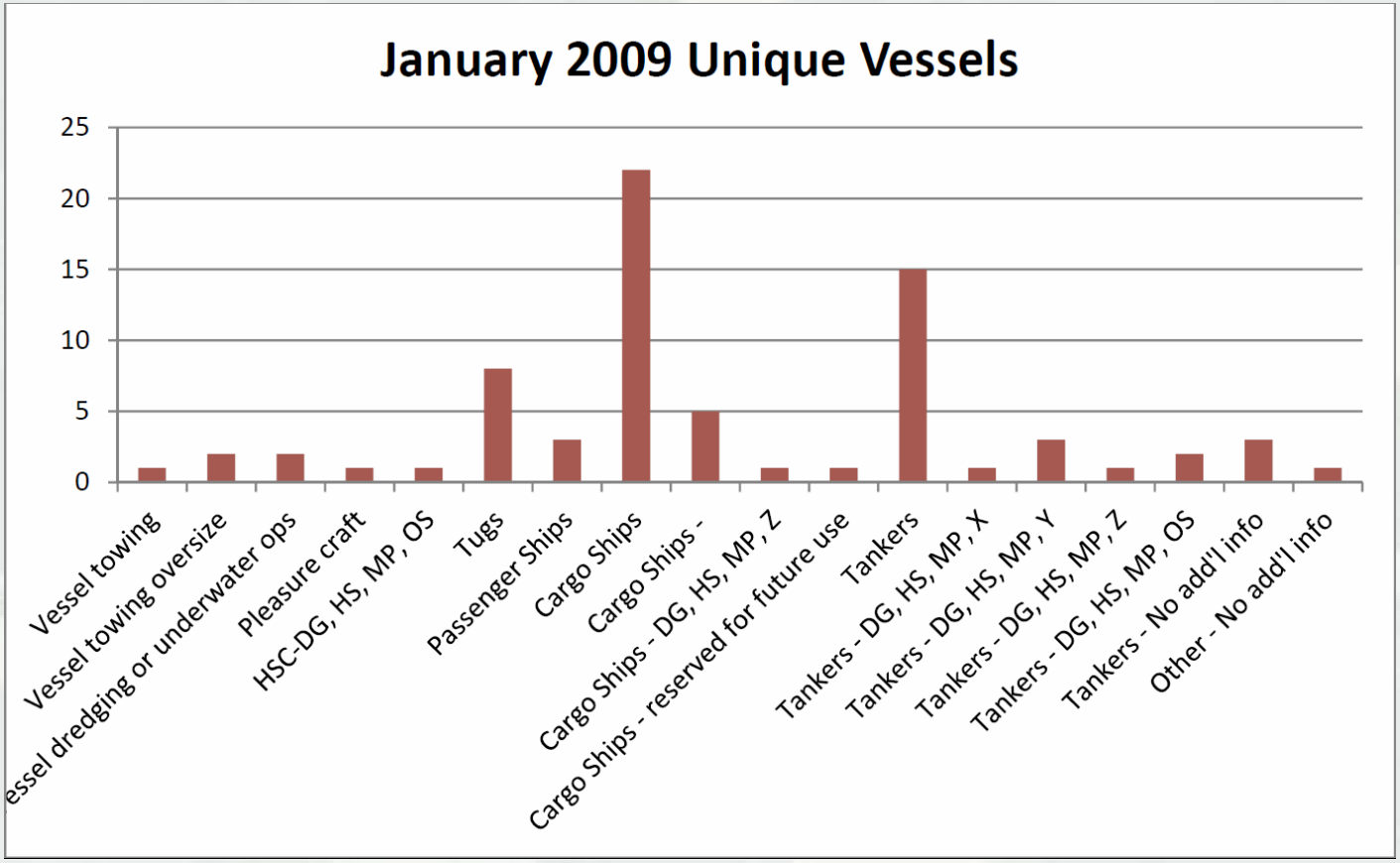


Source: Scully, 2012

BASIC IMPLEMENTATION

- User Profiles
- Decision Support
- Vessel Transit Data Collection

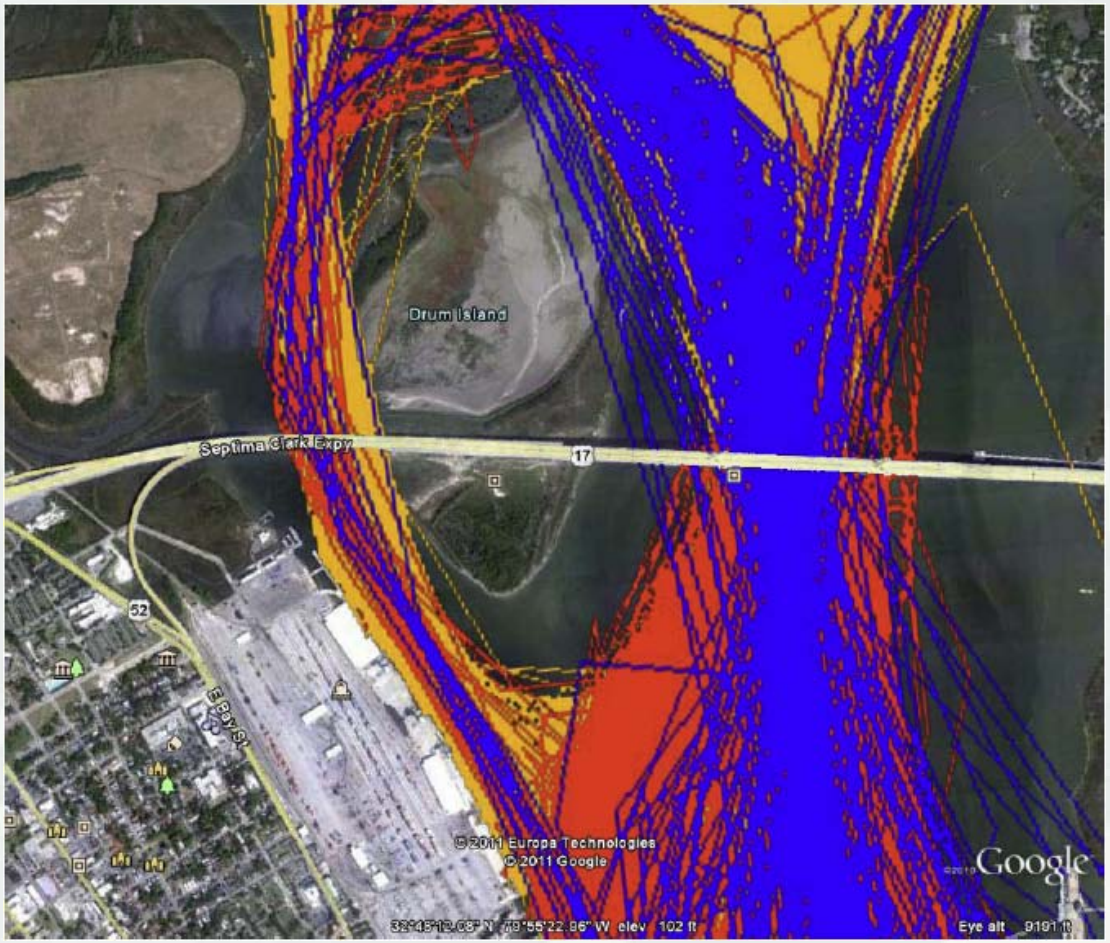
User Profiles



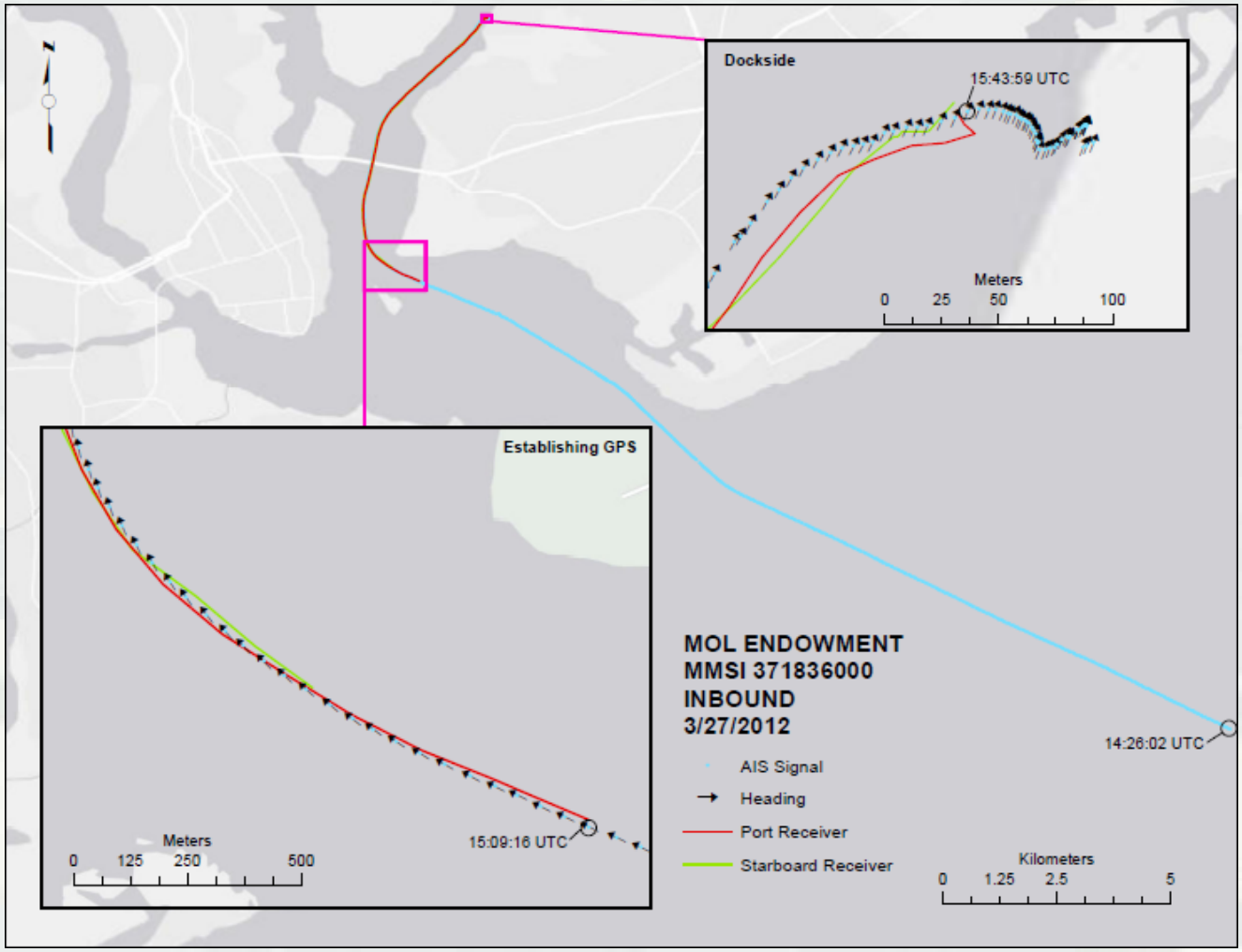
- Size
- Type
- Activity
- Reach-Level

Decision Support

- Suitability
- Interactions
- Potential Hazards
- Potential Damage



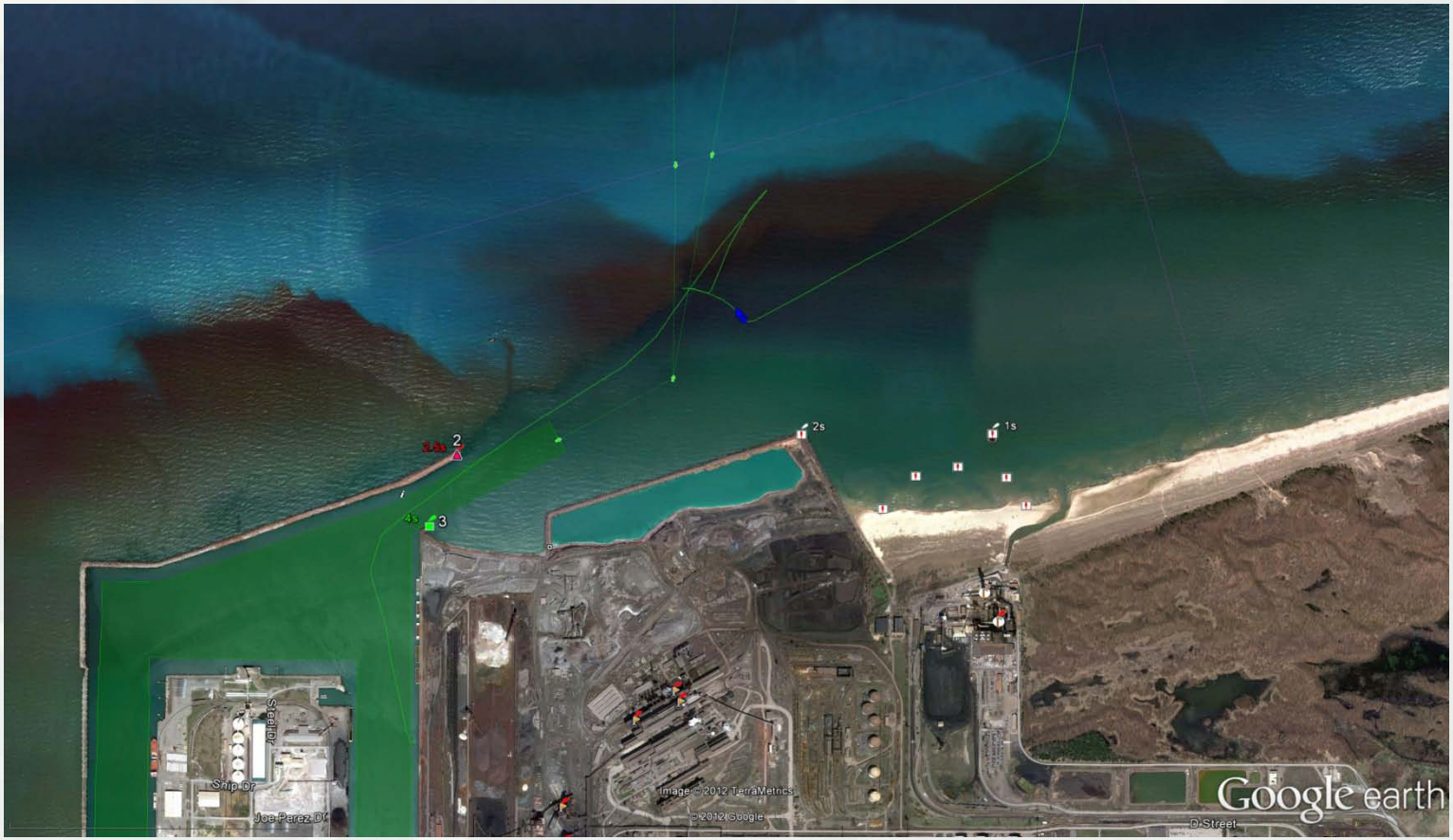
Vessel Transit Data Collection



- Similar Data
- Less Processing
- More Detail
- Cheaper

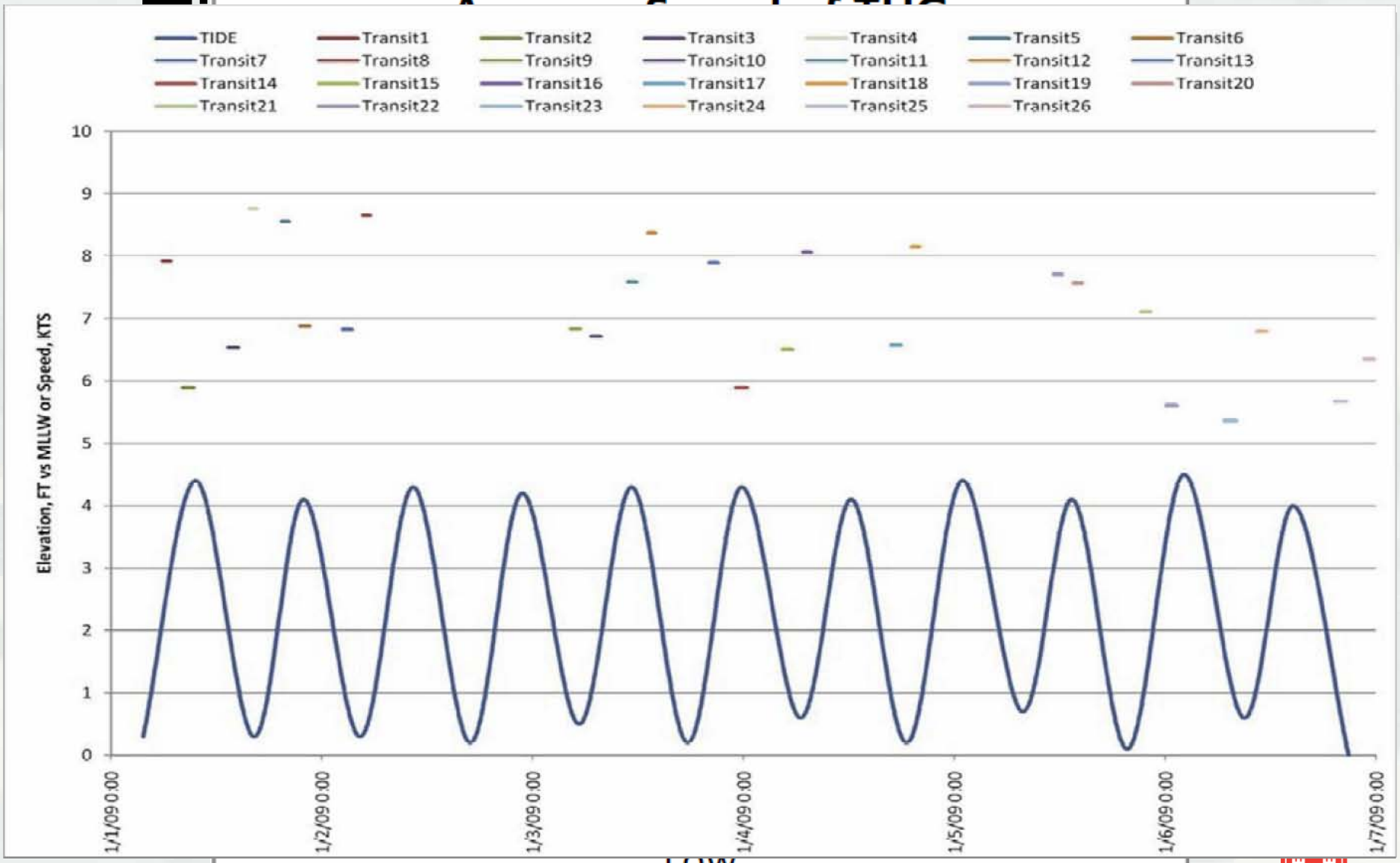
Vessel Transit Data Collection

- 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?


TIDE
Transit1
Transit2
Transit3
Transit4
Transit5
Transit6
Transit7
Transit8
Transit9
Transit10
Transit11
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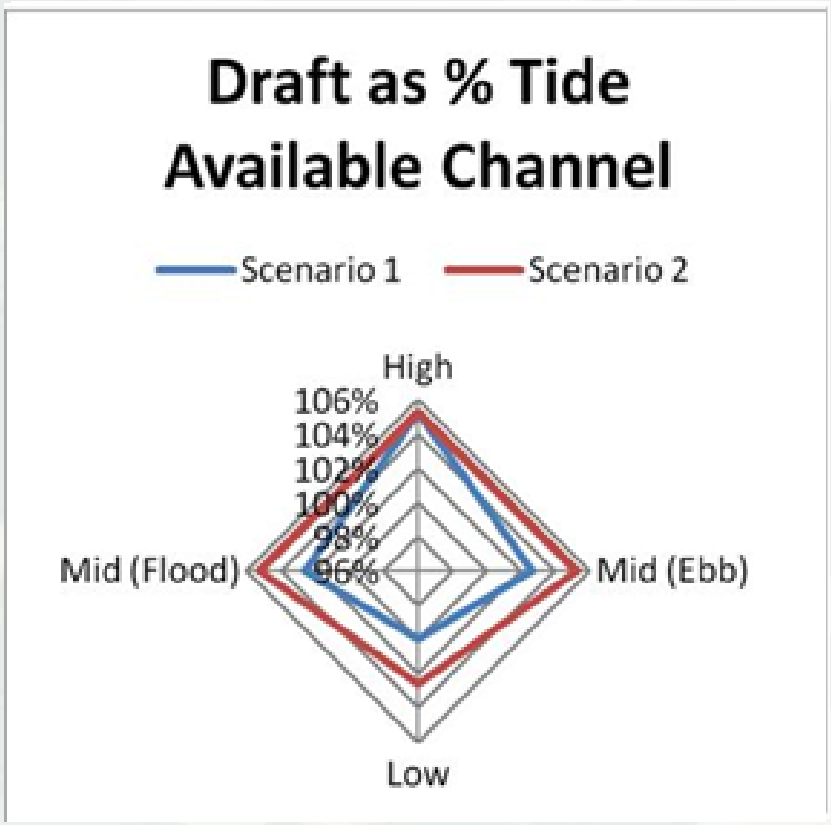
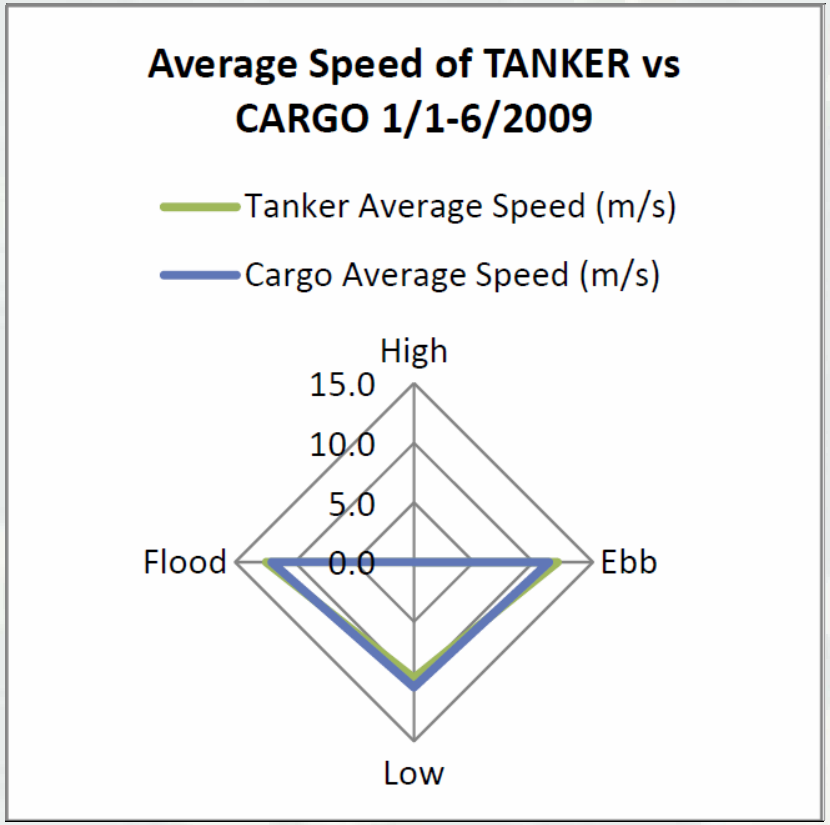
Transit19
Transit20
Transit21
Transit22
Transit23
Transit24
Transit25
Transit26
Elevation, FT vs MLLW or Speed, KTS
10
9
8
7
6
5
4
3
2
1
0
1/1/09 0:00
1/2/09 0:00
1/3/09 0:00
1/4/09 0:00
1/5/09 0:00
1/6/09 0:00
1/7/09 0:00

LOW

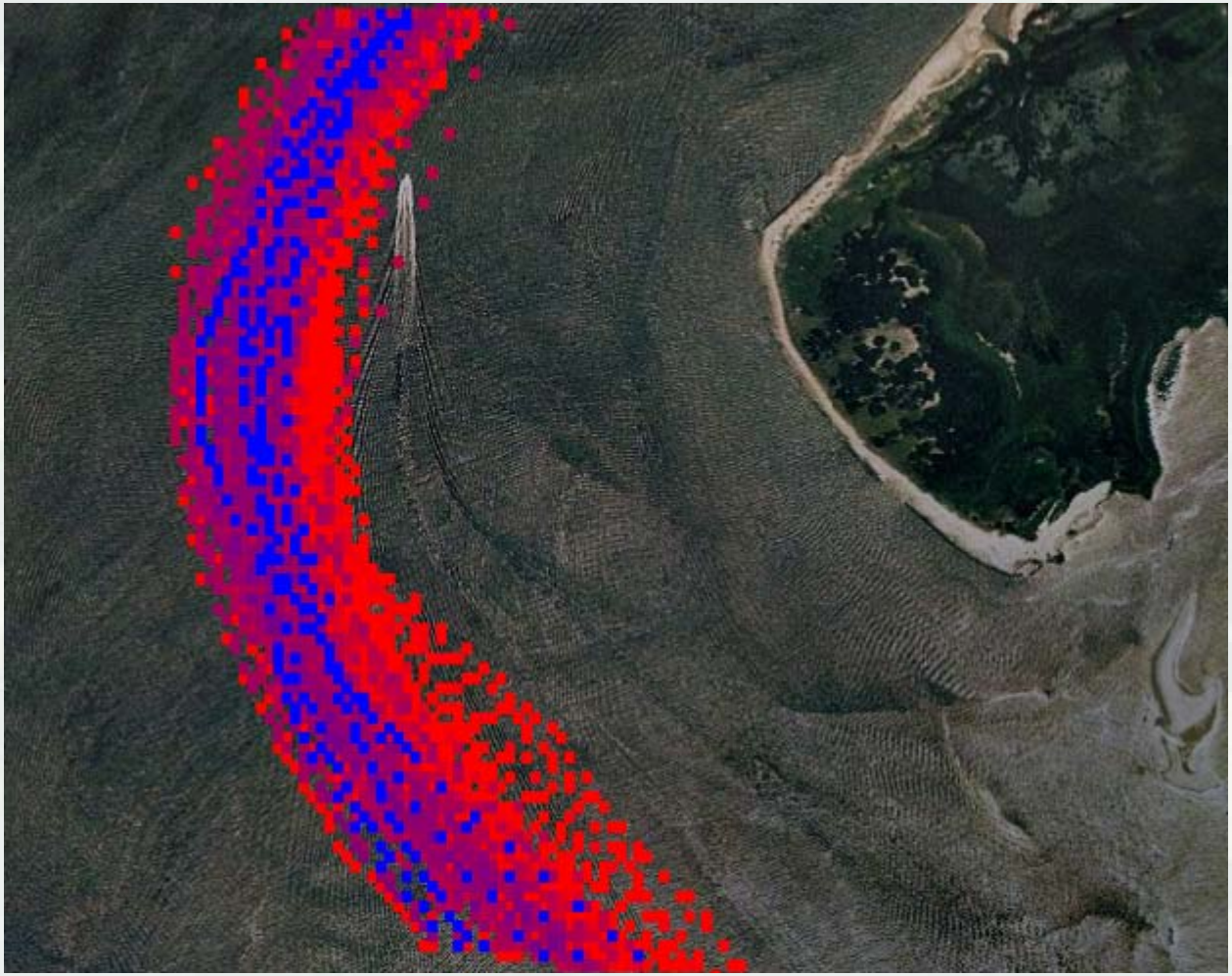
Detailed Vessel Comparisons



Detailed Vessel Comparisons

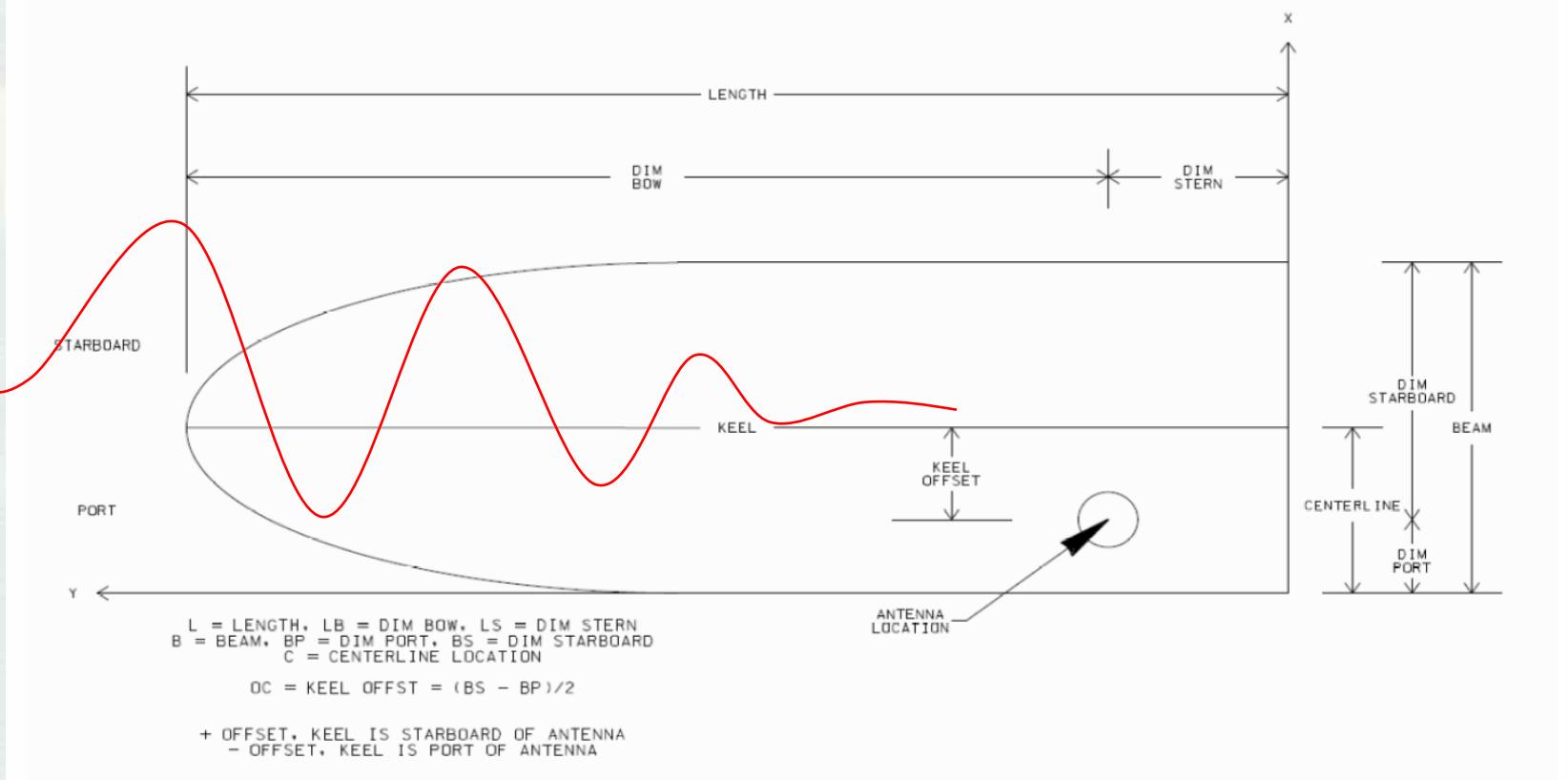


Changing Traffic Patterns

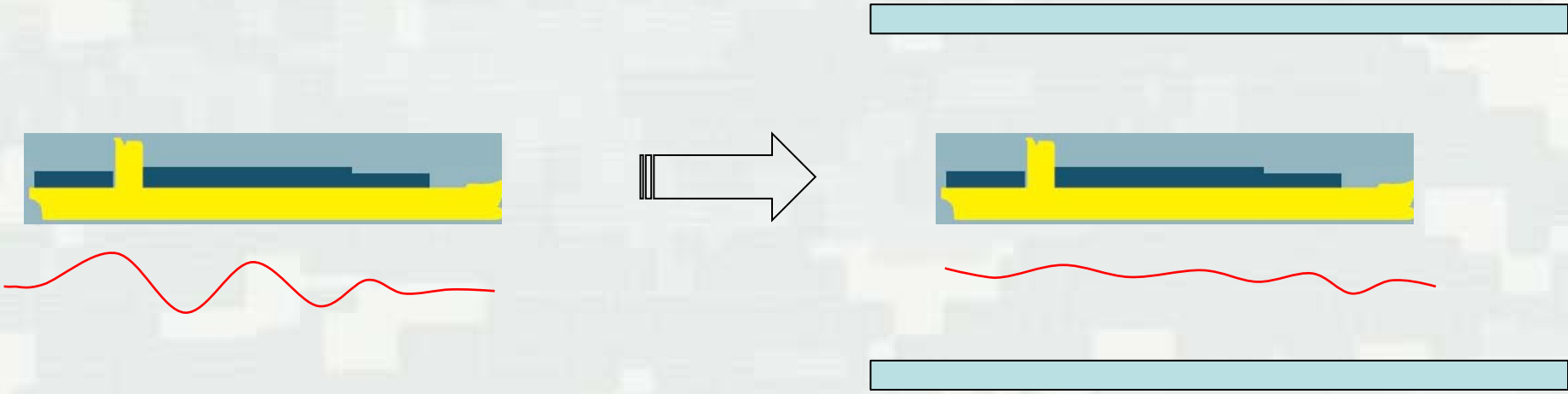


- Density plot changes over time represent response to changes in channel conditions.

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

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Questions?

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