

AIS History and Future Improvements in Waterway Management

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on detail to USACE-HQ

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US Army Corps of Engineers
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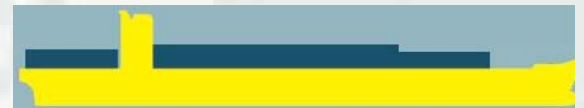
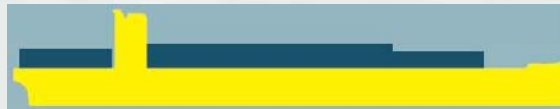
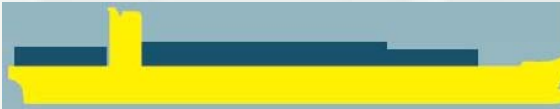
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WHAT IS AIS?

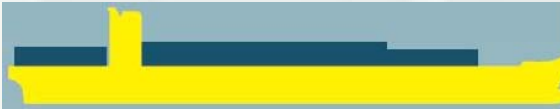
- Primarily for safety and maritime domain awareness
- Time-stamped position
- Vessel identifying information
- Vessel type classification
- Vessel dimensions
- Vessel “behavioral” information



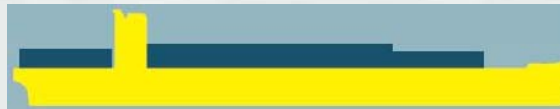
AIS IN REAL TIME



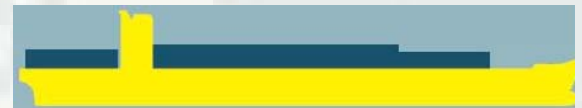
AGGREGATE AIS RECORD



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



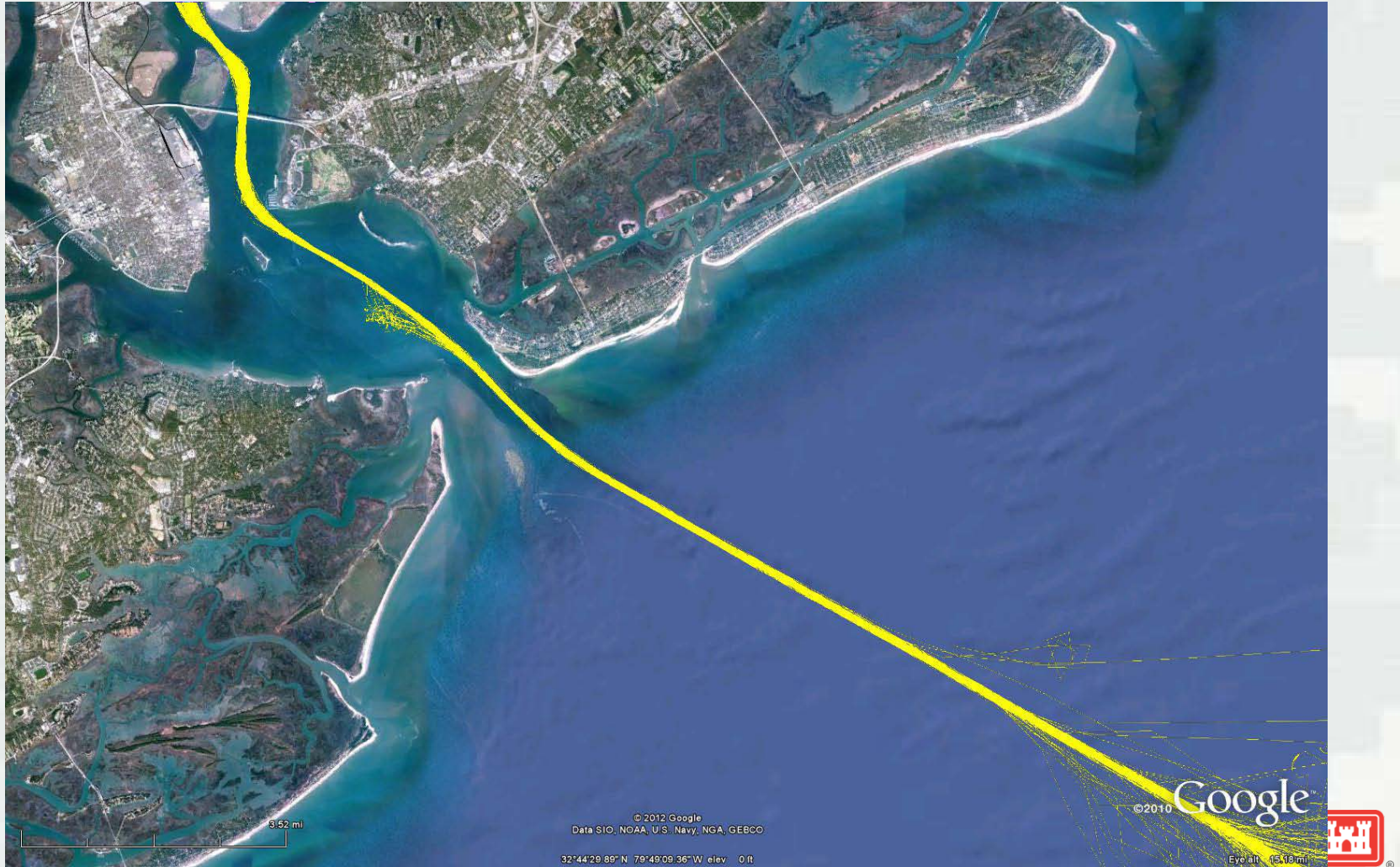
$X_{T1}, Y_{T1}; \{P_{T1}\}$



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

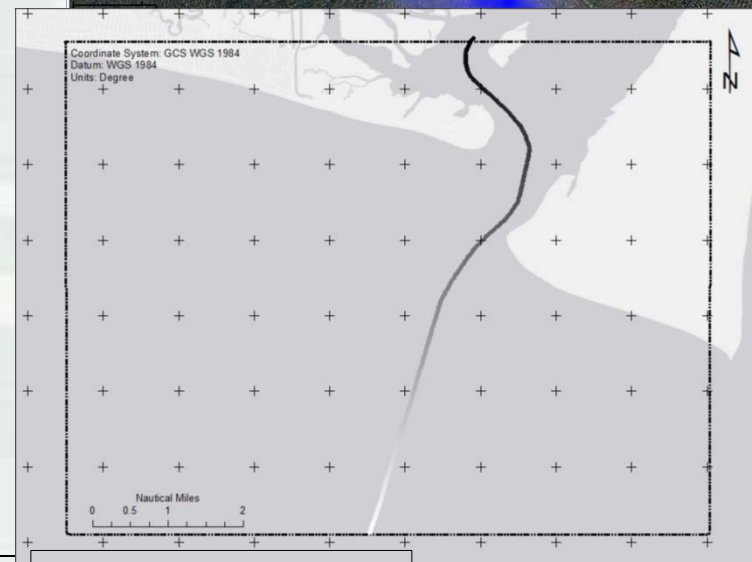
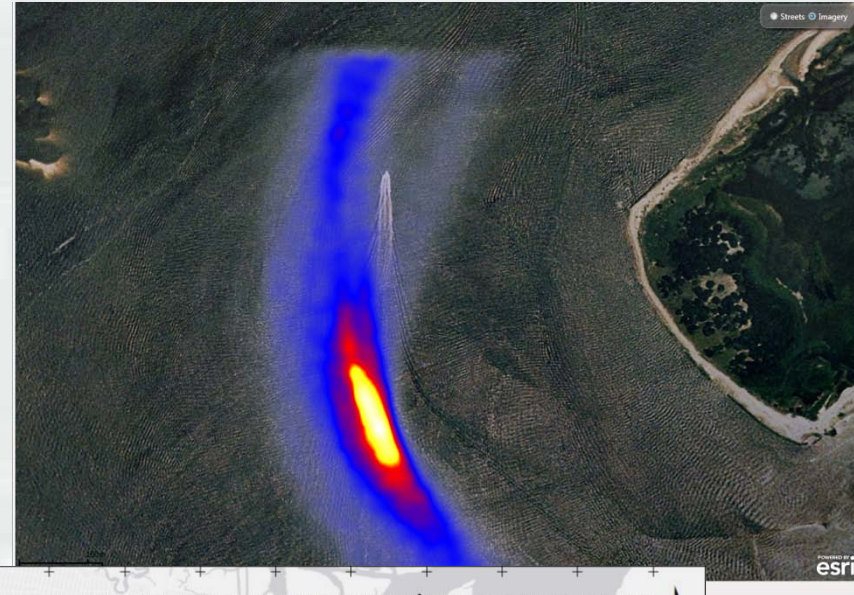


WHAT DOES IT MEAN?



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

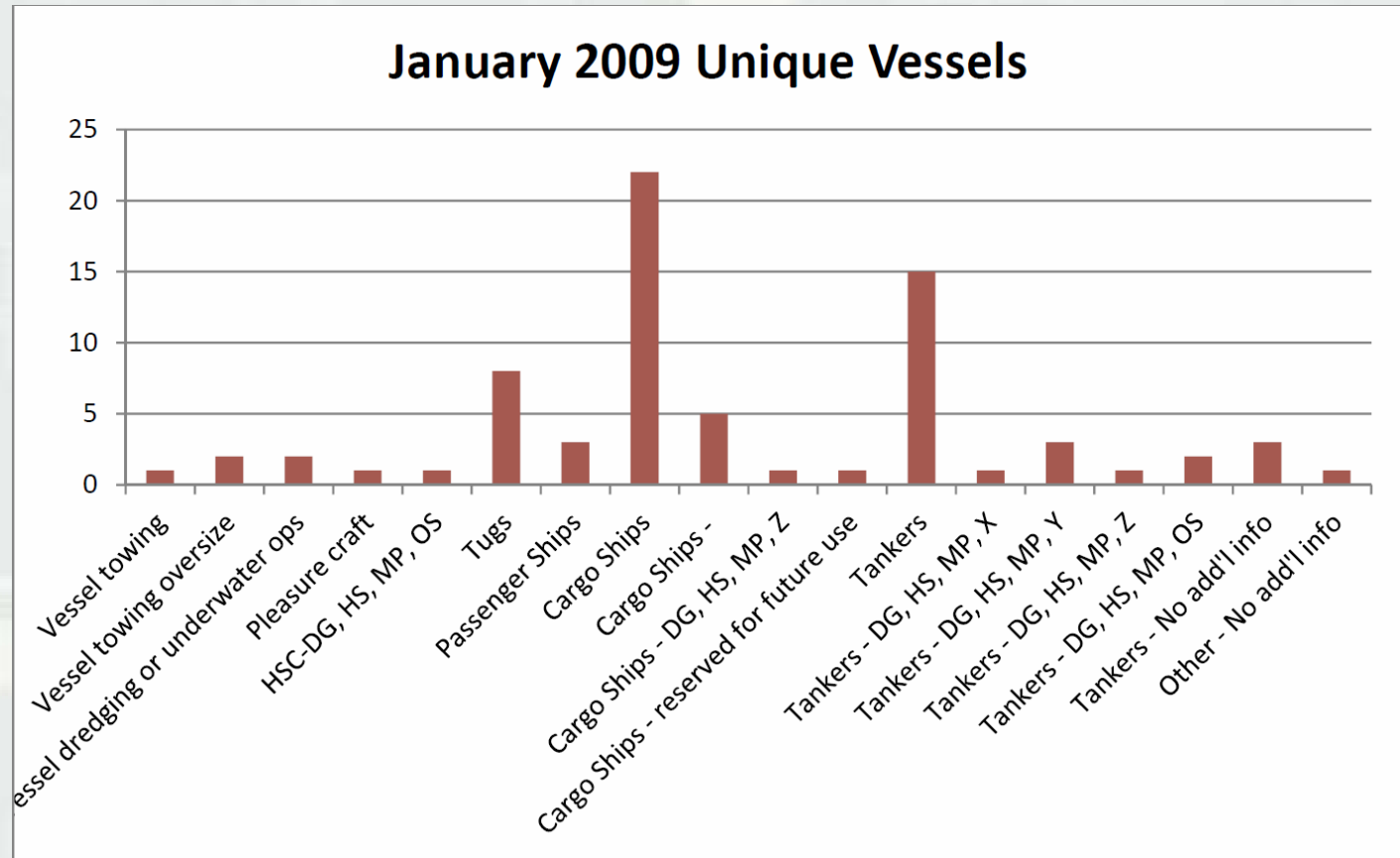
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BASIC IMPLEMENTATION

- User Profiles
- Decision Support
- Vessel Transit Data Collection



User Profiles

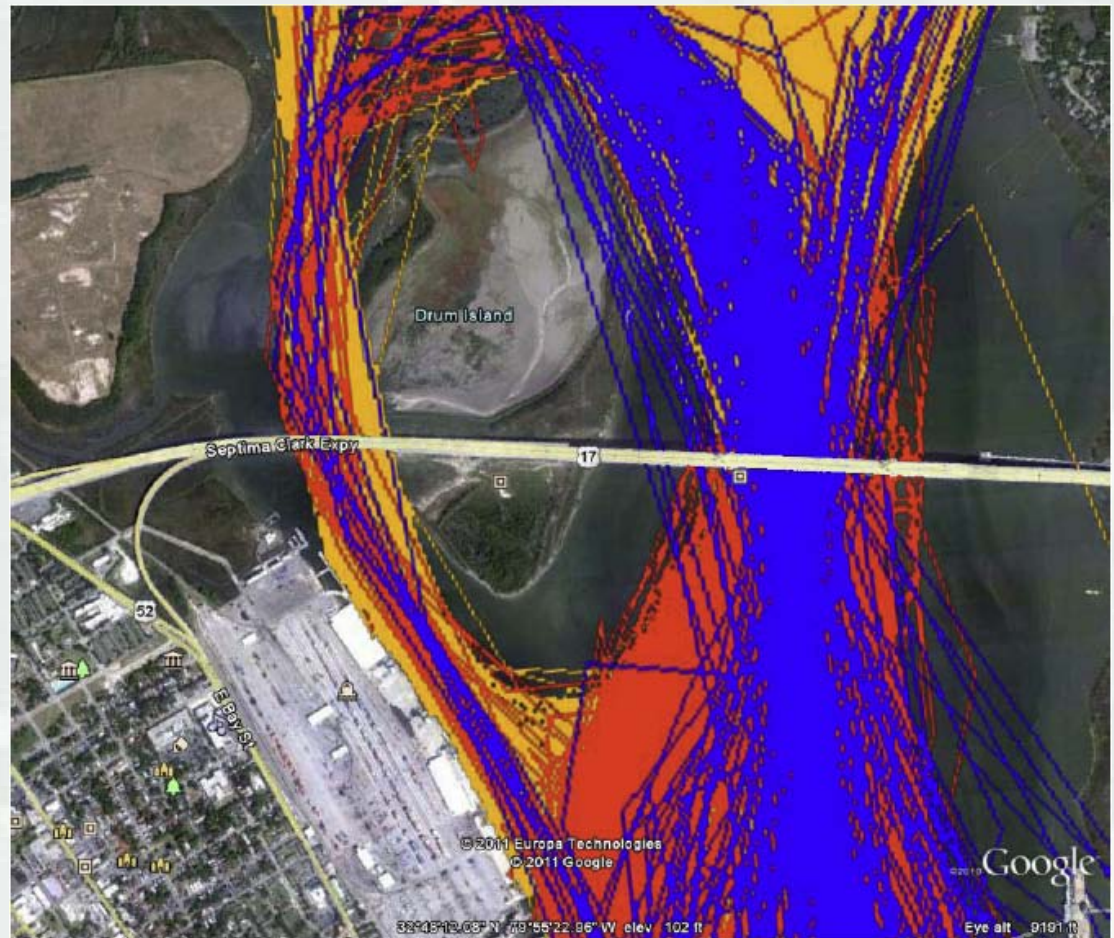


- Size
- Type
- Activity
- Reach-Level

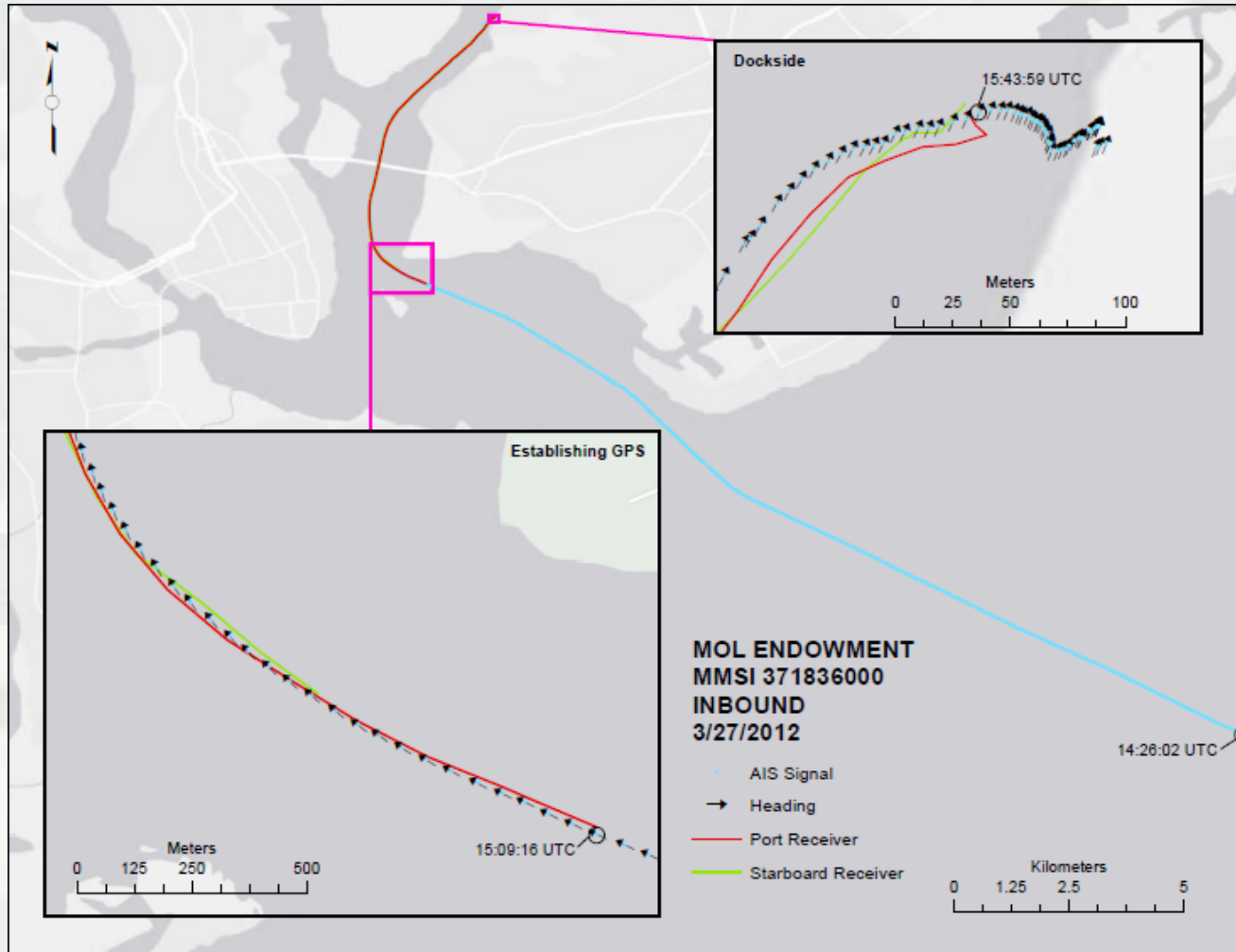


Decision Support

- Suitability
- Interactions
- Potential Hazards
- Potential Damage



Vessel Transit Data Collection

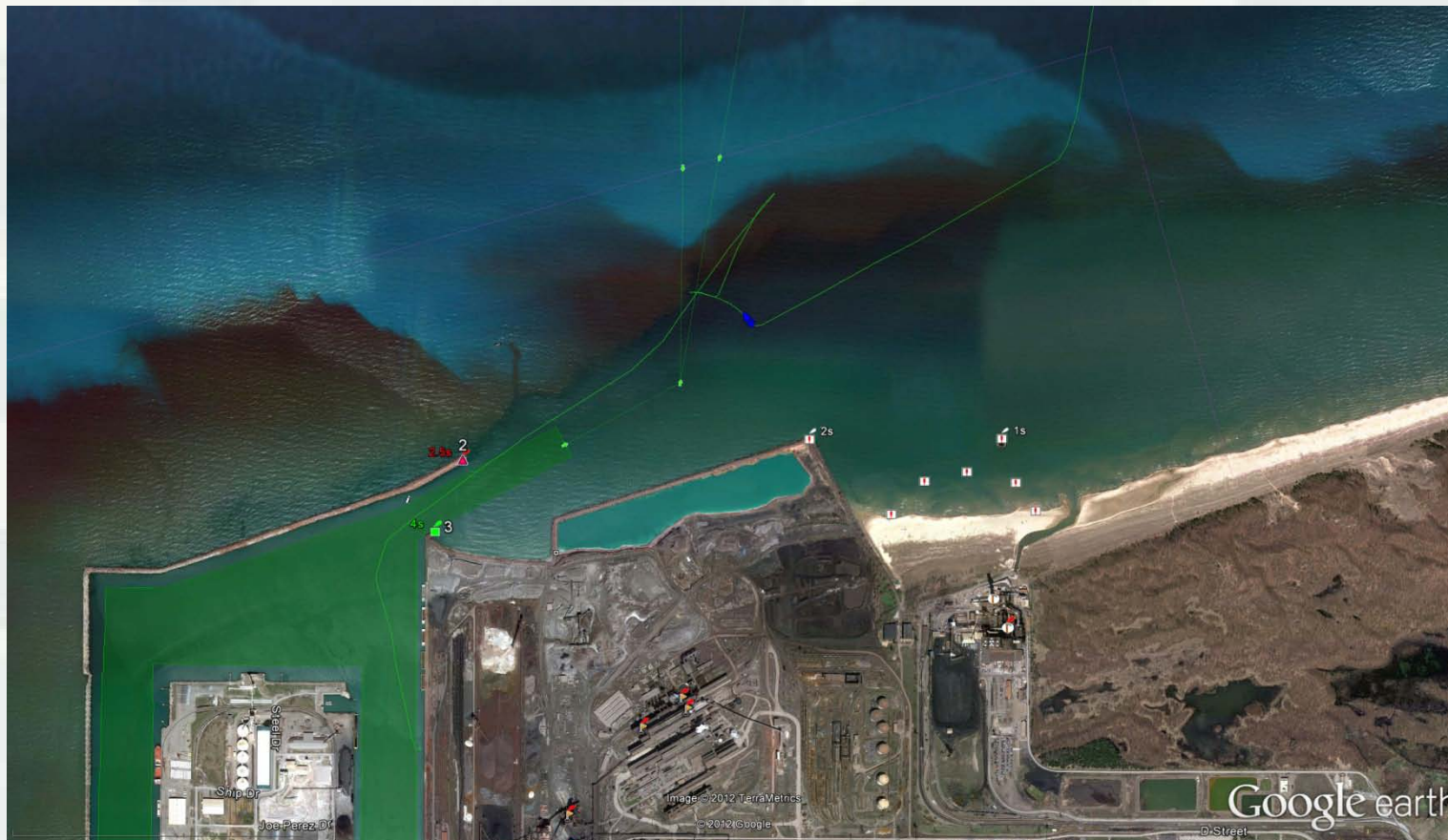


- Similar Data
- Less Processing
- More Detail
- Cheaper



Vessel Transit Data Collection

- Channel Obstruction
- Event Verification

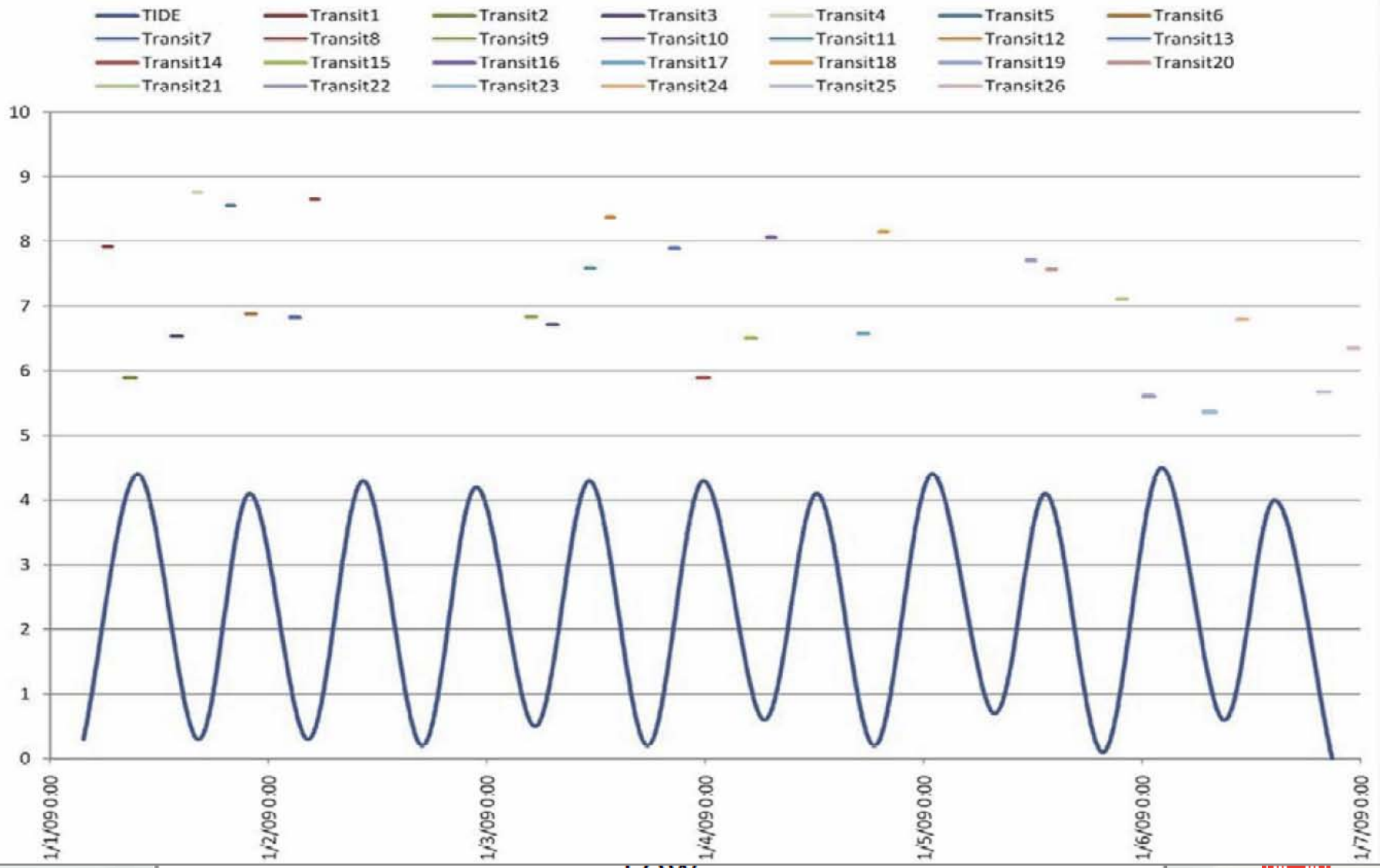


COMPLEX APPLICATIONS

- 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?



Elevation, FT vs MLLW or Speed, KTS



LOW

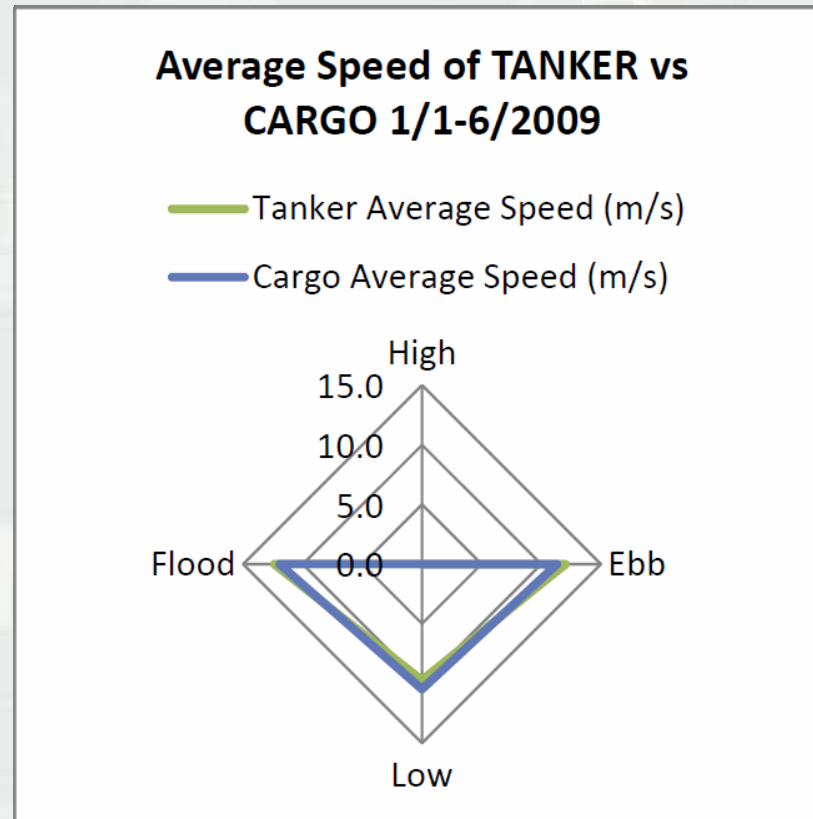


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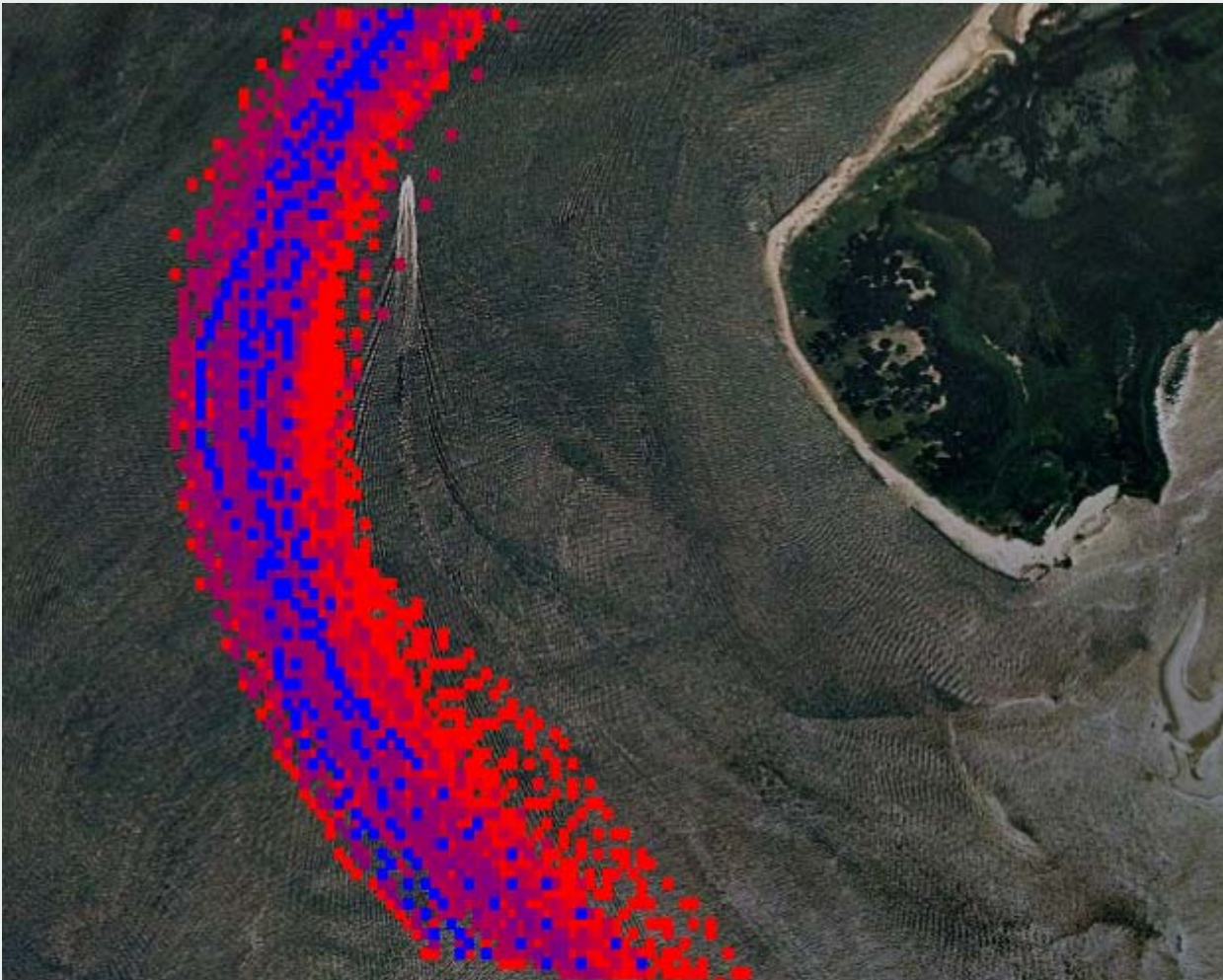
Detailed Vessel Comparisons



Detailed Vessel Comparisons



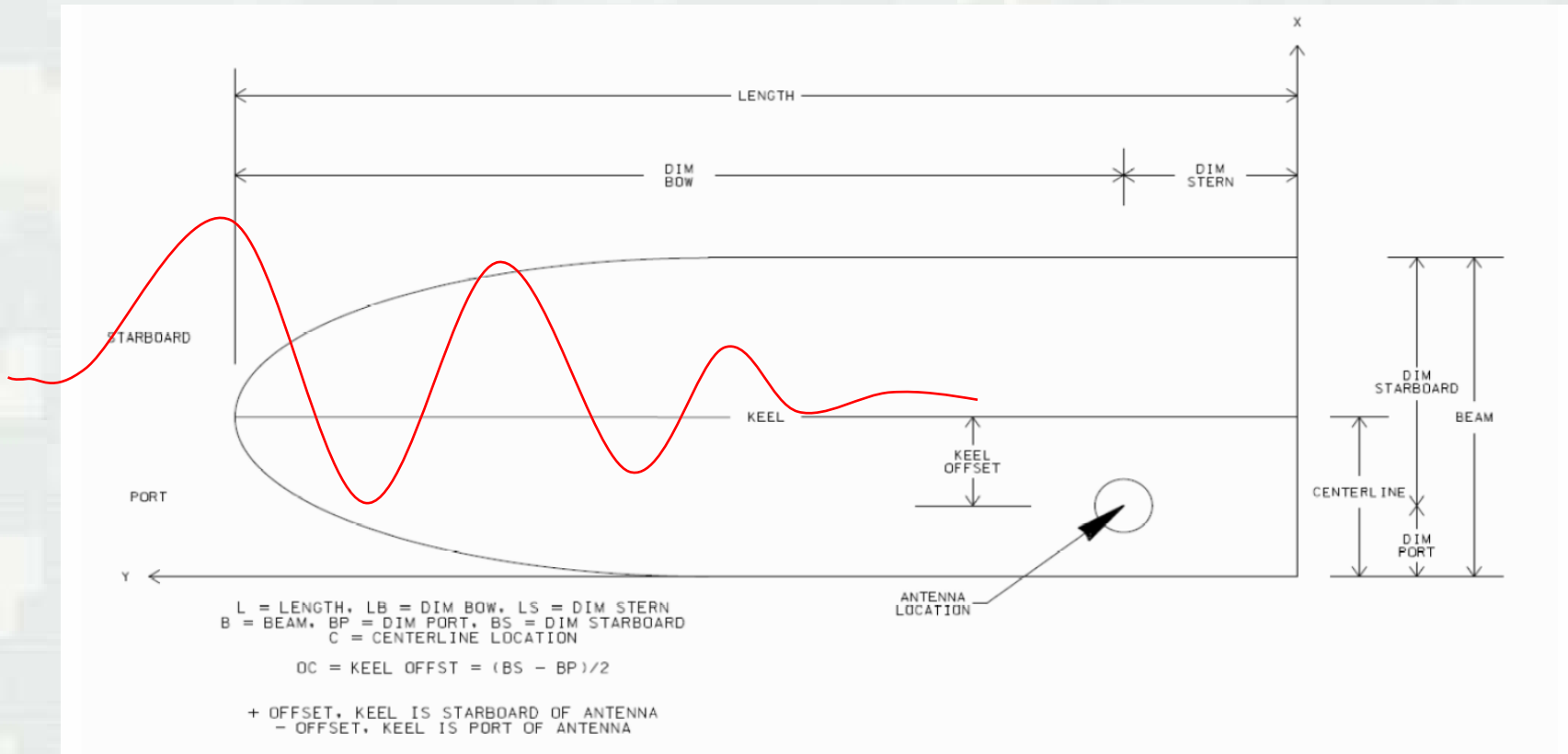
Changing Traffic Patterns



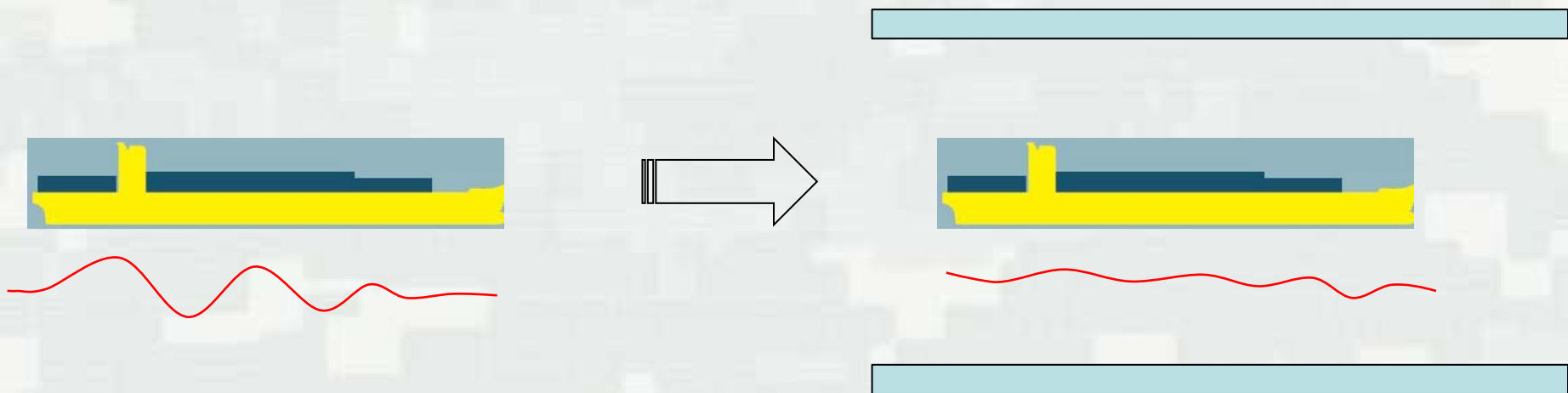
- Density plot changes over time represent response to changes in channel conditions.



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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