AIS History and Future Improvements in Waterway Management

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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

January 2009 Unique Vessels
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 Corrected Comparisons

- Draft-centered focus
- Draft compared to authorized project depth
- Draft compared to available depth
- Speed, heading or other
Detailed Vessel Comparisons

Draft as % Tide Available Channel

- Scenario 1
- Scenario 2

- High
- 106%
- 104%
- 102%
- 100%
- 98%
- 96%

- Mid (Flood)
- Mid (Ebb)
- Low
Detailed Vessel Comparisons

Average Speed of TANKER vs CARGO 1/1-6/2009

- Tanker Average Speed (m/s)
- Cargo Average Speed (m/s)

Speed intervals:
- High
- 15.0
- 10.0
- 5.0
- Flood
- 0.0
- Ebb
- Low
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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