



U.S. Department of Transportation
Bureau of Transportation Statistics

BTS Applications of Vessel Automatic Identification System (AIS) Data

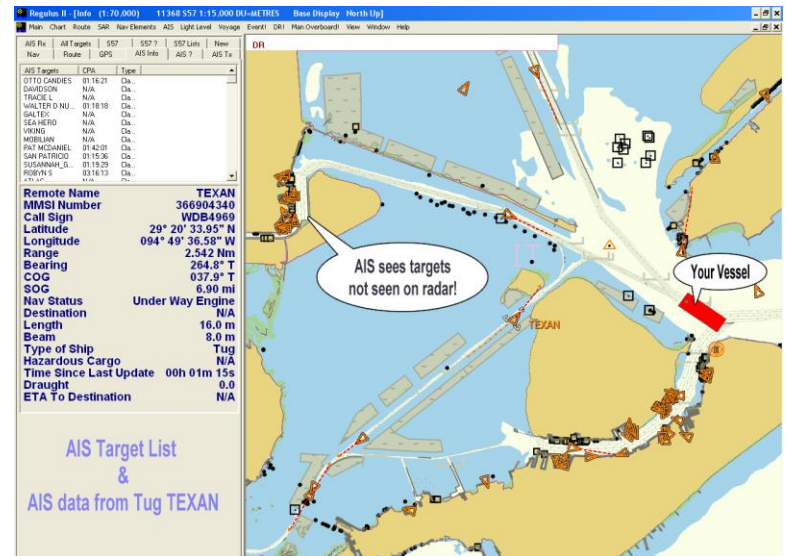
Bureau of Transportation Statistics
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5th ITF Transportation Statistics Annual Meeting

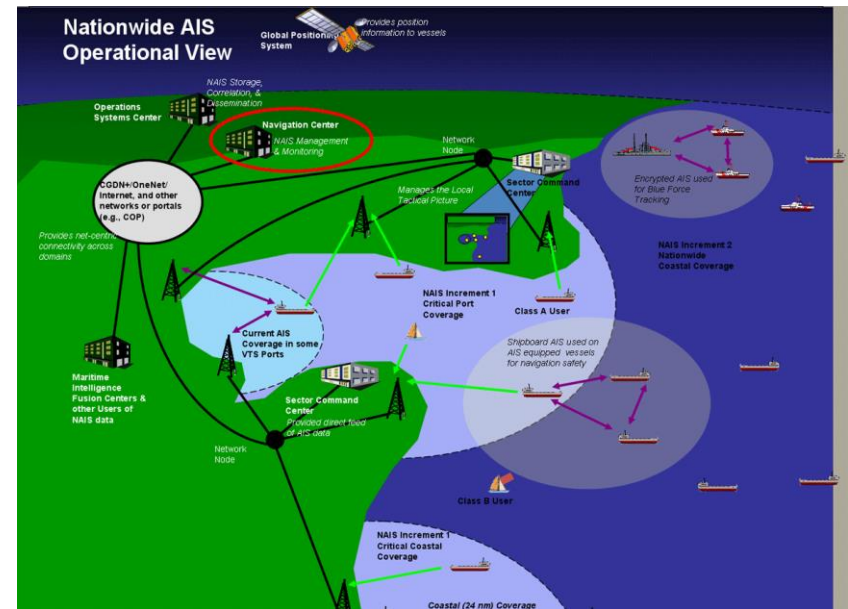
What is AIS?

- Automatic Identification System (AIS) is a vessel tracking system, operating in the marine radio band, that is comparable to an aircraft's transponder for collision avoidance.
- Vessel Traffic Service is similar to Air Traffic Control, using AIS to provide navigational advice as vessels transit between open water and U.S. ports.



Who and Where is AIS Operated?

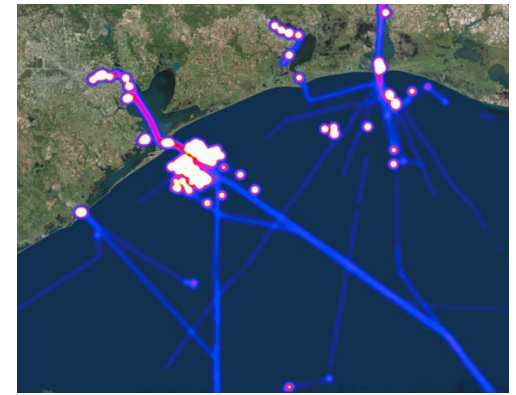
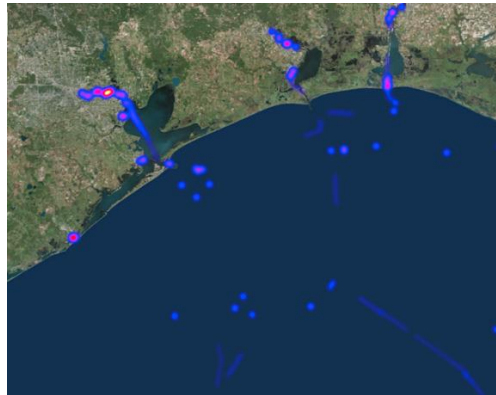
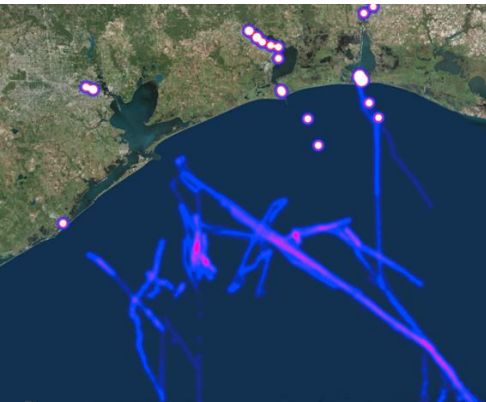
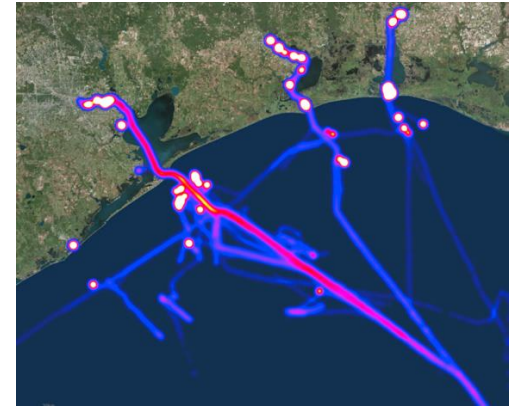
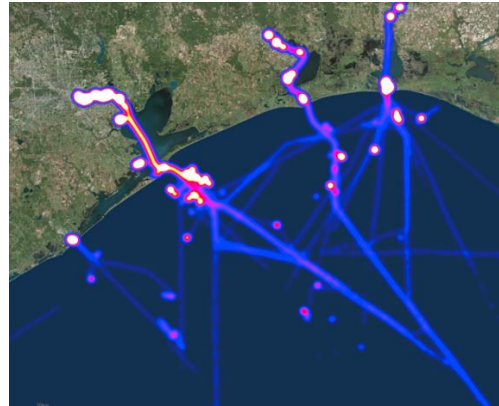
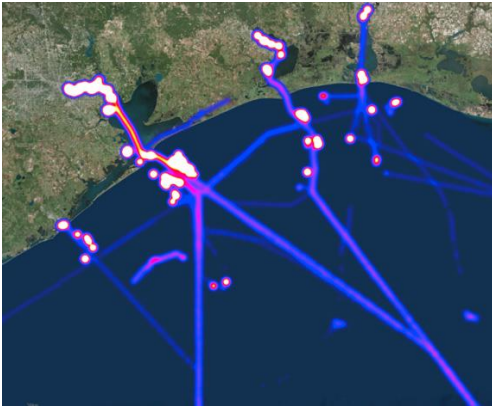
- The U.S. Coast Guard operates the Nationwide Automatic Identification System (NAIS), which consists of approximately 200 shore stations located throughout the coastal continental United States, inland rivers, Alaska, Hawaii and Guam.
- NAIS is designed to collect AIS transmissions from nearby vessels.
- AIS is a rich, nationally-consistent BIG data source.



What and When AIS Is Broadcasted?

- Onboard AIS automatically transmits and receives a wealth of vessel information every 2 to 10 seconds while the vessel is underway, or every 3 minutes while at anchor.
- AIS automatically provides the following broadcast information to and from shore stations, other ships, and aircraft:
 - vessel's identity (MMSI #)
 - navigational status
 - speed
 - latitude/longitude
 - course
 - other safety-related information

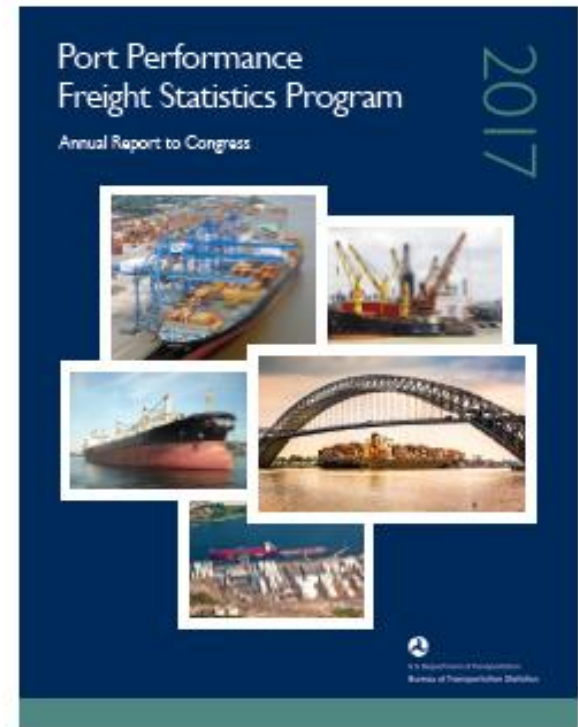
AIS Depicts a Vibrant Picture of Vessel Movement



AIS Application 1:

Port Performance Freight Statistics

- The Bureau of Transportation Statistics' Port Performance Freight Statistics Program provides nationally consistent throughput and capacity measures for the top 25 ports by tonnage, container, and dry bulk.



Leveraging BIG Data Sources

- BTS is leveraging BIG data sources such as AIS (vessel transponder broadcast) to explain port operations and measure port performance.
- BTS has partnered with the U.S. Army Engineer Research and Development Center (ERDC) to survey ferry service and create port performance metrics.

Looking Inside the Box

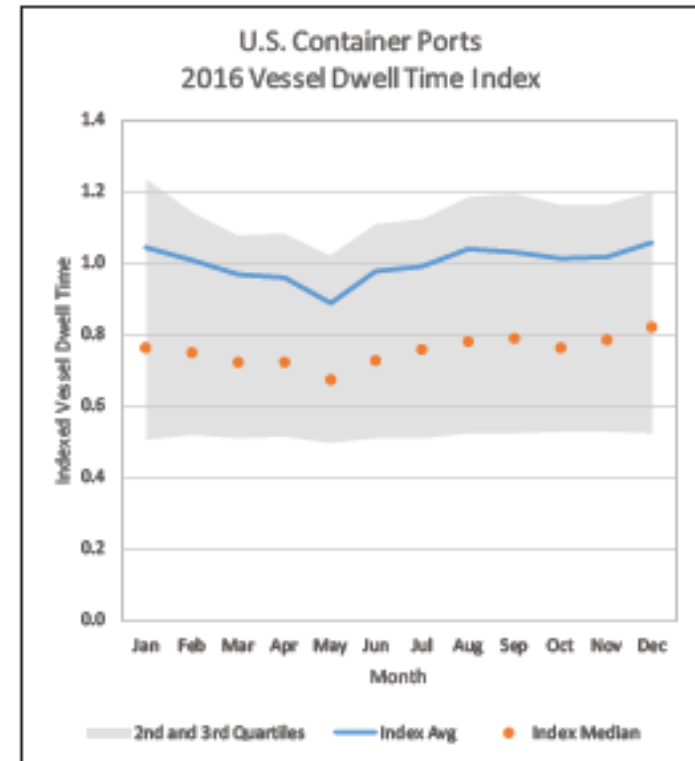
- BTS created waterside port boundaries (“boxes”), by using geo-fence technique, around piers and wharves defined in Master Docks Plus by U.S. Army Corps of Engineers.
- Once a containership stops (e.g., speed = 0 and navigational status = anchor) in the “box,” BTS starts to record its dwell time.
- This yielded more than 18,000 records for vessels in container ports and terminals.

An Example of Port Boundary Boxes

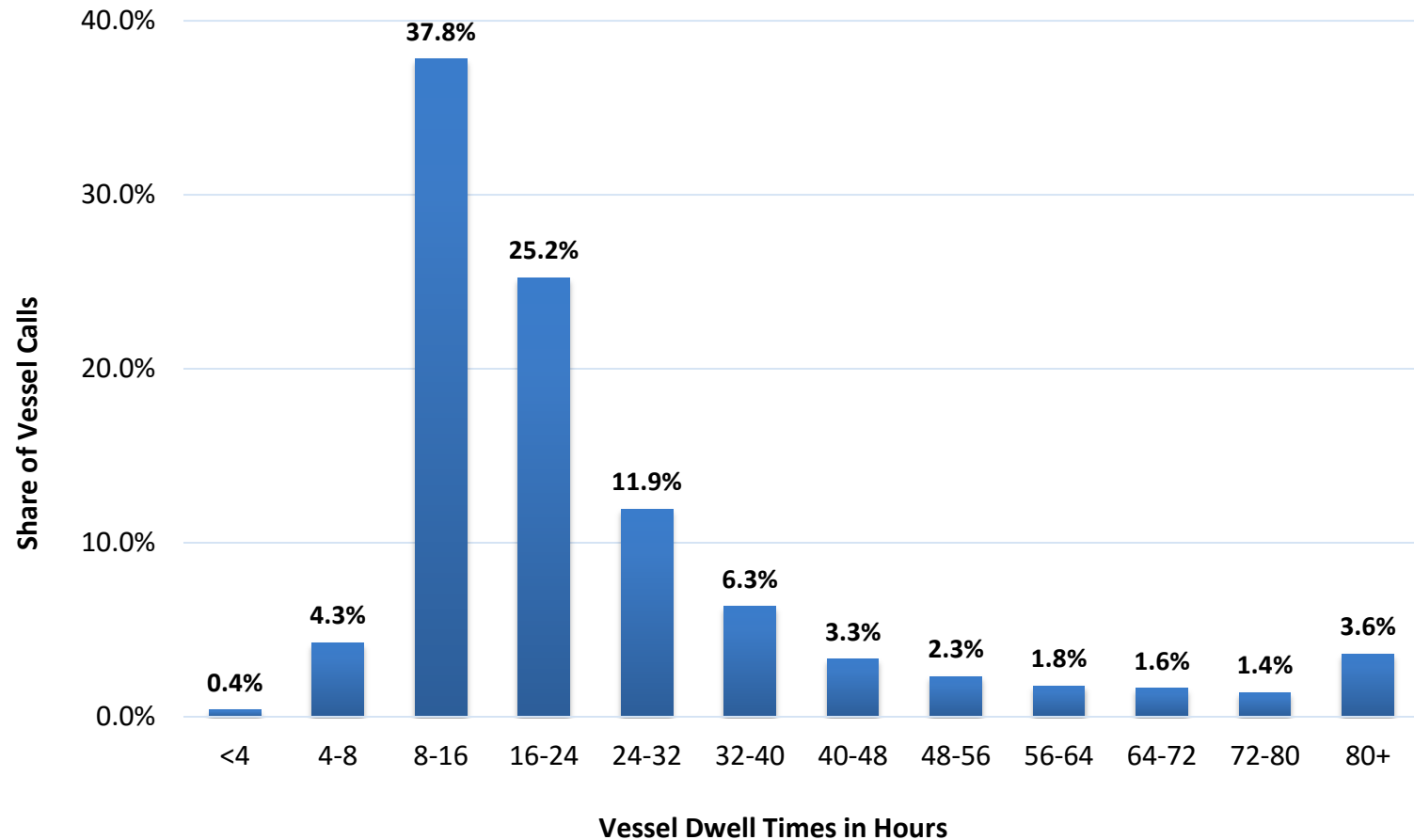


Calculating Vessel Dwell Times

- Dwell time is the amount of time a vessel spends in port, mostly loading and unloading cargo.
- Every effort is made to minimize this amount of time. Shorter dwell times are desirable because vessel operating costs typically rise with dwell time.



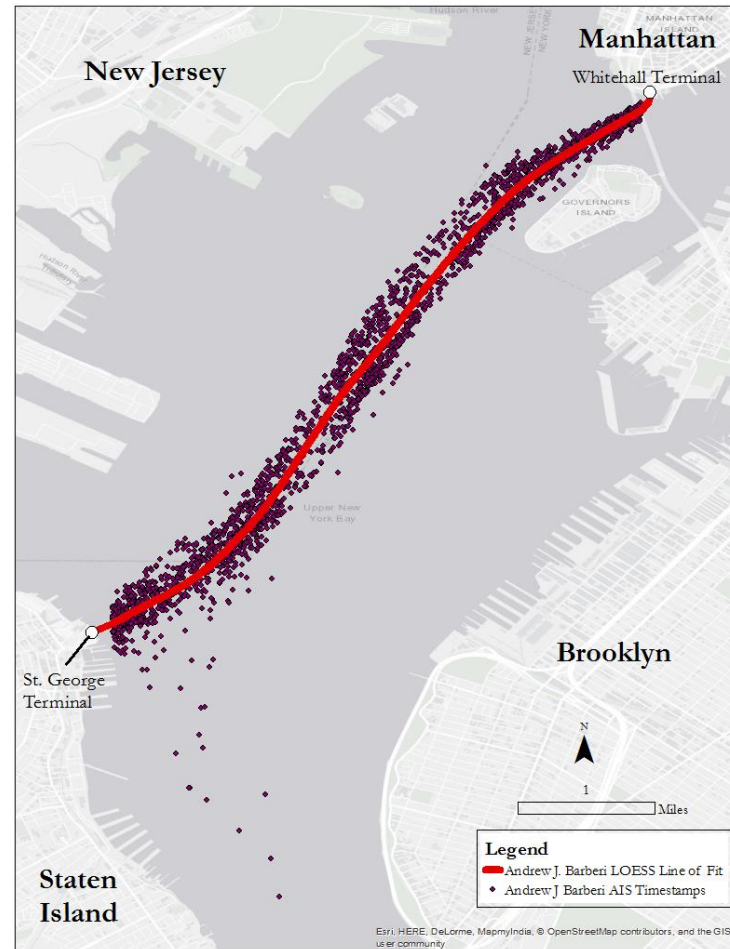
Dwell times for two out of five container vessels are within a day of scheduled vessel call.



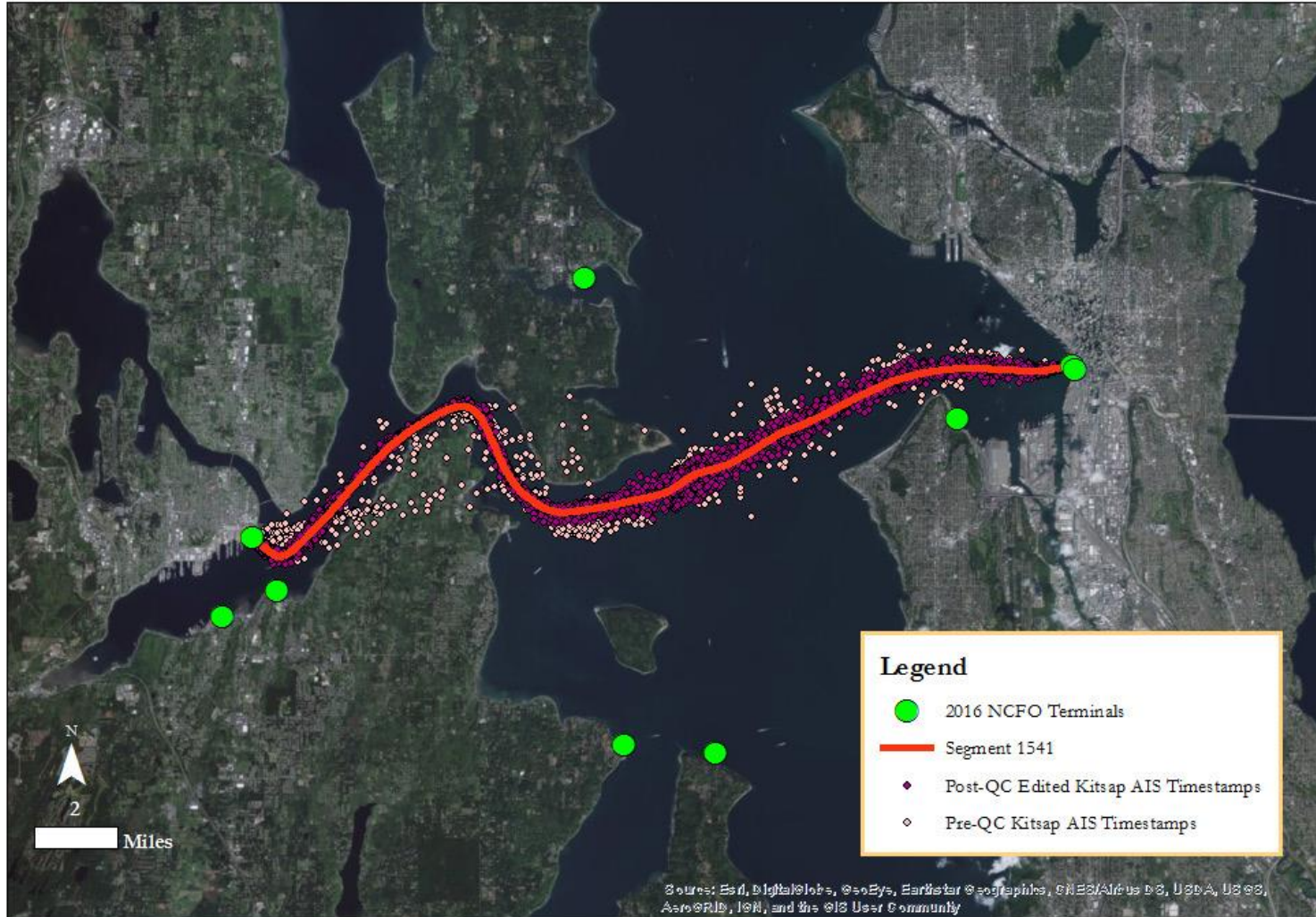
AIS Application 2: Ferry Routes

- Every two years BTS conducts a National Census of Ferry Operators (NCFO).
- Using AIS data, BTS is able to map, calculate distances, and visualize individual ferry routes -- defined as the fixed route service between passenger and vehicle ferry terminals in the U.S. that service the public road network.

An example of A Ferry Route



Final segments are generated by smoothing the AIS data by using the LOESS regression model.



Lessons Learned in Using AIS Data

- **Data Quality**
 - AIS messages are broadcast over very high frequency (VHF) radio and can be subject to disruptions from terrain or weather events.
 - Not all AIS messages can be matched with external vessel attribute systems.
 - Some messages are manually entered by the users and could be subject to keying errors.
- **Area coverage**
 - Data gaps exist (e.g., May 2016 data for the Ports of Long Beach and Los Angeles) due to system downtime.