



## Tracking Barges Carrying Hazardous Cargo: Detecting Anomalies and Predicting Risky Situations

### The Need for Automated Tracking

In April of 2003, the U.S. Coast Guard set up the Inland River Vessel Movement Center to monitor barges carrying Certain Dangerous Cargo on the U.S. inland waterways. While there are less than 100 shipments of these types of cargos daily, each shipment is extremely large (over 2200 Tons on average). Any incident could have massive consequences. Operators in certain regions are required to report movements via phone, FAX or (for two large companies) an hourly position report. The reports are generated manually or as a by-product of the company's tracking system; however,

they are not linked to tracking devices on the barges, so barges are not tracked continuously or consistently. Also, there is no system to automatically identify a strange or anomalous activity and no means of predicting when a barge could be expected in a high risk area.

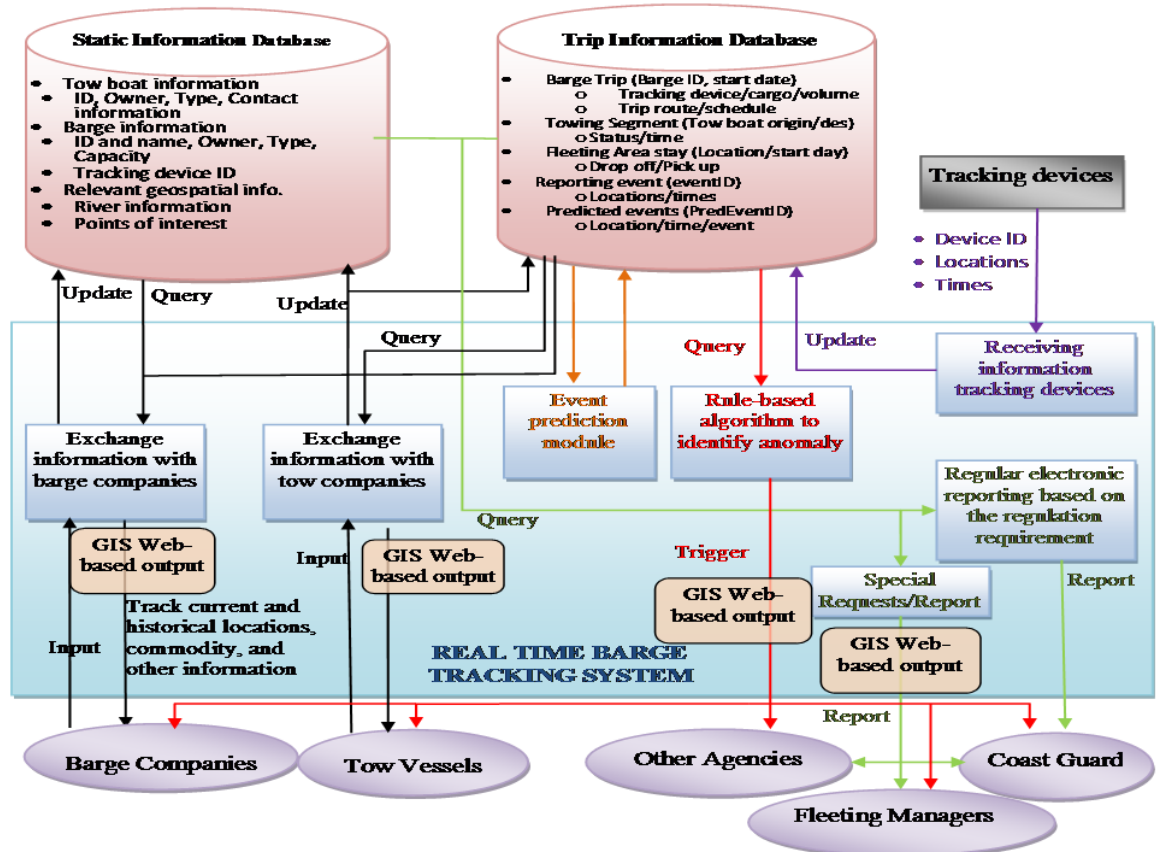
### TRACC

In partnership with Mississippi State University, ORNL is developing TRACC, a web-based system for accepting tracking reports from GPS units mounted on barges, determining its location on the river system, detecting anomalies, predicting the track of the barge, and anticipating risky situations.

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TRACC Architecture

The prediction module uses a sophisticated non-linear process to combine data from previous tracking device reports with historic data for each pool in the river system to predict speeds and delays along the route. As the system predicts routes, risky situations can be identified such as two tows passing in a congested area or the accumulation of a large quantity of incompatible cargo in a location.

The anomaly detection process uses reports and predictions to search for unanticipated stops and starts, barges separated from a tow, unexpected

changes in direction, deviations from projected route, or loss of communication.

An initial set of operational tests on tracking hardware provided data on the capabilities of various units. An operational test of the software system linked to a fleet of barges will be conducted in cooperation with a hazardous cargo shipper.

This effort is supported by the Department of Homeland Security through the Southeast Region Research initiative (SERRI).

**Trip Information**

**Barge Information**

|          |                     |
|----------|---------------------|
| Barge    | TNBarge             |
| BargeVIN | 123456789TN456      |
| Material | Acetone Cyanohydrin |
| Amount   | 275 Tons            |

**Tow Information**

|              |                |
|--------------|----------------|
| Tow          | WW Dyer        |
| Phone        | 270-210-1112   |
| Fax          | 270-210-1112   |
| E-mail       | dyer@gmail.com |
| Total Barges | 2              |

**Alerts**

**Anomaly Detected!!!**  
Two Barges in same Tow cannot be this far.

For more information please contact Mike Hilliard at HilliardMR@ornl.gov or (865) 576-5337.