Supporting Secure and Resilient Inland Waterways

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Inland Waterways

• Nearly 12,000 miles of navigable commercial inland and intracoastal waterways

• Disruption can have widespread economic and societal impact
  • 20% of coal
  • 40% of U.S. petroleum and petroleum products
  • 60% of grain exports

• One barge
  = 60 tractor trailers
  = 15 railcars

SOURCE: U.S. Army Corps of Engineers
Project Overview

• Funded through DHS National Transportation Security Center of Excellence
  – Collaborative project between University of Arkansas and Rutgers University
• Project dates July 2010 through June 2013
• Completed one of three project phases
Project Goal

• Develop a prototype decision support system that
  – Integrates cargo prioritization models, freight movement models and geographic information system (GIS) technology
  – Provides decision-making support for prioritization and offloading of waterborne cargo during major disruptions
  – Indicates level of resiliency in terms of multi-modal capacity in the event of attacks or natural disasters against inland waterway transportation systems
Project Deliverables

• Prototype SSRIW Decision Support System
  – Working prototype

• Conceptual Framework for National Model
  – Updated process flow chart showing data sources available and decision trees showing break out of different resources (rail cars, population centers, etc.)
Study Area

- 154 mile section of the Upper Mississippi River including Lock & Dam #14 just north of Davenport, Iowa and Lock & Dam #19 at Keokuk, Iowa
- Develop a digital and geospatially accurate map and related database of all
  - Locks, dams and bridges
  - Ports and terminals
  - Freight rail
  - Highways
  - Other infrastructure
Cargo Prioritization

• Systematic review of existing cargo prioritization measures and models

• Factors potentially impacting cargo prioritization
  – Risk, e.g., hazardous cargo
  – Economic value of cargo
  – Timing – normally FIFO
  – Seasonality
  – Perishability (grain)
  – Domestic/exports
  – Inventory levels
  – Criticality of empty barges
Cargo Prioritization (cont.)

• Beginning to interface with USCG on their procedures and existing tools for cargo priority
  – Overall requirements to facilitate recovery of commerce are common for all sectors
  – Variability by USCG sector
    • Procedures, tools
    • Uniqueness of commodity flow, ports
    • Seasonality, incident-specific issues
  – SSRIW DSS needs to be flexible enough to be tailored for use by each sector and incident
**Infrastructure Knowledgebase**

- Aerial Imagery
- Navigation Data Center / Master Docks Data
- Marine Transportation System Recovery Unit Data
- CTA Intermodal Network and Terminal Database*

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Infrastructure Knowledgebase

Infrastructure Knowledgebase

Infrastructure Knowledgebase + CTA Intermodal Network and Terminal Database

Response Network

Conceptual Framework for National Model

Current Emergency Response Protocols

Decision Support System (DSS) w/ Graphical User Interface

Infrastructure Knowledgebase

Real-time data via Web Services

Automated prioritization of cargo movements

Improved, DSS supported response protocol workflow
Prototype Model Framework

Problem Definition & Identification of Stakeholders

Define requirements

System Design

Development Cycle (Prototypes to Final)

Testing

Final Implementation

System Design

Data:
• Geodatabase/SDE
• ORNL Transport Networks – Fortran – output are ascii files
• Prioritization Model – output TBD

Visualization:
• ArcServer 10
• Microsoft SQL
• ArcGIS API for Flex
• Time series
• User tools to be created in – VBA, C#, Java, ArcObjects, or Python
Research Team

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