Supporting Secure and Resilient Inland Waterways

Letitia Pohl, Matt Campo, and Jennifer Rovito

2nd Annual Maritime Risk Symposium

November 9, 2011

Acknowledgement: This material is based upon work supported by the U.S. Department of Homeland Security under Grant Award Number 2008-ST-061-TS003. The work was conducted through the Mack-Blackwell Rural Transportation Center at the University of Arkansas and the Center for Transportation Safety, Security and Risk at Rutgers University.

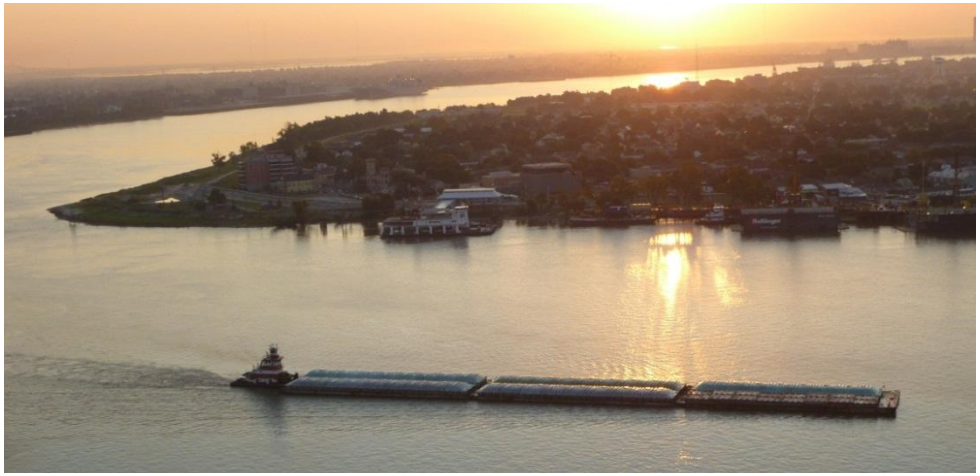
Inland Waterways

- 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

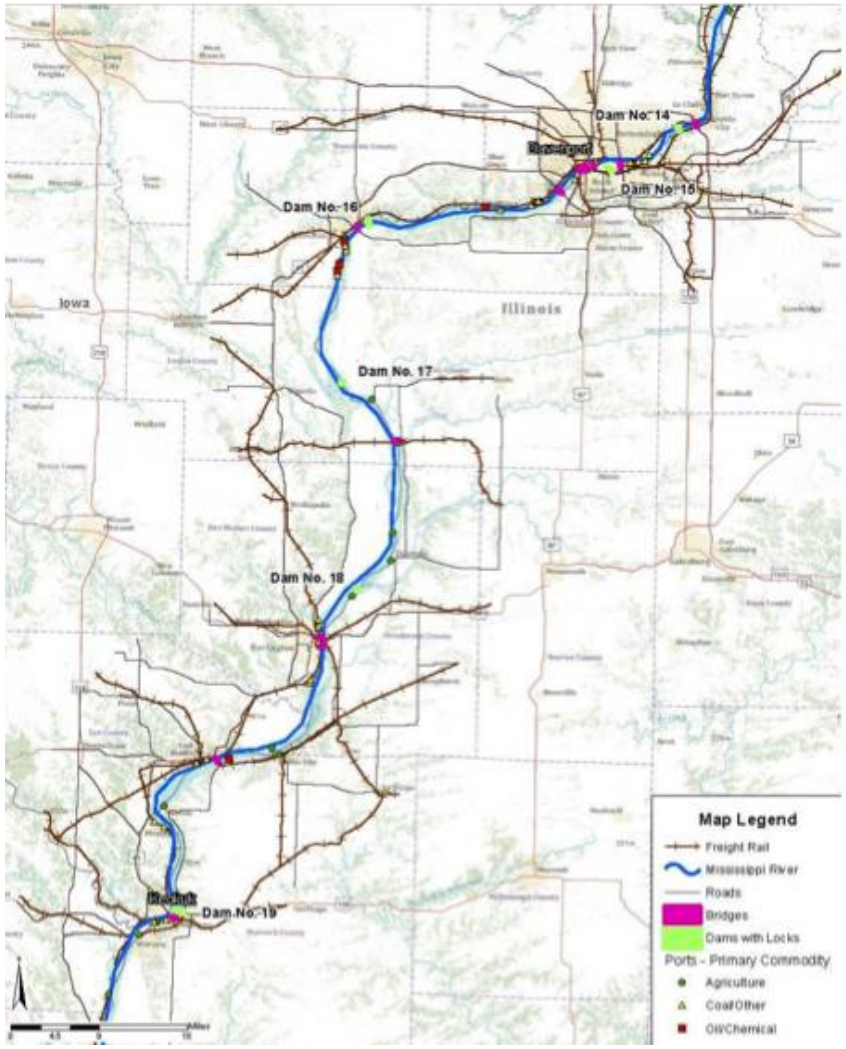
- Develop a prototype decision support system that
  - Integrates cargo prioritization models, freight movement models and geographic information system (GIS) technology
  - Provides decision-making support for prioritization and offloading of waterborne cargo during major disruptions
  - Indicates level 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

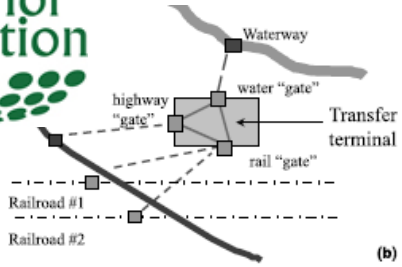
Infrastructure Knowledgebase

Aerial Imagery

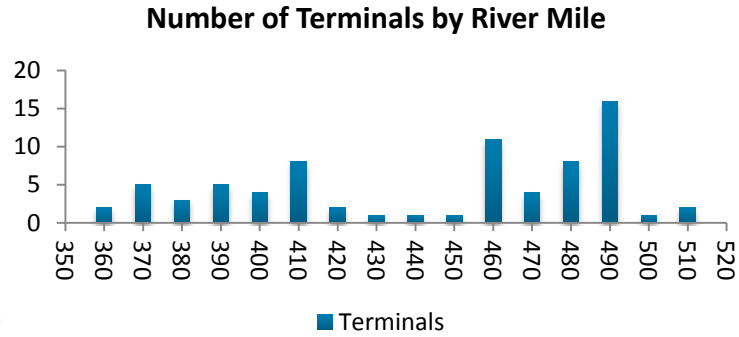
Navigation Data Center / Master Docks Data

Marine Transportation System Recovery Unit Data

Center for Transportation Analysis



CTA Intermodal Network and Terminal Database*



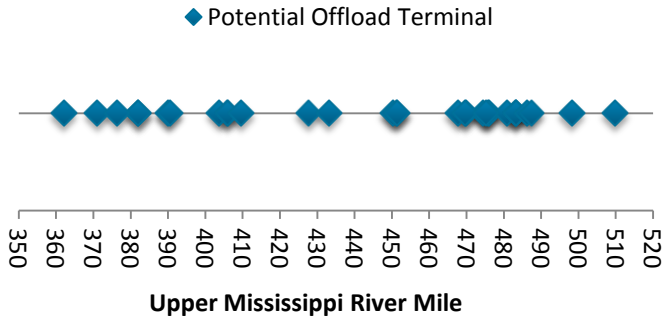


*Image Source: Southworth, F. and Peterson, B.E. (2000) Intermodal and international freight network modeling. Transportation Research Vol C8:147-166.

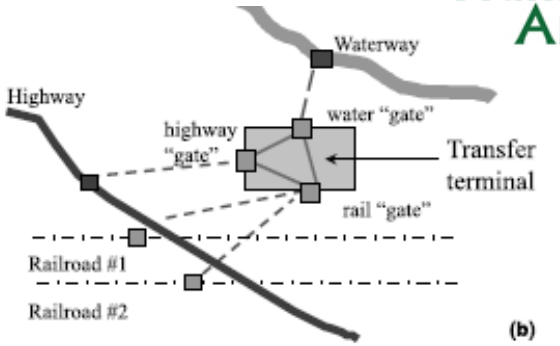
Infrastructure Knowledgebase

Image Source: *Bing Maps*. Microsoft Corporation. 2010. http://www.bing.com/maps/.

Infrastructure Knowledgebase

Infrastructure Knowledgebase

+

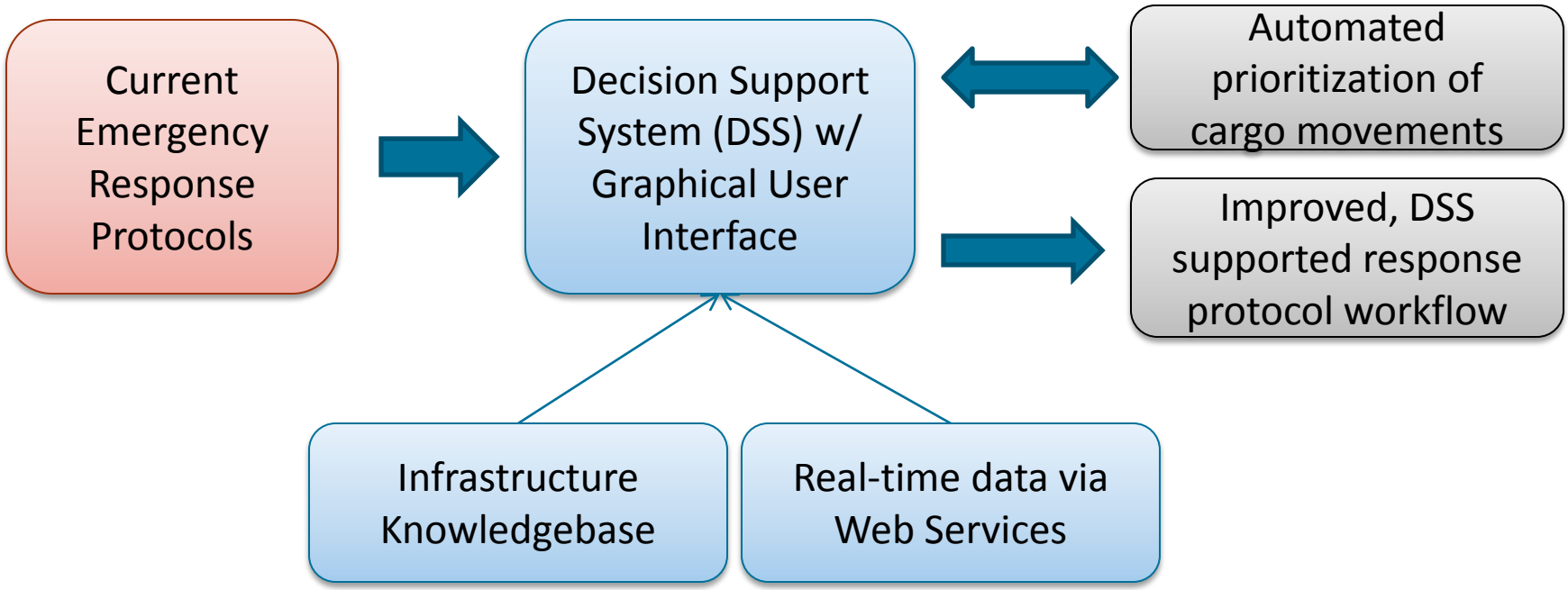


CTA Intermodal Network and Terminal Database*

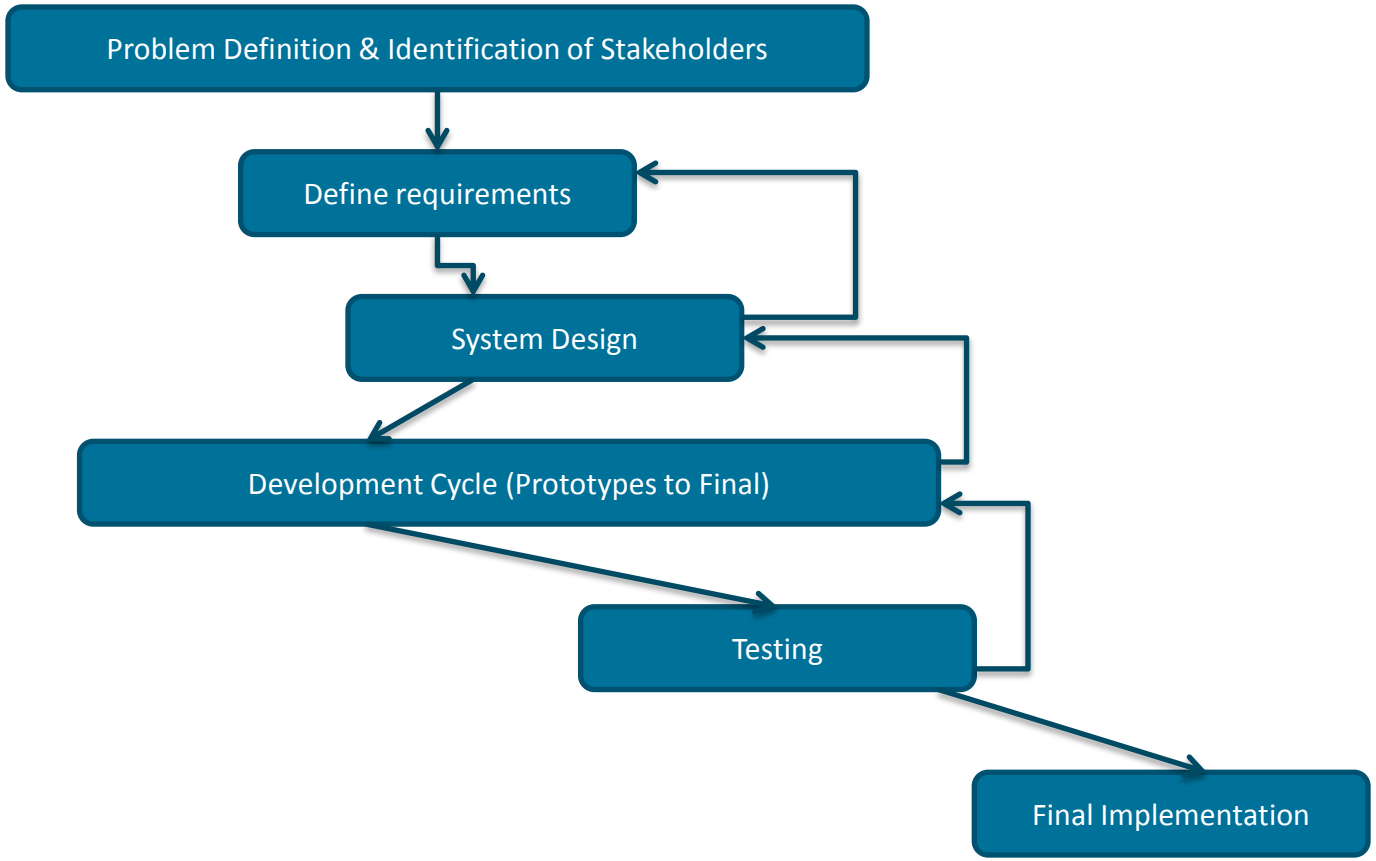
Response Network

*Image Source: Southworth, F. and Peterson, B.E. (2000) Intermodal and international freight network modeling. Transportation Research Vol C8:147-166.

Conceptual Framework for National Model



Prototype Model Framework



Framework taken from: Sugumaran, Ramanathan and John Degroote. 2011. Building Desktop SDSS. *Spatial Decision Support Systems: Principles and Practices* 7: 271.

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

University of Arkansas Mack-Blackwell Rural Transportation Center

Heather Nachtmann (PI): hln@uark.edu

Justin Chimka: jchimka@uark.edu

Edward Pohl: epohl@uark.edu

Letitia Pohl: lpohl@uark.edu

Jingjing Tong: tong@uark.edu

Ryan Black: rwblack@mail.uark.edu

Rutgers Center for Transportation Safety, Security, and Risk

Henry Mayer (PI): hmayer@ejb.rutgers.edu

Michael Greenberg: mrg@ejb.rutgers.edu

Jennifer Rovito: jrovito@ejb.rutgers.edu

Matt Campo: mcampo@eden.rutgers.edu