



MIT Center for Transportation & Logistics

The National Center for Secure and Resilient Maritime Commerce

CSR Port Resilience Report



James Rice – MIT CTL

Kai Trepte – MIT CTL

Matt Mattingley – The Mattingley Group



CSR – A Department of Homeland Security National Center of Excellence for Port Security



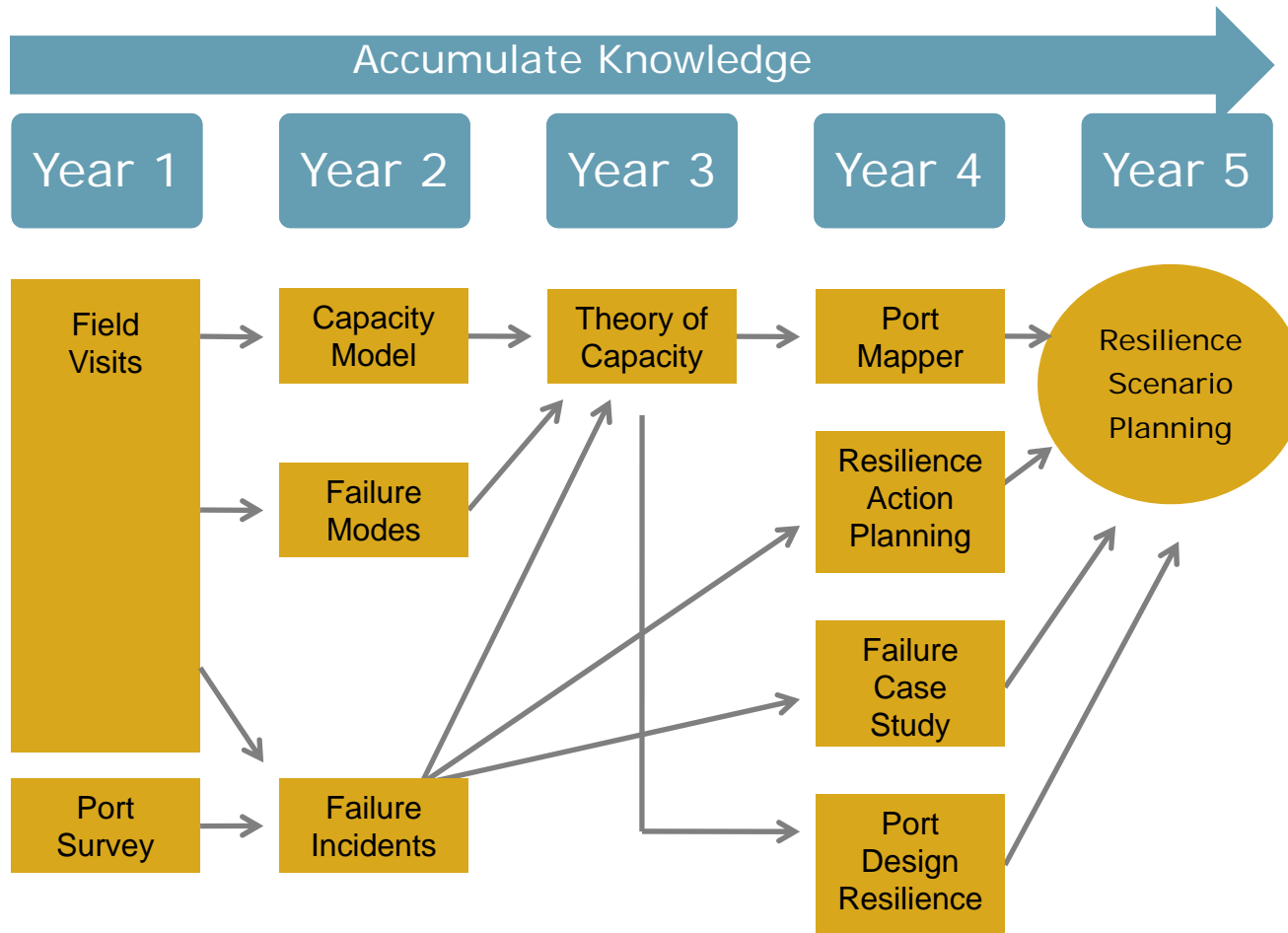
CSR Port Resilience Report

James Rice
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Agenda

- Research timeline (How we got here)
- Our latest work (Portmapper)
- How it works
- Scenarios of how it can be used (Today)
 - Food and Farm
 - Explosives
 - Disruption at PoLA (containers)
- Possible Future Development
 - Scenarios integrating FAF
- Questions

Research Timeline



Year 3 Summary and Year 4 Plans

- Year 3 Summary Highlights
 - Port Resilience Survey – Structural Equation Modeling
 - Port Capacity Study/Model updated with 2008-2009 data
 - Framework for Port Capacity Analysis
 - Ocean conveyance/Port Delay Study (contin thru Year 4)
- Year 4 Plan Highlights
 - Port Mapper & Capacity Study Scenarios
 - Port Resilience Action List
 - Provide critical data and input to modeling effort
 - Port Case Study Database – add Sendai disaster
 - Field visits to inland waterways (Port of Catoosa +)

Most recent developments

- Capacity work very insightful
 - But impact and insights not available without an analyst
 - No visceral feel for the magnitude of the data
 - E.g. Regional concentration of certain products lead to vulnerabilities – Hurricane Katrina caused \$800 MM in lost imports, raised food costs in the US by 3%*
 - E.g. Disruptions at top ports require 16% (petroleum), 26% (container), 50% (food & farm) additional capacity
- It would be useful to visually illustrate where resilience and security issues exist

To address this need we created a tool to help visualize cargo handed at US ports

MIT Port Mapper



The screenshot shows a Mozilla Firefox browser window displaying the MIT Port Mapper website. The browser's address bar shows the URL portmap.mit.edu/ApplicationOverview.htm. The page features the MIT Center for Transportation & Logistics logo and the text "MIT PORT MAPPER". A welcome message states: "Welcome to the MIT Port Mapper beta site. The Port Mapper was designed to identify domestic US ports that could possibly absorb cargo in the event of a disruption at a port. However, are there other ways that this tool could be useful? The research team has posted the Port Mapper tool online to gather input from users on how we might possibly further develop the tool." Below this is an "Application Overview" section that explains the tool's current setup: "At present, the application is set up to plot and link ports based on the commodities that they handle. The user makes two selections: - Choice of state or choice of SIC Group/SIC Family or SIC Description - Choice of all ports or top ten ports, or a specific port by name (note that once you select a specific SIC type, only those ports that handle that SIC will be displayed)". A large text box at the bottom of the screenshot contains the text: "Located at <http://portmap.mit.edu/ApplicationOverview.htm>". The browser's status bar at the bottom shows the current time and weather: "Now: 16°F Wed: 40°F Thu: 44°F".

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MIT PORT MAPPER

WELCOME TO THE MIT PORT MAPPER BETA SITE. THE PORT MAPPER WAS DESIGNED TO IDENTIFY DOMESTIC US PORTS THAT COULD POSSIBLY ABSORB CARGO IN THE EVENT OF A DISRUPTION AT A PORT. HOWEVER, ARE THERE OTHER WAYS THAT THIS TOOL COULD BE USEFUL? THE RESEARCH TEAM HAS POSTED THE PORT MAPPER TOOL ONLINE TO GATHER INPUT FROM USERS ON HOW WE MIGHT POSSIBLY FURTHER DEVELOP THE TOOL.

Application Overview

At present, the application is set up to plot and link ports based on the commodities that they handle. The user makes two selections:

- Choice of state or choice of SIC Group/SIC Family or SIC Description
- Choice of all ports or top ten ports, or a specific port by name (note that once you select a specific SIC type, only those ports that handle that SIC will be displayed)

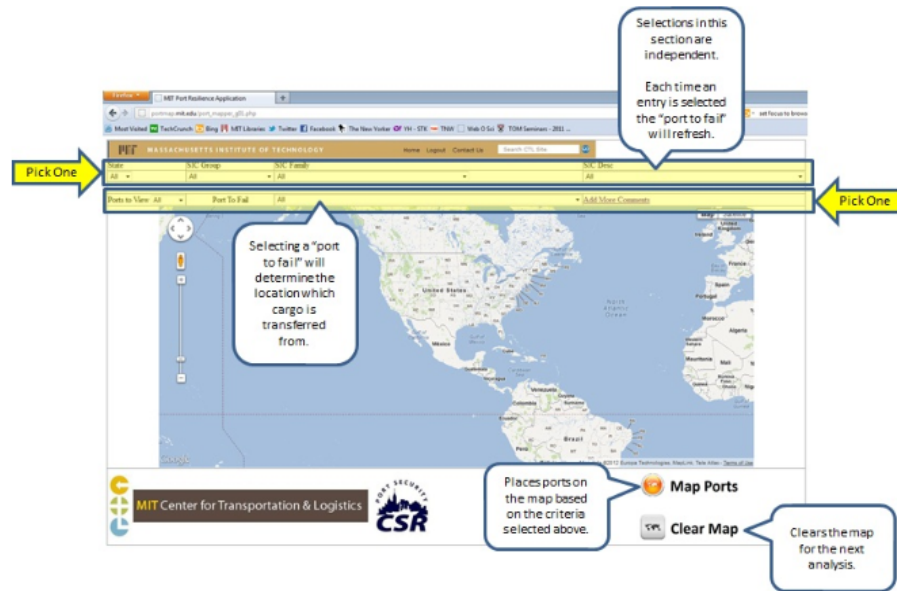
user should refresh the page.

The user is invited to provide additional comments by clicking on Additional

Now: 16°F Wed: 40°F Thu: 44°F

We want feedback & input

again after you use the tool. Once you provide your input below, click on Submit Comments... and you will be redirected to the application page.



How could this application help you?

(Required)

What would you like to see this application do?

(Required)

Name:

(Required)

Email:

(Required)

Submit Comments And Run Application

Portmapper Option: SIC Group

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State	SIC Group	SIC Family	SIC Desc
All	All	All	All
Add More Comments			

Ports to View All	<div style="border: 1px solid black; background-color: white; padding: 2px;"> All All Other Chemicals Coal Container Food and Farm Products Manufactured Equipment Manufactured Goods Petroleum Raw Materials Waste and Scrap </div>	
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Portmapper Option: SIC Description

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GO

State	SIC Group	SIC Family	SIC Desc
All	All	All	All

Ports to View	All
Port To Fail	All

SIC Desc

- All
- All Other - 9900 Unknown or NEC
- Chemicals - 3110 Nitrogenous Fert.
- Chemicals - 3120 Phosphatic Fert.
- Chemicals - 3130 Potassic Fert.
- Chemicals - 3190 Fert. & Mixes NEC
- Chemicals - 3211 Acyclic Hydrocarbons
- Chemicals - 3212 Benzene & Toluene
- Chemicals - 3219 Other Hydrocarbons
- Chemicals - 3220 Alcohols
- Chemicals - 3230 Carboxylic Acids
- Chemicals - 3240 Nitrogen Func. Comp.
- Chemicals - 3250 Organo - Inorg. Comp.
- Chemicals - 3260 Organic Comp. NEC
- Chemicals - 3271 Sulphur (Liquid)
- Chemicals - 3272 Sulphuric Acid
- Chemicals - 3273 Ammonia
- Chemicals - 3274 Sodium Hydroxide
- Chemicals - 3275 Inorg. Elem., Oxides, & Halogen Salts
- Chemicals - 3276 Metallic Salts

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Map Ports

Clear Map

Portmapper Option: Port to Fail

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GO

State	SIC Group	SIC Family	SIC Desc
All	All	All	All

Ports to View All	Port To Fail	<div style="background-color: #e0e0e0; padding: 2px; border-bottom: 1px solid #ccc;">All</div> <div style="padding: 2px;"> <ul style="list-style-type: none"> PORT OF SOUTH LOUISIANA, LA HOUSTON SHIP CHANNEL, TX SUMMARY OF TRAFFIC TOTAL WATERBORNE COMMERCE OF THE PORT OF NEW YORK, NY LONG BEACH HARBOR, CA CORPUS CHRISTI, TX BEAUMONT, TX PORT OF NEW ORLEANS, LA LOS ANGELES HARBOR, CA MOBILE HARBOR, AL LAKE CHARLES, LA PORT OF PLAQUEMINES, LA HAMPTON ROADS, VA PORT OF BATON ROUGE, LA TEXAS CITY, TX TAMPA HARBOR, FL NORFOLK HARBOR, VA BALTIMORE HARBOR AND CHANNELS, MD PORT OF PITTSBURGH, PA DULUTH-SUPERIOR HARBOR, MN AND WI </div>	Add More Comments
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The map displays the North Pacific Ocean on the left and the North Atlantic Ocean on the right. Countries shown include the United Kingdom, Ireland, France, Spain, Portugal, Morocco, Algeria, Mauritania, Mali, Guinea, Burkina Faso, Ghana, Nigeria, Venezuela, Colombia, Guyana, Suriname, Ecuador, Peru, Bolivia, and Brazil. A list of port abbreviations (RN, PB, PE, AL, SE) is visible near the coast of South America.

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Map Ports

Clear Map

Portmapper Option: All or Top 10 Ports

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State	SIC Group	SIC Family	SIC Desc
All	All	All	All

Ports to View: All | Port To Fail: All | [Add More Comments](#)

Map | Satellite

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Map Ports Clear Map

Use of Portmapper

- Uses publicly available data coupled with data collected through CSR project to plot ports on map
- Allows for the selection of:
 - States
 - Commodities
 - Ports
- Currently only considers data from ACoE, continental US (excluding islands, Alaska)

To demonstrate potential uses we offer several scenarios of possible application

Scenario: Food and Farm Ports

All Food and Farm ports

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State	SIC Group	SIC Family	SIC Desc
All	Food and Farm Products	All	All

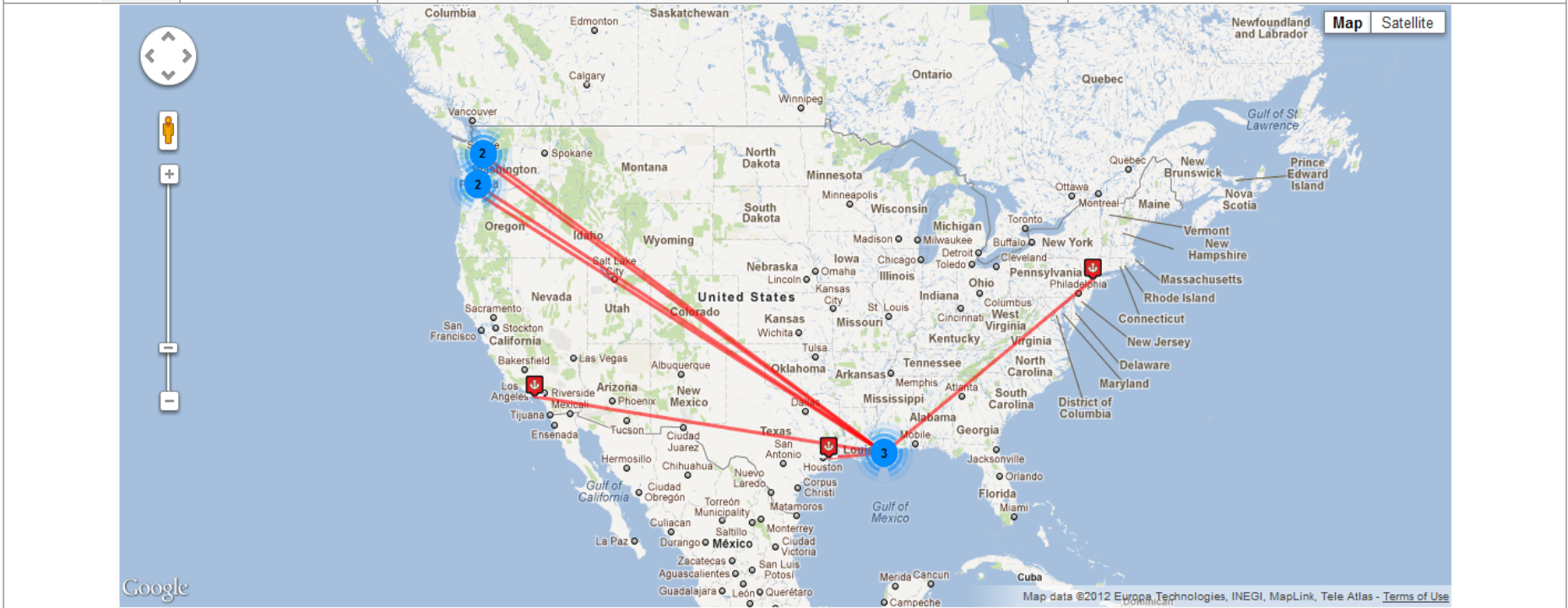
Ports to View	Port To Fail	All	Add More Comments
All			

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Top 10 F&F Ports

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State	SIC Group	SIC Family	SIC Desc
All	Food and Farm Products	All	All
Ports to View: Top 10 Port To Fail: All Add More Comments			





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Map Ports


Clear Map

Observations

- High concentration of F&F ports in one region
 - List shows top three in NO/So La region
- Long distances to the other top 10 ports which have major F&F capacity
 - Five ports of the remaining top 10 require Panama Canal crossing or cross-country rail/truck movements
- Analysis:
 - Significant vulnerability at PoNO/So La
 - Consider options to spread F&F cargo handling
 - Consider options for movement of F&F in the event of a disruption

Scenario: Ports handling explosives

All ports handling explosives

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State	SIC Group	SIC Family	SIC Desc
All ▾	All ▾	All ▾	Chemicals - 3293 Explosives ▾

Ports to View	Port To Fail		Add More Comments
All ▾		All	

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Map Ports

Clear Map

Top 10 ports handling explosives

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State	SIC Group	SIC Family	SIC Desc
All	All	All	Chemicals - 3293 Explosives

Ports to View Top 10	Port To Fail	All All LOS ANGELES HARBOR, CA LONG BEACH HARBOR, CA SEATTLE HARBOR, WA SUMMARY OF TRAFFIC TOTAL WATERBORNE COMMERCE OF THE PORT OF NEW YORK, NY TACOMA HARBOR, WA WILMINGTON, NC CHARLESTON HARBOR, SC OAKLAND HARBOR, CA SAVANNAH HARBOR, GA PORT OF PORTLAND, OR	Add More Comments
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Map Ports

Clear Map

Top 10 ports handling explosives

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State	SIC Group	SIC Family	SIC Desc
All ▾	All ▾	All ▾	Chemicals - 3293 Explosives ▾

Ports to View	Port To Fail	All	Add More Comments
Top 10 ▾			

Map Satellite

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Map Ports

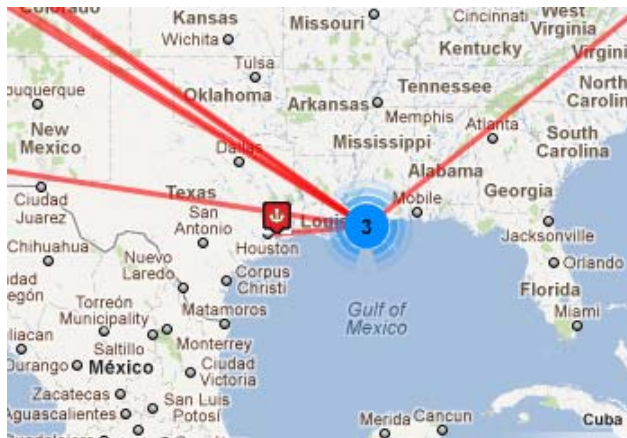
Clear Map

Observations

- Majority of ports handling explosive appear to be on east coast
 - Somewhat balanced spread of the top 10; 6 on west coast and 4 on east coast
- Long distances to the other top 10 ports which have major explosives capacity
- Analysis:
 - What is the tradeoff between constraints/investment in special explosives handling processes and need for cargo handling ports?
 - Does it make sense to have explosives handled in ports that are otherwise already highly vulnerable? E.g. Port of New Orleans?

Food & Farm and Explosives vulnerability

- Top Food & Farm ports handle explosives
- Amount of explosives in these ports is relatively small
- A port closure due to an **explosives incident** closes 3 of the Top 10 Food & Farm ports causing damage to exports and the national economy



Scenario: Disruption at Port of LA

All Container Ports in US

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State	SIC Group	SIC Family	SIC Desc
All ▾	Container ▾	All ▾	All ▾

Ports to View All ▾	Port To Fail LOS ANGELES HARBOR, CA ▾	Add More Comments
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Map Ports

Clear Map

Top 10 Container Ports in US

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State	SIC Group	SIC Family	SIC Desc
All ▼	Container ▼	All ▼	All ▼

Ports to View	Port To Fail		
All ▼		<div style="border: 1px solid #ccc; padding: 5px;"> <div style="background-color: #e0e0e0; padding: 2px;">All</div> <div style="background-color: #007bff; color: white; padding: 2px;">All</div> <div style="padding: 2px;">LOS ANGELES HARBOR, CA</div> <div style="padding: 2px;">LONG BEACH HARBOR, CA</div> <div style="padding: 2px;">SUMMARY OF TRAFFIC TOTAL WATERBORNE COMMERCE OF THE PORT OF NEW YORK, NY</div> <div style="padding: 2px;">SAVANNAH HARBOR, GA</div> <div style="padding: 2px;">OAKLAND HARBOR, CA</div> <div style="padding: 2px;">NORFOLK HARBOR, VA</div> <div style="padding: 2px;">TACOMA HARBOR, WA</div> <div style="padding: 2px;">SEATTLE HARBOR, WA</div> <div style="padding: 2px;">HOUSTON SHIP CHANNEL, TX</div> <div style="padding: 2px;">CHARLESTON HARBOR, SC</div> <div style="padding: 2px;">MIAMI HARBOR, FL</div> <div style="padding: 2px;">PORT EVERGLADES HARBOR, FL</div> <div style="padding: 2px;">JACKSONVILLE HARBOR, FL</div> <div style="padding: 2px;">BALTIMORE HARBOR AND CHANNELS, MD</div> <div style="padding: 2px;">PORT OF NEW ORLEANS, LA</div> <div style="padding: 2px;">PORT OF PORTLAND, OR</div> <div style="padding: 2px;">WILMINGTON HARBOR, DE</div> <div style="padding: 2px;">PORT OF BOSTON, MA</div> <div style="padding: 2px;">GULFPORT HARBOR, MS</div> </div>	Add More Comments

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Map Ports

Clear Map

Top 10 Container Ports in US

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State	SIC Group	SIC Family	SIC Desc
All ▾	Container ▾	All ▾	All ▾

Ports to View Top 10 ▾	Port To Fail <input style="width: 90%;" type="text" value="LOS ANGELES HARBOR, CA"/>	Add More Comments
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Map Ports

Clear Map

Observations

- Top container ports – LA, then LB, then NY/NJ, then Savannah
- Majority of larger ports handling containers are on east coast
- Long distances to the other top 10 ports which have major container capacity
- Analysis:
 - Vessels rerouted to east coast may be too big for Panama Canal
 - Possible and likely for cargo to offload in Mexico or Canada (Prince Rupert) – but at what cost to US economy in terms of lost port trade, additional delays and costs?

Possible Future Developments

Possible Future Developments

- Integrate Port Mapper with other sources of data for comprehensive assessment of cargo flows: specifically Freight Analysis Framework (FAF) data
 - Look at aggregate policy planning tool
 - Look at macro trends and issues
 - Look at overall port system resilience issue
 - Focus application on ports (port-specific data)
 - Look at individual port planning tool
 - Look at marketing initiatives to capture additional cargo volume
 - Look at individual port resilience issues
-

Scenario Integrating FAF: Impact of Disruption on Freight Flows

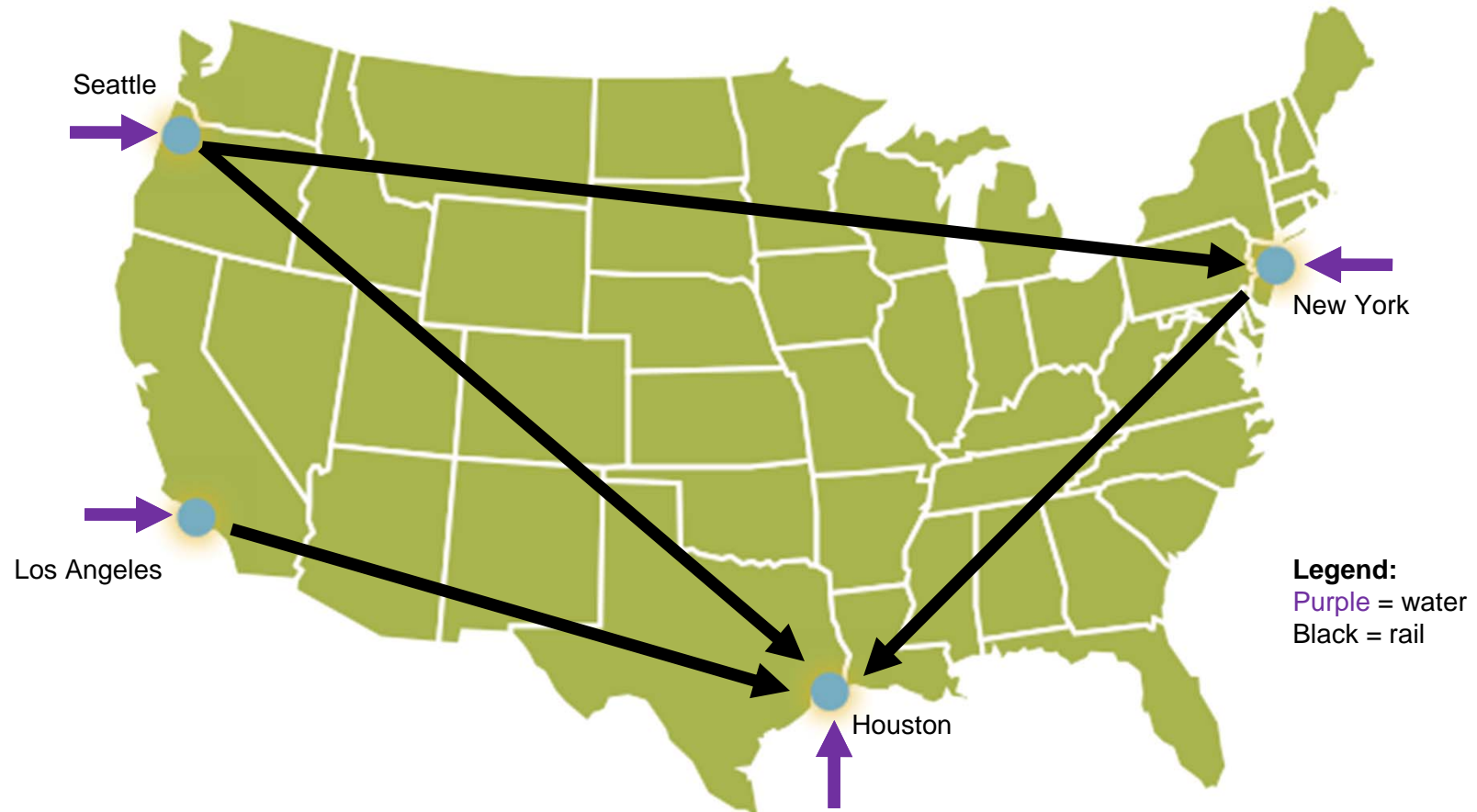
What is FAF data

- Freight analysis framework (FAF) compiled by Department of transportation (http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/faf3/netwkdbflow/index.htm)
- Model of commodity movements in United States
- Captures commodity, mode, state and use for 2007, 2009 with a forecast through 2040
- Provides the potential to link port data with transport data to develop scenario planning tool for policy makers and port managers

Linking port data with FAF data

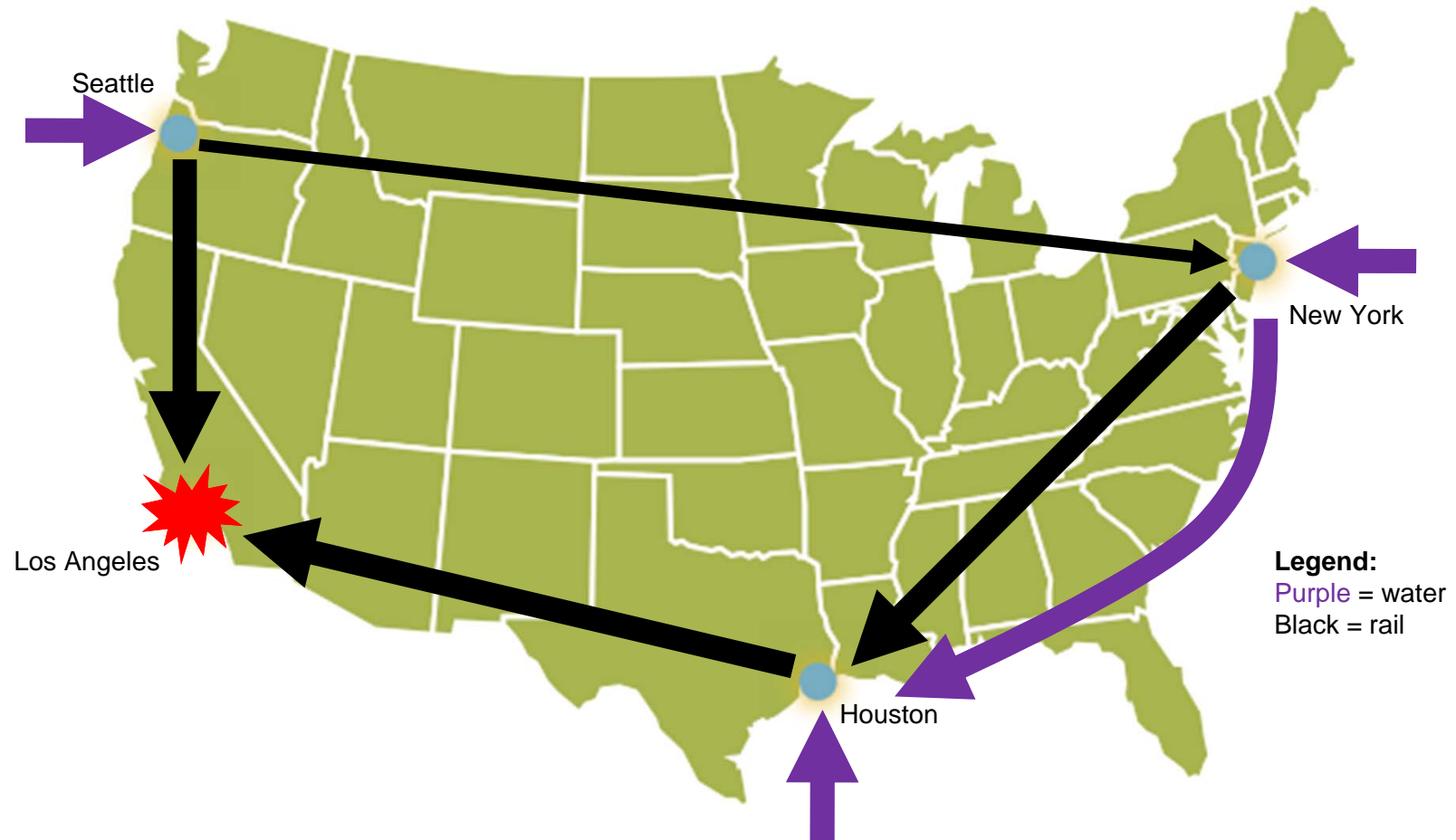
- Develop mapping of commodity flows in the United States
- Understand interaction between ports and transportation
- Develop methodology to allocate resources among ports to maximize system resilience
- Create regional resilience plans and checklists for handling port failures when they occur

Inbound Container Flows into/out of Ports



Note: only rail and waterborne flows considered

A disruption changes flows at ports & between



Note: only rail and waterborne flows considered

FAF Data Enables Resilience Scenario Planning

- Consider change of flows with disruption at PoLA/LB
- Integrating FAF may highlight changes in flows:
 - Additional cargo flows via vessels into Seattle
 - Additional cargo flows via rail into LA/LB from Seattle, Houston
 - Additional cargo flows via vessels into Houston, New York
 - Additional cargo flows via rail and vessel into Houston
- What infrastructure investments are necessary to accommodate potential shifts in flow?
 - Intermodal?
 - Infrastructure at ports?

Questions

- Future development depends upon potential user
 - Potential users: Planners, analysts charged with considering infrastructure investments, resilience analysis and planning for system resilience. Others?
 - What are the most important developments to pursue?
- Lots of potential enhancements
 - Port capacity look up, distance calculation, integrate FAF....
- Online tool solicits user feedback
 - <http://portmap.mit.edu/ApplicationOverview.htm>
 - Would you be willing to speak with our developer about the application?
- Thank you – Jim Rice, Kai Trepte, Matt Mattingley
 - jrice@mit.edu, 617.258.8584