Innovative Technologies for a Resilient Marine Transportation System

Transportation Research Board

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U.S.ARMY

US Army Corps of Engineers
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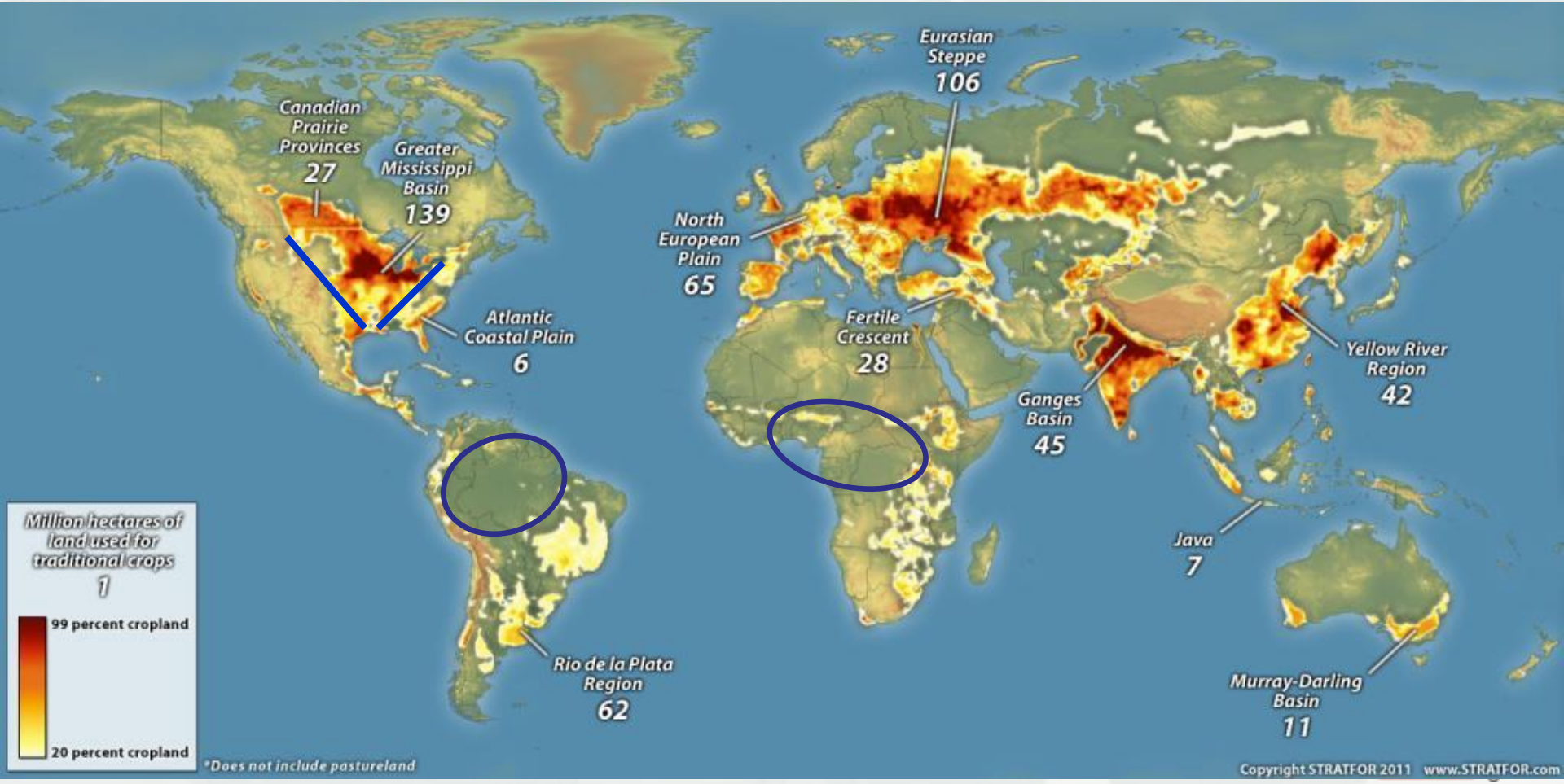
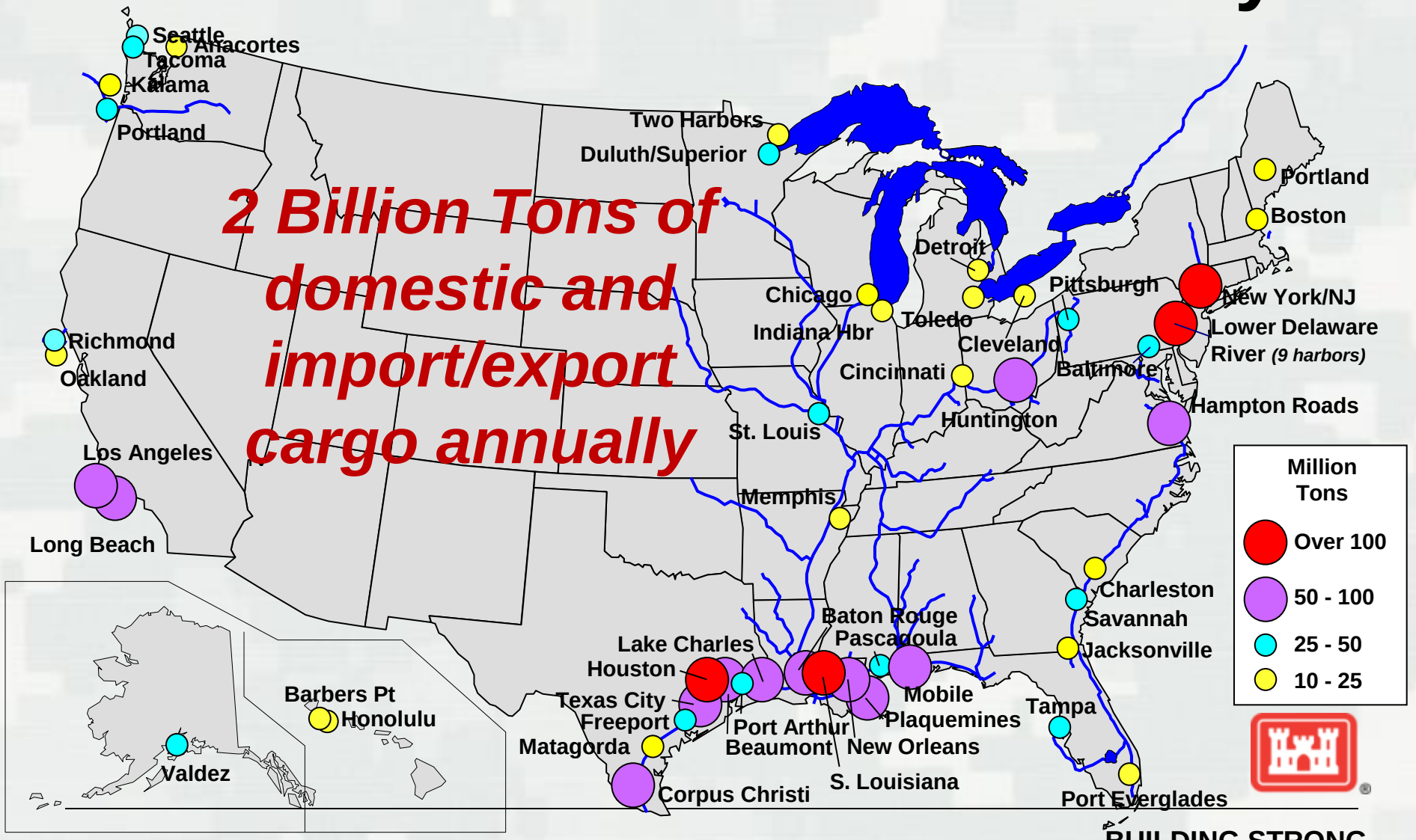
Overview

- Importance of MTS
- Fiscal and Structural Challenges
- Resilience of MTS
- Innovative Technologies that Enhance MTS Resiliency
- Gaps and Future Challenges

Global Agricultural Zones and the Basis for US Greatness



U.S. Ports and Inland Waterways: Vital to our National Economy



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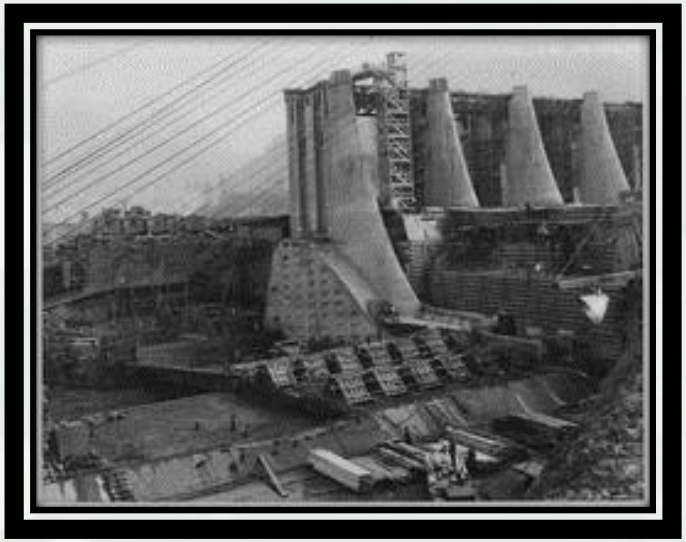
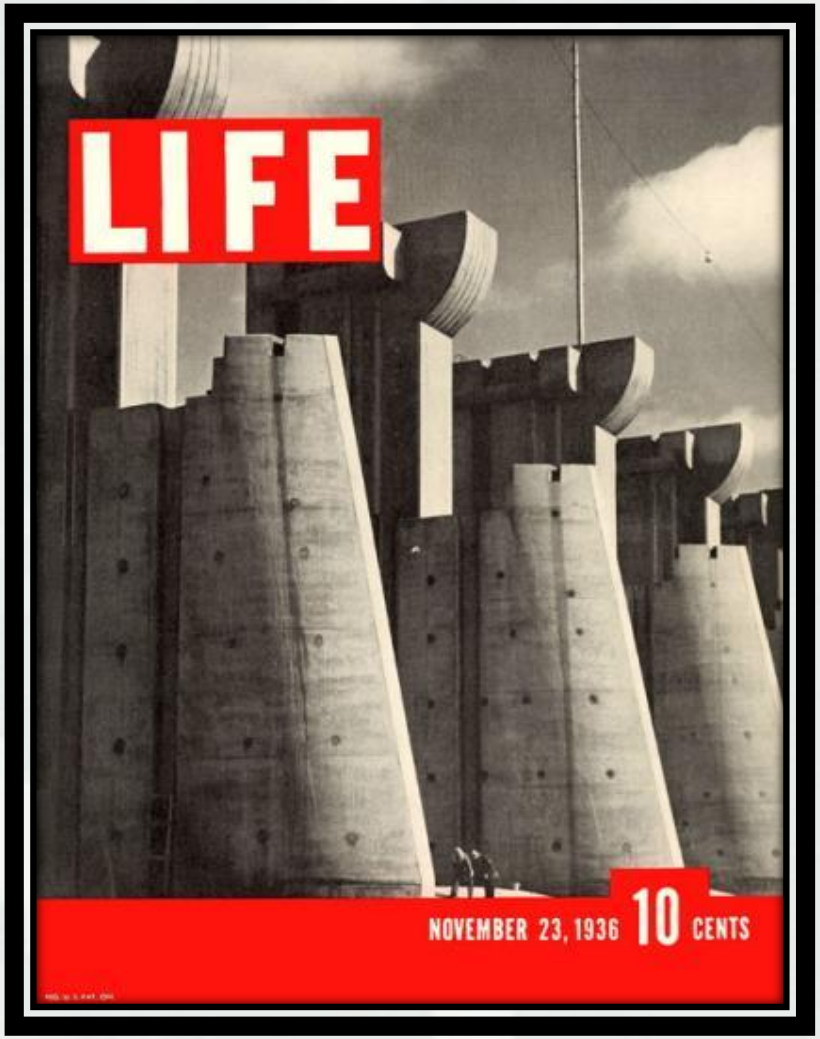
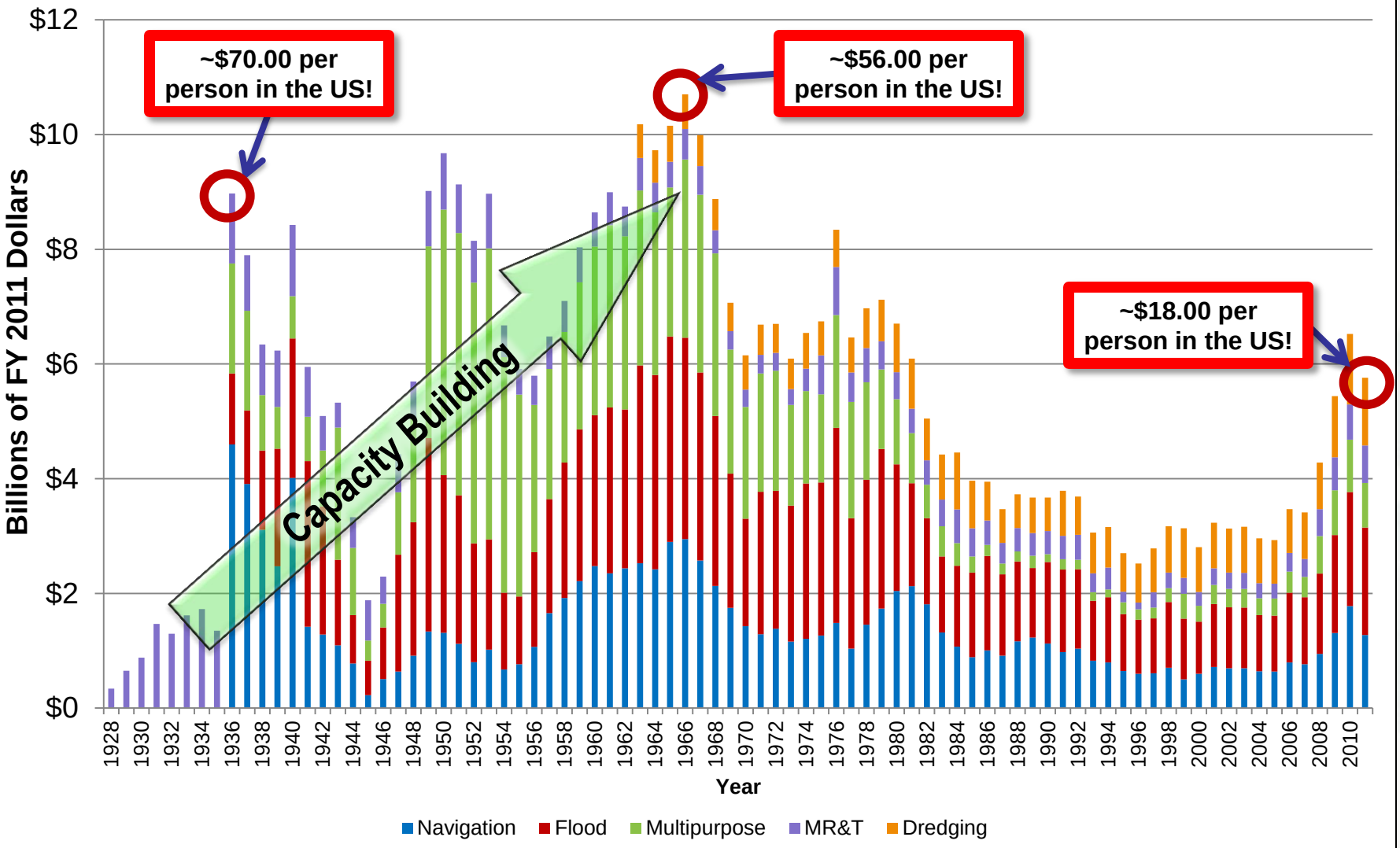
The 20th Century "Golden Age" of Infrastructure Construction

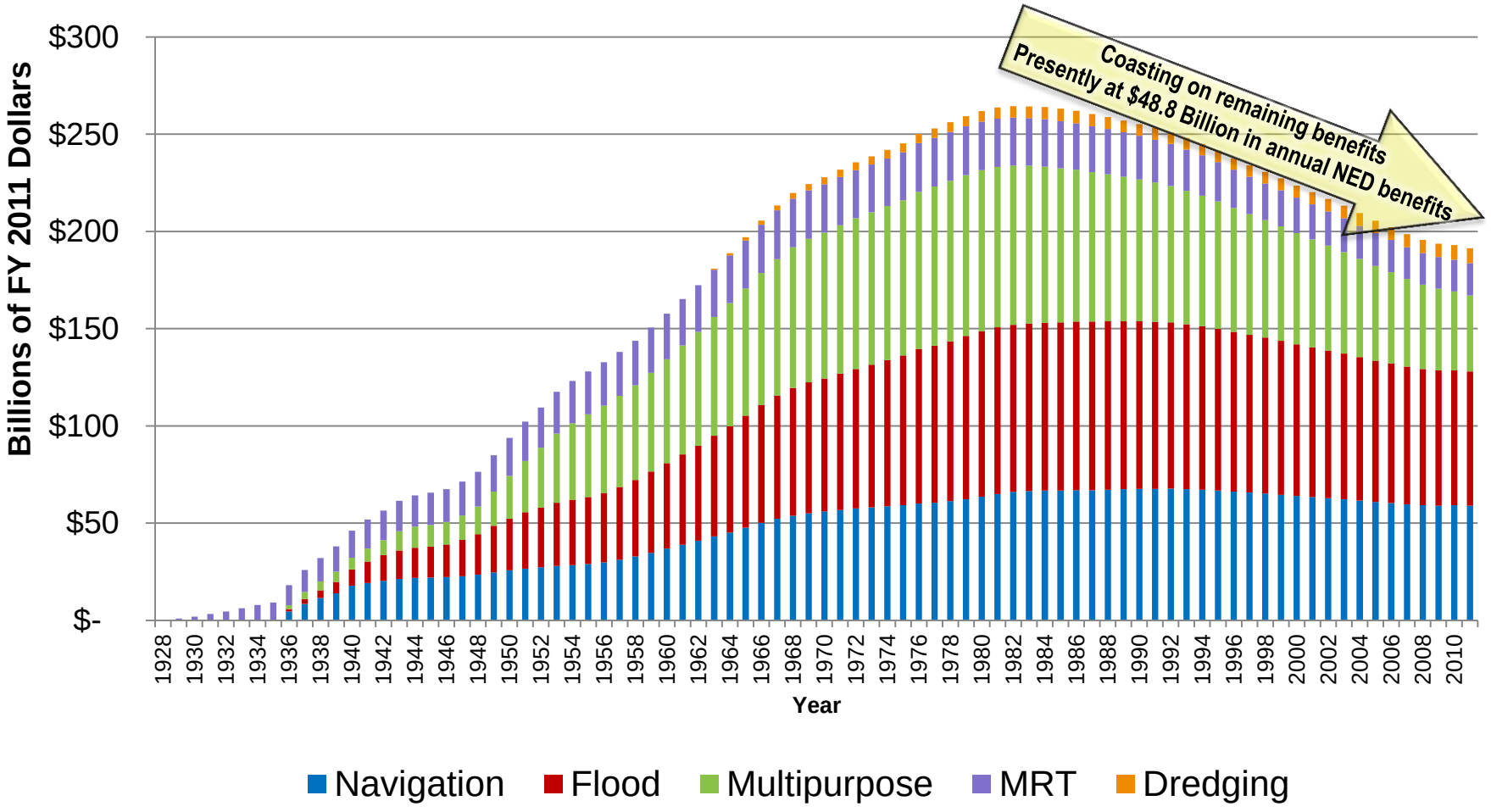




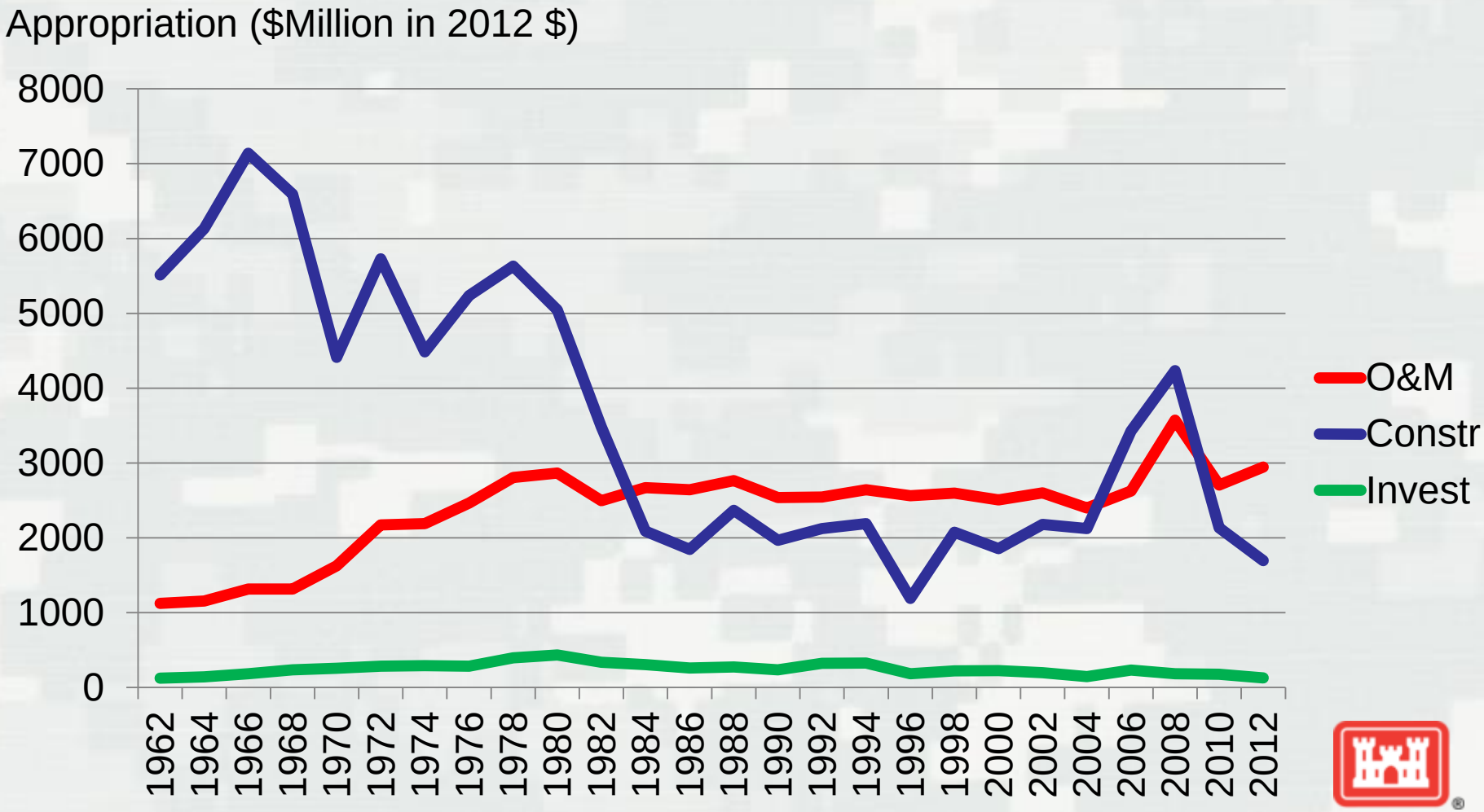
Historical Investments by USACE Functional Category 1928 to 2011



USACE Capital Stock Value by Functional Category, 1928 to 2011

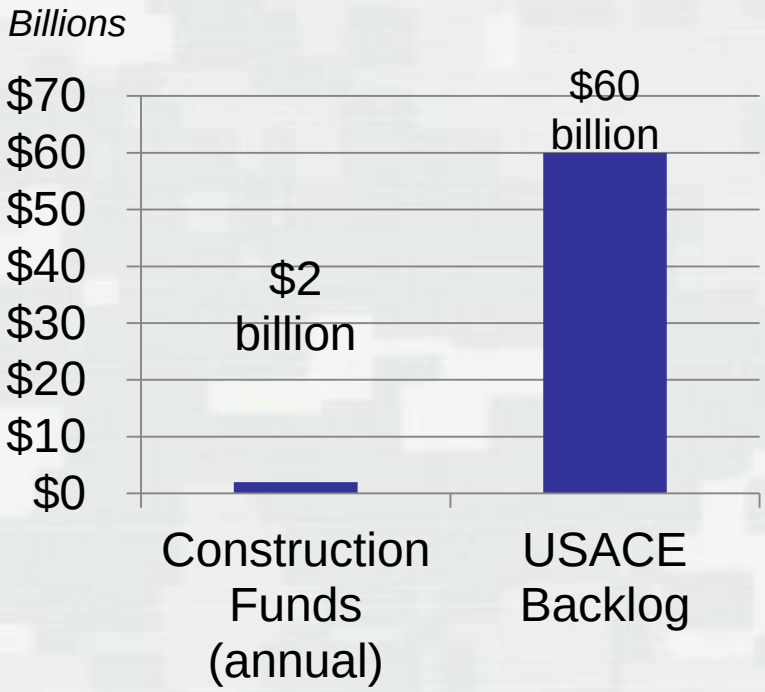


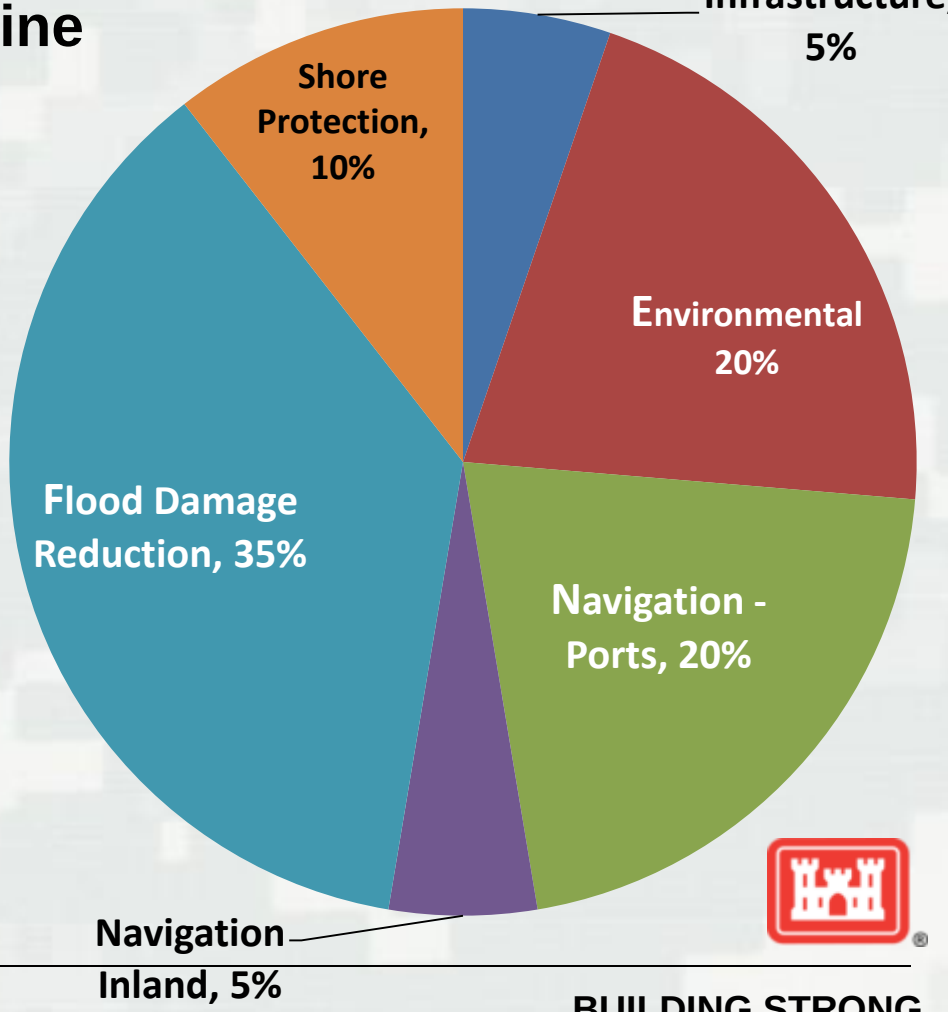
Long Term Civil Works Funding Trends: Changing the Character of the Corps



USACE Civil Works Construction Backlog

Backlog of Congressionally Authorized Projects by Business Line





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Transforming Civil Works

Importance of MTS

- MTS contributes tremendously to US Economy
  - In 2006: $2 Trillion, 14% of GDP, 8 Million jobs
- World-wide disruptions can affect U.S. ports tremendously
  - 1995: Kobe, Japan earthquake caused US $50-100 B
  - 2002: 11-day Labor Strike on the west coast cost $2 Bill/day
  - 2005: Hurricane Katrina reduced U.S. vessels by 50%
  - 2008: Hurricanes Gustav & Ike U.S. $322 M/day
  - 2008: Miss. River Oil spill on cost $275K / Day
  - 2012: Super Storm Sandy

Oil skimmers on Miss. River

Resilience of the MTS

A ***resilient*** Marine Transportation System **prepares**, **resists**, **recovers**, and **adapts** to successfully function under the stress of disturbances.

Successful Functioning of the MTS means **safely** transporting required **tonnage** between ports in least **time** at least **cost**

Disturbances can be **natural** (storms, floods, sea level rise earthquakes) **anthropogenic** (oil spill, fuel embargo, terrorism)

How is the MTS Resilient?

Prepare:

Electronic Navigation Charts:
Rapid & accurate channel surveys

Dredging:

- Over-depth dredging anticipating future shoaling
- Preparing for post-Panamax vessels
- Placement of sediment to buffer against future storms

How is the MTS Resilient?

Resist:

Locks and Dams:

- Multiple Lock chambers
- Improved Materials / Sensors

Coastal Jetties:

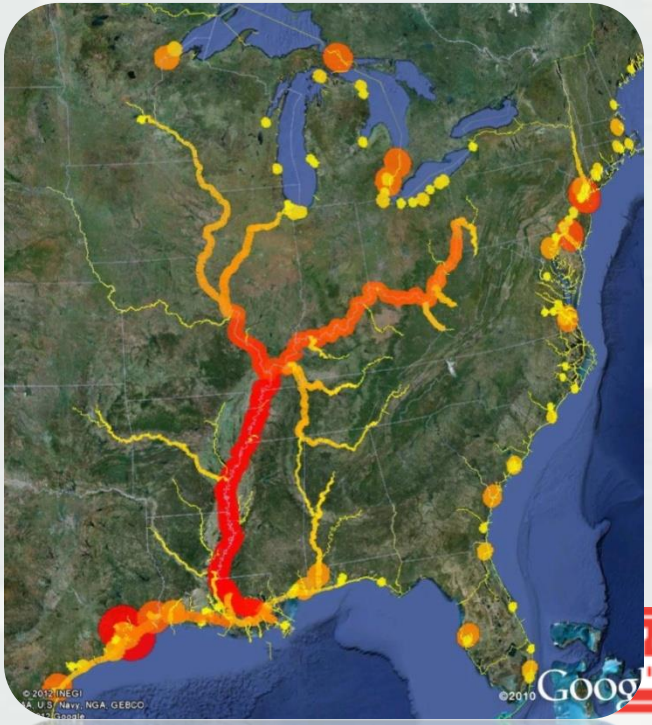
- Reduce navigation channel infilling
- Improve navigability by reducing waves, currents

How is the MTS Resilient?

Recover:

Emergency Dredging Operations: Restore navigable depth

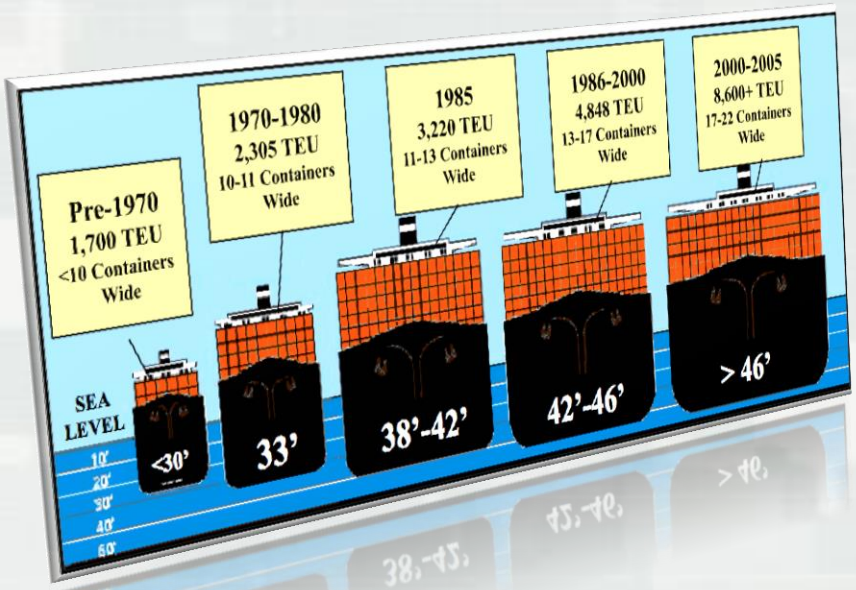
Alternative Ports: Facilitate functioning during downtime



How is the MTS Resilient?

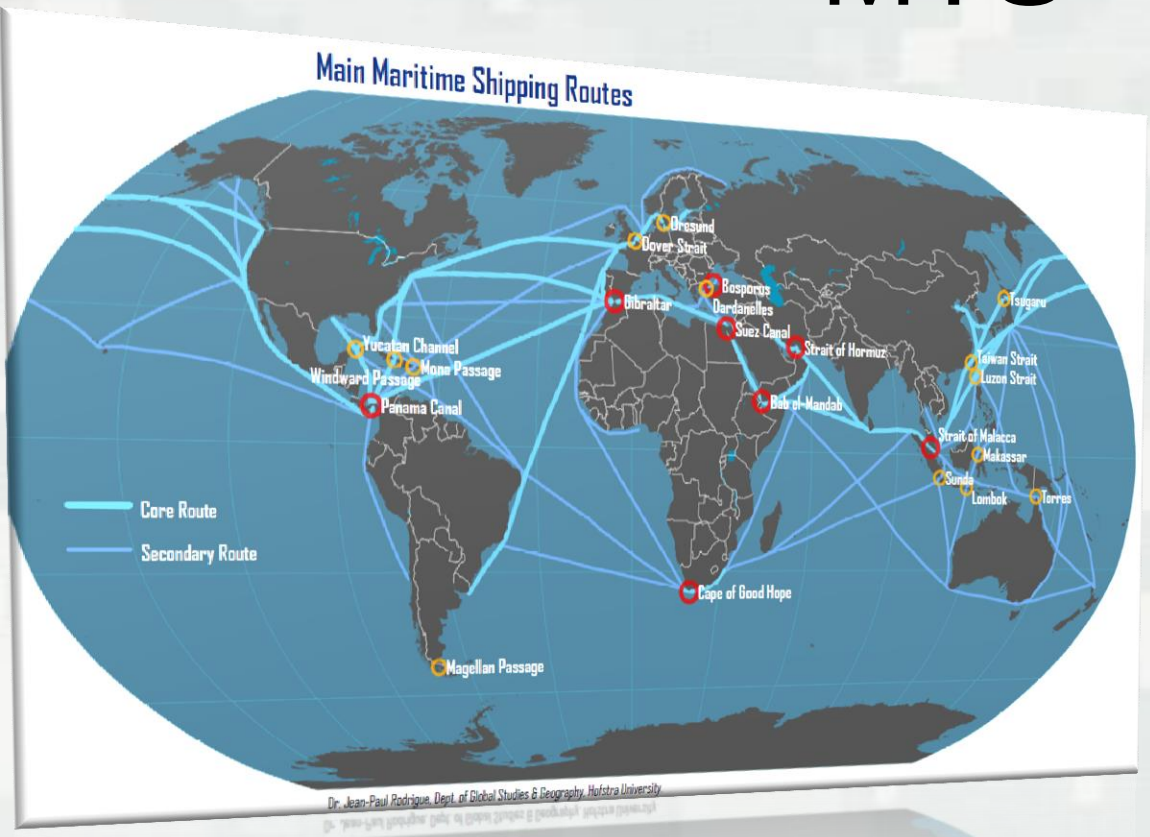
Adapt:

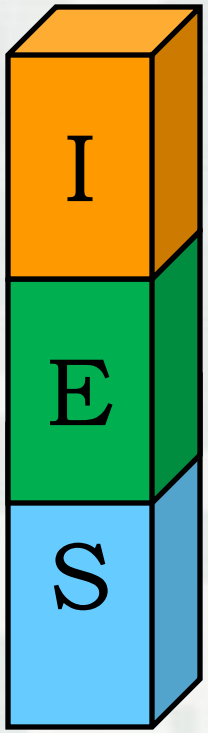
Dredging: Deepening for post-Panamax vessels



Aids to Navigation: Reposition ATON to mark safe passages

Evaluating Resiliency: Identify Critical Features of the MTS





Infrastructure

Environment

Safety and Security

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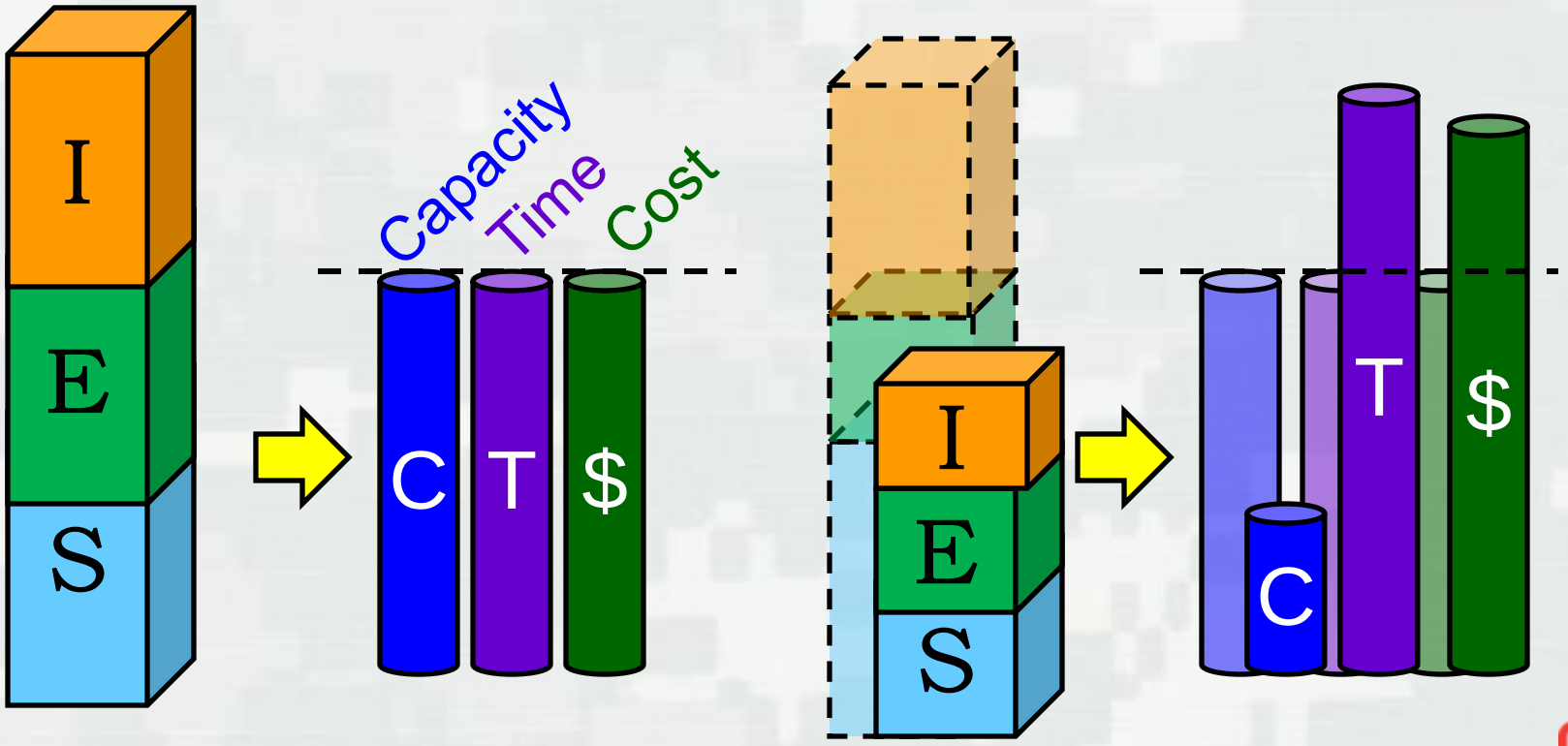
Evaluating Resiliency: Identify Performance Metrics

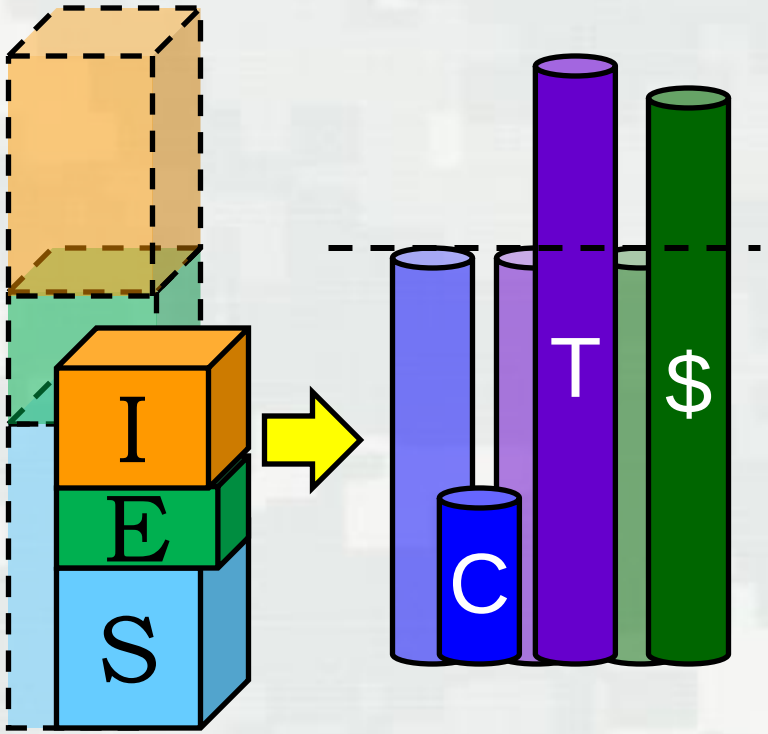
Successful Operation:

Disturbance:

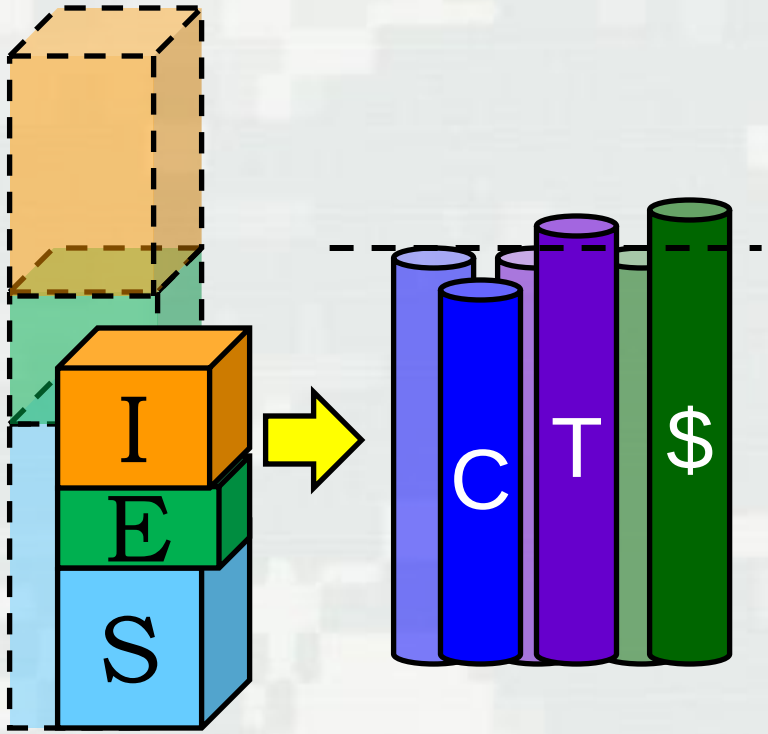


A Resilient MTS

Low Resiliency:



With Resilient Measures:



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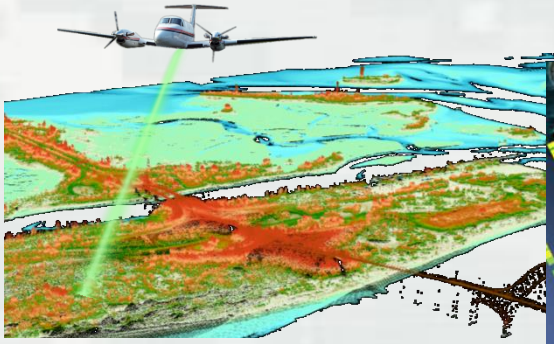
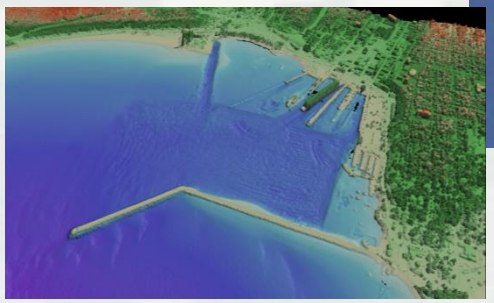
Prepare:

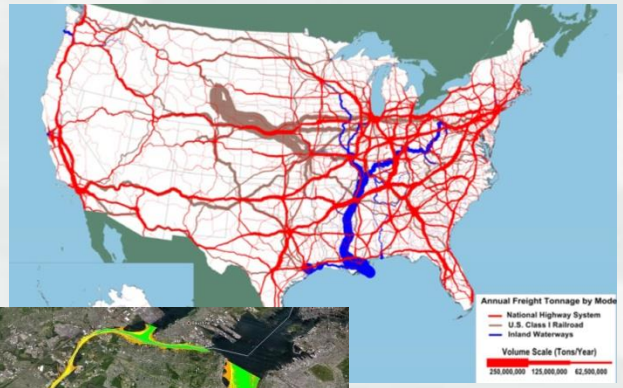
Measuring System Vulnerabilities

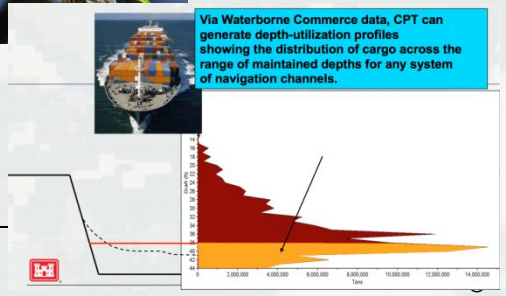


Gilgo Beach area of Jones Beach Island Post-Sandy



Monitoring System Performance

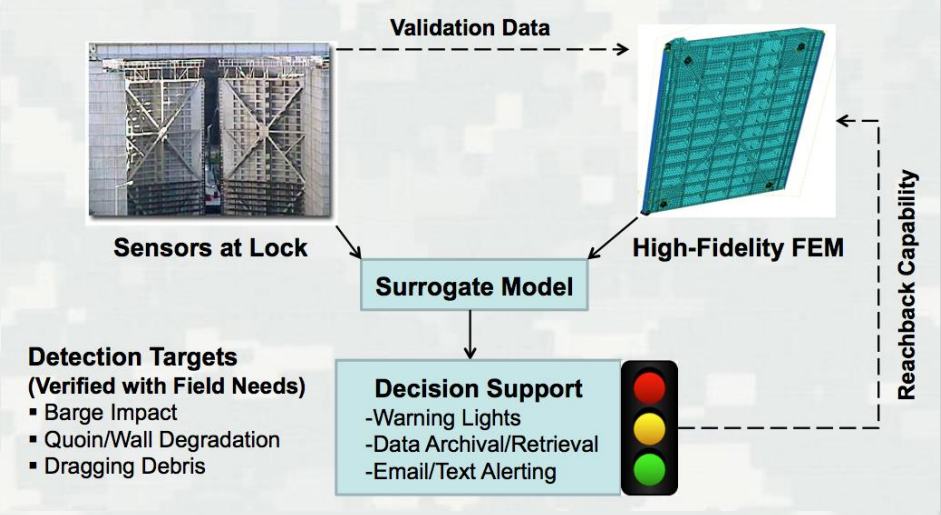




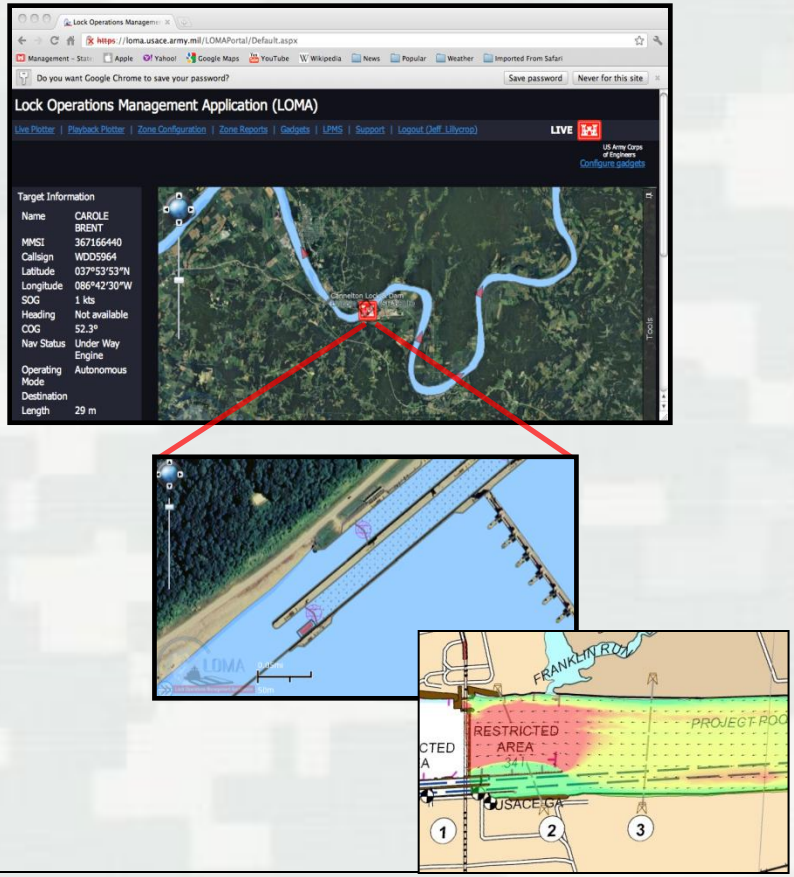
Innovative Research & Development

Resist:

Real-Time Monitoring



Situational Awareness



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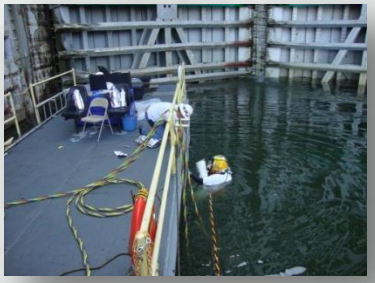
Recover:

Nearshore Dredged Berms

Entrance to Tampa Bay, FL

Innovative Materials



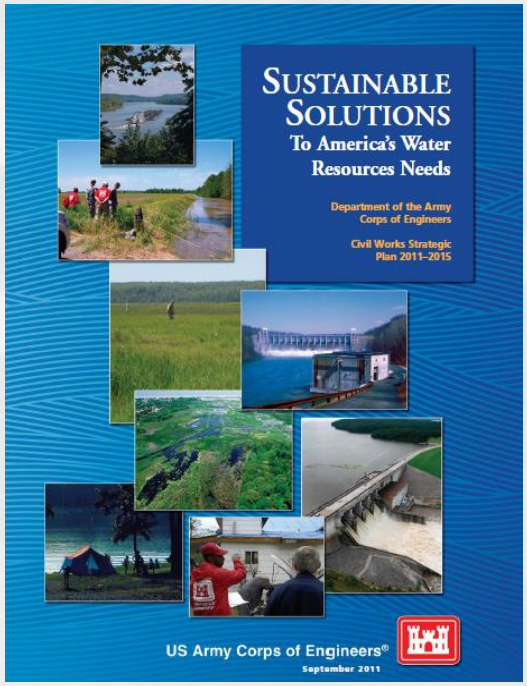
Innovative Research & Development

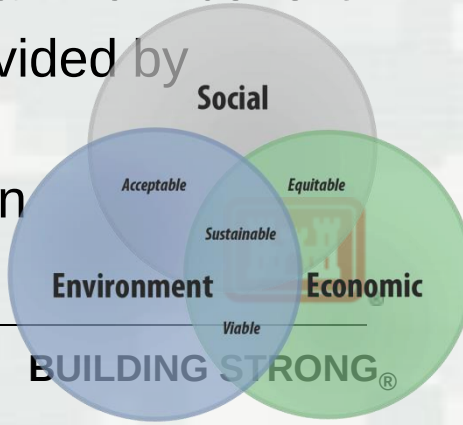
Adapt:

Engineering With Nature

…the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes.

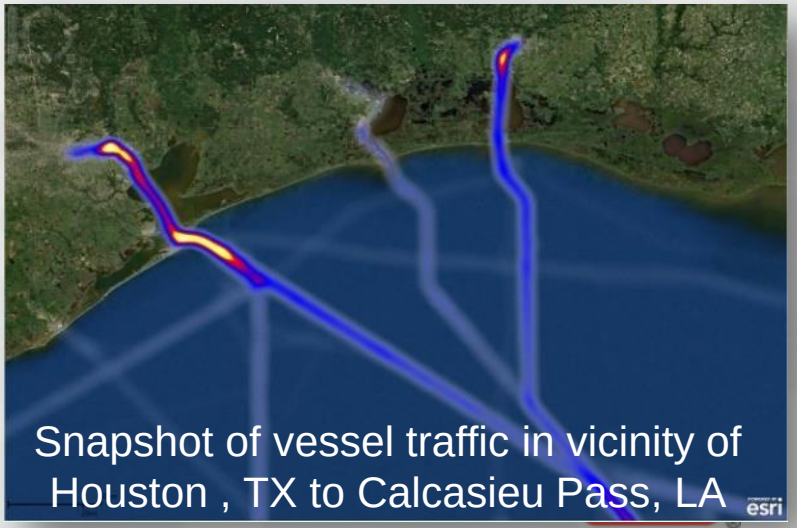
- Science and engineering that produces operational efficiencies
- Using natural process to maximum benefit
- Expanding the benefits provided by projects
- Science-based collaboration





Gaps in Innovative Technologies

- Innovative materials to achieve more robust, rapid repairs
- Novel dredging & placement capabilities
- Linkages between MTS, rail, road, air
- Systems optimization of ports, waterways, and operations
- Future of Navigation data access



Snapshot of vessel traffic in vicinity of Houston , TX to Calcasieu Pass, LA

BIG Unknowns

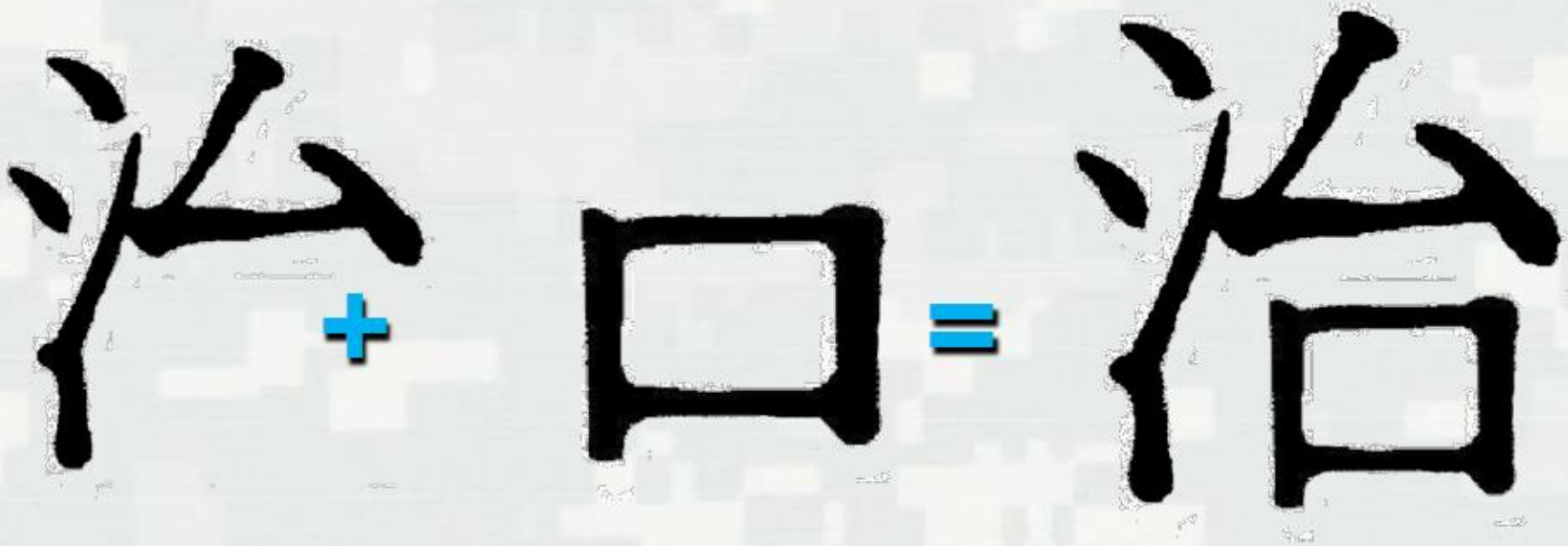
- Climate Change
  - Changes in precipitation patterns, sea level, lake level
- Arctic Routes
  - Change in transportation patterns – Suez vs. Panama Canals
- Increased Environmental Controls
  - Carbon emissions, air quality standards, dredging and placement operations
- Dredging and Placement Efficiencies
  - Substantial demands on innovative placement

The Challenge for the 3rd Biennial R&D Conference

- Identify the primary disturbances facing successful operation of the MTS now and in 20 years
- Determine priority areas for R&D and technology to enhance MTS resilience now and in 20 years
- Quantify and Track MTS Resilience Performance

Water management (and water reform) is ALWAYS political…..

Ancient Chinese Characters:



River + Dike = Political Order