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# *Transportation and Security*

**Robert E. Gallamore**

*The Transportation Center  
Northwestern University*

**Transportation Research Forum**

**Annual Meeting**

**March 7, 2005**



# *The New Challenge for Transportation – Security*

- **Understanding Threats and Vulnerabilities**
  - **Intelligence: Getting It and Sharing It**
  - **Facilities Protection –Gates, Guards, & Guns**
  - **Cyber Security**
- **Aviation Security – the Most Visible Part of DHS**
- **Special Problem of Container Security**
- **Who Pays?**

THE  
9/11  
COMMISSION  
REPORT

FINAL REPORT OF THE NATIONAL COMMISSION ON  
TERRORIST ATTACKS UPON THE UNITED STATES



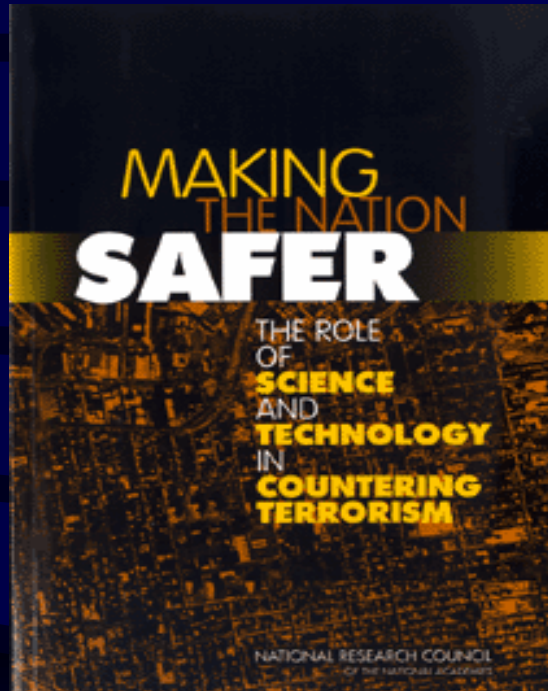
AUTHORIZED EDITION

# *9/11 Commission: Four Kinds of Failures*

- *Imagination*
  - Problem of Cultural Asymmetry
  - Understanding Commercial Aircraft Could Be a WMD
- *Policy*
  - Underestimating the Threat
  - Richard Clarke's Warnings Incisive, but . . .
- *Capabilities*
  - Trapped in Institutions of the Cold War
  - Weaknesses of Domestic Agencies – FBI, INS, FAA
- *Management*
  - Missed Opportunities to Thwart 9/11
  - Info Not Shared, Analysis Not Pooled

*“No one looked behind the curtain.”*

# *National Academies Committee on Science and Technology to Counter Terrorism*



Transportation Panel

Mortimer L. Downey, Chairman

Transportation Research Board

## *Study Focus*

- Catastrophic Terrorism
- Combination of Likelihood and Severity

## *Catastrophic Threats*

- Weapons of Mass Destruction
- Cyber Attacks
- Disruption as well as Destruction

# *GENERAL STRATEGIES AND RESEARCH NEEDS*

- **Nuclear** Control weapons & materials at source
- **Biological** Research, prepare, distribute responses
- **Chemical/Explosives** Sensors & filters
- **Info Technology** Network security/ER communications
- **Energy** SCADA controls/adaptive grid/vulnerabilities
- **Cities/Infrastructure** Emergency responder support
- **Transportation** Layered system security
- **People** Trusted spokespersons
- **Complex Systems** Data fusion/data mining/red-teaming
- **Cross-Cutting Tech** Sensors/robots/SCADAs/systems analysis
- **Deployment** Homeland Security Institute, Partnerships among feds/states/locals/universities



# TRANSPORTATION SYSTEM

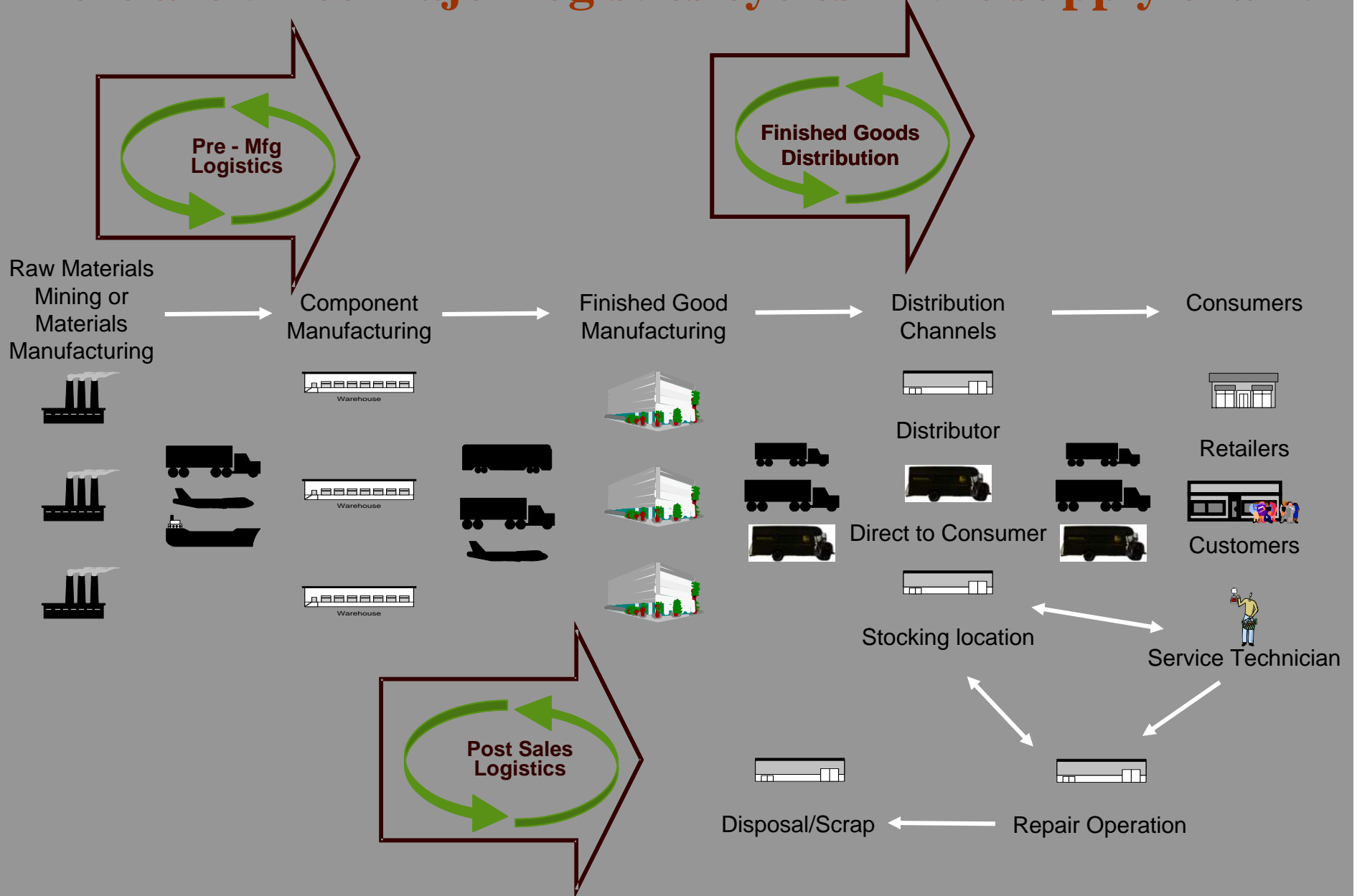
- Open and accessible—by design
- Extensive and ubiquitous
- Diverse and institutionally divided
- Global linkages to society and the economy
- Transport as target and weapon

• “Logistics Revolution” = Take Out Inventory & Redundant Facilities

# *Freight Industry Characteristics*

- Scale and Complexity of the Transport Networks
  - Diversity of Modes and Providers
  - Range of Operations
  - Multiple Points of Interconnection
  - Both Fixed Facilities and Vehicles
- Information Systems Complexity
  - Increased Dependency on Vulnerable Systems
  - Difficulty of Authenticating Users
- Public-Private Interactions
  - Multiple Security Agencies Requiring Coordination

# There are three major logistics cycles in the supply chain.



# COUNTER-TERRORISM ACTIONS

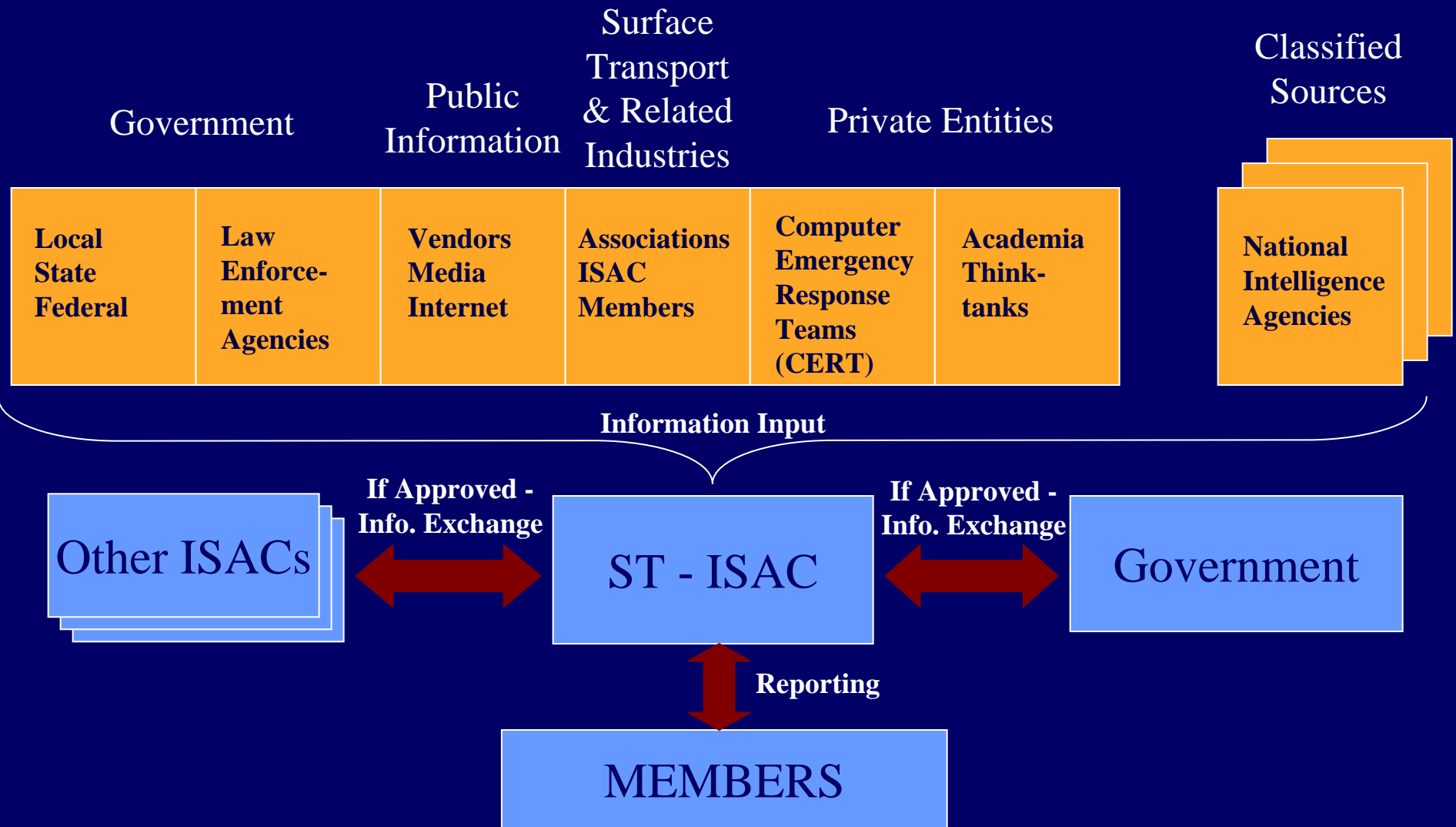
- **Predict:** Intelligence and surveillance of targets and means
- **Prioritize:** *Use risk management techniques to rank and fund counter-measures*
- **Prevent:** Disrupt networks, contain threats
- **Protect:** Harden targets, immunize populations
- **Interdict:** Frustrate attacks, manage crisis
- **Response & Recover:** Evacuate, **re-route traffic**, mitigate damage, expedite cleanup
- **Attribute:** Identify attacker to facilitate response

# OPTIMUM SECURITY SYSTEMS

- Technologically sophisticated, yet operationally feasible
- Layered—multi path, multi challenge to terrorist
- “Curtains of Mystery”
- Go beyond “gates, guards, and guns”
- Take account of economic consequences of both the terrorist action and counter-measure

*Must make difficult trade-offs based on risk analysis, cost, and benefit of specific strategies for countering terrorist plots.*

# *The Information Sharing Challenge*



# THE AVIATION SYSTEM

- High visibility even if not highest risk – passenger screening has received disproportionate funding and attention
- Steps to improve layering are underway
  - Access Controls
  - Better Screening and Sensors
  - Coordination/Systems Approach
- Better information integration can improve performance
  - Trusted shippers/travelers
  - CAPPS for screening selection
  - Human factors tools useful for supporting screeners
- [Some] Hardening still required

# THE INTERMODAL CONTAINER SYSTEM

- Excellent delivery system for international and domestic cargo—including terrorists and WMDs
- Current security is essentially perimeter-based, 2%-3% inspection
- Future needs to be collaborative among carriers, shippers, and security forces



# PUBLIC TRANSIT SYSTEMS

- Open system-difficult access control for public spaces
- Key needs—situational awareness, sensor development, operational planning
- System recovery and cleanup capacity
- Long run: Better station designs and system redundancy

# OTHER TRANSPORTATION MODES

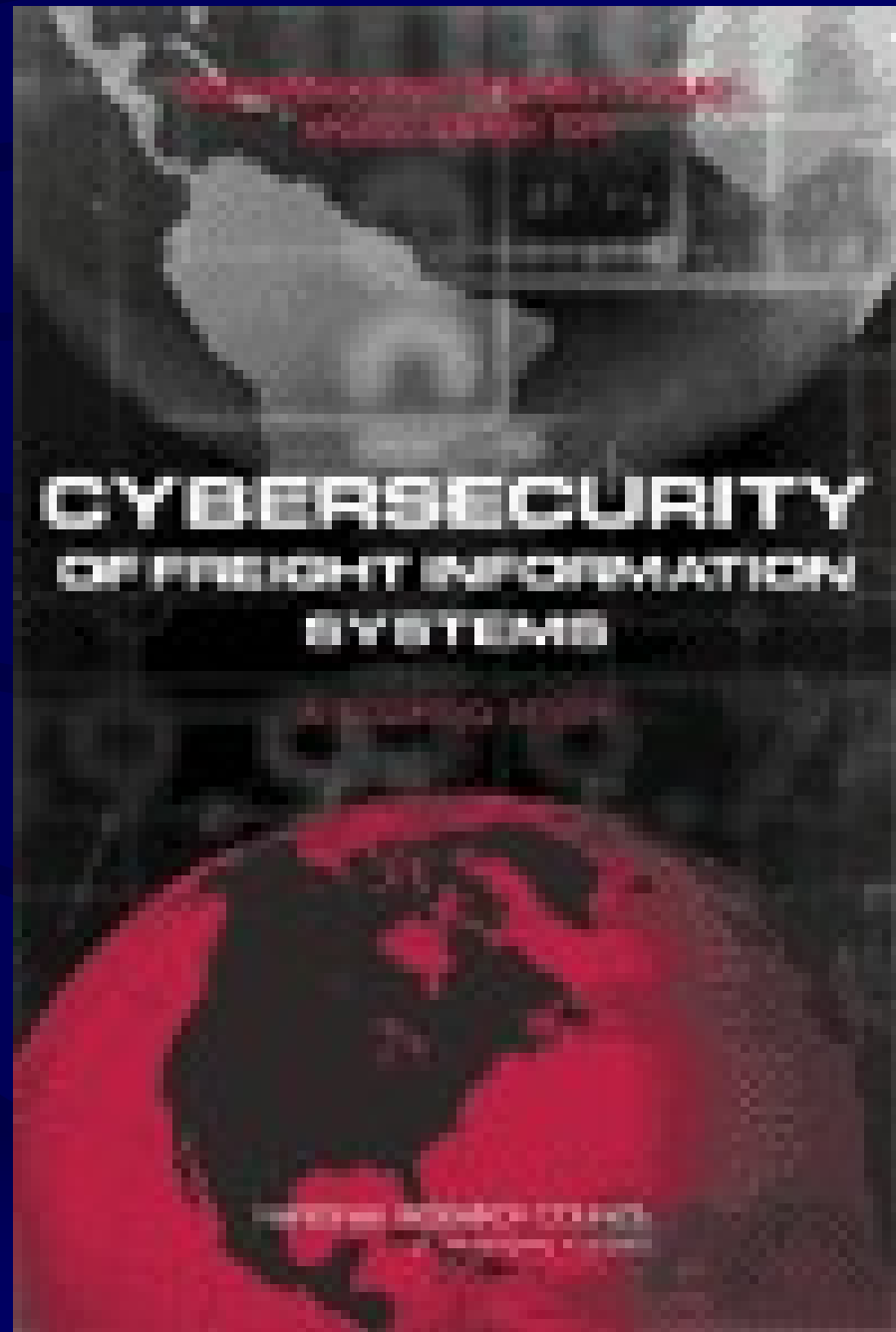
- Hazardous Materials Shipments –
  - Truck and Rail
  - Barges
  - Pipelines
  - LNG Imports
- Cyberthreats to SCADA systems

# RESEARCH NEEDS

- **Technology**—faster, better, cheaper, smaller, usable in the real world
- **Systems Approach**—understand how the system works—design security in
- **Human Factors**—recognize that even perfect systems are run by imperfect people
- **Unconventional Thinking**—what is in the terrorist's mind? How do we stay ahead?

***TRB  
SPECIAL  
REPORT 274***

**Robert E. Gallamore, Chair  
The Transportation Center at  
Northwestern University**



# *IT Trends and Emerging Technologies*

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- Electronic Supply Chain Manifesting
- Real-Time Monitoring
- Decentralized System Architecture
- Embedded Processors
- Electronic Data Interchange
- Increased Reliance on the Internet
- Global Interconnection of Systems
  - Firewalls – Access Controls
  - Problems of User Authentication

*Risk is new IT applications make transport / logistics more vulnerable to terrorist acts – even from far away.*

# *Embedded Processors and Enabling Technologies*

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- Direct Transfer between Real and Cyber Worlds – Untouched by Human Hands
- RFID Tags, Active and Passive
- E-Sensors
- Smart Seals

*Controversial Area: Standards, Info Security, Cost Burden*

# *Committee Recommendations for DHS / TSA Transportation Cyber-Security Analysis*

- Task 1. Determine Vulnerabilities in Freight IT Systems
  - Existing & Evolving Systems
  - Prioritization by Risk (Probability \* Consequences)
  - Plus Cost & Operational Impact of Implementation
- Task 2. Review Current Practices for IT Security
- Task 3. Determine Potential for IT Security Enhancements in Transport and Logistics Sector
- Task 4. Analyze Policies to Reduce Cyber-Vulnerabilities
- Task 5. Assess Economic Impact of Cost Penalties Imposed on Freight Transport

# *The New Challenge for Transportation – Security*

- Understanding the Threats and Our Vulnerabilities
  - Intelligence: Getting It and Sharing It
  - Facilities Protection –Gates, Guards, & Guns
  - Cyber Security
- Aviation Security – the Most Visible Part of DHS
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## *Some Economic Issues*

- What Is the Effect of Security Investments on Economic Outputs?
- Can Thin Margins in Transport Support Additional Security Mandates if Privately Borne?
- When Does Security Cost Become a Concern?
- What Form of Public Participation in Security Costs Would Be Most Effective (e.g. Tax Credits)?

# *Can We Afford to Reinvest in Transportation?*

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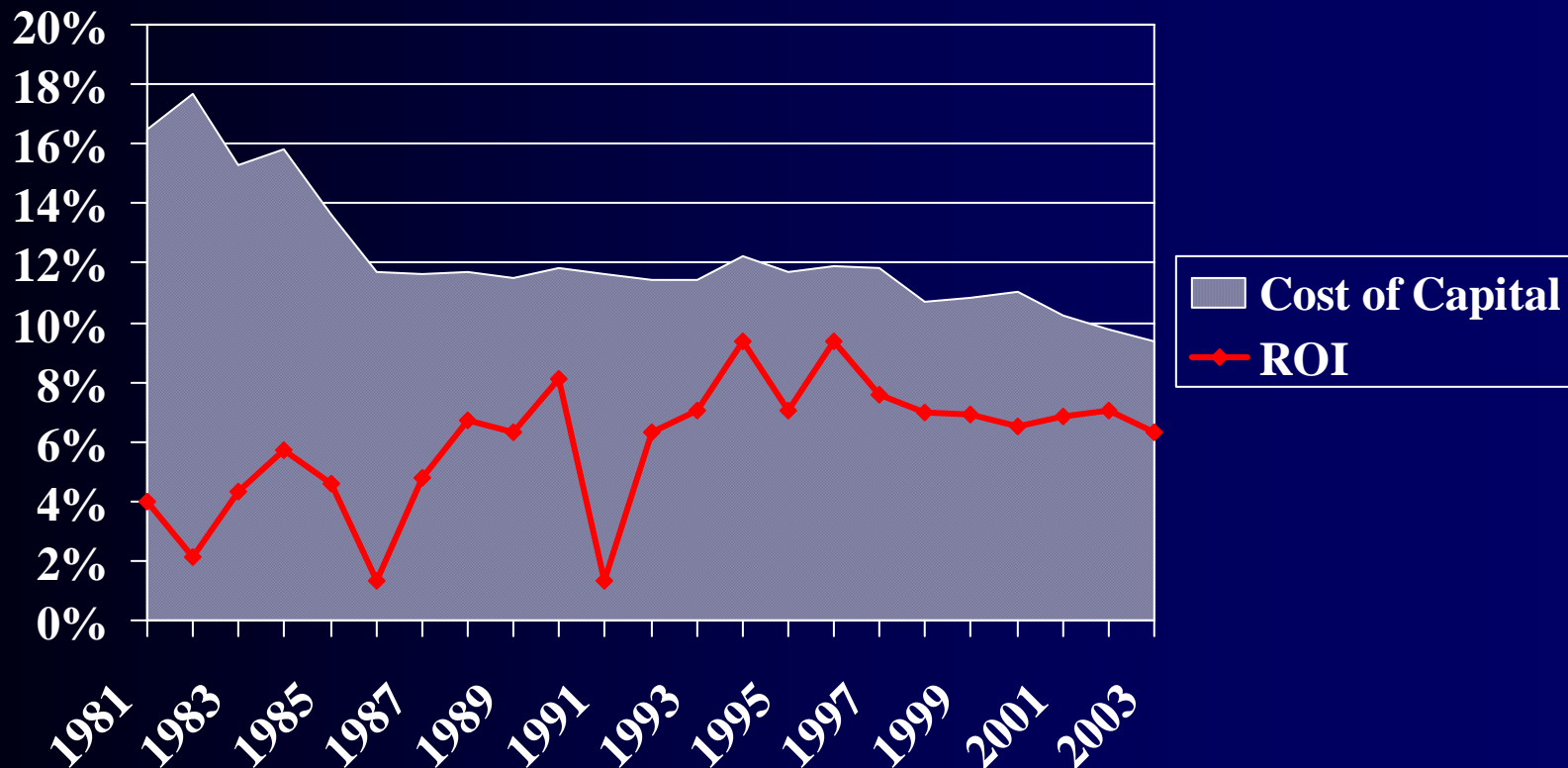
- **Can We Not?!**
  - Total Logistics Portion of GDP = **10%**
  - About \$1,000,000,000,000 (\$One Trillion) Annually
  - Transportation = 19% of Consumers' Expenditures
- **Traffic Cyclical but Trend Steadily Up**
- **Carriers Largely Used Up Excess Capacity**
  - Railroads & Intermodal Facilities – Access to Ports
  - Interstates, Urban Arterials – 52% of Urban Interstates Congested (1995)
  - Inland Waterways – e.g. Ohio River
  - Pipelines to Some Regions – e.g. Nashville and Chicago

# *Financing Future Capacity*

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- Private Firms Need Adequate Returns for Reinvestment
- Public Policy Needs to be Fair and Flexible
  - Avoid Market Distortions
  - Allow States and Regions to Influence Choices
- Public Incentives for R&D, Security, Environment, Energy Technology

# *Class I Railroads: Cost of Capital Exceeds Return on Investment*



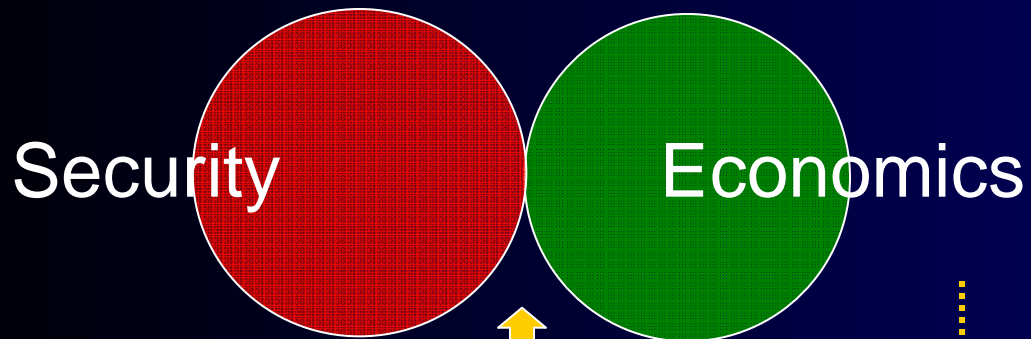
*Source Data Courtesy of the Association of American Railroads*

## *Summary: Solutions Going Forward for Transportation with Security*

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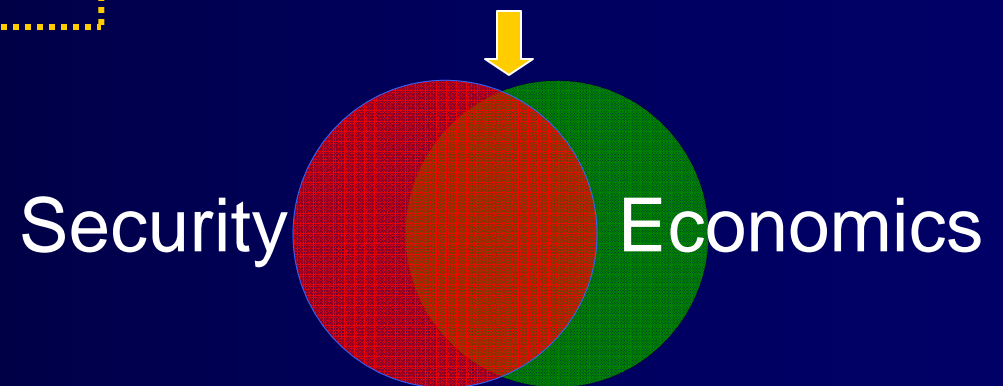
- Improve Private Carrier ROI to Enable Reinvestment and Service Improvement – (Surge/Slack Capacity Trade-offs)
- Promote Intermodal Service Alternatives
  - Make the Best Use of Available Modal Capacity
  - Reauthorize and Fund Flexible Public Intermodal Infrastructure Program – Focus on Connections and Hubs
  - Develop Genuine Public Private Partnerships
- Invest in Technology – Intelligent Systems
- Public Financing for Anti-Terrorism Measures
  - Hardening of Key Physical Facilities (e.g. Control Centers)
  - Cyber Security Measures, Including ST-ISAC Support
  - Container Security Initiatives (Operation Safe Container, Monitoring, etc.)

# *Is There Synergy Between Transport Economics and Security Outlays?*



*No Economic Benefit to Security Enhancements*

*Significant Economic Benefit to Security Enhancements*



*Thank You*

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