

Policy Considerations in Securing the Global Containerized Supply Chain

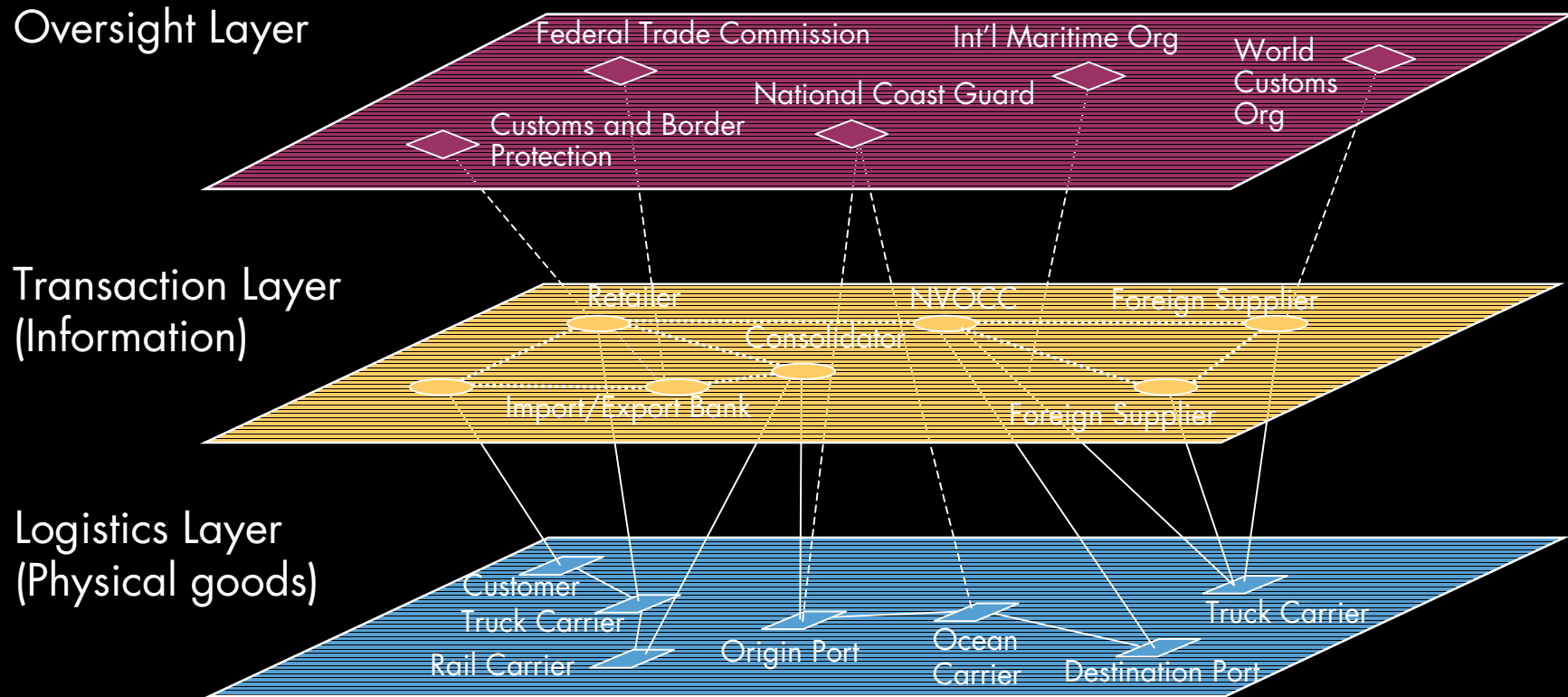
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Terrorist Attacks on the Global Container Supply Chain Are a Significant Threat

- **Supply chains**

- **Supply chains are key for global commerce**
- **Supply chain is an attractive target for terrorism**
- **Increasing supply chain security**
- **A case study**
- **Conclusions and some questions**

A supply chain can be viewed as three interdependent and interacting networks or layers



NVOCC Non-vessel Operating Common Carrier

Oversight or Regulatory Relationship

Contractual Relationship

Physical Relationship



Measuring the performance of policies to secure global supply chains

- **Efficiency**
- **Reliability**
- **Transparency**
- **Fault tolerance**
- **Resilience**

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What kind of attacks?

Terrorists could use the supply chain in two ways:

- Smuggle weapons through the supply chain to facilitate attacks not involving the supply chain**
- Target the supply chain itself as a way to damage the economy**

Why a significant risk?

Supply chain is an attractive target for terrorism and key for global commerce:

- Threat analysis: Meets terrorist stated goals and may be within their capabilities**
- Vulnerability analysis: Difficult to protect**
- Consequence analysis: A successful hit could result in significant damage (both economic and loss of life)**

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Container Traffic is Key for Global Commerce

- **Share of containerised cargo is already large...**
 - 6.3% of world traffic in 1980
 - 23.3 % of world traffic in 2003
 - 26.6% of world traffic in 2005
- **...and is expected to continue growing...**
 - Average annual growth in TEU shipped of 9.3% from 1993 to 2003
 - World's largest ports handling over 20 million containers annually
 - 432.2 million TEU port throughput in 2010
- **...rendering significant benefits to our economies**
 - 25% of U.S. exports and imports by value
 - \$490 billion worth of goods annually
 - US logistics costs dropped from 16.1% of GDP in 1980 to 10.1% in 2000
 - Annual savings in logistics of foreign trade approximately \$150B

... and These Containers Move Very Quickly



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Supply chain is an attractive target for terrorism because it is easy to hit

- **Supply chain is an open system and inherently vulnerable to attacks**
- **Terrorist action shifting to relatively easy to strike soft targets emphasizing on inflicting economic damage**
- **Only 5–6% of containers are physically inspected**
- **Theft and smuggling highlight vulnerabilities**

Supply chain is an attractive target for terrorism because it is difficult to protect

- **Major investments needed in low-margin industry (ownership problem)**
- **Lack of clearly defined responsibilities and liabilities of actors in the chain**
- **The scale of the problem**
- **Conflicting, unclear, and overlapping jurisdictions of national and international regulatory and oversight authorities**
- **Lack of uniformity in the rules and their application for making transactions in different parts of the world/countries**
- **Lack of standards (technological and operational)**
- **Link between security and throughput**

Supply chain is an attractive target for terrorism because a hit can results in significant damage

- **Shocks to supply chain cause ripple effects in industries**
 - A ten day shut down of ports on the West Coast of the U.S. resulted in estimates of economic damage ranging from \$0.5 – 19 billion
- **Impact of 9/11:**
 - Insurance industry lost \$30 to \$58 billion and insurance premiums skyrocketed (by up till 200%)
 - Total economic cost estimated at \$120 billion
- **Impact of Limburg attack:**
 - \$56m loss borne by insurers; insurance premiums rose by 300% resulting in additional costs of \$150.000 per docking
 - Shipping bypassed Yemeni ports; decrease in Yemeni ports by 50%
 - Potentially disastrous impact upon Yemen economy (losing approx. \$4 million a month), regime, and individual ports.

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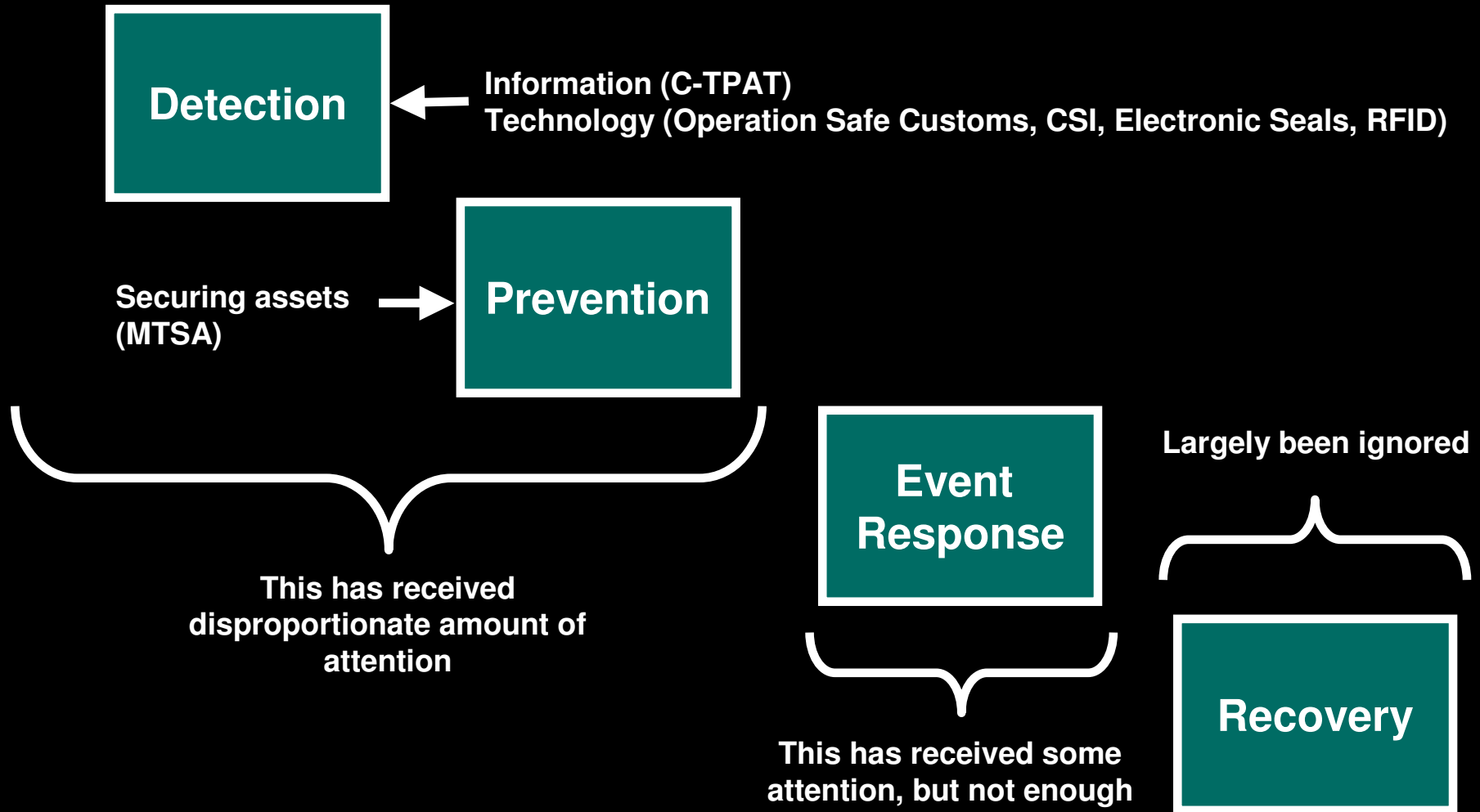
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Recognition of the Threat Has Motivated an Array of Container Security Reforms

Focus of Measure	Security Measures
Port and Vessel Security	<ul style="list-style-type: none">• International Ship and Port Security (ISPS) Code• Maritime Transportation Security Act (MTSA) 2002
Border Extension	<ul style="list-style-type: none">• Container Security Initiative (CSI)• 24-hour Advanced Manifest Rule (AMR)• 96-hour advanced notice of arrival
Supply Chain Management	<ul style="list-style-type: none">• Customs-Trade Partnership Against Terrorism (C-TPAT)• Smart and Secure Trade Lanes (SST)
Technology Development/Deployment	<ul style="list-style-type: none">• Operation Safe Commerce (OSC)

Even with all of this, are we any more secure?

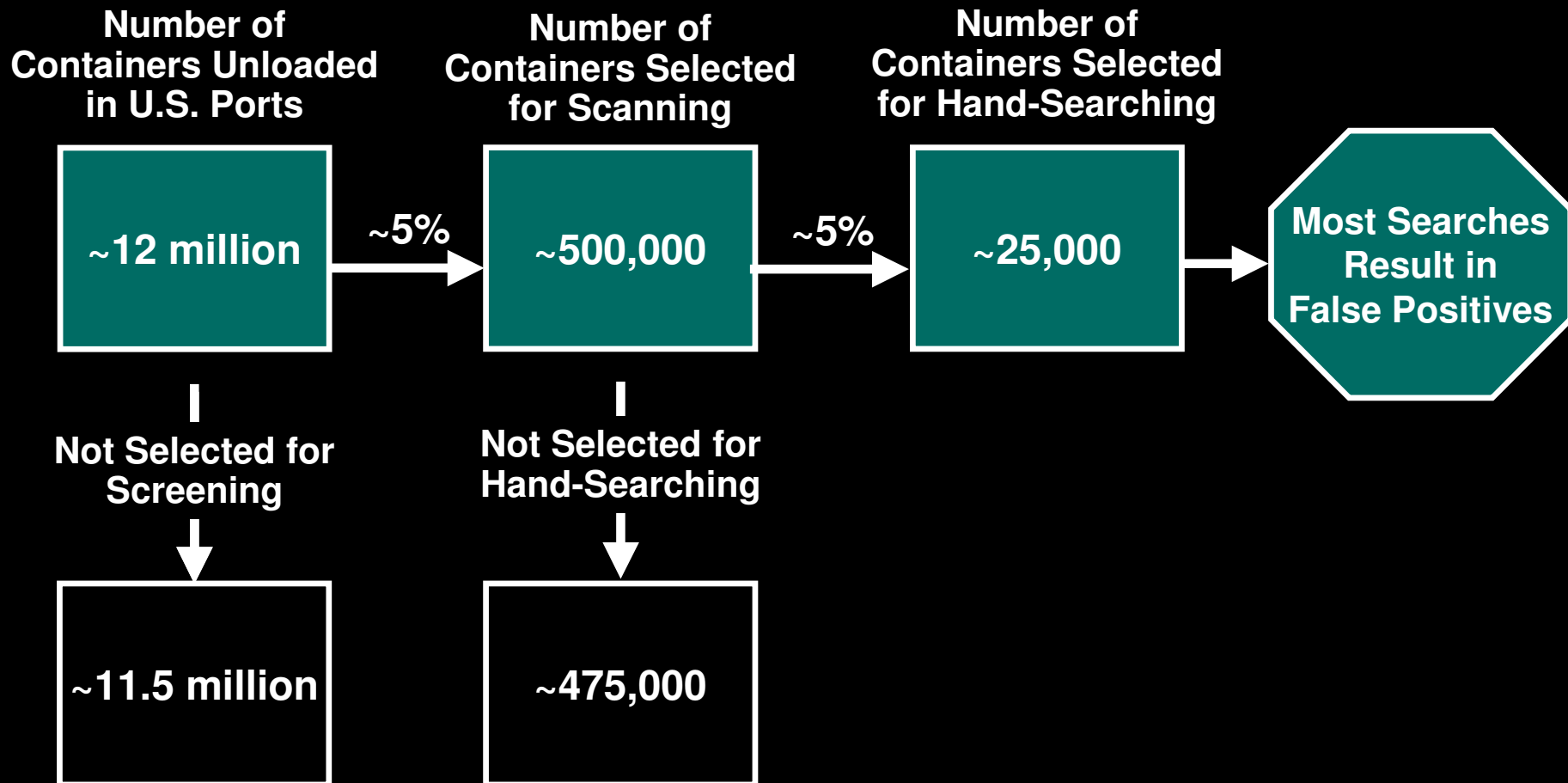
Guarding against threats: How much to invest in each option, and in what?



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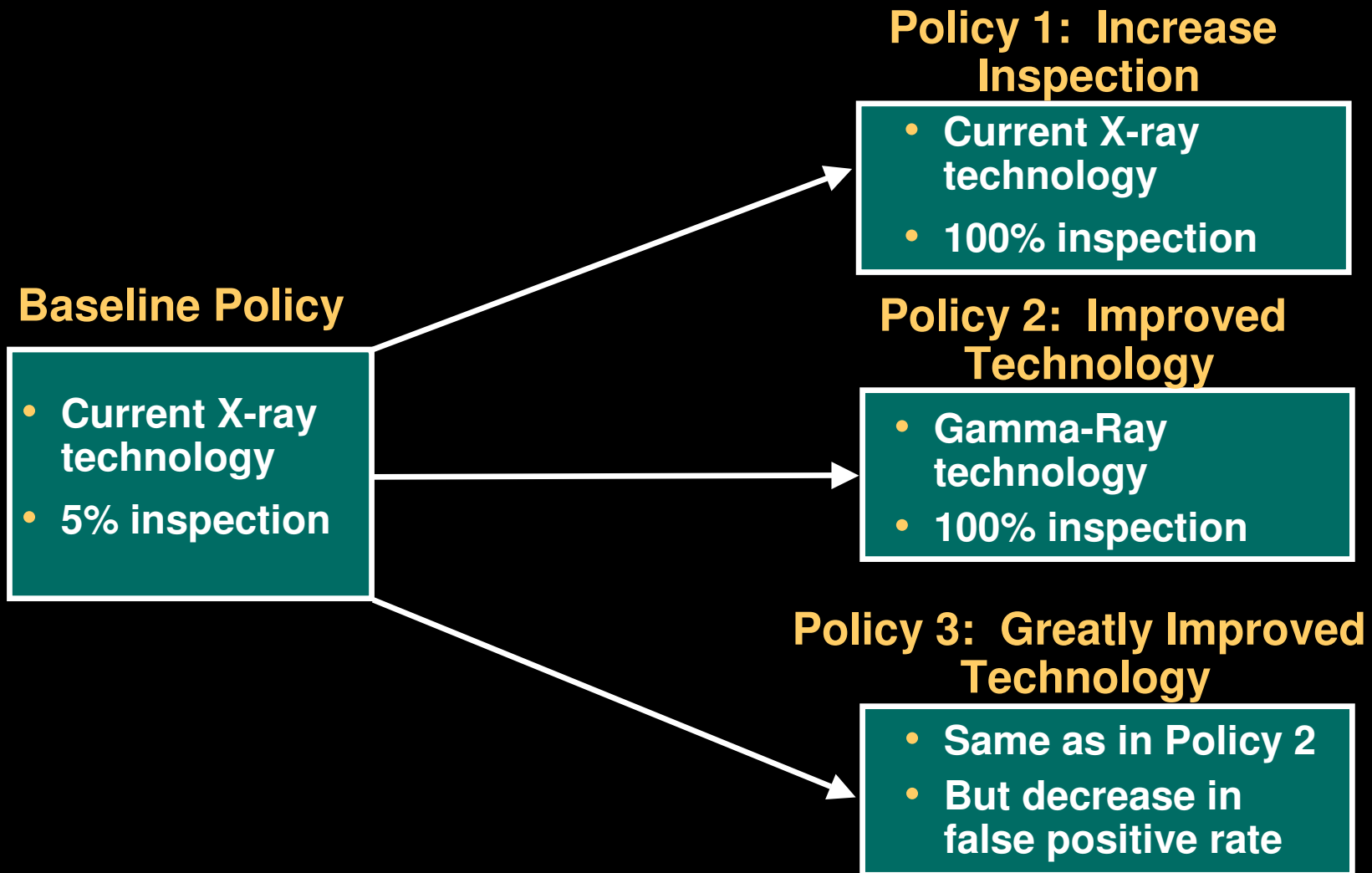
Containers Enter a Multi-step Process on Arrival at U.S. Ports



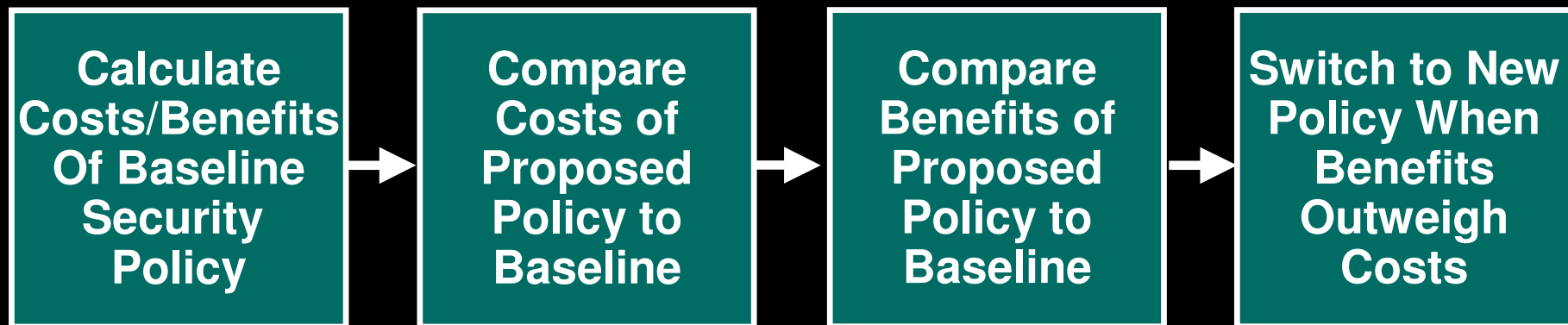
Case Study: Under What Scenarios Is 100% Container Inspection Viable?

- **What would 100% screening do to costs and delays?**
- **What technological and operational improvements would help the most?**
- **How does port size change policy choice?**

We Assessed Viability of Decision to Switch to One of Three Alternative Policies



We Took a Cost/Benefit Approach to Evaluate Proposed Security Measure Policy Choice



Analysis Addressed Uncertainty in Several Model Parameters

- **Volume of containers shipped**
 - U.S. total, large port, and small ports considered
- **Technology cost and performance**
 - Capital, operations, and maintenance
 - Inspection, detection, and false positive rates
- **Costs of container delays**
- **Cost of terrorist attacks: from \$1 billion to \$1 trillion**

We Considered Both a National and an Individual Port Perspective

Location	Arrival Rate
U.S.	1474 TEU/hr., over 157 ports
Large Port: “Los Angeles”	365 TEU/hr.
Small Port: “Miami”	50 TEU/hr.

Delay Cost

\$0-\$60 per cont., per hr.

Attack Cost

\$1 billion - \$1 trillion

Attack sizes considered were:

- **Larger than '93 WTC and '95 OK City**
- **On par with natural disasters**
- **Range of estimates for 9/11 or nuclear attack**

We Compared Three Policies to the Base Case

Parameter	Base Policy 5%	100% Inspection, Same Tech. (Policy 1)	100% inspection, Slightly Improved Tech. (Policy 2)	100% inspection, Greatly Improved Tech. (Policy 3)
Scanning Rate	20 TEU/hr.	20 TEU/hr.	30 TEU/hr.	30 TEU/hr.
False Positive Rate	5%	5%	5%	1%
Equipment Cost	\$4.5 million	\$4.5 million	\$1 million	\$1 million
Maintenance Costs	\$200,000	\$200,000	\$90,000	\$90,000
Operators per Scanner	4	4	4	4
Hand Searching Rate	1 cont./day	1 cont./day	4.8 cont./day	4.8 cont./day
Hand Inspectors per Team	5	5	5	5



Based on X-ray
technology



Based on gamma-ray
technology






100% Inspection Is Only Cost Effective for Large Attacks or with Improved Technology

Attack Costs (\$ Billion)	Current Technology	Improved Technology	Greatly Improved Technology
1	Red	Red	Yellow
10	Red	Yellow	Green
100	Yellow	Green	Green
1,000	Green	Green	Green

Nationwide Implementation Depends on Attack Costs and Probability of Attack

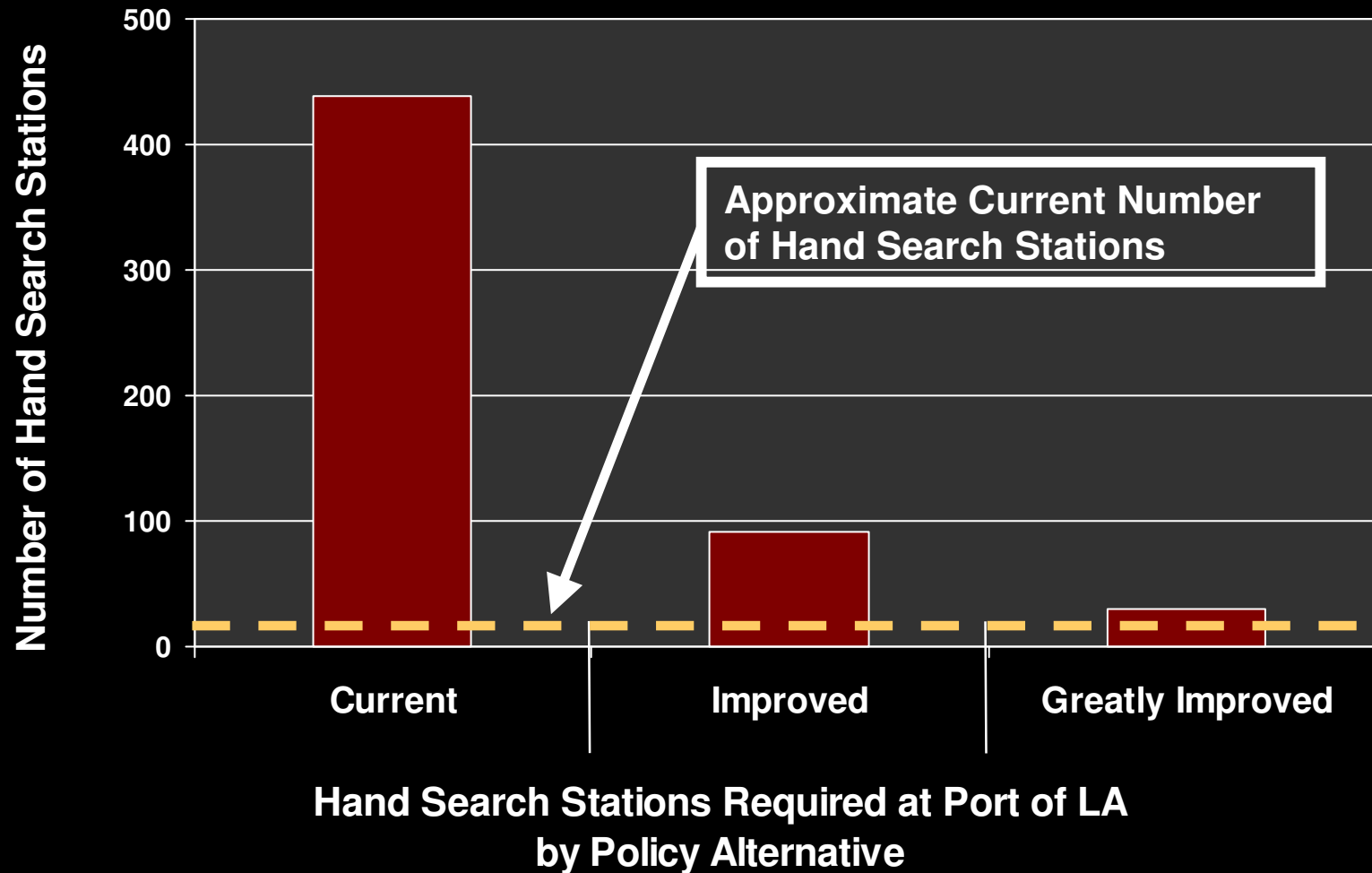


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1,000	Green 	Green 	Green

But by other parameters, some findings are infeasible

Personnel Requirements at Large Ports May Be Infeasible with Current/Improved Technology



Conclusions of Case Study

- **100% inspection is not viable using current technologies**
 - Benefits may only be greater than costs for damages in excess of \$100 Billion
 - Even then, more than 6,000 inspectors required at a large port, versus around 300 in 2004
- **New technology improves viability of 100% inspection**
 - Reduction in false positives drives labor and land requirements down
 - New costs on par with base costs

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Conclusions

- **Specific links in supply chains are more secure, but the supply chain system is NOT secure**
- **There is no magic bullet, multiple measures are needed**
- **Policy makers have not given event response and recovery measures much attention**
- **Analysis of policies should estimate effects of policy measures on performance of supply chains (efficiency, reliability, transparency, fault tolerance, resilience)**
- **Security and efficiency are linked but distinct – increasing fault tolerance and resilience will require creating redundancies and slack**

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Threshold Probability for Switching to a New Inspection Policy

$$P(\text{Attack}) = \frac{\text{Change in Equipment, Labor, Delay Costs}}{\text{Attack Cost} * (\text{Change in Detection Rate})}$$