

An aerial photograph of a large, white-hulled ship, possibly a research vessel or a large ferry, sailing on a dark, choppy sea. The ship has a prominent superstructure with multiple windows and a mast with various antennas and equipment. The ship is moving towards the right side of the frame, leaving a white wake behind it. The overall tone of the image is somewhat somber due to the dark water and the high-contrast lighting.

Building Resiliency into the Supply Chain: Principles and Best Practices

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Project Information

- Funded through United States Department of Homeland Center of Excellence at Texas A&M University – Cross-Border Threat Screening and Supply Chain Defense (CBTS)
 - <https://cbts.tamu.edu/>
 - Work supported by the United States Department of Homeland Security under Grant Award Number 18STCBT00001.
- Project customer/champion is United States Coast Guard (USCG)
 - Viewpoint is that of the USCG -- to manage vessel traffic



Motivation for Research

- A salient lesson from COVID-19 is the fragility of our supply chain.
- Risks to marine transportation systems (MTS) result in loss of expected operations and bottle-necked supply chains.
- This project is examining disrupting events regardless of their source for both natural and man-made events.
 - Each type of disruption presents unique circumstances and causes but with common consequences.
 - Resiliency principles and best practices are applicable to response and recovery technologies regardless of the disrupting event
 - If we can capture principles and best practices for resilient supply chains, these results are generally applicable.

Project Goal & Outcomes

- Goal of Supply Chain Resiliency:
 - Supply chain continues to operate with expected outcomes regardless of the disrupting event (e.g., weather, cyber-attack, pandemic).
- Project Outcomes:
 - Supply Chain Resiliency Capability Maturity Model for DHS and the USCG
 - Principles & Best Practices Guidebook
 - Primarily for DHS and the USCG
 - Information will aid commercial shipping with Principles and Best Practices for supply chain resiliency



Project Objectives

Develop resiliency principles and best practices that reduce the risks to the global supply chain.

Specifically, project objectives are:

1. Compare and contrast the characteristics and causes of disrupting events and consequences.
2. Develop a framework of Resiliency Principles and Best Practices for the maritime supply chain.
3. Distribute the Resiliency Principles and Best Practices to industry practitioners to solicit input and ensure the validity and usability of the developed concepts.



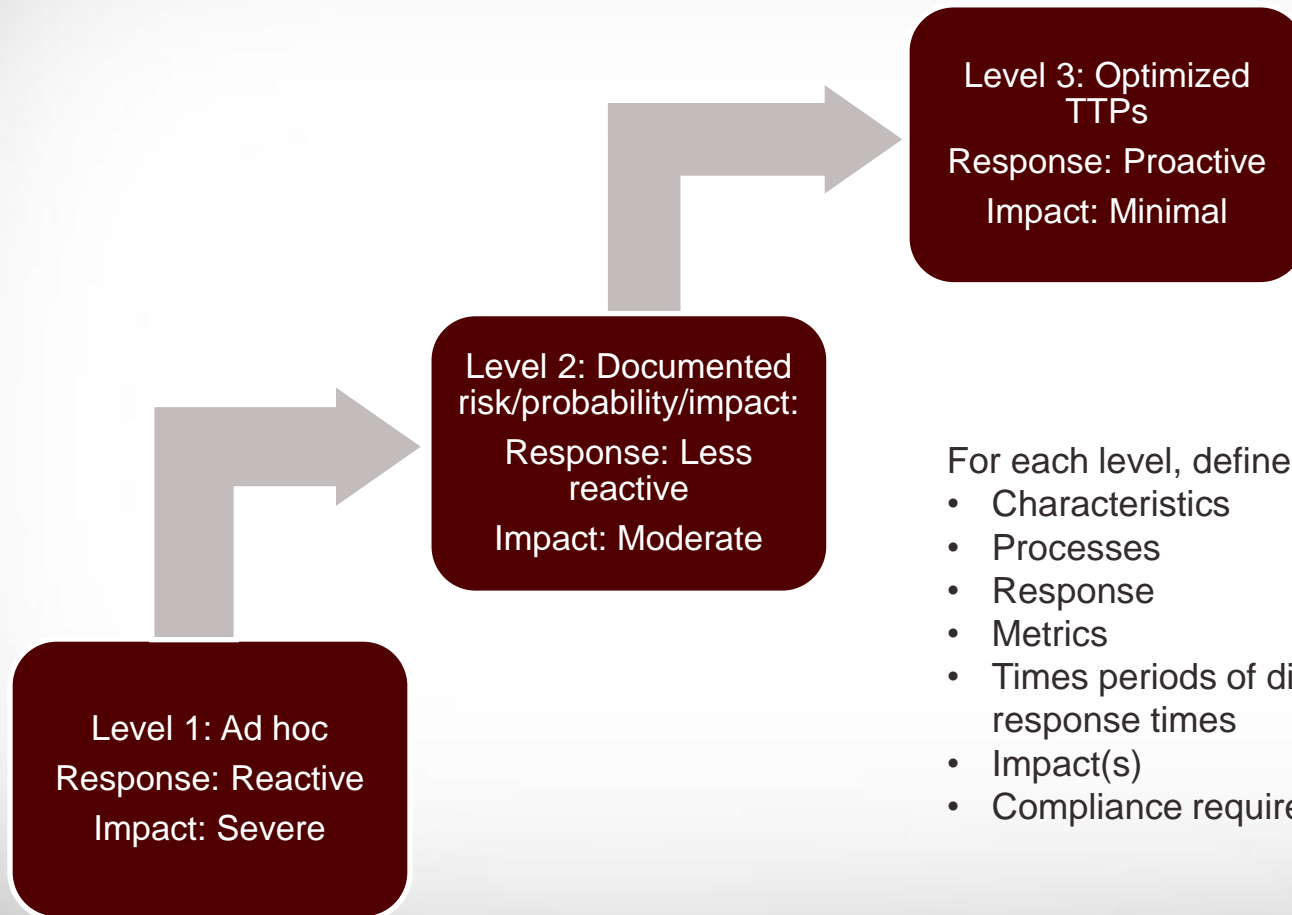
Event Characterization: Supply Chain Disruptor Scenarios in the Ports

- Physical/natural (e.g., weather event, fire in a tanker port terminal) and other disruptive events (e.g., global pandemics)
- Port systems (e.g., computers, power) disruptions / destructions
 - Complex hardware/software infrastructure systems
- Supply chain control (Port Systems Control)
 - Third-party cascading disrupting events (e.g., cyber, unintentional)
- Cyber attack
- Unintentional damage (e.g., human error, mistake)

Supply Chain Resiliency Capability Maturity Model

- Why a *capability maturity model*?
- Define maturity levels (3) for supply chain resiliency
- Current state-of the art:
 - Supply Chain Capability Maturity Model (SC-USCG-CMM) from the those whose goods are in the supply chain, and not from a USCG perspective
- Our research insights:
 - Develop SC-USCG-CMM for vessel management (i.e., USCG)
 - Develop metrics to provide confidence in using SC-USCG-CMM where metrics provide a pathway for improving business processes

Supply Chain Maturity Model Levels



For each level, define:

- Characteristics
- Processes
- Response
- Metrics
- Times periods of disrupting event and response times
- Impact(s)
- Compliance requirements

Supply Chain Maturity Model

- Lowest Level (severe impact)
 - Processes: Ad hoc, reactive
 - Response: Reactive to the specific supply chain disruption
- Medium Level (moderate impact)
 - Processes: Constant monitoring of identified risks according to a specified risk framework
 - Response: A designated response coordinator has documented risk/probability/impact assessments and established guidelines and procedures.
 - Characterization: More analysis, less reactive, but not optimized
- Optimized Level (minimal impact)
 - Processes: Optimized TTPs (tactics, techniques, procedures) in place for coordinated response including performing a “lessons learned” assessment for continuous improvement after disrupting events.
 - Response: Proactive, not reactive
 - Utilizes a supply disruption playbook (principles and best practices)
 - Designated response coordinator and team with assigned roles and responsibilities



Aspects of the SC-USCG-CMM: Define for Each Level

- Characteristics of that level
- Processes defined at that level
- Response mechanisms
- Metrics to monitor performance/capture method Time periods (short, medium, long-term)
 - Disrupting event time period
 - Response/recovery times
 - Impacts/consequences
- Compliance requirements
 - Level of documentation required and to what standards



Metrics

- Develop metrics to provide confidence in using SC-USCG-CMM where metrics provide a pathway for improving business processes.
- Relate metrics to the maturity levels to determine effectiveness
- Give confidence in the decisions.



Example Metrics

Metric	Data Availability	How Used
Port Congestion	USCG has AIS (Automatic Identification System) to determine vessel positions to reduce vessel congestion within each port's traffic center.	Improve planning and decision support. American Association of Ports provides a forum for experiences sharing. AIS is established by USCG.
Transportation costs – caused by delays from both inter-modal and waterway traffic.	Financial documents, capital expenditure, maintenance and operating costs.	Conduct regular reviews for cost comparisons, budgeting, and cost improvement.
Port/Marine Infrastructure – Available resources for response.	Port Operations Center Vessel Traffic systems are required by International Ship and Port Facilities Security Code (ISPS) and the International Maritime Organization (IMO) requirements.	Determine resources available for response and recovery operations.

Response Characterization

	Level 1: Reactive response	Level 2: Less reactive/more proactive response	Level 3: Optimized response
Characterized by	Focus: Deal with the emergency. Ad hoc processes; no or incomplete risk assessments; lack of coordination of all assets and systems	Focus: Deal with the emergency. Some level of monitoring of risk/probability/impact assessments with some guidelines and procedures	Focus on consequences of disrupting event.
Short-term event (e.g., hurricane, cyber attack)	May be adequate as specific to event, but more likely an uncoordinated response depending on team experience with events.	Capability to respond to a previously unseen disrupting event based on team experience and assessment of risk.	Optimized TTPs for coordinated response including performing lessons learned to implement continuous improvement after disrupting events.
Medium or longer-term event (e.g., pandemic)	Short-term measures fail due to lack of resources, exhausted workforce, or lack of experience.	Proper response depends more on having experienced workforce who can continually redefine response processes.	

Research Path Forward

- Continue to develop Principles & Best Practices Guidebook through iterative release/review
- Continue research by expanding concepts related to SC-CMM and incorporate multiple management viewpoints
- Influence future work in supply chain resiliency by soliciting input from both government and commercial entities



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- Work is in progress with completion date of summer 2022
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