Risk Reduction and Resource Allocation Model

Pacific Northwest NATIONAL LABORATORY

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PNNL has developed and delivered a Risk Reduction and Resource Allocation Model (3RAM) that is novel in its approach to risk assessments for maritime transportation security in that it uses dynamic system risk, calculated over time. Our approach allows the user to determine a baseline risk -- the risk resulting from an unmitigated decision strategy (e.g., no security measures in place) for a given period of time, as well as the reduced risk resulting from the deployment of security measures across the system. 3RAM provides the user with an operational tool to assess the relative risk reduction as a result of alternative security measures, provides recommended optimal resource allocations when resources are constrained and provides a deterrence using a randomness factor for security asset allocations.

Uniqueness:

- Most quantitative risk assessments focus on a single point in time; 3RAM is dynamic and computes risk continually over time
- Resource allocation recommendations are “optimized” based on Operations Research algorithms
- The methodology used is robust enough to apply to multiple threats and scenarios

Capabilities:

- 3RAM calculates risk for each specific transportation node (e.g., barge, bulk, container, cruise, ferry, fishing vessels) at each hour of the day and then also the overall transportation system risk (e.g., Port facilities, or Port as a whole)
- Risk results are both forecasted for the next time period (e.g., days, weeks, month) based on predicted system ridership and tonnage (e.g., volume of pax, goods, and materials estimated from historical data) and back casted based on actual system ridership and tonnage for the previous time period
- Recommendations returned from 3RAM include where and when to allocate security personnel, patrols, and other security measures including screening technologies to optimize risk buy down
- Surge operations can be easily formulated if additional security resources are made available to optimize risk buy down based on increased threat projection (MARSEC level 1, 2, or 3)
- Through its functionality, 3RAM offers the ability to compare the risk-based performance of competing decision strategies for various threats
- To increase deterrence across the system, 3RAM has a randomness factor built in to ensure security measures cannot be predicted
- Model has been through IV&V and has been approved for deployment and use as an Alternative Security Plan by USCG
- Applications to additional transportation or infrastructure security needs are straightforward

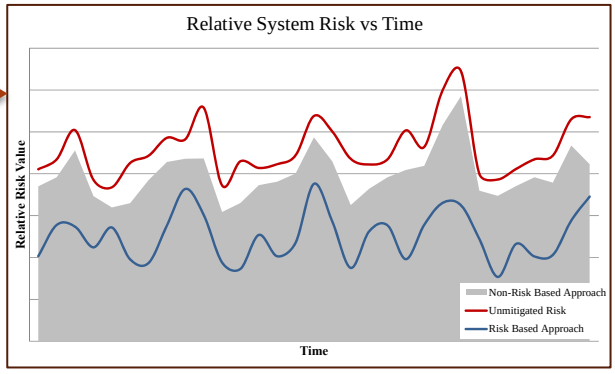
Impact:

- 3RAM provides the user with an operational tool to assess the relative risk reduction as a result of alternative threat reduction measures and provides recommended resource allocations
- 3RAM provides the user with a planning tool to assess relative risk reduction as a result of alternative threat reduction measures and reduced/increased resource allocations
- 3RAM can be tailored by the user based on intelligence, specific events, and or incidents to reassess and deploy resource allocations for a specific time period
- 3RAM randomness factor for deterrence built in and can be varied by the user

Historical ridership data

Asset availability

3RAM



Organic Security Modifiers

(lower is better)

Element Number	Organic Security Element	Modifier Designator	Modifier Value	Exponent Designator	Maximum Exponent Value
1	Law Enforcement Canines	m_1	0.5	n_1	2
2	Law Enforcement Officers	m_2	0.3	n_2	2
3	USCG Presence	m_3	0.7	n_3	1
4	CBP Presence	m_4	0.6	n_4	1
5	Contract Security Presence	m_5	0.8	n_5	1
6	Miscellaneous Security Presence	m_6	0.8	n_6	1

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