COORDINATING CB ENGAGEMENT SCENARIOS WITH THE CBRN DATA MODEL

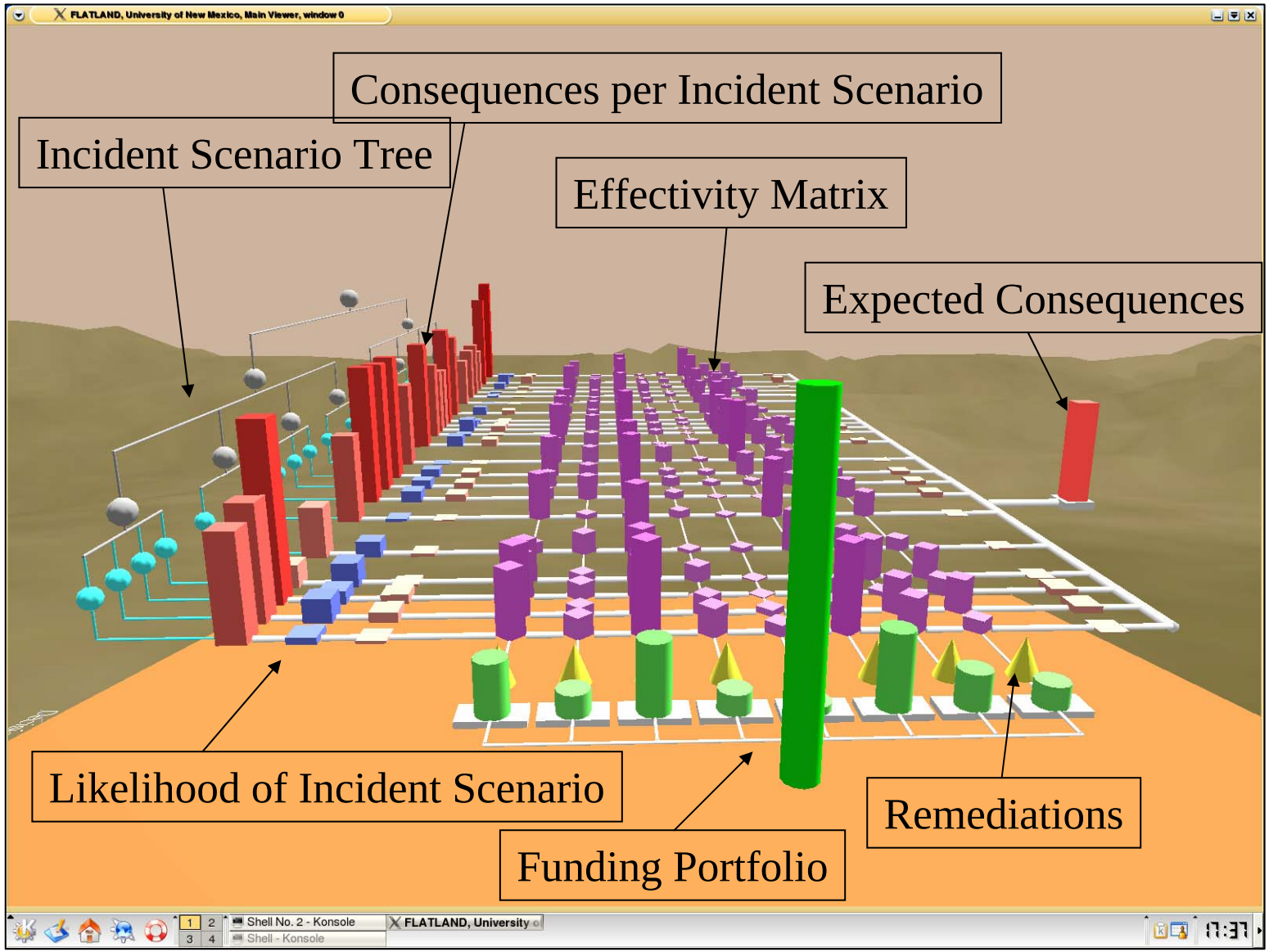
by

Stephen Helmreich
Computing Research Laboratory / NMSU
Sundara Vadlamudi, Markus Binder
Monterey Institute of International Studies

OUTLINE

- Introduction
- CB Scenarios – General
- CB Scenarios – Detail
- CB Scenarios and the CBRN Data Model
- Conclusion

Visualization of Mockup System



Criteria for a useful CB incident scenario

- Able to deal with uncertainty
- Accessible to experts
- Compatible with deeper scenarios
- Can be used to generate interpolated scenarios
- Can deal with hypothetical improvements to defensive measures

Utility of the CB incident scenario

- For S&T funding allocations for CB research
- For development / deployment of CB mitigation projects
- For similar tasks in similar areas (e.g., RN research, development, deployment)
- For other tasks requiring similar capabilities

CB incident scenario detail

- Inherent vulnerability
- Inherent characteristics
- Defensive measures
- Cost/impact

Inherent vulnerability-1

Inherent Vulnerability	Parameter	Range of Values / Units
Agent Characteristics (CW)	Agent	One of the following: {Sarin, soman, tabun, VX, mustard, lewisite, chlorine, hydrogen cyanide, phosgene, cyanogens chloride}
	Persistency	low / medium / high
	Ect50	(mg-min/m^3)
	Time for effect	minutes
	Mortality (untreated)	0%-100%
	Prophylaxis available	YES / NO
	Treatment available	YES / NO

Inherent vulnerability-2

Inherent Vulnerability	Parameter	Range of Values / Units
Agent Characteristics (BW)	Agent	One of the following: {anthrax, botulinum toxin, ricin, smallpox, yersinia pestis, glanders, tularemia, brucellosis}
	Sunlight Degradation Rate	0%-100% / minute
	Ect50	(mg-min/m^3)
	Incubation period	days
	Mortality (untreated)	0%-100%
	Vaccine	YES / NO
	Treatment available	YES / NO
Disperal Pattern	Mode of agent delivery	Point Source / Line Source

Inherent characteristics-1

Inherent Characteristics	Parameter	Range of Values / Units
Proximity to Civilian Infrastructure	Civilian infrastructures close to facility	One or more of the following: {major highway; civilian airport; city center; civilian port; other high-density civilian population}
Air Flows	Prevailing wind direction	(Compass coordinates, e.g. NE, SSE,W, etc.)
Ambient Temperature	Prevailing temperatures in target area at time of attack	Degrees fahrenheit
Time of Attack	Time of day	HH:MM

Inherent characteristics-2

Inherent Characteristics	Parameter	Range of Values / Units
Access to Offsite Medical Service	Rating of facility where "0" represents a facility with no immediate access to an offsite medical service and "5" represents immediate access to a large well-equipped medical service	0-5
Access to Civilian Hazmat Response	Rating of facility where "0" represents a facility with no access to a Hazmat team and "5" represents immediate access to a large well-equipped Hazmat team	0-5

Defensive measures-1

Defensive Measure	Parameter	Range of Values / Units
Chemical Agent Detector	Type	C1, C2, C3, …,C27,… (0 indicates null set)
	Agents detectable by sensor	One or more of the following: {Sarin, soman, tabun, VX, mustard, lewisite, chlorine, hydrogen cyanide, phosgene, cyanogens chloride}
	Range of detection	(in meters)
	Time for detection	(in minutes)
	False positive rate	0%-100%
	False negative rate	0%-100%
	Number of detectors deployed at facility	(integer)

Defensive measures-2

Biological Agent Detector	Type	B1, B2, B3,…,B27,… (0 indicates null set)
	Agents detectable by sensor	One or more of the following: {anthrax, botulinum toxin, ricin, smallpox, yersinia pestis, glanders, tularemia, brucellosis}
	Range of detection	(in meters)
	Time for detection	(in minutes)
	False positive rate	0%-100%
	False negative rate	0%-100%
	Number of detectors deployed at facility	(integer)

Defensive measures-3

Perimeter Protection	Presence of wall and fence	YES / NO
	Presence of barricaded gates	YES / NO
	Number of armed guards	(integer)
	Anti-missile Defense	YES / NO

Defensive measures-4

Protective Equipment	Mask Type	MK1, MK2, MK3, …,MK27,… (0 indicates null set)
	Avbl of Masks	0%-100%
	Suit Protection factor	(0-5)
	Mask Wearability	(0-5)
	NBC Suit Type	S1, S2, S3, …,S27,… (0 indicates null set)
	Avbl of NBC Suits	0%-100%
	NBC Suit Protection factor	(0-5)
	NBC Suit Wearability	(0-5)
	Positive pressure system	YES / NO
	Personnel indoors	0%-100%

Defensive measures-5

MOPP Level	Level of defense preparedness	MOPP 1-4
Trained Onsite Personnel	Rating of facility, where “0” represents a facility with no dedicated medical response team with CB defense training and “5” represents a facility with a dedicated CB response team.	0-5

Defensive measures-6

Chemical Prophylaxis	Type	PC1, PC2,…PC21,… (0 indicates null set)
	Agents effective against	Nerve agents, blood agents, choking agents, vesicants
	Risk level of side-effects – combined measure of probability and severity	low / medium / high
	Effectiveness	low / medium / high
	Maximum number of days safe to take prophylaxis continually	(integer)
	Number of days before prophylaxis becomes effective	(integer)
	Minimum number of days between pre-treatment cycles	(integer)
	Average percentage of base personnel receiving prophylaxis at any given time under normal conditions	0-100%

Defensive measures-7

Defensive Measure	Parameter	Range of Values / Units
Biological Prophylaxis	Type	PB1, PB2, …, PB42,… (0 indicates null set)
	Agents effective against	anthrax, botulinum toxin, ricin, smallpox, yersinia pestis, glanders, tularemia, brucellosis
	Risk level of side effects	Low / medium / high
	Effectiveness	Low / medium / high
	Number of days after inoculation commences before prophylaxis is effective	(integer)
	Duration of effectiveness in days	(integer)
	Percentage of base personnel inoculated	0-100%

Defensive measures-8

Medical Treatment (Chemical)	Type	MT1, MT2,…,MT47,… (0 indicates null set)
	Agents effective against	Nerve agents, blood agents, choking agents, vesicants
	Effectiveness	0-5
	Percentage of facility personnel covered by the antidote stockpile	0-100%
Medical Treatment (Biological)	Type	MT1, MT2,…,MT47,… (0 indicates null set)
	Agents effective against	Nerve agents, blood agents, choking agents, vesicants
	Effectiveness	0-5
	Percentage of facility personnel covered by treatment	0-100%

Impact/Cost

Impact / Cost	Parameter	Range of Values / Units
Casualties	Personnel killed or and / or injured	(integer)
Mission impact	Service dependent, (eg: Air-Force – Sortie generation rate reduction)	0-100%
Remediation costs	Cost to restore facility to full pre-attack capability	millions of $US
Geopolitical Impact	Affect on USG prestige	low / medium / high
S&T cost	Cost for research for new CB defensive measures	millions of $US
Deployment cost	Cost for fielding of new CB defensive measures	millions of $US
S&T time	Time to complete research for new CB defensive measures	(in months)
Deployment time	Time to complete fielding of new CB defensive measures	(in months)

Connections to the CBRN Data Model

- Top level: ACTIONs and OBJECTs
- ACTIONs are either EVENTs (unplanned) or TASKs (planned)
- Our SCENARIO is a conjoined CBRN-EVENT and a response TASK
- Connected by an ACTION-FUNCTIONAL ASSOCIATION
- OBJECTS are connected to the EVENTs and TASKs

Basic connections

- Inherent vulnerability – CBRN-EVENT / CHEMICAL-BIOLOGICAL-EVENT
- Inherent characteristics – FACILITY
- Defensive measures – ACTION-EVENT
- Cost/Impact – limited connection to Data model

Connections – Examples

- (Scenario) Air flows – (Data Model) WIND
- Agent – CHEMICAL/BIOLOGICAL-MATERIEL-TYPE
- Dispersal Mechanism – CBRN-EVENT-DELIVERY-MECHANISM
- Sensor – CBRN-SENSOR-TYPE

Connections – More examples

- Wall – WALL
- Gate – GAT
- Armed guards – GUARDN / GUARD
- Casualities – MEDICAL-FACILITY-STATUS-INTERVAL-CASUALTY-GROUP

Conclusions

- We have presented a detailed CB incident scenario that we believe is
  - Useful for our purposes
  - Is compatible with the CBRN Data Model
  - May be useful for other purposes

- Feedback? Questions?