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# USING ADAPTIVE MODELING TO VALIDATE CBRN RESPONSE ENTERPRISE (CRE) CAPABILITIES

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## ABSTRACT

This presentation will describe how the Emergency and Disaster Management Simulation (EDMSIM) was applied in context to a multi-stakeholder collaborative structure, to determine the adequacy of the emergency response to an improvised nuclear detonation in a major metropolitan area. The Chemical, Biological, Radiological, Nuclear (CBRN) Response Enterprise (CRE) Adaptive Modeling Laboratory was organized jointly by the National Guard Bureau (NGB) and the United States Northern Command (USNORTHCOM) as a way to validate the type, sequence of deployment and capacity of 17,600 CRE personnel and associated equipment who, on short notice, would respond with decontamination, medical and search-and-extraction resources to aid local jurisdictions. The laboratory used EDMSIM to drive the consumptive behavior of displaced populations and model the application of capacities to the disaster.

## 1 INTRODUCTION

Adaptive capacities in this experiment are the resources that leaders would apply incrementally to adapt to the social needs created by a disaster, in concert with the application of other agencies' adaptive capacities. Adaptive capacities would be applied with respect to resource notification and transportation lead-times and incorporate the results of "on-the-fly" feedback loops created by the incremental application of resources. The outcome of the adaptive modeling is to create what Hoffman (2015) describes as a "plausible trajectory," which visualizes a geographically specific evaluation of the CRE's capability to contribute to lifesaving operations.

## 2 INCORPORATING THE EFFECT OF HUMAN COLLABORATION ON DYNAMIC ASSESSMENT

The laboratory is designed to consider the performance of collaborative teams, since they affect priorities and the timeliness of response decisions. For example, in a disaster, the Unified Coordination Group is a multi-agency, multi-jurisdiction adhocracy that must quickly organize and negotiate response priorities. There are many psycho-social factors that influence group interaction that may speed or slow the response. According to Ozawa (2014), people trust one another and collaborate effectively when they understand each other's competence, share a sense of commitment, care about the solution to the problem and observe that fellow participants behave consistently with expectations.

Furthermore, according to Zellner, Hoch and Welch (2014), there are obstacles that stand in the way of developing needed trust, which include inaccurate perceptions of the problem between stakeholders and the incentive to "free ride" on the efforts of others. These factors make the management of multi-scale change through local interactions very difficult. To overcome these barriers, participants must develop a sense of shared vulnerability which can be created through context rich scenarios and assembling stakeholders so they can, "Conceive and compare future outcomes [through modeling]. Collective judgments about how to prepare the future improve with greater diversity in four elements;

sharing a common perspective, sharing a common interpretation of the problem, using heuristics and using predictive modeling."

The use of modeling supports collaborators by helping them to overcome the incentive to "free ride." Stakeholders free ride when they reserve their own resources, in order to preserve their ability to act at a later time, or to prevent wasting the resource due to uncertain outcomes. Modeling overcomes this incentive by helping participants to visualize what is needed, where it is needed and how their input affects the whole system. Models show a plausible end-to-end view of the process giving collaborators a sense of how critical dependencies perform in context to the system. Finally, models provide a useful experimentation platform to test hypothesis and provide incremental performance data.

## 3 LABORATORY DESIGN

The laboratory incorporates a multi-agency stakeholder group to help guide the development of the simulation and scenario. The stakeholder group includes decision-makers and planners from local and state emergency management, the Federal Emergency Management Administration, the Department of Defense and the National Guard. The same group participates in a pre-seminar validation meeting where the scenario, planning heuristic and simulation are validated and accepted by all. The stakeholder group then participates in a three-day seminar where laboratory controllers introduce a scenario vignette for participants to begin play.

The laboratory structure supports an interagency systems model that characterizes the coordination environment. The entire model is driven by the simulation which provides data to inform the situation. The amount of fidelity regarding the situation diminishes as one steps back through echelons. Efforts by lower echelons to improve situation fidelity in higher echelons flow upwards through reports, requests and common operating pictures.

Starting at the local level, emergency managers engage in an assessment, prioritization, coordination and implementation heuristic cycle. During implementation, laboratory controllers enter resource order instructions given by managers into EDMSIM, which moves and consumes resources. Based on reports and visualizations produced by EDMSIM, managers identify resource gaps and create a demand signal to cue resource requirements higher in the adhocracy. State and federal level managers engage in similar heuristics and create a demand signal for other agencies to answer within their respective echelon. As resources are applied, their effects are modeled and reported by EDMSIM, assessed by managers to determine residual needs and the heuristic cycles begin again.

## 4 CONCLUSION

While plausibility has a rather "bad reputation in science," it still is a viable decision-support mechanism, especially where there are physical limitations to experimentation (such as scale) (Hoffman, 2015). The CRE Adaptive Modeling Laboratory establishes viable trajectories where leaders within an adhocracy can see the potential effects of the application of their agency's resources. Conversely, they also learn what resources were not needed time and time again, which could improve their later fiscal decisions.

## REFERENCES

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