RAPID: Network Improvisation in Emergency Response: An Application to Debris Removal Operations

David Mendonça
Rensselaer Polytechnic Institute

Research under this RAPID award will investigate decision making processes within the emergent multi-organizational network that is undertaking post-Hurricane Sandy debris removal operations in the State of New York. The research is expected to contribute to an expanding body of research on how organizations improvise: that is, how organizations take creative and useful action under time constraint, with little or no possibility of undoing previous actions. This work will investigate simultaneous design and execution of the debris removal mission, focusing specifically on describing the evolving structure of relationships among the responding organizations, as well as their approach to addressing the many novel challenges arising from this event. It will examine the relationship between degree of improvisation within the organization and its performance, focusing specifically on tradeoffs between efficiency, effectiveness and distribution of effort. Detailed performance data will be extracted from records of loads hauled, as collected using existing computer-based systems, supplemented with questionaire data and cost estimates.

Methodologically, the work will employ and extend methods drawn from research on queueing networks to analyze debris removal activities, supplemented by statistical- and simulation-based methods for characterizing the behaviors of individuals and groups within these networks. This research is expected to improve understanding of how individual- and group-level activities (here, in the debris removal field) contribute to organizational-level performance. It is also expected to produce new techniques for characterizing non-routine decision making within emergent, multi-organizational networks.

The **intellectual merit** of the proposed research is in the collection and use of operational data to develop better theory regarding time-critical decision making in organizations. The work will employ an expanded range of methodological tools for investigating improvisation within queueing networks. Multiple methods for data collection will be used, including capture of transactional, archival and observational data, thereby providing multiple perspectives on the phenomena of interest. Finally, process-centered modeling approaches will be used to reveal underlying dynamics of improvisation in organizations.

The **broader impacts** of this research are in advancing discovery while promoting learning, through presentations to practicing professionals on the methods and results of this research. Enhancement of infrastructure will occur through the creation of validated data sets for addressing improvised behavior within complex queueing networks. Results of this work will be broadly disseminated through publications and presentations in academic and practitioner venues, to include seminars that introduce new tools and techniques to the practice of debris management. Finally, this work is expected to benefit society by contributing to its ability to plan for and respond to large-scale disasters, particularly by improving understanding of the determinants of debris removal performance.

Work to date has consisted of meetings with state and local emergency planners, field visits to Nassau County (Long Island) and New York City, as well as observation of debris planning meetings surrounding the design of the Fire Island debris removal mission. Data are currently being collected on loads hauled in Nassau County. Ongoing work includes preliminary data analysis and simulation modeling.