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Mega-City/Mega-Disaster Reduction: Persistent Challenges in Response and Recovery Management

Typical emergency response operating philosophies use a functionally-oriented command and control system to direct response and recovery following any sort of emergency event. In the U.S. this is systematized in national doctrine as the National Incident Management System (NIMS), which has at its core the Incident Command System (ICS). NIMS/ICS is an "all-hazards" approach intended to be employed to manage incidents of all types and of all sizes. This and other conceptually similar approaches around the world have a long and strong track record of success at enabling effective incident mitigation. Chief among the advantages of such systems is a commonly understood set of management conventions that allows numerous disparate agencies to work together seamlessly.

The way contemporary incident command and management systems are designed presumes that management requirements scale linearly from small, simple incidents to very large very complex incidents. The notion is that smaller incidents use a collapsed version of ICS, whereby only those functions warranted by the incident are staffed, and single individuals may assume several functional responsibilities. For larger, more complex incidents, or as a small incident grows larger and more complex, command and control structures expand to meet the demands of incident response. For very large incidents, multiple incident management teams each direct portions of the incident and are harmonized by superordinate command, control, and coordinating structures. Thus the management approach applied is essentially the same, regardless of the size and complexity of the incident.

In fact, however, though current incident management operating philosophies succeed well during moderately-sized or well-understood disaster events, they are inadequate in the face of very large, very complex incidents like Hurricane Katrina. Instead of scaling up

to address these incidents, management systems persistently fail in substantial ways. Disaster after disaster, after action reports document management challenges that frustrate the effectiveness of response and recovery efforts. This means that a major gap in preparedness for Mega-City/Mega-Disasters (MCMDs) is an assured management infrastructure to guarantee effective command, control, coordination, and communication. In particular, there are three areas where the capability of current management systems is insufficient:

Leadership. MCMD scenarios are plagued by unclear, multiple, duplicative, isolated, and sometimes conflicting and uncooperative command structures. Large incidents demand that robust command and control structures emerge out of the initial chaos that inevitably ensues when disasters strike so that resources may be brought to bear quickly and effectively to save lives. Typically, though, these incidents also involve a multitude of agencies from many disciplines and jurisdictions—and even from several different nations—each of which directs its own resources. Since each entity has legitimate missions, responsibilities, and authorities, each uses its own command and control process to take charge, in a legitimate attempt to meet the needs the agency faces and solve the problems it is supposed to solve. Absent a pervasive approach to which all participants subscribe, however, confusion results. Note that the term “command and control,” does not assume structures that are unitary, rigid, or static. In fact, successful management requires collaboration, flexibility, and adaptability across multiple diverse actors. Likewise, management approaches need not be imposed, but may develop organically. Thus the practical challenge and research puzzle is how coherent joint management networks can emerge in MCMDs where there are a very large number of organizations involved who don’t know each other and don’t habitually work together.

Communications. Our systems of coordination are predicated on being able to garner and disseminate information to support collaborative decision-making and enable joint operations. A major challenge of large disasters is that they destroy our physical infrastructure, including our communications systems. Despite the known limitations and fragility of the existing infrastructure, we lack contingency plans for how to communicate when technology fails (or is destroyed). And beyond this, communications isn’t entirely (or even fundamentally) a technology problem. Communicating requires that people have useful, actionable information and that they are willing to share it with each other. Thus

we face three research challenges: how to develop communications systems that will be available to us even during catastrophic events; how to create communications systems that work independent of technology; and how to generate the trusted relationships on which effective communications depend among people distributed across multiple, disparate, geographically distant organizations.

Logistics. Large-scale, long-duration incidents demand more resources–personnel, equipment, supplies, commodities, specialized capabilities–than any agency or government can maintain on hand, so these resources must be obtained rapidly when a disaster occurs. This makes resource identification, acquisition, management, and distribution a major function of incident management. Resources must be obtained "real-time," but normal management systems are too slow and are not designed to obtain large amounts of supplies rapidly and to distribute them directly to the places where they are needed, especially when transportation systems are disrupted. Private sector resource distribution systems, which make expert use of techniques like just-in-time resource delivery, are not designed around the episodic and uneven flows associated with disasters. Thus the research challenge is how to design systems that can predict the resource demands that will be levied by a disaster, identify resources to fill these demands in real time, and plan delivery systems that will work under the conditions created by the disaster.

Absent robust solutions to these fundamental challenges, response and recovery to MCMDs will be severely hindered. Viable solutions necessarily rest on technological innovation, particularly in the form of predictive models, management information systems, and decision support systems. That said, these technological solutions must give explicit consideration to the implications for people and the ways in which people interact in organizations and management structures which are designed around current tools and technologies. In short, solutions must be both usable and useful, and research approaches must therefore involve scientists, technologists, engineers, social scientists, and emergency response practitioners in close partnership with each other.