CENTER FOR HAZARDS RESEARCH AND POLICY DEVELOPMENT
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# The Role of Mobile Emergency Tactical Communication Systems for Disaster Response

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## Introduction

Enhanced communications continue to be of vital importance for effective response to disasters. Lack of communications directly contributes to low levels of situational awareness for both high-level commanders and emergency responders in the field. When all lines of contact are down, effective response to disaster is greatly diminished. Establishing and maintaining lines of direct contact between decision makers, formal and informal responders, government officials, and the public is a primary objective in any emergency planning or response scenario. A continuing reexamination of providing emergency communications is critical for lessening the impacts of future disasters. Utilizing advances in technology that allow for higher degrees of mobility for communications systems introduces a new level of flexibility for operational command structures.

## Emergency Operations Centers

The emergency operations center (EOC) is regarded as the central physical point in an emergency communications infrastructure. Perry (1995) provides a definition for the emergency operations center; in addition to assembling and managing emergency

response, the EOC serves as the hub for communications with other levels of government, the private sector, and the public. The EOC is the physical location at which the coordination of information and resources normally take place (U.S Department of Homeland Security, 2004). In many jurisdictions EOCs are intended to serve as the central decision making node for response efforts. The EOC in Honolulu, Hawaii not only houses communications and radio devices for EMS, hospitals, police, fire, utility companies, and federal, state, and other county agencies, but is also designed to establish operational policy (Prizzia and Helfand, 2001).

Standing EOCs, or those activated to support larger, more complex events, are typically established in a more central or permanently established facility at a higher level of organization within a jurisdiction (U.S Department of Homeland Security, 2004). There are some advantages to housing emergency operations in a fixed location. Maintaining distance from incident sites that are dangerous and potentially disruptive to command personnel is important. In cases where hazard effects are multi-jurisdictional it is helpful for complicated organizational structures to locate EOCs in a large space for comfortable accommodation of representatives and officers from various agencies.

While standing EOCs serve the central command and control node during disasters, there are drawbacks in tying decision making processes to a fixed location at a distance from the incident scene. Emergency Operations Centers with stations for all participants within a single “war room” go a long way to promote cooperation between the local agencies represented in that room, but communication in the field is generally still a considerable problem (Wolshon et al, 2005). Poor communications with incident responders decreases the situational awareness of the command staff at the EOC. Such

unfamiliarity with the on-scene situation leads to poor decision-making. McEntire describes the situation after the March 2000 tornado in Fort Worth, TX:

> Another problem evident during the response was a lack of initial communication between field personnel and emergency managers in the operations center. After the tornado dissipated, the emergency operations center (EOC) sent city crews into the downtown area to start the process of debris removal. Unfortunately, the emergency operations center was not aware of the dangerous condition owing to the hanging glass from the high-rise buildings (2002).

Also, there is possibility that the EOC will be destroyed or rendered useless due to the effects of a disaster. Many EOCs along the Gulf Coast suffered this fate during Hurricane Katrina in 2005. Flooding in New Orleans on August 30 forced the closure of the Orleans Parish EOC, leaving the Mayor with no ability to command local efforts or to guide State and Federal support for two days following the storm (U.S. Assistant to the President for Homeland Security and Counterterrorism, 2006). In Waveland, Mississippi the storms generated by Katrina destroyed all command and control communications even though the city had staged resources at various public buildings and on the outskirts of the city (US House of Representatives, 2006). In such cases the loss of capacity to direct response efforts greatly contributes to breakdowns in effective incident management.

**Incident Command and Communications**

Operationally, response and support agencies rely heavily upon communication to support a comprehensive and complex emergency management system necessary to ensure a well-orchestrated response to emergency incidents (Anderson and Gow, 2002).

To increase the level of communications between EOCs and on-scene personnel, the National Incident Management System (NIMS) sets guidelines for Incident Command Posts (ICPs) to be located within the immediate disaster or emergency area and operated under the directives laid out in the Incident Command System (ICS). Not only does the ICP relay critical information to staff at the EOC, it serves as the location of the tactical-level, on-scene incident command and management organization (U.S Department of Homeland Security, 2004). ICPs are established by Incident Commanders (ICs). Following this establishment, and throughout the incident, the IC performs seven functions (Perry, 2003):

- conducts initial situation evaluation and continual reassessments;
- initiates, maintains and controls communications;
- identifies incident management strategy, develop an action plan and assign resources;
- calls for supplemental resources, including EOC activation;
- develop an organizational command structure;
- continually reviews, evaluates and revises incident action plan; and
- provides for continuing, transferring and terminating command.

While both the EOC and ICP could in theory be located side-by-side, maintaining a distinct separation between the ICP and the EOC allows for flexibility in the chain of command and hopefully a decrease in miscommunications. For example, officials at the EOC can make off-scene logistical decisions such as the procurement of emergency supplies, while ICs direct the field personnel when immediate action is necessary. McHugh describes how a county-wide EOC and city-level Incident Command interacted during severe flooding in 1993 in a district of Tucson, Arizona:

> Following the activation of the EOC and the Rincon district's ICS, the Sheriff's commanders responsible for each visited to confirm how the two structures would interface. In brief, the role of the EOC was confirmed to be one of county-wide co-ordination that focused on county-wide policy decisions, resource allocation, planning, and public information functions. Simultaneously, the role of the Rincon district ICS was the command and control of incidents occurring within that district (McHugh 1995).

**Mobile Command and Communications**

Department of Homeland Security guidance states that in smaller or single jurisdiction incidents the ICP can perform as the EOC (2004). An on-scene communications center provides obvious advantages for directing sensitive and often dangerous response operations due to heightened situational awareness. Mobile command and control was successfully employed at a large scale in the 2001 World Trade Center disaster. During the World Trade Center attacks emergency managers, along with the Mayor, utilized a mobile emergency operations unit to maintain command while retreating as the area around the impact site became increasingly dangerous (Kendra and Wachtendorf, 2003).

Technological advances provide personnel with tools once only available at fixed operations centers. Incident Commanders do not have to rely on a stationary EOC at another location to attain maps or search databases to find critical information for the response efforts. For example, new technologies used extensively in response efforts for the Northridge earthquake included computers, cellular telephones, geographic information systems (GIS) data bases, satellite communications, and teleconferencing (Quarantelli, 1997).

Many jurisdictions do not have access to the latest software, computer hardware, and communications technologies for response to natural disasters or terrorist attacks. It

may not be economically efficient or even feasible to equip every jurisdictional EOC with state-of-the-art telecommunications and spatial analysis tools. Such circumstances demonstrate the need for a low-cost, rapidly deployable package to connect the Incident Commander with local agencies and emergency officials at the state and federal level. In such cases it would be prudent for regional authorities to maintain a readily deployable solution for communications and data acquisition in the event of disaster.

**Mobile Communications Technology**

The portability of modern technologies allows for new flexibility in the command chain as sophisticated communications equipment can be transported to almost any location via boat or rugged, all-terrain vehicles. On-scene personnel now have access to a similar level of communications prowess that in the past would only be possible at a traditional, stationary EOC. Combined with the appropriate vehicle, technology that allows for both wireless voice and data transmissions can be deployed to almost any location, including areas within the incident vicinity.

Wireless communication technology is becoming a critical component of the emergency communications infrastructure, not only because of its portability, but equally due to low cost and capability to operate independently from fixed and potentially vulnerable wire line-based trunking for transmission and reception of information (Anderson and Gow, 2002). Wireless communications have greatly increased the quality of information that can be transmitted to and from an ICP. Mapping and spatial data can be relayed from the scene to personnel at almost any location via wireless networks to laptop computers.

Satellite telephony and voice-over-IP telephone systems greatly enhance communications in the field. A satellite telephone is a wireless device that uses mobile satellite service to send voice and data. Voice-over-IP (Internet protocol) phones convert audio signals and telephony control signals into Internet protocol packets that plug into data networks and operate like traditional telephone sets. Mississippi Emergency Management Agency (MEMA) personnel have mobile satellite radios for communications and after Katrina struck, this was often the only functional form of communications in the state (US Senate, 2006). Portable satellite phones purchased during Katrina are now a part of Mississippi's State Emergency Response Team deployment package and can be issued to local authorities as a redundant system in disasters (H. Res 437: Hurricane Katrina).

Communications interoperability is frequently seen as a technical solution for coordinating emergency response, particularly across agencies from different jurisdictions. Innovations in radio interoperability provide for single systems that can communicate on a wide range of frequencies. The capability is important since responders at the local level or responders in rural areas often operate on different frequencies than state agencies and even neighboring jurisdictions. For example, during the Hurricane Floyd evacuation, personnel from different state agencies found themselves unable to directly communicate within and across agencies (Wolshon, 2002). The Department of Transportation's emergency operations staff in South Carolina was at times unable to communicate with the state police and other field personnel because these agencies used separate field radio systems (Wolshon, 2002). Advocates argue that radio

interoperability could lead to a future where no person loses a life or is injured because available information could not be shared (National Task Force on Interoperability, 2003)

While technological advancements can dramatically improve emergency communications, the possibility of total failure of the communications infrastructure can render the most sophisticated equipment useless. Hurricane Katrina demonstrated that emergency responders can never fully rely on interoperable radio or satellite telephone in the face of catastrophe. During the Katrina response, emergency personnel found that nearly all forms of communication, such as cell phones, landlines, and satellite phones were down, and the Louisiana State Police radio was inoperable because the frequency on which it operated was clogged with users (McKay, 2006). According to MEMA director Robert Latham (2005):

> The entire communication infrastructure of Mississippi's Gulf Coast was destroyed and systems in many other parts of our state were rendered inoperable while systems that were operational were overloaded. While we have invested millions of dollars in communication interoperability, the issue after Katrina was operability.

Many have lauded the satellite phone specifically for emergency communications. However, anecdotal evidence from response efforts for Hurricane Katrina suggests that satellite phones may not be a communications best practice. New Orleans Mayor Ray Nagin said that he had "a huge box of satellite phones that did not work" and in Mississippi, a Federal Emergency Management Agency (FEMA) employee said that satellite phone connections were "sporadic" (US Senate, 2006). Representatives of Globalstar, a major satellite phone provider that supplies the federal government, Louisiana, and Mississippi, claim that the problems with satellite phones do not appear to have been caused by the phones themselves or the satellite networks; rather, a

combination of user error and buildings or other objects obstructing satellite signals are the more likely culprits (US Senate, 2006).

**Mobile Operations Centers**

FEMA maintains large mobile operation vehicles as a part of several Mobile Emergency Response Support (MERS) detachments located in strategic locations across the US. The vehicles are deployed to serve as command and communications facilities for FEMA response teams or to support state or local officials:

> The Emergency Operations Vehicle (EOV), assigned to the FEMA Mobile Emergency Response Support (MERS) Detachment in Denton, Texas is an 82 foot long tractor/trailer weighing 92,000 pounds. A section of the trailer sides expands to form a work area capable of housing a 20-25 person Federal Response Team. The remainder of the trailer houses the MERS Operations and Communications Centers, a Reception area, and a small office for the Team Director (Federal Emergency Management Agency, 2005).

Tractor/trailer-style mobile operations centers offer space for multiple agencies and a degree of comfort for response commanders. Larger vehicles also have the capability to transport larger quantities of communications equipment and other supplies.

A drawback for mobile operations vehicles of this size is a reduction in access to hard to reach areas. When there is a desperate need for on-scene communications larger command vehicles have a limited degree of mobility. In urban settings, large tractor trailers have difficulty navigating damaged infrastructure. Such was the case for FEMA's "Red October" EOV in the aftermath of Hurricane Katrina:

> As the situation unfolded in New Orleans, and the flooding destroyed much of the command and control capability of the city, FEMA officials decided to move Red October to New Orleans to provide on-site command and control to its advance team and to help connect with New Orleans and National Guard authorities at the Superdome. However, Red October was unable to do so because of its oversized dimensions (US House of Representatives, 2006).

FEMA MERS detachments include the more maneuverable Quick Reaction System (QRS). The QRS is a rapid response system consisting of 4-wheel drive vehicles and support equipment including a satellite terminal, cellular telephones, laptop computers, radios, water, food, batteries, and generators (Federal Emergency Management Agency, 2005). Investigators of the Hurricane Katrina response effort questioned why FEMA did not deploy a smaller communications vehicle, similar to the QRS, to the Superdome when the Red October experienced difficulties moving there, or why FEMA did not attempt to airlift smaller MERS equipment (satellite phones in particular) into the Superdome once New Orleans flooded (US Senate, 2006).

Smaller, more mobile command and communications gear is available from commercial providers. A common arrangement is to house portable, interoperable communications suites in a vehicle paid for and maintained by state or local agencies. Quantum Research International offers a system designed to fit on the cargo area of a full-size pickup truck similar to a small camper (Quantum Research International, 2005). Some commercial vendors offer portable and interoperable systems that can be configured for mobile use in vans or SUVs by regional contractors.

The cost of commercially-procured mobile operations systems is an issue for rural jurisdictions or small incorporated areas. The Kentucky Homeland Security University Consortium (KHSUC), an association of researchers from Kentucky state colleges, is

developing and testing a more affordable mobile communications platform. The goal of the Man-portable Interoperable Tactical Operations Center (MiTOC) is to design, test, deploy and evaluate a suite of portable interoperable voice, data, radio, and video technologies mounted in a truck or helicopter. The researchers seek to validate the strategy as a less expensive solution than equipping every jurisdiction with an EOC or an expensive command center bus (KHSUC, 2005). Involving state-funded research institutions in the advancement of mobile emergency communications systems lowers costs further as systems are not developed for profit.

Kentucky's MiTOC demonstrates the flexibility of a mobile command and communications suite. Units are designed to support emergency management operations along with incident scene command structures. Through configuration in all-terrain or amphibious vehicles units can be rapidly deployed to provide not only command communications, but as in the case of the MiTOC, a wireless remote weather station, plume modeling capabilities, cellular data connectivity, and the ability to set up wireless communications networks (KHSUC, 2005). Beyond serving as an informal EOC, mobile units can act as command centers for special events. The MiTOC was assigned to the infield police compound during the 2005 Kentucky Derby to provide situational awareness, surveillance, and an on-site weather station at the venue (KHSUC, 2005). Similarly, the City of Chicago recently deployed mobile, interoperable communications at a major festival allowing over twenty separate agencies to coordinate their emergency preparedness and potential response (Raytheon, 2005).

## Conclusion

A question for emergency management agencies and disaster researchers alike is how to conceptualize the operations of mobile command and communications systems. Some look to best practices from federal agencies and programs such as SAFECOM and the FEMA National Incident Management System (NIMS). Personal experiences and suggestions from a cadre of professional emergency services personnel from areas of law enforcement, emergency management, medical services, and fire are valuable resources for developing an operational concept for mobile communications (KHSUC, 2005).

A military style command structure as laid out in the ICS and NIMS seems to be the preferred approach for managing the interface between operational organization and emergency communications. Some question this concept of operations where emergency communications are configured from the top-down. Granot (1997) describes an environment of doubt regarding the applicability of military style command for disaster response. He argues for the development of informal, ad hoc channels for emergency co-ordination through exchange and communication (Granot, 1997).

Despite the operational concept, mobile communications and command centers provide heightened levels of situational awareness for emergency response. In particular, the report on Hurricane Katrina from the US Congress (2006) praises both MEMA and Pearl River County Mississippi for using Department of Homeland Security (DHS) grant funding to invest in mobile communications units that allowed for sustained emergency communications within the county and with officials at the state level. The US Senate (2006) investigation of the Hurricane Katrina response effort recommends the development of regional networks of mobile communications teams:

> The Department of Homeland Security (DHS) should strengthen its mobile emergency response teams' ability to provide communications support during disasters. DHS should acquire and position at regional offices mobile communications suites or caches of secure, interoperable emergency communications equipment and systems that can be deployed when normal land line, mobile, and radio systems are disrupted or destroyed.

The flexibility of mobile command and communications allows for optimal on-scene interaction between incident responders combined with an ability to act as a communications clearinghouse for support activities and information dissemination to the public. This paper highlights the importance of flexible communications for emergency operations, but communications, even state of the art wireless systems, are not the only factor for effective emergency response. Preparedness to respond through a continuing series of exercises, drills, and simulations should also remain a paramount concern; particularly when new, and untested technologies are employed.

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