

Interstate Partnerships in Emergency Management: Emergency Management Assistance Compact (EMAC) in Response to Catastrophic Disasters

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Abstract: The Emergency Management Assistance Compact (EMAC) is a mutual aid agreement and partnership between states that allows states to assist one another in responding to natural and man-made disasters. The assistance is often in advance of Federal disaster assistance. This article examines EMAC's response to the catastrophic disasters Hurricanes Katrina and Rita in order to address the significant need for analysis of emergency management at the state level. A content analysis of news reports, government documents, and reports from a number of institutions was performed to determine the volume and direction of EMAC's performance and its transactions during the response operations. A major finding was the lack of current EMAC training taken by responders, reducing communication and coordination, and potentially, efficiency and effectiveness of the response operations. A network analysis using the NEMA/EMAC 2005 Hurricane After-Action Report was conducted by the UCINET social network analysis program. Network analyses assessed the relationships among the responding organizations to coordinate their emergency response operations.

Keywords: Networks, EMAC, Emergency management, Interstate partnerships, Horizontal partnerships

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Introduction

The policies and practices that guide response to disaster vary widely across federal, state, and municipal entities. In responding to large scale disasters, both horizontal and vertical coordination is necessary, reinforcing the importance of “loosely coupled” (Drabek 1990), or flexible, partnerships, as “...a decentralized system (that) provides for varying forms of partnerships among federal, state, and local governments with specialized roles for elements of the private sector” (Drabek 1990: 13). The Emergency Management Association Compact (EMAC) is a mutual aid agreement and partnership between states that allows states to assist one another in responding to natural and man-made disasters (Kapucu 2005). It offers clear implementation and ratification procedures, allowing states to assist each other with some certainty of the expectations and responsibilities involved. When federal disaster assistance is required, EMAC allows states to provide assistance to one another in advance of the Federal Emergency Management Agency (FEMA).

The Federal government focuses on regional and state cooperation and collaboration as a system to ensure better emergency response and preparedness and better use of resources (NEMA 2006; DHS 2004a, 2004b), however, most emergency management research has focused on local and federal level analysis. There is a need for state level analysis of emergency management systems (Waugh and Streib 2006). Interstate relations have been studied by public administration scholars (i.e., Bowman 2004; Zimmerman 2002, 1996; Mushkatel and Wescher 1985). EMAC has been mentioned in some of these studies as an example for state mutual aid compacts, however, EMAC has not been studied in detail. This study contributes to our

understanding of interstate relations in emergency management, examining EMAC's response to a catastrophic disaster as example.

EMAC was first introduced in 1993 as a result of the Governor of Florida's dissatisfaction with the Hurricane Andrew emergency response operations. EMAC was approved by Congress in 1996 as Public Law 104-321 and requires states to legislate EMAC in order to be a member of the Compact. The 50 states, the District of Columbia, Puerto Rico and the U.S. Virgin Islands have now enacted EMAC legislation.

This article examines the following questions: What key strategies were used by state emergency managers to coordinate the interstate networks that emerged following Hurricanes Katrina and Rita? What was the life span of the interstate networks that emerged after the hurricanes? What was the pattern of relationships between the states in response to the hurricanes? What policy and procedural recommendations are appropriate for state emergency managers regarding the implementation of the key strategies to coordinate interstate networks that emerged following the hurricanes?

This study incorporates a literature review and documentary analysis including State and FEMA/DHS situation reports and after action reports, plus a social network analysis of the document data. In studying emergency response operations, the network perspective has been of interest for disaster researchers for decades (Kapucu 2006a). Organization theorists have shown a continuing interest in the evolution of organizational forms from tightly coupled forms, to moderately coupled bureaucracies, to loosely coupled networks. This study is an example of how interstate networks are energized to act in response to disasters using EMAC's response to hurricanes in 2005. This research uses networks, partnerships, and collaborations in intergovernmental relations in a disaster response mechanism as a theoretical framework. This

study goes beyond thinking of “network” as a metaphor and develops closer empirical examination of networks in terms of policy and management. The implications to policy and management include the argument by James Mitchell (2006) that partnerships are essential to the American system of hazard management and will become more important as the world confronts new kinds of threats.

Theoretical Framework: Networks in Emergency Management

Notions of partnership have proven their value in reducing hazards and are both rooted in the societal traditions of the U.S. and well suited to the complexities of contemporary American life ((Kapucu 2006a; Mitchell 2006; Townsend 2006; Schneider 2005; Kamarck 2004; Bardach 1998; Drabek 1990). While the term network is often used loosely to incorporate all coordination that is not hierarchal or market, there are three types of network coordination that rely upon voluntary participation and mutual trust to succeed: partnerships, networks, and collaborations. Partnerships, networks, and collaborations have distinguishing characteristics that are identifiable by the participating parties’ investment and formality in the relationship. Partnerships occur when public or private organizations agree to work together to meet a mutually decided goal. These relationships are generally limited in scope and the organizations remain independent of one another but can become more integrated as the relationship grows (Klitgaard and Treverton 2004; Mandell 2004; Drabek 2003). Conversely, networks are characteristically defined by the level of interorganizational dependence, variety of actors and goals, and length of relationships. Based upon these characteristics, networks can be placed on a continuum based upon “the degree to which the individual members remain separate and autonomous or form a new, combined, unit for long-term change and interactions” (Mandell 2004: 5). Robert Agranoff (2004) identified four types of networks named informational,

developmental, outreach, and action that as titled described the intent and purpose of the network. These networks, as applied to the network continuum, provide a good base for using network characteristics to define the level of network because as you move from one end of the continuum to the other, the degree of interdependence and the need for collaboration varies. Loosely coupled networks, for example, are composed of parts or systems that are autonomous (Weick and Roberts 1993; Orton and Weick 1990; Weick 1989; Ostrom 1990). The benefits of loosely coupled systems include flexibility and adaptability, and the ability to adjust quickly to meet the changing environmental demands of disasters and catastrophic events (Zimmerman 2002; Dhillon and Orton 2001).

Networks and partnerships play an important role as a policy instrument for addressing natural hazards and disasters (Mitchell 2006). The formal or informal partnerships of public, nonprofit, and private agencies have permitted these groups to combine and lever their separate contributions to hazard mitigation programs (Mitchell 2006). The multi-level U.S. government structure, the division of power among the three government branches, and the principle of checks and balances imply a need for bridge-building, with an additional need for cooperation because of the size of the country.

William Waugh (2006) refers to the collaborative and cooperative orientation of the nation's emergency management networks. States interact with each other in a variety of ways in the American federal system. The focus of this article is an interstate cooperation, Emergency Management Assistance Compact (EMAC), and its response to the 2005 Hurricanes: Katrina and Rita. Freedberg (2002) states the significance of EMAC. "So what does the compact actually do? States helped each other long before EMAC, through a variety of specific regional

agreements and a nationwide civil defense compact dating from the 1950s. But states had no comprehensive and consistent national standard to turn to” (p. 1002-3).

In the U.S., unlike in some other federal government systems, states can develop relationships and connections without the approval of the Federal government. This flexibility enables states to develop inter-jurisdictional and regional partnerships (Bowman 2004; Agranoff and McGuire 2003; Zimmerman 2002; Peters and Pierre. 2001; Voit and Nitting 1999). The growing number of horizontal relationships is a result of complex issues requiring the use of management tools that fall outside of the boundaries of the traditional vertical relationship (Bowman 2004; O’Toole 2003, 2000). Mutual aid agreements require state legislative approval (Zimmerman 1996). States work together to solve common problems that affect them jointly, including, in the case of EMAC, disaster response and recovery. Organizations tasked with addressing issues that have a great scope, affect a large population, or require an immense amount of resources have crossed traditional hierarchal boundaries, and state lines, to collaborate with other states.

The horizontal relationships created through governance are forms of interstate relations and can be utilized to identify better ways to respond to disaster situations. While intergovernmental relations can take form as a partnership or collaboration, other relationships are created through reorganization, deregulation, devolution, regulation, capacity building, conflict management, and individual and group communication depending on the need of the agencies and the issue (Radin 2003).

Interstate Coordination in Response to Catastrophic Disasters

Catastrophic events are occurrences that are notable, rare, unique, and profound, in terms of their impacts, effects, or outcomes. Hurricane Katrina is an example of a catastrophic event

with significant impact upon humanity. All members of the community were affected, and no single organization could have managed the response alone. The capacity of a society to understand and manage emergencies depends on its ability to understand, anticipate, prepare for, and respond to them. Communities responding to disasters are seen as coping collectively with shared pain, loss, and disruption and as temporarily suspending ongoing conflicts and disagreements in the interest of meeting urgent needs and beginning the recovery process. Resilient communities are characterized by reduced failure, measured in terms of lives lost, damage, and negative social and economic impacts, and reduced time to recovery – that is, more rapid restoration of the social systems and institutions to their normal, pre-disaster levels of functioning (Comfort and Kapucu 2006; McEntire 2002; McLoughlin 1985).

Intergovernmental relations are used to coordinate between and among the various levels of government focusing on interorganizational coordination to implement policy decisions (Walters and Kettl 2005; Waugh 2004; O'Toole 2003, 2000). Coordination requires that different positions or actors perform subtasks of the decision in a sequential order versus collaboration where team members must cooperate throughout all stages of the task. Furthermore, coordination is focused uninterrupted operation of the sequential tasks with no reference to outcome while collaboration is highly focused on achieving the intended outcome (Drabek 2003; Denise 1999; Birkland 1997). The differentiation between coordination and collaboration makes them useful tools depending on the nature of the cooperative effort (Mandell 2004). Networks and partnerships are commonly referenced as the vehicles of collaboration, but collaboration can also be a product of a highly distinguished, interdependent relationship (Kamensky and Burlin 2004). Whereas networks and partnerships represent high levels of autonomy and separation, the organizations of collaboration are highly interdependent to the

point of creating a new entity from the collaboration process (Mandell 2004). Finally, interstate coordination is a political process (Peters 1998). Interstate relations occur in a political environment. Within this environment, the most successful coordination efforts are those that are done voluntarily, but results in a trade off in how well these voluntary actors can perform (Peters 1998). Coordination among networks can be guided by understanding the organizations underlying values. Networks created to implement coordination of activities are best created of voluntary organizations with similar intents and purposes.

Interstate Relations as Interorganizational Networks

Interstate relations act as interorganizational collaborations when multiple organizations go beyond simply coordinating activities and resources (Denise 1999; Mandell 2004; Tierney 1985; Waugh and Sylves 1996; Wright 1998; Kamensky, Burlin, and Abramson 2004; Waugh 2004, 2000). The use of integrated interdependent collaborations as a form of interstate relations allows states to work together and create a new solution to a problem larger than any one state can handle.

In addition to group processes such as respect, trust, and regular interaction, states must have the capacity to collaborate in order to be successful in disaster response operations. A state's capacity to collaborate includes having the appropriate resources (e.g., financial, technological, human, and time) to contribute to a collaborative effort. Not only does a state need to be able to support its commitment to the collaboration, the state needs to be able to effectively communicate within an interagency context. Eugene Bardach (1998) identified interagency collaborative capacity (ICC) as an important framework for creating new collaborative efforts. Building ICC is compared to building a house; it requires not only tools and supplies but the knowledge to build the house correctly. Successful collaboration capacity

building is a “function of the skill and purposiveness of craftsman interacting with the quality of available materials and the craftsmen’s ability to fashion protections against potentially destructive environmental forces such as personnel turnover and the erosion of political alliances” (Bardach 1998: 49). Building capacity for interagency collaboration requires that participating managers remain steadfast in the process without giving in to personal preferences. Collaboration efforts integrate multiple organizations to create a new product, yet the product belongs to the organizations and the collaboration, not the individuals. The power of creation can be confused with ownership and the need for control, which is actually detrimental to the collaborative effort.

Public administrators faced with the task of coordinating the efforts of networks or creating a new product through collaboration are not necessarily experts on working in an interagency context. In a network, the implementation of network programs is often done in home agencies. The individual agencies take their network assignments and implement them with their organization’s resources, which lie outside the direct view of network peers. However, this limits the ability of the network to ensure successful implementation because ultimately, the agency is independent (Agranoff 2004). In collaborations, the challenge exists in overcoming the organizations’ structural and cultural differences and to “determine its strengths and weaknesses for encouraging cooperative effort; and then to tap common interest and exchange, as appropriate and practical, to increase prospects for success” (O’Toole 2003: 238). The prospects for success are highlighted by bringing on board capable partners, developing a supportive environment, and structuring to achieve results (NAPA 2004, 2003).

Interstate relations in emergency management is foremost the coordination of multiple state agencies with independent responsibilities to come together to accomplish a task that

cannot be accomplished alone. This synergy is exemplified by the efforts of first responders in disaster situations. Local emergency management officials hold the Emergency Operations Center (EOC) as the nucleus of response operations where representatives of public safety, fire/rescue, law enforcement, city, local health departments, and local water districts meet to ensure that necessary information is communicated in a timely fashion. Press conferences are held to inform residents of the current disaster situation and provide additional instruction. Various informal networks respond during a disaster such as those providing immediate shelter, food, or health services during and after the disaster. Public, private, and nonprofit organizations align themselves with one another based upon their purpose and coordinate their efforts by communicating through the EOC to support the community. Applying this framework to homeland security becomes unclear as the scope of the disaster become wider and more ambiguous and the number of the agencies participating grows.

A successful organization is built upon interdependency, trust, and sharing the credit for successes (Agranoff 2004). Developing trust among agencies is done by mutual learning and action in a network. The actions that most build trust are the completion of accepted assignments, follow through and commitment to the cause. A high level of interdependency among agencies also builds trust and strengthens the network because agencies recognize the reciprocal need to be a competent peer (Agranoff 2004; O'Toole 2003; Mandell 2004). If one partner does not perform their objectives in an interdependent relationship, the other is bound to fail as well. This places accountability with each agency and their peer is likely to be their biggest motivator. In addition, individual organizations accepting praise for a network success breeds discontent among the network agencies and overall, negatively affects the network.

Effective horizontal relationships are essential to improving the disaster response mechanisms that currently exist (Agranoff 2004; Kettl 2004).

Emergency Management Assistance Compact (EMAC)

The Emergency Management Assistance Compact (EMAC) is a national interstate mutual aid compact that facilitates the sharing of resources, personnel and equipment across state lines during times of disaster and emergency. EMAC was legislated by each member state legislature and governor and was ratified and signed into law by the U.S. Congress (PL 104-321) in 1996.ⁱ The 50 states, the District of Columbia, Puerto Rico and the U.S. Virgin Islands have enacted EMAC legislation.ⁱⁱ EMAC visions itself as the cornerstone of national mutual aid, to facilitate the efficient and effective sharing of resources between member states during times of emergencies or disasters affecting a member state.

In 1992, Hurricane Andrew slammed into Florida. In response, the Southern Governors Association (SGA) began development of a mutual aid compact. In 1993, 17 governors signed the Southern Region Emergency Management Assistance Compact (SREMAC), later expanded to EMAC, the first national compact since the Civil Defense Act of 1950. EMAC was activated for the first time during Hurricane Opal in 1995, with the National Emergency Management Association (NEMA) assuming the role of administrator of EMAC (Bea 2006; NEMA 2006b, 2000; Kapucu 2005; Voit 2003; Zimmerman 2002). Currently, all 50 states, the District of Columbia, Puerto Rico, and U.S. Virgin islands are members of EMAC. EMAC is administered by National Emergency Management Association (NEMA) and the compact includes key provisions in reimbursement, liability and workers compensation (NEMA 2006b).

EMAC establishes an implementation plan whereby member states all agree to standard operating procedures for requesting and providing assistance. EMAC requires that the

legislatures of each member state ratify the compact language, which eliminates confusion over who is a member of the compact and provides a legal framework to facilitate assistance and reimbursement. EMAC addresses all the issues associated with requesting, assistance, reimbursement of services, workman's compensation, insurance, and liability in advance of a disaster (Phillips 2006; Zimmerman 2002). EMAC allows states to assist each other with some certainty of the expectations and responsibilities involved, which in turn would increase the likelihood of them doing so at considerably reduced risk of suit or of great expense.

EMAC activation, in simplified terms, occurs in four steps: 1) a disaster occurs, and a state governor declares a state of emergency; 2) the state Emergency Management Agency assesses the needs; 3) resources are requested via the EMAC system; and 4) the assisting state(s) provide resources. EMAC is a state to state agreement and "EMAC deployments are legal contracts, not arbitrary mobilizations" (NEMA 2006b: 21). Private local resources can only be deployed under EMAC if there is an agreement between the state and the private volunteer organization. What EMAC does and what it does not do is clear. EMAC does maximize the use of all available resources, coordinate resource deployments with the National Response Plan (NRP) structure and resources, expedite and streamline delivery of assistance between member states, protect state sovereignty, and provide management and oversight for requesting and receiving interstate aid. EMAC does not replace the need for federal support, alter a requesting state's operational direction and control structure, or endorse or support self-deployment or self-dispatching from any source. EMAC is not the answer to meeting all resource shortages, but when properly executed for its intended purpose, EMAC has proven to be very effective (Coople 2006; Shaifer 2006).ⁱⁱⁱ

Although equipment and hardware replacement is available through mutual-aid and other sources, affected local and state personnel quickly become overwhelmed and need critical personnel support for long-term/protracted operations. EMAC can provide peer positional augmentation for a vast number of emergency functions. EMAC applications include: state/local EOC support, damage assessment, disaster recovery, logistics, donations management, security, communications, fire fighting, aviation support, biological/chemical events, medical personnel/resources, hazard mitigation, community outreach, search and rescue, debris clearance, information and planning, public health, hazardous materials, human services/mass care, animal control, information/planning, and terrorist events. The key points to remember are that any available capability of a member state can be shared with other member states and the EMAC system provides the mechanism for doing this (Shaifer 2006).

The most important component of the EMAC process is active state membership. EMAC committee and executive task force positions are comprised of member state personnel, and member State Authorized Representatives execute the compact on behalf of their respective states. They are authorized to execute EMAC documents and obligate state resources and funds. The State Designated Representative is the primary operations point of contact for EMAC requests. Each year one EMAC signatory state assumes the National Coordinating Group (NCG) role – the operational arm of EMAC. The purpose of the NCG is to function as the central coordinating actor to facilitate the smooth flow of resources and expertise from EMAC member states and territories to the requesting disaster-impacted state/s. The New York State Emergency Management Office served in the NCG role from September 2004 until September 2005; Hurricane Katrina made landfall in Southeast Louisiana on August 29, 2005.

While states are capable of managing most emergencies, there are times when disasters exceed state and local resources and therefore require outside assistance. Usually, this assistance comes from federal agencies. However, not all disasters are eligible for federal disaster assistance. EMAC provides another way for states to receive interstate aid in a disaster (ICMA 2006). EMAC assistance may supplement federal assistance when the latter is available or replace federal assistance when unavailable. EMAC allows for a quick response to disasters using the unique resources and expertise possessed by member states.

EMAC creates an interstate network for sharing of resources in response to disasters. EMAC aims to maximize use of available resources, coordinate deployment of EMAC resources with the National Response Plan resources, and expedite and streamline delivery of assistance between member states. EMAC does not replace Federal support, permit use of National Guard resources for military purposes, nor alter operational direction and control. It does allow states to provide assistance to one another in advance of the FEMA. One of the purposes of EMAC is to avoid delays in FEMA assistance and to automate the provision of mutual aid. EMAC member states are responsible to be prepared to coordinate a request for, or the provision of, interstate mutual aid to implement EMAC.

Method

We have conducted content analyses of news reports, government documents, and after action reports from various institutions. The main goal of the content analysis was to find out the volume and the direction of EMAC's performance and its coordination of transactions and resources during its response to the catastrophic disaster. The study utilizes data from the content analyses of related news reports from the New York Times; FEMA National Situation Reports; Florida State Emergency Response (SERT) Situation Reports; New Orleans City

Reports; Louisiana State Situation Reports; Mississippi State Situational Reports; Hurricane Katrina: A Nation Still Unprepared, Report of the Senate Committee on Homeland Security and Governmental Affairs; White House Katrina Report of February 2006; EMAC 2005 Hurricane Katrina After-Action Report, and EMAC Post Deployment Survey (NEMA 2006c).^{iv}

Network analysis using the UCINET social network analysis program was used to assess the relationships among the organizations that responded to the catastrophic disasters. The EMAC network is driven from daily records of EMAC and partner agencies' activities, as reported in the NEMA/EMAC 2005 Hurricane After-Action Report, by using UCINET network analysis software program. UCINET is a comprehensive software program for the analysis of social networks. The program contains several network analytic routines (e.g., centrality measures, dyadic cohesion measures, positional analysis algorithms, and clique), and general statistical and multivariate analysis tools such as multi-dimensional scaling, correspondence analysis, factor analysis, cluster analysis, and multiple regression (Borgatti, Everett, and Freeman 2002).

Findings and Discussions

Interstate Coordination: EMAC in Response to Catastrophic Hurricanes in 2005

Government performance in managing emergency response operations in response to the Hurricanes Katrina and Rita in 2005 was not at an acceptable level (U.S. House of Representatives 2006; U.S. Senate 2006; GAO 2005). Several of the criticisms were based on the highly bureaucratic structure of the current emergency management system. Government officials and scholars have been searching for alternative disaster management systems in response to catastrophic disasters. Most of them were focused around the network and flexible adaptive models of emergency management (Kapucu and van Wart 2006; Wise 2006). Mitchell

(2006) states “the flexible, broad-based, partnership-based approach...has served so well and is so promising for the future....” (p. 249). The effectiveness of EMAC is credited to several factors: administrative oversight and support staff, upfront problem-solving through the Compact’s language, continuity of operations, continual improvement, customized technology development, and active and committed state membership. The member state responsibilities are echoed in the lessons learned from Hurricane Katrina operations: education and training.

Hurricanes in 2005, especially Hurricane Katrina, required the largest disaster response and recovery in U.S. history. EMAC coordinated and deployed “equipment and personnel totaling \$830 million, with 48 states sending more than 66,000 people” in coordinating states’ responses to catastrophic disasters Hurricane Katherine and Rita (NEMA 2006b: 19).

According to the U.S. House of Representative report (2006), “... the Emergency Management Assistance Compact (EMAC), a critical part of the national emergency management framework, successfully provided unprecedented levels of response and recovery personnel and assets to the Gulf Coast in record time following Hurricane Katrina ... EMAC was widely praised for its quick and effective process for putting vital resources into every aspect of the response” (p. 132). As of May 24, 2006, the total estimated EMAC response to Hurricanes Katrina and Rita (Florida, Louisiana, Mississippi, Alabama, Texas, National Coordinating Team, and Regional Coordinating Team) included 65,929 personnel deployed (19,426 civilians and 46,503 National Guardsmen). The estimated cost is in the area of \$830,000,000 (NEMA 2006c).

In response to Hurricane Rita, EMAC deployed 4,389 personnel (1,201 civilians and 3,188 National Guardsmen) at an estimated cost of \$57,100,000. EMAC answered 180 requests for assistance from Louisiana and 38 requests for assistance from Texas. EMAC’s response to Katrina was primarily in Louisiana and Mississippi. In Louisiana, 1028 requests for assistance

were met with the deployment of 37,466 personnel (7,753 civilians and 29,713 National Guardsmen) at an estimated cost of \$426,100,000. In Mississippi, 911 requests for assistance were met with the deployment of 23,973 personnel (10,407 civilians and 13,566 National Guardsmen).

EMAC's Response as Interorganizational Network

EMAC Louisiana partnership network is presented in Figure 1 below. It is apparent from the visual representation of the network that the EMAC plays a significant role in coordinating the emergency response resources. Also apparent from the network is that there is more focus on law enforcement compared to the other functions of emergency management. There are several agencies/resources that are not well coordinated in the network.

<<Figure 1 about here>>

Figure 1 depicts the overall network of interaction of all organizations interacting in response to Hurricane Katrina in Louisiana. An analysis of network centrality identifies those actors that are the most important in shaping the performance of the network, as they have the most ties with other actors (Wasserman and Faust 1994). Three types of centrality measures have been used to measure the performance of the network: degree centrality, closeness centrality, and betweenness centrality (Comfort and Haase 2006). Table 1 presents the measures for degree centrality. Organizations that have more ties with others have higher degree centrality. According to Table 1, therefore, LE Strike Team is the organization that had the maximum number of ties with other organizations in the network, followed by EMAC. The summary measure of centralization for the network is 10.46%, which means that the power of individual actors does not vary much across the network, and is an indicator of a loosely coupled network.

<<Table 1 about here>>

Table 2 presents the measures for closeness centrality. Closeness centrality indicates how close an actor is to all other actors in the network (Wasserman and Faust 1994). This measure is useful in estimating the flow of information through a network. The exchange of information occurs more quickly if the actors are close to one another (Comfort and Haase 2006; Kapucu 2006b). Table 2 shows that LE Strike Team and EMAC, for example, had the least farness or the highest closeness degrees, meaning that they were able to reach other actors faster than any other organizations in the network.

<<Table 2 about here>>

Betweenness is a measure of the extent to which an actor lies in the direct path of communication between two other actors (Wasserman and Faust 1994). Having greater betweenness centrality for an actor means that more actors are dependent on the actor to communicate with other actors. None of the organizations had a betweenness degree more than zero in our calculation.

Cliques are subsets of organizations that develop recurring patterns of interaction in the conduct of disaster operations. They are important in understanding the network. They are usually developed in an effort to facilitate disaster response operations, however, they may also inhibit sharing of information and resources with other organizations in the network (Comfort and Haase 2006; Kapucu 2006b). UCINET analysis identified no cliques composed of at least three organizations. That shows a weak EMAC coordination in response to Katrina and Rita in Louisiana.

EMAC Mississippi partnership network is presented in Figure 2 below. The coordination and cohesion in the Mississippi network can easily be seen. EMAC played a significant role in

coordinating emergency resources and there are not too many uncoordinated resources in the network.

<<Figure 2 about here>>

Figure 2 depicts the overall network of interaction of all organizations in response to Hurricane Katrina in Mississippi. An analysis of network centrality identifies those actors that are the most important in shaping the performance of the disaster response network, as they have most ties with other actors (Wasserman and Faust 1994). Again, three types of network measures were utilized in here: degree centrality, closeness centrality, and betweenness centrality. Table 3 presents the measures for degree centrality. The summary measure of centralization for the network is 18.81%, which again shows that there was a low level of variability of power of individual actors across the network, and is an indicator of a loosely coupled response network. In Mississippi network, EMAC has the highest level of degree centrality, meaning it was able to directly reach the highest number of organizations.

<<Table 3 about here>>

Table 4 presents the measure for closeness centrality for the Mississippi network. According to the table, by having the highest closeness centrality EMAC was the closest organization to all others and could reach other organizations faster than any other organization in the network.

<<Table 4 about here>>

Table 5 shows us which actors have more betweenness power in the Mississippi network. Only four organizations had a betweenness degree more than zero. The maximum betweenness is 3.000 while the mean of betweenness for the network is 0.026. The standard deviation of the network is 0.234. These numbers show us there is less heterogeneity among the betweenness

power of the actors in the network. The network centralization index is 0.01% and this shows the overall betweenness power is significantly low. There were a very limited number of organizations that were important as an intermediary for others to reach another actor in the network. That means an actor in the network was not very dependent on other organizations in communicating with or reaching others (see Table 5).

<<Table 5 about here>>

As for cliques in the Mississippi network composed of at least three organizations, UCINET identified four of them. The identified cliques are: 1) Georgia, EMAC A-Team, and Pennsylvania; 2) Florida Expeditionary Medical Support, Florida, and Florida Department of Forestry; 3) Florida Expeditionary Medical Support, Florida, and Florida Department of Transportation; and 4) Georgia, Honcock County Emergency Operation Center, and Pennsylvania. These cliques demonstrate that the EMAC operations in response to catastrophic disasters were better coordinated in Mississippi. Several organizations were able to work as sub groups within the EMAC coordinated response system compared to no sub groups identified in Louisiana.

EMAC's Response: Key Issues and Lessons Learned

As demonstrated by the network analyses above, we can easily conclude that the EMAC's coordination in Mississippi was much more effective than in Louisiana. Obviously the size of the catastrophe was much larger in Louisiana than Mississippi. Second and most importantly Mississippi was assisted by the State of Florida. Florida had the most experience with EMAC's development and its implementation.

Based on the after action report and content analyses, in general, EMAC deployment of resources and personnel was effective and worked well. However, some issues and problems

were identified with EMAC's response to hurricanes in 2005 (Bea 2006; NEMA 2006a). EMAC is an interstate mutual aid tool required in complex interstate actions. These complex interactions of EMAC processes deserve some close scrutiny. According to the EMAC post-deployment survey results (NEMA 2006a), out of 734 survey responders only 13% had taken EMAC training class in the previous two years. In the absence of infrequent EMAC activations, current training is critical to efficiency and effectiveness. Other significant findings regarding problems and issues are listed in Table 6.

<<Table 6 about here>>

The following areas were identified by the survey respondents as well managed and coordinated by EMAC: EMAC-A Teams helpfulness, the home state EMAC representatives, people on the ground did a very good job without a clear direction, national level EMAC structure was fast and effective in identifying critical needs and matching individuals to immediate areas needing attentions, and EMAC personnel easily fit into existing structure.

Poor communication and interoperability, miscommunications, lack of coordination between Federal, state, local, EMAC, and deployed personnel, inadequate living conditions, and long time to deploy EMAC resources were the most frequently commented EMAC issues. Despite positive and negative experiences of EMAC deployment, 92% of 704 respondents wanted to be deployed via EMAC in the future.

The EMAC After Action Report covers leadership, coordination and A-Team operations in the following categories: Operations; Command and Control; Logistics; Finance; and Resource Management. Significant Report recommendations include: regularly schedule training for both trainers and operators, create a standard set of checklists for A-Team operations, automatically inform all Member States when a resource request is filled and identify the

designated Assisting State(s), develop rapid response A-Team capability, incorporate EMAC guidance regarding National Guard deployments, have a description of EMAC included in the National Response Plan, establish a cooperative relationship with professional associations whose members traditionally engage in disaster operations.

The reports also cover administration and management and resources deployed under EMAC. Report recommendations for the future include: EMAC Member States should review statewide emergency response plans to ensure that a comprehensive and current inventory of local response resources is included; direct dialogue between the requesting and offering entity should be encouraged whenever feasible to ensure that the specific requirement is clearly understood and the responding resources fully match the requirement; EMAC should be included in State and local government personnel training and in all disaster training exercises. A common theme was the importance of continuing and enhancing the outreach and training program for all audiences.

Conclusion

Effective response and recovery operation require partnership and trust between government agencies at all levels (Kapucu 2006a). EMAC has proven countless times to be a multi-faceted, all-hazard based method for supplementing resource shortfalls. EMAC has been activated 72 times since 1995 for such notable disaster events as hurricanes (2004 and 2005), major flooding, wild land fires, Y2K, terrorist attacks, tornadoes, the Rhode Island Club Fire and the Columbia Space Shuttle explosion. As evidenced by the amount of support rendered under the Compact during Hurricanes Katrina and Rita, the strongest asset provided through EMAC is skilled personnel, with 65,929 personnel deployed.

The EMAC response to Hurricanes Katrina and Rita in 2005 was the largest activation of EMAC since its inception in 1993. The commitments of assistance from EMAC member states demonstrate how significant interstate mutual aid partnerships can be in disaster responses. EMAC was used as the primary network for providing assistance to impacted states. Key strategies leading to the effectiveness of EMAC include: administrative oversight, up-front problem-solving through the Compact's language, and customized technology development. The UCINET analysis identified cliques in Mississippi's EMAC response, i.e., subsets of organizations that develop recurring patterns of interaction. The identification of cliques in Mississippi, but not Louisiana, suggests a differing length in the life span of the interstate networks.

As member states to EMAC, the states respond to one another's needs in time of disaster. The EMAC Louisiana partnership network makes apparent that the EMAC played a significant role in coordinating emergency response resources, was focused on law enforcement, and that there were several agencies/resources that were not well coordinated in the network. The coordination and cohesion of the Mississippi could be easily seen. EMAC played a significant role in coordinating emergency resources and there were not too many uncoordinated resources in the network. Additionally, the actors in the network were not especially dependent on some other actors to communicate with others. The pattern of relationships in both states was that of loosely coupled networks.

State emergency managers must continue to outreach to intrastate emergency management organizations within their state and federal partners to make certain they understand EMAC's protocols so they can be prepared to respond when needed. A noteworthy EMAC post-deployment survey result was the fact that only 13% of 734 respondents had taken an EMAC

training class in the previous two years. A policy and procedural recommendation is the enhancement of the outreach and training program for all audiences.

States are increasingly developing joint partnerships. EMAC partnership among states has several potential implications to other parts of the homeland security mission of the state governments and the Department of Homeland Security. EMAC can be seen as a viable alternative to the bureaucratic and inflexible disaster management system of DHS. This horizontal partnership formation among states in solving common problems, such as dealing with disasters, presents new challenges for state public administrators. The study of interstate partnership in emergency management contributes to our knowledge and understanding of state government.

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Table 3: Degree Centrality

	Degree	NrmDegree	Share
Mean	1.832	0.969	0.005
Std Dev	4.120	2.180	0.012
Sum	348.000	184.127	1.000
Variance	16.972	4.751	0.000
SSQ	3862.000	1081.157	0.032
MCSSQ	3224.611	902.721	0.027
Euc Norm	62.145	32.881	0.179
Minimum	0.000	0.000	0.000
Maximum	37.000	19.577	0.106
Network Centralization = 18.81%			
Heterogeneity = 3.19%			
Normalized = 2.68%			

NOTE: NrmDegree = normed degree

Organizations that have highest degree centrality in response to Hurricane Katrina

	Degree	NrmDegree	Share
EMAC A-Team	37.000	19.577	0.106
FL	32.000	16.931	0.092
EMEDS	21.000	11.111	0.060
LE Strike Team	11.000	5.820	0.032
CR Team	10.000	5.291	0.029
Honcock Co EOC	9.000	4.762	0.026

NOTE: NrmDegree = normed degree

Table 4: Closeness Centrality

	inFarness	outFarness	inCloseness	outCloseness
Mean	35731.969	35731.969	0.529	0.529
Std Dev	653.812	522.808	0.011	0.009
Sum	6789074.000	6789074.000	100.538	100.523
Variance	427470.344	273327.938	0.000	0.000
SSQ	242668191744.000	242638913536.000	53.224	53.199
MCSSQ	81219368.000	51932308.000	0.025	0.015
Euc Norm	492613.625	492583.906	7.295	7.294
Minimum	28729.000	29674.000	0.526	0.526
Maximum	35910.000	35910.000	0.658	0.637

NOTE: SSQ = Sum of Squares; MCSSQ = Mean Centered Sum of Squares; Euc Norm = Euclidean Norm

Organizations that have highest closeness centrality in response to Hurricane Katrina

	inFarness	outFarness	inCloseness	outCloseness
EMAC A-Team	28729.000	35910.000	0.658	0.526
EMEDS	31941.000	35910.000	0.592	0.526
LE Strike Team	33643.000	35910.000	0.562	0.526
CR Team	34020.000	35910.000	0.556	0.526
Honcock Co EOC	34209.000	35910.000	0.552	0.526
IMT & IMT Type 3	34587.000	35910.000	0.546	0.526
HAZMAT	34778.000	35910.000	0.543	0.526
SHMO	35154.000	35910.000	0.538	0.526
Emergency Med Team	35155.000	35910.000	0.538	0.526
NFIP	35343.000	35910.000	0.535	0.526

Table 5: Betweenness Centrality

	Betweenness	nBetweenness
Mean	0.026	0.000
Std Dev	0.234	0.001
Sum	5.000	0.014
Variance	0.055	0.000
SSQ	10.500	0.000
MCSSQ	10.368	0.000
Euc Norm	3.240	0.009
Minimum	0.000	0.000
Maximum	3.000	0.008
Network Centralization Index = 0.01%		

NOTE: SSQ = Sum of Squares; MCSSQ = Mean Centered Sum of Squares; Euc Norm = Euclidean Norm

*Organizations that have highest betweenness centrality in response to Hurricane Katrina**

	Betweenness	nBetweenness
OH	3.000	0.008
PA	1.000	0.003
FL DOF	0.500	0.001
FL DOT	0.500	0.001

*Only 4 were identified

Table 6: EMAC Post-Deployment Survey Results

<i>Pre-Deployment Factors</i>	Percentage of Respondents
Those who took EMAC training class in last two years	13%
Those who felt EMAC education and training need significant improvements	53%
Those familiar with EMAC policies and procedures prior to deployment	32%
Those who stated their assignments were clear before deployment	70%
Those who received adequate description of the deployment conditions	74%
Those who stated they received clear mobilization instructions	77%
<i>Operational Factors</i>	
Those who were briefed and given instructions upon arrival	85%
Those who reported regularly during deployment	91%
Those who received clear mission assignments and tasks	81%
Those who thought there was sufficient continuity of operations	65%
Those who thought there was a clear chain of command	76%

Source: NEMA 2006a

Appendix: List of organizations that participated in response operations (Mississippi and Louisiana)

#	Abbreviation	Organization
1	AK	Alaska
2	AL	Alabama
3	AR	Arkansas
4	AZ	Arizona
5	CA	California
6	CO	Colorado
7	DC	District of Columbia
8	DE	Delaware
9	FL	Florida
10	GA	Georgia
11	IA	Iowa
12	ID	Idaho
13	IL	Illinois
14	IN	Indiana
15	KS	Kansas
16	KY	Kentucky
17	MA	Massachusetts
18	MD	Maryland
19	ME	Maine
20	MI	Michigan
21	MN	Minnesota
22	MO	Missouri
23	MS	Mississippi
24	MT	Montana
25	NC	North Carolina
26	ND	North Dakota
27	NJ	New Jersey
28	NM	New Mexico
29	NV	Nevada
30	NY	New York
31	OH	Ohio
32	OK	Oklahoma
33	OR	Oregon
34	PA	Pennsylvania
35	RI	Rhode Island
36	SC	South Carolina
37	SD	South Dakota
38	TN	Tennessee
39	TX	Texas
40	UT	Utah
41	VA	Virginia
42	VT	Vermont
43	WA	Washington
44	WI	Wisconsin
45	WV	West Virginia
46	ALNG	Alabama National Guard
47	ALS	Advance Life Support

48	ANG	Air National Guard
49	ATS Co	American Tower Systems Corporation
50	AZNG	Arizona National Guard
51	CANG	California National Guard
52	CISM	Critical Incident Stress Management Team
53	CONG	Colorado National Guard
54	CR	Crane Rental
55	CRT	Community Relations Team
56	DENG	Delaware National Guard
57	DMORT	Disaster Mortuary Operational Response Team
58	DRC	Disaster Relief Club
59	EDICS	Emergency Deployable Interoperable Communications System
60	EMAC	Emergency Management Assistance Compact A-Team
61	EMEDS	Expeditionary Medical Support
62	EMT	Emergency Medical Team
63	ESFs	Emergency Support Functions
64	FCo	Forrest County
65	FLDOF	Florida Department of Forestry
66	FLDOT	Florida Department of Transportation
67	FLNG	Florida National Guard
68	HarCoEOC	Harrison County Emergency Operation Center
69	HAZMAT	Hazardous Materials
70	HCo	Harford County
71	HCoIMAT	Hancock County Incident Management Assistance Team
72	HonCoEOC	Honcock County Emergency Operation Center
73	HorCo	Horry County
74	ILNG	Illinois National Guard
75	IMERT	Illinois Medical Emergency Response Team
76	INNG	Indiana National Guard
77	ISISCS	Interim SATCOM Incident Site Command Set
78	JaCo	Jackson County
79	JeCo	Jefferson County
80	JP	Jefferson Parish
81	KBI	Kansas Bureau of Investigation
82	KSNG	Kansas National Guard
83	KYNG	Kentucky National Guard
84	LAA	Louis Armstrong Airport
85	LADSS	Louisiana Department of Social Services
86	LAEOC	Louisiana Emergency Operation Center
87	LANG	Louisiana National Guard
88	LASP	Louisiana State Police
89	LDC	Louisiana Department of Corrections
90	LEST	Law Enforcement Strike Team
91	LOT	Law and Order Team
92	LSA	Lutheran Services in America
93	LT	Logistics Team
94	MABASTF	Mutual Aid Box Alarm System Task Force
95	MANG	Massachusetts National Guard
96	MARC	Mid America Regional Council
97	MCoSO	Madison County Sheriff's Office

98	MDNG	Maryland National Guard
99	MED1	Mobile Emergency Department-1 Team
100	MEDEVAC	Medical Evacuation
101	MG	Medical Group
102	MING	Michigan National Guard
103	MobEOC	Mobile Emergency Operation Center
104	MONG	Missouri National Guard
105	MP	Military Police
106	MSSH	Mississippi State Hospital
107	MTA	Metropolitan Transportation Authority
108	NCNG	North Carolina National Guard
109	NENG	Nevada National Guard
110	NFIP	National Flood Insurance Program
111	NGEIS	Natnal Guard Environmental Impact Statement
112	NHNG	New Hampshire National Guard
113	NJNG	New Jersey National Guard
114	NMSP	National Marine Sanctuary Program
115	NOEMT	New Orleans Emergency Medical Team
116	NOEOC	New Orleans Emergency Operation Center
117	NOPA	New Orleans Port Authority
118	NU	Nichols University
119	NYNG	New York National Guard
120	NYPD	New York Police Department
121	OHNG	Ohio National Guard
122	ORNG	Oregon National Guard
123	PANG	Pennsylvania National Guard
124	PBEEFCE	Prime Base Engineer Emergency Force Civil Engineering
125	PDA	Presbyterian Disaster Assistance
126	PIO	Public Information Office
127	PPEM	Plaquemines Parish EM
128	QRF	Quick Reaction Force
129	SARTIMT	State Agricultural Response Team Incident Management Team
130	SATCOM	Satellite Communication
131	SCNG	South Carolina National Guard
132	SDNG	South Dakota National Guard
133	SERT	State Emergency Response Team
134	SHMO	State Hazard Mitigation Office
135	SIMT	State Incident Management Team
136	SRT	Search and Rescue Teams
137	StNASA	Stennis NASA Center
138	TALCE	Tanker Airlift Control Element Cadre
139	TNNG	Tennessee National Guard
140	TP	Tammeny Parish
141	TTCS	Tennessee Technology Center at Shelbyville
142	TXNG	Texas National Guard
143	TYPE1IMT	Type I Incident Management Team
144	TYPE2IMT	Type II Incident Management Team
145	TYPE3IMT	Type III Incident Management Team
146	USAFT	United States Air Force Team
147	USAR	United States Army Reserve

148	USARLEST	United States Army Reserve Law Enforcement Support Team
149	USARTF	United States Army Reserve Task Force
150	USDA	United States Department of Agriculture
151	UTNH	Utah National Guard
152	VOAD	Voluntary Organizations Active in Disaster
153	VTNG	Vermont National Guard
154	WIC	Woman, Infants and Children
155	WING	Wisconsin National Guard
156	WR	Water Rescue
157	WYNG	Wyoming National Guard

ⁱ FEMA (DHS) has been supportive of the development of interstate compacts in response to disasters. Stafford Act (42 USC 519) section 611h encourages interstate agreements in emergency management.

ⁱⁱ EMAC is usually housed in the Resource Unit of the Planning Section for NIMS compliances; however some states prefer that the unit be housed in the Logistics Section. NEMA/EMAC suggests the following for NIMS compliances: definitions of key terms used in the agreement; roles of responsibilities of individual parties; procedures for requesting and providing assistance; procedures, authorities, and rules for payments, reimbursement, and allocation of costs; notification procedures; protocols for interoperable communications; relationships with other agreements among jurisdictions; worker's compensation; treatment of liability and immunity; recognition of qualifications and certifications; and sharing agreements, as requires.

ⁱⁱⁱ We thank Leon Shaifer and Angela Coople of NEMA for providing current data about the EMAC and its operations in response to Hurricanes Katrina and Rita.

^{iv} The 2005 Report describes the storms and the resulting conditions and provides an overview of EMAC, the operational systems and the resources deployed during the response and recovery operations. It describes major accomplishments and operational, administrative, and managerial issues and recommendations to improve EMAC implementations in the future (Phillips 2006). *Source*: NEMA 2006a