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THESIS

THE NATIONAL RESPONSE SYSTEM: THE NEED TO LEVERAGE NETWORKS AND KNOWLEDGE

by

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March 2006

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Hurricane Katrina highlighted serious deficiencies in America's national approach to emergency management of Incidents of National Significance (IoNS). Although Homeland Security Presidential Directive Five identifies a broad, unified effort to respond to domestic incidents, barriers to the achievement of this goal exist in our culture, policies and processes. When viewing our national response from the perspective of network theory and knowledge management, specific gaps are identified in doctrine, organizational composition and technological capability. An agenda for change to the National Response Plan and National Incident Management System should integrate the strengths of the network design and address the critical role that knowledge plays in shaping response efforts at all levels. A comprehensive strategy to change the culture and approach of our response community includes streamlining organizational roles of the Unified Command and local Emergency Operations Centers, expanding the Unified Command to include the private sector and NGOs as equal partners, implementing a Knowledge Management Annex to the National Response Plan and deploying a mesh network communications system as part of the proactive federal response.

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THE NATIONAL RESPONSE SYSTEM: THE NEED TO LEVERAGE NETWORKS AND KNOWLEDGE

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ABSTRACT

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This thesis is closure for me in many ways. I've covered so much ground personally and professionally over the past 18 months that it's difficult to remember what life was like before I entered NPS.

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Aloha,
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I. INTRODUCTION

A. THE NATIONAL RESPONSE SYSTEM IN CRISIS

Hurricane Katrina slammed into the Gulf Coast almost four years after the terrorist attacks on New York City and the Pentagon, and these are the seminal events in our homeland security history. They are also the epicenter of America's debate over our national ability to prepare and respond to catastrophic events. While the two events bring to mind widely disparate images of suffering and heroism, each provides an opportunity to reflect on the performance of our national response system. In many ways, America is left with more questions than answers. Did our complex network of response agencies perform as designed, at the local, regional and national levels? What critical elements of the effort succeeded and which failed? Is local emergency management germane in all situations? For those Incidents of National Significance (IoNS) as defined in the National Response Plan (NRP), what is an appropriate role for the military with respect to command and control of domestic incidents? Katrina and 9/11 challenged the preconceived notions of the resiliency of our response efforts in New York, Louisiana, Mississippi and Alabama. Evaluating how the response network formed in crisis and exposing the seams of this network, including the federal, state, and local agencies, private sector and Non Governmental Organizations (NGOs), provides insight into our future ability to manage operations in the wake of a catastrophe. While the exhaustive review of the *National Commission on Terrorist Attacks Upon the United States, The 9/11 Commission Report* provides a glimpse of nearly every facet of the attacks the attacks of 2001, many of the lessons of Hurricane Katrina continue to be published at the time of this writing.

Yet, even in the immediate aftermath of an enormous disaster the size of Hurricane Katrina, much of the review can focus on a few significant enablers of the response common to all disasters, whether man-made or natural, intentional or accidental. The NRP creates a "national framework in terms of both product and process"[1] for domestic incident management and reinforces the authority and jurisdiction of individual

[1] The Department of Homeland Security, *National Response Plan (Final) Full Version* (Washington, D.C.: U.S. Dept. of Homeland Security, December 2004), i, http://knxup2.ad.nps.navy.mil/homesec/docs/dhs/nps08-010605-06.pdf [Accessed January 15, 2006].

agencies to support the effective emergency management operations. Success in emergency response operations, however, does not rest solely with agreements on command and control, jurisdiction, and authority. It is the process of knitting together myriad agencies and sectors to achieve unity of effort that determines success. Absent this effective collaboration of interagency efforts, the NRP becomes a paper tiger which documents the collective yet uncoordinated response of our entire nation.

B. CRITICAL ENABLERS OF OUR SUCCESSFUL RESPONSE

Ultimately, the success of emergency response operations hinges on two process-related elements that receive little attention in the NRP or other strategic policy documents. This paper examines the nexus and interdependency of these variables: the formation of the response network in the aftermath of an Incident of National Significance (IoNS) and the management of knowledge throughout that network. Both elements are critical enablers of local command and control of emergency management functions that fuel the decision-making process of all levels of government and both directly impact the proper balance of federal, state and local power and resources.

C. RESPONSE NETWORK ISSUES

While broadly encompassing virtually every conceivable detail of emergency planning and response, the central element of the NRP is the coordinating mechanism by which the federal government provides resources to state and local agencies. This hierarchy is designed to bridge all agency boundaries and sectors of the economy and designate the appropriate level of federal resources based on local needs. Yet this government-centric hierarchy represents just a portion of the complex small-world network which emerges in the affected community. Especially in crisis, organizations must be agile, immediately aware of the evolving situation, and flexibly meet the demands of the community. While autonomous decision-making and network centric operations are conducive in this environment, bureaucracies often rely on a prescriptive chain-of-command that fails to keep pace with the dynamic and evolving situation. Theoretically, the network of first responders, the community, the private sector and NGOs all influence emergency response activities—many directly impact the decision-making process of the Incident Commander. Imagine the NRP as an inverted pyramid of resources—ultimately, all resources come to rest on the local jurisdiction and under the

leadership of the Incident Commander who must instantly integrate the vast network of resources. How this network forms, in an environment in which virtually all local command and control infrastructure is non-existent, will provide a key insight in developing future emergency response plans.

D. KNOWLEDGE MANAGEMENT ISSUES

Critical information flows through the response network to provide the Incident Commander with the situational awareness to allocate resources for emerging problems, determine the appropriate mix of assets, and request additional support to fill identified gaps. When one or more agencies are involved or the disaster involves multiple agency and political jurisdictions, the Incident Commander may be replaced by a Unified Command, as defined in the NIMS.[2] With respect to this document, most of the references to the senior decision-making entity at the tactical level of disaster/emergency management will be referred to as the Unified Command. Managing this precious information as it is transformed into knowledge affects the speed and effectiveness of all response efforts. Interestingly enough, this subject also receives little discussion in policy, yet is mentioned only as an "important" feature of the NRP. One could argue that organizations are generally assumed to be interoperable by merely assimilating into the construct of the National Incident Management System (NIMS). In theory, information readily flows across agency and sector seams and it adequately supports the NIMS decision-making process. Unfortunately, little attention is paid to the process of collaboration that must occur within the Emergency Operations Center (EOC) and throughout the entire response network. It is this collaborative effort that determines how to acquire, retain, and analyze information so that it can be transformed into timely and relevant knowledge.

Aligning with the national planning guidance, EOCs at all levels of American government are organized according to the NIMS model and utilize specific channels to manage and filter information to the Incident Commander. These channels, called Emergency Support Functions (ESFs), relate to a specific topic, i.e., Emergency Management, Urban Search & Rescue, Firefighting, Mass Care, etc. Little guidance,

[2] The Department of Homeland Security, *National Incident Management System* (Washington, D.C.: United States Dept. of Homeland Security, March 1, 2004), http://knxup2.ad.nps.navy.mil/homesec/docs/dhs/nps14-030604-02.pdf [Accessed January 12, 2006].

however, is provided regarding the cross-ESF application of this information and the collaborative procedures necessary within the multi-agency environment. The effective management of this knowledge directly influences the quality of the decision-making process—good decisions are made with timely, accurate and complete information; poor decisions are typically linked to a lack of knowledge regarding the elements of the disaster.

E. KEY RESEARCH QUESTIONS

Several research questions are to be addressed in the following chapters:

- How does emergency response policy, at the federal and state levels, address the formation of the social network of first responders that forms in the aftermath of an Incident of National Significance (IoNS)?
- What are the characteristics of the *ad hoc* network that forms and how does the response topology enable organizational interoperability?
- How does the significant devastation of all communication systems affect the formation of the response network?
- To what degree is the decision making process of the Incident Commander or Unified Command impacted by this network and knowledge environment?

F. THESIS ORGANIZATION

This paper is organized into the following sections:

- Chapter I is an overview of the issues affecting response operations and identification of the key research questions;
- Chapter II is a literature review of Network Theory and Knowledge Management;
- Chapter III is a short explanation of the research methods used to complete this project;
- Chapter IV is an overview of federal, state and local policies and statutes that impact on network operations and knowledge management in the incident management field;
- Chapter V is a comparative case study of the response operations conducted in Hancock County, Mississippi, following the landfall of Hurricane Katrina on August 29, 2005.
- Chapter VI provides the policy implications of networks and knowledge and how these theories applied to the environment of the response operations in Hancock County. Issues are analyzed from the doctrinal, organizational and technological aspects of the response network. Recommendations are offered as potential paths for future study or as solutions to existing gaps revealed in the analysis.

- Chapter VII is the conclusion of the thesis.

G. MOVING FORWARD

As America continues to refine and develop our incident management system, leveraging the strength of networks to achieve knowledge interoperability—moving beyond the NIMS and its primary focus of organizational interoperability—will be a critical step in our homeland security progress. A thorough examination of the policy context and its application in the aftermath of Hurricane Katrina may provide the foundational argument for a change agenda to the National Response Plan.

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II. LITERATURE REVIEW: NETWORK THEORY AND KNOWLEDGE MANAGEMENT

A. NETWORK THEORY

Within the past decade, the study of social networks has taken on new prominence in the field of complexity theory. Large, complex systems define most of the components of our world, from the World Wide Web to the U.S. power grid system to our telecommunications system. Social networks form as people and organizations connect with other people and organizations in a variety of conditions. Much of the way in which these networks form and how they function have been examined and explained by social scientists and mathematicians.

1. Networks and Small Worlds

Modern network theory traces its roots to Leonard Euler who, in 1783, developed a mathematical proof regarding the "Bridges of Konigsberg," Russia. This proof was groundbreaking because it explained the relationship of the bridges in terms of a graph and as a series of nodes and links.[3] Euler thus created modern graph theory and his proof was marginally developed and improved over the next two centuries by a variety of mathematicians. Yet the underlying question of how these graphs, or networks are formed, remained undiscovered until the 1950s when random graph theory was discovered by Paul Erdos and Alfred Renyi.[4] Erdos and Renyi theorized that random associations of nodes led to a graph in which all nodes possessed approximately the same number of links.[5] Two key assumptions of this theory were that the number of nodes remained constant and that all nodes were characteristically equivalent, i.e. no hierarchy existed within the random network. Random graph theory was further refined in 1967 by Stanley Milgram, who discovered that, within a network of any size, any two nodes are separated by approximately six links.[6] Milgram found that a vast network will collapse

[3] Alberto-Laszlo Barabasi, *Linked: How Everything is Connected to Everything Else and what it Means for Business, Science, and Everyday Life* (Cambridge: Perseus Books Group, 2003), 11.

[4] Mark Buchanan, *Nexus: Small Worlds and the Groundbreaking Science of Networks,* ed. Angela von der Lippe (New York: W. W. Norton & Company, 2002), 35.

[5] Ibid., 22.

[6] Ibid., 30.

upon itself and display a degree of separation between any two nodes that is significantly smaller than the total number of links in the network.

Continuing to further refine the study of networks, Mark Granovetter published *The Strength of Weak Ties* in 1972, which introduced a revolutionary concept in the field. Granovetter concluded that society is composed of dense clusters of tightly connected nodes, some of which have "weak" links to other clusters. These weak links actually serve as bridges between these small worlds and prevent any cluster from becoming isolated.

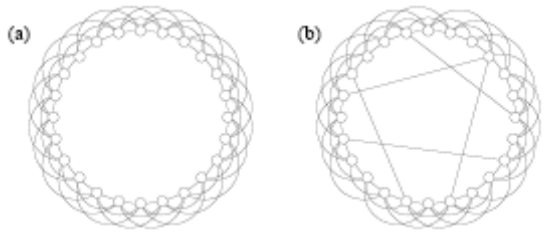

Figure 1. A) Random network, B) Random Network with Weak Ties[7]

These weak links between assume a heightened level of significance because they tie the network of small worlds together.[8] This concept differs from the random network, in that any node within the random network has an equal likelihood of being connected to any other node. Granovetter proved that small clusters are more likely to be highly interconnected and possess a few links that tie them into the rest of the network. In 1998, Duncan Watts and Steven Strogatz theorized that while maintaining the same degree of clustering within a network, the weak ties that span to other small worlds significantly shrink the diameter of the entire network.[9] Even though these models moved the understanding of networks significantly forward, critical features exhibited among small worlds still remained unexplained.

That was until the discovery of network hubs, which are nodes that develop an unusually large number of links. This concept originates with the ideas of economist Vilfredo Pareto, who provided the foundation for the development of the 80/20 rule in the

[7] Buchanan, *Nexus*, 44.

[8] Ibid., 44.

[9] Barabasi, *Linked*, 53.

early 1900s.[10] Applied to network theory, this rule holds that roughly eighty percent of the links within a network are possessed by only about twenty percent of the nodes. Building on this concept, Barabasi proposed that many networks are scale-free, in that no one node possesses the same number of links as all other nodes. He found that the distribution of links within the network followed the Power Law, meaning that just a few hubs possessed most of the links in the network and that even if the number of nodes increases significantly, the number of links between any two nodes increases negligibly.[11] The Power Law distribution guides the transformation of the random network into one which is "scale-free"—and the networks invisibly transform from a state of chaos to a more orderly condition.

One of the primary differences between random networks and most real networks is the concept of network growth. Real networks continuously grow and expand the number of nodes, whereas random networks are constant. Barabasi found that real networks are governed by two laws: growth and preferential attachment.[12] Growth is straightforward, but preferential attachment means that any node entering the network will attach itself to a node with more links. This rich-get-richer phenomenon pervades scale-free networks throughout the world. Barabasi also introduced the concept of a fitness connectivity product, which is a qualitative measure of a node's attractiveness in establishing new links among the network.[13] This attractiveness among nodes drives competition within the network for new links as networks expand. The underlying truth of scale-free network theory is summed up best by Barabasi, "no matter how large and complex a network becomes, as long as preferential attachment and growth are present, it will maintain its hub dominated scale-free topology."[14]

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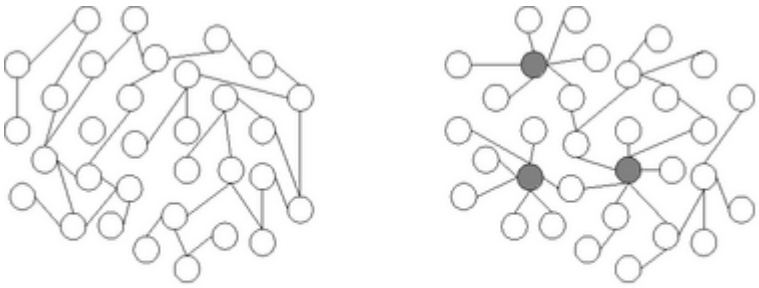
[10] Barabasi, *Linked*, 66.

[11] Buchanan, *Nexus*, 86.

[12] Barabasi, *Linked*, 86.

[13] Ibid., 96.

[14] Ibid., 91.



(a) Random network (b) Scale-free network

Figure 2. A Random and Scale-Free Network[15]

2. Network Strengths and Vulnerabilities

Scale-free networks robustly absorb failure at the nodal level, yet are highly vulnerable to failure at the hub. For most scale-free networks, many nodes can be removed from the network with little impact on the viability of the entire system. The networks, because of their scale-free nature, survive these failures. Attacking the hubs, however, yields a different result. Within any scale-free network, if even a few hubs are disabled, system failure results and the network will devolve into isolated components. This "cascading failure" is the most serious vulnerability of the scale-free network and provides an opportunity to focus resources on the hubs as a preventive strategy.

3. Network-Centric Operations

The study of Network-Centric Operations (NCO) emerged over the past decade as military organizations engaged a battle against the asymmetric threat of terrorism. In 1996, John Arquilla and David Ronfeldt coined the use of the term "Netwar" in study of this form of conflict that is less than war.[16] Netwar protagonists use the strength and speed of networks to communicate and conduct decentralized operations. The performance of the network is based on dense, "all-channel" communications among all nodes.[17] In the tension between network and hierarchical organizations, netwar characteristics tend to erode the power of hierarchies.[18] Two central counter-netwar concepts emanate from the Arquilla and Ronfeldt findings: 1) a network approach is

[15] Barabasi, *Linked*, 91

[16] John Arquilla and others, *The Advent of Netwar* (Santa Monica: RAND, 1996), 5, http://www.rand.org/publications/MR/MR789/ [Accessed January 12, 2006].

[17] Ibid., 10.

[18] Ibid., 81.

needed to defeat a network, and 2) the first organization to master the networked form of operations will have a distinct advantage.[19]

Within military organizations, the concept of Centralized Command – Decentralized Execution (CCDE) is gaining popularity as organizations focus on the flow of information throughout the network and how that information affects the decision making process. CCDE blurs the distinction between organization levels and renders invalid many previous agreements on authority, jurisdiction, and command-and-control.[20] In the words of VADM Mustin in National Defense Publication (NDP-6), "You must be prepared to take action…when certain conditions are met; you cannot anticipate minute-by-minute guidance."[21]

The way in which networks organize is particularly germane to this thesis. "The network is the enterprise. While the firm continues to be the unit of accumulation of capital…and strategic management, business process is performed by ad hoc networks."[22] Several network forms, from the perspective of the organization, are relevant to the way in which information impacts the decision making process. Three forms take shape; 1) extra-networks which are designed and governed by the organization, 2) inter-network, designed and governed by the organization but open for outside participation, and 3) an open network used by anyone willing to participate in knowledge creation.[23] The cultural environment of the network will have a significant impact on the development of a knowledge management system. Cross-cultural situations are particularly difficult because of the different language systems among

[19] John Arquilla and others, *The Advent of Netwar* (Santa Monica: RAND, 1996), 82, http://www.rand.org/publications/MR/MR789/.

[20] Richard M. Gomez, "Centralized Command - Decentralized Execution: Implications of Operating in a Network Centric Warfare Environment" (Master's Thesis, Air War College), 6, http://stinet.dtic.mil/cgi-bin/GetTRDoc?AD=A424605&Location=U2&doc=GetTRDoc.pdf [Accessed April 25, 2005].

[21] Ibid., 18.

[22] Sven A. Carlsson, "Knowledge Managing and Knowledge Management Systems in Inter-Organizational Networks," *Knowledge and Process Management* 10, no. 3 (July-September 2003): 198.

[23] Ibid.

participating groups.[24] If network centric organizations are to succeed and sustain a competitive advantage, managing knowledge within the network becomes the paramount concern.[25]

B. KNOWLEDGE MANAGEMENT (KM)

1. Why is Information Important to Organizations?

In today's Information Age, knowledge is *the* crucial asset for organizations, whether they are from the public or private sectors.[26] KM study has focused on the role of knowledge in the business world as corporations improve service and reduce costs. The global marketplace is so intensely competitive across all sectors that the acquisition and management of knowledge is a transcendental capability that provides benefits not achievable through other technological advances.[27] Advances in product capabilities, service delivery techniques, or manufacturing technology are temporary in nature, while an organization's ability to master its own internal knowledge is one of the few sustainable advantages.[28]

To realize the central role knowledge plays in all modern organizations, consider the information-centric nature of government and private sector activities, in which the only tangible resource that flows through an organization is knowledge. Competitive advantage is derived from unique knowledge and how the organization manages internal and external knowledge.[29] In the words of Peter Drucker, "knowledge has become the key economic resource and the dominant—and perhaps even the only—source of comparative advantage."[30] Despite its critical importance and the commonly accepted

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[24] Nigel J. Holden and Harald F. O. Von Kortzfleisch, "Why Cross-Cultural Knowledge Transfer is a Form of Translation in More Ways than You Think," *Knowledge and Process Management* 11, no. 2 (April-June 2004): 128.

[25] Carlsson, "Knowledge Managing and Knowledge Management Systems," 194.

[26] Claudio Garavelli, Michele Gorgoglione and Barbara Scozzi, "Knowledge Management Strategy and Organization: A Perspective of Analysis," *Knowledge and Process Management* 11, no. 4 (October-December 2004): 273.

[27] Mark E. Nissen and James Espino, "Knowledge Process and System Design for the Coast Guard," *Knowledge and Process Management* 7, no. 3 (July-September 2000): 165.

[28] Carlsson, "Knowledge Managing and Knowledge Management Systems," 194.

[29] Ibid., 195.

[30] Nissen and Espino, "Knowledge Process and System Design," 165.

view that knowledge is the most sustainable future advantage, few organizations are truly capable of leveraging and managing knowledge.[31]

The mastery of knowledge yields tangible and intangible results that are comprehensive and self-sustaining. These benefits include: 1) improved performance, 2) higher productivity and greater efficiency, 3) elevating people as a valuable resource of the organization, and 4) applying knowledge as an advantage over competitors.[32] Although the previous discussion revolved around the business argument for improved knowledge management, a direct application to the military environment has also been developed. In the military context, operational knowledge directly leads to improved battlefield awareness and information superiority so desired by commanders in all forms of warfare. "There is no fusing of information that meets the needs of all warriors. However, with concise, accurate, timely and relevant information, unity of effort is improved and uncertainty is reduced, enabling the force as a whole to exploit opportunities and fight smarter."[33]

So why is information superiority so critical, and why now? Simply put, it is the only long-term advantage that an organization can achieve in the dynamic global environment. Whether the organization is a multi-national corporation or a local emergency agency, knowledge is the key to sustained future success. Within the field of KM, many efforts are focused on the intersection of Information and Communication Technology (ICT) and Knowledge Management Systems (KMS) to acquire information superiority in all aspects of operations.[34]

2. Data, Information, Knowledge or Wisdom?

Before organizations successfully implement efforts to acquire, analyze and leverage internal knowledge, defining the context of organizational information is crucial. From this perspective, information and knowledge are often treated as synonyms, yet this

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[31] Kuan Yew Wong and Elaine Aspinwall, "Knowledge Management Implementation Frameworks: A Review," *Knowledge and Process Management* 11, no. 2 (April-June 2004): 93.

[32] Xiaoming Cong and Kaushik V. Pandya, "Issues of Knowledge Management in the Public Sector," *Electronic Journal of Knowledge Management* 1, no. 2 (2003): 27, www.ejkm.com [Accessed April 24, 2005].

[33] Richard M. Gomez, "Centralized Command - Decentralized Execution," 1.

[34] Carlsson, "Knowledge Managing and Knowledge Management Systems," 195.

confusion of terms is often misleading and can create significant challenges when developing an enterprise-wide knowledge management system.[35]

Separating information from knowledge has always been problematic—even the ancient Greeks struggled with framing the notion that knowledge resides in the individual and the role of the individual is to contextualize knowledge. Information, on the other hand, is something external to the human existence.[36] Confusion over this terminology leads to the perspective that "one man's knowledge is another man's data."[37] As KM has matured, however, more precise definitions have been forthcoming. Data is considered raw fact, while information is data put into meaning. Knowledge is derived from information by making comparisons, identifying consequences and making connections. Furthermore, knowledge may be viewed as a resource in that it can be transferred, recombined, licensed, codified, and entered into a computer to create value to an organization.[38] Wisdom becomes the use of accumulated knowledge.[39] Additional attempts to clarify knowledge have focused on its active context and demonstrating how it is created, shared, integrated and used.[40] This perspective is more focused on the process of developing knowledge than on content.[41] It is within this process that knowledge emerges as a flow of interacting changes taking place in the minds of people who are involved in the learning process and is observable by its effects on behavior, thought processes, values, and beliefs.[42]

So how does this process of transformation occur? Knowledge is generally classified as either explicit (capable of being captured and written down in databases and

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35 Vlatka Hlupic, Athanasia Pouloudi and George Rzevski, "Towards an Integrated Approach to Knowledge Management: 'Hard', 'Soft' and 'Abstract' Issues," *Knowledge and Process Management* 9, no. 2 (April-June 2002): 90.

36 Hilary C. M. Kane, "Reframing the Knowledge Debate, with a Little Help from the Greeks," *Electronic Journal of Knowledge Management* 1, no. 1 (2003): 33, www.ejkm.com [Accessed April 24, 2005].

37 Ibid.

38 Carlsson, "Knowledge Managing and Knowledge Management Systems," 195.

39 Cong and Pandya, "Issues of Knowledge Management in the Public Sector," 26.

40 Kane, "Reframing the Knowledge Debate," 34.

41 Carlsson, "Knowledge Managing and Knowledge Management Systems," 195.

42 Garavelli, Gorgoglione and Scozzi, "Knowledge Management Strategy and Organization: A Perspective of Analysis," 273.

can be easily communicated and transferred) or tacit (which resides in the mind and is more difficult to communicate and transfer).[43] The definition of these two types of knowledge varies in every situation, making the management of both more difficult.[44] Despite the challenge of accurately defining knowledge as either tacit or explicit, it is widely agreed that a tremendous amount of knowledge is embedded in internal processes, practices and internal documents and routines throughout all organizations.[45]

In general, the management of knowledge includes the development of information that supports the knowledge process and transfer of that knowledge throughout the enterprise network. Knowledge generation occurs through either the process of discovery (e.g., data mining, brainstorming, pattern analysis, or insight) or derivation (e.g., the use of process knowledge and employee experience to improve the organization's internal process).[46]

Perhaps one of the greatest challenges to KM is the effective transfer, or translation, of knowledge. This knowledge transfer is closely linked to translation, which is often considered the oldest practice of converting knowledge from one domain to the other.[47] The transfer of information is not merely an issue of effective understanding, but also includes the wider conversion into the user's existing domain and context. This function is made all the more difficult because of variables that affect the transformation process. These variables are often identified as social (cultural), external (communication), combination (analytical) and internal (comprehension) and each presents a challenge to the effective design, implementation and function of a KM system. These variables form the heart of the knowledge transfer process and are

[43] Cong and Pandya, "Issues of Knowledge Management in the Public Sector," 27.

[44] Kane, "Reframing the Knowledge Debate," 37.

[45] Cong and Pandya, "Issues of Knowledge Management in the Public Sector," 26.

[46] Clyde W. Holsapple and Kiku Jones, "Exploring Primary Activities of the Knowledge Chain," *Knowledge and Process Management* 11, no. 3 (July-September 2004): 163.

[47] Nigel J. Holden and Harald F. O. Von Kortzfleisch, "Why Cross-Cultural Knowledge Transfer is a Form of Translation in More Ways than You Think," *Knowledge and Process Management* 11, no. 2 (April-June 2004): 128.

influenced by ambiguity (the lack of clarity of the information), interference (cultural biases), and a lack of network equivalence (no similar definition exists in two separate networks).[48]

Knowledge transfer can also be viewed from the perspective of its impact on organizational objectives and, when used in a cross-cultural (or cross-network) application, achieve unity of effort and harmonization between different components of the organization. This transfer of knowledge creates and sustains value because: 1) it can be viewed as an activity that supports the improved performance of the network, 2) it is focused on a process and end-product quality, 3) levels of accuracy can be assigned, and 4) constraints exist to ensure the production of good results.[49] Additional considerations need to be made for the accuracy and volume of the knowledge being transferred between organizations and entities. Knowledge transfer occurs along a continuum of varying degrees, from the general idea, to sufficient information, to the availability of most information, to the point at which virtually all information is conveyed. Despite these considerations, many organizations continue to focus their efforts on the technological aspects of KM, yet many leadership and human-related factors remain critical to the overall success of the strategy. As the active incorporation of ICT and KM provide great improvements over the continuous problems of stove-piped systems and the automation of manual processes, and other problems, much information may still be classified as "just a flow of messages," not knowledge.[50]

3. What is Knowledge Management?

Although the precise definition of knowledge may be amorphous, KM is regarded as the "strategies and processes of identifying, capturing and leveraging knowledge."[51] Others depict KM as the process to ensure the right knowledge is available in the right

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[48] Nigel J. Holden and Harald F. O. Von Kortzfleisch, "Why Cross-Cultural Knowledge Transfer is a Form of Translation in More Ways than You Think," *Knowledge and Process Management* 11, no. 2 (April-June 2004): 128.

[49] Nigel J. Holden and Harald F. O. Von Kortzfleisch, "Why Cross-Cultural Knowledge Transfer is a Form of Translation in More Ways than You Think," *Knowledge and Process Management* 11, no. 2 (April-June 2004): 128.

[50] Nissen and Espino, "Knowledge Process and System Design," 166.

[51] Wong and Aspinwall, "Knowledge Management Implementation Frameworks: A Review," 96.

form, to the right processor, at the right time, for the right cost.[52] The essence of managing knowledge is deciding with whom to share information, what should be shared, how it should be shared, and actually sharing and using it.[53] As organizations raise up information as *the* critical currency of the future, all resources and capabilities will be redefined in terms of how they impact or improve the enterprise-wide knowledge system.

The ontology of KM consists of the primary activities of knowledge acquisition (from external sources), knowledge selection (from internal sources), knowledge generation (producing knowledge by discovery or derivation from existing knowledge), knowledge assimilation (altering the state of an organization's knowledge resources), and knowledge emission (embedding knowledge into organizational outputs).[54] Other perspectives identify four general processes in KM, including knowledge creation, knowledge organization, storage and retrieval, knowledge transfer and knowledge application.[55]

KM combines theory and practice, but is also multi-disciplinary and incorporates human, organizational and technical factors to create a holistic approach to sustain organizational competitiveness.[56] The variables that most affect KM strategy are related to organization culture, managerial style, the atmosphere, and the criteria adopted for division of labor (i.e., employee span of control, process specialization, etc.). Garavelli proposed a robust framework to assess KM initiatives, which included: relevance and applicability of proficiency (the ability to carry out tasks by using specific knowledge); commitment (of leadership, which is a critical issue in determining organizational design and management), behavior (cooperation and/or competition among the network), atmosphere (the political or ideological environment of the network), style of direction (the role of senior management in the knowledge process), prevalent type of knowledge (tacit or explicit), and the knowledge source (describes the main origin of knowledge).[57]

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[52] Holsapple and Jones, "Exploring Primary Activities of the Knowledge Chain," 156.

[53] Cong and Pandya, "Issues of Knowledge Management in the Public Sector," 27.

[54] Holsapple and Jones, "Exploring Primary Activities of the Knowledge Chain," 157.

[55] Carlsson, "Knowledge Managing and Knowledge Management Systems," 196.

[56] Hlupic, Pouloudi and Rzevski, "Towards an Integrated Approach to Knowledge Management," 91.

[57] Garavelli, Gorgoglione and Scozzi, "Knowledge Management Strategy and Organization," 277.

Currently, most KM systems are limited to handling data rather than knowledge, since they are usually designed to deal with structured data, in which information is directly entered into fields or can be categorized and easily transferred throughout a network.[58] In general terms, the major activities of the KM cycle include organizational and technical issues and can be categorized through the identification of data, generation of information, codification of information and transfer knowledge. Identification and generation activities are focused on the acquisition of knowledge through either internal or external sources.[59] Information is generated through discovery (e.g., data mining, brainstorming, analysis of activity patterns, or seizing upon a revelation) or derivation (using the tacit knowledge of the organizational process to improve outcomes).[60] The *acquisition* of this knowledge can be direct or indirect. Direct acquisition may take place by: obtaining or licensing data or patents, using a competitor's intelligence, exploiting windows of opportunity for technological advance, obtaining trade secrets, collection of information from external sources, reviewing professional literature, leveraging technological advances, receiving external training, or participating in a collaborative acquisition. This is a wide scale acquisition of knowledge that affects the entire organization. The indirect acquisition method involves the assimilation of tacit knowledge through the entire workforce.[61] Following knowledge acquisition, *selection* leverages internal sources, organizes knowledge and transfers knowledge for immediate or subsequent use, action (applied as soon as it is received) or storage (used from a database).[62] Building upon this foundation, knowledge *assimilation* is the class of activities that alter the state of an organization's knowledge resources by internally distributing and storing acquired, selected or generated knowledge. These activities can be classified as either publishing (an emphasis on archiving and unidirectional flow of

[58] Hlupic, Pouloudi and Rzevski, "Towards an Integrated Approach to Knowledge Management," 91.

[59] Chandra S. Amaravadi and In Lee, "The Dimensions of Process Knowledge," *Knowledge and Process Management* 12, no. 1 (January-March 2005): 68.

[60] Holsapple and Jones, "Exploring Primary Activities of the Knowledge Chain," 163.

[61] Ibid.

[62] Ibid.

knowledge) or interacting (multi-directional flow of knowledge). Assimilation activities can be classified as formal (well defined, institutionalized) or informal (a more ad hoc approach).[63]

Information and Communication Technology (ICT) enable the easy connection of individuals and permit knowledge to be captured, stored, accesses and converted in form.[64] Good quality communications transfer knowledge with high values of: 1) availability (timeliness of the exchange of information), 2) suitability (means of presentation), and 3) accuracy (level of detail transmitted).[65] Two main uses of ICT and KMS are identified as generally supporting the learning organization or the supporting of a specific knowledge process which leads to a comparative advantage.[66]

4. Knowledge as a Catalyst for Organizational Change

Perhaps one of the most transformational issues relevant to the field of KM is that information is now being viewed as a driver of organizational change. The effective management of knowledge involves more than simply exploiting the data held on information systems. It requires attention to the "softer" parts of the organization, such as how organizational structures and processes combine intellectual and human capital for learning, innovation and problem solving. Through these processes, better service can be provided by improving the impact of knowledge management. At present, most information systems simply support organizational structures to collect and disseminate information.[67]

Most KM strategies support the traditional organizational model which is focused on stable responsibilities and static organizational charts. The existing hierarchy designates formal relationships, groups individuals into departments and organizations, and designs systems to ensure effective communication, coordination and integration

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[63] Holsapple and Jones, "Exploring Primary Activities of the Knowledge Chain," 163.

[64] Garavelli, Gorgoglione and Scozzi, "Knowledge Management Strategy and Organization," 273.

[65] Armando Calabrese, "The Evaluation of Quality of Organizational Communications: A Quantitative Model," *Knowledge and Process Management* 11, no. 1 (January-March 2004): 47.

[66] Carlsson, "Knowledge Managing and Knowledge Management Systems," 197.

[67] Hlupic, Pouloudi and Rzevski, "Towards an Integrated Approach to Knowledge Management," 91.

vertically between organizational layers.[68] As organizations become more integrated, the way that employees must collaborate changes dramatically. The implementation of multi-disciplinary, cross-functional teams is critical for process-based organizations. These teams provide more responsibility, decision-making power and flexibility so that organizational performance increasingly relies on these teams. Some KM practitioners have identified an urgent need that exists for companies to break from the traditional organization model and adopt key processes that are by definition cross-functional and deemphasize the functional structure of an organization.[69] Processes cannot become the only basis for organizational structure, however. Most organizations have to adopt a multi-dimensional matrix structure in which process responsibility is a key dimension. With this new structure, the role of middle and top managers has to be redesigned to develop and sustain coordination mechanisms.[70]

In summary, KM gives organizations the ability to: 1) identify, consider and respond to strengths, weaknesses, opportunities and threats, 2) act, assimilate feedback and react in these areas simultaneously, 3) develop the capacity to operate in real-time environments, 4) understand and create real value as determined by users of knowledge.[71]

C. NETWORK AND KNOWLEDGE INTERDEPENDENCY

When viewed in the abstract, it may appear that network theory and knowledge management are two independent fields of study, yet in the environment of a catastrophic disaster, both influence and shape the adequacy of the response effort. Additional examination will reveal that these two critical concepts are actually interdependent, as communications strengthens network cohesion and the network requires the management of knowledge to conduct effective and efficient operations.

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[68] Wim Vanhaverbeke and Huub Torremans, "Organizational Structure in Process-Based Organizations," *Knowledge and Process Management* 6, no. 1 (March 1999): 43.

[69] Ibid., 44.

[70] Vanhaverbeke and Torremans, "Organizational Structure in Process-Based Organizations," 51.

[71] Hlupic, Pouloudi and Rzevski, "Towards an Integrated Approach to Knowledge Management," 92.

III. RESEARCH METHODS

A. RESEARCH OVERVIEW

This thesis project focused on the development of changes to the response community and National Response Plan. This agenda for change is based on a review of the social network analysis and knowledge management and the application of those fields on various policies that enact emergency management authorities and responsibilities.

B. POLICY REVIEW

Applying the observations of network analysis and knowledge management, a thorough review of response policy was conducted. This review included an assessment of the relevance of these two fields on the National Homeland Security Strategy, the National Response Plan, the National Incident Management System, the National Strategy for the Protection of Critical Infrastructure and Key Assets, the State of Mississippi Emergency Management Law, the Mississippi Comprehensive Emergency Management Plan (also known as the Mississippi Emergency Operations Plan), the Mississippi Statewide Mutual Aid Compact and other policy documents. Key issues drawn from these policy documents focused on the validity of local control of response actions for catastrophic incidents and the role of various government agencies in supporting network formation and knowledge management systems.

C. HANCOCK COUNTY, MISSISSIPPI CASE STUDY

A case study of the emergency response in Hancock County was completed. Although it is the smallest of the three counties in Mississippi affected by Hurricane Katrina, Hancock County serves as an important example for other communities throughout America. Even considering the relatively small population, the response environment was extremely complex due to three factors: the significant devastation to all existing infrastructure throughout the County, the loss of the local command and control capability over response agencies, and the overwhelming flow of response agencies into the local area. The source of much information from the Hancock County case study comes from several Incident Action Plans generated by FEMA and the Hancock County Emergency Management Agency. Other information was gleaned from

reports provided by members of the incident command staff and NGOs that worked in Hancock County after Katrina's landfall. Additionally, the author deployed to Hancock County as the Task Force Director of U.S. Coast Guard forces in Mississippi, and a significant amount of information in the case study comes from close personal observation of the response activities during this time period.

IV. RESPONSE POLICY

A. ORIGINS OF LOCAL INCIDENT MANAGEMENT

In American history, emergency management functions have traditionally been the purview of state and local governments. The Tenth Amendment of the Bill of Rights specifies that, "the powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people."[72] This statement forms the basis for the balance of power between federal, state and local authorities. The ideal of local emergency management is supported in the NIMS and the NRP. The NRP goes so far as to state that "a basic premise…is that incidents are generally handled at the lowest organizational level possible."[73] Additionally, the NRP describes that "state, county and local EOCs represent the physical location at which the coordination of information and resources to support incident management activities normally takes place."[74] The concept that domestic incidents are managed by community leaders is pervasive throughout policy documents at all levels of government.

B. A HIERARCHICAL APPROACH TO INCIDENT MANAGEMENT

The federal role in domestic incident management evolved as significant catastrophes in the United States created strategic changes to the incident management process. In the aftermath of Hurricane Andrew in 1992, the Federal Emergency Management Agency (FEMA) assumed the lead role coordinating all federal resources in situations where state and local agencies were overwhelmed. As an outcome of Hurricane Andrew, FEMA developed the Federal Response Plan (FRP), which linked all federal disaster response activities under a broad plan. While the FRP focused heavily on federal government response actions, the terrorist attacks of 9/11 exposed weaknesses in our national approach and several policies were implemented to improve America's preparedness and resilience.

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[72] U.S. Constitution Online, http://www.usconstitution.net/xconst_Am10.html [Accessed January 11, 2006].

[73] Department of Homeland Security, *National Response Plan*, 15.

[74] Ibid., 39.

1. The National Homeland Security Strategy

In the first-ever national strategy specifically focused on domestic security, President Bush defined "homeland security" as "a concerted national effort to prevent terrorist attacks…and minimize the damage and recover from attacks that do occur."[75] Several critical mission areas are identified in the strategy which further clarifies the national strategy, including those for emergency services and information sharing and systems.[76] Within the Emergency Preparedness and Response mission area significant changes were outlined, including the promulgation of a single all-hazards incident management plan, the creation of a national incident management system, and the enabling of seamless communication among all responders.[77] The national vision for information sharing stresses the horizontal and vertical sharing of information, the common awareness of all resources and threats, and the incorporation of all source data.[78]

a. The National Incident Management Strategy

Building upon the Homeland Security Strategy, President Bush signed the "Directive on Management of Domestic Incidents," also known as Homeland Security Presidential Directive Five (HSPD 5), and established a clear direction for the federal, state and local agencies to respond and support emergency management. Within HSPD 5, the President stressed that to "prevent, prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies…the United States Government shall establish a single, comprehensive approach to domestic incident management."[79] Additional elements of the policy emphasize:

- the organizational interoperability of all government agencies, at the federal, state and local levels, to work "efficiently and effectively" together;
- a reemphasis that all incidents should be managed at the local level, calling upon the federal government to "assist when their [local] resources are

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[75] Department of Homeland Security, *National Strategy for Homeland Security* (Washington, D.C.: United States Office of Homeland Security, July 2002), 2, http://knxup2.ad.nps.navy.mil/homesec/docs/whitehouse/nat_strat_hls.pdf [Accessed January 10, 2006].

[76] Ibid., 30.

[77] Ibid., 43.

[78] Ibid., 56.

[79] George W. Bush, *Management of Domestic Incidents*, Homeland Security Presidential Directive/HSPD-5, February 28, 2003, http://www.whitehouse.gov/news/releases/2003/02/20030228-9.html [Accessed January 24, 2006].

overwhelmed" and that "initial responsibilities for managing domestic incidents generally falls on the State and local authorities;"

- Promote partnerships with the private sector and NGOs to "ensure adequate planning, equipment, training and exercise activities…to address incident management capabilities;"
- "information related to domestic incidents is gathered and provided to the public, the private sector, State and local authorities, Federal departments and agencies."

b. The National Incident Management System (NIMS)

With the introduction of NIMS in 2003, the Bush Administration enacted the comprehensive national model of disaster management that spanned all jurisdictions and functional disciplines. This NIMS policy created a framework for interoperability designed to support the decision-making process of the Incident Commander.[80] The foundation of the NIMS is embodied within the core of the Incident Command System (ICS) organizational structure, which was first developed by the fire services in the western United States in the 1970s. The NIMS organization identified in Figure 3 applies the fire service model by employing the common lexicon which enables the organizational integration of dissimilar agencies and disciplines. Within this structure, the Incident Command function establishes strategic priorities for disaster response; Operations plans and executes activities that are designed to achieve the strategic goals of the organization; Planning maintains an accurate assessment of the disaster and the status of resources available; Logistics manages the assigned resources to sustain operations; and Finance/Administration ensures accountability for all assigned resources. This complex, process-oriented approach to disaster management requires a limited span of control for any individual component and the strict adherence to the ICS terminology, making it possible for dissimilar agencies to work together easily.

[80] Department of Homeland Security, *National Incident Management System*, 14.

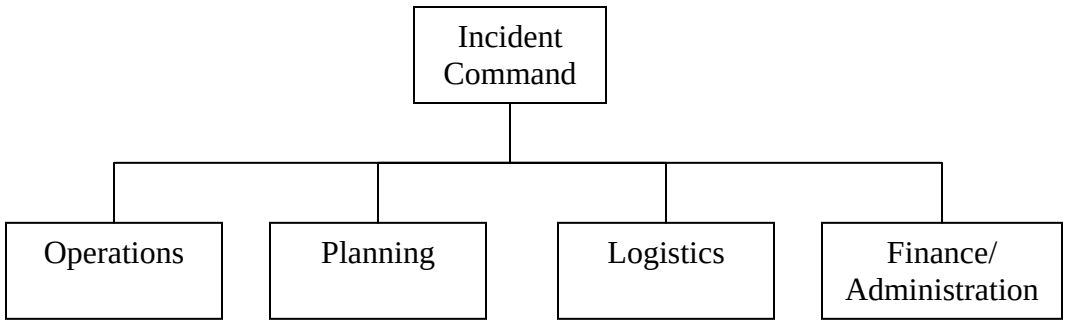

Figure 3. Incident Command System – Command and General Staff[81]

While NIMS does achieve organizational interoperability and consistency with respect to structure and language (i.e., the differences between Sections, Groups, Divisions and Task Forces, for example), some comprehensive requirements receive little attention in the policy. "Establishing and maintaining a common operating picture and ensuring accessibility and interoperability" is a specific goal of the communications and information management systems of the NIMS.[82] This notional common operating picture would allow information to be shared across all jurisdictions and disciplines and facilitate a comprehensive decision-making process. This system "enable(s) Federal, State, local, tribal and private-sector and nongovernmental entities to integrate their information needs into a common operating picture."[83] Unfortunately, this is the only mention of the common operating picture in the NIMS. Strangely, the responsibility for the *function* of information management is not assigned to any specific unit within the command system, but the entities most closely linked to information management are the units from Communications and Situation.[84]

Incident specific communications are managed by the Communications Unit which falls under the Planning Section of the ICS. The Communications Unit operates the incident communications center, distributes and repairs communications equipment, and maintains several radio networks, including the command net, tactical

81 Department of Homeland Security, *National Incident Management System*, 49

82 Ibid.

83 Ibid., 51.

84 Ibid., 76.

nets, support nets, ground-to-air nets, and air-to-air nets.[85] The predominant focus of the Communications Unit is the establishment and maintenance of voice and Automated Data Processing (ADP) systems, yet the management of the content flowing through these systems receives little mention in policy.

Information flow in the NIMS process is, however, a direct result of a complex planning process which culminates in the development of the Incident Action Plan (IAP), a detailed planning document designed to reflect the goals and strategies of the incident command. The planning process merges current information regarding the situation, possible future events, and strategies to attain incident objectives and develop the IAP for the next operational period. The NIMS policy stresses simplicity and emphasizes that during the initial stages of the response, a plan must be developed "that can be communicated through concise oral briefings."[86] Several appendices to the IAP often detail additional aspects of the response, including the organizational chart, assignment list, communications plan, and logistics plan.[87] Despite being specifically mentioned as an imperative issue in Chapter V of the NIMS policy, the concept of information management is not addressed elsewhere in the policy, as either a functional goal or responsibility.

c. The National Response Plan (NRP)

While a full review of the National Response Plan will not be conducted within this document, several elements of the NRP are particularly enlightening to gain a working knowledge of the plan that is germane to the development of networks and knowledge management. This comprehensive, "all hazards" plan provides coordinating guidance for all federal agencies in the event of a domestic incident, whether it be a result of a terrorist attack or natural disaster. To be more precise, the NRP is "a concerted national effort to prevent terrorist attacks within the United States, reduce America's vulnerability to terrorism, major disasters, and other emergencies; and minimize the damage and recover from attacks, major disasters, and other emergencies that occur."[88]

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[85] Department of Homeland Security, *National Incident Management System*, 84.

[86] Ibid., 97.

[87] Ibid., 103.

[88] Department of Homeland Security, *National Response Plan*, 1.

Within the context of this thesis, however, an overview of the Base Plan, the Catastrophic Incident Annex, the Private Sector Coordination Support Annex, and the Volunteer and Donations Management Support Annex is likely to be sufficient.

The NRP does indeed establish the single, national approach to domestic incident management envisioned in HSPD5. Within the framework of the NRP, the use of NIMS "can be partially or fully implemented in the context of a threat…or the response to a significant event."[89] At every level of the response organization, interagency roles and responsibilities are displayed in Table 1, whether they are local, state or federal.

Emergency Support Function	***Primary Federal Agency***
ESF 1 Transportation	Department of Transportation
ESF 2 Communications	Department of Homeland Security
ESF 3 Public Works & Engineering	Department of Defense; US Army Corp of Engineers
ESF 4 Firefighting	Department of Agriculture, US Forest Service
ESF 5 Emergency Management	Department of Homeland Security, FEMA
ESF 6 Mass Care, Housing and Human Services	Department of Homeland Security, FEMA
ESF 7 Resource Support	General Services Administration
ESF 8 Public Health & Medical Services	Health and Human Services
ESF 9 Urban Search & Rescue	Department of Homeland Security, FEMA
ESF 10 Oil and Hazardous Material Response	Environmental Protection Agency
ESF 11 Agriculture and Natural Resources	Department of Agriculture
ESF 12 Energy	Department of Energy
ESF 13 Public Safety and Security	Department of Homeland Security
ESF 14 Long-term Community Recovery	Several primary agencies

[89] Department of Homeland Security, *National Response Plan,* 1.

Emergency Support Function	*Primary Federal Agency*
and Mitigation	
ESF15 External Affairs	Department of Homeland Security, FEMA

Table 1. Designation of ESF Primary Agencies[90]

Coordinating federal support for national incidents is the critical objective of the NRP, and Figure 4 (below) depicts the organizational framework designed to identify and coordinate the movement of federal resources to the disaster. Within this organization, all federal efforts are coordinated through the Joint Field Office (JFO) and led by the Principal Federal Official (PFO). As the leader of all federal disaster efforts, the PFO is responsible for the seamless integration of federal support to state and local agencies and to resolve interagency conflicts. The JFO, composed of a large, multiagency staff, aggregates state and local disaster requirements and coordinates operations to enable the effective and efficient prevention, preparedness, response and recovery efforts.[91] The JFO resembles the ICS structure of the NIMS, but it also includes an element named the Coordination Group, which consists of senior federal and state officials to advise the PFO, and a Coordination Staff.

Within the Coordination Group, the Federal Coordinating Official (FCO) determines the type and level of federal resources that will assist in the disaster response. The FCO's responsibilities include conducting an initial appraisal of the incident, coordinating the delivery of federal resources to state and local governments, and working in conjunction with the State Coordinating Official to allocate resources as appropriate. Depending on the severity of the disaster, the PFO and FCO may elect to deploy additional resources. Among many of the resources available for deployment are: Emergency Response Teams (ERTs), Federal Incident Response Support Teams (FIRSTs), Disaster Medical Assistance Teams (DMATs), Veterinarian Medical Assistance Teams (VMATs), Disaster Mortuary Operational Response Teams (DMORTs), National Medical Response Teams (NMRTs), Urban Search and Rescue (US&R) teams, and Type 1 and Type 2 Incident Management Teams (IMTs).

[90] Department of Homeland Security, *National Response Plan*, ESFv.

[91] Ibid., 28.

In addition to this broad federal government support to disaster response, Department of Defense resources may be requested if all civilian federal agency resources are overwhelmed. Requests for DoD assistance flow from the FCO to the Defense Coordinating Official (DCO). The only exception to this request flow is for those requirements involving the U.S. Army Corps of Engineers, the National Guard, or DoD support provided directly to the Federal Bureau of Investigation.

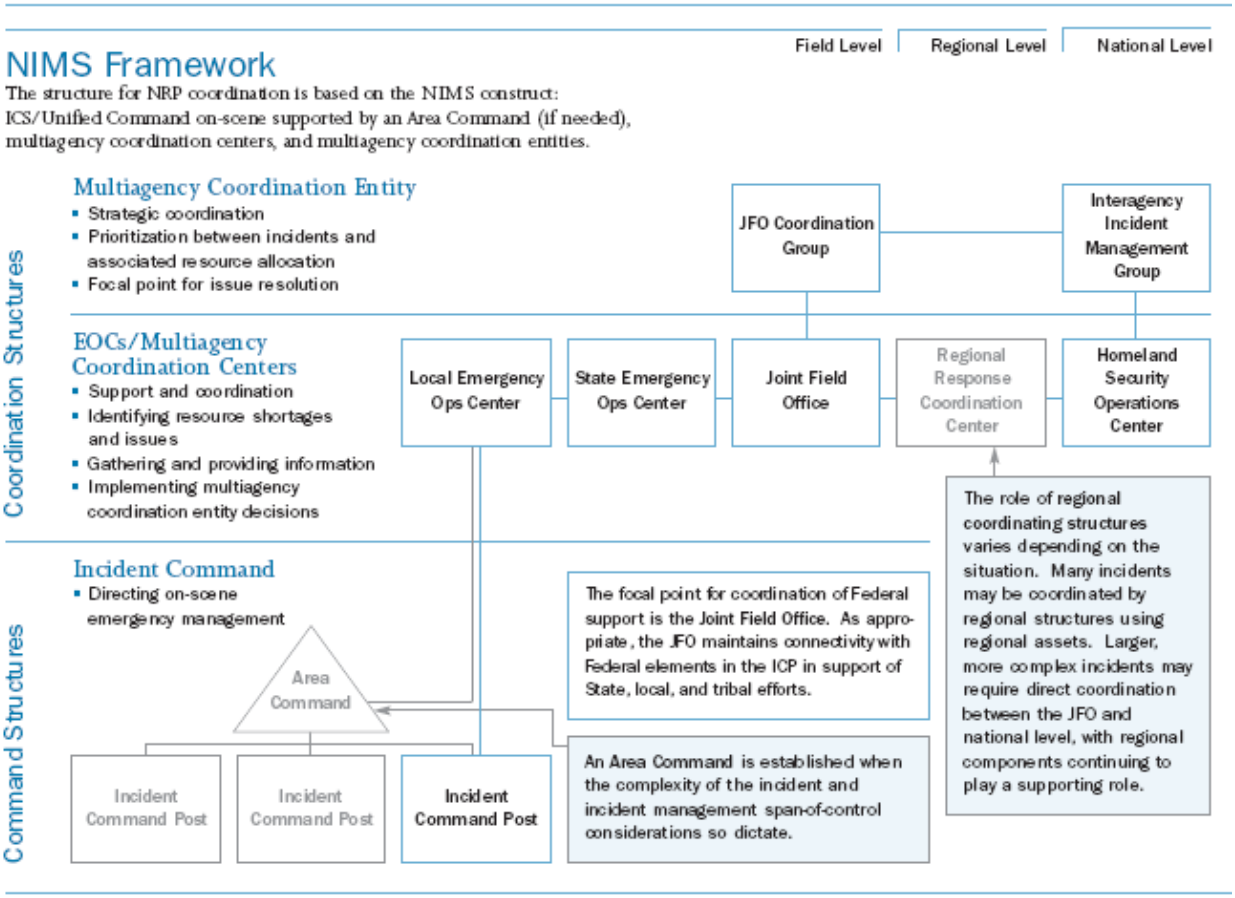

Figure 4. The NIMS Framework from the National Response Plan[92]

While many federal agencies control many resources available for disaster response, the Governor possesses exclusive authority that establishes limits to federal authority and support. Chief among these powers is the ability to declare a state of emergency and the provision of special police powers to various agents of the state, such as the police auxiliary. Powers among the states vary widely in this regard, yet all states

[92] Department of Homeland Security, *National Response Plan*, 18.

recognize the Governor as the principal state official who directs response activities. It is within this capacity that the Governor oversees the execution of the statewide emergency disaster plan, communicates with the public, enters into mutual aid agreements with other states and requests federal assistance when state and local resources are insufficient.[93]

The official with the most unclear role in the NRP is the Local Chief Executive Officer, defined as the mayor or city or county manager who is responsible for the public safety of the citizens within an affected community. This executive is responsible for local resource coordination, may suspend local laws and ordinances, fulfills a key leadership role in the community, participates in mutual aid agreements and may request State or Federal assistance if local resources are overwhelmed.[94] It is at this level of the response organization that most response services will be delivered—yet it receives the least discussion in the NRP when viewed in comparison to the PFO, FCO and Governor.

Within the NRP, several special annexes describe situations and actions that transcend the function-specific ESF annexes contained in Table 1. Within the Catastrophic Incident Annex, an Incident of National Significance (IoNS) is defined as "any natural or man-made incident…that results in extraordinary levels of mass casualties, damage, or disruption severely affecting the population, infrastructure…and/or government functions."[95] The NRP envisions a proactive federal response in anticipation of, or in response to, an IoNS and assigns expanded roles and authorities for all federal agencies under these special conditions. To fully develop the roles and responsibilities, several planning assumptions guide agency actions to develop strategies and manage catastrophic incidents. Particularly relevant when considered in the context of Hurricane Katrina, some of these assumptions are:

- Tens of thousands of displaced persons
- Incident of National Significance
- Presidential Disaster Declaration
- Nature and scope of the disaster may include…natural or manmade hazards

[93] Department of Homeland Security, *National Response Plan*, 8.

[94] Ibid.

[95] Ibid., CAT-1.

- Multiple incidents occur simultaneously
- Significant disruption of the area's critical infrastructure
- Response capabilities of the local authorities is overwhelmed and many first responders may be victims
- Lack of situational awareness for 24 to 48 hours
- Large scale evacuations may occur
- Large numbers of people may be left homeless
- Environmental impacts severely challenge governments and communities to achieve a timely recovery

Within the Private Sector Coordination Support Annex, the Federal Government specifies several avenues in which private-to-public collaboration is conducted. Included among these are the DHS Private Sector Office, the Information Analysis and Infrastructure Protection/Infrastructure Coordination Division, the National Infrastructure Coordination Center, and the Infrastructure Liaison during IoNS.[96] While much policy is devoted to the cooperation of the federal government with the private sector, the relationship between the local government and private sector is considerably less well-defined and is "determined in large measure by the nature, scope and magnitude of the incident."[97]

The treatment of NGOs is even vaguer within the context of the NRP. The donation of goods and services by NGOs is laid at the feet of the "state, local and tribal governments."[98] DHS, as per the NRP, plays a coordinating role to assist in establishing an organization to manage volunteers and donations, yet most of the responsibility in forming the collaborative network rests on the local incident command.

d. The National Strategy for the Protection of Critical Infrastructure and Key Assets

President Bush signed this strategy into effect in February 2003 and highlighted the concept that America's critical infrastructure provides essential goods and

96 Department of Homeland Security, *National Response Plan*, PRV-4.

97 Ibid.

98 Ibid., VOL-1.

services, connectivity and interoperability, and public safety.[99] Emergency Services is included among the thirteen critical infrastructure sectors—from a national perspective, the vast network of first responders continues to face the challenges of 9/11, including non-interoperable communications, inadequate information sharing, and a lack of redundant systems.[100] The strategy focuses on developing resilience within the first responder community, i.e., the network of public service agencies including fire, Emergency Management Services and law enforcement. President Bush adopted several initiatives to assist the first responder community and targeted government efforts on the adoption of interoperable communications, the development of redundant communications networks, the protection of the response infrastructure, and the enhancement of mutual aid agreements.[101] Many of these initiatives, particularly as they relate to communications technology, have gained significant attention after the National Commission on Terrorist Attacks Upon the United States (9/11 Commission) recommended that Congress should "ensure communications connectivity between and among civilian authorities, local first responders and the National Guard."[102] In October 2001, the Office of Management and Budget designated Project SAFECOM as the primary E-government initiative to address the challenge of interoperable communications.[103]

SAFECOM. This program was created in 2001 to "unify the federal government's efforts to…establish reliable public safety communications and achieve

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99 The Office of the President of the United States, *National Strategy for the Physical Protection of Critical Infrastructure and Key Assets* (Washington, D.C.: United States White House Office, February 2003), 6, http://knxup2.ad.nps.navy.mil/homesec/docs/whitehouse/physical_strategy.pdf [Accessed January 15, 2006].

100 *National Strategy for the Physical Protection of Critical Infrastructure and Key Assets*, 43.

101 Ibid., 44.

102 *9/11 Commission*, 397.

103 Linda D. Koontz and others, *Key Cross-Agency Emergency Communications Effort Requires Stronger Collaboration* (Washington, D.C.: U.S. Government Accountability Office, 2004), http://www.gao.gov/htext/d04494.html [Accessed February 10, 2006].

national wireless interoperability."[104] While SAFECOM was initially led by the Department of the Treasury, leadership of the project migrated to FEMA and is now managed under the responsibility of the DHS Office for Interoperability and Compatibility. By design, SAFECOM is chartered to provide an interoperable communications solution for traditional public response agencies, yet the project's narrow definition of "first responder" resulted in the omission of public health, utility and transportation requirements.[105] State and local jurisdictions play a critical role in developing an interoperable communications system. They are likely to be the first agency to arrive and the last to leave an incident and 90 percent of the public safety communications infrastructure in the United States is owned by state and local governments.[106] This program, however, is primarily focused on the interoperability of federal agencies, not on a broader definition of first responders. Despite the need to develop a federal, state and local system of interoperability, SAFECOM "does not appear to be planning a standardized network overlay that can encompass the many useful, but mostly not connected, networks that already play vital roles in public safety communications."[107]

C. MISSISSIPPI EMERGENCY MANAGEMENT

Consistent with the Tenth Amendment of the U.S. Constitution, states maintain many rights under their specific authorities that are independent from the Federal government. Among these rights is the authority to manage domestic incidents within each state. Applying these rights in the context of Hurricane Katrina, the State of

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104 William O. Jenkins and Thomas James, *Federal Leadership and Intergovernmental Cooperation Required to Achieve First Responder Interoperable Communications* (Washington, D.C.: U.S. Government Accountability Office, 2004), 11, http://64.233.179.104/search?q=cache:dFc5OUruHTUJ:www.gao.gov/new.items/d04740.pdf+Federal+Leadership+and+Intergovernmental+Cooperation+Required+to+Achieve+First+Responder+Interoperable+Communications&hl=en&gl=us&ct=clnk&cd=1 [Accessed February 5, 2006].

105 William O. Jenkins and Thomas James, *Federal Leadership and Intergovernmental Cooperation Required to Achieve First Responder Interoperable Communications* (Washington, D.C.: U.S. Government Accountability Office, 2004), 17, http://64.233.179.104/search?q=cache:dFc5OUruHTUJ:www.gao.gov/new.items/d04740.pdf+Federal+Leadership+and+Intergovernmental+Cooperation+Required+to+Achieve+First+Responder+Interoperable+Communications&hl=en&gl=us&ct=clnk&cd=1 [Accessed February 5, 2006].

106 Ibid., 61.

107 Linda K. Moore, *Public Safety Communications: Policy, Proposals, Legislation and Progress* (Washington, D.C.: Congressional Research Service, 2005), CRS-8, http://knxup2.ad.nps.navy.mil/homesec/docs/crs/nps18-060105-01.pdf [Accessed January 2006].

Mississippi enacted three specific documents: the Emergency Management Law (Title 33, Chapter 15, Mississippi Code of 1972), the Mississippi Emergency Operations Plan (MEOP), and the Statewide Mutual Assistance Compact (SMAC) (revised June 2000).

1. Mississippi Emergency Management Law

Within this law, Mississippi defined a "catastrophic disaster" as requiring "massive state and federal assistance, including immediate military involvement."[108] The Governor of Mississippi, as in many states, possesses broad powers to direct state-wide actions in the even of catastrophic disaster. Among these are: 1) working with the Mississippi Emergency Management Agency (MEMA) to develop a comprehensive plan for the state and integrate local plans into the state-wide plan, 2) determining the requirements of the state for life saving supplies in the event of a disaster, 3) cooperating with the President and Armed Forces, and, 4) entering into reciprocal aid agreements with other states and the federal government.[109] Under a declared state of war (as opposed to an emergency), the Governor can assume powers far beyond those typically granted. These additional powers include assuming the direct operational control of all emergency management forces and the commandeering of any private property for "the protection of the public or at the request of the President, the Armed Forces or the Emergency Management Agency of the United States."[110] MEMA is responsible for developing a comprehensive emergency management plan which includes several specific responsibilities for evacuation, sheltering, response, recovery and the establishment of standards for local community plans. None of these provisions articulate the responsibility to develop a plan to manage incident information. Each county shall also "develop an emergency management plan and program…consistent with the State…plan."[111] These local organizations are also required to "establish as necessary, a primary and one or more secondary operating centers to provide continuity

[108] *The Emergency Management Law, Title 33, Chapter 15, Mississippi Code of 1972,* (1972, Amended 2004): 1, http://www.msema.org/documents/EMLawRevised2004.doc [Accessed January 14, 2006].

[109] *Emergency Management Law, Title 33, Chapter 15, Mississippi Code of 1972,* 8.

[110] Ibid., 12.

[111] Ibid., 17.

of government, and direction and control of emergency operations."[112] No discussion of the private sector or NGOs is contained within the Mississippi Emergency Management Law.

2. Mississippi Emergency Operations Plan

The MEOP describes response and recovery operations in Mississippi that are related to emergencies and major disasters. The MEOP is built on five primary assumptions: 1) that local governments possess certain resources to provide for their people, 2) MEMA will conduct an assessment of the severity of the emergency, 3) the Governor, if necessary, will declare a state of emergency, 4) the State EOC will be activated to support a coordinated State and Federal response, and 5) if State and local resources are exceeded, Federal assistance will be requested under the Robert T. Stafford Relief and Emergency Assistance Act.[113] Within the MEOP, examples of response activities include, coordinating emergency operations, establishing priorities, mobilizing personnel and equipment, and conducting emergency operations, i.e., search and rescue, providing emergency medical services, etc. The plan recognizes that the initial responsibility of response, including the direction, control and coordination of operations "rests with the Local government."[114] At the local level, the President of the Board of Supervisors is the primary executive that may: establish a local EOC and secondary control centers, request State assistance, and organize and staff an emergency organization for the purpose of coordinating and managing disaster response and recovery.[115] More specific information is contained in the ESF annexes, including those on Information and Planning (ESF5) and the Hurricane Annex.

The ESF5 function within the MEOP supports both the dissemination of disaster-related information to the public and the development of Incident Action Plans to establish priorities, strategies and solutions for public service agencies. Information is developed through contact with public agencies and disseminated within a structure system of flash reports, situation reports and IAPs. The ESF5 function is specifically

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[112] *Emergency Management Law, Title 33, Chapter 15, Mississippi Code of 1972*, 18.

[113] Mississippi Emergency Management Agency, "Mississippi Emergency Operations Plan" (Planning Document, Mississippi Emergency Management Agency, Jackson, MS, 1999), 4.

[114] Ibid., 7.

[115] Ibid., 22.

tasked with "providing Information Management Systems and Automated Data Processing to all functional ESFs."[116] Information management, as specified within the ESF5 annex, indicates that several agencies are to provide information on a variety of relevant information, yet no specifics are given as to the actual information requirements or the potential use of that information by other ESF functions within the organization.

3. Mississippi Emergency Management Assistance

Under the provisions of the Mississippi Emergency Management Law, many local communities, including Hancock County, are party to the Statewide Mutual Aid Compact (SMAC), which was revised in June 2000. The process for requesting mutual aid begins with a request from a community threatened by an overwhelming disaster.[117] As a participating agency, all communities "shall render assistance…to the extent possible."[118] Within the SMAC, the requesting agency is responsible for providing food and housing for assisting agencies and coordinating communications for all assisting agencies.[119] Within the SMAC, MEMA assumes the role of the coordinator of assistance between agencies and maintains records of all participating agencies and agreements.[120]

D. EMERGENCY MANAGEMENT ASSISTANCE COMPACT (EMAC)

As will be demonstrated later in this document, EMAC assistance in the wake of a catastrophic disaster is a critical enabler for state and local governments to continue to function. EMAC is an interstate mutual aid agreement that provides resources to an affected region after all local and state resources are overwhelmed. While an agreement, Congress approved EMAC legislation in 1996 and the terms of the agreement are monitored by the National Emergency Management Association.[121] To invoke support under EMAC, the Governor must declare a state of emergency, determine resource requirements, and identify specific resources that may be needed.[122]

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116 Ibid., ESF5-5.

117 *Statewide Mutual Aid Compact*, Public Law 1, (2000): 3, http://www.msema.org/documents/SMAC.doc [Accessed January 14, 2006].

118 *Statewide Mutual Aid Compact*, Public Law 1, (2000): 4.

119 Ibid., 5.

120 Ibid., 7.

121 *Emergency Management Assistance Compact*, Public Law 104-321, (1996): 1.

122 Keith Bea, "The Emergency Management Assistance Compact (EMAC): An Overview," *CRS Report for Congress* RS21227 (Washington, D.C.: Congressional Research Service, January 10, 2005), 4.

E. POLICY IMPLICATIONS

The cascading effect of these policies at the federal, state and local levels impacted response operations and activities in the aftermath of Hurricane Katrina. Policies and planning efforts of every organization would be tested by the crisis which unfolded after the largest natural disaster in American history. Debate continues on the adequacy of the government performance in Katrina's aftermath, but few who were involved in the response would ever be able to articulate that they were fully prepared for devastation of such historic proportions. The story of the response in Hancock County, the least populated yet most besieged county in Mississippi, would serve as a microcosm of the successes and failures of America's response network.

V. HANCOCK COUNTY, MISSISSIPPI: HURRICANE KATRINA GROUND ZERO

"I can only imagine this is what Hiroshima looked like 60 years ago." – Governor Barbour[123]

A. THE FIRST WAVE: PREPARATION AND DESTRUCTION

As Hurricane Katrina churned through the Gulf of Mexico after passing over south Florida, all local, state, and federal government agencies actively prepared for the certain disaster lying in the path of the storm. On Friday, August 26, 2006, Governor Haley Barbour of Mississippi declared a State of Emergency, which activated members of the Mississippi National Guard and also directed all agencies of the state to "discharge their emergency responsibilities" specified within the MEOP.[124] On 27 August, the Contra-Flow plan was activated to reverse the southbound lanes of Interstates 55 and 59 to accommodate thousands of evacuees from Mississippi and Louisiana.[125] School closures were announced for the next week for all districts in the southern portion of the state. As the cone of uncertainty regarding Katrina's path narrowed, Hancock County prepared for the worst. At 5pm on 27 August, Governor Barbour ordered a mandatory evacuation for all residents of Hancock County.[126]

Even as these preparations were being made, Katrina continued to surge north and strengthen to what would ultimately become a Category V storm, with winds gusting to 216 miles-per-hour. On August 29, a National Data Buoy Center buoy located 64

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[123] Huffstutter, John-Thor and P.J. Dahlburg, "Katrina's Rising Toll; 'this is our Tsunami'," *Los Angeles Times*, August 31, 2005, http://proquest.umi.com/pqdweb?did=889548851&Fmt=7&clientId=65345&RQT=309&VName=PQD [Accessed January 2006].

[124] Governor Haley Barbour, "Mississippi Executive Order 939," http://www.governorbarbour.com/EO939.htm [Accessed January 14, 2006].

[125] Mississippi Emergency Management Agency, *News Release* (Jackson, MS: Mississippi Emergency Management Agency, 2005), http://www.msema.org/newsreleases/documents/stateofemergency8.27.05.doc [Accessed January 20, 2006].

[126] Elana DeLozier, *Hurricane Katrina Timeline* (Washington, D.C.: The Brookings Institute, 2005), http://www.brookings.edu/fp/projects/homeland/katrinatimeline.pdf [Accessed December 20, 2005].

nautical miles south of Dauphin Island, Alabama recorded peak wave heights of 55 feet—the highest ever directly recorded by the NDBC.[127]

At approximately 6:10 a.m. on August 29, Katrina made a second landfall near Buras, Louisiana with 145 mile per hour winds. A third landfall came hours later, as Katrina's eye passed directly over the Chandeleur Islands off the Louisiana Coast and continued north up the Pearl River, which marks the boundary between Mississippi and Louisiana. Katrina arrived in Mississippi packing sustained winds at 125 miles per hour and pushing a storm surge greater than twenty-eight feet through the communities of Hancock County.[128]

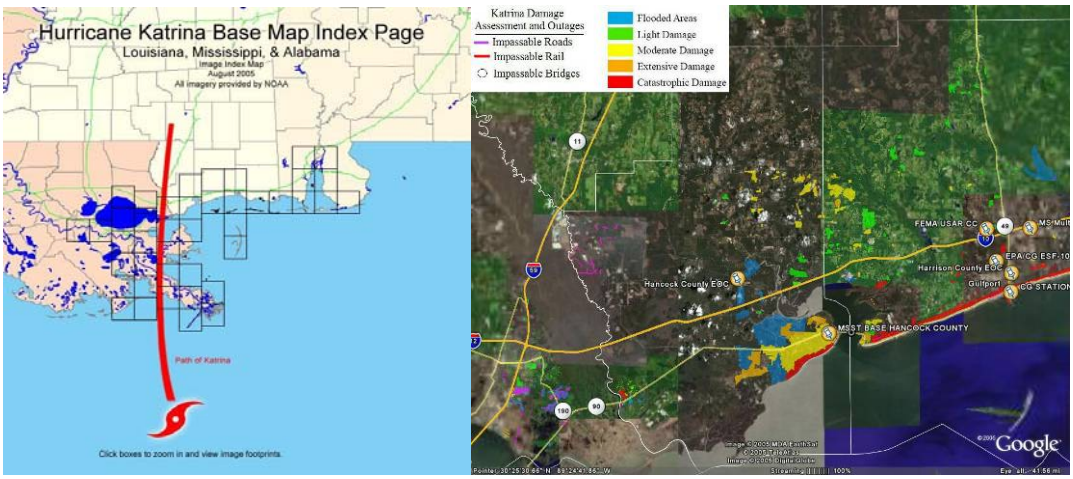

Figure 5. Hurricane Katrina Track and Damage Assessment[129]

The brutal combination of intense winds and surge devastated the Mississippi Coast. President Bush issued a Presidential declaration of a major disaster under the Stafford Act for Mississippi on August 29.[130] While difficult to measure with precision, the surge is estimated to have traveled six miles inland from the coast in many areas, and up to twelve miles up many bays and rivers.[131] The cities of Hancock County, including

[127] Richard D. Knabb, Jamie R. Rhome and Daniel P. Brown, *Tropical Cyclone Report* (Miami, FL: National Hurricane Center, December 20, 2005), 9.

[128] Ibid., 7.

[129] National Geospatial Agency, "NGA Earth," National Geospatial Agency, www.hurricaneimagery.org [Accessed January 20, 2006].

[130] Federal Emergency Management Agency, *Presidential Disaster Declaration* (Washington, D.C.: United States Dept. of Homeland Security, 2005), http://www.fema.gov/news/dfrn.fema?id=4505 [Accessed January 18, 2006].

[131] Knabb, Rhome and Brown, *Tropical Cyclone Report*, 9.

Pearlington, Waveland, Bay St. Louis, and Diamondhead were scoured by this immense force of nature. The deaths in Mississippi, after the completion of all response operations, stood at 224, with fifty-three deaths reported in Hancock County alone.[132] The American Red Cross found that in Hancock County, 10,900 family dwellings were completely lost, 3,600 suffered major damage and 1,800 sustained minor damage.[133] In less than twelve hours, Katrina destroyed nearly sixty-five percent of all 22,363 housing units located in Hancock County.[134] Throughout the state, 100 percent of all customers were without power, including all 45,000 residents of Hancock County. The entire telecommunications system for the coastal region of the state was destroyed, and BellSouth reported that 260,000 lines servicing 598,000 customers were affected.[135] Robert Latham, Director, Mississippi Emergency Management Agency accurately assessed that "Katrina will be remembered as one of the most deadly and costly disasters in our nation's history."[136]

B. THE SECOND WAVE: RESPONSE OPERATIONS

1. A Network Forms from Several Small Worlds

Prior to Katrina's landfall, the Hancock EMA Director and staff gathered at the EOC location in Bay St. Louis along US Highway 90. Based on their prior experience in this hurricane plagued region, they believed that this building was secure even though located in the southern portion of the county, despite being only one-half mile west of the Bay of St. Louis. Given its elevation at approximately twenty-six feet above sea level, the fact that it survived Hurricane Camille was probably the strongest argument for remaining at the EOC. In the EMA Director's assessment, the emergency management staff was paid to stay behind when everyone else leaves. Based on their assessment of

[132] Robin Fitzgerald, "State's Hurricane Death Toll Now 224," *Sun Herald*, October 14, 2005, http://www.sunherald.com/mld/thesunherald/12908252.htm [Accessed January 14, 2006]; MSNBC, "Rising from Ruin: Two Towns Rebuild After Katrina," MSNBC, http://risingfromruin.msnbc.com/the_towns.html [Accessed February 10, 2006].

[133] American Red Cross, "Red Cross Damage Assessments," Mississippi Emergency Management Agency, http://www.msema.org/redcrossassessments.htm [Accessed January 14, 2006].

[134] U.S. Census Bureau, "State & County QuickFacts," United States Census Bureau, http://quickfacts.census.gov/qfd/states/28/28045.html [Accessed January 14, 2006].

[135] BellSouth, "After Katrina - Status of BellSouth's Mississippi Network," BellSouth, http://bellsouth.mediaroom.com/index.php?s=press_releases&item=1490 [Accessed January 25, 2006].

[136] Robert Latham and James N. Russo, *Q&A with MEMA Director and Deputy Federal Coordinating Officer* (Jackson, MS: Mississippi Emergency Management Agency, 2005) http://www.msema.org/newsreleases/documents/MEMAqa.doc [Accessed January 14, 2006].

Katrina's strength and track, the EMA staff believed that, while it would certainly be dangerous in Bay St. Louis, the EOC would be well out of reach of the dangerous storm surge.

Like many small communities, the Hancock County EMA has a minimal staff of four full-time employees, one of which is the director. The EMA Director and staff were joined by police and fire representatives from Bay St. Louis and Waveland, MEMA and FEMA representatives (although both the MEMA and FEMA liaisons departed for the NASA Stennis base prior to Katrina's landfall), and the local ham radio/public radio station remained in the EOC. In sum, approximately twelve people were present in the EOC as Katrina made its final approach north toward the Mississippi coast. Due to the activation of the Mississippi National Guard on 28 August by Governor Barbour, two Guardsmen were also present in the EOC. Their presence would prove critical, as their portable satellite telephone system became the only communications lifeline from the EOC to the outside world. All of these positions were filled by native citizens and volunteers from the local community—the people in the EOC were colleagues, friends, and family who had known each other since childhood. They shared a common bond similar to citizens in most small towns and most had experienced Hurricane Camille 36 years earlier. They knew and were familiar with every inch of Hancock County, the people, communities, and risks.

As Katrina moved nearer to shore, phone service was disrupted throughout the local area and the only forms of communication from the EOC were through the Mississippi National Guard satellite phone and the local ham radio broadcast station WQRZ-FM. When the winds increased during landfall, reaching a peak of 125 miles per hour, with gusts to 150, the situation turned dangerous in Bay St. Louis. Storm surge now had moved through and decimated the coastal communities, reaching thirty feet according to subsequent NOAA assessments. Some local citizens who had failed to evacuate began futile attempts to flee the flooded streets while the storm was at its fullest force. From the EOC building, the staff witnessed winds tearing apart block after block of buildings and surging waters filled US90 up to four feet deep. Everyone quickly realized that Katrina would be much worse than Camille. They waited, prayed, wrote

their social security numbers on their arms for identification, and planned for the rescue and response operations that would come later.

As Katrina subsided on the night of August 29, local first responders began to assess the immediate damage and take the initial steps to restore their community. The toll on first responders was particularly costly, as virtually every fire and police vehicle in Hancock County was damaged beyond repair, further hampering all efforts to marshal an effective response. All public buildings in the City of Waveland were destroyed, including the historic city hall and fire and police departments. The Waveland police actually found themselves forced out of the station during the height of the storm and survived only by clinging to a bush for five hours.[137] With no communications and few vehicles available for transportation, the Hancock County EOC began an on-demand type service—as people provided information to the EOC personnel (all by face-to-face communications because phone, radio and cellular services were out), the EOC personnel saved people located nearby in Bay St. Louis. Transportation was impossible, so most of these efforts were conducted on foot as rescue personnel assisted survivors to shelter or to the rudimentary medical care that emerged at the Hancock Medical Center. Even these efforts, however limited, were severely hampered by the thousands of flooded vehicles, the downed power lines from every utility pole in the region, and millions of tons of debris that choked every street in every community. Eventually, EOC personnel began to organize into small groups and linked survivors with the centers for mass care that emerged in Bay St. Louis at the Kmart and Wal-Mart parking lots. No coordination was possible by radio—communication and coordination in the first days following Katrina was performed strictly through face-to-face meetings either on the street among first responders or at the EOC among the staff.

On August 31, help arrived for the EOC in the form of the Incident Management Team 4 from Manatee County, Florida. Staffed by professional emergency managers who were specifically trained to perform a variety of roles in an Incident Command System (ICS), IMT4 immediately integrated into the local command and provided the

[137] Frances Fragos Townsend, *The Federal Response to Hurricane Katrina: Lessons Learned* (Washington, D.C.: The White House, 2006), http://www.whitehouse.gov/reports/katrina-lessons-learned.pdf [Accessed February 25, 2006], 127.

majority of the staff for the incident command organization. While providing critical assistance to the overwhelmed local victim-responders, IMT4 also brought in a limited communications capability in a Recreational Vehicle (RV) that was equipped with a satellite phone system. This RV became a critical conduit for resource requests, as the IMT4 staff entered requests into an ADP system named "Tracker" and transmitted to the Florida State EOC in Tallahassee. These requests were then communicated to the Mississippi State EOC in Jackson, MS. All of this activity occurred at a time when the Hancock County EOC was largely unusable due to flooding damage, so most coordination of operations occurred in the mud and dust filled streets behind the EOC. As days passed, other EMAC agencies arrived in RVs to provide assistance at the EOC, including the Bolivar County (MS) Fire Department which brought in another satellite communications system. The streets around the EOC became congested with hundreds of first responders and vehicles. Add to this situation the extremely hot weather conditions (clear conditions with high temperatures in the mid 90s), open sewage, limited sanitation throughout the area, a lack of potable water, no showers, and limited food—conditions were rough at the EOC, but every day saw some improvements. Realizing that the current location was untenable, the EMA Director and Incident Command staff began the process of shifting the EOC to the Alternative Education Center at Stennis Airport (located several miles south of the NASA Stennis facility). The move happened on September 4 and, while still without power (meaning no air conditioning) or running water, provided a much more flexible base of operations for the EOC that would have to support the tremendous influx of support from the nation.

The Stennis Airport site quickly became the center of the response efforts for the entire county as a makeshift city sprouted up overnight. With the movement of the EOC and the arrival of the National Guard Task Force Lee, several thousand responders now resided at the very small general aviation facility and the surrounding areas. Every parking lot overflowed with EMAC vehicles, RVs turned into mini-command posts, dozens of portable showers and toilets, and hundreds of tents. The road to the EOC was often lined with hundreds of tractor-trailers delivering supplies to the Hancock County High School (located adjacent to the Alternative Education Center) and the staging area established by FEMA.

After flooding to the first floor, the Hancock Medical Center (located in Bay St. Louis) staff moved patients outside of the building and provided medical care in a field hospital type environment. People from the entire community straggled into the facility's parking lot in Bay St. Louis, many suffering from a variety of illnesses and injuries. Medicinal supplies of all kinds were scarce, and the entire Medical Center's stores of insulin, tetanus, and morphine were lost. The Eli Lily Corporation of Indianapolis, Indiana flew 1500 pounds of medical supplies into Mobile, Alabama on a corporate jet on August 31. These supplies were transported to the Hancock Medical Center by the U.S. Coast Guard and were the first relief supplies that arrived into Hancock County. More help was on the way. FEMA DMAT teams arrived on August 30 to assist the medical center staff to provide emergent care—and they would remain in the community throughout the response phase, providing a critical resource for the devastated community. The several DMAT teams listed in Table 1 spread throughout the County to provide emergent medical care. Throughout the coming weeks, the Hancock Medical Center however became the center of the ESF8 (Medical Care & Public Health) mission.

Prior to Katrina's landfall, the FEMA and MEMA representatives to Hancock County moved from the EOC to the NASA Stennis facility. Although the local EMA and agencies remained in the EOC location in Bay St. Louis, the state and federal agency strategy designated the NASA Stennis facility as the primary base of operations. Indeed, FEMA personnel from around the nation began arriving at the NASA Stennis facility on 30 August, and the NASA Stennis base would prove to be a crucial staging area for resources flowing into the County. Large U.S. Forest Service (USFS) saw crews began to operate south in the Bay St. Louis, Waveland and Pearlington areas, clearing debris from the roads to allow emergency transportation. The USFS teams would ultimately be joined in the debris removal by the Army Corps of Engineers, U.S. Navy Construction Battalion Two, and hundreds of NGO volunteers. As large shipments of goods became available in the community, nearly all of those resources flowed through the NASA Stennis site.

Dozens of citizens, most in a dazed and confused state of shock, began to cluster in the locations that would ultimately become the Points of Distribution (PODs) for food, water and ice. The Bayou Talla Church, Save-A-Center, Gulfview Elementary School,

Dedeaux School, American Legion Post 58, Charles B. Murphy School, and Wal-Mart became the newly established community centers and the primary location for interagency mass care efforts. It was here that a large majority of the NGO work began to take shape, as volunteers from faith-based organizations and other volunteer groups provided essential services to Katrina victims. Mobile kitchens, staffed and led by a variety of church groups, the Salvation Army, and the American Red Cross, were operated in these areas for weeks to feed thousands of meals to the recently homeless. By any measure, the amount of material flowing through the network of PODs was incredible. By September 10, 2005, for example, guardsmen distributed over 30,000 gallons of potable water, 128,000 pounds of ice, and 188,000 Meals Ready to Eat (MREs) to Hancock County residents.[138]

The critical role filled by the National Guard in Mississippi cannot be overstated. The National Guard effort, code named Joint Task Force Cyclone, consisted of a total military strength of 12,484 guardsmen. These troops were organized across several task forces: Task Force Lee operated in Hancock and Pearl River Counties (2141 troops); TF Wright in Harrison County (1821 troops), TF Quick in Jackson County (1002 troops), TF Keifer covered all other counties (3115 troops), TF Guardian provided military police support throughout the state with 1047 troops, and TF Engineer directly supported ESF3 (Public Works & Engineering) with 1362 troops. Within Hancock County, TF Lee operated the PODs, provided security at dozens of checkpoints throughout the county, and completed hundreds of "tailgate missions"—driving into the hardest hit areas of the county with water, ice and MREs for Katrina victims.

Urban Search and Rescue operations followed a different strategy. While most of the other agencies providing support to Hancock County also camped within the county limits, US&R teams were based out of the waterpark in adjacent Harrison County. Establishing a temporary base in Harrison County created a situation in which the US&R teams worked in Hancock, but communicated little with the other entities involved in disaster response—they came into the county, conducted operations and left. Communications, already tremendously difficult, were made even more challenging

[138] Army National Guard, "Joint Task Force Cyclone Operational Briefs" (Powerpoint Briefing Slides, Jackson, MS, 2005).

because of the remoteness of the US&R base camp. This physical barrier created confusion between the US&R teams and the Hancock EOC, which attempted to determine the status of rescue and recovery efforts throughout the County. Little detailed information was exchanged between the US&R teams and the EOC and few local resources or people were used by the US&R teams in the search process. As a consequence of these difficulties, Hancock County officials often found themselves frustrated by the lack of information available on US&R operations and tasked local resources to perform search activities in areas already saturated by the FEMA US&R teams.

Law enforcement operations were primarily coordinated through the EOC by representatives from the Florida Department of Law Enforcement. The incident command post for law enforcement activities was located in the Kmart parking lot in Bay St. Louis, with several EMAC organizations arriving to assist local law enforcement agencies to maintain law and order in the community. As the National Guard troops under Task Force Lee arrived in large numbers on September 4, police officers were gradually replaced at checkpoints so that they could actively patrol neighborhoods to maintain an active law enforcement presence throughout the county.

Day-by-day, many additional incident command posts were established to meet the almost unlimited needs to rebuild Hancock County. These efforts included thousands of government employees from federal, state and local agencies, the private sector (BellSouth alone had over 1500 employees working on restoring lines), the military (2141 members), and volunteers numbering in the thousands. A comprehensive accounting of all organizations is particularly elusive, because the widespread communications problems prevented an accurate recording of organizational strength and the chaotic environment severely limited the capture of information in official documents. Much of this information has been compiled as a result of interviews, personal accounts, and post-deployment reports from the various agencies. Table 2 below is a partial list of the public agencies, private sector organizations, and NGOs worked in Hancock County within the two weeks after Katrina's landfall.

Location	Description	Agencies
Winn Dixie (Bay St. Louis), Chevron (Diamondhead), Dolly's (Kiln), Kmart (Bay St. Louis)	ESF2 Communications Telephone Banks	Bellsouth, Southern Linc, Alltell, Nextel
Stennis Airport	ESF3 Public Works & Engineering; Debris Removal	Army Corps of Engineers, US Forest Service, Navy Amphibious Construction Battalion 2, Christian Life Church, Diamondhead Baptist Church, Diamondhead Presbyterian Church, Diamondhead United Method Church, UTURN for Christ, Adventist Community Team Services, Clermont Harbor & Pearlington United Methodist Church, Kiln Public Library, Voice of Calvary Ministries, Word of Faith Christian Fellowship, Zuni Hotshot Crew, Pearlington Recovery Resource Center, Christian Reformed World Relief Committee
Stennis Airport	ESF4 Firefighting	Osceola County (FL) Fire Department, Carbondale & Rural Fire Protection District, Bolivar County Fire, Chickasaw County Fire, City of Luka Fire, City of Madison Fire, Sunflower County Fire, Fairfax County Fire
Stennis Airport	ESF5 Emergency Management	Hancock County EMA, Florida IMT Team 4, Nvision, Mississippi National Guard, GIS Corps

Location	Description	Agencies
Bay St. Louis Train Depot, Kiln Library, Diamondhead Club, Bay St. Louis Second Street School	ESF6 Mass Care, Housing & Human Services; Operation Blue Roof	Army Corps of Engineers; Samaritan's Purse, Church of Jesus Christ of Latter Day Saints, Diamondhead Baptist Church, Adventist Community Team Services, UTURN for Christ, Diamondhead United Methodist Church, Christian Life Church
North Central Elementary	ESF6 Mass Care, Housing & Human Services; Shelter	American Red Cross, Salvation Army, World Shelter, Christian Life Church, Voice of Calvary Ministries, United Way of Southern Mississippi, Diamondhead United Methodist Church, St. Rose de Lima Church, Gulf Coast Women's Center for Nonviolence, Victory Baptist Church
Kmart (Bay St. Louis)	ESF6 Mass Care, Housing & Human Services, Disaster Recovery Center	FEMA
Kmart (Bay St. Louis), Mcleod St. Park, Diamondhead United Methodist Church, Dedeaux School, Necaise, Winn Dixie, Second St. Elementary, Bayou Talla Church, Diamondhead Fire Department, Hancock North Elementary School	ESF6 Mass Care, Housing & Human Services; Mobile Kitchen	Christian Life Church, Woodman, 7th Day Adventist Church, Salvation Army, Gulf Coast Community Foundation, International Aid, Mercy Corps, St. Rose de Lima Church, United Way, Americorps,
Bayou Talla Church, Save A Center, Gulfview Elementary, Dedeaux School, American Legion Post 58, Charles B. Murphy School, Wal-Mart	ESF6 Mass Care, Housing & Human Services; Points of Distribution;	FEMA, Bay Area Food Bank, America's Second Harvest, HHF (His Hands & Feet), Bastrop Ministerial Alliance, Christian Life Church, Citrus County (FL)

Location	Description	Agencies
		Hurricane Disaster Relief Team, Diamondhead Baptist Church, Diamondhead Community Presbyterian Church, Diamondhead United Methodist Church
Hancock Medical Center (Bay St. Louis), Kiln Medical Center (Kiln), Waveland Health Department, Save A Center (Bay St. Louis)	ESF8 Public Health & Medical Services	DMAT Missouri Team 1, DMAT Florida Team 6, DMAT Florida Team 1, DMAT Strike Team Pennsylvania 1, DMAT Strike Team Connecticut 1, DMAT Strike Team North Carolina 1, Medical Center staff, American Medical Response, Gulf Coast Women's Center for Nonviolence, Center for Disease Control, Christian Life Church, Diamondhead Community Presbyterian Church, UTURN for Christ, Clermont Harbor & Pearlington United Methodist Church, Word of Faith Christian Fellowship, Church of Jesus Christ of Latter Day Saints, Gulf Coast Missionary Baptist Association, Powerhouse of Deliverance Ministries, United Way of Southern Mississippi, The Order of the Good Samaritan, Lutheran Disaster Response, Pearlington Recovery Resource Center,
Stennis Airport	ESF10 Oil and HAZMAT	US Environmental Protection Agency, US Coast Guard MIC-K Mobile, Mississippi Department

Location	Description	Agencies
		of Environmental Quality Assessment Team, Mississippi Department of Marine Resources, National Guard Civil Support Team
Crews operated 24/7 throughout Bay St. Louis, Waveland, Diamondhead, Kiln, Rock Hill, Necaise	ESF12 Energy	Coast Electric, Alabama Power, Florida Power and Light
Kmart (Bay St. Louis), Stennis Airport	ESF13 Public Safety and Security	Bay St. Louis Fire Department, Waveland Police Department, Florida Department of Law Enforcement, US Coast Guard Marine Safety & Security Team 91108, Hancock County Sheriff Office, Federal Protective Service, US Marshal Service, Mississippi State Police, Ohio Army National Guard, Mississippi Army National Guard, Florida Highway Patrol, Missouri Highway Patrol

Table 2. Location and Type of Response Organizations Present in Hancock County, August 29 to September 15, 2005[139]

2. Communications Infrastructure Failures Severely Impact the Flow of Information and Situational Awareness

As previously mentioned, all forms of communication in Hancock County were virtually unusable immediately following Katrina's landfall and through most of early September. Throughout all of Mississippi, nearly 600,000 Bellsouth customers were affected by Hurricane Katrina. By September 1, service had been restored to over

[139] This list of responding agencies is a compilation from several sources, including the Incident Action Plans of the Hancock County EOC, the Mississippi State EOC, the Joint Field Office, email from NGO volunteer coordinators, IMT4 staff from Manatee County, Florida, and information collected by the author while leading U.S. Coast Guard forces in Hancock County until late September 2005.

130,000 customers; by September 6 telephone service was restored to over 500,000 homes. The situation in Hancock County though, was much more severe, because more than one-half of the 23,000 lines remained without service more than two weeks after impact.[140]

With nearly all telephone and cellular communications out, information traveled between organizations by word of mouth and couriers, even well into mid September. This inability to communicate between agencies and sectors created an environment that made collaboration extremely difficult and time consuming—particularly harmful in a situation where time is of the essence. These conditions enabled the network of the response community to evolve into a classic small world network. Agency representatives, serving as the "weak links" between the small worlds of the ESFs and command posts, required face-to-face communication to provide information and receive mission assignments. Meetings held twice daily at the EOC permitted the Incident Commander to develop operational plans for the next day, however many of these weak links were unable to disseminate any of the IAP planning documents to their personnel due to power and ADP difficulties. Ironically, the highest level planning document developed by the Incident Commander was often limited in distribution and unavailable to the front-line first responders due to a lack of resources at the EOC to make copies. Because the community was completely unprepared to establish an alternate EOC and coordinate the actions of thousands of first responders, no adequate copying capability or process would be available until late September. Transportation difficulties further complicated the performance of the weak links, because they were often required to travel across the entire County on roads choked full of debris and downed power lines to attend EOC planning meetings.

The flow of information and knowledge in this environment was particularly problematic due to Information and Communications Technology (ICT) failures and the resulting communications crisis. In the early stages of the crisis, some organizations (including the EOC), used satellite phones provided by the National Guard, FEMA or one of the EMAC or SMAC agencies. Yet, this reliance on voice communications provided a

[140] Hancock County IAP, September 13, 2005.

very narrow slice of bandwidth when considering the volume of disaster related information that needed to be communicated. Imagine the Incident Commander attempting to summarize all community requirements and interagency actions in the span of a phone call to the State EOC or the Joint Field Office. The ability to transfer large amounts of data would not be possible until the EOC servers were recreated making email and Internet connectivity possible. Additionally, the flow of information mandated within the ICS also shaped the development of much of the message available to the Incident Commander. After the EOC relocated to the Alternative Education Center, IMT4 began to meticulously organize the incident command staff—this organization also shaped the flow and aggregation of information as it entered the EOC. As ESF desk representatives acquired information from the variety of command posts and sources, this information was sporadically transferred with other elements of the IMT staff, but a process was never established that structured this person-to-person collaboration. Virtually all of the storage and transfer of information was done manually, on preprinted ICS forms, yet none of the forms possess instructions on information sharing. Further inhibiting this collaboration was the composition of the staff, many of whom were EMAC personnel from other states who had no preexisting relationship with their counterparts. This mixed bag of disaster related information, little of which was current or complete, was consolidated into the Katrina IAP and transmitted daily by fax to the State EOC. Limited paper copies were available for response agencies, as both the time to print the IAP and paper were scarce resources. Unfortunately, no capability existed to disseminate the IAP electronically, as no server or email connectivity was possible until approximately September 13. The barriers to effective information flow within the EOC were present at the technological, organizational and human levels.

All of these conditions directly affected the quality of information available to the Incident Commander and the staff of the EOC. While information sources were numerous throughout the county (every organization listed in Table 2 could be viewed as a possible source), the means to acquire that information by the EOC was not sufficient to provide it vertically and horizontally among the network. Collaboration among the ESF desks was often *ad hoc*, almost always dependent upon the knowledge and insight of the ESF representatives to recognize that information presented to them may be applicable to

other agencies or functions. To surmount the telecommunications challenges, the EOC established a twice-per-day meeting schedule to coordinate operations throughout the entire county. The analysis of that information by the EOC staff, including the IMT4 volunteers from Florida and other states, was conducted without the benefit of any ADP tools to adequately analyze the reports or the local knowledge to place the information into context. As the information was consolidated to form the IAP, the absence of details created a report that contained large generalizations regarding the overall activity and plans for the next operational period yet few details. Even though the IAP was actually a generalized plan, no means existed to effectively disseminate it to the broad response network residing and working in Hancock County. All of these factors led to an environment in which the Incident Commander, acting on the very thinnest of information, made resource and response decisions for the entire community.

C. EXPOSING AND CLOSING THE GAPS

Much has, and will be, written in the Katrina postmortem on the wide range of agency and leadership successes and failures.[141] While the Select Bipartisan Committee of the 109th Congress detailed its findings in "A Failure of Initiative" and the White House report similarly provided "The Federal Response to Hurricane Katrina: Lessons Learned", much of this analysis focused on the failure of individual agencies and leaders, but not the process of disaster management. This paper attempts to hone in on the underlying processes that created an environment of failure, through gaps in policy and procedures at all levels and the implementation of flawed policy. The final analysis of Katrina is much too broad and complex an issue to be examined completely in this document, however, a critical review of the issues affecting the response network and the management of knowledge within that network will be examined. Before entering into a more detailed discussion of the various perspectives of the disaster environment, some general observations of the Hancock County case study may provide appropriate context for the analytical conclusions drawn in the next chapter.

1. Accuracy of Planning Assumptions

Several of the planning assumptions, e.g., evacuees, overwhelmed local resources, no common operational picture, etc., contained within the NRP Critical Incident Annex

[141] Both the White House and Congressional reports on the government response to Katrina were published in late February, too late for a full integration into the analysis of this paper.

were accurate as they applied to Hancock County in the aftermath of Hurricane Katrina. While accurate, most Americans cannot grasp the sheer enormity of the devastation without observing the devastation firsthand. Many first responders, who witnessed the damage from the air, found it difficult to reconcile aerial images with what they found later on the ground. In the event of a future Incident of National Significance (IoNS), the NRP planning assumptions could hold true for any scenario involving a Weapon of Mass Effect: tens of thousands displaced, a Presidential disaster declaration, significant disruption of the critical infrastructure, response capabilities of the local jurisdiction overwhelmed and local emergency personnel unable to perform their duties because they are also victims. As indicated above, all first responders in Hancock County were immediately overwhelmed and the local government was in peril for several days following landfall. In the final analysis, the NRP determination regarding overwhelmed local resources should consider the concept that virtually *no* government exists at ground zero.

2. Disparity in Local Capabilities

As characterized in the NRP and NIMS, the EOC and local executive assume critical roles in coordinating local incident management actions and implementing Continuity of Operations (COOP) plans after a major catastrophe. Counties throughout the nation should not be considered as equals, in terms of technical sophistication or resources, and this imbalance places an even greater burden on the state and federal government to respond proactively to an IoNS. Consistency of response must be built in at the Federal level, because the wide disparity of state and local government capabilities and resources directly translates into varying degrees of resiliency. Many large cities are likely to have a sufficient staff and facility to respond initially—but that is likely not to be the case for many small cities which may have lost their EOC and whose first responders are also victims. In this environment, as observed in Hancock County, the majority of initial response actions will be chaotic and uncoordinated until the local EOC is reestablished as the core entity for emergency management and community recovery.

3. Few Alternatives Exist if Local COOP Fails

Historically, and within the current National Response Plan, local emergency management agencies are responsible for providing support and coordination to response

activities, yet no concrete alternatives are offered in the national or state policy documents that replace, in totality, the function of the local EOC. The efficacy of the NRP is based on the proper functioning of the *local organization*, which enables the state and federal agencies to take action, as appropriate. If the local entities are overwhelmed, the entire response system will begin to break down until such a time as a local (or possibly state or military) organization regains control of the response efforts. In the Hancock County situation, while the local government and emergency management operation were overwhelmed, no precise mechanism was triggered in the MEOP that initiated a transfer of emergency management functions and responsibility to the State. Even more difficult is the political issue involved in this decision, as the general premise that all disasters are local is a common view and any attempt to control the event by outside entities will likely be rejected by the local community and elected officials.

4. EMAC Support is Essential

Hundreds, if not thousands, of EMAC volunteers like the IMT4 Team from Manatee County Florida became an essential resource that was immediately available to support the local first responders in Hancock County. EMAC agencies arrive to the disaster area with extensive training in both the Incident Command System and their specific area of expertise, whether it is firefighting, public safety, mass care, etc. While possessing significant technical knowledge, they will often lack local knowledge or the long-term personal relationship developed among the community of local first responders. The overnight arrival of thousands of responders from every corner of the nation fuels an already chaotic response environment and many EMAC agencies are likely to begin working with a limited knowledge of the vast network of other agencies operating in their immediate vicinity. A post-deployment survey conducted by EMAC is particularly revealing of the challenges faced in a major disaster. Of the top ten difficulties faced by the respondents, five of the ten dealt with communications issues that affected the organization (e.g., poor communication, miscommunication, and lack of coordination between Federal/state/local/agencies/EMAC and deployed personnel; lack

of adequate maps of the area; inadequate lines of communication; personnel not qualified for mission assignment; and took too long to deploy resources, equipment and personnel.)[142]

EMAC personnel, pushed to the forefront by the absence of the local first-responders, may be placed in the awkward situation of coordinating local activities among a network of unfamiliar agencies, with no functioning communication system, in territory that is foreign to most. All of these factors inhibit the natural formation of collaborative working groups among the ESF communities. What results is the devolution of the response network into isolated pockets which consist of familiar organizations, yet any horizontal flow of information is stunted by organizational and technical limitations. Without a method to easily bridge the agency or sector divide, the EMAC organizations, and the other organizations of the response network, will acquire small world characteristics and be linked to other efforts and agencies by the weakest of links. These weak links may be further limited in their efficient exchange of information because face-to-face communication is required in most situations. This factor not only makes active, on-going coordination of activities more difficult, but it also limits the amount of information that is relevant at the time of the exchange—information is either dated or too vague.

5. Integration of Military into Response Command

Many state and local government officials are likely to be confused over the role of the Armed Forces and many will assume that the military will exercise a primary command-and-control role due to the introduction of a large contingent of troops. Although the perception may exist that the military is in command of the incident (as evidenced by LTG Honore's adventures in the Katrina and Rita response), the reality is quite different. Military forces engage only when requested by the state and maintain a separate and distinct chain-of-command linked to the United States Northern Command. A clear break from the local incident command is maintained and reiterated in the NRP. The military units that arrive after a catastrophic incident will far outnumber any local emergency personnel, making it even more attractive for the military to be considered as

[142] Emergency Management Assistance Compact, http://test.emacweb.org/?866 [Accessed February 18, 2005]

the solution for all problems and an available pool of manpower for some jobs that they may be ill suited to perform. In Hancock County, over 2000 National Guard troops (and many more in type-specific task forces, such as the military police) directly assisted the local community by staffing PODs, manning checkpoints, clearing debris, etc. While these military units provide critical services that the local community can no longer offer, coordinating operations between military and other organizations (whether they be EMAC, private sector or NGOs) continues to be challenging. Two reasons drive these difficulties: the operation of different communications systems (on the technological level) and the parallel chain-of-command that reinforces civilian-military agency stovepipes (on the organizational level). While the National Guard and other military units are critical to response and recovery efforts (as shown in the Hancock County example), the command-and-control issue between civil and military authorities under the NRP is likely to remain unclear at the tactical level of the incident.

VI. ANALYSIS AND RECOMMENDATIONS

A. A NEW WAY OF THINKING

In "Networks and Netwars", John Arquilla and David Ronfeldt proposed that hierarchical organizations often fail when combating a determined and highly networked adversary. Stretching this analogy over the Katrina landscape, one can assume that most government agencies operate today in a highly networked environment of stakeholders. While certainly not *netwar*, perhaps the crisis environment rests somewhere between *netwar* and the normal environment of stable operations. There is clearly no intention by any entity to attack the public or our infrastructure as would be the *netwar* case, but a network forms nonetheless in response operations, much of the network is currently designed to be outside the control of the Incident Commander. Do we have the luxury during the response to an Incident of National Significance (IoNS) to have resources that are not synchronized? Katrina clearly answered no.

To further analyze the composition and operation of networks, Arquilla and Ronfeldt developed a framework of characteristics based on the organization (structure), narrative (founding principles), doctrine (policy and process), technology (systems) and social (cultural) views. While the authors designed this model to evaluate enemy networks, it may be useful to further decompose and explain the complex and interdependent network which forms in the wake of a major disaster. Analyzing the response community in this way may provide an opportunity to consider a different perspective than the current *government-centric* approach. Rather, a network view will highlight the strategic importance of institutionalizing multi-channel collaboration and require significant changes to the existing Information, Communications and Technology infrastructure that will enable broader collaboration. In the future, organizational agility, information superiority and comprehensive resource *unity of effort* will be critical in maintaining a comparative advantage in prevention and response activities to counter threats to homeland security. Within the context of this paper, the analysis of network and knowledge management is limited to the organizational, doctrinal and technological aspects of the Arquilla/Ronfeldt model.

Before tendering analytical observations, it may be best to restate the key research objectives of this thesis: 1) How does emergency response policy of federal, state, and local governments address the growth of the social network of first responders after an Incident of National Significance (IoNS)?, 2) What are the characteristics of the *ad hoc* network that develops and how does the response topology enable organizational interoperability and resiliency?, 3) How does the significant devastation of all communication systems impact the response network?, and 4) To what degree is the decision-making process of the Incident Commander or Unified Command impacted by knowledge environment of the management staff?

B. THE DOCTRINAL PERSPECTIVE

1. Analysis: Top-Down Hierarchy in a Network Environment

The first research question focuses on the concept of how response policy shapes the formation of the network at all levels in the aftermath of a catastrophic incident. In this highly dynamic environment, the NIMS and NRP create a top-down hierarchy of incident management by doctrine and procedure. The coordinating mechanism contained in Figure 4, when translated into the terms of network theory, could be construed as a series of nodes and links. Within this network, the local EOC assumes the role of the central hub of the entire network and possesses the more links to other organizations (nodes) than any other node within the network. If we consider the response community as a scale-free network and follow Barabasi's theory of hubs, the network development meets the two laws of the real network—real growth and preferential attachment. The network, as clearly demonstrated in Hancock County, continues to grow and add other nodes of response organizations, and most will preferentially attach via weak links to the local EOC.

At the federal and state levels, the NRP and NIMS solidify an interagency environment in which authorities and jurisdiction are stable and well-defined. This stable environment is effective when the environment is static—hierarchies are well suited for this type of activity. Yet this approach fails to display the agility and flexibility needed at the *tactical* level of a major disaster because the environmental conditions have changed due to the overwhelming devastation, the loss of local resources and the inability to communicate. Arquilla and Ronfeldt observed that a hierarchal organization when

introduced into this environment will, in all likelihood, fail to maintain pace with current events. The reliance on centralized decision-making and command-and-control characterize the top-down, hierarchical approach to operations and the process-focus that is consistent with most bureaucracies. This centralized decision making process is highly dependent upon disaster-related knowledge and timely communications, both of which no longer exist. Disaster knowledge, designed to move vertically to decision makers, typically arrives late, often lacks specifics, and is irrelevant or incorrect by the time of its arrival.

2. Analysis: More than an Incident Command

With respect to research question number two, most incidents will be managed by local officials, even though hundreds of new agencies have arrived on scene with thousands of first responders and volunteers. This concept of local control is the pillar of emergency management that is reflected through statutes and policies at the federal and state levels. The local officials are also victims. Many of these people may not be capable, whether from shock or lack of expertise, of providing the necessary direction and leadership to the enormous influx of resources. Both examples surfaced in Hancock County, as the four-person emergency management staff became the head of a monolithic organization they were ill prepared to lead. This combination of the inability to function (due to victimization) and the inability to lead (due to the massive change in organizational structure and complexity) reinforces the premise that the response is simply too large and diverse for a single Incident Commander to effectively manage. The decision continuum at all levels of planning, from the NRP to the local, is unclear how to transition from Incident Command to Unified Command and the formation of a Unified Command is left to the discretion of the local officials.

3. Analysis: Response Lacks a Knowledge Management Strategy

How information is collected, stored, analyzed and translated into knowledge is the central argument of research question four. Both the NIMS and NRP lightly address the management of information throughout the network. While NIMS mentions Information Management and Communications as a high priority within the structure, it is not specifically assigned an organizational task within the framework. The NRP approaches information management in a similar fashion by vaguely referencing the

development of the "common operating picture," but not specifically placing the development of the COP at any level of the response network. As mentioned earlier, this lack of definition of knowledge management at the federal levels permits a similar *laissez faire* treatment at the state and local levels. Ultimately, the result is a fragmented approach to acquiring, analyzing and storing disaster information and creating and translating knowledge to fuel the decision-making process.

Even more fundamental is the fact that no organization, within NIMS or the NRP, is assigned the functional responsibility to holistically manage knowledge. The Mississippi Comprehensive Emergency Operations Plan does focus some attention on information management, and further describes the process of collecting and providing disaster-related information within the Emergency Support Functions (ESFs) to support the overall planning process. What is reflected in policy is a KM system that does more than simply support organizational elements in the collection and dissemination of information. No comprehensive approach, however, exists for the management of disaster-related knowledge that spans horizontally across ESFs or vertically among organizational levels. This failure to specify responsibility for knowledge management directly impacts on the decision-making process of the Incident Command. While data continuously flows through the Incident Command System on predesignated and highly-formatted documents, no specific entity within the system is responsible for managing how the situational assessments are formed. The ICS is focused on the content of the disaster message, not on the process by which it was developed. This lack of rigor in developing situational awareness and knowledge may create a false "truth" for senior leaders that is contingent upon the accuracy and timeliness of the information and drive the allocation and request for resources. The lack of a Knowledge Management Strategy (KMS) at the federal level begets a similar void at the state and local levels as agencies align their efforts with an incomplete national plan.

4. Recommendation: Streamline the Relationship between the Local EOC, the Incident Commander, Unified Command and Area Command in the NRP

Particularly in light of the chaos that ensues after a catastrophe, the current response policy should be amended to streamline and simplify the roles and relationship between critical command-and-control elements. First responders can ill afford the time

to navigate through an arcane and confusing web of roles and responsibilities, especially when faced with the challenges to communication and collaboration that were present in a situation such as Hancock County. Organizational simplicity and unity of effort is essential and several changes should be integrated into the National Response Plan and Catastrophic Incident Annex (CIA). As mentioned above, for truly catastrophic situations, a single Incident Commander is likely to be incapable of effectively managing the response efforts. Two primary changes are required to simplify and clarify these relationships:

a. The NRP-CIA Should Mandate the Establishment of a Unified Command at the Local Level to Broaden Emergency Management Capability and Perspective

Too much discretion is left to the local incident management personnel and officials to determine if a Unified Command should be established following an IoNS. The entire response effort builds on the foundation of their decisions—yet deciding when to change organizational form to a Unified Command (perhaps one of the most vaguely defined decisions) due to the complexity of the disaster is left to chance. Just as the CIA identifies specific response actions, the determination that a Unified Command be established at the local level should dovetail with the Presidential Disaster Declaration.

b. The Unified Command Entity Should Be Merged with the Area Command and This Organization Should Be Located at the Local EOC

The merger of the Area Command and Unified Command will resolve an unclear seam in response policy and clarify organizational responsibilities for emergency management. In concert with this restructuring, the role of the EOC should be expanded to include command-and-control of response efforts, beyond merely supporting and coordinating operations. This shift in roles for the EOC comes at the expense of the Area Command, but it removes the command-and-control element from the ad hoc organization and assigns it to the organization that is a permanent and fixed element of the response network. Particularly after a major disaster, and applying the lessons from Hancock County as an appropriate example, the response community forms around the EOC and this enables the preferential attachment of links within the response network. While the NRP currently treats the EOC as a coordinating entity, in the context of the real

network, EOCs become the network hub that continues to function when many other infrastructure nodes have been destroyed. As more organizations are drawn to the EOC, the network will become more cohesive, collaboration will be improved, and unity of effort achieved.

5. Recommendation: Integrate a Knowledge Management Strategy within the NIMS and NRP

Mastering the creation and translation of disaster knowledge should be viewed as a critical element to sustain comparative advantage for future response efforts. Comparative advantage in this discussion is relative, because in the private sector, comparative advantage equates to maintaining an edge over competitors. In disaster operations, however, comparative advantage should be considered in terms of maintaining an edge over the situation itself—does the Unified Command possess a solid grasp of what has happened, what is happening and what will happen? Improved technical capabilities will always be developed, but how we apply disaster knowledge will determine the success of our future response and serve as a catalyst of organizational change.

The ability to develop and master knowledge must be articulated in policy at the federal level, so that state and local emergency procedures address the development of a common operating picture. One alternative may be to create a Knowledge Management Unit within the NIMS structure that would have the specific function of determining: disaster information requirements, information sources, analytical and collaborative processes, retention and recall requirements, and how knowledge is transmitted throughout the network. Close cooperation with the Communications and Situation Units would be required in developing and maintaining awareness of evolving disaster operations and conditions. A major element of the Knowledge Management Unit would be to develop and integrate the disaster data elements into the Common Operating Picture (COP) and make it accessible for the entire response network, both horizontally and vertically.

C. THE ORGANIZATION PERSPECTIVE

1. Analysis: Collaboration is Ill Defined at All Levels

The characteristics of the response network address the heart of the second research question. The NIMS and NRP lack details regarding the development of the network among the private sector, NGOs and local officials. While some efforts exist at the federal level (such as the Department of Homeland Security Office of State and Local Coordination), little information is available to support any systematic attempt to develop a broad effort of collaboration between government and either the private sector or NGOs beyond the integration of the American Red Cross into the disaster community. Although this collaborative approach has gained some momentum within the Department of Homeland Security (particularly in the field of critical infrastructure assessment and protection), the full integration of public and non-public activities has not occurred. While the NGOs and private sector provide critical resources to the response effort, the lack of a coherent top-to-bottom policy exacerbates the divide between the two sides. The gap created by a lack of comprehensive collaborative effort limits the process and knowledge interoperability of the entire response network.

2. Analysis: A Broad National Effort Requires a Redefinition of the Response Network

While HSPD5, NIMS and the NRP provide a hierarchical approach to incident management, the response environment in America has changed. Rapid situational awareness among all levels of the response organization is expected to focus resources on the most critical areas of the disaster. At the Hancock County EOC, the Mississippi EOC, the Joint Field Office, the Homeland Security Operations Center, and the White House, immediate feedback was needed to support the decision making process. The presumption within the NRP that a clear understanding of the situation at the incident site will not be gained for 24 to 48 hours is no longer valid. The crushing and all-consuming drive for information from the White House to the Unified Command requires a tremendous degree of granularity and diversity much of which is outside the span of control of the government agencies leading the response. NGOs have a tremendous amount of information on mass care efforts, telecommunications companies on infrastructure damage and capabilities, utility companies on the rate of repair of electrical service. The resulting *adhocracy* which, while under government leadership, draws

heavily on private sector agencies to provide essential services for the displaced masses. As in Hancock County, NGOs fill critical roles to provide relief and assistance and are often unencumbered by the bureaucratic restrictions of government agencies. They are agile, leverage the power of the internet to build support for their efforts, and can be expected to respond immediately to the disaster area. Currently, while NIMS and the NRP account for the integration of the private sector and NGOs into the response efforts, this policy should be altered to integrate them as full partners into the disaster response organization. Homeland security is transforming from a government service to a shared system of values and culture throughout America (public and private alike). Although this thesis does not specifically address the goal of *preventing* terrorism, response operations and prevention actions at the tactical level are so intertwined it is often difficult to determine a difference. Most of the players involved in preventing terrorism are the first responders, whether they are from the fire service, law enforcement or medical profession. The distinction between prevention and response at the local level is, in many ways, immaterial to the operation of the network—the network continues to grow and form, conducting both prevention and response activities.

As the response to a major disaster on the scale of Hurricane Katrina unfolds, how the network evolves should be considered in future discussions of response policy. Arquilla and Ronfeldt theorize that a hybrid approach to network-centric operations in which hierarchies *and* networks are used by governments may be the most successful strategy when facing a networked adversary.[143] Perhaps the use of the hierarchies is sufficient at the federal and state levels because of the stable environment, but crisis conditions at the local level should lead us to consider employing an all-channel network to improve organizational agility and resilience.

3. Analysis: The Local Network Integrates Small Worlds, Hubs and Weak Links

Most people and organizations develop and maintain close ties with others that have a similar culture and background. This affinity certainly applies for many of the response organizations which were present in Hancock County: the US&R teams formed

[143] John Arquilla and David F. Ronfeldt, *Networks and Netwars: The Future of Terror, Crime, and Militancy* (Santa Monica: RAND, 2001), 327, http://www.rand.org/publications/MR/MR1382/ [Accessed January 12, 2006].

a cohesive unit, as did the National Guard, as did the law enforcement officers, etc. When the network continues to grow nodes of a similar type, internal communication and links between similar organizations will be quite dense. Within these groups, inertia prevents the easy development of weak links, but it is the weak ties that binds the entire network together and creates network resiliency. More will be discussed from the technology perspective in the next section, but the weak links operating between agencies are faced with a tremendous communications challenge and often rely on face-to-face interaction to exchange information and guidance. The lack of a collaborating communications capability severely restricted the full integration of a broader response community into the effort led by the Hancock EOC. More will be presented on technology later in this section.

The development of the small worlds is directly forecast by the network evolution proofs identified by Watts and Barabasi. To further analyze the vulnerability of the entire network, an assessment of the risk to the EOC could be beneficial. Viewing the EOC as the primary network hub through a fault-tree tool would integrate the following threats into the model: human failures (responders as victims), technological failures (communication infrastructure devastation) and process failures (no effective Knowledge Management System to shape situational awareness). As mentioned in the implications in Chapter V, the Continuity of Operations Plan (COOP) for any local EOC gains national scrutiny (under the very worst conditions), because the entire national response effort is based on the local government functionality that is manifested at the local hub. If the local EOC fails, there is a high likelihood that the response system will suffer a cascade failure, as Katrina clearly demonstrated.

4. Recommendation: Expand Local Unified Command to Include Government, Private Sector and NGO Leaders

The NIMS and the NRP provide the basic structure for the Unified Command concept, yet changes are required to leverage all the capabilities of the response network that evolves after a major disaster. Bill Carwile, the FCO for Katrina response in Mississippi, advocated an expansion of the Unified Command concept in his reflections

on his experience at the Joint Field Office.[144] While the traditionally defined Unified Command includes a diverse assembly of *government* partners, maybe an expanded definition of the Unified Command should integrate all agencies, or their representatives, operating in the community. Civilian government resources, as identified previously, are only a portion of the network that will respond to an event—many organizations will arrive in the local community and begin to work, often outside of the visibility of the Unified Command. Developing a linkage to the private sector and NGOs is critical to develop the single unified approach envisioned in HSPD5. Local incident commands should be expanded from the government-centric current form, to include, at a minimum, private sector and NGO leaders. In the context of Hancock County, this could have taken on several different forms, but much of the formation of the Unified Command could be the result of an ongoing effort to build cross-sector collaboration in emergency management. Maybe this attempt at building consensus among the community would put the local elected official in the Unified Command with the emergency management director. Another version could possibly call for the president of the Chamber of Commerce to serve as the private sector representative. Forming this collaborative effort might include the integration of utility and energy companies (whether BellSouth or Mississippi Power). Regarding NGOs in the Unified Command, one alternative could be to designate the coordinator of the Gulf Coast Interdenominational Disaster Task Force to serve as the representative. Or perhaps the senior-most leader of the Salvation Army could fill that role. Many possibilities exist to build a broader coalition that moves beyond a government-only solution and taps into the resources of the wider community. Integrating and collaborating at the command level, as well as the incident command post level, will move the entire network closer to knowledge and process interoperability.

5. Recommendation: Designate EOCs as Critical Infrastructure as the Primary Hubs of the Scale-Free Response Network

Based on the presumption that the local response network is *scale-free* because of the growing network and its preferential attachment of links to the EOC, "hardening" the EOC becomes a paramount concern to prevent a cascading failure of the entire response

[144] William L. Carwile, "Unified Command and the State-Federal Response to Hurricane Katrina in Mississippi," *Homeland Security Affairs* I, no. 6 (2005). http://www.hsaj.org/hsa/volI/iss2/art6 [Accessed January 20, 2006]

network. While the National Strategy for the Protection of Critical Infrastructure and Key Assets identifies Emergency Response as critical sector, the aim of the program is focused on interoperable communications at the incident level. This gap existed for years, but drew significant attention after the tragic communications failures partially contributed to first responder deaths on 9/11. Despite the emphasis on improving the technological capability and doctrine to effectively use these resources, any consideration of the response network as a "system of systems" has been absent from policy. Interoperability, as envisioned by the SAFECOM, is focused on voice communication interoperability, not the flow of knowledge throughout an interoperable network that extends beyond the first responder at the scene of an incident. Because the entire response network so heavily relies on the proper functioning of the local EOC during major disasters, expanding the Emergency Response segment of the national strategy to include local and state EOCs would be beneficial. With respect to hardening the EOC against the three system faults identified earlier, there may be some movement occurring in this direction already. To offset human failures due to victimization, the use of EMAC Incident Management Teams prestaged to staff and run the EOC may prevent the possibility of a system failure. Regarding the technological fault, satellite telephones were sporadically used in Mississippi to support senior decision-makers within the EOCs, but a more comprehensive solution is offered in the next section. Finally, with respect to the process fault, the adoption of a Knowledge Management strategy and creation of a KM Unit within the NIMS structure should close the knowledge process gap.

D. THE TECHNOLOGICAL PERSPECTIVE

1. Analysis: Limited View of Interoperable Communications

The third research question addressed the impact of telecommunications on the response effort. Telecommunications shortfalls cut through the Katrina response in two ways: first, by too narrowly defining the nodes of the network supported by the government program, and second, on the traditional over-reliance on ICT systems and not a more holistic approach to the hard and soft sides of the Knowledge Management system. The resulting impact of these communications failures affected every member of the network, regardless of position.

Efforts within the National Strategy for the Protection of Critical Infrastructure and Key Assets focused on solving the problems of 9/11 with respect to interoperable communications—defined as tactical voice networks for first responders. Unfortunately, initiatives like SAFECOM have made little progress to develop a comprehensive national system of interoperability. The SAFECOM effort though is even more limited because of the narrow definition of first responder—most of the response network of Katrina would fall outside the umbrella of SAFECOM. What is needed is a broad, open response network that ties together government agencies, the private sector, NGOs and even the military. While the NRP envisions a broad, national response to catastrophic incidents that encompasses all of these elements, the current communications strategy reinforces government-introduced cultural barriers to collaboration and cooperation.

2. Analysis: All-Channel Flow of Information is Needed

As envisioned in the NIMS, the development of the IAP is critical to the planning process of the incident. Yet the development of the IAP is linked to the ability of the local jurisdiction to effectively plan. As the situation in Hancock County developed during Katrina, the devastation at the EOC directly influenced the ability of the Incident Commander or Unified Command to capture information and transfer that knowledge to the State EOC, the JFO and the entire network. At the initial stages of the disaster, voice reports of the situation are insufficient to describe the magnitude of the devastation and the resources required. Written reports, copied and disseminated to a relatively small number of key leaders, are insufficient to effectively convey all the disaster related information to members of the response community. An improved method of communicating information throughout the network is needed that permits both horizontal and vertical communication in a variety of methods. While the federal initiative to design an interoperable communications system focuses on the development of voice systems, the possibility of developing a system that encompasses both voice and data is a clear requirement for major catastrophes.

The fourth research question focused on the KM system and how its performance affected the decision-making of the Incident Commander. Perhaps the ICS planning process, culminating in the development of the IAP, is the closest kin to a KMS within the NIMS and NRP landscape. This flow of information within most EOCs relies on the

exchange of hardcopy paper forms (for example, ICS form 201 is the Incident Action Plan form, ICS 214 is a Requisition Request form, etc.) within or among Emergency Support Functions. Completing these forms is a *learned* practice, in terms of capturing the content and the manner of transmission. It also may limit the all-channel flow of situational awareness throughout the response organization because it places the decision for translating the information in the hands and head of the ESF representative. As these reports are developed, the information is aggregated to develop a comprehensive operational plan for the next period. Who determines what details drop out of the process? Is there a system or structure to this aggregation, or does it merely reside in the mind of the ESF representative who makes the decision at the time of the writing of the IAP? Does the ESF representative, who is likely either a local responder-victim or an outside EMAC professional, have a clear understanding of the context of the information they have acquired, analyzed, stored, aggregated and translated? Many of these issues should be considered as the response community begins to shift focus on the process by which knowledge is acquired and shared. While the NIMS enables and supports the development of limited information, the design and flow of knowledge throughout the organization is problematic and lacking a coherent strategy.

3. Analysis: Voice Communications are Insufficient to Provide a Common Operating Picture

Imagine the frustration of the Unified Command in Hancock County in the weeks after Katrina. A prolonged inability to communicate severely hampered interagency coordination, the acquisition and identification of resources and material desperately needed by the community, and the inefficient allocation of available capabilities. Some agencies doubled their efforts in conducting US&R searches, while other portions of the County were left untouched because of poor communications and coordination. While a limited number of satellite phones were immediately available to the Unified Command staff, any communications via voice captures a message between only two members of the response network. After the conversation is concluded, it then became incumbent upon each member to share their insight and understanding of the conversation, strategy, etc. with the other members of the Unified Command. This preoccupation with voice communications (stemming directly from 9/11, HSPD5, the NSPCIKA, and the SAFECOM initiative) belies the real technological gap: in a massive catastrophe and

response, data communications pushed through broadband systems between command-and-control elements may be more critical as voice communications. For certain, tactical voice communications interoperability should not be eliminated from the national strategy, but our focus should further examine the comprehensive requirement from the perspective of knowledge interoperability. Do the knowledge requirements of the local EOC, State EOC, and JFO better align with the delivery of detailed disaster information by data, rather than voice? Perhaps a combination of both is best, yet it is clear that the national priority is voice interoperability between first responders at the incident. Knowledge interoperability between command centers is not even reflected or considered in the Emergency Response sector of the NSPCIKA.

4. Technological Recommendation: Integrate Hastily Formed Networks (HFN) and Mesh Networks as Federal Disaster ICT Initiative

David Lancaster and the Hastily Formed Networks (HFN) team at the Naval Postgraduate School developed and implemented an ICT capability to fill the immediate communications gap after the Indonesian Tsunami in December 2005 and Katrina.[145] HFN deployments have proven successful, although on a limited scale with respect to the comprehensive disaster response network. It is the time to elevate the idea to national prominence. HFN, as defined by Lancaster, allows for a "global, broadband rapidly deployable network node complete with Internet reach-back, voice, data and video capability."[146] At a minimum, this is the type of communications requirement for each local EOC defined within the NRP framework. This capability will serve to "harden" the EOC node—the network will grow around the EOC and as additional resources flow into the area, preferentially attach to it. This capability would permit all the members of the Unified Command staff to immediately communicate disaster assessments, resource requirements and emerging issues within the local EOC, to the state EOC, and to the JFO. Comprehensive situational awareness at all command levels should be the goal and it is attainable with the expansion of the application of the HFN concept. That, however, is only the initial phase in the transition to complete knowledge interoperability.

[145] David D. Lancaster, "Developing a Fly-Away-Kit (FLAK) to Support Hastily Formed Networks (HFN) for Humanitarian Assistance and Disaster Relief (HA/DR)," (Master's Thesis, Naval Postgraduate School, Monterey, California), 1-71, http://library.nps.navy.mil/uhtbin/cgisirsi/Sat+Jan+14+17:26:33+PST+2006/SIRSI/0/518/0/05Jun_Lancaster.pdf/Content/1?new_gateway_db=HYPERION [Accessed January 14, 2006].

[146] Ibid., 2.

Beyond the confines of the EOC, an enormous and complex response network exists—hundreds, perhaps thousands, of information sources are available that form and shape the collective understanding of the disaster situation and response. Linking these sources, and resources, via the HFN to the local EOC will create a more cohesive response network that bridges all sectors and disciplines. In the future, most responders will arrive at the site of a disaster with the essentials to begin working: transportation, some food and water, portable lodging, and a communications/ADP capability. Imagine if the responders who arrive to work for an NGO, bringing a portable laptop computer with them on their deployment, could instantly communicate via email or instant messaging with their counterpart on the EOC staff.

Taking this concept one step further, Motorola Corporation (as far back as 2003) offered a Mesh Networks Enabled Architecture (MEA) technology solution that enabled "end users to instantly form a broadband wireless network among each other."[147] This solution allows users to move seamlessly between infrastructure-based and peer-to-peer networks. The proprietary system designed by Motorola is obviously limited by contract, i.e., it is not an open system designed for use by any and all members of a community. However, in the situation of a major disaster, the MEA solution is very much what the entire network needs to initiate broad collaboration among all partners.

Many options for progress exist to make this network system a reality. One alternative is for the federal government to assume a leadership role, even at the local level, to deliver an MEA-like system that links all members of the network. Another possibility would be fielding that expeditionary capability under the direction of the states. A third alternative would be to field a robust similar capability to all EOCs and communities, however the sheer magnitude of that undertaking is likely cost-prohibitive. The preferred alternative of these is for federal government leadership: state and local personnel are far too overwhelmed with executing the actions of disaster response and tending to their own needs, to be burdened with fielding a complex, yet critical communications system. Communications at the local level must be restored as soon as possible after the disaster—any delay greatly increases the possibility of a system failure

[147] Lancaster, "Developing a Fly-Away-Kit (FLAK) to Support Hastily Formed Networks," 58.

of the response network. Fielding an MEA-like system under federal leadership may prevent that from occurring and establish an environment of collaboration that ties together all elements of the response network under a Unified Command.

5. Recommendation: Design and Implement a Response Knowledge Management System

Throughout this document, several sources have stressed the critical role knowledge plays as an organization's only sustaining enabler of future success. Although the private sector has taken significant steps to realize this in redesigning organizational structures and processes, most public agencies have not implemented similar KM systems. Further complicating the issue for the response network is its *ad hoc* nature. This diverse network forms quickly under different conditions, locations, and leadership. Every disaster is unique and each complex in its own way. How can an effective KM system be implemented in this situation, when so many elements are fluid?

Once again, the EOC takes on a central role in the development and integration of a KM system. When viewed from a physical perspective, the local EOCs and state EOCs are the only fixed locations represented in Figure 4, the coordinating framework of the NRP. All of the other organizations are moving targets and shaped by the situation. This fluid situation requires a more comprehensive and thoughtful approach to designing and implementing a KM system in this environment. Within the NIMS, the creation of a Knowledge Management Unit should be considered to assign organizational responsibility. Within the NRP, the development of the KM strategy should be included as a supporting annex that is on par with other annexes regarding Financial Management, Logistics, Private-Sector Coordination, Public Affairs, and Volunteers and Donations, etc. This elevation of the visibility of KM in the two central policies of the federal government will have a corresponding ripple effect through the policy environment at the state and local levels. While the first recommendation in this section addressed the ICT challenges of the network, a comprehensive KM system designed to achieve knowledge interoperability at all levels should be implemented. The simple aspect of this issue certainly is to recommend a course of action—it is much more difficult to design and implement than to offer a recommendation. However for major disasters, Katrina and 9/11 should have identified virtually all the components of disaster related knowledge

that a theoretical KM system would require. The challenge is to maintain the momentum to change our culture, technology and processes.

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VII. CONCLUSION

Unfortunately, tragedies are the catalysts that force us to change our systems and ways of thinking. The attacks of 9/11 and Hurricane Katrina have left an indelible mark on our national response system, and each tragedy highlighted many areas and issues that require significant improvement. Although much of the Katrina examination has been focused on New Orleans, lessons have been learned by communities throughout the Gulf Coast region. The real question is do we have the wisdom and determination to change?

In my view, Katrina presents an opportunity to put forward a different thesis to a problem that we have faced in the past and we will certainly be called to face again. While several national policies have articulated that America should create a broad, national approach to disaster response, our culture inhibits us from doing so. Leveraging the network of first responders, regardless of affiliation, is an element of that vision. Designing and implementing a Knowledge Management System that supports the full integration of the broader network will not only improve the use of resources, but also improve operational performance and decision-making. Changing and improving our doctrine to include both elements of this strategy is required at the federal level—a change that will ultimately drive additional cultural changes in state and local governments.

While reflecting on our national response to Katrina, I was struck by a quote from David Halberstam's book *The Amateurs* about the 1985 U.S. Olympic rowing team. "When most oarsmen talked about their perfect moments in a boat, they referred not so much to winning a race but to the feel of the boat, all eight oars in the water together, the synchronization almost perfect. In moments like that, the boat seemed to lift right out of the water. Oarsmen called that the moment of *swing*."[148] The entire nation, pulling together, in perfect synchronization—now that's unity of effort.

[148] James Surowiecki, *The Wisdom of Crowds* (New York: First Anchor, 2005), 176.

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