ACTION AND INFORMATION NETWORKS IN DISASTER MANAGEMENT

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Abstract

Disasters require quick, decisive action by disaster managers under intense conditions of uncertainty. The response organizations that form to meet the challenge are a collection of actors with a variety of experience, training, priorities and communications abilities, and form a unique, emergent social network. The size, scope and dynamics of the event make it difficult to gather clear, timely, pertinent data, assign and share meaning to inform critical decisions. This study describes the *planned, reported, perceived and desired* (PRPD) networks in emergency management mass care response operations and the information needs of the disaster manager during the threat and immediate response phases of the disaster to build an effective common operating picture (COP). Utilizing the National Incident Management System (NIMS) and the Emergency Support Function (ESF) organizing concept of the National Response Plan as a framework, the networks of actors and information are identified and compared to actual data and networks that were demonstrated in federal and state disaster response operations through the historic Gulf Coast hurricane season of 2005.

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PREFACE

"It was a dark and stormy night ..."

The research for this dissertation started in 1978 as I entered public safety and have served since as a firefighter, paramedic, lifeguard, instructor and disaster manager. This experience has provided me witness to personal emergencies and wide-spread disasters. I have been honored to work within a variety of organizations that have responded to them, and privileged to have served those in need. Along the way, I've had some dedicated, knowledgeable teachers, mentors and colleagues

My first experiences with disasters beyond my first-due fire district were with the Allegheny County (Pennsylvania) Emergency Medical Services Office in the 1980's where I served as the deputy to the Coordinator, Daniel T. Fitzhenry, JD, MPA, MPH. Dan provided me with experiences and opportunities, and an ongoing friendship, that helped shape my career and education ever since.

Within a five year period, our office coordinated a series of unique EMS responses to catastrophic flash floods, the complete evacuation of a hospital and a nursing home, countless hazardous materials incidents and weather emergencies. The county emergency operations center at that time was a small conference room, equipped only with a couple of paper maps, telephones, ashtrays and a large can of fallout shelter carbohydrate supplements. The activation team usually consisted of Dennis Narey of County EMA, the late Richard "Dick" Winters of

County Police, and me. We worked many dark, stormy nights, gaining invaluable experience and realizing that "sometimes, you gotta do dams," our office's term for being able to step into whatever role, wherever needed, in a disaster.

The ACEMS Office also worked with the Veterans Administration in Pittsburgh during the early stages of the National Disaster Medical System (NDMS) and provided the foundation for the formation of the Disaster Medical Assistance Team - Pennsylvania 1 (DMAT-PA1).

The American Red Cross gave me disaster experiences beyond western Pennsylvania as a government liaison, ESF #06 Mass Care and Critical Response Team member (1999-2008). I was assigned as the ESF #06 lead on the federal Emergency Response Team – Advance Element (ERT-A) to the Florida State Emergency Operations Center for Hurricane Wilma. I was deployed again to the Gulf Coast in the summer of 2006 to the FEMA Joint Field Office (JFO) in Baton Rouge, LA as an ESF #06 representative; our task was contingency planning for a potential evacuation of the coastal parishes in the event of another catastrophic event.

My involvement in federal disaster activities was due to being recruited and mentored by Ms. Margaret (Peggy) Mott, formerly with ARC national headquarters and currently with the Federal Emergency Management Agency. She provided me with training, practical experiences, and introductions to countless leaders in government and non-profit emergency management. Mr. Adrian Grieve, Executive Director of the Berks County (Pennsylvania) Chapter and the State Lead for Disaster Services provided me with opportunities to work with chapters across the state to improve planning and response capacity, and has always been a phone call away during disaster operations.

I'm forever grateful to the faculty of the Graduate School of Public and International Affairs for preparing me for this dissertation and my academic career; particularly, to my

doctoral committee. I would not have survived my graduate education without the guidance, support and sponsorship of my advisor, Dr. Louise Comfort, Ph.D., professor and principal investigator for the *Interactive, Intelligent Spatial Information System (IISIS) Project.* The IISIS Project looks to solve many of the knowledge management constraints described in this paper.

Additional thanks are due the practicing disaster managers who participated in the interviews for this study and to the external affairs staff in the various agencies that helped identify and schedule the interviews, and provided other information. The candor in their recollections during the interviews was informative for me beyond the confines of this research project.

Throughout my public safety career and academic endeavors there has been one friend and colleague who has provided unique insights, encouragement, critique, and has long served as my partner in sensemaking: Dr. David E. A. Johnson, Ph.D. As I write, DJ and family are moving from Pittsburgh as he accepts a faculty position at Missouri State University. The public safety community in Allegheny County is losing a tremendous teacher and disaster manager. It is truly Missouri's gain.

This dissertation is dedicated to my wife, Karen. It has only been through her love, encouragement, patience and unceasing prayer that I have been able to pursue my education, work in the field and return home safely.

DISCLAIMER

My affiliation with the National Disaster Medical System and the American Red Cross are provided as biographical information. No official sponsorship or endorsement of this dissertation by the American National Red Cross, U.S. Department of Health and Human Services, or the U.S. Department of Homeland Security was provided or should be inferred.

1.0 INTRODUCTION

Disaster managers, a handful of researchers and the residents of areas stricken by disasters have focused on the response to and recovery from disasters long before September 11, 2001. Since the second airplane struck the World Trade Centers in New York City, disasters have attracted the attention of a wide variety of public administrators, elected officials, a broader constituency of researchers, vendors and the general public. Often repeated in news stories, official after-action reports and conversations around firehouse kitchen tables are the communications failures and lack of interoperability of equipment used by the responders. Federal agencies have provided vast amounts of research and demonstration project funding to develop systems to reduce these communications failures. Equipment interoperability is one thing; the availability of, ability to obtain, capacity and willingness to share information are other matters. Getting, understanding, and sharing reliable, valid, timely data in a rapidly changing environment and within a network of varied actors, has long been the challenge of disaster managers.

Disasters, be they natural, intentionally or unintentionally man-made, present policy and administration complexities far beyond the expectations of disaster managers. Whether the manager represents a governmental or non-governmental response agency, the disaster event and subsequent physical and social events present them with significant information challenges. The dynamics of the events, whether real or perceived, cause experienced managers to follow the axiom, “prepare for the worst and hope for the best.” The goal of this paper is to help the

managers prepare *better* for the next disaster. Information flow in a disaster is either feast or famine. Either the necessary information is not readily available or buried deep in reports, radio traffic and rumor. Managers forced into decisions under conditions of uncertainty lead to response operations that are not optimally efficient or effective. Disaster managers have unnecessarily been victims of this uncertainty; bits of valuable data existed and unfortunately may have been kept from the decision makers, not by avarice, but simply by someone holding the information who didn't realize that it was important to pass along.

1.1 DESCRIPTION AND PURPOSE OF THIS STUDY

This study is one of information and actor relationships within *planned, reported, perceived and desired (PRPD)* networks, using the literature of social network theory coupled with complex adaptive systems and policy and decision analysis. This study will analyze the social networks in which disaster managers obtain and share information and meaning within the larger natural, social and built environments (Mileti, 1999) affected by a disaster. The theoretical basis will draw upon a variety of other contexts, including military actions and "peacetime" policy analysis, applied to the disaster event and response organizations.

This study consists of three data collection and analysis phases. The first phase of this study explores disaster management structures to identify the planned data flow and actor networks. Using the *National Response Plan* (NRP) (US Department of Homeland Security, 2004), and the various state emergency operations plans (EOP) the analysis of planned, pre-disaster networks of action assesses the a priori interaction and interdependency of actors within the response organization implied within the NRP. The second phase uses content analysis of

written records, primarily situation reports (sitreps) from the presidentially declared disasters and emergencies to document the actual networks that coordinated the mass care responses to Hurricanes Katrina, Rita and Wilma in 2005. Mass Care generally refers to the shelter, feeding, bulk distribution and disaster welfare information (DWI) activities. The coded data allowed the comparison of reported to the planned networks of action. Findings from this comparison enable the evaluation of the closeness of the NRP to the reported findings as a disaster management framework.

The third phase uses semi-structured interview data from practicing disaster managers to identify their *perceived* and *desired* networks. The interviews also provide a rich description of the elements of essential information (EEI) sought and communications methods used in the responses, as well as a basis of information to improve future performance.

The four types of networks – planned, reported, perceived and desired (PRPD) – were compared to identify the discrepancies and commonalities among them. The findings will serve as a basis to inform and perform theory-driven practice. In order for this study to be accepted by the practitioners, it is presented using the terminology, systems, and shared frustrations common to the field. It is also a tool for researchers to better understand the practitioners through these frames.

1.1.1 Statement of the Specific Problem

Disaster managers work within a network based on EOPs, laws and organizational structures which provide a framework for how to organize response structures, purportedly flexible enough to adapt to any size and scope of disaster. The disaster event, response and resource demands, personnel and information availability create needs to modify, formally or informally, these

action and information networks. The networks also affect the ability of individuals and agencies to develop the situational awareness accurate enough to achieve a common operating picture (COP) to inform decision and action.

Through the identification of the planned, reported, perceived and desired (PRPD) networks, disaster managers can revise plans, information management and technology, train and exercise to create more efficient and effective networks for subsequent operations. Technology-aided information flows can provide decision support in these highly complex systems.

1.1.2 The Disaster Event and the Disaster manager

The definition of what constitutes a disaster has been argued repeatedly. Drabek (1991) proposes a simple distinction between an *emergency* and a *disaster*:

> Emergencies are "routine" adverse events that do not have communitywide impact or do not require extraordinary use of resources or procedures to bring conditions back to normal.

In this definition, most local response organizations are capable of handling an *emergency* within their jurisdiction, with the resources, experience and authority available to them. A response network familiar with the system, known by all actors, manages local events. In contrast, a *disaster* forces the response organizations to or beyond their bounded capacities for response, available mutual aid systems and may involve, either by necessity or by legislation, the involvement of higher levels of government. Agencies may face changing missions or emergent, spontaneous taskings for which they were not previously aware or prepared. A *disaster*, then, is dependent on the jurisdiction's size, resources, experience, preparation and capacity to cope with the hazards it faces (Johnson, 2004).

As an event progresses from emergency through disaster to levels of operation requiring state or federal involvement, the number of actors and complexity of communication grows. The unfolding events require actors to share a *common operating picture (COP)* of the events. This *situational awareness* is difficult to achieve in networks in which information for effective orientation and decision is unavailable. Boyd's *OODA,* (Coram, 2002) requires *observation* and *orientation* to inform *decision* for *action*. In the observation stage, outside information, unfolding circumstances and environmental interaction, coupled with feedback from previous decisions and actions, are required to build the situational awareness (orientation). The disaster event and its consequences on human needs, infrastructure and response organizations often prevent timely, accurate information flows among decision makers, making it difficult to create a common operating picture.

The general need for information in analysis and decision making in disaster environments is no different from other applications of policy analysis. Policy-relevant information is the basis for analysis and argument (Fischer & Forester, 1993). Structuring a problem requires data to sense the problem, define the situation, and find the right solutions (Dunn, 2004). Whether the problem is building the Interstate Highway System or how to evacuate portions of Houston, Texas for Hurricane Rita via Interstate 45, adequate, timely, context-relevant information is required.

Disaster management is policy analysis in a hurry; it requires many of the same elements and demands of routine public administration, but with significant constraints. Chief among these are time, data, and the immediate threats to life, property, environment, and economy. The effects of the disaster on the stricken area and the response organization can intensify these constraints. Initial conditions may not be known, indicators may be obscured, interactions and

interdependencies unknown (Perrow, 1984). Information overloads, as well as the paradigmatic discounting of valid data by actors are internally imposed constraints. Sifting through information in these time sensitive events requires effective, efficient networks of action, bolstered by pre-disaster training, education, experience and the appropriate application of technology.

1.1.3 Large-scale Disasters

The most complex, disaster management situations are those that involve multiple jurisdictional actors. Aside from the political strains placed on the network by competing elected officials and colleagues, differences in focus, priority, systems, resources, authority and mission change exist across jurisdictions. Intergovernmental issues inevitably arise in disaster situations because of these differences. Interaction and interdependencies can be both beneficial and detrimental to the response effort. Initial actions by subordinate organizations can create immediate and subsequent conditions that make or break the management attempts. Complexity grows with the infusion of non-governmental organizations (NGO), faith-based organizations (FBO) and spontaneous response and relief groups and individuals.

Within the Commonwealth of Pennsylvania, governmental emergency management at the local level is fragmented between the public safety agencies (fire, police and emergency medical services) and the role of the emergency management coordinator (EMC) as a non-operational actor. While state law (35 PA CS) requires municipalities and counties to have an EMC and an emergency operations plan, the EMC has no authority to direct and command emergency operations, unless they hold some other position with its own inherent authority, such as a police

or fire chief. The extent of local authority is to provide for local public safety and services through day-to-day resources, suspend rules related to contracting and bidding related to the emergency, implement its emergency operations plan and request assistance from the next highest level of government. State government emergency management *structures* vary, but all are based on the constitutional or legislative authorities of the governor. The Congressional Research Service found that state emergency and disaster management *authorities* are similar, with any differences attributed to specific hazards or legislative priorities, such as non-federal assistance programs (Bea, Runyon, & Warnock, 2004). These similarities may also be attributed to federal legislation, initiatives and grant requirements that reinforce form and function following finance.

Multi-jurisdictional response structure is nearly always scalar. In the Pennsylvania example, municipal agencies initiate disaster response activities. If needs exceed the capacity of the municipality, the county can provide assistance. Escalated events may require the assistance of the state, resulting in a Governor's declaration of emergency or disaster. If the state is overwhelmed, the Governor may request assistance from the federal government in the form of either a declaration of *emergency* or *major disaster* by the president (see Appendix A). The federal government is limited in its initiation of emergency response without a governor's request to those situations in which it "exercises exclusive or preeminent responsibility and authority" (42 USC 5191): events that occur on federal lands or on navigable waterways, certain criminal acts or acts of terrorism. Some scale-free organizations exist, but they are largely non-governmental organizations (NGO) and voluntary organizations active in disaster (VOAD), such as the American Red Cross (ARC), though these may be internally scalar.

1.1.4 Federal Disaster Declarations

The federal legislation that provides the legal authority for most disaster response and recovery actions is the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (PL 106-390, 2000). The genesis of this legislation, and the first standing legislation for disaster response and relief are the Federal Disaster Relief Act of 1950 (PL 81-875, 1950) and the Civil Defense Act of 1950 (PL 81-920, 1950). Until 1950, federal disaster assistance was provided by special legislation or through existing authorities of the various federal agencies, or the ARC under its own authority. Separate until the formation of the Federal Emergency Management Agency (FEMA) in 1979, the combination of disaster response and relief with civil defense is termed *dual use*, an all-hazards approach that is applicable to natural as well as attack events.

The Stafford Act provides for three types of disaster declarations: *fire management assistance (FMAD), emergency declarations (ED), and major disasters (MD).* Between 2001 and 2005, there were 611 declarations under Stafford, with 98.2% related to natural events (see Appendix A). A single disaster may lead to multiple declarations, specific to the requesting state; separate federal response operations will emerge from each declaration for each state. Additionally, a Small Business Administration (SBA) declaration may accompany the presidential declaration, enabling loans to businesses and homeowners. The US Department of Agriculture (USDA) has various mechanisms for assisting in crop and livestock disasters. The US Department of Health and Human Services (USDHHS) has the authority to declare public health emergencies.

Other federal agencies have existing authorities to provide assistance to disaster-stricken states and municipalities. The Environmental Protection Agency (EPA) has authorities under the Superfund Amendments and Reauthorization Act (SARA) (PL 99-499, 1986) for hazardous

materials incidents. The US Coast Guard (USCG) and the US Army Corps of Engineers (USACE) have responsibilities and primary jurisdiction for a number of events which affect navigable waterways. The Department of Justice (USDOJ) and some DHS agencies have law enforcement and investigatory jurisdiction. A Stafford declaration does not affect these existing authorities.

1.1.5 Planned Networks: The National Response Plan

FEMA issued the *Federal Response Plan* (FRP) (Federal Emergency Management Agency, 1992) to guide Stafford Act response and recovery activities through a structure based on 12 emergency support functions (ESFs) (see Appendix B). The FRP was not a comprehensive plan for federal emergency management, however. The *National Oil and Hazardous Substances Pollution Contingency Plan* and the *Federal Radiological Emergency Response Plan* (FREPR) also guided federal response to specific emergencies. Following the 1995 bombing of the Alfred P. Murrah Federal Building in Oklahoma City, terrorism became a serious federal concern. Presidential Decision Directive 39 relating to Counterterrorism (Clinton, 1995), required the addition of a terrorism annex, known as the *Consolidated Operations Plan (CONOPS)* to the FRP.

The September 11, 2001 attacks prompted the passage of the Homeland Security Act of 2002 (PL107–296, 2002) and the creation of the Department of Homeland Security (DHS). The Act and Homeland Security Presidential Directive 5 relating to the Management of Domestic Incidents (Bush, 2003) required the consolidation of federal plans to manage *incidents of national significance*. This new designation incorporated the various incident designations in the assortment of federal plans, including the Stafford declarations. The 12 ESF's were expanded to

15 and the original 27 signatory agencies grew to 32. The signatory agencies include 16 cabinet-level organizations, the Federal Bureau of Investigation (FBI), 13 independent establishments and government corporations, and two non-governmental organizations. This title of the revised FRP became the *National Response Plan (NRP).*

HSPD-5 also required the development of a National Incident Management System (NIMS), which would be required for all federal, state and local response and recovery operations related to incidents of national significance. The 2005 Hurricane Season was the first major application of the NRP and NIMS, and Hurricane Katrina was the most devastating natural disaster to strike the U.S., so the individuals and agencies were working within a novel response milieu in a catastrophic disaster.

NIMS is based on the incident command system (ICS) developed in California in the early 1970's to manage response to large-scale firefighting efforts (Emergency Management Institute, 2005). While the California ICS is credited as the genesis, the concepts of ICS date long back in military and organizational theory history, to at least Adam Smith's (1776) division of labor and Henri Fayol's (1916) unity of command and direction. ICS, and thus, NIMS are inherently scalar. Information flows through official channels, via situation reports, and through whatever informal channels are available, but only by willing actors. By analyzing information needs and actors, both as *reported* and *perceived* by the practitioners, data flows and networks of operation can be identified and anticipated before the disaster to reduce constraints on search and alternative generation. NIMS and ICS are further explained in Chapter 4.

1.1.6 Action Networks during the 2005 Hurricane Season

A *tropical cyclone* is a weather system characterized by counter-clockwise, upper atmosphere rotation originating over warm, tropical waters. In the Atlantic Ocean, these systems often form off the African coast and build as they move westward toward the United States. As the cyclone increases in size and rotation, a center of low atmospheric pressure begins to form and strengthen. Cyclones with sustained wind speeds less than 38 miles per hour (33 knots) are *tropical depressions*, and are numbered by their sequence in the hurricane season (June 1 – November 30). Once the cyclone reaches 39 MPH (34 knots) it is defined a *tropical storm* and acquires a name. Cyclones over 74 MPH (64 knots) are *hurricanes* and retain the name of the storm from which it grew. The characteristics include high winds, which may spawn tornadoes over land, heavy rain, high seas and flooding waves termed *storm surge*. Once a storm makes landfall, it can spread residual storm effects over a large geographical area spanning from Texas to New England. In the past 40 years, there has been an average of eleven named storms per year, with six of those becoming hurricanes and two becoming major hurricanes (Blake, Jarrell, Rappaport, & Landsea, 2005). The National Hurricane Center (NHC) issues forecast products relating to tropical events. Disaster managers watch these products closely. The products include:

- *Daily Tropical Weather Outlook* reports where storm potential first appears, as conditions become favorable for storm development.
- *Advisories* list all current watches, warnings, positions, pressures and wind speeds
- *Discussions* explain the rationale for the forecasts
- *Strike Probabilities* give five time periods and percent probabilities of the storm center striking within 65 nautical miles from a stated position

Advisory graphics are also produced. The *Three- and Five-day Cone/Warning*, *Strike Probabilities*, and *Wind Swaths* provide visual explanation of the projected landfall and track of the storm. The five-day cones showing the first warnings for Hurricanes Katrina (Florida and Gulf Coast strikes), Rita and Wilma are displayed in Figure 1.

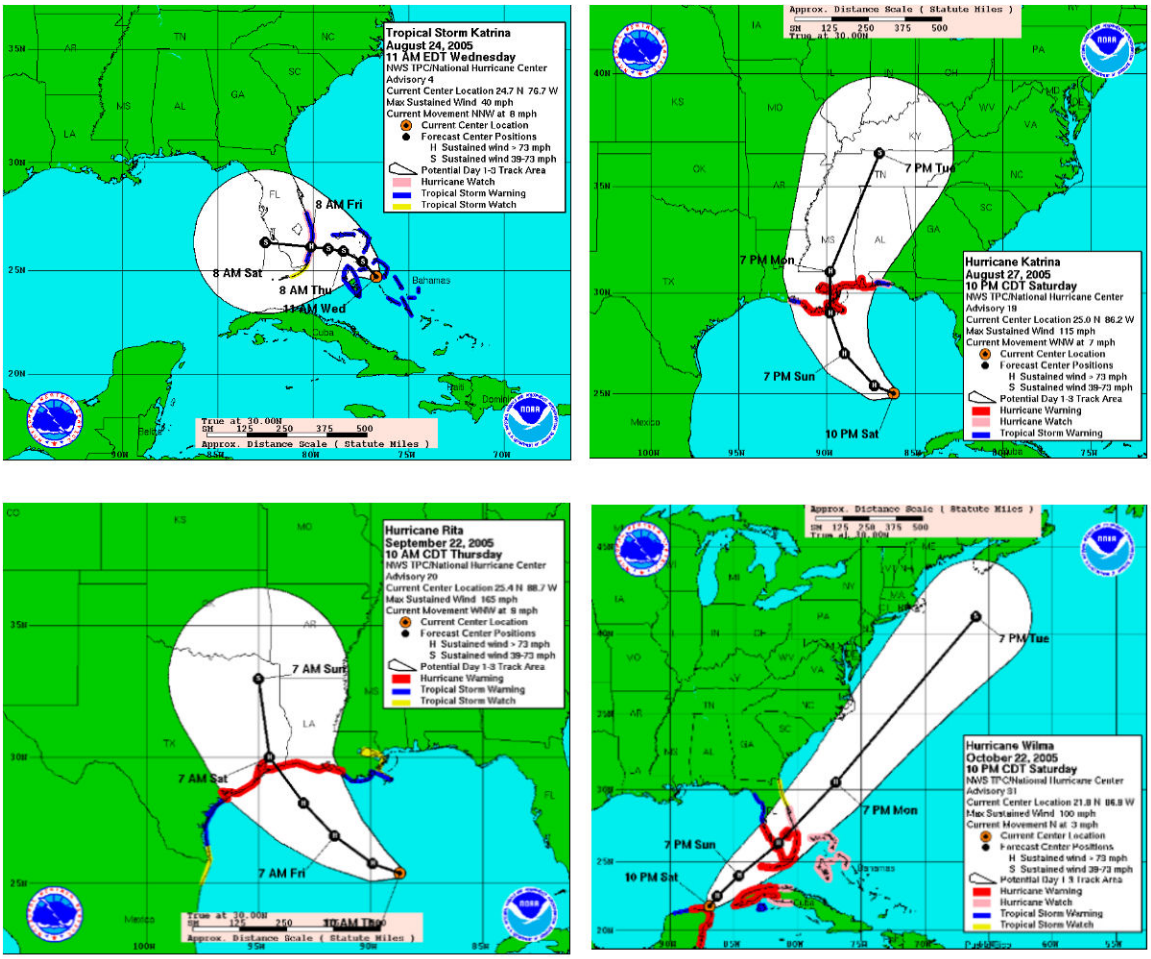

Figure 1: Five-Day Prediction Cones (Source: National Hurricane Center)

During the 2005 season, there were eight named storms in the Atlantic Ocean and Caribbean. Thirty-three (33) states (including the District of Columbia) and seven of ten FEMA Regions were either affected by or within the potential one- to three- day track area for tropical cyclones in the Atlantic Ocean and Gulf of Mexico (National Hurricane Center, 2005). This does not include the states and regions that provided support to the Hurricane Katrina evacuation and

Emergency Management Assistance Compact (EMAC) operations. Six of the eight storms resulted in Presidential major disaster declarations. The focus of this study is the storms that affected the Gulf Coast states most significantly: Hurricanes Katrina, Rita and Wilma, described in Table 1.

Table 1: Hurricanes Katrina, Rita and Wilma

Hurricane	Date of Landfall	Category at Landfall	States Receiving Presidential Declarations
Katrina (Florida)	25-Aug-05	1	Florida (MD)
Katrina (Gulf Coast)	29-Aug-05	3	Alabama (ED/MD) Louisiana (ED/MD) Mississippi (ED/MD) Texas (ED)
Rita	24-Sep-05	3	Florida (ED) Louisiana (ED/MD) Texas (ED/MD)
Wilma	24-Oct-05	3	Florida (MD)

ED: Emergency Declaration MD: Presidential Declaration of Major Disaster

Physical impact aside, the geographic and temporal proximity of these storms present unique organizational sequelae in which the disaster managers were required to function. With this number of states and FEMA regions involved with three storms and 14 presidential declarations, information flow would have been difficult to manage in a manner that was efficient and preventive of "cross-contamination" of information from different storms and states. In a single state, single storm event there could be at least 80 information nodes involved between the state, federal Emergency Response Team-Advance (ERT-A), Regional Resource Coordination Center (RRCC), National Response Coordination Center (NRCC) and the headquarters of each Lead Federal Agency (LFA) and the ARC. This estimate assumes that all

fifteen ESF's had been activated and staffed by the state and each federal facility. The term *segment* denotes a specific group of information separated by ESF, government, facility and event. If the single state declaration has the potential for 80 nodes each holding one segment of information, the addition of a second storm-declaration may maintain the same nodes (80) but now double the information segments (160). This is a conservative estimate, since county, municipal and NGO's are not counted in this assumption. Even with this estimate, structuring information becomes as difficult, if not more so than collecting it in the first place.

1.1.7 Perceived Networks

NIMS requires that emergency management personnel, including ESF support agency personnel, receive training in the NRP and NIMS, and are expected to function within the scalar structure prescribed in the NRP for reporting and accountability (see Appendix B). Although the NIMS structure is in place, the Federal Coordinating Officer (FCO), in charge of each federal response structure, has the ability to modify structures as necessary for the operation or as limited by the available staffing. Even if the structure is formally based on NIMS, each worker soon develops an informal network for information and action. An experienced ESF worker learns the nature of the information that others create or can access, and "OP(eration)-friends" are sought in spite of the table of organization (TOO).

The ramp-up of operating locations, or facilities, in a federal response operation typically follows a predictable pattern. Once FEMA identifies an event as a potential cause for federal response, it activates one or more of the ten RRCCs with the appropriate ESF's for the event. As it appears a presidential declaration may be requested, an ERT-A is deployed to the affected state's EOC. Neither the RRCC nor the ERT-A might have a full complement of ESF's, which

may require actors to perform double duty. A Rapid Needs Assessment Team (RNAT) may be deployed for forward area assessment, and seldom has a full array of ESF's represented. Impromptu networks and improvisational staffing are common. Not until the Joint Field Office (JFO) is established might a predictable TOO be developed, although actors may remain the same. The initially established informal networks probably persist.

A focus of Phase III is to determine how practitioners perceive these networks and how important they are to the success or failure of the operation. The semi-structured interviews with practicing disaster managers provide a matrix of the interactions, insight into EEI, technology and organizational dynamics, and how they can be exploited for the improvement of future operations.

1.1.8 Desired Networks

Disaster managers are often overwhelmed by the amount of information that is available to them but can also be confounded by information that is not. Information very well might be available, but not known to the actor. Personal experience bears that you find that the missing piece of information did exist, but was on someone else's desk at the critical time needed. "If I only had that information *yesterday*!"

The practitioners are aware and can articulate well what kinds of information they need, or can tell stories of decisions that could have gone better, or went surprisingly well. The design of the desired networks portion of Phase III elicits these stories, wishes and complaints and join them into a network design that can inform socio-technical solutions, subsequent research and improve future response.

1.2 IMPORTANCE OF THE STUDY

The emergency management structure and the intensity of storms impacting the Gulf Coast States during the 2005 season presents structures and data to which social network, complex adaptive systems, policy and decision analysis can be applied and expanded. The relationships between actors in these networks hold opportunities to tie a variety of theoretical perspectives together in a novel analytic manner.

Practically, this study will document the information framework for mass care disaster managers based on the ESF structure required by the NRP and NIMS and compare and contrast it with actual response documentation. It will identify the strength of response actor networks, and the nodes and links that need to be bolstered in disaster preparedness, response and recovery, and define an information framework to which technology can be applied for improvement. This study will enhance understanding of the disaster environment, and the critical role of the disaster manager, the individuals directly affected by the disaster, and the witnessing public.

Disaster environments are rapidly dynamic situations in which information may be limited in quantity, quality, timeliness and congruency. Infrastructure damage may prevent efficient transfer of information from field to decision makers and back. By studying the contrast between disaster operations and emergency planning assumptions, it will be possible to identify structures of information sources and demands to reduce search and improve situational awareness, development of a COP and the decisions and actions in subsequent events.

Disaster managers, immersed in this dynamic environment, are natural, boundedly rational actors and are often overwhelmed or confounded by conflicting or absent information.

The manager is an individual actor within a larger, scalar organization, subject to organizational and political demands, and is additionally constrained by organizational capacity, including information gathering and processing resources and bureaucratic structures. The nature of the disaster management network is typically one in which unfamiliar actors are placed by a wide variety of organizations, both governmental and non-governmental, to meet the challenges of the event. Inexperienced actors or those with limited training exacerbate these constraints, or will be joined in the response network by those who are. By describing the information needs and prescribing a structure for data collection and dissemination, disaster management can become more efficient and responsive.

Improvements in emergency management information and decisions will have a positive impact on those most affected by the disaster – the affected population, whether they consider themselves "victims" or "survivors." The affected population, however, can create difficulties for the decision-maker. Each has varying disaster-caused or exacerbated needs and varied demands for services from the response organizations; the needs and the service demands may be real or exaggerated. Portrayed by the media in varying states of peril or need, the affected create unanticipated demands on response organizations for services. It can be difficult for the disaster manager to determine the holistic priority for service delivery in the shadow of specific "victim" awareness, which, while real, may detract from more pressing needs of those not fortunately highlighted in such a manner. Better information and decision support to the manager can provide more accurate focus and priority to balance the response.

Finally, improvements to information management can counteract demands arising from the witnessing public and political leadership. These individuals have media-induced or personal

biases that create informational or resource demands on the response system, drawing from the attention needed to meet actual disaster threats and needs. These well-intentioned, though sometimes inappropriate, desires to assist or re-direct the response effort create pressures on the disaster manager that can be counteracted with robust, realistic, anticipatory decision support.

1.3 SCOPE OF THE STUDY

Disasters are categorized as natural, technological and attack-related. Simplifying this further, disasters arise from unintentional or intentional causality. The integration of disaster response and relief with civil defense in the 1970's gave rise to dual-use concepts applicable to either causality. This study, while focusing on the preparation for and response to natural disasters, specifically, tropical events, will offer improvements to the data collection, communications issues and networks in all categories of extreme events.

The primary sources of information used in this study are the (US Department of Homeland Security, 2004) and state EOP's; the disaster situation reports, or sitreps, issued by FEMA and state emergency management agencies and other response organizations; and interviews with practicing managers and emergency personnel who were engaged in mass care response operations in the set of overlapping hurricanes in the fall of 2005. The temporal scope is both conceptual and specific. In conceptual context, the threat and operational periods of the disaster are considered. The *pre-threat phase* is what disaster managers refer to as normal readiness, "clear-sky" or "peacetime activities;" in other words, day-to-day preparedness. The *increased readiness phase* is that period when a disaster event is a possibility, in essence, hurricane season. The *threat* period is when a disaster is expected. This may begin when the state

is within the National Hurricane Center's five-day prediction cone. The *response* phase is during landfall and immediately after when the priorities are life safety and incident stabilization. These are not the only phases considered in disaster management, but are those considered within this study.

The specific temporal scope of this study is the Atlantic hurricane season of 2005, between August 20 and November 30. This study will focus on the federal and state responses to presidentially declared emergencies and major disasters for Hurricanes Katrina, Wilma and Rita, specifically in the Gulf Coast states of Alabama, Florida, Mississippi, Louisiana and Texas and the necessary federal response structures and facilities which supported them.

Disaster response organizations are heterogeneous networks of individual actors, based on a standardized disaster plan, but most often without common first-hand experience working in their assigned network. Even if the luck of the draw would find the exact set of individuals, changes in temporal, geographical, jurisdictional or other contexts would create differences in the network. The network actors are responsible for meeting the challenges posed by the threat or impact of a disaster. The information and decision processes require the network to gather, orient to, share meaning of, communicate and act upon a rapidly dynamic environment. Planning, exercising and participating in actual events can help build network ties and bring efficiency to problem search and building a common operating picture. By studying the planned, actual and desired networks, these improvements will be translated into more effective disaster response.

1.4 MAJOR RESEARCH QUESTION

The two major research questions for this study are:

- What are the differences and similarities among the federal and state disaster management networks anticipated in the NRP, reported during actual incidents, perceived by practitioners post-event, and desired by those actors for future events? The designations of the networks are *planned, reported, perceived* and *desired (PRPD).*
- What information was used by the interviewees in managing the mass care response, how was this communicated and what improvements need to be made for future disaster operations?

The first research question will provide the framework for understanding the actors and networks anticipated during the preparedness phase and various perspectives of the actual and future responses. This PRPD analysis concept provides a novel manner in which to describe and compare networks, and has application beyond the study of disaster response. The second research question will describe the elements of essential information (EEI) necessary used or desired by the actors within the mass care response. The EEIs are the building blocks of situational awareness. By describing their nature and methods of communication, the concept of a common operating picture (COP) can be developed before the next disaster. These research questions will be further specified in Chapter 3.

1.5 SUMMARY

Disaster management requires the blending of the practitioner's understanding of plans, laws and practices with an effective analysis of the disaster environment in order to effectively employ resources to meet demands. The practitioner is not alone in this task nor are they without competition for information and resources. They must be able to understand the network of actors within which they are nested, the information available to them and needed by others, and to share within the network a meaning of information and action. This is the basis of a common operating picture (COP).

This chapter has provided background and setting to the Gulf Coast mass care response to Hurricanes Katrina, Rita and Wilma in 2005. An understanding of the legal and practical concepts of federal disaster response and assistance to the states, as well as the involvement of NGOs is necessary in order to analyze the networks and develop the EEIs. The legal and practical frameworks are not sufficient in themselves to provide the richness of understanding needed to improve future disaster operations. In Chapter 2, the theoretical framework, drawing particularly on behaving, adaptive systems and decision analysis will further support the subsequent explanation of findings and conclusions.

2.0 THEORETICAL FRAMEWORK

2.1 REVIEW OF LITERATURE

The emergency management system is an interrelated network that incorporates elements of scalar and non-scalar structure (Barabási, 2002). The organizations, jurisdictions and the individuals, all creations of society, operate within natural, social and built environments (Mileti, 1999). The intentional design or emergence by which these actors and networks have been created, and their interfaces can be the root of the difficulty as well as the success in mounting the mass care response to this set of disasters. With this in mind, the theoretical foundation of this research will be based, in order of primacy, on the literature of social networks, complex adaptive systems (CAS) and policy and decision analysis. In order to explain the relationship of emergency management and to derive recommendations for theory-driven practice (Burt, 1992) this literature review will explore the nature of the components, namely the behaving system and the environment (Simon, 1996; Luhmann, 1983), the network as a whole, the actor, other actors (Luhmann, 1986; 1983; Burt, 1992) and the need for intra-actor sense making in negotiating these systems (Weick, 1995).

2.1.1 Behaving Systems and their Environment

Simon describes design as "how things *ought* to be … in order to *attain* goals, and to *function*" (Simon, 1996). Designed or *artificial* things "can be characterized in terms of functions, goals, adaptation." Further, they are described "in terms of imperatives as well as descriptives." Design consists of three components: *internal* and *external environments*, separated by an interface, or *artifact*. The outer environment serves as the mold that forms the artifact. The artifact serves as the separation between the environments, full of physical, chemical and perhaps rational properties. It is across this artifact of varying attraction, cohesion and permeability, that the balance between inner and outer systems is maintained. This balance, enabling the system to be maintained, is adaptation. The entity that attempts this balance is the *behaving system*.

Placing the actor with others within an environment creates a social network, the analysis of which is "motivated by a structural intuition based on ties linking social actors" (Freeman, 2004). Luhmann (1986) provides a four-part structure for this analysis of network relations, which includes systems theory, cybernetics, "phenomenological disclosure of meaning" and *autopoiesis*. The systems theory component refers to the description by Parsons (1977) that social action is interaction among a plurality or actors, which becomes distinguishable as unity (system) within an environment, with actors' expectations mediated symbolically. Returning to Simon, this *symbol mediation* is an adaptive behavior of the actor, be it between the actor and the environment or with other actors.

Luhmann's explanation of autopoiesis serves here as a heuristic by which the response organization constructs a common operating picture (COP) from situational awareness. We become situationally aware from the observation of perturbations of the social environment within the natural and built environments as they are impacted by a disaster agent. Generally,

this will be referred to as the disaster environment, in which the response organization exists. Within the response organization, there are systems of actors (responders) charged with general and specific functions to meet the needs of both the disaster-affected individual and the response organization itself. The system of responders continually defines itself through the understanding that it shares about itself, the environment and the relationship between them, *with* itself. This is called a *self-referential*, or *autopoietic* system. The responders act based on a shared meaning and cross-referencing of both existing conditions (actuality) and the desired future conditions (potentiality) (Luhmann, 1983). Luhmann describes three required dimensions of meaning: social, temporal and functional (Lee, 2000).

Lee interprets Luhmann that communication "is the only genuinely social phenomena" and that communication "occurs when Alter intentionally transmits information through a medium to Ego who understands it as anticipated" (Lee, 2000). While the information and the medium can be specified, understanding can at best be anticipated. Meaning is dependent on "double contingency" which includes a number of factors such as shared language, willingness, agreement and memory. Successful communication occurs when meaning is exchanged and action is coordinated.

There are two types of media for what Luhmann terms "utterance" of information: disseminating and success media. "Disseminating media determine and increase the number of recipients of a communication." Disseminating media can be addressed as in specific email recipient groups or mass communicated as in broadcast media. Success media, alternatively, "are symbolically generalized media that convey meaning within a specific societal system," (Lee, 2000) such as sitreps and damage assessment reports. Even within success media, there are

differing meanings for the same information, as will be described in the functional dimension, below.

The temporal context is the timeframe in which the information must be obtained, meaning assigned, action prescribed and taken. Specialization increases complexity, what Luhmann called “negentropy.” There is only so much time and information sources available in a disaster, increasing the reliance on shared communication and understanding between responders.

The functional dimension emerges from the differentiation of responders, and the meanings the differences create. The differences are based on segmentation such as the separate ESFs or stratification as in the hierarchical nature positions within ICS. Each differentiation communicates (information/media/understanding) based on its own distinctions. Meal counts and shelter populations may not have importance to the ESF #12 Energy lead, but the status of electric and natural gas utility outages and the availability of other fuels is very meaningful to the ESF #06 Mass Care lead.

The separate functional systems can create operational and structural couplings between them. An operational coupling is the result of one system acting upon, or “irritating” another in a manner that alters its operations. Within mass care, the evacuation group creates an operational coupling in the sheltering group by announcing the intent to move 1,000 people to a specific area without a currently operating shelter. Structural coupling is occurring within the feeding group as it “struggles to find a way to cope with a recurring source of environmental irritation,” namely, the increased demands for feeding evacuees, shelterees and workers. The success of the communication is displayed by the success with which the group uses the information in a self-referential manner (Lee, 2000).

In the self-referential, autopoietic system, structural change and action is triggered by environmental perturbations and the co-adaptation of the system "in order to remain viable within it" (Goldspink & Kay, 2003). Thus, external perturbations are assigned meaning based on internal dynamics, cross-referencing and the decision that action is required for adaptation. Decision is based on the expectations that the system has for its desired state (Kay, 2001).

Building the common operating picture (COP) thus requires the ability to sense the perturbations in the environment in a manner in which meaning is assigned by and anticipated states are determined appropriately by the systemic actors. The COP depends on the cross-referencing of past meaning; simply stated, by what the individual actor, and to the hopes of Argyris, the organization has learned. Achieving this requires obtaining information about the environmental irritations, disseminating it to the systems and subsystems (social dimension) in a timely (temporal dimension) and useful (functional dimension) manner to inform adaptive action. Luhmann indicates, however, that "there is no supermedium capable of lending a uniform meaning to all communications" (Lee, 2000). The development of a COP faces this challenge.

From the environment, the actors, and thus the system, draw information. The actor that tends to accept information and advice from their environment is termed *docile* by Simon. Follett's (1926) *law of the situation* can be applied here; orders should arise from the situation, the situation is always evolving, and the "orders should involve circular not linear behavior." This circularity can be defined as "feedback-mediated action" or *cybernetics* (Wiener, 1948). In cybernetics, the actor mediates information from the environment, enabling action corrections to meet a desired or required path. Weiner (1948) borrows two terms from neurophysiology, *ataxia* and *purpose tremor*. Ataxia refers to the actor's receipt of feedback but the inability to act upon

it through some manner of constraint. Purpose tremor occurs in the actor that is receiving too much feedback, creating wildly fluctuating control of behavior making sustained correction impossible to achieve. The disorderly, ineffective exploration that negates exploitation by the system to progress is termed *eternal boiling* (Axelrod & Cohen, 1999).

Appropriate feedback and the ability to process it are addressed by several of the authors presented here. Primarily, Simon's (1947) assertion that actors have limitations in receiving, storing, retrieving and communicating information is summarized in his term *bounded rationality*. The behaving system processes adaptive information by symbol mediation, internal representations of the external environment to which the behaving system is attempting to adapt. Effective processing of these symbols enables intelligent action. Procedural rationality is where information meets intellect and data meets decision. These decisions are made based upon *heuristics* that, in light of bounded rationality, lead the actor to *satisfice* upon a decision that is considered "good enough." The interpretation of the symbols is filtered through the actor's frames of reference, positioned from the actor's individual, organizational, geographic or other vantage point, all of which are in varying degrees of concert. An actor can behave in purely individual best interest, organizational best interest, or in some nature of balance. By subtracting bounded from complete rationality, the actor is left with an incomplete rationality, in which heuristic, emotion or guessing will fill the gap without optimization.

Luhmann observes that the actor is always less complex than the environment, creating difficulties for the actor in reducing the complexity of the differential states. In Simon's terms, an artifact is a creation or a man-made object. Knowing about the goals and outer environment, "the shape of the task environment," prediction with some degree of success of the artifact's behavior is possible. This adaptation to the external environment is termed *substantive*

rationality by Simon. The behavior of the system is also related to the adaptive capacities of the inner environment. This is termed its *procedural rationality*. These forms of rationality are as constrained, or bounded, as any other (Simon, 1983)

Given that an actor has the ability to utilize feedback in a bounded manner; continual application of cybernetic-controlled action should result in the improvement of processing information. Argyris and Schön (1974; 1996)address this learning by imposing a second feedback loop. Not stopping at feedback to modify action as does cybernetics, *double-loop learning* takes feedback one-step further to modify theory and belief that drives the action. Procedural rationality within the actor and the network structure between actors serve as the primary constraints to learning. The procedural rationality common to the network's actors, based on shared meaning and goals, are what make the network a learning organization (Argyris & Schön, 1996).

Luhmann's concept of *resonance* is related to Simon's substantive rationality (Luhmann, 1986). Point-to-point connections between the system and the environment would quickly overwhelm the system. The system will establish *selective interconnections* in order to avoid becoming overwhelmed and to distinguish itself from the environment. In order to extract data from the environment, the system will compare information to internal standards and reduce the difference between the current and desired state of the system. In this manner, resonance contains portions of and is similar to both Weick's s*ensemaking* (1995) and Festinger's *cognitive dissonance* (1957). The representation of the internal standard must be as valid as the environmental goal. If the internal standard becomes the referent, and is not constantly compared and correlated to the goal, the system risks transposing the two. In this case, actions focus less on the true goal of reaching the desired state than on the self-referentiality. The resonant system is

able to define and maintain its true essence or mission in the wider environmental context. The ability of the actor to maintain, improve and reproduce elementally (individually) its mission and its systemic role is summarized in Luhmann's concept of autopoiesis.

Hierarchical structures in the response organization exist and will doubtfully ever be eliminated from American response networks. Following Hurricane Katrina, calls for increased control and accountability will assure that hierarchies will remain, if not tighten. Argyris (1973) however, views hierarchical, top-down structures as power-centric and stifling of the individual actor's self-actualization and creativity. Simon (1973) counters that structure has less to do with "who controls" and more with "what is accomplished or who supports whom." Simon also argues that:

> (The actor) must be provided with an environment sufficiently simple and stable for the limits of his reason … Man creates best when he operates in an environment whose constraints are commensurate with the capacities of his bounded rationality. More constraint restricts his creativity, less throws him into confusion and frustration.

Comparing this statement to Luhmann, Argyris' argument would seem to support self-referentiality while Simon's supports resonance and autopoiesis.

Disaster managers are naturally bounded individual actors working within an organization that provides both benefits and constraints. Both the individual actors and the organization exist within the disaster environment. In order to make decisions that lead to appropriate outcomes, the individuals need to successfully identify the conditions of the environment and the needs of the affected population, assign meaning and chose action options. The challenge is building a common operating picture (COP) from the situational awareness that is interpreted by a variety of individuals with selective interconnections to the environment.

Improvement of the shared environmental awareness and communication between the actors requires an understanding of the social networks that they form and within which they work.

2.1.2 Social Networks

Networks can be characterized as a common environment-bound, interacting and/or interdependent group of actors, arranged as individuals and linked into groups. One network can be embedded within other networks or environments, rather like a concentric set of Russian matrioshka dolls. In a study of inter-organizational networks relating to juvenile offenders, Miller (1980) describes one such nest in five levels. Level I is the actor, described by its professional and personal attributes. Successively, actors are embedded within their agency (Level II) and the "interagency network of professional exchange" that includes contacts, influence, respect support and assistance (Level III). Level IV consists of contacts outside of the immediate interagency network, but with which the network must communicate. Finally, the larger community policy space constitutes Level V. Miller's framework provides analogy to the disaster management system which will be explored later in this study.

The networks within which the disaster manager exists are multi-dimensional. The ESF #06 Mass Care lead may be an ARC employee assigned to FEMA working within a state EOC. The geographic and temporal aspects of the disaster create changing environments to which the individual and the network must adapt. Adaptation changes the network's ability to gain and communicate a common operating picture.

2.1.3 Adaptive Systems

Some systems contain a structure, situated within an environment, in which it can modify its inner relationships to maximize or exploit these characteristics in order to achieve progress. This exploitation is at the heart of the complex adaptive system (Holland, 1995; Axelrod & Cohen, 1999). The exploitation can be thought of as a *lever point* where a small input can create a significantly larger output. Within the temporal and conceptual context of an event, exploitation has a critical dependence on, and can exercise its largest *leverage* on changing *initial conditions* (Kauffman, 1993). The environment is changed in this manner, thus creating the necessity for the network to successfully evolve and continually to meet the new challenge.

Comfort (1999) concluded that effective disaster response organizations are complex adaptive socio-technical systems with the proposal of the Dynamic Disaster Response System Model. The model describes the response organization as a set of interacting and interdependent relationships requiring articulated communication processes through which the organization can collectively act and learn. The agents within the organization represent collections of rules and rule syntaxes that use information as stimuli for response and adaptation, lever points for building the complex adaptive system, and the structure for building internal models (Holland, 1995). Making the transition from merely a collection of actors into an adaptive socio-technical system requires the anticipation of the actor's ability to search and exchange information and facilitate intra- and inter-organizational learning within the context of the initial conditions in which the system is situated. Given these components, the adaptive system emerges, with the resultant capacity greater than the sum of the parts.

The percolation of this adaptation between actors, near- and far-neighbors is highly desirable (Stauffer & Aharony, 1992). Axelrod and Cohen (1999) refer to the harnessing, rather

than the control, of complexity though the strategies used by agents within a context to structure interaction patterns. Analysis of these interaction patterns can improve situational analysis and decision-making in future events. This current study will identify patterns in previous events for future reproductions with adaptive variation.

At the heart of these successes is the ability of the actors to form uninhibited communicative networks. These networks consist of an interconnected actor set with varying preferential attachment and a balance of strengths and sensitivities, or vulnerabilities to influence (Barabási, 2002). The network is changed by the emergence of new actions subsequent to the initial conditions, and raised to a phase transition by the information, knowledge and experience of the actors (Strogatz, 2003). The phase transition from a collection of actors to an adaptive system requires information "kicks" to activate the agent and facilitate synchronization as exhibited by free, sustaining interaction and interdependence. Emergence is characterized by this coherence with either the beneficial cascade of successes, which improve progress toward the goal, or the detrimental cascade of failures.

While a completely saturated (Hanneman, 2001), percolated (Stauffer & Aharony, 1992)network would represent a utopian response organization, some fragmentation will be present. The network will consist of clusters of actors directly connected, but connections will naturally exist between clusters, even if actor-to-actor communication is not possible. These connected clusters, as well as the clusters themselves, can be considered *small worlds* (Watts, 2003). Even if connections between actors are across intermediaries, they should not be discounted. These weak ties begin with small-scale interactions and result in larger scale patterns, referred to by Granovetter (1973) as the *micro-macro bridge*. Weak-ties represent non-

redundant resources; if everyone has the same contacts, there is nothing new or unique that can be learned.

Social networks, no matter how similar the actors, are not homogeneous. Wellman (1983) characterizes social systems as "networks of dependency relationships resulting from the differential possession of scarce resources at the nodes and the structured allocation of these resources at the ties." Resource access within the disaster environment can be classified as *materiel, information* and *influence*. This study focused on information; however materiel and influence cannot be ignored in describing the network relationships. The access to resources by the entire network can increase its competitiveness with other systems. Situating the network of responders against the suboptimal network of disaster-affected individuals in crisis, a form of competition can be conceptualized. Competition is based on exploitation of nonequivalencies between actors or systems. Burt (1992) calls attention to *structural holes* as "entrepreneurial opportunities for information access, timing, referrals and control." This competition is dependent on relations between actors not their individual attributes, although those attributes may affect the actor's ability to create and maintain productive relationships. The ability of the network to accommodate *structurally induced action* is based on the benefits of those relationships.

Understanding the nature of the network can be used to describe and prescribe organizations better suited for response to crises (Krackhardt & Stern, 1988). The Krackhardt-Stern assumptions staircase upon one another, particularly that crisis leads to perception of uncertainty and threat, resulting in conflict among subgroups, which may result in increased commitment to "home subunits" and reduced cooperation with others. Their assumption is that the conflict will cause actors to view systemic resource allocation to be inappropriately viewed

as a zero-sum game, resulting in system members joining the external environment (the disaster) as a competitor, thus withholding information from needing actors in other subunits. To improve the system's ability to overcome crisis, trust and strong relationships are required.

The nature of a tropical storm and the science of meteorology provide the network with time to anticipate environments, needs and response capacities. The pre-landfall activation of facilities enable the network to begin to collect information, assign information and interaction patterns. The small-world clusters of actors, such as those assigned to the various sections, branches and groups have time to acclimate to the new organizational environments and their individual co-workers. Those co-workers, as unique, perhaps peculiar individuals, will have information needs for decision analysis, with varied manners of communicating and analyzing data. The right information, even in the best of networks, may not be easy to find.

2.1.4 General Needs for Information

Disaster response structures are comprised of a combination of actors with varying styles of decision-making. Perry and Moffat (1997) suggest a two dimensional taxonomy for the manner in which decisions can be analyzed. Along one axis, are the *psychological foci*, whether or not the analysis is based on internal processes, such as recognition-primed decision-making (RPD) (Klein, 2002) or ignoring the process and considering only the external aspects of the decisions themselves. The second axis is the *contextual content*, or how the decision is placed within the environment. The decision is either situation-based, referred to as *context-full*, or is not related to the operational situation, *context-free*. Disaster management, like the maritime warfare examples of Perry and Moffat, contains decisions, which are highly context-full, and are subject to six decisional components: *threat perception, time, risk aversion, political factors, environment and*

strategy aims. The decisions can vary, though, on the psychological axis. The current study is less concerned with analysis of the psychological foci, but the difference between context-full and context-free is the difference between effective practice and armchair analysis.

As stated previously, disaster management can be characterized as "policy analysis in a hurry." For the disaster manager, problem sensing and structuring (Dunn, 2004) are key. Sensing of problem situations in specific locations or populations may be difficult. Damage or disaster assessment takes time, focuses on property and infrastructure, with varying foci on human needs impact. Information found in the process may not be communicated because the assessors do not realize its importance to someone in another specialty or there is no place to report it on the form. Rapid needs assessment is conducted in larger disasters by multidisciplinary teams, but focuses on immediate needs that may change over time. Since the disaster manager may be dealing with stale or missing information, assumptions may meet some needs, but the lack of precision spreads resources thin or misses pockets of greater need.

The lack of precise information leads to ill- or at best moderate structuring of the problems (Dunn, 2004). Dunn lists the characteristics of problems that add to the complexity of the policy process - *interdependence*, *subjectivity*, *artificiality and dynamics.* The speed with which analysis must be completed and decisions made, coupled with the imprecise nature of information and/or assessment, make all of these characteristics into constraints. Thus, most of the disaster manager's problems are difficult to structure. Dunn characterizes the structuring elements to include the number of decision makers, available alternatives, utilities or values of the decision makers, the outcomes and probabilities. Well-defined problems have one or few decision makers, limited alternatives, consensus in utility and value, certainty or some risk in outcomes with calculable probabilities. Disaster problems seldom have this clarity or certainty.

To bring clarity to problem situations, the experienced disaster manager will draw on experiences, whether in disasters, similar situations in non-urgent cases, or training. For example, two of the interviewees, both paramedics, used patient assessment references in trying to sense make the response operations. Neustadt and May (1986) present a method of situation definition that can be applied in this case. Problem situations can be defined by comparing present situations to analogous ones. The closeness of comparison is gauged by characterizing what is *known, unclear* and *presumed* about the analogue and comparator. Combinations of known and unclear are what drive the presumed, and this matrix can be applied by the savvy manager to the Perry and Moffat (1997) decisional components, as well as Dunn's characteristics of problems and structuring elements to determine the needs, resources, alternatives and outcomes with improved probability and reliability. As information grows, the analogy's elements move between the categories of *known, unclear* and *presumed* to draw a clearer picture. Obviously, the more known elements than unclear and presumed, better conclusions can be drawn.

Developing situational awareness and a common operating picture (COP) among the decision makers in this ill-structured policy space requires rapid orientation. While numerous decision-making processes have been proposed, a compact but rich process, *OODA*, was identified by a retired US Air Force fighter pilot, John R. Boyd for rapid military decision-making (Coram, 2002). The components of OODA are *observation, orientation, decision and action*: observation leads to appropriate orientation required for decisions leading to action. The more efficient the decision maker is in applying OODA, especially in comparison to their adversary, the better. Time compression of the loop by the decision maker is desirable;

compression by the adversary is not. Applying this to disaster management, the effects of the disaster are the adversary and naturally constrain the OODA process. The disaster manager, who is able to overcome these constraints, by better observation and orientation, will be the victor. With information and experience, and a functional network fortune favors the prepared mind.

In OODA, the observation step is highly information dependent. This is information specific to the events at hand – the initial and immediate subsequent conditions of the disaster area, the human needs for protection and recovery, and the infrastructure and resource constraints are all pieces of the puzzle. This new information is blended with the analyst's past in the orientation step for analysis and synthesis. Other components of orientation include cultural traditions and genetic heritage. Returning to Boyd's original concepts, these components related to both the actor and the aggressor. In disaster management, the prior experiences, traditions and heritage of the individual decision maker and the response network, the affected population, and the response actors need to be considered in the analysis and synthesis. These traits affect the network-ability of the actor within the response organization.

Making informed decisions is as necessary in disaster management as any other aspect of public administration. The chief problem lies in the difficulty in obtaining context-full from non-validated sources or limited access. Problem definition is exacerbated by contrary or missing information, political influence, personal bias or organizational constraints to effective, meaningful communication. These points are important to restate as the theory and research continue to unfold.

2.2 CONCEPTUAL FRAMEWORK AND THEORETICAL MODEL

The disaster manager is an actor within a network of other managers, culled within concentric environments of a response organization and the physical and social disaster context. Between these actors are varying types and strengths of interactive and interdependent relationships by which they attempt to build a consensus of shared meaning of the events surrounding them and the actions that must be taken in order to mount a response. The meaning of information garnered from the environments is subject to varying definition, which leads to frustration of communication and may create untoward intra-system competition. In order to build a communicating network through which information and meaning can be fostered, cybernetic-based organizational learning, of the outer environment (the disaster) and the inner environment (the response organization) is required.

Figure 1 displays graphically the conceptual relationship between the theories described above. Once the disaster manager is assigned to the operation, they begin to collect information about the event in order to inform their actions; they begin Boyd's OODA before they leave home. Their observation and orientation are part of the situational awareness needed to develop the common operating picture, but they are now situated within the network of other actors with whom they must form relationships in which to interact, communicate information and share meaning. As the network emerges, goals are identified, and the communication becomes actionable information.

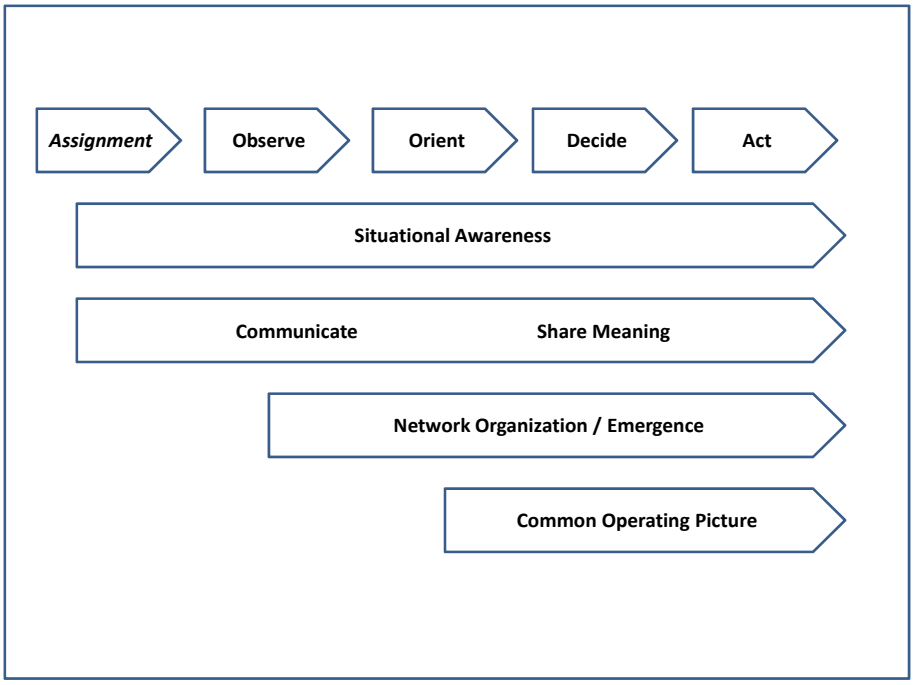

Figure 2: Conceptual Framework

Building effective, efficient information and actor networks prior to the disaster are central to disaster response. Access to information and shared meaning, and the willingness and ability to exchange, create favorable initial conditions to foster a self-organizing system. Connections, cooperation, barrier-elimination, efficient transfers of system resources, and management, primarily valid, timely information, are required for the network to meet the challenge of crisis (Krackhardt & Stern, 1988). Through the analyses being proposed in this research project, the planned, reported, perceived and desired (PRPD) networks will be analyzed with the purpose of leveraging network power to inform and improve disaster management organizations.

The theoretical model driving data collection and analysis is the comparison and contrasts among the disaster management action networks: planned, reported, perceived and desired. The

information framework to support decision-making by practicing managers in disaster management must be planned, executed, evaluated and revised to reflect changes in actors and their environment. The framework of this study will require a set of assumptions and the acknowledgement of several limitations.

2.2.1 Assumptions

The assumptions followed in designing and conducting this research include:

1. All actors have similar understanding of NIMS and the NRP as would be developed by successfully completing the FEMA Emergency Management Institute courses *IS-700 National Incident Management System: an Introduction* (Emergency Management Institute, 2004) and *IS-800 National Response Plan: an Introduction* (Emergency Management Institute, 2004).
2. States and sub-state disaster management structures are in concert with the ESF structure as represented in the NRP. If structures are not explicitly the same, the ESF-analogues developed in this study will allow transformation of sub-federal structures into a common framework. All declared disasters have response structures and facilities as identified in NRP and NIMS.
3. Response organizations are not closed systems from their environments (Scott, 2002) but are an artificial boundary of the response organization is required for the purposes of this study.
4. The demands for information and resources will be similar across states for declarations arising from tropical cyclones' landfall and dissipation effects.

5. The states share the same need for a presidential declaration and subsequent response structure, even though each state will generally have differing specific needs depending on the degree of impact, vulnerability, preparedness and political foci.
6. All written reports are truthful representations of actual events, even if they are not complete.

2.2.2 Limitations

The limitations of this study are:

1. Data collection is limited to written documents and a set of semi-structured interviews with experienced disaster managers, supplemented by personal experience in disaster management and personal observation and interaction with other disaster managers over the past thirty years.
2. The written documents are only those that are available at the time of the study. Internal documents or those with security classifications may contain richer sources of data or evidence contradictory to this study.
3. The federal teams that respond to a state for a declaration are assembled from a large number of governmental and non-governmental organizations and their paid and unpaid staff. Similarly, states may have a pool from which to pull a coordination team. No two teams are exactly alike. Each team, which may change several times within each disaster relief operation, will have idiosyncrasies, which can skew the expected behaviors.

2.3 SUMMARY

A functional network of response actors is based on the ability to communicate and analyze information, share meaning and adapt to dynamic environments. To accomplish this, the actor must understand the relationships among the actors within the network, the goals and needs of the network, communication methods and abilities of the actors in the network. The first research question seeks to describe the actors, the network, and interactions between nodes. The network analysis will show the size and density of the overall network, displaying the information carrying capacity of the actors. The network analysis also will show the nature of specific actors: which are more central, which occupy positions to control communication and an indication of their ability to be overwhelmed by information search and provision. The comparison of the planned, reported, perceived and desired (PRPD) networks will also identify the capacity of plans to anticipate actual actor networks, and provide planners the ability to select planning actors based on prior performance.

Actors need to understand how to structure information in a manner that effectively and efficiently relates changes in the external and internal environments to facilitate successful adaptation. The concentric and overlapping networks in which an actor holds membership may have different information and adaptation needs, reflexes and rates of change that help or hinder full adaptation of those same networks, thereby challenging the individual actor. The second research question structures the inquiry that will enable the analysis of the 2005 hurricane response events to help meet these needs in future disasters. How, when, what and to whom information should be communicated is important for responders to understand. Why they should communicate is summarized, simply, as to build the common operating picture.

Just as the disaster manager needs to understand the internal and external environments and share meaning in order to be effective, so must the researcher. In order to explain the network and information needs presented in this chapter, a research methodology that extracts the interrelationship and interdependence of actors in the PRPD networks is necessary. Network comparison requires the analysis of written artifacts and interview responses in a manner that shows the structure of networks, strength of actors and the information needed to sustain and improve response. Chapter 3 provides the basis of this research design and defines terminology and concepts necessary for the subsequent description of the analysis.

3.0 RESEARCH METHODOLOGY

3.1 OVERVIEW OF METHODOLOGY

This three-phase study will incorporate a mixed-method, sequential exploratory strategy (Cresswell, 2003). Sequential exploratory strategy begins with transforming qualitative, text-based data to quantitative data via content analysis and coding (Flick, 2002). The analytical priority will focus on the quantitative data, integrated at the analysis step, and used to build the network and group membership data.

The first phase of the study (planned networks) analyzes and codes the content of the NRP and state EOPs to determine the planned networks. The interactions among actors and interdependencies of information will establish pre-disaster expectations for the structure and information flow within a response operation. The second phase (reported networks) will applies content analysis and coding to actual incident briefings and sitreps issued during the response operation to determine the reported structures and flows. The third phase (practitioner perceived and desired networks) uses semi-structured interviews with experienced disaster managers to determine the perceived networks and to identify a desired network for effective response operations. The interviews also provide understanding of information needs, problems and solutions. These data will be compared to determine the ability of the NRP in prescribing these interactions and interrelationships, and to test the hypotheses of the study.

The rationale for performing the actor network analysis is two-fold. First, an understanding of the network in which the information can be exchanged more richly describes the environmental constraints and enablers of information flow. Power, centrality and betweenness, or lack thereof, will change what and how information can be exchanged accepted and acted upon, through formal and/or informal channels. Second, the actor network will provide the basis for recommendations to improve the response system and for further investigation. The actor positions will also identify possible choke points for information flow. If a small number of actors are identified as such, planning and technology can be used to improve the information flow and consequent performance of the system.

The general research questions are further refined into specific questions to build the knowledge base. Specific questions relate to the actors who participated in the response activities, the data elements they used and how they communicated this information. These concepts are applied throughout the planned, reported, perceived and desired (PRPD) network concept, as well as within the context of the response in total and those anticipated in the future.

3.1.1 Specific Research Questions

The two major research questions for this study are:

- What are the differences and similarities among the federal and state disaster management networks anticipated in the NRP, reported during actual incidents, perceived by practitioners post-event, and desired by those actors for future events? The designations of the networks are *planned, reported, perceived* and *desired*.

- What information was used by the interviewees in managing the mass care response, how was this information communicated and what improvements need to be made for future disaster operations?

In order to provide the necessary specificity to the research and measurements, the major research questions are further refined. For the planned networks, the inquiry includes:

- What actors are identified in the NRP?
- What networks do these actors form?
- How does the planned network compare to others in the study?
- What interdependencies exist among actors in the planned network?
- What data elements are identified in the NRP?
- What data elements relate to ESF #06 Mass Care?
- How can the data elements be transformed into analogies for ESF #06 Mass Care?
- What patterns of information flow do the data elements form?

The inquiry for the reported networks, used to guide the content analysis coding, includes:

- What actors are identified in the written records of the event?
- What networks of actors are documented in the written records of the event?
- What data elements are contained in the written records from actual incidents?
- What are the similarities and differences between the planned and reported networks?

The inquiry for the perceived networks, used to guide the interviews, includes:

- Using interviews, what actors are perceived as performing transactions within the disaster management system?

- What interactions among actors are perceived in the performance of these transactions?
- What networks are perceived among the interacting agencies?
- What are the similarities and differences between the planned and perceived networks?
- What are the similarities and differences between the perceived and reported networks?

The inquiry for the desired networks, used to guide the interviews, includes:

- Using interview and survey data, what are the desired interactions among the actors within the disaster management system?
- What networks do these desired interactions construct?
- What are the similarities and differences between the planned and desired networks?
- What are the similarities and differences between the reported and desired networks?
- What are the similarities and differences between the perceived and desired networks?
- What are the possible causes of discrepancies, if identified, between networks

The inquiry for the all networks includes:

- What are the similarities and differences between the planned, reported, perceived and desired (PRPD) networks in emergency operations?
- What information and technology was used by the practitioners to manage mass care operations?

- How can information management, technology and organization be improved for future emergency planning and operations?

A summary of the networks appears in Table 2.

Table 2: Summary of Networks

Phase	Network	Source	Unit of Analysis / Observation
1	Planned	ICS, NRP and State Emergency Operations Plans	Agency and functional leads / interactions specified in the texts
2	Reported	Written records of response activities	Agency and functional leads / interactions reported in situation reports and other official records
3	Perceived	Interviews	Agency and functional leads / individual disaster management practitioners
	Desired	Interviews	Agency and functional leads / individual disaster management practitioners

3.2 UNITS OF ANALYSIS AND OBSERVATION

The units of analysis for the study are the agency and ICS/ESF positions that participate in disaster response operations. States are required to utilize the same minimal organization, although primary agencies across the state may change. For example, the primary agencies for ESF #06 Mass Care at the federal level are FEMA and the ARC; in Florida, it is the Department of Business and Professional Regulation and in Texas, The Salvation Army. Through the coding of data, both actions and agencies will be transformed into ESF-analogues for cross-jurisdictional analysis.

Table 3: ESF #06 Primary Mass Care Agencies

Level	ESF #06 Mass Care Agencies
Federal	Federal Emergency Management Agency
	American National Red Cross
Alabama	Department of Human Services
Florida	Department of Business and Professional Regulation
Louisiana	Department of Social Services
Mississippi	Department of Human Services
Texas	The Salvation Army

The unit of observation will change with the analysis of each network. For the planned and reported networks, the unit of observation will be the interactions among the agencies that perform and support the emergency support functions. The planned interactions are those connections built within the EOPs and the tables of organization. The reported interactions will consist of those explicit transactions between agencies that are documented in the situation reports.

In Phase III, the units of observation will turn to the individual practitioners, experienced in working within the response operation structure, either at a federal, state or sub-state level, for all Katrina/Rita/Wilma declarations. A stratified, random sample of 34 semi-structured interviews was conducted selected from the set of response organizations. These individuals represented federal and state governments, as well as non-governmental response agencies. The interview process is described in more detail below. The design of the data collection instruments was based on the findings from the analysis of the planned and reported networks.

3.3 DATA COLLECTION AND CODING

Actor data coding recognizes three aspects: agency, ESF and role. Agency coding reflects the name of the agency and its parent organization (see Appendix C). The Department of Justice, as a whole, has responsibilities, but so do subordinate organizations such as the Federal Bureau of Investigation (FBI) and the Office of Victim Compensation (OVC). Coding by agency and parent will enable further mining of the network should it become necessary.

From the practitioner's point of view, each ESF is distinct from a specific agency. While it may be a FEMA employee who is the ESF #05 Emergency Management "lead," identifying interactions with ESF #05 Emergency Management as simply FEMA or even broader, DHS, is far too general to be useful in defining issues and solving problems. The nodes within the network matrices are thus based on the assumption that ICS and the NRP are a *meta-agency*, with their own specific actors. In the matrices, each ICS position and ESF lead are considered a unique node, regardless of their "home" agency. This also enables the intergovernmental comparison of matrices. Likewise, a manner in which state agencies are genericized was necessary as there are different names and responsibilities of departments between the states. This is described further in Chapter 4.

Table 4: Emergency Support Functions

ESF #01	Transportation
ESF #02	Communications
ESF #03	Public Works and Engineering
ESF #04	Firefighting
ESF #05	Emergency Management
ESF #06	Mass Care, Housing, and Human Services
ESF #07	Resource Support
ESF #08	Public Health and Medical Services
ESF #09	Urban Search and Rescue
ESF #10	Oil and Hazardous Materials Response
ESF #11	Agriculture and Natural Resources
ESF #12	Energy
ESF #13	Public Safety and Security
ESF #14	Long-term Community Recovery and Mitigation
ESF #15	External Affairs

3.3.1 Agency v. Functional Analogs

Activities are those response actions performed by the agencies, such as feeding, sheltering, providing ice, etc. During content analysis, an activity was coded analogously as the ESF responsible. If a federal sitrep listed “ice”, the conversion would be to ESF #03 Public Works. If, however, the activity was “special medical needs within a general population shelter,” it was coded to both ESFs #06 Mass Care and #08 Health and Medical. The progression of activity to function was necessary to assure consistency in coding. The activity analogs are listed in Table 5.

Table 5: Activity Analogs

Activity	Variable	Analog
Bulk Distribution	*a_bd*	ESF #06 Mass Care and #07 Resource Management
Donations	*a_don*	ESF #07 Resource Management and Donations
Feeding	*a_feed*	ESF #06 Mass Care
Ice	*a_ice*	ESF #03 Public Works
Medical Activities	*a_medical*	ESF #08 Health and Medical
Search and Rescue	*a_sar*	ESF #09 Urban Search and Rescue
Shelter, General Population	*a_shel*	ESF #06 Mass Care
Shelter, Special Needs and Medical	*a_spns*	ESF #08 Health and Medical
Water, potable	*a_water*	ESF #07 Resource Management

3.3.2 Content Analysis Assumptions

In order to build the knowledge base from the content analysis and interviews, assumptions about the roles of the actors and the manner in which they communicated are necessary to standardize the data:

- Within the context of network analysis, the agency that reports or leads the interaction is termed the originator, lead or source of coordination (sources).
- Agencies listed in association with or support of an originator, activity or function, are considered *recipients* (sinks) of coordination or responders to requests made by the lead agencies.
- Communication between agencies exists outside of plans and reports, which cannot be captured in the planned and reported networks. This unreported communication is captured in the interviews to the extent of the memory of the interviewee.
- Other agencies, organizations and sub-state levels of government were involved in the response, but are excluded from this study unless specified in the interviews.

- All interactions are recorded and analyzed as directed (asymmetric) ties, which enables the centrality, betweenness and influence measurements.

3.3.3 Selection of Cases and Method of Content Analysis for Network Analysis

The content analysis was performed manually on the NRP, the state EOPs in effect in 2005, and the federal and state sitreps for the event. The federally-generated sitreps were grouped by state, independent of state-generated sitreps, except for Mississippi, which were combined with federal. Since federal and state sitreps are not inter-compared, this combination was performed. There were a minimum of 30 sitreps analyzed for each state–federal combination, in order to capture the interactions occurring during the threat and immediate response phases of the events, the time in which most mass care activities occur.

Table 6: Distribution of Situation Reports Analyzed

	Federal	State				
		Katrina	Rita	Wilma	Combined	Total
Alabama	30	30				60
Florida	30	30	24	30		114
Louisiana	30				30	60
Mississippi	30					30
Texas	30	30	30			90
Total	150	90	54	30	30	354

The content analysis frequencies were transformed using Excel® into a 168x168 matrix spreadsheet which enabled the clarification of activity-ESF-agency transformations. Florida and Texas had separate sitreps for each storm response, and the content analysis results were combined into a state composite. Alabama and Louisiana had composite sitreps, and Mississippi

was combined with Federal. The Excel® spreadsheets enabled the combination of sitreps for separate storms into one spreadsheet for each state.

3.4 INTERVIEWS

To obtain the information to build the perceived and desired networks, as well as the data for the information, technology and organizational observations, semi-structured telephone interviews were conducted. Following the approval by the University of Pittsburgh Institutional Review Board, a total of 34 interviews were completed between May 12 and June 14, 2008.

The key agencies from which the expert interviewees were selected were identified in the planned and reported networks. The individuals were representative of the three primary ESFs related to the study, and spanned governmental, NGO and FBO actors. The interviews were arranged through contact with external affairs and leadership staff of the ESF #05 Emergency Management, ESF #06 Mass Care and ESF #08 Health and Medical agencies. The interview selection design is detailed in Table 7.

Table 7: Interview Selection Design

	Interviews	
ESF	Designed	Actual
#05 Emergency Management	4	4
#06 Mass Care	16	19
#068 Health and Medical	6	7
Voluntary Agency Liaison	4	4
Total	30	34

Due to the nature of the storms and the organizational structures of the agencies that the interviewees represented, 15 had experience with more than one storm, state or role. Where these experiences sufficiently differed for each individual, they were counted as separate case observations within each interview. A total of 56 separate observations were recorded. A distribution of interviewees per counted observation is shown in Table 8

Table 8: Distribution of Interviewees per Counted Observation

Observations Per Interviewee	n	%
1	19	55.9
2	11	32.4
3	2	5.9
4	1	2.9
5	1	2.9
Total	34	100.0

Interviewees were classified by their primary agency affiliation at the time of the interviews. Affiliations were evenly split between governmental and non-governmental staff members (paid and unpaid). As the interviewees were aggregated by observation, non-governmental staff members represented 58.9%, as more of these interviewees were assigned to diverse operations. The distribution of agency affiliation by interviewees and observations is shown in Table 9**.**

Table 9: Agency Affiliation Distribution

	Interviews		Observations	
	n	%	n	%
Federal Agencies				
FEMA	8	23.5	11	19.6
NDMS	6	17.6	7	12.5
VA	1	2.9	2	3.6
Total Federal	15	44.1	20	35.7
State EMA				
Alabama	1	2.9	1	1.8
Florida	1	2.9	2	3.6
Total State	2	5.9	3	5.4
Non-Governmental Organization				
ARC	10	29.4	20	35.7
NVOAD	1	2.9	1	1.8
Total NGO	11	32.4	21	37.5
Faith Based Organization				
Baptist	2	5.9	4	7.1
Salvation Army	4	11.8	8	14.3
Total FBO	6	17.6	12	21.4
Total	34	100.0	56	100.0

The interviewees had a considerable amount of disaster experience. The mean number of years' experience was 21.4 (median = 19.5). The mean number of federally declared disasters for the interview population was 28.7 (median = 12.5). The number of state and locally declared disasters which were attended by the interviewees was not obtained, but would be considerably higher for non-federal staff members. The distribution of experience is shown in Table 10 and Table 11.

Table 10: Interviewees' Years of Experience

Number of Years	Interviews	
	n	%
<5	1	2.9
6-10	6	17.6
11-15	6	17.6
16-20	5	14.7
21-25	4	11.8
26-30	4	11.8
31-35	3	8.8
36-40	3	8.8
41-45	1	2.9
46-50	1	2.9
Total	34	100.0
Mean	21.4	
Median	19.5	

Table 11: Interviewees' Declaration (Federal) Experience

Number of Declarations	Interviews	
	n	%
<5	7	20.6
6-10	5	14.7
11-15	6	17.6
16-20	5	14.7
21-25	1	2.9
26-30	2	5.9
31-35	-	-
36-40	2	5.9
41-50	-	-
51-60	-	-
61-70	-	-
71-80	1	2.9
80+	5	14.7
Total	34	100.0
Mean	28.7	
Median	12.5	

The assessment of educational attainment of the interviewees shows that 25 have at least an associate's degree or certificate with 21 having at least a four-year degree. Some interviewees held more than one degree. The most common majors were health-care related (five, 17.9%), with business, fire science, political science and psychology equally following (three, 10.7%). Only one interviewee reported holding a degree in emergency management. The distribution of educational attainment is shown in Table 12.

Table 12: Education Attainment of Interviewees

	Interviews			Interviews	
Highest Degree Reported	n	%	Reported Degree Majors	n	%
Associate or Certificate	4	11.8	Business	3	10.7
Bachelor's Degree	12	35.3	City Planning	1	3.6
Graduate Degree	9	26.5	Communications	1	3.6
Not indicated	8	23.5	Education	2	7.1
No degree	1	2.9	Emergency Management	1	3.6
			Engineering	1	3.6
Total	34	100.0	Fire Science	3	10.7
			Geology	1	3.6
			Health Care	5	17.9
			Hospital Administration	1	3.6
			Political Science	3	10.7
			Psychology	3	10.7
			Public Administration	2	7.1
			Social Work	1	3.6
			Total	28	100.0

Once assigned to a disaster operation, the primary affiliation, work assignments and locations change for federal and non-governmental staff. The highest number of assignments was to the area command facilities (16, 28.6%). These facilities include incident, area and unified command posts, as well as ARC disaster relief operation headquarters within each state. The second most frequent facilities were the federal joint field offices (JFOs) which also included the

Area Field Offices (AFOs). These facilities primarily house federal and non-governmental staff. The assignment location with the highest frequency was Louisiana (17, 30.4%) followed by Washington, DC and other national coordination facility locations (10, 17.9%). The distribution of assignments is shown in Table 13.

Table 13: Distribution of Observations by Assigned Facility and Location

	Observations			Observations	
Facilities	n	%	Location	n	%
Federal Joint Field Office	10	17.9	Alabama	4	7.1
National Response Coord Center	4	7.1	Florida	4	7.1
Regional Resource Coord Center	4	7.1	Louisiana	17	30.4
State EOC	6	10.7	Mississippi	9	16.1
Operations Center, Agency	4	7.1	Texas	7	12.5
Area Command	16	28.6	Region IV	4	7.1
Service Delivery Site	8	14.3	Region VI	1	1.8
Other facility	4	7.1	Washington DC and other	10	17.9
Total	56	100.0	Total	56	100.0

Observation of assignments were classified by the type of role they played, either as an ESF lead, an ICS position (such as the Human Services Branch Chief) or as a general representative of a specific agency. The assignments primarily supported one of four functions within the operation: ESF #05 Emergency Management, #06 Mass Care, #08 Health and Medical, or the Voluntary Agency Liaison. These roles are described in Table 14 and Table 15.

Table 14: Distribution of Observations by Assignment Type

	Observations	
	n	%
ESF Lead Position	14	25.0
ICS Position	19	33.9
Agency Representative	23	41.1
Total	56	100.0

Table 15: Distribution of Observations by Supported ESF

	Observations	
ESF	n	%
ESF #05 Emergency Management	4	7.1
ESF #06 Mass Care	36	64.3
ESF #08 Health and Medical	10	17.9
Voluntary Agency Liaison	6	10.7
Total	56	100.0

The agency to which the individual was assigned may be different than their primary affiliation. As mentioned above, the primary affiliation was that held at the time of the interviews not at the time of the disaster. Additionally, ARC staff assigned to ESF #06 Mass Care lead roles were categorized as FEMA and The Salvation Army staff members assigned to ESF #06 in Texas were categorized as Texas EMA. State employees functioning in another state with EMAC were assigned to EMAC. The distribution of agency assignments is shown in Table 16 and the length of assignments is shown in Table 17.

Table 16: Distribution of Observations by Agency Assignment

Agency	Observations n	%
Federal Agencies		
FEMA	14	25.0
NDMS	7	12.5
USAF	1	1.8
VA	2	3.6
State EMA		
Alabama	1	1.8
Florida	1	1.8
Texas	1	1.8
Non-Governmental Organization		
ARC	14	25.0
EMAC	1	1.8
NVOAD	1	1.8
Faith Based Organization		
Adventist	2	3.6
Baptist	4	7.1
Salvation Army	7	12.5
Total	56	100.0

Table 17: Distribution of Observations by Length of Assignment (days)

	Observations n	%
<5 days	4	7.1
6-10	9	16.1
11-15	9	16.1
16-20	3	5.4
21-25	2	3.6
26-30	16	28.6
>31	13	23.2
Total	56	100.0
Average	30.4	
Median	30.0	

3.5 DATA ANALYSIS FOR NETWORK MEASUREMENTS

Once the content analysis of the plans and situation reports was completed and the perceived and desired interview data was obtained, the actor data was collated into standardized matrices. In order to develop the network measurements to address the first research question, the standardized matrices enabled an analysis routine that was reliable across all of the networks. The matrix rows and agency membership by network are shown in Appendix D. The description of the data collection, coding and analysis related to the information and communications aspects of the second research question is included throughout Chapter 6.

Once the matrices were entered into Excel®, The Ucinet® computer software was used to calculate reciprocated (*symmetrical*) and unreciprocated (*asymmetrical*) network properties as necessary for the analysis. Both network-wide (*macro*) and node-specific (*micro*) and inter-node (*meso*-) indicators are used in the comparisons. According to Hanneman (2001), the primary component of a network is a *node*, which in this study is the actors and the data referents, connected to one another by relational *edges*.

The macro-measurements include *size* and *density*. Size refers to the number of nodes and the potential edges within the network. If all of the nodes were connected across the network, the network would be termed *fully saturated*. While this is seldom the case, the network would range from more or less saturated, reflected in the density measurement. In disaster management, the size and density can be an important indicator of the response organization's capacity to process information effectively and efficiently. More saturated networks can imply that the actors are fully connected and have the potential for receiving all of the pertinent information. Saturation could also have a negative connotation in that actors may become overloaded with information beyond their boundaries for processing (Simon, 1947).

The density output of Ucinet® was modified for this study. Since the 168x168 matrices were used for all networks, the standard output calculated the density for a network size of 28,056. In order to conceptualize the density for the actual participating nodes, the actual network size ($k*k$-1) was divided by the sum of ties present in the network to obtain the modified density measures for this study.

Micro-measurements focus on each node's potential connection to others. Absent connections, which do not permit communication, indicate that the node is isolated from some part of the network. Present asymmetrical connections are used to send information, in which case the originating node is a source, or receive information, where the originating node would be a sink. Symmetrical connections would be both sending and receiving edges. Completed edges are measured in degree; either out-degree for *sources* and in-degree for *sinks.* This is depicted in Table 18.

Table 18: Relationship of the inflow and outflow of information between nodes

		INFLOW (receives requests)	
		High	Low
OUTFLOW (issues requests)	High	quad-A Balanced (Source and Sink) In-degree > mean Out-degree > mean	quad-B Source-Dominated (Outsiders) In-degree < mean Out-degree > mean
	Low	quad-C Sink-Dominated (Consumer) In-degree > mean Out-degree < mean	quad-D Isolate-Dominated In-degree < mean Out-degree < mean

The nature of the ESF and the phase of the response will determine the nature of the symmetry. An ESF with a life-saving or sustaining mission may be primarily a source or even an isolate before the event, and a sink immediately after. The balanced communicator has the requisite flexibility to support and to be supported; however, this property may make it vulnerable to information overload and the attendant inefficiencies

Meso-measurements are those of how well a node is connected to others, and whether it prevents other nodes from connecting to others directly is indicated by measures of centrality and power. Freedom to communicate with other nodes and alternative edges are signs of a scale-free network. Either structurally or stochastically, a node can be in a position to facilitate edging and likewise to prevent it. By being between other nodes, the central node has structural advantage to become a choke point for information, as naturally occurs in a hierarchical structure.

The measures of meso-connectedness are based on *closeness* and *betweenness*. The closer a node is to another, the greater its ability to influence and to be influenced by direct bargaining and exchange, an advantageous structural position for an actor. Being between nodes is advantageous to the node wishing to exercise authority, control or extract transaction fees. For information sharing purposes, the scale-free nature of closeness and limited betweenness is desirable.

Table 19: Network measurements by scope and significance

Scope	Measurement	Description	Significance
Macro	Size	Number of nodes within the network	The greater the number of nodes (k), the greater the possible number of ordered pairs (k * k-1)
	Density	How close a network is to achieving its total potential of ordered pairs	Within Ucinet®, the mean score represents the percentage of possible ties present. The standard deviation indicates the variation in the ties between nodes.
Meso	Betweenness	The intermediary nature of a node	Higher values indicate that the node lies between more connections between other nodes, and can facilitate or hinder communication between them
	Closeness	The overall proximity to other nodes within the network	Higher values indicate that the node has more direct connections to other nodes in the network without intermediaries, reducing the interference from other nodes which may attempt to exercise control or influence
Micro	Out-degree	The sum of connections FROM the node TO others	Higher values indicate how influential a node can be.
	In-degree	The sum of connections TO a node FROM others	Values indicate the amount of information a node can receive; higher values can indicate prestige or power, but also indicate that the node can suffer from information overload

3.6 SUMMARY

The data collection and quantification techniques outlined in this chapter provide the basis to answer the first research question through the analysis of the planned, reported, perceived and desired (PRPD) networks in Chapter 5. The networks will be compared on macro-, meso- and micro-measurements which will describe the overall nature of the networks as well as the connectedness and power relationships of and between specific actors. It also introduces the data

collection design that will support the qualitative analysis, amplified in Chapter 6, which will describe the information, communication and organization in answer to the second research question.

In order to understand the internal and external environments, a description of the actors that comprise the networks, the concepts used to organize them, and the disaster events as they took place is provided in Chapter 4.

4.0 DESCRIPTION OF NETWORK ACTORS AND ENVIRONMENTS

Understanding the internal and external environments in which the networks are situated and with which they must interact is necessary to determine the necessary improvements for communication, adaptation and the development of a common operating picture (COP). This chapter lists the agencies that comprise the response organizations and provides a description of their legal, historical or operational aspects. Also included are descriptions of NIMS and the structure of FEMA. The chapter concludes with state-specific information on the emergency management structures, disaster experience and the impacts of Hurricanes Katrina, Rita and Wilma.

4.1 AGENCY CHARACTERISTICS

4.1.1 Federal Departments

The federal agencies included in the analysis were listed in the NRP with clarifications provided by the US Government Manual 2005-06 Edition. In many cases, the cabinet-level departments were further classified by sub-agency in order to specify the variety of roles and responsibilities. When a specific actor is not known, the actor is classified by the lowest known agency.

Table 20: Federal Departments

Department	Abbreviation	Variable
Agriculture	USDA	*u_a*
Commerce	USDOC	*u_c*
Defense	USDOD	*d_dod*
Education	USDED	*u_ed*
Energy	USDOE	*u_en*
Health and Human Services	USDHHS	*u_hh*
Homeland Security	USDHS	*u_hs*
Housing and Urban Development	USHUD	*u_hud*
Interior	USDOI	*u_i*
Justice	USDOJ	*u_j*
Labor	USDOL	*u_l*
State	USDOS	*u_s*
Transportation	USDOT	*u_t*
Treasury	USTREAS	*u_tr*
Veterans Affairs	USVA	*u_va*

4.1.2 Uniformed Services

The US Department of Defense (DOD) is grouped by service. The US Army Corps of Engineers (USACE) is separated from the US Army (USA) as the ESF #03 Public Works lead. The US Marine Corps, due to the low frequency of mentions, is combined with the US Navy (USN). Reserve components are included with the active duty service. National Guard units are considered with their respective states' Adjutant General or Military Department. The Civil Air Patrol (CAP), the auxiliary of the US Air Force (USAF) is categorized as a national-scope voluntary organization, described below. The US Coast Guard is listed with the Department of Homeland Security.

The non-combatant uniformed services of other departments, such as the Commissioned Corps of the Public Health Service (PHS) and the National Oceanographic and Atmospheric Administration (NOAA), are listed with their parent agencies. The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PL 107-188, 2002) defined the term "intermittent disaster response appointees," such as members of the various National Disaster Medical System (NDMS) teams. NDMS appointees have civilian employment protections under the Uniformed Services Employment and Reemployment Rights Act (38 USC 4301 et. seq.) and though are in uniform, are not considered part of the "uniformed services".

Table 21: Uniformed Services

Department	Uniformed Service	Abbreviation	Variable
USDOD	US Air Force	USAF	*d_af*
	US Army	USA	*d_army*
	US Army Corps of Engineers	USACE	*d_ace*
	US Navy and Marine Corps	USN / USMC	*d_nmc*
USDOC	National Oceanographic and Atmospheric Administration (commissioned corps)	NOAA	*u_c_noaa*
USDHHS	US Public Health Service (commissioned corps)	USPHS	*u_hh_phs*
USDHS	US Coast Guard	USCG	*u_hs_uscg*

4.1.3 Federal Independent Establishments and Government Corporations

Non-departmental agencies, such as administrations, government corporations and partnerships are also part of the analysis.

Table 22: Federal Independent Establishments and Government Corporations

Agency	Abbreviation	Variable
Environmental Protection Agency	EPA	*u_epa*
Federal Communications Commission	FCC	*u_fcc*
General Services Administration	GSA	*u_gsa*
National Aeronautics and Space Administration	NASA	*u_nasa*
Nuclear Regulatory Commission	NRC	*u_nrc*
Office of Personnel Management	OPM	*u_opm*
Small Business Administration	SBA	*u_sba*
Social Security Administration	SSA	*u_ssa*
Tennessee Valley Authority	TVA	*u_tva*
US Agency for International Development	USAID	*u_aid*
US Postal Service	USPS	*u_usps*

4.1.4 National Disaster Medical System (NDMS)

NDMS is a partnership between the Departments of Defense (DOD), Health and Human Services (USDHHS), Homeland Security (USDHS) and Veterans Affairs (VA) partnership that provides a system of deployable disaster medical assets to provide appropriate patient care and transportation in a public health emergency and to support military and VA hospitals in a military health emergency (Emergency Management Institute, 2007). The system also includes a network of civilian definitive care facilities (hospitals) to support federal medical needs.

In May, 1982, Congress passed the VA/DOD Health Resources Sharing and Emergency Operation Act (PL 97-174, 1982) which established the VA (then, the Veterans Administration) as the primary medical backup to the DOD in the event of war or national emergency. In July 1982, President Reagan issued National Security Decision Directive Number 47 “Emergency Mobilization Preparedness” (Reagan, 1982) stating:

> It is the policy of the United States to develop systems and plans to ensure that sufficient medical personnel, supplies, equipment, and facilities will be available and deployed to meet essential civilian and military health care needs in an emergency.

NSDD-47 initiated the transition from the Civilian-Military Contingency Hospital System (CMCHS) to NDMS. The need for a national disaster medical program for national security and emergencies was further supported in through President Reagan's Executive Order 12656: Assignment of emergency preparedness responsibilities (Reagan, 1988).

Currently, the deployable assets of NDMS include, but are not limited to:

- Disaster Medical Assistance Teams (DMAT), which provide direct medical care in support or place of overwhelmed local medical resources.
- Disaster Mortuary Response Teams (DMORT), which provide identification and mortuary services in mass fatality incidents
- Veterinary Medical Assistance Teams (VMAT), currently known as National Veterinary Response Teams (NVRT), which assess veterinary medical and health needs, and provide zoonotic disease surveillance in public health emergencies.

With the passage of the Homeland Security Act of 2002 (PL107–296, 2002) responsibility for the deployable assets was assigned to FEMA from the USPHS. Following the release of the report *The Federal Response to Katrina: Lessons Learned* (Townsend, 2006) responsibility returned to the DHHS with the passage of the Pandemic and All-Hazards Preparedness Act (PL 109–417, 2006).

4.1.5 Native American Tribal Agencies

There are eleven Native American tribal agencies recognized in the five state region of study (US Bureau of Indian Affairs, 2008). In the mass care context, tribal agencies are only mentioned in the Mississippi reports. For the purposes of this study, tribal interaction is listed as a single node and is not subdivided.

4.1.6 National-Scope Voluntary Organizations and Professional Associations

National-scope voluntary organizations (NSVO) are those agencies with services provided primarily by un-paid personnel, even if the organization has paid positions. These organizations are present in every state, and are not primarily affiliated with a religious organization. The NRP specifically includes three NSVO's as signatories: the ARC, Corporation for National and Community Service (CNCS) and the National Voluntary Organizations Active in Disaster (NVOAD).

Table 23: National Scope Voluntary Organizations

Organization	Abbreviation	Variable
Amateur Radio Organizations	----	*n_ham*
Amateur Radio Emergency Services	ARES	----
Radio Amateur Communications Emergency Service	RACES	----
American Red Cross	ARC	*n_arc*
Americas Second Harvest	ASH	*n_ash*
Association of Public Safety Communications Officers	APCO	*n_apco*
Civil Air Patrol	CAP	*n_cap*
Corporation for National and Community Service	CNCS	*n_cncs*
Emergency Management Assistance Compact	EMAC	*n_emac*
United Way	UW	*n_uw*
Voluntary Organizations Active in Disaster (state or national)	NVOAD	*n_voad*
Non-governmental organization, not otherwise specified	----	*n_nos*

4.1.6.1 Signatory NVSO's

American Red Cross

The ARC is a congressionally chartered treaty obligation organization (36 USC 300101, et. seq.) with responsibilities related to the Geneva Conventions, support of the military and, "to carry out a system of national and international relief in time of peace, and to apply that system in mitigating the suffering caused by pestilence, famine, fire, floods, and other great national calamities, and to devise and carry out measures for preventing those calamities."

ARC was established in 1881. While other national Red Cross societies focused on armed conflict, ARC was the first society to respond to peacetime natural disasters in order to prepare for service in war. Its first disaster, forest fires in Michigan (Hurd, 1959) known as "The Thumb Fires," claimed one million acres of land and 282 lives (Michigan Department of Natural Resources, 2007). The primary ARC services began with this fire, and include mass care (sheltering, feeding and bulk distribution) and individual client services (financial assistance and mental health counseling).

ARC was the only non-governmental agency with primary responsibility for an ESF in the NRP, ESF #06 Mass Care. ARC also has representation on the Interagency Incident Management Group (IIMG), the Homeland Security Operations Center (HSOC) and provides ESF #06 Mass Care teams to RRCC's, ERT-A's and JFO's. ARC Disaster Services are provided by a combination of paid and unpaid staff from the national headquarters and a network of local chapters through a personnel deployment Disaster Services Human Resources (DSHR) system. The national headquarters is located in Washington, DC, which also houses its Disaster Operations Center (DOC).

Corporation for National and Community Service (CNCS)

The Corporation for National and Community Service (CNCS) is a federal corporation (42 USC 12651) that encourages and provides unpaid and stipended community service programs (National Archives and Records Administration, 2005). The primary CNCS programs are the Senior Corps and AmeriCorps. The Retired and Senior Volunteer Program (RSVP), part of the Senior Corps, provides volunteer opportunities for people over the age of 55 in a variety of community organizations. AmeriCorps members receive education tuition assistance in return for concentrated community service "to meet critical needs in education, the environment, public safety, homeland security, and other areas" (Corporation for National and Community Service, 2006). CNCS members were actively involved in disaster relief operations during the 2005 hurricane season as members of local, state and national response organizations.

National Voluntary Organizations Active in Disaster

The National Voluntary Organizations Active in Disaster (NVOAD) is a coordinating body for member agencies who participate in various aspects of disaster response (National Voluntary Organizations Active in Disaster, 2007). NVOAD is a 501c(3) organization with national members and state affiliated VOAD organizations. The organization does not directly perform relief and recovery operations, but provides a framework for the variety of national and state members to coordinate services to reduce duplication of benefits (DOB) and meet unmet needs of communities and individuals. NVOAD is a signatory to the NRP, a support agency for ESF #06 Mass Care, and a cooperating agency for Donations and Voluntary Agency Management Support.

4.1.6.2 Amateur Radio Organizations

The network of amateur radio operators providing assistance in disasters is composed of organization affiliated and non-affiliated volunteers. The two primary amateur radio organizations are the Amateur Radio Emergency Services (ARES) and Radio Amateur Communications Emergency Service (RACES).

ARES is a section of the American Radio Relay League (ARRL), a national association of amateur radio operators, who are registered to provide emergency communications services in disasters, usually in support of other VOAD's (American Radio Relay League, 2000). RACES organizations are similar, but are specifically sponsored by local and state emergency management agencies. RACES operations are described and restricted by FCC regulations (47 CFR 97.407).

Other organizations have amateur radio components, such as the Salvation Army Team Emergency Radio Network (SATERN) and those operators affiliated with the ARC and the Baptist organizations. Amateur radio can provide support to damage assessment and relief coordination, as well as provide health and welfare messages. In this study, the amateur radio operators, regardless of affiliation, are combined into one node (*n_ham*).

4.1.6.3 Civil Air Patrol

The Civil Air Patrol (CAP) is a congressionally-chartered, private non-profit organization (36 USC 40301, et. seq.) that encourages civilian aviation, assistance in local and national emergencies and non-combat support to the USAF. CAP is the official civilian auxiliary to the USAF (10 USC 9442) and each state-based wing can provide assistance to state emergency management agencies, such as search and rescue, aerial reconnaissance, transportation and communications.

4.1.6.4 Emergency Management Assistance Compact

The Interstate Emergency Management Assistance Compact (PL 104-321, 1996) provides for mutual aid between the states for disaster emergencies. In 1996, Congress approved the EMAC, granting consent to the first member states, including Florida, Louisiana and Mississippi, and has grown to include all 50 states. EMAC enables states to share resources within a standard legal framework. EMAC assistance is coordinated by the National Emergency Management Association (NEMA).

4.1.6.5 Other Organizations

America's Second Harvest (ASH) is a national organization representing over 200 food banks that provided over 83.5 million pounds of food and groceries to individuals and mass care feeding operations during the 2005 hurricane season (America's Second Harvest, 2005).

The United Way primarily serves as a fundraising mechanism for non-profit organizations through local affiliates around the country. In some locations, United Way provides telephone help-lines to refer callers to social services in the community and may also assist with the coordination of spontaneous disaster volunteers.

4.1.7 Faith Based Organizations

The 2005 Hurricane Season witnessed the involvement of faith based organizations (FBO), the number of which it may be impossible to tally. Within this study, church and religious based organizations were classified by their primary denominational affiliation, with a general category to facilitate non-categorizable organizations. There are five main denominations identified in this study: Adventist, Baptist, Roman Catholic, Methodist and The Salvation Army. The exclusion of

specific churches or agencies is merely due to the limitations of this study, and is in no way diminutive of the services they provide. As specific groups were mentioned, they were captured and included in the network as possible.

Adventist Community Services (ACS) focuses on bulk distribution of clothing, food and hygiene items, and performs warehousing and donations management activities. ACS reports that it provided over $40 million worth of products through eight warehouses in the Gulf Coast during the 2005 Hurricane response (Adventist Community Services, 2005).

Baptist organizations include the American Baptist Men's Ministries (ABM), the Southern Baptist Convention (SBC) and local churches. ABM provides clean-up, repair and initial rebuilding services. SBC provides a variety of services, particularly in mass care, preparing meals in mobile kitchens, usually for delivery or serving by other VOADs. A single SBC mobile kitchen site may be able to produce up to 50,000 meals per day. By December 1, 2005, SBC kitchens had prepared 12,874,915 meals, provided 91,349 showers, completed 23,306 loads of laundry and purified 21,595 gallons of water in the Gulf Coast states (Southern Baptist Convention, 2005).

Roman Catholic organizations, primarily Catholic Charities and The Society of St. Vincent DePaul, as well as local churches, provide clothing, household items, home repair assistance, emotional and spiritual care and other recovery needs (Catholic Charities USA, n.d.).

Methodist organizations include the United Methodist Committee on Relief (UMCOR) and local churches. UMCOR provides relief supplies as well as longer-term recovery needs of individuals and families (United Methodist Council on Relief, 2008).

The Salvation Army Emergency Disaster Services provides feeding, sheltering, cleanup and restoration services, donations management, spiritual and emotional care, disaster social

services and emergency communications (The Salvation Army, 2008). The Salvation Army has a fleet of mobile kitchens and feeding vehicles (canteens) which were deployed to the Gulf. In the State of Texas, The Salvation Army is the lead agency for ESF #06 Mass Care.

Table 24: Faith Based Organizations

Faith Based Organization	Variable
Adventist	*c_adv*
Baptist	*c_bap*
Catholic	*c_cath*
Methodist	*c_meth*
The Salvation Army	*c_salv*
Brethren Disaster Ministries	*xch_bdm*
Church World Service	*xch_cws*
College Youth Ministry	*xch_cym*
Lutheran	*xch_lut*
Latter Day Saints - Mormon	*xch_mor*
Muslim	*xch_mus*
Scientology	*xch_sci*
Other religious organization	*c_other*

4.2 NATONAL INCIDENT MANAGEMENT SYSTEM (NIMS)

A common difficulty in managing disaster response is in understanding, “Who’s in charge?” This seemingly simple question was one of the basic issues in the 1970 wildfire season in southern California in which over 500,000 acres burned, 700 homes destroyed and 16 lives lost in a 13 day period. In response, Congress authorized the US Forest Service to work with the State of California and several city and county fire departments to improve the coordination of multi-agency resources, communications, standardized terminology and training for major incidents. This project developed the Incident Command System (ICS) for improving incident management and the Multi-

agency Coordination System (MACS) for coordinating multiple agencies or multiple incidents (FIRESCOPE, 1988).

A similar effort to improve operating efficiency and safety was underway in the 1970's by the Phoenix, AZ Fire Department. The Fireground Command System (FGC) was designed to improve the response to smaller fire department operations (Emergency Management Institute, 2005; Brunacini, 1985). FGC utilized similar concepts, particularly unity of command and span of control, but utilized different terminology. In 1990, the National Fire Service Incident Management System Consortium was established and enabled fire service representatives from both command systems to reach a consensus on incident command (Emergency Management Institute, 2005).

While ICS was a common tool for organizing fire resources, other public safety, emergency management agencies, NGO response organizations and health care were not standardized. Even in areas where ICS was in use, local variations existed. Additionally, the only federal requirement for the use of *an* ICS was in relation to hazardous materials response required by SARA (PL 99-499, 1986).

Although command and control issues were identified in after action reports from September 11, 2001, resistance to the adoption of ICS continued. In an October 8, 2002 article, the New York Times quoted the City of New York Police Commissioner, Raymond W. Kelly, responding to City Council's questioning of the command and control issues raised in the after action review of the city's response by McKinsey & Company, "There is the NIIMS system that keeps coming up … This is the national incident response system that is used by the federal government. It really is focused on forest fires, it is focused on municipalities that can't handle an incident by themselves, that need groupings of several agencies to come from all over a county

or indeed all over the country. I don't think that that kind of system is appropriate for New York City" (Baker, 2002).

On February 28, 2003, President George W. Bush issued Homeland Security Presidential Directive Number 5, Management of Domestic Incidents (Bush, 2003), with the purpose "To enhance the ability of the United States to manage domestic incidents by establishing a single, comprehensive national incident management system." HSPD-5 also directed the development of the NRP. NIMS came to include standardization requirements for command and management, preparedness, resource management, communications and information management, supporting technologies and ongoing management and maintenance.

ICS has as its organizing principles:

- Common terminology, to improve understanding across agencies and operations
- Modular organization, to allow utilization in small and large operations
- Management by objectives, to establish operational priorities and strategies
- Reliance on an Incident Action Plan (IAP), to document and communicate the incident commander's intent and direction
- Chain of command and unity of command, to assure accountability
- Unified Command, to include appropriate leadership of the operational forces, and
- Manageable span of control, based geographically or functionally, to improve supervision and evaluation

ICS is structured through two primary groupings of staff: command staff and general staff. The command staff performs functions in direct support of the incident commander. These

include *public information, safety* and *liaison* functions. The four general staff sections perform the functions to meet the needs of the response organization: *operations, logistics, planning* and *finance and administration*. This arrangement of responsibilities is used also in the organization of federal response operations under the NRP. An example table of organization for the NRP is shown in Figure 3. The ICS division of responsibilities and arrangement of actors is used also in the organization of federal response operations under the NRP. An example table of organization (TOO) for the NRP is shown in Figure 4.

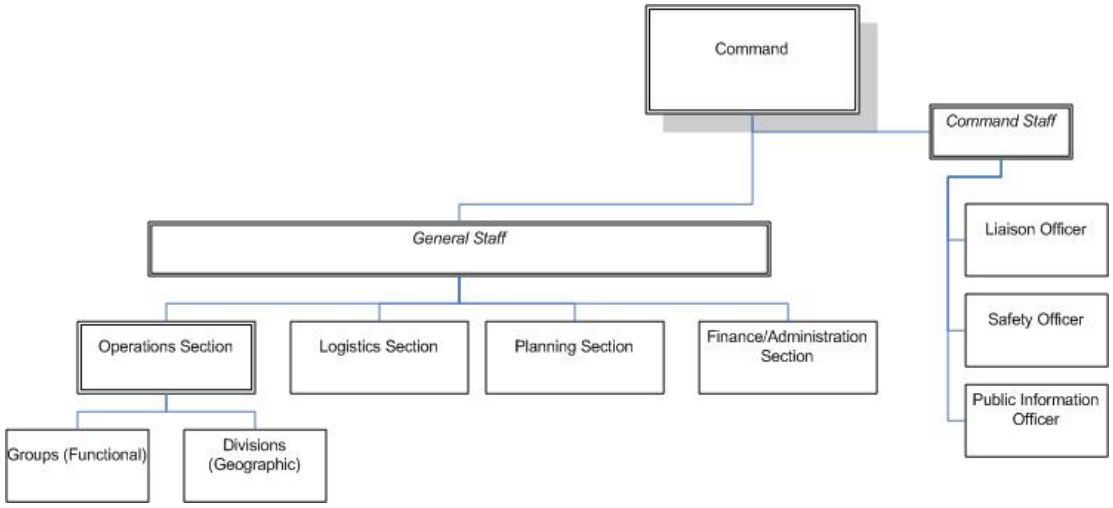

Figure 3: Incident Command System, Command and General Staff

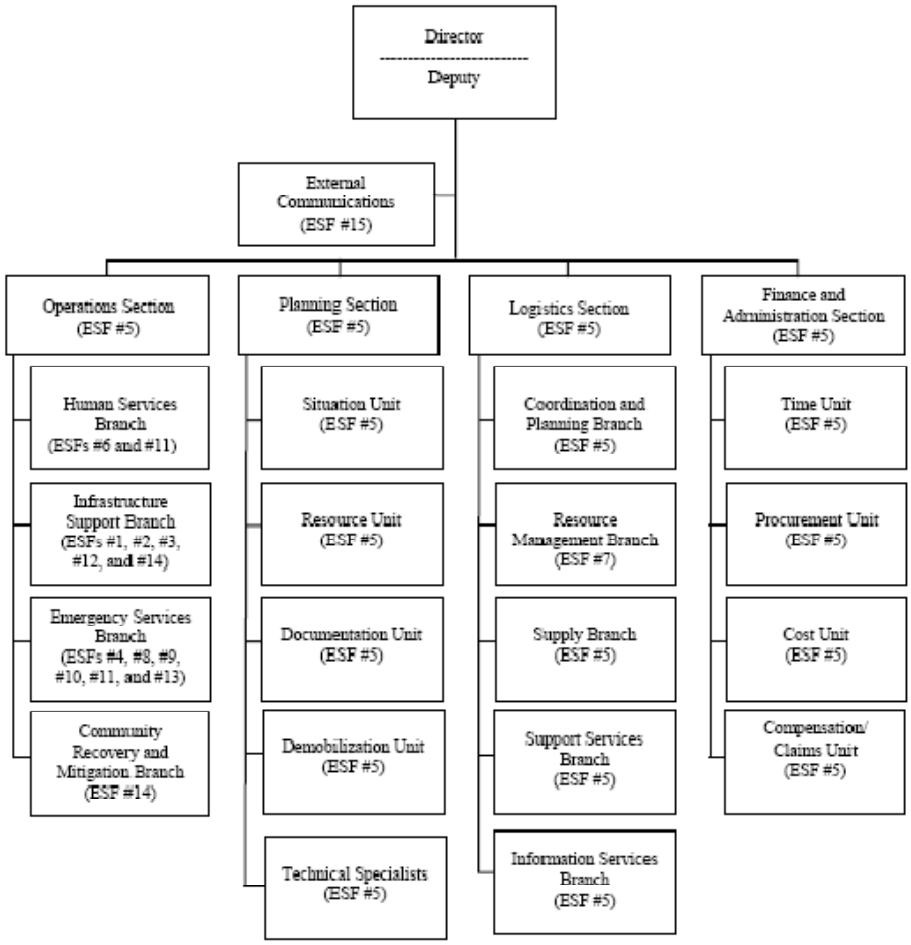

Figure 4: ICS as applied to the National Response Plan

4.2.1 FEMA Structure

President Carter created FEMA by Executive Order (Carter, 1979) from a variety of federal civil defense, disaster prevention and relief organizations. When the Department of Homeland Security was established by the Homeland Security Act of 2002 (PL107–296, 2002) FEMA was absorbed and became officially known as the Emergency Preparedness and Response Directorate, though this designation was short lived, and seldom used outside of DHS.

There are national and regional facilities and groups that coordinate federal disaster response. At the federal headquarters level, the Interagency Incident Management Group (IIMG) is comprised of senior officials from various federal agencies to lead the strategic response to an incident of national significance. The National Response Coordination Center (NRCC) is FEMA's headquarters point of coordination for response and recovery operations. The NRCC is staffed by ESF representatives.

FEMA maintains offices in the ten federal regions (see Figure 5). Each office maintains relationships with the state and territorial emergency management agencies within the region. To coordinate responses, each has a primary and alternate Regional Resource Coordination Center (RRCC). In the event of increased readiness or an actual event, the RRCC is staffed with representatives from the necessary ESFs for the disaster. If a declaration seems probable, the region will deploy an Emergency Response Team – Advance Element (ERT-A) to the state emergency operations center to coordinate response. Once a declaration has been issued, a Joint Field Office (JFO) will be established and the responsibilities of the RRCC and the ERT-A will absorb into the JFO.

Figure 5: Federal Regions (Source: FEMA website)

FEMA Regions IV (Atlanta, GA) and VI (Denton, TX) were the landfall regions. Due to magnitude of the events and the wide scale dispersion of evacuees to cities throughout the country, all regions were operational. Teams from other regions were sent into IV and VI to provide additional staffing and support. Additional supplements to the normal workforce were provided by reservists or “disaster assistance employees” (DAEs), temporary employees provided for by the Stafford Act.

4.3 STATE STRUCTURES

4.3.1 Standardization of Terms

The interstate variety of agency names and responsibilities presented a challenge to the coding of plans and reports. In order to specify activities rather than specific agency names, state agency analogues were created. For example, the variable name *st_eld* was used for state agencies that provide services to the elderly. In each state, there is a different name for these agencies: Alabama Department of Senior Services (Commission on Aging), Florida Department of Elder Affairs, Louisiana Governor's Office of Elderly Affairs, Mississippi Department of Aging and Adult Services, and the Texas Department of Aging and Disability Services.

4.3.2 ALABAMA (FEMA Region IV)

The State of Alabama has a landmass of 50,744 square miles and a general coastline of 53 miles (National Oceanographic and Atmospheric Administration, 1975). The state has 67 counties, two of which are coastal to the Gulf of Mexico. The population of the coastal counties is 540,258 or 12.1% of the state's total population of 4,599,030 (US Census Bureau, 2008).

The Alabama Department of Civil Defense was created by the Alabama Emergency Management Act of 1955, and renamed the Alabama Emergency Management Agency (AEMA) in 1983. The EMA Director reports to the Governor, and serves as the Assistant Director of Homeland Security. Homeland Security is a separate agency, created by the Alabama Homeland Security Act with no responsibilities for emergency management functions. The state EOC is located in Clanton, AL. The emergency operations plan ESF structure follows that of the NRP. Alabama adopted EMAC in 2001 (Bea, Runyon, & Warnock, 2004).

4.3.2.1 Stafford Act Declaration History for Alabama

Alabama received 11 Stafford Act declarations between 2001 and 2005: eight were major disasters, five of which were for tropical events. Alabama already had a declaration and ongoing recovery operation for Hurricane Dennis in July, 2005. Alabama received declarations for Katrina's landfall and for the support of other Gulf States' evacuations.

Table 25: Federal Declaration History, 2001-2005, Alabama

Class	Type	Dec	No	Date	Disaster
Natural	Severe Storm	MD	1362	3/5/2001	Severe Storms & Flooding
Natural	Fire	FMAD	2395	11/20/2001	Northeast Alabama Fire Complex
Natural	Severe Storm	MD	1399	12/7/2001	Severe Storms and Tornadoes
Natural	Tropical	MD	1438	10/9/2002	Tropical Storm Isidore
Natural	Severe Storm	MD	1442	11/14/2002	Severe Storms and Tornadoes
Natural	Severe Storm	MD	1466	5/12/2003	Severe Storms, Tornadoes and Flooding
Natural	Tropical	MD	1549	9/15/2004	Hurricane Ivan
Natural	Tropical	MD	1593	7/10/2005	Hurricane Dennis
Natural	Tropical	ED	3214	8/28/2005	Hurricane Katrina
Natural	Tropical	MD	1605	8/29/2005	Hurricane Katrina
Natural	Tropical Support	ED	3237	9/10/2005	Hurricane Katrina Evacuation

4.3.2.2 Katrina

The NHC issued the first advisory showing Alabama within the 3-day strike probability cone on Thursday, August 25. The first watches were posted on Saturday, August 27, changing to warnings later that day. Katrina made landfall as a category 3 hurricane at 06:10 CDT, Monday, August 29, and continued to affect the state's weather until the morning of August 30.

Alabama received an emergency declaration, FEMA-3214-EM on August 28 in advance of the storm and a presidential declaration of major disaster, FEMA-1605-DR for Katrina on August 29. The declaration eventually included 22 counties: 11 counties for public assistance (PA) and individual assistance (IA), 11 for PA only and all counties in the state eligible for the Hazard Mitigation Grant Program (HMGP). The population of the counties receiving IA and PA declarations was 852,464 (19.2%) and for PA only, 1,024,635 (23.0%). This represents 42.2% of the state. There were two fatalities indirectly attributed to Katrina in Alabama (Knabb, Rhome, & Brown, 2005).

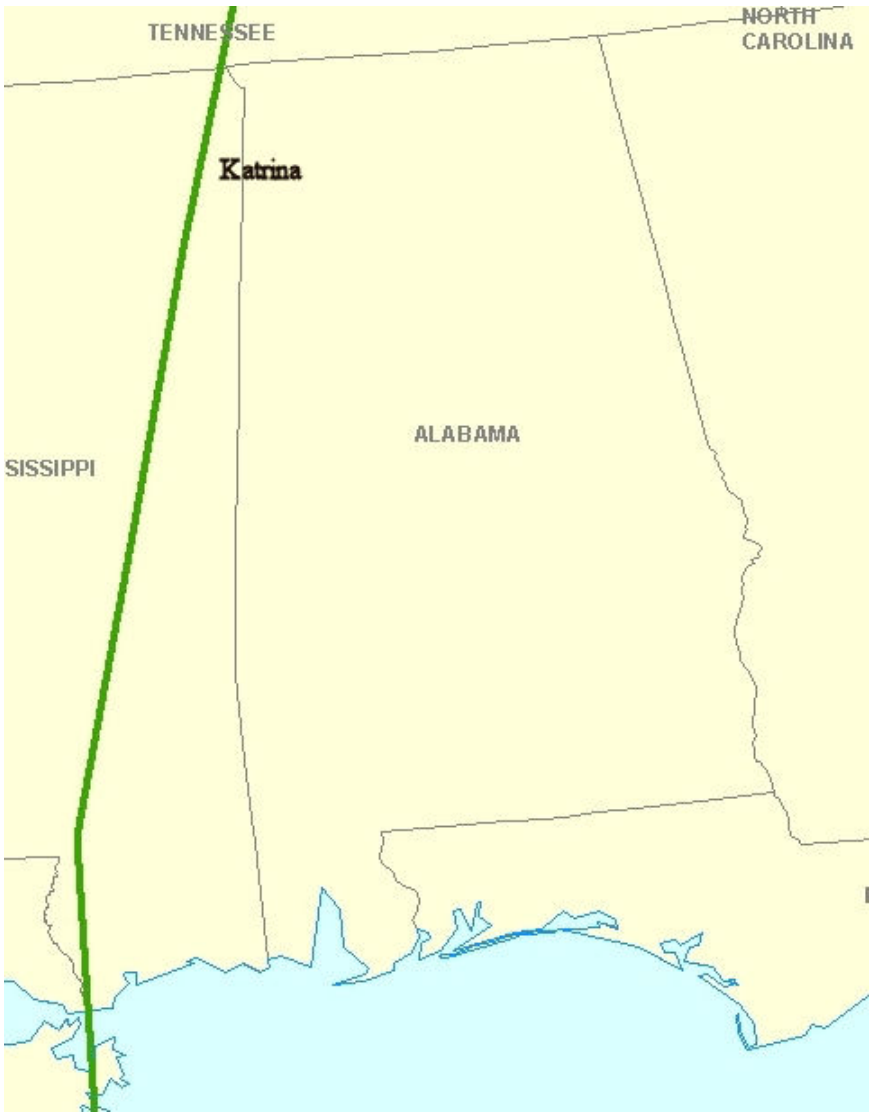

Figure 6: Storm Track, Katrina, Alabama

4.3.3 FLORIDA (FEMA Region IV)

The State of Florida has a landmass of 53,926 square miles and a general coastline of 1,350 miles: 580 on the Atlantic Coast and 770 on the Gulf Coast (National Oceanographic and Atmospheric Administration, 1975). The state has 67 counties, 35 of which are coastal. The

population of the coastal counties is 12,285,697 or 76.9% of the state's total population of 15,982,378 (US Census Bureau, 2008).

The Florida Division of Emergency Management (DEM) was created by the State Emergency Management Act. DEM is related administratively to the Department of Community Affairs, but is a separate entity, with the DEM director reporting to the Governor. A domestic (homeland) security office is maintained separate from the DEM, within the Florida Department of Law Enforcement. DEM maintains the state emergency operations center in Tallahassee, FL. Florida was one of the original stated to enter into EMAC (Bea, Runyon, & Warnock, 2004).

Florida's ESF structure differs from the NRP. Federal ESF #11, Agriculture and Natural Resources relates to State ESFs #11, Food and Water, and #17, Animal Protection and Agriculture. Federal ESF #13 Public Safety and Security is ESF #16 in the state plan. There is no specific state equivalent ESF for ESF #14, Long Term Community Recovery and Mitigation. The state plan has two additional ESFs, #13, Military Support and #16, Volunteer and Donation Management. The structure is compared to the NRP in Table 26.

Table 26: Florida ESF Structure

Federal		Florida	
ESF	Title	ESF	Title
1	Transportation	1	Transportation
2	Communications	2	Communications
3	Public Works and Engineering	3	Public Works and Engineering
4	Firefighting	4	Firefighting
5	Emergency Management	5	Info and Planning
6	Mass Care, Housing, and Human Services	6	Mass Care
7	Resource Support	7	Resources
8	Public Health and Medical Services	8	Health and Medical
9	Urban Search and Rescue	9	Search and Rescue
10	Oil and Hazardous Materials Response	10	Hazardous Materials
11	Agriculture and Natural Resources	11	Food and Water
		17	Animal Protection and Agriculture
12	Energy	12	Energy
13	Public Safety and Security	16	Law Enforcement and Security
14	Long-Term Community Recovery and Mitigation	-	-
15	External Affairs	14	Public Information
-	Department of Defense	13	Military Support
-	Voluntary Agency Liaison (VAL)	15	Volunteers and Donations

4.3.3.1 Stafford Act Declaration History for Florida

Florida had more Stafford Act declarations than the other states in the study for the 2001-2005 period than the other states in the study. Of 23 declarations, 12 were MDs, ten of which were for tropical events. Florida already had a declaration and ongoing recovery operation for Hurricane Dennis, which hit the Panhandle in July, 2005. Florida received declarations for Katrina and Wilma's landfall and for support of other Gulf States' Katrina evacuations.

Table 27: Federal Declaration History, 2001-2005, Florida

Class	Type	Dec	No	Date	Disaster
Natural	Winter	MD	1359	2/6/2001	Severe Freeze
Natural	Fire	FMAD	2353	2/18/2001	Lakeland Fire Complex
Natural	Fire	FMAD	2355	2/19/2001	Caloosahatchee Fire Complex
Natural	Fire	FMAD	2354	2/19/2001	Okeechobee Fire Complex
Natural	Fire	FMAD	2357	4/17/2001	Orlando Fire Complex
Natural	Fire	FMAD	2358	4/18/2001	Myakka Fire Complex
Natural	Fire	FMAD	2359	4/25/2001	Everglades Fire Complex
Natural	Fire	FMAD	2360	5/15/2001	Chipola River Fire Complex
Natural	Fire	FMAD	2361	5/16/2001	Escambia Fire Complex
Natural	Fire	FMAD	2363	5/23/2001	Perry Fire Complex
Natural	Tropical	MD	1381	6/17/2001	Tropical Storm Allison
Natural	Tropical	MD	1393	9/28/2001	Tropical Storm Gabrielle
Natural	Severe Storm	MD	1460	4/25/2003	Tornado
Natural	Severe Storm	MD	1481	7/29/2003	Severe Storms and Flooding
Natural	Tropical	MD	1539	8/13/2004	Hurricane Charley and Tropical Storm Bonnie
Natural	Tropical	MD	1545	9/4/2004	Hurricane Frances
Natural	Tropical	MD	1551	9/16/2004	Hurricane Ivan
Natural	Tropical	MD	1561	9/26/2004	Hurricane Jeanne
Natural	Tropical	MD	1595	7/10/2005	Hurricane Dennis
Natural	Tropical	MD	1602	8/28/2005	Hurricane Katrina
Natural	Tropical Support	ED	3220	9/5/2005	Hurricane Katrina Evacuation
Natural	Tropical	ED	3259	9/20/2005	Tropical Storm Rita
Natural	Tropical	MD	1609	10/24/2005	Hurricane Wilma

4.3.3.2 Katrina

The NHC issued the first advisory showing Florida within the 3-day strike probability cone on Tuesday, August 23. The first watches were posted later that day, and warnings by Wednesday, August 24. Katrina made landfall as a category 1 hurricane on Thursday, August 25 near the Miami-Dade and Broward County line. By 01:00 the next morning, Katrina proceeded off the

Gulf Coast of Florida near Cape Sable. On Saturday, August 27, the NHC posted hurricane warnings for the Panhandle for the return of Katrina to Florida, which occurred on Monday, August 29.

Florida received a presidential declaration of major disaster, FEMA-1602-DR for Katrina on August 28. The declaration eventually included 11 counties for PA only, HMGP statewide, with no IA approved. Florida received an emergency declaration, FEMA-3220-EM on September 5 in support of the Katrina Evacuation from other parts of the Gulf Coast. There were 14 fatalities directly or indirectly attributed to Katrina in Florida (Knabb, Rhome, & Brown, 2005).

4.3.3.3 Rita

The NHC issued the first advisory showing South Florida and the Keys within the 3-day strike probability cone on Saturday, September 17. The first watches were posted on Sunday, September 18, which continued and expanded on Monday, September 19. Rita did not make landfall in Florida, but rain bands did affect the Keys. Rip currents in the Gulf related to one death in Florida (Knabb, Brown, & Rhome, 2006).

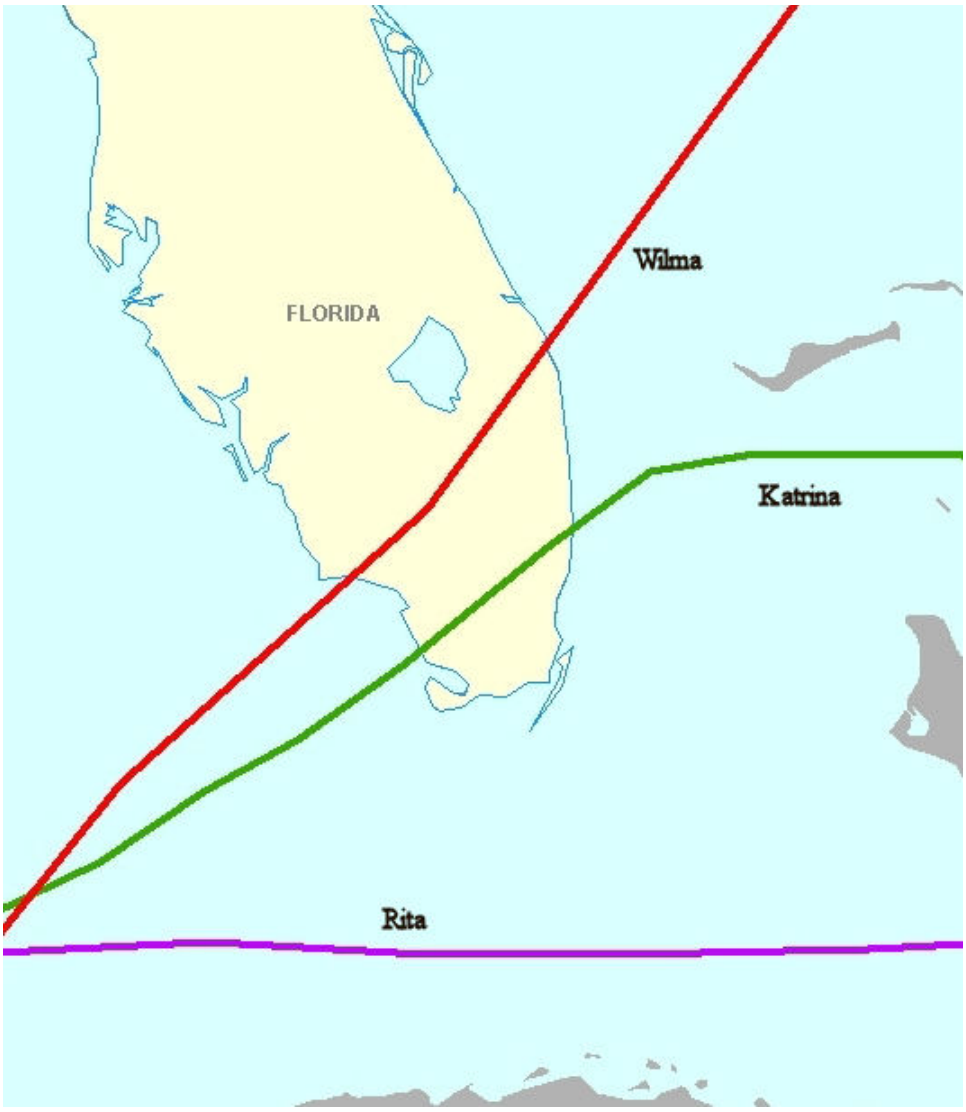

Figure 7: Storm Tracks, Southern Florida

4.3.3.4 Wilma

The NHC issued the first advisory showing South Florida and the Keys within the 3-day strike probability cone on Wednesday, October 19, but the storm moved slower than early forecasts anticipated. The first watches were posted on Saturday, October 22 changing to warnings that evening. Wilma made landfall as a category 3 hurricane on Monday, October 24 near Cape

Romano at approximately 06:30 and traveled quickly across the state, entering the Atlantic Ocean near Jupiter as a category 2 hurricane at about 11:00.

Wilma produced 10 tornadoes between October 23 and 24. Five fatalities were reported, and $20.6 billion in damages was estimated, making Wilma the third costliest hurricane behind Katrina and Andrew (Pasch, Blake, Cobb, & Roberts, 2006). Florida received a presidential declaration of major disaster, FEMA-1609-DR for Wilma on October 24. IA was approved for 20 counties (13 counties for PA and IA, and seven for PA only) and HMGP statewide. The population of the counties receiving IA and PA declarations was 6,770,717 (42.4%) and for PA only, and 1,270,514 (7.9%). This represents 50.3% of the state.

4.3.3.5 Combined Impact

For the two storms that made landfall and impacted the state, 13 (19.4%) counties received IA and PA for at least one storm, representing 6,770,717 (42.4%) residents and 14 (20.9%) received PA only for at least one storm, representing 2,066,372 (12.9%) residents. A total of 27 (40%) counties and 8,837,089 (55%) residents were covered by a declaration.

4.3.4 LOUISIANA (FEMA Region VI)

The State of Louisiana has a landmass of 43,561 square miles and a general coastline of 397 miles (National Oceanographic and Atmospheric Administration, 1975). The state has 64 parishes, 13 of which are coastal to the Gulf of Mexico. The population of the coastal parishes is 1,701,551 or 38.1% of the state's total population of 4,468,976 (US Census Bureau, 2008)

During the 2005 Hurricane season, the Louisiana Office of Homeland Security and Emergency Preparedness (LOHSEP) was housed within the Military Department, reporting to the Adjutant General. In 2006, the office was transferred to the Governor's office (GOHSEP). Emergency management is governed by the Homeland Security and Emergency Assistance and Disaster Act. The State EOC is located in Baton Rouge. Louisiana follows the NRP ESF structure, with the addition of ESF #16, Military Support. The state was one of the original states to enter into EMAC (Bea, Runyon, & Warnock, 2004).

4.3.4.1 Stafford Act Declaration History for Louisiana

Between 2001 and 2005, Louisiana had 12 Stafford Act declarations: nine major disasters, seven of which were for tropical events. Louisiana received declarations for Katrina and Rita's landfall.

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Table 28: Federal Declaration History, 2001-2005, Louisiana

Class	Type	Dec	No	Date	Disaster
Natural	Winter	MD	1357	1/12/2001	Severe Winter Storm
Natural	Tropical	MD	1380	6/11/2001	Tropical Storm Allison
Natural	Tropical	MD	1435	9/27/2002	Tropical Storm Isidore
Natural	Tropical	MD	1437	10/3/2002	Hurricane Lili
Technological	Space	ED	3172	2/1/2003	Loss of the Space Shuttle *Columbia*
Natural	Severe Storm	MD	1521	6/8/2004	Severe Storms and Flooding
Natural	Tropical	MD	1548	9/15/2004	Hurricane Ivan
Natural	Tropical	MD	1601	8/23/2005	Tropical Storm Cindy
Natural	Tropical	ED	3212	8/27/2005	Hurricane Katrina
Natural	Tropical	MD	1603	8/29/2005	Hurricane Katrina
Natural	Tropical	ED	3260	9/21/2005	Hurricane Rita
Natural	Tropical	MD	1607	9/24/2005	Hurricane Rita

In July, 2004, local, state, federal and NGO emergency management officials conducted a planning exercise called "Hurricane Pam," affecting 13 southeastern Louisiana parishes. The scenario included 120 MPH winds, 20" of rain and the overtopping of levees, resulting in the

destruction of 500,000 to 600,000 structures and the displacement of one million individuals. The after action plan called for the identification of 1,000 shelters capable of operating for up to 100 days, but in-state resources were only capable of providing shelter support for the first three to five days (Federal Emergency Mangement Agency, 2004).

4.3.4.2 Katrina

The NHC issued the first advisory showing Louisiana within the 3-day strike probability cone on Friday, August 26. The first watches were posted on Saturday, August 27, changing to warnings later that day. Katrina made landfall as a category 3 hurricane at 06:10 CDT, Monday, August 29, and continued to affect the state's weather until the morning of August 30.

Louisiana received an emergency declaration, FEMA-3212-EM on August 27 in advance of the storm and a presidential declaration of major disaster, FEMA-1603-DR for the impact on August 29. The declaration eventually included 64 parishes: 31 parishes for PA and IA, and 33 for PA only, and HMGP statewide. The population of the counties receiving IA and PA declarations was 3,109,601 (69.6%) and for PA only, 1,359,375 (30.4%). This represents 100% of the state. There were an estimated 1,577 fatalities directly or indirectly attributed to Katrina in Louisiana (Knabb, Rhome, & Brown, 2005).

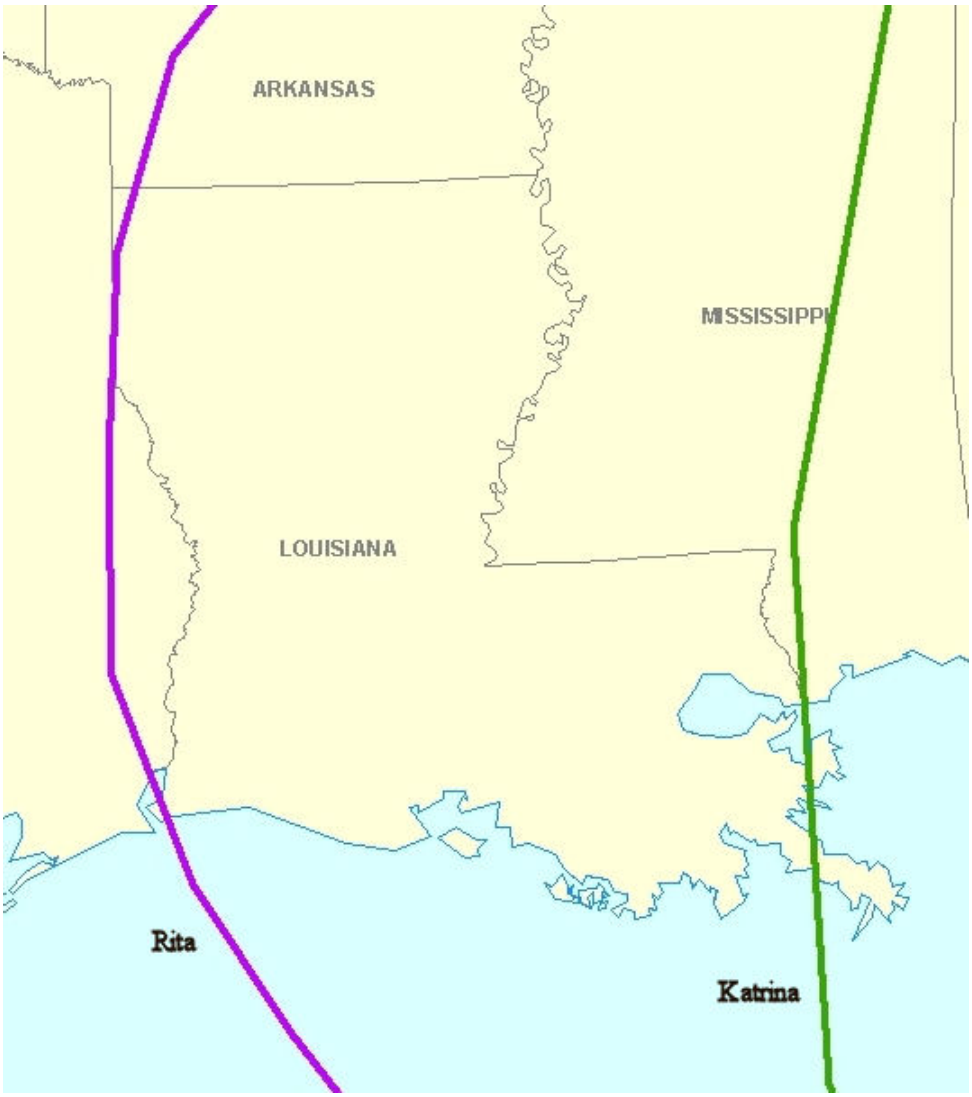


Figure 8: Storm Tracks, Katrina and Rita, Louisiana

4.3.4.3 Rita

The NHC issued the first advisory showing Louisiana within the 3-day strike probability cone on Tuesday, September 20. The first watches were posted on Wednesday, September 21, changing to warnings on Thursday. Rita made landfall on Saturday, September 24 near the Texas border as a category 3 hurricane at approximately 07:40. Rita followed the state line, becoming a tropical

storm near Beaumont, TX at noon. By 02:00 Sunday morning, Rita crossed the Louisiana - Arkansas state line as a tropical depression.

Louisiana received an emergency declaration, FEMA-3260-EM on September 21 in advance of Rita, and a presidential declaration of major disaster, FEMA-1607-DR on September 24. The declaration eventually included 62 parishes (23 parishes for PA and IA, and 39 for PA only) and HMGP statewide. The population of the counties receiving IA and PA declarations was 2,451,646 (54.9%) and for PA only, 2,017,330 (45.1%). This represents 100% of the state. There was one death attributed to Rita in Louisiana (Knabb, Brown, & Rhome, 2006).

4.3.4.4 Combined Impact

For the two storms that made landfall and impacted the state, 38 (59.4%) parishes received IA and PA for at least one storm, representing 3,409,660 (76.3%) residents. 26 (40.6%) received PA only for at least one storm, representing 1,059,316 (23.7%) residents. This represents 100% of the counties and population.

4.3.5 MISSISSIPPI (FEMA Region IV)

The State of Mississippi has a landmass of 46,906 square miles and a general coastline of 44 miles (National Oceanographic and Atmospheric Administration, 1975). The state has 82 counties, three of which are coastal to the Gulf of Mexico. The population of the coastal counties is 363,988 or 12.8% of the state's total population of 2,844,658 (US Census Bureau, 2008).

The Mississippi Emergency Management Agency (MEMA) was created by the Mississippi's Emergency Management Law. MEMA is an independent agency and the director reports directly to the governor. A separate Office of Homeland Security exists in the state. The

state emergency operations center is located in Pearl. Mississippi follows the same ESF structure as the NRP. Mississippi was one of the original states to enter into EMAC (Bea, Runyon, & Warnock, 2004).

4.3.5.1 Stafford Act Declaration History for Mississippi

Mississippi had 12 Stafford Act declarations between 2001 and 2005: 11 major disasters, five of which were for tropical events. Mississippi already had a declaration and an ongoing recovery operation for Hurricane Dennis, which made landfall in July, 2005. Mississippi received a declaration for Katrina's landfall.

Table 29: Federal Declaration History, 2001-2005, Mississippi

Class	Type	Dec	No	Date	Disaster
Natural	Severe Storm	MD	1360	2/23/2001	Tornadoes and Severe Storms
Natural	Severe Storm	MD	1365	4/17/2001	Severe Storms & Flooding
Natural	Tropical	MD	1382	6/21/2001	Tropical Storm Allison
Natural	Severe Storm	MD	1398	12/7/2001	Severe Storms and Tornadoes
Natural	Tropical	MD	1436	10/1/2002	Tropical Storm Isidore
Natural	Severe Storm	MD	1443	11/14/2002	Severe Storms and Tornadoes
Natural	Severe Storm	MD	1459	4/24/2003	Severe Storms, Tornadoes and Flooding
Natural	Severe Storm	MD	1470	5/23/2003	Severe Storms, Tornadoes, and High Winds
Natural	Tropical	MD	1550	9/15/2004	Hurricane Ivan
Natural	Tropical	MD	1594	7/10/2005	Hurricane Dennis
Natural	Tropical	ED	3213	8/28/2005	Hurricane Katrina
Natural	Tropical	MD	1604	8/29/2005	Hurricane Katrina

4.3.5.2 Katrina

The NHC issued the first advisory showing Mississippi within the 3-day strike probability cone on Thursday, August 25. The first watches were posted on Saturday, August 27, changing to warnings later that day. Katrina made landfall as a category 3 hurricane at 06:10 CDT, Monday,

August 29, and by 14:00, was a category 1 hurricane as it passed over central Mississippi. By 20:00, as Katrina neared Meridian, MS, it dropped to a tropical storm.

Mississippi received an emergency declaration, FEMA-3213-EM on August 28 in advance of the storm, and a presidential declaration of major disaster, FEMA-1604-DR for Katrina's impact on August 29. The declaration eventually included 82 counties (49 counties for PA and IA, and 33 for PA only) and HMGP statewide. The population of the counties receiving IA and PA declarations was 1,931,619 (67.9%) and for PA only, 913,039 (32.1%). This represents 100% of the state. There were 238 fatalities directly or indirectly attributed to Katrina in Mississippi (Knabb, Rhome, & Brown, 2005).

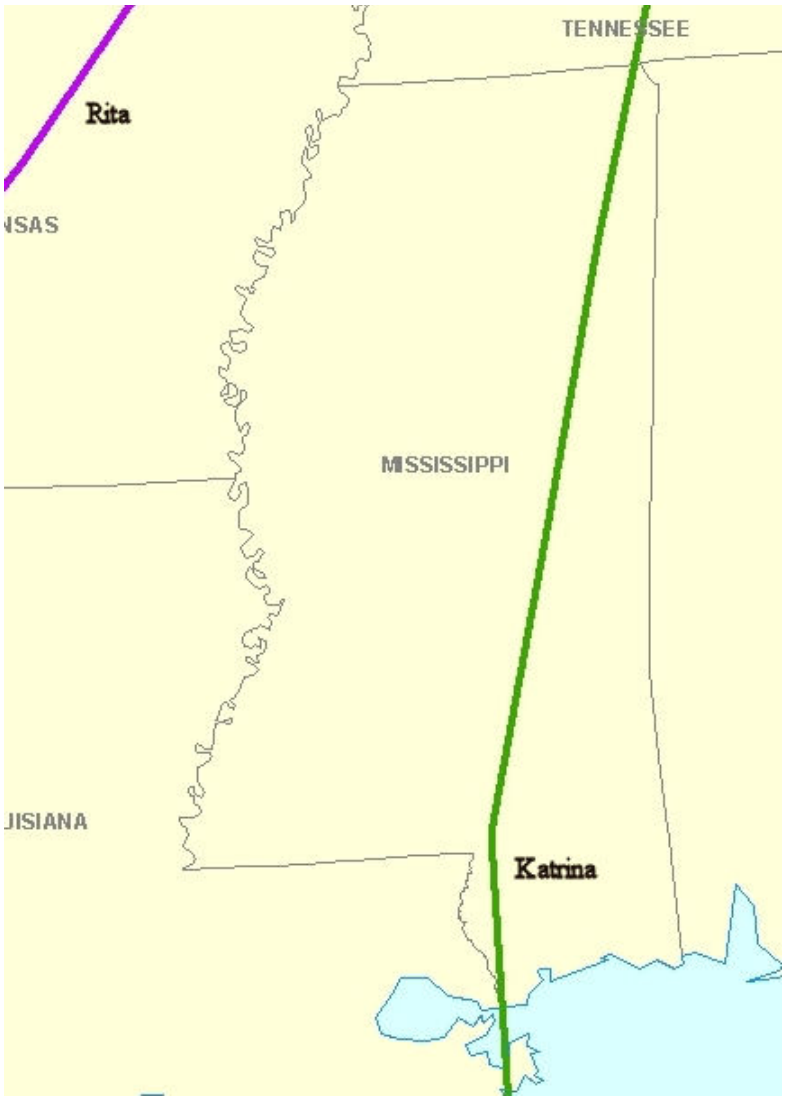


Figure 9: Storm Track, Katrina, Mississippi

4.3.6 TEXAS (FEMA Region VI)

The State of Texas has a landmass of 261,797 square miles and a general coastline of 367 miles (National Oceanographic and Atmospheric Administration, 1975). The state has 254 counties, 15 of which are coastal to the Gulf of Mexico. The population of the coastal counties is 5,019,463 or 24.1% of the state's total population of 20,851,820 (US Census Bureau, 2008).

The Texas Disaster Act of 1975 established the Division of Emergency Management (DEM) within the Department of Public Safety. The Director of Public Safety also serves as the Director of DEM and the Office of Homeland Security. A state emergency management coordinator is responsible for the day-to-day operation of DEM. The state operations center is located in Austin, TX. The state has 22 disaster districts, each with a disaster district committee chaired by a commanding officer of the Texas Highway Patrol. Each committee includes local representatives of state agencies, boards, and commissions and organized volunteer groups with representation on the state emergency management council. Each disaster district maintains an emergency operations center (Bea, Runyon, & Warnock, 2004).

The Texas ESF structure is significantly different from the NRP, though all NRP functions are represented. There are 23 ESF's, and their relation to NRP ESF's is described in Table 30.

Table 30: Texas ESF Structure

Federal		Texas	
ESF	Title	Annex	Title
1	Transportation	S	Transportation
2	Communications	B	Communications
2	Communications	A	Warning
3	Public Works and Engineering	K	Public Works and Engineering
4	Firefighting	F	Firefighting
5	Emergency Management	N	Direction and Control
6	Mass Care, Housing, and Human Services	C	Shelter and Mass Care
6	Mass Care, Housing, and Human Services	E	Evacuation
7	Resource Support	M	Resource Support
8	Public Health and Medical Services	H	Health and Medical Services
9	Urban Search and Rescue	R	Search and Rescue
10	Oil and Hazardous Materials Response	Q	Hazardous Materials/Oil Spill Response
11	Agriculture and Natural Resources	V	Food and Water
12	Energy	L	Energy and Utilities
13	Public Safety and Security	G	Law Enforcement
14	Long-Term Community Recovery/Mitigation	J	Recovery
14	Long-Term Community Recovery/Mitigation	P	Hazard Mitigation
15	External Affairs	I	Public Information
-	Department of Defense	W	Military Support
-	Voluntary Agency Liaison	T	Donations Management

4.3.6.1 Stafford Act Declaration History for Texas

Texas experienced 12 Stafford Act declarations between 2001 and 2005: seven major disasters, three of which were for tropical events. Texas received declarations for Rita's landfall and for the support of other Gulf States' evacuations.

Table 31: Federal Declaration History, 2001-2005, Texas

Class	Type	Dec	No	Date	Disaster
Natural	Fire	FMAD	2351	1/5/2001	Alsbury Fire
Natural	Fire	FMAD	2352	1/5/2001	Amherst Street Fire
Natural	Winter	MD	1356	1/8/2001	Severe Winter Storm
Natural	Severe Storm	MD	1379	6/9/2001	Severe Storms & Flooding
Natural	Severe Storm	MD	1425	7/4/2002	Severe Storms and Flooding
Natural	Tropical	MD	1434	9/26/2002	Tropical Storm Fay
Natural	Severe Storm	MD	1439	11/5/2002	Severe Storms, Tornadoes, and Flooding
Technological	Space	ED	3171	2/1/2003	Loss of the Space Shuttle Columbia
Natural	Tropical	MD	1479	7/17/2003	Hurricane Claudette
Natural	Tropical	ED	3216	9/2/2005	Hurricane Katrina
Natural	Tropical	ED	3261	9/21/2005	Hurricane Rita
Natural	Tropical	MD	1606	9/24/2005	Hurricane Rita

4.3.6.2 Katrina

While Katrina did affect the weather in Texas, the greatest impact was from the large number of evacuees that left Louisiana before and after the storm, and those evacuated after the storm. The first shelters opened on Saturday, August 27. By Sunday evening, August 28, Texas had opened or placed on standby 114 shelters in anticipation of 28,000 evacuees. As the disaster grew, and the New Orleans Superdome “shelter of last resort” had to be evacuated, Texas Governor Rick Perry and Louisiana Governor Kathleen Blanco reached an agreement on Wednesday, August 31 that the Superdome evacuees would be transferred to the Houston Astrodome. At the height of the sheltering operations, Houston alone would house 27,000 people in congregate shelters (Townsend, 2006). Texas received an emergency declaration, FEMA-3216-EM to support the Katrina evacuations on September 2. By August, 2006, the FEMA reimbursement to Texas for sheltering, interim housing and special protective services was $514 million (Federal Emergency Management Agency, 2006).

4.3.6.3 Rita

The NHC issued the first advisory showing Texas within the 3-day strike probability cone on Tuesday, September 20. The first watches were posted on Wednesday, September 21 changing to warnings on Thursday. Rita made landfall on Saturday, September 24 near the Louisiana border as a category 3 hurricane at approximately 07:40 AM. Rita followed the state line, becoming a tropical storm near Beaumont at noon. By 02:00 AM Sunday morning, Rita crossed the Texas, Louisiana, Arkansas line as a tropical depression.

Texas received an emergency declaration, FEMA-3261-EM on September 21 in advance of the storm and a presidential declaration of major disaster, FEMA-1606-DR for Rita on September 24. The declaration eventually included all counties (20 counties for PA and IA, and the rest for PA only) and HMGP statewide. The population of the counties receiving IA and PA declarations was 5,416,433 (26.0%) and for PA only, 15,435,387 (74%). This represents 100% of the state. There were four fatalities directly and 55 indirectly attributed to Rita in Texas (Knabb, Brown, & Rhome, 2006).

Figure 10: Storm Track, Rita, Texas

4.4 SUMMARY

The mass care response networks are comprised of federal and state government agencies, a variety of non-governmental and faith based organizations, and ESF and ICS positional actors. These actors are included in a variety of configurations across the states and the planned, reported, perceived and desired (PRPD) networks. The federal government and the individual states define their plans, and thus their planned networks, according to their perceived needs. What is not clear is if analysis of prior disaster experience is applied to planning actor inclusion. The states have similar federal disaster experiences, except for Florida at nearly twice the declarations, yet the anticipatory ability of the state plans in the Katrina/Rita/Wilma responses was at best 28.95% (explained in detail in Chapter 5.) This may have been an effect of the scope of the storms and the availability of response resources across such a wide geographic area, or may indicate the need for the revision of EOPs.

The appropriate inclusion and arrangement of actors in the plan should reduce information search in a disaster, thus improving the common operating picture (COP). The PRPD analysis concept can guide the identification of network actors and structures. This will be further explored in the next two chapters.

5.0 NETWORK COMPARISONS

5.1 OVERVIEW OF ANALYSIS

5.1.1 Description of Networks Presented

This chapter focuses on the first research question, "What are the differences and similarities among the federal and state disaster management networks anticipated in the NRP and state plans, reported during actual incidents, perceived by practitioners post-event, and desired by those actors for future events? The designations of the networks are *planned*, *reported*, *perceived* and *desired (PRPD).*"

The analysis presented describes the nature of the networks for each state, the regional coordination structures, and the combination of all networks. For the analysis of the planned mass care networks, two are shown: the state plan and the state plan joined with the NRP. This information was obtained by content analysis of the state EOPs and NRP. These analyses were used in comparison to the remaining networks to determine the ability of the plans to anticipate the networks that were identified in the remaining networks.

The analysis of the reported networks required the content analysis of sitreps as described in Section 3.5. The sitreps for the state and federal EMAs were combined due to apparent

overlap of reporting. The reported networks were the largest in three of the states, and most centralized in four. This may be due to the hierarchical nature of how the reports are collated or that more information was available to the reporter at the time of preparation.

The analysis of the perceived and desired networks was enabled by the interview data described in Section 3.4. The data is presented from the practitioner's point of view, and will be necessarily limited to the knowledge of actors that they had local to their operations. This is both limiting, as they do not have the larger picture of mass care, and expanding, as they had knowledge of actors that were not foretold in planning or made it into the sitreps. Their perceptions also provide insight into the informal interactions between other known actors. The desired networks are a result of these perspectives, and do not necessarily represent a maximized *desirable* network.

The networks for each state are combined into an overall network to identify the total population of actors. Care should be taken in assuming that the combined network provides a comprehensive list of actors that should be included in EOPs. Inclusion of an actor may have been the result of time-dependent satisficing or a source of last resort rather than the best choice for the task. The complete planned, reported, perceived and desired (PRPD) analysis concept will provide the validity to better guide to planning inclusion and situation reporting.

A separate analysis is shown for regional and national coordination networks. These included interviews with individuals working at coordination support facilities such as the Regional Resource Coordination Center (RRCC), National Response Coordination Center (NRCC), ARC Disaster Operations Center (DOC) and other locations. These interviews provided the unique perspective on the support activities provided to the state-based operations. There are no analyses of planned or reported networks in this section.

Finally, all of the networks are aggregated to show the overall planned, reported, perceived, desired and combined networks. This provides a description of the nature of the mass care efforts across the entire Gulf Coast, and a clearer guide to improving the actors' communication flow and technology, as well as the organization of the response actors to improve common operating picture (COP) development.

5.1.2 Review of Measurements

The following measurements are used in the analysis of the network data:

- *Size* refers to the number of nodes within the network. The greater the number of nodes (k), the greater the possible number of ordered pairs (k * k-1).
- *Density* describes how close a network is to achieving its total potential of ordered pairs.
- *Average number of ties* refers to the average number of nodes to which a node in the network is connected. This can also be considered the mean number of near neighbors within the network.
- *Average tie length* refers to the mean distance between nodes in the network. A lower average tie length indicates that information travels a shorter distance with fewer intermediaries between actors in the network.
- *Network Centrality Measures* indicate the nature of how the network compares to a perfect "star network" in which all information must pass through a single gatekeeper. This is the ultimately controlled network. The *Freeman's node betweenness* indicates the centrality related to actors being in the direct path of information between actors. The *flow centrality* measure is a measure of the

indirect influence that actors have over information flow. This is described more in context of the measures within each network analysis.

- *Betweenness* describes the intermediary nature of a node. Higher values indicate that the node lies between more connections than other nodes, and can facilitate or hinder communication between them
- *Closeness* describes the overall proximity to other nodes within the network. Higher values indicate that the node has more direct connections to other nodes in the network without intermediaries, reducing the interference from other nodes which may attempt to exercise control or influence
- *Out-degree* refers to the sum of connections from the node to others. Higher values indicate how influential a node can be.
- *In-degree* is the sum of connections to a node from others. Values indicate the amount of information a node can receive; higher values can indicate prestige or power, but also indicate that the node can suffer from information overload.

A full description of the network measures is provided in Section 3.5.

5.2 ALABAMA

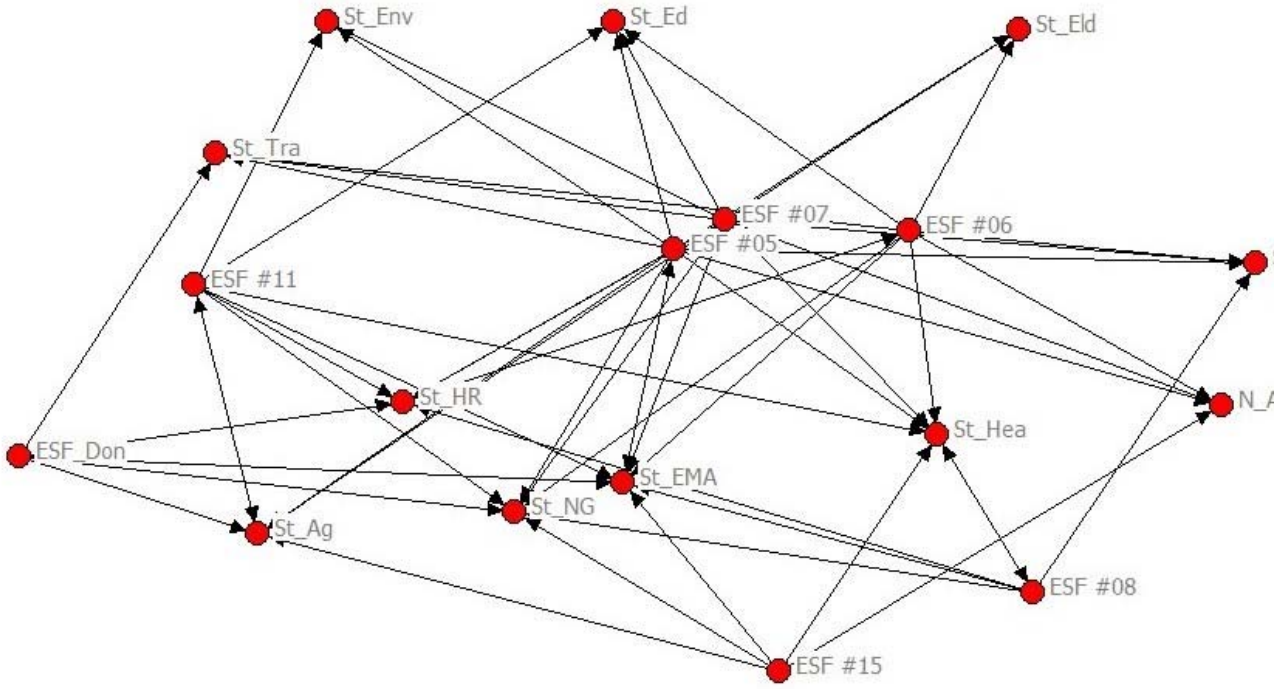
5.2.1 Planned Network Summary – Alabama State Plan

The network formed within the Alabama State Plan (PLN_{AL}) contains eighteen (18) actors *(k)* for a network size of 306 ($k*k$-1). This is small, but comparable to the Florida and Texas plans. The

58 observed ties result in a modified network density of 0.189, which indicates that 18.9% of the available connections between actors have been made. The average number of ties per actor is 3.222 with an average tie length, or distance between all actors in the network, of 2.102. Compared to the mass care portion of the NRP (PLN_{NRP6}), PLN_{AL} is a smaller and denser network, which should make communication easier, but limits the number of potential actors with which to interact.

This network is primarily considered source-dominated in the connectedness and flow of information between the majorities of the actors (quad-B). This indicates that the majority of the actors have a higher degree of information outflow than inflow; they initiate more requests for information and service than they provide to others. Appropriately managed, this can spread work among a larger number of actors supporting a few, potentially busier, actors.

The node betweenness network centrality index (Freeman's) is 0.18% which indicates a less centralized network, with fewer actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 54.41% which indicates a larger number of actors with more general influence over the ties between actors. This can indicate that there are fewer opportunities for bottle-necks, or choke-points of information to be created or exploited.



Legend:			
esf #05	Emergency Management	*st_ed*	State Agency, Education
esf #06	Mass Care, Housing & Human Services	*st_eld*	State Agency, Elderly
esf #07	Resource Support	*st_ema*	State Agency, EMA
esf #08	Public Health and Medical Services	*st_env*	State Agency, Environment
esf #11	Agriculture and Natural Resources	*st_hea*	State Agency, Health
esf #15	External Affairs	*st_hr*	State Agency, Human Resources
esf_don	Donation Management	*st_mh*	State Agency, Mental Health / Retardation
n_arc	American Red Cross	*st_ng*	State Agency, Military / National Guard
st_ag	State Agency, Agriculture	*st_tra*	State Agency, Transportation

Figure 11: Planned Network Diagram –State Plan, Alabama

5.2.1.1 Actor and Interaction Analysis

The betweenness mean of the network is 0.074 with moderate variability (SD 0.042) and the centrality mean is 0.082 with moderate variability (SD 0.056). This moderate variability indicates that the more influential actors are not necessarily constrained in the manner in which they may interact or who they interact with. The actor with the greatest positional advantage, both direct and indirect, between other actors is the state emergency management agency (*st_ema*, nBet 0.179, *z* 2.476, nFlow 0.217, *z* 2.407). The state EMA has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are ESF #05 Emergency Management (*esf#05,* out 0.066, *z* 1.488, quad-B) and ESF #07 Resource Support (*esf #07,* out 0.066, *z* 1.488, quad-B).

The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: the state emergency management agency (*st_ema*, in 0.042, *z* 1.543, quad-C) , the National Guard (*st_ng*, in 0.042, *z* 1.543, quad-B), and the state health department (*st_hea,* in 0.036, *z* 1.086, quad-C).

Table 32: Centrality, Power and Connectedness - State Plan, Alabama

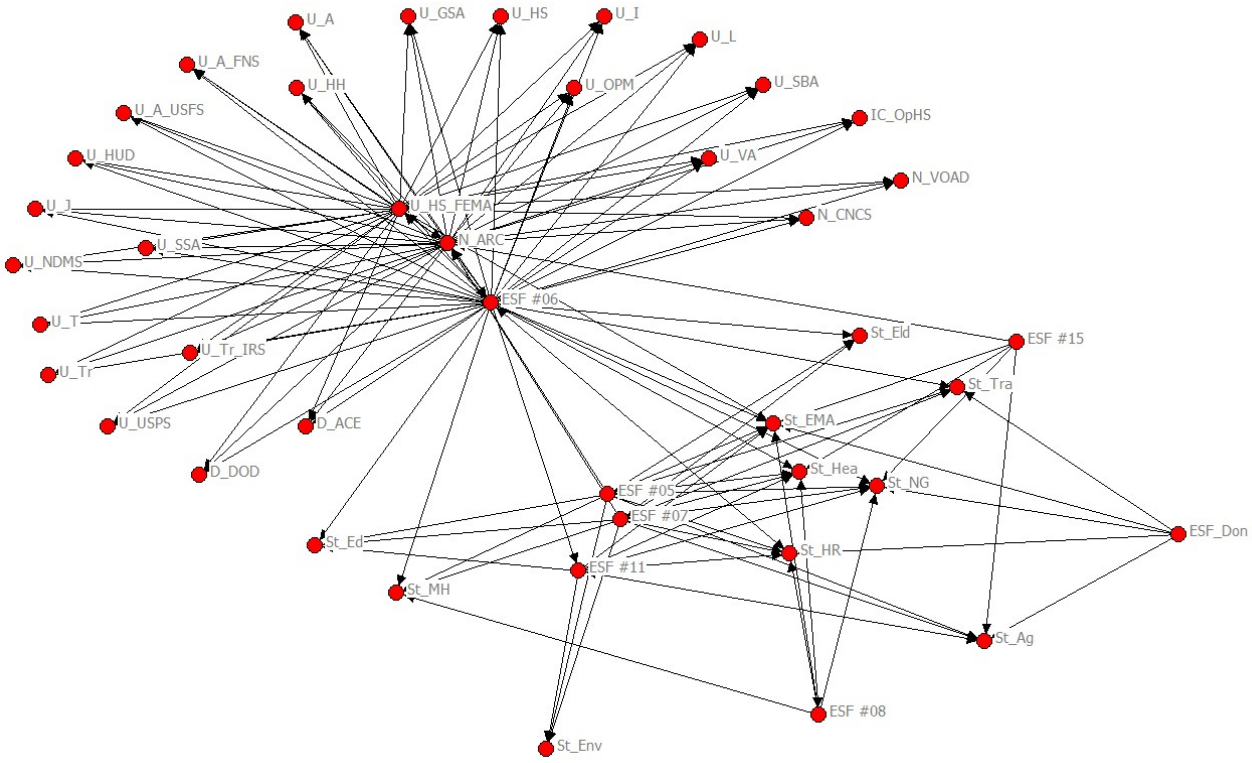
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
st_ema	State EMA	0.179	2.476	1	0.217	2.407	1
esf #05	Emergency Mgmt	0.08	0.154	2	0.031	-0.92	8
esf #07	Resource Mgmt	0.08	0.154	2	0.031	-0.92	8
esf #06	Mass Care	0.075	0.04	4	0.069	-0.232	6
esf #11	Agriculture	0.059	-0.357	5	0.051	-0.571	7
2. Ranked by Flow Centrality							
st_ema	State EMA	0.179	2.476	1	0.217	2.407	1
esf #11	Agriculture	0.037	-0.862	9	0.099	0.294	2
st_hr	State Human Resources	0.057	-0.386	6	0.091	0.155	3
esf #08	Health/Medical Services	0.055	-0.435	7	0.077	-0.093	4
st_ag	State Agriculture	0.041	-0.783	8	0.076	-0.119	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #05	Emergency Mgmt	0.066	1.488	1	0.006	-1.2	12
esf #07	Resource Mgmt	0.066	1.488	1	0.006	-1.2	12
esf #06	Mass Care	0.054	0.968	3	0.006	-1.2	12
esf #11	Agriculture	0.042	0.449	4	0.006	-1.2	12
esf #08	Health/Medical Services	0.03	-0.071	5	0.006	-1.2	12
4. Ranked by In-Degree							
st_ema	State EMA	0.012	-0.85	8	0.042	1.543	1
st_ng	National Guard	-	-	-	0.042	1.543	1
st_hea	State Health Dept.	0.006	-1.11	9	0.036	1.086	3
st_hr	State Human Resources	0.006	-1.11	9	0.036	1.086	3
st_ag	State Agriculture	0.006	-1.11	9	0.030	0.629	5

5.2.2 Planned Network Summary – Alabama State Plan Joined with NRP

The network formed when the Alabama State Plan and the NRP are joined (PLN_{ALF}) contains 43 actors *(k)* for a network size of 1,806 (*k***k*-1). The 137 observed ties result in a modified network density of 0.076, which indicates that 7.6% of the available connections between actors have been made. The average number of ties per actor is 3.186 with an average tie length, or distance between all actors in the network, of 2.255. Compared to the mass care portion of the NRP (PLN_{NRP6}), and the state plan (PLN_{AL}), PLN_{ALF} is larger and less dense network, which indicates that there are more potential interactions, though there are currently fewer occurring.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majorities of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.007 and the flow network centrality index is 0.339, both indicating that this network is less centralized than the formal command structure of ICS (PLN_{ICS}). This can indicate the need for leadership development or a clarification of the ICS structure.



Legend:

d_ace	US Army Corps of Engineers	*st_tra*	State Agency, Transportation
d_dod	US Dept of Defense	*u_a*	Agriculture, US Dept. of (USDA)
esf #05	Emergency Management	*u_a_fns*	USDA - Food and Nutrition Service
esf #06	Mass Care, Housing & Human Services	*u_a_usfs*	USDA - Forest Service
esf #07	Resource Support	*u_gsa*	General Services Administration
esf #08	Public Health and Medical Services	*u_hh*	Health and Human Services, US Dept. of
esf #11	Agriculture and Natural Resources	*u_hs*	Homeland Security, US Dept. of
esf #15	External Affairs	*u_hs_fema*	FEMA
esf_don	Donation Management	*u_hud*	Housing & Urban Develop., US Dept. of
ic_ophs	ICS Operations Human Services Branch	*u_i*	Interior, US Dept. of
n_arc	American Red Cross	*u_j*	Justice, US Dept. of
n_cncs	Corp for National and Community Service	*u_l*	Labor, US Dept. of
n_voad	Vol. Org. Active in Disaster	*u_ndms*	National Disaster Medical System
st_ag	State Agency, Agriculture	*u_opm*	Office of Personnel Management
st_ed	State Agency, Education	*u_sba*	Small Business Administration
st_eld	State Agency, Elderly	*u_ssa*	Social Security Administration
st_ema	State Agency, EMA	*u_t*	Transportation, US Dept. of
st_env	State Agency, Environment	*u_tr*	Treasury, US Dept. of
st_hea	State Agency, Health	*u_tr_irs*	Treasury - Internal Revenue Service
st_hr	State Agency, Human Resources	*u_usps*	US Postal Service
st_mh	State Agency, Mental Health / Retardation	*u_va*	Veterans Affairs, US Dept. of
st_ng	State Agency, Military / National Guard		

Figure 12: Planned Network Diagram –State Plan Joined with NRP, Alabama

5.2.2.1 Actor and Interaction Analysis

The betweenness mean of the network is 0.215 with high variability (SD 0.223) and the centrality mean is 0.162 with moderate variability (SD 0.106). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact. The actors with the greatest direct positional advantage to control interaction between other actors are: ESF #06 Mass Care (*esf #06*, nBet 0.709, *z* 2.219), the state human resources department (*st_hr*, nBet 0.507, *z* 1.311), and ARC (*n_arc*, nBet 0.375, *z* 0.718). Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are ESF #06 Mass Care (*esf #06*, nFlow 0.375, *z* 2.003) and the state emergency management agency (*st_ema*, nFlow 0.312, *z* 1.416). FEMA (*u_hs_fema*, nFlow 0.197, *z* 0.333) ranked third in flow centrality, but was lower in betweenness (nBet 0.005, *z* -0.941) at the rank of 11, indicating its influence without high direct control.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.210, *z* 2.146, quad-B), FEMA (*u_hs_fema*, out 0.162, *z* 1.444, quad-B), and ARC (*n_arc*, out 0.156, *z* 1.356, quad-A).

The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: the state emergency management agency (*st_ema*, in 0.048, *z* 3.112, quad-C), National Guard (*st_ng*, in 0.042, *z* 2.465, quad-B), state health department (*st_hea*, in 0.036, *z* 1.819, quad-C), and the state human resources department (*st_hr*, in 0.036, *z* 1.819, quad-C). The in-degrees for ESF #06 Mass Care, FEMA, ESF #05 Emergency Management and ESF #07 Resource Management ranked much

lower, though their out-degrees ranked among the top five. This indicates that these actors request more than they provide in this network scenario.

Table 33: Centrality, Power and Connectedness - State Plan Joined with NRP, Alabama

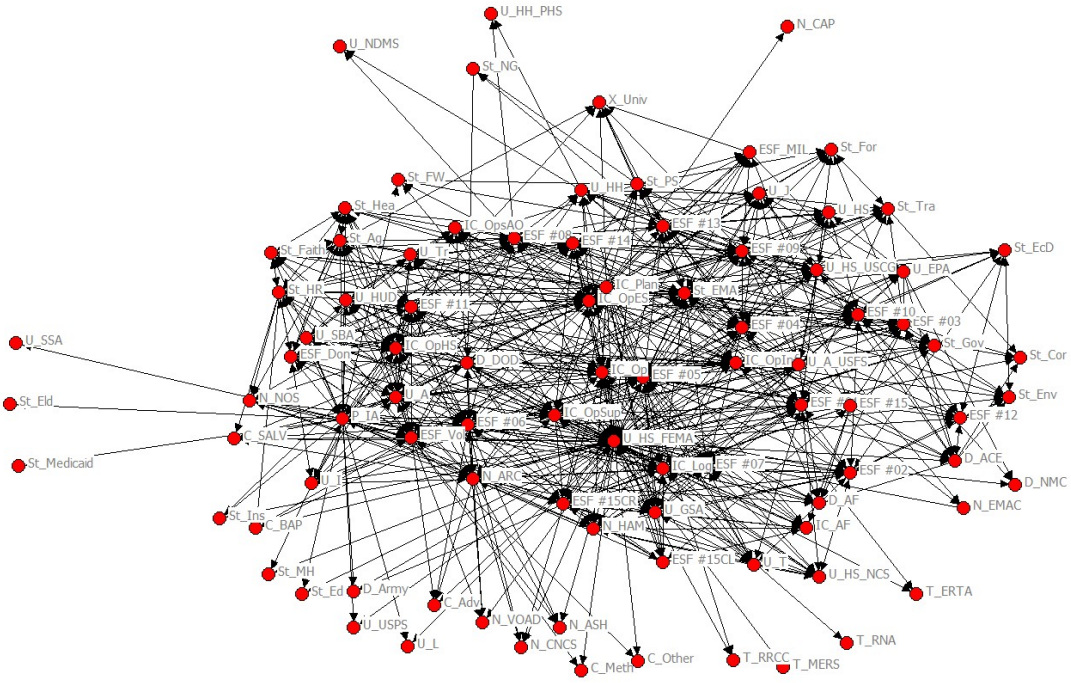
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #06	Mass Care	0.709	2.219	1	0.375	2.003	1
st_hr	State Human Resources	0.507	1.311	2	0.117	-0.43	8
n_arc	American Red Cross	0.375	0.718	3	0.186	0.222	4
esf #11	Agriculture	0.171	-0.195	4	0.139	-0.22	7
st_ema	State EMA	0.163	-0.232	5	0.312	1.416	2
2. Ranked by Flow Centrality							
esf #06	Mass Care	0.709	2.219	1	0.375	2.003	1
st_ema	State EMA	0.163	-0.232	5	0.312	1.416	2
u_hs_fema	FEMA	0.005	-0.941	11	0.197	0.333	3
n_arc	American Red Cross	0.375	0.718	3	0.186	0.222	4
st_hea	State Health Dept.	0.043	-0.771	9	0.174	0.109	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.210	2.146	1	0.018	-0.120	10
u_hs_fema	FEMA	0.162	1.444	2	0.012	-0.767	37
n_arc	American Red Cross	0.156	1.356	3	0.030	1.173	5
esf #05	Emergency Mgmt	0.066	0.040	4	0.006	-1.413	39
esf #07	Resource Mgmt	0.066	0.040	4	0.006	-1.413	39
4. Ranked by In-Degree							
st_ema	State EMA	0.012	-0.749	10	0.048	3.112	1
st_ng	National Guard	-	-	-	0.042	2.465	2
st_hea	State Health Dept.	0.006	-0.837	11	0.036	1.819	3
st_hr	State Human Resources	0.006	-0.837	11	0.036	1.819	3
n_arc	American Red Cross	0.156	1.356	3	0.030	1.173	5

5.2.3 Reported Network Summary - Alabama

The Alabama reported network (RPT_{AL}) contains 59 actors *(k)* for a network size of 3,422 (*k***k*-1). The 429 observed ties result in a modified network density of 0.125, which indicates that 12.5% of the available connections between actors have been made. The average number of ties per actor is 7.27 with an average tie length, or distance between all actors in the network, of 1.955. Compared to the combined Alabama state plan and the NRP (PLN_{ALF}), RPT_{AL} is a larger, denser network, which increases the potential number of interactions, but may result in communication overload.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majorities of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 1.300% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 19.669% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



c_adv	FBO, Adventist	*st_ag*	State Agency, Agriculture
c_bap	FBO, Baptist	*st_ecd*	State Agency, Economic Development
c_salv	FBO, Salvation Army	*st_ema*	State Agency, EMA
d_ace	US Army Corps of Engineers	*st_env*	State Agency, Environment
d_af	US Air Force	*st_faith*	State Agency, Comm. & Faith Based Initiatives
d_dod	US Dept of Defense	*st_for*	State Agency, Forestry
esf #03	Public Works and Engineering	*st_gov*	State Governor's Office
esf #05	Emergency Management	*st_hea*	State Agency, Health
esf #06	Mass Care, Housing & Human Services	*st_hr*	State Agency, Human Resources
esf #07	Resource Support	*st_ng*	State Agency, Military / National Guard
esf #08	Public Health and Medical Services	*st_ps*	State Agency, Police
esf #11	Agriculture and Natural Resources	*st_tra*	State Agency, Transportation
esf #13	Public Safety and Security	*st_trib*	State Agency, Tribal Affairs
esf #15cl	Congressional and Legislative Relations	*t_erta*	Emergency Response Team - Advance
esf #15cr	Community Relations	*t_mers*	Mobile Emergency Response System
esf_don	Donation Management	*u_a*	Agriculture, US Dept. of (USDA)
esf_mil	Military (State Only)	*u_a_fsis*	USDA - Food Safety and Inspection Service
esf_vol	Volunteer Management	*u_a_nrcs*	USDA - National Resource Conservation Svc
ic_log	ICS Logistics Section (ESF #7)	*u_gsa*	General Services Administration
ic_ophs	ICS Operations Human Services Branch	*u_hh_phs*	HHS - US Public Health Service
ic_opsao	ICS Operations Air Operations Branch	*u_hs*	Homeland Security, US Dept. of
ic_opsup	ICS Operations Section Support	*u_hs_fema*	FEMA
ic_plan	ICS Planning Section	*u_hud*	Housing & Urban Develop., US Dept. of
n_arc	American Red Cross	*u_i*	Interior, US Dept. of
n_ash	Americas Second Harvest	*u_ndms*	National Disaster Medical System
n_cncs	Corp for National and Community Service	*u_opm*	Office of Personnel Management
n_ham	RACES/ARES (Amateur Radio)	*u_tr_irs*	Treasury - Internal Revenue Service
n_nos	NGO, not otherwise specified	*u_usps*	US Postal Service

Figure 13: Reported Network Diagram, Alabama

5.2.3.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.044 and the centrality mean is 0.044, both with moderate variability (SD 0.036). This measure of variability indicates that the more influential actors are relatively constrained in the manner which they may interact and with whom they interact. The actors with the greatest direct positional advantage to control interaction between other actors are: the state emergency management agency (*st_ema*, nBet 1.322, *z* 3.979), ESF #06 Mass Care (*esf #06*, nBet 0.822, *z* 2.250), and ESF #05 Emergency Management (*esf #05*, nBet 0.669, *z* 1.723). Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are: the state emergency management agency (*st_ema*, nFlow 1.456, *z* 4.122), US Department of Defense (*d_dod*, nFlow 0.857, *z* 2.086), and ESF #05 Emergency Management (*esf #05*, nFlow 0.798, *z* 1.886). ESF #03 Public Works (*esf #03*, nFlow 0.528, *z* 0.971) ranked fourth in centrality, but had the much lower rank of 33 for betweenness, indicating that public works was very influential without being controlling.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.192, *z* 2.823, quad-A), FEMA (*u_hs_fema*, out 0.174, *z* 2.456, quad-A), and ARC (*n_arc*, out 0.150, *z* 1.966, quad-A).

The actors with the largest number of in-degree connections, who fulfill requests for information and service are: ESF #06 Mass Care (*esf #06*, in 0.126, *z* 2.293, quad-A), ESF #05 Emergency Management (*esf #05*, in 0.114, *z* 1.956, quad-A), the state EMA (*st_ema*, in 0.114, *z* 1.956, quad-A), and FEMA (*u_hs_fema*, in 0.114, *z* 1.956, quad-A).

Table 34: Centrality, Power and Connectedness - Reported Network, Alabama

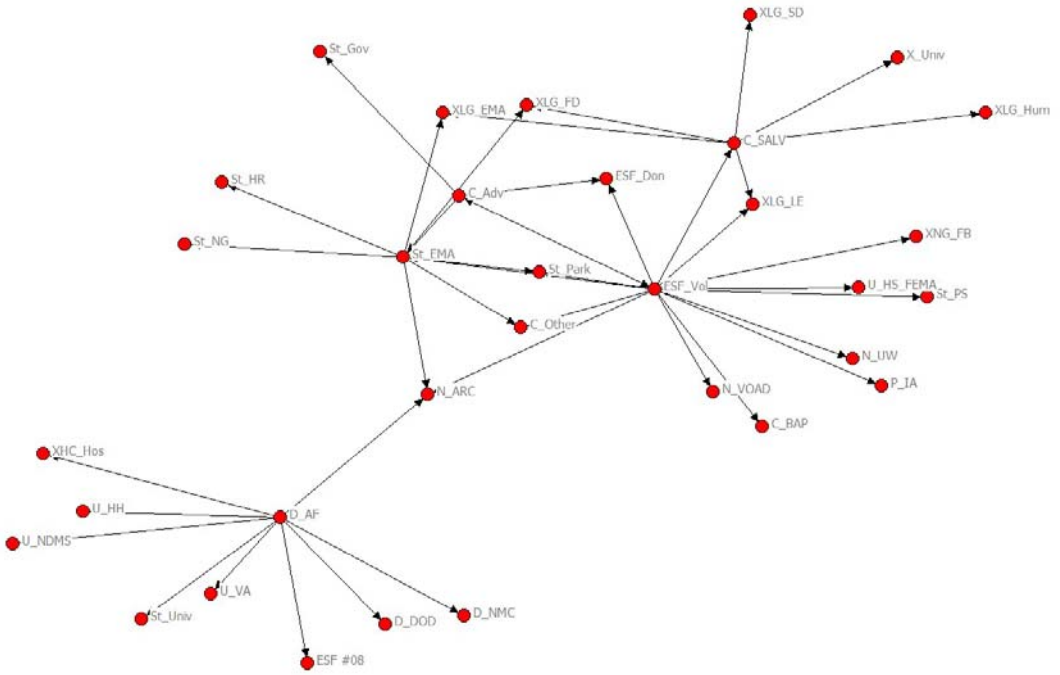
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
st_ema	State EMA	1.322	3.979	1	1.456	4.122	1
esf #06	Mass Care	0.822	2.250	2	0.291	0.164	9
esf #05	Emergency Mgmt	0.669	1.723	3	0.798	1.886	3
u_hs_fema	FEMA	0.619	1.550	4	0.510	0.909	5
n_arc	American Red Cross	0.323	0.527	5	0.287	0.153	10
2. Ranked by Flow Centrality							
st_ema	State EMA	1.322	3.979	1	1.456	4.122	1
d_dod	Dept of Defense	0.188	0.060	8	0.857	2.086	2
esf #05	Emergency Mgmt	0.669	1.723	3	0.798	1.886	3
esf #03	Public Works	0.001	-0.587	33	0.528	0.971	4
u_hs_fema	FEMA	0.619	1.550	4	0.510	0.909	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.192	2.823	1	0.126	2.293	1
u_hs_fema	FEMA	0.174	2.456	2	0.114	1.956	2
n_arc	American Red Cross	0.150	1.966	3	0.096	1.450	6
p_ia	Individual Assistance	0.138	1.721	4	0.078	0.945	11
esf_vol	Vol. Agency Liaison	0.126	1.477	5	0.090	1.282	9
4. Ranked by In-Degree							
esf #06	Mass Care	0.192	2.823	1	0.126	2.293	1
esf #05	Emergency Mgmt	0.114	1.232	6	0.114	1.956	2
st_ema	State EMA	0.114	1.232	6	0.114	1.956	2
u_hs_fema	FEMA	0.174	2.456	2	0.114	1.956	2
esf #11	Agriculture	0.102	0.987	8	0.102	1.619	5

5.2.4 Perceived Network Summary - Alabama

The Alabama perceived network (PER_{AL}) contains 33 actors *(k)* for a network size of 1,056 (*k***k*-1). The 41 observed ties result in a modified network density of 0.038, which indicates that 3.8% of the available connections between actors have been made. The average number of ties per actor is 1.242 with an average tie length, or distance between all actors in the network, of 1.441. Compared to the combined Alabama state plan and the NRP (PLN_{ALF}) and the Alabama reports (RPT_{AL}) PER_{AL} is a smaller and less dense network, indicating a constraint on potential interactions and that there are few currently occurring. This may indicate a lack of organizational capacity in response.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majorities of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.050% and flow network centrality index is 38.731%, indicating a less centralized network compared to the formal command structure of ICS (PLN_{ICS}).



Legend:

c_adv	FBO, Adventist	*st_ng*	State Agency, Military / National Guard
c_bap	FBO, Baptist	*st_park*	State Agency, Parks
c_other	FBO, Other, not specified	*st_ps*	State Agency, Police
c_salv	FBO, Salvation Army	*st_univ*	State Agency, University/Higher Ed
d_af	US Air Force	*u_hh*	Health and Human Services, US Dept. of
d_dod	US Dept of Defense	*u_hs_fema*	FEMA
d_nmc	US Navy and Marine Corps	*u_ndms*	National Disaster Medical System
esf #08	Public Health and Medical Services	*u_va*	Veterans Affairs, US Dept. of
esf_don	Donation Management	*x_univ*	University, non-state related
esf_vol	Volunteer Management	*xhc_hos*	Health Care, Hospitals
n_arc	American Red Cross	*xlg_ema*	Local Govt, Emergency Management
n_uw	United Way	*xlg_fd*	Local Govt, Fire
n_voad	Vol. Org. Active in Disaster	*xlg_hum*	Local Govt, Human Services
p_ia	Individual Assistance	*xlg_le*	Local Govt, Law Enforcement
st_ema	State Agency, EMA	*xlg_sd*	Local Govt, School District
st_gov	State Governor's Office	*xng_fb*	NGO, Food Bank, NOS
st_hr	State Agency, Human Resources		

Figure 14: Perceived Network Diagram, Alabama

5.2.4.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.035 with low variability (SD 0.012) and the centrality mean is 0.033 with low variability (SD 0.018). This measure of variability indicates that the more influential actors are more predictable in the manner which they interact and with whom. The actor with the greatest positional advantage, both direct and indirect,

between other actors is the Voluntary Agency Liaison (*esf_vol*, nBet 0.049, *z* 1.126, nFlow 0.054, *z* 1.180, represented in interviews). The VAL has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actor with the greatest out-degree influence, which issues more requests for action or information is the Voluntary Agency Liaison (*esf_vol*, out 0.090, *z* 1.616, quad-B, represented in interviews). The actor with the largest number of in-degree connections, who fulfills more requests for information and service than other actors in this network is the ARC (*n_arc*, in 0.018, *z* 3.135, quad-B).

Table 35: Centrality, Power and Connectedness - Perceived Network, Alabama

		Node Betweenness			Flow Centrality		
	Node	nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf_vol	Vol Agency Liaison	0.049	1.126	1	0.054	1.180	1
st_ema	State EMA	0.031	-0.343	2	0.016	-0.975	4
c_salv	Salvation Army	0.025	-0.784	3	0.022	-0.667	3
c_adv	Adventists	-	-	-	0.041	0.462	2
2. Ranked by Flow Centrality							
esf_vol	Vol Agency Liaison	0.049	1.126	1	0.054	1.180	1
c_adv	Adventists	-	-	-	0.041	0.462	2
c_salv	Salvation Army	0.025	-0.784	3	0.022	-0.667	3
st_ema	State EMA	0.031	-0.343	2	0.016	-0.975	4
		Out Degree			In-Degree		
	Node	Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf_vol	Vol Agency Liaison	0.090	1.616	1	0.006	-0.432	9
d_af	US Air Force	0.054	0.190	2	-	-	-
st_ema	State EMA	0.042	-0.285	3	0.012	1.351	2
c_salv	Salvation Army	0.036	-0.523	4	0.006	-0.432	9
c_adv	Adventists	0.024	-0.998	5	0.006	-0.432	9
4. Ranked by In-Degree							
n_arc	American Red Cross	-	-	-	0.018	3.135	1
c_other	Other FBO	-	-	-	0.012	1.351	2
esf_don	Donations Mgmt.	-	-	-	0.012	1.351	2
st_ema	State EMA	0.042	-0.285	3	0.012	1.351	2
st_park	State Parks	-	-	-	0.012	1.351	2

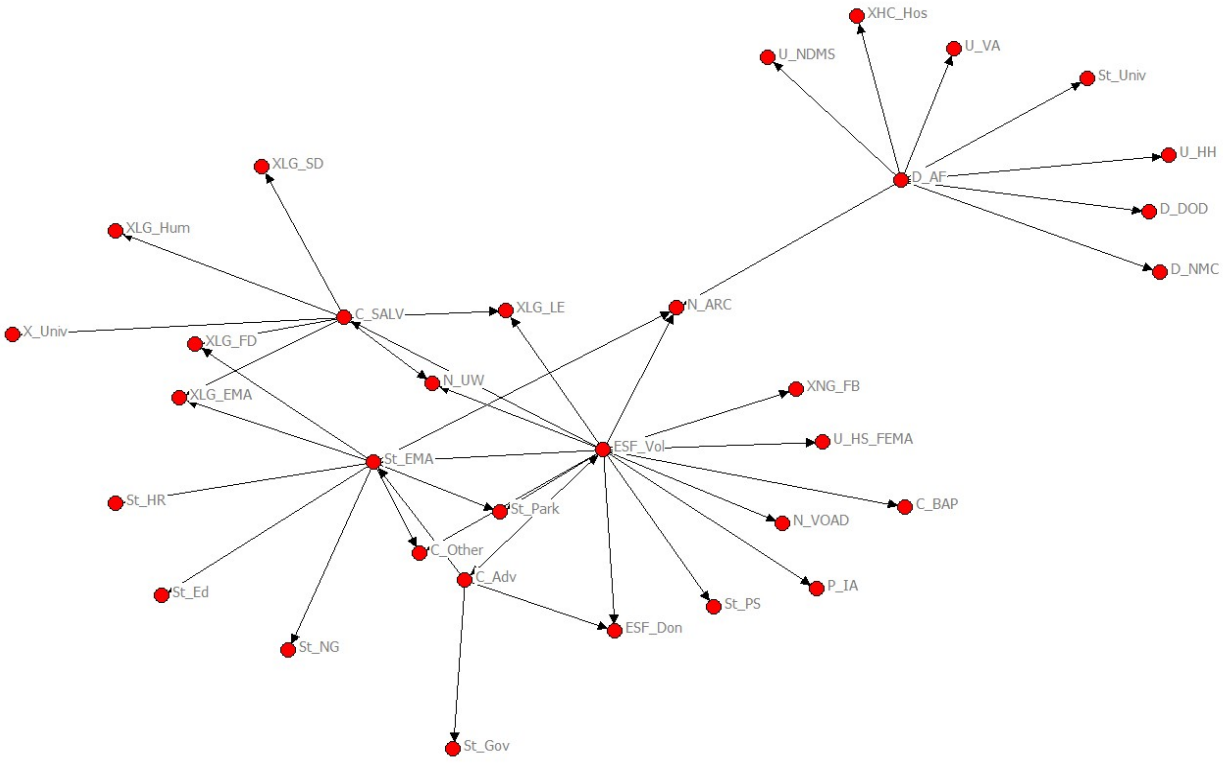
5.2.5 Desired Network Summary - Alabama

The Alabama desired network (DES_{AL}) contains 33 actors *(k)* for a network size of 1,056 (*k*k*-1). The 42 observed ties result in a modified network density of 0.0397, which indicates that 3.97% of the available connections between actors have been made. The average number of ties per actor is 1.272 with an average tie length, or distance between all actors in the network, of

1.451. DES_{AL} is smaller than the other Alabama networks, is less dense than the combined state plan and NRP (PLN_{ALF}) and the reported (RPT_{AL}) networks, but denser than the perceived (PER_{AL}) network.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majorities of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.050% and flow network centrality index is 37.775%, both indicating a less centralized network when compared to the formal command structure of ICS (PLN_{ICS}). This can indicate the need for leadership development or a clarification of the ICS structure in use for the response.



Legend:

c_adv	FBO, Adventist	*st_ng*	State Agency, Military / National Guard
c_bap	FBO, Baptist	*st_park*	State Agency, Parks
c_other	FBO, Other, not specified	*st_ps*	State Agency, Police
c_salv	FBO, Salvation Army	*st_univ*	State Agency, University/Higher Ed
d_af	US Air Force	*u_hh*	Health and Human Services, US Dept. of
d_dod	US Dept of Defense	*u_hs_fema*	FEMA
d_nmc	US Navy and Marine Corps	*u_ndms*	National Disaster Medical System
esf_don	Donation Management	*u_va*	Veterans Affairs, US Dept. of
esf_vol	Volunteer Management	*x_univ*	University, non-state related
n_arc	American Red Cross	*xhc_hos*	Health Care, Hospitals
n_uw	United Way	*xlg_ema*	Local Govt, Emergency Management
n_voad	Vol. Org. Active in Disaster	*xlg_fd*	Local Govt, Fire
p_ia	Individual Assistance	*xlg_hum*	Local Govt, Human Services
st_ed	State Agency, Education	*xlg_le*	Local Govt, Law Enforcement
st_ema	State Agency, EMA	*xlg_sd*	Local Govt, School District
st_gov	State Governor's Office	*xng_fb*	NGO, Food Bank, NOS
st_hr	State Agency, Human Resources		

Figure 15: Desired Network Diagram, Alabama

5.2.5.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.037 with low variability (SD 0.012) and the centrality mean is 0.036 with low variability (SD 0.016). This measure of variability

indicates that the more influential actors are more predictable in the manner which they interact and with whom. The actor with the greatest positional advantage, both direct and indirect, between other actors, is the Voluntary Agency Liaison (*esf_vol*, nBet 0.049, *z* 0.973, nFlow 0.054, *z* 1.123, represented in interviews). The VAL has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actor with the greatest out-degree influence, which issues more requests for action or information is the Voluntary Agency Liaison (*esf_vol,* out 0.090, *z* 1.635, B, represented in interviews). The actor with the largest number of in-degree connections, who fulfills more requests for information and service than other actors in this network is the ARC (*n_arc*, in 0.018, *z* 3.154, quad-B).

In analyzing the network diagram (Figure 15) there is a cut point between ARC (*n_arc*) and the group of ESF #08 Health and Medical Services actors, represented in the cut point node for the US Air Force (*d_af*). This cut point appears to be due to interview artifact and may disappear with a fuller set of interview data.

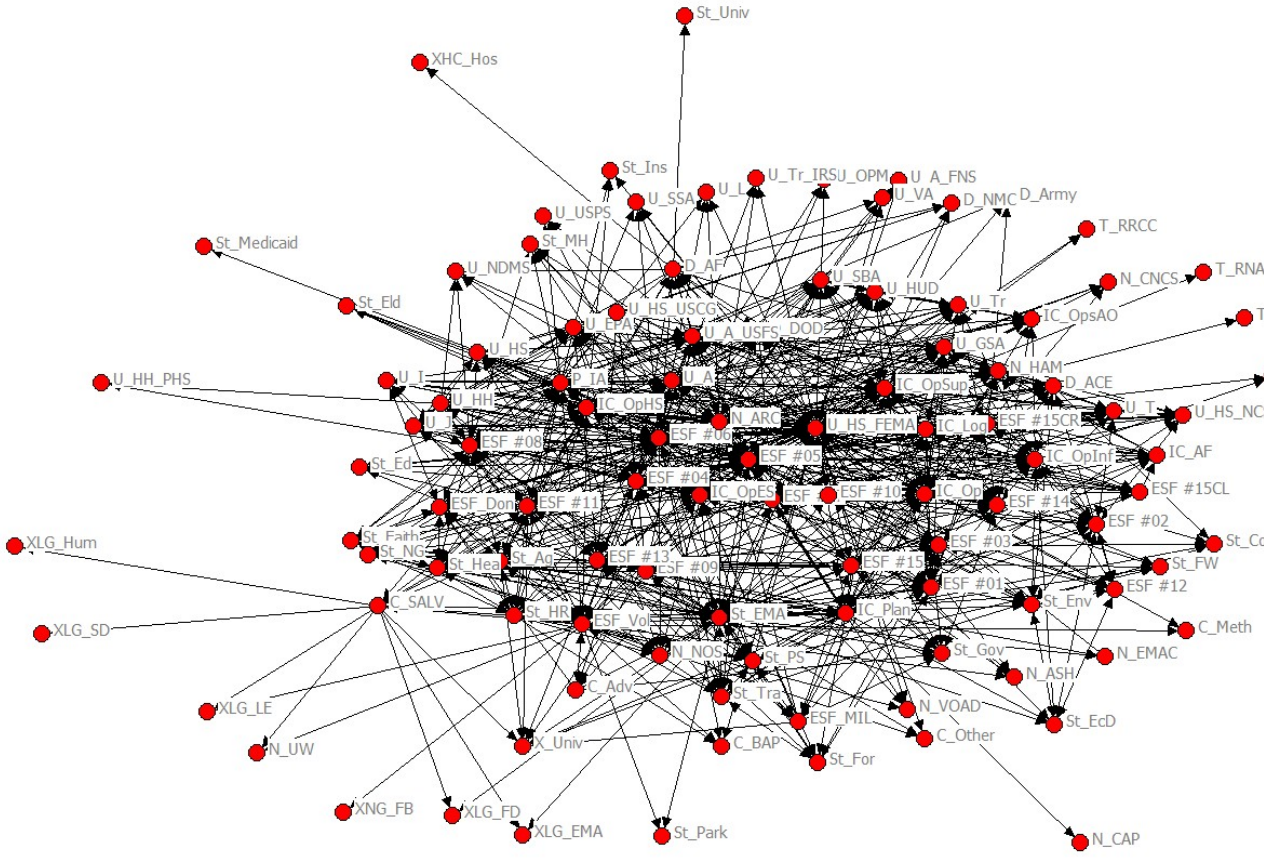
Table 36: Centrality, Power and Connectedness - Desired Network, Alabama

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf_vol	Vol. Agency Liaison	0.049	0.973	1	0.054	1.123	1
st_ema	State EMA	0.038	0.051	2	0.023	-0.786	3
c_salv	Salvation Army	0.025	-1.025	3	0.022	-0.898	4
2. Ranked by Flow Centrality							
esf_vol	Vol. Agency Liaison	0.049	0.973	1	0.054	1.123	1
c_adv	Adventists	-	-	-	0.045	0.561	2
st_ema	State EMA	0.038	0.051	2	0.023	-0.786	3
c_salv	Salvation Army	0.025	-1.025	3	0.022	-0.898	4
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf_vol	Vol. Agency Liaison	0.090	1.635	1	0.006	-0.584	10
d_af	US Air Force	0.048	-0.099	2	-	-	-
st_ema	State EMA	0.048	-0.099	2	0.012	1.285	2
c_salv	Salvation Army	0.042	-0.347	4	0.006	-0.584	10
c_adv	Adventists	0.024	-1.090	5	0.006	-0.584	10
4. Ranked by In-Degree							
n_arc	American Red Cross	-	-	-	0.018	3.154	1
c_other	Other FBO	-	-	-	0.012	1.285	2
esf_don	Donations Mgmt.	-	-	-	0.012	1.285	2
n_uw	United Way	-	-	-	0.012	1.285	2
st_ema	State EMA	0.048	-0.099	2	0.012	1.285	2

5.2.6 Combined Network Summary - Alabama

The combination of all Alabama networks ($COMB_{AL}$) contains 86 actors *(k)* for a network size of 7,310 (*k***k*-1). The 549 observed ties result in a modified network density of 0.075, which indicates that 7.5 % of the available connections between actors have been made. The average number of ties per actor is 6.384 with an average tie length, or distance between all actors in the network, of 2.048.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majorities of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 16: Combined Network Diagram, Alabama

5.2.6.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.066 with low variability (SD 0.272) and the centrality mean is 0.079 with low variability (SD 0.254). This measure of variability indicates that the more influential actors are more predictable in the manner which they interact and with whom. The actors with the greatest direct positional advantage to control interaction between other actors are ESF #06 Mass Care (*esf #06*, nBet 1.944, *z* 0.664) and the state emergency management agency (*st_ema*, nBet 1.806, *z* 0.592). Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are the state emergency management agency (*st_ema*, nFlow 1.858, *z* 1.006) and the Adventist FBOs (*c_adv*, nFlow 1.824, *z* 0.979). The Adventists ranked markedly lower at 34 for betweenness, indicating that while they are influential, they are not controlling.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.323, *z* 1.846, quad-A), FEMA (*u_hs_fema*, out 0.275, *z* 1.438, quad-A), and ARC (*n_arc*, out 0.251, *z* 1.234, quad-A). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are the state emergency management agency (*st_ema*, in 0.138, *z* 0.693, quad-A) and ESF #06 Mass Care (*esf #06*, in 0.126, *z* 0.558, quad-A).

Table 37: Centrality, Power and Connectedness - Combined Network, Alabama

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #06	*Mass Care*	1.944	0.664	1	0.948	0.285	4
st_ema	State EMA	1.806	0.592	2	1.858	1.006	1
n_arc	American Red Cross	1.485	0.423	3	0.922	0.265	5
u_hs_fema	FEMA	1.364	0.360	4	0.953	0.289	3
esf_vol	Vol Agency Liaison	0.848	0.089	5	0.741	0.121	6
2. Ranked by Flow Centrality							
st_ema	State EMA	1.806	0.592	2	1.858	1.006	1
c_adv	Adventists	0.002	-0.356	34	1.824	0.979	2
u_hs_fema	FEMA	1.364	0.36	4	0.953	0.289	3
esf #06	Mass Care	1.944	0.664	1	0.948	0.285	4
n_arc	American Red Cross	1.485	0.423	3	0.922	0.265	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.323	1.846	1	0.126	0.558	2
u_hs_fema	FEMA	0.275	1.438	2	0.114	0.423	4
n_arc	American Red Cross	0.251	1.234	3	0.120	0.490	3
esf #05	Emergency Mgmt	0.168	0.520	4	0.114	0.423	4
esf_vol	Vol Agency Liaison	0.168	0.520	4	0.096	0.221	8
4. Ranked by In-Degree							
st_ema	State EMA	0.156	0.418	6	0.138	0.693	1
esf #06	Mass Care	0.323	1.846	1	0.126	0.558	2
n_arc	American Red Cross	0.251	1.234	3	0.120	0.490	3
esf #05	Emergency Mgmt	0.168	0.520	4	0.114	0.423	4
u_hs_fema	FEMA	0.275	1.438	2	0.114	0.423	4

5.2.7 Summary of Alabama Networks

The reported network is the largest of the non-aggregated Alabama networks with 59 nodes, a network size of 3,422 and 7.271 average ties per node. The state plan, however, is the densest at 19.0% saturation.

Actors that are unique, study-wide, appearing in Alabama's reported network are the ICS Operations Section Air Operations *(ic_opao*) and the state department of economic development *(st_ecd).* The only agency mentioned as desired for future events that was not included in the other networks was the state department of education (*st_ed).*

5.2.7.1 Agency Composition of Alabama Networks

The total number of all government agencies in the network compositions ranged from 20 (68.97% of agencies, less positions) in the perceived network to 32 (91.43%) in the aggregated planned network. The number of federal government civilian agencies fell from 20 (57.14%) in the aggregated planned network to a low of four in the perceived (13.79%) and the desired (13.33%) networks. The number of state government agencies fell from 13 (33.33%) in the reported network to a low of seven in the perceived (24.14%) network. This change may be a combined result of the plans' ability to anticipate the involvement of the agency actors and the perspective of the interviewees being aware of agencies that are proximal to their position as near neighbors and not those farther away in the network. The number of all non-government agencies ranged from three (8.57%) in the aggregated planned network to nine in the perceived (3.10%) and desired (3.00%) networks. This may indicate that planning for future operations

would be improved, and more reflective of past practice, with the inclusion of additional NGO and FBO response agencies.

5.2.7.2 Actor Presence in Alabama and Federal Plans

The aggregated plans were 37.21% accurate in anticipating the actors that would be involved in these response operations; 12.79% of the planned agencies did not appear in any of the other networks, while 50.00% of the active agencies did not appear in the plan. The state plan was 28.95% accurate in anticipating the non-federal actors that would be involved in these response operations; 5.26% of the planned agencies did not appear in any of the other networks, while 65.79% of the active agencies did not appear in the plan.

There were nine actors that appeared in at least one planned and all other networks: US Department of Defense (*d_dod*), Donations Management (*esf_don*), ARC (*n_arc*), NVOAD (*n_voad*), State EMA (*st_ema*), State Department of Human Resources (*st_hr*), National Guard (*st_ng*), FEMA (*u_hs_fema*), and NDMS (*u_ndms*).

There were six specific agency actors that were not in the mass care plans but were in all other networks: Adventist FBOs (*c_adv*), Baptist FBOs (*c_bap*), The Salvation Army (*c_salv*), US Air Force (*d_af*), State Governor's office (*st_gov*), and State Police (*st_ps*). Consideration should be given to adding these agencies to the ESF #06 plan.

Table 38: Network Comparison Table, Alabama

	NRP6	Planned PLNAL	PLNALF	Reported RPTAL	Perceived PERAL	Desired DESAL	Combined COMBAL
Agency Count							
NIMS/NRP Position	3	7	8	20	4	3	21
US Government	20	0	20	13	4	4	23
US Military	2	0	2	3	3	3	4
Tribal	0	0	0	0	0	0	0
State Government	1	10	10	13	7	8	18
Local Government	0	0	0	0	6	6	6
National NGO	3	1	3	6	3	3	7
State/Local NGO	0	0	0	0	1	1	1
Faith Based	0	0	0	3	4	4	4
Business	0	0	0	1	1	1	2
Total actors (k)	29	18	43	59	33	33	86
Network Size (k*k-1)	812	306	1806	3422	1056	1056	7310
Sum of ties	80	58	137	429	41	42	549
Density (modified)	0.099	0.190	0.076	0.125	0.039	0.040	0.075
Avg ties per actor	2.759	3.222	3.186	7.271	1.242	1.273	6.384
Avg distance	1.048	2.102	2.255	1.955	1.441	1.451	2.048
Univariate Comparison							
quad-A	0	0	1	18	0	0	9
quad-B	26	9	8	5	9	9	1
quad-C	0	4	4	4	1	1	5
quad-D	3	5	30	32	23	23	71
Out-degree mean		0.032	0.063	0.054	0.049	0.050	0.020
Out-degree SD		0.023	0.068	0.049	0.025	0.024	0.049
In-degree mean		0.022	0.019	0.044	0.007	0.008	0.020
In degree SD		0.013	0.009	0.036	0.003	0.003	0.031

Centralization Index	ICS	PLNAL	PLNALF	RPTAL	PERAL	DESAL	COMBAL
Betweenness	1.25%	0.18%	0.70%	1.30%	0.05%	0.05%	1.89%
Flow Centrality	52.30%	54.44%	33.90%	19.67%	38.73%	37.78%	14.71%

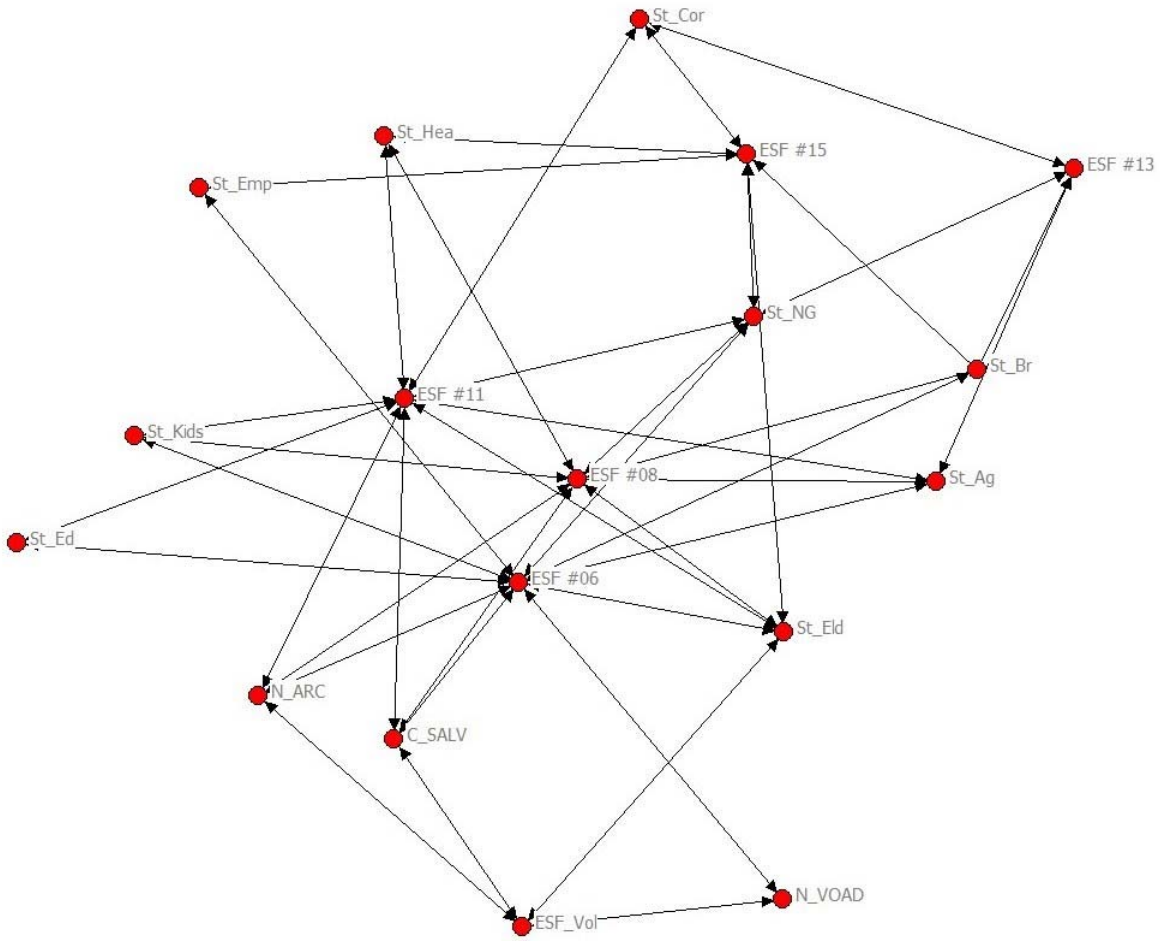
5.3 FLORIDA

5.3.1 Planned Network Summary – Florida State Plan

The network formed within the Florida State Plan (PLN_{FL}) contains 18 actors *(k)* for a network size of 306 (*k***k*-1). This is small, but comparable to the Alabama and Texas plans. The 79 observed ties result in a modified network density of 0.258, which indicates that 25.8% of the available connections between actors have been made. The average number of ties per actor is 4.389 with an average tie length, or distance between all actors in the network, of 2.007. Compared to the mass care portion of the NRP (PLN_{NRP6}), PLN_{FL} is a smaller and denser network, which should make communication easier, but limits the number of potential actors with which to interact.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majorities of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.310% and flow network centrality index is 31.475%, indicating a less centralized network than the formal command structure of ICS (PLN_{ICS}). This can indicate the need for leadership development or a clarification of the ICS structure in use for the response.



Legend:				
	c_salv	FBO, Salvation Army	*st_ag*	State Agency, Agriculture
	esf #06	Mass Care, Housing & Human Services	*st_br*	State Agency, Professional Regulation
	esf #08	Public Health and Medical Services	*st_cor*	State Agency, Corrections
	esf #11	Agriculture and Natural Resources	*st_ed*	State Agency, Education
	esf #13	Public Safety and Security	*st_eld*	State Agency, Elderly
	esf #15	External Affairs	*st_emp*	State Agency, Employment Services
	esf_vol	Volunteer Management	*st_hea*	State Agency, Health
	n_arc	American Red Cross	*st_kids*	State Agency, Children and Families
	n_voad	Vol. Org. Active in Disaster	*st_ng*	State Agency, Military / National Guard

Figure 17: Planned Network Diagram – State Plan, Florida

5.3.1.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.062 with moderate variability (SD 0.080) and the centrality mean is 0.065 with moderate variability (SD 0.092). This moderate

variability indicates that more influential actors are not necessarily constrained in the manner in which they may interact or who they interact with. They have less predictable patterns of interaction within the network. The actors with the greatest positional advantage, both direct and indirect, between other actors are ESF #06 Mass Care (*esf #06*, nBet 0.319, *z* 3.207, nFlow 0.365, *z* 3.266) and ESF #11 Agriculture and Natural Resources (*esf #11*, nBet 0.201, *z* 1.740, nFlow 0.192, *z* 1.387). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. Actors with the greatest out-degree influence are those that issue more requests for action or information. A large in-degree measure indicates an actor who fulfills more requests for information and service. Occasionally, an actor will have high degrees in both measures, indicating that they have the potential for decreased capacity to manage information or meet other demands. If they have sufficient resources, this may not hold true. The following actors in this network have high measures of out- and in-degree: ESF #06 Mass Care (*esf #06*, out 0.060, *z* 2.491, in 0.060, *z* 2.266, quad-A), ESF #11 Agriculture and Natural Resources (*esf #11*, out 0.054, *z* 2.047, in 0.054, *z* 1.862, quad-A), and ESF #08 Health and Medical Services (*esf #08*, out 0.042, *z* 1.159, in 0.048, *z* 1.458, quad-A).

Table 39: Centrality, Power and Connectedness - Planned Network – State Plan, Florida

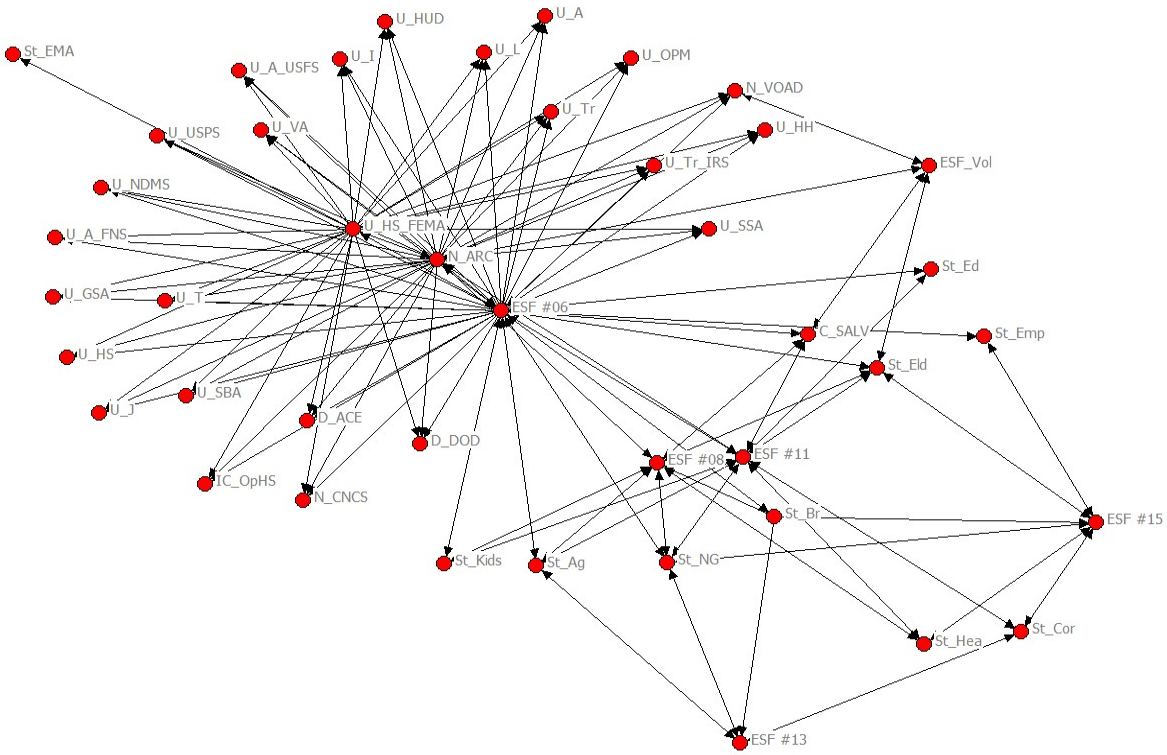
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #06	Mass Care	0.319	3.207	1	0.365	3.266	1
esf #11	Agriculture	0.201	1.740	2	0.192	1.387	2
esf #08	Health/Medical	0.100	0.481	3	0.117	0.574	4
st_ng	National Guard	0.079	0.218	4	0.031	-0.366	7
st_eld	State Dept. Elderly	0.079	0.213	5	0.024	-0.444	10
2. Ranked by Flow Centrality							
esf #06	Mass Care	0.319	3.207	1	0.365	3.266	1
esf #11	Agriculture	0.201	1.740	2	0.192	1.387	2
esf #15	External Affairs	0.074	0.150	6	0.133	0.745	3
esf #08	Health/Medical	0.100	0.481	3	0.117	0.574	4
esf_vol	Vol. Agency Liaison	0.027	-0.428	10	0.094	0.322	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	*Mass Care*	0.060	2.491	1	0.060	2.266	1
esf #11	Agriculture	0.054	2.047	2	0.054	1.862	2
esf #08	Health/Medical	0.042	1.159	3	0.048	1.458	3
esf #15	External Affairs	0.030	0.271	4	0.036	0.651	4
st_eld	State Dept. Elderly	0.030	0.271	4	0.030	0.247	5
4. Ranked by In-Degree							
esf #06	*Mass Care*	0.060	2.491	1	0.060	2.266	1
esf #11	Agriculture	0.054	2.047	2	0.054	1.862	2
esf #08	Health/Medical	0.042	1.159	3	0.048	1.458	3
esf #15	External Affairs	0.030	0.271	4	0.036	0.651	4
st_eld	State Dept. Elderly	0.030	0.271	4	0.030	0.247	5

5.3.2 Planned Network Summary – Florida State Plan Joined with NRP

The network formed when the Florida State Plan and the NRP are joined (PLN_{FLF}) contains 43 actors *(k)* for a network size of 1,806 (*k***k*-1). The 156 observed ties result in a modified network density of 0.086, which indicates that 8.6% of the available connections between actors have been made. The average number of ties per actor is 3.628 with an average tie length, or distance between all actors in the network, of 2.043. Compared to the mass care portion of the NRP (PLN_{NRP6}), and the state plan (PLN_{FL}), PLN_{FLF} is a larger and less dense network, which indicates that there are more potential interactions, though there are currently fewer occurring.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majorities of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.013 which indicates a more directly centralized network than the formal command structure of ICS (PLN_{ICS}), though the flow network centrality index is 0.430 which indicates a less centralized indirect network. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Legend:

c_salv	FBO, Salvation Army	*st_ng*	State Agency, Military / National Guard
d_ace	US Army Corps of Engineers	*u_a*	Agriculture, US Dept. of (USDA)
d_dod	US Dept of Defense	*u_a_fns*	USDA - Food and Nutrition Service
esf #06	Mass Care, Housing & Human Services	*u_a_usfs*	USDA - Forest Service
esf #08	Public Health and Medical Services	*u_gsa*	General Services Administration
esf #11	Agriculture and Natural Resources	*u_hh*	Health and Human Services, US Dept. of
esf #13	Public Safety and Security	*u_hs*	Homeland Security, US Dept. of
esf #15	External Affairs	*u_hs_fema*	FEMA
esf_vol	Volunteer Management	*u_hud*	Housing & Urban Develop., US Dept. of
ic_ophs	ICS Operations Human Services Branch	*u_i*	Interior, US Dept. of
n_arc	American Red Cross	*u_j*	Justice, US Dept. of
n_cncs	Corp for National and Community Service	*u_l*	Labor, US Dept. of
n_voad	Vol. Org. Active in Disaster	*u_ndms*	National Disaster Medical System
st_ag	State Agency, Agriculture	*u_opm*	Office of Personnel Management
st_br	State Agency, Professional Regulation	*u_sba*	Small Business Administration
st_cor	State Agency, Corrections	*u_ssa*	Social Security Administration
st_ed	State Agency, Education	*u_t*	Transportation, US Dept. of
st_eld	State Agency, Elderly	*u_tr*	Treasury, US Dept. of
st_ema	State Agency, EMA	*u_tr_irs*	Treasury - Internal Revenue Service
st_emp	State Agency, Employment Services	*u_usps*	US Postal Service
st_hea	State Agency, Health	*u_va*	Veterans Affairs, US Dept. of
st_kids	State Agency, Children and Families		

Figure 18: Planned Network Diagram – State Plan Joined with NRP, Florida

5.3.2.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.158 with high variability (SD 0.316) and the centrality mean is 0.204 with high variability (SD 0.314). This measure of variability indicates that the more influential actors have few constraints to the manner in which they may interact and with whom. They have less predictable patterns of interaction within the network. The actors with the greatest positional advantage, both direct and indirect, between other actors are ESF #06 Mass Care (*esf #06*, nBet 1.347, *z* 3.762, nFlow 1.207, *z* 3.196) and ARC (*n_arc*, nBet 0.510, *z* 1.113, nFlow 0.779, *z* 1.834). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.257, *z* 2.656, quad-A), ARC (*n_arc*, out 0.213, *z* 2.061, quad-A), and FEMA (*u_hs_fema*, out 0.199, *z* 1.863, quad-B). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ESF #06 Mass Care (*esf #06*, in 0.081, *z* 3.800, quad-A), ESF #11 Agriculture and Natural Resources (*esf #11*, in 0.074, *z* 3.285, quad-A), and ESF #08 Health and Medical Services (*esf #08*, in 0.059, *z* 2.254, quad-C).

Table 40: Centrality, Power and Connectedness - Planned Network – State Plan Joined with NRP, Florida

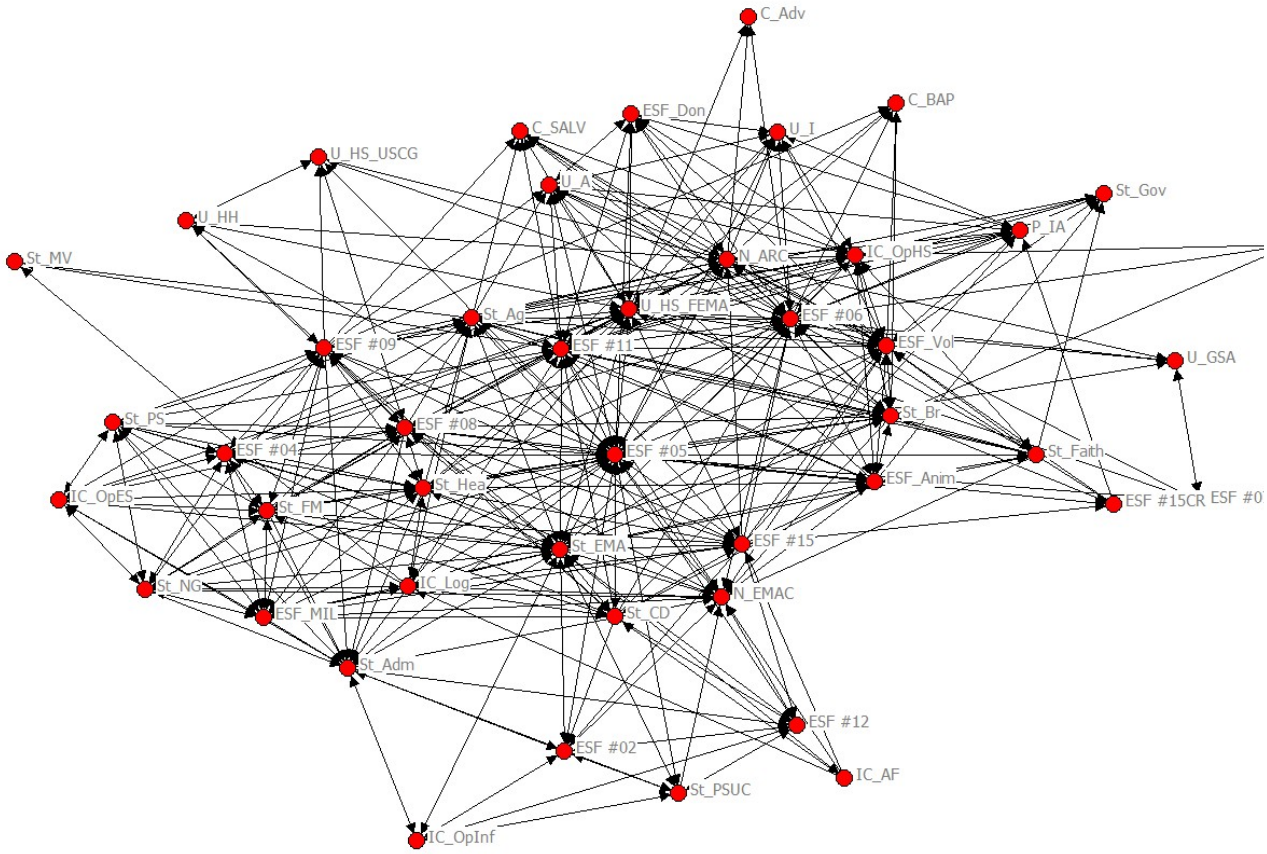
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #06	Mass Care	1.347	3.762	1	1.207	3.196	1
n_arc	American Red Cross	0.510	1.113	2	0.779	1.834	2
esf #11	Agriculture	0.352	0.614	3	0.324	0.381	4
st_ng	National Guard	0.150	-0.025	4	0.061	-0.456	11
esf #08	Health/Medical	0.143	-0.048	5	0.175	-0.092	6
2. Ranked by Flow Centrality							
esf #06	Mass Care	1.347	3.762	1	1.207	3.196	1
n_arc	American Red Cross	0.510	1.113	2	0.779	1.834	2
u_hs_fema	FEMA	0.065	-0.294	9	0.496	0.932	3
esf #11	Agriculture	0.352	0.614	3	0.324	0.381	4
esf #15	External Affairs	0.067	-0.289	8	0.242	0.120	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.257	2.656	1	0.081	3.800	1
n_arc	American Red Cross	0.213	2.061	2	0.037	0.707	5
u_hs_fema	FEMA	0.199	1.863	3	0.015	-0.839	39
esf #11	Agriculture	0.066	0.078	4	0.074	3.285	2
esf #08	Health/Medical	0.051	-0.120	5	0.059	2.254	3
4. Ranked by In-Degree							
esf #06	Mass Care	0.257	2.656	1	0.081	3.800	1
esf #11	Agriculture	0.066	0.078	4	0.074	3.285	2
esf #08	Health/Medical	0.051	-0.120	5	0.059	2.254	3
esf #15	External Affairs	0.037	-0.318	6	0.044	1.223	4
n_arc	American Red Cross	0.213	2.061	2	0.037	0.707	5

5.3.3 Reported Network Summary - Florida

The network within the Florida reports (RPT_{FL}) contains 46 actors *(k)* for a network size of 2,070 (*k***k*-1). The 514 observed ties result in a modified network density of 0.248, which indicates that 24.8% of the available connections between actors have been made. The average number of ties per actor is 11.174 with an average tie length, or distance between all actors in the network, of 1.833. Compared to the state plan combined with the NRP (PLN_{FLF}), RPT_{FL} is a larger, denser network, which increases the potential number of interactions, but may result in communication overload.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 1.540% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 12.524% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Legend:

c_adv	FBO, Adventist	*n_arc*	American Red Cross
c_bap	FBO, Baptist	*n_emac*	EMAC
c_salv	FBO, Salvation Army	*p_ia*	Individual Assistance
esf #02	Communications	*st_adm*	State Agency, Administration
esf #04	Firefighting	*st_ag*	State Agency, Agriculture
esf #05	Emergency Management	*st_br*	State Agency, Professional Regulation
esf #06	Mass Care, Housing & Human Services	*st_cd*	State Agency, Community Development
esf #07	Resource Support	*st_eld*	State Agency, Elderly
esf #08	Public Health and Medical Services	*st_ema*	State Agency, EMA
esf #09	Urban Search and Rescue	*st_faith*	State Agency, Comm. & Faith Based Initiatives
esf #11	Agriculture and Natural Resources	*st_fm*	State Agency, Fire Marshal
esf #12	Energy	*st_gov*	State Governor's Office
esf #15	External Affairs	*st_hea*	State Agency, Health
esf #15cr	Community Relations	*st_mv*	State Agency, Motor Vehicles
esf_anim	Animal Management	*st_ng*	State Agency, Military / National Guard
esf_don	Donation Management	*st_ps*	State Agency, Police
esf_mil	Military (State Only)	*st_psuc*	State Agency, Public Service/Utilities
esf_vol	Volunteer Management	*u_a*	Agriculture, US Dept. of (USDA)
ic_af	ICS Admin and Finance Section	*u_gsa*	General Services Administration
ic_log	ICS Logistics Section (ESF #7)	*u_hh*	Health and Human Services, US Dept. of
ic_opes	ICS Operations Emergency Svcs Branch	*u_hs_fema*	FEMA
ic_ophs	ICS Operations Human Services Branch	*u_hs_uscg*	DHS - US Coast Guard
ic_opinf	ICS Operations Infrastructure Branch	*u_i*	Interior, US Dept. of

Figure 19: Reported Network Diagram, Florida

5.3.3.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.044 with low variability (SD 0.036) and the centrality mean is 0.044 with moderate variability (SD 0.036). This measure of variability indicates that the more influential actors are relatively constrained in the manner which they may interact and with whom they interact.

The actors with the greatest positional advantage, both direct and indirect, between other actors are: ESF #05 Emergency Management (*esf #05*, nBet 1.564, *z* 4.582, nFlow 0.722, *z* 3.273), the state emergency management agency (*st_ema*, nBet 1.148, *z* 3.237, nFlow 0.921, *z* 4.437), and FEMA (*u_hs_fema*, nBet 0.475, *z* 1.064, nFlow 0.404, *z* 1.419). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #05 Emergency Management (*esf #05*, out 0.186, *z* 2.638, quad-A), the state emergency management agency (*st_ema*, out 0.168, *z* 2.216, quad-A), and ESF #06 Mass Care (*esf #06*, out 0.144, *z* 1.654, quad-A). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ESF #05 Emergency Management *(esf #05*, in 0.204, *z* 3.269, quad-A), the state emergency management agency (*st_ema*, in 0.174, *z* 2.553, quad-A), and FEMA (*u_hs_fema*, in 0.138, *z* 1.693, quad-A).

Table 41 : Centrality, Power and Connectedness - Reported Network, Florida

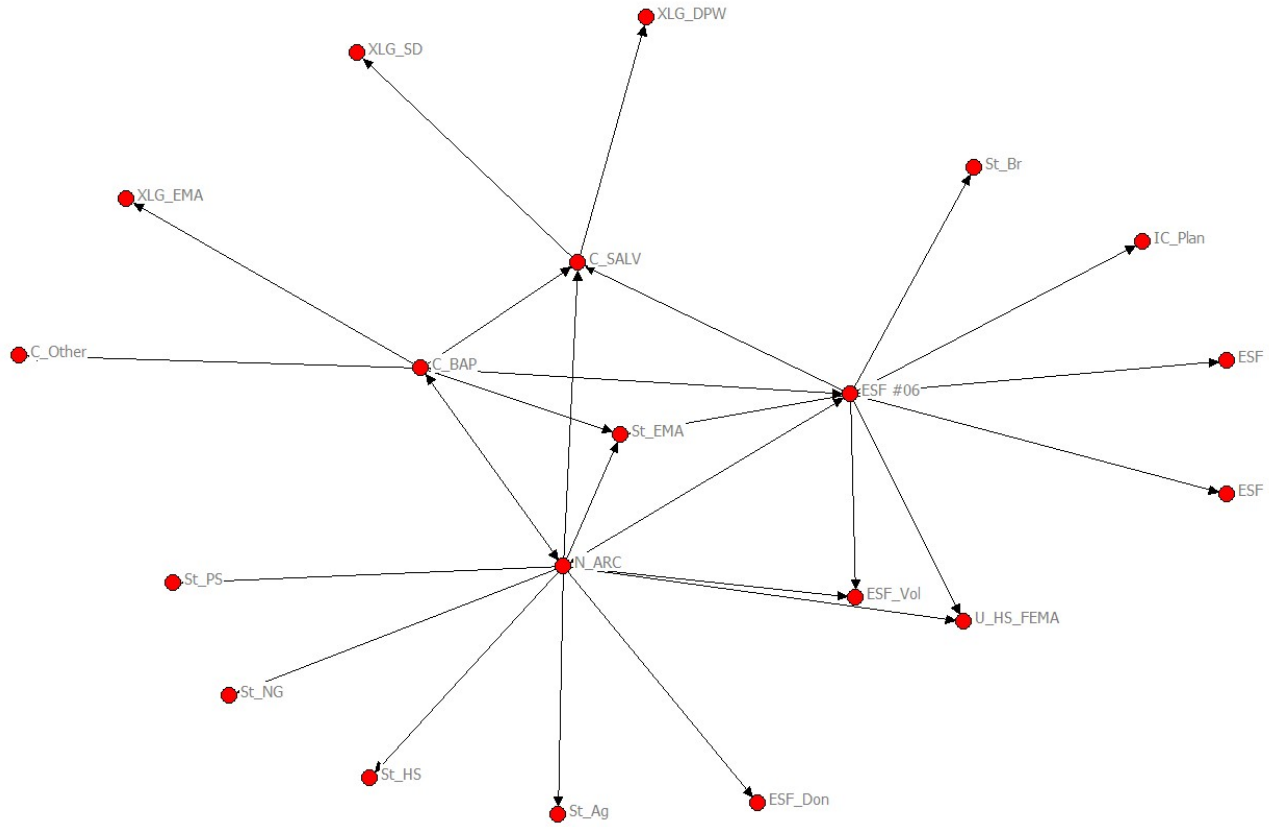
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #05	Emergency Management	1.564	4.582	1	0.722	3.273	2
st_ema	State EMA	1.148	3.237	2	0.921	4.437	1
u_hs_fema	FEMA	0.475	1.064	3	0.404	1.419	3
esf #06	Mass Care	0.311	0.534	4	0.279	0.691	5
esf_vol	Voluntary Agency Liaison	0.309	0.528	5	0.360	1.162	4
2. Ranked by Flow Centrality							
st_ema	State EMA	1.148	3.237	2	0.921	4.437	1
esf #05	Emergency Management	1.564	4.582	1	0.722	3.273	2
u_hs_fema	FEMA	0.475	1.064	3	0.404	1.419	3
esf_vol	Voluntary Agency Liaison	0.309	0.528	5	0.360	1.162	4
esf #06	Mass Care	0.311	0.534	4	0.279	0.691	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #05	Emergency Management	0.186	2.638	1	0.204	3.269	1
st_ema	State EMA	0.168	2.216	2	0.174	2.553	2
esf #06	Mass Care	0.144	1.654	3	0.114	1.121	5
esf #09	Search and Rescue	0.126	1.232	4	0.084	0.405	13
u_hs_fema	FEMA	0.126	1.232	4	0.138	1.693	3
4. Ranked by In-Degree							
esf #05	Emergency Management	0.186	2.638	1	0.204	3.269	1
st_ema	State EMA	0.168	2.216	2	0.174	2.553	2
u_hs_fema	FEMA	0.126	1.232	4	0.138	1.693	3
esf #11	Agriculture/Natural Resources	0.114	0.951	7	0.126	1.407	4
esf #06	Mass Care	0.144	1.654	3	0.114	1.121	5

5.3.4 Perceived Network Summary - Florida

The Florida perceived network (PER_{FL}) contains 20 actors *(k)* for a network size of 380 (*k***k*-1). The 29 observed ties result in a modified network density of 0.076, which indicates that 7.6% of the available connections between actors have been made. The average number of ties per actor is 1.45 with an average tie length, or distance between all actors in the network, of with 1.508. Compared to the state plan (PLN_{FL}) and reported (RPT_{FL}), PER_{FL} is a smaller and less dense network, indicating a constraint on potential interactions and that there are few currently occurring. This may indicate a lack of organizational capacity in response.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.040% and the flow network centrality index is 39.521%, indicating a less centralized network compared to the formal command structure of ICS (PLN_{ICS}). This can indicate the need for leadership development or a clarification of the ICS structure in use for the response.



Legend:			
c_bap	FBO, Baptist	*st_ag*	State Agency, Agriculture
c_other	FBO, Other, not specified	*st_br*	State Agency, Professional Regulation
c_salv	FBO, Salvation Army	*st_ema*	State Agency, EMA
esf #06	Mass Care, Housing & Human Services	*st_hs*	State Agency, Social/Human Services
esf #08	Public Health and Medical Services	*st_ng*	State Agency, Military / National Guard
esf #09	Urban Search and Rescue	*st_ps*	State Agency, Police
esf_don	Donation Management	*u_hs_fema*	FEMA
esf_vol	Volunteer Management	*xlg_dpw*	Local Govt, Public Works
ic_plan	ICS Planning Section	*xlg_ema*	Local Govt, Emergency Management
n_arc	American Red Cross	*xlg_sd*	Local Govt, School District

Figure 20: Perceived Network Diagram, Florida

5.3.4.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.027 with low variability (SD 0.011) and the centrality mean is 0.041 with low variability (SD 0.014). This measure of variability indicates that the more influential actors are more predictable in the manner which they interact and with whom.

The actor with the greatest positional advantage, both direct and indirect, between other actors is ARC (*n_arc*, nBet 0.040, *z* 1.126, nFlow 0.053, *z* 0.865, represented in interviews). The ARC has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actor with the greatest out-degree influence, that issues more requests for action or information is the ARC (*n_arc*, out 0.066, *z* 0.912, quad-A, represented in interviews). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are The Salvation Army (*c_salv*, in 0.018, *z* 2.258, quad-C, represented in interviews) and the state emergency management agency (*st_ema*, in 0.018, *z* 2.258, quad-B).

Table 42: Centrality, Power and Connectedness - Perceived Network, Florida

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	0.040	1.126	1	0.053	0.865	1
esf #06	Mass Care	0.032	0.482	2	0.044	0.244	3
c_salv	Salvation Army	0.022	-0.482	3	0.022	-1.442	4
c_bap	Baptists	0.014	-1.126	4	0.046	0.333	2
2. Ranked by Flow Centrality							
st_ema	State EMA	0.040	1.126	1	0.053	0.865	1
c_bap	Baptists	0.014	-1.126	4	0.046	0.333	2
esf #06	Mass Care	0.032	0.482	2	0.044	0.244	3
c_salv	Salvation Army	0.022	-0.482	3	0.022	-1.442	4
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
st_ema	State EMA	0.066	0.912	1	0.012	0.801	3
esf #06	Mass Care	0.060	0.669	2	0.012	0.801	3
c_bap	Baptists	0.036	-0.304	3	0.012	0.801	3
c_salv	Salvation Army	0.012	-1.276	4	0.018	2.258	1
4. Ranked by In-Degree							
c_salv	Salvation Army	0.012	-1.276	4	0.018	2.258	1
st_ema	State EMA	0.066	0.912	1	0.018	2.258	1
c_bap	Baptists	0.036	-0.304	3	0.012	0.801	3
esf #06	Mass Care	0.060	0.669	2	0.012	0.801	3
esf_vol	Vol Agency Liaison	-	-	-	0.012	0.801	3

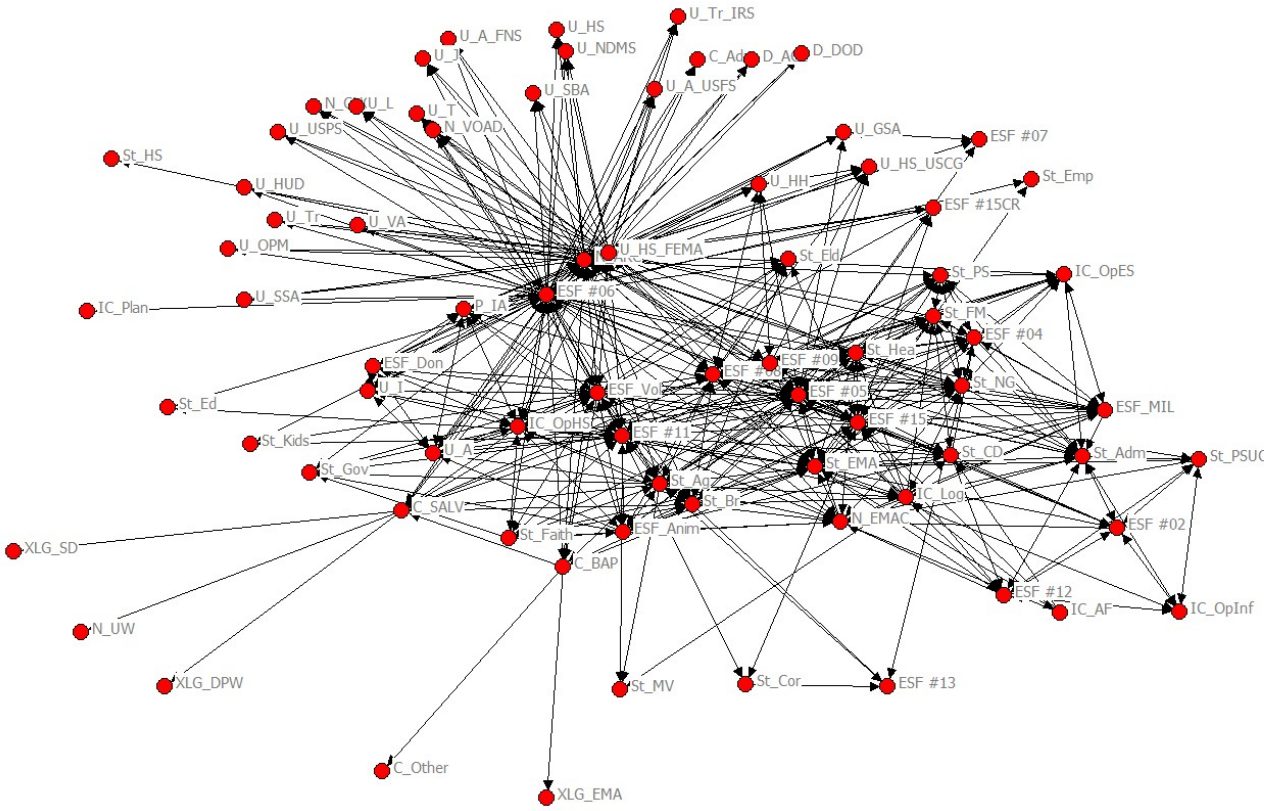
5.3.5 Desired Network Summary - Florida

The Florida desired network (DES_{FL}) contains 21 actors *(k)* for a network size of 420 (*k***k*-1). The 30 observed ties result in a modified network density of 0.071, which indicates that 7.1% of the available connections between actors have been made. The average number of ties per actor is 1.428 with an average tie length, or distance between all actors in the network, of 1.524. Compared to the other Florida networks, DES_{FL} is a smaller and less dense network, indicating a

constraint on potential interactions and that there are few currently occurring. This may indicate a lack of organizational capacity in response.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.040% and the flow network centrality index is 37.966%, indicating a less centralized network when compared to the formal command structure of ICS (PLN_{ICS}). This can indicate the need for leadership development or a clarification of the ICS structure in use for the response.



Legend:			
c_bap	FBO, Baptist	*st_ag*	State Agency, Agriculture
c_other	FBO, Other, not specified	*st_br*	State Agency, Professional Regulation
c_salv	FBO, Salvation Army	*st_ema*	State Agency, EMA
esf #06	Mass Care, Housing & Human Services	*st_hs*	State Agency, Social/Human Services
esf #08	Public Health and Medical Services	*st_ng*	State Agency, Military / National Guard
esf #09	Urban Search and Rescue	*st_ps*	State Agency, Police
esf_don	Donation Management	*u_hs_fema*	FEMA
esf_vol	Volunteer Management	*xlg_dpw*	Local Govt, Public Works
ic_plan	ICS Planning Section	*xlg_ema*	Local Govt, Emergency Management
n_arc	American Red Cross	*xlg_sd*	Local Govt, School District
n_uw	United Way		

Figure 21: Desired Network Diagram, Florida

5.3.5.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.030 with low variability (SD 0.011) and the centrality mean is 0.046 with low variability (SD 0.010). This measure of variability

indicates that the more influential actors are more predictable in the manner which they interact and with whom.

The ARC (*n_arc*, nBet 0.040, *z* 0.921, represented in interviews) has the greatest direct positional advantage between other actors. Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are the Baptist FBOs (*c_bap*, nFlow 0.053, *z* 0.746, represented in interviews) and ARC (*n_arc*, nFlow 0.053, *z* 0.746, represented in interviews).

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, that issue more requests for action or information are the ARC (*n_arc*, out 0.066, *z* 0.947, quad-A, represented in interviews) and ESF #06 Mass Care (*esf #06*, out 0.060, *z* 0.676, quad-A, represented in interviews). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are The Salvation Army (*c_salv*, in 0.018, *z* 2.324, quad-C, represented in interviews) and the state emergency management agency (*st_ema*, in 0.018, *z* 2.324, quad-B).

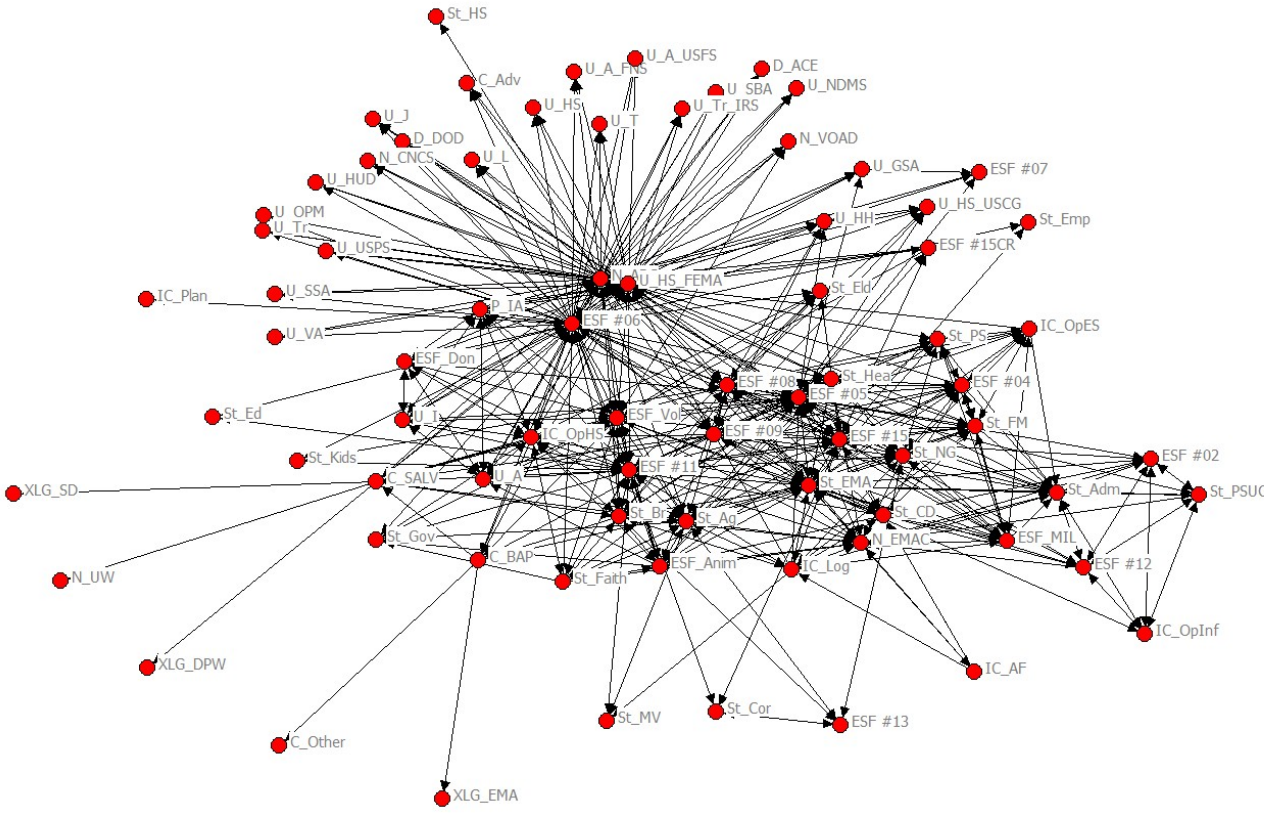
Table 43: Centrality, Power and Connectedness - Desired Network, Florida

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	0.040	0.921	1	0.053	0.746	1
c_salv	Salvation Army	0.032	0.251	2	0.032	-1.368	4
esf #06	Mass Care	0.032	0.251	2	0.044	-0.124	3
c_bap	Baptists	0.014	-1.423	4	0.053	0.746	1
2. Ranked by Flow Centrality							
c_bap	Baptists	0.014	-1.423	4	0.053	0.746	1
n_arc	American Red Cross	0.040	0.921	1	0.053	0.746	1
esf #06	Mass Care	0.032	0.251	2	0.044	-0.124	3
c_salv	Salvation Army	0.032	0.251	2	0.032	-1.368	4
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.066	0.947	1	0.012	0.845	3
esf #06	Mass Care	0.060	0.676	2	0.012	0.845	3
c_bap	Baptists	0.036	-0.406	3	0.012	0.845	3
c_salv	Salvation Army	0.018	-1.217	4	0.018	2.324	1
4. Ranked by In-Degree							
c_salv	Salvation Army	0.018	-1.217	4	0.018	2.324	1
st_ema	State EMA	-	-	-	0.018	2.324	1
c_bap	Baptists	0.036	-0.406	3	0.012	0.845	3
esf #06	Mass Care	0.060	0.676	2	0.012	0.845	3
esf_vol	Vol Agency Liaison	-	-	-	0.012	0.845	3

5.3.6 Combined Network Summary - Florida

The combination of all Florida networks ($COMB_{FL}$) contains 77 actors *(k)* for a network size of 5,852 (*k***k*-1). The 644 observed ties result in a modified network density of 0.110, which indicates that 11.0% of the available connections between actors have been made. The average number of ties per actor is 8.364 with an average tie length, or distance between all actors in the network, of 2.061.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 22: Combined Network Diagram, Florida

5.3.6.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.087 with low variability (SD 0.342) and the centrality mean is 0.099 with low variability (SD 0.324). This measure of variability indicates that the more influential actors are more predictable in the manner which they interact and with whom. ESF #06 Mass Care (*esf #06*, nBet 2.731, *z* 1.078, nFlow 2.233, *z* 1.303) has the greatest positional advantage, both direct and indirect. ESF #06 has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.299, *z* 1.642, quad-A), ARC (*n_arc*, out 0.251, *z* 1.234, quad-A), and FEMA (*u_hs_fema*, out 0.240, *z* 1.132, quad-A). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ESF #05 Emergency Management (*esf #05*, in 0.204, *z* 1.434, quad-A), the state emergency management agency (*st_ema*, in 0.186, *z* 1.232, quad-A), and ESF #11 Agriculture and Natural Resources (*esf #11*, in 0.168, *z* 1.030, quad-A)

Table 44: Centrality, Power and Connectedness - Combined Network, Florida

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #06	Mass Care	2.731	1.078	1	2.233	1.303	1
esf #05	Emergency Mgmt	1.888	0.635	2	0.862	0.217	6
u_hs_fema	FEMA	1.649	0.510	3	1.472	0.700	5
st_ema	State EMA	1.637	0.503	4	1.899	1.038	2
n_arc	American Red Cross	1.297	0.325	5	1.602	0.803	4
2. Ranked by Flow Centrality							
esf #06	Mass Care	2.731	1.078	1	2.233	1.303	1
st_ema	State EMA	1.637	0.503	4	1.899	1.038	2
c_salv	Salvation Army	0.540	-0.073	8	1.665	0.853	3
n_arc	American Red Cross	1.297	0.325	5	1.602	0.803	4
u_hs_fema	FEMA	1.649	0.510	3	1.472	0.700	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.299	1.642	1	0.162	0.962	4
n_arc	American Red Cross	0.251	1.234	2	0.120	0.490	8
u_hs_fema	FEMA	0.240	1.132	3	0.138	0.693	5
esf #05	Emergency Mgmt	0.186	0.673	4	0.204	1.434	1
st_ema	State EMA	0.168	0.520	5	0.186	1.232	2
4. Ranked by In-Degree							
esf #05	Emergency Mgmt	0.186	0.673	4	0.204	1.434	1
st_ema	State EMA	0.168	0.520	5	0.186	1.232	2
esf #11	Agriculture	0.150	0.367	6	0.168	1.030	3
esf #06	Mass Care	0.299	1.642	1	0.162	0.962	4
u_hs_fema	FEMA	0.240	1.132	3	0.138	0.693	5

5.3.7 Summary of Florida Networks

The reported network is the largest of the non-aggregated Florida networks with 46 nodes, a network size of 2,070 and 11.174 average ties per actor. The state plan, however, is the densest at 25.8% saturation.

Actors that are unique, study-wide, appearing in Florida's reports are: an ESF for animals and livestock *(esf_anim),* the ICS Operations Section Emergency Services Branch *(ic_opes),* the state departments of administration, *(st_adm),* community development *(st_cd),* and the public utilities commission *(st_psuc).*The only agency mentioned as desired for future events that was not included in the other networks was the United Way (*n_uw).*

5.3.7.1 Agency Composition of Florida Networks

The total number of all government agencies in the network compositions ranged from 10 in the perceived (7.14% of agencies, less positions) and desired (6.67%) networks to 32 (88.89%) in the aggregated planned network. The number of federal government civilian agencies fell from 20 (55.56%) in the aggregated planned network to a low of one in the perceived (7.14%) and the desired (6.67%) networks. This change may be a combined result of the plans' ability to anticipate the involvement of the agency actors and the perspective of the interviewees being aware of agencies that are proximal to their position as near neighbors and not those farther away in the network. The number of state government agencies fell from 14 (56.0%) in the reported network to a low of six in the perceived (42.86%) and desired (40.00%) networks. The ICS Planning Section, responsible for the generation of the sitreps would have a more encompassing view of agencies involved in the response than would the interviewees, as mentioned above.

The number of all non-governmental agencies remained relatively constant across all networks.

5.3.7.2 Actor Presence in Florida and Federal Plans

The aggregated plans were 24.68% accurate in anticipating the actors that would be involved in these response operations; 31.17% of the planned agencies did not appear in any of the other networks, while 44.16% of the active agencies did not appear in the plan. The state plan was 25.81% accurate in anticipating the non-federal actors that would be involved in these response operations; 19.35% of the planned agencies did not appear in any of the other networks, while 54.84% of the active agencies did not appear in the plan.

There were ten actors that appeared in at least one planned and all other networks: The Salvation Army (*c_salv*), ESF#06 Mass Care (*esf #06*), ESF #08 Health and Medical Services (*esf #08*), Voluntary Agency Liaison (*esf_vol*), ARC (*n_arc*), State Department of Agriculture *(st_ag*), State Bureau of Professional Regulation (*st_br*), State EMA (*st_ema*), National Guard (*st_ng*), and FEMA (*u_hs_fema*).

There were two specific agency actors that were not in the mass care plan but were in all other networks: Baptist FBOs (*c_bap*) and the State Police (*st_ps*). Consideration should be given to adding these agencies to the ESF #06 plan.

Table 45: Network Comparison Table, Florida

		Planned		Reported	Perceived	Desired	Combined
	NRP6	PLNFL	PLNFLF	RPTFL	PERFL	DESFL	COMBFL
Agency Count							
NIMS/NRP Position	3	6	7	21	6	6	23
US Government	20	0	20	6	1	1	21
US Military	2	0	2	0	0	0	2
Tribal	0	0	0	0	0	0	0
State Government	1	9	10	14	6	6	19
Local Government	0	0	0	0	3	3	3
National NGO	3	2	3	2	1	2	5
State/Local NGO	0	0	0	0	0	0	0
Faith Based	0	1	1	3	3	3	4
Business	0	0	0	0	0	0	0
Total actors (k)	29	18	43	46	20	21	77
Network Size (k*k-1)	812	306	1806	2070	380	420	5852
Sum of ties	80	79	156	514	29	30	644
Density (modified)	0.099	0.258	0.086	0.248	0.076	0.071	0.110
Avg ties per actor	2.759	4.389	3.628	11.174	1.450	1.429	8.364
Avg distance	1.048	2.007	2.043	1.833	1.508	1.524	2.061
Univariate Comparison							
quad-A	0	6	3	15	2	2	12
quad-B	26	0	1	6	3	3	0
quad-C	0	0	9	4	2	2	8
quad-D	3	12	30	21	13	14	57
Out-degree mean		0.026	0.060	0.073	0.043	0.045	0.023
Out-degree SD		0.013	0.074	0.043	0.025	0.022	0.050
In-degree mean		0.026	0.027	0.067	0.009	0.009	0.023
In degree SD		0.015	0.014	0.042	0.004	0.004	0.040

Centralization Index	ICS	PLNFL	PLNFLF	RPTFL	PERFL	DESFL	COMBFL
Betweenness	1.25%	0.31%	1.34%	1.54%	0.04%	0.04%	2.66%
Flow Centrality	52.30%	31.48%	43.02%	12.52%	39.52%	37.97%	11.04%

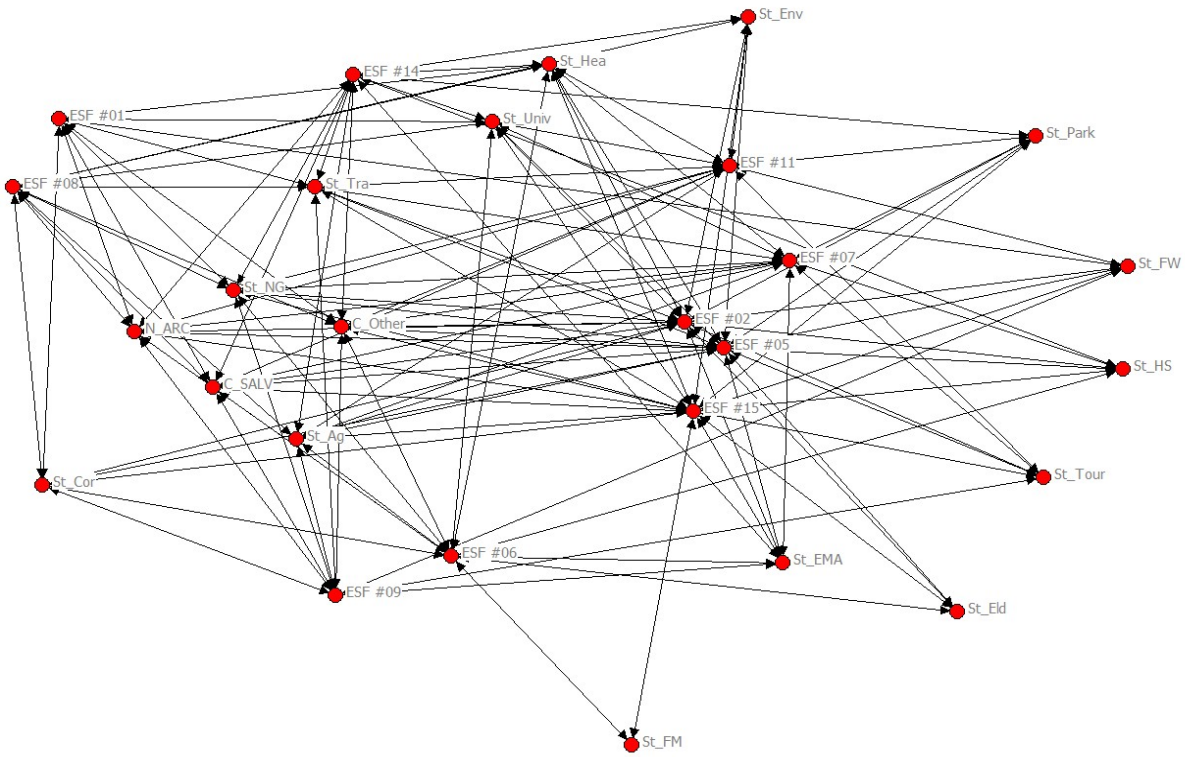
5.4 LOUISIANA

5.4.1 Planned Network Summary – Louisiana State Plan

The network formed within the Louisiana State Plan (PLN_{LA}) network contains 27 actors *(k)* for a network size of 702 (*k***k*-1). The 252 observed ties result in a modified network density of 0.358, which indicates that 35.8% of the available connections between actors have been made. This is the most dense of the non-combined networks. The average number of ties per actor is 9.333 with an average tie length, or distance between all actors in the network, of 1.766. Compared to the mass care portion of the NRP (PLN_{NRP6}), PLN_{LA} is smaller and denser network, which should make communication easier, but limits the number of potential actors with which to interact.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.310% and the flow network centrality index is 11.780%, indicating a less centralized network compared to the formal command structure of ICS (PLN_{ICS}). This can indicate the need for leadership development or a clarification of the ICS structure in use for the response.



Legend:

c_other	FBO, Other, not specified	*st_cor*	State Agency, Corrections
c_salv	FBO, Salvation Army	*st_eld*	State Agency, Elderly
esf #01	Transportation	*st_ema*	State Agency, EMA
esf #02	Communications	*st_env*	State Agency, Environment
esf #05	Emergency Management	*st_fm*	State Agency, Fire Marshal
esf #06	Mass Care, Housing & Human Services	*st_fw*	State Agency, Wildlife
esf #07	Resource Support	*st_hea*	State Agency, Health
esf #08	Public Health and Medical Services	*st_hs*	State Agency, Social/Human Services
esf #09	Urban Search and Rescue	*st_ng*	State Agency, Military / National Guard
esf #11	Agriculture and Natural Resources	*st_park*	State Agency, Parks
esf #14	Long-Term Recovery & Mitigation	*st_tour*	State Agency, Tourism
esf #15	External Affairs	*st_tra*	State Agency, Transportation
n_arc	American Red Cross	*st_univ*	State Agency, University/Higher Ed
st_ag	State Agency, Agriculture		

Figure 23: Planned Network Diagram – State Plan, Louisiana

5.4.1.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.072 with moderate variability (SD 0.071) and the centrality mean is 0.094 with moderate variability (SD 0.103). This moderate variability indicates that more influential actors are not necessarily constrained in the manner in

which they may interact or who they interact with. They have less predictable patterns of interaction within the network.

The actors with the greatest positional advantage, both direct and indirect, between other actors are: ESF #15 External Affairs (*esf #15*, nBet 0.315, *z* 3.425, nFlow 0.373, *z* 2.697), ESF #02 Communications (*esf #02*, nBet 0.205, *z* 1.878, nFlow 0.280, *z* 1.796), ESF #05 Emergency Management (*esf #05*, nBet 0.205, *z* 1.878, nFlow 0.280, *z* 1.796), and ESF #06 Mass Care (*esf #06*, nBet 0.146, *z* 1.044, nFlow 0.261, *z* 1.614). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. Actors with the greatest out-degree influence are those that issue more requests for action or information. A large in-degree measure indicates an actor who fulfills more requests for information and service. Occasionally, an actor will have high degrees in both measures, indicating that they have the potential for decreased capacity to manage information or meet other demands. If they have sufficient resources, this may not hold true. The following actors in this network have high measures of out- and in-degree: ESF #15 External Affairs (*esf #15*, out 0.102, *z* 2.159, in 0.102, *z* 2.159, quad-A), ESF #02 Communications (*esf #02*, out 0.096, *z* 1.877, in 0.096, *z* 1.877, quad-A), ESF #05 Emergency Management (*esf #05*, out 0.096, *z* 1.877, in 0.096, *z* 1.877, quad-A).

Table 46: Centrality, Power and Connectedness - Planned Network – State Plan, Louisiana

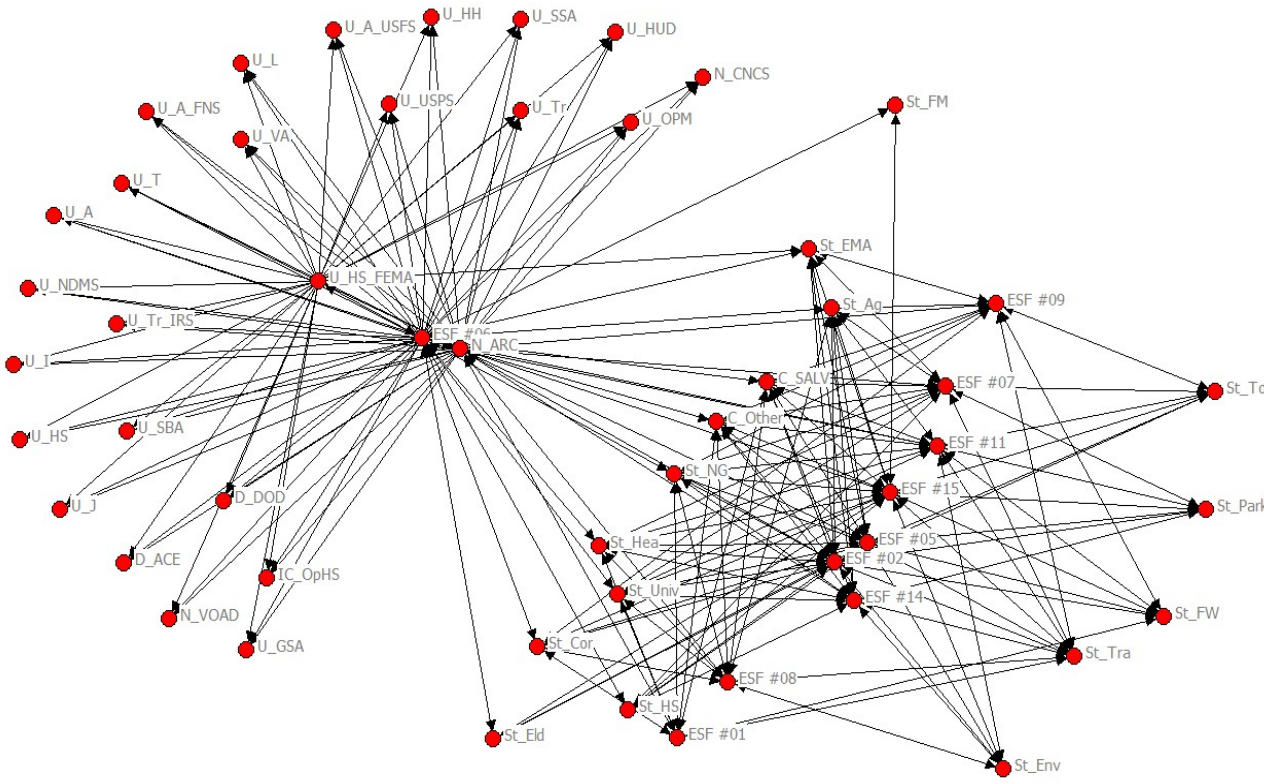
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #15	External Affairs	0.315	3.425	1	0.373	2.697	1
esf #02	Communications	0.205	1.878	2	0.280	1.796	2
esf #05	Emergency Mgmt	0.205	1.878	2	0.280	1.796	2
esf #06	Mass Care	0.146	1.044	4	0.261	1.614	4
esf #11	Agriculture	0.092	0.287	5	0.177	0.808	5
2. Ranked by Flow Centrality							
esf #15	External Affairs	0.315	3.425	1	0.373	2.697	1
esf #02	Communications	0.205	1.878	2	0.280	1.796	2
esf #05	Emergency Mgmt	0.205	1.878	2	0.280	1.796	2
esf #06	Mass Care	0.146	1.044	4	0.261	1.614	4
esf #11	Agriculture	0.092	0.287	5	0.177	0.808	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #15	External Affairs	0.102	2.159	1	0.102	2.159	1
esf #02	Communications	0.096	1.877	2	0.096	1.877	2
esf #05	Emergency Mgmt	0.096	1.877	2	0.096	1.877	2
esf #06	Mass Care	0.072	0.751	4	0.072	0.751	4
esf #07	Resource Mgmt	0.072	0.751	4	0.072	0.751	4
4. Ranked by In-Degree							
esf #15	External Affairs	0.102	2.159	1	0.102	2.159	1
esf #02	Communications	0.096	1.877	2	0.096	1.877	2
esf #05	Emergency Mgmt	0.096	1.877	2	0.096	1.877	2
esf #06	Mass Care	0.072	0.751	4	0.072	0.751	4
esf #07	Resource Mgmt	0.072	0.751	4	0.072	0.751	4

5.4.2 Planned Network Summary – Louisiana State Plan Joined with NRP

The network formed when the Louisiana State Plan and the NRP are joined (PLN_{LAF}) contains 52 actors *(k)* for a network size of 2,652 (*k***k*-1). The 330 observed ties result in a modified network density of 0.124, which indicates that 12.4% of the available connections between actors have been made. The average number of ties per actor is 6.346 with an average tie length, or distance between all actors in the network, of 1.915. Compared to the mass care portion of the NRP (PLN_{NRP6}), PLN_{LAF} is denser but less dense than the state plan alone (PLN_{LA}). It is larger than both, providing more potential actors with which to interact.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.013 which indicates a more directly centralized network than the formal command structure of ICS (PLN_{ICS}), but the flow network centrality index is 0.155, indicating a less centralized indirect network. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Legend:

c_other	FBO, Other, not specified	*st_hs*	State Agency, Social/Human Services
c_salv	FBO, Salvation Army	*st_ng*	State Agency, Military / National Guard
d_ace	US Army Corps of Engineers	*st_park*	State Agency, Parks
d_dod	US Dept of Defense	*st_tour*	State Agency, Tourism
esf #01	Transportation	*st_tra*	State Agency, Transportation
esf #02	Communications	*st_univ*	State Agency, University/Higher Ed
esf #05	Emergency Management	*u_a*	Agriculture, US Dept. of (USDA)
esf #06	Mass Care, Housing & Human Services	*u_a_fns*	USDA - Food and Nutrition Service
esf #07	Resource Support	*u_a_usfs*	USDA - Forest Service
esf #08	Public Health and Medical Services	*u_gsa*	General Services Administration
esf #09	Urban Search and Rescue	*u_hh*	Health and Human Services, US Dept. of
esf #11	Agriculture and Natural Resources	*u_hs*	Homeland Security, US Dept. of
esf #14	Long-Term Recovery & Mitigation	*u_hs_fema*	FEMA
esf #15	External Affairs	*u_hud*	Housing & Urban Develop., US Dept. of
ic_ophs	ICS Operations Human Services Branch	*u_i*	Interior, US Dept. of
n_arc	American Red Cross	*u_j*	Justice, US Dept. of
n_cncs	Corp for National and Community Service	*u_l*	Labor, US Dept. of
n_voad	Vol. Org. Active in Disaster	*u_ndms*	National Disaster Medical System
st_ag	State Agency, Agriculture	*u_opm*	Office of Personnel Management
st_cor	State Agency, Corrections	*u_sba*	Small Business Administration
st_eld	State Agency, Elderly	*u_ssa*	Social Security Administration
st_ema	State Agency, EMA	*u_t*	Transportation, US Dept. of
st_env	State Agency, Environment	*u_tr*	Treasury, US Dept. of
st_fm	State Agency, Fire Marshal	*u_tr_irs*	Treasury - Internal Revenue Service
st_fw	State Agency, Wildlife	*u_usps*	US Postal Service
st_hea	State Agency, Health	*u_va*	Veterans Affairs, US Dept. of

Figure 24: Planned Network Diagram – State Plan Joined with NRP, Louisiana

5.4.2.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.168 with high variability (SD 0.326) and the centrality mean is 0.181 with high variability (SD 0.284). This measure of variability indicates that the more influential actors have few constraints to the manner in which they may interact and with whom. They have less predictable patterns of interaction within the network.

The actors with the greatest positional advantage, both direct and indirect, between other actors are ARC (*n_arc*, nBet 1.356, *z* 3.642, nFlow 1.134, *z* 3.350) and ESF #06 Mass Care (*esf #06*, nBet 1.192, *z* 3.139, nFlow 0.868, *z* 2.416). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network. FEMA as a general agency (*u_hs_fema*, nBet 0.001, *z* -0.514, nFlow 0.765, *z* 2053) ranks third in centrality but markedly lower at 28 for betweenness, indicating that it has high influence, but much lower direct control. Its specific functions within the ESFs, however, remain high. This is shown in Table 47.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.228, *z* 3.089, quad-A), ARC (*n_arc*, out 0.210, *z* 2.735, quad-A), and FEMA (*u_hs_fema*, out 0.162, *z* 1.793, quad-B).

The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ESF #15 External Affairs (*esf #15*, in 0.102, *z* 2.548, quad-A), ESF #02 Communications (*esf #02*, in 0.096, *z* 2.309, quad-A), and ESF #05 Emergency Management (*esf #05*, in 0.096, *z* 2.309, quad-A). FEMA as a general agency had a much lower rank, 51, of in-degree measure (nBet 0.012, *z* -1.039). This indicates that FEMA issues more requests than it fulfills within this network scenario.

Table 47: Centrality, Power and Connectedness - Planned Network – State Plan Joined with NRP, Louisiana

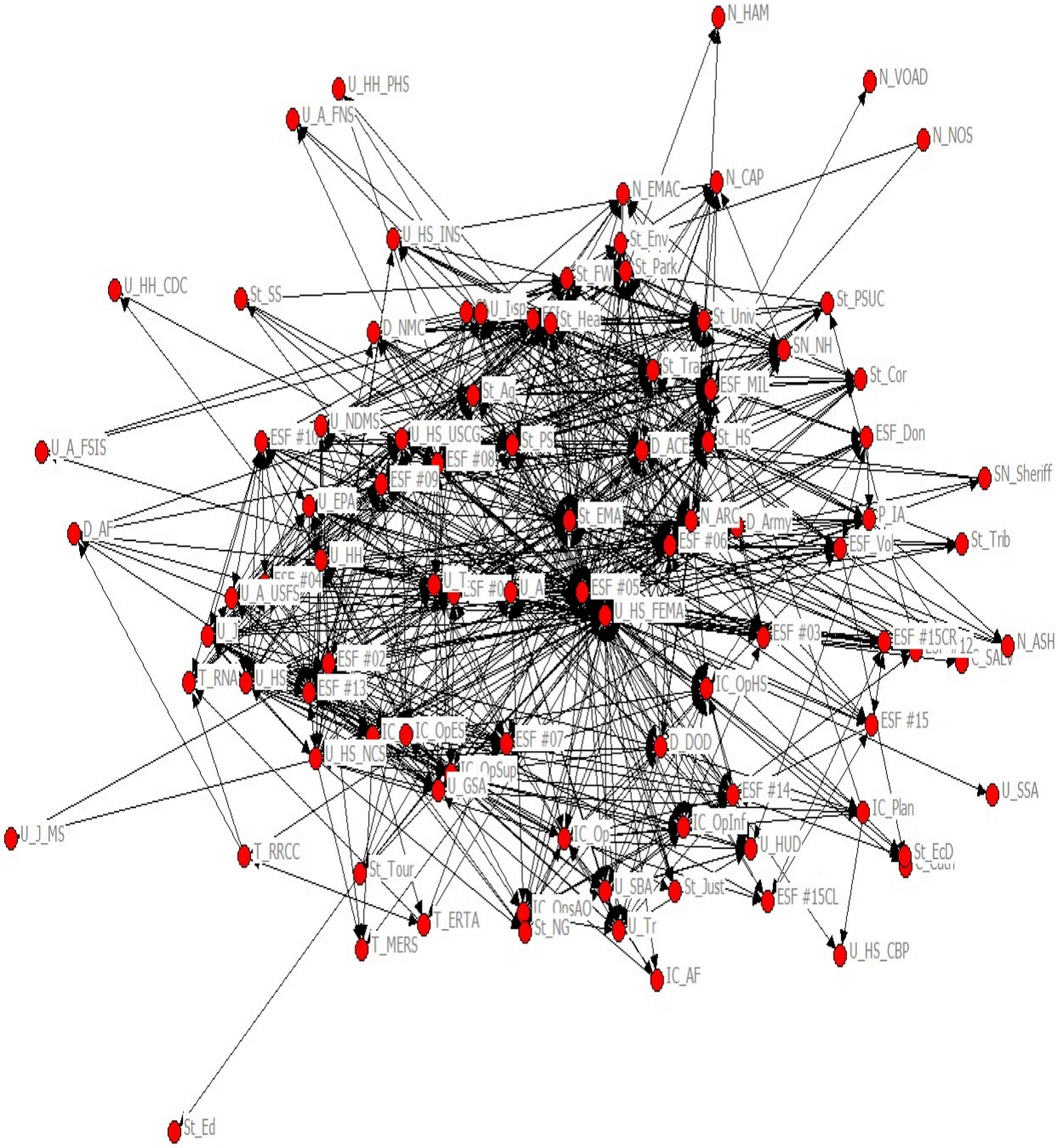
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	1.356	3.642	1	0.868	2.416	2
esf #06	Mass Care	1.192	3.139	2	1.134	3.350	1
esf #15	External Affairs	0.380	0.648	3	0.415	0.822	4
esf #02	Communications	0.272	0.319	4	0.277	0.336	5
esf #05	Emergency Mgmt	0.272	0.319	4	0.277	0.336	5
2. Ranked by Flow Centrality							
esf #06	Mass Care	1.192	3.139	2	1.134	3.350	1
n_arc	American Red Cross	1.356	3.642	1	0.868	2.416	2
u_hs_fema	FEMA	0.001	-0.514	28	0.765	2.053	3
esf #15	External Affairs	0.380	0.648	3	0.415	0.822	4
esf #02	Communications	0.272	0.319	4	0.277	0.336	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.228	3.089	1	0.078	1.591	4
n_arc	American Red Cross	0.210	2.735	2	0.066	1.113	8
u_hs_fema	FEMA	0.162	1.793	3	0.012	-1.039	51
esf #15	External Affairs	0.102	0.614	4	0.102	2.548	1
esf #02	Communications	0.096	0.497	5	0.096	2.309	2
4. Ranked by In-Degree							
esf #15	External Affairs	0.102	0.614	4	0.102	2.548	1
esf #02	Communications	0.096	0.497	5	0.096	2.309	2
esf #05	Emergency Mgmt	0.096	0.497	5	0.096	2.309	2
esf #06	Mass Care	0.228	3.089	1	0.078	1.591	4
esf #11	Agriculture	0.072	0.025	7	0.078	1.591	4

5.4.3 Reported Network Summary - Louisiana

The Louisiana reported network (RPT_{LA}) contains 65 actors *(k)* for a network size of 4,160 (*k***k*-1). The 569 observed ties result in a modified network density of 0.136, which indicates that 13.6% of the available connections between actors have been made. The average number of ties per actor is 8.754 with an average tie length, or distance between all actors in the network, of 1.921. Compared to the combination of the state plan and the NRP (PLN_{LAF}) RPT_{LA} is a larger, denser network, which increases the potential number of interactions, but may result in communication overload.

This network is primarily considered isolate-dominated in the connectedness and flow of information among the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 2.370% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 15.302% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



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Legend:

c_salv	FBO, Salvation Army	*st_hs*	State Agency, Social/Human Services
d_ace	US Army Corps of Engineers	*st_ng*	State Agency, Military / National Guard
d_af	US Air Force	*st_park*	State Agency, Parks
d_army	US Army	*st_ps*	State Agency, Police
d_dod	US Dept of Defense	*st_tour*	State Agency, Tourism
d_nmc	US Navy and Marine Corps	*st_tra*	State Agency, Transportation
esf #03	Public Works and Engineering	*st_trib*	State Agency, Tribal Affairs
esf #04	Firefighting	*st_univ*	State Agency, University/Higher Ed
esf #05	Emergency Management	*t_erta*	Emergency Response Team - Advance
esf #06	Mass Care, Housing & Human Services	*t_mers*	Mobile Emergency Response System
esf #07	Resource Support	*u_a*	Agriculture, US Dept. of (USDA)
esf #08	Public Health and Medical Services	*u_a_fns*	USDA - Food and Nutrition Service
esf #11	Agriculture and Natural Resources	*u_a_fsis*	USDA - Food Safety and Inspection Service
esf #15	External Affairs	*u_a_nrcs*	USDA - National Resource Conservation Svc
esf #15cr	Community Relations	*u_a_usfs*	USDA - Forest Service
esf_don	Donation Management	*u_gsa*	General Services Administration
esf_mil	Military (State Only)	*u_hh*	Health and Human Services, US Dept. of
esf_vol	Volunteer Management	*u_hh_cdc*	HHS - Centers for Disease Control
ic_log	ICS Logistics Section (ESF #7)	*u_hh_phs*	HHS - US Public Health Service
ic_ophs	ICS Operations Human Services Branch	*u_hs*	Homeland Security, US Dept. of
n_arc	American Red Cross	*u_hs_fema*	FEMA
n_ash	Americas Second Harvest	*u_hs_uscg*	DHS - US Coast Guard
n_voad	Vol. Org. Active in Disaster	*u_hud*	Housing & Urban Develop., US Dept. of
p_ia	Individual Assistance	*u_i*	Interior, US Dept. of
sn_hosp	State Hospital Assn	*u_nasa*	National Aeronautics and Space Admin
sn_nh	State Nursing Home Assn	*u_ndms*	National Disaster Medical System
sn_sheriff	State Sheriff's Assn	*u_opm*	Office of Personnel Management
st_ag	State Agency, Agriculture	*u_tr*	Treasury, US Dept. of
st_cor	State Agency, Corrections	*u_tr_irs*	Treasury - Internal Revenue Service
st_ema	State Agency, EMA	*u_usps*	US Postal Service
st_env	State Agency, Environment	*xas_am*	Association, Assembly Managers
st_fw	State Agency, Wildlife	*xas_com*	Association, Chamber of Commerce

Figure 25: Reported Network Diagram – Louisiana

5.4.3.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.044 with low variability (SD 0.036) and the centrality mean is 0.044 with moderate variability (SD 0.036). This measure of

variability indicates that the more influential actors are relatively constrained in the manner which they may interact and with whom they interact.

The actors with the greatest direct positional advantage to control interaction between other actors are: FEMA (*u_hs_fema*, nBet 2.398, *z* 5.452), ESF #05 Emergency Management (*esf #05*, nBet 1.286, *z* 2.733), and ESF #06 Mass Care (*esf #06*, nBet 0.678, *z* 1.246).

Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are: FEMA (*u_hs_fema*, nFlow 1.550, *z* 4.774), the US Army Corps of Engineers (*d_ace*, nFlow 0.896, *z* 2.454) and ESF #05 Emergency Management (*esf #05*, nFlow 0.745, *z* 1.918).

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: FEMA (*u_hs_fema*, out 0.251, *z* 3.988, quad-A), ESF #05 Emergency Management (*esf #05*, out 0.192, *z* 2.778, quad-A), and ARC (*n_arc*, out 0.162, *z* 2.173, quad-A). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: FEMA (*u_hs_fema*, in 0.228, *z* 3.162, quad-A), ESF #05 Emergency Management (*esf #05*, in 0.222, *z* 3.054, quad-A), and ESF #06 Mass Care (*esf #06*, in 0.204, *z* 2.729, quad-A). The State Human Services agency (*st_hs*, in 0.150, *z* 1756) has a high in-degree but a much lower rank, 16, in out-degree (out 0.078, *z* 0.480), indicating that it fulfills requests much more frequently than it issues, within this network scenario.

Table 48: Centrality, Power and Connectedness - Reported Network – Louisiana

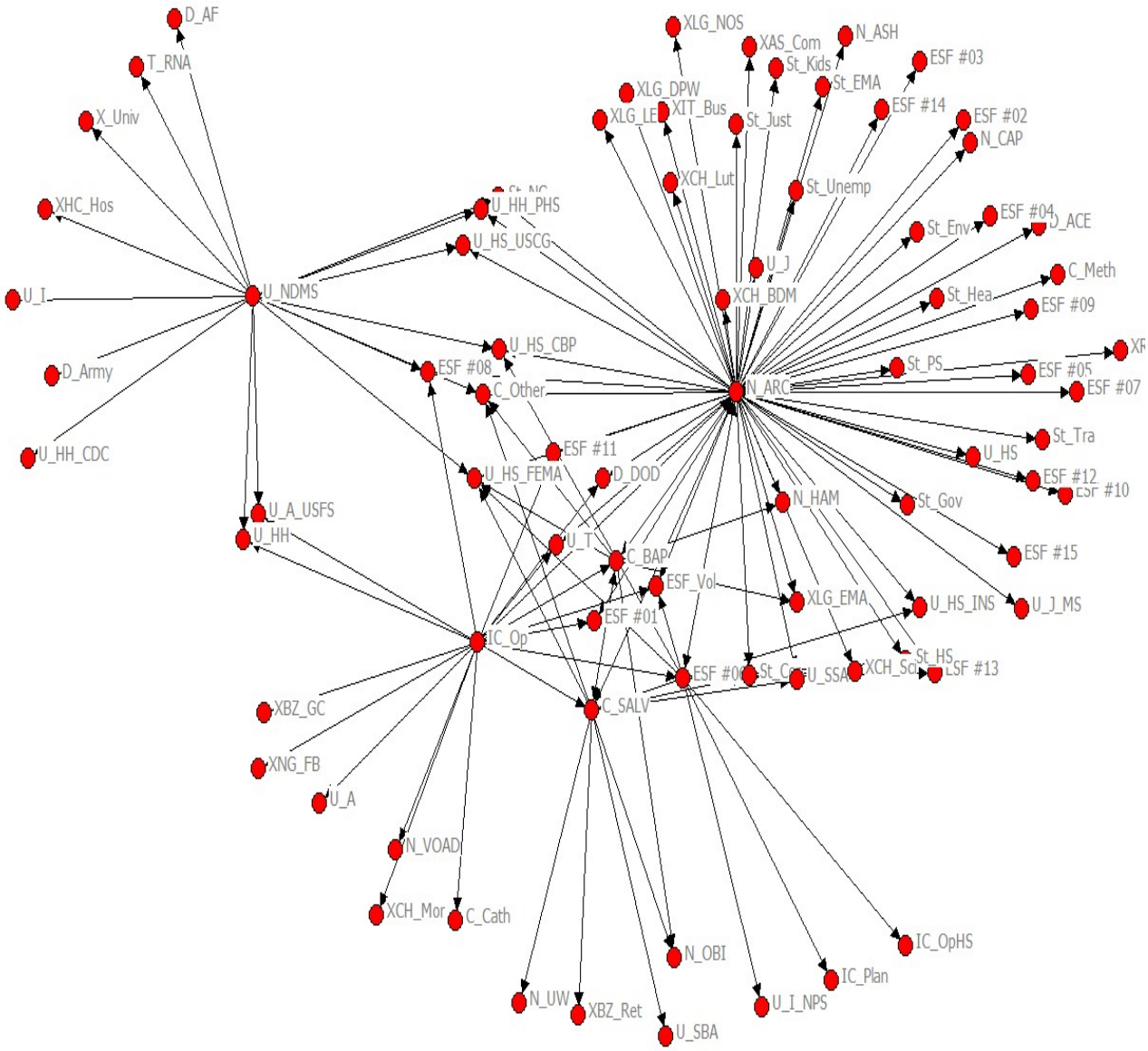
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
u_hs_fema	FEMA	2.398	5.452	1	1.550	4.774	1
esf #05	Emergency Mgmt	1.286	2.733	2	0.745	1.918	3
esf #06	Mass Care	0.678	1.246	3	0.417	0.753	7
u_i	US Dept of Interior	0.519	0.859	4	0.429	0.798	6
n_arc	American Red Cross	0.488	0.782	5	0.371	0.59	8
2. Ranked by Flow Centrality							
u_hs_fema	FEMA	2.398	5.452	1	1.550	4.774	1
d_ace	USA Corps of Engineers	0.299	0.321	9	0.896	2.454	2
esf #05	Emergency Mgmt	1.286	2.733	2	0.745	1.918	3
esf_mil	State Military ESF	0.386	0.534	6	0.475	0.959	4
d_dod	Dept of Defense	0.38	0.518	7	0.435	0.819	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
u_hs_fema	FEMA	0.251	3.988	1	0.228	3.162	1
esf #05	Emergency Mgmt	0.192	2.778	2	0.222	3.054	2
n_arc	American Red Cross	0.162	2.173	3	0.138	1.540	6
esf #06	Mass Care	0.120	1.327	4	0.204	2.729	3
st_ema	State EMA	0.120	1.327	4	0.144	1.648	5
4. Ranked by In-Degree							
u_hs_fema	FEMA	0.251	3.988	1	0.228	3.162	1
esf #05	Emergency Mgmt	0.192	2.778	2	0.222	3.054	2
esf #06	Mass Care	0.120	1.327	4	0.204	2.729	3
st_hs	State Human Services	0.078	0.480	16	0.150	1.756	4
st_ema	State EMA	0.120	1.327	4	0.144	1.648	5

5.4.4 Perceived Network Summary - Louisiana

The Louisiana perceived network (PER_{LA}) contains 82 actors *(k)* for a network size of 6,642 (*k***k*-1). The 120 observed ties result in a modified network density of 0.018, which indicates that 1.8% of the available connections between actors have been made. The average number of ties per actor is 1.463 with an average tie length, or distance between all actors in the network, of 1.67. PER_{LA} is a larger, less dense network than both the combined state plan and NRP (PLN_{LAF}) and a reported (RPT_{LA}) network which indicates that there are more potential interactions, though there are currently fewer occurring.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.700% which indicates a less centralized network, with fewer actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 81.213% which indicates a more centralized network compared to PLN_{ICS}, indicating that there are is larger number of actors with influence over the ties between actors.



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Legend:

c_bap	FBO, Baptist	*st_just*	State Agency, Justice
c_cath	FBO, Catholic	*st_kids*	State Agency, Children and Families
c_meth	FBO, Methodist	*st_ng*	State Agency, Military / National Guard
c_other	FBO, Other, not specified	*st_ps*	State Agency, Police
c_salv	FBO, Salvation Army	*st_tra*	State Agency, Transportation
d_ace	US Army Corps of Engineers	*st_unemp*	State Agency, Unemployment
d_af	US Air Force	*t_rna*	Rapid Needs Assessment Team
d_army	US Army	*u_a*	Agriculture, US Dept. of (USDA)
d_dod	US Dept of Defense	*u_a_usfs*	USDA - Forest Service
esf #01	Transportation	*u_hh*	Health and Human Services, US Dept. of
esf #02	Communications	*u_hh_cdc*	HHS - Centers for Disease Control
esf #03	Public Works and Engineering	*u_hh_phs*	HHS - US Public Health Service
esf #04	Firefighting	*u_hs*	Homeland Security, US Dept. of
esf #05	Emergency Management	*u_hs_cbp*	DHS - US Customs and Border Protection
esf #06	Mass Care, Housing & Human Services	*u_hs_fema*	FEMA
esf #07	Resource Support	*u_hs_ins*	DHS - Immigration & Naturalization Svc
esf #08	Public Health and Medical Services	*u_hs_uscg*	DHS - US Coast Guard
esf #09	Urban Search and Rescue	*u_i*	Interior, US Dept. of
esf #10	Oil and Hazardous Materials Response	*u_i_nps*	Interior - National Park Service
esf #11	Agriculture and Natural Resources	*u_j*	Justice, US Dept. of
esf #12	Energy	*u_j_ms*	Justice - US Marshals Service
esf #13	Public Safety and Security	*u_ndms*	National Disaster Medical System
esf #14	Long-Term Recovery & Mitigation	*u_sba*	Small Business Administration
esf #15	External Affairs	*u_ssa*	Social Security Administration
esf_vol	Volunteer Management	*u_t*	Transportation, US Dept. of
ic_op	ICS Operations Section	*x_univ*	University, non-state related
ic_ophs	ICS Operations Human Services Branch	*xas_com*	Association, Chamber of Commerce
ic_plan	ICS Planning Section	*xbz_gc*	Businesses, Govt Contractors
n_arc	American Red Cross	*xbz_ret*	Businesses, Retail Chains
n_ash	Americas Second Harvest	*xch_bdm*	FBO, Brethren Disaster Ministries
n_cap	Civil Air Patrol	*xch_lut*	FBO, Lutheran
n_ham	RACES/ARES (Amateur Radio)	*xch_mor*	FBO, LDS Mormons
n_obi	Operation Blessing International	*xch_sci*	FBO, Scientology
n_uw	United Way	*xhc_hos*	Health Care, Hospitals
n_voad	Vol. Org. Active in Disaster	*xit_bus*	Transit, Bussing Operators
st_cor	State Agency, Corrections	*xlg_dpw*	Local Govt, Public Works
st_ema	State Agency, EMA	*xlg_ema*	Local Govt, Emergency Management
st_env	State Agency, Environment	*xlg_le*	Local Govt, Law Enforcement
st_gov	State Governor's Office	*xlg_nos*	Local Govt, Not otherwise specified
st_hea	State Agency, Health	*xng_fb*	NGO, Food Bank, NOS
st_hs	State Agency, Social/Human Services	*xrc_int*	Red Cross, Other National Societies

Figure 26: Perceived Network Diagram, Louisiana

5.4.4.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.208 with high variability (SD 0.329) and the centrality mean is 0.191 with high variability (SD 0.278). This measure of variability indicates that the more influential actors have few constraints to the manner in which they may interact and with whom. They have less predictable patterns of interaction within the network.

The ARC (*n_arc*, nBet 0.700, *z* 1.496, nFlow 0.607, *z* 1.498, represented in interviews) has the greatest positional advantage, both direct and indirect. The ARC has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network. The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actor with the greatest out-degree influence, that issues more requests for action or information is the ARC (*n_arc*, out 0.341, *z* 1.994, quad-A, represented in interviews). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: FEMA (*u_hs_fema*, in 0.030, *z* 4.030, quad-B), ARC (*n_arc*, in 0.024, *z* 2.890, quad-A), The Salvation Army (*c_salv*, in 0.024, *z* 2.890, quad-C, represented in interviews), and other, non-specified FBOs (*c_other*, in 0.024, *z* 2.890, quad-B).

Table 49 : Centrality, Power and Connectedness - Perceived Network, Louisiana

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	0.700	1.496	1	0.607	1.498	1
c_salv	Salvation Army	0.067	-0.430	2	0.072	-0.430	2
esf #06	Mass Care	0.053	-0.472	3	0.032	-0.571	4
c_bap	Baptists	0.013	-0.595	4	0.053	-0.497	3
2. Ranked by Flow Centrality							
n_arc	American Red Cross	0.700	1.496	1	0.607	1.498	1
c_salv	Salvation Army	0.067	-0.43	2	0.072	-0.430	2
c_bap	Baptists	0.013	-0.595	4	0.053	-0.497	3
c_adv	Adventists	0.053	-0.472	3	0.032	-0.571	4
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.341	1.994	1	0.024	2.890	2
ic_op	ICS Operations Section	0.108	-0.108	2	0	-1.667	81
u_ndms	NDMS	0.096	-0.216	3	0	-1.667	81
esf #06	Mass Care	0.072	-0.431	4	0.012	0.611	9
c_salv	Salvation Army	0.060	-0.539	5	0.024	2.890	2
4. Ranked by In-Degree							
u_hs_fema	FEMA	-	-	-	0.030	4.030	1
c_other	Other FBO	-	-	-	0.024	2.890	2
c_salv	Salvation Army	0.060	-0.539	5	0.024	2.890	2
n_arc	American Red Cross	0.341	1.994	1	0.024	2.890	2
c_bap	Baptists	0.042	-0.701	6	0.018	1.751	5

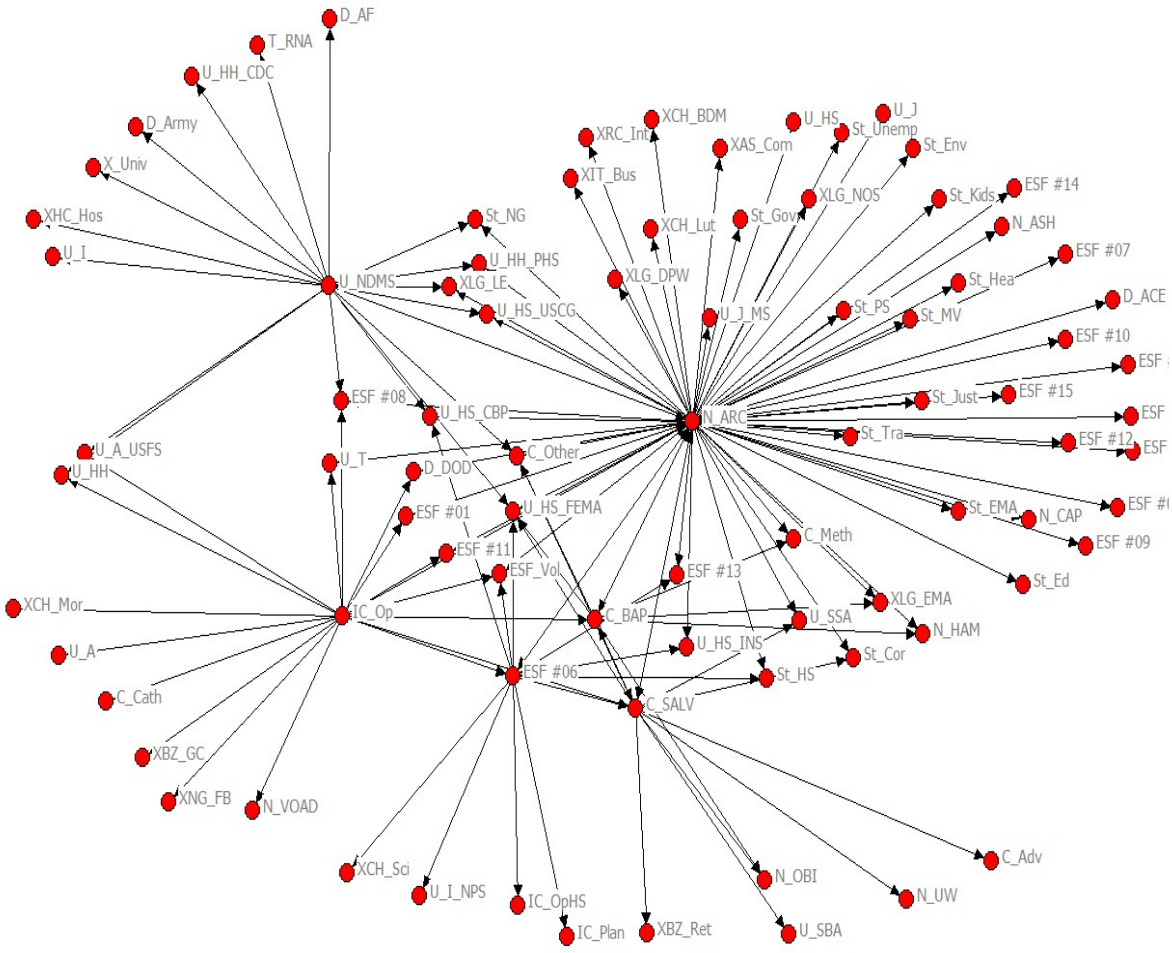
5.4.5 Desired Network Summary - Louisiana

The Louisiana desired network (DES_{LA}) contains 85 actors *(k)* for a network size of 7,140 (*k***k*-1). The 125 observed ties result in a modified network density of 0.017, which indicates that 1.7% of the available connections between actors have been made. This is the largest size, but the smallest density of the non-combined networks. The average number of ties per actor is 1.471 with an average tie length, or distance between all actors in the network, of 1.743. DES_{LA}

is larger than the other Louisiana networks, which indicates that there are more potential interactions. It is less dense than the combined state plan and NRP (PLN_{LAF}) and reported (RPT_{LA}) networks, and similar in density to the perceived network (PER_{LA}).

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.930% which indicates a less centralized network, with fewer actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 85.051% which indicates a more centralized network compared to the PLN_{ICS}, indicating that there are a larger number of actors with influence over the ties between actors. This can indicate that there are fewer opportunities for bottle-necks, or choke-points of information to be created or exploited.



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Legend:

c_adv	FBO, Adventist	*st_just*	State Agency, Justice
c_bap	FBO, Baptist	*st_kids*	State Agency, Children and Families
c_cath	FBO, Catholic	*st_mv*	State Agency, Motor Vehicles
c_meth	FBO, Methodist	*st_ng*	State Agency, Military / National Guard
c_other	FBO, Other, not specified	*st_ps*	State Agency, Police
c_salv	FBO, Salvation Army	*st_tra*	State Agency, Transportation
d_ace	US Army Corps of Engineers	*st_unemp*	State Agency, Unemployment
d_af	US Air Force	*t_rna*	Rapid Needs Assessment Team
d_army	US Army	*u_a*	Agriculture, US Dept. of (USDA)
d_dod	US Dept of Defense	*u_a_usfs*	USDA - Forest Service
esf #01	Transportation	*u_hh*	Health and Human Services, US Dept. of
esf #02	Communications	*u_hh_cdc*	HHS - Centers for Disease Control
esf #03	Public Works and Engineering	*u_hh_phs*	HHS - US Public Health Service
esf #04	Firefighting	*u_hs*	Homeland Security, US Dept. of
esf #05	Emergency Management	*u_hs_cbp*	DHS - US Customs and Border Protection
esf #06	Mass Care, Housing & Human Services	*u_hs_fema*	FEMA
esf #07	Resource Support	*u_hs_ins*	DHS - Immigration & Naturalization Svc
esf #08	Public Health and Medical Services	*u_hs_uscg*	DHS - US Coast Guard
esf #09	Urban Search and Rescue	*u_i*	Interior, US Dept. of
esf #10	Oil and Hazardous Materials Response	*u_i_nps*	Interior - National Park Service
esf #11	Agriculture and Natural Resources	*u_j*	Justice, US Dept. of
esf #12	Energy	*u_j_ms*	Justice - US Marshals Service
esf #13	Public Safety and Security	*u_ndms*	National Disaster Medical System
esf #14	Long-Term Recovery & Mitigation	*u_sba*	Small Business Administration
esf #15	External Affairs	*u_ssa*	Social Security Administration
esf_vol	Volunteer Management	*u_t*	Transportation, US Dept. of
ic_op	ICS Operations Section	*x_univ*	University, non-state related
ic_ophs	ICS Operations Human Services Branch	*xas_com*	Association, Chamber of Commerce
ic_plan	ICS Planning Section	*xbz_gc*	Businesses, Govt Contractors
n_arc	American Red Cross	*xbz_ret*	Businesses, Retail Chains
n_ash	Americas Second Harvest	*xch_bdm*	FBO, Brethren Disaster Ministries
n_cap	Civil Air Patrol	*xch_lut*	FBO, Lutheran
n_ham	RACES/ARES (Amateur Radio)	*xch_mor*	FBO, LDS Mormons
n_obi	Operation Blessing International	*xch_sci*	FBO, Scientology
n_uw	United Way	*xhc_hos*	Health Care, Hospitals
n_voad	Vol. Org. Active in Disaster	*xit_bus*	Transit, Bussing Operators
st_cor	State Agency, Corrections	*xlg_dpw*	Local Govt, Public Works
st_ed	State Agency, Education	*xlg_ema*	Local Govt, Emergency Management
st_ema	State Agency, EMA	*xlg_le*	Local Govt, Law Enforcement
st_env	State Agency, Environment	*xlg_nos*	Local Govt, Not otherwise specified
st_gov	State Governor's Office	*xng_fb*	NGO, Food Bank, NOS
st_hea	State Agency, Health	*xrc_int*	Red Cross, Other National Societies
st_hs	State Agency, Social/Human Services		

Figure 27: Desired Network Diagram, Louisiana

5.4.5.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.282 with high variability (SD 0.435) and the centrality mean is 0.211 with high variability (SD 0.296). This measure of variability

indicates that the more influential actors have few constraints to the manner in which they may interact and with whom. They have less predictable patterns of interaction within the network.

The ARC (*n_arc*, nBet 0.933, *z* 1.495, nFlow 0.654, *z* 1.496, represented in interviews) has the greatest direct and indirect positional advantage; it has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actor with the greatest out-degree influence, that issues more requests for action or information is the ARC (*n_arc*, out 0.347, *z* 1.994, quad-A, represented in interviews). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ARC (*n_arc*, in 0.030, *z* 3.889, quad-A, represented in interviews), FEMA (*u_hs_fema*, in 0.030, *z* 3.889, quad-B), other FBOs (*c_other*, in 0.024, *z* 2.787, quad-B), and The Salvation Army (*c_salv*, in 0.024, *z* 2.787, quad-C, represented in interviews).

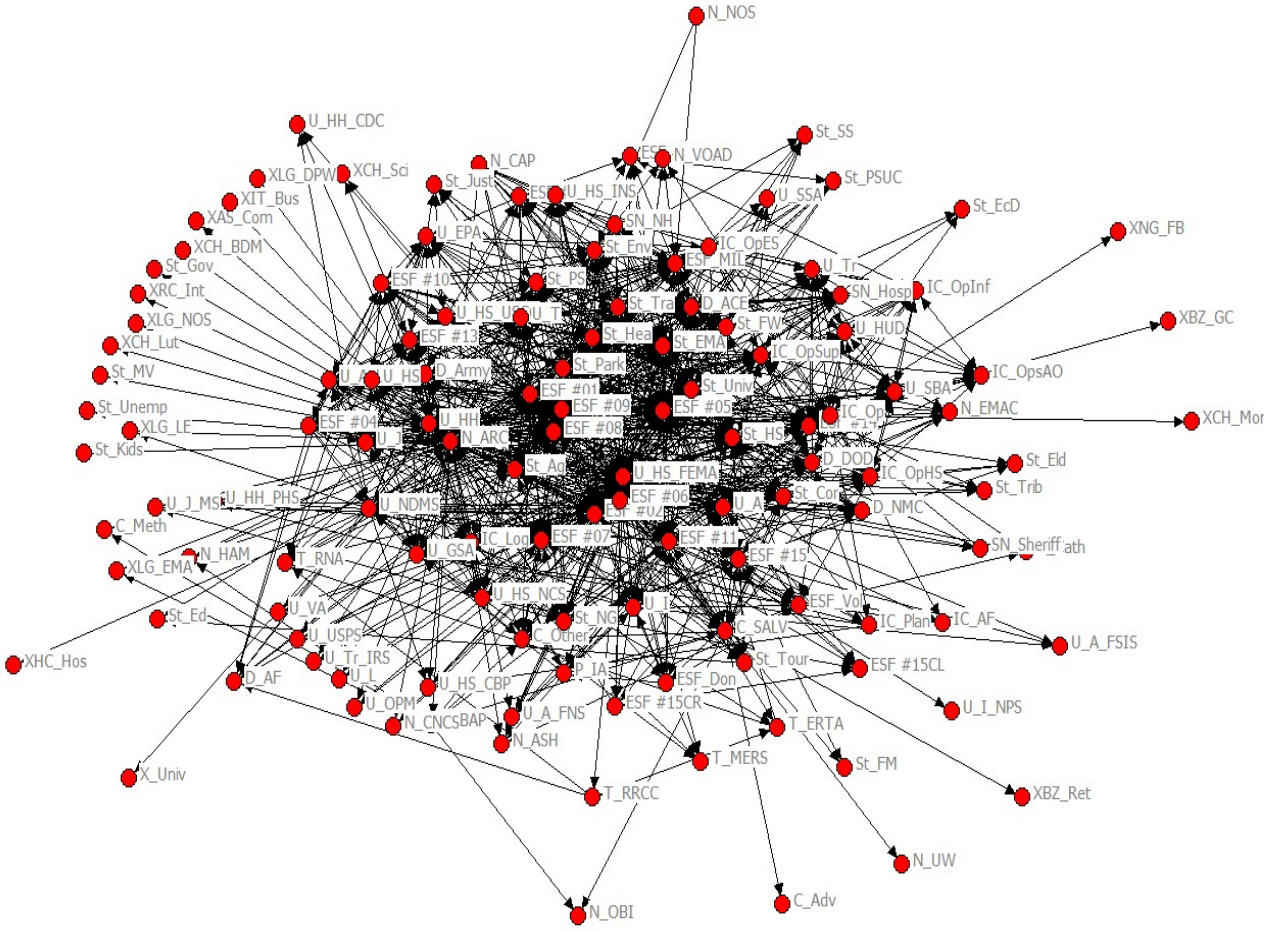
Table 50: Centrality, Power and Connectedness - Desired Network, Louisiana

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	0.933	1.495	1	0.654	1.496	1
c_salv	Salvation Army	0.098	-0.424	2	0.093	-0.397	2
esf #06	Mass Care	0.080	-0.464	3	0.043	-0.566	4
c_bap	Baptists	0.018	-0.607	4	0.053	-0.533	3
2. Ranked by Flow Centrality							
n_arc	American Red Cross	0.933	1.495	1	0.654	1.496	1
c_salv	Salvation Army	0.098	-0.424	2	0.093	-0.397	2
c_bap	Baptists	0.018	-0.607	4	0.053	-0.533	3
esf #06	Mass Care	0.080	-0.464	3	0.043	-0.566	4
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.347	1.994	1	0.030	3.889	1
ic_op	ICS Operations Section	0.108	-0.152	2	-	-	-
u_ndms	NDMS	0.108	-0.152	2	-	-	-
esf #06	Mass Care	0.072	-0.474	4	0.012	0.583	9
c_salv	Salvation Army	0.066	-0.528	5	0.024	2.787	3
4. Ranked by In-Degree							
n_arc	American Red Cross	0.347	1.994	1	0.030	3.889	1
u_hs_fema	FEMA	-	-	-	0.030	3.889	1
c_other	Other FBO	-	-	-	0.024	2.787	3
c_salv	Salvation Army	0.066	-0.528	5	0.024	2.787	3
c_bap	Baptists	0.048	-0.689	6	0.018	1.685	5

5.4.6 Combined Network Summary - Louisiana

The combination of all Louisiana networks ($COMB_{LA}$) contains 118 actors *(k)* for a network size of 13,806 (*k***k*-1). The 925 observed ties result in a modified network density of 0.067, which indicates that 6.7 % of the available connections between actors have been made. The average number of ties per actor is 7.839 with an average tie length, or distance between all actors in the network, of 2.145 as the average length of ties.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 28: Combined Network Diagram, Louisiana

5.4.6.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.160 with high variability (SD 0.748) and the centrality mean is 0.140 with moderate variability (SD 0.537). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The actors with the greatest positional advantage, both direct and indirect, between other actors are: ARC (*n_arc*, nBet 7.612, *z* 3.642, nFlow 5.596, *z* 3.966), ESF #06 Mass Care (*esf #06*, nBet 4.123, *z* 1.809, nFlow 2.348, *z* 1.394), and FEMA (*u_hs_fema*, nBet 3.910, *z* 1.698, nFlow 2.843, *z* 1.786). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. Actors with the greatest out-degree influence are those that issue more requests for action or information. A large in-degree measure indicates an actor who fulfills more requests for information and service. Occasionally, an actor will have high degrees in both measures, indicating that they have the potential for decreased capacity to manage information or meet other demands. If they have sufficient resources, this may not hold true.

The following actors in this network have high measures of out- and in-degree: ARC (*n_arc*, out 0.515, *z* 3.477, in 0.192, *z* 1.299, quad-A). FEMA (*u_hs_fema*, out 0.347, *z* 2.050, in 0.246, *z* 1.906, quad-A), ESF #06 Mass Care (*esf #06*, out 0.317, *z* 1.795, in 0.246, *z* 1.906, quad-A), and ESF #05 Emergency Management (*esf #05*, out 0.228, *z* 1.030, in 0.246, *z* 1.906, quad-A).

Table 51: Centrality, Power and Connectedness - Combined Network, Louisiana

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	7.612	3.642	1	5.596	3.966	1
esf #06	Mass Care	4.123	1.809	2	2.348	1.394	3
u_hs_fema	FEMA	3.910	1.698	3	2.843	1.786	2
esf #05	Emergency Mgmt	1.700	0.536	4	0.855	0.212	6
c_salv	Salvation Army	1.012	0.175	5	1.169	0.460	5
2. Ranked by Flow Centrality							
n_arc	American Red Cross	7.612	3.642	1	5.596	3.966	1
u_hs_fema	FEMA	3.910	1.698	3	2.843	1.786	2
esf #06	Mass Care	4.123	1.809	2	2.348	1.394	3
u_ndms	NDMS	0.962	0.149	6	1.252	0.526	4
c_salv	Salvation Army	1.012	0.175	5	1.169	0.460	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.515	3.477	1	0.192	1.299	4
u_hs_fema	FEMA	0.347	2.050	2	0.246	1.906	1
esf #06	Mass Care	0.317	1.795	3	0.246	1.906	1
esf #05	Emergency Mgmt	0.228	1.030	4	0.246	1.906	1
st_ema	State EMA	0.150	0.367	5	0.174	1.097	5
4. Ranked by In-Degree							
esf #05	Emergency Mgmt	0.228	1.030	4	0.246	1.906	1
esf #06	Mass Care	0.317	1.795	3	0.246	1.906	1
u_hs_fema	FEMA	0.347	2.050	2	0.246	1.906	1
n_arc	American Red Cross	0.515	3.477	1	0.192	1.299	4
esf #08	Health/Medical	0.126	0.163	10	0.174	1.097	5

5.4.7 Summary of Louisiana Networks

The perceived network is the largest of the non-aggregated Louisiana networks with 82 nodes, a network size of 6,642 but the lowest number of average ties per actor, 1.463. The state plan, however, is the densest at 35.9% saturation.

Actors that are unique, study-wide, appearing in Louisiana's reports are three state-wide associations for hospitals (*sn_hosp),* nursing homes *(sn_nh)* and sheriffs *(sn_sheriff).* NASA *(u_nasa)* was also unique to Louisiana's reported networks

The agencies mentioned as desired for future events that were not included in the other networks was the Adventists (*c_adv)* and the state departments of education *(st_ed)* and motor vehicles *(st_mv).*

5.4.7.1 Agency Composition of Louisiana Networks

The total number of all government agencies in the network compositions ranged from 36 (87.80% of agencies, less positions) in the aggregated planned network to 42 (64.62%) in the desired network. The total number of federal government civilian and state agencies remained relatively constant across the networks. The number of all non-government agencies ranged from five (12.20%) in the aggregated planned network to 23 (35.38%) in the desired network. Planning for future operations may be improved with the inclusion of additional NGO and FBO response agencies.

5.4.7.2 Actor Presence in Louisiana and Federal Plans

The aggregated plans were 39.83% accurate in anticipating the actors that would be involved in these response operations; 4.24% of the planned agencies did not appear in any of the other networks, while 55.93% of the active agencies did not appear in the plan. The state plan was 28.57% accurate in anticipating the non-federal actors that would be involved in these response operations; 5.36% of the planned agencies did not appear in any of the other networks, while 66.07% of the active agencies did not appear in the plan.

There were 26 actors that appeared in at least one planned and all other networks: The Salvation Army (*c_salv*), US Army Corps of Engineers (*d_ace*), US Department of Defense (*d_dod*), ESF #05 Emergency Management (*esf #05*), ESF#06 Mass Care (*esf #06*), ESF #07 Resource Management (*esf #07*), ESF #08 Health and Medical Services (*esf #08*), ESF #11 Agriculture and Natural Resources (*esf #11*), ESF #15 External Affairs (*esf #15*), ICS Operations - Human Services Branch (*ic_ophs*), ARC *(n_arc*), NVOAD (*n_voad*), State Department of Corrections (*st_cor*), State EMA (*st_ema*), State Department of Environmental Protection (*st_env*), State Department of Health *(st_hea*), State Department of Human Services (*st_hs*), National Guard (*st_ng*), State Department of Transportation (*st_tra*), USDA (*u_a*), US Forest Service (*u_a_usfs*), US Department of Health and Human Services (*u_h*h), DHS (*u_hs*), FEMA (*u_hs_fema*), US Department of the Interior (*u_i*), and NDMS (*u_ndms*).

There were eight specific agency actors that were not in the mass care plan but were in all other networks: Chambers of Commerce (*xas_com*), US Air Force (*d_af*), US Army (*d_army*), America's Second Harvest (*n_ash*), State Police (*st_ps*), Centers for Disease Control and Prevention (*u_hh_cdc*), Public Health Service (*u_hh_phs*), and US Coast Guard (*u_hs_uscg*).

Additional analysis should be performed to determine if these agencies should be added to the ESF #06 plan.

Table 52: Network Comparison Table, Louisiana

	NRP6	Planned PLNLA	PLNLAF	Reported RPTLA	Perceived PERLA	Desired DESLA	Combined COMBLA
Agency Count							
NIMS/NRP Position	3	10	11	17	20	20	27
US Government	20	0	20	20	18	18	30
US Military	2	0	2	5	4	4	5
Tribal	0	0	0	0	0	0	0
State Government	1	14	14	14	12	14	22
Local Government	0	0	0	0	6	6	6
National NGO	3	1	3	3	8	8	9
State/Local NGO	0	0	0	3	1	1	4
Faith Based	0	2	2	1	9	10	10
Business	0	0	0	2	4	4	5
Total actors (k)	29	27	52	65	82	85	118
Network Size (k*k-1)	812	702	2652	4160	6642	7140	13806
Sum of ties	80	252	330	569	120	125	925
Density (modified)	0.099	0.359	0.124	0.137	0.018	0.018	0.067
Avg ties per actor	2.759	9.333	6.346	8.754	1.463	1.471	7.839
Avg distance	1.048	1.766	1.915	1.921	1.670	1.743	2.145
Univariate Comparison							
Quad-A	0	13	8	24	1	1	16
Quad-B	26	0	1	6	23	24	1
Quad-C	0	0	12	1	3	3	10
Quad-D	3	14	31	34	55	57	91
Out-degree mean		0.056	0.071	0.054	0.120	0.125	0.033
Out-degree SD		0.021	0.051	0.050	0.111	0.112	0.066
In-degree mean		0.056	0.038	0.052	0.009	0.009	0.033
In degree SD		0.021	0.025	0.055	0.005	0.005	0.052

Centralization Index	ICS	PLNLA	PLNLAF	RPTLA	PERLA	DESLA	COMBLA
Betweenness	1.25%	0.31%	1.34%	2.37%	0.70%	0.93%	7.50%
Flow Centrality	52.30%	11.78%	15.48%	15.30%	81.21%	85.05%	11.72%

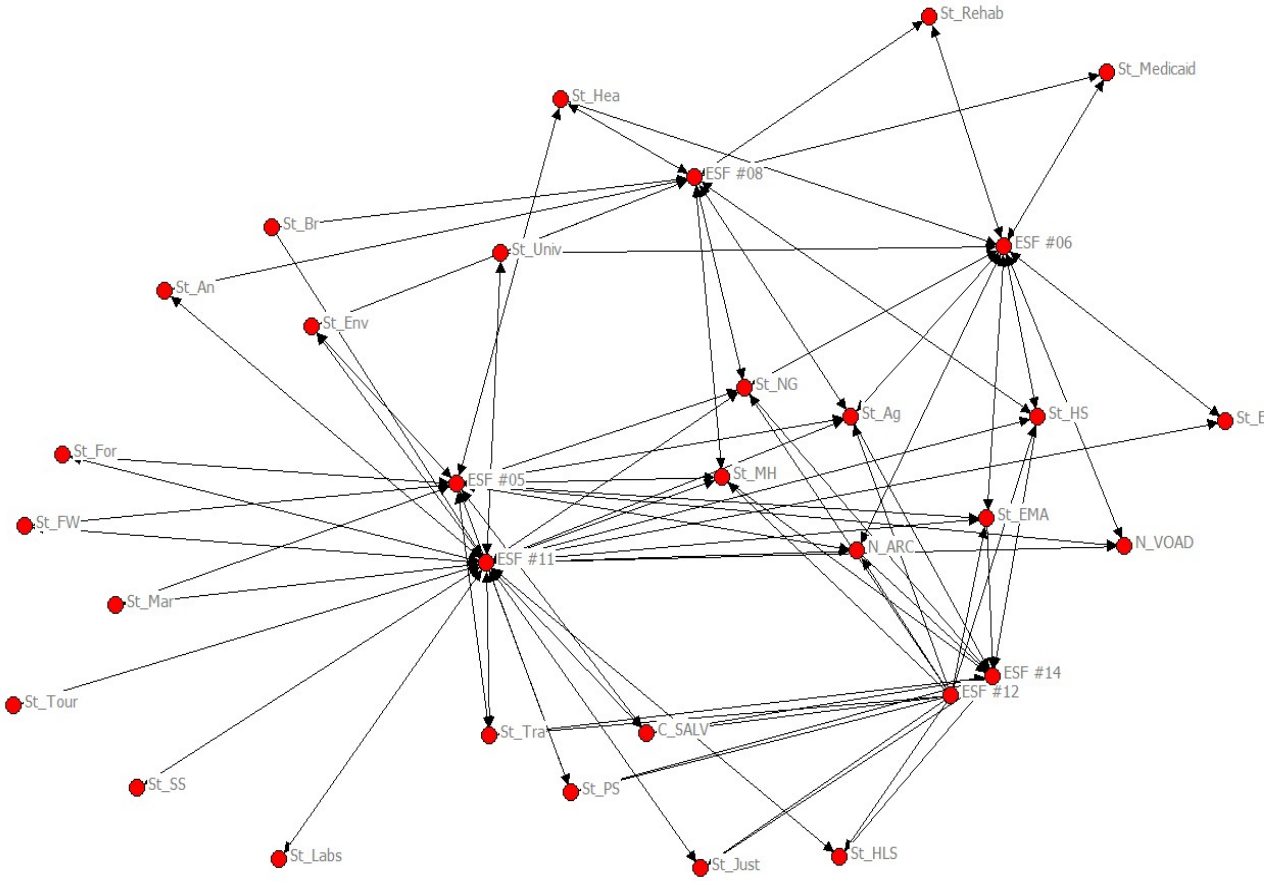
5.5 MISSISSIPPI

5.5.1 Planned Network Summary – Mississippi State Plan

The network formed within the Mississippi state plan (PLN_{MS}) network contains 46 actors *(k)* for a network size of 992 (*k***k*-1). The 138 observed ties result in a modified network density of 0.067, which indicates that 6.7 % of the available connections between actors have been made. The average number of ties per actor is 3.0 with an average tie length, or distance between all actors in the network, of 2.097. Compared to the mass care portion of the NRP (PLN_{NRP6}), PLN_{MS} is a larger, denser network, which increases the potential number of interactions, but may result in communication overload.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 1.730% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 45.976% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Legend:

c_salv	FBO, Salvation Army	*st_fw*	State Agency, Wildlife
esf #05	Emergency Management	*st_hea*	State Agency, Health
esf #06	Mass Care, Housing & Human Services	*st_hls*	State Agency, Homeland Security
esf #08	Public Health and Medical Services	*st_hs*	State Agency, Social/Human Services
esf #11	Agriculture and Natural Resources	*st_just*	State Agency, Justice
esf #12	Energy	*st_labs*	State Agency, Laboratories
esf #14	Long-Term Recovery & Mitigation	*st_mar*	State Agency, Marine
n_arc	American Red Cross	*st_medicaid*	State Agency, Medicaid
n_voad	Vol. Org. Active in Disaster	*st_mh*	State Agency, Mental Health / Retardation
st_ag	State Agency, Agriculture	*st_ng*	State Agency, Military / National Guard
st_an	State Agency, Animal	*st_ps*	State Agency, Police
st_br	State Agency, Professional Regulation	*st_rehab*	State Agency, Rehabilitation
st_ed	State Agency, Education	*st_ss*	State Agency, State Department
st_ema	State Agency, EMA	*st_tour*	State Agency, Tourism
st_env	State Agency, Environment	*st_tra*	State Agency, Transportation
st_for	State Agency, Forestry	*st_univ*	State Agency, University/Higher Ed

Figure 29: Planned Network Diagram – State Plan, Mississippi

5.5.1.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.137 with high variability (SD 0.348) and the centrality mean is 0.118 with high variability (SD 0.347). This measure of variability indicates that the more influential actors have few constraints to the manner in which they may interact and with whom. They have less predictable patterns of interaction within the network.

The actors with the greatest positional advantage, both direct and indirect, between other actors are ESF #11 (*esf #11*, nBet 1.744, *z* 4.621, nFlow 1.649, *z* 4.416) and ESF #05 Emergency Management (*esf #05*, nBet 0.449, *z* 0.898, nFlow 0.592, *z* 1.366). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. Actors with the greatest out-degree influence are those that issue more requests for action or information. A large in-degree measure indicates an actor who fulfills more requests for information and service. Occasionally, an actor will have high degrees in both measures, indicating that they have the potential for decreased capacity to manage information or meet other demands. If they have sufficient resources, this may not hold true.

The following actors in this network have high measures of out- and in-degree: ESF #11 (*esf #11*, out 0.132, *z* 3.836, in 0.138, *z* 3.908, quad-A), ESF #05 Emergency Management (*esf #05*, out 0.084, *z* 2.087, in 0.084, *z* 2.026, quad-A), and ESF #06 Mass Care (*esf #06*, out 0.066, *z* 1.432, in 0.066, *z* 1.398, quad-A). ESF #12 Energy (esf #12, out 0.066) ranked third for out-degree but had a nil out-degree, indicating that it only issued requests within this network.

Table 53: Centrality, Power and Connectedness - Planned Network – State Plan, Mississippi

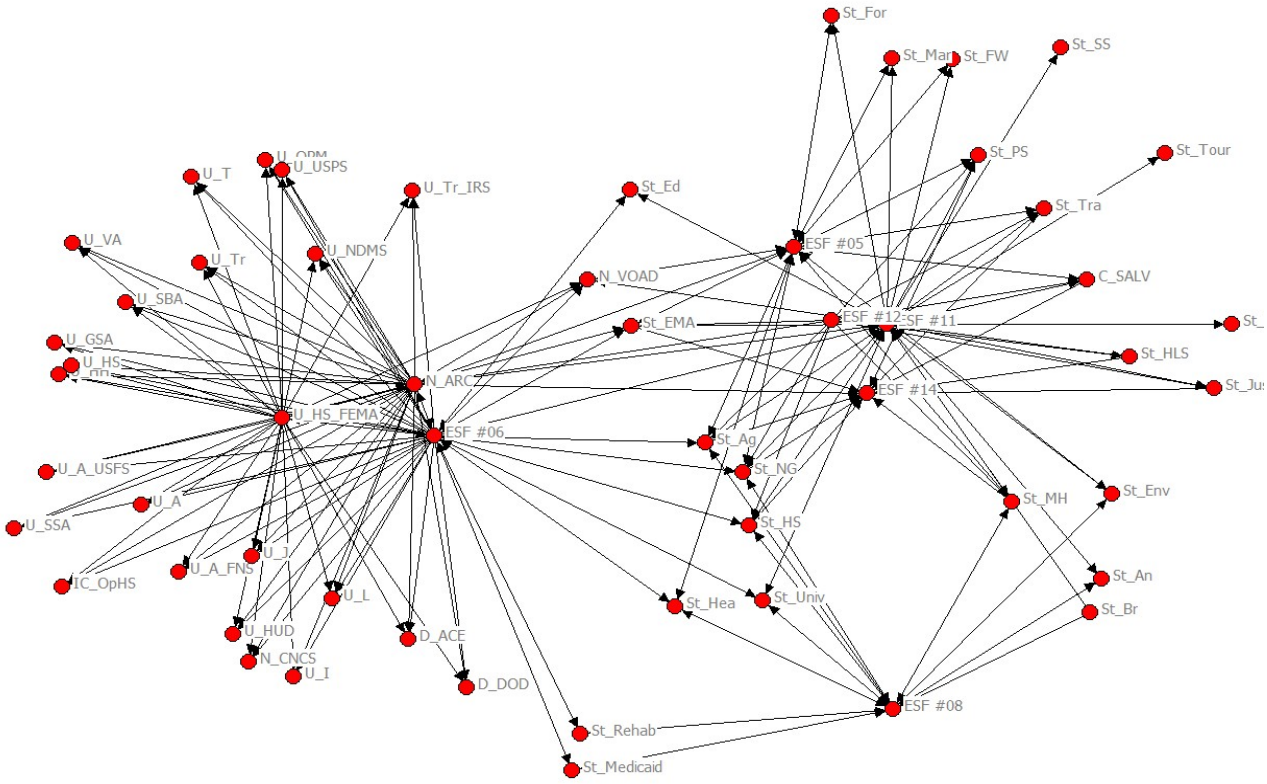
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #11	Agriculture	1.744	4.621	1	1.649	4.416	1
esf #05	Emergency Mgmt	0.449	0.898	2	0.592	1.366	2
esf #06	Mass Care	0.356	0.63	3	0.395	0.799	3
esf #08	Health/Medical	0.322	0.532	4	0.377	0.746	4
st_ag	State Agriculture	0.095	-0.121	5	0.005	-0.325	5
2. Ranked by Flow Centrality							
esf #11	Agriculture	1.744	4.621	1	1.649	4.416	1
esf #05	Emergency Mgmt	0.449	0.898	2	0.592	1.366	2
esf #06	Mass Care	0.356	0.63	3	0.395	0.799	3
esf #08	Health/Medical	0.322	0.532	4	0.377	0.746	4
st_ag	State Agriculture	0.095	-0.121	5	0.005	-0.325	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #11	Agriculture	0.132	3.836	1	0.138	3.908	1
esf #05	Emergency Mgmt	0.084	2.087	2	0.084	2.026	2
esf #06	Mass Care	0.066	1.432	3	0.066	1.398	3
esf #12	Energy	0.066	1.432	3	-	-	-
esf #08	Health/Medical	0.060	1.213	5	0.066	1.398	3
4. Ranked by In-Degree							
esf #11	Agriculture	0.132	3.836	1	0.138	3.908	1
esf #05	Emergency Mgmt	0.084	2.087	2	0.084	2.026	2
esf #06	Mass Care	0.066	1.432	3	0.066	1.398	3
esf #08	Health/Medical	0.060	1.213	5	0.066	1.398	3
esf #14	Recovery/Mitigation	-	-	-	0.066	1.398	3

5.5.2 Planned Network Summary – Mississippi State Plan Joined with NRP

The network formed when the Mississippi State Plan and the NRP are joined (PLN_{MSF}) contains 56 actors *(k)* for a network size of 3,080 (*k***k*-1). The 215 observed ties result in a modified network density of 0.070, which indicates that 7.0% of the available connections between actors have been made. The average number of ties per actor is 3.839 with an average tie length, or distance between all actors in the network, of 2.214. Compared to the mass care portion of the NRP (PLN_{NRP6}) and the state plan (PLN_{MS}), PLN_{MSF} is a larger and less dense network, which indicates that there are more potential interactions, though there are currently fewer occurring.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.027 which indicates a more directly centralized network than the formal command structure of ICS (PLN_{ICS}), but the flow network centrality index is 0.370, indicating that there is a less centralized indirect network. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



c_salv	FBO, Salvation Army	*st_mh*	State Agency, Mental Health / Retardation
d_ace	US Army Corps of Engineers	*st_ng*	State Agency, Military / National Guard
d_dod	US Dept of Defense	*st_ps*	State Agency, Police
esf #05	Emergency Management	*st_rehab*	State Agency, Rehabilitation
esf #06	Mass Care, Housing & Human Services	*st_ss*	State Agency, State Department
esf #08	Public Health and Medical Services	*st_tour*	State Agency, Tourism
esf #11	Agriculture and Natural Resources	*st_tra*	State Agency, Transportation
esf #12	Energy	*st_univ*	State Agency, University/Higher Ed
esf #14	Long-Term Recovery & Mitigation	*u_a*	Agriculture, US Dept. of (USDA)
ic_ophs	ICS Operations Human Services Branch	*u_a_fns*	USDA - Food and Nutrition Service
n_arc	American Red Cross	*u_a_usfs*	USDA - Forest Service
n_cncs	Corp for National and Community Service	*u_gsa*	General Services Administration
n_voad	Vol. Org. Active in Disaster	*u_hh*	Health and Human Services, US Dept. of
st_ag	State Agency, Agriculture	*u_hs*	Homeland Security, US Dept. of
st_an	State Agency, Animal	*u_hs_fema*	FEMA
st_br	State Agency, Professional Regulation	*u_hud*	Housing & Urban Develop., US Dept. of
st_ed	State Agency, Education	*u_i*	Interior, US Dept. of
st_ema	State Agency, EMA	*u_j*	Justice, US Dept. of
st_env	State Agency, Environment	*u_l*	Labor, US Dept. of
st_for	State Agency, Forestry	*u_ndms*	National Disaster Medical System
st_fw	State Agency, Wildlife	*u_opm*	Office of Personnel Management
st_hea	State Agency, Health	*u_sba*	Small Business Administration
st_hls	State Agency, Homeland Security	*u_ssa*	Social Security Administration
st_hs	State Agency, Social/Human Services	*u_t*	Transportation, US Dept. of
st_just	State Agency, Justice	*u_tr*	Treasury, US Dept. of
st_labs	State Agency, Laboratories	*u_tr_irs*	Treasury - Internal Revenue Service
st_mar	State Agency, Marine	*u_usps*	US Postal Service
st_medicaid	State Agency, Medicaid	*u_va*	Veterans Affairs, US Dept. of

Figure 30: Planned Network Diagram – State Plan Joined with NRP, Mississippi

5.5.2.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.275 with high variability (SD 0.647) and the centrality mean is 0.235 with high variability (SD 0.566). This measure of variability indicates that the more influential actors have few constraints to the manner in which they may interact and with whom. They have less predictable patterns of interaction within the network.

The actors with the greatest direct positional advantage to control interaction between other actors are: ESF #11 (*esf #11*, nBet 2.765, *z* 3.850), ARC (*n_arc*, nBet 1.616, *z* 2.073), and ESF #06 Mass Care (*esf #06*, nBet 1.405, *z* 1.746). Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are: ESF #11 (*esf #11*, nFlow 2.665, *z* 4.295), ESF #05 Emergency Management (*esf #05*, nFlow 1.043, *z* 1.428), and ESF #06 Mass Care (*esf #06*, nFlow 0.921, *z* 1.213).

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.216, *z* 3.243, quad-A), ARC (*n_arc*, out 0.174, *z* 2.468, quad-A), and FEMA (*u_hs_fema*, out 0.162, *z* 2.247, quad-B). FEMA, as a general agency, ranked markedly lower, 42, in in-degree, indicating that it issued far more requests than it fulfilled, in this network scenario.

The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ESF #11 (*esf #11*, in 0.144, *z* 5.308, quad-A), ESF #05 Emergency Management (*esf #05*, in 0.084, *z* 2.675, quad-A), and ESF #06 Mass Care (*esf #06*, in 0.072, *z* 2.148, quad-A).

Table 54: Centrality, Power and Connectedness - Planned Network – State Plan Joined with NRP, Mississippi

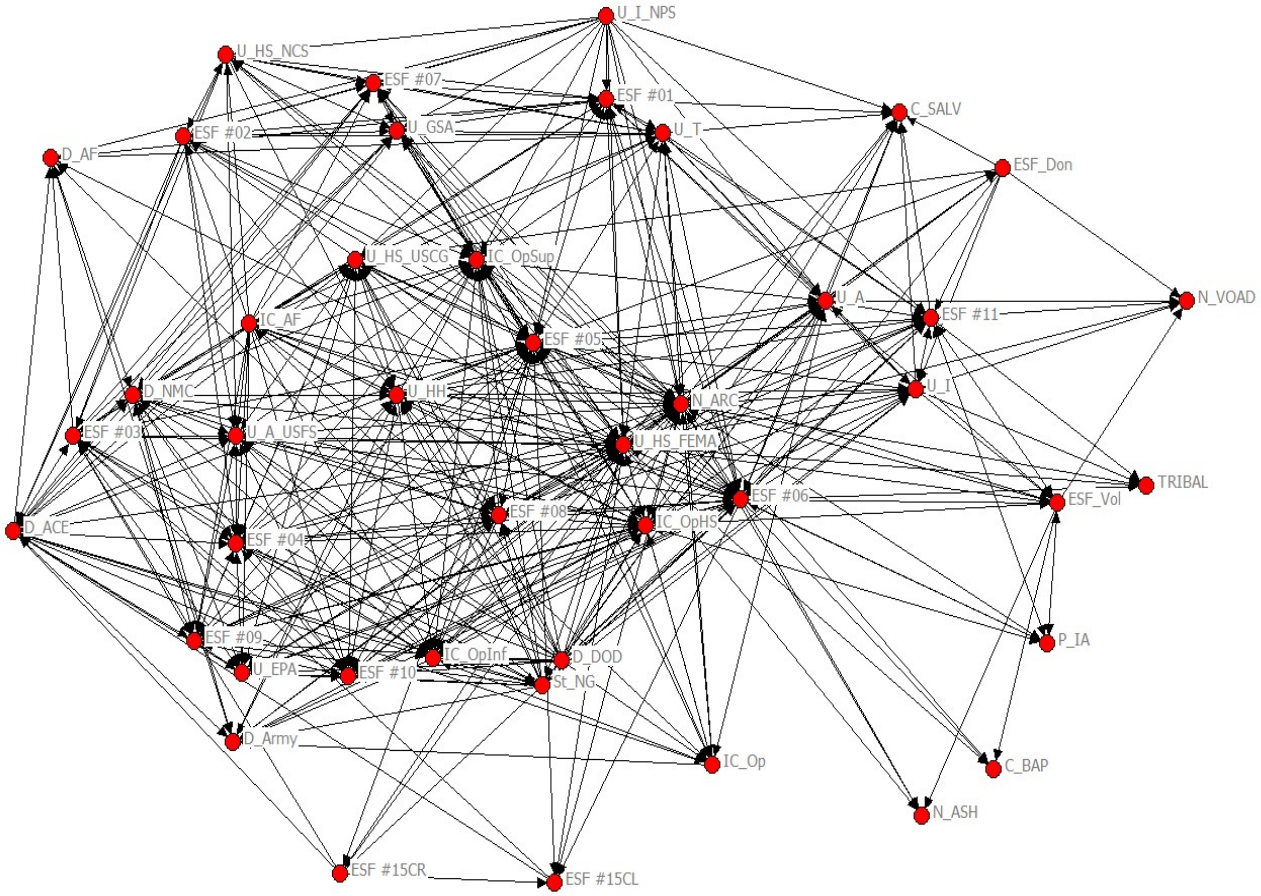
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #11	Agriculture	2.765	3.85	1	2.665	4.295	1
n_arc	American Red Cross	1.616	2.073	2	0.409	0.308	5
esf #06	Mass Care	1.405	1.746	3	0.921	1.213	3
esf #05	Emergency Mgmt	0.766	0.758	4	1.043	1.428	2
esf #08	Health/Medical	0.272	-0.005	5	0.652	0.737	4
2. Ranked by Flow Centrality							
esf #11	Agriculture	2.765	3.85	1	2.665	4.295	1
esf #05	Emergency Mgmt	0.766	0.758	4	1.043	1.428	2
esf #06	Mass Care	1.405	1.746	3	0.921	1.213	3
esf #08	Health/Medical	0.272	-0.005	5	0.652	0.737	4
n_arc	American Red Cross	1.616	2.073	2	0.409	0.308	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.216	3.243	1	0.072	2.148	3
n_arc	American Red Cross	0.174	2.468	2	0.03	0.306	6
u_hs_fema	FEMA	0.162	2.247	3	0.012	-0.484	42
esf #11	Agriculture	0.132	1.693	4	0.144	5.308	1
esf #05	Emergency Mgmt	0.084	0.807	5	0.084	2.675	2
4. Ranked by In-Degree							
esf #11	Agriculture	0.132	1.693	4	0.144	5.308	1
esf #05	Emergency Mgmt	0.084	0.807	5	0.084	2.675	2
esf #06	Mass Care	0.216	3.243	1	0.072	2.148	3
esf #08	Health/Medical	0.060	0.363	7	0.066	1.885	4
esf #14	Recovery/Mitigation	-	-	-	0.066	1.885	4

5.5.3 Reported Network Summary– Mississippi

The Mississippi reported network (RPT_{MS}) contains 44 actors *(k)* for a network size of 1,892 (*k***k*-1). The 552 observed ties result in a modified network density of 0.292, which indicates that 29.2% of the available connections between actors have been made. The average number of ties per actor is 12.545, the largest of the non-combined networks, with an average tie length, or distance between all actors in the network, of 1.667. Compared to the combined state plan and NRP (PLN_{MSF}), RPT_{MS} is a smaller and denser network, which should make communication easier, but limits the number of potential actors with which to interact.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 1.260% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 42.274% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Legend:

c_bap	FBO, Baptist	*ic_af*	ICS Admin and Finance Section
c_salv	FBO, Salvation Army	*ic_op*	ICS Operations Section
d_ace	US Army Corps of Engineers	*ic_ophs*	ICS Operations Human Services Branch
d_af	US Air Force	*ic_opinf*	ICS Operations Infrastructure Branch
d_army	US Army	*ic_opsup*	ICS Operations Section Support
d_dod	US Dept of Defense	*n_arc*	American Red Cross
d_nmc	US Navy and Marine Corps	*n_ash*	Americas Second Harvest
esf #01	Transportation	*n_voad*	Vol. Org. Active in Disaster
esf #02	Communications	*p_ia*	Individual Assistance
esf #03	Public Works and Engineering	*st_ng*	State Agency, Military / National Guard
esf #04	Firefighting	*tribal*	Tribal Government
esf #05	Emergency Management	*u_a*	Agriculture, US Dept. of (USDA)
esf #06	Mass Care, Housing & Human Services	*u_a_usfs*	USDA - Forest Service
esf #07	Resource Support	*u_epa*	Environmental Protection Agency
esf #08	Public Health and Medical Services	*u_gsa*	General Services Administration
esf #09	Urban Search and Rescue	*u_hh*	Health and Human Services, US Dept. of
esf #10	Oil and Hazardous Materials Response	*u_hs_fema*	FEMA
esf #11	Agriculture and Natural Resources	*u_hs_ncs*	DHS - National Communications System
esf #15cl	Congressional and Legislative Relations	*u_hs_uscg*	DHS - US Coast Guard
esf #15cr	Community Relations	*u_i*	Interior, US Dept. of
esf_don	Donation Management	*u_i_nps*	Interior - National Park Service
esf_vol	Volunteer Management	*u_t*	Transportation, US Dept. of

Figure 31: Reported Network Diagram, Mississippi

5.5.3.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.044 with low variability (SD 0.036) and the centrality mean is 0.044 with moderate variability (SD 0.036). This measure of variability indicates that the more influential actors are relatively constrained in the manner which they may interact and with whom they interact.

The actors with the greatest positional advantage, both direct and indirect, between other actors are: FEMA (*u_hs_fema*, nBet 1.278, *z* 4.989, nFlow 0.738, *z* 1.778), ESF #05 Emergency Management (*esf #05*, nBet 0.497, *z* 1.652, nFlow 1.859, *z* 5.342), and ARC (*n_arc*, nBet 0.365, *z* 1.089, nFlow 0.285, *z* 0.337). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. Actors with the greatest out-degree influence are those that issue more requests for action or information. A large in-degree measure indicates an actor who fulfills more requests for information and service. Occasionally, an actor will have high degrees in both measures, indicating that they have the potential for decreased capacity to manage information or meet other demands. If they have sufficient resources, this may not hold true.

The following actors in this network have high measures of out- and in-degree: FEMA (*u_hs_fema*, out 0.234, *z* 3.409, in 0.204, *z* 2.712, quad-A), ESF #06 Mass Care (*esf #06*, out 0.174, *z* 2.016, in 0.144, *z* 1.448, quad-A), ARC (*n_arc*, out 0.174, *z* 2.016, in 0.156, *z* 1.701, quad-A), and ESF #05 Emergency Management (*esf #05*, out 0.150, *z* 1.459, in 0.186, *z* 2.333, quad-A).

The ICS Finance and Administration (*ic_af*, out 0.138, *z* 1.18) ranked fifth in out-degree but markedly lower at 40 for in-degree, indicating that it issued far more requests than it fulfilled. Alternately, ICS Operations Support (*ic_opsup*, in 0.132, *z* 1.195) ranked fifth in in-degree and lower at 19 for out-degree, indicating that it fulfilled more requests than it made. These observations are for this network scenario, and are shown in Table 55.

Table 55: Centrality, Power and Connectedness - Reported Network, Mississippi

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
u_hs_fema	FEMA	1.278	4.989	1	0.738	1.778	2
esf #05	Emergency Mgmt	0.497	1.652	2	1.859	5.342	1
n_arc	American Red Cross	0.365	1.089	3	0.285	0.337	3
esf #06	Mass Care	0.314	0.869	4	0.274	0.300	5
d_nmc	US Navy & USMC	0.173	0.269	5	0.278	0.314	4
2. Ranked by Flow Centrality							
esf #05	Emergency Mgmt	0.497	1.652	2	1.859	5.342	1
u_hs_fema	FEMA	1.278	4.989	1	0.738	1.778	2
n_arc	American Red Cross	0.365	1.089	3	0.285	0.337	3
d_nmc	US Navy & USMC	0.173	0.269	5	0.278	0.314	4
esf #06	Mass Care	0.314	0.869	4	0.274	0.300	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
u_hs_fema	FEMA	0.234	3.409	1	0.204	2.712	1
esf #06	Mass Care	0.174	2.016	2	0.144	1.448	4
n_arc	American Red Cross	0.174	2.016	2	0.156	1.701	3
esf #05	Emergency Mgmt	0.15	1.459	4	0.186	2.333	2
ic_af	ICS Finance/Admin	0.138	1.18	5	0.012	-1.333	40
4. Ranked by In-Degree							
u_hs_fema	FEMA	0.234	3.409	1	0.204	2.712	1
esf #05	Emergency Mgmt	0.150	1.459	4	0.186	2.333	2
n_arc	American Red Cross	0.174	2.016	2	0.156	1.701	3
esf #06	Mass Care	0.174	2.016	2	0.144	1.448	4
ic_opsup	ICS Operations Support	0.078	-0.213	19	0.132	1.195	5

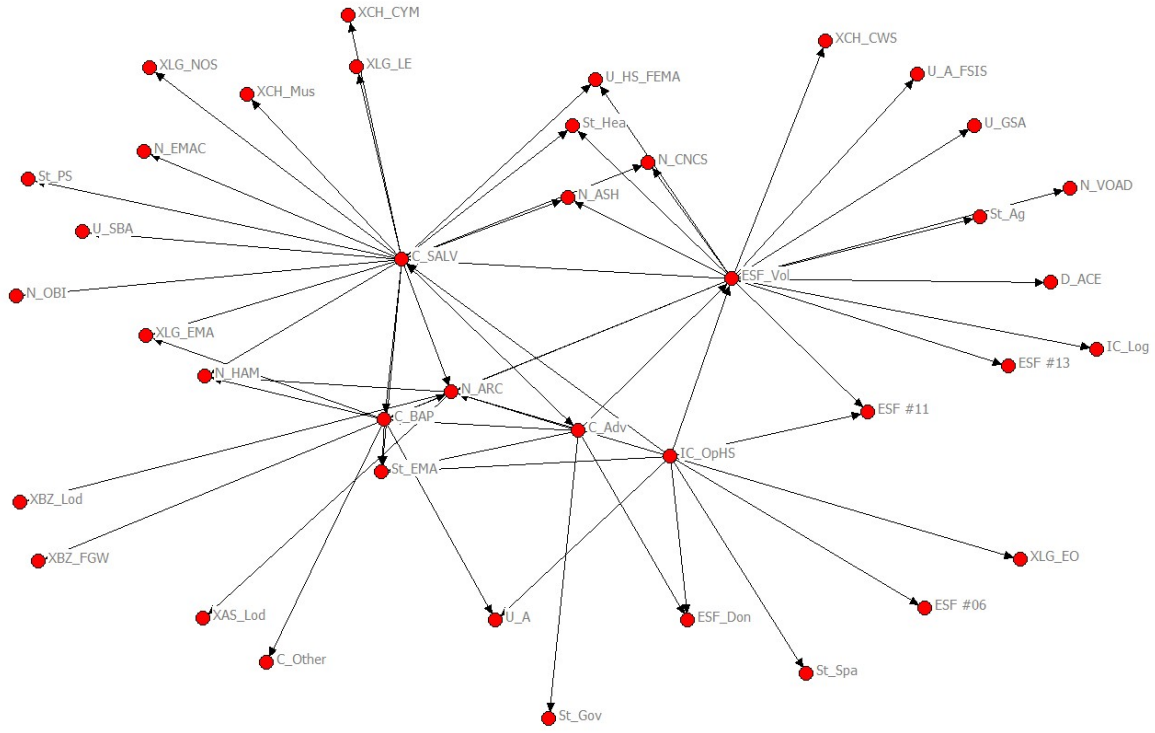
5.5.4 Perceived Network Summary– Mississippi

The Mississippi perceived network (PER_{MS}) contains 40 actors *(k)* for a network size of 1,560 (*k***k*-1). The 61 observed ties result in a modified network density of 0.039, which indicates that 3.9% of the available connections between actors have been made. The average number of ties per actor is 1.525 with an average tie length, or distance between all actors in the network, of 1.699. Compared to the combined state plan and the NRP (PLN_{MSF}) and the reported (RPT_{MS}) networks. PER_{MS} is a smaller and less dense network, indicating a constraint on potential interactions and that there are few currently occurring. This may indicate a lack of organizational capacity in response.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.140% which indicates a less centralized network, with fewer actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 72.964% which indicates a more centralized network compared to the PLN_{ICS} network, indicating that there are is larger number of actors with influence over the ties between

actors. This can indicate that there are fewer opportunities for bottle-necks, or choke-points of information to be created or exploited.



Legend:

c_adv	FBO, Adventist	*st_ema*	State Agency, EMA
c_bap	FBO, Baptist	*st_gov*	State Governor's Office
c_other	FBO, Other, not specified	*st_hea*	State Agency, Health
c_salv	FBO, Salvation Army	*st_ps*	State Agency, Police
d_ace	US Army Corps of Engineers	*st_spa*	State Agency, Space
esf #06	Mass Care, Housing & Human Services	*u_a*	Agriculture, US Dept. of (USDA)
esf #11	Agriculture and Natural Resources	*u_a_fsis*	USDA - Food Safety and Inspection Service
esf #13	Public Safety and Security	*u_gsa*	General Services Administration
esf_don	Donation Management	*u_hs_fema*	FEMA
esf_vol	Volunteer Management	*u_sba*	Small Business Administration
ic_log	ICS Logistics Section (ESF #7)	*xas_lod*	Association, Lodging
ic_ophs	ICS Operations Human Services Branch	*xbz_fgw*	Businesses, Food/Grocery, Wholesale
n_arc	American Red Cross	*xbz_lod*	Businesses, Lodging (Hotel/Motel)
n_ash	Americas Second Harvest	*xch_cws*	FBO, Church World Service
n_cncs	Corp for National and Community Service	*xch_cym*	FBO, College Youth Ministry
n_emac	EMAC	*xch_mus*	FBO, Muslim
n_ham	RACES/ARES (Amateur Radio)	*xlg_ema*	Local Govt, Emergency Management
n_obi	Operation Blessing International	*xlg_eo*	Local Govt, Elected Officials
n_voad	Vol. Org. Active in Disaster	*xlg_le*	Local Govt, Law Enforcement
st_ag	State Agency, Agriculture	*xlg_nos*	Local Govt, Not otherwise specified

Figure 32: Perceived Network Diagram, Mississippi

5.5.4.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.079 with moderate variability (SD 0.044) and the centrality mean is 0.151 with high variability (SD 0.126). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The Salvation Army (*c_salv*, nBet 0.138, *z* 1.341, nFlow 0.250, *z* 0.789, represented in interviews) has the greatest indirect and high indirect influence. The Salvation Army has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network. The Adventist FBOs (*c_adv*, nFlow 0.314, *z* 1.296, represented in interviews) have greatest indirect advantage to influence, rather than control, interaction.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are The Salvation Army (*c_salv*, out 0.108, *z* 1.356, quad-A, represented in interviews) and the Voluntary Agency Liaison (*esf_vol*, out 0.096, *z* 1.010, quad-A, represented in interviews). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are ARC (*n_arc*, in 0.030, *z* 3.618, quad-C, represented in interviews) and the state emergency management agency (*st_ema*, in 0.024, *z* 2.577, quad-B). The Adventists *(c_adv*, out 0.042, *z* -0.548) ranked fourth in out-degree, but markedly lower at 40 for in-degree, indicating that the Adventists issued far more requests than the fulfilled, in this network scenario.

Table 56: Centrality, Power and Connectedness - Perceived Network, Mississippi

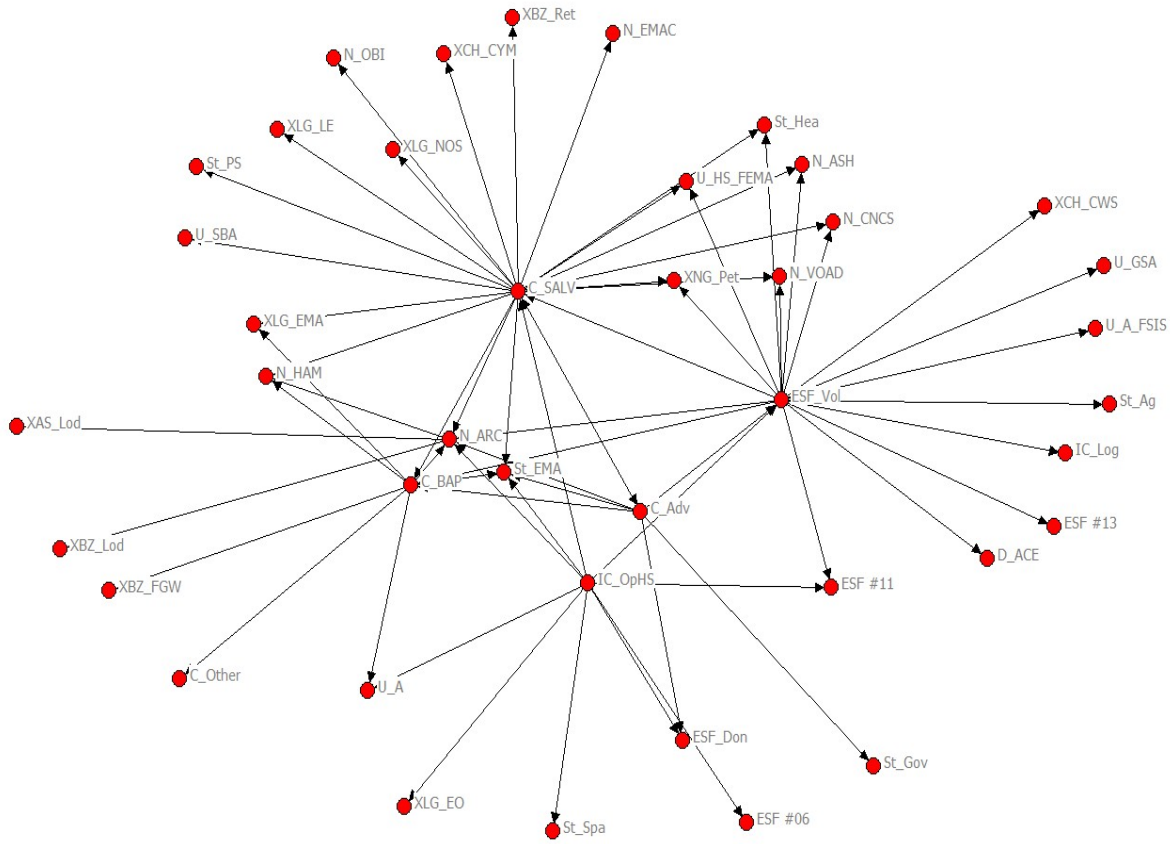
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
c_salv	Salvation Army	0.138	1.341	1	0.250	0.789	2
esf_vol	Vol Agency Liaison	0.114	0.795	2	0.115	-0.287	3
c_adv	Adventists	0.054	-0.557	3	0.314	1.296	1
c_bap	Baptists	0.047	-0.707	4	0.040	-0.885	4
n_arc	American Red Cross	0.040	-0.871	5	0.036	-0.913	5
2. Ranked by Flow Centrality							
c_adv	Adventists	0.054	-0.557	3	0.314	1.296	1
c_salv	Salvation Army	0.138	1.341	1	0.250	0.789	2
esf_vol	Vol Agency Liaison	0.114	0.795	2	0.115	-0.287	3
c_bap	Baptists	0.047	-0.707	4	0.040	-0.885	4
n_arc	American Red Cross	0.040	-0.871	5	0.036	-0.913	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
c_salv	Salvation Army	0.108	1.356	1	0.018	1.536	3
esf_vol	Vol Agency Liaison	0.096	1.010	2	0.012	0.495	6
ic_ophs	ICS Ops Human Services	0.060	-0.029	3	-	-	-
c_adv	Adventists	0.042	-0.548	4	0.006	-0.547	15
c_bap	Baptists	0.042	-0.548	4	0.018	1.536	3
4. Ranked by In-Degree							
n_arc	American Red Cross	0.018	-1.241	6	0.030	3.618	1
st_ema	State EMA	-	-	-	0.024	2.577	2
c_bap	Baptists	0.042	-0.548	4	0.018	1.536	3
c_salv	Salvation Army	0.108	1.356	1	0.018	1.536	3
n_ham	Amateur Radio	-	-	-	0.018	1.536	3

5.5.5 Desired Network Summary– Mississippi

The Mississippi desired network (DES_{MS}) contains 41actors *(k)* for a network size of 1,640 (*k***k*-1). The 64 observed ties result in a modified network density of 0.039, which indicates that 3.9% of the available connections between actors have been made. The average number of ties per actor is 1.561 with an average tie length, or distance between all actors in the network, of 1.681. Compared to the combined state plan and NRP (PLN_{MSF}) and the reported (RPT_{MS}) networks, DES_{MS} is a smaller and less dense network, indicating a constraint on potential interactions and that there are few currently occurring. This may indicate a lack of organizational capacity in response. Compared to the perceived network (PER_{MS}), DES_{MS} is larger than though similar in density.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.140% which indicates a less centralized network, with fewer actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 73.228% which indicates a more centralized network compared to PLN_{ICS}., indicating that there are a larger number of actors with influence over the ties between actors. This can indicate that there are fewer opportunities for bottle-necks, or choke-points of information to be created or exploited.



Legend:

c_adv	FBO, Adventist	*st_gov*	State Governor's Office
c_bap	FBO, Baptist	*st_hea*	State Agency, Health
c_other	FBO, Other, not specified	*st_ps*	State Agency, Police
c_salv	FBO, Salvation Army	*st_spa*	State Agency, Space
d_ace	US Army Corps of Engineers	*u_a*	Agriculture, US Dept. of (USDA)
esf #06	Mass Care, Housing & Human Services	*u_a_fsis*	USDA - Food Safety and Inspection Service
esf #11	Agriculture and Natural Resources	*u_gsa*	General Services Administration
esf #13	Public Safety and Security	*u_hs_fema*	FEMA
esf_don	Donation Management	*u_sba*	Small Business Administration
esf_vol	Volunteer Management	*xas_lod*	Association, Lodging
ic_log	ICS Logistics Section (ESF #7)	*xbz_fgw*	Businesses, Food/Grocery, Wholesale
ic_ophs	ICS Operations Human Services Branch	*xbz_lod*	Businesses, Lodging (Hotel/Motel)
n_arc	American Red Cross	*xbz_ret*	Businesses, Retail Chains
n_ash	Americas Second Harvest	*xch_cws*	FBO, Church World Service
n_cncs	Corp for National and Community Service	*xch_cym*	FBO, College Youth Ministry
n_emac	EMAC	*xlg_ema*	Local Govt, Emergency Management
n_ham	RACES/ARES (Amateur Radio)	*xlg_eo*	Local Govt, Elected Officials
n_obi	Operation Blessing International	*xlg_le*	Local Govt, Law Enforcement
n_voad	Vol. Org. Active in Disaster	*xlg_nos*	Local Govt, Not otherwise specified
st_ag	State Agency, Agriculture	*xng_pet*	NGO, Pet Care, NOS
st_ema	State Agency, EMA		

Figure 33: Desired Network Diagram, Mississippi

5.5.5.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.079 with moderate variability (SD 0.046) and the centrality mean is 0.154 with high variability (SD 0.131). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The actors with the greatest direct positional advantage to control interaction between other actors are The Salvation Army (*c_salv*, nBet 0.145, *z* 1.428, represented in interviews) and the Voluntary Agency Liaison (*esf_vol*, nBet 0.110, *z* 0.677, represented in interviews). Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are the Adventist FBOs (*c_adv*, nFlow 0.325, *z* 1.305, represented in interviews) and The Salvation Army (*c_salv*, nFlow 0.257, *z* 0.791, represented in interviews).

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actor with the greatest out-degree influence, that issues more requests for action or information is the Salvation Army (*c_salv*, out 0.120, *z* 1.429, quad-A, represented in interviews). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: the ARC (*n_arc*, in 0.030, *z* 3.620, quad-C, represented in interviews) and the state emergency management agency (*st_ema*, in 0.024, *z* 2.567, quad-B).

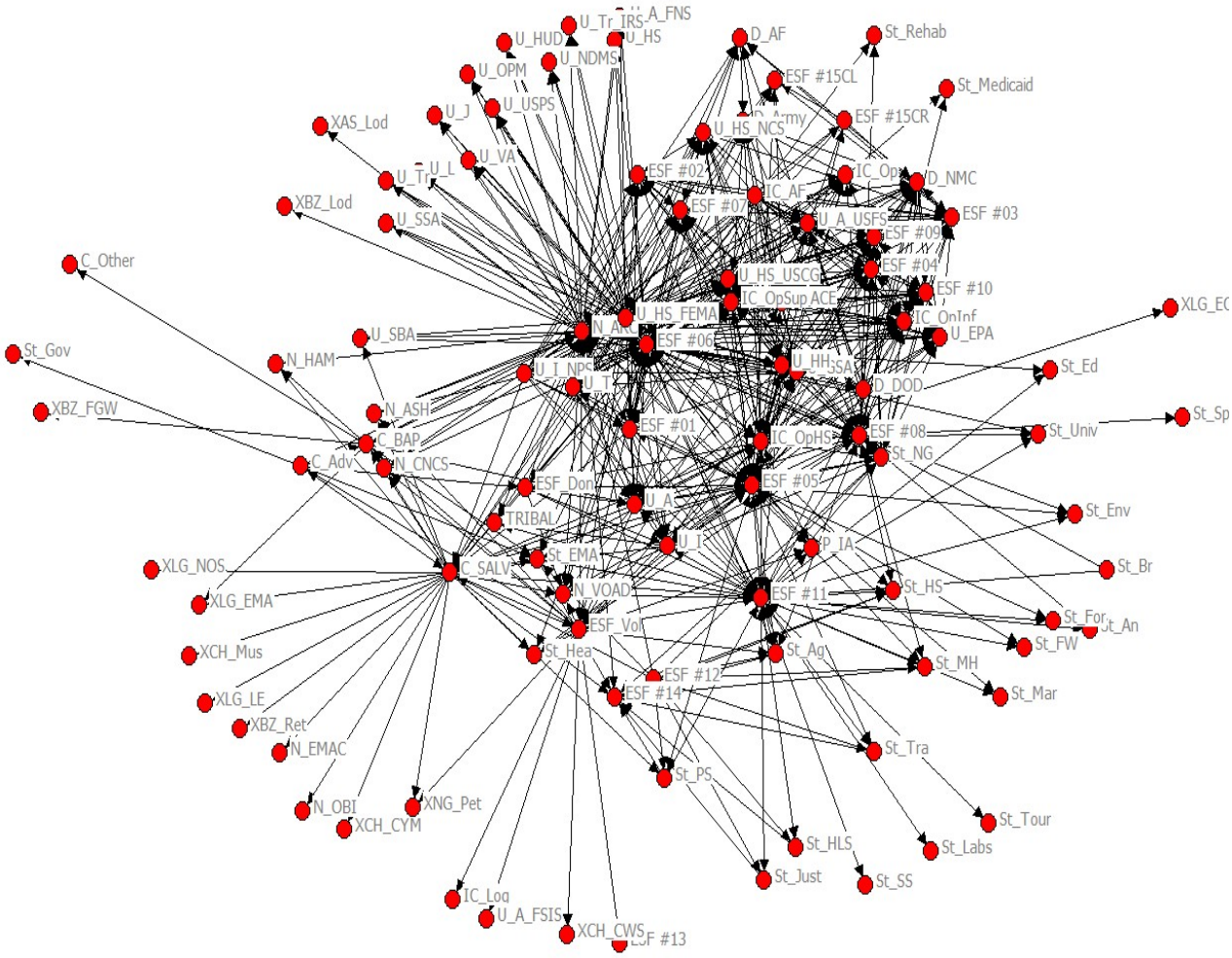
Table 57: Centrality, Power and Connectedness - Desired Network, Mississippi

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
c_salv	Salvation Army	0.145	1.428	1	0.257	0.791	2
esf_vol	Vol Agency Liaison	0.110	0.677	2	0.111	-0.325	3
c_adv	Adventists	0.051	-0.607	3	0.325	1.305	1
c_bap	Baptists	0.047	-0.671	4	0.040	-0.871	4
n_arc	American Red Cross	0.04	-0.827	5	0.036	-0.899	5
2. Ranked by Flow Centrality							
c_adv	Adventists	0.051	-0.607	3	0.325	1.305	1
c_salv	Salvation Army	0.145	1.428	1	0.257	0.791	2
esf_vol	Vol Agency Liaison	0.110	0.677	2	0.111	-0.325	3
c_bap	Baptists	0.047	-0.671	4	0.040	-0.871	4
n_arc	American Red Cross	0.040	-0.827	5	0.036	-0.899	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
c_salv	Salvation Army	0.120	1.429	1	0.018	1.515	3
esf_vol	Vol Agency Liaison	0.102	0.970	2	0.012	0.462	6
ic_ophs	ICS Ops Human Svc	0.060	-0.102	3	-	-	-
c_adv	Adventists	0.042	-0.561	4	0.006	-0.591	17
c_bap	Baptists	0.042	-0.561	4	0.018	1.515	3
4. Ranked by In-Degree							
n_arc	American Red Cross	0.018	-1.174	6	0.030	3.620	1
st_ema	State EMA	-	-	-	0.024	2.567	2
c_bap	Baptists	0.042	-0.561	4	0.018	1.515	3
c_salv	Salvation Army	0.120	1.429	1	0.018	1.515	3
n_ham	Amateur Radio	-	-	-	0.018	1.515	3

5.5.6 Combined Network Summary – Mississippi

The combination of all Mississippi networks ($COMB_{MS}$) contains 104 actors *(k)* for a network size of 10,712 (*k***k*-1). The 781 observed ties result in a modified network density of 0.073, which indicates that 7.3% of the available connections between actors have been made. The average number of ties per actor is 7.510 with an average tie length, or distance between all actors in the network, of 2.198.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 34: Combined Network Diagram, Mississippi

5.5.6.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.167 with moderate variability (SD 0.702) and the centrality mean is 0.156 with moderate variability (SD 0.613). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The actors with the greatest direct positional advantage to control interaction between other actors are: ESF #11 (*esf #11*, nBet 5.343, *z* 2.450), ESF #06 Mass Care (*esf #06*, nBet

3.671, *z* 1.572), and ESF #05 Emergency Management (*esf #05*, nBet 3.645, *z* 1.558). Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are: ESF #11 (*esf #11*, nFlow 5.229, *z* 3.675), The Salvation Army (*c_salv*, nFlow 3.596, *z* 2.382), and ESF #06 Mass Care (*esf #06*, nFlow 2.608, *z* 1.600).

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.329, *z* 1.897, quad-A), FEMA (*u_hs_fema*, out 0.329, *z* 1.897, quad-A), and ARC (*n_arc*, out 0.299, *z* 1.642, quad-A). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ESF #05 Emergency Management (*esf #05*, in 0.263, *z* 2.108, quad-A), ESF #11 (*esf #11*, in 0.228, *z* 1.704, quad-A), and FEMA (*u_hs_fema*, in 0.210, *z* 1.502, quad-A).

Table 58: Centrality, Power and Connectedness - Combined Network, Mississippi

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #11	Agriculture	5.343	2.450	1	5.229	3.675	1
esf #06	Mass Care	3.671	1.572	2	2.608	1.600	3
esf #05	Emergency Mgmt	3.645	1.558	3	2.179	1.260	4
u_hs_fema	FEMA	3.519	1.492	4	2.060	1.165	5
n_arc	American Red Cross	2.769	1.098	5	1.985	1.106	6
2. Ranked by Flow Centrality							
esf #11	Agriculture	5.343	2.450	1	5.229	3.675	1
c_salv	Salvation Army	2.669	1.045	6	3.596	2.382	2
esf #06	Mass Care	3.671	1.572	2	2.608	1.600	3
esf #05	Emergency Mgmt	3.645	1.558	3	2.179	1.260	4
u_hs_fema	FEMA	3.519	1.492	4	2.060	1.165	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.329	1.897	1	0.198	1.367	4
u_hs_fema	FEMA	0.329	1.897	1	0.210	1.502	3
n_arc	American Red Cross	0.299	1.642	3	0.180	1.165	5
esf #05	Emergency Mgmt	0.228	1.030	4	0.263	2.108	1
esf #11	Agriculture	0.186	0.673	5	0.228	1.704	2
4. Ranked by In-Degree							
esf #05	Emergency Mgmt	0.228	1.030	4	0.263	2.108	1
esf #11	Agriculture	0.186	0.673	5	0.228	1.704	2
u_hs_fema	FEMA	0.329	1.897	1	0.210	1.502	3
esf #06	Mass Care	0.329	1.897	1	0.198	1.367	4
n_arc	American Red Cross	0.299	1.642	3	0.180	1.165	5

5.5.7 Summary of Mississippi Networks

The reported network is the largest of the non-aggregated Mississippi networks with 44 nodes, a network size of 1,892 and 12.545 average ties per actor. It is also the densest network at 29.2% saturation.

Actors that are unique, study-wide, appear in three Mississippi networks. In the aggregated plan, the state departments of homeland security *(st_hls),* labor *(st_lab),* maritime activities *(st_mar),* rehabilitation *(st_rehab)* and the secretary of state *(st_ss).* In the reported network: tribal governments *(tribal)* and the US EPA *(u_epa).* In the perceived networks, a spontaneous Muslim organization *(xch_mus*), was not listed as a desired future actor as it was not well received by the local affected population.

Organizations that were mentioned as desired for future events that were not included in the other Mississippi networks were retail chain stores such as Wal-Mart (*xbz_car)* and an organization to care for pets *(xng_pet).*

5.5.7.1 Agency Composition of Mississippi Networks

The total number of all government agencies in the network compositions ranged from 16 in the perceived (4.85% of agencies, less positions) and desired (4.71%) networks to 45 (91.84%) in the aggregated planned network. The number of federal government civilian agencies fell from 20 (40.82%) in the reported network to a low of 5 in the perceived (15.15%) and the desired (14.71%) networks. The ICS Planning Section, responsible for the generation of the sitreps would have a more encompassing view of agencies involved in the response than would the

perspective of the interviewees being aware of agencies that are proximal to their position as near neighbors and not those farther away in the network. The number of state government agencies fell from 23 (46.94%) in the aggregated planned network to a low of 1 (4.35%) in the reported network. This change may be a combined result of the plans' ability to anticipate the involvement of the agency actors and the limitation of the interviewees' frames as stated above.

The number of all non-government agencies ranged from four (8.16%) in the aggregated planned network to 18 (52.94%) in the desired network. This may indicate that planning for future operations would be improved, and more reflective of past practice, with the inclusion of additional NGO and FBO response agencies.

5.5.7.2 Actor Presence in Mississippi and Federal Plans

The aggregated plans were 23.08% accurate in anticipating the actors that would be involved in these response operations; 30.77% of the planned agencies did not appear in any of the other networks, while 46.15% of the active agencies did not appear in the plan. The state plan was 18.75% accurate in anticipating the non-federal actors that would be involved in these response operations; 37.50% of the planned agencies did not appear in any of the other networks, while 43.75% of the active agencies did not appear in the plan.

There were ten actors that appeared in at least one planned and all other networks: The Salvation Army (*c_salv*), US Army Corps of Engineers (*d_ace*), ESF#06 Mass Care (*esf #06*), ESF #11 Agriculture and Natural Resources (*esf #11*), ICS Operations - Human Services Branch (*ic_ophs*), ARC (*n_arc*), NVOAD (*n_voad*), USDA (*u_a*), General Services Administration *(u_gsa*), and FEMA (*u_hs_fema*).

There were two specific agency actors that were not in the mass care plan but were in all other networks: Baptist FBOs (*c_bap*) and America's Second Harvest (*n_ash*). Additional

analysis should be performed to determine if these agencies should be added to the ESF #06 plan.

Table 59: Network Comparison Table, Mississippi

	NRP6	Planned PLNMS	PLNMSF	Reported RPTMS	Perceived PERMS	Desired DESMS	Combined COMBMS
Agency Count							
NIMS/NRP Position	3	6	7	21	7	7	25
US Government	20	0	20	11	5	5	25
US Military	2	0	2	5	1	1	5
Tribal	0	0	0	1	0	0	1
State Government	1	23	23	1	6	6	25
Local Government	0	0	0	0	4	4	4
National NGO	3	2	3	3	7	7	7
State/Local NGO	0	0	0	0	0	1	1
Faith Based	0	1	1	2	7	6	7
Business	0	0	0	0	3	4	4
Total actors (k)	29	32	56	44	40	41	104
Network Size (k*k-1)	812	992	3080	1892	1560	1640	10712
Sum of ties	80	138	215	552	61	64	781
Density (modified)	0.099	0.139	0.070	0.292	0.039	0.039	0.073
Avg ties per actor	2.759	4.313	3.839	12.545	1.525	1.561	7.510
Avg distance	1.048	2.097	2.214	1.667	1.699	1.681	2.198
Univariate Comparison							
quad-A	0	6	5	8	2	2	8
quad-B	26	2	3	6	10	12	4
quad-C	0	0	6	13	2	2	14
quad-D	3	24	42	17	26	25	78
Out-degree mean		0.027	0.040	0.087	0.061	0.064	0.028
Out-degree SD		0.027	0.054	0.043	0.035	0.039	0.057
In-degree mean		0.026	0.023	0.075	0.009	0.009	0.028
In degree SD		0.029	0.023	0.047	0.006	0.006	0.047

Centralization Index	ICS	PLNMS	PLNMSF	RPTMS	PERMS	DESMS	COMBMS
Betweenness	1.25%	1.73%	2.74%	1.26%	0.14%	0.14%	5.21%
Flow Centrality	52.30%	45.98%	37.04%	42.27%	72.96%	73.23%	11.81%

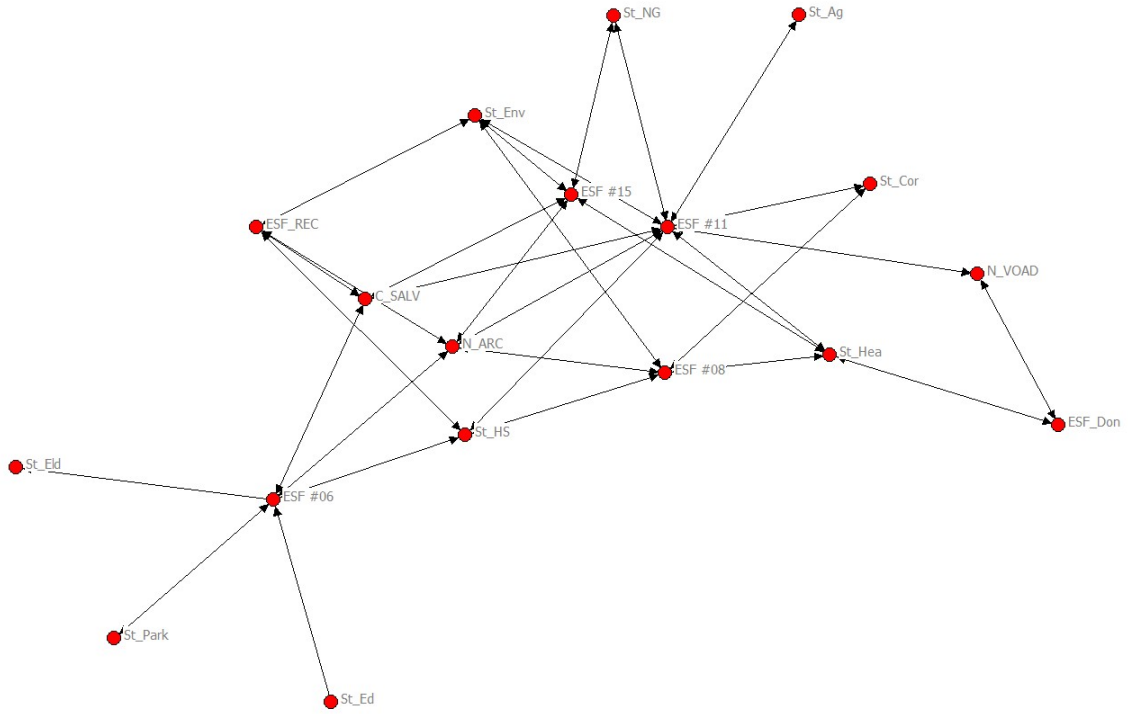
5.6 TEXAS

5.6.1 Planned Network Summary – Texas State Plan

The network formed within the Texas State Plan (PLN_{TX}) network contains 18 actors *(k)* for a network size of 306 (*k***k*-1). This is small, but comparable to the Alabama and Florida plans. The 60 observed ties result in a modified network density of 0.196, which indicates that 19.6% of the available connections between actors have been made. The average number of ties per actor is 3.333 with an average tie length, or distance between all actors in the network, of 2.278. This is the largest average tie length of the non-combined networks, indicating that actors are "farther away" from one another in this network. Compared to the mass care portion of the NRP (PLN_{NRP6}), PLN_{TX} is a smaller and denser network, which should make communication easier, but limits the number of potential actors with which to interact.

This network is primarily considered balanced in the connectedness and flow of information between the majority of the actors (quad-A). This indicates that the majority of the actors have a higher degree of information inflow and outflow measures, thus both providing and receiving requests and information. This may lead to information overload for these actors as they seek and send large amounts of information compared to the remaining actors.

The node betweenness network centrality index (Freeman's) is 0.380% and the flow network centrality index is 34.156%, indicating a less centralized network than the formal command structure of ICS (PLN_{ICS}). This can indicate the need for leadership development or a clarification of the ICS structure in use for the response.



Legend:

c_salv	FBO, Salvation Army	*st_ag*	State Agency, Agriculture
esf #06	Mass Care, Housing & Human Services	*st_cor*	State Agency, Corrections
esf #08	Public Health and Medical Services	*st_ed*	State Agency, Education
esf #11	Agriculture and Natural Resources	*st_eld*	State Agency, Elderly
esf #15	External Affairs	*st_env*	State Agency, Environment
esf_don	Donation Management	*st_hea*	State Agency, Health
esf_rec	Recovery (if separate from Mitigation)	*st_hs*	State Agency, Social/Human Services
n_arc	American Red Cross	*st_ng*	State Agency, Military / National Guard
n_voad	Vol. Org. Active in Disaster	*st_park*	State Agency, Parks

Figure 35: Planned Network Diagram – State Plan, Texas

5.6.1.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.090 with moderate variability (SD 0.103) and the centrality mean is 0.074 with moderate variability (SD 0.083). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The actors with the greatest positional advantage, both direct and indirect, between other actors are ESF #11 (*esf #11*, nBet 0.382, *z* 2.842, nFlow 0.315, *z* 2.897) and ESF #06 Mass Care

(*esf #06*, nBet 0.221, *z* 1.275, nFlow 0.186, *z* 1.350). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. Actors with the greatest out-degree influence are those that issue more requests for action or information. A large in-degree measure indicates an actor who fulfills more requests for information and service. Occasionally, an actor will have high degrees in both measures, indicating that they have the potential for decreased capacity to manage information or meet other demands. If they have sufficient resources, this may not hold true. The following actors in this network have high measures of out- and in-degree: ESF #11 (*esf #11*, out 0.054, *z* 2.649, in 0.054, *z* 2.612, quad-A), ESF #06 Mass Care (*esf #06*, out 0.030, *z* 0.712, in 0.030, *z* 0.768, quad-A), ESF #08 Health and Medical Services (*esf #08*, out 0.030, *z* 0.712, in 0.030, *z* 0.768, quad-A), ESF #15 External Affairs (*esf #15*, out 0.030, *z* 0.712, in 0.030, *z* 0.768, quad-A), and ARC (*n_arc*, out 0.030, *z* 0.712, in 0.030, *z* 0.768, quad-A).

Table 60: Centrality, Power and Connectedness - Planned Network – State Plan, Texas

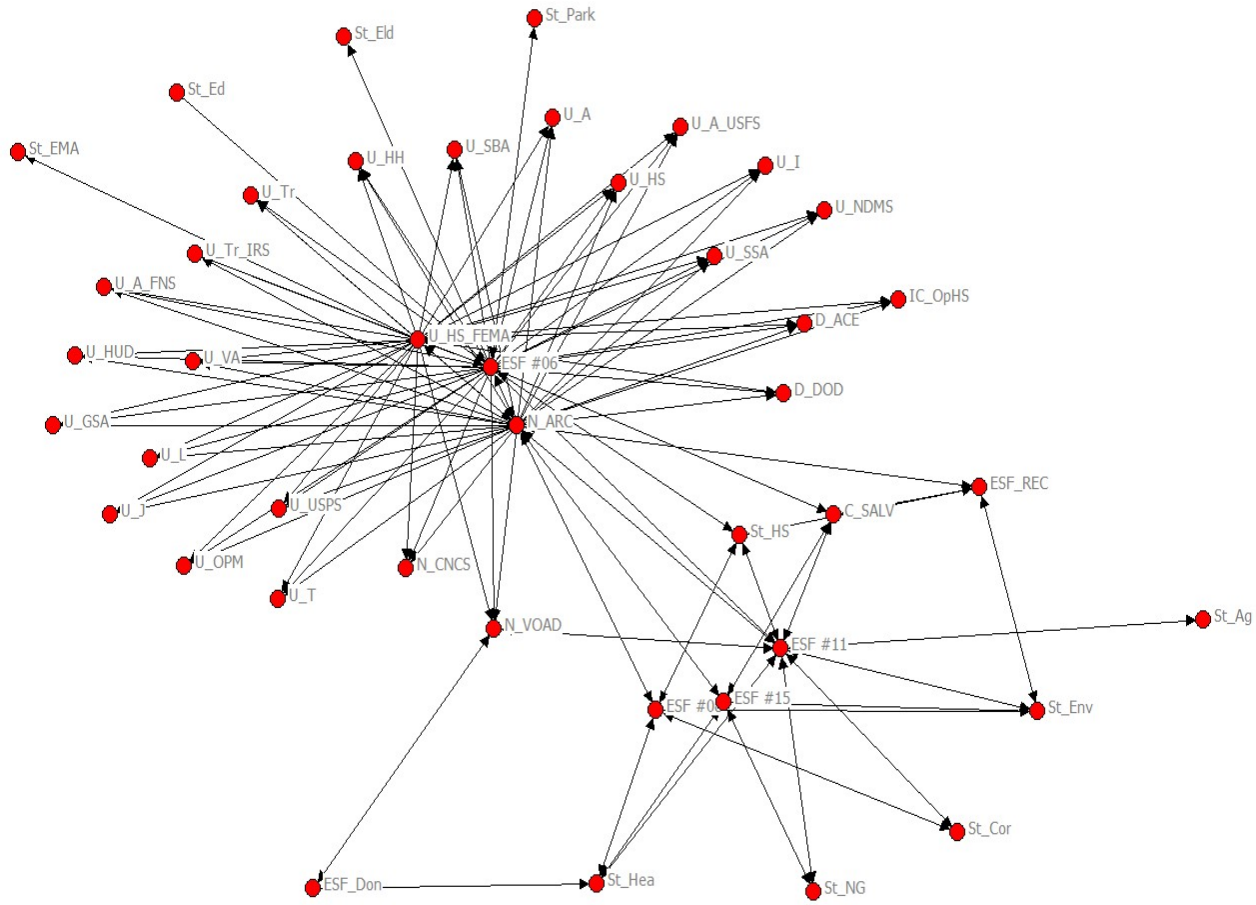
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #11	Agriculture	0.382	2.842	1	0.315	2.897	1
esf #06	Mass Care	0.221	1.275	2	0.186	1.350	2
n_arc	American Red Cross	0.132	0.405	3	0.036	-0.457	9
c_salv	Salvation Army	0.092	0.024	4	0.036	-0.457	9
st_hs	State Human Services	0.092	0.024	4	0.036	-0.457	9
2. Ranked by Flow Centrality							
esf #11	Agriculture	0.382	2.842	1	0.315	2.897	1
esf #06	Mass Care	0.221	1.275	2	0.186	1.350	2
st_hea	State Health Dept.	0.091	0.009	6	0.090	0.192	3
esf #08	Health/Medical	0.072	-0.175	7	0.079	0.054	4
esf #15	External Affairs	0.072	-0.175	7	0.079	0.054	4
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #11	Agriculture	0.054	2.649	1	0.054	2.612	1
esf #06	Mass Care	0.030	0.712	2	0.030	0.768	2
esf #08	Health/Medical	0.030	0.712	2	0.030	0.768	2
esf #15	External Affairs	0.030	0.712	2	0.030	0.768	2
n_arc	American Red Cross	0.030	0.712	2	0.030	0.768	2
4. Ranked by In-Degree							
esf #11	Agriculture	0.054	2.649	1	0.054	2.612	1
esf #06	Mass Care	0.030	0.712	2	0.030	0.768	2
esf #08	Health/Medical	0.030	0.712	2	0.030	0.768	2
esf #15	External Affairs	0.030	0.712	2	0.030	0.768	2
n_arc	American Red Cross	0.030	0.712	2	0.030	0.768	2

5.6.2 Planned Network Summary – Texas State Plan Joined with NRP

The network formed when the Texas State Plan and the NRP are joined (PLN_{TXF}) contains 43 actors *(k)* for a network size of 1,806 (*k***k*-1). The 138 observed ties result in a modified network density of 0.076, which indicates that 7.6% of the available connections between actors have been made. The average number of ties per actor is 3.209 with an average tie length, or distance between all actors in the network, of 2.25. Compared to both the mass care section of the NRP (PLN_{NRP}) and the state plan (PLN_{TX}) PLN_{TXF} is a larger and less dense network, which indicates that there are more potential interactions, though there are currently fewer occurring.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.011 and the flow network centrality index is 0.311 which indicates a less centralized network, directly and indirectly, than the formal command structure of ICS (PLN_{ICS}). This can indicate the need for leadership development or a clarification of the ICS structure in use for the response.



Legend:

c_salv	FBO, Salvation Army	*st_park*	State Agency, Parks
d_ace	US Army Corps of Engineers	*u_a*	Agriculture, US Dept. of (USDA)
d_dod	US Dept of Defense	*u_a_fns*	USDA - Food and Nutrition Service
esf #06	Mass Care, Housing & Human Services	*u_a_usfs*	USDA - Forest Service
esf #08	Public Health and Medical Services	*u_gsa*	General Services Administration
esf #11	Agriculture and Natural Resources	*u_hh*	Health and Human Services, US Dept. of
esf #15	External Affairs	*u_hs*	Homeland Security, US Dept. of
esf_don	Donation Management	*u_hs_fema*	FEMA
esf_rec	Recovery (if separate from Mitigation)	*u_hud*	Housing & Urban Develop., US Dept. of
ic_ophs	ICS Operations Human Services Branch	*u_i*	Interior, US Dept. of
n_arc	American Red Cross	*u_j*	Justice, US Dept. of
n_cncs	Corp for National and Community Service	*u_l*	Labor, US Dept. of
n_voad	Vol. Org. Active in Disaster	*u_ndms*	National Disaster Medical System
st_ag	State Agency, Agriculture	*u_opm*	Office of Personnel Management
st_cor	State Agency, Corrections	*u_sba*	Small Business Administration
st_ed	State Agency, Education	*u_ssa*	Social Security Administration
st_eld	State Agency, Elderly	*u_t*	Transportation, US Dept. of
st_ema	State Agency, EMA	*u_tr*	Treasury, US Dept. of
st_env	State Agency, Environment	*u_tr_irs*	Treasury - Internal Revenue Service
st_hea	State Agency, Health	*u_usps*	US Postal Service
st_hs	State Agency, Social/Human Services	*u_va*	Veterans Affairs, US Dept. of
st_ng	State Agency, Military / National Guard		

Figure 36: Planned Network Diagram – State Plan Joined with NRP, Texas

5.6.2.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.222 with high variability (SD 0.333) and the centrality mean is 0.206 with high variability (SD 0.223). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The actors with the greatest positional advantage, both direct and indirect, between other actors are: ARC (*n_arc*, nBet 1.123, *z* 2.706, nFlow 0.610, *z* 1.808), ESF #11 (*esf #11*, nBet 0.746, *z* 1.574, nFlow 0.599, *z* 1.758), and ESF #06 Mass Care (*esf #06*, nBet 0.607, *z* 1.156, nFlow 0.599, *z* 1.761). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.186, *z* 2.292, quad-A), ARC (*n_arc*, out 0.180, *z* 2.194, quad-A) and FEMA (*u_hs_fema*, out 0.162, *z* 1.899, quad-B). FEMA as a general agency ranked much lower (35) in the in-degree measure, indicating that it issued far more requests than it fulfilled, in this network scenario.

The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ESF #11 (*esf #11*, in 0.060, *z* 4.175, quad-A), ESF #06 Mass Care (*esf #06*, in 0.036, *z* 1.716, quad-A), and ARC (*n_arc*, in 0.036, *z* 1.716, quad-A).

Table 61: Centrality, Power and Connectedness - Planned Network – State Plan Joined with NRP, Texas

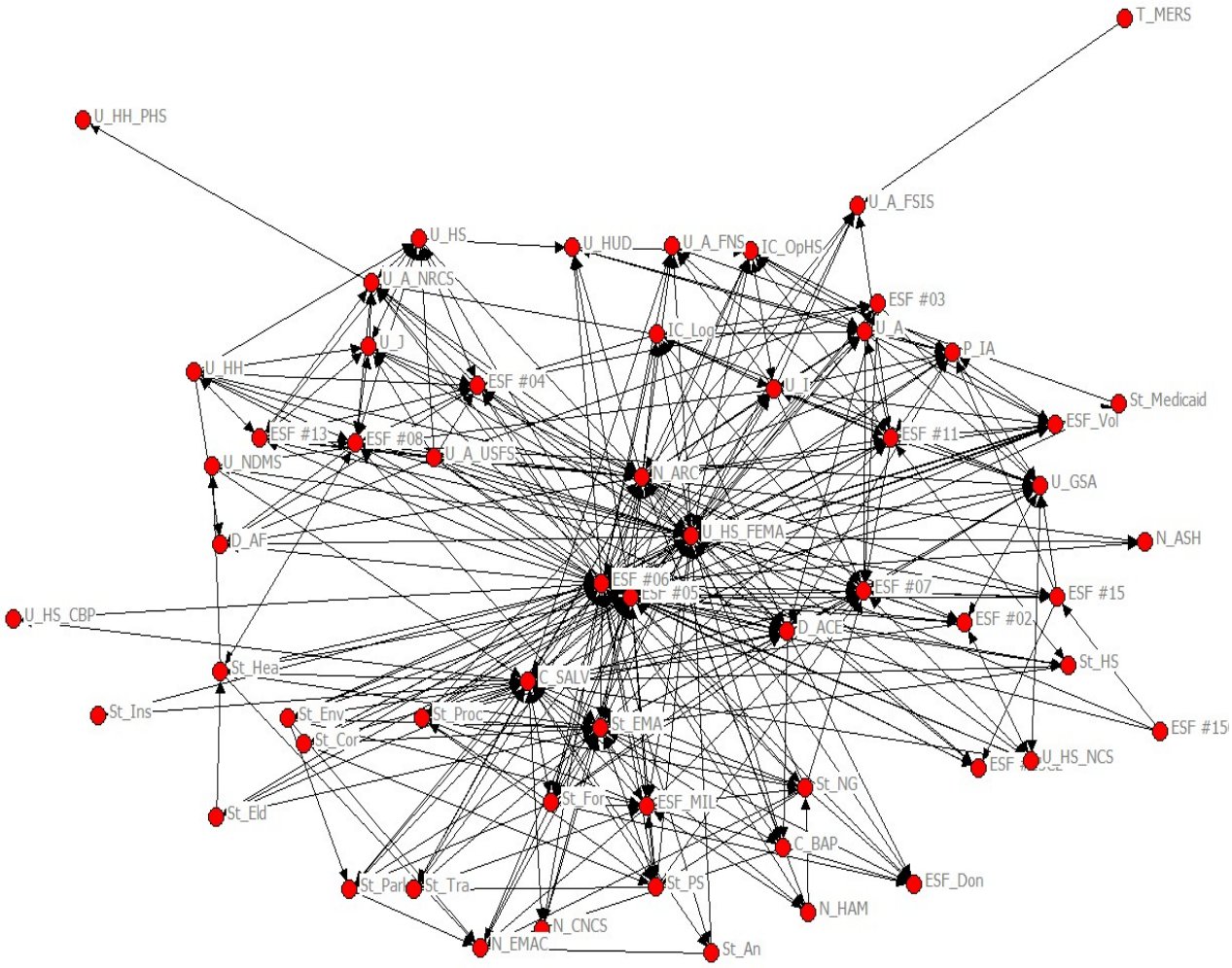
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	1.123	2.706	1	0.610	1.808	1
esf #11	Agriculture	0.746	1.574	2	0.599	1.758	3
esf #06	Mass Care	0.607	1.156	3	0.599	1.761	2
esf #08	Health/Medical	0.181	-0.125	4	0.130	-0.34	8
esf #15	External Affairs	0.181	-0.125	4	0.130	-0.34	8
2. Ranked by Flow Centrality							
n_arc	American Red Cross	1.123	2.706	1	0.610	1.808	1
esf #06	Mass Care	0.607	1.156	3	0.599	1.761	2
esf #11	Agriculture	0.746	1.574	2	0.599	1.758	3
u_hs_fema	FEMA	0.061	-0.483	10	0.362	0.700	4
st_hea	State Health Dept.	0.142	-0.241	6	0.164	-0.189	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.186	2.292	1	0.036	1.716	2
n_arc	American Red Cross	0.180	2.194	2	0.036	1.716	2
u_hs_fema	FEMA	0.162	1.899	3	0.012	-0.743	35
esf #11	Agriculture	0.054	0.131	4	0.060	4.175	1
esf #08	Health/Medical	0.030	-0.262	5	0.030	1.101	4
4. Ranked by In-Degree							
esf #11	Agriculture	0.054	0.131	4	0.060	4.175	1
esf #06	Mass Care	0.186	2.292	1	0.036	1.716	2
n_arc	American Red Cross	0.180	2.194	2	0.036	1.716	2
esf #08	Health/Medical	0.030	-0.262	5	0.030	1.101	4
esf #15	External Affairs	0.030	-0.262	5	0.030	1.101	4

5.6.3 Reported Network Summary – Texas

The Texas reported network (RPT_{TX}) contains 63 actors *(k)* for a network size of 3,906 (*k***k*-1). The 511 observed ties result in a modified network density of 0.131, which indicates that 13.1% of the available connections between actors have been made. The average number of ties per actor is 8.111 with an average tie length, or distance between all actors in the network, of 1.919. Compared to the combined state plan and NRP (PLN_{TXF}), $RPT_{TX\ is}$ a larger, denser network, which increases the potential number of interactions, but may result in communication overload.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 2.220% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 12.789% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Legend on following page

Legend:

c_bap	FBO, Baptist	*st_hea*	State Agency, Health
c_salv	FBO, Salvation Army	*st_hs*	State Agency, Social/Human Services
d_ace	US Army Corps of Engineers	*st_ins*	State Agency, Insurance
d_af	US Air Force	*st_medicaid*	State Agency, Medicaid
esf #02	Communications	*st_ng*	State Agency, Military / National Guard
esf #03	Public Works and Engineering	*st_park*	State Agency, Parks
esf #04	Firefighting	*st_proc*	State Agency, Procurement
esf #05	Emergency Management	*st_ps*	State Agency, Police
esf #06	Mass Care, Housing & Human Services	*st_tra*	State Agency, Transportation
esf #07	Resource Support	*st_trib*	State Agency, Tribal Affairs
esf #08	Public Health and Medical Services	*t_erta*	Emergency Response Team - Advance
esf #11	Agriculture and Natural Resources	*t_mers*	Mobile Emergency Response System
esf #13	Public Safety and Security	*u_a*	Agriculture, US Dept. of (USDA)
esf #15	External Affairs	*u_a_fns*	USDA - Food and Nutrition Service
esf #15cl	Congressional and Legislative Relations	*u_a_fsis*	USDA - Food Safety and Inspection Service
esf #15cr	Community Relations	*u_a_nrcs*	USDA - National Resource Conservation Svc
esf_don	Donation Management	*u_a_usfs*	USDA - Forest Service
esf_mil	Military (State Only)	*u_gsa*	General Services Administration
esf_vol	Volunteer Management	*u_hh*	Health and Human Services, US Dept. of
ic_log	ICS Logistics Section (ESF #7)	*u_hh_phs*	HHS - US Public Health Service
ic_ophs	ICS Operations Human Services Branch	*u_hs*	Homeland Security, US Dept. of
n_arc	American Red Cross	*u_hs_cbp*	DHS - US Customs and Border Protection
n_ash	Americas Second Harvest	*u_hs_fema*	FEMA
n_cncs	Corp for National and Community Service	*u_hs_ncs*	DHS - National Communications System
n_emac	EMAC	*u_hud*	Housing & Urban Develop., US Dept. of
n_ham	RACES/ARES (Amateur Radio)	*u_i*	Interior, US Dept. of
p_ia	Individual Assistance	*u_j*	Justice, US Dept. of
st_an	State Agency, Animal	*u_ndms*	National Disaster Medical System
st_cor	State Agency, Corrections	*u_opm*	Office of Personnel Management
st_eld	State Agency, Elderly	*u_tr_irs*	Treasury - Internal Revenue Service
st_ema	State Agency, EMA	*u_usps*	US Postal Service
st_env	State Agency, Environment	*xas_com*	Association, Chamber of Commerce
st_for	State Agency, Forestry		

Figure 37: Reported Network Diagram, Texas

5.6.3.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.044 with low variability (SD 0.036) and the centrality mean is 0.044 with moderate variability (SD 0.036). This measure of variability indicates that the more influential actors are relatively constrained in the manner which they may interact and with whom they interact.

The actors with the greatest direct positional advantage to control interaction between other actors are: ESF #05 Emergency Management (*esf #05*, nBet 2.263, *z* 3.951), ESF #06 Mass

Care (*esf #06*, nBet 2.140, *z* 3.713), and FEMA (*u_hs_fema*, nBet 1.482, *z* 2.448). Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are: ESF #06 Mass Care (*esf #06*, nFlow 1.605, *z* 4.164), The Salvation Army (*c_salv*, nFlow 1.359, *z* 3.437), and ESF #05 Emergency Management (*esf #05*, nFlow 1.087, *z* 2.635).

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. Actors with the greatest out-degree influence are those that issue more requests for action or information. A large in-degree measure indicates an actor who fulfills more requests for information and service. Occasionally, an actor will have high degrees in both measures, indicating that they have the potential for decreased capacity to manage information or meet other demands. If they have sufficient resources, this may not hold true.

The following actors in this network have high measures of out- and in-degree: ESF #06 Mass Care (*esf #06*, out 0.301, *z* 3.697, in 0.192, *z* 2.944, quad-A), ESF #05 Emergency Management (*esf #05*, out 0.257, *z* 3.001, in 0.240, *z* 3.930, quad-A), and FEMA (*u_hs_fema*, out 0.257, *z* 3.001, in 0.186, *z* 2.821, quad-A).

Table 62: Centrality, Power and Connectedness - Reported Network, Texas

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #05	Emergency Mgmt	2.263	3.951	1	1.087	2.635	3
esf #06	Mass Care	2.140	3.713	2	1.605	4.164	1
u_hs_fema	FEMA	1.482	2.448	3	0.793	1.766	4
c_salv	Salvation Army	1.007	1.536	4	1.359	3.437	2
n_arc	American Red Cross	0.620	0.792	5	0.494	0.883	6
2. Ranked by Flow Centrality							
esf #06	Mass Care	2.140	3.713	2	1.605	4.164	1
c_salv	Salvation Army	1.007	1.536	4	1.359	3.437	2
esf #05	Emergency Mgmt	2.263	3.951	1	1.087	2.635	3
u_hs_fema	FEMA	1.482	2.448	3	0.793	1.766	4
st_ema	State EMA	0.385	0.341	6	0.650	1.344	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.301	3.697	1	0.192	2.944	2
esf #05	Emergency Mgmt	0.257	3.001	2	0.240	3.93	1
u_hs_fema	FEMA	0.257	3.001	2	0.186	2.821	3
n_arc	American Red Cross	0.199	2.073	4	0.138	1.835	5
c_salv	Salvation Army	0.176	1.725	5	0.162	2.328	4
4. Ranked by In-Degree							
esf #05	Emergency Mgmt	0.257	3.001	2	0.240	3.93	1
esf #06	Mass Care	0.301	3.697	1	0.192	2.944	2
u_hs_fema	FEMA	0.257	3.001	2	0.186	2.821	3
c_salv	Salvation Army	0.176	1.725	5	0.162	2.328	4
n_arc	American Red Cross	0.199	2.073	4	0.138	1.835	5

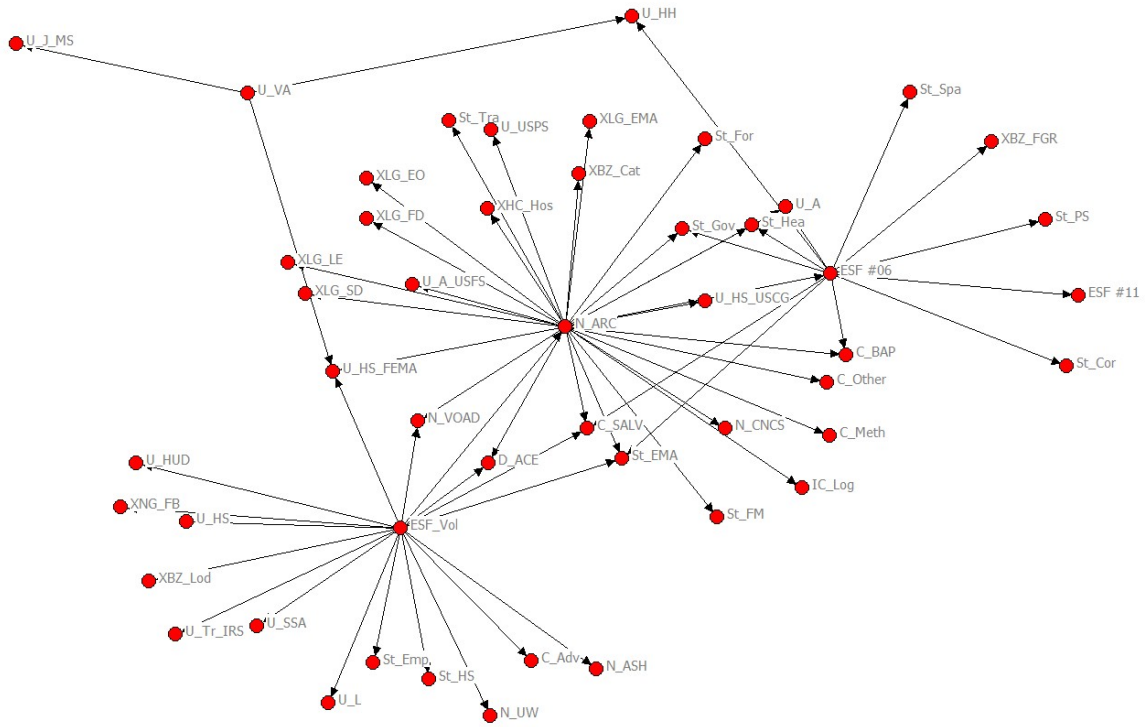
5.6.4 Perceived Network Summary – Texas

The Texas perceived network (PER_{TX}) contains 49 actors *(k)* for a network size of 2,352 (*k***k*-1). The 61 observed ties result in a modified network density of 0.026, which indicates that 2.6% of the available connections between actors have been made. The average number of ties per actor is 1.245 with an average tie length, or distance between all actors in the network, of 1.522.PER_{TX}

is less dense than both the state plan combined with the NRP (PLN_{TXF}) and the reported (RPT_{TX}), networks, indicating that there are fewer interactions occurring. It is larger than $PLN_{TXF,}$ indicating greater opportunities than planned, but smaller than $RPT_{TX,}$ indicating that it may be more constrained than what has been reported.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.170% and the flow network centrality index is 43.437%, indicating a less centralized network than the formal command structure of ICS (PLN_{ICS}). This can indicate the need for leadership development or a clarification of the ICS structure in use for the response.



Legend:

c_adv	FBO, Adventist	*st_tra*	State Agency, Transportation
c_bap	FBO, Baptist	*u_a*	Agriculture, US Dept. of (USDA)
c_meth	FBO, Methodist	*u_a_usfs*	USDA - Forest Service
c_other	FBO, Other, not specified	*u_hh*	Health and Human Services, US Dept. of
c_salv	FBO, Salvation Army	*u_hs*	Homeland Security, US Dept. of
d_ace	US Army Corps of Engineers	*u_hs_fema*	FEMA
esf #06	Mass Care, Housing & Human Services	*u_hs_uscg*	DHS - US Coast Guard
esf #11	Agriculture and Natural Resources	*u_hud*	Housing & Urban Develop., US Dept. of
esf_vol	Volunteer Management	*u_j_ms*	Justice - US Marshals Service
ic_log	ICS Logistics Section (ESF #7)	*u_l*	Labor, US Dept. of
n_arc	American Red Cross	*u_ssa*	Social Security Administration
n_ash	Americas Second Harvest	*u_tr_irs*	Treasury - Internal Revenue Service
n_cncs	Corp for National and Community Service	*u_usps*	US Postal Service
n_uw	United Way	*u_va*	Veterans Affairs, US Dept. of
n_voad	Vol. Org. Active in Disaster	*xbz_cat*	Businesses, Caterers (Aramark)
st_cor	State Agency, Corrections	*xbz_fgr*	Businesses, Food/Grocery, Retail
st_ema	State Agency, EMA	*xbz_lod*	Businesses, Lodging (Hotel/Motel)
st_emp	State Agency, Employment Services	*xhc_hos*	Health Care, Hospitals
st_fm	State Agency, Fire Marshal	*xlg_ema*	Local Govt, Emergency Management
st_for	State Agency, Forestry	*xlg_eo*	Local Govt, Elected Officials
st_gov	State Governor's Office	*xlg_fd*	Local Govt, Fire
st_hea	State Agency, Health	*xlg_le*	Local Govt, Law Enforcement
st_hs	State Agency, Social/Human Services	*xlg_sd*	Local Govt, School District
st_ps	State Agency, Police	*xng_fb*	NGO, Food Bank, NOS
st_spa	State Agency, Space		

Figure 38: Perceived Network Diagram, Texas

5.6.4.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.108 with moderate variability (SD 0.092) and the centrality mean is 0.047 with low variability (SD 0.020). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The ARC (*n_arc*, nBet 0.173, *z* 0.707, nFlow 0.061, *z* 0.707, represented in interviews) has the greatest direct and indirect positional advantage. The ARC has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actor with the greatest out-degree influence, that issues more requests for action or information is the ARC (*n_arc*, out 0.162, *z* 1.174, quad-A, represented in interviews) connection. The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: The Salvation Army (*c_salv*, in 0.018, *z* 2.785, quad-B), the state emergency management agency (*st_ema*, in 0.018, *z* 2.785, quad-B) and FEMA (*u_hs_fema*, in 0.018, *z* 2.785, quad-B).

The connectedness measures for this network are shown in Table 63 are limited by the number of interviewees for Texas, and are shown for illustration only.

Table 63: Centrality, Power and Connectedness - Perceived Network, Texas

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	0.173	0.707	1	0.061	0.707	1
esf #06	Mass Care	0.043	-0.707	2	0.032	-0.707	2
2. Ranked by Flow Centrality							
n_arc	American Red Cross	0.173	0.707	1	0.061	0.707	1
esf #06	Mass Care	0.043	-0.707	2	0.032	-0.707	2
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.162	1.174	1	0.012	1.198	4
esf_vol	Vol Agency Liaison	0.108	0.275	2	-	-	-
esf #06	Mass Care	0.078	-0.225	3	0.006	-0.389	12
u_va	US Veterans' Affairs	0.018	-1.223	4	-	-	-
c_adv	Adventists	-	-	-	0.006	-0.389	12
4. Ranked by In-Degree							
c_salv	Salvation Army	-	-	-	0.018	2.785	1
st_ema	State EMA	-	-	-	0.018	2.785	1
u_hs_fema	FEMA	-	-	-	0.018	2.785	1
c_bap	Baptists	-	-	-	0.012	1.198	4
d_ace	Corps of Engineers	-	-	-	0.012	1.198	4

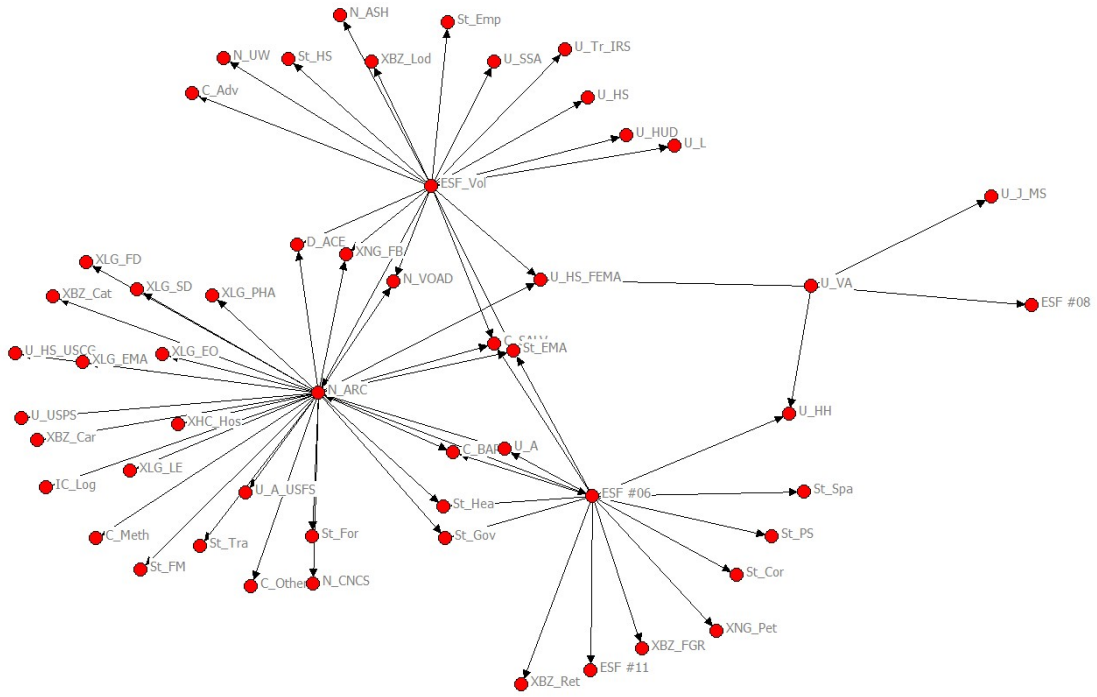
5.6.5 Desired Network Summary – Texas

The Texas desired network (DES_{TX}) contains 54 actors *(k)* for a network size of 2,862 (*k***k*-1). The 67 observed ties result in a modified network density of 0.023, which indicates that 2.3 % of the available connections between actors have been made. The average number of ties per actor is 1.240, the least out of the non-combined networks, with an average tie length, or distance between all actors in the network, of 1.546. DES_{TX} is less dense than the other Texas networks, indicating that there are fewer interactions occurring. It is larger than the state plan combined

with the NRP (PLN_{TXF}) and the perceived (PER_{TX}) networks, but smaller than the reported (RPT_{TX}) network.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.200% and the flow network centrality index is 46.346% which indicates a less centralized network when compared to the formal command structure of ICS (PLN_{ICS}). This can indicate the need for leadership development or a clarification of the ICS structure in use for the response.



Legend:

c_adv	FBO, Adventist	*u_a*	Agriculture, US Dept. of (USDA)
c_bap	FBO, Baptist	*u_a_usfs*	USDA - Forest Service
c_meth	FBO, Methodist	*u_hh*	Health and Human Services, US Dept. of
c_other	FBO, Other, not specified	*u_hs*	Homeland Security, US Dept. of
c_salv	FBO, Salvation Army	*u_hs_fema*	FEMA
d_ace	US Army Corps of Engineers	*u_hs_uscg*	DHS - US Coast Guard
esf #06	Mass Care, Housing & Human Services	*u_hud*	Housing & Urban Develop., US Dept. of
esf #08	Public Health and Medical Services	*u_j_ms*	Justice - US Marshals Service
esf #11	Agriculture and Natural Resources	*u_l*	Labor, US Dept. of
esf_vol	Volunteer Management	*u_ssa*	Social Security Administration
ic_log	ICS Logistics Section (ESF #7)	*u_tr_irs*	Treasury - Internal Revenue Service
n_arc	American Red Cross	*u_usps*	US Postal Service
n_ash	Americas Second Harvest	*u_va*	Veterans Affairs, US Dept. of
n_cncs	Corp for National and Community Service	*xbz_car*	Businesses, Cargo (FedEx, UPS)
n_uw	United Way	*xbz_cat*	Businesses, Caterers (Aramark)
n_voad	Vol. Org. Active in Disaster	*xbz_fgr*	Businesses, Food/Grocery, Retail
st_cor	State Agency, Corrections	*xbz_lod*	Businesses, Lodging (Hotel/Motel)
st_ema	State Agency, EMA	*xbz_ret*	Businesses, Retail Chains
st_emp	State Agency, Employment Services	*xhc_hos*	Health Care, Hospitals
st_fm	State Agency, Fire Marshal	*xlg_ema*	Local Govt, Emergency Management
st_for	State Agency, Forestry	*xlg_eo*	Local Govt, Elected Officials
st_gov	State Governor's Office	*xlg_fd*	Local Govt, Fire
st_hea	State Agency, Health	*xlg_le*	Local Govt, Law Enforcement
st_hs	State Agency, Social/Human Services	*xlg_pha*	Local Govt, Public Health Agencies
st_ps	State Agency, Police	*xlg_sd*	Local Govt, School District
st_spa	State Agency, Space	*xng_fb*	NGO, Food Bank, NOS
st_tra	State Agency, Transportation	*xng_pet*	NGO, Pet Care, NOS

Figure 39: Desired Network Diagram, Texas

5.6.5.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.128 with moderate variability (SD 0.099) and the centrality mean is 0.056 with low variability (SD 0.023). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The ARC (*n_arc*, nBet 0.198, *z* 0.707, nFlow 0.072, *z* 0.707, represented in interviews) has the greatest direct and indirect positional advantage. The ARC has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actor with the greatest out-degree influence, that issues more requests for action or information is the ARC (*n_arc*, out 0.180, *z* 1.240, quad-A, represented in interviews).The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: The Salvation Army (*c_salv*, in 0.018, *z* 2.873, quad-B), the state emergency management agency (*st_ema*, in 0.018, *z* 2.873, quad-B), and FEMA (*u_hs_fema*, in 0.018, *z* 2.873, quad-B).

The connectedness measures for this network are shown in Table 64 are limited by the number of interviewees for Texas, and are shown for illustration only.

Table 64: Centrality, Power and Connectedness - Desired Network, Texas

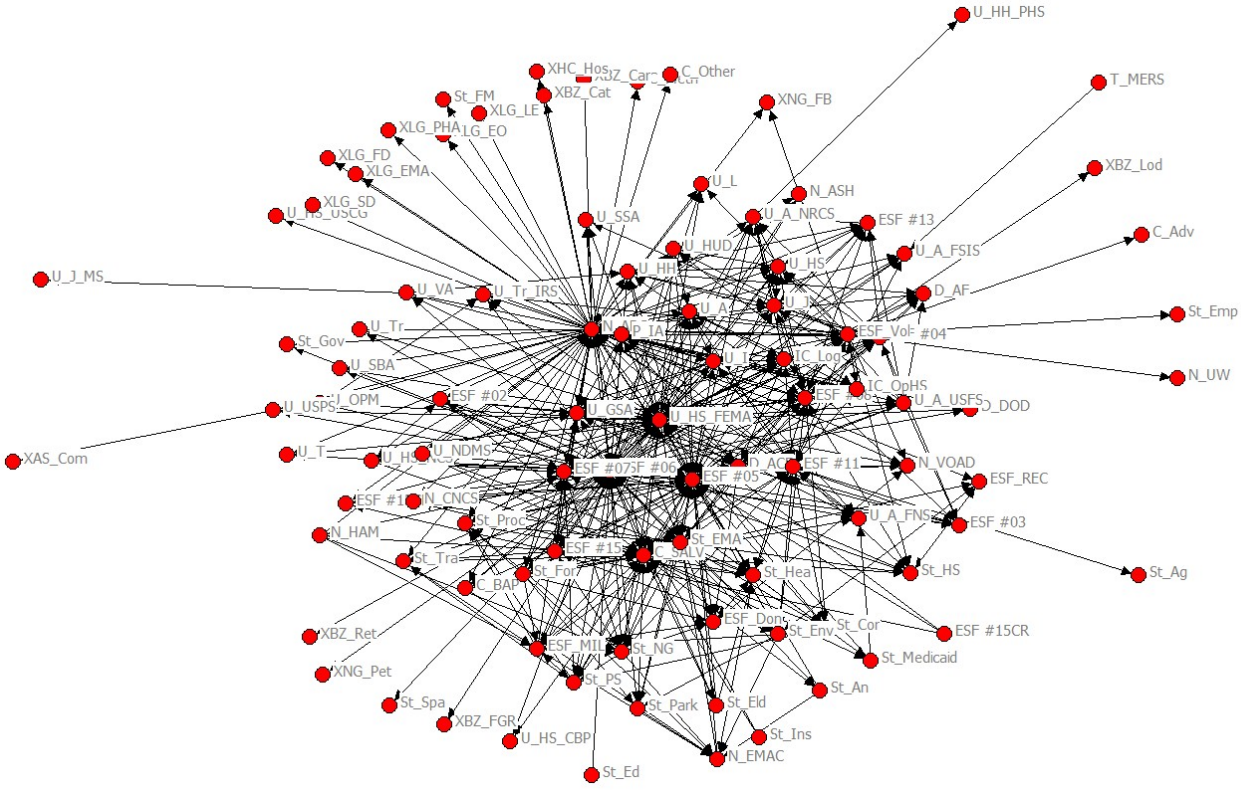
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	0.198	0.707	1	0.072	0.707	1
esf #06	Mass Care	0.058	-0.707	2	0.04	-0.707	2
2. Ranked by Flow Centrality							
n_arc	American Red Cross	0.198	0.707	1	0.072	0.707	1
esf #06	Mass Care	0.058	-0.707	2	0.04	-0.707	2
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.180	1.240	1	0.012	1.240	4
esf_vol	Vol Agency Liaison	0.108	0.117	2	-	-	-
esf #06	Mass Care	0.090	-0.164	3	0.006	-0.393	13
u_va	US Veterans' Affairs	0.024	-1.193	4	-	-	-
c_adv	Adventists	-	-	-	0.006	-0.393	13
4. Ranked by In-Degree							
c_salv	Salvation Army	-	-	-	0.018	2.873	1
st_ema	State EMA	-	-	-	0.018	2.873	1
u_hs_fema	FEMA	-	-	-	0.018	2.873	1
c_bap	Baptists	-	-	-	0.012	1.240	4
d_ace	Corps of Engineers	-	-	-	0.012	1.240	4

5.6.6 Combined Network Summary – Texas

The combination of all Texas networks ($COMB_{TX}$) contains 100 actors *(k)* for a network size of 9,900 (*k***k*-1). The 649 observed ties result in a modified network density of 0.066, which indicates that 6.6% of the available connections between actors have been made. The average number of ties per actor is 6.490 with an average tie length, or distance between all actors in the network, of 2.112.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the

actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 40: Combined Network Diagram, Texas

5.6.6.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.125 with moderate variability (SD 0.602) and the centrality mean is 0.110 with moderate variability (SD 0.433). This measure of

variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The actors with the greatest direct positional advantage to control interaction between other actors are: ESF #06 Mass Care (*esf #06*, nBet 4.800, *z* 2.165), ARC (*n_arc*, nBet 4.548, *z* 2.033), and FEMA (*u_hs_fema*, nBet 2.819, *z* 1.124). Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are: ARC (*n_arc*, nFlow 3.934, *z* 2.650), ESF #06 Mass Care (*esf #06*, nFlow 3.029, *z* 1.933), and The Salvation Army (*c_salv*, nFlow 1.478, *z* 0.705).

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are ARC (*n_arc*, out 0.395, *z* 2.457, quad-A), ESF #06 Mass Care (*esf #06*, out 0.377, *z* 2.304, quad-A) and FEMA (*u_hs_fema*, out 0.299, *z* 1.642, quad-A). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ESF #05 Emergency Management (*esf #05*, in 0.240, *z* 1.839, quad-A), ESF #06 Mass Care (*esf #06*, in 0.204, *z* 1.434, quad-A), and FEMA (*u_hs_fema*, in 0.192, *z* 1.299, quad-A)

Table 65: Centrality, Power and Connectedness - Combined Network, Texas

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #06	Mass Care	4.800	2.165	1	3.029	1.933	2
n_arc	American Red Cross	4.548	2.033	2	3.934	2.650	1
u_hs_fema	FEMA	2.819	1.124	3	1.425	0.663	4
esf #05	Emergency Mgmt	2.587	1.002	4	0.943	0.281	7
c_salv	Salvation Army	1.486	0.424	5	1.478	0.705	3
2. Ranked by Flow Centrality							
n_arc	American Red Cross	4.548	2.033	2	3.934	2.650	1
esf #06	Mass Care	4.800	2.165	1	3.029	1.933	2
c_salv	Salvation Army	1.486	0.424	5	1.478	0.705	3
u_hs_fema	FEMA	2.819	1.124	3	1.425	0.663	4
esf_vol	Vol Agency Liaison	0.923	0.128	7	1.213	0.495	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.395	2.457	1	0.150	0.827	5
esf #06	Mass Care	0.377	2.304	2	0.204	1.434	2
u_hs_fema	FEMA	0.299	1.642	3	0.192	1.299	3
esf #05	Emergency Mgmt	0.210	0.877	4	0.240	1.839	1
c_salv	Salvation Army	0.162	0.469	5	0.186	1.232	4
4. Ranked by In-Degree							
esf #05	Emergency Mgmt	0.210	0.877	4	0.240	1.839	1
esf #06	Mass Care	0.377	2.304	2	0.204	1.434	2
u_hs_fema	FEMA	0.299	1.642	3	0.192	1.299	3
c_salv	Salvation Army	0.162	0.469	5	0.186	1.232	4
n_arc	American Red Cross	0.395	2.457	1	0.150	0.827	5

5.6.7 Summary of Texas Networks

The reported network is the largest of the non-aggregated Texas networks with 65 nodes, a network size of 4,160 and 7.862 average ties per actor. The state plan, however, is the densest at 19.6% saturation.

Actors that are unique, study-wide, appear in three Texas networks. In the aggregated plan the separate state ESF for recovery (*esf_rec)* was mentioned. In the reported network, the state departments of insurance *(st_ins)* and procurement *(st_proc)* appear. In the desired networks, a parcel delivery service such as FedEx or UPS *(xbz_car*) and a local public health agency were mentioned. Additional organizations that were mentioned as desired for future events that were not included in the other Texas networks were retail chain stores such as Wal-Mart (*xbz_car),* ESF #08 Health and Medical Services *(esf #08)* and an organization to care for pets *(xng_pet).*

5.6.7.1 Agency Composition of Texas Networks

The total number of all government agencies in the network compositions ranged from 31 (68.89% of agencies, less positions) in the perceived network to 37 (82.22%) in the reported network. The number of federal government civilian agencies fell from 20 (55.56%) in the aggregated planned network to a low of 13 in the perceived (28.89%) and the desired (26.53%) networks. This change may be a combined result of the plans' ability to anticipate the involvement of the agency actors and the perspective of the interviewees being aware of agencies that are proximal to their position as near neighbors and not those farther away in the network. The number of state government agencies fell from 16 (35.56%) in the reported network to a low

of 11 (22.45%) in the perceived and the desired networks. The ICS Planning Section, responsible for the generation of the sitreps would have a more encompassing view of agencies involved in the response than would the interviewees, as mentioned above. The number of all non-government agencies ranged from four (11.11%) in the aggregated planned network to 17 (34.69%) in the desired network. This may indicate that planning for future operations would be improved, and more reflective of past practice, with the inclusion of additional NGO and FBO response agencies.

5.6.7.2 Actor Presence in Texas and Federal Plans

The aggregated plans were 36.00% accurate in anticipating the actors that would be involved in these response operations; 7.00% of the planned agencies did not appear in any of the other networks, while 57.00% of the active agencies did not appear in the plan. The state plan was 24.49% accurate in anticipating the non-federal actors that would be involved in these response operations; 4.08% of the planned agencies did not appear in any of the other networks, while 71.43% of the active agencies did not appear in the plan.

There were 18 actors that appeared in at least one planned and all other networks: The Salvation Army (*c_salv*), US Army Corps of Engineers (*d_ace*), ESF#06 Mass Care (*esf #06*), ESF#06 Mass Care (*esf #11*), ARC *(n_arc*), Corporation for National and Community Service (*n_cncs*), State Department of Corrections (*st_cor),* State EMA (*st_ema*), State Department of Health (*st_hea*), State Department of Human Services (*st_hs*), USDA (*u_a*), US Forest Service (*u_a_usfs*), HHS (*u_hh),* DHS (*u_hs*), FEMA (*u_hs_fema*), HUD (*u_hud*), Internal Revenue Service (*u_tr_irs*), and US Postal Service *(u_usps*).

There were five specific agency actors that were not in the mass care plan but were in all other networks: Baptist FBOs (*c_bap*), America's Second Harvest (*n_ash*), State Department of

Forestry *(st_for*), State Police (*st_ps*), and State Department of Transportation (*st_tra*). Additional analysis should be performed to determine if these agencies should be added to the ESF #06 plan.

Table 66: Network Comparison Table, Texas

	NRP6	Planned PLNTX	PLNTXF	Reported RPTTX	Perceived PERTX	Desired DESTX	Combined COMBTX
Agency Count							
NIMS/NRP Position	3	6	7	20	4	5	21
US Government	20	0	20	19	13	13	27
US Military	2	0	2	2	1	1	3
Tribal	0	0	0	0	0	0	0
State Government	1	9	10	16	11	11	22
Local Government	0	0	0	0	6	7	7
National NGO	3	2	3	5	5	5	7
State/Local NGO	0	0	0	0	1	2	2
Faith Based	0	1	1	2	5	5	5
Business	0	0	0	1	3	5	6
Total actors (k)	29	18	43	65	49	54	100
Network Size (k*k-1)	812	306	1806	4160	2352	2862	9900
Sum of ties	80	60	138	511	61	67	649
Density (modified)	0.099	0.196	0.076	0.123	0.026	0.023	0.000
Avg ties per actor	2.759	3.333	3.209	7.862	1.245	1.241	6.490
Avg distance	1.048	2.278	2.250	1.919	1.522	1.546	2.112
Univariate Comparison							
quad-A	0	10	3	14	1	1	6
quad-B	26	0	1	3	11	12	1
quad-C	0	0	8	6	0	0	5
quad-D	3	8	31	42	37	41	88
Out-degree mean		0.021	0.046	0.067	0.091	0.100	0.023
Out-degree SD		0.012	0.061	0.063	0.060	0.064	0.056
In-degree mean		0.020	0.019	0.049	0.007	0.007	0.023
In degree SD		0.013	0.010	0.049	0.004	0.004	0.040

Centralization Index	ICS	PLNTX	PLNTXF	RPTTX	PERTX	DESTX	COMBTX
Betweenness	1.25%	0.38%	1.11%	2.22%	0.17%	0.20%	4.70%
Flow Centrality	52.30%	34.16%	31.11%	12.79%	43.44%	46.35%	13.09%

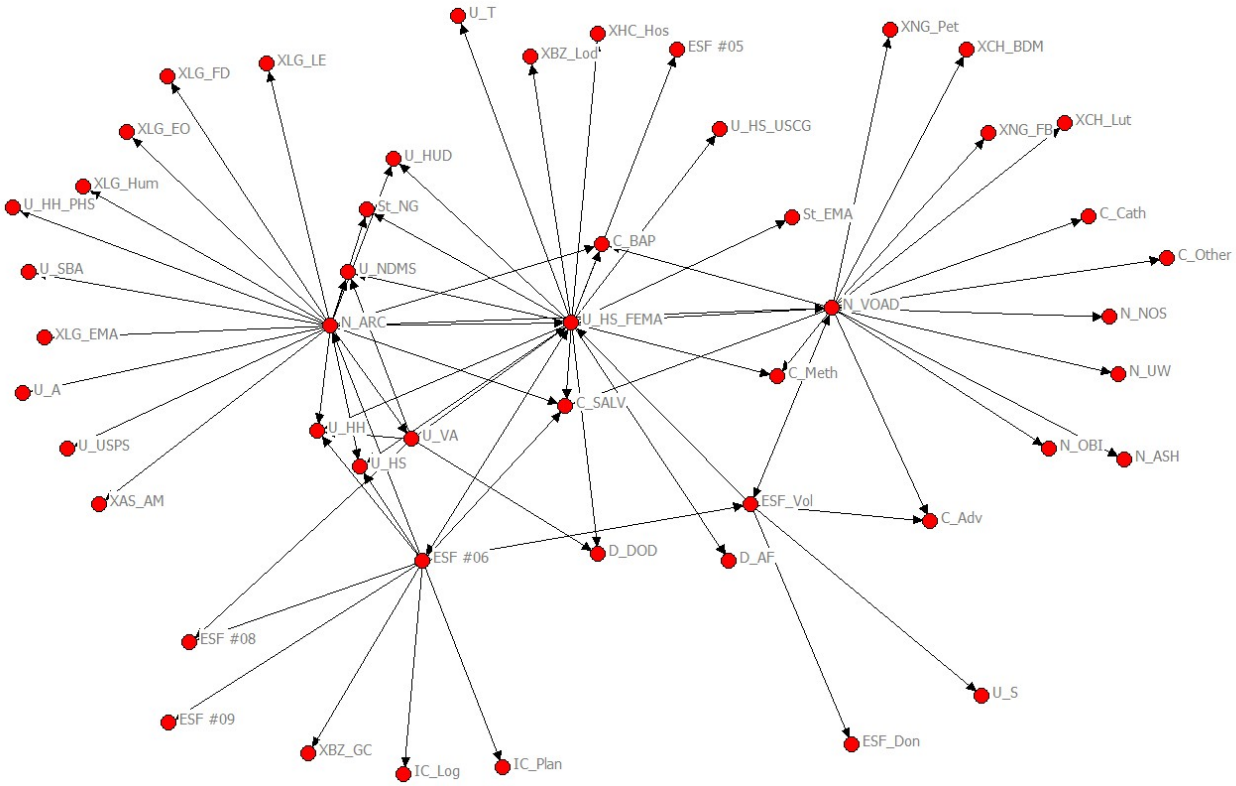
5.7 REGIONAL AND NATIONAL COORDINATION

5.7.1 Perceived Network Summary – Regional and National Coordination

The perceived regional and national coordination network (PER_{DC}) contains 52 actors *(k)* for a network size of 2,653 (*k***k*-1). The 76 observed ties result in a modified network density of 0.029, which indicates that 2.9% of the available connections between actors have been made. The average number of ties per actor is 1.462 with an average tie length, or distance between all actors in the network, of 2.054. Compared to the mass care portion of the NRP (PLN_{NRP6}), PER_{DC} is a larger and less dense network, which indicates that there are more potential interactions, though there are currently fewer occurring.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.390% which indicates a less centralized network, with fewer actors having positional advantage between other actors, compared to PLN_{ICS}. Conversely, the flow network centrality index is 70.336% which indicates a more centralized network compared to PLN_{ICS}, indicating that there are is larger number of actors with influence over the ties between actors. This can indicate that there are fewer opportunities for bottle-necks, but as the network diagram (Figure 41) displays, choke-points of information can still be created or exploited.



Legend:

c_adv	FBO, Adventist	*u_hh*	Health and Human Services, US Dept. of
c_bap	FBO, Baptist	*u_hh_phs*	HHS - US Public Health Service
c_cath	FBO, Catholic	*u_hs*	Homeland Security, US Dept. of
c_meth	FBO, Methodist	*u_hs_fema*	FEMA
c_other	FBO, Other, not specified	*u_hs_uscg*	DHS - US Coast Guard
c_salv	FBO, Salvation Army	*u_hud*	Housing & Urban Develop., US Dept. of
d_af	US Air Force	*u_ndms*	National Disaster Medical System
d_dod	US Dept of Defense	*u_s*	State, US Dept. of
esf #05	Emergency Management	*u_sba*	Small Business Administration
esf #06	Mass Care, Housing & Human Services	*u_t*	Transportation, US Dept. of
esf #08	Public Health and Medical Services	*u_usps*	US Postal Service
esf #09	Urban Search and Rescue	*u_va*	Veterans Affairs, US Dept. of
esf_don	Donation Management	*xas_am*	Association, Assembly Managers
esf_vol	Volunteer Management	*xbz_gc*	Businesses, Govt Contractors
ic_log	ICS Logistics Section (ESF #7)	*xbz_lod*	Businesses, Lodging (Hotel/Motel)
ic_plan	ICS Planning Section	*xch_bdm*	FBO, Brethren Disaster Ministries
n_arc	American Red Cross	*xch_lut*	FBO, Lutheran
n_ash	Americas Second Harvest	*xhc_hos*	Health Care, Hospitals
n_nos	NGO, not otherwise specified	*xlg_ema*	Local Govt, Emergency Management
n_obi	Operation Blessing International	*xlg_eo*	Local Govt, Elected Officials
n_uw	United Way	*xlg_fd*	Local Govt, Fire
n_voad	Vol. Org. Active in Disaster	*xlg_hum*	Local Govt, Human Services
st_ema	State Agency, EMA	*xlg_le*	Local Govt, Law Enforcement
st_ng	State Agency, Military / National Guard	*xng_fb*	NGO, Food Bank, NOS
u_a	Agriculture, US Dept. of (USDA)	*xng_pet*	NGO, Pet Care, NOS

Figure 41: Perceived Network Diagram, Regional and National Coordination

5.7.1.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.186 with high variability (SD 0.153) and the centrality mean is 0.098 with moderate variability (SD 0.117). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The actors with the greatest positional advantage, both direct and indirect, between other actors are FEMA (*u_hs_fema*, nBet 0.399, *z* 1.387, nFlow 0.280, *z* 1.549) and ARC (*n_arc*, nBet 0.316, *z* 0.845, nFlow 0.254, *z* 1.324), both represented in the interviews. These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ARC (*n_arc*, out 0.120, *z* 1.102, quad-A), FEMA (*u_hs_fema*, out 0.108, *z* 0.802, quad-A), and National VOAD (*n_voad*, out 0.102, *z* 0.651, quad-A). These three actors were represented in the interviews.

The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: FEMA (*u_hs_fema*, in 0.030, *z* 3.653, quad-A), The Salvation Army (*c_salv*, in 0.024, *z* 2.603, quad-B), and the US Department of Health and Human Services (*u_hh*, in 0.024, *z* 2.603, quad-B).

Table 67: Centrality, Power and Connectedness - Perceived Network, Regional and National Coordination

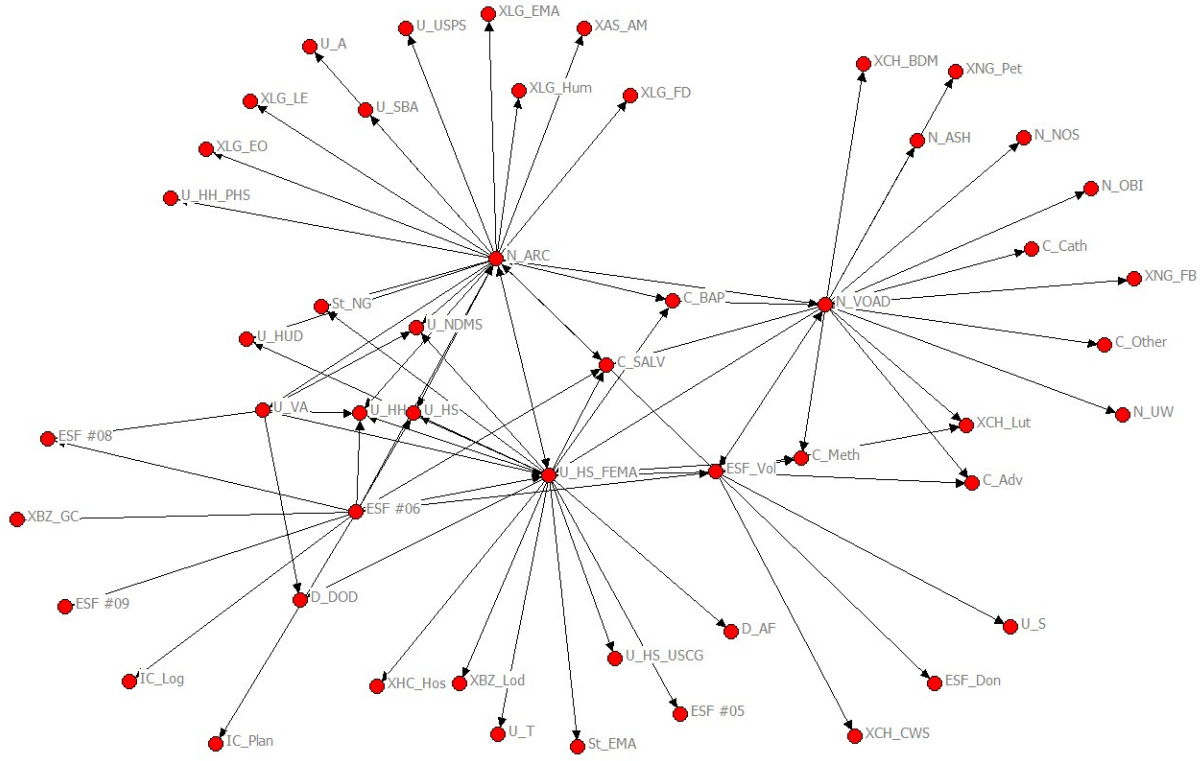
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
u_hs_fema	FEMA	0.399	1.387	1	0.280	1.549	1
n_arc	American Red Cross	0.316	0.845	2	0.254	1.324	2
u_hh	Health & Human Services	0.227	0.267	3	0.042	-0.48	4
esf #06	Mass Care	0.106	-0.522	4	0.069	-0.245	3
esf_vol	Vol Agency Liaison	0.063	-0.805	5	0.028	-0.601	5
2. Ranked by Flow Centrality							
u_hs_fema	FEMA	0.399	1.387	1	0.280	1.549	1
n_arc	American Red Cross	0.316	0.845	2	0.254	1.324	2
esf #06	Mass Care	0.106	-0.522	4	0.069	-0.245	3
u_hh	Health & Human Services	0.227	0.267	3	0.042	-0.48	4
esf_vol	Vol Agency Liaison	0.063	-0.805	5	0.028	-0.601	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.120	1.102	1	0.018	1.553	4
u_hs_fema	FEMA	0.108	0.802	2	0.030	3.653	1
n_voad	NVOAD	0.102	0.651	3	0.012	0.504	8
esf #06	Mass Care	0.066	-0.251	4	0.006	-0.546	16
esf_vol	Vol Agency Liaison	0.030	-1.152	5	0.012	0.504	8
4. Ranked by In-Degree							
u_hs_fema	FEMA	0.108	0.802	2	0.030	3.653	1
c_salv	Salvation Army	-	-	-	0.024	2.603	2
u_hh	Health & Human Services	-	-	-	0.024	2.603	2
c_bap	Baptists	-	-	-	0.018	1.553	4
n_arc	American Red Cross	0.120	1.102	1	0.018	1.553	4

5.7.2 Desired Network Summary – Regional and National Coordination

The desired regional and national coordination network (DES_{DC}) contains 51 actors *(k)* for a network size of 2,550 (*k***k*-1). The 80 observed ties result in a modified network density of 0.031, which indicates that 3.1% of the available connections between actors have been made. The average number of ties per actor is 1.569 with an average tie length, or distance between all actors in the network, of 2.013. Compared to the perceived (PER_{DC}) network , it is a larger, denser network, which increases the potential number of interactions, but may result in communication overload.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 0.004 which indicates a less directly centralized network when compared to the formal command structure of ICS (PLN_{ICS}), though the flow network centrality index is 0.623, indicating that it is a more indirectly centralized network. This can indicate that there are fewer opportunities for bottle-necks, but as the network diagram (Figure 42) displays, choke-points of information can still be created or exploited.



Legend:

c_adv	FBO, Adventist	*u_hh_phs*	HHS - US Public Health Service
c_bap	FBO, Baptist	*u_hs*	Homeland Security, US Dept. of
c_cath	FBO, Catholic	*u_hs_fema*	FEMA
c_meth	FBO, Methodist	*u_hs_uscg*	DHS - US Coast Guard
c_other	FBO, Other, not specified	*u_hud*	Housing & Urban Develop., US Dept. of
c_salv	FBO, Salvation Army	*u_ndms*	National Disaster Medical System
d_af	US Air Force	*u_s*	State, US Dept. of
d_dod	US Dept of Defense	*u_sba*	Small Business Administration
esf #05	Emergency Management	*u_t*	Transportation, US Dept. of
esf #06	Mass Care, Housing & Human Services	*u_usps*	US Postal Service
esf #08	Public Health and Medical Services	*u_va*	Veterans Affairs, US Dept. of
esf #09	Urban Search and Rescue	*xas_am*	Association, Assembly Managers
esf_don	Donation Management	*xbz_gc*	Businesses, Govt Contractors
esf_vol	Volunteer Management	*xbz_lod*	Businesses, Lodging (Hotel/Motel)
ic_log	ICS Logistics Section (ESF #7)	*xch_bdm*	FBO, Brethren Disaster Ministries
ic_plan	ICS Planning Section	*xch_cws*	FBO, Church World Service
n_arc	American Red Cross	*xch_lut*	FBO, Lutheran
n_ash	Americas Second Harvest	*xhc_hos*	Health Care, Hospitals
n_nos	NGO, not otherwise specified	*xlg_ema*	Local Govt, Emergency Management
n_obi	Operation Blessing International	*xlg_eo*	Local Govt, Elected Officials
n_uw	United Way	*xlg_fd*	Local Govt, Fire
n_voad	Vol. Org. Active in Disaster	*xlg_hum*	Local Govt, Human Services
st_ema	State Agency, EMA	*xlg_le*	Local Govt, Law Enforcement
st_ng	State Agency, Military / National Guard	*xng_fb*	NGO, Food Bank, NOS
u_a	Agriculture, US Dept. of (USDA)	*xng_pet*	NGO, Pet Care, NOS
u_hh	Health and Human Services, US Dept. of		

Figure 42: Desired Network Diagram, Regional and National Coordination

5.7.2.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.183 with moderate variability (SD 0.139) and the centrality mean is 0.092 with moderate variability (SD 0.106). This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact

The actors with the greatest positional advantage, both direct and indirect, between other actors are FEMA (u_hs_fema, nBet 0.365, *z* 1.309, nFlow 0.230, *z* 1.301) and ARC (n_arc, nBet 0.323, *z* 1.011, nFlow 0.257, *z* 1.561), both represented in the interviews. These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ARC (*n_arc*, out 0.120, *z* 1.132, quad-A), FEMA (*u_hs_fema*, out 0.108, *z* 0.793, quad-A), and National VOAD (*n_voad*, out 0.102, *z* 0.623, quad-A). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: FEMA (*u_hs_fema*, in 0.030, *z* 3.414, quad-A), and The Salvation Army (*c_salv*), ARC (*n_arc*) and the US Department of Health and Human Services (*u_hh*) all with similar measures (in 0.024, *z* 2.419)

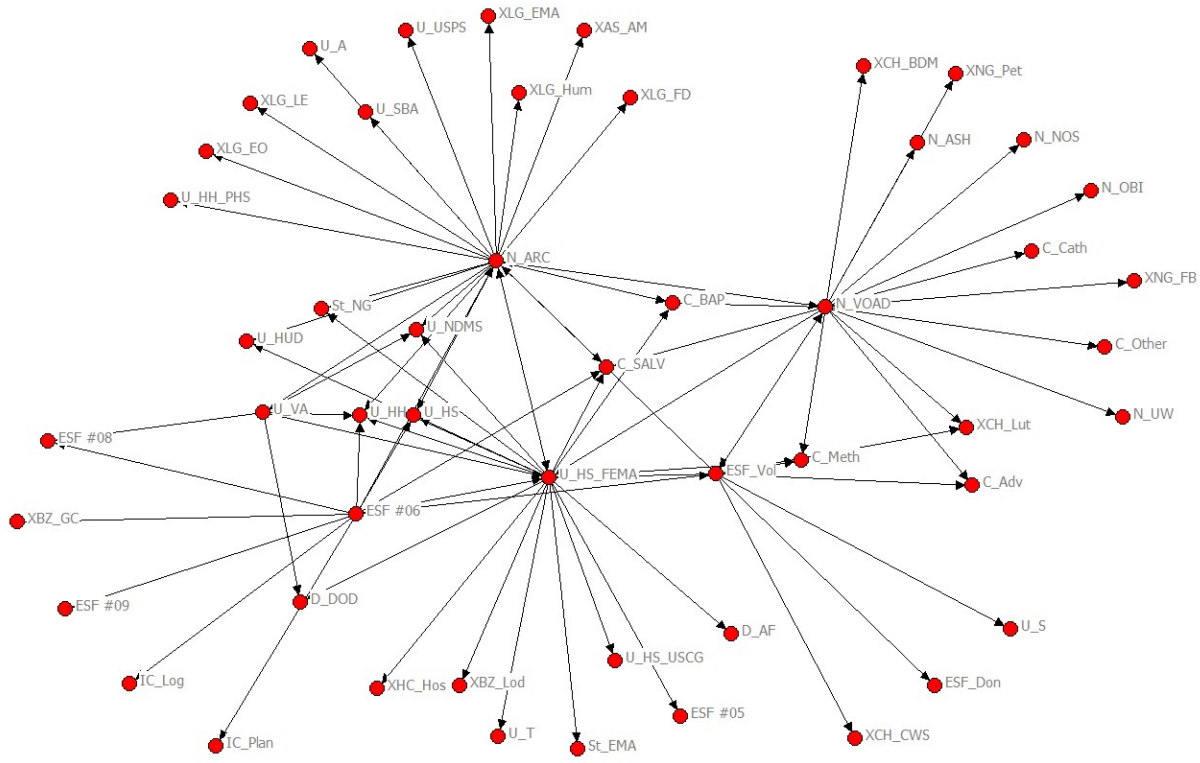
Table 68: Centrality, Power and Connectedness - Desired Network, Regional and National Coordination

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
u_hs_fema	FEMA	0.365	1.309	1	0.230	1.301	2
n_arc	American Red Cross	0.323	1.011	2	0.257	1.561	1
n_voad	Voluntary Org. Active in Disaster	0.195	0.091	3	0.036	-0.519	4
esf #06	Mass Care	0.115	-0.484	4	0.069	-0.208	3
esf_vol	Voluntary Agency Liaison	0.088	-0.678	5	0.033	-0.55	5
2. Ranked by Flow Centrality							
n_arc	American Red Cross	0.323	1.011	2	0.257	1.561	1
u_hs_fema	FEMA	0.365	1.309	1	0.230	1.301	2
esf #06	Mass Care	0.115	-0.484	4	0.069	-0.208	3
n_voad	Voluntary Org. Active in Disaster	0.195	0.091	3	0.036	-0.519	4
esf_vol	Voluntary Agency Liaison	0.088	-0.678	5	0.033	-0.55	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.120	1.132	1	0.024	2.419	2
u_hs_fema	FEMA	0.108	0.793	2	0.030	3.414	1
n_voad	Voluntary Org. Active in Disaster	0.102	0.623	3	0.012	0.429	9
esf #06	Mass Care	0.066	-0.396	4	0.006	-0.566	17
esf_vol	Voluntary Agency Liaison	0.054	-0.736	5	0.012	0.429	9
4. Ranked by In-Degree							
u_hs_fema	FEMA	0.108	0.793	2	0.030	3.414	1
c_salv	Salvation Army	-	-	-	0.024	2.419	2
n_arc	American Red Cross	0.120	1.132	1	0.024	2.419	2
u_hh	US Dept of Health / Human Services	-	-	-	0.024	2.419	2
c_bap	Baptists	-	-	-	0.018	1.424	5

5.7.3 Combined Network Summary – Regional and National Coordination

The combination of both regional and national coordination networks ($COMB_{DC}$) contains 51 actors *(k)* for a network size of 2,550 (*k***k*-1). The 80 observed ties result in a modified network density of 0.031, which indicates that 3.1% of the available connections between actors have been made. The average number of ties per actor is 1.569 with an average tie length, or distance between all actors in the network, of 2.013.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 43: Combined Network Diagram, Regional and National Coordination

5.7.3.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.007 with low variability (SD 0.042) and the centrality mean is 0.004 with low variability (SD 0.027). This measure of variability indicates that the more influential actors are more predictable in the manner which they interact and with whom.

The actors with the greatest direct positional advantage to control interaction between other actors are: FEMA (*u_hs_fema*, nBet 0.365, *z* -0.165), ARC (*n_arc*, nBet 0.323, *z* -0.187), and National VOAD (*n_voad*, nBet 0.195, *z* -0.254). Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are: ARC (*n_arc*, nFlow 0.257,

z -0.262), FEMA (*u_hs_fema*, nFlow 0.230, *z* -0.284), and ESF #06 Mass Care (*esf #06*, nFlow 0.069, *z* -0.411).

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ARC (*n_arc*, out 0.120, *z* 0.112, quad-B), FEMA (*u_hs_fema*, out 0.108, *z* 0.010, quad-B), and National VOAD (*n_voad*, out 0.102, *z* -0.041, quad-D). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: FEMA (*u_hs_fema*, in 0.030, *z* -0.521, quad-B), The Salvation Army (*c_salv*, in 0.024, *z* -0.588, quad-D), and ARC (*n_arc*, in 0.024, *z* -0.588, quad-B).

Table 69: Centrality, Power and Connectedness - Combined Network, Regional and National Coordination

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
u_hs_fema	FEMA	0.365	-0.165	1	0.230	-0.284	2
n_arc	American Red Cross	0.323	-0.187	2	0.257	-0.262	1
n_voad	NVOAD	0.195	-0.254	3	0.036	-0.437	4
esf #06	Mass Care	0.115	-0.296	4	0.069	-0.411	3
esf_vol	Vol Agency Liaison	0.088	-0.310	5	0.033	-0.440	5
2. Ranked by Flow Centrality							
n_arc	American Red Cross	0.323	-0.187	2	0.257	-0.262	1
u_hs_fema	FEMA	0.365	-0.165	1	0.230	-0.284	2
esf #06	Mass Care	0.115	-0.296	4	0.069	-0.411	3
n_voad	NVOAD	0.195	-0.254	3	0.036	-0.437	4
esf_vol	Vol Agency Liaison	0.088	-0.310	5	0.033	-0.440	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.120	0.112	1	0.024	-0.588	2
u_hs_fema	FEMA	0.108	0.010	2	0.030	-0.521	1
n_voad	NVOAD	0.102	-0.041	3	0.012	-0.723	9
esf #06	Mass Care	0.066	-0.346	4	0.006	-0.791	17
esf_vol	Vol Agency Liaison	0.054	-0.448	5	0.012	-0.723	9
4. Ranked by In-Degree							
u_hs_fema	FEMA	0.108	0.01	2	0.030	-0.521	1
c_salv	Salvation Army	-	-	-	0.024	-0.588	2
n_arc	American Red Cross	0.12	0.112	1	0.024	-0.588	2
u_hh	Health & Human Services	-	-	-	0.024	-0.588	2
c_bap	Baptists	-	-	-	0.018	-0.656	5

5.7.4 Summary of Regional and National Coordination Networks

The regional and national coordination networks are not compared to a planned network as this category represents levels of the specific agencies somewhat removed from the actual operations, performing support roles that would not be specifically included in the NRP. This category is

provided more to build a broader perspective for the aggregated perceived and desired networks, but more so for the information and organizational analyses in Chapter 6.

Table 70: Network Comparison Table, Regional and National Coordination

	Planned NRP6	Perceived PERDC	Desired DESDC	Combined COMBDC
Agency Count				
NIMS/NRP Position	3	8	8	8
US Government	20	13	13	13
US Military	2	2	2	2
Tribal	0	0	0	0
State Government	1	2	2	2
Local Government	0	6	6	6
National NGO	3	6	6	6
State/Local NGO	0	2	2	2
Faith Based	0	8	9	9
Business	0	3	3	3
Total actors (k)	29	50	51	51
Network Size (k*k-1)	812	2450	2550	2550
Sum of ties	80	76	80	80
Density (modified)	0.099	0.031	0.031	0.031
Avg ties per actor	2.759	1.520	1.569	1.569
Avg distance	1.048	2.054	2.013	2.013
Univariate Comparison				
quad-A	0	3	3	0
quad-B	26	11	12	2
quad-C	0	1	1	0
quad-D	3	35	35	49
Out-degree mean		0.076	0.080	0.003
Out-degree SD		0.040	0.035	0.016
In-degree mean		0.009	0.009	0.003
In degree SD		0.006	0.006	0.005
Centralization Index	ICS	PERDC	DESDC	COMBDC
Betweenness	1.25%	0.39%	0.36%	0.36%
Flow Centrality	52.30%	70.34%	62.27%	62.27%

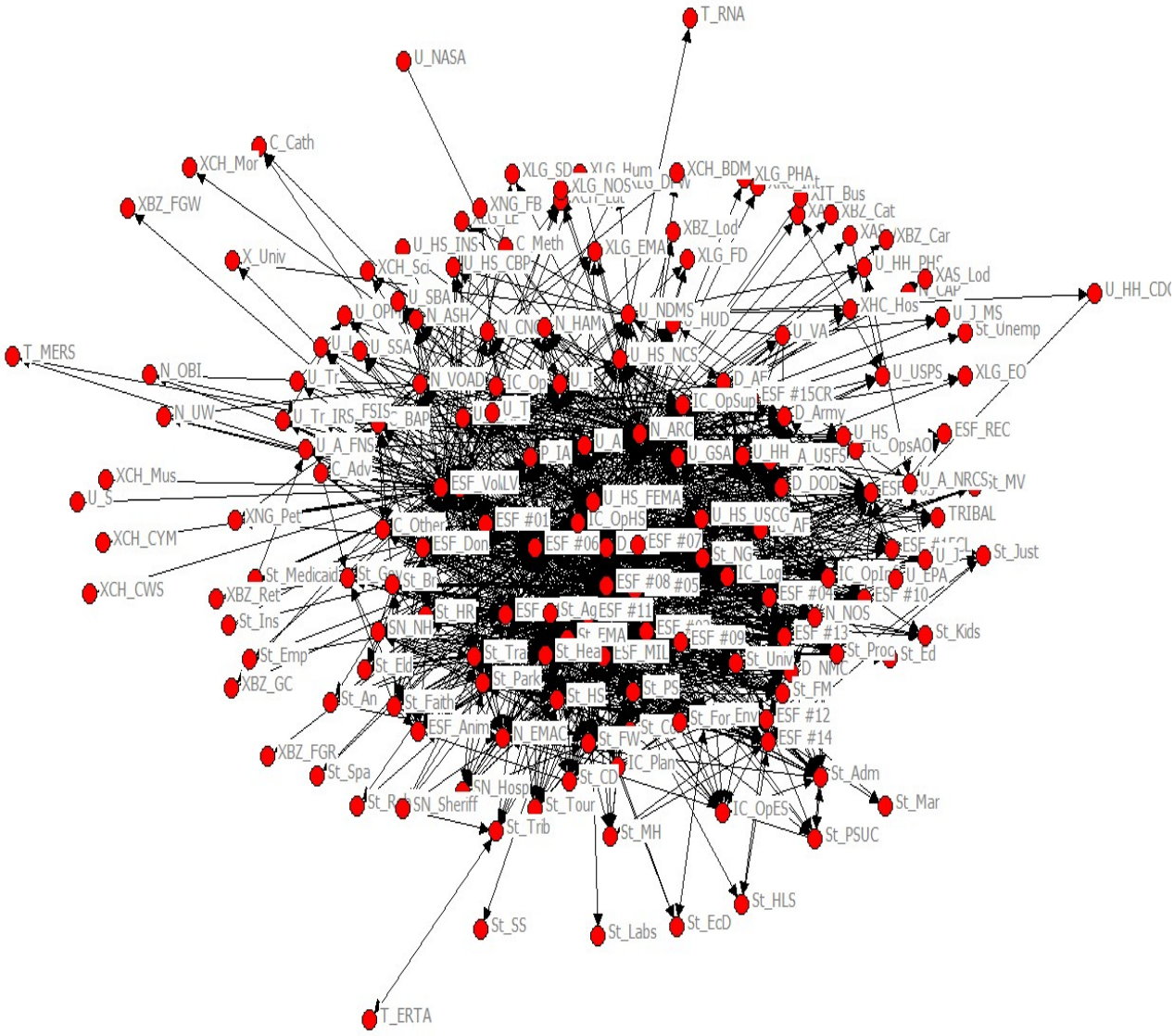
5.8 AGGREGATED

5.8.1 Planned Network Summary – Aggregated State Plans Joined with NRP

The network formed by the aggregation of all plans (PLN_{AGGF}) contains 73 actors *(k)* for a network size of 5,256 (*k***k*-1). The 467 observed ties result in a modified network density of 0.089, which indicates that 8.9% of the available connections between actors have been made. The average number of ties per actor is 6.397 with an average tie length, or distance between all actors in the network, of 2.178.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 3.320% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 18.073% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 44 : Planned Network Diagram, Aggregated

5.8.1.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.321 with moderate variability (SD 0.733) and the centrality mean is 0.300 with high variability (SD 0.669). This measure of

variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

The actors with the greatest positional advantage, both direct and indirect, between other actors are: ESF #06 Mass Care (*esf #06*, nBet 3.390, *z* 4.185, nFlow 2.937, *z* 3.944), ESF #11 (*esf #11*, nBet 2.975, *z* 3.620, nFlow 2.940, *z* 3.948), and ARC (*n_arc*, nBet 2.584, *z* 3.085, nFlow 2.002, *z* 2.546). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network. This measure of variability indicates that the more influential actors are not necessarily constrained in the manner which they may interact or with whom they interact.

FEMA as a general agency actor (*u_hs_fema* , nFlow 0.989, z 1.03) ranked fourth in centrality but much lower at 47 for betweenness, indicating that it had more indirect influence than direct control between the actors in this network scenario.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.353, *z* 4.045, quad-A), ARC (*n_arc*, out 0.272, *z* 2.894, quad-A), and ESF #11 (*esf #11*, out 0.213, *z* 2.057, quad-A). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ESF #11 (*esf #11*, in 0.221, *z* 4.011, quad-A), ESF #06 Mass Care (*esf #06*, in 0.162, *z* 2.651, quad-A), and ESF #05 Emergency Management (*esf #05*, in 0.154, *z* 2.481, quad-A).

Table 71: Centrality, Power and Connectedness - Planned Network Diagram, Aggregated

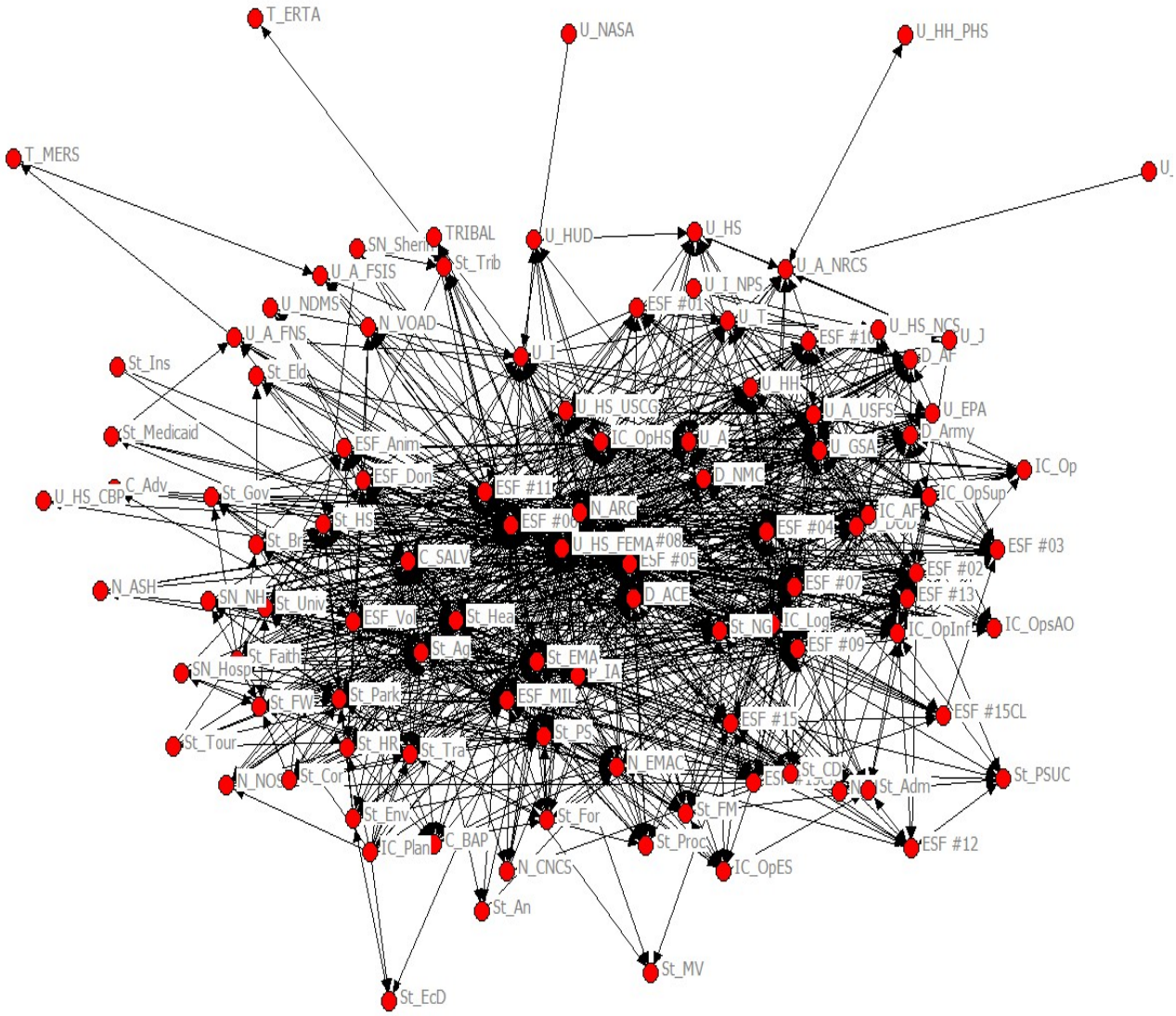
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #06	Mass Care	3.390	4.185	1	2.937	3.944	2
esf #11	Agriculture	2.975	3.620	2	2.940	3.948	1
n_arc	American Red Cross	2.584	3.085	3	2.002	2.546	3
esf #05	Emergency Mgmt	0.933	0.834	4	0.882	0.871	6
esf #08	Health/Medical Services	0.70	0.516	5	0.909	0.911	5
2. Ranked by Flow Centrality							
esf #11	Agriculture	2.975	3.620	2	2.940	3.948	1
esf #06	Mass Care	3.390	4.185	1	2.937	3.944	2
n_arc	American Red Cross	2.584	3.085	3	2.002	2.546	3
u_hs_fema	FEMA	0.001	-0.437	47	0.989	1.031	4
esf #08	Health/Medical Services	0.700	0.516	5	0.909	0.911	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.353	4.045	1	0.162	2.651	2
n_arc	American Red Cross	0.272	2.894	2	0.103	1.292	8
esf #11	Agriculture	0.213	2.057	3	0.221	4.011	1
u_hs_fema	FEMA	0.199	1.848	4	0.015	-0.747	59
esf #05	Emergency Mgmt	0.169	1.429	5	0.154	2.481	3
4. Ranked by In-Degree							
esf #11	Agriculture	0.213	2.057	3	0.221	4.011	1
esf #06	Mass Care	0.353	4.045	1	0.162	2.651	2
esf #05	Emergency Mgmt	0.169	1.429	5	0.154	2.481	3
esf #15	External Affairs	0.132	0.906	7	0.140	2.142	4
esf #08	Health/Medical Services	0.140	1.011	6	0.132	1.972	5

5.8.2 Reported Network Summary – Aggregated

The network formed by the aggregation of all reports (RPT_{AGG}) contains 117 actors *(k)* for a network size of 11,772 (*k***k*-1). The 1,621 observed ties result in a modified network density of 0.119, which indicates that 11.9% of the available connections between actors have been made. The average number of ties per actor is 13.85 with an average tie length, or distance between all actors in the network, of 1.945. Compared to the aggregated plan network (PLN_{AGGF}) RPT_{AGG} is a larger, denser network, which increases the potential number of interactions, but may result in communication overload.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 4.650% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 6.182% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 45: Reported Network Diagram, Aggregated

5.8.2.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.044 with low variability (SD 0.036) and the centrality mean is 0.044 with low variability (SD 0.036). This measure of variability indicates that the more influential actors are relatively constrained in the manner which they may interact and with whom they interact.

The actors with the greatest direct positional advantage to control interaction between other actors are: ESF #06 Mass Care (*esf #06*, nBet 4.805, *z* 5.024), FEMA (*u_hs_fema*, nBet 4.202, *z* 4.344), ESF #05 Emergency Management (*esf #05*, nBet 4.187, *z* 4.327), the state emergency management agency (*st_ema*, nBet 3.085, *z* 3.084), and ARC (*n_arc*, nBet 2.176, *z* 2.059). Those with the greatest indirect advantage to influence, rather than control, interaction between other actors are: the state emergency management agency (*st_ema*, nFlow 2.770, *z* 4.596), FEMA (*u_hs_fema*, nFlow 2.576, *z* 4.228), ESF #06 Mass Care (*esf #06*, nFlow 2.533, *z* 4.146), ESF #05 Emergency Management (*esf #05*, nFlow 2.001, *z* 3.136), and The Salvation Army (*c_salv*, nFlow 1.567, *z* 2.314).

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are: ESF #06 Mass Care (*esf #06*, out 0.419, *z* 3.675, quad-A), FEMA (*u_hs_fema*, out 0.419, *z* 3.675, quad-A), ESF #05 Emergency Management (*esf #05*, out 0.371, *z* 3.133, quad-A), ARC (*n_arc*, out 0.353, *z* 2.930, quad-A), the state emergency management agency (*st_ema*, out 0.305, *z* 2.388, quad-A), ESF #08 Health and Medical Services (*esf #08*, out 0.246, *z* 1.711, quad-A), ESF #04 Firefighting (*esf #04*, out 0.216, *z* 1.372, quad-A), Operations Section Human Services Branch (*ic_ophs*, out 0.216, *z* 1.372, quad-A), the US Army Corps of Engineers (*d_ace*, out 0.204, *z* 1.237, quad-A), and the state health department (*st_hea*, out 0.204, *z* 1.237, quad-A).

The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are: ESF #05 Emergency Management Emergency Management (*esf #05*, in 0.413, *z* 3.816, quad-A), ESF #06 Mass Care (*esf #06*, in 0.389, *z* 3.534, quad-A), FEMA (*u_hs_fema*, in 0.359, *z* 3.181, quad-A), the state

emergency management agency (*st_ema*, in 0.329, *z* 2.829, quad-A), ARC (*n_arc*, in 0.317, *z* 2.688, quad-A), ESF #08 Health and Medical Services (*esf #08*, in 0.263, *z* 2.053, quad-A), The Salvation Army (*c_salv*, in 0.251, *z* 1.912, quad-A), the US Army Corps of Engineers (*d_ace*, in 0.216, *z* 1.489, quad-A), the state health department (*st_hea*, in 0.216, *z* 1.489, quad-A), and the state department of agriculture (*st_ag*, in 0.204, *z* 1.348, quad-A).

Table 72: Centrality, Power and Connectedness - Reported Network, Aggregated

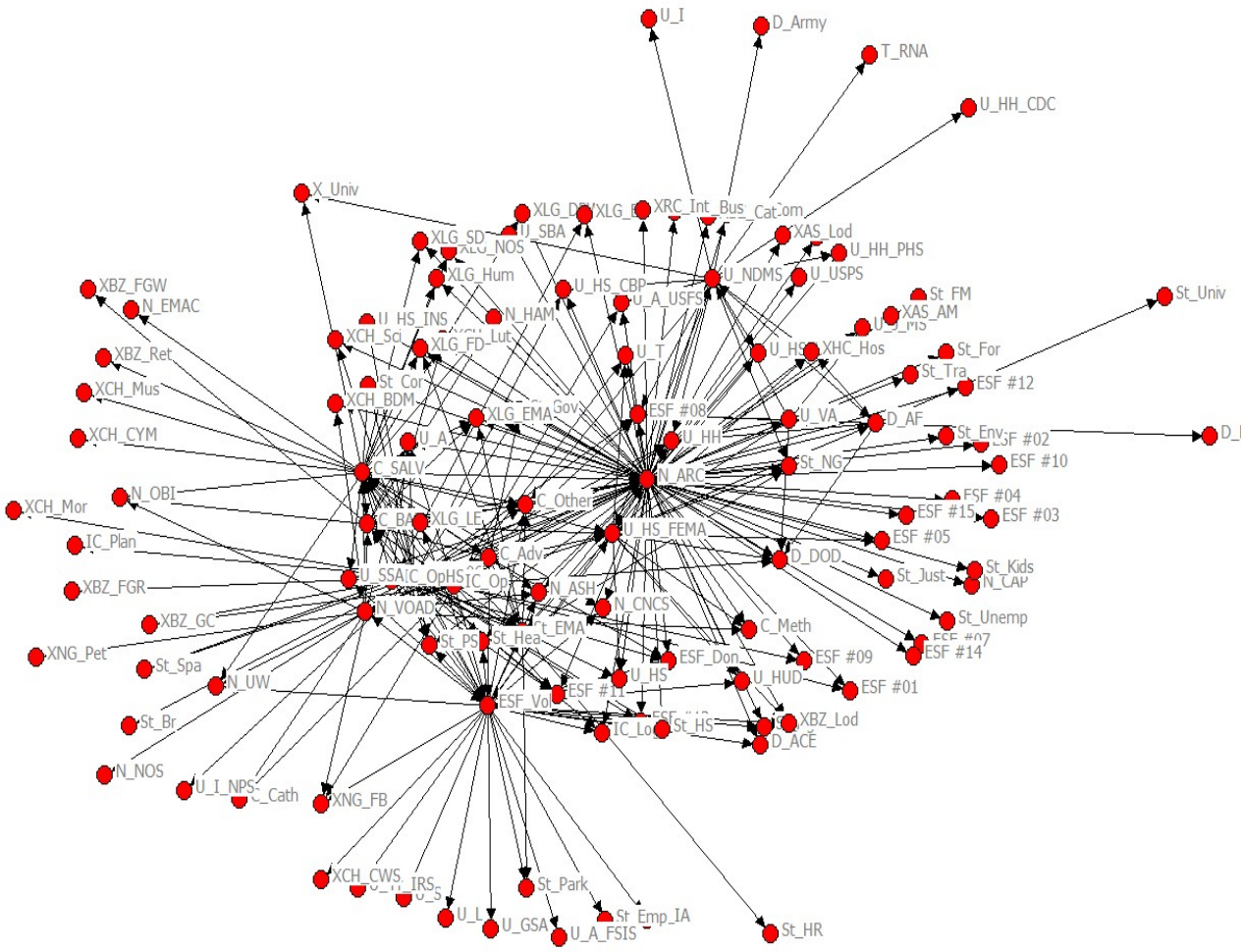
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
esf #06	Mass Care	4.805	5.024	1	2.533	4.146	3
u_hs_fema	FEMA	4.202	4.344	2	2.576	4.228	2
esf #05	Emergency Management	4.187	4.327	3	2.001	3.136	4
st_ema	State EMA	3.085	3.084	4	2.770	4.596	1
n_arc	American Red Cross	2.176	2.059	5	1.225	1.664	6
2. Ranked by Flow Centrality							
st_ema	State EMA	3.085	3.084	4	2.770	4.596	1
u_hs_fema	FEMA	4.202	4.344	2	2.576	4.228	2
esf #06	Mass Care	4.805	5.024	1	2.533	4.146	3
esf #05	Emergency Management	4.187	4.327	3	2.001	3.136	4
c_salv	Salvation Army	1.104	0.851	6	1.567	2.314	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
esf #06	Mass Care	0.419	3.675	0	0.389	3.534	2
u_hs_fema	FEMA	0.419	3.675	0	0.359	3.181	3
esf #05	Emergency Management	0.371	3.133	0	0.413	3.816	1
n_arc	American Red Cross	0.353	2.930	0	0.317	2.688	5
st_ema	State EMA	0.305	2.388	0	0.329	2.829	4
4. Ranked by In-Degree							
esf #05	Emergency Management	0.371	3.133	0	0.413	3.816	1
esf #06	Mass Care	0.419	3.675	0	0.389	3.534	2
u_hs_fema	FEMA	0.419	3.675	0	0.359	3.181	3
st_ema	State EMA	0.305	2.388	0	0.329	2.829	4
n_arc	American Red Cross	0.353	2.930	0	0.317	2.688	5

5.8.3 Perceived Network Summary – Aggregated

The network formed by the aggregation of all of the perceived networks (PER_{AGG}) network contains 120 actors *(k)* for a network size of 14,280 (*k***k*-1). The 293 observed ties result in a modified network density of 0.021, which indicates that 2.1% of the available connections between actors have been made. The average number of ties per actor is 2.442 with an average tie length, or distance between all actors in the network, of 2.065. Compared to the aggregated plan (PLN_{AGGF}) and reported (RPT_{AGG}) networks, PER_{AGG} is a larger and less dense network, which indicates that there are more potential interactions, though there are currently fewer occurring.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 2.980% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 44.048% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 46: Perceived Network Diagram, Aggregated

5.8.3.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.489 with high variability (SD 0.796) and the centrality mean is 0.587 with high variability (SD 0.713). This measure of variability indicates that the more influential actors have few constraints to the manner in which they may interact and with whom. They have less predictable patterns of interaction within the network.

The ARC (*n_arc*, nBet 2.996, *z* 3.149, nFlow 2.722, *z* 2.995) has the greatest direct positional advantage to control interaction between other actors. The Voluntary Agency Liaison (*esf_vol*, nFlow 1.159, *z* 0.802) has with the greatest indirect advantage to influence, rather than control, interaction between other actors.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are the ARC (*n_arc*, out 0.485, *z* 3.073, quad-A) and the Voluntary Agency Liaison (*esf_vol*, out 0.210, *z* 0.720, quad-A). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are ARC (*n_arc*, in 0.066, *z* 4.423, quad-A) and The Salvation Army (*c_salv*, in 0.054, *z* 3.389, quad-A).

Table 73: Centrality, Power and Connectedness - Perceived Network, Aggregated

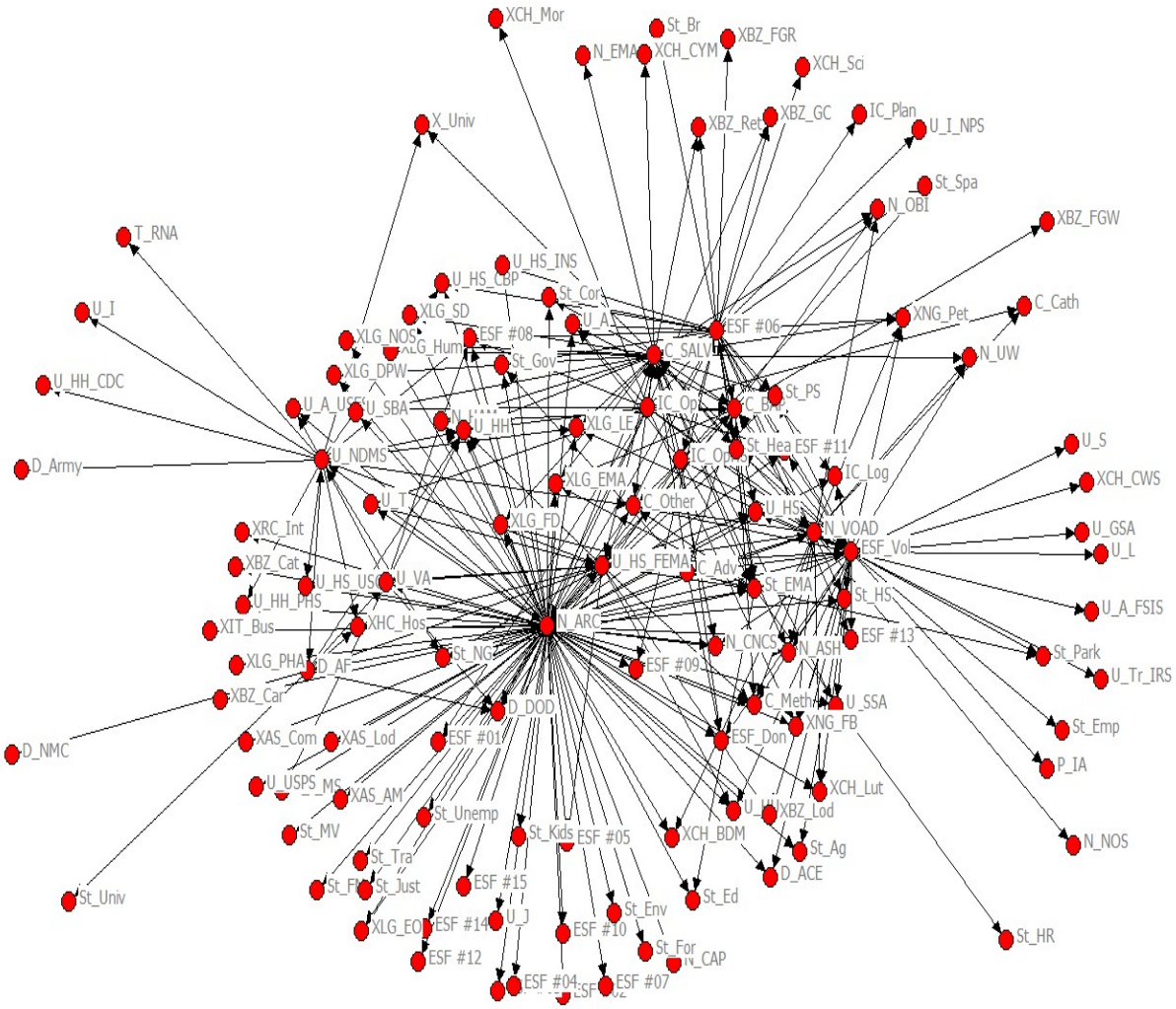
		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	2.996	3.149	1	2.722	2.995	1
u_hs_fema	FEMA	0.858	0.463	2	0.788	0.282	3
esf_vol	Vol Agency Liaison	0.567	0.099	3	1.159	0.802	2
esf #06	Mass Care	0.517	0.035	4	0.558	-0.04	4
c_salv	Salvation Army	0.489	0.000	5	0.454	-0.186	6
2. Ranked by Flow Centrality							
n_arc	American Red Cross	2.996	3.149	1	2.722	2.995	1
esf_vol	Vol Agency Liaison	0.567	0.099	3	1.159	0.802	2
u_hs_fema	FEMA	0.858	0.463	2	0.788	0.282	3
esf #06	Mass Care	0.517	0.035	4	0.558	-0.040	4
u_ndms	NDMS	0.261	-0.286	6	0.518	-0.097	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.485	3.073	1	0.066	4.423	1
esf_vol	Vol Agency Liaison	0.210	0.720	2	0.036	1.839	8
esf #06	Mass Care	0.180	0.464	3	0.030	1.322	10
c_salv	Salvation Army	0.168	0.362	4	0.054	3.389	2
ic_op	ICS Operations Section	0.108	-0.150	5	-	-	-
4. Ranked by In-Degree							
n_arc	American Red Cross	0.485	3.073	1	0.066	4.423	1
c_salv	Salvation Army	0.168	0.362	4	0.054	3.389	2
c_bap	Baptists	0.066	-0.508	9	0.048	2.872	3
st_ema	State EMA	0.042	-0.713	12	0.048	2.872	3
u_hs_fema	FEMA	0.108	-0.150	5	0.048	2.872	3

5.8.4 Desired Network Summary – Aggregated

The network formed by the aggregation of all desired networks (DES_{AGG}) contains 123 actors *(k)* for a network size of 15,006 (*k***k*-1). The 305 observed ties result in a modified network density of 0.020, which indicates that 2.0% of the available connections between actors have been made. The average number of ties per actor is 2.480 with an average tie length, or distance between all actors in the network, of 2.009. Compared to the other aggregated networks, DES_{AGG} is a larger and less dense network, which indicates that there are more potential interactions, though there are currently fewer occurring.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is 3.160% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 39.152% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 47: Desired Network Diagram. Aggregated

5.8.4.1 Actor and Interaction Analysis

The betweenness mean of the network is the network is 0.475 with high variability (SD 0.841) and the centrality mean is 0.556 with high variability (SD 0.640). This measure of variability

indicates that the more influential actors have few constraints to the manner in which they may interact and with whom. They have less predictable patterns of interaction within the network.

The ARC (*n_arc*, nBet 3.181, *z* 3.216, nFlow 2.542, *z* 3.104) has the greatest direct and indirect positional advantage. The ARC has a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. The actors with the greatest out-degree influence, those that issue more requests for action or information are the ARC (*n_arc*, out 0.509, *z* 3.061, quad-A) and the Voluntary Agency Liaison (*esf_vol*, out 0.228, *z* 0.785, quad-A). The actors with the largest number of in-degree connections, who fulfill more requests for information and service than other actors in this network are ARC (*n_arc*, in 0.072, *z* 4.837, quad-A) and The Salvation Army (*c_salv*, in 0.054, *z* 3.313, quad-A).

Table 74: Centrality, Power and Connectedness - Desired Network Diagram. Aggregated

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	3.181	3.216	1	2.542	3.104	1
esf_vol	Vol Agency Liaison	0.560	0.101	2	0.694	0.216	3
u_hs_fema	FEMA	0.558	0.099	3	0.703	0.23	2
esf #06	Mass Care	0.532	0.067	4	0.642	0.135	4
c_salv	Salvation Army	0.443	-0.038	5	0.483	-0.114	7
2. Ranked by Flow Centrality							
n_arc	American Red Cross	3.181	3.216	1	2.542	3.104	1
u_hs_fema	FEMA	0.558	0.099	3	0.703	0.23	2
esf_vol	Vol Agency Liaison	0.560	0.101	2	0.694	0.216	3
esf #06	Mass Care	0.532	0.067	4	0.642	0.135	4
c_adv	Adventists	0.020	-0.54	11	0.550	-0.008	5

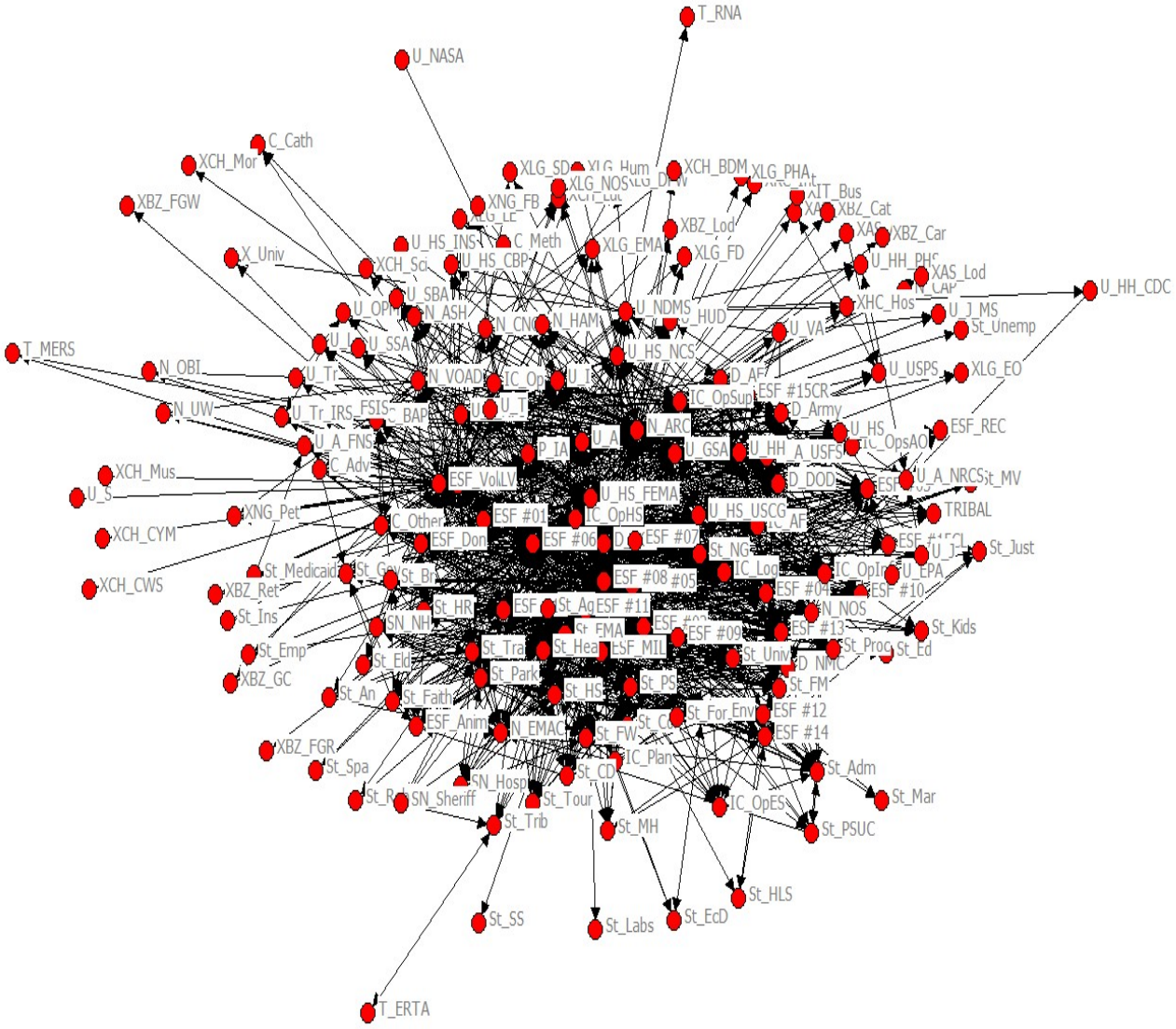
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.509	3.061	1	0.072	4.837	1
esf_vol	Vol Agency Liaison	0.228	0.785	2	0.036	1.788	8
esf #06	Mass Care	0.186	0.446	3	0.030	1.28	9
c_salv	Salvation Army	0.174	0.349	4	0.054	3.313	2
ic_op	ICS Operations Section	0.108	-0.183	5	-	-	-
4. Ranked by In-Degree							
n_arc	American Red Cross	0.509	3.061	1	0.072	4.837	1
c_salv	Salvation Army	0.174	0.349	4	0.054	3.313	2
c_salv	Salvation Army	0.072	-0.474	9	0.048	2.804	3
st_ema	State EMA	0.048	-0.668	11	0.048	2.804	3
u_hs_fema	FEMA	0.108	-0.183	5	0.048	2.804	3

5.8.5 Combined Network Summary – Aggregated

All networks were combined into one aggregated matrix ($COMB_{AGG}$). The $COMB_{AGG}$ network contains 167 actors *(k)* for a network size of 27,733 (*k***k*-1). The 2,100 observed ties result in a modified network density of 0.076, which indicates that 7.6% of the available connections between actors have been made. The average number of ties per actor is 12.575 with an average tie length, or distance between all actors in the network, of 2.093.

This network is primarily considered isolate-dominated in the connectedness and flow of information between the majority of the actors (quad-D). This signifies that the majority of the actors have both a lower degree of information in- and outflow; indicating that most of the actors in the network seek and provide less information or make fewer requests. Fewer actors may be making and fulfilling most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors.

The node betweenness network centrality index (Freeman's) is12.15% which indicates more actors having positional advantage between other actors, compared to the formal command structure of ICS (PLN_{ICS}). Conversely, the flow network centrality index is 7.32% which indicates there are fewer actors, overall, with influence on the ties between actors. This may create opportunities for competitive leaders, creating conflicts in the unity of command.



Note: The actor legend is included in previous state networks from which this network is constructed, and in detail in Appendices C and D.

Figure 48: Combined Network Diagram, Aggregated

5.8.5.1 Actor and Interaction Analysis

Centrality and Power has a betweenness mean of 0.679 with high variability (SD 1.903) and a centrality mean of 0.588 with high variability (SD 1.263). This measure of variability indicates

that the more influential actors have few constraints to the manner in which they may interact and with whom. They have less predictable patterns of interaction within the network.

The actors with the greatest positional advantage, both direct and indirect, between other actors are: ARC (*n_arc*, nBet 12.486, *z* 6.203, nFlow 8.549, *z* 6.305), ESF #06 Mass Care (*esf #06*, nBet 10.369, *z* 5.091, nFlow 6.576, *z* 4.742), and FEMA (*u_hs_fema*, nBet 5.981, *z* 2.786, nFlow 3.143, *z* 2.023). These actors have a greater ability to control directly, or influence indirectly, the interaction between other actors within this network.

The connectedness of a network is a measure of the information flows is indicated by out- and in-degrees. Actors with the greatest out-degree influence are those that issue more requests for action or information. A large in-degree measure indicates an actor who fulfills more requests for information and service. Occasionally, an actor will have high degrees in both measures, indicating that they have the potential for decreased capacity to manage information or meet other demands. If they have sufficient resources, this may not hold true.

The following actors in this network have high measures of out- and in-degree: ARC (*n_arc*, out 0.695, *z* 5.006, in 0.359, *z* 3.187, quad-A), ESF #06 Mass Care (*esf #06*, out 0.593, *z* 4.140, in 0.443, *z* 4.131, quad-A), FEMA (*u_hs_fema*, out 0.503, *z* 3.375, in 0.377, *z* 3.389, quad-A), and ESF #05 Emergency Management Emergency Management (*esf #05*, out 0.419, *z* 2.661, in 0.437, *z* 4.064, quad-A).

Table 75: Centrality, Power and Connectedness - Combined Network, Aggregated

		Node Betweenness			Flow Centrality		
Node		nBet	*z*-	Rank	nFlowBet	*z*-	Rank
1. Ranked by Node Betweenness							
n_arc	American Red Cross	12.486	6.203	1	8.549	6.305	1
esf #06	Mass Care	10.369	5.091	2	6.576	4.742	2
u_hs_fema	FEMA	5.981	2.786	3	3.143	2.023	5
esf #11	Agriculture	5.269	2.411	4	4.775	3.316	3
esf #05	Emergency Mgmt	5.167	2.358	5	2.588	1.584	7
2. Ranked by Flow Centrality							
n_arc	American Red Cross	12.486	6.203	1	8.549	6.305	1
esf #06	Mass Care	10.369	5.091	2	6.576	4.742	2
esf #11	Agriculture	5.269	2.411	4	4.775	3.316	3
c_salv	Salvation Army	4.692	2.108	6	4.536	3.127	4
u_hs_fema	FEMA	5.981	2.786	3	3.143	2.023	5
		Out Degree			In-Degree		
Node		Mean	*z*-	Rank	Mean	*z*-	Rank
3. Ranked by Out-Degree							
n_arc	American Red Cross	0.695	5.006	1	0.359	3.187	4
esf #06	Mass Care	0.593	4.140	2	0.443	4.131	1
u_hs_fema	FEMA	0.503	3.375	3	0.377	3.389	3
esf #05	Emergency Mgmt	0.419	2.661	4	0.437	4.064	2
c_salv	Salvation Army	0.335	1.948	5	0.305	2.58	8
4. Ranked by In-Degree							
esf #06	Mass Care	0.593	4.140	2	0.443	4.131	1
esf #05	Emergency Mgmt	0.419	2.661	4	0.437	4.064	2
u_hs_fema	FEMA	0.503	3.375	3	0.377	3.389	3
n_arc	American Red Cross	0.695	5.006	1	0.359	3.187	4
esf #08	Health/Medical Services	0.317	1.795	8	0.347	3.052	5

5.8.6 Summary of Aggregated Networks

The desired network is the largest of the aggregated networks with 124 nodes and a network size of 15,252. The reported network, however, is the densest at 13.80% saturation and has the largest number of average ties per actor, 14.872.

The aggregated plans were 39.52% accurate in anticipating the actors that would be involved in these response operations; 4.19% of the planned agencies did not appear in any of the other networks, while 56.29% of the active agencies did not appear in the plan.

There were 34 agencies that appeared in all aggregated networks:

- Faith Based Organizations
    - The Salvation Army *(c_salv)*
- Non-Governmental Organizations
    - American Red Cross *(n_arc)*
    - Corporation for National and Community Service *(n_cncs)*
    - Voluntary Agencies Active in Disaster (National or State) *(n_voad)*
- State Government Agencies
    - State Department of Agriculture *(st_ag)*
    - State Bureau of Professional Regulation *(st_br)*
    - State Department of Corrections *(st_cor)*
    - State Emergency Management *(st_ema)*
    - State Department of Environmental Protection *(st_env)*
    - State Fire Marshal *(st_fm)*
    - State Department of Forestry *(st_for)*
    - State Department of Health *(st_hea)*
    - State Department of Human Services *(st_hs)*
    - National Guard *(st_ng)*
    - State Department of Parks *(st_park)*
    - State Police *(st_ps)*

    - State Department of Transportation *(st_tra)*
    - State-related universities *(st_univ)*
- Federal Government Agencies
    - US Department of Agriculture *(u_a)*
    - US Forest Service *(u_a_usfs)*
    - General Services Administration *(u_gsa)*
    - US Department of Health and Human Services *(u_hh)*
    - US Department of Homeland Security *(u_hs)*
    - Federal Emergency Management Agency *(u_hs_fema)*
    - US Department of Housing and Urban Development *(u_hud)*
    - US Department of the Interior *(u_i)*
    - US Department of Justice *(u_j)*
    - National Disaster Medical System *(u_ndms)*
    - US Department of Transportation *(u_t)*
    - Internal Revenue Service *(u_tr_irs)*
    - US Postal Service *(u_usps)*
- US Military
    - US Army Corps of Engineers *(d_ace)*
    - US Department of Defense *(d_dod)*

There were 17 agencies that appeared in the reported, perceived and desired networks, but not in the planned network. Planning efforts should focus on the appropriate inclusion of actors, based on the specific jurisdiction's analysis of their appropriate actor networks:

- Faith Based Organizations
    - Adventist Organization *(c_adv)*
    - Baptist Organizations *(c_bap)*
- Non-Governmental Organizations
    - America's Second Harvest *(n_ash)*
    - Emergency Management Assistance Compact *(n_emac)*
    - Amateur Radio Operators *(n_ham)*
- State Government Agencies
    - State Governor's Office *(st_gov)* – program and administrative offices
- Federal Government Agencies
    - USDA Food Safety and Inspection Service *(u_a_fsis)*
    - US Centers for Disease Control and Prevention *(u_hh_cdc)*
    - US Public Health Service *(u_hh_phs)*
    - US Customs and Border Patrol *(u_hs_cbp)* (CBP was involved in security missions supporting mass care. This may be assumed by an appropriate law enforcement entity)
    - US Coast Guard *(u_hs_uscg)*
    - National Park Service *(u_i_nps)*
- US Military
    - US Air Force *(d_af)*
    - US Army *(d_army)*
    - US Navy and Marine Corps *(d_nmc)*

Table 76: Network Comparison Table, Aggregated

	Planned		Reported	Perceived	Desired	Combined
	NRP6	PLNAGGF	RPTAGG	PERAGG	DESAGG	COMBAGG
Agency Count						
NIMS/NRP Position	3	16	32	23	23	35
US Government	20	20	26	26	26	33
US Military	2	2	5	5	5	5
Tribal	0	0	1	0	0	1
State Government	1	30	30	21	23	42
Local Government	0	0	0	10	11	11
National NGO	3	3	7	11	11	11
State/Local NGO	0	0	3	2	2	5
Faith Based	0	2	3	13	12	13
Business	0	0	2	10	11	11
Total actors (k)	29	73	109	121	124	167
Network Size (k*k-1)	812	5256	11772	14520	15252	27722
Sum of ties	80	467	1621	293	305	2100
Density (modified)	0.099	0.089	0.138	0.020	0.020	0.076
Avg ties per actor	2.759	6.397	14.872	2.421	2.460	12.575
Avg distance	1.048	2.178	1.945	2.065	2.009	2.093
Univariate Comparison						
quad-A	0	15	33	4	4	40
quad-B	26	2	9	34	36	5
quad-C	0	10	10	6	6	17
quad-D	3	46	57	77	78	105
Out-degree mean		0.059	0.094	0.125	0.130	0.107
Out-degree SD		0.047	0.088	0.117	0.124	0.117
In-degree mean		0.047	0.089	0.015	0.015	0.076
In degree SD		0.043	0.085	0.012	0.012	0.089

Centralization Index	ICS	PLNAGGF	RPTAGG	PERAGG	DESAGG	COMBAGG
Betweenness	1.25%	3.32%	4.65%	2.98%	3.16%	12.15%
Flow Centrality	52.30%	18.07%	6.18%	44.05%	39.15%	7.32%

5.9 CHAPTER SUMMARY

Chapter 5 has provided the analysis of the actor-network aspects of the research questions. The actors were identified in the NRP and state plans, reports and, through the interviews, the perceived and desired networks in order to build the network matrices. Ucinet® was used to determine the macro-, meso- and micro-level measurements of each network, enabling comparison. This analysis also provided information on the nature of the specific actors within each of the networks.

The micro-level measurements of connectedness and information flow utilized a modification of the Hanneman (2001) description of balanced, source-, sink- and isolate dominated networks. Utilizing the in- and out- degrees of actors within each network, the actors and the network as a whole were ascribed a "quad" rating indicating the nature of the information flow. All but three of the non-aggregated networks were considered isolate-dominated, indicating that most of the actors asked for and provided lower levels of information, compared to a few more connected actors. This can indicate that the minority of actors are making most of the requests for service and information. This may lead to inefficiencies or overload of this smaller group of actors and under-utilization of the bulk of the available network due to difficulties and time spent in searching for information among the larger field of potential providers.

Table 77: Summary of Micro-measurement Quads for Networks and Actors

Out-flow (makes requests)	In-flow (receives/processes requests)					
		High			Low	
High		A Balanced (Source and Sink)			B Source-Dominated (Outsiders)	
		Networks:	1	3.00%	Networks:	2	6.10%
		Actors:	248	13.70%	Actors:	302	16.70%
Low		C Sink-Dominated (Consumer)			D Isolate-Dominated		
		Networks:	-	-	Networks:	30	90.90%
		Actors:	138	7.60%	Actors:	1123	62.00%

The planned networks were compared to the other networks, showing that the state plans are 18.75 to 28.95% effective in anticipating the actors that participated in the disaster response. Aggregating state plans with the NRP increases the range to 23.08 to 39.83%. A summary of these measures is shown in Table 78.

It was surprising to find that there were actors that were part of the plan but did not appear in subsequent networks. This may have been due to an agency's contributions to the planning process that do not translate into the response phase. The planning involvement of agencies not appearing in the plans, but appearing in other networks, needs to be addressed at the jurisdiction level after utilizing the planned, reported, perceived and desired (PRPD) analysis concept. This manner of analysis can "right-size" the planned networks as well as to guide the development of more inclusive, comprehensive situation reporting.

Table 78: Summary of State Network Measurements

State	Size	Density	Centrality	Plan Anticipation %	
				State	State+NRP
AL	Reported	Plan (State+NRP)	Reported	29.0	37.2
FL	Reported	Plan (State+NRP)	Reported	25.8	24.7
LA	Desired	Plan (State+NRP)	Reported	28.6	39.8
MS	Plan (State+NRP)	Reported	Plan (State+NRP)	18.8	23.1
TX	Reported	Plan (State+NRP)	Reported	24.5	36.0

The sizes of all reported networks were above the mean, suggesting that analysis of situation reports can better inform planning. The perceived networks, however, identified actors that were not discovered in plans or reports. These actors included many of the faith-based and all of the business organizations uncovered in the study. The prevalence of non-governmental and faith based organizations in all aspects of disaster response warrants further study to determine their role and how they interact with the governmental response agencies in order to improve this growing sector of disaster relief.

The comparison of the perceived to the desired networks revealed that the networks would remain basically similar, and would add few additional actors. In only one case was a perceived network agency not included in the desired, and that was perhaps due to local proclivities of the affected population, and not with the respondent.

In the next chapter, information from the situation reports and the interviews will identify the nature of communication between the actors, establish a basic information data set and determine the improvements being made and needed to improve future disaster operations.

6.0 INFORMATION, COMMUNICATIONS AND IMPROVEMENTS

6.1 INTRODUCTION

6.1.1 Overview

The second half of the interviews concerned the information or communication methods and improvements to their response agency. The data were categorized into perceived (response) and desired (improvements) groupings. The perceived category represents the information and technology that the actors used during the response phase of the relief operation, as well as the concerns that they raised. The desired category reflects those items which are either in progress or are needed to improve subsequent operations. Both of these provided the basis for the third section of this analysis, a basic set of information elements needed to inform, coordinate and report on mass care service delivery.

6.1.2 Data Collection and Analysis

The semi-structured interviews were conducted by telephone using the schedule which appears in Appendix D. The interview notes were transcribed and open coded into 786 segments: 725 (92.2%) relating to information utilized and required, and 61 (7.8%) relating to recommendations

for improvement and those already in progress. Additional coding steps are described for each data set. The data analysis was performed using Excel® 2007 and SPSS® 16.0.

6.2 PERCEIVED INFORMATION USE AND NEEDS

6.2.1 Description of Coding

The content of the observations was analyzed using the core, selective and axial coding method. The seven core codes represent the ICS command and general staff, internal and external environments. There are 20 selective codes. For the ICS command staff, these represent the officers. For the ICS general staff, these represent branches and units within the sections. For the internal and external environments, these represent concepts appropriate for the analysis. The coding framework for Section and Branch/Unit is shown in Table 79. The coding axial framework for each selective code will be described in the explanatory sections.

Table 79: Interview Data - Core Codes

Core Code (Section)	n	%
Command Staff	20	2.8
Finance and Administration	9	1.2
Logistics	271	37.4
Operations	184	25.4
Planning	111	15.3
External Environment	23	3.2
Internal Environment	107	14.8
Total	725	100.0

6.2.2 Command Staff

The Command Staff functions to serve the overall incident in support of Command. The three components of the Command Staff are the Liaison, Public Information and Safety Officers.

Table 80: Interview Results - Selective and Axial Codes for the Command Staff

	Selective Code (Branch/Unit)						Total
	Liaison		Public Information		Safety		
Core Code (Section)	n	%	n	%	n	%	
Command Staff	12	60.0	2	10.0	6	30.0	20
Axial Codes							
Assignment of personnel	10	83.3	-	-	-	-	10
Services Available	-	-	2	100.0	-	-	2
General Information	2	16.7					2
Staff Safety	-	-	-	-	6	100.0	6
Axial Code Total	12	100.0	2	100.0	6	100.0	20

The Liaison Officer (LNO) and their staff work with the representatives of the assisting and cooperating agencies. An assisting agency is defined as one that is providing resources directly to the operations of an incident, while a coordinating agency provides assistance other than direct or support functions (Emergency Management Institute, 2005). The actors who work on both sides of this relationship are generally referred to as liaisons.

Liaisons need to be properly selected for their skill set, particularly communications ability and interpersonal skills. As one individual stated, "You need to put the right people in liaison positions. There is a fundamental difference between responders and liaisons." Liaisons need to have sufficient knowledge of the local conditions affected by the disaster, be physically present in the appropriate facilities and must have an appropriate level of authority to provide correct, timely information.

The Public Information Officer (PIO) is responsible for all external communications. Their timely information to the affected population is necessary for them to understand the services available to them and the progress being made toward recovery. Public information is also important to the general public and political leadership for the same purposes, as well as to obtain the necessary support for the response operations.

Providing information is different from getting the message heard. Effectively communicating with the affected population is difficult due to the increased demands on their time and attention, as well as the unavailability of television, radio and newspapers. Sufficient information products, such as survivor newsletters, provided at the places of service delivery can be of assistance, and can provide a medium for messaging in a variety of languages.

Staff safety, or “force protection” includes the physical safety and mental health of the responders. Responders were operating in areas with physical hazards, such as debris, environmental hazards which could cause or exacerbate existing health problems, and in some cases, were exposed to physical violence. The ready availability of personal protective equipment and security forces is necessary for force protection.

Personnel accountability, knowing where staff was operating, and whether they are safe and accounted for, was identified as a problem in this operation. These personnel accountability reports (PARs) are a common concept in fire service applications of ICS that are needed throughout the response organization. These issues are addressed in the Recommendations section.

6.2.3 Finance and Administration

The Finance and Administration (F/A) section has two units applicable to this study: cost and procurement. The Cost Unit performs general accounting functions. The accounting for federal reimbursement to states, mission assigned federal agencies and NGO's, vendors and contractors is a complex practice. NGOs and FBOs need to balance expenditures with fundraising.

Of more concern was the difficult Procurement Unit activity of managing and tracking mission assignments (MA). Federal disaster assistance requested by the states or by federal agencies providing assistance to one another in the Stafford Act environment is initiated by an Action Request Form (ARF), formerly known as a Request for Federal Assistance (RFA). Once the ARF is approved by FEMA, it becomes an MA. The ARF/MA takes a complicated journey for approvals, specification, order placement, receipt, project management, payment and inter-agency reimbursement. ARF/MAs are can be lost, forgotten or delayed, so experienced project officers and requesters worry about the place their project holds in the chain, and each has their own method of tracking them. Tracking usually involves repetitive calls to the MA coordinator for status reports. The ARF/MA process was identified as a system-wide problem in after action reports (Townsend, 2006) and computer tracking systems are being studied.

A time consuming and easily erred part of the ARF/MA is writing the appropriate specification for the project. ESFs and agencies have repetitive requests for similar items and services, and have developed pre-scripted mission assignments (PSMA). The NIMS resource typing system has helped simplify pre-scripting, as well. The PSMAs can be agreed upon in advance by the ESFs, logistics, F/A and other process stakeholders, including contractors.

Table 81: Interview Results - Selective and Axial Codes for the Finance and Administration

	Selective Code (Branch/Unit)				
	Cost		Procurement		
Core Code (Section)	n	%	n	%	Total
Finance and Administration	3	33.3	6	66.7	9
Axial Codes					
Expense Tracking	1	33.3	-	-	1
Fund Raising / Reimbursement	2	66.7	-	-	2
Mission Assignments	-	-	6	100.0	6
Axial Code Total	3	100.0	6	100.0	9

6.2.4 Logistics

The Logistics Section and its organization was the largest portion of this content analysis grouping. Logistics is responsible for the service activities (Service Branch) and supplies, including personnel (Support Branch) for the rest of the response organization. The nature of the questionnaire contributed to the large number of responses relating to Logistics.

6.2.4.1 Service Branch – Communications Unit

The Communications Unit is responsible for the equipment and infrastructure that the response organization uses in the various activities. Included in this analysis are computer applications that are enabled by, though probably not developed by the Logistics section.

Table 82: Interview Results - Selective and Axial Codes for the Logistics, Services-Communications

Core Code (Section)	Selective Code: Services – Communications n	%
Logistics	249	91.9
Axial Codes		
Computer Application	32	12.9
Computer Equipment	53	21.3
Infrastructure, Satellite	16	6.4
Infrastructure, other communications	11	4.4
Telephone-based systems	97	39
Radio-based systems	22	8.8
Non-technical communications	17	6.8
Other information	1	0.4
Axial Code Total	249	100

Computer Technology and Applications

The computer equipment used in this response included desktop and laptop computers and handheld devices (Blackberry®), for accessing the internet and email, and were used to access specific computer applications. The applications can be categorized as geographic or database systems.

The geographic information systems (GIS) included references to aerial photography and remote sensing. GIS has a wide range of applications for improving situational awareness of damage, service delivery and recovery. In Section 6.4, GIS is indicated for specific EEIs for improving information sharing.

Database applications included internally- and commercially developed programs. The internally developed databases were used to help track ARF/MAs and offers of in-kind bulk donations (IKD). Two Microsoft programs, Access®, a database program distributed with Microsoft Office®, and the Groove® collaboration software were mentioned as being useful for

these internal applications. A web-based product, Tracker, was developed by Florida SEOC to communicate requests and reports between the state and counties. The FEMA Teleregistration database, used by the affected population to register for Individual Assistance (IA) was also used for information about specific applicants. Teleregistration was also helpful for disaster welfare information / reunification in identifying locations the applicants gave as temporary addresses.

Two commercial emergency management applications were mentioned: E-Team® and WebEOC®. E-Team® is a product of NC4's Public Sector, LLC, and has been used in large-scale disaster response and recovery operations including New York City's September 11, 2001 response (E-Team, 2008). E-Team® was mentioned once and the respondent that it did not work well for that particular user's needs. WebEOC® is a "web-enabled crisis information management system" produced by ESi Acquisition, Inc (ESi, 2007). WebEOC® was mentioned four times. One interviewee stated that it "was not visual enough" and another that "not everyone knew how to use it."

AidMatrix (Aidmatrix, 2008) is a web-based database application that coordinates in-kind donations (IKD) and other offers of assistance throughout the NGO community nationwide. This application was developed in response to the large number of donation offers for material and human resources during Katrina. It enables donors, VOADs and emergency management agencies to coordinate donation management activities.

The Coordinated Assistance Network (CAN) was developed after September 11, 2001 to assist client service agencies in the coordination of services available and offered to disaster-affected individuals (Coordinated Assistance Network, 2008). The network enables national, state and locally based human services organizations to reduce intake processing burdens on clients and to establish referral networks to meet needs.

The ARC “Family Links” KatrinaSafe.org website, now known as the “Safe and Well List”, was developed in cooperation with Microsoft and the International Committee of the Red Cross (ICRC) to assist disaster welfare information and family reunification in Katrina (ARC Safe and Well List, 2008). The website allowed affected people to list themselves as safe and permitted loved ones to search for the displaced if other communications were not possible. One interviewee stated that the system was operational, but the lack of internet service to the affected population was a barrier to its effective use.

ARC developed a shelter tracking database in the early stages of the Katrina response to collect information on operating shelters and populations, to limited success. This system is currently known as the National Shelter System (National Shelter System, 2008), and enables the collection of information including location, responsible agency, status (open, closed, standby) and populations. Separately, the Capital Area Chapter of the ARC in Tallahassee, FL maintained a website that enabled Florida ARC chapters to post shelter information. This “Tallytown” system was useful to the state EOC and the Regional Resource Coordination Center (RRCC) for understanding the status of shelters and populations, but did not archive information, requiring manual data capture from time to time.

Table 83: Frequency of computer application mentions in interviews

	n	%
GIS	8	25.0
Aerial Photo	1	3.1
Remote Sensing	1	3.1
WebEOC	4	12.5
E Team	1	3.1
Groove	1	3.1
Tracker	2	6.3
AidMatrix	1	3.1
Client Asst Network (CAN)	1	3.1
Dashboard	1	3.1
Electronic Medical Record (EMR)	2	6.3
Patient Tracking	1	3.1
Teleregistration	1	3.1
Safe and Well	1	3.1
Virtual Briefings	1	3.1
Non-Specific Database	4	12.5
Not otherwise specified	1	3.1
Total	32	100.0

Communications Infrastructure

The ability to communicate was enhanced by infrastructure enhancements brought into the disaster areas. Satellite links were used, specifically those that are a part of the FEMA Mobile Emergency Response System (MERS), ARC Emergency Communications Response Vehicles (ECRV) and military platforms. These systems have data and voice communications via satellite and a range of radio networks.

Cellular communications companies have portable cell sites known as “COWs” (cell site on wheels) that can be located in areas where additional or replacement cellular capacity is required. The specific performance of cellular communications will be discussed in the next section. The preparedness for infrastructure support will be included in Section 6.3

Table 84: Frequency of computer equipment mentions in interviews

	Computer Equipment		Infrastructure, Satellite		Infrastructure, other	
	n	%	n	%	n	%
Computer (Desk/Laptop)	16	30.2	-	-	-	-
Email	23	43.4	-	-	-	-
PDA/Blackberry	8	15.1	-	-	-	-
Internet	6	11.3	-	-	-	-
Satellite	-	-	9	56.3	-	-
Mobile Comm Support (MERS/ECRV)	-	-	5	31.3	-	-
Military	-	-	2	12.5	-	-
Cell on Wheels	-	-	-	-	2	18.2
Internet Service Provider	-	-	-	-	1	9.1
General Failures	-	-	-	-	7	63.6
Not a problem	-	-	-	-	1	9.1
Total	53	100.0	16	100.0	11	100.0

Voice and Other Communications

Voice communication was enabled by telephone or radio. Landline telephone systems were the most reliable where there was service or the availability of actual telephones in work locations. One interviewee stated that the only communication that was available in one area was a single pay phone which multiple organizations were using on a rotating basis. Other land based communications tools were conference calls, video teleconferences (VTC) and voice-over-internet (VOIP) systems. Phone banks, for outgoing calls of shelterees, and a call center, for incoming donation calls, were also used.

Cellular communications were used, but in forward areas, systems were inoperable due to infrastructure damage or saturation of the cell sites by other users. Push-to-talk cellular systems, such as the Nextel Direct Connect® system, sometimes worked where a cell call from the same device would not. This was also true of mobile text and email service, though actual send times may have been delayed.

Two-way radio systems, such as fire and police departments, and amateur radio systems provided voice communication. Amateur radio was identified as useful and is mentioned as a desired system for future operations, though in the current operation, the local availability of sufficient amateur radio operators was identified as problem.

Table 85: Frequency of communications devices mentioned in interviews

	Telephone-based		Radio-based		Non-technology	
	n	%	n	%	n	%
Landline	33	34.0	-	-	-	-
Pay Phone	1	1.0	-	-	-	-
Phone bank	1	1.0	-	-	-	-
Call Center	1	1.0	-	-	-	-
Conference Call	10	10.3	-	-	-	-
Teleconference, Video	1	1.0	-	-	-	-
Facsimile	4	4.1	-	-	-	-
Cellular	33	34.0	-	-	-	-
Direct Connect	3	3.1	-	-	-	-
Satellite Phone	9	9.3	-	-	-	-
Voice over Internet (VOIP)	1	1.0	-	-	-	-
Two Way Radio	-	-	11	50.0	-	-
Amateur Radio	-	-	11	50.0	-	-
Courier/Runner	-	-	-	-	5	27.8
Written	-	-	-	-	12	66.7
Photocopy	-	-	-	-	1	5.6
Total	97	100.0	22	100.0	18	100.0

6.2.4.2 Support Branch

The Logistics Section Support Branch has three units: Facilities, Ground Support (vehicles) and Supply (material and human resources). The Supply functions were mainly concerned with the status and location of supplies and the deployment, travel and maintenance of staff.

Table 86: Interview Results - Selective and Axial Codes for Logistics, Support

	Selective Code (Branch/Unit)						
	Support - Facilities		Support - Ground		Support - Supply		
Core Code (Section)	n	%	n	%	n	%	Total
Logistics	3	1.1	2	0.7	17	6.3	22
Axial Codes							
Equipment	1	33.3					1
In Kind Donations					2	11.8	2
Supplies					8	47.1	8
Vehicles			2	100			2
Solid Waste Removal	1	33.3					1
Warehousing	1	33.3					1
Staffing					7	41.2	7
Total	3	100	2	100	17	100	22

6.2.5 Operations

The Operations Section is responsible for all of the tactical operations at an incident (Emergency Management Institute, 2005). While the traditional components of mass care are sheltering, feeding, bulk distribution and disaster welfare information, the nature of the event require the expansion of operations to include the evacuation of residents from the Gulf Coast and special populations and medical shelters.

6.2.5.1 Evacuation Branch

Evacuations began before, during and after landfall. Residents self-evacuated by personal vehicle or were evacuated by bus or aircraft to other parts of the affected state or to other states around the country. Federally supported bus evacuation involved 1,100 busses providing transportation

to 35,000 people (Townsend, 2006). Air evacuation involved 85 flights of 25,590 people to 21 states (Federal Emergency Mangement Agency, 2005).

Information about the busses and flights was often difficult to obtain. The destination dates, times and even locations changed. Numbers of passengers, specific medical needs and the services that would be needed at the destination was not always available. Once the evacuees reached their destination, tracing separated family members was a difficult task.

Table 87: Interview Results - Selective and Axial Codes for Operations - Evacuation Branch

	Selective Code (Branch/Unit)	
	Evacuation	
Core Code (Section)	n	%
Operations	42	22.8
Axial Codes		
Bus Evacuation	3	7.1
Air Evacuation	17	40.5
Vehicle Availability	3	7.1
Evacuees	19	45.2
Axial Code Total	42	100.0

6.2.5.2 Medical Branch

Shelters are assumed to be either general population or special needs shelters, and are not considered to be places of medical care or disaster mortuary activities. In these disaster operations, the lines were blurred between all of these concepts, especially in the emergent places of refuge, such as the New Orleans Superdome, and the Houston Astrodome. Additionally, evacuation and sheltering of people from geriatric or other special care facilities could not be separated from the rest of the operations.

Most of the interview responses related to the assessment of medical needs, primarily for specific medical conditions or physical handicaps requiring special handling or equipment. For

the caregivers, past medical history information was sparse if available at all, as was the ability to create and maintain appropriate patient care records in an austere environment. Prioritization and the ability to transport patients to definitive care also were problematic.

Information was also required on the facilities that were designated or assumed to be special needs shelters. Locations, services and equipment available, supplies needed and population counts were needed in order to support operations and to direct those seeking shelter.

Table 88: Interview Results - Selective and Axial Codes for Operations - Medical Branch

	Selective Code (Branch/Unit)	
	Medical	
Core Code (Section)	n	%
Operations	25	13.6
Axial Codes		
Fatalities	1	4.0
Mental Health Issues	2	8.0
Patient Issues	17	68.0
Special Needs of Individuals	5	20.0
Axial Code Total	25	100.0

6.2.5.3 Mass Care Service Delivery Branch

Mass care operations primarily involved feeding and sheltering operations. Additional activities included longer-term placement of individuals in hotels, known as transient accommodations. Other single mentions included individual financial assistance, ice needs and chainsaw/tear-out services.

Feeding operations include kitchen sites, fixed feeding locations and mobile feeding routes. Some food, mainly Meals-Ready-to-Eat (MRE) and other shelf-stable meals, water and ice are provided at points of bulk distribution (PODs) as part of “the big four” (the fourth being blue tarps). Most of the information needed about feeding includes the locations, mobile routes and the meal counts. Meal counts and trends are important to ensure adequate locations, staffing

and supply of kitchens and feeding operations, as well as give indications to the progress of response into recovery. For examples, as electric utilities return, so do restaurants, grocery stores and the ability to store and prepare food at home. As potable water returns, the need for water and ice decrease. A tongue-in-cheek metric used in the Florida SEOC is the "Waffle Hut Index: If a Waffle Hut is closed, the area is condition red. If it's open with a limited menu, it's yellow. If it is open with a full menu, the area is green." A rebounding number of meals after a decline indicate a change in the area's condition, and warrants investigation.

Sheltering was performed by traditional mass care organizations such as ARC and The Salvation Army as well as in impromptu locations by spontaneous individuals or organizations. As with feeding, the primary information needed is location and population. Locations of known shelters could be mapped and attempts made to properly resource them. Unfortunately, there were a large number of shelters that were unknown or unidentified.

Shelter population is a fluid number and caused some issues between EMAs and NGOs. ARC, for example, has a standard shelter registration form and process, though it is not possible to enforce complete compliance by the shelter population. Shelter residents are requested to sign in and out at some shelters, but again, compliance is incomplete. ARC implemented the "overnight stays" count as the ability to produce other counts throughout the day proved impossible.

Table 89: Interview Results - Selective and Axial Codes for the Operations - Mass Care Operations

Core Code (Section)	Selective Code: Mass Care n	%
Operations	117	63.6
Axial Codes		
General	15	12.8
Bulk Distribution	4	3.4
Feeding operations	40	34.2
Hygiene issues	2	1.7
Individual Assistance	1	0.9
Ice	1	0.9
Shelter operations	34	29.1
Chainsaw/Tearout	1	0.9
Transient Accommodations	3	2.6
Reunification/Disaster Welfare Information	15	12.8
Duplication of Benefits	1	0.9
Axial Code Total	117	100.0

6.2.6 Planning

The Planning Section collects, evaluates and disseminates information within the response organization. Information for outside parties is disseminated by the PIO. The Planning Section within the frame of this study included the Demobilization and the Situation Unit.

6.2.6.1 Demobilization Unit

The Demobilization Unit plans for the release and return of incident resources, including staff. The references to demobilization within this study were to not knowing the plan or procedure for demobilization.

6.2.6.2 Situation Unit

The Situation Unit manages information to enable responders to understand the scope and severity of the incident, the Incident Action Plan (IAP) and the progress of incident actions. It is through this information that the actors share an understanding of the COP and adjusts the assumptions and actions of the response organization.

Table 90: Interview Results - Selective and Axial Codes for the Planning Core Code

	Selective Code (Branch/Unit)				
	Demobilization		Situation		
Core Code (Section)	n	%	n	%	Total
Planning	3	2.7	108	97.3	111
Axial Codes					
Services being provided	-	-	22	20.4	22
Sitreps	-	-	7	6.5	7
Recovery Planning	-	-	1	0.9	1
Media, general comments	-	-	2	1.9	2
Information	-	-	26	24.1	26
Projections	-	-	1	0.9	1
Disaster Assessment	-	-	28	25.9	28
Debris removal	-	-	1	0.9	1
Hazards	-	-	4	3.7	4
Public Health	-	-	2	1.9	2
Road conditions	-	-	1	0.9	1
Traffic conditions	-	-	1	0.9	1
Utility Status	-	-	9	8.3	9
Weather Products	-	-	3	2.8	3
General Information	3	100.0	-	-	3
Axial Code Total	3	100.0	108	100.0	111

Disaster / Damage Assessment (DA)

The term “damage assessment” has been replaced by the more inclusive term “disaster assessment.” Disaster assessment includes the damage assessment of the built and natural environment, and moves toward the impact on the social environments as well. The scope and

severity of disaster assessment fuels the needs assessment, which informs tactical service delivery.

DA information is culled from a number of sources. Local EMAs are responsible for funneling DA information through their counties and parishes to the state. ARC performs preliminary and detailed DA primarily relating to the damage to residential structures to guide client assistance. FEMA, SBA and USDA perform DA based on requests for declarations according to their own criteria to determine their levels of individual and public assistance. Collecting and correlating DA information is time-consuming and difficult to obtain from agencies involved in active response too busy to report what they've found.

In Wilma, Rapid Needs Assistance Teams (RNATs) were staged in Florida before landfall and were able to move into assessment areas as soon as the storm effects enabled helicopter travel. Other sources of information about damage and needs include the media, response personnel in the field and calls from the public.

Specific information needed by the interviewees included the geographic and demographic scope of the event, buildings and roads damaged, utility status, and physical hazards. Information about areas with criminal activity and violence was also desired. Both before landfall and after, traffic conditions affecting evacuation was important. Ongoing information about weather before, during and after landfall was needed. A summary of desired DA information is outlined in Section 6.4.

Needs Assessment

Needs Assessment is the extension of DA into the social environment. Basic human needs that are affected by the disaster need to be understood so that service delivery plans can

match the location and the specific need. One Salvation Army interviewee stated their motto, “Meet the need at the place of need in a timely manner.”

Needs assessment generally needs to be matched with the capacity of the response organization to meet them. A variety of governmental, NGO and FBO responders worked to provide mass care, and effective coordination of services is necessary to prevent duplication of benefits (DOB). Likewise, the comparison of services being provided to actual needs of the affected population is necessary to identify unmet needs, and plans to fulfill them.

Ongoing Operations and Transition

Information from ongoing DA, especially utility status, as well as debris removal and public health surveillance help to evaluate current operations and signify the transition from response to recovery. The response-recovery transition is not simply a change in terminology. It indicates that basic needs are being met by the affected population rather than by the response organization, and that community rebuilding is occurring. The timing of this transition varies from one disaster and community to another.

An important tool that the Planning section produces is the sitrep. The sitreps provide information across the operation so that needs, problems and progress can be understood by the individual responders, and provides documentation of the event. This is one of the tools by which the responders achieve their common operating picture. A standardized sitrep format was recognized by four interviewees as a needed improvement.

6.2.7 External Environment

The interviewees identified issues that impacted the response that were external from the network and the immediate disaster environment: legal and political. The axial codes for these are listed in Table 91.

Table 91: Interview Results - Selective and Axial Codes for the External Core Code

	Selective Code (Branch/Unit)				
	Legal		Political		
Core Code (Section)	n	%	n	%	Total
External	8	34.8	15	65.2	23
Axial Codes					
Confidentiality	1	12.5	-	-	1
Criminal Issues	2	25.0	-	-	2
Lawsuits	1	12.5	-	-	1
Rights of individuals	3	37.5	-	-	3
Sunshine Laws	1	12.5	-	-	1
Expectations	-	-	3	30.0	3
Influence	-	-	7	70.0	7
Axial Code Total	8	100	15	100	23

6.2.7.1 Legal

Legal issues, beyond the typical legal environment of disaster response, affected Katrina, Rita and Wilma operations like none before. “I’ve never experienced a disaster in which lawyers and judges were so involved,” stated one interviewee. Another stated, “it seemed daily that a lawsuit or threat of one changed our policies.”

A unique issue was related in two interviews, the presence of criminal offenders in shelters. State laws required that certain convicted offenders, primarily sex offenders, not be housed in general population shelters. The evacuee and shelter registration processes previously

described display the difficulty in enforcement of these laws, and places a law enforcement burden on the mass care agencies. Future operations need to take this into consideration and either establish separate shelters for these offenders or provide the appropriate law enforcement presence at the general population shelters.

Healthcare respondents expressed medico-legal concerns. The Health Insurance Portability and Accountability Act, known as HIPAA (PL 104-191, 1996) governs patient records, creating difficulty in obtaining past medical history information on evacuees and the maintenance of patient care records management and transfer for care provided to them. The Emergency Medical Treatment and Active Labor Act, or EMTALA (42 USC 1395dd) raised some concerns among the medical practitioners. EMTALA is a strict body of federal law and regulations on the provision of emergency medical care for uninsured individuals. The application of both HIPAA and EMTALA in disaster settings are for study in a separate research project.

Open records or "sunshine" laws and subpoenas became a concern. Florida has an open records law that responders working in the SEOC learn of quickly. Sitreps produced in the SEOC are posted on the public website and nearly all records are available for release. Congress issued subpoenas for records of the response as early as September 30, 2005 (House Select Bipartisan Committee to Investigate the Preparation and Response to Hurricane Katrina, 2005) and agencies sequestered records including entire email accounts in order to comply. Responders unfamiliar with these concepts must be made aware and take precautions for proper documentation and to avoid improper inclusion of non-response materials and comments.

6.2.7.2 Political

Local, state and federal elected officials impacted response operations. Understanding the expectations of officials is a normal and important part of the response. Interviewees reported that there was animosity between officials and response organizations. One of the interviews had a particularly difficult time in dealing with local elected officials: “What were they blaming us for today? Who’s angry with us?”

Political influence was not limited to elected officials. Elected and corporate officials exercised influence over decisions and priorities for service delivery and information. Respondents specifically mentioned the media’s part in generating these pressures:

- “(The officials had the) desire to beat the CNN effect.”
- “We were competing for attention with the outside world with Louisiana. They (officials) were not paying attention to the needs elsewhere.”
- “We got pushed past a town that could have really used us and went to New Orleans because of the publicity.”
- “(An organization) was creating problems for us, but we couldn’t do anything about it. (The organization) had people on our (national fundraising committee) and we had no choice.”
- “We were managing by rumor.”

There is a need to be able to share information within the response organization and as appropriate with elected officials and the media. Elected officials and the media are the realm of ESF #15 External Affairs, however the requests and rumors flow through and around external affairs workers. Prevention and management of these considerations are for future study.

6.2.8 Internal Environment

Problems arose within the response organization that could be present in any organization, whether it is a disaster response agency or not. These issues, such as basic ICS concepts, interpersonal relationships, information management and general organizational principles were termed the internal environment. The axial codes for the internal environment are shown in Table 92.

Table 92: Interview Results - Selective and Axial Codes for the Internal Core Code

	Selective Code (Branch/Unit)								
	ICS Concepts		Interpersonal		Information		Organizational		
Core Code (Section)	n	%	n	%	n	%	n	%	Total
Internal	14	13.1	3	2.8	35	32.7	55	51.4	107
Axial Codes									
Quality of information	-	-	-	-	23	65.7	-	-	23
Quantity of information	-	-	-	-	12	34.3	-	-	12
Interagency Coordination	-	-	-	-	-	-	43	78.2	43
Intra-agency Coordination	-	-	-	-	-	-	7	12.7	7
Span of Control	2	14.3	-	-	-	-	-	-	2
Chain of Command	8	57.1	-	-	-	-	-	-	8
Competence, individuals	1	7.1	-	-	-	-	-	-	1
Facilities	1	7.1	-	-	-	-	-	-	1
General Information	2	14.3	-	-	-	-	-	-	2
Organizational issues	-	-	-	-	-	-	5	9.1	5
Relationships, personal	-	-	3	100	-	-	-	-	3
Axial Code Total	14	100	3	100	35	100	55	100	107

6.2.8.1 ICS Structure

Of the 14 comments about the structure of the response organization, nine were negative. The issues centered about the lack of ICS, a chain of command, knowing who was “in charge” or who to contact. One respondent made the statement, “There was no functional chain of command

above us." Another stated, "We would get sporadic messages, but had no idea of their (the sender's) authority." When asked how they were able to accomplish their mission, one stated, "We improvised a lot."

Alternately, there were comments in support of ICS. "Officially, (our agency) didn't want us using ICS, but unofficially we were." Chain of command and span of control were specifically motioned as valuable tools to manage and communicate with large numbers of workers over a large geographic area.

6.2.8.2 Interpersonal Relationships

Interpersonal relationships were a source of positive and negative comments. The "normal" workplace tensions between workers does not disappear in a disaster setting; indeed, there are new organizational, occupational and personal stressors that may lead to even more frequent problems between people. Positively, the importance of prior working relationships with other responders was noted. "It helps to know the person … when things get bad." Prior relationships through training, planning and previous response operations reduce the acquaintance time needed to form effective working relationships.

6.2.8.3 Quality and Quantity of Information

Lack of information was only mentioned by one interviewee, and another stated that "the *amount* of information was not a problem." The issues arose in the quality and overload of information. Accuracy, credibility and timeliness were cited most often as problems. Getting "grounded information" was a common concern: "The part of communications that you can't guarantee is what you hear." A "lack of candor from government officials" was cited as was the belief that there was "intentional misinformation" being provided.

As was mentioned in the external political environment, “rumor drove decisions.” An agency official heard of a complaint about service delivery and assumed that it was within one of “his” operating units. “Meetings were held, a contract was let and the system that we thought was working fine was changed almost overnight, only to find out that the complaint was about (another part of the agency) and we weren’t the problem after all.”

Information overload was cited in the interviews. “There was a lot of information that was coming in, and it was difficult to wade through it.” Duplication of requests was noted, adding to the information load: “Eventually, it was over-communication. We had multiple calls looking for the same information.”

Table 93: Frequency of mentions about the quality and quantity of information

	Quality		Quantity	
	n	%	n	%
Accuracy	11	47.8	-	-
Credibility	8	34.8	-	-
Prioritization	1	4.3	-	-
Timing	3	13	-	-
Lack of information	-	-	1	8.3
Overload, information	-	-	10	83.3
Not a problem	-	-	1	8.3
Total	23	100.0	12	100

6.2.8.4 Inter- and Intra-agency Information

The sharing of information within and across agencies was identified as a problem. The summary points include knowing the services and capacity of your own organization, those of other agencies, and to encourage information sharing among “new-to-disaster” organizations. Several interviewees indicated that they had worked with a new agency or an “old agency with a new mission” in this set of operations. International organizations were involved for the first time in such a large role. ARC reported working with teams from the Canadian and French Red

Cross. Local church groups, non-profits and spontaneous organizations were mentioned. Coordination of information and assistance across state lines also was a factor. Indeed, with these new agencies, communication, coordination and cooperation are important to foster.

Meetings and briefings were an important method of sharing information. Meetings and briefings occurred in person, by teleconference and video teleconference. Agencies with limited staff were not able to provide representatives to all of the meetings necessary.

Intra-agency policy communication was identified as a cause of conflict and confusion. One stated, “we had almost daily changes in policy and procedure … we couldn’t keep up” while another stated, “receiving instructions or guidance was nil.” Information technology may help improve this internal communication problem.

6.3 DESIRED SYSTEM IMPROVEMENT

6.3.1 Overview

The interviewees, throughout the interviews and when asked specifically about necessary improvements, all expressed desired state components. The open code segments were analyzed, eventually revealing three cores: considerations for, implemented and recommended improvements. Selective and axial codes further refine these concepts. The core and selective codes are summarized in Table 94 and further in Table 95.

Table 94: Improvements Core Code and Selective Code Cross-tabulation

Core Code		Selective Code			
		Capacity	Planning	Political	Total
Consideration	Count	1	4	3	8
	% within Core Code	12.5	50.0	37.5	100.0
	% within Selective Code	2.0	50.0	100.0	13.1
Implemented	Count	16	3	-	19
	% within Core Code	84.2	15.8	-	100.0
	% within Selective Code	32.0	37.5	-	31.1
Recommendation	Count	33	1	-	34
	% within Core Code	97.1	2.9	-	100.0
	% within Selective Code	66.0	12.5	-	55.7
Total	Count	50	8	3	61
	% within Core Code	82.0	13.1	4.9	100.0
	% within Selective Code	100.0	100.0	100.0	100.0

6.3.2 Considerations for Improvement

The consideration codes reflected concepts that the interviewees felt were necessary components of specific actions for improvement. Non-specific observations about the improvement of future operations were made, and are considerations that can be incorporated into more specific actions.

The use of ICS or specific components was identified by most of the interviewees. Chain of command and understanding the table of organization seemed to be a common theme. A particular mention was made regarding the delegation of authority in ICS: People should have knowledge and delegate authority to make decisions "keep it legal, take care of the client, and tell me about it later"

The media was mentioned throughout the interviews, as sources of information and frustration to the responders. Incorporating the media into communications support, disaster assessment and even response can be explored. One interviewee stated, "If they can get cameras in, why can't they take a couple of bottles of water with them?"

Spontaneous organizations, large numbers of unaffiliated volunteers, and new missions for existing agencies changed the nature of service delivery. Including representative individuals in planning and preparedness for future disasters may improve performance. Additionally, public education may help to manage the expectations of individuals interested in volunteering or donating. The demands on the response organization may be reduced through these preparedness activities.

Interstate differences shape the response by federal and NGOs. While the Stafford Act, NRP and NIMS require standard legal and operational environments, state legal, political and historical aspects give response activities and organizations local differences that need to be understood in order to work effectively in the system. Elections have changed local and state officials and administrations since Katrina. Interstate differences will remain regardless of federal intervention, and need to be considered in planning.

The federal government faces an administration change in 2009. FEMA has faced changes with all presidential administrations, from the inception of the agency in 1979 by President Carter to the elevation of the FEMA Director to cabinet status under President Clinton to the creation of the Department of Homeland Security by President G. W. Bush. The evaluation of changes to the NRP and NIMS will need to be made in light of this change in political and bureaucratic environments.

6.3.3 Implemented Actions

The implemented actions are those that have already been initiated or completed to improve response. Response agencies have performed internal analyses, conducted performance reviews and utilized external assessments to identify needs and improvements for future response. FEMA conducted a gap analysis to determine state strengths and shortfalls, and incorporated the findings into state specific planning efforts. Federal agencies have improved their interagency planning and cooperation. "There has been greater cooperation between the agencies in DC. None of them wanted FEMA's bad press."

The Gulf Coast states and the FEMA regions have implemented specific planning projects with dedicated staff. FEMA has assigned state-specific FCO's and bulk distribution logistic planners. A Gulf Coast planning cell is maintained "warm" with a limited staff starting in the spring and "goes hot" with a larger staff to support operations once hurricane season begins in June.

NVOAD has strengthened since Katrina. Greater activity at the state level and more national members has increased activity, as well as staffing and stature of the national organization.

The National Disaster Medical System team assets (DMATs, DMORTs, and NVRTs) have been transferred back under the operational control of the DHHS from Homeland Security. The full impacts of this change are yet to be determined.

Perhaps the most sweeping change in federal response is the adoption of the National Response Framework (NRF) the replacement for the NRP. The most significant change in mass care is the change in responsibilities of and for ESF #06 Mass Care. Under NRF, ESF #06 Mass Care has changed to include "Mass Care, Emergency Assistance, Housing, and Human

Services," responsibilities beyond sheltering, feeding, bulk distribution and disaster welfare information. Additionally, ARC is no longer a primary, but remains a support agency.

Agencies have also improved staff development activities. Additional training programs have been developed by the Emergency Management Institute for federal response coordination. Specialty equipment has been purchased and technology response teams have been developed.

6.3.4 Recommendations for Action

Recommendations for action are those specific improvements that the interviewees desired to have made, and is either being considered or not.

An improvement in computer technology, applications, redundancy and continuity is required, as is the ability of responders to work without technology or ready communications. Staff needs to be trained and practice with technology, especially the variety of applications in use at the various federal, state and local facilities.

Intergovernmental cooperation and assistance needs to reflect the strengths and organizational capacities of the jurisdictions. Response capability needs to be enhanced at the most local level, whether that is at the municipal level of government, local chapter of NGOs and congregations of the FBOs. The community emergency response team (CERT) concept needs to be expanded to include disaster assessment and shelter management components. Local and state planning groups and VOADs need to be enhanced and supported, and leadership provided by individuals experienced in disaster response operations.

Interstate mutual aid and the EMAC system proved helpful to the affected states, though intergovernmental "freelancing" was occurring in cities receiving or asking, outside of official channels, to receive evacuees. The Katrina response in which Florida provided an incident

management team (IMT) and provided comprehensive response management in six Mississippi counties can serve as model by which larger interstate assistance activities can be fashioned.

Table 95: Axial Codes for Capacity and Planning

	Selective Code								
	Capacity			Planning			Total		
	Count	% within Selective Code	% within Axial Code	Count	% within Selective Code	% within Axial Code	Count	% within Selective Code	% within Axial Code
Capacity Analysis	3	6.0	100.0	-	-	-	3	5.2	100.0
Contingency Planning	2	4.0	100.0	-	-	-	2	3.4	100.0
Equipment	10	20.0	100.0	-	-	-	10	17.2	100.0
Information Management	1	2.0	100.0	-	-	-	1	1.7	100.0
Media Inclusion	-	-	-	2	25.0	100.0	2	3.4	100.0
Mission change	-	-	-	2	25.0	100.0	2	3.4	100.0
Organizational Change	14	28.0	87.5	2	25.0	12.5	16	27.6	100.0
Staffing Issues	20	40.0	100.0	-	-	-	20	34.5	100.0
State Improvements	-	-	-	2	25.0	100.0	2	3.4	100.0
Total	50	100.0	86.2	8	100.0	13.8	58	100.0	100.0

6.4 MINIMUM DATA SET – ELEMENTS OF ESSENTIAL INFORMATION

6.4.1 Overview

The interviews revealed specific information needs to anticipate, coordinate and report on service delivery in the disaster context. Anticipatory information guides the mobilization of resources, placement of service delivery sites, and logistics and budget planning to determine the expected needs of the affected people matched to the capacity of the responding agencies. Coordinative information matches the anticipatory information to the capacity of and activities by the responding agencies. This requires a sufficient inflow of new information about the

environment and population and evaluation of the services being provided. Reporting information is necessary to guide forecasting and to inform agency officials as to the extent of operations and continued operational needs.

The elements are specified by the manner in which they can be collected and displayed. Statistical information is that which is best reported as raw numbers, percentages or ratios. Geographic information relates to specific locations, areas or routes, and can match other specifications to GIS products. Temporal information relates to schedules and time periods. Other information is that which needs to be shown graphically or in narrative.

6.4.2 Disaster Assessment Information

The timing of DA information spans from the preparedness phase, increased readiness, warning, impact, post-impact, response and recovery phases.

During the increased readiness and warning phases, the storm's potential impact drives decisions for opening facilities, staffing, recommending evacuation areas and supportive actions. Prior disaster experience, weather forecasting and computer modeling can inform these decisions.

Impact and post-impact information focuses on physical damage as it relates to social needs. The summary question is "What is the ability of people to remain in safe, functional homes in damage-free communities receiving appropriate levels of services?" Damage to structures, disrupted utilities, environmental hazards and a reduced capacity of protective services require supplemental services to be infused into the area, or people removed from the area while necessary restoration can be made.

Response phase information includes on-going assessment of existing and new hazards and the progress of emergency protective measures. Stability of the event refers to the sustained progress toward recovery. Service delivery projections, such as sheltering and feeding, relate to the restoration of livable homes with basic utilities depend on the knowledge of this progress.

Basic demographic information about the people in an area informs service delivery. Population density, homeownership, median income, preponderance of specific age groups and family types, institutionalized population, availability of transportation and utilities are some general examples of service delivery information needs.

The type of damage incurred by an area makes a difference. Hurricane winds affect structures above ground and utilities. Flooding affects foundations of structures and roadways and brings a variety of public health concerns.

Table 96: Elements of Information, Disaster Assessment

		Statistical	Geographic	Temporal	Other
DA	People remaining in area	X	x		
	Estimated insurance coverage	X	x		
	Demographics	X	x		
	Damage area		x		
	Damaged structures	X	x		
	Damaged infrastructure	X	x		
	Weather information		x	x	
	Progress of debris removal	X	x		
	Hazards, physical		x		x
	Hazards, criminal		x		x
	Hazards, public health		x		x
	Areas flooded		x		
	Stability of event		x	x	x
	Sources of information				x
Utilities	Number of customers affected	X	x		
	Number of customers restored	X	x		
	Areas without utilities	X	x		
	Estimated time of restoration	X	x	x	

6.4.3 Evacuation

The extent to which an area will be evacuated sets a cascade of information needs and service delivery actions into play. In order to make an evacuation recommendation or order, the expected storm effects have to be matched to geographic and demographic considerations, which are part of the pre-landfall disaster assessment. Computer models, such as the National Hurricane Center's Sea, Lake and Overland Surges from Hurricanes (SLOSH) Program and Hurricane Evacuation (HURREVAC) Program can provide guidance on the areas to be evacuated. Traffic studies can inform the timing and selection of traffic routes. GIS can help identify existing or needed services along routes, such as feeding and fuel.

Evacuation destinations need to be assessed for necessary services, shelter capacity and support, feeding and the capacity of the infrastructure to meet the increase demands of the new population. The long-distance evacuation by bus and aircraft required more planning for services en route and on-board the conveyances. Hygiene, physical and mental health assessments and services were required. Service delivery planning at the arrival location depended on this information, as well as basic information such as the arrival time and number of evacuees. This information was either poorly communicated or not available.

The tracking of specific individuals was required for disaster welfare information, reunification and legal purposes. Evacuees may not have had appropriate forms of identification to make the data collection efforts valid. A centralized clearinghouse for information was not available, other than the self-reporting efforts of the Safe and Well Website. The necessity of tracking of criminal offenders, particularly sex offenders, was expected of agencies without law enforcement authority or competence, and may have been out of balance with the rights of other individuals. Tracking remains a conundrum between disaster management, law enforcement and civil rights concerns.

Table 97: Elements of Information, Evacuation

	Statistical	Geographic	Temporal	Other
Number of evacuees	X	x		
Number of flights/buses	X	x		
Number of potentially displaced (total)	X	x		
Number of staff assigned	X			
Locations, arrival/departure		x		
Origin of evacuees		x		
Route traffic information		x	x	x
Routes		x	x	x
Timing, arrival/departure			x	
Evacuees, information about				x
Evacuees, information for				x
Evacuees, Registration and Tracking				x
Services needed at destination		x		x
Services needed en route		x		x

6.4.4 Special Needs Populations

Special needs populations include those with specific medical, health and emotional requirements. These individuals may have pre-existing or disaster-caused requiring professional attention. They may have been living alone and dependent on visiting nurses or family-provided care, residents of nursing homes or patients in hospitals. Sheltering and other basic needs may be required for family caregivers and service animals.

The assessment of needs, available and additional services and supplies is necessary for the proper provision of care commensurate with the well-being of the individual. Locations of service delivery and the level of care that can be provided can be shown using GIS, as can the extent of utility disruptions affecting the original facilities.

In order to provide appropriate care, past medical history information is needed by medical personnel and is not always available in the disaster setting, especially for those patients residing outside of a healthcare facility. Ongoing documentation of patient care, the availability of medical command orders and protocols, and information about transfer facilities, such as trauma centers and unaffected hospitals are information concerns of the medical providers.

Table 98: Elements of Information, Special Needs

		Statistical	Geographic	Temporal	Other
Patients	Number of patients	X	x		
	Location, DMAT		x		
	Care records				x
	History				x
	Needs				x
	Protocols				x
	Tracking				x
	Triage/prioritization				x
Hospitals / Nursing Homes	Number of patients	X			
	Capacity	X	x		
	Location		x		
	Communications status				x
	HVAC status				x
	Needs				x
	Services available				x
	Utility status, cooling water				x
	Utility status, electricity				x
	Utility status, potable water				x
	Utility status, sewage				x
Fatalities	Count	X			
	Capacity (for mortuary services)	X			
	Location, DMORT		x		

6.4.5 Fixed Facility Information

The location and operating information about all fixed facilities needs to be known for service delivery, staffing and other logistics. GIS can assist in the processing of this information, particularly about the physical locations, areas serviced by, utility status affecting and environmental threats to the building itself. Supply status, schedules, safety and security information needs to be conveyed to workers and administrators,

Table 99: Elements of Information, Fixed Sites

	Statistical	Geographic	Temporal	Other
Number of staff assigned	x			
Locations		x		
Schedule, operating			x	
Schedule, staff			x	
Communications status		x		x
Emergency procedures				x
Fuel status				x
Hygiene facilities (latrines, showers)		x		x
Responsible party				x
Security				x
Supplies needed/on-hand				x
Trash and waste removal				x
Utility status, electricity		x		x
Utility status, potable water		x		x
Utility status, sewage		x		x

6.4.6 Service Delivery Site Information

Information about service delivery locations includes the physical elements described in the preceding section, as well as information about the specific services being provided. Service information informs decisions about continuing or changing services within an area as well as the effective resourcing of the facility itself.

The affected individuals in the community need to know where to obtain services and what services are available. Locations of facilities, routes to them and even the availability of transportation to needs communicated to them as well as to workers who may make referrals to these locations.

Table 100: Elements of Information, Shelters and Bulk Distribution

		Statistical	Geographic	Temporal	Other
Shelters (all)	Population count	X			
	Capacity	X			
	Number of staff assigned	X			
	Location		x		
	Schedule, operating			x	
	Schedule, staff			x	
	Legal issues				x
	Pets/animals				x
	Services available				x
	Services needed				x
	Unmet needs				x
Bulk Distribution	Capacity	X			
	Count, commodities, issued	X			
	Count, commodities, on hand	X			
	Count, individuals served	X			
	Number of staff assigned	X			
	Location		x		
	Schedule, operating			x	
	Schedule, staff			x	
	Commodities available				x
	Unmet needs				x

Feeding operations require 24-hour support and advanced planning of several days to maintain. The capacity of preparation and delivery operations, supplies, services, menus and staffing needs to be matched with the current and anticipated demand for meals and potable water to make service delivery decisions. This information can be matched to other measures, such as shelter counts and utility restoration to trend services for demobilization.

Table 101: Elements of Information, Feeding Operations

		Statistical	Geographic	Temporal	Other
Feeding, Kitchens	Capacity	X	x		
	Count, meals prepared	X	x	x	
	Count, meals projected	X	x	x	
	Number of staff assigned	X			
	Location		x		
	Schedule, operating			x	
	Schedule, staff			x	
	Menu planning				x
	Order tracking				x
	Unmet needs				x
Feeding, Fixed sites	Capacity	X	x		
	Count, meals projected	X	x		
	Count, meals served	X	x		
	Number of staff assigned	X			
	Location		x		
	Schedule			x	
	Unmet needs				x
Feeding, Mobile	Capacity	X	x		
	Count, meals projected	X	x		
	Count, meals served	X	x		
	Count, vehicles	X			
	Number of staff assigned	X			
	Routes		x		
	Schedule			x	
	Unmet needs				x
	Fuel status				x

6.4.7 Other Service Delivery Information

Interagency communication about services available and specific information about assistance to specific clients is necessary to reduce DOB for improved service delivery, making available funding stretch farther and reduce fraud. Effective referral networks help agencies match the affected individuals with the location or agency that can best fit their needs.

Between sheltering and returning the individual to a longer-term residence, hotels and motels can be used, in a practice called transient accommodations (TA). With the nearly national dispersion of Katrina evacuees, the ability to provide TA fell to a number of NGOs and contractors. Information about the location, procedure and reimbursement for TA is necessary to assure the needs of the individuals and the vendors are met.

Disaster welfare information and reunification require a standardized process of registering evacuees, centralizing a database, and enabling a search process that respects the privacy rights and desires of the individuals. The Safe and Well Website can provide some of the information management, but is limited by the availability of the internet. Additional integration of patient tracking, police missing persons, criminal offender and shelter population data would make the tracking of displaced individuals possible, but existing legal constraints and practical implementation barriers require broader study.

Table 102: Elements of Information, Other Service Delivery

		Statistical	Geographic	Temporal	Other
Inter-agency	Clients served	X			x
	Service delivery locations		x		x
	Headquarters locations		x		
	Support facilities locations		x		
	Schedules, operational			x	x
	Duplication of benefits		x	x	x
	Unmet needs		x		
Transient accomo-dations	Locations		x		
	Vendors / Contractors		x		x
	Procedure				x
	Clients assisted	X			
	Expense/cost	X			
Disaster Welfare Information	Count, requests	X			
	Count, registrations	X			
	Count, reunified	X			
	Procedure, staff				x
	Procedure, displaced individual				x
	Procedure, seekers				x

6.4.8 Organizational Information

Responders need to understand the organization of which they are a part. This includes information about the structure of the organization, such as ICS positions, facilities and chain of command. They need to understand the information and tools available to them to perform their tasks, such as computer applications in use, specific procedures and organizational or legal constraints. The ability to share information in meetings, learn about the response effort through briefings and sitreps, and eventually, how to leave the operation to return home is necessary for the efficient and effective use of the workforce.

Table 103: Elements of Information, Organizational

	Statistical	Geographic	Temporal	Other
Number of staff assigned	x			
Number of staff working	x			
Operational Expenses (costs)	x			
Areas with communications / without		x		
Locations of response communications assets		x		
Lodging and personal services for staff		x		
Meeting schedules			x	
Reporting schedules			x	
ARF/MA Tracking				x
Chain of command / TOO				x
Computer applications in use				x
Contact lists				x
Demobilization				x
Differences between states				x
Procedures/Policies				x
Resource and capacity reports				x
Sitreps				x

6.5 SUMMARY

Chapter 6 provided analysis and explanation of the experiences of the interviewees as they recalled their response to the 2005 hurricane relief operations. In order to situate the results in the environment of disaster response, the ICS structure was used to guide the coding of information provided during the interviews. The analysis included the perceived difficulties in performing in this unique disaster environment and the desire for improvement for the response system and the individual responders.

The use of ICS as a structure for this study was chosen partly as a result of the concerns raised in the interviews that targeted specific issues that ICS attempts to address, but also out of the need to describe the required management system in a manner that begins to explore its

applicability and shortcomings in various response operations. Additional research is needed to determine the appropriate application of the principles of ICS and its scalar nature in a variety of response situations.

The interviews provided a list of elements of essential information needed by the mass care workers to perform in a disaster involving such a large number of displaced persons and requiring wide-spread sheltering, special needs care and feeding. A description of the communications methods was also provided, as well as a discussion about the quality and quantity of information to which the responders were exposed. It seems that there was not a shortage of information, but serious concerns for the reliability and timeliness of information at hand.

The EEIs can be categorized into disaster assessment, evacuation, service delivery and internal environment components. The disaster assessment information includes information about the social, natural and built environments directly affected by the disaster which will create demands or hinder the ability of agencies to provide services. Disaster assessment includes ongoing progress of debris removal and establishment of necessary utilities and services that will enable the affected population to return home and begin recovery.

The nature of the evacuation must be understood in order to provide services to people during the evacuation travel and upon arrival at their destination. This disaster was unique in that evacuees were being bused and flown to areas of the country remote from the disaster area. This created demands on disaster managers unaccustomed to the influx of evacuees and confusion about the number, needs and even destination of the evacuation travel.

Service delivery information was required to make sure that human needs were met at appropriate times and places and to reduce the duplication of efforts by a wide variety of

traditional, non-traditional and spontaneous service providers. The information about service delivery included information about the direct services available and the facilities and support systems.

Service delivery and the operation and logistics of the response agencies required inter- and intra- agency communication and coordination that was hampered, at times, by the lack of technology and a responsive organizational structure. To develop a common operating picture (COP), the ready availability of coherent information, based on the EEIs described in this chapter, facilitated by technological interoperability, across an effective human organization is required.

Political and legal influences shaped the response and the work environment differently in this set of disasters. Lawyers became part of the response organization as subpoenas, injunctions and lawsuits arose during the response effort. Shortcomings in the relief operation were spotlighted in the media, causing additional impact from elected officials at all levels of government, all across the country.

The internal work environment was discussed. The internal structure of the organization, the ability to effectively communicate in the workplace, and to obtain effective guidance and leadership were difficult in this response. This was carried into the desired improvements. While mentions of increased staffing were made, there was more of a concern for effective training and staff development to be made available, and to properly select disaster workers prior to deployment.

The information in this chapter illustrates the necessary improvements in the information management, technology and organizational development for effective, efficient relief operations in which a COP is shared by all.

7.0 CHALLENGES AND IMPLICATIONS FOR PRACTICE AND RESEARCH

The first six chapters have focused on the translation of disaster management practice into research design and analysis. In this final chapter, the results of the research design and analysis are translated into practice improvements. The research questions focused on the comparison of networks and information needs with the goal of informing practitioners how to build a more cohesive response organization and establish a clear COP. The planned, reported, perceived and desired (PRPD) analysis concept provided the basis for understanding the networks - the internal environments of the response organization – and the information needs they have. To build the effective organization and develop strong COPs, disaster managers need to understand the improvements from the public management, policy, organizational and technology perspectives.

7.1 CHALLENGES TO IMPROVING EMERGENCY MANAGEMENT

7.1.1 Challenges from Management Perspectives

7.1.1.1 Implementing and using ICS

As long as NIMS remains the requirement for organizing response and its adoption as one of the primary federal funding requirements, managers need to understand the integration of its requirements into their emergency operations through all of the emergency management phases.

It requires staff development, including training, exercise, evaluation and installation of the tenets of discipline and communication inherent in ICS. This is a challenge, since managers are trained and encouraged to use a variety of management styles and concepts “during peacetime” that are less command and control oriented than ICS.

The challenges to effective ICS implementation need to be viewed from the organizational and information perspectives of the ICS features. The command-and-control features address the “who’s in charge?” questions and help to develop official channels of communication. Current training for ICS focuses more on the structural features of the table of organization, and needs to improve focus on the facilitative features related to communications, planning and management by objectives. The facilitative features provide the actors with the ability to recognize formal and informal connections, share information and meaning and permit adaptive systems to emerge. The vertical focus created by a formal table of organization, while important for accountability, limits the tangential orientation to other actors necessary for effective network development.

7.1.1.2 Planning

Federal funding requirements have some level of control over the physical products of the planning process while less over the actual development. There is a range of planning processes. Inclusive outcomes-based planning processes, with a wide range of stakeholders may be employed with varying degrees of success based on the dynamics and leadership of the group. Internal planning processes, in which the organization focuses on its own needs, capacity and desires, are beneficial only to a point. There are also plans written in the vacuum of a cubicle in order to simply meet a grant deliverable. Planning is only as good as the dialog it encourages and capacity it builds. The process should include the analysis framework proposed in this study. The

capture of past planning assumptions and procedures, matched with the reported and perceived performance of the response organization can inform the future desired state of emergency response.

7.1.1.3 Response

Governmental and non-governmental agencies need to be integrated into response operations in a manner consistent with the legal requirements and restrictions in balance with the needs generated by the disaster event. This integration includes mechanisms of notification, mobilization, coordination of services, interagency communication, standardized reporting, and inter-operable equipment and computer applications.

The interoperability of communications has traditionally focused on hardware and software. The concept needs to be expanded into the interoperability of people: common language, common awareness and a common willingness to openly and honestly communicate.

7.1.2 Challenges from Policy Perspectives

7.1.2.1 Legal Aspects

Federal legislation after Katrina, Rita and Wilma has changed the response environment. The Post-Katrina Emergency Reform Act (PL 109–295, Title VI, 2006) reorganized FEMA within the DHS and establishes requirements and responsibilities to the FEMA Administrator as the "principal advisor to the President, the Homeland Security Council, and the Secretary for all matters relating to emergency management in the United States" to the point that the President may appoint the Administrator as a cabinet member during disasters or acts of terrorism. This is in contrast to the subordinate position the FEMA director had during Katrina. The law also limits

the Secretary's ability to "substantially or significantly reduce the authorities, responsibilities, or functions of the Agency or the capability of the Agency to perform those missions, authorities, responsibilities, except as otherwise specifically provided."

The Act also requires the development of mass evacuation plans, integrated between the states and federal government, as well as the identification of shelter locations and capabilities. Part of this includes the appropriate manner of public information before, during and after a disaster. Specific provisions are made for special needs and individuals with disabilities. Of particular change to disaster assistance is the provision for the "provision of rescue, care, shelter, and essential needs … to individuals with household pets and service animals; and … to such pets and animals.'' These specifications for evacuation planning, shelter identification, special needs and pets brings a wide range of preparedness and response issues to emergency managers.

The Pandemic and All-Hazards Preparedness Act (PL 109–417, 2006) established the Assistant Secretary for Preparedness and Response (ASPR) within HHS and transferred the primary responsibility for NDMS back from DHS. While NDMS was an HHS asset prior to the Homeland Security Act transfer in 2003, the large-scale deployment of NDMS assets for Katrina, Rita and Wilma were accomplished under DHS. The deployment of large numbers of NDMS teams has not occurred since the return to HHS.

7.1.2.2 National Response Framework

The National Response Framework (NRF) (US Department of Homeland Security, 2008) became effective on March 22, 2008, replacing the NRP. The GAO reports, however, that FEMA did not adequately involve non-federal stakeholders, including states and NGOs, in the revision process (US Government Accountability Office, 2008). As this study has demonstrated, mass care is provided largely by non-federal entities. The effects of the NRF revision process and its implementation for future disasters will require evaluation.

7.1.2.3 Improving Environmental Awareness in Policy Analysis

Policy analysis within disaster management is highly dependent on understanding the environments in which the responder exists and works to define problems and solutions. There are nine *facets* of the disaster environment identified throughout this study, summarized here, that can improve disaster policy and management, and are the basis for future policy analysis research.

Who are the actors? – The disaster manager needs to identify the affected population, the responding agencies, the appointed and elected officials and potential resource providers that are a part of the disaster environment. Understanding the affected population – the number, demographics, displacement and needs – the responding agencies and potential providers will better define the service delivery needs. Understanding the responding agencies will determine the manner in which effective communication and planning can occur. Knowing the role and nature of, and communicating with officials will help to manage their expectations of the response organization's performance, and can improve access to resources.

What is the natural and built environment? The location of the event changes the anticipation of needs. The original forecast track of Hurricane Wilma was through the Everglades; as one interviewee stated, “we thought it was just going to upset a bunch of alligators.” The actual slow speed, size and track of the storm created more human needs and physical damage than originally anticipated. Understanding the threatened structures and basic geography is the difference between the a response to wind-driven damage that Alabama and Mississippi received from Katrina, and one to the damaged levees that lead to the flood-driven damage in New Orleans. There are different needs for different impact areas.

What is the temporal environment? The timing of the storms in 2005 – first Dennis, then Katrina, Rita and Wilma – created demands on the response organization and the availability of resources. FEMA and the states of Alabama, Florida, and Mississippi had recovery operations in place for Hurricane Dennis when Katrina first threatened. This gave these areas a head start on staffing and logistics for Katrina. But by the time Rita and Wilma arrived, staffing and the availability of resources was short. Being able to understand the timing of events can help the disaster manager understand the needs and capacity of the disaster environment, and the fatigue of the other actors in the system.

What is the economic environment? Economics encompasses, at least, the affected population, the response organization and the financial support that the response can receive. The economic capacity of the affected population may indicate the prior mitigation of homes and businesses, the ability to self-evacuate and shelter and financially survive the recovery process. The economic capacity of the local supporting areas can impact evacuation: are there sufficient businesses and services along routes and at the destination to support the evacuees?

This is not just a financial concern: the economics, that is the supply and demand, of response resources such as equipment and personnel, must also be considered. The economic capacity of the response organization determines the scope of services. The request for a Stafford declaration is inherently to improve the ability to fund governmental response and recovery costs, to provide individual assistance, and enhance response capacity. Non-governmental and faith-based organizations need sufficient financial surge capacity to initiate response and an effective fund-raising effort to continue operations and replenish depleted funds.

What is the legal environment? The enabling and restrictive nature of existing disaster law to anticipated events can be included in the planning process, but it needs to be understood by all appropriate response personnel. In this set of disasters, existing laws not considered during disaster planning, such as the restrictions on the movement and sheltering of some criminal offenders impacted service delivery.

What is the organizational environment? The organizing principles of ICS are currently required for the response organization, but implementation, training and actual, successful utilization across agencies varies. If ICS is to remain the standard, it needs to be consistently implemented by the response agencies, and understood by political actors and spontaneous organizations. Regardless of the formal or informal organizational structure used, it needs to be effectively communicated to the people working within it, maintained in order to retain utility, and be flexible enough to incorporate new ideas and meet new demands.

What is the political environment? Elected and organizational politics needs to be understood and managed to its practical extent. Response agency personnel who cross state lines are normally challenged in understanding political structures, but the interviews raised unique issues with the role of the County Judges in Texas and the Parish Presidents in Louisiana.

Elected officials in the affected areas were involved to varying degrees, both helping and hindering response operations. The scope of these disasters also captured the interest and activity of elected officials across the country. One interviewee recalled an experience in a non-Gulf Coast state in which a local elected official, "brokered a deal for (the city) to receive evacuees, but no one else knew about it until they called a press conference."

Intergovernmental politics impacts disaster response. States deal with a large number of county and larger municipal governments, with varying political influence. Some local governments are more docile, in Simon's sense of the word, and others are politically active to the point that the state dare not cross the local officials. In one state it was observed, "We can't tell that (local government) anything, they're going to do what they want and we can't stop them."

There are also political issues involving state and federal interaction. In one state, an individual representing the federal government was told by a state official, "You're here at our request, so you need to follow my lead," and by a federal official, "After everything else that has happened, we're not going to trust (the state) when they say they can 'handle' anything."

What externalities might be created? All actions that the response organizations take create a new disaster environment, locally or elsewhere. This was magnified as part of the disaster environment of New Orleans was transplanted into other areas across the country via the evacuation flights and busses. A year after Katrina, the contingency planning for another evacuation met the resistance of other cities due to the demands placed on the municipal services, employment and housing markets. "We received thousands of evacuees last year, and they're still here. We're still trying to catch up."

What is the strategic horizon? What are the long-range goals of the response actions and how will they affect recovery? Placing displaced residents in travel trailers for a defined period had worked well prior to Katrina. But three years later, trailers are still inhabited due to the lack of recovery capacity at the government, family and individual levels. Actions taken during the response phase may have longer range and broader policy impacts than anticipated. The disaster manager needs to extend the strategic horizon while analyzing policy decisions.

Understanding these environmental facets can improve disaster policy and decision analysis, but require a greater understanding of the conditions within the disaster environment before, during and after the disaster impact. This requires greater preparation of the disaster manager through training, education, planning and experience, and a knowledge management system that can distribute data and inform decision in an efficient, effective and accessible manner. More research is needed to further describe and ground these facets.

7.1.3 Challenges from Organizational Perspectives

The response to Katrina, Rita and Wilma saw interaction between government, NGOs, FBOs and the private sector never before experienced in a natural disaster response. Each set of organizations holds different mandates, missions, regulatory environments and senses of time and economy. There are different perspectives held by paid and unpaid staff of the organizations. Each sector has its place in the response, but the interface between them is unique, and must be considered in preparedness and response. Maintaining the effective balance in planning efforts, learning the capacities and constraints of each other and how each can be coupled into seamless response are lofty though necessary goals to achieve. Simply increasing the number of agencies in the plan, and thus, the size of the planned network, will not necessarily improve the plan or the

response organization. Network analysis enables the identification of the “right-sizing” of planning actors based on the analysis of centrality, power and connectedness. Conversely, just because an agency was included in the response, doesn’t necessarily mean that they are the most suited for the task - it may have been a satisficing involvement. Additional evaluation is required.

NGOs and FBOs that are not currently involved in disaster response and recovery are encouraged to learn where they fit into the system. Spontaneous organizations created challenges for the system, and may feel pushed aside and disenfranchised when the existing response agencies ask them not to perform a certain activity or to perform it in a specific manner. Just as citizens are urged to take actions to care for themselves and loved ones in a disaster, these organizations also need to think about how they will respond in an emergency.

7.1.4 Challenges from Technology and Communication Perspectives

Information management solutions are required to capture raw information from the field, from a variety of sources, and integrate it into the various products needed by consumers. Responders seem to be collecting information from a variety of sources - some redundant, others scarce - and do not have the ability to share information across organizational and even functional boundaries. Information found at one part of the response may be desperately needed in another.

The ability to share information may be due to lack of application or platform interoperability, lack of funding or the technical capacity of the organizations or the individuals. The effectiveness with which the actors can share awareness informs decisions. The lack of information creates duplication, misplacement or absence of services.

7.2 LIMITATIONS OF THE STUDY AND IMPLICATIONS FOR FUTURE RESEARCH

7.2.1 Limitations

This study was limited in a number of ways that may impact its generalizability to future disasters and other response functions. It was limited in its application to the response phase of mass care to a set of tropical storms in five specific states, with federal and NGO assistance in the policy framework of the NRP. One of the storms, Katrina, was catastrophic in nature and the remaining storm responses were impacted by the overwhelming commitment of resources to Katrina. How can this framework of analysis be applied to the other ESFs? Can it be applied to other disaster causative agents? How will it apply to other areas of the country? Are the findings applicable under the legal and policy revisions by the federal government since 2005? Would the findings be different in the recovery phase of the operation?

Additionally, the results are limited by the sources of data. The documentation within the sitreps was merely a snapshot of the environment and activity, and could not accurately reflect a comprehensive representation of actual operations. The interviews were limited by the recollections and emotions of the responders nearly three years after the events. Miles' Law (Miles, 1978) also applies to the interviewees: "Where you stand depends on where you sit." These caveats are not to imply that the interviewees' statements are not valid or valuable, just that they need to be understood within in the proper frame.

7.2.2 Future Research

The limitations stated above are starting points for future research to inform public policy and administration. Additionally, more in-depth analysis of mass care and special needs activities, their operations, logistics and finance, can be instructive and supportive of improvements in those areas of service delivery. Expanding the time-frame, from evacuation and initial sheltering, to longer-term assistance with basic needs is warranted.

Further research is needed to determine the appropriate inclusion of elected officials and spontaneous organizations in disaster planning, response and recovery. An understanding of the activities and levels of success of these groups in various disaster situations can lead to effective integration in future operations.

Research is needed into the impacts of post-Katrina reforms. What is the effect of the FEMA restructuring or the NRF? How will the change to ESF #06 Mass Care and the role change for the ARC affect future mass care operations? How effective will the reversion of NDMS field assets to the DHHS be in meeting public health needs?

A better understanding of the socio-technological solutions is needed. How can situational awareness be captured, integrated and communicated to the responders, governing officials and the general public in a manner that fosters the development of common operating pictures? How can this be accomplished in the austere “steno pad” environment of the first responder?

Of broader application beyond emergency management, expansion of the intergovernmental comparison of agency responsibilities concept in this study can be useful. Here, the comparison of responsibilities across the five states as they apply to disaster management is used. How are agency responsibilities for disaster management, transportation,

healthcare, law enforcement and other functions of government dispersed among departments and agencies across all states? How are they aligned in tribal and insular governments?

7.3 SUMMARY OF RESEARCH QUESTIONS

The findings from this study are summarized briefly in response to the two major research questions:

- What are the differences and similarities among the federal and state disaster management networks anticipated in the NRP, reported during actual incidents, perceived by practitioners post-event, and desired by those actors for future events?
- What information was used by the interviewees in managing the mass care response, how was this communicated and what improvements need to be made for future disaster operations?

The network comparison showed that the combined state plans and the NRP anticipate between 23.08 and 39.83% of the actors that were present in the overall response effort. Some plans included agencies that did not appear in the remaining networks and all of the plans were not inclusive of all actors involved in the response. There are four possible reasons for this discrepancy. First, governmental response plans are management tools of the executive branch and primarily serve as taskings to and responsibility statements for executive agencies and departments. Second, the lower levels of government are assumed as requestors of assistance rather than as response partners, and are not specifically included as named planning actors. Third, there may be a reluctance to include a more broad inclusion of NGOs, FBOs and in particular, corporations and private businesses for political, practical or legal reasons, a topic for

additional research. Finally, no plan can cover all contingencies of the disaster itself, the needs of the public or the emergence of spontaneous organizations.

The schema of reported, perceived and desired network analyses can provide a richer framework for understanding response organization networks and information needs to improve the planning process and capacity to respond. Network analysis, especially the centrality, power and connectedness measures of actors, can indicate those agencies appropriate for planning inclusion and to identify the flow of information necessary for the common operating picture. The analysis can be performed based on the jurisdiction's own disaster experience or on a closely similar proxy. Performing this manner of analysis and evaluation provides the double-loop learning necessary for organizational improvement ((Argyris & Schön, 1974; 1996)

The networks of actors and information explained here show the importance of effectively organizing the response effort. The interviewees indicated frustration with not knowing who the other actors were, what their roles were, capabilities and how to communicate with them. This frustration was also expressed in not knowing the hierarchy and expectations of their own agencies, not just of others. Knowing the other actor members of the internal environment is a key to solving problems of communication and shared meaning (Luhmann, 1986; Simon, 1996)

The requirement for the use of NIMS is the primary solution for solving these organizational issues. Though NIMS was in effect for this response, its use by novice agencies, absence in others, and, as expressed by the interviewees, the poor communication of its structures and expectations where it was in place, create opportunities for improvement and additional research. The hierarchical nature of ICS, while useful for purposes of accountability, may not enable the edge-of-chaos flexibility to enable emergence of adaptive systems necessary

to meet the dynamic demands of the disaster environment (Comfort, 1999). In its defense, there are critical situations in disaster management where collaboration must give way to a clear command and control model, so familiar to public safety and the military. The art of effective utilization and success of ICS is in knowing the proper balance and timing of its structural and facilitative features.

The use of the term “desired” in the network schema requires further clarification. Desired, in this study, refers to the network actors that the interviewees prefer and expect to work with in future disasters. Their selection is bounded by their knowledge of near-neighbor actors and their needs in the activities they performed in these events. The term should not be implied to indicate that these locally-desired (expected) networks are universal maximizations of what would constitute a *desirable* response network. This study focused on the networks and information needs of the mass care response, but can be applied to other disaster functions across the temporal phases of emergency management: preparedness, response, recovery and mitigation. A boundary was established in this study in order to focus on the meeting of immediate human needs during the response phase, but there were connections between all 15 ESFs in providing mass care. The same method of analysis can be used to explore and describe the action and information networks for the rest of the ESF #08 Health and Medical response activities, the transition of response phase sheltering to longer-term housing during recovery, to disaster events other than hurricanes, or to the day-to-day activities of disaster management bureaucracies.

Future responses can be improved by the addition of integrated knowledge management systems and technology. This research shows that disaster managers were affected more by an overload and questionable validity of information than by the absence of information. If quality decisions require quality information, this is clearly a root problem. By identifying the elements of essential information and developing technology to improve the sharing of valid information and meaning, decision support systems can enhance situational awareness and the building of a COP for the response actors. Simplification of information technology platforms, including affordable or free applications that can be utilized by smaller governmental, non-governmental and faith-based organizations will improve the access and necessary buy-in to enable a grander vision of interoperability.

7.4 CONCLUSION

Concluding this research project without reflecting (Schön, 1983) sensemaking (Weick, 1995), "double-looping" (Argyris & Schön, 1996; 1974) and admitting the bounds of my rationality (Simon, 1947) would be disingenuous. There are numerous, some difficult, lessons through the process and from the product of this dissertation. Distilling them into a conclusion, the most important concepts relate to the common operating pictures and the organizational development required for effective disaster management.

The COP necessary for coordinated action relies on the ability of a group of boundedly rational actors to selectively obtain essential information from the external disaster environment. This information is communicated across the actor network, comparing it to the capacity of the internal environment to understand it, develop action options and appropriately act upon it. But

the network itself necessary to facilitate the communication and shared meaning is subject to forces that inhibit its ability to resonate and achieve the goal of alleviating the needs of the people affected by the disaster. Actions taken by internal and external actors either enhance or inhibit the ability of the system to make adjustments to the information from the environment and other actor and learn in the process. Alan Brunacini, the fire chief who developed the Fireground Command System observed, “Most big screwed-up situations start with one small out-of-balance step in the wrong direction – be careful of confusion snowballs that start rolling downhill” (Brunacini, 1985).

The governmental solution to disaster response organizational disarray is NIMS, particularly the hierarchical structure of ICS. The interview data provides a mixed review of the performance of ICS in these disasters. To be fair, the NIMS requirements were new to many of the actors who were using it and some agencies had not complied with the standardization requirements of the system. ICS does provide a command and control structure required for the legal accountability of response actors. Still, the hierarchical nature of the command components of ICS crossing government jurisdictions and non-governmental boundaries may inhibit the ability of the networks to quickly adapt to changing conditions.

What may be lost in the implementation of ICS are its features that are not related to tables of organization, unity of command and span of control. The basic training program for ICS identifies common terminology, management by objectives, information and intelligence management, and integrated communications as these features (Emergency Management Institute, 2005). This is not to serve as an indictment of the ICS concept, as there are applications for a clear command and control model to manage life and death situations. This analysis should serve a reminder to me, as a practitioner and instructor, to emphasize the features that can

facilitate shared meaning and adaptive network development, and as a researcher, to help identify appropriate applications and solutions for ICS or whatever it's theory-driven, practice-informed revision or replacement may be.

An interviewee stated, "We don't know that mass care is broken based just on Katrina in Louisiana." The purpose of this study was not to determine if mass care is broken. The attempt is to inform planners, managers and responders what networks emerged among the agencies, the information that is needed to inform mass care operations, and how service delivery can be strengthened in future operations. The nature of Katrina and the timing of Rita and Wilma may be a unique occurrence, but future disasters will require the provision of evacuation, feeding and sheltering operations, which will forever be compared to Katrina, Rita and Wilma. Lessons have been learned and applied by the responding agencies through their collective or individual, formal or informal sensemaking of the events. It is my hope that this study adds to the knowledge available to the planners, responders and researchers in some positive manner, to make them more efficient, effective and safe in their activities.

APPENDIX A

DISASTER DECLARATION HISTORY UNDER THE STAFFORD ACT

There are three (3) types of declaration under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (PL 106-390, 2000):

- Fire Management Assistance - includes grants, equipment, supplies, and personnel, to any State or local government for the mitigation, management, and control of any fire on public or private forest land or grassland that threatens such destruction as would constitute a major disaster.
- Emergency - means any occasion or instance for which, in the determination of the President, Federal assistance is needed to supplement State and local efforts and capabilities to save lives and to protect property and public health and safety, or to lessen or avert the threat of a catastrophe in any part of the United States. This is generally limited to a maximum of $5 million, unless extended by the president and reported to Congress
- Major Disaster - means any natural catastrophe (including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought), or, regardless of cause, any

> fire, flood, or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this Act to supplement the efforts and available resources of States, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby.

Assistance includes that to individuals and families (IA) and public assistance (PA) to public agencies for emergency and "permanent work" (Federal Emergency Management Agency, n.d.). The PA categories are:

- Emergency Work
  - A - debris removal
  - B - emergency protective measures (which includes mass care response)
- Permanent Work
  - C - road systems and bridges
  - D - water control facilities
  - E - buildings, contents and equipment
  - F – utilities
  - G - parks, recreational and other facilities

Table 104: Stafford Act Declarations (2000-2005) by causation

	n	%	Cumulative %
Attack	4	0.7	0.7
Natural	600	98.2	98.9
Technological	7	1.1	100.0
Total	611	100.0	

Attack	Disasters because of enemy attack on the US (All were for September 11, 2001)
Natural	Disasters resulting from natural causes (Wildfires are assumed as natural events for the purposes of this study.)
Technological	Disasters resulting from man-made, unintentional causation

Table 105: Stafford Act Declarations (2000-2005) by disaster agent

	n	%	Cumulative %
Dam Break	1	0.2	0.2
Earthquake	5	0.8	1.0
Fire	245	40.1	41.1
Severe Storm	158	25.9	66.9
Space (Shuttle Accident)	2	0.3	67.3
Terrorism	4	0.7	67.9
Tropical	72	11.8	79.7
Tropical Support	43	7.0	86.7
Utility	4	0.7	87.4
Winter	77	12.6	100.00
Total	611	100.00	

Table 106: Stafford Act Declarations (2000-2005) by type of declaration

Declaration	n	%	Cumulative %
Emergency (ED)	105	17.2	17.2
Fire Management Assistance (FMAD)	240	39.3	56.5
Major Disaster (MD)	266	43.5	100.0
Total	611	100.0	

Table 107: Stafford Act Major Disaster Declarations during Hurricane Season 2005

		Date	State	Declaration
1593	-DR	10-Jul-05	Alabama	Hurricane Dennis
1594	-DR	10-Jul-05	Mississippi	Hurricane Dennis
1595	-DR	10-Jul-05	Florida	Hurricane Dennis
1596	-DR	22-Jul-05	South Dakota	Severe Storm
1597	-DR	22-Jul-05	North Dakota	Severe Storms, Flooding, and Ground Saturation
1598	-DR	1-Aug-05	Utah	Flood and Landslide
1599	-DR	22-Aug-05	Wyoming	Tornado
1600	-DR	23-Aug-05	Kansas	Severe Storms and Flooding
1601	-DR	23-Aug-05	Louisiana	Tropical Storm Cindy
1602	-DR	28-Aug-05	Florida	Hurricane Katrina
1603	-DR	29-Aug-05	Louisiana	Hurricane Katrina
1604	-DR	29-Aug-05	Mississippi	Hurricane Katrina
1605	-DR	29-Aug-05	Alabama	Hurricane Katrina
1606	-DR	24-Sep-05	Texas	Hurricane Rita
1607	-DR	24-Sep-05	Louisiana	Hurricane Rita
1608	-DR	7-Oct-05	North Carolina	Hurricane Ophelia
1609	-DR	24-Oct-05	Florida	Hurricane Wilma
1610	-DR	26-Oct-05	New Hampshire	Severe Storms and Flooding

Table 108: Stafford Act Emergency Declarations during Hurricane Season 2005

		Date	State	Declaration
3212	-EM	27-Aug-05	Louisiana	Hurricane Katrina
3213	-EM	28-Aug-05	Mississippi	Hurricane Katrina
3214	-EM	28-Aug-05	Alabama	Hurricane Katrina
3215	-EM	2-Sep-05	Arkansas	Hurricane Katrina
3216	-EM	2-Sep-05	Texas	Hurricane Katrina

- continued -

		Date	State	Declaration
3217	-EM	5-Sep-05	Tennessee	Hurricane Katrina Evacuation
3218	-EM	5-Sep-05	Georgia	Hurricane Katrina Evacuation
3219	-EM	5-Sep-05	Oklahoma	Hurricane Katrina Evacuation
3220	-EM	5-Sep-05	Florida	Hurricane Katrina Evacuation
3221	-EM	5-Sep-05	West Virginia	Hurricane Katrina Evacuation
3222	-EM	5-Sep-05	North Carolina	Hurricane Katrina Evacuation
3223	-EM	5-Sep-05	Utah	Hurricane Katrina Evacuation
3224	-EM	5-Sep-05	Colorado	Hurricane Katrina Evacuation
3225	-EM	7-Sep-05	Michigan	Hurricane Katrina Evacuation
3226	-EM	7-Sep-05	DC	Hurricane Katrina Evacuation
3227	-EM	7-Sep-05	Washington	Hurricane Katrina Evacuation
3228	-EM	7-Sep-05	Oregon	Hurricane Katrina Evacuation
3229	-EM	7-Sep-05	New Mexico	Hurricane Katrina Evacuation
3230	-EM	7-Sep-05	Illinois	Hurricane Katrina Evacuation
3231	-EM	10-Sep-05	Kentucky	Hurricane Katrina Evacuation
3232	-EM	10-Sep-05	Missouri	Hurricane Katrina Evacuation
3233	-EM	10-Sep-05	South Carolina	Hurricane Katrina Evacuation
3234	-EM	10-Sep-05	South Dakota	Hurricane Katrina Evacuation
3235	-EM	10-Sep-05	Pennsylvania	Hurricane Katrina Evacuation
3236	-EM	10-Sep-05	Kansas	Hurricane Katrina Evacuation
3237	-EM	10-Sep-05	Alabama	Hurricane Katrina Evacuation
3238	-EM	10-Sep-05	Indiana	Hurricane Katrina Evacuation
3239	-EM	10-Sep-05	Iowa	Hurricane Katrina Evacuation
3240	-EM	12-Sep-05	Virginia	Hurricane Katrina Evacuation
3241	-EM	12-Sep-05	Arizona	Hurricane Katrina Evacuation
3242	-EM	13-Sep-05	Minnesota	Hurricane Katrina Evacuation
3243	-EM	13-Sep-05	Nevada	Hurricane Katrina Evacuation
3244	-EM	13-Sep-05	Idaho	Hurricane Katrina Evacuation
3245	-EM	13-Sep-05	Nebraska	Hurricane Katrina Evacuation
3246	-EM	13-Sep-05	Connecticut	Hurricane Katrina Evacuation
3247	-EM	13-Sep-05	North Dakota	Hurricane Katrina Evacuation
3248	-EM	13-Sep-05	California	Hurricane Katrina Evacuation
3249	-EM	13-Sep-05	Wisconsin	Hurricane Katrina Evacuation
3250	-EM	13-Sep-05	Ohio	Hurricane Katrina Evacuation
3251	-EM	13-Sep-05	Maryland	Hurricane Katrina Evacuation
3252	-EM	13-Sep-05	Massachusetts	Hurricane Katrina Evacuation
3253	-EM	13-Sep-05	Montana	Hurricane Katrina Evacuation
3254	-EM	14-Sep-05	North Carolina	Hurricane Ophelia
3255	-EM	19-Sep-05	Rhode Island	Hurricane Katrina Evacuation
3256	-EM	19-Sep-05	Maine	Hurricane Katrina Evacuation
3257	-EM	19-Sep-05	New Jersey	Hurricane Katrina Evacuation
3258	-EM	19-Sep-05	New Hampshire	Hurricane Katrina Evacuation
3259	-EM	20-Sep-05	Florida	Tropical Storm Rita
3260	-EM	21-Sep-05	Louisiana	Hurricane Rita
3261	-EM	21-Sep-05	Texas	Hurricane Rita
3262	-EM	30-Sep-05	New York	Hurricane Katrina Evacuation
3263	-EM	30-Sep-05	Delaware	Hurricane Katrina Evacuation
3264	-EM	19-Oct-05	Massachusetts	Severe Storms and Flooding

APPENDIX B

NATIONAL RESPONSE PLAN EMERGENCY SUPPORT FUNCTIONS

ESF #1 – Transportation

Primary Agency:
US Dept. of Transportation

- Federal and civil transportation support
- Transportation safety
- Restoration/recovery of transportation infrastructure
- Movement restrictions
- Damage and impact assessment

ESF #2 - Communications

Primary Agency:
DHS, Information Analysis and Infrastructure Protection, National Communications System

- Coordination with telecommunications industry
- Restoration/repair of telecommunications infrastructure
- Protection, restoration, and sustainment of national cyber and information technology resources

ESF #3 - Public Works and Engineering

Primary Agencies:
DOD, U.S. Army Corps of Engineers
FEMA

- Infrastructure protection and emergency repair
- Infrastructure restoration
- Engineering services, construction management
- Critical infrastructure liaison

ESF #4 - Firefighting

Primary Agency:
USDA Forest Service

- Firefighting activities on Federal lands
- Resource support to rural and urban firefighting operations

ESF #5 - Emergency Management

Primary Agency:
FEMA

- Coordination of incident management efforts
- Issuance of mission assignments
- Resource and human capital
- Incident action planning
- Financial management

ESF #6 - Mass Care, Housing, and Human Services

Primary Agencies:	- Mass care (sheltering, feeding, disaster welfare information)
FEMA	- Disaster housing
American Red Cross	- Human services

ESF #7 - Resource Support

Primary Agency:	- Resource support (facility space, office equipment
General Services Administration	and supplies, contracting services, etc)

ESF #8 - Public Health and Medical Services

Primary Agency:	- Public health
Dept. of Health and Human Services	- Medical
	- Mental health services
	- Mortuary services

ESF #9 - Urban Search and Rescue

Primary Agency:	- Life-saving assistance
FEMA	- Urban search and rescue

ESF #10 - Oil and Hazardous Materials Response

Primary Agencies:	- Oil and hazardous materials (chemical, biological, radiological,
Environmental Protection Agency	etc) response
DHS US Coast Guard	- Environmental safety and short- and long-term cleanup

ESF #11 - Agriculture and Natural Resources

Primary Agencies:	- Nutrition assistance
USDA	- Animal and plant disease/pest response
Food and Nutrition Service	- Food safety and security
Animal and Plant Health Inspection Service	- Natural and cultural resources and historic properties protection
Food Safety and Inspection Service	and restoration

ESF #12 - Energy

Primary Agency:	- Energy infrastructure assessment, repair, and restoration
Dept. of Energy	- Energy industry utilities coordination
	- Energy forecast

ESF #13 - Public Safety and Security

Primary Agencies:	- Facility and resource security
Dept. of Homeland Security	- Security planning and technical and resource assistance
Dept. of Justice	- Public safety/security support
	- Support to access, traffic, and crowd control

ESF #14 - Long-Term Community Recovery and Mitigation

Primary Agencies:
Dept. of Agriculture
Dept. of Commerce
FEMA
Dept. of Housing and Urban Development
Dept. of the Treasury
Small Business Administration

- Social and economic community impact assessment
- Long-term community recovery assistance to States, local governments, and the private sector
- Mitigation analysis and program implementation

ESF #15 - External Affairs

Primary Agency:
FEMA

- Emergency public information and protective action guidance
- Media and community relations
- Congressional and international affairs
- Tribal and insular affairs

APPENDIX C

CODING OF AGENCIES

AGENCIES OTHER THAN STATE GOVERNMENT

ICS Positions	
ic_af	ICS Finance and Administration Section
ic_log	ICS Logistics Section (ESF #7)
ic_op	ICS Operations Section
ic_opes	ICS Operations Section Emergency Services Branch
ic_ophs	ICS Operations Section Human Services Branch
ic_opinf	ICS Operations Section Infrastructure Branch
ic_opsao	ICS Operations Section Air Operations Branch
ic_opsup	ICS Operations Section Support Branch
ic_plan	ICS Planning Section
Emergency Support Functions	
esf #01	Transportation
esf #02	Communications
esf #03	Public Works and Engineering
esf #04	Firefighting
esf #05	Emergency Management
esf #06	Mass Care, Housing, and Human Services
esf #07	Resource Support
esf #08	Public Health and Medical Services
esf #09	Urban Search and Rescue
esf #10	Oil and Hazardous Materials Response
esf #11	Agriculture and Natural Resources
esf #12	Energy

esf #13	Public Safety and Security
esf #14	Long-Term Community Recovery and Mitigation
esf #15	External Affairs
esf #15cl	Congressional and Legislative Relations
esf #15cr	Community Relations
esf_anim	Animal Management
esf_don	Donation Management
esf_mil	Military (State Only)
esf_rec	Recovery (if separate from Mitigation)
esf_vol	Volunteer Management – Voluntary Agency Liaison

Programs and Teams

p_ia	Individual Assistance
t_erta	Emergency Response Team – Advance Element
t_mers	Mobile Emergency Response System
t_rna	Rapid Needs Assessment Team
t_rrcc	Regional Response Coordination Center

Federal Agencies

u_a	Agriculture, US Dept. of (USDA)
u_a_fns	USDA - Food and Nutrition Service
u_a_fsis	USDA - Food Safety and Inspection Service
u_a_nrcs	USDA - National Resource Conservation Service
u_a_usfs	USDA - Forest Service
u_epa	Environmental Protection Agency
u_gsa	General Services Administration
u_hh	Health and Human Services, US Dept. of (HHS)
u_hh_cdc	HHS - Centers for Disease Control
u_hh_phs	HHS - US Public Health Service
u_hs	Homeland Security, US Dept. of (DHS)
u_hs_cbp	DHS - US Customs and Border Protection
u_hs_fema	DHS - FEMA
u_hs_ins	DHS - Immigration and Naturalization Service
u_hs_ncs	DHS - National Communications System
u_hs_uscg	DHS - US Coast Guard
u_hud	Housing and Urban Development, US Dept. of
u_i	Interior, US Dept. of
u_i_nps	Interior - National Park Service
u_j	Justice, US Dept. of
u_j_ms	Justice - US Marshals Service
u_l	Labor, US Dept. of
u_nasa	National Aeronautics and Space Administration
u_ndms	National Disaster Medical System

u_opm	Office of Personnel Management
u_s	State, US Dept. of
u_sba	Small Business Administration
u_ssa	Social Security Administration
u_t	Transportation, US Dept. of
u_tr	Treasury, US Dept. of
u_tr_irs	Treasury - Internal Revenue Service
u_usps	US Postal Service
u_va	Veterans Affairs, US Dept. of
tribal	Tribal Government

Dept. of Defense Agencies

d_ace	US Army Corps of Engineers
d_af	US Air Force
d_army	US Army
d_dod	Dept of Defense
d_nmc	US Navy and Marine Corps

Non-Governmental and Voluntary Agencies

n_arc	American Red Cross
n_ash	Americas Second Harvest
n_cap	Civil Air Patrol
n_cncs	Corp for National and Community Service
n_emac	Emergency Management Assistance Compact
n_ham	Amateur Radio (RACES/ARES/other)
n_nos	NGO, not otherwise specified
n_obi	Operation Blessing International
n_uw	United Way
n_voad	Voluntary Organizations Active in Disaster (state or national)
sn_hosp	State Hospital Assn
sn_nh	State Nursing Home Assn
sn_sheriff	State Sheriff's Assn
xas_am	Association, Assembly Managers
xas_com	Association, Chamber of Commerce
xas_lod	Association, Lodging
xng_fb	Non-Governmental Organization, Food Bank unspecified
xng_pet	Non-Governmental Organization, Pet Care unspecified
xrc_int	Red Cross, Other National Societies

Faith Based Organizations

c_adv	Adventist organizations
c_bap	Baptist organizations
c_cath	Catholic organizations

c_meth	Methodist organizations
c_other	Other religious organization
c_salv	Salvation Army
xch_bdm	Brethren Disaster Ministries organizations
xch_cws	Church World Service organizations
xch_cym	College Youth Ministry organizations
xch_lut	Lutheran organizations
xch_mor	LDS Mormons organizations
xch_mus	Muslim Organizations
xch_sci	Scientology organizations

Local Government and Services

xhc_hos	Health Care, Hospitals
xit_bus	Transit, Bussing Operators
xlg_dpw	Local Government, Public Works
xlg_ema	Local Government, Emergency Management
xlg_eo	Local Government, Elected Officials
xlg_fd	Local Government, Fire
xlg_hum	Local Government, Human Services
xlg_le	Local Government, Law Enforcement
xlg_nos	Local Government, Not otherwise specified
xlg_pha	Local Government, Public Health Agencies
xlg_sd	Local Government, School District

Business and Private Sector

x_univ	University, non-state related
xbz_car	Businesses, Cargo (FedEx, UPS)
xbz_cat	Businesses, Caterers (Aramark)
xbz_fgr	Businesses, Food/Grocery, Retail
xbz_fgw	Businesses, Food/Grocery, Wholesale (Sysco, US Food)
xbz_gc	Businesses, Government Contractors
xbz_lod	Businesses, Lodging (Hotel/Motel)
xbz_ret	Businesses, Retail Chains (Home Depot, Wal-Mart)

STATE AGENCY CODING AND CORRELATION

st_adm	Administration	FL Dept. of Management Services LA Governor's Office Division of Administration TX State Comptroller of Public Accounts
st_ag	Agriculture	AL Dept. of Agriculture and Industries FL Dept. of Agriculture & Consumer Services LA Dept. of Agriculture and Forestry MS Dept. of Agriculture and Commerce, TX Dept. of Agriculture
st_an	Animal	TX Animal Health Commission
st_br	State Bureau of Professional Regulation	FL Dept. of Business and Professional Regulation
st_cd	Community Development	FL Dept. of Community Affairs TX Dept. of Housing and Community Affairs
st_cor	Corrections	AL Dept. of Corrections FL Dept. of Corrections LA Dept. of Corrections MS Dept. of Corrections TX Dept. of Criminal Justice
st_ecd	Economic Development	AL Dept. of Economic and Community Affairs Enterprise FL LA Dept. of Economic Development MS Development Authority TX Economic Development Council
st_ed	Education	AL Dept. of Education FL Dept. of Education LA Dept. of Education MS Dept. of Education TX Education Agency

st_eld	Elderly	AL Dept of Senior Services (Commission on Aging) FL Dept. of Elder Affairs LA Governor's Office of Elderly Affairs MS Dept. of Aging and Adult Services TX Dept. of Aging and Disability Services
st_ema	EMA	AL Emergency Management Agency FL Governor's Division of Emergency Management LA Office of Homeland Security & Emergency Preparedness MS Emergency Management Agency TX Governor's Division of Emergency Management
st_emp	Employment Services	FL Agency for Workforce Innovation
st_env	Environment	AL Dept. of Environmental Management FL Dept. of Environmental Protection LA Dept. of Environmental Quality MS Dept. of Environmental Quality, TX Commission on Environmental Quality
st_faith	Community and Faith Based Initiatives	AL Governor's Office of Faith Based and Community Initiatives FL. Commission on Community Service TX One Star Foundation
st_fm	Fire Marshal	FL State Fire Marshal MS State Fire Marshal
st_for	Forestry	AL Forestry Commission FL Division of Forestry MS Dept. of Forestry Commission TX Forest Service
st_fw	Wildlife	AL Dept. of Conservation and Natural Resources FL Fish and Wildlife Conservation Commission LA Dept. of Wildlife and Fisheries MS Dept. of Wildlife Fisheries & Parks.
st_gov	State Governor's Office	

st_hea	Health	AL Dept. of Public Health FL Dept. of Health LA Dept. of Health & Hospitals MS Dept. of Health TX Dept. of State Health Services
st_hls	Homeland Security	AL Dept. of Homeland Security MS Office of Homeland Security
st_hr	Human Resources	AL Dept. of Human Resources
st_hs	Social/Human Services	LA Dept. of Social Services MS Dept. of Human Services TX Dept. of Human Services
st_ins	Insurance	AL Dept. of Insurance LA Dept. of Insurance MS Dept. of Insurance TX Dept. of Insurance
st_just	Justice	AL Attorney General FL Attorney General LA Dept. of Justice MS Attorney General TX Attorney General's Office
st_kids	Children and Families	AL Dept. of Children's Affairs FL Dept. of Children & Families MS Dept. of Youth Services TX Dept. of Family and Protective Services
st_lab	Labor	AL Dept. of Labor FL Dept. of Labor & Employment Security LA Dept. of Labor MS Dept. of Employment Security TX Workforce Commission
st_mar	Marine	AL Port Authority MS Dept. of Marine Resources

st_medicaid	Medicaid	AL Medicaid Agency TX Health and Human Service Commission
st_mh	Mental Health / Retardation	AL Dept. of Mental Health and Mental Retardation MS Dept. of Mental Health, TX Dept. of Mental Health and Mental Retardation
st_mv	Motor Vehicles	FL Dept. of Highway Safety & Motor Vehicles LA Office of Motor Vehicles MS Motor Vehicle Commission
st_ng	Military	AL Military Dept. FL Dept. of Military Affairs LA National Guard MS National Guard TX Adjutant General's Dept.
st_park	Parks	FL Dept. of Agriculture & Consumer Services LA Dept. of Natural Resources MS Dept. of State Parks TX Parks and Wildlife Dept.
st_proc	Procurement	TX Building and Procurement Commission
st_ps	Police	AL Dept. of Public Safety FL Dept. of Law Enforcement LA State Police MS Dept. of Public Safety TX Dept. of Public Safety
st_psuc	Public Service/Utilities Commission	AL Public Service Commission FL Public Service Commission LA Public Service Commission MS Public Service Commission TX Public Utility Commission
st_rehab	Rehabilitation	AL Dept. of Rehabilitation Services MS Rehabilitation Services TX Dept. of Assistive and Rehabilitative Services

st_spa	Space (State)	FL Space Authority University of Texas Center for Space Research
st_ss	State Dept. (State)	AL Secretary of State FL Dept. of State LA Secretary of State MS Secretary of State
st_tour	Tourism	Visit Florida LA Dept. of Culture, Recreation & Tourism MS Dept. of Tourism Development
st_tra	Transportation (State)	AL Dept. of Transportation FL Dept. of Transportation LA Dept. of Transportation & Development MS Dept. of Transportation TX Dept. of Transportation
st_trib	Tribal Affairs	LA Governor's Office of Indian Affairs
st_unemp	Unemployment	AL Dept of Industrial Relations
st_univ	University, State Related	

APPENDIX D

NETWORK MATRIX COLLATION

The actor membership of each network is shown in the following matrices. The presence of an actor is indicated by a “1” in the appropriate cell. The order of each matrix follows the order as the agencies are listed in Appendix C for ease of reference.

Table 109: Actor - Network Membership for Alabama and Florida

		Alabama						Florida					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
ICS Admin and Finance Section	*ic_af*									1			1
ICS Logistics Section (ESF #7)	*ic_log*			1			1			1			1
ICS Operations Section	*ic_op*												
ICS Operations Emergency Svcs Branch	*ic_opes*									1			1
ICS Operations Human Services Branch	*ic_ophs*		1	1			1		1	1			1
ICS Operations Infrastructure Branch	*ic_opinf*									1			1
ICS Operations Air Operations Branch	*ic_opsao*			1			1						
ICS Operations Section Support	*ic_opsup*			1			1						
ICS Planning Section	*ic_plan*			1			1				1	1	1
Transportation	*esf #01*												
Communications	*esf #02*									1			1
Public Works and Engineering	*esf #03*			1			1						
Firefighting	*esf #04*									1			1
Emergency Management	*esf #05*	1	1	1			1			1			1
Mass Care, Housing & Human Services	*esf #06*	1	1	1			1	1	1	1	1	1	1
Resource Support	*esf #07*	1	1	1			1			1			1
Public Health and Medical Services	*esf #08*	1	1	1	1		1	1	1	1	1	1	1
Urban Search and Rescue	*esf #09*									1	1	1	1
Oil and Hazardous Materials Response	*esf #10*												
Agriculture and Natural Resources	*esf #11*	1	1	1			1	1	1	1			1
Energy	*esf #12*									1			1
Public Safety and Security	*esf #13*			1			1	1	1				1
Long-Term Recovery & Mitigation	*esf #14*												
External Affairs	*esf #15*	1	1				1	1	1	1			1
Congressional and Legislative Relations	*esf #15cl*			1			1						
Community Relations	*esf #15cr*			1			1			1			1
Animal Management	*esf_anim*									1			1
Donation Management	*esf_don*	1	1	1	1	1	1			1	1	1	1
Military (State Only)	*esf_mil*			1			1			1			1
Recovery (if separate from Mitigation)	*esf_rec*												
Volunteer Management	*esf_vol*			1	1	1	1	1	1	1	1	1	1
Individual Assistance	*p_ia*			1	1	1	1			1			1
Emergency Response Team - Advance	*t_erta*			1			1						
Mobile Emergency Response System	*t_mers*			1			1						
Rapid Needs Assessment Team	*t_rna*												
Regional Response Coordination Center	*t_rrcc*												

		Alabama						Florida					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
Tribal Government	*tribal*												
Agriculture, US Dept. of (USDA)	*u_a*		1	1			1		1	1			1
USDA - Food and Nutrition Service	*u_a_fns*		1				1		1				1
USDA - Food Safety and Inspection Service	*u_a_fsis*			1			1						
USDA - National Resource Conservation Svc	*u_a_nrcs*			1			1						
USDA - Forest Service	*u_a_usfs*		1				1		1				1
Environmental Protection Agency	*u_epa*												
General Services Administration	*u_gsa*		1	1			1		1	1			1
Health and Human Services, US Dept. of	*u_hh*		1		1	1	1		1	1			1
HHS - Centers for Disease Control	*u_hh_cdc*												
HHS - US Public Health Service	*u_hh_phs*			1			1						
Homeland Security, US Dept. of	*u_hs*		1	1			1		1				1
DHS - US Customs and Border Protection	*u_hs_cbp*												
FEMA	*u_hs_fema*		1	1	1	1	1		1	1	1	1	1
DHS - Immigration & Naturalization Svc	*u_hs_ins*												
DHS - National Communications System	*u_hs_ncs*												
DHS - US Coast Guard	*u_hs_usc g*									1			1
Housing & Urban Develop., US Dept. of	*u_hud*		1	1			1		1				1
Interior, US Dept. of	*u_i*		1	1			1		1	1			1
Interior - National Park Service	*u_i_nps*												
Justice, US Dept. of	*u_j*		1				1		1				1
Justice - US Marshals Service	*u_j_ms*												
Labor, US Dept. of	*u_l*		1				1		1				1
National Aeronautics and Space Admin	*u_nasa*												
National Disaster Medical System	*u_ndms*		1	1	1	1	1		1				1
Office of Personnel Management	*u_opm*		1	1			1		1				1
State, US Dept. of	*u_s*												
Small Business Administration	*u_sba*		1				1		1				1
Social Security Administration	*u_ssa*		1				1		1				1
Transportation, US Dept. of	*u_t*		1				1		1				1
Treasury, US Dept. of	*u_tr*		1				1		1				1
Treasury - Internal Revenue Service	*u_tr_irs*		1	1			1		1				1
US Postal Service	*u_usps*		1	1			1		1				1
Veterans Affairs, US Dept. of	*u_va*		1		1	1	1		1				1

		Alabama						Florida					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
US Army Corps of Engineers	*d_ace*		1	1			1		1				1
US Air Force	*d_af*			1	1	1	1						
US Army	*d_army*												
US Dept of Defense	*d_dod*		1	1	1	1	1		1				1
US Navy and Marine Corps	*d_nmc*				1	1	1						
American Red Cross	*n_arc*	1	1	1	1	1	1	1	1	1	1	1	1
Americas Second Harvest	*n_ash*			1			1						
Civil Air Patrol	*n_cap*												
Corp for National and Community Service	*n_cncs*		1	1			1		1				1
EMAC	*n_emac*									1			1
RACES/ARES	*n_ham*			1			1						
NGO, not otherwise specified	*n_nos*			1			1						
Operation Blessing International	*n_obi*												
United Way	*n_uw*				1	1	1					1	1
Vol. Org. Active in Disaster	*n_voad*		1	1	1	1	1	1	1				1
State Hospital Assn	*sn_hosp*												
State Nursing Home Assn	*sn_nh*												
State Sheriff's Assn	*sn_sheriff*												
NGO, Food Bank, NOS	*xng_fb*				1	1	1						
NGO, Pet Care, NOS	*xng_pet*												
Red Cross, Other National Societies	*xrc_int*												
FBO, Adventist	*c_adv*			1	1	1	1			1			1
FBO, Baptist	*c_bap*			1	1	1	1			1	1	1	1
FBO, Catholic	*c_cath*												
FBO, Methodist	*c_meth*												
FBO, Other, not specified	*c_other*				1	1	1				1	1	1
FBO, Salvation Army	*c_salv*			1	1	1	1	1	1	1	1	1	1
FBO, Brethren Disaster Ministries	*xch_bdm*												
FBO, Church World Service	*xch_cws*												
FBO, College Youth Ministry	*xch_cym*												
FBO, Lutheran	*xch_lut*												
FBO, LDS Mormons	*xch_mor*												
FBO, Muslim	*xch_mus*												
FBO, Scientology	*xch_sci*												

		Alabama						Florida					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
Health Care, Hospitals	*xhc_hos*				1	1	1						
Transit, Bussing Operators	*xit_bus*												
Local Govt, Public Works	*xlg_dpw*										1	1	1
Local Govt, Emergency Management	*xlg_ema*				1	1	1				1	1	1
Local Govt, Elected Officials	*xlg_eo*												
Local Govt, Fire	*xlg_fd*				1	1	1						
Local Govt, Human Services	*xlg_hum*				1	1	1						
Local Govt, Law Enforcement	*xlg_le*				1	1	1						
Local Govt, Not otherwise specified	*xlg_nos*												
Local Govt, Public Health Agencies	*xlg_pha*												
Local Govt, School District	*xlg_sd*				1	1	1				1	1	1
University, non-state related	*x_univ*				1	1	1						
Association, Assembly Managers	*xas_am*												
Association, Chamber of Commerce	*xas_com*			1			1						
Association, Lodging	*xas_lod*												
Businesses, Cargo (FedEx, UPS)	*xbz_car*												
Businesses, Caterers (Aramark)	*xbz_cat*												
Businesses, Food/Grocery, Retail	*xbz_fgr*												
Businesses, Food/Grocery, Wholesale	*xbz_fgw*												
Businesses, Govt Contractors	*xbz_gc*												
Businesses, Lodging (Hotel/Motel)	*xbz_lod*												
Businesses, Retail Chains	*xbz_ret*												
State Agency, Administration	*st_adm*									1			1
State Agency, Agriculture	*st_ag*	1	1	1			1	1	1	1	1	1	1
State Agency, Animal	*st_an*												
State Agency, Professional Regulation	*st_br*							1	1	1	1	1	1
State Agency, Community Development	*st_cd*									1			1
State Agency, Corrections	*st_cor*							1	1				1
State Agency, Economic Development	*st_ecd*			1			1						
State Agency, Education	*st_ed*	1	1			1	1	1	1				1
State Agency, Elderly	*st_eld*	1	1				1	1	1	1			1
State Agency, EMA	*st_ema*	1	1	1	1	1	1		1	1	1	1	1
State Agency, Employment Services	*st_emp*							1	1				1
State Agency, Environment	*st_env*	1	1	1			1						
State Agency, Comm. & Faith Based Initiatives	*st_faith*			1			1			1			1
State Agency, Fire Marshal	*st_fm*									1			1

		Alabama						Florida					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
State Agency, Forestry	*st_for*			1			1						
State Agency, Wildlife	*st_fw*												
State Governor's Office	*st_gov*			1	1	1	1			1			1
State Agency, Health	*st_hea*	1	1	1			1	1	1	1			1
State Agency, Homeland Security	*st_hls*												
State Agency, Human Resources	*st_hr*	1	1	1	1	1	1						
State Agency, Social/Human Services	*st_hs*										1	1	1
State Agency, Insurance	*st_ins*												
State Agency, Justice	*st_just*												
State Agency, Children and Families	*st_kids*							1	1				1
State Agency, Laboratories	*st_labs*												
State Agency, Marine	*st_mar*												
State Agency, Medicaid	*st_medicaid*												
State Agency, Mental Health / Retardation	*st_mh*	1	1				1						
State Agency, Motor Vehicles	*st_mv*									1			1
State Agency, Military / National Guard	*st_ng*	1	1	1	1	1	1	1	1	1	1	1	1
State Agency, Parks	*st_park*				1	1	1						
State Agency, Procurement	*st_proc*												
State Agency, Police	*st_ps*			1	1	1	1			1	1	1	1
State Agency, Public Service/Utilities	*st_psuc*									1			1
State Agency, Rehabilitation	*st_rehab*												
State Agency, Space	*st_spa*												
State Agency, State Department	*st_ss*												
State Agency, Tourism	*st_tour*												
State Agency, Transportation	*st_tra*	1	1	1			1						
State Agency, Tribal Affairs	*st_trib*			1			1						
State Agency, Unemployment	*st_unemp*												
State Agency, University/Higher Ed	*st_univ*				1	1	1						

Table 110: Actor - Network Membership for Louisiana and Mississippi

		Louisiana						Mississippi					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
ICS Admin and Finance Section	*ic_af*									1			1
ICS Logistics Section (ESF #7)	*ic_log*			1			1				1	1	1
ICS Operations Section	*ic_op*				1	1	1			1			1
ICS Operations Emergency Svcs Branch	*ic_opes*												
ICS Operations Human Services Branch	*ic_ophs*		1	1	1	1	1		1	1	1	1	1
ICS Operations Infrastructure Branch	*ic_opinf*									1			1
ICS Operations Air Operations Branch	*ic_opsao*												
ICS Operations Section Support	*ic_opsup*									1			1
ICS Planning Section	*ic_plan*				1	1	1						
Transportation	*esf #01*	1	1		1	1	1			1			1
Communications	*esf #02*	1	1		1	1	1			1			1
Public Works and Engineering	*esf #03*			1	1	1	1			1			1
Firefighting	*esf #04*			1	1	1	1			1			1
Emergency Management	*esf #05*	1	1	1	1	1	1	1	1	1			1
Mass Care, Housing & Human Services	*esf #06*	1	1	1	1	1	1	1	1	1	1	1	1
Resource Support	*esf #07*	1	1	1	1	1	1			1			1
Public Health and Medical Services	*esf #08*	1	1	1	1	1	1	1	1	1			1
Urban Search and Rescue	*esf #09*	1	1		1	1	1			1			1
Oil and Hazardous Materials Response	*esf #10*				1	1	1			1			1
Agriculture and Natural Resources	*esf #11*	1	1	1	1	1	1	1	1	1	1	1	1
Energy	*esf #12*				1	1	1	1	1				1
Public Safety and Security	*esf #13*				1	1	1				1	1	1
Long-Term Recovery & Mitigation	*esf #14*	1	1		1	1	1	1	1				1
External Affairs	*esf #15*	1	1	1	1	1	1						
Congressional and Legislative Relations	*esf #15cl*									1			1
Community Relations	*esf #15cr*			1			1			1			1
Animal Management	*esf_anim*												
Donation Management	*esf_don*			1			1			1	1	1	1
Military (State Only)	*esf_mil*			1			1						
Recovery (if separate from Mitigation)	*esf_rec*												
Volunteer Management	*esf_vol*			1	1	1	1			1	1	1	1
Individual Assistance	*p_ia*			1			1			1			1
Emergency Response Team - Advance	*t_erta*			1			1						
Mobile Emergency Response System	*t_mers*			1			1						
Rapid Needs Assessment Team	*t_rna*				1	1	1						
Regional Response Coordination Center	*t_rrcc*												

		Louisiana						Mississippi					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
Tribal Government	*tribal*									1			1
Agriculture, US Dept. of (USDA)	*u_a*		1	1	1	1	1		1	1	1	1	1
USDA - Food and Nutrition Service	*u_a_fns*		1	1			1		1				1
USDA - Food Safety and Inspection Service	*u_a_fsis*			1			1				1	1	1
USDA - National Resource Conservation Svc	*u_a_nrcs*			1			1						
USDA - Forest Service	*u_a_usfs*		1	1	1	1	1		1	1			1
Environmental Protection Agency	*u_epa*									1			1
General Services Administration	*u_gsa*		1	1			1		1	1	1	1	1
Health and Human Services, US Dept. of	*u_hh*		1	1	1	1	1		1	1			1
HHS - Centers for Disease Control	*u_hh_cdc*			1	1	1	1						
HHS - US Public Health Service	*u_hh_phs*			1	1	1	1						
Homeland Security, US Dept. of	*u_hs*		1	1	1	1	1		1				1
DHS - US Customs and Border Protection	*u_hs_cbp*				1	1	1						
FEMA	*u_hs_fema*		1	1	1	1	1		1	1	1	1	1
DHS - Immigration & Naturalization Svc	*u_hs_ins*				1	1	1						
DHS - National Communications System	*u_hs_ncs*									1			1
DHS - US Coast Guard	*u_hs_uscg*			1	1	1	1			1			1
Housing & Urban Develop., US Dept. of	*u_hud*		1	1			1		1				1
Interior, US Dept. of	*u_i*		1	1	1	1	1		1	1			1
Interior - National Park Service	*u_i_nps*				1	1	1			1			1
Justice, US Dept. of	*u_j*		1		1	1	1		1				1
Justice - US Marshals Service	*u_j_ms*				1	1	1						
Labor, US Dept. of	*u_l*		1				1		1				1
National Aeronautics and Space Admin	*u_nasa*			1			1						
National Disaster Medical System	*u_ndms*		1	1	1	1	1		1				1
Office of Personnel Management	*u_opm*		1	1			1		1				1
State, US Dept. of	*u_s*												
Small Business Administration	*u_sba*		1		1	1	1		1		1	1	1
Social Security Administration	*u_ssa*		1		1	1	1		1				1
Transportation, US Dept. of	*u_t*		1		1	1	1		1	1			1
Treasury, US Dept. of	*u_tr*		1	1			1		1				1
Treasury - Internal Revenue Service	*u_tr_irs*		1	1			1		1				1
US Postal Service	*u_usps*		1	1			1		1				1
Veterans Affairs, US Dept. of	*u_va*		1				1		1				1

		Louisiana						Mississippi					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
US Army Corps of Engineers	*d_ace*		1	1	1	1	1		1	1	1	1	1
US Air Force	*d_af*			1	1	1	1			1			1
US Army	*d_army*			1	1	1	1			1			1
US Dept of Defense	*d_dod*		1	1	1	1	1		1	1			1
US Navy and Marine Corps	*d_nmc*			1			1			1			1
American Red Cross	*n_arc*	1	1	1	1	1	1	1	1	1	1	1	1
Americas Second Harvest	*n_ash*			1	1	1	1			1	1	1	1
Civil Air Patrol	*n_cap*				1	1	1						
Corp for National and Community Service	*n_cncs*		1				1		1		1	1	1
EMAC	*n_emac*										1	1	1
RACES/ARES	*n_ham*				1	1	1				1	1	1
NGO, not otherwise specified	*n_nos*												
Operation Blessing International	*n_obi*				1	1	1				1	1	1
United Way	*n_uw*				1	1	1						
Vol. Org. Active in Disaster	*n_voad*		1	1	1	1	1	1	1	1	1	1	1
State Hospital Assn	*sn_hosp*			1			1						
State Nursing Home Assn	*sn_nh*			1			1						
State Sheriff's Assn	*sn_sheriff*			1			1						
NGO, Food Bank, NOS	*xng_fb*				1	1	1						
NGO, Pet Care, NOS	*xng_pet*											1	1
Red Cross, Other National Societies	*xrc_int*				1	1	1						
FBO, Adventist	*c_adv*					1	1				1	1	1
FBO, Baptist	*c_bap*				1	1	1			1	1	1	1
FBO, Catholic	*c_cath*				1	1	1						
FBO, Methodist	*c_meth*				1	1	1						
FBO, Other, not specified	*c_other*	1	1		1	1	1				1	1	1
FBO, Salvation Army	*c_salv*	1	1	1	1	1	1	1	1	1	1	1	1
FBO, Brethren Disaster Ministries	*xch_bdm*				1	1	1						
FBO, Church World Service	*xch_cws*										1	1	1
FBO, College Youth Ministry	*xch_cym*										1	1	1
FBO, Lutheran	*xch_lut*				1	1	1						
FBO, LDS Mormons	*xch_mor*				1	1	1						
FBO, Muslim	*xch_mus*										1		1
FBO, Scientology	*xch_sci*				1	1	1						

		Louisiana						Mississippi					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
Health Care, Hospitals	*xhc_hos*				1	1	1						
Transit, Bussing Operators	*xit_bus*				1	1	1						
Local Govt, Public Works	*xlg_dpw*				1	1	1						
Local Govt, Emergency Management	*xlg_ema*				1	1	1				1	1	1
Local Govt, Elected Officials	*xlg_eo*										1	1	1
Local Govt, Fire	*xlg_fd*												
Local Govt, Human Services	*xlg_hum*												
Local Govt, Law Enforcement	*xlg_le*				1	1	1				1	1	1
Local Govt, Not otherwise specified	*xlg_nos*				1	1	1				1	1	1
Local Govt, Public Health Agencies	*xlg_pha*												
Local Govt, School District	*xlg_sd*												
University, non-state related	*x_univ*				1	1	1						
Association, Assembly Managers	*xas_am*			1			1						
Association, Chamber of Commerce	*xas_com*			1	1	1	1						
Association, Lodging	*xas_lod*										1	1	1
Businesses, Cargo (FedEx, UPS)	*xbz_car*												
Businesses, Caterers (Aramark)	*xbz_cat*												
Businesses, Food/Grocery, Retail	*xbz_fgr*												
Businesses, Food/Grocery, Wholesale	*xbz_fgw*										1	1	1
Businesses, Govt Contractors	*xbz_gc*				1	1	1						
Businesses, Lodging (Hotel/Motel)	*xbz_lod*										1	1	1
Businesses, Retail Chains	*xbz_ret*				1	1	1					1	1
State Agency, Administration	*st_adm*												
State Agency, Agriculture	*st_ag*	1	1	1			1	1	1		1	1	1
State Agency, Animal	*st_an*							1	1				1
State Agency, Professional Regulation	*st_br*							1	1				1
State Agency, Community Development	*st_cd*												
State Agency, Corrections	*st_cor*	1	1	1	1	1	1						
State Agency, Economic Development	*st_ecd*												
State Agency, Education	*st_ed*					1	1	1	1				1
State Agency, Elderly	*st_eld*	1	1				1						
State Agency, EMA	*st_ema*	1	1	1	1	1	1	1	1		1	1	1
State Agency, Employment Services	*st_emp*												
State Agency, Environment	*st_env*	1	1	1	1	1	1	1	1				1
State Agency, Comm. & Faith Based Initiatives	*st_faith*												
State Agency, Fire Marshal	*st_fm*	1	1				1						

		Louisiana						Mississippi					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
State Agency, Forestry	*st_for*							1	1				1
State Agency, Wildlife	*st_fw*	1	1	1			1	1	1				1
State Governor's Office	*st_gov*				1	1	1				1	1	1
State Agency, Health	*st_hea*	1	1	1	1	1	1	1	1		1	1	1
State Agency, Homeland Security	*st_hls*							1	1				1
State Agency, Human Resources	*st_hr*												
State Agency, Social/Human Services	*st_hs*	1	1	1	1	1	1	1	1				1
State Agency, Insurance	*st_ins*												
State Agency, Justice	*st_just*				1	1	1	1	1				1
State Agency, Children and Families	*st_kids*				1	1	1						
State Agency, Laboratories	*st_labs*							1	1				1
State Agency, Marine	*st_mar*							1	1				1
State Agency, Medicaid	*st_medicaid*							1	1				1
State Agency, Mental Health / Retardation	*st_mh*							1	1				1
State Agency, Motor Vehicles	*st_mv*					1	1						
State Agency, Military / National Guard	*st_ng*	1	1	1	1	1	1	1	1	1			1
State Agency, Parks	*st_park*	1	1	1			1						
State Agency, Procurement	*st_proc*												
State Agency, Police	*st_ps*			1	1	1	1	1	1		1	1	1
State Agency, Public Service/Utilities	*st_psuc*												
State Agency, Rehabilitation	*st_rehab*							1	1				1
State Agency, Space	*st_spa*										1	1	1
State Agency, State Department	*st_ss*							1	1				1
State Agency, Tourism	*st_tour*	1	1	1			1	1	1				1
State Agency, Transportation	*st_tra*	1	1	1	1	1	1	1	1				1
State Agency, Tribal Affairs	*st_trib*			1			1						
State Agency, Unemployment	*st_unemp*				1	1	1						
State Agency, University/Higher Ed	*st_univ*	1	1	1			1	1	1				1

Table 111: Actor - Network Membership for Texas and Regional/National

		Texas						Regional		
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	Perceived	Desired	Combined
ICS Admin and Finance Section	*ic_af*									
ICS Logistics Section (ESF #7)	*ic_log*			1	1	1	1	1	1	1
ICS Operations Section	*ic_op*									
ICS Operations Emergency Svcs Branch	*ic_opes*									
ICS Operations Human Services Branch	*ic_ophs*		1	1			1			
ICS Operations Infrastructure Branch	*ic_opinf*									
ICS Operations Air Operations Branch	*ic_opsao*									
ICS Operations Section Support	*ic_opsup*									
ICS Planning Section	*ic_plan*							1	1	1
Transportation	*esf #01*									
Communications	*esf #02*			1			1			
Public Works and Engineering	*esf #03*			1			1			
Firefighting	*esf #04*			1			1			
Emergency Management	*esf #05*			1			1	1	1	1
Mass Care, Housing & Human Services	*esf #06*	1	1	1	1	1	1	1	1	1
Resource Support	*esf #07*			1			1			
Public Health and Medical Services	*esf #08*	1	1	1		1	1	1	1	1
Urban Search and Rescue	*esf #09*							1	1	1
Oil and Hazardous Materials Response	*esf #10*									
Agriculture and Natural Resources	*esf #11*	1	1	1	1	1	1			
Energy	*esf #12*									
Public Safety and Security	*esf #13*			1			1			
Long-Term Recovery & Mitigation	*esf #14*									
External Affairs	*esf #15*	1	1	1			1			
Congressional and Legislative Relations	*esf #15cl*			1			1			
Community Relations	*esf #15cr*			1			1			
Animal Management	*esf_anim*									
Donation Management	*esf_don*	1	1	1			1	1	1	1
Military (State Only)	*esf_mil*			1			1			
Recovery (if separate from Mitigation)	*esf_rec*	1	1				1			
Volunteer Management	*esf_vol*			1	1	1	1	1	1	1
Individual Assistance	*p_ia*			1			1			
Emergency Response Team - Advance	*t_erta*			1			1			
Mobile Emergency Response System	*t_mers*			1			1			
Rapid Needs Assessment Team	*t_rna*									
Regional Response Coordination Center	*t_rrcc*									

		Texas						Regional		
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	Perceived	Desired	Combined
Tribal Government	*tribal*									
Agriculture, US Dept. of (USDA)	*u_a*		1	1	1	1	1	1	1	1
USDA - Food and Nutrition Service	*u_a_fns*		1	1			1			
USDA - Food Safety and Inspection Service	*u_a_fsis*			1			1			
USDA - National Resource Conservation Svc	*u_a_nrcs*			1			1			
USDA - Forest Service	*u_a_usfs*		1	1	1	1	1			
Environmental Protection Agency	*u_epa*									
General Services Administration	*u_gsa*		1	1			1			
Health and Human Services, US Dept. of	*u_hh*		1	1	1	1	1	1	1	1
HHS - Centers for Disease Control	*u_hh_cdc*									
HHS - US Public Health Service	*u_hh_phs*			1			1	1	1	1
Homeland Security, US Dept. of	*u_hs*		1	1	1	1	1	1	1	1
DHS - US Customs and Border Protection	*u_hs_cbp*			1			1			
FEMA	*u_hs_fema*		1	1	1	1	1	1	1	1
DHS - Immigration & Naturalization Svc	*u_hs_ins*									
DHS - National Communications System	*u_hs_ncs*			1			1			
DHS - US Coast Guard	*u_hs_uscg*				1	1	1	1	1	1
Housing & Urban Develop., US Dept. of	*u_hud*		1	1	1	1	1	1	1	1
Interior, US Dept. of	*u_i*		1	1			1			
Interior - National Park Service	*u_i_nps*									
Justice, US Dept. of	*u_j*		1	1			1			
Justice - US Marshals Service	*u_j_ms*				1	1	1			
Labor, US Dept. of	*u_l*		1		1	1	1			
National Aeronautics and Space Admin	*u_nasa*									
National Disaster Medical System	*u_ndms*		1	1			1	1	1	1
Office of Personnel Management	*u_opm*		1	1			1			
State, US Dept. of	*u_s*							1	1	1
Small Business Administration	*u_sba*		1				1	1	1	1
Social Security Administration	*u_ssa*		1		1	1	1			
Transportation, US Dept. of	*u_t*		1				1	1	1	1
Treasury, US Dept. of	*u_tr*		1				1			
Treasury - Internal Revenue Service	*u_tr_irs*		1	1	1	1	1			
US Postal Service	*u_usps*		1	1	1	1	1	1	1	1
Veterans Affairs, US Dept. of	*u_va*		1		1	1	1	1	1	1

		Texas						Regional		
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	Perceived	Desired	Combined
US Army Corps of Engineers	*d_ace*		1	1	1	1	1			
US Air Force	*d_af*			1			1	1	1	1
US Army	*d_army*									
US Dept of Defense	*d_dod*		1				1	1	1	1
US Navy and Marine Corps	*d_nmc*									
American Red Cross	*n_arc*	1	1	1	1	1	1	1	1	1
Americas Second Harvest	*n_ash*			1	1	1	1	1	1	1
Civil Air Patrol	*n_cap*									
Corp for National and Community Service	*n_cncs*		1	1	1	1	1			
EMAC	*n_emac*			1			1			
RACES/ARES	*n_ham*			1			1			
NGO, not otherwise specified	*n_nos*							1	1	1
Operation Blessing International	*n_obi*							1	1	1
United Way	*n_uw*				1	1	1	1	1	1
Vol. Org. Active in Disaster	*n_voad*	1	1		1	1	1	1	1	1
State Hospital Assn	*sn_hosp*									
State Nursing Home Assn	*sn_nh*									
State Sheriff's Assn	*sn_sheriff*									
NGO, Food Bank, NOS	*xng_fb*				1	1	1	1	1	1
NGO, Pet Care, NOS	*xng_pet*					1	1	1	1	1
Red Cross, Other National Societies	*xrc_int*									
FBO, Adventist	*c_adv*				1	1	1	1	1	1
FBO, Baptist	*c_bap*			1	1	1	1	1	1	1
FBO, Catholic	*c_cath*							1	1	1
FBO, Methodist	*c_meth*				1	1	1	1	1	1
FBO, Other, not specified	*c_other*				1	1	1	1	1	1
FBO, Salvation Army	*c_salv*	1	1	1	1	1	1	1	1	1
FBO, Brethren Disaster Ministries	*xch_bdm*							1	1	1
FBO, Church World Service	*xch_cws*								1	1
FBO, College Youth Ministry	*xch_cym*									
FBO, Lutheran	*xch_lut*							1	1	1
FBO, LDS Mormons	*xch_mor*									
FBO, Muslim	*xch_mus*									
FBO, Scientology	*xch_sci*									

		Texas						Regional		
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	Perceived	Desired	Combined
Health Care, Hospitals	*xhc_hos*				1	1	1	1	1	1
Transit, Bussing Operators	*xit_bus*									
Local Govt, Public Works	*xlg_dpw*									
Local Govt, Emergency Management	*xlg_ema*				1	1	1	1	1	1
Local Govt, Elected Officials	*xlg_eo*				1	1	1	1	1	1
Local Govt, Fire	*xlg_fd*				1	1	1	1	1	1
Local Govt, Human Services	*xlg_hum*							1	1	1
Local Govt, Law Enforcement	*xlg_le*				1	1	1	1	1	1
Local Govt, Not otherwise specified	*xlg_nos*									
Local Govt, Public Health Agencies	*xlg_pha*					1	1			
Local Govt, School District	*xlg_sd*				1	1	1			
University, non-state related	*x_univ*									
Association, Assembly Managers	*xas_am*							1	1	1
Association, Chamber of Commerce	*xas_com*			1			1			
Association, Lodging	*xas_lod*									
Businesses, Cargo (FedEx, UPS)	*xbz_car*					1	1			
Businesses, Caterers (Aramark)	*xbz_cat*				1	1	1			
Businesses, Food/Grocery, Retail	*xbz_fgr*				1	1	1			
Businesses, Food/Grocery, Wholesale	*xbz_fgw*									
Businesses, Govt Contractors	*xbz_gc*							1	1	1
Businesses, Lodging (Hotel/Motel)	*xbz_lod*				1	1	1	1	1	1
Businesses, Retail Chains	*xbz_ret*					1	1			
State Agency, Administration	*st_adm*									
State Agency, Agriculture	*st_ag*	1	1				1			
State Agency, Animal	*st_an*			1			1			
State Agency, Professional Regulation	*st_br*									
State Agency, Community Development	*st_cd*									
State Agency, Corrections	*st_cor*	1	1	1	1	1	1			
State Agency, Economic Development	*st_ecd*									
State Agency, Education	*st_ed*	1	1				1			
State Agency, Elderly	*st_eld*	1	1	1			1			
State Agency, EMA	*st_ema*		1	1	1	1	1	1	1	1
State Agency, Employment Services	*st_emp*				1	1	1			
State Agency, Environment	*st_env*	1	1	1			1			
State Agency, Comm. & Faith Based Initiatives	*st_faith*									
State Agency, Fire Marshal	*st_fm*				1	1	1			

		Texas						Regional		
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined	Perceived	Desired	Combined
State Agency, Forestry	*st_for*			1	1	1	1			
State Agency, Wildlife	*st_fw*									
State Governor's Office	*st_gov*				1	1	1			
State Agency, Health	*st_hea*	1	1	1	1	1	1			
State Agency, Homeland Security	*st_hls*									
State Agency, Human Resources	*st_hr*									
State Agency, Social/Human Services	*st_hs*	1	1	1	1	1	1			
State Agency, Insurance	*st_ins*			1			1			
State Agency, Justice	*st_just*									
State Agency, Children and Families	*st_kids*									
State Agency, Laboratories	*st_labs*									
State Agency, Marine	*st_mar*									
State Agency, Medicaid	*st_medicaid*			1			1			
State Agency, Mental Health / Retardation	*st_mh*									
State Agency, Motor Vehicles	*st_mv*									
State Agency, Military / National Guard	*st_ng*	1	1	1			1	1	1	1
State Agency, Parks	*st_park*	1	1	1			1			
State Agency, Procurement	*st_proc*			1			1			
State Agency, Police	*st_ps*			1	1	1	1			
State Agency, Public Service/Utilities	*st_psuc*									
State Agency, Rehabilitation	*st_rehab*									
State Agency, Space	*st_spa*				1	1	1			
State Agency, State Department	*st_ss*									
State Agency, Tourism	*st_tour*									
State Agency, Transportation	*st_tra*			1	1	1	1			
State Agency, Tribal Affairs	*st_trib*			1			1			
State Agency, Unemployment	*st_unemp*									
State Agency, University/Higher Ed	*st_univ*									

Table 112: Actor - Network Membership for the Aggregated Networks

		Aggregated					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
ICS Admin and Finance Section	*ic_af*			1			1
ICS Logistics Section (ESF #7)	*ic_log*			1	1	1	1
ICS Operations Section	*ic_op*			1	1	1	1
ICS Operations Emergency Svcs Branch	*ic_opes*			1			1
ICS Operations Human Services Branch	*ic_ophs*		1	1	1	1	1
ICS Operations Infrastructure Branch	*ic_opinf*			1			1
ICS Operations Air Operations Branch	*ic_opsao*			1			1
ICS Operations Section Support	*ic_opsup*			1			1
ICS Planning Section	*ic_plan*			1	1	1	1
Transportation	*esf #01*	1	1	1	1	1	1
Communications	*esf #02*	1	1	1	1	1	1
Public Works and Engineering	*esf #03*			1	1	1	1
Firefighting	*esf #04*			1	1	1	1
Emergency Management	*esf #05*	1	1	1	1	1	1
Mass Care, Housing & Human Services	*esf #06*	1	1	1	1	1	1
Resource Support	*esf #07*	1	1	1	1	1	1
Public Health and Medical Services	*esf #08*	1	1	1	1	1	1
Urban Search and Rescue	*esf #09*	1	1	1	1	1	1
Oil and Hazardous Materials Response	*esf #10*			1	1	1	1
Agriculture and Natural Resources	*esf #11*	1	1	1	1	1	1
Energy	*esf #12*	1	1	1	1	1	1
Public Safety and Security	*esf #13*	1	1	1	1	1	1
Long-Term Recovery & Mitigation	*esf #14*	1	1		1	1	1
External Affairs	*esf #15*	1	1	1	1	1	1
Congressional and Legislative Relations	*esf #15cl*			1			1
Community Relations	*esf #15cr*			1			1
Animal Management	*esf_anim*			1			1
Donation Management	*esf_don*	1	1	1	1	1	1
Military (State Only)	*esf_mil*			1			1
Recovery (if separate from Mitigation)	*esf_rec*	1	1				1
Volunteer Management	*esf_vol*	1	1	1	1	1	1
Individual Assistance	*p_ia*			1	1	1	1
Emergency Response Team - Advance	*t_erta*			1			1
Mobile Emergency Response System	*t_mers*			1			1
Rapid Needs Assessment Team	*t_rna*				1	1	1
Regional Response Coordination Center	*t_rrcc*						

		Aggregated					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
Tribal Government	*tribal*			1			1
Agriculture, US Dept. of (USDA)	*u_a*		1	1	1	1	1
USDA - Food and Nutrition Service	*u_a_fns*		1	1			1
USDA - Food Safety and Inspection Service	*u_a_fsis*			1	1	1	1
USDA - National Resource Conservation Svc	*u_a_nrcs*			1			1
USDA - Forest Service	*u_a_usfs*		1	1	1	1	1
Environmental Protection Agency	*u_epa*			1			1
General Services Administration	*u_gsa*		1	1	1	1	1
Health and Human Services, US Dept. of	*u_hh*		1	1	1	1	1
HHS - Centers for Disease Control	*u_hh_cdc*			1	1	1	1
HHS - US Public Health Service	*u_hh_phs*			1	1	1	1
Homeland Security, US Dept. of	*u_hs*		1	1	1	1	1
DHS - US Customs and Border Protection	*u_hs_cbp*			1	1	1	1
FEMA	*u_hs_fema*		1	1	1	1	1
DHS - Immigration & Naturalization Svc	*u_hs_ins*				1	1	1
DHS - National Communications System	*u_hs_ncs*			1			1
DHS - US Coast Guard	*u_hs_uscg*			1	1	1	1
Housing & Urban Develop., US Dept. of	*u_hud*		1	1	1	1	1
Interior, US Dept. of	*u_i*		1	1	1	1	1
Interior - National Park Service	*u_i_nps*			1	1	1	1
Justice, US Dept. of	*u_j*		1	1	1	1	1
Justice - US Marshals Service	*u_j_ms*				1	1	1
Labor, US Dept. of	*u_l*		1		1	1	1
National Aeronautics and Space Admin	*u_nasa*			1			1
National Disaster Medical System	*u_ndms*		1	1	1	1	1
Office of Personnel Management	*u_opm*		1	1			1
State, US Dept. of	*u_s*				1	1	1
Small Business Administration	*u_sba*		1		1	1	1
Social Security Administration	*u_ssa*		1		1	1	1
Transportation, US Dept. of	*u_t*		1	1	1	1	1
Treasury, US Dept. of	*u_tr*		1	1			1
Treasury - Internal Revenue Service	*u_tr_irs*		1	1	1	1	1
US Postal Service	*u_usps*		1	1	1	1	1
Veterans Affairs, US Dept. of	*u_va*		1		1	1	1

		Aggregated					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
US Army Corps of Engineers	*d_ace*		1	1	1	1	1
US Air Force	*d_af*			1	1	1	1
US Army	*d_army*			1	1	1	1
US Dept of Defense	*d_dod*		1	1	1	1	1
US Navy and Marine Corps	*d_nmc*			1	1	1	1
American Red Cross	*n_arc*	1	1	1	1	1	1
Americas Second Harvest	*n_ash*			1	1	1	1
Civil Air Patrol	*n_cap*				1	1	1
Corp for National and Community Service	*n_cncs*		1	1	1	1	1
EMAC	*n_emac*			1	1	1	1
RACES/ARES	*n_ham*			1	1	1	1
NGO, not otherwise specified	*n_nos*			1	1	1	1
Operation Blessing International	*n_obi*				1	1	1
United Way	*n_uw*				1	1	1
Vol. Org. Active in Disaster	*n_voad*	1	1	1	1	1	1
State Hospital Assn	*sn_hosp*			1			1
State Nursing Home Assn	*sn_nh*			1			1
State Sheriff's Assn	*sn_sheriff*			1			1
NGO, Food Bank, NOS	*xng_fb*				1	1	1
NGO, Pet Care, NOS	*xng_pet*				1	1	1
Red Cross, Other National Societies	*xrc_int*				1	1	1
FBO, Adventist	*c_adv*			1	1	1	1
FBO, Baptist	*c_bap*			1	1	1	1
FBO, Catholic	*c_cath*				1	1	1
FBO, Methodist	*c_meth*				1	1	1
FBO, Other, not specified	*c_other*	1	1		1	1	1
FBO, Salvation Army	*c_salv*	1	1	1	1	1	1
FBO, Brethren Disaster Ministries	*xch_bdm*				1	1	1
FBO, Church World Service	*xch_cws*				1	1	1
FBO, College Youth Ministry	*xch_cym*				1	1	1
FBO, Lutheran	*xch_lut*				1	1	1
FBO, LDS Mormons	*xch_mor*				1	1	1
FBO, Muslim	*xch_mus*				1		1
FBO, Scientology	*xch_sci*				1	1	1

		Aggregated					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
Health Care, Hospitals	*xhc_hos*				1	1	1
Transit, Bussing Operators	*xit_bus*				1	1	1
Local Govt, Public Works	*xlg_dpw*				1	1	1
Local Govt, Emergency Management	*xlg_ema*				1	1	1
Local Govt, Elected Officials	*xlg_eo*				1	1	1
Local Govt, Fire	*xlg_fd*				1	1	1
Local Govt, Human Services	*xlg_hum*				1	1	1
Local Govt, Law Enforcement	*xlg_le*				1	1	1
Local Govt, Not otherwise specified	*xlg_nos*				1	1	1
Local Govt, Public Health Agencies	*xlg_pha*					1	1
Local Govt, School District	*xlg_sd*				1	1	1
University, non-state related	*x_univ*				1	1	1
Association, Assembly Managers	*xas_am*			1	1	1	1
Association, Chamber of Commerce	*xas_com*			1	1	1	1
Association, Lodging	*xas_lod*				1	1	1
Businesses, Cargo (FedEx, UPS)	*xbz_car*					1	1
Businesses, Caterers (Aramark)	*xbz_cat*				1	1	1
Businesses, Food/Grocery, Retail	*xbz_fgr*				1	1	1
Businesses, Food/Grocery, Wholesale	*xbz_fgw*				1	1	1
Businesses, Govt Contractors	*xbz_gc*				1	1	1
Businesses, Lodging (Hotel/Motel)	*xbz_lod*				1	1	1
Businesses, Retail Chains	*xbz_ret*				1	1	1
State Agency, Administration	*st_adm*			1			1
State Agency, Agriculture	*st_ag*	1	1	1	1	1	1
State Agency, Animal	*st_an*	1	1	1			1
State Agency, Professional Regulation	*st_br*	1	1	1	1	1	1
State Agency, Community Development	*st_cd*			1			1
State Agency, Corrections	*st_cor*	1	1	1	1	1	1
State Agency, Economic Development	*st_ecd*			1			1
State Agency, Education	*st_ed*	1	1			1	1
State Agency, Elderly	*st_eld*	1	1	1			1
State Agency, EMA	*st_ema*	1	1	1	1	1	1
State Agency, Employment Services	*st_emp*	1	1		1	1	1
State Agency, Environment	*st_env*	1	1	1	1	1	1
State Agency, Comm. & Faith Based Initiatives	*st_faith*			1			1
State Agency, Fire Marshal	*st_fm*	1	1	1	1	1	1

		Aggregated					
Agency	Variable	State Plan	State Plan + NRP	Reported	Perceived	Desired	Combined
State Agency, Forestry	*st_for*	1	1	1	1	1	1
State Agency, Wildlife	*st_fw*	1	1	1			1
State Governor's Office	*st_gov*			1	1	1	1
State Agency, Health	*st_hea*	1	1	1	1	1	1
State Agency, Homeland Security	*st_hls*	1	1				1
State Agency, Human Resources	*st_hr*	1	1	1	1	1	1
State Agency, Social/Human Services	*st_hs*	1	1	1	1	1	1
State Agency, Insurance	*st_ins*			1			1
State Agency, Justice	*st_just*	1	1		1	1	1
State Agency, Children and Families	*st_kids*	1	1		1	1	1
State Agency, Laboratories	*st_labs*	1	1				1
State Agency, Marine	*st_mar*	1	1				1
State Agency, Medicaid	*st_medicaid*	1	1	1			1
State Agency, Mental Health / Retardation	*st_mh*	1	1				1
State Agency, Motor Vehicles	*st_mv*			1		1	1
State Agency, Military / National Guard	*st_ng*	1	1	1	1	1	1
State Agency, Parks	*st_park*	1	1	1	1	1	1
State Agency, Procurement	*st_proc*			1			1
State Agency, Police	*st_ps*	1	1	1	1	1	1
State Agency, Public Service/Utilities	*st_psuc*			1			1
State Agency, Rehabilitation	*st_rehab*	1	1				1
State Agency, Space	*st_spa*				1	1	1
State Agency, State Department	*st_ss*	1	1				1
State Agency, Tourism	*st_tour*	1	1	1			1
State Agency, Transportation	*st_tra*	1	1	1	1	1	1
State Agency, Tribal Affairs	*st_trib*			1			1
State Agency, Unemployment	*st_unemp*				1	1	1
State Agency, University/Higher Ed	*st_univ*	1	1	1	1	1	1

APPENDIX E

INTERVIEW SPECIFICATION

INTERVIEW SCHEDULE

A. Introduction

Thank you for agreeing to this interview.

My name is Robert Skertich. I am a doctoral candidate at the Graduate School of Public and International Affairs, University of Pittsburgh. I am conducting this study for scientific purposes only. Your responses will be kept under professional standards of confidentiality.

The purpose of the interview is to determine the networks of agencies that you recall working with during the Katrina/Rita/Wilma disaster response operations, and how you might modify the network if the same magnitude of storm reoccurs.

This interview is specifically concerned with the interaction among agencies providing immediate human services (such as sheltering, feeding and bulk distribution) during the 2005 Hurricane Season (Katrina, Rita, Wilma) in the Gulf States (Alabama, Florida, Louisiana, Mississippi and Texas).

The specific time frame is during the response phase and does not include long-term recovery activities.

B. Demographic Information

1. How long have you been working or volunteering in emergency management?
2. What degrees and/or specialized certifications do you hold?
3. How many presidential declarations have you worked?
4. During the 2005 Hurricane Season:
    a. For which agency did you work/volunteer?
    b. Which storm(s) did you work?
    c. What was your assignment location?
    d. What was your role?
    e. How long were you assigned to this operation?

C. Questions

1. (Perceived) *What network of agencies providing response-oriented human services and mass care did the interviewee recall working with during the storm?*

    Q1-1 During this storm, which agencies did you work with to coordinate or provide human services/mass care?

    Q1-2 Had you worked with these agencies on previous disasters?

        a. If no, explain why (not required/available, new agency/role, etc):

2. (Desired) *What network of agencies does the interviewee believe would be optimal in future disaster operations?*

Q2-1 If the same disaster occurs next season, and you are asked to coordinate human services/mass care, with which agencies would you choose to work?

Q2-2 Are there agencies that you worked with in the 2005 storms that you would not choose or expect to work with in the future? If so, explain

3. (Supplemental Questions) *What essential elements of information were collected and how were they communicated?*

Q3-1 In providing human services/mass care, what were your information needs?

Q3-2 What information seemed most difficult to obtain? Why?

Q3-3 How was information communicated?

Q3-4 How would you improve information collection, sharing and reporting?

4. (Supplemental Questions) *How can response operation networks be improved?*

Q4-1 What, in your judgment, would be the highest priorities for improving performance in state/federal response to future disasters?

Q4-2 What changes, if any, have been made to improve performance in state/federal coordination in future disasters?

Q4-3 In what ways have the needs and services of disaster management changed, in your state since the occurrence of the 2005 hurricanes?

Letter to Interviewees

Action and Information Networks in Disaster Management
Dissertation Research Project

Robert L. Skertich, PhD Candidate, Public Policy and Administration
University of Pittsburgh Graduate School of Public and International Affairs

Telephone:
Email:
Mailing Address:

The purpose of this research study is to study will identify and compare the planned, reported, perceived and desired networks of organizations in the response to Hurricanes Katrina, Rita and Wilma. For that reason, I will be contacting state, federal and non-governmental representatives of response organizations to ask them to participate in a brief (20-30 minute) interview.

If you are willing to participate, the interview questions will ask about your background (i.e., length of time working in emergency management, specialized training and education, prior disaster experience) as well as your recollections about the agencies you worked with in providing disaster relief during the Katrina, Rita and/or Wilma responses, and your opinions about which agencies you would desire to work with in future events of this nature.

There are no foreseeable risks associated with this project, nor are there any direct benefits to you. This interview will be entirely anonymous, so your responses will not be identifiable in any way. All responses are confidential and all results will be kept under lock-and-key. Your participation is voluntary, and you may withdraw from this project at any time.

This study is being conducted by Robert Skertich, who can be reached at (phone) or (email) if you have any questions.

University of Pittsburgh Institutional Review Board Approval # PRO08030005 received 5/6/2008

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