

5-2007

Comparison of Disaster Logistics Planning and Execution for 2005 Hurricane Season

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Recommended Citation

Iqbal, Qamar; Mehler, Kristin; and Yildirim, Mehmet Bayram, "Comparison of Disaster Logistics Planning and Execution for 2005 Hurricane Season" (2007). *InTrans Project Reports*. 167.
http://lib.dr.iastate.edu/intrans_reports/167

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Comparison of Disaster Logistics Planning and Execution for 2005 Hurricane Season

Abstract

After Hurricane Katrina, in the Gulf Coast region, millions of lives were impacted because of the lack of availability of transportation, shelter, food, water, drugs, etc. Hurricane Katrina raised many concerns in terms of the federal government's capability, including their operational plan and necessary coordination strategies between state and federal governments to come up with a robust response in these catastrophic incidents. It has become apparent that developing a better operational plan is needed. To improve disaster relief, better logistics planning, which also requires better forecasting methods, is needed. Further more, to increase collaboration at all levels, it is also necessary to have more reliable communication technologies and a better information technology structure which will enable better coordination between different agencies. Utilizing technologies such as geographic information systems (GIS) and real-time tracking systems will ensure that the available disaster relief stocks will be distributed fairly to everybody.

Keywords

Coordination; Disaster preparedness; Disaster relief; Disasters; Disasters and emergency operations; Geographic information systems; Hurricanes; Information technology; Real time information; Tracking systems; Logistics; Humanitarian supply chain; Hurricane Katrina disaster relief

Disciplines

Civil Engineering

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Comparison of Disaster Logistics Planning and Execution for 2005 Hurricane Season



Final Report
May 2007

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Technical Report Documentation Page

1. Report No. MTC Project 2006-01		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Comparison of Disaster Logistics Planning and Execution for 2005 Hurricane Season				5. Report Date May 2007	
				6. Performing Organization Code	
7. Author(s) Qamar Iqbal, Kristin Mehler, and Mehmet Bayram Yildirim				8. Performing Organization Report No.	
9. Performing Organization Name and Address Midwest Transportation Consortium 2711 South Loop Drive, Suite 4700 Ames, IA 50010-8664				10. Work Unit No. (TRAIS)	
				11. Contract or Grant No.	
12. Sponsoring Organization Name and Address U.S. Department of Transportation Research and Special Programs Administration 400 7th Street SW Washington DC 20590-0001				13. Type of Report and Period Covered Final Report	
				14. Sponsoring Agency Code	
15. Supplementary Notes Visit www.ctre.iastate.edu for color PDF files of this and other research reports.					
16. Abstract <p>After Hurricane Katrina, in the Gulf Coast region, millions of lives were impacted because of the lack of availability of transportation, shelter, food, water, drugs, etc. Hurricane Katrina raised many concerns in terms of the federal government's capability, including their operational plan and necessary coordination strategies between state and federal governments to come up with a robust response in these catastrophic incidents. It has become apparent that developing a better operational plan is needed.</p> <p>To improve disaster relief, better logistics planning, which also requires better forecasting methods, is needed. Furthermore, to increase collaboration at all levels, it is also necessary to have more reliable communication technologies and a better information technology structure which will enable better coordination between different agencies. Utilizing technologies such as GIS and real-time tracking systems will ensure that the available disaster relief stocks will be distributed fairly to everybody.</p>					
17. Key Words logistics—humanitarian supply chains—Hurricane Katrina disaster relief				18. Distribution Statement No restrictions.	
19. Security Classification (of this report) Unclassified.		20. Security Classification (of this page) Unclassified.		21. No. of Pages 47	22. Price NA

COMPARISON OF DISASTER LOGISTICS PLANNING AND EXECUTION FOR 2005 HURRICANE SEASON

**Final Report
May 2007**

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Preparation of this report was financed in part through funds provided by the U.S. Department of Transportation, through the Midwest Transportation Consortium, Project 2006-01.

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ACKNOWLEDGMENTS

The authors would like to thank the Midwest Transportation Consortium for sponsoring this research.

EXECUTIVE SUMMARY

After Hurricane Katrina, in the Gulf Coast region, millions of lives were impacted because of the lack of availability of transportation, shelter, food, water, drugs, etc. Hurricane Katrina raised many concerns in terms of the federal government's capability, including their operational plan and necessary coordination strategies between state and federal governments to come up with a robust response in these catastrophic incidents. It has become apparent that the development of a better operational plan is needed.

The task of providing immediate disaster relief and recovery assistance needs careful planning and the cooperation of the entire country. Although there is sufficient transportation planning at the federal level, the 2005 hurricane season proved that even the U.S. was not ready for relief operations when local issues resulted in the failure of national efforts. As a result, America needs to carefully plan disaster relief logistics in order to have the right amount of material in the right place at the right time, given the incredible demands that hurricane-affected areas face.

In this project, we identify the current state of disaster relief transportation planning and the logistics of disaster, including delivery of supplies by the federal, state, and local governments. A summary of the problems that occurred during and immediately after Hurricane Katrina is presented. Finally, this project provides recommendations for improvements after discussing the operational structure of the U.S. in the humanitarian supply chain.

The major result of our analysis indicates that Hurricane Katrina was a very large scale natural disaster for which federal, state, and local governments were not prepared. As a result, relief efforts could not get to the required level in the very short run after Katrina's landfall. Given the transportation infrastructure in Louisiana and Mississippi, one might conclude that the evacuation efforts were successful. However, for those who could not evacuate or who chose to stay back, the relief response was not adequate after the disaster. Communication was a very big problem, especially given the level of destruction in the infrastructure. Hurricane Katrina also proved that effective communication and collaboration between different agencies is needed to facilitate timely disaster relief.

INTRODUCTION

“Preparing through education is less costly than learning through disaster” said Max Mayfield, Director of the National Hurricane Center (Emergency Essentials 2007). Hurricane Katrina, considered the costliest and deadliest hurricane in the history of the United States (Wikipedia 2006), exemplified this statement. The storm surge caused massive and catastrophic damage along the Gulf Coast, affecting Mississippi, Louisiana, and Florida in particular. Preparation to cope with the disaster in any of the states was not satisfactory and raised many concerns. State and federal governments seemed to be blaming each other for this inefficient logistics operation. FEMA was questioned as having lack of situational awareness, shortage of trained professionals and resources, and so on by the states while the federal government made state governments responsible for not communicating with FEMA as required. A CNN survey showed public opinion on the matter: 13% said President Bush was responsible, 18% made the federal government responsible, 25% pointed their fingers towards state and local governments, and 38% went for the neutral approach and said no one was to blame (Wikipedia 2007).

In this project, we tried to focus on the major causes of the operation failure, coming up with recommendations that can be used as guidelines for the future. This project is organized as follows:

1. First, a general framework of logistics management in a disaster is presented.
2. Then, the response plans for the federal government and state governments are summarized.
3. Finally, after discussing the logistics planning and execution during Hurricane Katrina, recommendations for improvements in logistics operations during a disaster are provided.

DISASTER LOGISTICS

Disaster is a term that can be defined in different ways, depending on whether the spectrum is broad or narrow. Organizations and agencies define it according to the context. For the Red Cross, a disaster is an occurrence such as hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, earth quake, drought, blizzard, pestilence, famine, fire, explosion, volcanic eruption, terrorist attack, building collapse, transportation wreck or any other situation that causes human sufferings or creates human needs that the victims cannot alleviate without assistance (Red Cross). According to the WHO, a disaster is any occurrence that causes damage, ecological disruption, loss of human life, deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community area (WHO).

Disaster management aims to minimize and mitigate the effects of a disaster (Freeman et al. 2003). In the pre-disaster phase, disaster effects and events are studied and plans are made to fight against them. In the during disaster phase, activities are performed to minimize the losses that result from the disaster. Finally, in the post-disaster phase, attempts are made to neutralize the disaster's long-term effects as well as to establish real-time response to decrease the unwelcome aftermath of disaster. See Table 1 for details about these three phases.

Table 1. Phases of disaster management

Pre-disaster	During disaster	Post-disaster
Risk identification	Evacuation	Emergency response
Mitigation	Rescue and reporting	Rehabilitation & reconstruction
Disaster response planning	First aid Supply relief	

In pre-disaster disaster management (Wikipedia 2006), several measures are undertaken to understand the vulnerability of the community to disaster and to prevent or protect the community from disaster. The goals are to identify the risk of and minimize the effects of a disaster to which a community is exposed by using the following methods: hazards assessment (how frequently disaster strikes a certain location and what is the severity of a disaster if it strikes), vulnerability assessment (population of the community and assets exposed) and risk assessment using hazard monitoring (such as via geographical information systems) and forecasting tools (e.g., using hurricane hunters).

In the pre-disaster phase, initiatives to reduce the impact of disaster via structural and nonstructural mitigation measures are undertaken. Structural mitigation uses technology/engineering to minimize losses due to disaster. Underground transmission lines, levels, dams, channel diversion are typical examples of structural mitigations. Studies have shown that adequate grading and soil analysis ordinates in the city of Los Angeles, California can reduce land slide losses by 97% (Petak and Atkisson 1982). Argentina's flood rehabilitation project invested \$173 million, which saved \$187 million in damages during the 1997 floods (World Bank). A potential negative side of structural mitigation measures is that they may give

people a false sense of security. The confidence in these projects sometimes is the precursor of magnifying actual loss. The 1993 flooding of the Mississippi river is an apparent example of this phenomenon (Benson 1997).

All non-engineered measures to mitigate the impacts of disaster, including legislation, land-use planning, building codes, training and insurance, are considered non-structural mitigation measures. Some studies reveal that, upon inspection, personal lack of sufficient and proper knowledge prevents effective enforcement. As a practical example, research indicates that in Florida insured property losses from Hurricane Andrew would have been reduced by 25% through building code compliance. Land-use planning is another area that gained effective criticism. Unplanned growth in major cities accelerated the losses from disasters (Sanderson 2000).

In disaster response planning, emergency response action plans are developed before the disaster occurs in order to minimize its effects. Some of the tools utilized in disaster response planning include the following:

- Implementing reliable emergency warning methods
- Conducting emergency drills to test disaster response before the disaster and to highlight the shortcomings in disaster response operations and pave the way for more robust preparation for disaster
- Forming emergency operation centers near the affected area to provide first-aid services
- Developing logistics warehousing to store all essentials (e.g., water, clothes)
- Developing evacuation plans
- Designing reliable communication systems between different agencies and the affected population

During the disaster, the hope is that all of the pre-disaster planning has prepared the public and the different agencies to minimize the losses by executing plans for evacuation, reporting, communication, first aid, and supply relief to distribute food and other goods to the community.

Post-disaster planning is conducted to neutralize the disaster's long-term effects as well as to analyze real-time response to decrease the unwelcome aftermath of disaster. As soon as disaster strikes, proper emergency response may reduce its effects. Emergency response may include involvement of emergency services such fire fighters, police, volunteers, and NGOs. However, efficient coordination between all parties is needed to maximize the benefit achieved as a result of these operations. A proper number of medical teams, food and logistics should be supplied to the affected area using any possible means of transportation since earlier response may increase the chance of minimizing the effects and limiting the casualties.

After the initial response, rehabilitation and reconstruction takes place to restore the affected area, if possible, to its previous state. Income generating projects as well as funds generated at the local and national levels, and sometimes at the international level, may be required. It is ideal to include mitigation measures during the reconstruction phase to avoid creation of prior vulnerable conditions again.

LOGISTICS MANAGEMENT IN DISASTER

The Council of Logistics Management (1985) defines logistics as “the process of planning, implementing and controlling the efficient flow and storage of raw materials, in-process inventory, finished goods, services and related information from point of origin to point of consumption (including inbound, outbound, internal and external movements) for the purpose of conforming to customer requirements” (CLM 1985).

Humanitarian logistics is the process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods and materials, as well as related information, from the point of origin to the point of consumption for the purpose of alleviating the suffering of vulnerable people (Thomas and Kopczak 2005). In Table 2, we summarize the attributes of commercial and humanitarian supply chains (Beamon 2004). Humanitarian supply chains have a very unpredictable demand, very short lead time, challenging inventory policies, and unreliable information flow to minimize suffering in the affected areas.

Table 2. Commercial and humanitarian supply chains

Attributes	Commercial supply chain	Humanitarian supply chain
Demand pattern	Relatively stable, predictable	Mostly unpredictable
Lead time	Controlled by supplier-manufacturer-DC-retailer	Zero lead time
Inventory control	Well-defined structure	Challenging due to variations in lead times, demands, and demand locations
Information system	Structured and reliable	Unreliable, incomplete, nonexistent
Strategic goals	To produce goods satisfying customers as well as minimizing cost and maximizing profit	To minimize loss of life and alleviate suffering
Demand	Products	Suppliers and people

Logistics Management

Logistics is an essential component of emergency response plans at both state and national levels to ensure the availability of the right commodity in the right location at the right time and in the right quantities. Logistics planning for a disaster requires knowledge of geographic, social, political, and physical characteristics of the region. In general, logistics planning addresses the following questions:

- What resources are needed and in what quantity? How can they be procured?
- How can they be transported to the affected location?
- Which teams are taking part in the operation?
- How is coordination achieved between different teams?

To address these questions, it is necessary to determine the availability of strategic resources for logistic support by utilizing the following methods:

- Analyzing the capacity of the transport infrastructure to move supplies
- Finding potential sites for logistic hubs and distribution centers
- Assessing the capacity of the ports and airports and whether they can handle emergency operation under different conditions
- Analyzing government policies, plans and preparation for logistic support

During a disaster, several logistics decisions should be made. Timely procurement of disaster relief goods should be made to meet the needs of the victims in a disaster. Any delay in procurement may complicate logistic operations and accelerate casualties. Effective operation of the procurement process requires financial resources to maintain the procurement activities before and during disaster.

Delivery of supplies to the desired location is a function of transport structure. If a location is exposed to disaster, and history depicts the frequency to an appreciable amount, transport structure that connects this area to the other safe areas must be improved in order to ensure that supplies can be provided to the affected areas in a reasonable amount of time.

To achieve timely delivery of disaster relief supplies, it is extremely important to determine the warehousing sites and to determine which items should be stored. Warehouses should have an organized and systematic delivery to the desired location and should also serve as safe location to store goods so that they do not go waste or become contaminated.

When a disaster happens, timely distribution of supplies to the people is important. This must be structured in such a way as to respond according to the needs of the community. Priorities should be given to the most affected regions and there should be coordination between different agencies.

All of the logistics operations (procurement, transportation, distribution, warehousing) are closely linked to each other. Failure in one area may result in the failure of the entire logistics operation.

Operations researchers have been actively working to develop models and solution techniques that can address issues in emergency logistics so as to decrease the effects of disaster to the lowest level. Many mathematical models have been developed that pertain to number of facilities to be built in disaster season. Some answer the question of resource allocation in emergency; others take into consideration the issues related to evacuating the population in emergency and analyze how supply chain reliability and effectiveness can be improved to facilitate disaster response. We refer the readers of this report to papers by Wright et al. (2006) for a comprehensive review paper on location and resource allocation, evacuation models, and disaster relief planning and response.

RESPONSE PLANS

The U.S. humanitarian supply chain structure starts with local government. If the local government does not have the necessary resources, state assistance is requested and state response plans are activated. Similarly, if the disaster is beyond the state government's control, the federal government takes over the operation. The process flow chart in Figure 1 below summarizes this procedure.

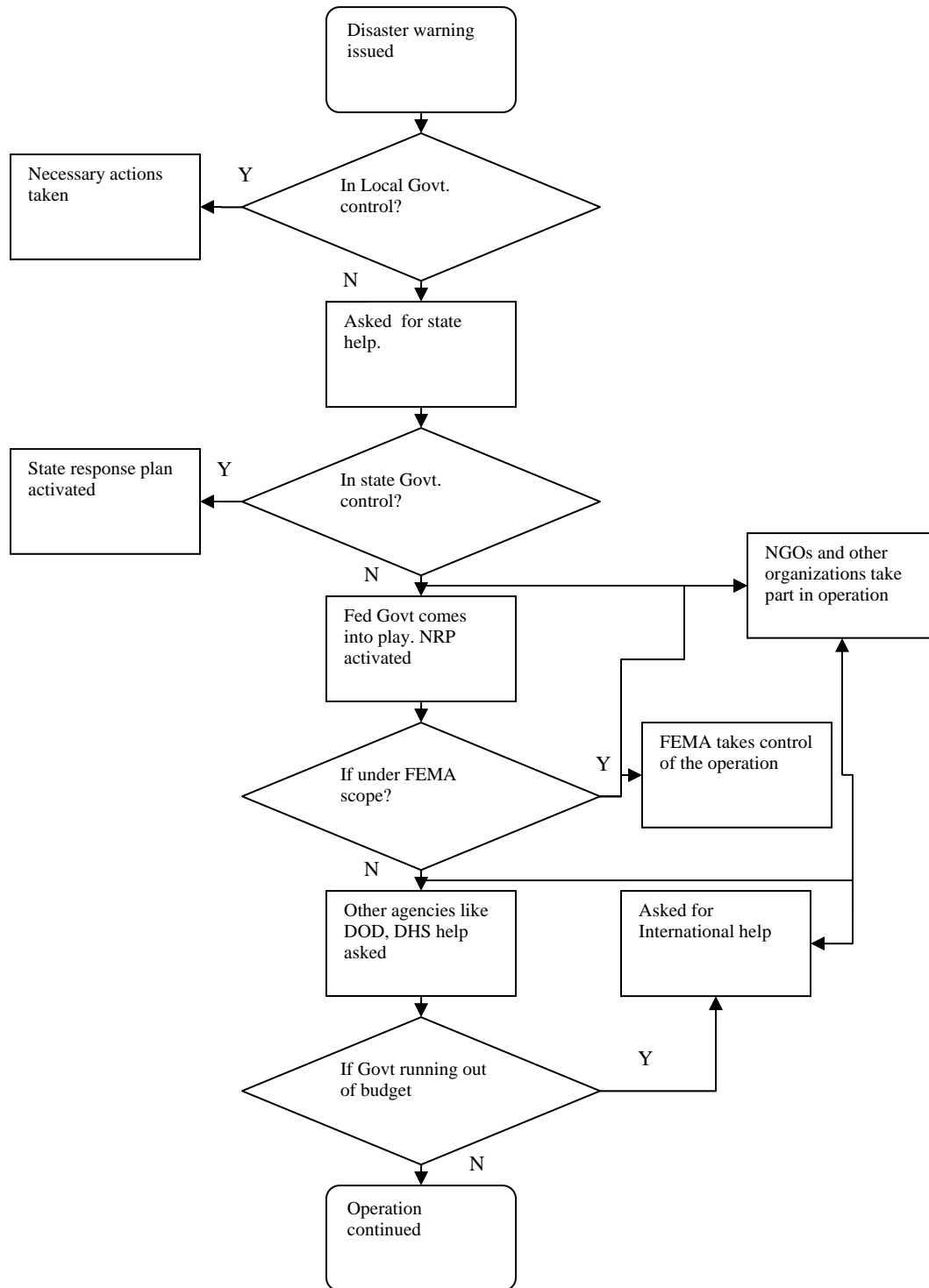


Figure 1. Operational structure of the U.S. humanitarian supply chain

National Response Plan

The National Response Plan (NRP) is an all-discipline, all-hazards plan that establishes a single, comprehensive framework for the management of domestic events. NRP presents the structure and mechanisms for the coordination of federal support to state, local, and tribal incident managers and creates direct federal authorities and responsibilities. NRP also has important functions in homeland security, such as prevention of terrorist attacks within the United States, planning for diminishing weaknesses against all natural and manmade hazards, and minimizing the damage and assisting in the recovery from any disasters and terrorist effects. The NRP has a base plan, emergency support functions annexes, support annexes, and incident annexes.

The base plan is an overall structure of NRP detailing the processes that fall into the domain of national support in incident management. The base plan integrates the efforts and resources of federal, state, local, tribal, and private sectors as well as non-governmental organizations. The base plan explains planning assumptions, roles and responsibilities, concept of operations, incident management actions, and plan maintenance instructions.

The Emergency Support Function Annexes summarize the functions of the federal government during an incident under separate sections. ESF includes the following sections:

- ESF #1 – Transportation
- ESF #2 – Communications
- ESF #3 – Public Works and Engineering
- ESF #4 – Firefighting
- ESF #5 – Emergency Management
- ESF #6 – Mass Care, Housing, and Human Services
- ESF #7 – Resource Support
- ESF #8 – Public Health and Medical Services
- ESF #9 – 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

Support annexes provide effective administration and functional process in order to have a successful implementation of the NRP. Support annexes include Financial Management, International Coordination, Logistics Management, Private-Sector Coordination, Public Affairs, Science and Technology, Tribal Relations, Volunteer and Donations Management and Worker Safety and Health. The focus of this project is logistics, which is part of the support annexes. Table 3 illustrates the ESFs related to logistics that are activated in disaster response.

Table 3. ESFs related to logistics in the National Response Plan (NRP)

ESF	Function	Coordinating agency
ESF # 1	Transportation	Department of Transportation (DOT)
ESF # 2	Communications	Department of Homeland Security (DHS)
ESF # 3	Public Works and Engineering	U.S. Army Corps of Engineers (USACE)
ESF # 5	Emergency Management	Department of Homeland Security (DHS)
ESF # 7	Resource Support	General Services Administration (GSA)
ESF # 8	Public Health and Medical Services	Department of Health and Human Services (HHS)

Logistics Management under NRP

Before activating a resource, needs and situational assessments are made by the Regional Response Coordination Center (RRCC) and the National Response Coordination Center (NRCC), which in turn dictate the degree and scope of the response. NRCC maintains continuing assessment methodology during the incident. NRCC reports to coordinating agencies Department of Homeland Security (DHA), Emergency Preparedness and Response (EPR), and Federal Emergency Management Agency (FEMA) about the significance of the incident and the degree of resources needed.

Material Requirement Planning

If the event is of national significance, time is the most important factor. The initial material requirement is fulfilled from current federal stocks, or from commercial sources if necessary. If federal inventory of relief goods is insufficient, then General Service Administration (GSA), which is responsible for all procurement activities for the federal government, is activated. The goal of GSA is to provide the required quantities of items needed in a cost effective and timely manner. GSA provides support to federal, state, local, and tribal governments through emergency relief supplies and facility space.

Transportation

Transportation requirements for the operation are assessed by ETC in coordination with NRCC, to determine the best mode and source of transportation. The Department of Transportation (DOT) is capable of providing transportation as needed. The main responsibilities of the DOT include the following:

- Providing technical assistance at the federal, state, local, and tribal levels in evacuation and movement restriction planning
- Determining the most viable transportation networks to, from, and within the incident area

- Working with state and local transportation departments and industry partners to assess the damage to the transportation infrastructure, analyze the impact of the incident on transportation operations nationally and regionally, and report promptly as changes occur

Storage and Distribution

Coordinating agencies DHS, EPR, and FEMA have to consider where to form the mobilization center, which serves as a focal point for pre-positioning, receipt and distribution of supplies. Ideally it has to be established as close to the affected area as possible to avoid delays in operation and fulfillment of requests. Forward movement of teams, supplies, and equipment is the responsibility of the mobilization center manager. Other responsibilities of the mobilization center manager include life-support functions of the members of the team and safeguarding of all nonhuman resources that arrive at the center(s).

Staffing

Emergency Support Function # 5 (Emergency Management) is responsible for supporting overall activities of the federal government for domestic incident management in support of the National Response Coordination Center (NRCC), Regional Response Coordination Center (RRCC), and Joint Field Officers (JFO) operations. Emergency Support Function # 5 implements the Execution Checklist for proactive deployment of federal staff and emergency response teams. ESF #5 is also responsible for maintaining an on-call workforce of trained and skilled reserve employees to provide surge capability to perform essential emergency management functions on short notice and for varied duration. When it is activated, highlights of the role of ESF #5 include the following:

- Providing a trained and experienced staff to fill management positions in the Command, Operations, Planning, Logistics, and Finance and Administration Sections of the NRCC, RRCC, IOF, and JFO.
- Initiating NRCC monitoring of potential or developing incidents and supporting of the efforts of regional and field operations.
- Initiating RRCC coordination of operations and situational reporting to the NRCC until JFO is operational.
- Providing staff for the Logistics Section Chief to manage the control and accountability of federal supplies and equipment; resource ordering; delivery of equipment, supplies, and services; resource tracking; facility location and operations; transportation coordination; and information technology systems services and other services.
- Providing staff from DHS/EPR/FEMA for the Operations Branch Director position and for different purposes including infrastructure support, emergency services, and mitigation.

FEMA Logistics Distribution Centers

Distribution centers are the aspects of any logistics operation that expedite the response of the responsible authorities to any major natural incident. Distribution centers are ideally located near the zone which tends to be affected due to natural incidents. The software, past data, and mathematical models provide a good picture of where these distribution centers should be located and in what strength. Locating the distribution center near the area which tends to be least affected by the incident is a waste of resources and time. Therefore, in choosing a location for the distribution center, thought must be given to achieve optimum benefit from the center by providing maximum response with minimum capital in minimum possible time with a minimum number of distribution centers.

FEMA, which became part of the U.S. Department of Homeland Security in 2003, is responsible for managing federal response to national catastrophic incidents. Establishing and maintaining logistics centers across the country also falls under the domain of FEMA. According to FEMA's fact sheet, states' needs during any major incident are served by the federal government through the logistics centers. These logistics centers are located in Marietta, GA; Berryville, VA; Cumberland, MD; Ft. Worth, TX; Frederick, MD; and San Jose, CA. The three offshore storage sites are located in Guam, Hawaii, and Puerto Rico. Pre-positioned disaster supply containers are located in logistics centers, thus enhancing FEMA's capability to accelerate emergency response to any U.S. territory. The logistics centers contain emergency relief supplies such as blankets, meals ready-to-eat (MREs)/Emergency Meals, bottled water, generators, cots, blankets, tarps, and Blue Roof sheeting. Two of the eight logistics centers carry specialized resources which include computer equipment and electronics, emergency medical supplies, and equipment for emergency medical operations.

When states request federal support, a mobilization center is activated near the affected territory. The mobilization center is basically a focal point for pre-positioning receipt and distribution of supplies. Mobilization centers manage and coordinate the logistics and operations, including forward movement of teams, supplies, and equipment. Deployed resources are further processed and forwarded by the logistics section to one of the three locations: the incident logistics base, an operations sections staging area, or a state/federal controlled distribution point.

All federal assets at the mobilization center(s) remain under the oversight of the logistics sections of the NRCC when it is activated and actively involved in brokering resources to the impacted area. When the NRCC is not activated, the mobilization center(s) is under the oversight of the logistics response center of the DHS/EPR/FEMA logistics branch.

State Response Plans

Each state in the United States has its own way of treating or handling emergencies and disasters. Some of the states, including Louisiana and Mississippi, have comprehensive plans to respond to disasters to a larger extent, whereas others do have an emergency operation plan but only at a minor level. To respond to a major natural disaster is beyond the scope of a state plan because major disasters require federal support and intervention. When it comes to a hurricane, Louisiana beats other states with its strength to meet disaster because it enjoys a good infrastructure and

Operation Plan. Mississippi closely follows Louisiana in its ability to respond to disasters. Florida also has some strength to fight hurricane but not at the astronomical level. We now discuss the Louisiana and Mississippi response plans in some detail.

Louisiana Emergency Operation Plan (EOP)

Louisiana calls its response plan an “Emergency Operation Plan” and this plan addresses issues related to state emergency whether created by terrorism or any natural disaster. The EOP is a comprehensive plan which is organized into Emergency Support Function (ESF) annexes which deal with each domain of emergency operation listed below.

- ESF #1 – Transportation
- ESF #2 – Communications
- ESF #3 – Public Works and Engineering
- ESF #4 – Firefighting
- ESF #5 – Emergency Management
- ESF #6 – Mass Care, Housing and Human Services
- ESF #7 – Resource Support
- ESF #8 – Public Health and Medical Services
- ESF #9 – Search and Rescue
- ESF #10 – Oil Spill, Hazardous Materials and Radiological
- ESF #11 – Agriculture
- ESF #12 – Energy
- ESF #13 – Public Safety and Security
- ESF #14 – Community Recovery, Mitigation and Economic Stabilization
- ESF #15 – Emergency Public Information
- ESF #16 – Military Support to Civilian Affairs

It is the responsibility of the state agencies to implement ESFs and update them according to the situation as necessary. We will look in this section at the emergency management annex because it relates to the logistics issues in which we are interested.

The purpose of the “EOP” is to establish firm and consistent procedures, and necessary guidelines to help the activation, organization, and operations of the Louisiana Governor’s Office of Homeland Security and Emergency Preparedness (GOHSEP) Emergency Operation Center (EOC) during local, state or federal emergencies.

Communication

The situation of the disaster or emergency is assessed by the EOC, which provides the Director of the GOHSEP (D-GOHSEP) a central location where relevant information about an emergency is received and processed. In this way, the EOC serves as a focal point for all communications among different agencies of the state.

Situation Assessment

Logistics and operational details are documented in a report format called “Situation Reports,” (SITREPS) which details the progress during a response. This report is a basic indicator of the performance of the agencies working in a disaster and may exhibit their shortcomings. If the report reveals an unsatisfactory outcome of the operation plan, the state is able to call for federal help. This report also serves as evidence of the state’s ability or inability to cope with disaster.

Storage and Distribution

The “EOP” states that resources and storage facilities should be in as close proximity as possible to the location where the incident occurred in order to avoid transportation delay and expense. If local/regional storage is exhausted, the EOC comes into action and provides the necessary support and assistance.

Material Requirement Planning

The operation division (a part of GOHSEP) deals with the issues of operation, activation and organization of the EOC. The material and inventory requirement is assessed by the EOC if regional government fails to handle the situation. The EOC is actually activated by order of the Director of GOHSEP (D-GOHSEP), who further takes the responsibility of material and staff requirements during the operation. The EOC works with local, state, or federal agencies.

Mississippi Emergency Response Plan

Mississippi’s emergency response plan is called the “Mississippi Comprehensive Emergency Management Plan (CEMP)” by the Mississippi Emergency Management Agency (MEMA). The purpose of CEMP is to describe the state of Mississippi’s approach to response and recovery activities related to emergencies and major disasters. Furthermore, CEMP intends to provide a decision framework to strengthen the state’s response and recovery operations during disaster.

Likewise, the NRP state response plan provides a general structure of the emergency response plan. It gives a reader an instant understanding of the state plan and its scope. Mississippi maintains very good planning guidelines on paper which can be executed as needed. The other sections of CEMP contain ESFs, Support Annexes, and Incident Annexes.

CEMP contains guidance for emergency support functions. The ESFs are as follows:

- ESF # 1 – Transportation
- ESF # 2 – Communications
- ESF # 3 – Public Works and Engineering
- ESF # 4 – Firefighting
- ESF # 5 – Emergency Management
- ESF # 6 – Mass Care, Housing, and Human Services

- ESF # 7 – Resource Support
- ESF # 8 – Public Health and Medical Services
- ESF # 9 – Urban Search and Rescue
- ESF # 10 – Oil and Hazardous Materials Response
- ESF # 11 – Animals, 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

Support annexes basically outline the framework through which state, local and tribal entities and other concerned organizations coordinate and execute the common functional processes and administrative requirements necessary for efficient and effective incident management.

Incident annexes deal with specific catastrophic and unique hazards affecting the state. The purpose of these annexes is to provide the guidelines and operational understanding required in different types of incidents. Examples of incidents include biological incidents, cyber incidents, and nuclear/radiological incidents.

The state of Mississippi uses the National Incident Management System (NIMS) as a base principle for emergency management. The NIMS paves the way to provide a common platform for federal, state, and local governments to work in emergency management operations. This is expected to accelerate the operational speed and recovery process a great deal.

The state is responsible for ensuring that all emergency management functions be coordinated to the maximum extent with comparable functions of the federal government. State government bears a responsibility to respond on an emergency basis for the properties that fall into the possession of the state. The state agencies in close proximity to the affected area should provide all necessary assistance to the local government. Furthermore, direct guidance to local authorities is a responsibility of the state government as is any level of assistance the local government has requested. If the state government with all of its resources is unable to fight the disaster, a request to the federal government is submitted. The State Emergency Operation Center (SEOC) may be activated depending on the magnitude and severity of disaster.

In Mississippi, logistics operations and support are carried out by the various centers under MEMA, as described below. Whenever the State Emergency Operation Center (SEOC) is activated at a level III or higher, MEMA staff is assigned responsibility for ESF # 5, ESF # 14, and ESF # 15 activities and responsibility to support ESFs that have been activated.

A Mobile Operation Center (MOBOPS), a motor vehicle equipped with radio, video, facsimile, and satellite communications services, is a dynamic communication response base. The deployment process is accomplished by ESF personnel to support continued state and local operations in the affected area. Face-to-face communication between people in the affected areas and the agencies is achieved by the Disaster Recovery Center (DRC) which is a facility located in an impacted area. A primary field location which serves as a coordination response site between FEMA and the state is defined as Joint Field Office (JFO) Operations and works on a 24

hours basis in emergencies. A State Emergency Response Team (SERT) is a combination of MEMA personnel and other state agencies, depending on the need and situation. The SERT will deploy to the State Earthquake Support Center (SESC) in case of earthquake or the Hurricane Support Center (SHSC) in case of a hurricane. The SERT mission includes the following:

- Equip the SHSC or SESC for operational readiness
- Establish a capable state response presence in the disaster
- Become local government's point of contact for state assistance
- Coordinate the use of available disaster area resources
- Prioritize specific action to reduce life-threatening conditions
- Channel local unmet resource needs to the SEOC

Emergency Support Functions (ESFs)

ESF # 5, called the Emergency Management Annex, covers a wide range of activities which includes supporting overall activities of state government for all incident management, providing the core management and administrative functions to support the response to significant incidents affecting local and state operations, and providing staff for logistics. The purpose is to manage the control and accountability of state supplies, equipment, and accessories, which includes ordering the resources and further extends to delivery of equipment, resource tracking, facility location and operations, and other logistics services as well as transportation. The logistics section coordinates with ESF #7 (Resource Support), which further implements the logistics management support annex to the CEMP base plan. If beyond the operational capability of the state, the logistics section coordinates with DHS and FEMA to request assets as required.

STATE OF LOGISTICS DURING KATRINA

August 29, 2005, changed the landscape of the Gulf Coast region forever. Inflicting more than \$200 billion of damage on the region, Hurricane Katrina was the most economically devastating hurricane in United States history. However, any monetary loss does not hold a candle to the loss of over 1,300 lives.

Mississippi Efforts

As Hurricane Katrina made landfall in New Orleans, neighbor state Mississippi was waging a battle of its own against the storm. On August 27, 2005, two days before landfall, Mississippi governor Haley Barbour declared a state of emergency. This was followed the next day by a federal declaration of a state of emergency for Mississippi by President Bush. Katrina would strike the following day. Hurricane Katrina was classified as a Level 1 category, or massive attack. SEOC was made 24 hours operational and all state ESFs were activated. Katrina corresponded with a FEMA RRCC level 1 (Massive Incident).

By August 29, volunteer agencies were already prepared to enter the area. The agencies prepared to distribute water and supplies to local government services and shelters. However, FEMA director Michael D. Brown requested that first responders not go into affected areas without first being dispatched, saying, “The response to Hurricane Katrina must be well coordinated between federal, state, and local officials to most effectively protect life and property. We appreciate the willingness and generosity of our nation’s first responders to deploy during disasters. But such efforts must be coordinated so that fire-rescue efforts are the most effective possible.” (Whitehouse 2006)

FEMA supported that decision by saying that it had 500 trucks of ice, 500 trucks of water, and 350 trucks of MREs to distribute within the area. However, it took the trucks days to make their way to the area. In the meantime, more than 54,000 people occupied 317 shelters, waiting for aid to reach them.

The theme of the Mississippi response to Hurricane Katrina was that of a Unified Command. Following Florida’s time-tested disaster response plan, Mississippi officials committed to a consistent unification of agencies and efforts.

The Unified Command concept joins federal, state, and local efforts with the creation of a core group of leaders. This core consists of a representative from the State Governor’s Office, the State Coordinating Officer and the Federal Coordinating Officer. These three leaders meet at the onset to determine how each can best complement the others. These leaders remain in close proximity and contact through the duration of the response. The Unified Command system maintained working communication during the Mississippi response, overseeing the distribution of supplies when they finally arrived.

As Mississippi officials watched the storm approach by way of Florida, they began to calculate emergency evacuation plans. On August 27, the same day the governor declared a state of emergency, Mississippi activated its Emergency Operations Center. While the state began issuing evacuation orders, local governments were hesitant to open shelters. However, as the

president declared a federal state of emergency for the state, Red Cross shelters began opening their doors. By the time Katrina hit Mississippi, many of the shelters, including the Jackson Coliseum, were at capacity after just 24 hours of being open. Many other residents, however, opted to stay home and ride out the storm in upper levels, or even on roofs (Wikipedia 2007).

The Unified Command ensured that a Joint Field Office was set up to synchronize response efforts. It initially operated out of the State Emergency Center in Jackson. In the days following the disaster, state response teams moved to a joint field office and established branch field offices in various locations, including Biloxi. An interesting point to note is that the Mississippi response was entirely independent of the contemporary Louisiana response. Many people point to the differences in planning, evacuation, and implementation of emergency operations as the reasons behind the stark contrast in casualties between the two states following the disaster.

Because Katrina caused a level 1 response, MEMA staff was assigned the lead of ESF #5 (Emergency Management), ESF #14 (Long-Term Community Recovery and Mitigation), and ESF #15 (External Affairs), as well as any additional ESFs that may have been activated. Staff received uniform training on the basic Incident Command System, such that everyone understood what they were going to do. When the response became a joint response, a detailed list of instructions was given to everyone involved with the purpose of making sure that everyone was on the same page.

In Mississippi, each day of response execution would begin with an action planning meeting, at which the unified command and section chiefs would meet to agree upon the objectives for the day, and evaluate the previous day's goals. There were also operations and logistics meetings to determine the most effective way to accomplish those objectives (Carwile 2005).

During the Katrina disaster, the joint response team had a list of primary objectives, which included the ensuring safety and security of personnel, delivering supplies to both refugees and responders, and continuing the search for survivors (Carwile 2006).

During the aftermath of Hurricane Katrina, Mississippi was initially overwhelmed by the magnitude of the event. At that point, gulf-neighbor Florida stepped in to help. Florida, which is quite accustomed to hurricane response, sent its 3,000 member SERT team to assist in the efforts in the lower six Mississippi counties. The Florida SERT team provided the use of its GIS system to assist with the communication problems that plagued the gulf area at the time (ArcNews Winter 2005/2006).

Louisiana Efforts

The two main pitfalls of the Louisiana response plan during the Katrina response were ESF #1 (Transportation) and ESF #2 (Communications). Transportation remained one of the major shortfalls of the Louisiana response. The evacuation of New Orleans left hundreds of thousands of people stranded in the area, struggling to survive. Those left were either left to fend for themselves in upper-levels of houses and on roofs or were corralled into the Superdome. The Superdome created a sub-human living environment, even if it was only for a short time. There

started to be an effort to remove people from the area; however, miscommunications regarding means of evacuation prevented many from being able to leave for several weeks.

FEMA was not ready for the magnitude of the disaster. As it struggled to fill supply orders, it faced the greater problem of getting those supplies to the affected area. Truck drivers were not given proper directions and would end up lost. When they did begin to approach the area, they faced the problem of damaged roads and infrastructure. Although New Orleans had long known that it was susceptible to a hurricane disaster, the city did not have the proper roads and alternate routes available for transporting relief supplies.

Communication was the major downfall of the Louisiana response. Examples of communication problems include the following: lack of public information before and during the disaster, miscommunications between FEMA and the state, and unclear directions given to workers.

Federal and State Response to Hurricane Katrina

On August 26, 2005, Hurricane Katrina struck the Florida coast, killing 11 people before making its way westward, toward Louisiana. The next day, George W. Bush declared a State of Emergency for Louisiana, directing FEMA to “coordinate all disaster relief efforts.” The same day, the first hurricane watch was issued at 10 am. On August 28, as Katrina became a Category 4 hurricane, the first hurricane warning was issued and New Orleans Mayor Ray Nagin issued a mandatory evacuation decree for the city (Jordan 2006).

Preceding the official warnings, there was a flurry of general storm watches and warnings. Some argue that there were actually too many warnings, that the high number of warnings, including several tornado warnings, made it difficult to perceive the nature of the storm. Many times tornado warnings are issued in the time surrounding a hurricane due to the high winds characteristic of the storm. However, in this particular instance, a tornado warning was hazardous because people seeking shelter in low levels of houses were vulnerable to the oncoming wall of water that swept the city as the levees broke (Weatherdata.com 2007).

Evacuation of New Orleans

Evacuation warnings were dispatched via radio, television, internet, even telephone. However, this was not entirely effective as many of those left were from impoverished areas and some did not have access to those media.

At the fundamental level, the concept of evacuation is simple—move people away from danger. In reality, evacuations, particularly evacuations on a mass scale, are complex undertakings. As the nation clearly saw during Hurricanes Katrina and Rita, it is not always possible to evacuate everyone who is in danger. The most obvious problem is the sheer scope of the event. Hurricane evacuations may involve millions of people over hundreds of thousands of square miles. In addition, because evacuations are inconvenient and disruptive, evacuees often delay travel decisions until the threat appears imminent, thus compressing the enormous travel demand into shorter time periods (Wolshon 2006).

In retrospect, many consider the Katrina evacuation to be a success in terms of evacuation logistics. On August 28, 2005, New Orleans mayor Ray Nagin ordered a mandatory evacuation of the city. An estimated 70–80 percent of the city of New Orleans was evacuated, mostly by means of personal vehicle, before the storm hit.

Louisiana had experienced hurricanes in previous years, such as Hurricanes Ivan and George. The two hurricanes had mandated the evacuation of the population, giving valuable lessons that diminished the blow of Katrina. Ivan clearly indicated to officials that, “Transportation infrastructure is not designed to accommodate evacuation-level demand” (DOT 2005). From Ivan, DOT officials had learned loading techniques and methods of flow which allowed for more people to be able to leave the area quickly, such as using multiple loading points. However, the plans to expand the infrastructure had not been implemented. Coupled with the growing coastal population, the evacuation was not as ideal as it could have been. There were, however, many positive aspects of the New Orleans evacuation, thanks to the experiences of the years before (Nigg 2005).

First, evacuation was prioritized, moving people in low lying, dangerous areas first. Also, the access management plan spread the flow of traffic, moving as many vehicles as possible off the freeway onto highways and other road ways. Louisiana DOT traffic data does show the evenly spread of traffic flow, even through more isolated, sparsely populated areas.

While the movement of people out of the area preceding the storm was an improved success, the movement of residents following the storm was dismal, a stark contrast. An estimated 100,000 to 300,000 remained in the city and were left to attempt a vertical evacuation, seeking shelter in higher parts of buildings and other structures for a short amount of time (Wikipedia 2007).

Part of this widespread vertical evacuation was the notorious use of the Superdome as a mass shelter for some 26,000 people. While the structure provided a physical shield against flooding and the elements, it created a large logistical problem to provide food, water, and materials for people housed in the dome. Residents were told to bring a three day supply of bottled water to the dome; however, many did not have the supplies and were counting on receiving them upon arrival.

Many residents who remained in the city had chosen not to evacuate out of necessity. Some were responsible for elderly or immobile family members. Even more people simply did not have the means of transportation needed to leave the city. This need, obviously, remained following the storm, calling for the widespread transport of a very large number of people. It was arranged that buses would come to evacuate refugees to the Astrodome, but buses did not arrive at the Superdome until September 1st—three days later.

There was also a concerted effort to evacuate residents by means of everything from Amtrak trains to buses to aircraft to ship. By September 5, 2005, around 66,000 people had been evacuated, either by road or by air, and over 1,200 buses had been employed by the Department of Transportation for the evacuation. Since the disaster, some controversy has arisen as to whether this was a sufficient effort to move people from the area. One example would be the inactivity of scores of public school buses, as residents remained in the city.

Many of the evacuation failures of Katrina revolved around those remaining in the city. Many are left with the picture of New Orleans citizens stranded on rooftops, suffering from dehydration as they awaited their rescue. While the city had made evacuation planning prior to the disaster, including “neighbor helping neighbor” policies, lack of communication killed those efforts and made them non-effective during the crisis. Many residents were simply unaware of what to do in the situation, leading to widespread confusion and panic in a region having a large underprivileged population where roughly 112,000 people had no access to a personal vehicle.

However, something needed to be done for the people remaining in the area. Most had lost everything to the storm. There was widespread need and what many considered to be widespread disorganization of meeting that need (Jordan 2006).

Meeting the Needs of Those Remaining

Following a disaster, providing for the basic needs of those affected by it becomes a time-sensitive priority. The dispensation of necessary supplies is handled in a very systematic, pre-arranged fashion. Immediately, the local sector attempts to meet the needs of its affected citizens with existing resources. From there, all unmet needs go immediately to the county and state. If the county and state are unable to fill the needs from existing stockpiles, commercial means, or Emergency Management Assistance Compacts, then an Assistance Relief Form is filled out with the RRCC/ER-A/JFO Operations.

It then becomes the responsibility of the federal government to provide food, water, ice, and supplies as well as logistical support, disaster centers, and public works projects for those suffering from the disaster.

The federal supply chain has seven links. It begins at one of several FEMA logistics centers, located throughout the country. These centers work with commercial storage sites for the procurement of any supplies which they do not already control. The centers will also contact other federal agency sites to fill supply needs. The supplies are then sent to mobilization centers, where they are prepared to be sent out to damaged areas. The supplies are sent to federal operation staging areas, then to state staging areas to be organized and directed to the specific locations, or points of distribution (FEMA 2007).

The Department of Homeland Security utilized the Barksdale Air Force Base as its FEMA Mobilization Center during the Katrina disaster. Toward the end of October, disaster relief supplies were transferred and shipped out of the Camp Beauregard Federal Operational Staging Area in Pineville, Louisiana. The Barksdale MOB supplied over 18 million liters of water and 38 millions pounds of ice to relief agencies, such as the Red Cross, the Salvation Army, and to areas of Louisiana needing disaster medical teams. The MOB also provided the relief organizations with cots, generators, plastic, and MREs (meals ready-to-eat) (DeFord and Sinkler 2005).

The Barksdale MOB was activated on August 28, 2005. Both contract and independent truck drivers responded to the call, transporting supplies to the MOB from federal agencies as well as commercial vendors, such as Wal-Mart and Home Depot.

As of September 5, 2005, the Department of Transportation had secured more than 1, 639 trucks to deliver more than 25 million MREs, 31 million liters of water, 19 million pounds of ice, and 215,000 blankets. The trucks combined with the largest airlift ever on U.S. soil to deliver the supplies to the affected areas. The DOT also utilized vessels in the U.S. Ready Reserve Fleet to provide temporary housing and evacuate citizens.

“We need to act now to mobilize resources like these ships that can support what is going to be a long term commitment to rebuilding the region,” said Secretary of Transportation Norman Mineta. “These vessels are designed to operate in any kind of environment, unloading supplies to help rebuilding communities and house essential personnel” (Department of Transportation 2005).

As supplies began to stream into the area, the distribution of supplies returned to a more localized level. On this level, the distribution of supplies fell mainly to non-governmental and nonprofit organizations. Supplies, which came in from federal holdings and commercial sources, were sent to organizations such as the Red Cross and Salvation Army, along with numerous volunteer groups. This included many volunteer groups which had traveled to the region to help with disaster efforts.

The federal sector encountered many problems and logistical speed-bumps as they tried to physically move such a large amount of material goods to a disaster torn area. Some of these problems included the inefficient movement of supplies and the waiting time that many refugees’ faces while in desperate need.

Despite the vast criticism of the federal government’s inefficiency, private suppliers, such as Wal-Mart, made a vast impact in the gulf following the hurricane. Wal-Mart, which operates daily in a competitive supply market, had 45 trucks of goods ready to deliver before landfall. The company secured a gas line in Brookhaven, Miss., to keep the process free from roadblocks. In the end, Wal-Mart donated \$20 million, 1,500 truckloads of supplies, and food for 100,000 meals. Their overwhelming generosity is accentuated by the efficient delivery of the goods (Wal-Mart Fact sheet 2007).

CAUSES OF LOGISTICS FAILURE IN HURRICANE KATRINA

Federal Preparation

FEMA response to Katrina

Hurricane Katrina demonstrated FEMA's incapability and lack of preparation to face catastrophic disaster. As DHS Secretary Chertoff expressed,

Although FEMA pre-positioned significant numbers of personnel, assets, and resources before the hurricane made landfall...we now know that [FEMA's] capability was overwhelmed by the magnitude of the storm. It was a question of whether they had the tools and capabilities that they needed in order to do the job properly. (Special Report of the Committee on Homeland Security and Governmental Affairs 2006)

Prior to joining FEMA, most of the front office staff had no emergency management experience. When Michael Brown became acting deputy director for FEMA, he had insufficient emergency management experience. Patrick Rhode accompanied Brown as chief of staff; he also had no experience in this sector. Many other FEMA leaders joined FEMA with no relevant experience. Even Eric Tolbert, director of response at FEMA, said the following:

The impact of having political appointees in the high ranks of FEMA...that's what killed us, was that in the senior ranks of FEMA there was nobody that even knew FEMA's history, much less understood the profession and the dynamics and the roles and responsibilities of the states and local governments. (Special Report of the Committee on Homeland Security and Governmental Affairs 2006)

MITRE, a nonprofit consulting firm, conducted an assessment to explore the major causes of FEMA's inefficiency in responding to disasters. In January 2005, the report stated that

The void is in leadership. There's none... None of the senior leadership understand the dynamics of how response and recovery actually works...this administration does not understand the value and importance of emergency management. (Special Report of the Committee on Homeland Security and Governmental Affairs 2006)

Limited Funds

FEMA's capability was further weakened by lack of funds and resources. FEMA seemed to criticize the Department of Homeland Security (DHS) for their high membership fees and taxes. FEMA acting Chief Operating Officer Ken Buris stated, "In order to pay DHS's contributions or taxes, FEMA could no longer afford to refill personnel positions when they became vacant."(Whitehouse 2006)

Due to its lack of resources, it was difficult for FEMA to carry on its operation. FEMA asked for additional funding from DHS, but their requests were rejected.

Shortage of Personnel

Although FEMA had been understaffed in the past, it was during Katrina that this shortcoming became evident. FEMA had a wonderful operation plan on paper, but the execution of that plan proved to be unsuccessful during Katrina. FEMA did not have the proper number of staff to implement the plan in a successful way.

FEMA's Intensive Capability

FEMA had a role to play in both the response and recovery operations; however, FEMA seemed to be fulfilling both responsibilities poor way, which raised numerous concerns. FEMA Federal Coordinating Officers (FCO) said in this regard:

FEMA is not trained, FEMA is not equipped, FEMA is not organized to do very large response operations...if you want big capability, you got to make a big investment. And there is no investment in response operations for a catastrophic disaster. (Special Report of the Committee on Homeland Security and Governmental Affairs 2006)

FEMA Emergency Response Plan

FEMA triggers emergency response teams to handle disasters. For major events, National Emergency Response Teams (ERT-N) are formed. But during Katrina, the response teams were inadequately trained and equipped. A memo from FEMA's cadre of FCOs to Brown said, "FEMA's ERT-Ns are unprepared because they had zero funding for training, exercises or team equipment." Brown replied, "I reported to DHS but could not obtain funding for the needed changes" (White House 2006).

NRP and Hurricane Katrina

When the National Response Plan (NRP) was publicly issued in January 2005, Tom Ridge, then DHS secretary, said, "America is better prepared today, thanks to the National Response Plan" (Special Report of the Committee on Homeland Security and Governmental Affairs 2006). There were several weaknesses in the NRP that made it difficult to implement during Katrina. We will look one-by-one at each point that caused the NRP to be ineffective during Katrina.

A High Level Document

NRP is reputed to be a complex, 400 plus page document which is difficult to understand for a reader the first time. The Office of the Vice President expressed, "NRP is very detailed, acronym-heavy document that is not easily accessible to the first-time user" (Special Report of the Committee on Homeland Security and Governmental Affairs, Chapter 27, 2006).

Inadequate Implementation

To achieve the desired results, a systematic training and implementation strategy was mandatory. Just a few months after the issuance of NRP, Katrina occurred. DHS had no prior experience in implementing the NRP, so it remained an invalid document in most aspects. Proper implementation efforts had not been made after the publication of NRP, and DHS had failed to conduct a comprehensive training. Given this scenario, it was unrealistic to expect that the “most efficient response plan” (as it was claimed to be) would be of any help in a massive disaster like Katrina.

Legal Issues

The NRP created some controversy in defining the role of the Principal Federal Officials (PFO) and Federal Coordinating Officers (FCO). The Stafford Act says that FCOs will be appointed by president in the case of major disaster. Under this Act, FCO is made responsible to coordinate the administration of relief, and take necessary initiative to assist citizens in emergency. But NRP created a new PFO position which was contradictory to the Act. That’s why the division of responsibilities between FCO and PFO is always unclear. One of the FEMA leading officials expressed, “If you need to invoke the Stafford Act for whatever reason, you are always going to have an issue with the relationship of the PFO and the FCO together” (Special Report of the Committee on Homeland Security and Governmental Affairs 2006).

Lack of Catastrophic Planning

A major technical drawback of NRP is that it neither addresses specific scenarios and situations nor provides operational details for catastrophic events. Admiral Allen criticized the document.

This [NRP] is a high level document. I think as you are able to establish the parameters of almost a spectrum of an all hazards type of an approach to things that you need to be more detailed planning on how you would respond to it...a national disaster is one thing; a natural disaster with a radiological event is an entirely different issue.

Detailed planning for catastrophic events is extremely important for successful operations. Some of the experts recommend that NRP should be supported and supplemented by more detailed and robust operational implementation plans (WHOM). It is now evident that NRP had no provisions for planning for a widespread catastrophic event; Katrina served as an example.

Inefficient Contracting System

As of November 30, 2005, almost \$19 billion had been obligated by the federal government to relieve the immediate suffering of the victims, to remove debris, and to reimburse the federal agencies. A description of the allocation of funds by the federal government follows.

Table 4. Funds allocated by the federal government as of November 30, 2005

Funds	Amount
Human services (e.g. employment compensation)	\$8 billion
Debris removal	\$2.2 billion
Reimbursement to federal agencies for technical and direct assistance	\$4.4 billion
Hazards mitigation	\$14.7 billion
Administrative expenses, reimbursement to federal agencies for their mission assignment operation	\$4.7 billion

The New Orleans mayor criticized the funds allocation process.

[T]he money is sitting in the doggone bank...we can't use it, and as soon as they give us the money, they sent a team of auditors and said, "If you spend this money, we will be watching you real close..." So we are gun shy about how we use this money. (Special Report of the Committee on Homeland Security and Governmental Affairs 2006)

Pre-deployment—Too Late?

On August 28, President Bush authorized a declaration of emergency for Mississippi and Alabama. FEMA Director Michael Brown said,

When the president authorized, we began to pre-deploy all of the assets [including] the medical teams, the urban search and rescue teams, the emergency response, the management teams, the rapid needs assessment teams, pre-positioning the water, the meals ready-to-eat, the ice, the traps. (Special Report of the Committee on Homeland Security and Governmental Affairs 2006)

Landfall occurred on August 29; it was too late to deploy the activities.

Beyond the Scope of FEMA?

It is often suggested that Hurricane Katrina was so gigantic that it was beyond the budget and control of FEMA. FEMA never expected a massive disaster of Katrina's size to happen, so the agency budget was insufficient to respond to Hurricane Katrina. FEMA Director Brown expressed,

Hurricane Katrina was beyond the capacity of the state and local governments, and it was beyond the capacity of FEMA...it was the largest national disaster ever to strike the

U.S.'s 92,000 square miles; logistics were falling apart. (Special Report of the Committee on Homeland Security and Governmental Affairs 2006)

Altercation between State and Federal Government

FEMA Director Brown said, "The local parishes never got FEMA commodities because they never asked for them," but New Orleans Director of Homeland Security Col. Ebbert had a different opinion. Ebbert stated, "FEMA officials should have known what was needed from their own experience" (Special Report of the Committee on Homeland Security and Governmental Affairs 2006). FEMA officials went on to say that the state was incapable of analyzing and prioritizing the requests.

Parishes Non-familiarity with E-team Software

In Louisiana, local governments can make requests from the state government through a software program called "E-team." The software program serves as a connection channel between state and local governments; however, some of the local parish officials did not know how to use it. A state official once mentioned, "They don't know all the bells and whistles" (White House 2006).

Inappropriate Requests by Louisiana EOC to FEMA

FEMA criticized the Louisiana Emergency Operation Center for requesting FEMA assistance without giving much thought to it. Some of the requests were for such a general items that they could have been fulfilled by state resources. FEMA officials argued that EOC was just passing the requests to FEMA and was not using any filtration process.

Information System Software Not Consistent

Louisiana state officials were using a software named "E-team" while FEMA officials were working on a different software called "NEMIS" to communicate with state government and track their requests. State officials complained that the FEMA staff assigned to the EOC didn't know how to operate "E-Team." This lack of integration between the two software systems made things even more challenging.

FEMA IT System Not Extensive

The logistics system used by FEMA is called Logistics Information Management System (LIMS III) and is integrated with other FEMA IT systems. However, it cannot share information with other federal, state and local agencies. A FEMA spokesman mentioned, "[FEMA] logistics support systems have presented us with some concerns over the past 18 months, and we are addressing it" (White House 2006).

Lack of Trained Professionals

FEMA has 55 acquisitions personnel. Experts have suggested that it should have had at least 172 to effectively deal with Katrina. The DHS procurement process was decentralized and lacked a uniform approach. DHS has seven legacy procurement offices that have their own procedures and are not integrated with each other.

Poor Transportation Planning

Poor transportation planning could be seen during Hurricane Katrina. FEMA Director Brown accepted that FEMA had been experiencing difficulty in moving commodities during Katrina. FEMA was short of drivers to deliver commodities. FEMA officials started revising resumes on Saturday, August 27 to hire additional truck drivers. Almost 70 more truck drivers were needed to move commodities.

Inefficient Commodity Distribution System

Major deficiencies in commodities pre-staging could be observed during Katrina. FEMA's FCO of Mississippi William Carwile expressed concerns in emails to his superiors. Only 30 trucks of water, 15 of MREs, 2 of traps and 30 trucks of ice-water were at the FEMA base. Carwile wrote, "System appears broken...will now attempt to get product in alternate ways" (Special Report of the Committee on Homeland Security and Governmental Affairs 2006). Carwile further criticized that commodities were delivered inefficiently and ineffectively to Mississippi and Louisiana.

No Requests Tracking System

There was no method for tracking the progress of agencies from which FEMA had requested assistance. This tracking difficulty resulted in the duplication of requests, orders, and efforts, which was waste of time and money. Some orders were left unfilled, unchecked, and misdirected due to this failure.

Lack of Leadership

Mismanagement and lack of leadership in the relief efforts in response to the storm and its aftermath could be observed during Katrina. States seemed to be pointing their fingers toward the federal government, whereas the federal government was blaming the states for making things worse. The absence of leadership is recognized by many experts as the major cause of operational delays and altercations (Wikipedia 2007).

Evacuation Plan

Nagin and Blanco were held responsible for failing to implement New Orleans' evacuation plan, a failure which led to hundreds of deaths. Nagin has been criticized for delaying the emergency evacuation order until 19 hours before landfall.

LOGISTICS RECOMMENDATIONS

Upon analyzing the logistics failures in Hurricane Katrina, a myriad of recommendations can be given. The following list describes our recommendations to minimize the effects of a catastrophic event and to provide for the humanitarian needs of the affected people quickly and efficiently.

A Functional Operational Structure

The federal government should work with its homeland security partners in revising existing plans in order to ensure a functional operational structure—including within regions—and establish a clear, accountable process for all national preparedness efforts.

Joint Operation by DHS and DOD

During the operation, when DHS asked the Department of Defense (DOD) for help, it was a great relief. DOD is equipped with many resources and can better perform the major operations associated with response activities. The Departments of Homeland Security and Defense should jointly plan for the Department of Defense's support of federal response activities.

National Emergency Communication Strategy

During Hurricane Katrina, communication failure was very evident. The U.S. cannot afford to repeat this mistake again. The Homeland Security Council, with support from the Office of Science and Technology Policy, should develop a National Emergency Communications Strategy that supports communications operability and interoperability. Furthermore, FEMA should integrate their software with that of the states so that, in the future, states should not feel difficulty in communicating with FEMA. Smooth operation can only be achieved when state and federal agencies develop a common strategy for responding to disasters.

Modern, Flexible, and Transparent Logistics System

Systems should be based on established contracts for stockpiling commodities at the local level for emergencies as well as for the provision of goods and services during emergencies. Leveraging resources within both the public sector and the private sector is recommended. States should be aware of their logistics capabilities and shortcomings. At a minimum, states should stock items which will be drastically needed in disaster and should be able to fight the circumstances at the maximum level.

Mass Evacuation Operations

Evacuation operation during Katrina raised serious concerns. Many died due to the poor evacuation strategy. With intelligent execution of plans, many lives could be saved. The Department of Transportation, in coordination with other appropriate departments, must be

prepared to conduct mass evacuation operations when disasters overwhelm a population. FEMA and DOD should work together to come up with a better strategy before the occurrence of hurricane. Working at the eleventh hour will again invite destruction.

Public Communication Plan

The Department of Homeland Security should develop an integrated public communications plan to better inform public before, during, and after a disaster. The more the people are informed, the better they can manage things. Earlier warnings should be made a routine practice. People should be warned in such a way that they take things seriously and should learn to save their own lives at the first sign of danger. Regional mitigation should be given a first priority. Communities should develop hazards mitigation plans at the regional level. They should not rely on state government in all circumstances.

Interagency Coordination

DHS Security should lead an interagency review of current policies and procedures to ensure effective integration between agencies. This is extremely necessary if the purpose is to respond disaster in a very effective manner with minimum resources. If all agencies are working in full cooperation with each other, the results are always better.

Create a Culture of Preparedness

DHS should make citizen and community preparedness a national priority and each individual citizen should bear a responsibility to know the community plan and to step up to the plate during a disaster. Each region should have a comprehensive plan that can be executed in difficult times. Every individual should think as if he is responsible to save his life by himself. The more this approach penetrates into society, the better the nation will be able to respond during a disaster.

Encouragement to NGOs and Volunteers

State and local governments must engage NGOs in the planning process, certify their personnel, and provide them with the necessary resource support for their involvement in a joint response. Sometimes NGOs can perform better in operations due to their expertise and skills. If they are included in all operations and planning processes, better operation plans may result. Their suggestions must be invited at all levels.

Preposition Supplies

As it stands, FEMA has eight mobilization centers, located across the country, along with three offshore sites. These sites are expected to stock supplies and respond to any disaster that comes across FEMA's desk. It would seem that the locations of these centers are impractical, considering that most are fairly concentrated in the eastern portion of the country.

While it would be impractical to expect each state to create a storage center of that magnitude, it would be advantageous for each state to at least create a scale model. States should have a better working knowledge of how they will provide for their citizens in case of disaster. This should involve a dynamic model for the procurement of goods and should also outline how to quickly distribute those goods. It should operate out of a centralized location, which would be the state equivalent of a FEMA mobilization center.

Mobilization Centers should be established in centralized locations, making them most accessible to the entire state. Centers should be in locations that are least vulnerable to attack or disaster. For instance, in the case of Louisiana, the southern portion of the state is susceptible to hurricanes and tropical storms. On the other hand, the northern end of the state lies in an area that can experience tornados. As a result, a Mobilization Center should be located in the center of the state.

Involve Private Contractors

Following the Hurricane Katrina disaster, the federal government experienced scores of logistical problems in providing supplies and relief for refugees. However, private companies such as Wal-Mart were getting food and necessary supplies to the affected areas days before FEMA trucks.

Privatizing disaster response could revolutionize the response process. Companies like Wal-Mart have fine-tuned logistical models that they use on a daily basis to optimize their operations. Putting those models to work in disaster situations could cut days off the response time.

Under the proposed system, a contract to provide food, supplies, and materials to disaster sites would be put up for bid at the beginning of each year. FEMA would inspect the logistical models and plans of each candidate and award the contract to the company most able to reliably fill the order in the least amount of time.

Have a Unified Command System

Mississippi followed the Florida response model, which holds to the Unified Command concept. Louisiana, on the other hand, struggled with miscommunication on all levels. Integrating the Unified Command concept into emergency planning would be crucial to efficiently carrying out a coordinated response. It is a very practical and simple way to make sure that every single element of the operation is carried out in a consistent manner.

The Unified Command System is a simple method of bringing key officials of national, state, and local branches together each day to discuss objectives, efficient execution of those objectives, and past successes or failures. Those officials and leaders then return to their respective commands and instruct based on the discussions, thus creating a unified response.

In Louisiana, leaders also wanted to put together a unified response. However, their attempt included delaying any response from virtually any organization until everyone was on the same

page. While this may have been done with the best of intentions, it resulted in thousands of refugees left stranded and in great need.

A reform similar to the Unified Command System would prove useful for a state like Louisiana, which experienced miscommunication on all levels during Hurricane Katrina due to the fact that they did not have such a system in place.

Plan for Infrastructural Changes—Structural Mitigation

Even as FEMA trucks were facing miscommunication problems and misdirection, they faced the added challenge of navigating impassible roads. The infrastructure in and around the New Orleans area was clearly vulnerable to natural disaster, even though it was widely known that the area would potentially face the threat of a major hurricane at some point in time.

States should be required to assess their infrastructure in relation to the respective potential disaster threats that they face. For instance, the state of California should assess the structural soundness of overpasses in the possibility of an earthquake. States should also plan alternative routes, should roads become impassible.

Make Effective Use of GIS System

Some states, such as Florida, have Global Information Systems in place in the instance of a natural disaster. This uniform communication system keeps all branches of the response working from the same model and the same coordinates.

In the Mississippi response, Florida volunteered the use of its GIS, which expedited the process significantly. The state-level response, using the system, went much more smoothly than the FEMA response, which was losing trucks of shipments. Since the 2005 hurricane season, FEMA has begun working on equipping all of its transport trucks with such positioning systems.

Inter-State Coordination

An interesting aspect of the relief effort in the gulf was the fact that, for the most part, each state operated independently, despite the fact that FEMA had a strong hand in each. In cases of such widespread disaster and chaos, it would be wise to temporarily forget state lines and join efforts under one unified command, keeping the entire region in step.

Public Information—Following the Florida Model

Public information proved to be yet another weak spot for the Louisiana disaster response. Little to no clarity was provided to residents regarding the progress of the storm or time of the expected landfall. Evacuation directions were sketchy and late, at best. Those remaining to weather the storm were befuddled as to how to handle the situation in which they were stuck.

Again looking to hurricane veteran Florida as a model, one can see the need for widespread public knowledge regarding the disaster risks of its area. Florida devotes great amounts of time, energy, and money to public awareness campaigns, instructing the public about what to do in case of a hurricane. For instance, directions are given to design a personalized evacuation route and tips are given on making family survival kits, which stockpile foodstuffs and supplies to last several days.

CONCLUSION

The task of providing immediate disaster relief and recovery assistance needed careful planning and the cooperation of the entire country. From the failures of Katrina, one hopes that USA and the world are more prepared for a disaster of such scale. As a result, America needs to carefully plan disaster relief logistics in order to have the right amount of material at the right place at the right time given the incredible demands that the hurricane affected areas face.

In this project, we summarized what disaster relief logistics and planning are, and how federal and state level planning is executed when a disaster happens. A summary of the problems that occurred during and immediately after Hurricane Katrina was presented.

The major result of our analysis indicates that Hurricane Katrina was a very large scale natural disaster for which the federal, state, and local governments were not prepared. As a result, the relief efforts did not get to the required level to satisfy the needs of the affected population in the very short run (i.e., after Katrina's landfall). Given the transportation infrastructure in Louisiana and Mississippi, one might conclude that the evacuation efforts were successful. However, for those who could not evacuate or choose to stay back, the relief response after the disaster was not adequate.

To improve disaster relief, better logistics planning, which also requires better forecasting methods, is needed. Furthermore, to increase collaboration at all levels, it is also necessary to have more reliable communication technologies and a better information technology structure, which will enable better coordination between different agencies. Utilizing technologies such as GIS and real-time tracking systems will ensure that the available disaster relief stocks will be distributed fairly to everybody.

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