Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of: Independent Panel Reviewing the Impact of Hurricane Katrina on Communications Networks

COMMENTS OF M/A-COM, INC.

I. INTRODUCTION

Pursuant to 71 Federal Register 2233 (January 13, 2006), which invited comments from the public, M/A-COM hereby submits its comments on improving disaster preparedness, network reliability, and communications for first responders to the Federal Communications Commission's (FCC or Commission) Independent Panel Reviewing the Impact of Hurricane Katrina on Communications Networks. *See* January 12, 2006 Public Notice (DA 06-57). M/A-COM is one of the largest suppliers of two-way radios to the public safety community in the United States. Headquartered in Lowell, Massachusetts, M/A-COM is a subsidiary of Tyco Electronics, which is an operating segment of Tyco International. M/A-COM is a market leader in the supply of critical communications systems and equipment for public safety, utility, federal, and select commercial markets. M/A-COM is also a leading manufacturer and systems integrator of Internal Protocol (IP)-based public safety communications networks.

On January 6, 2006, the Federal Register published a notice that the Commission was forming an Independent Panel Reviewing the Impact of Hurricane Katrina on

Communications Networks (Independent Panel) pursuant to the Federal Advisory Committee Act (FACA). Shortly thereafter, on January 12, 2006, the Commission issued a Public Notice announcing that the first public meeting is scheduled for January 30, 2006 and that FCC Chairman Kevin Martin had appointed twenty-five members to the Independent Panel, including Chair Nancy Victory, partner at Wiley, Rein & Fielding, LLP, several public safety organizations, two providers each of wireline, wireless, broadcast, and satellite services, New Orleans's main cable provider, and one equipment provider. Notice of the meeting was published in the Federal Register on January 13, 2006.

The stated purpose for this Independent Panel is to "review the impact of Hurricane Katrina on the telecommunications and media infrastructure in the areas affected by the hurricane;" to "study the impact of Hurricane Katrina on all sectors of the telecommunications and media industries, including public safety communications;" and ultimately to "make recommendations to the FCC by June 15, 2006 regarding ways to improve disaster preparedness, network reliability, and communications among first responders." M/A-COM supports the purposes of the Independent Panel and appreciates the forthcoming effort that will be required of its members.

M/A-COM submits these comments to assist the Independent Panel in its task and to offer our unique viewpoint and experience, which may not be represented otherwise. *See* 5 U.S.C. §§ 5(b)(2) & (3). M/A-COM was the system provider to the City of New Orleans's first responders and operates approximately twenty public safety systems in the Gulf, including a system covering the entire state of Florida.[1] During Katrina, M/A-

[1] *See* Attachment A (Map of M/A-COM Gulf Coast Trunking Systems).

COM systems in locations like New Orleans, St. Tammany Parish, and Harrison County, MS were the only systems that continued to operate, and in some cases radios were loaned to neighboring agencies, such as City of Slidell, until their systems were restored. M/A-COM could certainly speak to the impact of Katrina on the public safety communications and infrastructure in the region. After Katrina, M/A-COM commissioned a study by an industry-recognized technical consultant to review the impact of the hurricane on the systems in her path. We submit that study to the Independent Panel to facilitate its review and development of recommendations.[2] The successes of M/A-COM's systems during Katrina and other hurricanes, notably the five that barraged Florida continuously in 2004, can provide insight into "ways to improve disaster preparedness, network reliability, and communications among first responders." In addition, M/A-COM's systems offer valuable lessons on how to improve disaster preparedness, network reliability, and first responder communications in general, for any widespread incident.

Much of the focus by the media following Katrina was on the lack of interoperability. But before you can have *inter*operability, you need *operability.* Public safety entities expect hardened systems that will allow first responders to communicate under any conditions. Public safety systems have to meet mission critical requirements, including redundant transmission, back-up power, and "ruggedized" radios. Public safety systems must have features not necessary or economically viable in the commercial space, such as incident command and control, talk group management, priority and

[2] *See* Attachment B (*Coastal Mississippi and Louisiana Radio System Overview: Interoperability Feature and How Systems Performed During Hurricane Katrina*, Tusa Consulting Services, Inc. (September 2005)).

preemption protocols, a high degree of security, and reliability. The survivability of a public safety system is paramount in a disaster for the basic communications need of *operability.*

During the recovery phase of a disaster, when emergency personnel from other jurisdictions begin to arrive to assist on the scene, interoperability among local and visiting emergency personnel becomes critical for minimizing loss of life and property damage and restoring public order. M/A-COM offers its perspective on the need for operability and interoperability during the three phases of a disaster: preparation, during the disaster, and recovery.

II. IMPACT OF KATRINA ON THE TELECOMMUNICATIONS INFRASTRUCTURE IN THE AREAS AFFECTED BY THE HURRICANE

M/A-COM supplied the public safety communications network to New Orleans, one that enabled city police, fire departments, and EMS personnel to interoperate during the aftermath of Hurricane Katrina. Carefully designed by an independent consultant with extensive local experience, the New Orleans system incorporated many elements that provided for storm survivability – these will be subsequently described. As a result, the M/A-COM system worked without mishap for over a decade, providing valuable interoperability among the 6,000 radios used daily by the police, fire, and EMS departments. From its inception, M/A-COM's system was sized to ensure that it could provide interoperability and handle severe worst-case communications demands during natural and man-made disasters or peak communications surges during recurring events such as Mardi Gras where public safety radio use is high. The New Orleans system also

incorporates special interoperability features to communicative with over 10 neighboring agencies, in case of any major incidents during Mardi Gras, Jazz Fest, or other events.

M/A-COM systems in the Gulf experienced the best track record of availability, because of M/A-COM's experience and success at designing and deploying Category-4 resistant public safety systems coupled with its other disaster preparedness practices. Key elements of M/A-COM's success are careful system planning and site hardening. Some of the design elements of these systems include:

- Provision of independent licensed microwave links connecting the sites, not dependent on commercial phone or fiber links (for example, those that failed in the Louisiana State Police system)
- Backup battery systems
- Backup generator systems, using multiple fuel sources, including local fuel tanks to provide operation up to 14 days
- Sites elevated above the flood plain
- Towers, antennas, equipment shelters hardened to withstand 140 MPH winds
- Overlapping coverage from multiple sites, designed for portable radio use 95% in building use and 97% in vehicle
- Radio equipment redundancy
- Interoperability links (over 10 links were available to neighboring localities such as Jefferson Parish, Slidell, and others from the New Orleans system but unfortunately most of these links from non-M/A-COM systems were down)

- Provision of a "backup to the backup" analog conventional mutual aid repeater system
- Continual upgrading and improvements (M/A-COM performed improvements to the New Orleans system in 1999, 2003, 2004, and 2005)

The design of those assets reflects our first priority—minimizing disruption of service. M/A-COM incorporates into its designs lessons learned from earlier disasters.

In addition, upon receiving the warning of Hurricane Katrina, M/A-COM *pre-positioned* its regional resources out of harm's way to stand ready to repair any damage. M/A-COM positioned its command and control center in advance of Katrina in Lynchburg, Virginia, well out of the hurricane's path, to monitor reliably the performance of M/A-COM's twenty systems in the Gulf region before, during, and after Katrina made landfall. For example, our statewide system in Florida operated continuously to support public safety during Rita, and in the face of near-constant barrage from four successive hurricanes during the 2004 season.

All of M/A-COM's systems in the Gulf worked continuously before, during, and after the hurricanes, with the exception of a brief outage to the main system in New Orleans. The New Orleans M/A-COM system had multiple levels of redundancy built in. But during Katrina commercial power failed. As planned, M/A-COM's main site reverted to generator power. However, a shard of wind-driven debris pierced the main site back-up generator's radiator, causing it to fail. In accordance with normal operating plans, alarms are sent automatically to a central location notifying dispatchers of a generator failure and of the switch to battery backup power. Unfortunately, the dispatchers had all been ordered to vacate the police headquarters because of flooding, so

no one was there to receive and act on the generator failure alarm. When the back-up battery power expired, M/A-COM system technicians immediately attempted to enter the city to restore system power. However, in the ensuing chaos of the looting and flooding, they were turned back, despite their credentials. Eventually access was obtained and the generator was repaired within a few hours after getting to the site. However, precious time was lost and first responders were forced to revert to the "backup to the backup" mutual aid repeater system. The delay caused by that inability to access the generator was the only "down time" in any of M/A-COM's twenty radio systems deployed in the region, including the systems for Mobile, Biloxi, Gulfport, and St. Tammany Parish. The New Orleans system operated continuously thereafter, and during Rita when New Orleans was flooded a second time.

M/A-COM's trunking system in the New Orleans Airport allowed the Louis Armstrong International Airport to become a major triage area following the hurricanes, due to its robust support of a number of different first responders and emergency medical personnel. Because of the flexibility of the system, emergency personnel from different disciplines were able to turn the airport into a makeshift hospital, caring for thousands of patients and then coordinating their evacuation to other hospitals in the South. Once the New Orleans system was repaired from hurricane damage, the system functioned continuously to support New Orleans police and firefighting forces, while surrounding systems were still off the air.

III. WAYS TO IMPROVE DISASTER PREPAREDNESS, NETWORK RELIABILITY AND COMMUNICATIONS AMONG FIRST RESPONDERS

Disaster preparedness, network reliability, and effective communications all require interoperability. Much has been said about the need for interoperability, both by Members of Congress and by the public safety community and industry. There is an expectation that there should be an easy fix for the current lack of interoperability. To solve the problem, we need to understand the problem. Radio *operability* refers to different radios produced by different manufacturers built to transmit over the same frequency using a standard protocol. That has been achieved. Much more difficult is achieving the goal of *inter*operability among radios operating in 6 different public safety frequency bands, such as users in the 800 MHz or 150 MHz band communicating with users in the 512 MHz or 700 MHz band (or even the 380-400 MHz band used for Federal public safety operations). This problem is solved through an interoperability network, not by purchasing more new radios.

It is often assumed that providing 24 MHz of public safety spectrum in the 700 MHz band, currently occupied by broadcasters prior to their transition to digital television (DTV), would solve the interoperability problem between users in different bands. While additional spectrum in the 700 MHz band would alleviate overcrowding in other public safety frequency bands (i.e., relieve frequency congestion in areas where it is a problem), it could exacerbate, rather than alleviate, interoperability problems. This is because; existing public safety systems already operate across several other public safety bands. Adding another frequency bands aids greatly with capacity, but does not necessarily aid in achieving interoperability.

M/A-COM supports legislation for a finite date for the DTV transition and the reallocation of 24 MHz of the 700 MHz band for public safety use. But that 24 MHz of spectrum cannot accommodate all of the law enforcement, emergency services personnel, and other public safety units, let alone the many federal and state emergency agencies with which local first responders should interoperate. So policymakers should not look to the reallocation of 700 MHz spectrum alone to solve interoperability problems. Rather it should look 700 MHz spectrum for bringing critically needed additional capacity.

Another untrue assumption is that by simply buying all the first responders in this country the same radio built for the same band, near-term interoperability is achieved. This assumption is flawed for at least two reasons. First, there is simply not enough capacity in any single frequency band to host the approximately 3,000,000 public safety first responders who need interoperability. Second, the cost to supply new radios to all first responders has been estimated to be anywhere from $17 billion to over $50 billion. This is an enormous investment, given that there are more elegant solutions that are more time and cost effective.

How can interoperability be provided most expeditiously and in a cost-effective way that takes into account the realities of a challenging budget environment? M/A-COM proposes using technology that is available today to convert voice calls to IP packets, which traverse an IP network, so that all first responders, regardless of the frequency used, can talk to each other. That is, one network – not one radio – to deliver nationwide first responder and Federal responder communications interoperability. An IP network, managed by IP servers running a Public Safety grade application would enable the translation. M/A-COM is not proposing a national *radio* system. This is not a

suggestion to buy every first responder in the country a new radio. M/A-COM is proposing a unified, secure, reliable IP-based public safety network with the capability and capacity to handle multiple widespread disasters through the interoperation of existing radio systems. Because the network would be IP-based, it would provide greater network reliability, flexibility, resiliency, and redundancy, and it would be future-proof. M/A-COM envisions an interoperability network that would deploy non-proprietary IP technology, but would not use the public Internet, and hence would provide security and reliability essential to the public safety community. Most importantly, the network would be robust and hardened for public safety use, using geographically redundant equipment and mesh techniques so that the network is inherently self-healing to failures. Important elements of priority, emergency alarms, and pre-emption, necessary in the command structure of public safety, would be included.

The idea of an IP-based interoperability network is simple: put all the radio systems on one advanced digital IP network. A radio operating on one system cannot talk *directly* to a radio operating on another system on a different frequency. But, if both systems are on the same network, one radio can talk through the Network to a radio on another system. First responders from state and local emergency agencies will benefit from greater interoperability during crisis situations.

The vast majority of public safety communications equipment in the field today is still analog-based. In an IP-based public safety network, a software application would convert analog voice signals to digital IP packets, thus becoming interoperable with other analog systems and digital systems that are part of the IP-based network. An IP-based interoperability network would not replace that existing infrastructure, nor require

communities to immediately undertake expensive, wholesale replacement of their communications equipment or costly, time-consuming training for new radio use.

An IP-based interoperability network could use widely available servers and other components provided by a large number of equipment manufacturers. M/A-COM has demonstrated this concept by deploying several systems based on IP backbone technology in daily use in multiple locations. Near Washington, D.C., multiple Maryland counties have jointly chosen to interoperate, in the Maryland Eastern Shore Interoperability Network (MESIN). This network is operating successfully and provides interoperability to a number of disparate local public safety entities, federal agencies, and utilities spread over 9 counties. The MESIN system provides interoperability to participating first responders, regardless of the radio used or spectrum in which they operate.

On the federal side, federal agencies have used this technology to permit numerous facilities in various locations to interoperate. For example, the U.S. Army in the Nation's Capitol Region (NCR) system uses this interoperability technology, permitting ten military installations to not only interoperate with each other but also with more than 50 local first responder agencies. The NCR system gave the annual Boy Scout Jamboree host, Fort A.P. Hill, much needed interoperability with local police and emergency medical rescue teams during the 2005 Jamboree when hundreds of boys required emergency care because of heat stroke. That interoperability allowed rapid rescue and treatment of the boys.

As demonstrated in MESIN and other systems, this technology can be used with radios from any manufacturer. First responders using systems provided by other vendors

can use IP-based interoperability technology to communicate with other first responders in a disaster.[3]

Today, federal and local first responders normally use different frequency bands and therefore cannot talk to each other. If federal and state and local first responders were on an IP-based interoperability network, they could effectively communicate – by sending communications as IP packets over a secure intranet – during widespread incidents such as the preparation, duration, and recovery from Katrina and Rita. They could also communicate during homeland security emergency preparedness exercises.

An IP-based interoperability network costs a fraction of what it would cost to replace all the radio systems in the field. An IP-based interoperability network would facilitate the migration from legacy radio systems to new systems by also allowing them to interoperate, regardless of the pace or scale of that migration. An IP-based interoperability network would allow local governments to minimize costs by maximizing use of current assets, including radios. Because an interoperability network would permit public safety to use existing radios, public safety users can continue to use their current frequencies. An IP-based interoperability network works spectrally and financially. Since it would be IP-based, such an interoperability network would not take away capacity from existing radio systems that must continue to serve local users.

Another way to improve disaster preparedness, network reliability, and communications for first responders is to install the necessary equipment to make operational the mutual aid channels already assigned to public safety and the common use channels assigned to the federal agencies. After such installations, those channels

[3] In fact, M/A-COM's system is the only DHS-qualified Anti-Terrorist Technology in the two-way radio industry, qualified under DHS's SAFETY Act. *See* 6 U.S.C. §§ 441-444.

would be ready for use across the country, regardless of where the next disaster strikes. Once connected to a national IP interoperability network, those mutual aid or common use channels would also permit first responders in the incident area to communicate with remote (i.e., not in the disaster area) federal support, who would be in a better position to direct more federal first responders into the disaster scene, as needed.

Until today, policymakers and the public safety community have always attempted to solve communication problems with radios. And, because radios are all different, the more radios we throw at the problem, the more complicated the problem becomes. Additionally, where the government directs its efforts impacts success. We cannot fund exclusively at the lowest level and expect interoperability at all levels (the "upside-down pyramid" approach). We cannot expect local governments to fix a national problem. Policymakers should not expect the "upside-down pyramid" approach anymore than their predecessors should have expected that an interstate highway system could have been created by connecting all the Main Streets in America. Instead, we should leverage the existing investments we have made, while at the same time creating a national level plan, and enact it to ensure that all those upgraded local systems can interoperate on a national IP network.

The role the vendor of a public safety radio system plays in the various stages of a disaster is also critical (the vendor cannot simply sell equipment and then take itself out of the disaster equation). If there is disaster warning, as was the case with Hurricane Katrina, M/A-COM, for example, pre-positions resources to be ready to repair any damage. As noted above, M/A-COM positioned its command and control center in advance of Katrina in Lynchburg, Virginia, well out of the hurricane's path, to monitor

reliably the performance of the 20 M/A-COM systems in the Gulf region before, during, and after Katrina made landfall. If there is no warning, however, speed of response is critical. In all cases survival of the communications assets is paramount. The design of those assets reflects M/A-COM's first priority—minimizing disruption of service, or ensuring "operability". We incorporate into our designs lessons learned from earlier disasters, such as positioning the New Orleans system well above the flood line, even in anticipation of the levee breach.

During and immediately after a disaster, we must be able to make any repairs quickly. One unanticipated factor in New Orleans was the difficulty for our radio technicians—some of the first persons returning to New Orleans—in reaching the equipment in order to repair it in a timely manner. The situation delayed critical repairs. M/A-COM therefore recommends that in the future, technicians to critical infrastructure be credentialed as first responders, and that the credentialing system be recognized throughout the many layers of city, county, state, and federal public safety agencies. The delay in safely accessing the New Orleans generator represented the only "down time" in any of M/A-COM's twenty radio systems deployed in the region, including the systems for Mobile, Biloxi, Jackson, Gulfport, St. Tammany Parish, Harrison County MS, and others.

During the disaster recovery phase, the need for interoperability among units of first responders is at its most critical. In those precious hours after a disaster strikes, life saving is maximized by the efficiency of first responders, which is facilitated by communications interoperability of multidisciplinary responders. Use of an IP-based

interoperability network could facilitate such interoperability without the requirement of costly and time-consuming replacement of existing radios and systems.

Additionally, until commercial power is restored, more efficient means of delivering fuel and transporting maintenance technicians must be found. When an area is flooded or access is difficult because of downed trees and utility poles, priority must be given to maintaining the standby power supply of the first responder communications systems. The logistics of providing this during and after Katrina proved very difficult, and as recently as December, 2005, some sites were still running on backup generators.

IV. CONCLUSION

The solution to improve disaster preparedness, network reliability, and first responder communications is IP technology. Using existing, cost-effective IP equipment, a national interoperability network, connecting public safety entities and federal agencies, would be well within our economic and deployment reach. A national network used by Federal, State, Tribal, and Local Public Safety entities would deliver interoperability, at affordable cost, and therefore improve disaster-related communications for first responders. Radios don't save lives—people do. But people must be able to communicate before they can help. When the need is great and requires great help, the communications capability must be great also. To improve disaster-related communications in the future, we urge you to embrace secure IP-based, solutions to maximize reliable interoperability of first responders and emergency service providers.

Respectfully Submitted,

/s/

Kent D. Bressie
HARRIS, WILTSHIRE & GRANNIS LLP
1200 Eighteenth Street, NW
Washington, DC 20036
(202) 730-1300

Counsel for M/A-COM

Damon Ladson
HARRIS, WILTSHIRE & GRANNIS LLP
1200 Eighteenth Street, NW
Washington, DC 20036
(202) 730-1300

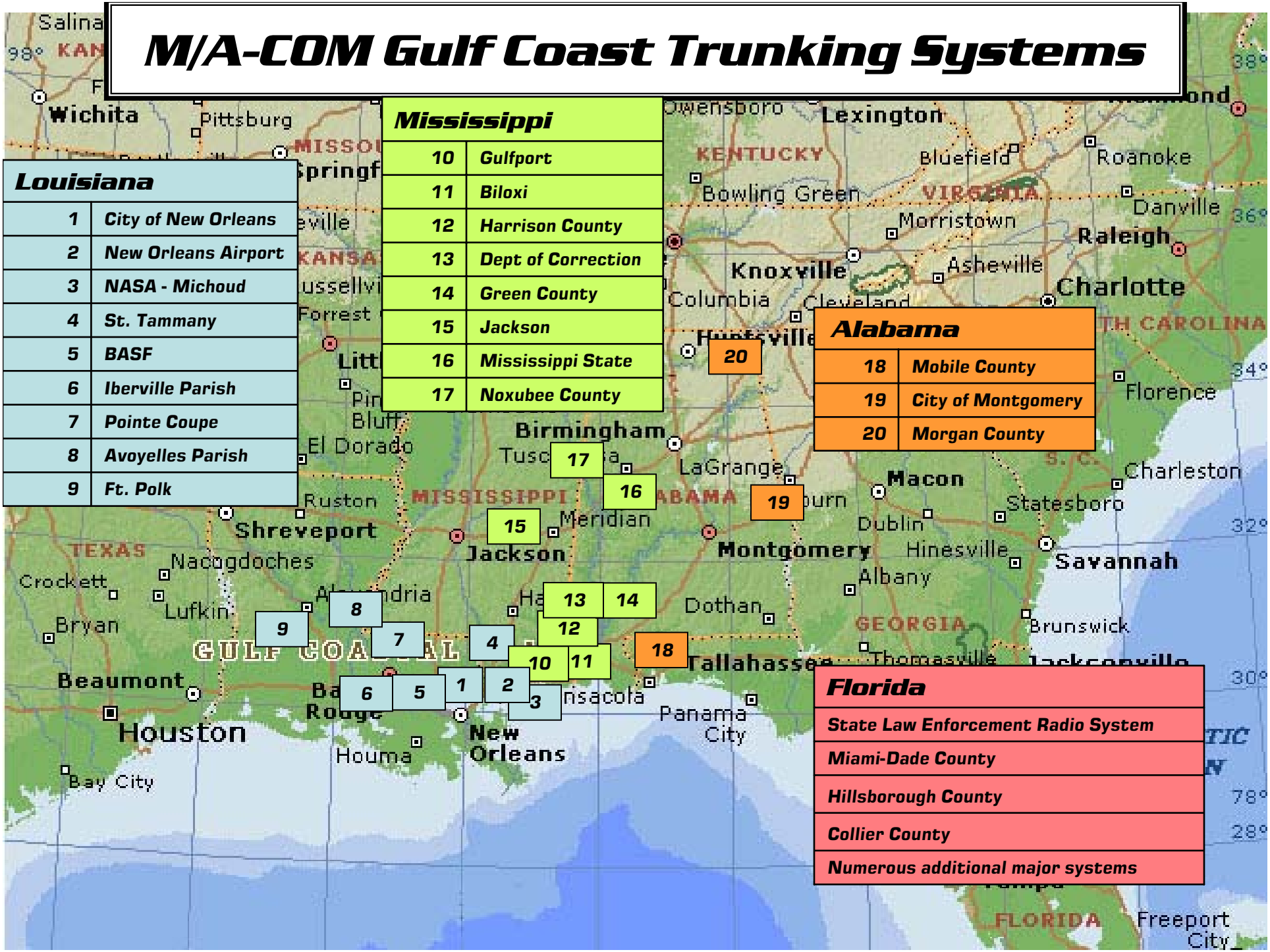
Technical Advisor for M/A-COM

January 30, 2006

Attachment A

Attachment A

M/A-COM Gulf Coast Trunking Systems



Louisiana	
1	City of New Orleans
2	New Orleans Airport
3	NASA - Michoud
4	St. Tammany
5	BASF
6	Iberville Parish
7	Pointe Coupe
8	Avoyelles Parish
9	Ft. Polk

Mississippi	
10	Gulfport
11	Biloxi
12	Harrison County
13	Dept of Correction
14	Green County
15	Jackson
16	Mississippi State
17	Noxubee County

Alabama	
18	Mobile County
19	City of Montgomery
20	Morgan County

Florida
State Law Enforcement Radio System
Miami-Dade County
Hillsborough County
Collier County
Numerous additional major systems

Attachment B

Coastal Mississippi and Louisiana Radio System Overview

Interoperability Features and How Systems Performed During Hurricane Katrina

Summary

Conclusions

Background Narrative

Background for:

U.S. Senate Committee on Commerce, Science, and Transportation; Hearing on Communications in a Disaster

Coastal Mississippi and Louisiana Radio System Overview

Interoperability Features and How Systems Performed During Hurricane Katrina

SUMMARY:

Local Entity	Radio System	Vendor	Supports	During Storm	After	Restoration
Harrison County, MS (Harrison county 911 Emergency Communications District)	800MHz ProVoice	M/A-COM	+Gulfport, Long Beach, Pass Christian +Biloxi, D'Iberville +Interoperable connections with Hancock County, St. Tammany Parish and New Orleans, LA	OPERATIONAL	OPERATIONAL	NONE NEEDED
City of New Orleans (Orleans Parish)	ProVoice 41-channel 800MHz Radio Network & 12-Channel UHF	M/A-COM	Police, Fire, EMS and Airport operations.	OPERATIONAL	PARTIALLY OPERABLE	COMPLETED
St. Tammany Parish	ProVoice Simulcast	M/A-COM	+Sheriff's Office + All St. Tammany law enforcement	OPERATIONAL	OPERATIONAL	NONE NEEDED
Jackson County, MS (Jackson County Emergency Communications District)	800MHz Smartzone/Astro 3.6	Motorola	+ Sheriff's Office, +Office of Emergency Preparedness, +Gautier Police and Fire Departments +small subset of Jackson County Volunteer Fire Departments.	FAILED – FIRST 48 HOURS	PARTIALLY OPERABLE	YES – WITHIN 96 HOURS
St. Bernard Parish	UHF, VHF Conventional	Various	+Sheriff's Office +Fire +E911	FAILED	INOPERABLE	NO
Plaquemines Parish	800MHz, VHF	Motorola	Sheriff's Office and Volunteer Fire and (E911)	FAILED	INOPERABLE	NO
Jefferson Parish	800 MHz simulcast Smartzone/Astro 3.6	Motorola	+East/west bank of Jefferson parish +Lafitte and Grand Isle	FAILED	PARTIALLY OPERABLE	IN PROCESS
St. Tammany Parish-Slidell	Smartnet II/Astro 3.6 system	Motorola	Slidell operates Smartnet. Shared by local police and fire	FAILED	FAILED	NO Migrated Slidell onto ProVoice
Louisiana State Police	Network of 800MHz analog trunked radio systems (Smartzone)	Motorola	Orleans, Jefferson, St. Bernard, Plaquemines, St. Tammany	PARTIALLY FAILED (New Orleans Area)	PARTIALLY OPERATIONAL	COMPLETED

CONCLUSIONS:

The three radio systems that SURVIVED Hurricane Katrina shared crucial design aspects:

- Each used licensed protected microwave for site interconnectivity
- Equipment shelters were rated for 150MPH winds.
- All transmitter, receiver, and control point sites operated on DC power
- No uninterruptible power systems were used for transmitter sites
- All sites used natural gas/LPG generators
- All sites had towers and antennas designed to withstand 140MPH winds
- All remote transmitter sites were elevated (including generators)
- Transmitter battery backup systems were sized for up to 12 hours operation
- 800MHz infrastructure used distributed processors
- Pre-designed fall back modes maintained trunked radio functionality

The radio systems that FAILED to survive Hurricane Katrina shared the following design deficiencies:

- Reliance on UPS equipment having short run times (single point of failure)
- Use of diesel generators (risk of fuel contamination and delivery interruptions) in lieu of natural gas/LPG generators
- Ground-mounted equipment shelters and generators
- Poorly designed equipment shelter facilities, prone to wind damage
- Antennas and/or towers improperly designed for local environment
- Use of leased Telco site interconnectivity, in lieu of license microwave.
- Trunked radio configurations designed without critical redundancies.
- Little or no attention given to failure modes of operation.

Coastal Mississippi and Louisiana Radio System Overview

Interoperability Features and How Systems Performed During Hurricane Katrina

BACKGROUND NARRATIVE [i]

A. Jackson County, MS

The Jackson County Emergency Communications District operates a three-site 800MHz Motorola Smartnet II/Astro 3.6 trunked radio system. Tower sites are located at Fountainblue (adjacent to Fire station), Pascagoula (within the County's Emergency Operations Complex) and Vancleave (co-located with an electric utility).

The 800MHz radio system supports the Jackson County Sheriff's Office, Office of Emergency Preparedness, Gautier Police and Fire Departments and a small subset of Jackson County Volunteer Fire Departments.

During the height of Hurricane Katrina, all three tower sites as well as the E911 Public Safety Answering Point (PSAP) and radio dispatch center, located at the Sheriff's Office Headquarters Facility in Pascagoula, failed. With the entire 800MHz/PSAP network suffering flooding or wind-related damage, there was no 800MHz radio communications for approximately 48 hours, however, all sites were restored, to a fashion, within 96 hours after storm passage.

Many of the smaller municipalities within Jackson County had not migrated onto the 800MHz radio network and continued to operate separate VHF radio systems. All of these VHF radio communication systems had failed due to loss of electrical service, damaged antennas or flooded facilities.

The only form of meaningful radio interoperability available within Jackson County was its two NPSPAC 800MHz mutual aid channels (I-CALL and I-TAC). These repeater stations were located at the Vancleave tower site but were likewise off the air for approximately 48 hours after storm passage. Users were able to communicate, to a very limited extent with neighboring Harrison County by virtue of its intact Mutual Aid NPSPAC infrastructure

B. Harrison County, MS

The Harrison County 911 Emergency Communications District operates a five-site 800MHz dual simulcast radio network. A three-site, 20-channel EDACS ProVoice system provides coverage throughout the Cities of Gulfport, Long Beach and Pass Christian. A two-site 10-channel EDACS ProVoice simulcast system provides coverage principally for the Cities of Biloxi and D'Iberville. Both systems have substantial overlapping coverages and are integrated, using a M/A-COM Integrated Multisite Controller or IMC, into a seamless radio network for countywide operations. All municipal and county public safety operations utilize this shared radio network and enjoy inherent radio-to-radio interoperability between County agencies.

Interoperability to adjacent Hancock County is via VHF base stations, located at the Harrison County prime tower site. Additional link base stations are include for communications to St. Tammany Parish (800MHz EDACS) and New Orleans, Louisiana (800MHz EDACS). Using M/A-COM Causeway patch technology, Harrison County radio users have the ability to select and activate these various radio patches by selecting the appropriate patch talkgroup on their radios or by requesting manual patch activation by their radio dispatchers.

In addition to the trunked radio system, the County operates five NPSPAC 800MHz Mutual Aid Repeaters, in accordance with FCC guidelines. This mutual aid system allows responders from outside agencies, having 800MHz radio equipment, to communicate regardless of proprietary vendor technologies.

The Harrison County radio system survived the full impact of Hurricane Katrina, yet had sustained no aftermath service interruptions and continues to operate, today.

C. St. Bernard Parish

St. Bernard operates a six-channel UHF conventional radio system for Sheriff's Office operations and a two-channel VHF conventional radio system for Fire operations. Radio dispatching and E911 operations are co-located at the Sheriff's dispatch center.

The entire St. Bernard Parish was devastated by Hurricane Katrina and was nearly 100% flooded. The entire public safety radio/E911 communication system failed and continues to be inoperable.

Since neighboring Orleans, Jefferson and Plaquemines Parishes operate 800MHz radio networks, St. Bernard had no true radio-to-radio interoperability with adjacent areas due to frequency incompatibility.

D. Plaquemines Parish

Plaquemines Parish is located between St. Bernard and Jefferson Parishes. The Parish has been utilizing a conventional 800MHz radio system for Sheriff's Office operations. Fire operations have used VHF technology.

Interoperability between the Sheriff's Office and Parish Volunteer Fire Departments, prior to the Hurricane, was extremely limited and what interoperability then available was accomplished using dispatcher-initiated radio patches via wireline connections.

The entire Plaquemines Parish area was devastated by Hurricane Katrina and nearly 100% flooded. The entire radio/E911 network for the Parish was totally disabled, due to flooding and wind damage.

E. Jefferson Parish

The Jefferson Parish Sheriff's Office operates an 800MHz two-site simulcast Motorola Smartzone/Astro 3.6, which serves the East/West Bank of Jefferson Parish. As Jefferson Parish extends far south and includes Grand Isle, two smaller four-channel 800MHz subsystems are located in Lafitte and Grand Isle. These two sites are networked with the prime simulcast system, using the Smartzone switch, into a wide area communications network.

The Fire Department operates an analog Motorola 800MHz trunked dispatch/conventional talkgroup network.

It is reported that all systems failed during the height of Hurricane Katrina, most failures as a result to high winds and, for those sites in lower Jefferson Parish, rising flood waters. The most spectacular single event being the catastrophic failure and total collapse of the Jefferson Parish Sheriff's Office 400ft. prime communications tower in Gretna.

Once the trunked radio systems failed during the actual storm event, critical public safety operations shifted to remaining NPSPAC mutual aid transmitters operated by the State Police and the City of New Orleans.

Emergency repairs to the JPSO radio network have been initiated. A 300ft crane is temporarily serving as the Gretna tower.... with a permanent replacement many weeks away. Emergency repairs had also been made to the network's second simulcast site (Galleria), however, that location later failed due to telephone circuit interconnectivity outages. No repairs have been made to radio tower sites in lower Jefferson Parish due to high water and unsafe conditions.

F. City of New Orleans (Orleans Parish)

The City operates an EDACS ProVoice 41-channel Tier I 800MHz radio Network for Police, Fire, EMS and Airport operations. Local government communications for other City agencies utilize a 12-channel UHF radio network termed Tier II. The New Orleans Tier I radio network is the largest of its type in the Louisiana/Mississippi Gulf Coast and serves approximately 4,500 radio users.

The radio network consists of:

A. Two-site, 24-channel simulcast radio system

B. Armstrong Airport 9-channel site

C. Irish Bayou 5-channel site

D. Two Primary and three secondary dispatch locations

E. Multi-hour battery backup and natural gas generators

F. NPSPAC Mutual Aid subsystem

G. Integrated Multisite/Simulcast Network Controller

The radio system continued full operations throughout the passage of Hurricane Katrina and well into Monday after the storm's passage. Late Monday afternoon the primary transmitter site, Energy Centre, failed due to generator damage caused by airborne debris. The secondary Cox site was disabled due to an off-path microwave antenna. State Police blocked access repair technicians and ignored Letters of Authorization allowing full access and passage into the City. Generator was repaired Thursday and the system resumed operation September 1st (Thursday night). The realignment of the microwave antenna required three days due to a persistent sniper that eluded detection by both NOPD SWAT and the National Guard.

The EDACS Causeway feature was equipped, prior to Hurricane Katrina, to provide both automatic and dispatcher-controlled (radio-to-radio) interoperability with Jefferson Parish Sheriff's Office, DEA, St. Tammany Sheriff's Office, St. Bernard Police/Fire, City of Slidell Police and Fire, the Regional Transit Authority and the State Police. In the storm's aftermath, additional interoperability links have been installed to support helicopter/Fire department rescue operations as well as communications with the National Guard.

Flooding throughout Orleans Parish made the primary, as well as secondary, dispatch centers uninhabitable. While the EDACS radio dispatch equipment remained operational at these locations, none of the primary/secondary sites could be staffed due to personnel-safety concerns.

G. St. Tammany Parish

The St. Tammany Sheriff's Office operates an 8-channel, 5-site EDACS ProVoice simulcast radio system. This radio system is now shared by all of St. Tammany law enforcement (Madisonville, Folsom, Mandeville, Covington, Abita Springs) with the exception of the City of Slidell. Slidell operates a single-site 7-channel Motorola Smartnet II analog/digital radio system, shared by City police and fire services.

St. Tammany is served by twelve volunteer and paid fire departments. Four are now operable on the EDACS ProVoice system, one is operable on the Motorola system and the remaining departments operate conventional VHF radio systems.

The entire St. Tammany Parish area was impacted by Hurricane Katrina, but the actual eye of the storm...with sustained winds near 145 miles per hour...passed over the City of Slidell.

The entire EDACS ProVoice radio network remained operational throughout the hurricane and remains operational, today. The Slidell radio system failed during the storm, which prompted the immediate migration of Slidell public safety operations onto the Sheriff's ProVoice system.

The St. Tammany Sheriff's Office also maintains a five-channel, two-site NPSPAC Mutual Aid radio network and Causeway interoperability links with Hancock County (VHF), Harrison County (800MHz), New Orleans (800MHz), Louisiana State Police (800MHz) and the Causeway Police (800MHz LSP and UHF).

H. Louisiana State Police

The State Police operates nine district locations (Troops) throughout the State of Louisiana. Each Troop has an assigned 800MHz Motorola analog trunked radio system or systems, depending upon the location and officer density within a Troop service area. These many smaller 800MHz systems, interconnected by either Louisiana Department of Transportation microwave or leased telephone circuits, become part of a statewide Smartzone communications network located in Baton Rouge.

Functionally, the Orleans, Jefferson, St. Bernard and Plaquemines areas are supported by State Police Troop B, while St. Tammany is served by Troop L. Within the New Orleans/Jefferson Parish area, Troop B's main ten-channel transmitter site is located at Bridge City, approximately 8.5 miles northwest of New Orleans. Additionally, one Interoperability NPSPAC mutual aid channel is located at the Superdome and two others at the Bridge City site.

During Hurricane Katrina, the Bridge City site was flooded and was rendered inoperable. The Superdome site failed due to site-related damage and loss of electrical power. Replacement repeater stations were installed at the Bridge City site and it was restored to operations by September 1st.

Public Safety Radio Network Performance: Hurricane Katrina

Hancock, Harrison and Jackson County, Mississippi were positioned on the northeast quadrant of Hurricane Katrina and were exposed to the storm's highest peak hurricane force winds and largest tidal surges. Hancock County's entire VHF public safety radio infrastructure was destroyed. Within the last week, Motorola has provided and installed an emergency single-site 800MHz trunked radio system that is providing a measure of communications support within those towns having the worst devastation: Bay St. Louis, Diamondhead and Waveland. An $8.5 million dollar contract has been awarded to Motorola to further expand their deployment and complete emergency radio network repairs.

Similarly, Jackson County experienced very high storm surges within the coastal City of Pascagoula. These surges ultimately destroyed a key tower site and E911 radio dispatch

facility. This 800MHz Motorola radio system required costly repairs to all three tower sites and full replacement of radio infrastructure equipment at the Pascagoula tower.

By contrast, the five-site Harrison County EDACS ProVoice Network operated throughout the storm's passage and has required only minor infrastructure repairs. Harrison's was the only public radio system operable along the Mississippi Gulf Coast for several days after the hurricane's passage.

Continuing westward, the eyewall of Katrina passed directly over the City of Slidell (St. Tammany Parish), and exposed that area to 140 miles per hour sustained winds. Here, the City of Slidell's Motorola police/fire radio communication system completely failed. Fortunately, the St. Tammany Sheriff's Office radio system (EDACS ProVoice) continued to operate, as designed, throughout the hurricane and has required only minor infrastructure repairs.

All public safety radio systems operated by St. Bernard, Plaquemines, Jefferson Parish and State Police Troop B (Bridge City) failed during the passage of Hurricane Katrina. The only radio system operable during and in the immediate aftermath of Hurricane Katrina was the City of New Orleans Tier-I Radio Network (EDACS ProVoice). The system did, however, drop off the air late Monday due to a prime-site generator failure and did not resume operation until late Thursday night. The necessary repair, a small hole in a generator radiator caused by flying debris, could have been completed within hours. Yet, an unexplainable failure of Louisiana State Police field officers to allow unimpeded passage of City-permitted repair technicians back into New Orleans delayed this simple, but urgently needed repair.

The three radio systems that survived Hurricane Katrina shared critical design aspects:

- Each used licensed protected microwave for site interconnectivity
- Equipment shelters were rated for 150MPH winds.
- All transmitter, receiver, and control point sites operated on DC power
- No uninterruptible power systems were used for transmitter sites
- All sites used natural gas/LPG generators
- All sites had towers and antennas designed to withstand 140MPH winds
- All remote transmitter sites were elevated (including generators)
- Transmitter battery backup systems were sized for up to 12 hours operation
- 800MHz infrastructure used distributed processors

- Pre-designed fall back modes maintained trunked radio functionality

The many radio systems that failed to survive Hurricane Katrina shared the following design deficiencies:

- Reliance on UPS equipment having short run times (single point of failure)
- Use of diesel generators (risk of fuel contamination and delivery interruptions) in lieu of natural gas/LPG generators
- Ground-mounted equipment shelters and generators
- Poorly designed equipment shelter facilities, prone to wind damage
- Antennas and/or towers improperly designed for local environment
- Use of leased Telco site interconnectivity, in lieu of license microwave.
- Trunked radio configurations designed without critical redundancies.
- Little or no attention given to failure modes of operation.

---

[i] Prepared for M/A-COM, Inc. by Independent Consultant:
Dominic F. Tusa
Tusa Consulting Services, Inc.
3416 Metairie Heights
Metairie, LA 70002

504-837-3971 tel
504-400-8873 mobile
954-243-1999 mobile

http://www.tusaconsulting.com/