Communications in Disaster Response

Issues, Observations and Recommendations

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BACKGROUND

For the last nine years I have been the Radio Systems Manager for Polk County Florida operating a trunked radio system serving some sixty local, state and federal agencies as well as providing a data network for a number of those agencies. Polk County is a central Florida county roughly the size of the state of Rhode Island. Prior to coming to Polk County I served as Director of Communications for Lee County Florida responsible for radio, telephone, cellular, pagers, CATV franchises, county-wide data network and data connectivity for the five county Judicial District. Before entering the communications arena I spent thirteen years as a police officer.

Currently I have served for 9 years as the Chairman of Sub-Region 5 of the Federal Communications Commission Region 9 Regional Planning Committee after serving as the Region Committee Vice Chairman for the seven years prior.

During my tenure in communications I have been directly involved in providing disaster communication following: Hurricanes 1) Andrew 2)Opal 3)Charlie 4)Frances 5)Ivan 6)Jeanne 7)Dennis 8)Katrina 9)Wilma, as well as numerous tropical storms and brush-fires. The response to Hurricane Katrina involved a thirty day deployment to Hancock County Mississippi where the eye wall made landfall.

In the case of Hurricanes Charlie, Frances, and Jeanne I, my county and my radio system were also victims as the eye of those three storms crossed Polk County within a six week period. These three Hurricanes provided us the dubious distinction of being the only county to ever be hit three times in one season.

I have read many of the reports, comments, and recommendations on communications following the 2005 Hurricane Season with a great deal of interest and curiosity . I know personally, and have talked to many of the communications professionals actually involved with these events. I am also aware that like myself, none of the people actually involved in the response have heard from those writing the reports.

A review of any disaster after action report will always find communications, or lack thereof, a major topic of criticism. This is true in this country as well as anywhere in the world. Following the events of September 11 and the resulting communications debacle one would certainly have expected a significant improvement by the time Hurricane Katrina made landfall. Given the amount of grant funding and budget dollars spent on communications along with the push for interoperability in public safety communications, improvement should have been expected. Such improvement was not the case, nor is any likely until such time as a President appoints a Disaster Communications Transformation Administrator with the authority to mandate the necessary change.

OVERVIEW

By its very nature a disaster affects all infrastructure in the area local to the event. The area can be relatively small when dealing with events such as tornados to an entire region of the nation in the case of Hurricane Katrina. This affected infrastructure includes the power grid with both generation and distribution stations, water and sewer services, transportation networks, fuel and food distribution, medical services, telephone system outside plant and central offices and all forms of wireless communications dependant on terrestrial infrastructure. In short, all of the services we take for granted on a daily basis are disrupted or destroyed. The loss of these services in conjunction with the mass casualties and overall damage and destruction resulting from the incident are what defines the event as a disaster.

The "First Responders" to a disaster are the local public safety agencies who are also victims of the event, and the public safety agencies adjacent or reasonably close to the event. While many state and federal agencies including FEMA play critical roles in disaster response they are not, and should not be viewed as "First Responders". Some state and federal agencies such as State Police / Highway Patrol and the Coast Guard do fulfill "First Responder" duties. It must be remembered that the overall resources of these state and federal agencies are spread thin and continue to have responsibilities outside the disaster area. The lack of understanding of the mandates of many of these agencies coupled with unrealistic expectations has caused unwarranted criticism of FEMA in particular and the DHS and overall Federal Government response in general.

A truism regarding disasters can be stated as: If you are the victim of a disaster you are at the mercy of your neighbors ability to come and help you. If your neighbor is the victim of a disaster they are at the mercy of your ability to come to their aid. Every agency at the Federal, State and Local level who provide Public Safety services should recognize they have a responsibility to be capable of deploying a Service Delivery Package consistent with the overall size and capability of their organization. In terms of Law Enforcement a small agency may only be able to offer up one officer and his vehicle who can augment a larger response unit. A large department may field fifty officers of their own augmented with additional officers by the smaller surrounding agencies.

Polk County Florida is capable of providing an entire self supporting Public Safety service delivery unit consisting of Law Enforcement, Fire Services and Emergency Medical Services and a Disaster Communications Infrastructure Unit. The combined Task Force includes its own housing, feeding, fueling, power and road clearing equipment as necessary. The Task Force is capable of taking full responsibility for a given geographic area or combining with other response agencies in a joint command operation. While staffed in large part by County agencies it is augmented by the municipalities within the County. A key element in the successful operations of the Task Force has been their ability to deploy communications infrastructure capable of providing full land mobile radio service covering their area of operation. That communications capability was sorely tested in the Hurricane Katrina response trying to provide coverage to an entire county and all of the responders with disparate systems.

DISASTER COMMUNICATIONS

Providing communication in a disaster environment provides complications and challenges in an already complex field. A disaster event creates communication needs well beyond the scope of normal daily operations and at the same time renders the majority of in-place communications system inoperable. All disaster response agencies, planners and response commanders must take this particular condition into account and must provide a solution as to how their people will communicate within the disaster area as well as how they will communicate back to their home area. This condition is exacerbated by the lack of a national standard or system. The result is responders showing up with disparate systems spanning the spectrum including Low Band, VHF, UHF and 800MHz that have no interoperability. Consequently two responders from different agencies can not even talk to each other across the street much less function as a cohesive unit.

Another truism of disaster response including disaster communications is: If you didn't bring it with you, then don't expect to have it. Every victim agency can tell of groups of responders showing up and the commander coming over and asking; Where is our hotel, when do you feed us, and where do we pick up radios? Without prior planning even the best intentioned can wind up as an additional liability on an already overtaxed logistics capability. All response, including communications must be well thought out before an incident, not after you have arrived.

Following Hurricane Katrina there has been much discussion on Satellite Communications Systems. (Sat-Com) While Sat-Com for both voice and data certainly has its place in disaster response it is not, and can not be the primary solution. The overall limitations of both bandwidth capacity as well as penetration within buildings limits Sat-Com to administrative and logistical uses. ie: Strategic Communications. First responders in a disaster are faced with an immediate need for functional systems that support front line operations. ie: Tactical Communications.

Another truism in Disaster Communications, and in Disaster Response as a whole can be stated as: All failures of communications in a disaster response can be attributed to a lack of imagination. Communications planning for a disaster needs to take into consideration all forms and types of communications including wired and wireless, civil, commercial and military, voice, data and video. This planning needs to extend from Sat-Com down to paper messages and runners. All possible situations regarding the local systems must be taken into account and contingencies planned for each circumstance and the potential loss or failure of each type of system.

Following Hurricane Ivan the Escambia County radio systems were still on the air and functioning as were commercial wireless carriers. Wire line services along the coast were disrupted but with much of the local infrastructure working, communications requirements for

Task Force Polk were limited to our area of operation. We provided trunked radio services to all of the out of county responders assigned to work in our area of operations and provided interconnect with Escambia County.

Following Hurricane Katrina there were no systems operating within Hancock County Mississippi. The portable tower and 800 MHz trunking system provided by Task Force Polk along with the additional radios provided by Motorola Communications and Electronics, Inc. was the primary tactical communications system on the air. Within ten days a second trunked system was placed on the air at a tower site in the North side of Hancock County. This site provided coverage throughout the North part of the county. The Hancock County agencies started switching over to the new system a short time later. The out of county responders and the Hancock agencies operating in the Southern part of the county continued operation on the Task Force Polk system for thirty days. A portable tower and second trunked system were provided by Motorola at the end of the first month to relieve the Polk County equipment.

For those agencies operating within Hancock County that required operations on other bands we placed VHF and UHF repeaters on the air and implemented patches between the disparate systems to achieve interoperability. As an example: the national guard helicopter unit doing night patrols in support of law enforcement did not have 800MHz narrowband capability but did have VHF FM radio capability. An agreed upon VHF repeater was brought on the air and that channel patched into the 800MHz talk group being used for law enforcement patrol. This combination allowed the helicopter crews to talk directly to the law enforcement officers on the ground.

Strategic communication were handled with both 800MHz and Sat-Com. Communicatinos between the forward command area, the Hancock County Emergency Operations Center, and the MAC Unit operating in Harrison County were handled primarily with 800MHz radio. The EOC and Forward Command could talk on the trunking system. One of the National Mutual Aid conventional channels was operating with a directional antenna pointed at the MAC unit in Harrison County. Another National mutual aid conventional repeater was operating for coordination with response units arriving in Hancock County and in support of Florida State units with M/A-Com radios.

We established a wireless access point serving all of the computers with wireless capability in the forward command area. This tactical LAN was supported with Internet access through a satellite system provided by Harris Communications. The Internet access was also made available to the Waveland Police Department building from the Forward Command area with a spread spectrum point-to-point link.

The Mobile Radio Repair Shop and the technicians that accompanied Task Force Polk served the entire thirty day period. During that time they provided local and long range communications systems in support of the operations, assisted in repair and restoration of local systems, and programmed and maintained mobile and portable radios for all of the responders coming into the area. Within the first week the three technicians had programmed over seven hundred radios to work on the Task Force infrastructure. The crew maintained a stock of charged portable radio batteries for the bulk of the responders who did not have charging capability. In addition the crew also provided computer support to all responding agencies who needed assistance setting their equipment up to operate on the wireless Internet link.

The Polk County Disaster Communications Unit operation in Hancock County Mississippi following Hurricane Katrina was a success story. It also defined one of the major communication problems in disaster response in that there is one unit with all of the necessary capabilities and there needs to be at least fifty units like it within the Gulf Coast Region alone. The practical height of a portable tower system is 100'. In the reasonably flat terrain of the costal areas based on 800 MHz this will provide between 300 and 600 square miles of coverage per site.

In addition to a trunked system to handle the bulk of the tactical communications requirements the units would need to have similar capabilities to those of the Polk County unit to include: VHF, UHF, 800 MHz Conventional National Mutual Aid channels, 800 MHz trunked system, Sat-Com for both Internet access and voice, as well as a Wireless Access Point to allow for wireless LAN capability in the immediate area and spread spectrum point-to-point equipment to extend the connectivity to adjacent areas and facilities. There will need to be technicians who are both familiar with the equipment and who have been trained to function in the austere environment found in disaster areas.

The solution for disaster communications falls into four categories being: Short Term, Mid Term, Long Term and an Optimal Plan which would be the best case solution. The general guidelines for each of those four solution levels follow. While a patchwork solution for any of these levels is possible, the most effective way to implement any of them would entail a directive from the National Command Authority mandating the implementation. Such a mandate would need to include the time frame in which it must be complete and an assignment of both the responsibility and the corresponding authority to manage the implementation.

SHORT TERM PLAN

The first step would be for the purchase of at least one hundred portable tower site units similar to the Polk County system. Due to the lead time for production of the units this must be done quickly if any of the units are to be available for the 2006 Hurricane Season. All other issues involved can be worked out while the units are in production. FEMA should probably be the purchasing authority and funding could be derived from any and all current grant funding for interoperable communications systems or communications system enhancements.

Following the order for the mobile tower sites an order will need to be placed for the communications suite to be installed in each unit. Funding for the communications package will also be derived from current grant sources in the same manor as the mobile tower sites. The considerations for the communications package equipment needs to be based on compatibility with existing public safety systems, robustness of the equipment, and availability of parts, support, and technicians. Initially some of the trunking systems will need to be Motorola and some will need to be M/A-Com. There must be a guarantee from the companies that the equipment they are providing can and will be upgraded to the APCO 25 standard when deemed necessary.

In conjunction with the State Emergency Management Agencies a decision will need to be reached as to which local agencies will receive the mobile tower sites. Local agencies should have an opportunity to apply for one of the units. Applications should require the following commitments from the receiving agency:

1. They will maintain the equipment in operational / deployable condition at all times.
2. They have and will maintain technical staff necessary to operate the units.
3. They will deploy the units and the necessary staff when and where needed.
4. They will ensure their technical staff will acquire and keep current the necessary training on the equipment.
5. Equipment provided will not be diverted for any other use and the agency will replace any lost, stolen, or damaged equipment.

Of the remaining fifty units, twenty should be assigned to East coast local agencies and twenty assigned to West coast local agencies. The remaining ten should be maintained by FEMA as rapid response units from two central locations. ie: Atlanta and Denver or similar configuration. If handled on a priority basis at least some of these units would be available during the 2006 Hurricane Season.

MID TERM PLAN

In 2009 additional public safety bandwidth is to be made available in the 700 MHz portion of the spectrum. As a condition of approval for the Region Plans for each state the FCC Regional Planning Committees should have a mandate to establish no less than twenty-five channels that are reserved for disaster communications trunked system use. This would allow multiple five channel trunked systems to be used in close proximity without interference. Due to the limited range of low towers the frequencies can continue to be re-used throughout the disaster area.

FEMA and the states can prepare a channel allocation plan for use of these channels based on possible site locations within each state. As system ID's and control channel assignments can be reused, the disaster systems can be pre-programmed into first responder mobile and portable radios. At such time as the mobile sites are implemented responders will only need to change channels to be able to operate from the systems.

By this time a set of incentives should be developed and in place to assist state and local agencies to migrate to APCO-25 compliant radio systems. A large portion of communications related grant funding from all sources should be earmarked for just this purpose. At a point that makes sense the Disaster Communications Mobile Tower Site equipment can be upgraded to the APCO-25 standard. As state and local agencies migrate there will be less of a need for large caches of portable radios as a larger proportion of responders will be carrying APCO-25 compliant radios.

During this time leading up to this point FEMA and DHS should have a plan in place to insert at least two satellites with extremely large bandwidth capability into geostationary orbit over the North American continent. The purpose of these two satellites will be to support federal, state, and local Sat-Com for both daily and disaster related use. The capabilities of these units should include voice, data, and video capability with earth stations providing Internet access. The purpose of these satellites should be mandated to support public safety agencies.

The bulk of the bandwidth should be split between local agencies and the DHS agencies with a small amount available to the states. Seldom is an entire state government cut off from hard wire voice and data communications systems. Local government agencies, especially those on or close to the coast can expect to be cut off for weeks following a major Hurricane. Link budgets can be established that provide some dedicated bandwidth to each agency and a larger volume of shared bandwidth that will be assigned dynamically. The use by local agencies will be limited to testing, training, and secondary uses. During an actual disaster all non disaster related local agency use would be prohibited for the duration freeing up bandwidth for disaster use.

LONG TERM PLAN

In conjunction with the Short and Mid Range Plans the federal government must establish a single, nation wide radio communications system. Such a system must be mandated for all DHS and DOJ agencies. In addition the mandate would cover any other agency that provides first responder services or is involved with national security and the protection of its people and resources. This would include the military at CONUS installations.

As has been clearly demonstrated in every natural disaster as well as the terrorist attacks of September 11th we must all be able to communicate. Both the regular military as well as the National Guard from many states were present following Hurricane Katrina. Many civilian agencies responded to the Pentagon on September 11th. Both local, state and federal agencies were involved in the September 11th attack on the World Trade Center.

It is long past time for the federal, state and local governments to share information and communications resources. It is even longer passed time for the federal agencies to bury the axes of turf issues and cooperate. Part of the problem they have faced in overcoming this issue is that their people can not communicate with each other. This creates a barrier of mistrust that has festered for two centuries and has been reinforced by policy.

The unified federal communications system would be the standard to which all state and local agency systems would have to comply. All of the systems should be connected and any local, state, or federal officer should be able to go anywhere in any state or territory and be able to communicate with any agency with one radio. The technology is available today to have a joint system serving all agencies that protects their day to day communications but allows them to interact at any level when necessary.

The overall system would be served with a backbone consisting of fiber optic cable, microwave and Sat-Com. To the extent possible it will make use of existing towers and tower sites. By sharing tower site resources between the local, state and federal level we can have a nation-wide radio tower site network without a large capital investment. The funds saved through such a venture of cooperation instead of duplication could be far better spent on the upgraded systems and enhanced levels of redundancy. The new backbone systems would provide for enhanced data services in particular for federal agencies as they have to service the entire country. This provides a far greater ability to provide services to the citizens at a reduced overall cost.

OPTIMAL PLAN

1. The President appoints a National Communications Transformation Administrator.
2. The President issues a directive to all federal agencies to comply with the transformation.
3. Short term plan outlined above is put into effect.
4. Department of Transportation and Corps of Engineers are tasked with the fiber backbone project.
5. Defense Department, NASA, NTIA, FCC, and NSA tasked with satellite backbone and earth-station project.
6. FEMA, DHS and DOJ tasked to develop a cooperative agreement with the states and territories regarding joint use of tower site facilities and compatibility of systems. Secondary tasking to assist states in developing agreements with local governments for same.
7. Transformation Administrator meets with NTIA and FCC to identify specific spectrum to be used for the system.
8. Transformation Administrator meets with communications manufacturers and outlines the nature of the project. Communication manufacturers tasked to develop joint workgroups for: A) System design and technology, B) Infrastructure hardware, C) Subscriber hardware, D) System security, E) System Management, F) System implementation and integration. Overall the design is for a single system based on a standard all can build to. This may entail each manufacturer building different portions or several manufacturers building identical parts.
9. DHS, DOJ, State and Local agencies prepare state-wide working groups for each state and territory to identify existing infrastructue and develop overall state-wide system design.
10. Transformation Administrator, NTIA, NSA and FCC review and approve system design.
11. Manufacturing begins.
12. System implementation and integration begins.
13. System testing begins.
14. User training begins.
15. Agency cut-overs begin.
16. System build-out completes.
17. System cut-overs complete.
18. Normal operation and maintenance mode starts.
19. Technology evaluation and upgrade planning process begins.

DISASTER COMMUNICATIONS MOBILE TOWER SITE EQUIPMENT

1. Tower trailer with 100' tower, 8' x 8' equipment shelter, 10Kw Generator, fuel tank
2. Prime Mover for tower trailer: F-350 4WD V-10 or equivalant
3. 5-ch 800 MHz Trunked Radio System
4. 3 800 MHz conventional repeaters
5. 2 UHF Conventional repeaters
6. 4 VHF Conventional repeaters
7. 2 military SINCGARS type radios capable of being a retransmission point for Guard and Military
8. Associated antennas, cables, tools, spare parts.
9. 8' x 34' Mobile Radio Repair Shop Trailer
10. Prime Mover for Mobile Radio Shop trailer: F-650 w/ crew cab, flat bed (or equivalent) and 30Kw generator
11. Radio shop equipment for programming and repair including spare parts and tools.
12. Sat-Com system for both voice and data connectivity
13. Wireless access point
14. Rajant Corp. Breadcrumbs for MESH type network to extend Wireless access point. (Min. 3)
15. Spread spectrum point - to - point links. (Min 1 pair w/antennas and cables)
16. URC-200 AM/FM, VHF/UHF Aviation radio
17. Icom hand-held aviation radio
18. SGC-2000 HF Radio
19. Raytheon/JPS ACU-T or Motobridge interoperability equipment
20. Data network equipment including server, workstations, printers
21. Battery chargers capable of charging a minmum of 100 portable radio batteries at a time.
22. Portable telephone key system with 25 phone sets, wire, jacks, and telephone tools. (24 lines in by 48 extension capability)
23. 4-wire T-1 to RJ-45 Ethernet Multiplexers with 4 T-1 capability. (1-pair)
24. 80 Kw trailer mounted generator with power cables.
25. Prime mover for generator: F-350 Box Truck or equivalent.
26. Cache of portables 100 - 200 with minimum of 2 batteries each.
27. Crew support for up to 6, minimum crew of 3.
28. Extra hardline, connectors, and antennas of various types.
29. Service monitor
30. Spectrum analyzer

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