An Analysis of Inter-Agency Radio Communications with Emergency Responders

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Abstract

Interagency communication among emergency responders has been a long-standing problem since the implementation of the two-way radio. The achievement of interoperability among users of various frequencies is essential to increase efficiency and safety between different entities of public safety. Many current communications systems are proprietary in nature, making them incompatible with one another. This research will focus on the concerns of interagency communication of first responders and the barriers that exist in its development. The scope of this research will also analyze local law enforcement agencies in Northwest Florida and their interoperability among other emergency services. First responders are critical to the initial reaction plans of manmade or natural disasters and common frequency capabilities are necessary in achieving interoperability.

Introduction

Research Problem

The diversity of communication systems among emergency responders prohibits inter-operability between agencies. These agencies operate on a wide variety of communications systems to include VHF and UHF. Ordinarily, these systems cannot communicate with one another. Another problem is that manufacturer's communications systems are generally proprietary in nature. That is their systems are not compatible with each other. The various technologies used by each manufacturer make them incapable to integrate communications with one another.

Currently, most organizations achieve interagency communications by obtaining radios with compatible frequencies or speak face to face at a scene. One of the most common forms of interagency communication takes place between organizations via third party, i.e. dispatch-to-dispatch and then to the on scene units. This type of indirect or relayed message system is susceptible to miscommunication and delays. Coordinating a plan of action during the course of an emergency may involve several messages being sent back and forth, compounding delays for relaying critical information.

Emergency responders have publicized problems concerning interoperability issues for several years. Not until significant events such as the tragedies of the World Trade Center terrorist attacks and the Columbine shootings did the problems become magnified and placed into the public spotlight. In the Columbine incident, "responders from various agencies had no communications system that would permit them to

communicate with each other. Agencies used their own radio systems, which were incompatible with those of others." (Mayer-Schonberger 2002)

The question for the need to facilitate real-time interoperability exists among law enforcement and other emergency responders today. The ability to achieve real time interagency communication is a formula that has eluded our current state of emergency operations with our local governing agencies.

Background

The invention of radio communication began in the mid 1800's from theories developed by two English physicists, Michael Faraday and James Maxwell. These theories were applied in 1888 by German physicist Heinrich Hertz in the construction of a spark-gap transmitter which generated radio waves from an electric spark. Heinrich Hertz measured these electromagnetic radio waves by their wavelength and velocity. These characteristics of velocity and wavelength were identified as frequency. The shortest waves were identified as the highest frequency and the longest waves as having the lowest frequency. These measurements of frequency (hertz) were named in honor of radio pioneer Heinrich Hertz. Then in 1895 an Italian electrical engineer, Gugliemo Marconi, developed this technology for transmitting and receiving wireless telegraph signals. It was not until the early 1900's where the development of this technology by English physicist and engineer Sir John Ambrose Fleming and American inventor Lee De Forest was voice transmission made possible from amplified wireless signals.

Early law enforcement communication was derived from the use of whistles or a tap of a night stick. Beginning in 1917, the Detroit Police began using a "booth car" system where motorized units were deployed in two man teams. The communications device at the time was a telephone located inside the booth where law enforcement would standby waiting for assignments or advise dispatch of any problems.

In October of 1919, the Radio Corporation of America, known as RCA, was established in the United States and consumer radio broadcasts for entertainment and news came into popularity. These public broadcasts founded law enforcement's initial use of wireless technology. AM frequency was initially used by broadcasters for commercial operation. During these broadcasts, police would have the regular programming interrupted to announce information over the air on significant incidents to police cruisers which monitored these stations on their AM patrol car radios.

In 1921 the Detroit Police Department began experimenting with a low band, one-way mobile radio system. Not until 1928 did the department implement the use of one-way radio communications in its patrol vehicles. (Dobson) The dispatcher generally transmitted calls during that era however, mobile patrols could not reply and used telephone "call boxes" to relay information to dispatchers or acknowledge the call. Although one-way radio at the time was a dramatic improvement, problems such as coordinating pursuits and roadblocks existed. Other deficiencies included the inability to request back up patrols, and relaying pertinent information on crimes in progress. Other obstacles with the use of these early radios were their internal workings which were

extremely fragile because of the vacuum tubes they used. These early radios operated on batteries which had to be continuously replaced only after a few hours of use.

The initiation of the two-way police radio began in 1933 by the Bayonne Police Department in New Jersey and propelled emergency responders into today's modern day communications systems. During this same year, the invention of the FM frequency was made. The use of two-way radio systems multiplied and expanded to other law enforcement agencies around the country during this time period.

In 1939 the Connecticut State Police advanced radio operations by utilizing a frequency modulation (FM) system greatly reducing static and interference that the old amplitude modulated (AM) systems encountered. Two-way FM radio became the standard for agencies throughout the country after the achievements gained by the Connecticut State Police.

1942 marked an era where each patrol car in the Detroit Police Department was equipped with two-way mobile radio systems. By 1952 the agency instituted car-to-car capability with their communications. Until 2002, most systems were operating with analog (FM) radio systems. Recently, agencies have migrated towards digital systems controlled by computer.

Today's modern technology has advanced law enforcement communications into a new era. The development of higher frequency radios such as the current 800 MHz systems provide a combination of two-way radio communications that are computer enhanced with "trunking" capabilities. A trunking radio system can automatically allocate a small group of radio repeaters among many different users. The trunked system increased efficiency and operated by computer software.

With the development of new technology in wireless communications, the current spectrum of radio frequencies becomes more and more congested. This radio spectrum is a limited resource which is divided into bandwidths such as UHF and VHF. These bandwidths are in turn divided into frequencies or megahertz, also known as MHz. Currently, there are more that 18,000 law enforcement agencies and more than 35,000 fire and emergency medical agencies operating within the 10 Federal Communications Commission designated bands for public safety use in the United States. (West, 2004)

As reported by the Federal Communication Commission (2004), the lack of radio spectrum available, has created a problem with interference among first responders from commercial cellular services. Steps are currently being taken to correct the spectrum problem by the Federal Communications Commission which will be a first step. In August 2004, the FCC ordered frequency changes with the use of the 800 MHz frequency due to the aforementioned interference problems associated with cellular telephone services. The restructuring of public safety use of this frequency is scheduled to be completed within the next three years. The changes are the result of a three year study conducted by the FCC concerning the interference problems. The plan calls for commercial cellular service in the 700 MHz, 800 MHz, and 900 MHz spectrum to be relinquished to public safety in exchange for a spectrum in the 1.9 GHz band. However, action by our government agencies to focus on the interoperability problem still needs immediate attention. This reconfiguration of the spectrum will

provide separation between public safety and commercial operation of the 800 MHz frequency. The FCC plan is a closer step towards the interoperability goal.

The lack of interagency communication played a critical factor in the number of fatalities during the terrorist attacks of September 11th. Crucial information needed to make informed decisions regarding evacuations of facilities was not passed on to assisting agencies. As reported in the 9/11 Commission Report (2004) investigating the tragedy, "At 9:00 the PAPD commanding officer of the WTC ordered an evacuation of all civilians in the World Trade Center complex because of the magnitude of the calamity in the North Tower. This order was given over WTC Police radio channel W which could not be heard by the deputy fire safety director in the South Tower."

Since the September 11th tragedy, several states have adopted comprehensive plans to implement radio interoperability. One such plan is called the Statewide Law Enforcement Radio System (SLERS) which is being implemented to assist state agencies in Florida. The system is based on the use of a single series of frequencies, allowing interagency communication. The SLERS system is composed of seventeen participating state agencies and consolidated dispatch centers around the state. According to The Florida Legislature Office of Program Policy Analysis and Government Accountability (2004) the system is due to be completed by late 2005 with each agency utilizing 800 MHz radio systems capable of communication statewide.

As state and federal agencies focus on the need to implement radio interoperability, local agencies are looked upon to follow suit with systems to deliver needed interagency communication.

As reported by The Department of Homeland Security (2004) "In July of 2004, President Bush formally announced the RapidCom 9/30 initiative." The program focuses on first responder communications in ten high-threat cities in the event of incidents such as terrorist attacks. These locations include New York, Chicago, Washington, Los Angeles, San Francisco, Philadelphia, Houston, Jersey City, Miami, and Boston. The RapidCom 9/30 program provides resources in assisting these locations in achieving effective response capabilities.

Given the current state of local interagency communications, it is important to identify the critical need to each stakeholder in order to form an accord in developing interoperability.

In order to identify the need, a survey of all agencies must be conducted. The survey should incorporate general responses covering incidents involving first responders.

An indication of the current scope of this problem is highlighted from the U.S. Conference of Mayors, in a June 2004 survey of 192 cities; found that 60% of respondents indicated that city public safety departments did not have interoperability with the state emergency operations center. Also noted in the survey was that only 66% of agencies had interoperability across police, fire, and EMS.

Purpose and Rationale

This research is intended to reflect the current state of interagency communications in the Northwest Florida region and identify operating systems that are used between first responder agencies. It is also intended to identify practical formulas

in selecting a communications system compatible with interoperability between first responders.

With the objective of obtaining interagency communications encompassing multiple stakeholders, it is critical to analyze current operating systems to formulate a solution towards interoperability. Protocols must be coordinated on multi-agency levels to maximize efforts in establishing these goals.

The reality of interagency communication must be a standard for all emergency services in order to maximize resources. Communications play a critical factor in ensuring the safety of not only first responders, but to the citizens that they serve.

Methods

This research project was formulated from literature reviews and personal interviews. Literature on issues concerning emergency responders and interoperability was readily available through Internet research. Due to the large volume of information available, reviews were conducted using specific text searches on “interagency radio communications”. Personal interviews were conducted with local law enforcement agencies within a five county area in Northwest Florida consisting of Escambia, Santa Rosa, Okaloosa, Walton, and Bay. A standardized set of questions concerning existing interagency radio communications was presented to each entity. Two groups of agencies were identified: Agencies that lacked any form of interoperability and agencies that had initiated some type of interoperability in their communication systems.

Group Profiles

In identifying each agency’s radio capabilities, they were all surveyed with questions structured on whether they did or did not possess interoperability in communications with other emergency service agencies. These other agencies were specifically identified during the survey as Emergency Medical Services and Fire Department. Questions were also agency specific and identified whether they were mobile or base communications that had these capabilities with other first responders. Those agencies that possessed current interoperability or some form of it were queried as to the successfulness of the system and also identified what agencies they currently had communication with, Emergency Medical Services and/or Fire Department.

Results

Of the agencies surveyed, 30% reported that they had interagency radio communication capability from their mobile patrols to their local Fire Department. While 20% confirmed that the same mobile patrols had interoperability with EMS. Upon identifying the capabilities of their respective dispatch centers, 70% reported that their dispatchers had radio communications with the Fire Department. While only 20% had

direct radio contact with EMS from the dispatch center. Only 10% had across the board interoperability with EMS and Fire Department with both mobile and base stations.

One noticeable point brought up during the interview process was that of the agencies that lacked interoperability on the road, 50% reported the use of “Nextel” or similar brand “Push to Talk” cellular telephones. It was undetermined if Fire Department or Emergency Medical Services also carried such devices as they were not surveyed during this research.

Using a Likert Scale of one to ten, with ten being the highest in satisfaction, each member was surveyed on their interagency communications capability. Half of those surveyed recorded answers as below satisfied, identifying “4" or less for their answers. Only one agency responded with an answer of “10", being extremely satisfied with their communications capabilities. Only 30% of the agencies surveyed identified their interagency communications abilities as above satisfactory. Of the agencies surveyed for identification of their operating systems, 80% reported using 800 MHz communication systems.

Discussion and Conclusion

As indicated from the survey information compiled from the Northwest Florida area, the lack of interagency communication is a problem in the region. The disparity and the need of a coordinated effort to correct the problem will only allow it to thrive. Collaborative planning between government agencies will be the only resolve for this problem. From information obtained during this research the evidence points to a long road ahead in achieving interoperability for the majority of agencies.

Stakeholders in an interagency project should be identified and discussions initiated to identify commonalities for the interoperability goal. Having a shared understanding of interoperability issues will help “sell” the idea to outside entities. They may be contacted in order to share information on systems that are already established. Learning from others mistakes and developing a system from successful programs saves time and money.

A plan of action for the development of interagency communication must be considered. This would include preparation and adoption of recommended solutions from each entity. Formulating a strategy based on experiences from real world emergency incidents or from planned exercises is necessary in the development of a communications solution.

Available funding options to finance the operation must also be considered. Strategies should include grant funding from federal and state programs. When considering financial strategies, maintenance and training costs should also be included.

Identification of responsibilities and protocols for operation of the system are also necessary fundamentals that should be investigated. Issues such as who will provide maintenance and upkeep on the system, will it be “in house” or contracted out? How will the system be used? Agencies should establish agreements such as using “plain talk” to lesson confusion in communicating and instituting other parameters of its use.

Evaluation of available operating systems with equipment suppliers should be considered. Investigating what technologies are available and what spectrums of frequencies may be used are important issues. Engage a strategic plan of action to implement the communication system that is acceptable to each stakeholder. Setting a time line for the development and completion of a plan is essential.

Interoperability is a necessity that can support scenarios that include terrorist attacks and disasters such as hurricanes and hazardous material incidents. It can also support non-emergency operations; such as multi-agency task force operations, VIP escorts for dignitaries, special events, and other planned mutual aid situations.

In each of the aforementioned strategies, there is an essential hurdle they must face; of these solutions, which will be the most cost effective while providing the interoperability goal? The deployment of any system is usually restricted by what an agency can afford to operate and maintain. Thorough research in the development and planning stages are critical to the selection of a system.

To determine the scope of the interoperability problem on a larger scale, more thorough research is needed by incorporating other first responders and a broader base of law enforcement entities. Variables that were not included in this research for agency satisfaction for interagency communications were field services personnel which may have provided more insight to the problem.

Interagency communications is fragmented at best and has reached a critical point due to the lack of interoperability of communication systems. With the absence of a clear plan to achieve the interoperability goals, the severity of the problem will result in greater catastrophes. Providing our first responders with the necessary tools to do the job is a challenge that must be accomplished. It is incumbent upon our government agencies to formulate a collective agreement in finding solutions to the problem.

Lieutenant Ronald Gay has served the Okaloosa County Sheriff's Office since 1987. Ron also served as a police officer for two years in Georgia and proudly served our county for six years as a military police officer in the U.S. Army. Ron is currently a supervisor in the Patrol Division for his agency.

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Appendix A

Glossary

AM – Amplitude Modulation

FCC – Federal Communications Commission

FM - Frequency Modulation

Interoperability – Capability of communication between two or more entities in real time.

MHz – Megahertz

PAPD – Port Authority Police Department

RCA – Radio Corporation of America

SLERS – Statewide Law Enforcement Radio System

Spectrum - Usable radio frequencies in the electromagnetic distribution.

UHF – Ultra High Frequency

VHF – Very High Frequency

WTC – World Trade Center

Appendix B

Interview Questions:

1) Does your department have interagency communications with other first responders?

2) Do mobile patrols have interagency communication with EMS?

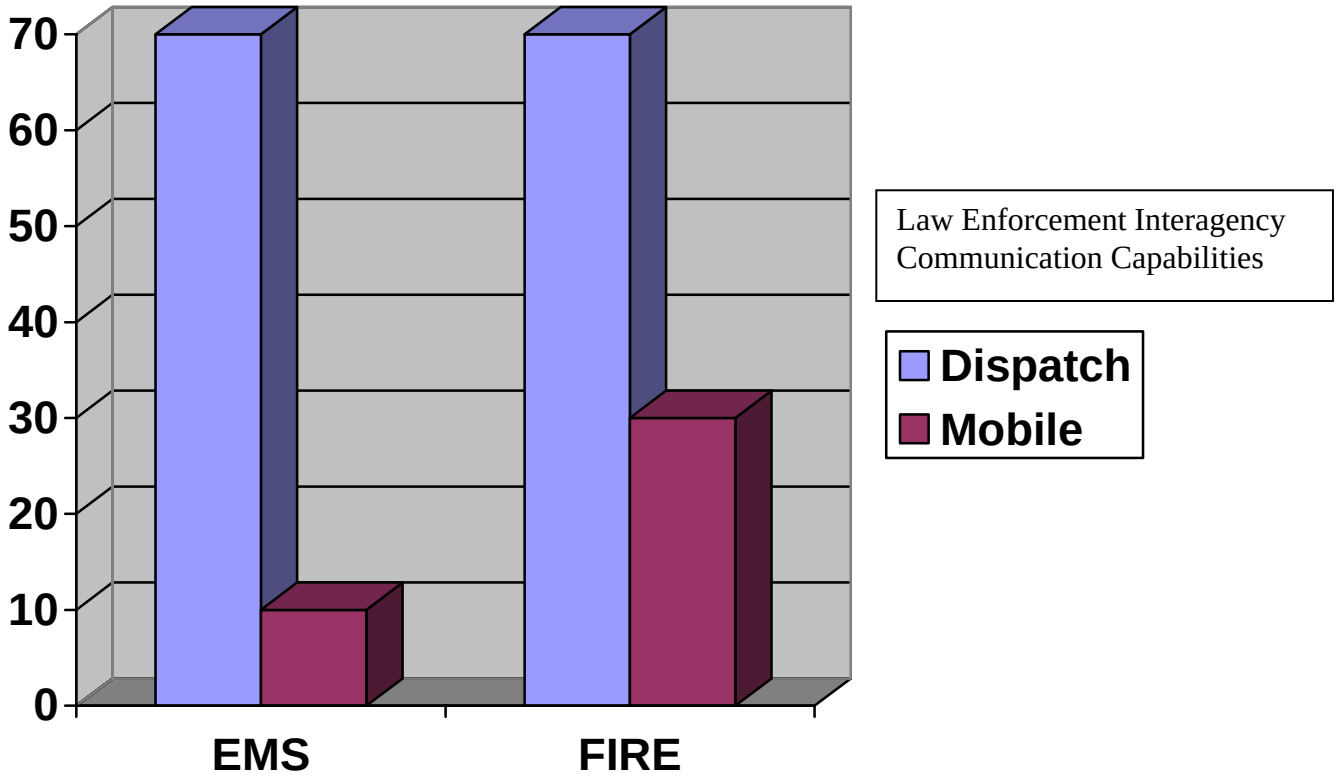
3) Does your dispatch center have radio interoperability with EMS?

4) Do mobile patrols have radio communication with Fire Department?

5) Does your dispatch center have radio communication with Fire Department?

6) What kind of system is your agency currently operating with?

7) How would you rate your current state of interagency communications with other first responders on a scale of 1 to 10 (10 being the highest)?



Interagency Communication