IDENTIFYING THE INTEROPERABILITY EXPERIENCE OF PUBLIC SAFETY AGENCIES

EXECUTIVE ANALYSIS OF FIRE SERVICE OPERATIONS IN EMERGENCY MANAGEMENT

by

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ABSTRACT

Interoperable radio communications has been and continues to be a critical component of effective and safe emergency incident operations for all public safety agencies. The problem was that the public safety agencies of the Charlottesville-Albemarle community realized that they had no plan to achieve effective interoperable radio communications. The purpose of this Applied Research Project was to analyze the complex nature of interoperable radio communications, identify factors that impede interoperability, identify viable interoperability solutions and to develop an Interoperability Strategic Planning Guide. Historical and evaluative research methods were utilized to answer the following questions: 1. What is the interoperability experience within public safety agencies? 2. What are the factors that impede interoperability? 3. What interoperability solutions are available to create effective interoperable radio communications? 4. How can public safety agencies avoid interoperability pitfalls? A literature review was conducted at the National Fire Academy's Learning Resource Center. City of Charlottesville and Charlottesville Fire Department (CFD) policies, reports and documents were reviewed. Internet research was also used to discover new interoperability solutions that were available. A survey of the public safety agencies in the Commonwealth of Virginia was conducted to determine their experience with interoperable radio communications. Results revealed that 75 % of the survey respondents had a measurable increase in the need for interoperability over the past five years. Additionally, 75% of the respondents also reported that they had a daily experience with interoperability. The results also indicated that 90.5% of the respondents indicated that they used an Incident Management System (IMS) and 86.3% used a Unified Command approach to major emergency events.

The results of literature review also revealed that there were a myriad of interoperable radio communications solutions that are available. Recommendations offered included: Identifying factors that impede interoperability; developing a list of recommended interoperable radio communication solutions; and developing a strategic planning guide to be used to implement the most effective interoperable radio communications solution.

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INTRODUCTION

Interoperable radio communications has been an integral aspect of effective emergency incident management for fire, rescue, EMS and law enforcement agencies. Issues with interoperable radio communications have existed since the days when radio communications were first introduced. Over decades, this interoperability gap grew based on call volume, development of disparate radio systems, inadequate planning, inadequate funding and inadequate radio frequency (RF) spectrum. While the problem was not a new one, the terrorist attacks of 9/11 focused the nation's concern about the ability for public safety agencies to effectively communicate, especially during catastrophic events. With the number of calls for assistance multiplying each year, and the ever-increasing potential for major events such as the bombing in Oklahoma or the terrorist attacks on 9/11, the emphasis on effectively implementing interoperable radio communications is paramount.

The Charlottesville, Virginia Fire Department (CFD) and the other regional public safety agencies have not had a formal procedure to achieve interoperable radio communications. Since the 1970's, the CFD has utilized the Incident Command System (ICS) as a means of coordinating emergency incidents involving multiple-agency responses. While there have been some small and quick-fix measures that have been implemented to address interoperable radio communications and a new 800 mhz radio system is being negotiated, there has been no formal development of an Interoperability

Radio Communications policy. As such, it currently cannot be ascertained how the various public safety agencies will communicate during such an event.

Another aspect of managing major incidents is the interaction of the regional Emergency Operations Center (EOC) that may be activated to formalize coordination of resources throughout the government and the community. The EOC conducts a minimum of two exercises per year. The mock incident(s) that comprises the exercises dictates what agencies participate. Because Emergency Management is a function of the fire, rescue and law enforcement agencies, there is always multi-agency participation. Unfortunately, these exercises are conducted without a formalized interoperable communications plan. This diminishes the ability of the agencies to effectively communicate during these exercises.

The purpose of this research project is to attempt to identify interoperability experience levels of other public safety agencies and use that to develop an interoperability strategy for the Charlottesville-Albemarle community. Historical and evaluative research methods were utilized to answer the following questions:

1. What is the interoperability experience with other public safety agencies?
2. What are factors that impede interoperable radio communications?
3. What interoperable radio communications have been implemented by other localities?
4. What, if any of these recommendations can be adapted to our region's specific situation?

BACKGROUND AND SIGNIFICANCE

The Charlottesville-Albemarle region is located in central Virginia and also includes the student and faculty population of the University of Virginia serving a combined population of over 160,000 and is comprised of urban, suburban, and rural areas. The Charlottesville-Albemarle region is a geographic area that includes 744 square miles with both flat and mountainous aspects. Three separate police departments, two separate sheriffs departments, two separate combination fire departments and three separate volunteer EMS agencies serve the region. All emergency calls are received via 911 at the joint Emergency Communications Center (ECC) and dispatches emergency incidents for all public safety except for fire department responses. Fire service dispatches are conducted for the region from the CFD Headquarters Station. The ECC is a jointly operated 911/Dispatch center and oversight is provided by representatives from the City, County and University of Virginia.

The Charlottesville-Albemarle region operates 4 career fire stations, 1 career airport fire station, 7 volunteer stations, 3 volunteer rescue squads, 5 law enforcement agencies with is comprised with over 800 personnel.

Both the City of Charlottesville and the Albemarle County have seen growth in its respective population growth. The last United States Census showed the City of Charlottesville's growth at a rate of 1.1% or an increase of 4,708. Albemarle County showed a population increase of 2.1% or 16,072. This has increased both the housing and commercial infrastructure to support the population growth. This, in turn has impacted the City of Charlottesville and Albemarle County Fire Departments with a 52% increase in calls for service.

Specific procedures for interoperable radio communications have never been addressed. This study will attempt to do that. This applied research project will relate to Interoperable Radio Communications, to the Incident Command System module, Unit 3, and the Emergency Operations Center module, Unit 9, of Executive Analysis of Fire Service Operations in Emergency Management.

LITERATURE REVIEW

The National Fire Academy's Learning Resource Center (LRC), as well as regional policies, procedures and guides, and Internet research of other interoperability reports, surveys and efforts were used as literature research for this project. Since this project was fairly broad and general, a great deal of information was available to address the issues being studied.

In the student manual for the National Fire Academy's *Executive Analysis of Fire Service Operations in Emergency Management,* it states that "The ICS is probably one of the most important tools available to the executive-level chief officer in dealing with the responsibility of managing emergency incidents." (p. SM 3-4) While this is not specifically focused on interoperable radio communications, it does establish the necessary foundation for command, control and communication. "Interoperability cannot be achieved by technology alone and requires the foundation for command and control to be established first and foremost. Interoperable communications can only be achieved through a comprehensive strategy that combines wireless interoperability, common language, limiting agency specific terminology/10 codes, unified command, joint training and practical drills, radio discipline, and standard operating guides." (T.

Garrett, personal communication, November 12, 2002) "The findings that a lack of confidence in an ability to communicate in a mutual aid environment, and in the ability to establish links with state and federal agencies, are predictive of communications difficulties that may be anticipated if an event similar to that of September 11 were to occur within New Hampshire's borders. As is noted in the discussion of the interaction of Command, Control, Coordination and Communication that follows, technical wireless interoperability is only one in a series of vital elements necessary to insure adequate communications." (Lund, 2001) "Incident Command Systems (ICS) are key to the effective use of current interoperability solutions, you can't have one without the other." (Lanktree, 2002) In an article addressing emergency management concerns, "Emergency management is a team effort with response plans that rely on cooperation and coordination among local, state, and federal agencies." (Lee, 2003)

In 1998, a report was completed for the National Institute of Justice, which identified, "Routine police work requires effective coordination and communication with other police agencies, fire departments, emergency medical services and public service organizations." (Taylor, 1998) While technology was recognized as a significant factor, other factors such as knowledge and training have an affect on interoperability success. "As agency size increases, so does the familiarity with initiatives related to interoperability in wireless communications. Agencies that participate in joint training activities that use communications equipment were significantly more confident in their abilities to handle all types of interoperability situations." (Taylor, 1998) Interoperability is extremely important to all agencies. "…93% interoperating on a daily or weekly basis with local organizations, 63% with State-level organizations daily or weekly." (Taylor,

1998) There were two surveys that were conducted regarding interoperability which included a National Institute of Justice Report entitled, “State and Local Law Enforcement Wireless Communications and Interoperability: A Quantitive Analysis” and a report from the University of New Hampshire entitled, “The Lessons of Non-Interoperability in Public Safety Communication Systems”. In the national sample, “seventy-four percent of respondents rated their agency’s ability to establish radio links at the local level as excellent, compared to 50% with State organizations and 15% with Federal organizations. In New Hampshire, 80% of respondents rated their agency’s ability to establish a radio communication link with local level organizations as excellent, 39% assigned the same rating to their ability to establish links to State public safety organizations, and 6% rated their ability to establish a radio communication link with Federal organizations as excellent.” (Lund, 2001) Various articles report that agencies of all sizes and types identified limitations in funding and radio frequency bands as the two biggest obstacles to interoperability.

The need for interoperability was highlighted from the 1982 Air Florida crash in the Potomac River, “That’s when they said, ’We can’t have any lives lost just because the agencies can’t talk to each other’.” (Murphy, 2001) Another article stresses, “interoperable communications can mean the difference between life and death for citizens and public safety personnel.” (Siegle, July 2001) The 1998 Florida fires were referenced to emphasize the challenges firefighters and emergency medical crews faced without good interoperability.

“Among key findings from a program survey of 1,045 fire departments nationwide, it noted that lack of radio interoperability caused one-third to experience difficulty in

responding to emergencies." (Murphy, 2001) "In recent years, a growing number of acts of domestic terrorism, civil disturbance, and natural disasters have demonstrated the need for local, state, and federal public safety providers to better coordinate their efforts at the scene of an incident. The response to emergency incidents is therefore significantly compounded if, during these events, emergency personnel have limited radio communications. Homeland security is also shaping the need for interoperability among varying public safety agencies." (Weisner, 2002) During the Oklahoma bombing in 1995 communications was a serious problem. "Public safety professionals from numerous jurisdictions converged on Oklahoma City and with different and often incompatible radio systems in use, non-interoperability was prevalent. Runners were used to deliver written messages." (Lund, 2002) In Los Angeles County during the Kinneloa Fire (Firestorm 93), hundreds of units, thousands of personnel overloaded and "communications discipline completely broke down". (Lund, 2002) "Significant incidents where non-interoperability issues were noted include: Los Angeles Riots, the New Hampshire Drega Incident, World Trade Center, Pentagon, Worcester Warehouse Fire, Seattle World Trade Organization Protests, Florida Wildfires of 1998, and Columbine." (Lund, 2001)

"Siegel noted the problems police, fire and other emergency services face in talking to each other and emphasized contributions the program had made in seeking solutions. We're very active with the FCC on spectrum issues for public safety." (Burnell, 2001)

Joe Lieberman called on the Bush Administration to devote the attention and resources for first responders to overcome fundamental handicaps they face in the war

against terrorism. “Guaranteeing that first responders have interoperable communications equipment should be among our highest priorities. It is unacceptable, in the Information Age, for public safety officials to be without the communications tools they need.” (Lieberman, 2003) The Public Safety Wireless Network estimates the long-term cost of replacing all communications equipment used by state and local governments at $18 billion. Obviously this amount of money is not available. FEMA is trying to coordinate bridging technologies to help agencies integrate disparate networks. FEMA CIO Ron Miller has been meeting with state and local government officials and industry members to fashion criteria and guidelines for granting funds for communications. “Ron Miller stated, ‘In the best of all possible worlds, everybody would have compatible radios, and networks would be integrated. But that’s not the way the world is right now.’” (Mears, 2002) Mike Worthington, general manager of Safety and Security Solutions at Motorola was quoted, “Right now, we think there are $40 to $50 billion worth of radio networks that have been installed that just cannot be thrown away overnight.” (Mears, 2002) In an Investor Alert 2003, Motorola expanded its Portfolio of Interoperable Mobile Communications solutions with a cost-effective mobile system by adding the JPS ACU-1000 to its rapidly deployable solution, the Motorola BMS 1000. PSComm’ representative Kirkendall agreed that FEMA’s strategy was the right approach. “There are technologies being used right now that allow for patching that can be implemented very quickly and cheaper than 800-MHz build-up or something like that”. (Mears, 2002) A Maryland project is currently underway where state police communications centers are being linked by an ACU-1000 radio interconnect device manufactured by JPS Communications. “The ACU-1000 radio interconnect device

manufactured by JPS Communications can interconnect disparate radio systems including high-frequency radios, land mobile radios on various frequencies, cellular, wireline and satellite communications." (Mears, 2002)

Although there have been isolated successes, most states and large metropolitan areas lack rudimentary wireless interoperability. "A successful plan for wireless interoperable communications for a specific region or state takes years to develop, and typically requires a special committee to help agencies work through the associated issues and problems." (Welsh, 2002) "A PSWN spokesperson was quoted that a statewide approach to interoperability is recommended over a regional or local one. The recommendation further suggested that a statewide executive committee be established to oversee implementation of an interoperability plan in every state." (Welsh, 2002) Cellular Telecommunications and Internet Association (CTIA) representatives stated "Effective homeland defense will require a nationwide, interoperable network for first responders, according to the federal government, industry and the nation.

Seven months after September 11, the message is clear – public safety needs spectrum to build a coast-to-coast, interoperable communications network." (Larson, 2002) Joe Allbaugh also said, "Communications is the number one problem our country faces when it comes to any type serious incident." (Larson, 2002) While efforts are underway to free up the 700 MHz frequency band, those frequencies will not be available until 2006 or 2007. Legislation has been introduced in the form of H.R. 3397 Homeland Emergency Response Operations (HERO) Act to provide the additional frequencies for public safety. "Allocation of the 700 MHz band will double the amount of radio spectrum available for public safety." (Smith, 2002) The National Governor's

Association noted, “The communications capabilities of law enforcement, fire, EMS, disaster relief and other emergency agencies are restricted by the limited amount of radio spectrum allocated for public safety operations, especially in large metropolitan areas, where there are insufficient radio frequencies to accommodate public safety communications needs. The result is lack of interoperability.” (Smith, 2002) Arlington County Fire Chief Ed Plaugher said that the argument for more dedicated radio spectrum has been an ongoing battle for decades prior to September 11. (Plaugher, personal communications, November 11, 2002) The FCC reports that out of the 800 MHz frequency band, public safety only holds 23.2 MHz of spectrum. In 2001, the Federal Communications Commission (FCC) adopted a Fourth Report and Order and adopted Project 25 Phase I as the voice standard for communications on the 700 MHz band interoperability channels, which are specifically set aside to allow different public safety entities to communicate with one another. The FCC further recommended that states should develop and administer plans for using the interoperability channels. The National Conference of Legislatures reports that California, Indiana, Maryland, Minnesota, Montana, New Hampshire, Michigan, Oregon and West Virginia have established some type of official statewide interoperability coordinating group.

The FCC has established the Public Safety National Coordination Committee (NCC) and charged it with formulating an operational plan for achieving nationwide interoperability in the 700 MHz band. “The IAFC joined other public safety organizations to endorse the Project 25 standard for public safety digital radio communications.” (Breugman, personal communication, February 13, 2003) Project 25 was created by the Association of Public Safety Communications Officials (APCO) and had four major

objectives. These were: (1) provide enhanced functionality with equipment and capabilities focused on public safety needs, (2) improve spectrum efficiency, (3) ensure competition among multiple vendors through Open Systems Architecture, and (4) allow effective, efficient, and reliable intra-agency and inter-agency communications." (Gambel, 2002)

As an interim spectrum solution it was recommended by the National Governor's Association to share frequencies that have been reallocated to the Department of Defense (DoD) which include the 138-144 MHz band. In February 2002, the DoD reported to Congress that sharing of this frequency band could be done "on a limited, coordinated basis" (Smith, 2002) The use of this frequency band provides spectrum during the interim. Another initiative underway and endorsed by a number of public safety agencies is the Nextel proposal for substantial reallocation of the 800 MHz band. "The Nextel proposal would shift all 800 MHz public safety operations to a contiguous block of spectrum at 806-816/851-861, and all 800 MHz digital SMR operations to 816-824/861-869 MHz. Nextel's proposal includes a substantial financial commitment intended to offset this relocation." (Briese, personal communications, November 21, 2001)

Public safety agencies from different jurisdictions historically have tended to depend on stand-alone systems that prove incompatible with each other. "Even with all of the advances of the digital era, digital systems often aren't designed to interface with other digital systems." (Murphy, 2001) "It is estimated that only 450 local, state and federal agencies worldwide have installed interoperable radio systems. Others wait in line for homeland security funds.

The impact of successful interoperable solutions is highlighted by the 7-year upgrade of the King County crisis management system for the Seattle area. “The new system provided a level of effective interoperability communications during the Seattle earthquake that are lacking in many other areas of the country.” (Benesh, 2001) “The Pentagon incident demonstrates in a very public way how critically important communications capabilities are for public safety agencies. The report found that the majority of local public safety responders at the scene experienced little difficulty establishing interoperable communications during the initial response. Due to existing mutual-aid agreements, most first responders had Arlington County’s frequencies pre-programmed into their radios and had frequently used the radio equipment for other mutual-aid responses.” (Rooney, 2002) Most of this can be attributed to the planning efforts following the Air Florida Flight 90 incident in 1982. There is, however, a dark side to the Pentagon communications during the September 11 attack. “When federal authorities joined in, the mutual-aid provisions of the 800 MHz radio system fell short. Their radios weren’t built to talk to the others, and soon the chaos consumed all.” (Sinha, 2002) Arlington County Ed Plaugher explained that the Nextel phones were later used to link first responders to federal authorities. “The Direct Connect feature worked great and never went down during the entire event.""(Plaugher, personal communication, February 2003)

In South Florida, various levels of government faced radio-related problems. The U.S. Immigration and Naturalization Service, the U.S. Border Patrol, Florida Highway Patrol and the Miami-Dade Police Department have a need for interoperable communications to deal with border security issues. “With financial assistance from

PSWN, three hubs were set up. Through these hubs, everyone can talk to one another as needed." (Careless, 2002) But even the stationary solutions will not always work. "In this case, PSWN supplied Dade, Broward, and Monroe Counties with a TRP-1000, the transportable version of JPS Communications' ACU-1000. This unit can be driven directly to the scene of an incident and disparate radios can be plugged in to create an interoperable communications network." (Careless, 2002) The U.S. Naval Research Laboratory in Washington has outfitted a high-mobility, multi-purpose, wheeled vehicle (HMMWV, pronounced "Humvee" or "Hummer") with almost every telecommunications link a public safety agency might need. "Our goal was to devise a unit that could roll into a 'hot zone' and immediately provide first responders with the connectivity that they need. This unit is equipped with a rigid shelter with a roof-mounted 1.5 satellite dish, the InfraLynx is fitted with a JPS Communications ACU-1000 modular interconnect. With its 1.5m satellite antenna, the InfraLynx can connect as many as 96 landline telephones. The vehicle has diesel tanks which will allows it to run for four days without refueling." (Careless, 2002)

Converting existing systems to become interoperable can be timely and expensive. "Baltimore, for example, just spent $70 million to overhaul its radio system to make it compatible with neighboring jurisdictions." (Sinha, 2002) "But interoperability isn't just about hardware; it's about cooperation and shared planning." (Careless, 2002) Increased cooperation cannot come too soon; in the wake of September 11, there's no room for turf fights among public safety services. "Interoperability cooperation and planning may also help to reduce per-agency costs while boosting network performance and coverage. Put plainly, interoperability makes sense. It's a cost-saver, a resource-

saver, and a life-saver." (Careless, 2002) "We found that for interoperability to be successful you had to cooperate to interoperate." (T. Garrett, personal communications, November 12, 2002) "Interoperability benefits also include millions of dollars in potential cost savings, cost avoidance, and cost recovery." (Weisner, 2002) "Public safety agencies need to stop operating as separate island communication systems on different frequency bands." (Lanktree, 2003)

Throughout the research there were many references to the definition of interoperability. Definitions of interoperability are somewhat varied. The Public Safety Wireless Network defines interoperability as, "The ability of public safety personnel in different agencies or jurisdictions to communicate with each other by radio on demand, in real time." The Commonwealth of Virginia defined interoperability as, "The ability for people from different functional areas to communicate effectively at an incident site (tactical) or between jurisdictions or levels of government (strategic)." In Georgia, a definition is offered, "The ability of two or more parties to seamlessly exchange information, when, and where it is needed, even when disparate communications/information systems are involved." The Public Safety Wireless Network further breaks interoperability down into categories which include day-to-day, mutual-aid and tactical. Day-to-day interoperability is simply the daily operations at simple incidents. Mutual-aid involves multiple agencies and tactical involves larger events such as disasters and major events.

The progress of interoperability is varied. A National Interoperability Index has been compiled by the Public Safety Wireless Interoperability National Strategy. This national index evaluates activity by each state and measures that progress based on a

scale of new, developing, established or mature. To date, only two states (Michigan and North Carolina) were rated as 'mature' interoperability efforts. Twenty-four (24) states are rated as 'developing', eleven (11) were rated as established and the remainder was rated as 'new'. Interoperability can be a daunting task. Michigan, one of the states that is measured with an interoperability mature system received some bad press regarding their 181 tower, $221 million radio system. "The system has failed to deliver on the ambitious promise of communicating seamlessly across Michigan." (Martindale, 2003) The Detroit News reported that the system had dead zones, portable radios ineffective inside buildings, unable to deliver computer data. There are many interoperability solutions that are being implemented. As noted earlier, Michigan has implemented a 181-tower 800 MHz digital radio system. Chicago's Department of Emergency Communications launched a pilot interoperability project. They received a grant from the U.S. Department of Justice's Advanced Generation of Interoperability for Law Enforcement (AGILE) program, which allowed for the purchase of six TRP-1000 which are the transportable version of the ACU-1000 sold by JPS Communications. "Each of these units is a ten-radio suite with two telephone connections which allows interconnect of radios of different frequencies and bands, along with mobile telephones, together." (Careless, 2001) The National Fire Interagency Fire Center in Boise, Idaho, presently achieves interoperability through a radio cache of over 8,000 radios and self-built cross-links. There is an effort to implement a digital radio system following the Project 25 standard. "E.F. Johnson and Motorola Inc. are two of the first companies to manufacture APCO 25-compliant equipment. Others are Kenwood USA Corp. of Long Beach, Calif., and Maycom Audio Systems of the Netherlands. 'There are maybe five or six

manufacturers now,' Ridgell said. 'A year from now there might be 20.'" (Jackson, 2002) North Carolina is looking to implement a statewide 800 MHz radio system that will maximize and integrate with local 800 MHz radio systems with the new statewide system. The state of Pennsylvania has settled on an 800 MHz digital trunked network using radio technology from M/A-COM. "The software based system, called Open Sky, uses technology based on TCP/IP and Cellular Digital Packet Data (CDPD), a data transfer technology that moves packets at speeds up to 19.2K bits/second." (Mears, 2002) M/A-COM's effort is one part of the $222 million Pennsylvania Public Safety Radio Project.

"ComNet-Ericsson Critical Radio Systems Inc. of Lynchburg, Va., was awarded the contract for the Florida Statewide Radio Communications Project. Under this contract, ComNet-Ericsson will help build and operate a communications system for state agencies." (Welsh, 2000)

The Metropolitan Washington D.C. area has initiated the Capital Wireless Integrated Network (CapWIN). As reported by the AGILE program, this project is a mobile computing interoperability solution for the Washington Metropolitan Region and will integrate transportation and public safety data and voice systems—creating the first multi-state, inter-jurisdictional integrated wireless network in the United States.

There are many solutions that are available and they are varied in price and complexity. There are some new suggestions that offer new thoughts toward the development of private-public partnerships to implement interoperability solutions. This will require that public safety agencies consider relinquishing control of a system to a commercial carrier. "Homeland security is a national problem, not a federal, mission.

Protecting our nation's critical infrastructure will require new ways of doing business. New Democrats support strong public-private partnerships. Government should provide information, conduct research to develop new technologies and protocols, and create incentives and standards for private infrastructure security." (Smith, personal communications, February 7, 2002) One example of a public-private partnership is noted, "An interesting opportunity presents itself because a communication system that closely parallels the predicted operational needs for the new Homeland Security Department already exists. Its called Nextel. Perhaps a straightforward business deal could be struck involving the bulk purchase of handsets and airtime minutes (pooled by geopolitical districts) for use by "non local" agency operatives. After all, these regular local folks have been relying on economic interoperability long before talking about disasters became fashionable." (Dunford, 2002) "Despite the need for interoperability, few federal or state organizations possess the financial resources or technical expertise to implement and maintain interoperable wireless communications systems beyond their immediate vicinity and spectrum allocations. Nextel's iDEN wireless technology platform could be used as an example of how a public wireless network can be built, implemented, and maintained in a manner consistent with the reliability and functionality expectations of existing public safety land mobile radio (LMR) networks. Handsets working on this system could be implemented that can provide multiple services such as a long-range digital walkie-talkie service, digital cellular, mobile messaging, and wireless Internet and application access. There is also the ability for Nextel's iDEN to interoperate with existing two-way radio, public telephone, encryption, paging and other voice and data connections." (S. Forbes, personal communication, February 12, 2003)

In a brochure from the National Institute of Justice titled, *When They Can't Talk – Lives are Lost*, five key barriers that block interoperability are identified which include incompatible and aging communications equipment, limited and fragmented funding, limited and fragmented planning, a lack of cooperation and coordination, and limited and fragmented radio spectrum.

PROCEDURES

Definitions of Terms

AGILE. Abbreviation for Advanced Generation Interoperability for Law Enforcement.

APCO. An abbreviation for Associated Public Safety Communications Officers Association.

Band. The spectrum or device used to collect or radiate electromagnetic waves.

CFD. Abbreviation for Charlottesville Fire Department.

Channel. A single unidirectional or bi-directional path for transmitting or receiving, or both, of electrical or electromagnetic signals.

Coverage. The geographic area included within the range of a wireless radio system.

Day-to-day Interoperability. Coordination during routine public safety operations (fighting fires, vehicular pursuit).

Dead spots (or dead zones). The area, zone, or volume of space that is within the expected range of a radio signal, but in which the signal is not detectable and

therefore cannot be received. Common causes of dead spots include depressions in the terrain and physical structures.

Digital signals. A signal in which discrete steps are used to represent information.

DoD. Abbreviation for Department of Defense.

ECC. Abbreviation for Emergency Communications Center.

EMS. Abbreviation for Emergency Medical Services.

EOC. Abbreviation for Emergency Operations Center.

EOP. Abbreviation for Emergency Operations Plan.

FCC. Abbreviation for Federal Communications Commission.

Frequency. For a periodic function, the number of cycles or events per unit time.

Frequency bands. Frequency bands where land mobile radio systems operate in the United States.

IAFC. Abbreviation for International Association of Fire Chiefs.

ICS. Abbreviation for Incident Command System.

IMS. Abbreviation for Incident Management System.

Interoperability. The ability of public safety agencies to be able to talk to one another—to exchange voice and/or data with one another on demand and in real time.

Kilohertz (KHz). A unit of frequency denoting one thousand (103) Hz.

Megahertz (MHz). A unit of frequency denoting one million (106) Hz.

Mutual-Aid Interoperability. Joint and immediate response to a catastrophic incident or natural disaster and requires tactical communications among numerous groups of public safety personnel (airplane crashes, bombings, forest fires, earthquakes, and hurricanes).

NIIMS. Abbreviation for National Interagency Incident Management System.

NIJ. Abbreviation for National Institute of Justice.

NPSAC. Abbreviation for National Public Safety Advisory Committee.

PSWN. Abbreviation for Public Safety Wireless Network.

Radio Cache. A portable or permanent storage facility for radios.

RF. Abbreviation for Radio frequency.

Spectrum. The usable radio frequencies in the electromagnetic distribution.

Tactical Interoperability - local, state, and federal agencies coming together for an extended period of time to address a public safety concern (extended recovery operations for major disasters, provide security at major events, and conduct operations in prolonged criminal investigations).

Trunked Radio System. A system that integrates multiple channel pairs into a single system.

Research Methodology

The desired outcome of this research project was to create a list of recommendations for use in development and implementation of a region-wide interoperability solution. The research was historical research in that a literature review was conducted to understand the factors that impede interoperability and to identify solutions that have been implemented by other localities to achieve interoperability. The data gathered were based on surveys of actual experiences of other emergency service agencies, information from consultants in the field of expertise, and from manufacturers who provide interoperability solutions. This research methodology used the online resources of the Learning Resource Center, the Internet, personal interviews, personal

correspondence, and a survey device called the Applied Interoperability Survey and is contained within Appendix A.

The research was action research in that the information gathered through historical research was applied to the actual development of an interoperability-planning guide. The compilation of interoperability information was developed from historical research through the use of a survey device titled Interoperability Survey. The results of that survey are broken down into several categories and are embodied in Appendices A through B.

- Appendix A – Survey Questions.
- Appendix B – General Survey Results.

Assumptions and Limitations

Although interoperability has become a very recognized problem, there are so many references to existing and emerging technologies to achieve interoperability that is difficult to identify all of the viable solutions that are available. In addition, the technology curve is on the verge of major new technological applications.

Another factor that limits this research paper is that very few agencies have actually accomplished interoperability and are presently evaluating solutions that are available. This limits the ability of this research to objectively review and evaluate the viability of these solutions.

The fact that there are no true common interoperability standards that encompasses and addresses the new solutions that are becoming available at an increased rate. While the Project 25 standard typically addresses public safety radio

systems, there are new interoperability solutions that may not be addressed by it. Interoperability solutions are varied in complexity, functionality, versatility and cost.

Another limitation to evaluating interoperability effectiveness is hindered by the limited understanding of interoperability solutions by emergency service providers.

One last limitation in revealing survey respondents was requested by several as they did not wish to be identified within the survey as they were concerned that this may be used as a means of manufacturers or vendors to contact them in reference to their answers.

RESULTS

A sample planning checklist is shown in Appendix D.

Answers to Research Questions

Research Question 1. An overwhelming number of survey respondents indicated that they had a very high experience with interoperability. Local operations had the highest experience of interoperability at 75.8% on a daily basis; interoperability with the state level at 28.4%, and 8.4% at the federal level. The exposure to the various levels of interoperability was also relative to the size and type of incident. When reference was made to day-to-day operations, the interoperability scale mirrored the results of the local operations. When reference was made to major or catastrophic events, the results were inverse as far as interoperable experience with other levels of government. While interoperability at the federal level on a day-to-day level was 8.4%, it escalated to 77.9% during major or catastrophic events. This is primarily due to the assistance needed to handle these types of situations.

The survey also showed that 40% of departments had an increased need for interoperability with other agencies over the last five (5) years. The ability of departments' radio systems to effectively deal with interoperability at the various levels was spread across the scale. Approximately 52% felt that interoperability would be better in five (5) years.

The survey indicates that 90% of the agencies surveyed were using a local Incident Management System. Equally impressive, 86.3% were using a Unified Command approach to major emergency incidents. Adding to these positive numbers, 74.7% surveyed participated in joint training exercises.

Most public safety agencies own their own land mobile radio (LMR) systems and 76.3% of these systems are analog. Presently 61.5% of LMR systems are conventional in nature while the remainder are trunked radio systems. 44.2% of those surveyed indicated that they planned to significantly upgrade or replace their existing LMR system in the next five years. Radio system replacements by preference were digital-52%, analog-10%, and 36% did not know. Trunked radio had the highest direction for future LMR systems with 49.5% while 15.8% referenced conventional and 34% did not know. Sixty percent of those surveyed indicated that interoperability would have a significant impact on the procurement of a new LMR system.

Research Question 2. Factors that impede interoperability (also known as non-interoperability factors) were accumulated from the respondents' submissions. These submissions are summarized below:

- Lack of Unified Incident Management
- Incompatibility

    - Radio systems
    - Frequency differences
    - Conflict between new technology and old (digital vs. analog)
    - Terminology
    - Use of ‘10-codes’ or other agency specific ‘lingo’
- Overloaded radio frequencies
- Lack of training/practice in:
    - Incident Management System
    - Proper use of radio equipment
- Lack of radio discipline
- Turf Battles
- Limitations in funding
- Lack of operable equipment
- Radio Frequency interference
- Fading radio signal - inadequate signal coverage
- Topography
- Outdated/obsolete radio equipment
- Inadequate in-building coverage
- Uncontrolled self-dispatch of mutual aid agencies
- Insufficient system redundancy
- Limitations of public cellular capabilities

Question 3. Interoperable solutions that have been implemented in other localities are many and they vary significantly in complexity, functionality, versatility and cost. A listing of interoperable communication methods are summarized in Appendix C.

Question 4. The most important lessons that can be applied to this region's interoperability plan is to recognize the factors that impede interoperability and to coordinate/plan a formalized interoperability communications plan. "Interoperability cannot be achieved by technology alone and requires the foundation for command and control to be established first and foremost. Interoperable communications can only be achieved through a comprehensive strategy that combines wireless interoperability, common language, limiting agency specific terminology/10 codes, unified command, joint training and practical drills, radio discipline, and standard operating guides." (T. Garrett, personal communication, November 12, 2002)

Suggestions and Comments

The last question on the survey asked for suggestions or comments regarding successful implementation of interoperable communications. Surprisingly, 60% responded that they did not know how to answer the questions as they did not know enough about interoperability solutions available and that they were just beginning to evaluate how to achieve it.

Eighty Five percent surveyed said that planning with other agencies and localities had helped them solve interoperability with simple local solutions.

One other comment worthy of note involved incident command. Ten percent surveyed said that they were able to achieve interoperability through unified command operations even though working on disparate radio systems.

DISCUSSION

To begin with, the data from the survey device showed that almost every agency had interoperability experiences within the 2001 calendar year. The survey also indicates that 75.8% surveyed that interoperability needs have increased over the last 5 years. Forty percent of those surveyed reported that the interoperability needs had changed “a great deal” in the past 5 years.

Reinforcing the fact that there is such a high degree of recognition for the ability to achieve interoperable radio communications, approximately 44.2 % indicated that they had plans to significantly update or replace their radio systems. Eighty-one percent of respondents reported that interoperability would be an issue when procuring a new radio system. A concern that is raised is that when asked what the next preference for a radio system, 36.8% reported that they did not know. There appears to be a gap between interoperability needs and the knowledge about interoperability solutions. Thirty seven percent of respondents also reported that they did not know whether a new radio system would be analog or digital. Some written responses from the survey indicated that they did not know the difference. From the responses, there appears to be a gap in knowledge toward interoperability and radio systems for departments that were smaller and more rural.

Interoperability at the local level seems to be fairly well addressed. The survey showed that 72.6% have designated one radio channel solely for communicating with other organizations. However, 74.7% of the agencies surveyed reported that they did not have a formal interoperability communications plan. While interoperability via a

technology device is fairly well addressed, it can only be as successful as to the plan that coordinates how that communication is achieved. The ability to have everyone to communicate over a radio system to everyone else in real time often leads to very ineffective communications and chaos.

The ability to achieve interoperability is noted as not being as successful as the incidents extend beyond the local community. According to the survey, 79% reported that their ability to achieve interoperability at the federal level was poor. Almost 30% rated their ability to achieve interoperability at the state level as poor. The Public Safety Wireless Network (PSWN) has urged states to coordinate interoperability. There was no reference to an overall national strategy.

There is also very good news that most agencies that responded to the survey used incident and unified command systems for larger emergency incidents. Additionally, 74.7% indicated that they also participated in joint training exercises. This is reinforced in the Charlottesville-Albemarle as exercises are jointly planned and involve every discipline from the City of Charlottesville, County of Albemarle and the University of Virginia. The region is also supported by a jointly prepared emergency operations plan. There, is however, no formal interoperability communications component within that plan.

When it comes to the obstacles that interfere with interoperability, the 4 factors that were noted as major problems included: different bands (36.8%), funding (69.5%), different communications modes (41%) and coverage (28.4%).

Interoperability solutions are many. As noted earlier, the interoperability solutions that are available are varied based on complexity, functionality, versatility and cost. The

marketplace has become flooded with many ‘interoperability solutions’, many of which have little or no deployed experience. This makes the procurement of interoperable solutions more difficult than ever before. It becomes critical to plan more than ever before. Since interoperability involves many different agencies, planning must consider the varying levels of interoperability (day-to-day, mutual-aid, tactical) along with the various agencies and jurisdiction levels (local, state, federal).

One thing is clear from this study and from the literature review: Interoperable communications can only be achieved through a comprehensive strategy that combines wireless interoperability, common language, limiting agency specific terminology/10 codes, unified command, joint training and practical drills, radio discipline, and standard operating guides that address interoperable communications.” (T. Garrett, personal communication, November 12, 2002)

RECOMMENDATIONS

This study is able to answer the basic research questions presented in the Introduction. It is apparent that there is a need for the development of a region-wide interoperability communications plan. It is also very apparent that all agencies and jurisdictions that may need to communicate with one another be involved in the planning process.

In order to achieve a successful interoperability plan, the following suggestions are offered as recommendations:

1. Identify the local barriers that impede interoperability.
2. Establish a region-wide Interoperability Council
    - Plan, coordinate and implement a formal interoperability plan.

- Review and coordinate with state and national initiatives.
- Determine funding available to support interoperability efforts.
- Support training efforts.

3. Develop an Interoperability Planning Guide

REFERENCE LIST

Benesh, P. (2001, March) Technology in Crisis: New Radio System lets Seattle Respond. *Investors Business Daily,* p. A6.

Burnell, S. (2001, May) Agencies Still Reaching for Wireless World. United Press International, General News Section.

Carless, J. (2001, November) Chicago blazes affordable path to radio interoperability. *Mobile Radio Technology,* pp. 23-24.

Careless, J. (2002, June) Interoperability: Its about saving lives. *Mobile Radio Technology* [On-line]. Available:

http://mrtmag.com/microsites/magazinearticle.asp?made=print&magazineid=15023

Careless, J. (2002, September) Infralynx Hummer delivers interoperability on wheels. *Mobile Radio Technology,* pp 19-21.

Gambel, D. (2002, February) Security Modeling for Public Safety Communications Specifications. (*Mitretek Report*). McLean, VA: Mitretek Systems, Inc.

Lanktree, C. (2002, December) New Jersey Public Safety Communications Interoperability. (*Pubic Safety Wireless Network Report*). Washington, D.C.: Public Safety Wireless Network.

Larson, T. (2002, April) Homeland Security Needs Communications. *Wireless Newsline* [On-line]. Available:

http://www.wow-com.com/news/press/press/body.cfm?record_id=1080

Lee, R. (2003, February) Wireless Interoperability Key to Emergency Management Success. *Virginia Department of Emergency Management Magazine,* pp. 49-51.

Lieberman, J. (2003, February*) Public Safety Officials must have 21st Century Communications*. Senate Press Statement [On-line]. Available: http://www.senate.gov/~gov_affairs/020603.htm

Lund, D. (2002, April) The Lessons of Non-Interoperability in Public Safety Communication Systems. (*Benchmarks and Blueprints V*). Durham, NJ: University of New Hampshire.

Martindale, M. (2003, March) New Radio System is Full of Bugs. *Detroit News,* p. 4.

Mears, J. (2002, July) Homeland Defense looks to Wireless. *Network World Fusion* [On-line]. Available: http://www.fedsources.com/elements/learnabout/fsinews/networkworldfusion_070802.asp

Mears, J. (2002, July) Pennsylvania agencies standardize on 800 MHz. *Network World Fusion*, pp. 3-4.

Murphy, R. (2001, July) Interoperability: Critical for Public Safety. *Sheriff Magazine,* p. 51.

Murphy, J., Siegle, D. (2001, March) Special Report: Saving Lives through Public Safety Wireless Interoperability. *Fire Chief Magazine,* pp 59-61.

Rooney, M. (2002, February) Answering the call: Communications Lessons Learned from the Pentagon Attack. *Public Safety Wireless Network* [On-line]. Available:

http://www.pswn.org

Siegle, D. (2001, July) PSWN: Working to save lives and protect property. Law Enforcement Technology, pp. 116-128.

Sinha, V. (2002, September) Just Talk? *Washingtonpost.com* [On-line]. Available:

http://www.washingtonpost.com/ac2/wp-dyn/A62641-2002Sept10?

Smith, B. (2002, February) Homeland Security – Communications. National Governor's Association [On-line]. Available:

http://www.nga.org/common/issuebriefdetailprint/1,1434,3298,00.html

Taylor, M. (1998, January) Wireless Communication and Interoperability. (*National Law Enforcement & Corrections Technology Center):* Taylor, M., Epper, R., Tolman, T.

Weisner, T. (2002, February) Wireless Safety Interoperable Communications Program. (*Project SAFECOM Report*). Washington, D.C.: Department of Treasury.

Welsh, W. (2000, July) M/A-Com tunes Run for State Radio Deals. *Washington Technology* [On-line]. Available:

http://www.washingtontechnology.com/news/15_8/cover/1543-1.html

Welsh, W. (2002, July) Interoperable Wireless Communications: Easier Said than Done. *Washington Technology* [On-line]. Available:

http://www.washingtontechnology.com/news/17_7/cover/18506-1.html

APPENDIX A
INTEROPERABILITY SURVEY

INTRODUCTION: The following survey will be used for my Executive Fire Officer Research Project.

Please answer the following questions and return to:

Charles L. Werner
3331 Martin Kings Road
Charlottesville, VA 22902

DEFINITIONS

1) Definition of Interoperability: Essential communication links within or between public safety and public service communication systems that permit units from two or more different agencies to interact with one another and to exchange information according to a prescribed method in order to achieve predictable results. This may include communication between governmental and non-governmental public safety and public service providers.

2) First Responders: Fire, emergency medical personnel, law enforcement, and other identified entities who, by specialty or profession, normally arrive first on the scene of an emergency incident to assess or take action to save lives, protect property, and/or mitigate the situation.

3) Types of Interoperability Responses: Day-to-Day, Mutual Aid, and Tactical

Day-to-Day Response (e.g., Mode 1, automatic aide, routine structure fire, automobile accident)
- Most often encountered type of interoperability - on scene communications.
- Commonly used in areas of concurrent jurisdiction.
- Commonly used where agencies need to monitor each other's routine traffic.
- If agencies are using different radio bands, may involve the use of multiple radios.
- Communications with other primary response agencies.
- Communications with receiving medical facilities.

Mutual Aid Response (e.g., Mode 2 or 3, railroad derailment, hazardous materials incident, multiple-related disasters)
- Can involve multiple agencies with little opportunity for prior planning.
- Often requires assignment of several to many small groups, each on their own talk group or frequency.
- Once on scene, typically involves the use of portable and mobile radios.

Tactical/Major event (e.g., Mode 4, extended response/disaster recovery operation or major event)
- Usually involves several levels of government (federal, state, and/or local) operating at incident/event.
- Typically an opportunity for prior planning exists.
- Usually involves use of portable and/or covert equipment.
- Often requires extensive close-range communications.
- Users may rove in and out of infrastructure coverage (metro to rural, in and out of buildings).

Does your agency have at least one radio channel solely designated for communicating with other organizations?

Yes
No

HOW OFTEN does your agency have radio communication with the following levels of public safety and/or public service organizations (see definitions on page 2)? (Check all that apply)

	Daily	Weekly	Monthly	Yearly	Never
Federal					
State					
Local					

_ _

Identify the TYPES of interoperability (see definitions on page 2) your agency has experienced during the 2001 calendar year with the following levels of public safety and/or public service organizations. (check all that apply)

	Day-to-Day	Mutual Aid	Tactical
Federal			
State			
Local			

_ _

To what extent has your agency's need for interoperability with other public safety and public service organizations changed over the past five years? (Circle Only One)

Great Decrease	Some Decrease	No Change	Some Increase	Great Increase

_ _

Rate your agency's ABILITY to establish a radio communication link with each of the following levels of public safety and/or public service organizations. (Check one for each Level)

	Poor	Not –So Good	Fair	Good	Excellent
Day-to-Day Level					
Mutual Aid Level					
Tactical Level					

_ _

Rate the ABILITY of your agency's radio system to effectively handle the three types of interoperability as defined on page 2. (Check one for each Level)

	Poor	Not –So Good	Fair	Good	Excellent
Day-to-Day Level					
Mutual Aid Level					
Tactical Level					

Rate your agency's OVERALL ABILITY to handle interoperability situations 5 years ago, today, and estimate its ability 5 years into the future. (Check one for each time period)

	Poor	Not –So Good	Fair	Good	Excellent
5 Years Ago?					
Today?					
5 Years from Now?					

Based on your agency's experience, indicate the severity of each of the following obstacles to interoperability. (Please check one rating for each category)

	Not a Problem	Small Problem	Neutral	Some Problem	Major Problem
Different Bands					
Human Limitations					
Analog vs Digital					
Conventional vs Trunked					
Coverage Problems					
Limits of commercial svcs					
Lack of Planning					
Lack of Funding					
Political Barriers					
Turf Issues					

To your knowledge, does your jurisdiction have a formal written interoperability plan? (Circle One)

Yes
No

– –

Does your agency participate in joint training exercises with other organizations that involve the actual use of communication equipment? (Circle One)

Yes
No

– –

Which best describes your PRIMARY land mobile radio system? (Circle One)

Analog
Digital
Don't Know

– –

Do you own or lease its primary land mobile radio system? (Circle One)

Own
Lease
Other
Don't Know

Does your agency use BOTH analog and digital radio systems? (Circle One)

Yes
No
Don't Know

Which best describes your PRIMARY land mobile radio system? (Circle One)

Conventional (not trunked)
Trunked
Don't Know

Does your agency have plans to replace or substantially upgrade its land mobile radio system within the next 5 years? (Circle One)

Yes
No

What is your agency's preference for its NEXT land mobile radio system? (Circle One)

Analog
Digital
Don't Know

Does your agency plan to use BOTH analog and digital radio systems? (Circle One)

Yes
No
Don't Know

What is your agency's preference for its NEXT land mobile radio system? (Circle One)

Conventional (not trunked)
Trunked
Don't Know

How important will interoperability ISSUES be to your agency when it purchases its next land mobile radio system? (Circle One)

Not Important	Somewhat Important	Important	Very Important	Extremely Important

_ _

What are the wireless communications interoperability issues for your agency? Please write in your response(s).

APPENDIX B
INTEROPERABILITY SURVEY RESULTS
Based on 51 Respondents out of 150

Does your agency have at least one radio channel solely designated for communicating with other organizations?

Yes (72.6%)
No (27.4%)

HOW OFTEN does your agency have radio communication with the following levels of public safety and/or public service organizations (see definitions on page 2)? (Check all that apply)

	Daily	Weekly	Monthly	Yearly	Never
Federal	8.4%	3.2%	7.4%	18.9%	62.1%
State	28.4%	14.7%	15.8%	14.7%	26.3%
Local	75.8%	15.8%	3.2%	4.2%	1.1%

Identify the TYPES of interoperability (see definitions on page 2) your agency has experienced during the 2001 calendar year with the following levels of public safety and/or public service organizations. (check all that apply)

	Day-to-Day	Mutual Aid	Tactical
Federal	8.4%	13.7%	77.9%
State	27.4%	40%	32.6%
Local	65.3%	25.3%	9.5%

To what extent has your agency's need for interoperability with other public safety and public service organizations changed over the past five years? (Circle Only One)

Great Decrease	Some Decrease	No Change	Some Increase	Great Increase
2.1%	1.1%	21.1%	35.8%	40%

Rate your agency's ABILITY to establish a radio communication link with each of the following levels of public safety and/or public service organizations. (Check one for each Level)

	Poor	Not –So Good	Fair	Good	Excellent
Federal Level	**77.9%**	**9.5%**	**8.4%**	**2.1%**	**2.1%**
State Level	**29.5%**	**23.2%**	**25.3%**	**15.8%**	**6.3%**
Local Level	**5.3%**	**4.2%**	**14.7%**	**30.5%**	**45.3%**

Rate the ABILITY of your agency's radio system to effectively handle the three types of interoperability as defined on page 2. (Check one for each Level)

	Poor	Not –So Good	Fair	Good	Excellent
Day-to-Day Level	**12.6%**	**8.4%**	**24.2%**	**31.6%**	**23.2%**
Mutual Aid Level	**17.9%**	**22.1%**	**26.3%**	**23.2%**	**10.5%**
Tactical Level	**42.1%**	**18.9%**	**16.8%**	**12.6%**	**9.5%**

Rate your agency's OVERALL ABILITY to handle interoperability situations 5 years ago, today, and estimate its ability 5 years into the future. (Check one for each time period)

	Poor	Not –So Good	Fair	Good	Excellent
5 Years Ago?	**53.2%**	**22.3%**	**19.1%**	**2.1%**	**3.2%**
Today?	**11.7%**	**20.2%**	**30.9%**	**27.7%**	**9.6%**
5 Years from Now?	**10.6%**	**14.9%**	**21.3%**	**25.5%**	**27.7%**

Based on your agency's experience, indicate the severity of each of the following obstacles to interoperability. (Please check one rating for each category)

	Not a Problem	Small Problem	Neutral	Some Problem	Major Problem
Different Bands	10.5%	10.5%	17.9%	24.2%	36.8%
Human Limitations	15.8%	16.8%	34.7%	20%	12.6%
Analog vs Digital	24.2%	14.7%	21.1%	18.9%	21.1%
Conventional vs Trunked	24.2%	13.7%	24.2%	17.9%	20%
Coverage Problems	11.6%	7.4%	34.7%	17.9%	28.4%
Limits of commercial svcs	24.2%	8.4%	28.4%	17.9%	21.1%
Lack of Planning	12.6%	16.8%	27.4%	27.4%	15.8%
Lack of Funding	3.2%	2.1%	6.3%	18.9%	69.5%
Political Barriers	15.8%	12.6%	26.3%	22.1%	23.2%
Turf Issues	28.4%	16.8%	20%	15.8%	18.9%

To your knowledge, does your jurisdiction have a formal written interoperability plan? (Circle One)

Yes 25.3%
No 74.7%

Does your agency participate in joint training exercises with other organizations that involve the actual use of communication equipment? (Circle One)

Yes 89.5%
No 10.5%

Which best describes your PRIMARY land mobile radio system? (Circle One)

Analog 76.3%
Digital 23.7%
Don't Know

Do you own or lease its primary land mobile radio system? (Circle One)

Own 82.1%
Lease 1.1%
Other 10.5%
Don't Know 6.3%

Does your agency use BOTH analog and digital radio systems? (Circle One)

Yes 21.1%
No 78.9%
Don't Know 0%

Which best describes your PRIMARY land mobile radio system? (Circle One)

Conventional (not trunked) 61.5%
Trunked 38.5%
Don't Know 0%

Does your agency have plans to replace or substantially upgrade its land mobile radio system within the next 5 years? (Circle One)

Yes 44.2%
No 55.8%

What is your agency's preference for its NEXT land mobile radio system? (Circle One)

Analog 10.5%
Digital 52.6%
Don't Know 36.8%

Does your agency plan to use BOTH analog and digital radio systems? (Circle One)

Yes 43.2%
No 23.2%
Don't Know 33.7%

What is your agency's preference for its NEXT land mobile radio system? (Circle One)

Conventional (not trunked) 15.8%
Trunked 49.5%
Don't Know 34.7%

How important will interoperability ISSUES be to your agency when it purchases its next land mobile radio system? (Circle One)

Not Important	Somewhat Important	Important	Very Important	Extremely Important
3.2%	2.1%	13.7%	21.1%	60%

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What are the wireless communications interoperability issues for your agency? Please write in your response(s).

Unified Command provides ability to achieve interoperability. – 5 submissions.

Don't believe that interoperability is that important and too much emphasis. – 1 submission.

Very frustrated in lack of funding from federal government. – 10 submissions.

Appendix C
Interoperable Communications Methods

800 MHz radio systems

Transportable Communications Systems (ACU-1000)

Secure 2-Way Paging, Mutual-Aid Radio Systems

Linked Proprietary Trunked Systems

In-Tunnel Interoperability Systems

Interstate Interoperability

Cross System Interconnect Systems

Console-Console Patch

Radio Cache deployment

Cross-Band Repeaters

Commercial Services

Multiband-Multimode Radios

Dispatch Handoff

Trunked/Conventional Interconnect

Radio Exchange

Consolidated Tower Communications Sites

Voice/Data over IP (VoIP)

APPENDIX D
INTEROPERABILITY PLANNING GUIDE

1. Determine the localities to which you might be able to partner.
2. List the agencies to which you wish to achieve interoperable communications.
3. Develop a regional interoperability-coordinating group.
4. Educated and involve elected officials in the planning process.
5. Develop an interoperability communications functional “wish list”.
6. Develop a regional interoperability communications plan.
7. Conduct a communications asset survey to determine existing communications capabilities.
8. Evaluate coverage areas where interoperability needs to occur.
9. Review standards and/or legislation that may effect decisions.
10. Each Department must assess their needs during routine operations, disaster preparedness, and future growth.
11. Determine how and when you need to communicate with other agencies
12. Educate your representatives on the basic technology choices.
13. Develop first and second tier interoperability agreements.
14. Conduct joint training exercises to test the interoperable communications
15. Implement regional incident/unified command systems.
16. Review and interface with state and national interoperability efforts.
17. Identify funding sources and apply for grants.
18. Establish a joint grant team to seek and apply for funding from various sources.
19. Attend interoperability seminars to stay abreast of the emerging technologies.