Why Can't We Talk?

Working Together To Bridge the Communications Gap To Save Lives

A Guide for Public Officials

interoperability

Supplemental Resources

February 2003

NATIONAL TASK FORCE ON INTEROPERABILITY

U.S. Department of Justice

Office of Justice Programs

National Institute of Justice

Office of the Director

Washington, D.C. 20531

Letter from the Director of the National Institute of Justice,

To protect the public, the first responder and law enforcement communities must be able to communicate effectively. Historically, there have been many technological impediments to timely and effective sharing of information. Communication interoperability has been a persistent problem, along with issues concerning spectrum availability, embedded infrastructure, and immature standards. A solution to this national issue can only be achieved through the recognition of the problem and a cooperative effort for its resolution at all levels of government and industry.

To assist in finding solutions, the Department of Justice through the National Institute of Justice (NIJ) supported the National Task Force on Interoperability (NTFI) and its development of a series of guides, entitled: *When They Can't Talk Lives are Lost*, as well as *Why Can't We Talk?, Working Together to Bridge the Communications Gap to Save Lives, A Guide for Public Officials*. These guides highlight the crucial issue of communication interoperability and provide information on critical topics, including governance, funding, and radio spectrum use.

As part of a comprehensive federal government effort to address communication interoperability issues, NIJ is reissuing updated versions of the NFTI guides. Our support of NTFI and the development of these documents are but one of the ways that NIJ is approaching the problem. NIJ continues to support information technology development and information standards to support the law enforcement and first responder communities. We hope these guides and other publications available on our website at http://www.nijcommtech.org/ will help illuminate communications interoperability issues and encourage members of the first responder and law enforcement communities to work with the federal government in forging solutions.

Sincerely

Sarah Hart

Sarah Hart
Director

On September 11, 1996, 5 years to the day before the 9/11 terrorist attack, the Public Safety Wireless Advisory Committee (PSWAC) released its final report, which stated that "unless immediate measures are taken to alleviate spectrum shortfall and promote interoperability, public safety will not be able to adequately discharge their obligation to protect life and property in a safe, efficient, and cost-effective manner." Several years later, public safety is still grappling with inadequate spectrum and radio communication systems that do not communicate with one another.

In an era where technology can bring news, current events, and entertainment to the farthest reaches of the world, many law enforcement officers, firefighters, and emergency medical service personnel working in the same jurisdiction cannot communicate with one another. The inability of our public safety officials to readily communicate with one another threatens the public's safety and often results in unnecessary loss of lives and property. Recognizing that solutions to this national issue can only be achieved through cooperation between all levels of government, 18 national associations representing State and local elected and appointed officials and public safety officials formed a task force to address this issue. The case studies and articles contained in this document are the result of the significant commitment by members of this task force who shared their knowledge, experience, and wisdom. Member associations include the following organizations.

- National Institute of Justice, Communications Technology Program (CommTech)
- Department of Homeland Security, SAFECOM program
- Association of Public Safety Communications Officials International, Inc.
- International Association of Chiefs of Police
- International Association of Fire Chiefs
- International City/County Management Association
- Major Cities Chiefs
- Major County Sheriffs' Association
- National Association of Counties
- National Association of State Chief Information Officers
- National Association of State Telecommunications Directors
- National Conference of State Legislatures
- National Criminal Justice Association
- National Emergency Management Association
- National Governors Association
- National League of Cities
- National Public Safety Telecommunications Council
- National Sheriffs' Association
- The Council of State Governments
- The United States Conference of Mayors

For more information on interoperability, updated material, and supplemental resources, visit www.nijcommtech.org

Interoperability Case Studies

Case Study: Capital Wireless Integrated Network

Background

The Capital Wireless Integrated Network (CapWIN) is a partnership of communities and the agencies serving the Capital Region (Washington, D.C., Maryland, and Virginia) working together to develop an Integrated Mobile Wireless Public Safety and Transportation Network. The network will provide interagency communication to ensure a coordinated response to any transportation, natural disaster, or public safety incident in the Washington D.C. region.

This integrated communication network will be the first multiState, multijurisdictional wireless public safety system in the United States and will serve as a model for other areas of the country. The system will enable public safety and transportation officials from over 40 local, State, and Federal agencies to communicate with one another in real time. CapWIN will provide firefighters, police, transportation officials, and other authorized emergency personnel with wireless access to multiple government databases during critical incidents, giving first responders and other public safety officials pertinent information to make critical decisions. This real-time information will enhance public safety.

The network is designed to eliminate the confusion that can plague first responders currently hobbled by incompatible communication systems and insufficient information and thus provide more effective and efficient management and coordination of multiple responding agencies.

Strong partnerships

The strength of CapWIN is the partnerships that have developed and the sense that agencies have to work together for the greater good of their communities. Public safety agencies have to change the way they

have done business. Partnerships have to be formed and people have to share resources and work together to meet the challenges of the future. This project is an example of remarkable teamwork on the part of many people including the Executive Committee, State and local officials from Maryland, Virginia, and the District of Columbia, Federal agencies, and members of Congress.

CapWIN is designed for simplicity and ease of use. Officials will communicate with one another on the network via an Instant Messaging application deployed at low cost, through industry standard devices such as personal computers, personal digital assistants (PDAs), and data-enabled mobile phones. Authorized users will be able to set up response teams—secure high-performance chat rooms—to handle unexpected events such as natural disasters, traffic collisions, fires, or terrorist threats. A police officer responding to a traffic collision, for example, will be able to communicate simultaneously with key personnel, including ambulance drivers, firefighters, and transportation response units and centers, as well as the hazardous materials team and other special units, if needed. Network users will be able to establish longer term groups to stay in touch with one another during ongoing assignments—a criminal investigation, for example.

Technology overview

The CapWIN contract was awarded to the IBM Corporation in July 2002. It is an open network that uses a browser mobile client. CapWIN features include the following.

- There is minimal impact to legacy systems. Strictly limiting the impact to legacy or existing systems not only avoids the cost of modifying or replacing legacy systems, it also avoids the costs, risks and schedule impact of re-training end users and system managers.

- CapWIN uses open, scalable, and reliable Web-based architecture. IBM's architecture provides a highly scalable and modular platform for cost-effective future system growth—within existing participants or through the addition of new agencies. (Scalable architecture refers to the ability of a system to grow easily. Modular architecture refers to the ability of a system to easily add capabilities.)

- CapWIN offers efficient use of limited bandwidth allowing the use of lower cost wireless systems.

- Extensive use of technology standards improves off-the-shelf inter-

operability and enhances the long-term ability to cost effectively implement future technological advancements.

- CapWIN uses Commercial Off the Shelf (COTS) packages that will be readily configured for initial deployment and can be modified or reconfigured by CapWIN personnel to meet future requirements, reduce initial development cost, risk and schedule, and maximize long-term vendor independence.

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Case Study: State of South Dakota Radio System

The State of South Dakota has built a radio communications system that allows public safety radio users from all local, State, and Federal levels of government in South Dakota to communicate any place and any time with existing radio systems.

Radio communications background

State Radio had its inception in the 1940s with a lowband (39 MHz) system consisting of a few towers that were tied together with radio (RF) links. The lowband radio frequency offered the greatest range and required the least number of stations. In the early 1960s, the statewide communications system was interlinked via a microwave network. The State Department of Transportation added VHF highband (150-170 MHz) to the system in the 1970s, primarily for the engineering staff to have a communications system within their own organization. The highband frequencies enabled quieter radio operation and the ability to "repeat" the signal, vastly extending the range vehicle to vehicle. The forest fires in the late 1980s prompted the building of a State Division of Forestry highband system in the Black Hills. Constructed primarily for fire and emergency response, the system allowed for handheld radio operation during fire fighting. Corrections facilities also came on line, beginning in the 1970s and continuing through the

1990s. The Sioux Falls correctional units were the first to acquire an in-house system with a UHF (450-470 MHz) repeater system. The UHF frequency enabled communications in a campus-type situation. Also in the 1990s, communications systems developed at some of the major park and recreation areas in the state. Lewis & Clark, Oakwood, Farm Island/West Bend, and Newton Hills all have UHF systems providing portable (handheld) radio coverage.

Today the State government radio infrastructure consists of 43 towers, 22 transmitter sites, and a microwave interconnect system. State government uses 1,929 mobile (vehicle) radios and 618 portable (handheld) radios on lowband, highband, and UHF. Local public safety agencies use more than 5,000 mobiles and 3,500 portables on lowband, highband, UHF, and 800 MHz systems. The government has an internal mandate to be completely on highband by 2005.

The lowband frequency in use from the 1940s has a number of fundamental problems. Lowband is the most prone to skip—radio signals bounce off the atmosphere to interfere with other radio systems—and to interference from computers and other electronic equipment. As other local, county, and Federal agencies developed communication systems for their needs, the move was made to other frequencies such as VHF highband (150-170 MHz), UHF (450 MHz), and to a limited extent 800 MHz. These frequencies offered a much cleaner signal and proved more flexible in operation. The primary problem created by these moves was an inability to talk between State organizations. For example, a snowplow operator was unable to talk to a highway patrolman.

Interoperability solutions

To address these problems, in its 1999 session, the South Dakota Legislature approved a bill that directed eight State agencies to integrate their telecommunications functions and facilities into a single cohesive network. Funding for the State Radio system comes from a $7 million COPS [Office of Community Oriented Policing Services] grant from the U.S. Department of Justice, a $4 million appropriation from the 2001 legislative session, an additional COPS grant of almost $4 million, over $1 million from a Highway Safety grant, and $1.43 million in State agency funding. These funds were used to buy the radio system infrastructure, mobile, and portable radios for State government agencies and mobile radios for local public safety agencies. After a lengthy evaluation process, a Motorola VHF (150 MHz) digital trunked system was chosen as the best fit for South Dakota, based upon the following criteria.

- It is compatible with 73 percent of existing local mobile units in the State and all Federal users.

- It provides direct compatibility with Federal users and meets the Federal 2005 mandate for public safety radio communications to be on VHF.

- There are no usage fees for local agency use.

- There are many radio dealers in the State.

- The system uses existing State and Federal facilities (towers, buildings, etc.).

A trunked radio system allows many users to share a limited number of radio channels by utilizing the first available channel for each conversation. Because it doesn't have dedicated channels, a trunked radio system allows the radio to "hop" from channel to channel to find an open path, more efficiently using the channels at a site. The channels at all sites are available for use by all users and are linked together by a control computer located in Pierre. As the microphone push-to-talk (PTT) button is depressed, an open channel is selected and a communications path is set up between those users in the talk group. This eliminates the need to wait for an open channel, as is the case on a dedicated repeater, and allows for a much more efficient use of the frequency. The trunked technology allows:

- More efficient use of radio channels, lowering system costs;

- Communications with any public safety user, anywhere in the State—from mobile users to portable users to dispatchers;

- Complete autonomy for each talkgroup (a predefined group of radio users who can privately communicate with one another). Radio service can be made to follow the radio anywhere in the State;

- Enhanced system management to ensure high availability, reliability, and serviceability; and

- Bridging from analog to digital technology. New radios can access old systems while old radios can access the new system through mutual aid channels.

One frequency ensures interoperability

The State's radio system solution allows existing analog VHF users to communicate day one—at a minimum through the statewide mutual aid channel. All proposed radios can utilize any VHF system—whether new, existing, analog, or digital. Ultimately, using one frequency ensures radio communications anywhere in South Dakota. Additionally, VHF allows the easiest, least costly path of local agency migration into the digital world. For those operating on UHF (450 MHz) or 800 MHz, the State is using crossband repeaters to allow access to the mutual aid channel in their area. The local agencies are responsible for installing and maintaining the repeater equipment.

The system allows State and local radio users to transmit data in addition to their normal voice communications. Now maps, fingerprints, and other data flow to the State's public safety officials in the field and to local agencies with computers to receive and transmit data. The communities in South Dakota benefit with a VHF digital, trunked network by getting improved Federal, State, and local communications; improved emergency response; standardized communications; modern communications facilities; and data communications.

Digital radios act like computers

A trunked radio is basically a computer with a receiver and transmitter attached. Digital radios send and receive voice and data digitally — sending 1s and 0s through the air rather than analog audio waves. Digital radios convert the signals back to analog to play over the speaker. Each radio has a digital address much the same as a computer on a network. This address identifies the radio to the central network controller, which then directs a given transmission to those users listening to a particular talk group. Radios can search across talk groups and the radio user can easily switch between the primary talk group and any other talk group, such as the statewide mutual aid channel.

The mobile/portable radios for use on this system will also accommodate all conventional (non-trunked) VHF channels. This allows communications on both old and new radio systems with a single radio, allowing local agencies relatively easy migration from their older conventional systems. All radios are "data ready" and APCO 25 compliant (the Federal government's standard), operate in the federally mandated narrowband (12.5 MHz), and have built-in security features.
With all radio sites at various towers across the State linked through

the central controller in Pierre, radio users have access to the system anywhere in the State. Radio users can communicate across the State simply by speaking into the microphone, just like using a public telephone system.

The State has engineered its radio sites to have a minimum of four trunked channels. One is used to run the system, leaving three channels for handling radio calls. A trunked channel can support between 75 to 100 radio users.

In addition to the trunked channels, there is an overlay of mutual aid channels. These are conventional VHF channels that are slated to be placed at 35 sites statewide. These channels allow anyone with an older conventional VHF radio to communicate with those on the new system. These channels are conventional repeaters and will operate only in the coverage area of those repeaters—not across the State. All State radios are equipped with these frequencies. State Radio dispatch monitors these channels around the clock. A dedicated data channel that will allow the use of mobile data terminals (MDTs) by law enforcement or other agencies has also been placed at each site.

Talk groups

Agency groupings (talk groups) have been established with the cooperation of local users. These talk groups allow private conversations within that talk group, similar to that of a dedicated channel. The system is "fleet-mapped" to connect the members of a talk group regardless of their location within the State. Multiple talk groups—up to 256—can be programmed into the radios and can be scanned between groups.

The development of talk groups required input from the agencies using the system. Talk groups can be added or modified at a later date, but the State can be much more efficient if it's done at the start. The primary issue is determining whether the new system is going to be utilized now or in the future as the primary communication system for the agency. If the system is going to be the secondary system, a more regional approach for that agency would be the most practical. Larger departments whose radio communications are mostly within their immediate group define a talk group for those users. For agencies whose communications are with another department, such as a local police department, sheriff's office, or fire department, a regional talk group may be more practical.

Management

The radio system and network are supported by South Dakota's Bureau of Information and Telecommunications' (BIT) State Radio group. The State maintains the towers, repeater equipment, central controller, and transport equipment. Local users are responsible for maintenance and repair of the mobiles and portables in use by those agencies and any related control equipment (console/dispatch) used.

Phased system implementation

The radio system infrastructure was implemented in phases, starting with the Black Hills/western South Dakota region, followed by eastern South Dakota, and finally the central part of the State. Coordination of the system programming for the mobile units has been accomplished as the radio system infrastructure was brought on-line. Because the new digital radios work on the existing conventional radio systems, many of these new digital radios were in use prior to the radio system coming on-line. State personnel and contracted private dealers reprogrammed radios in the field and provided operating instructions.

The central network switch and five pilot sites were installed in November 2001. Twelve transmitters serving West River and the Black Hills were installed in June 2002. The rest of the State (18 transmitters) and the entire system was operational by July 2002. Six additional transmitters were added in October 2002 for enhanced portable coverage.

With the majority of local radio users in the State operating on VHF, access to the State system is gained by simply programming the Mutual Aid channel into their current radios. The Mutual Aid channel allows communications with all State users and dispatch centers. This allows the local entity to phase in new digital radios on their own schedule. In addition to working on local agency systems, these new radios offer more capabilities on the State system.

For those operating on UHF or 800 MHz, the State offered a cross-band repeater to those users that allows access to the mutual aid channel in their area. The system operator is responsible for installation and maintenance of the repeater equipment. Lowband users continue to have a government station available in their area to access State Radio (SRC) dispatch.

Dispatch centers have many options.

- An inexpensive VHF control station connected to the dispatch equipment allows access to the local mutual aid channel.

- Digital trunked control stations can be connected to console equipment that allow access to particular talk groups. Initial State dispatch talk groups alignment is around tower sites (geographical), allowing a local dispatch center to monitor dispatch related traffic only in their area. Additional coverage areas can be added as needed.

- A digital trunked base can be set up in the dispatch center that allows access to all authorized talk groups.

- A direct connection to the central controller can be established. This allows backup of any connected site by any other connected site. This option requires particular dispatch equipment, and a transport to the master site in Pierre.

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Case Study: State of Indiana Radio System

Background

In 1997, public safety communications in Indiana formed a quilt of incompatibility. Some agencies like the Indiana State Police were on a 30-year-old lowband VHF system, others were on highband, UHF, and different types of 800 MHz systems. Interoperability was the exception. The reality of the 1990s was that there were not enough funds for every public safety agency to have all the personnel and equipment necessary to handle every situation that might arise. What the times demanded and the public deserved was an integrated communications system. Modern trunking voice and mobile data technology made it possible for different agencies to share a single communication system in which they communicated with whom they needed at a particular time. Because television does not show agencies that are unable to talk to one another, the public believes that such a communications system exists today. When most people are informed of the current communications situation, the most common response is, "You mean they can't do it now?"

When a new police superintendent was appointed by the new governor, a survey of the Indiana State Police indicated that building a modern communications system to replace their 30-year-old system was a top priority. Since 1990, Indiana had been gradually building a State-focused Motorola analog 800 MHz system, but implementation had been delayed by lack of funding. Most of the funding had come from a Federal program, the Chemical Stockpile Emergency Preparedness Program, to prepare for a possible incident at the Newport Army Ammunition Plant, where 1,300-ton containers containing VX nerve agent were stored. In 1997, the Indiana General Assembly appropriated $7.5 million to the Indiana State Police to build the next phase of the project, but the superintendent took a fresh look at the radio communications problem before continuing the old program. How should a public safety communications system be designed to meet the demands and limits of the 1990s?

The Indiana State Police Superintendent was a strong advocate of a statewide, integrated public safety communication system that any public safety agency could use. The initiative to construct such a system was called Project Hoosier SAFE-T (Safety Acting For Everyone-Together. Its goal was to bring together every public safety agency—local, State, and Federal; fire, EMS, law enforcement, emergency man-

agement, and transportation—in Indiana so they could communicate with one another.

Solutions—the Integrated Public Safety Commission

To build support for the integrated communications system, the major statewide law enforcement associations and the Federal Bureau of Investigation (FBI) came together to form the Integrated Law Enforcement Council (ILEC). Subsequently, EMS and the major statewide organizations representing the fire service, counties, cities, and towns came on board. The governor formalized the status of the council through an executive order in 1998. This council became the major conduit for communication between the State and the local governments. In 1999, the Indiana General Assembly created the Integrated Public Safety Commission by statute (IC 5-26). Its membership includes a mayor, county commissioner, police chief, the Special Agent in Charge of the FBI for Indiana, superintendent of State police, fire chief, and six others representing the private sector and the legislature. It is the governance body for Project Hoosier SAFE-T.

To bring together over 475 cities and towns, 92 counties, and innumerable townships to share a common vision required a massive communication effort. Over the first 4 years, first the ILEC and then the IPSC held four governor's summits, numerous regional meetings, and focus groups. It conducted a survey of the public safety agencies and published a newsletter for all of the constituents of its members and to the members of the General Assembly and Congress. Inclusion of the State, county, and municipal political leaders was important because the hurdle to constructing this system was not the technology, but ensuring that those who controlled the purse strings considered it worth funding.

After the General Assembly failed to provide requested funding for implementation of the system in 1999, the IPSC decided to use the existing Federal and State appropriations—several million dollars that Congress had earmarked for Project Hoosier SAFE-T—to fund some demonstration projects so the legislature would have tangible evidence of what the system could do. The IPSC expected to receive applications from one or two consortiums. It received applications from 12 consortiums, comprising 68 of 92 counties, with one consortium made up of 14 counties The consortiums generated nearly 800 letters of support from local government officials, providing a powerful story to take to the General Assembly.

In 2001, IPSC sought funding first using a surcharge on the 9-1-1 fees on land-based and wireless phones. The telephone companies opposed this effort and carried the day. Later in the session, IPSC tried to obtain some of the proceeds from riverboat gaming for a one-time infusion of cash, but the effort was unsuccessful.

In the aftermath of September 11, the lack of interoperable communications was cited as a major hindrance in public safety's response. IPSC returned to the General Assembly in 2002 focusing on the counterterrorist aspect of Project Hoosier SAFE-T. The Counterterrorism and Security Council (CTASC) made Project Hoosier SAFE-T its top legislative priority in its counterterrorism bill. The Lieutenant Governor, who served as chair of the CTASC, lobbied personally on behalf of Project Hoosier SAFE-T. The Speaker of the House, also a CTASC member, carried the bill. The Senate CTASC member and the Public Policy Committee Chair carried it in the Senate. The bill passed with difficulty. It established a funding mechanism that lasts until 2019 using Bureau of Motor Vehicles service fees and provided for bonding.

The key factor in winning the support of the locals was how IPSC structured the State's relationship to them. Project Hoosier SAFE-T would save lives and save money. The State would construct the backbone of the system—towers, controllers, and connectivity between the components of the system. There would be no user fees. The locals only had to purchase their user equipment. IPSC determined that the difference in cost between constructing a State-only system and an integrated, interoperable communications system was 4 percent. The concept of user fees was a major impediment to local participation. IPSC negotiated discounted pricing that would apply to the smallest town as well as to the largest State agency. Participation in the system was totally voluntary. The IPSC membership contained only one State representative. Most important of all, there was consistent communication with all interested parties throughout the process.

Local involvement not only made sense from a public safety standpoint, it added to the political impetus. State legislators respond more readily to concerns voiced by their constituents than by a State agency. During hearings on the bill that created IPSC, representatives of the public safety and government associations testified in a historic demonstration of unity. When the testimony was complete, the chair of the House Ways and Means Committee asked committee members if there was anyone who dared to vote against the bill.

Today, IPSC has begun the 4-year phased construction of the system. It is a Motorola Astro 800 MHz voice and data system comprised of

129 towers that is available to every local State and Federal public safety agency that chooses to join the system. The decision not to require Project 25 in the Request for Proposal was based on the higher cost and lower level of interoperability of Project 25 equipment. It also would have eliminated any competition for the infrastructure portion of the proposal because only one manufacturer makes Project 25 equipments.

The first implementation of Project Hoosier SAFE-T, Johnson County, has every public safety agency from volunteer fire departments to the sheriff's department to the Indiana State Police, State Emergency Management, and Department of Natural Resources on the new system. Lives are being saved. Johnson County estimates it saved over $2 million dollars by using Project Hoosier SAFE-T instead of building its own system. The city of Crawfordsville, soon to be joined by Montgomery County, came on the system in June 2002 and is communicating with Indiana State Police troopers, Department of Natural Resources officers and, in the near future, some of the public safety agencies in Tippecanoe County to the north.

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Case Study: Tornado Alley

April 1996

A tornado ripped through south central Indiana, spreading devastation across Johnson County, Indiana. The fire and law enforcement agencies that responded could not talk to one another either because they were on one of the 18 incompatible communications systems in the county or were among the 30 plus responders sharing one channel and stepping all over each other. Communication chaos reigned. Control and calm was not restored for 96 hours.

September 2002

A tornado rips through the same area. Its path parallels that of the 1996 tornado, only 1,000 feet to the east. The devastation that followed was even greater than in 1996. Total damage is estimated to exceed $7 million. This time, however, the four law enforcement and nine fire departments that responded shared a single trunked, voice communications system, implemented just 8 months earlier in conjunction with the Integrated Public Safety Commission (IPSC). IPSC is responsible for implementing Project Hoosier SAFE-T, an initiative to develop a statewide, interoperable, voice and data communication system for local, State, and Federal public safety agencies. The response to the tornado would be the first real-life test of the system. These 13 departments communicated with one another when needed, seamlessly. Control and calm for this disaster was restored in 7 hours. The new system handled 12,955 transmissions in 7 hours, almost 31 per minute and 4,000 in the peak 2-hour period. The nearly unanimous reports from various local government and public safety officials was that the new communications system performed extremely well and enabled the interagency communications that were critical to responding properly to the disaster.

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Case Study: Minnesota Metropolitan Public Safety Radio System

Background

Late in the 1980s, the growing need for more land mobile (two-way) radio spectrum for public safety use coincided with new, emerging trunking technologies. In response, the Federal Communications Commission (FCC) allocated more public safety frequencies. New bands were allocated in the 800 MHz range, eliminating underused

UHF television allocations. To encourage shared systems, trunking, and improved local and regional coordination, the FCC required that some of these new bands be set aside for shared, coordinated use.

At the same time, the Twin Cities—Minneapolis and St. Paul—were experiencing rapid population growth. New suburban police, county sheriffs, State patrol, fire, and EMS agencies were finding it difficult, and in some cases impossible, to find radio channels they could license for their two-way systems. Moreover, interoperability between and among agencies in times of need for mutual aid was difficult. Some visionary public safety professionals in the Twin Cities began to call for a new radio system that could utilize the new bands opened up by the FCC and that, at the same time, could greatly improve the ability for separate agencies to talk to one another when necessary.

Metropolitan Radio Board

The legislature authorized a planning commission, which included representatives from local government, counties, State law enforcement, and other public safety providers, that met for several years, developing a plan for an integrated region-wide radio system that would span the entire metropolitan area and solve the interoperability problems. This resulted in legislation to create the Metropolitan Radio Board, charged with the responsibility to finalize plans, oversee construction, provide financing, and set policy for the new system. At the time the Board was created, both the State of Minnesota and Hennepin County had been planning separate upgrades of their outmoded radio systems. The separate legacy systems were, in effect, "silos." They could talk within their agencies, but could not easily communicate with outside entities. With passage of the legislation, the legislature hoped to encourage the idea of a shared infrastructure that would improve the ability to talk between agencies and, at the same time, provide significant economies of scale.

The original proposal was for the State to pay the entire cost of the system. Following months of hearings, however, the law that finally emerged was something of a hybrid. The Minnesota Department of Transportation, MnDOT—the lead agency for the State's two-way radios—would finance half the cost of the backbone, partly through general obligation bonds, and partly with monies from the State's trunk highway fund. The other half of the capital costs would come from the Metropolitan Radio Board, which would have revenue bonds issued on its behalf by the Metropolitan Council. The debt service would be provided by 4 cents collected monthly on all wired and wire-

less telephone lines, statewide. The 4 cents is part of the so-called "9-1-1 surtax." Most of the rest of the surtax (now totaling 33 cents) goes to subsidize the cost of providing emergency 9-1-1 service in the State.

Several other aspects of the legislation that became law are important to understand.

- The legislature made participation optional for local governments.

- Local governments, if they opted to participate in the shared system, would be required to pay the cost of their own subsystems—additions to the backbone required to extend service to large buildings, underground structures, etc., that would be required for counties and cities. Additionally, all users were required to pay the cost of the subscriber radios—portables and mobiles carried by users.

- Equipment that would provide limited interoperability between conventional legacy systems (the "silo" systems) and the new regionwide system, was required by law.

- MnDOT was mandated to own and operate the backbone, while the Board would set system standards and policy once it was operational.

- Membership on the Board was designed to provide a maximum of local input. Fourteen Board members are elected officials from counties and cities. Only one representative from the State was placed on the Board, as well as one from the Metropolitan Council.

The decision to separate the powers and to diffuse decisionmaking has been a success. No single entity—local or State—is perceived as being too powerful. The interests of local governments are preserved, yet operations for the regional backbone are centralized, with experienced professionals clearly doing a highly competent job.

The system that ultimately was constructed and is now going into operation was provided by Motorola. It is designed and built with "open architecture," meaning that multiple manufacturers can make equipment that works on the system. That, in turn, provides both price and features competition. The architecture is based on the The Association of Public-Safety Communications Officials - International, Inc., (APCO) Project 25 standard, now gaining growing acceptance

around the Nation. The governmental entities that elected to fully participate in the system include the State of Minnesota (State Patrol, MnDOT, Department of Natural Resources, Bureau of Criminal Apprehension, etc.); the Metropolitan Council (Metro Transit and Metro Mobility and the new Light Rail Transit system); Hennepin County; Carver County; the cities of Minneapolis and Richfield; and North Memorial Medial Transportation.

Following the events of September 11, 2001, there was renewed interest in persuading more entities to join the system. An effort in the legislature to provide more 9-1-1 money to assist locals with capital needs was partially successful. The Radio Board will begin receiving 5.5 cents in 2004, resulting in the ability to subsidize local governments up to 30 percent of the cost to join. Since the legislature adjourned, Anoka County and Allina Health Systems have voted to join the system, and planning is underway to design and build the second phase of the system, which entails extension to the remainder of the metro area. Another effort is planned in the coming session of the legislature to expand the system statewide and to review the governance structure.

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Case Study: Public Safety Radio Interoperability in Colorado

Background

Colorado's population is concentrated on the Front Range, the region north and south of Denver along the eastern edge of the Rocky Mountains. In the 1970s the area outside the Front Range was largely rural, with the Front Range itself a mix of urban, suburban, and rural areas. The population of Colorado has doubled in the last 30 years. Much of the growth has occurred in the Front Range, although the

mountainous western portion of the State has grown significantly also. Colorado's eastern plains have not seen significant population growth and some counties in the plains have lost population.

General law enforcement in Colorado is the responsibility of the county sheriffs and the municipal police departments. There is no State-level general law enforcement agency, although the Colorado State Patrol, organized in the 1930s, has statewide jurisdiction for traffic law enforcement. In the early 1970s, most Colorado law enforcement agencies operated VHF radio systems. A few still had lowband systems, and a few were beginning to consider UHF systems.

Public safety telephone answering and radio dispatching were handled by a variety of means. Larger cities generally ran a police communications center, sometimes also providing dispatch for fire and emergency medical services. The State Patrol operated a network of communications centers throughout the State. In rural areas, sheriffs, fire, and municipal police sometimes relied on these centers. A statewide standard frequency, known as CSP-3 was used for mutual aid and by officers working outside the range of their home system. Most agencies also installed the National Law Enforcement Emergency Channel (NLEC) in their base stations and mobile radios.

An economic downturn in the early 1990s resulted in pressure on the State legislature to save money. One result of this pressure was passage of legislation that required the State Patrol to develop a plan to consolidate multiple rural dispatch centers into a few regional dispatch centers.

In addition to consolidation of dispatch centers, the State developed a plan for an 800 MHz digital trunked radio system. State officials met with sheriffs in 1992 and attempted to convince them to join the digital trunked radio system. State officials made it clear that a decision had been made to go with the 800 digital trunked radio system and they were not interested in discussing other options. The reception from the sheriffs was mixed. Some sheriffs in urban areas were interested, but many others were not. Sheriffs were concerned that a digital trunked radio system would be extremely expensive and that it would provide less coverage than the existing systems. VHF can cover mountainous terrain with fewer tower sites than the much higher frequency 800 MHz radio waves. State officials also warned that the Federal Communications Commission (FCC) would soon be auctioning off the VHF spectrum that most Colorado public safety agencies used and that it would no longer be available. The Sheriffs' reaction to this was to join a lobbying effort, which eventually resulted in abandon-

ment of the plan to auction the VHF spectrum.

State officials touted their plan by explaining that with the new system, a State trooper in the northeast corner of the State could have conversation with a trooper in the southwest corner of the State. Local officials expressed concern that there was very little need for that type of communication. A greater fear was that local governments would be unable to afford the new system, with the result that while the State trooper could talk to a fellow troopers hundreds of miles away, they would lose interoperability with local law enforcement. For day-to-day public safety operations, loss of this interoperability was a grave concern.

There were also concerns that the channel crowding problems that digital trunked radio is designed to solve are, for the most part, simply not problems in Colorado, and that although digital trunked radio solves some of the problems associated with VHF analog radio, it brings with it a whole new set of problems.

Despite the concerns, and fueled extensively by a telecommunications industry lobbying effort, Colorado's legislature passed authorizing legislation for the 800 MHz digital trunked radio in the mid-1990s. A special fund was set up to finance acquisition of the system. Initial appropriations were made and the State, in cooperation with some of the urban counties, began to develop the system.

Today the 800 MHz digital trunked radio system has been implemented in Arapahoe, Douglas, and Jefferson counties for State and local law enforcement. The system is working quite well for those users. The city of Denver, with the largest police department in the State, maintains an 800 MHz system provided by a different manufacturer than the State system that is incompatible with the State system. In Boulder County, the State patrol has gone to the digital trunked radio system, but the county and municipal law enforcement, fire, and EMS remain on a VHF system that works well and provides interoperability. Most State Patrol cars in Boulder County now have two radios, one on the digital trunked radio system, and another on the county's VHF system. The digital trunked radio system does not provide coverage in the mountainous half of Boulder County, so State troopers must now rely on the county dispatch system when they are in the mountains.

State officials now face a new problem. Because of the latest economic downturn, coupled with revenue and expenditure limitations placed in the State constitution, money is not available to complete the system. State officials (not the same persons who originally proposed the sys-

tem) are faced with a dilemma. Insufficient funds are available to complete the system. Part of the system works well, but the outlook for implementation of the system in the remainder of the State is mixed. The hope for full funding from the Federal government is a slim possibility.

What are the lessons to be learned from this experience? First, State officials' decision to implement a 800 MHz system without consulting local officials resulted in resistance from local officials. A more flexible approach would likely have received a better reception. A corollary is that the 800 MHz digital trunked radio system offered no advantages, and multiple disadvantages, over existing systems.

A third issue involves the cost of the proposed system. While some jurisdictions had sufficient resources to purchase a complete new system, most Colorado communities simply could not afford to spend the money required to join the digital trunked radio system. Finally, reliance on industry for technical advice is not always in the best interest of local government.

Where does Colorado go from here? That remains to be seen. The State is too deeply invested in digital trunked radio to back out. Some urban counties are satisfied with the new system. In areas where State agencies have shifted to digital trunked radio and locals have not, the big picture of interoperability is actually worse than it was previously. Time will tell what the future holds.

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Case Study: State of North Carolina Interoperability Initiatives

Background

In 1993, the North Carolina State Highway Patrol began exploring the feasibility of statewide mobile data communications for its officers. Research revealed that infrastructure for a statewide network would exceed $100 million. A pilot project was conducted with 20 mobile terminals shared among 8 State and local law enforcement agencies to determine the viability of mobile data communications in the State. Not only was this an instant success, it was the first true method of interoperability between law enforcement officers in North Carolina.

The 1994 Special Crime Session of the North Carolina General Assembly commissioned a study of criminal justice information issues. Of those issues, two had a direct impact for officers on the street—the study of a statewide mobile data network (MDN) and a statewide 800 MHz voice trunking radio network (VTN).

Solutions

Construction on the mobile data network began in 1994 with funding made available through the U.S. Department of Justice Byrne Grants, administered by the Governor's Crime Commission, legislative appropriations, and Federal grants. Network construction was completed in phases as funding was available. The fifth phase is currently in process with a completion date of December 2002. This phase will make coverage available in a 100 counties in North Carolina, which total more than 48,000 square miles.

Growth of the network has brought growth in the user base. As of July 2002, there are approximately 270 Federal, State, and local agencies sharing the mobile data network with over 7,100 users that enjoy interoperability between agencies and users. In addition to interoperable communications, officers have access to the North Carolina's Motor Vehicle files, sex offender files, conceal carry weapon permits, domestic violence files, the National Law Enforcement Telecommunication System (NLETS), and the Federal Bureau of Investigation's National Crime Information Center (NCIC). This technology is available to all public safety officers in North Carolina from the largest department to the small, one-car, two-officer rural department.

The success of the mobile data network has been the steadfast commitment between Federal, State, and local agencies to share infrastructure resources. By using towers owned by other agencies, North Carolina has been able to complete the network infrastructure, originally estimated at $l00 million for approximately $15 million. The concept of sharing resources and interoperability between officers has made this network a model for others both nationally and internationally.

North Carolina's next venture is to construct a statewide voice trunking network for use by all public safety agencies in North Carolina. Technology and spectrum issues have caused public safety managers to review their communications plans; however, the events on September 11, have forced everyone to not only look inward at communications plans, but to look outward at North Carolina's abilities to communicate with other public safety agencies that will be responding to the same incident.

North Carolina has faced this issue twice in recent history. In 1996, Hurricane Fran not only crashed into the coastline, but produced hurricane-strength winds inland as far as Raleigh, crippling the capital city for weeks. The second event was Hurricane Floyd in 1999. Floyd brought flood waters that exceeded anything ever recorded in the State, displacing business, families, and even cemeteries. This event saw the largest mobilization of relief forces ever amassed in North Carolina. Not only were the inadequacies in flood plans revealed, but the need for a robust interoperable interagency communications system was evident.

For example, the State Highway Patrol's primary communication system is a lowband radio system designed in the 1930s. State-of-the-art in its time, this network is quickly becoming obsolete due to the lack of availability of replacement parts. In North Carolina there are more that 30 local governments that have invested in interoperable 800 MHz communications systems. North Carolina's plan is to maximize the compatibility of these systems for a statewide interoperable voice trunking communications system. North Carolina's first construction, a combined effort of the State Highway Patrol and Wake County officials, will be a $20 million interoperable radio system that will provide communications for a number of agencies. In addition to the Wake County project, 800 MHz voice infrastructure is being installed along the I-40 corridor from New Hanover County (Wilmington) to Wake County (Raleigh) to expedite the evacuation of coastal residents in the event of the next hurricane. North Carolina is currently seeking funding to extend its voice trunking network initiatives statewide.

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Case Study: Utah Communications Agency Network (UCAN)

The Utah Communications Agency Network (UCAN) radio system is a public safety radio system operable in the 800 MHz band as authorized by the Federal Communications Commission (FCC). The system serves 93 public safety agencies with analog and digital radio communications used to respond to emergency situations, such as accidents, terrorism, kidnapping, transportation emergencies, and management of State parks and lands and correctional facilities. The network is comprised of Federal, State, county, municipal, and multi-jurisdictional agencies including, among others, the Utah Department of Public Safety, Utah Highway Patrol, the U.S. Marshall and U.S. Forest Service, the Salt Lake County Fire/EMS, the West Jordan Police Department, the Drug Enforcement Administration Metro Narcotics Task Force, and the Valley Emergency Communications Center.

The founding legislation was completed in 1997, establishing a Quasi-State Agency, governed by the users. The Executive Committee is elected by the users and serve alternating terms as voted on by the 93 agencies. Each agency has one vote. The Executive Committee comprises 15 members, 10 local government and five State members, appointed by the governor, who represent the State agencies.

The total investment in radio, microwave, power supplies, and backup generators is $17 million plus an additional $4 million to provide service for the 2002 Olympics, paid for by a combination of Federal, State, and local funding. Ongoing costs are covered by a fee-for-service paid by participating agencies for each radio connected to the system.

The system is electronically tied to 16 Enhanced 9-1-1 (E 9-1-1) communications centers located in nine Utah counties, serving 80 percent of Utah's population. Equipment at urban and remote transmitting

facilities network calls. The calls are routed via computer programming, which transfers the calls to the appropriate dispatch facility and/or other system user. Each user has a console (in dispatch) or a portable (handheld) or mobile (in the vehicle) radio that responds to the call and allows for two-way communications. The system has regional and systemwide event channels, which allow large groups of users to communicate when responding to large-scale events.

During the 2002 Winter Olympic Games, the system supported 15,600 users processing 8.5 million calls in 17 days or approximately 500,000 calls in 24 hours. (Normal traffic loading averages 10,000 users processing 190,000 calls per 24 hours.) The system is built to a public safety standard and features redundant connectivity (microwave), backup generators, and power supplies. The sites and facilities are built to a 99.999 percent operational capability. Where possible, UCAN has established leases for transmitter space; however, UCAN has constructed facilities where necessary to provide the coverage for public safety communications. The total investment in radio, microwave, power supplies, and backup generators is over $17 million plus an additional $4 million to provide service for the 2002 Olympics. The following is a summary of the system sites and facilities.

Box Elder/Weber/Morgan County —This portion of the network covers the Weber and Box Elder area of the system. It is inclusive of seven sites; three broadcasting simultaneously and four supporting sites. The sites are located at the Ogden Public Safety Center (leased), Rocky Point (owned), South Ogden Drivers License Facility (leased), Mount Ogden (leased), Promontory Point (owned), Morgan Peak (leased), and Reservoir Hill (owned). This portion of the system supports 65 channels for communications purposes and covers the Box Elder, Weber, and Morgan County Areas with overlapping coverage into Davis County.

Davis County—This portion of the network covers the Davis County area. It is inclusive of six sites; four broadcasting simultaneously and two supporting sites. The sites are located at the Davis County Jail (leased), Layton City Office (leased), Clearfield City Office (owned), Bountiful Police office (leased), Francis Peak (leased) and Davis Landfill (owned). This portion of the system supports 58 channels and covers the Davis County area with overlapping coverage into Weber and Salt Lake County.

Salt Lake County—This portion of the network covers the Salt Lake County area. It is inclusive of seven sites; four broadcasting simultaneously and three supporting sites. The sites are located at Valley

Emergency Communications Center (leased), Fred House Academy-2 sites (leased), Granite Water Tank (owned), City Creek Peak (owned), Nelson Peak (leased), and Parleys Canyon (leased). This portion of the system supports 68 channels and covers the Salt Lake County area with overlapping coverage into Davis and Utah Counties.

Utah County—This portion of the network covers the Utah County area. It is inclusive of seven sites; four broadcasting simultaneously and three supporting sites. The sites are located at the Utah County Jail (leased), Lake Mountain (leased), BYU Kimball Towers (leased), Alpine (owned), Sundance Ski resort (leased), West Mountain (owned), and Teat Peak (leased). This portion of the system supports 64 channels and covers the Utah County area with overlapping coverage into Salt Lake and Wasatch Counties.

Wasatch County—This portion of the network covers the Wasatch County area. It is inclusive of four sites. The sites are located at Clayton Peak (owned), Wasatch Justice Complex (leased), Strawberry Peak (jointly owned), and Current Creek Peak (leased). This portion of the system supports 28 channels and covers the Wasatch County area with overlapping coverage into Utah County.

Summit County—This portion of the network covers the Summit County area. It is inclusive of four sites. The sites are located at Lewis Peak (owned), Quarry Mountain (leased), Summit Justice Center (leased), and Medicine Butte (leased). This portion of the system supports 28 channels and covers the Summit County area to the Wyoming border.

Tooele County—This portion of the network covers the Tooele County area. It is inclusive of four sites. The sites are located at Vernon Hills (leased), South Mountain (leased), Delle (leased), and Wendover Peak (leased). This portion of the system supports 18 channels and covers the Tooele County area to the Nevada border.

Sanpete County—This portion of the network includes one site Barton's Peak (leased), which will provide service to the Gunnision Valley Correctional facility. This portion of the system will use channels and covers portions of Sanpete County. Additional sites may be added to supplement coverage and serve additional users.

Standalone Repeaters

The system also has 10 standalone repeater sites that will supplement the network. These repeaters give backup support in case of site failure. They also provide interoperability between agencies on different networks. There are three of these repeaters installed with an additional seven scheduled to be installed when suitable facilities are identified.

A typical "owned" facility consists of a prefabricated building located on private, Bureau of Land Management, or Forest Service ground with an associated tower structure for the antennas. Each site has emergency backup power (generator) and an un-interruptible power supply. The radio equipment is installed in the building and all the equipment is grounded to a common ground system for electrical and lightening protection. Periodic maintenance is performed at each site on a regular basis. Each site is alarmed and monitored electronically at UCAN office facilities, allowing for the implementation of quick maintenance and repair. Technicians can dial into the network using a computer to review system performance and operations.

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Interoperability Articles

Principles for Moving Toward Interoperability

The toughest issue facing governments when deciding to implement an interoperable communications system is not how to implement the new technology or even obtaining financing; rather it is how to obtain political buy-in. The need to convince public safety agencies and the governing bodies that an investment in the new technology is a higher priority than another investment is crucial. When asking agencies to change how they do business and governing bodies to allocate large sums of money, they must be very comfortable that they are taking the correct approach. How to achieve this comfort varies; however, there are certain overarching principles that will lead to a greater chance of success.

Inclusion is important

Because the purpose of interoperable communication systems is to improve public safety radio communications, it is vital to include potential participants early in the planning and decisionmaking process. If this is not done, the communications system may not adequately address an agency's needs. This may cause the agency not to join, and public safety will suffer. Developing an integrated system is more difficult because of the potential conflicting needs of the various levels of government and public safety disciplines.

Inclusion of agencies and public officials in the planning process should be both horizontal and vertical. The comprehensiveness of the inclusion depends on the willingness of the agencies at each level to put aside traditional turf issues. Inclusion must occur early in the process, not only so that the system design will accommodate the other agencies, but also so that the communication system partners will have a real voice in the design.

Horizontal inclusion requires an assessment of which agencies communicate with one another and can agree to share a system. Law enforcement, fire, EMS, and emergency management are usually included. Often departments of transportation and public works are overlooked as partners; however, in many cases, it makes sense to include them. If

an area has a college or major manufacturing facility, including their law enforcement or security agency may make sense. Schools also have an interest in interoperability with public safety communications system, particularly in light of the Columbine tragedy. The trunking technology used by most modern vendors allows several agencies to be on the same system without interfering with one another's communications; however, there are technological capacity limits that may prevent some public sector agencies, such as public works, from coming on the system. This is most likely to occur with a statewide system.

Vertical inclusion should also be considered because of the overlap of jurisdictions or areas of responsibility among public safety agencies (city/county, city/State, city/county/State, city/township/county/State/Federal). It does not make sense for these jurisdictions to build overlapping radio systems.

Working together to establish interoperability requires that all participants are comfortable with the paradigm shift—a new way of building public safety radio communications. There must be a constant and consistent effort to include all of the partners every step of the way.

At the beginning, develop a snapshot of the current state of communications, including the identification of the key players. Who those key players are will vary; however, the major associations—public safety and governmental—can play a significant leadership role. Although they do not have a direct stake in the issues, they do have a "bully pulpit" and the ability to communicate with their members. Their support lends credibility to the effort, not only with their members, but also with policymakers. Associations also have the ability to reach their members through publications. Focus groups can help to refine information, gauge the relative importance of issues, or frame the message.

Comfort with the new interoperability paradigm requires reassurance that the new radio system will do the job. Holding regional meetings or statewide summits to discuss the initiative in detail is useful in educating prospective interoperability partners. At these meetings, discuss technology issues but avoid technological jargon. The focus should be on the public safety improvements and money savings that will result from the new communications system. Regular newsletters and informational brochures that focus on the current problems and how the new communications system will save lives and save money is important and will pay off greatly in the long run. Send the materials to political decisionmakers as well as public safety officials.

The voluntary nature of the initiative must be a constant refrain. Even though a compelling argument can be made that public policy and fiscal reasons demand that agencies come on the new system, making participation mandatory will hurt efforts to establish it. If the education efforts are well done, participation will be compelling even though voluntary.

The interoperability governance structure must take steps to maximize autonomy. The new trunking technology not only allows several agencies to share the same system without interfering with one another, it also maximizes agency control in that each agency can decide which of their personnel are on the system and what talk groups are assigned to them. The governance structure must reassure the agencies that it will not unduly exert control over them. This can be achieved by having representatives of either every agency or governmental unit or every type of agency or governmental unit, depending on the number of agencies serve on the governing body.

Setting realistic expectations

It is easy to oversell the benefits of interoperable communications systems; however, there has never been a perfect communications system. Reinforce this fact because users may expect perfection. Unrealistic expectations cause frustration. Develop a survey to measure the quality of the current system. The survey is useful not only in designing the system, but also in helping the users to accurately compare the old system to the new system. The governance structure staff should conduct participate in user training to ensure that the users hear about the limits of the system.

After the statewide, regional, and focus group meetings and surveys have been completed, create a roadmap of how to implement the new communications system. It should contain findings on the status of current communication systems, a recap of the input obtained from the meetings and surveys, and a plan for going forward. The key component of this roadmap is the establishment of the governance structure that will oversee the implementation.

Procurement

When developing the procurement instrument for selection of the integrator, focus on performance-based rather than specification-based instruments. A performance-based procurement instrument maximizes

the flexibility of the vendor to find cost-effective solutions, enhances competition by allowing more vendors to participate, requires less technological expertise thus cutting the cost of consultants, and requires less preparation.

One governmental entity drafted a specifications-based Request For Proposals (RFP) for a new communications system that was a several inches thick. It even specified the torque on the bolts on the towers. Another issued an RFP for a similar system that was performance based. It was about one half inch thick.

A final argument for performance-based requirements is legal. If you specify exactly how the system is to be built, legally the integrator need only build what you asked for whether or not it serves your needs. If you set performance requirements and the system does not perform as required, you can hold the vendor responsible regardless of how it was constructed.

Any procurement should allow any other governmental entity to purchase equipment and services for the same price as the issuing entity. Inclusion of the other entities gives additional bargaining clout because you are negotiating for more customers. It also provides equity to the smaller governmental entities who will benefit from the pricing traditionally available only to the larger entities.

Governing structure

The governance structure must be representative of the major public safety agencies and elected governmental entities. Exactly who should be included is a decision that is unique to each area. This is a political decision that requires the key political players to be involved. Err on the side of inclusion. At the very least, include representatives of law enforcement, fire, EMS and emergency management. Campus law enforcement and industrial security will need to be able to communicate with others at certain times. Departments of transportation and schools also have significant need for communications with public safety at times. Elected officials with budgetary responsibility must be included. Depending on what sources of funding may be tapped, you may want to include legislative representatives. The appointing entity should not appear to have the upper hand by virtue of the appointment power. The governing structure should attempt to achieve political and geographic balance.

Because different political entities come together to work on the initiative, a memorandum of understanding (MOU) is important. It sets out the rights and responsibilities of the entities among one another and with the governing body. While not legally enforceable, having this document will lessen the potential for misunderstandings. It should state what the governing body will provide and what the entities will provide. It should define the limits.

The governing body should have the following powers:

- General authority to develop coordinated responses.
- A means of sharing information operationally and technologically to improve public safety.
- Contracting for the services required to accomplish the body's goals.
- Approval of system users.
- System planning.
- Implementation of a comprehensive communication system.
- Fund generating and financing capability, if needed.
- Operational control of the system.

Challenges

The most difficult challenge is motivating people to abandon their old paradigms, ignore turf issues, and formalize at the agency level what the public safety workers live every day—commonality of work, commitment, and service. For this to happen, a bond based on mutual trust must form.

The second most difficult challenge is moving past the sticker shock. The new technology costs a great deal more than the old. An apt comparison would be going from a typewriter to a computer. One way to get past sticker shock is to develop a creative way to finance the system so that existing programs do not suffer as the new system is implemented.

Third, because the system is integrated, there will be more users with

different backgrounds using it. Operationally, this can be a big problem. What if the "10" codes (shorthand codes used to shorten a voice transmission) are different for the agencies? Who is in command at the incident? Who should be on the command talk group to minimize confusion? The agencies must work these issues out before the crisis hits.

Fourth, it is far easier to build out a system for one's own agency. It is tempting to return to the old ways of implementing a radio system, agency by agency. There are no other factors that need to be considered. No meetings or surveys. No worries about inclusion. But, even though the integrated approach is more difficult and takes longer to implement, in the long run it is much better for the public safety agencies and the public.

Lessons learned

- The decision to implement a new communications system is based on a number of issues, including political issues, technological, and financial issues.
- Strike the right balance between technology experts and policy experts. The policy experts should lead the way.
- Find an executive champion who is committed for the long haul.
- Communicate early and often.
- The first question is always, "How much will it cost?" Decisionmakers require firm budget numbers before committing.
- Find the right partners. Choose the vendor as much for the project team as for the technology. Choose the governmental entities with whom you have a good relationship and can work.
- Inclusion. Inclusion. Inclusion.

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Initial Considerations in Moving Toward Interoperability

Interoperability, in practice, means different things to different people. Political and jurisdictional influences ultimately decide what level of interoperability is acceptable by way of funding and response levels. In principle, interoperability has an ideal goal, everyone can communicate when necessary, as necessary.

Reality is quite different, which is why there are few, if any, systems in operation that provide all users total interoperability and all needed capacity and capability. True interoperable systems are, in fact, an effective compromise to sharing communications resources, where all participating entities contribute to a common system and agree on its purpose.

There are fundamental considerations to explore to determine an acceptable definition and what level of interoperability is necessary to address everyone's needs. Where this determination falls short of the ideal, long-term objectives should be part of the interoperability strategy that is agreed upon and implemented.

The strategy should be available (and accessible) to the elected and appointed officials who come later, in order to learn the issues and be prepared to improve the strategy when additional opportunity, funding and the inclination is there to do so.

Interoperability is an iterative process. Buying new equipment does not automatically create interoperability, but it's a significant step in that direction. Elected officials need to know it is not a matter of simply spending money on a problem that will take years to correct.

There are short-term viable solutions, but only through long-term planning will interoperability be realized for the vast majority of public safety responders. The urgency for elected officials should be in recognizing the sheer magnitude of the problem and that stakeholders should be assembled as quickly as possible to begin addressing the problem.

Below are several considerations (and there are others) that should be explored. Any one of these, or a combination of all of them, can be called interoperability. Whatever form interoperability takes, elected and appointed officials and stakeholders need to find the right solutions and strategies that best fits their definition for interoperability. These, in turn, should support the local, State, and Federal needs for interoperability.

Consolidated system infrastructure

Sharing resources and reducing costs is a driving principle behind consolidation. The cost may not necessarily be less when compared to existing obsolete systems, but the cost per user will be less for a system with more advanced capabilities that would not be possible with many older systems.

Whether voice or data, the need to access and share information can lead to reduced incompatibility by designing and implementing the proper functional and technical solutions. A perceived need for equal access and capability can contribute to public safety support for developing, funding, and implementing a consolidated system.

For densely populated metropolitan areas, consolidation and shared infrastructure is practically a necessity. For rural States and regions, large-scale consolidation can be feasible with a significant level of participation from local, State, and Federal agencies.

Consolidation does not imply all functionality and control is handed to one entity. Consolidation may mean that a governing entity is accountable for maintaining the performance and service levels on behalf of the operating entities. The operating entities may continue to carry out their duties with little perceived change in their normal operations.

Multijurisdictional coordination

Everyone has a stake and should be involved. Bringing agencies together with diverse interests, missions and goals is vital to achieving interoperability at any level. Implementing long-term interoperable solutions requires input from all participating agencies at all levels of government.

The initial goal should not be to agree to a particular technology or solution. The initial goals must be to agree that—there is a problem; we are the people who will solve the problem; and we can agree on defining the problem.

Elected officials can be instrumental in asking for solutions that are cost effective and derived from open participation. Tools should be available to aid in this process of defining and solving. Metrics should be available to assist officials in gauging progress.

Technical solutions and standards

A governing body or the participating entities should not determine technical details. Agreement on the needs and goals of interoperability should be the focus. Technical considerations should contribute to the iterative process of developing and refining the interoperability strategy and determining the most feasible means to achieve the goals.

Technical solutions can promote interoperability in many ways. Technical standards are essential, but technical considerations should not drive the discussion. A technical subgroup can report to the governing body on how to accomplish the interoperability goals established by the governing body and stakeholders, or lacking a professional technical body, a consultant could assist in this role.

Flexible migration and integration

Within the constraints of available spectrum and other considerations, the more users joining the system, the cheaper the cost of participation is per user. Autonomy is important to preserve at any level of government. An interoperability strategy should fully recognize each participating entity's mission and stake in a shared solution. A successful agreement to jointly fund a shared infrastructure may require that dispatching functions remain as they currently are. No one should feel a need to protect his or her turf.

Today's technology has opened up many possibilities for sharing resources. The extent of resource sharing and its feasibility rests with the governance structures and participants.

Policies and procedures

A governing body should issue agreed-upon guidelines and establish equitable representation. The primary purpose of the governing body should be to ensure the system integrity and service levels to the public safety entities relying on the system.

A policy and procedures document should ensure that operational entities are responsible for their use of the system and that each entity cooperates with joint operations guidelines to ensure no single participant dominates or overwhelms system capability.

Mutual aid agreements

Not all interoperability problems stem from the inability to communicate. Neighboring jurisdictions may need to meet to discuss how they can better use the resources already available. This may include frequency-sharing agreements for emergencies, or issuing radios from a cache, stored and issued for emergency responses.

Mutual aid cooperation among jurisdictions can foster trust and illuminate the need for interoperability at higher levels. This can generate interest in exploring and developing longer term solutions, such as consolidating infrastructure or jointly funding interoperable solutions.

Enhanced capabilities

Today's technology is inherently more advanced, affordable, and interoperable than in the past. Digital radio channels, encryption, computer-aided dispatch, and mapping all enhance public safety capability; however, most public safety jurisdictions use analog channels, which are easy to intercept and eavesdrop. This is not necessarily a deterrent to interoperability. Dispatching is primarily a tool for coordinating emergency calls and responses. Mutual aid coordination may be accomplished at the officer level on the street or through a dispatcher calling a neighboring jurisdiction's dispatcher by telephone to relay vital information.

Achieving technically advanced interoperability that is rapidly accessible by all users requires coordinated participation and agreement that the various capabilities are needed and feasible to implement. Not all jurisdictions require the same capabilities to fulfill their duties. There are more technologically advanced requirements for some and more cost-efficient solutions for others. Where enhanced capabilities are presently cost prohibitive, the long-term strategy should reflect a path to achieving the needs of all the participants and attracting additional participants to contribute to the long-term interoperability measures and goals.

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A Historical Perspective of Public Safety Radio Spectrum

Historically, radio spectrum was assigned to public safety agencies as they demonstrated a need for added spectrum. Beginning in the 1930s, the Federal Communications Commission (FCC) assigned added spectrum in the band available when the need was identified, normally at higher frequencies with each assignment. Thus, local and State public safety agencies today operate in 10 separate and generally incompatible bands.

While public safety has been a leader in developing wireless technology, the mission-critical requirements of the public safety user—coverage, features, durability, reliability—led to a niche market with associated high costs for the specialized equipment needed for these applications. The niche market has also limited the number of manufacturers in the public safety marketplace, hindering competition. Because of its size and unique requirements, the public safety market will never realize the economies of scale found with commercial systems, such as cellular and PCS. At the same time, public safety systems provide their users with critical coverage, features, functions, and reliability unheard of in the commercial marketplace.

Today's legacy systems were designed to provide the greatest coverage at lowest cost, leading to high-powered, high-elevation sites. By design, these sites limit the reuse of their radio spectrum over a great distance. This radio spectrum inefficiency has led to the need for more radio spectrum—a never-ending circle.

Starting in the mid-1980s the FCC promoted a technology solution to spectrum efficiency known as trunking when it opened the 800 MHz band for radio communications. In a trunking system, a limited number of physical radio channels are shared among a number of user talk groups—(emergency medical, fire, law enforcement—assigned on a priority basis by a computerized system. From the public safety perspective, trunking brought added features and promoted interoperability among participants on a particular system; however, the standard for these systems (known as APCO Project 16) was a functional standard and the three major United States manufacturers of public safety radio systems developed different and incompatible technologies.

In 1989, with digital technology on the horizon, a conglomerate of

local and State public safety associations, the Federal government, and radio manufacturers began the development of a series of open standards to promote spectrum efficiency, interoperability, competitive procurement, and user-friendly equipment for digital public safety radios—this effort is known as Project 25. Following certification of the Project 25 standards series by the American National Standards Institute, the FCC in 2001 adopted Project 25 as the required technology for use on the interoperability channels in the new 700 MHz band.

Regulatory inertia has delayed the implementation or upgrade of local and State public safety systems, even though funding is immediately available. For example, in 1996 the Public Safety Wireless Advisory Committee (PSWAC), a Federal advisory committee jointly chartered by the FCC and National Telecommunications and Information Administration (NTIA), recommended the assignment of 25 MHz of additional radio spectrum to public safety within 5 years to meet a critical radio spectrum shortage. In 1997, Congress subsequently directed the FCC to make the reassignment of 24 MHz of television spectrum to public safety by December 31, 1998. This assignment, the largest ever made to public safety, more than doubled the amount of spectrum available to local and State public safety agencies. But while the FCC completed the spectrum reassignment in February 1997, it took the FCC until February 2002 to develop and codify the operational and technical requirements that allowed this spectrum to be used. Much of this spectrum will remain unusable in major metropolitan areas until incumbent television stations relocate, a process that may drag on beyond 2006.

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Governance Structure Options

Voluntary consortium

There has been a recent emergence and growth of informal partnerships or voluntary consortia that offer flexibility and adaptability in providing transportation and law enforcement services across jurisdictional lines. Often these innovative forms of organization are better able to focus on customer satisfaction and performance measurement than traditional hierarchical or contractual organizations. Recent discussions have centered on the role of these informal partnerships (or voluntary consortia) in providing regional-scale transport functions and operations.

The E-Z Pass electronic toll and traffic management system is an example of a voluntary consortia that works well. Operating in the Eastern and Northeastern U.S., E-Z Pass currently includes 15 to 20 member agencies operating bridges, tunnels, and toll roads. Membership is completely voluntary and based initially on development and acceptance of common technical specifications and shared procurement of radio-frequency automatic vehicle identification transponders (tags). Each agency must procure or produce a tag-reader system that is interoperable with the other member systems to achieve system user transparency for motorists.

The I-95 Corridor Coalition is another excellent example of a voluntary consortium in a multijurisdictional environment. Started in the early 1990s to improve incident response and coordination, the Coalition today is a major player in the deployment and integration of a number of intelligent transport systems in the areas of traveler information, commercial vehicle safety and productivity, and electronic payments. In these areas, the Coalition operates as a public-private partnership. The Coalition provides important planning and evaluation functions for its projects.

Among some 35 full member organizations and jurisdictions, 13 States, the District of Columbia, and numerous local jurisdictions are represented. Four membership levels are offered in the I-95 Corridor Coalition—full members, owns or operates a major facility or is part of USDOT); affiliate members, metropolitan planning organization (MPOs) and associations; associate members, operates local system and law enforcement agencies; and friends of the coalition, all others. Each full member receives one seat and one vote on the executive board. They also are allowed representation on the steering committee

and various program committees. It should be noted that the U.S. Department of Transportation named this effort an integral part of the "Priority Corridors" project in 1991, and provided funding at that time. Federal funding was renewed through TEA-21 (a transportation funding bill) funds in 1998 and continues to the present.

The Coalition has been an emergent, evolutionary organization. It is apparent that hierarchy and long-term organizational planning were not hallmarks; rather, Coalition members operated in a challenging environment of change and uncertainty and growth in demands on the organization. The Coalition was initially organized according to topical groups—highway operations group, requirements and technology group, private-public sector partnership group, and budget and policy group. By the mid-1990s, the Coalition had reorganized into functional areas. From the highway operations group, four sub-corridor scale, regional groups developed. The requirements and technology group reduced their role in light of developments elsewhere. The private-public partnership group, important at first, later dissolved into the budget and policy group, which remained a leading force in the Coalition. By 1997, further organizational development took shape. The executive board and steering committee remained, while the working groups noted above were replaced with several Program Track Committees. They include the Track Committees for Program Management, Coordinated Incident Management, and Commercial Vehicle Operations.

This evolution is an essential and important feature of the voluntary consortia type of organization, and illustrates the freedom and flexibility inherent in these types of organizations.

Joint powers agreement

Many organizations proceed very successfully under a joint powers agreement—a written compact or agreement setting forth participants, structure, and funding, and often accompanied by a set of bylaws. Joint powers agreements are executed among jurisdictions with the same constitutional or statutory powers.

Examples of joint powers agreements include Houston's TranStar, which has now evolved into a partnership known as an "Interlocal Agreement." The organization has strong support from its State Department of Transportation (TxDOT), and in this way it has exhibited characteristics of the State agency leadership type of organization as well.

Another very successful example of a joint powers agreement organization is the Automated Regional Justice Information System (ARJIS) in the San Diego area. ARJIS is a criminal justice network utilized by over 40 local, state and federal agencies in the San Diego California region. This includes ten voting member agencies, plus 33 other ex-officio members. ARJIS is a joint powers agreement, charged with supporting a regional web-based enterprise network that brings together over 10,000 registered users at 2,500 terminals and printers.

The ARJIS secure Intranet contains data on the region's criminal cases, arrests, citations, field interviews, traffic accidents, gang information, and stolen property. ARJIS promulgates technical and operational standards and interfaces to all criminal justice systems in the region. A critical success factor for ARJIS is the "single point of entry" concept to query all regional justice data.

State agency leadership

Often new law enforcement and transportation systems are initially deployed at or within a State agency. The State's resources and expertise are used to launch the activity. This is the case with the Southern California ITS High Priority Corridor. It has heavy sponsorship from California's Department of Transportation, Caltrans. In Arizona, AzTech, although now based on a Memorandum of Understanding (MOU) among participating agencies, has had major sponsorship from the State of Arizona and Maricopa County. These large agencies can form a reasonable host or incubator for projects.

Local jurisdiction as host

This organizational structure may be designed for short-term or transactional purposes, rather than to create permanent new capacity or new policy directions. In this way, a local jurisdiction (city, county, or State) may agree to lend its purchasing or engineering or accounting expertise and processes to a project. There may be a few policy decisions made by the host jurisdiction, but mostly it is just a host. Participants from the host jurisdiction and other jurisdictions control policy decisions. Examples might include the Woodrow Wilson Bridge reconstruction project in Washington, D.C., or some multi-State truck permit compacts among State Departments of Transportation.

Interstate compact agreement and organization

The interstate compact agreement and organization is a written contract among States to cooperate on a policy issue or program that extends across and through State boundaries. When approved by Congress, interstate compacts automatically become Federal law. Many interstate compacts function without the need of Congressional approval.

Many interstate agreements and regional planning authorities have their roots in the economic collapse of the Great Depression. The Tennessee Valley Authority (TVA) was at that time the only interstate compact authority that could claim the capacity and political power to accomplish true regional planning and execution of those plans. Many other authorities would follow that were variously tasked with flood control, drainage, and power generation. Other interstate compacts at that time included the Port Authority of New York, the Colorado River Compact, the Interstate Palisades Commission, and the Lake Champlain Bridge Commission. In addition to the areas of rivers, power generation, and bridges, interstate compacts were also already in existence, by 1935, concerning minimum standards of labor legislation and an Interstate Oil Compact Commission. With regard to water rights and interstate river compacts, a Federal panel in 1973 found that the interstate compact is the preferred institutional arrangement for regional water resources planning and management.

In addition to settlement of disputes through internal means—discussion among compact members or arbitration—or judicial means—U.S. Supreme Court—there is also a third method for resolving disputes arising from Interstate Compacts. Congress can exercise its authority, under the Commerce Clause of the Constitution, and has applied that authority to issues related to the Hoover Dam and the lower Colorado River.

Other public authority or quasi-government taxing authority

Public authorities, including regional transportation authorities, are the most common form of government business organization. They often have their own sources for at least part of their revenue. They may have part-time boards, and may "borrow" employees from States or elsewhere. Many have significant board representation by business people representing related respective interests.

Commissioner and organizational loyalties may be split between responsiveness to the political authority that appointed or created them, and responsibility to the bondholders or users that will fund the operation. Examples of public authorities include toll road authorities and municipal utility authorities.

Common arguments for and against the creation and use of public authorities are often contradictory. For example, a good reason not to use a public authority, e.g., it may lead to fragmentation of government structure, may conflict or cancel out an argument in favor of using a public authority, e.g., it may facilitate intergovernmental cooperation.

Metropolitan planning organization sponsorship

Some high-technology operating organizations are sponsored by, or are spin-offs from, the federally designated MPO in a region. In the Washington area, that organization is known as COG, or the Metropolitan Washington Council of Governments. The best example of this type of secondary organizational development or spin off is with the Metropolitan Transportation Commission (MTC) in the San Francisco area.

The MTC in the nine-county San Francisco Bay Area is the region's designated Metropolitan Planning Organization. In addition to these planning responsibilities, the MTC also operates the Bay Area Toll Authority (BATA), operates the Service Authority for Freeways and Expressways (SAFE), administers revenue from toll bridges, and directs dedicated funding for regional freeway incident programs.

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This Thing Called Radio Spectrum

For those old enough to remember or for those who watch it on cable, there was a 1960s show called *The Twilight Zone*. The host, Rod Serling, would open each episode by announcing, "Imagine if you will..." and then go on to explain the usually terrifying predicaments the actors would face in the Twilight Zone. As the episode began, Serling would intone, "You have just entered the Twilight Zone." The state of public safety radio spectrum is not quite as dire as those situations in which the Twilight Zone actors found themselves, but it could be. Public safety needs more and better managed radio spectrum to communicate with one another and to protect the public.

Most people have little idea of what radio spectrum is. So, "imagine if you will..." that there are billions of vehicles trying to get from the east coast of the United States to the west coast, from the Canadian border to the Mexican border and all points in between. The only way for these vehicles to successfully navigate to their destination is over the roads of America. Those roads are analogous to radio spectrum. Without roads, vehicles go nowhere. Without radio spectrum—the roads over which radio waves travel—radio communications go nowhere. The billions of vehicles trying to navigate the terrain to get somewhere are like public safety communications—voice, data, and image messages—trying to get to their intended destination.

Now imagine that each local government designed and constructed their own roads, without considering or coordinating with their neighbors. While this might work well for traveling within each jurisdiction, travel among jurisdictions would be a disaster. Streets would not line up, and travel from city to city would be nearly impossible. With few exceptions, this analogy effectively describes the current condition of our public safety communications infrastructure. Most public safety agencies cannot directly communicate with other public safety agencies in their region, even when numerous agencies collectively respond to an emergency. Why? One reason it that their radio communication systems are scattered over different frequency bands of the radio spectrum. Another reason—inadequate amount of radio spectrum. Public safety radio spectrum has just entered the "Twilight Zone."

Technically, what is radio spectrum? If you ask the average person, most would not be able to provide a satisfactory answer. Yet radio spectrum is one of our Nation's most valuable resources. Radio spectrum transmits electronic signals. More than 98 percent of all public

safety agencies use wireless radios as their primary means of communication. Without spectrum, the radios are useless.[1] Originally allocated to voice transmissions, radio spectrum is now used for many other transmissions, such as cell phones, videos, and other types of data. As technology progresses, more and more electronic devices require radio spectrum in order to operate. As a result, it is fast becoming more scarce, more valuable, and is eagerly sought by competing (private and governmental) interests. The amount of radio spectrum currently allocated to public safety agencies is considered to be inadequate and, as a result, achieving interoperability is more difficult.

The radio frequency spectrum within the United States extends from 9 kHz to 300 GHz and is allocated into more than 450 frequency bands. 900 MHz cellular telephones are licensed to operate in a 900 MHz band and common garage door openers at 40 MHz. All public safety radios need FCC-licensed frequencies to operate. One of the biggest obstacles to overcome in order to achieve interoperability is proper management of the public safety radio frequency spectrum. Today, public safety spectrum is spread across many frequency bands, making it difficult or impossible for one agency to communicate with another.

Radio spectrum is divided into bands such as the FM band on a radio. Bands are then divided into frequencies, such as kilohertz (kHz) or Megahertz (MHz).

Imagine dividing the country into many slices and then placing mountains in between those slices. Getting from one slice (frequency band) to another is made more difficult because of those mountains (non-public safety frequency bands). It is generally acknowledged that today's public safety agencies operate in assigned frequencies across 10 or more different bands of radio spectrum. Many of the new digital 800 MHz trunked systems are based on proprietary techniques, so even when operating on the same 800 MHz frequency, communication from one manufacturer's radio cannot be heard by another manufacturer's radio.

Public safety mission requirements are being shaped by the emergence of new wireless technologies; some help, while others hinder. Of those that have the potential to improve public safety missions, wideband data and video technologies support any number of public safety applications, such as imaging and real-time video. Public safety has changed and emerging technologies can assist in making them more responsive to the needs of the public they serve. New applications are quickly being viewed as critical to the public safety mission and are used for a wide variety of activities, such as geographic positioning, continuous vehicle location, report transmission, electronic messaging, and access to data repositories (e.g. National Crime Information

1. Source: "State and Local Law Enforcement Wireless Communications and Interoperability: A Quantitative Study," National Institute of Justice, and "Analysis of Fire and EMS Communications Interoperability," Public Safety Wireless Network.

Center). With these technologies, public safety can have real-time access to and transmit building plans, mug shots, fingerprints, and photos of accidents, injured persons, and crime scenes. Video is fast becoming a necessity as opposed to a luxury for public safety. Video can be used for monitoring the movements of suspects, major fires, prison riots—the list is endless. Use of these technologies not only enhance the capability of individual units and agencies, it assists in activities in which interoperability is key, coordinating the activities of multiple agencies or personnel.[2]

With all the challenges facing public safety and the vast array of technologies that can assist in their mission-critical tasks, the public safety community is unable to maximize the use of wideband data and video because of the lack of radio spectrum. Only one channel is presently available for use by public safety.[3] Additional spectrum is needed if public safety is to be able to exploit these technologies and those in the future.

This resource, that cannot be seen or felt, but without which, lives could and would be lost, is critical to public safety agencies. It is not just in major disasters such as the World Trade terrorist act or the Oklahoma City bombing; it is vital for day-to-day operations – traffic and industrial accidents, police chases, drug busts, or just being able to communicate with one another from different sections of the city or town. Public safety mandates that personnel have access to effective radio spectrum not only to serve the public, but also to ensure their own safety.[4] However, there are some major problems that must be addressed to ensure that public safety personnel are able to perform their jobs:

- Radio spectrum is a finite resource. It is the electromagnetic real estate in the sky. What exists today is all there will ever be. It cannot be created or increased. What exists must be re-allocated and better managed.

- There is an inadequate amount of radio spectrum dedicated to public safety.

- The limited amount of radio spectrum allocated to public safety is subject to interference from commercial wireless services and radio and TV broadcasters, within the U.S. from our Mexican and Canadian neighbors.

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2. "Public Safety Radio Frequency Spectrum: Highlighting Current and Future Needs—Final Report," Public Safety Wireless Network, January 2000.

3. "Technology Subcommittee Final Report," p. 23.

4. See, "Public Safety – Radio Spectrum: A Vital Resource for Saving Lives and Protecting Property," Public Safety Wireless Network.

- The radio spectrum allocated to public safety is not contiguous. Narrow frequency bands for public safety are scattered throughout a wide spectrum range which severely limits the ability of public safety to communicate across agencies and jurisdictions.

- The ability to harness radio spectrum is limited by technology. For the most part, industry, not public safety, set the standards for equipment and software. Their needs, not those of public safety, drive research and development

How serious is the problem?

On September 11, 2001, American Airlines flight 77 with 58 passengers and crew was crashed by terrorists into the Pentagon. In July 2002, the leadership of Arlington County, Virginia, issued an after action report. Communications, or the lack of effective communications, figured prominently in the report. The report indicated that, "Almost all aspects of communications continue to be problematic, from initial notification to tactical operations. Cellular telephones were of little value in the first few hours and cellular priority access service (CPAS) is not provided to emergency responders. Radio channels were initially over saturated and interoperability problems among jurisdictions and agencies persist. Even portable radios that are otherwise compatible were sometimes preprogrammed in a fashion that precluded interoperability. Pagers seemed to be the most reliable means of notification when available and used, but most firefighters are not issued pagers. The Arlington County Emergency Operations Center (EOC) does not have an installed radio capacity and relied on portable radios coincidentally assigned to staff members assigned duties at the EOC."[5] The inability of public safety agencies to effectively communicate when and where needed is, in part, related to the lack of adequate, contiguous radio spectrum solely for public safety use.

A 1996 study conducted by the Public Safety Wireless Advisory Committee (PSWAC) concluded that the total amount of radio spectrum allocated for use by public safety is insufficient to meet current and future needs. PSWAC recommended that an additional 97.5 MHz of radio spectrum be made available to public safety in order to meet current and emerging public safety needs that include narrowband and broadband data communications. To date, only 24 MHz has been

5. For the full report, see http://www.co.arlington.va.us/fire/edu/about/docs/aar.htm.

Radio Spectrum Issues

VHF (150-170 MHz)

- Inadequate capacity in most areas
  - — Extreme overcrowding in metropolitan areas
  - — Fully occupied even in rural areas
- Inefficient allocation between Federal/Non-Federal use

UHF (450- 512 MHz)

- Extremely crowded in metropolitan areas
- Heavily occupied in other areas

700 MHz

- Blocked by TV stations in most metropolitan areas until 12/31/06 OR when 85% of households have DTV
- Canadian/Mexican border issues
- Potential for interference from commercial services
- Equipment cost and tower siting requirements (due to more limited range than UHF/VHF) can be a problem

800 MHz

- Very limited capacity in most metropolitan areas
- Facing harmful interference from Nextel and other commercial users
- Equipment cost and tower siting requirements (due to more limited range than UHF/VHF) can be a problem

made available as the result of congressional and FCC actions and, unfortunately, this is not available due to TV incumbency. Even with this allocation, that still leaves a gap of 73.5 MHz of radio spectrum. The total amount is needed for mission-critical activities of public safety personnel.[6] Compounding the problem is that little of the currently allocated radio spectrum is available for interoperability purposes; spectrum that enables multiple public safety organizations to communicate with one another using their own departmentally-issues radios rather than having to go through a centralized dispatch unit or handling multiple radios belonging to other agencies, or worse, not being able to communicate at all.

What's been done?

In 1995, the FCC adopted a plan regarding radio spectrum requirements at that time and through the year 2010. Recognizing that it did not have the information or parties involved to adequately address the problem, the FCC, together with the National Telecommunications and Information Administration (NTIA), established the Public Safety Wireless Advisory Committee (PSWAC) to provide assistance and

6. "The Role of States in Public Safety Wireless Interoperability," Public Safety Wireless Network, p. 10.

advice.[7]

The following year, PSWAC submitted its final report to the FCC and NTIA that sounded the alarm regarding the extent to which the lack of adequate radio spectrum hampered and would continue to hamper public safety mission-critical activities. This hue and cry indicated that an additional 97.5 MHz of radio spectrum is needed by the year 2010 to enable public safety to keep pace with its expanding needs. As the PSWAC reported indicated, "in the short term (within 5 years), approximately 25 MHz of new public safety allocations are needed."[8] However, the issue of interoperability required additional radio spectrum. The report recommended that 2.5 MHz of spectrum below 512 MHz should be designated.[9] With an additional 70 MHz of general radio spectrum to be used for voice, data, image, and video, these allocations would provide public safety a total of 145.05 MHz of radio spectrum.

In the Balanced Budget Act of 1997, Congress committed an additional 24 MHz of the radio spectrum in the 700 MHz band to public safety; however, this reallocation is tied to the relocation of analog TV channels as part of the television industry move to digital television (DTV) and upon the availability of equipment that can use that allocation.

700 MHz and digital television migration

The FCC allocated a major block of radio spectrum from this band for public safety purposes in 1998, and designated a portion of that spectrum for interoperability purposes. All radio equipment operating in this new band will be interoperable, so that all 700 MHz band users will be able to communicate with one another in the field. In addition, it is expected that most equipment in the band will be interoperable with the existing base of 800 MHz band users. Another portion of the band has been allocated for direct licensing to the States. The 700 MHz band is particularly well suited for wide area (county, large city, State) systems that can accommodate all public safety users and are inherently interoperable.

In most major metropolitan areas, some or all of the 700 MHz radio spectrum allocated for public safety is blocked by ongoing television

7. "A Progress Report on Public Safety Spectrum—Final Report," Public Safety Wireless Network, November 2001.

8. See Public Safety Wireless Advisory Committee (PSWAC Report), p. 3.

9. Currently, there is only a small amount of spectrum allocated to public safety for interoperability. this is particularly true below the 512 MHz bands where the majority of public safety organizations operate.

broadcast operations on channels 63, 64, 68, 69 (and to some extent by adjacent channels 62, 65, and 67). Current law, passed by Congress in 1997, permits those TV stations to remain on the air until December 31, 2006, or until 85 percent of households in the relevant market have access to digital television (DTV) signals, which ever is later. There are about 250 million television sets currently in use in the United States. Only 3.5 million (14 percent) are capable of receiving DTV signals directly or through a set-top box. Just think about the number of television sets in any given home of office. How many owners are just willing to replace them all with DTV?

Another factor in consumer acceptance of the DTV is the cost of converting. Current prices are not consumer friendly. The ability of public safety to use the 700 MHz radio spectrum is contingent upon how fast the public throws away its analog televisions and converts to DTV. There is another kink in the process—television manufacturers have been slow to accept the DTV modulation standard. Still other manufacturers have recommended changes that would result in greater cost effectiveness and efficiency; however, these changes will increase the time needed to move the process and vacate the radio spectrum bands. This conflict within the industry may inhibit manufacturing the sets until the conflict is resolved.[10]

This 24 MHz of radio spectrum comes with even more strings attached. A timeline was established by Congress for broadcasters to relinquish the spectrum. To date, migration is moving more slowly than previously anticipated. Migration is being hampered by DTV set prices, the inability of cable to carry the signal, and a lack of programming. The desire of the industry to vacate the channels is in part driven by set affordability and consumer desire to change over to the new technology. Former FCC Chairman William E. Kennard urged Congress to speed up the transition in October 2000. He stated that it took color TV 22 years and VCRs 16 years to reach 85 percent penetration into the consumer market. Current timelines for DTV migration have been set for 2006.

Milestones were also set for the migration, and to date, several have been missed. Migration is behind schedule and at the current rate, it is unlikely that transition to DTV will occur by 2006. If the milestones are not met, public safety will be denied access to this valuable radio spectrum for many years. Recognizing that something needed to be done to move the process along, Kennard offered three viable suggestions to move the process along. He suggested that Congress reconsider the 85 percent penetration "loophole on the 2006 date so that it could not be used as a 'trick number' to justify making the double dose of radio spectrum and broadcaster entitlement for the next 25 years."

10. "Public Safety Radio Frequency Spectrum: Digital TV Transition Status," Public Safety Wireless Network, p. 3.

He also suggested that Congress direct the FCC to adopt requirements that all new television sets include the capability to receive the DTV signals. Finally, he proposed that Congress require that, as of January 1, 2006, broadcasters pay a fee for the use of the analog channel should they not vacate." [11]

Current FCC Chairman Michael Powell created an FCC DTV Task Force to review the transition to DTV and to make recommendations to the Commission about steps to facilitate the transition and promote the rapid recovery of radio spectrum for other uses. He has indicated that a big part of the problem were unrealistic expectations mandated by the 2006 target date. He advised that the task force will assist in setting priorities and moving the process forward; however, he cautioned that the Commission must review the DTV transition in light of "new realities that have arisen out of the tragic events of September 11," adding that "We must be aware of the financial impact of the attacks on our media companies. We must be aware of the impact on consumer spending. We must be aware of the needs of public safety and other wireless services for additional spectrum."[12]

In an attempt to speed up the process and facilitate clearance of the 700 MHz band, the FCC has adopted rules to accommodate the implementation of voluntary band-clearing among incumbent broadcasters and new licensees in the band.[13] The FCC can only do so much—the public safety community should reach out and take a leadership position on this issue or there is the distinct possibility that the 2006 date will be missed and this radio spectrum not acquired for years to come.

One final caveat—although the 700 MHz and 800 MHz bands are emerging as the primary public safety bands for the State and public safety community, at this time, no mobile, portable, or base station radio equipment operate in the 700 MHz band. Further, no public safety equipment is readily available that can support both bands.[14]

What about 800 MHz?

11. See Remarks by Federal Communications Commission Chairman William E. Kennard to the Museum of Television and Radio (October 2000).

12. FCC News Release, re "Creation of FCC Digital Television Task Force," (rel. October 11, 2001).

13. WT Docket 99-168, CD Docket 98-120, MM Docket 00-39, "Order on Reconsideration of the Third Report & Order," (rel. September 17, 2001).

14. "A Progress Report on Public Safety Spectrum – Final," Public Safety Wireless Network, p. 8.

Many States, counties, and cities are planning new multi-agency, wide-area radio communications systems. Such systems are cost efficient, and improve the ability of police, fire, EMS, and other first responders to communicate in the field. All too often, first responders from different agencies cannot communicate at emergency scenes because they use radios operating on incompatible frequency bands. A solution is to develop improved interoperable radio systems. Most of the new interoperable radio systems are in the 800 MHz band.

Interoperability is not easily achieved with today's technology. Radio technology in use today is limited by geography. Radio communications depend on frequency assignments, which are specific to a geographic area, and on the physical characteristics of power and emissions that are limited to a specific radius around a radio tower. Towers can be interconnected and frequencies reassigned to create a large coverage area, such as a statewide radio system; however, the operations of an extended area system become extremely complex. Before the last few years, statewide systems were rarely constructed for public safety uses. Public safety relied on local conventional radio systems licensed to a single user organization. With the advent of trunked radio systems, carrying very high price tags and requiring complicated frequency coordination the idea of regional, countywide and statewide public safety systems with many user agencies is becoming more common. Radio systems for public safety are still often constructed to serve a single county, and often a single agency, such as a police department, within the county.

Just as our economy and society are becoming more and more global, the business of protecting life and property on the local level has become more mobile, more sophisticated, more information dependant, and more dispersed. Agency needs are changing, from single systems serving only local agencies or a single local agency, to a greater demand for interoperability on demand. This growing need for interoperability is affecting strategic decisions to share radio systems and dispatch centers, to build systems with extended coverage area and to establish systems as a utility rather than viewing radio communication systems as another internal tactical and operations function. This conceptual growth and development is natural and useful. Ten years ago most cellular and paging suppliers were providing only local service, but only recently have they combined their radio spectrum to create national services. As users become more dependent on mobility in a wider area, public safety radio has to evolve.

The more public safety and public service users there are on the same system, the more inter-agency interoperability, both during day-to-day

routine operations and during a crisis. Criminal deterrence and apprehension is improved. Fire and EMS response is more efficient. Highway maintenance is safer. Cooperation and coordination between response agencies, service, and levels of government are all improved. This equates to better public safety for all communities.

The existing public safety radio spectrum in the 800 MHz band is being used by many State and local governments for current wide-area interoperable radio communications systems. However, the 800 MHz band currently faces growing interference problems from commercial radio operations. The FCC is considering proposals to address that interference problem by clarifying responsibility for correcting interference and to re-configure the band to reduce the potential for interference. Some of these proposals would also increase the amount of 800 MHz band radio spectrum available for public safety use, which would provide additional capacity for new and existing interoperable radio communications systems.

In addition to the interference problem, there is another problem facing the 800 MHz band. All of the designated public safety channels in the 800 MHz band are already assigned to users in most major metropolitan areas, leaving little or no room for new system development or expansion of existing systems. Radio spectrum in the adjacent 700 MHz band has been allocated for public safety, but as discussed previously, it cannot be used in most of the heavily populated portions of the Nation because of ongoing television broadcast operations on the same frequencies.

Standards

Suppose the promised 700 MHz spectrum was available right now. Would there be interoperability? Would public safety personnel be able to communicate without problems? The simple answer is "no." Few radios are currently available that can use the radio spectrum. According to the PSWN report, Public Safety Radio Frequency Spectrum: Digital Television Transition Status, it would take 18 to 24 months for manufacturers to make compatible radios available for general use. Here's another problem—funding. Most public safety agencies determine their budgets, at a minimum, 1 year, and in many cases 3 to 5 years in advance. Agencies are purchasing equipment today from the last funding cycle. Since the 2006 date is somewhat elusive, no public safety agency can logically budget for equipment that uses radio spec-

trum that is not yet available for them. This inability to plan affects the manufacturers. They will not fund development of radios when customers don't exist. They will not expend time, effort, and money until the spectrum is available and funds have been budgeted.

Let's go back to the Twilight Zone. The radio spectrum has been freed up, manufacturers are heavily involved in research, development, and production, and public safety has been given the go ahead to purchase new equipment. Is the problem solved? Probably not. There is still another hurdle that must be overcome—the lack of standards.

This is not a new problem. The need for open standards in public safety wireless communications began about 20 years ago. Prior to that time, the technical compatibility of voice communications systems relied on the common use of frequency modulated analog or analog FM, signaling. In effect, this was the standard; however, as manufacturers began making improvements to the functionality and efficiency of their products, they began using signaling protocol that was unique to each manufacturer. They developed proprietary systems that were incompatible with other manufactured systems in the same way that the personal computers of the 1980s could not read one another's data or use one another's software.[15] Standards are the underlying rules or laws that govern the development of services, networks, and procedures. The use of standards for equipment and software would alleviate many of the interoperability problems faced today.[16]

In a free market society where money is often the driving force, equipment manufacturers want their products to drive the industry. This leads to two problems. First, public safety has no control over the type of equipment and software they need and must purchase. Second, there is little incentive for manufacturers to develop standards that allow for interoperability. The industry is driven by what the manufacturer wants instead of the needs of the public safety industry.

Manufacturers argue that they can't build to standards because there are no true standards and they risk developing equipment and software that might be obsolete before it comes on the market. The answer is that if public safety drives the development of standards, they would exist. Manufacturers could build to them, there would be true competition, and systems could really become cost effective. Without stan-

15. See "Public Safety: Wireless Communications Standards Awareness Guide," Public Safety Wireless Network, p. 3.

16. "LMR Systems Development Primer," Public Safety Wireless Network.

dards, public safety agencies have to buy new equipment from the manufacturer that originally built the infrastructure system if they must add to a system or join an interoperable network.

Greater spectral efficiency—trunked versus conventional systems

There are two ways in which radio systems utilize the frequencies upon which they operate: conventional and trunking operation.[17] A conventional system, still the most popular system type in the United States, utilizes a single dedicated frequency or channel for each specific communication requirement. In other words, if an agency has three frequencies for its radio system, it might use one channel for all car-to-station transmissions, one channel for station-to-car transmissions, and the other for car-to-car transmissions. When a emergency medical technician keys the microphone and transmits on a frequency, everyone else using that channel must wait until he/she is finished before making their own transmission. When no one is talking on a channel, that frequency is sitting idle and not being used.

Trunked radio systems provide a relatively efficient system for multiple agencies in a geographic area that can share a radio system. In a trunked system, each agency can have its own talk groups and dispatch channels, but can also tune to other agencies' talk groups and dispatch, or to predefined tactical channels when they need to monitor or talk with another responder.

Trunking is a relatively new radio technology, developed in response to severe frequency shortages in public safety as a means to increase radio spectrum efficiency. It was made possible as a result of FCC allocation of 800 MHz frequencies to public safety in the 1980s, which gave manufacturers the necessary standardized channel pairs required to make the technology viable. Trunking is a computer-controlled system that uses all the available frequencies in a pool, allocating an open frequency each time someone on the system pushes-to-talk (PTT). Users are programmed into computerized groupings called talk groups, based on the operational criteria of the agency or agencies on the system. Patrol officers in a particular sector could be placed within one talk group, detectives in another, SWAT in another, and administrative personnel in another. All of the system users utilize the same pool of frequencies. When a user keys the microphone, the system selects an open frequency and puts the user on it. When the user stops transmitting, that frequency immediately becomes available for the system to assign to the

Conventional Systems

Simplex

One terminal of the system transmits while the other terminal receives. The simplex dispatching system consists of a base station and mobile units, all operating on a single frequency.

Half Duplex

In this type of system, the base station transmits on the mobile's receive frequency and vice versa. However, the half-duplex terminal does not allow simultaneous transmission and reception.

Full Duplex

In full-duplex systems, radios can transmit and receive simultaneously. This operation uses two frequencies, like the half-duplex. The difference is that the transmitter and the receiver can both be powered full time.

17. For a detailed discussion of conventional and trunked systems, see "Comparisons of Conventional and Trunked Systems," Public Safety Wireless Network, May 1999.

next user. In this manner, frequency idle time is drastically reduced, and users within a properly sized talk group spend far less time waiting for a clear talk-path. This electronic control enables users to take advantage of the fact that some transmitted channels are idle at a particular time while others are busy. The result is a more balanced load sharing between trunks. This is in contrast to a nontrunked or conventional system where the users exercise their own access to the system by listening for idle time and making manual channel selections. Radio spectrum efficiency and operational effectiveness are greatly improved using trunked systems as long as the system is sized correctly for the numbers of users with an adequate number of frequencies.

Trunking is the commonly accepted term for electronically controlled sharing of a relatively small number of communications channels among a relatively large number of users.

Digital versus analog systems

The 700 MHz band is specifically set aside for modern radio systems, with high spectrum efficiency. This requires digital technology. Most of today's radio systems are analog systems meaning, in rough terms, that the sound waves created by the voice are converted by the radio microphone into an electrical signal that represents the sound wave of the voice, which is then attached to a carrier wave and transmitted to a receiver. The receiver then converts the signal back to a sound wave via a speaker. With a digital radio, a voice-generated sound wave is converted to an electrical signal via the microphone in the same manner as the analog system. The radio then converts that signal into bits and bytes, the ones and zeros of computer machine language, which is compressed and transmitted over the radio carrier wave to the receiver, then decoded, converted, and pumped back through a speaker.

Digital technology has several advantages over analog. First, it is much more spectrally efficient, allowing a greater number of users over the same bandwidth. Second, digital signals have a better voice quality over longer ranges than analog signals. The signals themselves travel the same distance, but because digital transmissions are a machine language sampling of a vocal sound wave and not the sound wave itself, its quality remains constant throughout its given range. Whereas an analog signal gradually degrades as the distance between the transmitter and receiver increases until it is unreadable, a digital transmission will remain clear and intelligible over a longer range and then drop off quickly. Properly designed, a digital radio system will give much better voice quality over wider areas.

Third, digital transmissions are computer code, making encryption and increased security, an inherent capability. Digital transmissions are

easily encrypted by simply encoding and decoding the bits and bytes through software programming in the radio. And finally, data are data—whether voice, text, or full-motion video, its all ones and zeros. This makes integrated voice and data radio systems much easier to function. Integrated voice and data means one communication system instead of two redundant and highly expensive systems.

The availability of adequate radio spectrum and interoperability go hand and hand. Any community considering implementing or upgrading radio communications systems must understand the importance of this vital and limited resource.

Achieving Interoperability—A State-Level Focus Requiring Coordination and Planning

Many State and local jurisdictions planning trunked radio services are well aware of the costs to construct these systems. They are extremely expensive. Tower locations are difficult to come by; buildings and site improvements add to the expense. On top of that, the operating, maintenance, replacement and expansion costs of a successful network are an additional set of financial challenges that must be adequately addressed. For example, the City of Portland, Oregon, has had an 800 MHz trunked radio system in operation throughout Multnomah, County, Oregon, for 9 years; however, they are still constructing new transmit towers. Why? The region is experiencing tremendous growth, and with it, demand for public safety services in areas that were not originally on the coverage maps. Moreover, development within county boundaries continues to change coverage characteristics requiring the city to add simulcast or intelligent repeater sites to keep coverage at the correct levels. With more users, and more equipment, radio operating expenses continue to increase.

There are several major challenges to expanding the city or county style "radio utility" model beyond a specific region. Regional identity is one. Since radio systems are often funded through voter approved bond initiatives, they compete for funds with other local services, including parks, education and even money to hire police, fire personnel, and other public safety personnel. This creates a difficult set of political realities in getting local jurisdictional participation if they are required to "pony up" bond revenue or tax increment financing. The less ownership they feel for the system, the less likely they are to sacrifice taxation ability to communication over other local needs. The answer here is to design an incentive funding mechanism that, for example, provides

system funding from the State, matching dollars or other incentives from the State or Federal government for organizations willing to buy into service from a regional, State or Federal provider rather than overbuild.

There are several key issues that need to be addressed when implementing an interoperability strategy at the State level.

Coordination and partnerships—the need for State-level leadership

State government must take provide leadership and facilitation to ensure that radio systems are developed around a central plan developed in cooperation and involving all levels of government with local, county, and State participation. Although it would be nice to have all public safety agencies in a State operating on the same frequency with the same compatible equipment, this solution is cost prohibitive and unrealistic. Therefore, it is imperative that regional systems are developed utilizing newer technologies that permit cross communication between the agencies and maximize the use of available radio spectrum. In the denser metropolitan areas other considerations must be taken into consideration given the population size and number of agencies that operate on public safety frequencies. Regional and metropolitan consortiums can only be realized through State-level leadership. In order to foster the necessary relationships among the various agencies, State government must focus on five distinct areas:

- **Awareness and Education.** Elected and appointed officials, the public, and the majority of the user agencies must all be educated on the importance of this issue. This is a public safety matter that affects all citizens and yet most are not familiar with interoperability issues. Elected officials need to understand the importance of addressing the interoperability issue and understand the potential negative impact to public safety if we continue to permit communication systems to be built without the ability to communicate with one another. Education on this issue is not always easy as discussion can quickly turn into terms that are not familiar to the average person. Therefore presentations specially designed for target audiences, such as legislative bodies, must be created. Local fire, EMS, and law enforcement agencies must be educated in the importance of this issue to their own safety as well to the public in general. The past incidents in both Oklahoma and New York City have more than enough tragic incidents to drive home the need to make this matter a number one priority.

- **Legislation.** Once the legislature and elected officials have been made aware of this critical issue, the State must create, through legislation, some oversight body or commission that will have the responsibility to manage radio spectrum through proper frequency allocation, channel available funding, promote and enforce standards-based technology, promote creation of regional shared systems and, most importantly, ensure that the State maintains a concentrated focus on this issue with the daily responsibility to coordinate interoperability activities with other regions, Federal agencies, and local entities

- **Funding.** Of all the issues surrounding interoperability, funding ranks as the biggest obstacle. Replacement of the old radio infrastructure is extremely costly. Most funding authorities do not recognize the benefit from such an investment and challenge the need to do a complete system replacement. Many advocate for a piecemeal approach, which usually hinders interoperability success and helps ensure that the monopoly of the existing vendor is maintained. The State must take the lead to coordinate funding sources and develop creative funding strategies to turn these old systems into modern regional systems capable of interagency communication. Since the World Trade Center disaster and renewed emphasis on Homeland Security, funding is becoming available to address these issues. Interestingly enough, millions are being spent every year on replacement radio systems in numerous States and local agencies; however, only with the proper use of new technologies, proper education of the entities responsible for funding, passage of necessary legislation, and creation of an office to manage the development of public safety communication systems throughout the State can the funding be put to its maximum benefit.

Moving radio spectrum management to higher organizational level/responsibility

- **Frequency Coordination.** As previously stated, radio spectrum and the frequencies comprised within are a scarce and limited natural resource. State government must treat them as such and utilize the allocated frequencies, where feasible, on a shared basis providing the most benefit to all who need this resource to carry out their respective public safety duties. In some respects, the management of the allocated spectrum should be considered similar to a utility,

and managed and coordinated in such a manner as to eliminate the stovepipe mentality that builds barriers to the creation of cooperative agreements. State government can foster this sharing by not only supporting and directing the development of regional plans, but also through the creation of one or more frequency coordinators within each State who are knowledgeable of interoperability issues and not only coordinate with the various agencies, but as an advocate for the State. This should be a full-time position incorporated into the legislative commission mentioned above and be empowered to represent the State on issues with the various local agencies. This also places the state in a better position to advocate and leverage policies with the FCC and other Federal agencies responsible for radio spectrum allocation, licensing, and management. Frequency coordination within a State and within certain regional and/or jurisdictional boundaries is a must in order to achieve efficient spectrum utilization.

- **Development of an Interoperability Plan.** The State must provide the leadership and guidance necessary for the development of a planning process. This process must involve all the appropriate public safety agencies and the end result must be a workable plan that has acceptance and the buy-in of the various groups involved. Public safety agencies, by their very nature, are not inclined to share resources. To achieve the goal of interoperability, cooperation, the creation of partnerships and the sharing of resources are mandatory for any successful endeavor. A well-developed and coordinated plan is the key to achieving this goal. The State can also add an additional incentive by providing technical assistance to the local agencies during the planning process. In many cases this support can serve as the training and education necessary to ensure a successful plan. Finally, the State and appointed officials must manage and recognize "home rule" issues. Many local and municipal officials will feel that their home rule authority is being superceded and may resist regional planning concepts proposed by the State. A well-developed and coordinated plan must recognize that disasters are local incidents and will affect most heavily on the local public safety agencies that will be the first responders when any type of incident occurs. Therefore the State must clearly identify the benefits to participation in regional plans and establish a strategic direction for local participation. Local agencies must have input and participation in order for the planning process to be successful.

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"The task force brings local and State elected and appointed officials together with representatives of the public safety community to develop national strategies for solving this critical public safety need."

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"Fire and rescue departments from different jurisdictions routinely work together to provide emergency services to the public, but they cannot always communicate with one another. It is critically important that the entire fire and emergency services community support the need for improved communications interoperability and additional spectrum. State and municipal officials and the organizations that represent them nationally, working with emergency first responders, are an integral part of this significant effort to improve interoperability."
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For more information and to obtain a copy of the guide, brochure or supplemental resources, please visit www.nijcommtech.org