Improving Interoperability through Shared Channels

Homeland Security

Version 2

Contents

Executive Summary

Communications interoperability refers to the ability of emergency response agencies to talk across disciplines and jurisdictions via radio communications systems, exchanging voice and/or data with one another on demand, in real time, when needed, and as authorized. *Improving Interoperability Through Shared Channels* is designed for emergency response officials who are interested in improving communications interoperability in their community or region, but face the challenge of determining what solution best meets their needs.

With the number of technical solutions available, the decision is complex; officials must understand that technology is only one piece of the interoperability problem. For a solution to be successful, governance, standard operating procedures (SOPs), training and exercises, and the promotion of routine use must all be adequately addressed.

This guide is intended to focus on one solution—shared channels—that can provide an improved level of communications interoperability by using existing systems and resources. This guide will help the emergency response community understand the level of effort, resources, and key actions needed to implement a shared channel solution. It will also provide case studies of regions that have successfully implemented a shared channel solution. Ultimately, this guide will provide officials with the necessary information to assist in determining if a shared channel solution is appropriate for their region. The guide will accomplish this by:

- Providing an overview of the options available for improving voice interoperability.
- Defining the shared channel solution.
- Highlighting key questions that should be asked when considering implementation of a shared channel solution.
- Describing the technical considerations that may affect a shared channel solution.
- Outlining the key actions a region must take in implementing a shared channel solution.
- Highlighting case studies of regions that have successfully implemented a shared channel solution.

Communications interoperability refers to the ability of emergency response agencies to talk across disciplines and jurisdictions via radio communications systems, exchanging voice and/or data with one another on demand, in real time, when needed, and as authorized.

Technical Solutions for Voice Interoperability

Each agency and community has unique communications resources, needs, and requirements. However, no "one size fits all" technical solution exists that can adequately provide voice and/or data interoperability for every scenario. As a result, localities and regions must typically employ a number of solutions to meet their interoperability requirements. Officials charged with improving interoperability face the difficult challenge of determining not only which solutions best meet their needs, but which ones are also affordable given limited funding.
Figure 1 depicts the technical solutions available to improve interoperability as outlined in the technology element of the Interoperability Continuum.

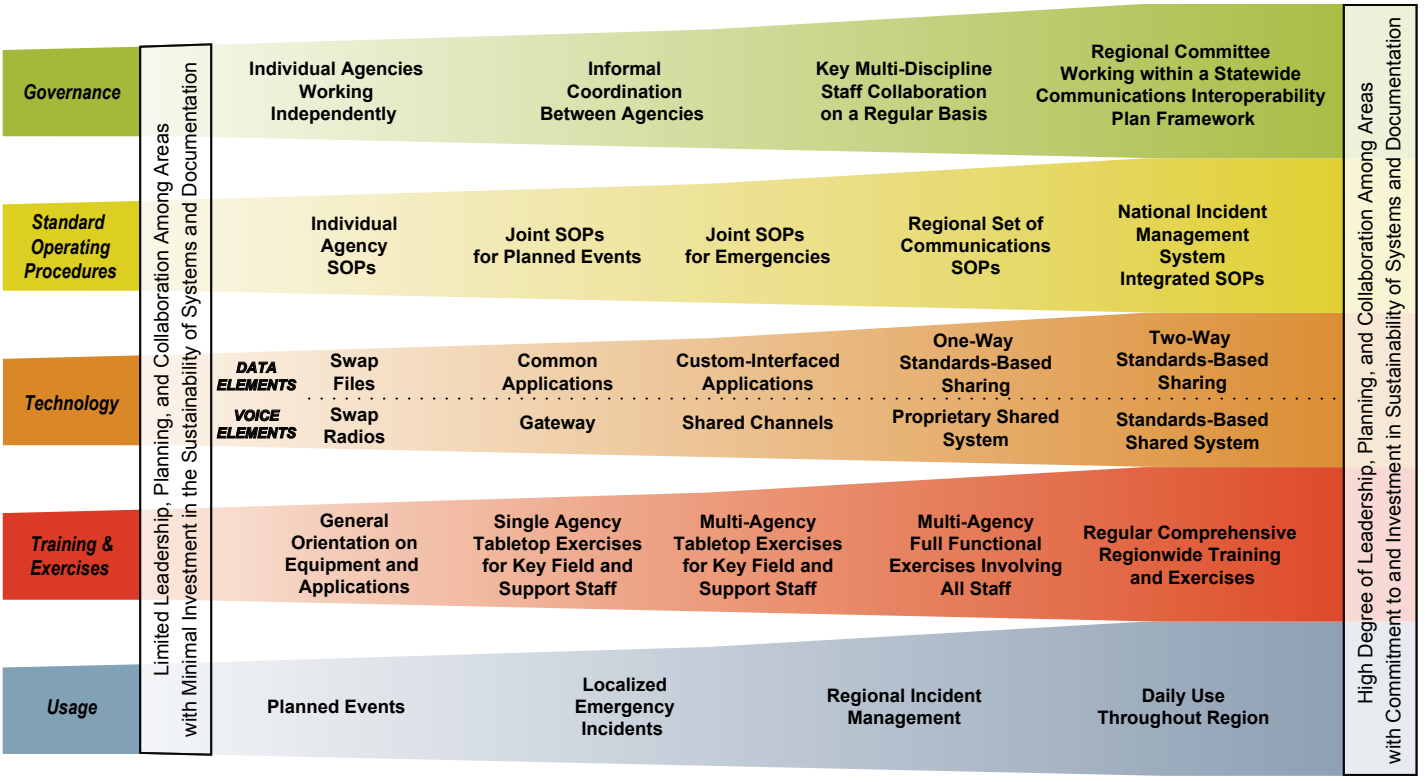

Figure 1: *The Interoperability Continuum framework depicts the five critical elements of interoperability success—governance, standard operating procedures, technology, training and exercises, and usage. All of these are necessary to successfully establish effective interoperable communications. Emergency response organizations can use this tool to assess their current level of interoperability and to determine what elements are lacking or need further development.*

While the Interoperability Continuum contains technical solutions for both voice and data interoperability, this guide focuses on those solutions designed to increase an agency or region's voice interoperability. As such, the specific technical solutions for voice interoperability that the Interoperability Continuum identifies are outlined below:

Swap Radios

Swapping radios may consist of emergency response agencies trading radio equipment for the duration of an event or issuing radios to emergency responders from a compatible set of radios known as a radio cache. This solution achieves a basic level of interoperability; however, swapping radios as an event occurs can be time-consuming, management-intensive, and may only provide limited results. Swap Radios is a solution that is often best suited for communications at the command and control level. However, large tactical radio caches may provide interoperability for nearly all emergency responders on the scene of a prolonged incident.

Gateways

Gateway solutions can provide interoperability by allowing users to connect incompatible radio systems or frequency bands to provide a common talk path for voice communications. Gateways available today include portable, mobile, and fixed devices that can provide connectivity for the duration of an event or incident. However, gateway solutions do have limitations: 1) gateways inefficiently use radio spectrum because each gateway talk path requires a separate channel or talkgroup for each incompatible radio system and frequency band; 2) a gateway's effective geographic coverage at an incident is limited by the range of the systems and radios used for the talk path; 3) complex gateways may require trained staff to set up and operate, and the incident may be over before a common talk path can be established.

Shared Channels

Shared channels consist of frequencies licensed to individual agencies by the Federal Communications Commission (FCC) and allocated by the licensee for use by other agencies for the purpose of interoperability. The use of shared channels can improve interoperability by establishing a common frequency over which multiple jurisdictions or disciplines can communicate. This solution can be achieved using existing systems and resources as long as the shared channels are pre-programmed into each piece of equipment, and the radios operate in the same frequency band. Similarly, shared talkgroups are specific radio resources that are shared with other agencies and disciplines throughout a trunked radio system. The use of shared channels improves the efficient use of spectrum; however, the limited availability of frequencies and the potential for radio communications congestion can limit the effectiveness of this solution.

Proprietary Shared Systems and Standards-Based Shared Systems

Shared systems refer to the use of a single radio system infrastructure to provide service to multiple agencies within a region. A standards-based shared system promotes competitive procurement by allowing agencies to use a wide selection of products to meet specific user needs. A proprietary shared system, on the other hand, prevents open competition by forcing users to procure one manufacturer's product exclusively. With proper planning, regionally shared systems can provide optimal functionality and interoperability for users of the system in the region; however, this type of solution can be costly to construct.

The technical solutions outlined above each have benefits and limitations; yet, given the variety of existing systems, none can solely provide the greatest interoperability. A combination of these solutions is required to best accommodate the communications needs of a region or

community. However, this guide highlights the shared channel solution because it can be achieved using existing systems and limited resources.

What Are Shared Channels?

Shared channels are common radio channels or talkgroups that are established and programmed into radios prior to an incident to provide a conduit for interoperable communications among agencies. For a shared channels interoperability solution to be successful, each piece of radio equipment must be able to function in a conventional, non-trunked mode, operate in the same frequency band, and be pre-programmed with each of the shared channels. For shared talkgroups to be effective, trunked systems must also be in the same band and be from a compatible manufacturer.

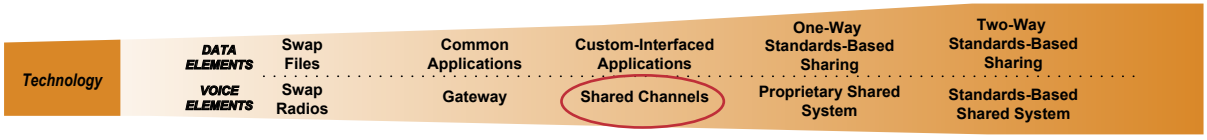

Figure 2: *As a part of the Interoperability Continuum, shared channels can refer to either "shared channels" or "shared talkgroups."*

As shown in Figure 2, the Interoperability Continuum and this guide will often refer to shared channels and talkgroups synonymously, which is not always the common practice. "Shared channels" are generally identified as a solution for conventional radio systems—systems in which specific frequencies are assigned to specific groups of users. "Shared talkgroups," on the other hand, are often defined as a solution between separate, but compatible trunked radio systems—systems in which frequencies are pooled among all users under an automated, priority-based system of channel resource sharing. In both cases, shared channels and talkgroups must operate in the same frequency band. This document uses the term "shared channels" to represent both "shared channels" and "shared talkgroups," except where specifically distinguished.

The development and execution of a shared channel solution requires understanding the effort, resources, and key actions involved, which are outlined in the remainder of the document. However, a number of key questions and technology considerations should first be addressed to determine whether a shared channel solution should be considered at all.

Deciding To Share Channels Regionally: Key Questions

A shared channel solution should be considered when a region can answer the following questions affirmatively:

1. ***Does your region have an existing governance structure that can oversee an emergency response interoperable communications effort? If not, does it have the ability and resources to establish a governance structure?***

   Governance means establishing a shared vision and an effective organizational structure to support a project or initiative. The proper governance structure is important to the success of any interoperability solution. Establishing a common governance structure

will improve communication, coordination, and cooperation across the region and across disciplines. A governing body should consist of local, tribal, state, and Federal organizations as well as representatives from all relevant emergency response organizations within an identified region. Typically, an overarching governance group will identify operational and technical working groups to handle the finer details of a shared channel solution.

2. ***Does your region have the ability to assess its current communications capabilities?***

   To fully understand the level of effort needed to implement a shared channel solution, a region must develop an understanding of its current communications technology through a comprehensive operational and technical assessment. A local or state emergency response community often has the technical capacity to become interoperable, yet has not fully assessed its capabilities or engaged in the coordination needed to make capabilities operational. When conducting an assessment, regions should determine whether they have enough channels available for shared use without reducing the effectiveness of other operations. Moreover, regions should assess whether they are using available National Interoperability Channels[1].

3. ***Are the agencies in your region open to sharing resources such as spectrum?***

   Development and implementation of a shared channel solution requires, above all, coordination and cooperation. If agencies in a region are open to sharing resources and working cooperatively to achieve an improved level of interoperability, a shared channel solution can be feasible and effective. However, conflicts between agencies, resulting from competing values, objectives, and authorities, can often impede cooperation. A community or region must determine whether the differing agencies are capable of cooperating and sharing. If they are capable, development and execution of a shared channel solution may be achieved inexpensively compared to other technology solutions.

4. ***Can your region dedicate the required resources?***

   While development of a channel plan can be cost-effective, it does not come without expense. The resources and costs for the successful development and implementation of shared channels can include:

   - **Time and Commitment:** Above all, this effort requires considerable commitment and time from the identified stakeholders and leadership to properly plan, develop, implement, manage, and use the shared channel solution.
   - **Radio Programming:** Once shared channels are agreed upon, all radios must be programmed to include these resources. If a community or region does not have the ability to program its radios, it may have to locate a qualified service center to do so.
   - **Technology Procurement:** In some cases, agencies will have to purchase additional technology such as gateways to provide connectivity among disparate systems in a region.
   - **Channels/Talkgroups:** Some disciplines and jurisdictions may need to share one or more of their own channels to help the region identify and designate shared interoperability resources. A willingness to dedicate channels/talkgroups to the region will enhance the safety of the emergency response community and citizenry it serves.

[1] The Office of Emergency Communications encourages all local, tribal, state, and Federal agencies to review and adopt the standard channel nomenclature for all FCC-designated National Interoperability Channels released by the National Public Safety Telecommunications Council, commonly known as NPSTC. A full list of these channels and a corresponding standard channel nomenclature can be found on page 38.

Technology Considerations

While only one piece of a robust interoperability strategy, technology is a critical component of a successful solution. The development and implementation of a shared channel solution involves a number of technical considerations. When evaluating the potential use of a shared channel solution, system planners should consider the following:

- **System mode:** Conventional or trunked
- **System type:** Digital or analog
- **Manufacturer:** Vendor, trunking technology, and proprietary or non-proprietary components
- **Frequency band:** VHF, UHF, 700 MHz[2], or 800 MHz

To make a shared channel solution possible, user groups must operate on compatible systems. This means all systems must be able to operate in analog mode or support compatible digital and trunking standards. For example, a shared channel solution could be possible if all users operate on conventional analog systems in the VHF band. Another solution might include users from multiple jurisdictions operating on shared talkgroups with compatible, 800 MHz digital trunked systems. Where users operate on different bands or use incompatible digital technology, interoperability would have to be accomplished using a different solution, such as a gateway.

In addition to system compatibility, a region must have frequencies available for shared use in order for a shared channel solution to work. Regions should consider whether regional, state, or National Interoperability Channels are available for use. Without the ability to obtain or identify frequencies for shared use, a shared channel solution will not be possible.

Finally, regions should be aware of three significant FCC mandates and actions that will affect operations in the VHF, UHF, and 800 MHz bands:

- **Narrowbanding:** The FCC has mandated that the emergency response community operating on wideband (25 kHz) channels operating below 512 MHz will be required to move to narrowband (12.5 kHz) channels by January 1, 2013. The aim is to promote more efficient use of limited spectrum resources.
- **Rebanding:** The FCC has mandated the rebanding of the 800 MHz band to separate commercial wireless provider channels from public safety channels in order to prevent interference. The FCC has established a schedule to migrate to the new channels by 2008.
- **700 MHz:** 24 MHz of the 700 MHz spectrum band will be released in February 2009 for use by the emergency response community. The FCC has designated a portion of the 700 MHz public safety spectrum for nationwide interoperable communications.

Because these mandates may affect channels in the bands mentioned, regions will need to plan accordingly to prevent disruption of their shared channel solution. Further information about these issues can be found in the Additional Resources—Spectrum Information section at the end of this guide.

[2] As specified in the Deficit Reduction Act of 2005 (Pub. L. No. 109-171), 24 MHz of the 700 MHz spectrum band will be released in February 2009 for use by the public safety community. The FCC has designated a portion of that spectrum for nationwide interoperable communications.

Key Actions for Developing and Implementing Shared Channels

As the Interoperability Continuum indicates, success in each of the elements of the Continuum is necessary to develop an effective solution and to ensure its proper use and implementation. The following are key actions to take when developing a shared channel solution in order to incorporate all elements of the Interoperability Continuum:

Action 1 Establish a Governance Structure and Gain the Proper Leadership Commitment

A proper governance structure can address and overcome the challenges that could impede any effort to improve interoperability through shared channels[3]. To develop a proper governance structure, a region must take the following actions:

- Establish key relationships with high-level representatives who have decision-making authority and who represent agencies that need to be included in the shared channel plan, including multi-disciplinary and multi-jurisdictional agencies across all levels of government (local, tribal, state, and Federal).
- Develop a locally driven governance structure that incorporates key stakeholder organizations and ensures an appropriate level of local practitioner membership and input.
- Elect a leader who is familiar with the communication needs and technology capabilities of the region, and who can identify potential funding resources.
- Establish a working group of representatives from each agency to ensure everyone is a part of the decision-making process.

In addition to forming a governance structure to lead the effort, it is important to gain support and commitment from political leadership across the region. The governing body should:

- Establish relationships with local administrators and elected officials to gain policy and resource support. Long-term support for the maintenance, upgrades, and eventual replacement of the system is essential to the effort's continuing success. If possible, a region should seek legislation to gain authority and funding for the governance structure overseeing interoperability efforts. Consider leveraging the support and experience of the state's interoperability executive committee and other regional governance groups[4].

[3] The National Task Force on Interoperability identifies five key challenges to interoperability—incompatible and aging communications equipment, limited and fragmented funding, limited and fragmented planning, lack of coordination and cooperation, and limited and fragmented spectrum. Each of these challenges can affect an effort to improve interoperability through shared channels.

[4] The promotion and adoption of both statewide and regional governance groups was formerly established as part of the Public Safety Interoperable Communications Grant Program, commonly known as the PSIC grants, and the Fiscal Year 2007 Homeland Security Grant Program, or HSGP. Both programs required States and Territories to develop and adopt a Statewide Communications Interoperability Plan, referred to as a SCIP. More information can be found at http://www.safecomprogram.gov.

Action 2

Conduct an Operational Assessment

A thorough operational assessment will measure each individual agency's existing capabilities and compare them with surrounding agencies to identify existing gaps, resources, and interoperability solutions. The operational assessment should include:

- Mission objectives
- Multi-disciplinary and multi-jurisdictional interoperability requirements (who needs to talk to whom and under what circumstances)
- User expectations
- Organizational structure and operations
- Compliance with the National Incident Management System (NIMS)
- Existing communications gaps and limitations
- Lessons learned from previous emergency incidents

Action 3

Conduct a Technical Assessment

A technical assessment will inventory and assess equipment, capabilities, and infrastructure currently in place, thereby allowing the region to identify gaps and potential limitations to determine if changes or upgrades are required. The assessment should include an inventory of:

- FCC licensees within the region by agency, frequency, and band
- Communications systems in the region, including type of system (i.e., analog/digital, conventional/trunked, proprietary, or open standard)
- Portable, mobile, and fixed radios and capabilities
- Existing channels and talkgroups, including state and National Interoperability Channels
- Communications sites and capabilities, including the identification of site users
- Propagation, coverage, and footprint for each system
- System capacity and redundancy
- Current interoperability technologies

Action 4

Identify Shared Channels and Establish Policies and Procedures

Once a region has conducted a full operational and technical assessment, the participating agencies can identify radio resources to share, provided that sharing is agreed to by the FCC licensee. In most circumstances, agencies will need to share some of their own resources to help the region identify and designate interoperability channels or talkgroups. Where channel availability is limited, the use of FCC-designated National Interoperability Channels can supplement or replace the use of specific agency channels to ensure that there is no disruption to existing systems. The National Interoperability Channels can also provide a baseline level of interoperability for outside agencies responding to a major event within the region.

Policies and procedures must be established to govern the use of the agreed upon shared channels and to determine when their use is needed and authorized. These policies and procedures should incorporate the following principles:

- **Flexibility:** Although regions can conduct extensive planning efforts to prepare for the variables that may affect a response effort, unforeseen circumstances will undoubtedly occur. It is important that the established policies and procedures allow for flexibility so the emergency response community can adjust accordingly.
- **Autonomy:** Individual agencies should be allowed to maintain a level of autonomy as long as it does not affect interoperability across the region. Agencies know their communications needs best and should have the authority to address those needs as they see fit.
- **Standard Channel Nomenclature:** Operational confusion during incident response can result when agencies use different names for the same channel. This confusion can delay response and hinder interoperability at an incident, endangering life and property. Potential confusion can be prevented by agreeing to a standard channel naming convention for shared channels across a region. The Office of Emergency Communications (OEC) encourages all local, tribal, state, and Federal agencies to review and adopt the standard channel nomenclature for all FCC-designated National Interoperability Channels released by the National Public Safety Telecommunications Council (NPSTC).
- **Plain Language:** To avoid mistakes during an event, regions should promote the use of plain language over radio communications when using shared channels. A standardized plain language protocol between all jurisdictions would remove the confusion that may occur when agencies do not use the same codes and signals[5].
- **Discipline:** Radio discipline may break down when a large number of users have access to shared channels. Overcrowding may occur, causing interference among transmissions. Protocols must be established to manage the volume of radio traffic on shared channels during an incident. Policies and procedures should incorporate communications features of the Incident Command System (ICS) included in NIMS[6]. These policies must be reinforced through regular training and exercises.

[5] For more information about the use of plain language, SAFECOM has released *Plain Language Guide: Making the Transition from 10-Codes to Plain Language*. This document can be found at http://www.safecomprogram.gov.

[6] The DHS National Integration Center Incident Management Systems Division oversees all aspects of NIMS. More information can be found at http://www.fema.gov/emergency/nims/.

Action 4 cont'd — Identify Shared Channels and Establish Policies and Procedures

- **Licensing Options:** When implementing a shared channel solution across a region, officials should understand the applicable rules and regulations governing the use of radio frequencies as issued from the FCC [7]. For example, whereas many National Interoperability Channels are designated for use by any emergency response agency, channels such as 154.280 MHz (fire response) and 155.475 (law enforcement) are designated for intra-discipline use only.

Action 5 — Create a Regional Channel or Talkgroup Plan

A channel or talkgroup plan is a tool for organizing a region's available emergency response interoperability resources that incorporates the agreed upon shared channels and their associated policies and procedures. It can help ensure that all end users know the purpose of the channels or talkgroups, how to access them, who should be allowed access, and how and when authorization for access and use should occur. Ideally, a plan serves as a tool for identifying and managing the use and sharing of spectrum resources for improved interoperability through shared channels. Tables 1 and 2 provide templates for identifying and documenting shared channels and shared talkgroups within a channel or talkgroup plan.

Primary Use	Frequency	Channel Name	Description	License Holder

Table 1: *Channel Plan Template*

Primary Use	System ID	Talkgroup ID	Talkgroup Name	Description

Table 2: *Talkgroup Plan Template*

[7] 47 C.F.R. Part 90 contains the rules and regulations for Private Land Mobile Radio Services, which provides for the internal communications needs of emergency response organizations and other non-commercial users of two-way radio services. Information on 47 C.F.R. Part 90 can be found at http://wireless.fcc.gov/rules.html.

Action 6

Develop a Regional Memorandum of Understanding

Regions should develop a regional Memorandum of Understanding (MOU) with input and agreement from all agencies in the region. The MOU should identify and define the following:

- Governance structure with the proper authority to develop, lead, and implement the solution
- Roles and responsibilities for all members of the governing body
- Leadership, personnel, and funding support to secure resources necessary for success
- Mechanism to monitor compliance to the MOU
- List of the designated shared channels and their intended purposes
- Policies and procedures to govern the use of the shared channels
- Channel plan to provide users with a quick reference guide of available shared channels
- Cost-sharing plan to spread costs equitably across agencies
- Procedure to review, renew, and amend the MOU

Action 7

Program Radios

All user radios in the region must be programmed with the shared channels. This will require:

- **Radio Technicians:** If a region does not have technicians on staff, then it will need to procure services from their local vendor or partner with vendors to train volunteers from each agency to perform the reprogramming themselves.
- **Process and Schedule:** Implementing a shared channel solution requires users to give up their radios for reprogramming. Regions should coordinate efforts to minimize disruption to their neighboring agencies and ongoing emergency response operations. As many grant funding programs do not cover overtime for emergency responders involved in reprogramming, officials will need to review their funding sources to ensure compliance with their process and schedule.

Action 8

Train and Exercise on the Use of Shared Channels

A shared channel solution will only be successful if the user community is properly trained and familiar with its proper use. Although radio communications are a critical resource for the emergency response community, training on the use of communications equipment is often overlooked. To successfully implement a shared channel solution, a community or region should consider the following actions:

- Commit resources to manage a program that provides training and exercises on the use of shared channels.
- Identify and deliver guidelines and requirements for regional training and exercises.
- Conduct a multi-agency tabletop exercise for key field and support staff[8].
- Include a communications component in all exercises that require radio use.
- Ensure training occurs regularly to retain a level of competency with the proper use of the shared channels.

Success will be assured by regular and comprehensive exercises that incorporate realistic scenarios of shared channels use.

Action 9

Regularly Use Shared Channels

Shared channels should be used regularly to ensure that the emergency response community becomes familiar and comfortable with their operation. Ideally, communities will use interoperability equipment and procedures daily; however, regular use may be prevented by the following common problems:

- Only a small group of emergency responders regularly use the shared channels.
- Shared channels are not integrated into day-to-day operations.
- Emergency responders from different jurisdictions and disciplines may not interact daily.

To encourage regular use of shared channels, a region should:

- Choose a strategy that reflects operational needs.
- Institutionalize regular use and review of shared channel policies and procedures.
- Incorporate the use of shared channels into existing regional incident management procedures.
- Build the use of shared channels into all regional planned events.

[8] The Homeland Security Exercise and Evaluation Program defines a series of exercises of increasing complexity, along with appropriate planning and evaluation steps, to ensure exercises are documented, effective, and identify operational and technical gaps along with an improvement plan to address those gaps. More information can be found at https://hseep.dhs.gov/.

Case Studies

Several regions across the country have successfully implemented a shared channel interoperability solution. In fact, many agencies, specifically fire services, have historically used shared channels as a part of their communications strategies. What makes the following case studies unique is the regional implementation of multi-discipline and multi-jurisdictional shared channels. The regions highlighted in the following case studies are not merely sharing a common channel across one discipline in the region or using a shared channel to coordinate response within a single jurisdiction. Rather, the regions have developed a shared channel solution that allows for communications during incident response across all disciplines and jurisdictions when needed and as authorized.

The regions have successfully implemented a shared channel solution by addressing all elements of the Interoperability Continuum. They have specifically leaned on a strong governance structure to coordinate, plan, implement, and manage all interoperability activities in their area. The three case studies come from the State of Montana, the Boston Metropolitan Area, and the Central Florida region.

The regions were chosen to provide examples of successful shared channel use in diverse geographic and political environments. The State of Montana has used a set of statewide shared channels since 1990 to provide interoperability in its large and rural state. The Boston Metropolitan Area has transformed the requirements of a DHS grant program into a region-wide communications initiative that has brought together the sometimes fractured public safety agencies in its densely populated region. The Central Florida region has utilized the resources of large county governments, the State of Florida, and Federal grants to create a redundant web of interoperability solutions across its suburban counties. When considered together, these case studies can provide real-world best practices and lessons learned to emergency response officials interested in implementing a shared channel solution in their region.

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Quick Guide

This section provides a quick look at the highlights of each case study. It is not an exhaustive list, but a short summary of the best practices presented in the case studies for each element of the Continuum.

Governance

[Page 29] Central Florida migrated from an informal meeting of radio technicians to a regional governance organization in order to secure grant funding to build out a shared channels interoperability solution across nine counties.

[Page 21] The Boston Metropolitan Area organized a governance structure led by the Boston Mayor's Office using third-party facilitation to create a comprehensive, regional shared channel plan.

Standard Operating Procedures

[Page 16] Montana distributed a written set of SOP's that specifically outlined what shared channels to use, when to use them, and how to incorporate their use in a large Incident Command System response.

[Page 28] Central Florida created a one-page SOP that outlined how to properly use shared talkgroups during an escalating law enforcement incident.

Technology

[Page 30] Central Florida used grant funding to build out a series of 800 MHz and VHF channels that provided a baseline level of interoperability across the region.

[Page 23] The Boston Metropolitan Area created a regional channel plan incorporating new and existing shared channels from all participating agencies, jurisdictions, and regional public safety organizations.

Training and Exercises

[Page 24] The Boston Metropolitan Area developed a train-the-trainer session to train radio technicians from each public safety agency in the region, allowing them to quickly distribute communications training.

[Page 16] The State of Montana collaborated with statewide public safety organizations to include the use of shared channels in their training manuals and exercises.

Usage

[Page 17] Montana created a set of statewide shared channels that are used extensively by emergency responders for multi-discipline, multi-jurisdictional mutual aid incidents.

[Page 31] Seminole County in Central Florida created a standard radio template that allows any radio user in the county to access a shared talkgroup from Seminole County or from the surrounding region.

State of Montana

Introduction

The unique qualities of the State of Montana present a number of challenges for public safety officials. Montana (Figure 3) is large and sparsely populated, with a diverse physical environment and varied weather. Because of its relative isolation from the major population centers in the U.S., Montana has developed a distinct culture that is exhibited through its staunchly independent emergency response community. Despite these challenges, public safety officials in the state successfully created a shared channel solution that has provided multi-discipline and multi-jurisdictional radio communications to emergency responders for almost two decades.

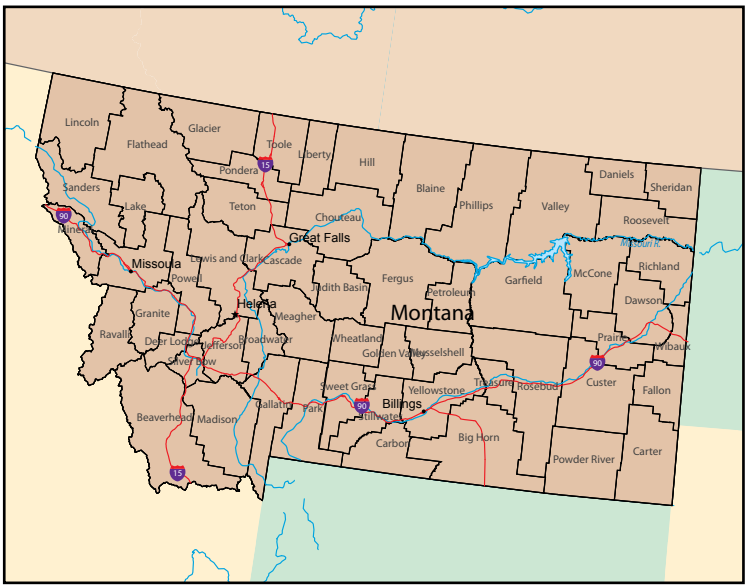

Figure 3: *The State of Montana is large and sparsely populated, with a diverse physical environment and varied weather.*

Background

During the late 1980s, public safety agencies in Montana, in need of additional channel capacity, began to replace their one and two channel, low-band, VHF radios as funding became available. The majority of agencies in the state purchased multi-channel, high-band, VHF analog radios. With this new, more complex equipment being deployed across the state, public safety officials and cross-discipline emergency responders began to discuss the need for a comprehensive statewide communications strategy. Although no single event triggered the conversation, the exceptional fire season of 1988 highlighted a number of the existing operability and interoperability problems facing public safety, including channel congestion, inadequate communications plans, and difficulty communicating across disciplines and jurisdictions during mutual aid situations.

Governance

As a result, late in 1988 the Governor of Montana created the Public Safety Communications Task Force to develop a practitioner-driven set of recommendations for enhancing public safety communications in the state. This task force consisted of practitioners representing all of the major public service associations in Montana, including government, hospital and public health organizations, representatives from state agencies with established radio systems, and other stakeholders interested in promoting public safety communications. The Department of Administration managed the Task Force and was responsible for implementing its recommendations.

Design and Implementation

The Task Force recommended creating a set of statewide shared channels and granting usage rights to individual agencies based on each agency's need. To implement the solution, the Department of Administration collaborated with a working group of Task Force members to license a set of common frequencies statewide, give each frequency a color-based name (Gold, Red, Brown, etc.), and create a group of Standard Operating Procedures that governed each channel's use.

This solution was written into administrative law and published in a statewide manual titled, Montana Mutual Aid and Common Frequencies Guide[9].

The manual was an integral part of the state's strategy because it offered an easy way to consolidate and distribute the shared channel information. It contained a listing of all the channels and their respective frequencies, authorization language, and SOPs specific to each discipline. Each SOP outlined where and how each specific channel would be used and contained ICS diagrams for law enforcement, fire services, emergency medical services (EMS), disaster and emergency services, and search and rescue incidents of varying size. Channel names were assigned based on their usage. For example, all channels used by fire services were named a shade of red while law enforcement was given the names of "Black" and "Blue." Lastly, the appendices contained the actual administrative rules that enacted the shared channels, sample incident radio communication plans, and a sample interagency agreement.

Rollout

During the rollout of the new statewide shared channels, the Department of Administration distributed copies of the manual to all public safety agencies across the state, and made a concerted effort to increase awareness and promote adoption. Staffers from the Department of Administration traveled frequently to localities across Montana to meet with public safety officials and promote the statewide shared channel solution. The state also collaborated with statewide and regional organizations such as the Montana State University Fire Services Training School to add usage of the channels to their training materials and spread adoption within their constituencies.

Keys to Successful Adoption of Statewide Shared Channels:

- Persistence and consistency of message from the state
- Success of early adopters
- Comprehensiveness of the plan
- Free licensing from state
- Availability of additional channels to increase operability
- Sense of ownership within the community because plan was developed by practitioners

Public safety officials were initially skeptical of the state's efforts. Many emergency responders were unconvinced of the necessity and usefulness of a solution that was pushed from the state level down to local agencies. Officials were even more concerned about upgrade and maintenance costs. The state was able to diffuse some of the concerns about the cost of adoption by doing the following: 1) the state paid for and held the license for the shared channels, but signed interagency agreements with participating agencies to allow free usage of the frequencies; and 2) the state negotiated term contracts with radio manufacturers that allowed all public safety agencies to economically purchase compatible, high-band, VHF radio equipment. The adoption rate was initially slow despite these cost savings, the distribution of the manual, and endorsement of the plan by public safety associations. The remaining skepticism was eventually overcome by a number of key factors, including the state's persistent efforts to publicize the statewide channels, the success experienced by early adopters, the comprehensiveness of the practitioner-driven solution, and the ability for local responders to easily provide input to the guide.

[9] The 2005 version of the Montana Mutual Aid and Common Frequencies Guide can be found at http://itsd.mt.gov/techmt/publicsafety/docs/2005_mutual_aid_book_2005_web_final.pdf.

The extraordinary success of the shared channel solution is best quantified by the number of public safety agencies that currently operate on the VHF band. While nationwide 62 percent of public safety agencies use VHF equipment[10], in Montana, only three public safety agencies do not operate on the VHF band. Procurement of radio equipment outside of the VHF band has been limited by the desire to use and be available on the statewide share channels.

Current Usage

Current usage of the statewide shared channels is extensive and frequent across Montana. Agencies as dissimilar as rural volunteer fire departments and the Montana Department of Transportation use the channels daily. The result is a simple, consistent, and powerful communications tool that has enabled emergency responders to more effectively perform their mission.

Keys to Effectively Using Shared Channels:

- Communications designed to support the command structure
- Bottom-up development
- Pre-planning
- Accessible list of shared channels
- Daily use of channels
- Simplicity

Because of the extensive use, the public safety community has experienced a number of surprises in its inter-discipline communications. For instance, as the frequency of contact with other disciplines and jurisdictions increased, many law enforcement agencies were forced to move away from 10-codes in favor of a plain language protocol. Similarly, the Gold channel, or State Common Mutual Aid channel, sustained far-reaching success as it became the de facto statewide call channel. State officials were surprised by the adoption of the Gold channel as a universal "check-in" channel for mutual aid incidents because they did not envision the channel being used in that capacity. However, because the majority of public safety agencies and a large number of other users programmed the Gold channel into their radios, its use became standard across the state.

Even agencies outside of the typical emergency responder community have adopted the shared channels. In one incident, a snowplow driver was able to radio a passing ambulance on the Gold channel to update them on upcoming road conditions. This timely information exchange would have been impossible if agencies across the state were not consistently using the statewide shared channels.

Lessons Learned

With the initial printing of the "Montana Mutual Aid and Common Frequencies Guide" manual in 1990, the state established working groups of emergency responders across various disciplines to solicit suggestions for improvement and steer the development of future versions of the guide. Based on that feedback, the state issued a second edition of the manual in 1994 which introduced a number of changes.

[10] This figure is taken from the 2006 National Interoperability Baseline Survey. Full findings can be found at http://www.safecomprogram.gov/SAFECOM/baseline/.

While the majority of the manual remained the same, the connection between communications and ICS as outlined by SOPs in the manual was significantly changed.

As depicted in Figure 4, the 1990 edition of the manual aligned channel use under ICS strictly by discipline.

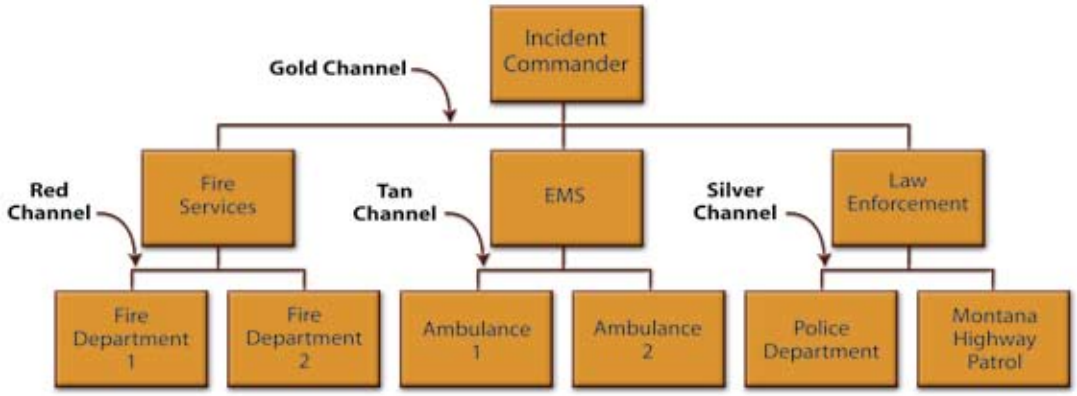

Figure 4: *The ICS diagram included in the 1990 "Montana Mutual Aid and Frequencies Guide" divides the shared channels by discipline.*

However, the second edition (Figure 5) of the manual moved closer to the standard ICS template by assigning channels based on function.

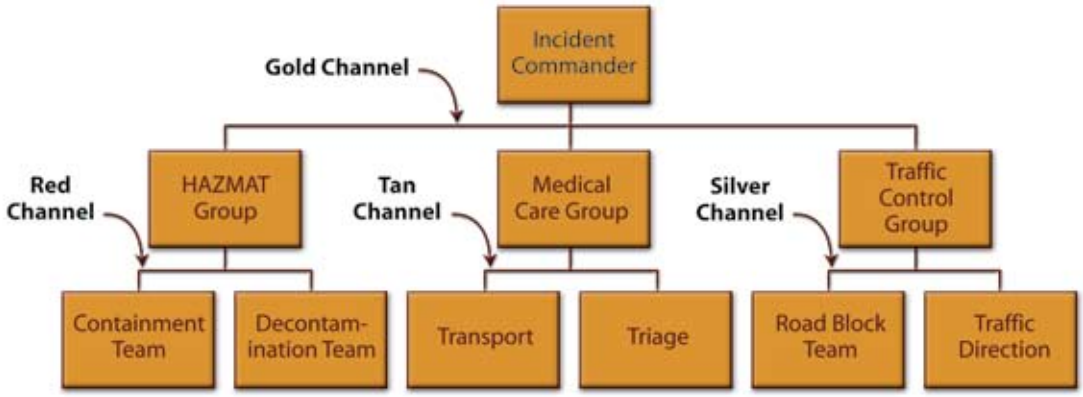

Figure 5: *The 1994 edition of the guide assigns shared channels to functional groups.*

The change reflected an evolving understanding of command structure during incident response. The result allowed communications to support command, as opposed to trying to fit a command structure atop an existing communications plan. In addition to the changes in the SOPs, the state licensed two additional frequencies to provide for statewide fire repeater coverage because of the need for increased communications range during fire incidents. This change allowed fire services to use shared channels with portable repeaters and proved to be an important addition in a state that routinely experiences large, multi-agency wildfires in hard-to-reach areas.

Public safety officials have indicated additional operability and interoperability issues related to the state's strategy. At the statewide level, interference and bleed-over caused by bordering states and older equipment present the biggest operability challenges. Perhaps the most significant challenge is the misuse of the shared channels. Some agencies and individuals compound the interference issues by using the frequencies for non-emergency or personal use. Locally, the lack of additional channels for inter-discipline mutual aid (i.e., additional "Gold" channels) hampers the ability of emergency responders to create cross-discipline teams or respond to several incidents within the simplex range of the radio equipment.

Future

In response to these ongoing operability issues, which are especially prevalent along the northern border of the state, the state created a locally driven initiative known as the Interoperability Montana (IM) Project[11]. IM is a public safety consortium composed of representatives of Montana's 56 counties and seven Native American Nations. It is dedicated to improving communications capabilities, and integrating local, tribal, state, and Federal interoperability efforts. The consortium is managed by the Department of Administration's Information Technology Services Division.

As a result of the locally driven IM effort, the state is endorsing the construction of a statewide Project 25 (P25)[12] compatible digital trunked shared system operating in the VHF band. The system is designed to integrate into the current conventional analog radio equipment by allowing communication between P25 narrowband digital trunked users and existing conventional users. Numerous attempts at creating a statewide shared system have failed in the past; however, the success of this effort is largely due to the direct involvement and leadership of local officials. The decision to use P25 standard equipment in the VHF band and the availability of funding from Federal sources has also encouraged success. The new system is meant to supplement the existing shared channels while the state is slowly brought onto the digital trunked system. However, there are technical limitations to using the new system for both digital and analog communications.

For instance, priority scanning of both analog and digital channels is impossible, and while every repeater site on the new system will be able to communicate with analog devices, users will be required to carry a list of repeater sites, frequencies, and tones to access the repeater. Nevertheless, officials are confident that the same perseverance and consistency of message that brought success to the statewide shared channels will ultimately lead to the success of the IM project.

Why Shared Channels Worked in Montana:

- Visionary leadership directed the effort from the beginning.
- Simplicity and comprehensiveness of the plan allowed easy adoption.
- VHF radio equipment was standard across the state.
- Shared channels were designed for daily use.
- Channels were available for free to any public safety agency.
- Information on the shared channels was widely distributed.
- Small public safety budgets forced innovation and creativity.
- Peer pressure worked better than state pressure.

While the state's public safety communications efforts will be directed towards building out and supporting the new P25 VHF digital trunked system, officials are firmly committed to supporting the existing statewide shared channels. Amendments to the manual will incorporate the statewide and regional talkgroups available on the new statewide digital VHF system, National VHF Interoperability Channels, and changes to existing frequencies due to the FCC's narrow banding requirement for 2013.

[11] More information about the Interoperability Montana project can be found at http://interop.mt.gov/.

[12] Project 25 is a user-driven suite of ANSI-accredited standards for interoperable digital two-way wireless communications products that was developed in North America by local, tribal, state, and Federal representatives and the Telecommunications Industry Association. More information on the standard can be found at http://www.project25.org.

Boston Metropolitan Area

Introduction

Public safety agencies in the Boston Metropolitan Area (Figure 6) are distinguished by their proud history and strong, individual identity. Their culture is reinforced by Massachusetts's local government structure that puts responsibility for providing public services on a series of highly independent townships. Unlike states outside of New England that primarily organize around large county governments, townships in Massachusetts, especially in the Boston Metropolitan Area, are small, distinct, and economically stratified. These townships, building off such qualities, tend to create individual solutions apart from the larger region.

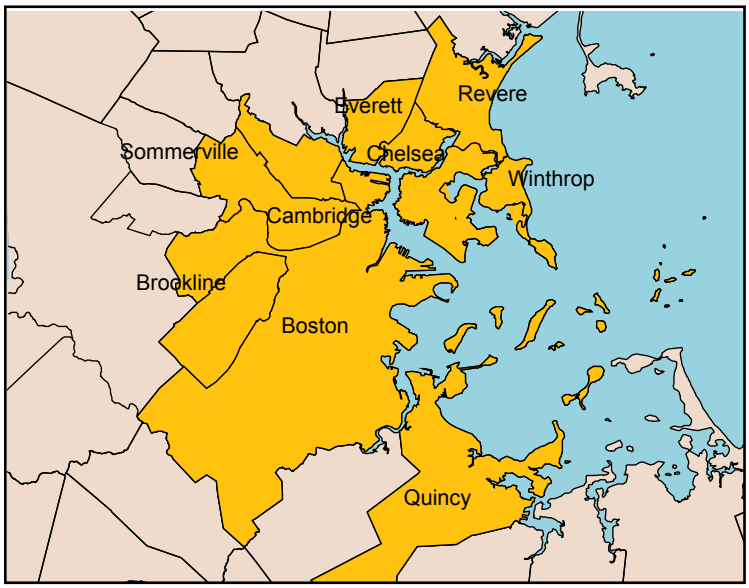

Figure 6: *The Metro Boston Homeland Security Region (MBHSR) contains the following jurisdictions: Boston, Brookline, Cambridge, Chelsea, Everett, Quincy, Revere, Somerville, and Winthrop.*

With these factors, regionalism and collaboration between jurisdictions has been historically limited. However, the region still has decisively and successfully moved forward with a shared channel strategy to improve communications between these highly independent public safety agencies. For this case study, the Boston region is defined as the nine jurisdictions first denoted by the DHS Urban Area Security Initiative (UASI) grant program: Boston, Brookline, Cambridge, Chelsea, Everett, Quincy, Revere, Somerville, and Winthrop.

Background

Before the terrorist attacks of September 11, 2001, the Boston region had three large regional public safety organizations that coordinated intra-discipline communications between their member agencies. The Greater Boston Police Council, a regional association of police agencies, created the Boston Area Police Emergency Radio Network (BAPERN), a system of repeated UHF channels that provided local, agency-specific communications as well as mobile-to-mobile inter-jurisdictional communications. While the system was well-designed and extensively used, the limited number of available channels led to radio communication congestion. Additionally, Boston Police, the largest department in the region, did not include BAPERN channels in its mobile or portable radios because of limited channel capacity, although they were available to dispatchers. Despite the limitations, the system supported a baseline level of interoperability between law enforcement agencies.

For the fire services in the region, METROFIRE, an association of 35 fire departments in the Boston Metropolitan Area, provided planning, training, and mutual aid coordination. As one component of the association's mutual aid agreement, METROFIRE provided a regional UHF radio system that gave fire departments three regional channels to use mutual aid situations: METROFIRE Dispatch, METROFIRE Red, and METROFIRE Blue.

EMS agencies historically coordinated communications through the Metropolitan Boston EMS Council, Inc., a regional group that was responsible for managing the Central Medical

Emergency Direction (CMED) in the region. CMED took the lead role in directing ambulance-to-hospital, but not on-scene or tactical communications. While sufficient in providing ambulance-to-hospital communications, the CMED did not provide radio resources for either EMS command, tactical, or multi-discipline communications.

The region has also historically been similar in its equipment use and radio band. The majority of public safety communications took place over conventional UHF radio systems, although there were a number of agencies that operated outside of the prevailing model. Because of the strength of the BAPERN system, most of the region's law enforcement agencies continue to operate in the UHF band. Area fire departments are split between UHF and VHF radio systems, although, significantly, within the UASI region, the Chelsea, Everett, and Revere fire departments operate on the VHF band. Regionally the two exceptions to UHF and VHF predominance are the Cambridge and the Massachusetts Port Authority (MASSPORT) radio systems, which are both using 800 MHz trunked systems.

Governance

In July 2003, DHS designated Boston as a high-threat urban area under the UASI grant program. This allowed the metropolitan area to receive grant funding to improve public safety readiness and response. The Boston UASI region was later named the Metro Boston Homeland Security Region (MBHSR). As the core city in the region, Boston took the lead role in planning and implementing UASI activities through the Mayor's Office of Emergency Preparedness (MOEP). Each jurisdiction designated a Jurisdictional Point of Contact (JPOC) to serve as a liaison between the MOEP and the jurisdiction's leaders for the coordination of homeland security projects in the region. In order for agencies to receive grant funds, the region had to cooperate on a regional level. As many agencies lacked the independent resources to make the changes needed to increase operability and interoperability, agreement was not difficult to attain.

The MBHSR's governance structure was established by the MOEP after examining the best practices of other regions that successfully implemented regional communications groups, including the National Capital Region and greater Los Angeles. Built on these initial ideas, the current executive committee of the MBHSR consists of the nine JPOCs, and is responsible for voting on the recommendations of each subcommittee. Each jurisdiction assigns one voting member to sit on the Communications Interoperability Subcommittee (CIS), a working group of practitioners assigned to evaluate, design, and implement the MBHSR communications interoperability initiatives. Also invited to participate in the CIS meetings are representatives from other agencies and organizations, including the Massachusetts State Police, the Massachusetts Bay Transportation Authority (MBTA), MASSPORT, and regional organizations such as the Greater Boston Police Council, METROFIRE, and the Metropolitan Boston EMS Council, Inc.

While the CIS was a formal group created with the establishment of the MBHSR, many of the CIS members had previous experience working together on regional projects. The CIS worked diligently to incorporate the new members and define the procedures of the group that would shape and guide decision making. The initial efforts by the CIS were directed towards ironing out these differences by creating a charter that detailed the group's purpose and procedures.

A critical factor in the success of the CIS was the use of a third party facilitator to organize, run, and manage the meetings. Having a non-biased third party allowed the group to work without the political concerns involved in having one jurisdiction or agency control the meetings. The group was encouraged to adopt a regional perspective during discussions and decision making. In addition to moving the discussion from the local to the regional, the facilitator was also able to lead the group from conversations focused solely on UASI funding to a conversation about creating solutions.

Design and Implementation

In order to establish an interoperability strategy, the CIS used focus groups and assessments to identify the current state of communications in the region and the vision for the region in the future. Focus groups were held with representatives from law enforcement, fire response, EMS, and dispatch. Thorough technical and operational surveys were used to assess the current capabilities and gaps across the region. Surveys were given to MBHSR jurisdictions as well as important outside agencies. When the focus groups and surveys were complete, the CIS working groups developed a number of initiatives to close the technical and operational gaps identified in the data.

Before settling on their strategy, the CIS eliminated a number of possible alternative solutions. Among the ideas suggested was to join the statewide 800 MHz system and pay a user fee to the state. However, this idea was considered politically impossible because jurisdictional governments had long desired to control their own radio resources. In addition, the coverage and propagation of the state's system would prevent local officials from modifying their own networks to allow for greater effectiveness. The CIS also considered building an entirely new regional shared system. However, similar concerns over the ownership of the system and the enormous expense for initial capital outlay and maintenance eliminated this proposal as well.

Ultimately, the CIS decided to move forward with a series of initiatives that would utilize the existing infrastructure by taking intentional actions to upgrade, enhance, and supplement the region's radio resources. The vision was to allow any emergency responder in the region to communicate across discipline and jurisdictional lines. This meant setting standards, upgrading equipment, building out existing systems, acquiring additional spectrum, and creating a regional standardized channel plan. The following initiatives were principal to this strategy:

- Set minimum system and subscriber standards for new equipment.
- Create a process for developing SOPs and MOUs and apply to current and future capabilities.
- Bring all MBHSR equipment to a minimum level of capability and supportability.
- Obtain additional radio spectrum.
- Build out existing mutual aid systems for enhanced in-street coverage and provide additional capacity.
- Address the lack of interoperability between VHF fire departments and other stakeholders.
- Develop standard regional channel plans.

The result of the initiatives was an interoperability strategy that focused on the use of shared channels as the preferred technical solution. By bringing all of the MBHSR agencies onto the UHF band, including Cambridge with permanent console patches, and giving all agencies standardized equipment, the MBHSR created the foundation on which the channel plan and standardized SOPs were effectively enacted.

Creating a working, effective channel plan was a major initiative of the CIS. The CIS divided the workload by assigning the channel plan initiative to a working group that would evaluate the idea and create a recommendation to take to the CIS. As designed by the working group, the channel plan was a standardized radio template that contained all of the shared UHF channels that each MBHSR jurisdiction agreed to share. It also contained the existing shared channels from BAPERN, METROFIRE, and EMS.

The working group decided to include all of the MBHSR-agency channels in the channel plan. Before this decision was made, deliberation centered on whether to include the entire MBHSR in the plan or to split the MBHSR and create separate plans for each district. In the end, the working group decided that it would be limiting the number of resources available to an incident commander during an emergency if it did not provide all of the channels in the same plan.

By programming all of the available channels into each radio, the CIS attempted to remove communications resources and equipment as hindrances in large-scale incidents. The standard MBHSR radio would be programmed with the same channels and zones, would function in a similar manner, and would be familiar to any emergency responder in the region. Table 3 shows the channel plan that was implemented by the MBHSR.

	BAPERN	EMS	Fire Response	Interoperability	METROFIRE	Police	Local Zone(s)
Channel 1	*agency main*	*agency main*	*agency main*	*agency main*	*agency main*	*agency main*	*agency choice*
Channel 2	*BAPERN 4 Direct*	*BAMA*	*Boston 1*	*BAMA*	*agency main*	*Boston CW 1*	*agency choice*
Channel 3	*BAPERN 3*	*BEMS 12*	*Boston 2*	*UCALL*	*Metro Red*	*Brookline*	*agency choice*
Channel 4	*BAPERN 4*	*BEMS 13*	*Boston 3*	*UCALL A Direct*	*Metro Red Direct*	*Cambridge PD-1*	*agency choice*
Channel 5	*BAPERN North*	*BEMS 14*	*Boston 4*	*UTAC 1*	*Metro Blue*	*Chelsea*	*agency choice*
Channel 6	*BAPERN South*	*BEMS 16*	*Brookline*	*UTAC 1 A Direct*	*Metro Blue Direct*	*Everett*	*agency choice*
Channel 7	*BAPERN West*	*Cataldo Ambulance*	*Cambridge FD-1*	*UTAC 2+*	*Metro Orange*	*Quincy*	*agency choice*
Channel 8	*BAPERN Central*	*Fallon Ambulance*	*Chelsea*	*UTAC 2 A Direct*	*Metro Orange Direct*	*Revere*	*agency choice*
Channel 9	*BAPERN NorthWest*	*General Ambulance*	*Everett*	*UTAC 3*	*Metro Green*	*Somerville*	*agency choice*
Channel 10	*MBTA PD 1*	*Professional Interop*	*Quincy*	*UTAC 3 A Direct*	*Metro Green Direct*	*Winthrop*	*agency choice*
Channel 11	*MBTA PD 2*	*agency main*	*Revere*	*Metro Red*	*Metro White RX*	*MBTA PD 1*	*agency choice*
Channel 12	*MBHSR 1*	*agency main*	*Somerville 1*	*MBHSR 1*	*MBHSR 1*	*MBTA PD 2*	*agency choice*
Channel 13	*MBHSR 2*	*agency main*	*Somerville 2*	*MBHSR 2*	*MBHSR 2*	*BAPERN 3*	*agency choice*
Channel 14	*UTAC 1 A Direct*	*agency main*	*Winthrop*	*BAPERN 3*	*UTAC 1 A Direct*	*BAPERN 4*	*agency choice*
Channel 15	*UTAC 2 A Direct*	*agency main*	*Metro Red*	*BAPERN 4*	*UTAC 2 A Direct*	*BAPERN 4 Direct*	*agency choice*
Channel 16	*agency main*	*agency main*	*agency main*	*agency main*	*agency main*	*agency main*	*agency choice*

Highlighted cells indicate that the channel does not yet exist or is not a UHF frequency. All such channels will be "agency main" as default.

Table 3: *The current MBHSR Channel Plan shows six separate zones and placeholders for future radio resources.*

The channel plan is organized to enable more effective interoperability. Zone 1 on each radio is programmed to replace the former channel lineup for each local agency. The remaining plan contains the following six zones: BAPERN, EMS, Fire Response, Interoperability, METROFIRE, and Police. The Fire and Police zones contain the main agency UHF channels from each UASI jurisdiction. BAPERN and METROFIRE zones contain the existing shared channels from each organization. The Interoperability zone contains the FCC-designated National Interoperability Channels on the UHF band as well as the main mutual aid channels from BAPERN and METROFIRE. The channel plan allows for the addition of future channels, which are contingent upon the acquisition of additional radio licenses and equipment.

The success of the region's strategy rested not only upon the economic use of existing channels, but also on the strategic build out of additional channels. The region did not possess extra frequencies that could be dedicated to interoperability, and many local agencies felt constrained by the lack of tactical channels for their own operations. The CIS identified both quick-hit and long-term actions to help ease radio communications congestion and improve interoperability. The first step involved assessing current radio licenses and applying for additional frequencies for use throughout the region. The second step was to identify unused resources and apply UASI grant funds to bring them online. For instance, Brookline reclaimed a UHF frequency that it had lent to a local police agency on a handshake agreement. The frequency was used to add

an additional tactical channel to Brookline's system to increase its operational capacity. Finally, the CIS worked with BAPERN and METROFIRE to coordinate their plans for system upgrades with the MBHSR channel plan. Both BAPERN and METROFIRE expanded their coverage and channel capacity through grant dollars that were not associated with UASI.

The strategy of using shared channels across the MBHSR also required standardized equipment for effective implementation. The technical assessments performed by the CIS indicated that new radios were necessary for a number of reasons. In order to implement the channel plan across the entire region, each agency had to be brought up to a baseline level of technology. Some agencies were using radios that did not have the channel capacity or zone capabilities for the new channel plan. In addition, the fire departments that were operating on the VHF band needed new UHF equipment to communicate with the rest of the MBHSR agencies. While moving the VHF fire departments to the UHF band required the acquisition of additional UHF channels, the CIS decided to begin the rollout of the channel plan before the licensing was completed.

Rollout

The channel plan was successfully rolled out to the MBHSR in early 2006. Visor and pocket cards with the regional channel plan were printed and distributed to emergency responders. Existing radios were reprogrammed to match the channel plan and the new MBHSR radios were delivered by the manufacturer.

The reprogramming of existing radios was a complicated and cumbersome task. The UASI grants provided funding to perform the reprogramming for agencies that lacked full time radio technicians while larger agencies performed their own reprogramming. As reprogramming was occurring, UASI-procured radios were distributed to agencies that lacked sufficient equipment. Unfortunately, as soon as the radios were delivered, the CIS members found that some of the radios did not perform as expected and needed to be returned to the manufacturer for replacement. While this action delayed the introduction of the channel plan in some jurisdictions and created headaches for training, it was necessary to ensure reliable communications throughout the region.

Keys to Successful Implementation and Rollout of MBHSR Channel Plan:

- A strong working group with talented and experienced staff created the channel plan.
- The region saved money through cost compromises, but retained all of the necessary functionality.
- Visor and pocket cards were easily distributed and accessible to emergency responders.
- Train-the-trainer type training minimized disruption to agencies.
- Sharing of grant funding allowed reprogramming dollars to go to agencies without radio technicians on staff.

The CIS created a training plan that included a train-the-trainer session with the radio technicians from each MBHSR agency. Each technician then went back to his or her agency and conducted training sessions for colleagues. Training went relatively smoothly, however, because the UASI-procured radios had to be returned to manufacturer, the delay between the training and

the actual use of the new radios stretched into months. Many emergency responders were confused by the interface when they finally received the new MBHSR radio, and some of the training had to be repeated.

While most emergency responders in the region welcomed the new channel plan and enhanced radios, many were resistant to change. Typical officers or firefighters didn't immediately see the benefit of having all of the shared channels in the region programmed into their radios and were opposed to the change from simple, one zone radios, to multiple zone, multiple jurisdiction sets. However, not all emergency responders dismissed the radios and channel plan. Acceptance of the new technology appeared to depend on the age of the responder, as many younger responders quickly accepted the complicated radios and associated interoperability. In general, chiefs were also more supportive of the changes, despite their relative length of service. The reluctance to change felt across the region was a function of both culture and use. Leadership from the top and a commitment to increasing use of the regional shared channels will be a key factor in breaking down these ingrained barriers in the future.

Current Use

Currently the new MBHSR-wide shared channels are rarely used. When they are put in use, it is primarily during planned events. Despite this, most MBHSR officials commend the channel plan for its thoroughness and consistency. The successful rollout of the channel plan and the new MBHSR radio equipment has given public safety agencies the resources necessary to create dynamic, effective interoperability. However, the use of the shared channels depends on continued training and the development of standard SOPs.

The infrequent usage can be partially attributed to the inconsistent availability of MBHSR radios during rollout and the continued reliance on VHF radio equipment in some jurisdictions due to FCC licensing delays. Many responders are reluctant to use the shared channels without knowing with certainty that the entire region is using the channel plan. This hesitancy can also be blamed on the lack of standardized procedures for use of a shared channel. Some responders have reported being reprimanded by dispatchers and other responders when attempting to use another agency's channel. The current interim procedure included in the region's MOU directs emergency responders not to use a shared channel unless a commanding officer specifically instructs them to do so. The CIS will need to continue to develop SOPs and training to help overcome these challenges and to promote more consistent use.

Despite the infrequent usage, most officials agree that the effort is worthwhile. The fact that all responders in the MBHSR have the same radio resources available to them is an invaluable tool for a region during a large-scale emergency. As the region progresses and barriers between agencies continue to diminish, usage and the effectiveness of the channel plan should increase. One of the biggest benefits of the channel plan effort was the increased collaboration among MBHSR members. Bringing the region together and having it agree upon a common path forward will serve the region well in the future.

Lessons Learned

A number of lessons learned came out of the creation of the regional channel plan, among them the licensing of shared channels for interoperability use. Once the region decided to share channels across jurisdictional boundaries, the CIS worked with each agency to upgrade and renew their FCC licenses to reflect the change. In some cases, the licenses for the channels were being upgraded from a maximum of 150 radios to over 6,000 radios, reflecting the possibility that every user in the MBHSR could now access the agency's channel. The requested change added significant time to the licensing efforts because of the ongoing discussion between the MBHSR and the FCC. The CIS creatively circumvented the impasse by creating an MOU between the UASI jurisdictions that granted authorization for other agencies to use the shared channels.

Another challenge for the CIS was the assignment of radio IDs to specific agencies. Because agencies across the MBHSR were given authorization to roam on all the participating radio systems, each radio had to be assigned a unique hexadecimal radio ID that identified that unit. Creating a system that organized radio IDs and incorporated the needs of each of the nine jurisdictions was difficult enough. However, the CIS also had to consider the partner radio systems such as BAPERN and METROFIRE to ensure compatibility with their radio ID conventions.

Future

The future looks bright for communications interoperability in the Boston region. The MBHSR has made large and definitive strides since its inception. Most notably, the MBHSR has implemented an interoperability strategy based on shared channels and a standardized regional channel plan. However, moving forward, the region is faced with a number of challenges including the sustainability of a regional governance group when the UASI grant program is no longer available.

The CIS is looking at a number of technical upgrades in the near future to finish out its five-year strategic plan. The MBHSR is waiting to hear from the FCC on the licensing request for additional UHF channels. Channels will be used to move the VHF fire departments to UHF and to create additional regional MBHSR multi-discipline, multi-jurisdiction interoperability channels. As it currently stands, the region may not have adequate radio resources to effectively handle a large event. The MBHSR will also continue to work with partner organizations to incorporate additional resources that come online, such as the new BAPERN digital channels. Future connectivity to other agencies, such as the Massachusetts State Police, EMS providers, health care facilities, area colleges and universities, and private businesses, will be explored as well.

The CIS is also working on a data interoperability project that will create a secure high-speed public safety data network called PSNet. It will leverage existing networking assets to deliver connectivity between communications centers and allow for data sharing between agencies. The network will be governed by an executive committee, will be standards-based, and will allow for incremental, secure growth. The goal for the CIS is to establish data interoperability using the PSNet infrastructure in the same way that the channel plan and shared channels brought voice interoperability to the region.

Why Shared Channels Have Succeeded in the Boston Region:

- Strong governance group brought all parties under the same organization.
- Integrated approach to interoperability addressed each element of the Interoperability Continuum.
- Third party facilitation minimized political concerns over ownership and helped to strongly organize the effort.
- Regional view of the problem and solution was encouraged.
- Sharing of resources across the region provided a baseline level of interoperability.
- Coordination with existing regional organizations allowed the region to use existing resources.

Central Florida

Introduction

The story of Central Florida's public safety communications effort is one of steady, iterative steps towards regional interoperability. Rather than waiting for a single, comprehensive solution, public safety officials in the region have collaboratively taken small, effective actions to incrementally improve interoperable communications. From the building of shared systems to the creation of shared talkgroups, emergency responders now have a number of tools that allow for multi-discipline, multi-jurisdictional communications. Of all the tools, shared channels and shared talkgroups have proven to be the most effective and commonly used tools for emergency responders in the region. Their economy, availability, and ease of use have made them the preferred method of interoperable communications.

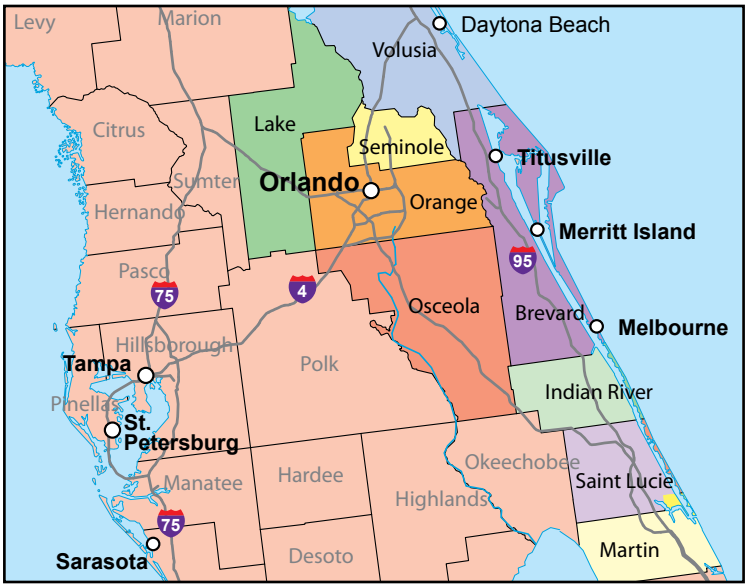

Figure 7: *The Central Florida region is defined for this case study as the counties of Brevard, Indian River, Lake, Martin, Orange, Osceola, Seminole, St. Lucie, and Volusia.*

Background

For this case study, Central Florida (Figure 7) is defined as a nine-county region with Orange County and the city of Orlando at its center. The region contains a diverse natural environment and a mostly suburban population of a little over 3.5 million people. Governmental decisions are primarily led by the large county governments and, as such, eight of the nine counties have county-wide shared systems that are used by all public safety employees in the particular county. Orange County is the lone exception, preferring to establish a consortium of cities within the county to build out a series of independent, yet interconnected, radio systems. Since their inauguration, these systems have served as a catalyst for further regional cooperation.

In 1986, Seminole County installed an 800 MHz analog trunked system, replacing the radio systems in use by disparate agencies across the growing county and creating one centrally located and administered shared system. The transition went smoothly; by the early 1990s the Orange County consortium decided to follow Seminole County and install an 800 MHz system from the same manufacturer. The manufacturer's technology was based on emerging push-to-talk commercial cellular technology that allowed for wide-area simulcast communications and roaming across compatible systems such as Seminole County's. Because the Orange County radio system was overlaid atop the city systems, the technology provided built-in redundancy for each agency. Most importantly, the technology allowed for the creation of wide-area simulcast shared talkgroups within Orange County and with neighboring Seminole County.

The project had success in collaboration. The jurisdictions agreed early in the process to maximize resources, improve interoperability, and optimize propagation. Because the systems allowed each jurisdiction to remain independent (i.e., the radios could operate in local or wide area), all players involved in the decision making supported the new systems. After the consortium's successful installation, Osceola County, Orange County's southern neighbor, installed a system from the same manufacturer, increasing the number of adjacent, compatible systems to seven. All participating jurisdictions agreed to share talkgroups.

Leading the technical discussions among the jurisdictions was a group of multi-discipline radio technicians from each agency. This group originated from an ad hoc monthly meeting centered around 9-1-1 centers, eventually evolving into a more formalized working group called the Radio Service Software[13] (RSS) managers working group. The group met on a routine basis to monitor progress, discuss any potential pitfalls, and write the policies and procedures that would govern the use of the systems. The group was successful because of trust built on personal relationships and because members left politics at the door. The RSS managers group would later form the nucleus of a formal regional governance group.

Design and Implementation

The Orange County consortium's new trunked radio systems allowed agencies to create as many talkgroups as could fit in their radios. Talkgroups were created for very specific user groups, often at the expense of operability and interoperability. Fire services tended to create a few tactical talkgroups and then provide access to any agency that might respond with them in mutual aid. In contrast, because of the nature of their work (i.e., small teams and sensitive information), law enforcement tended to create specific talkgroups for each division and to strictly limit access to these talkgroups.

Two years after the consortium's successful installation, a tragic incident occurred in Orange County that required agencies to rethink how they created and used talkgroups. Two plainclothes detectives were on duty when they witnessed a bank robbery in progress. As the detectives moved to apprehend the suspects, the incident escalated into a high-speed chase that continued across jurisdictional lines, prompting a request for support from several agencies. Unfortunately, the detectives were operating on a talkgroup with access given only to members of their plainclothes unit, effectively cutting off radio contact with other officers. As the chase continued onto the interstate, the severity of the incident prompted other law enforcement agencies to move in place to stop the suspects using spike strips. Tragically, the suspect's car unexpectedly hit the strips, slid out of control, and killed an officer from another agency.

The incident highlighted the most obvious shortcoming of the new systems: while technology provided significant technical advantages and new features, judicious usage, frequent training, and standardized SOPs were necessary to fully leverage these new capabilities and improve operability and interoperability. The system allowed for an almost unlimited number of talkgroups to be created, but by segmenting off specific units from open talkgroups, the system could effectively obstruct the flow of critical information. New technology could only provide the base on which operational interoperability solutions were developed.

The RSS managers group quickly made the solution to this shortcoming their top priority. The solution came from a Winter Park Fire Department lieutenant who proposed creating a set of wide-area simulcast talkgroups that would be available to any law enforcement agency in Orange County. The solution would allow a dispatcher to patch an officer's primary talkgroup to one of the wide-area talkgroups when an incident required a multi-jurisdictional response, but before a mutual aid request was initiated. Other agencies could then follow the incident and respond as needed. Once the patch was completed, the system would be configured to automatically digitize and record the conversation, a benefit not available on existing operational talkgroups. When the incident was over, the patch would be removed and the officer's primary talkgroup would revert back to autonomous use. These talkgroups eventually became known as the Metro talkgroups, and were programmed into every law enforcement radio county-wide.

This simple procedure shifted the responsibility away from the officer and allowed him to continue pursuit without dangerously reaching for the radio.

[13] Radio Service Software is a software package used to program radios.

The procedure also gave the dispatcher a larger role in coordinating regional communications, and, as an unintended benefit, simplified his dispatch console by removing the need to display all available talkgroups at once. The dispatch center became the centralized location for managing interoperable communications across the county, a trend that continued in the future. One success factor was the timing of the patch initiation. Establishing the patch before the request for outside agency support allowed the correct talkgroup information to be relayed to the assisting agencies, eliminating the confusion that normally ensued when asking responders to switch channels after they begin to assist.

The proposal gained quick political acceptance for two reasons: 1) instead of originating from a specific law enforcement agency, the solution was proposed by a RSS member outside of law enforcement, thereby removing political sensitivities over who owned the solution; and, 2) the Orange County Sheriff's Department and the city of Orlando Police Department shared responsibility in the administration of the Metro talkgroups so that four talkgroups operated on the Orange County system and four on the city of Orlando system. This configuration also created additional redundant capacity in case of one system failing.

The solution was successful because of its simplicity and economy. It easily allowed units to maintain their autonomous talkgroups while providing a way to handle escalating incidents. Training costs were minimal as each radio dispatcher was easily trained using a one-page SOP. Besides reprogramming the law enforcement radios, the solution required no additional technical investment by the relevant agencies. The procedure has been implemented for over 10 years and is now considered a routine part of daily incident response in Orange County.

Governance

After the terrorist attacks of September 11, 2001, the State of Florida created seven Regional Domestic Security Taskforces (RDSTFs) specifically designed to provide a formal governance structure to these regions, not only for radio communications, but also for preparedness and response. The Region 5 RDSTF governed the primary counties in Central Florida, including Brevard, Indian River, Lake, Martin, Orange, Osceola, Seminole, St. Lucie, and Volusia. The RSS managers group provided a foundation for the Region 5 communications subcommittee. With a formalized governance structure now in place, the region began to approach all funding and operational issues as a collective entity.

In 2003, Region 5 submitted an innovative regional proposal to address incompatibilities between frequency bands and proprietary systems to the Department of Justice's Office of Community Oriented Policing Services (COPS) grant program. The region's proposed solution was to build out five shared channels by installing a set of VHF and 800 MHz repeaters and base stations at communications centers across the region[14]. The solution allowed any agency to respond within Region 5 using existing radio equipment by accessing a repeater on a conventional analog shared channel. This channel could then be quickly patched to the host talkgroup. VHF users responding in an 800 MHz jurisdiction could switch to the VHF interoperability channel and be patched into an 800 MHz talkgroup. Similarly, an 800 MHz user could respond inside either a VHF county or an 800 MHz county using a system from a different manufacturer, switch over to a National Interoperability Channel, and then be patched into the host county's system.

While the city of Orlando actually held the UASI designation, to mitigate the significant initial capital and personnel investment Orlando ceded the grant recipient title and duties to Orange County, a larger organization.

[14] The five common frequencies were 8CALL90, 8TAC92, 8TAC93, 8TAC94, and a VHF repeater pair consisting of VTAC13 and VLAW31. Because the region was able to leverage existing channels, it avoided the necessity of licensing channels region-wide, which could have proved to be a difficult and potentially impossible task. A list of all FCC-designated interoperability channels in all bands can be found on page 38.

Orange County held the fiduciary and administrative responsibilities for the grant funding and the Orange County Sheriff's Department was the lead agency. The technical proposal and strong showing of regionalism allowed Region 5 to be awarded the COPS grant.

Politically, because the grant required a 25 percent investment from recipient agencies, some of the counties were reluctant to participate, citing the difficulty in raising the matching funds. There was also a divide between the technical and operational members of the Region 5 governance group. However, after educating leaders from each county on the operational advantages this solution was to produce, all nine counties agreed to fully participate, and the effort was launched.

During the installation, members of the Region 5 communications subcommittee encountered a number of surprises, most importantly an increased understanding of their own systems. To save grant funds on installation costs, most of the technical work was performed by a task force of radio technicians from across Region 5. This gave technicians an unprecedented understanding of the underpinnings of their complex systems, saving future maintenance costs on the back end and, in turn, creating a greater level of trust and cohesion among the subcommittee members.

The effort has been a success, but it has not been without its share of difficulties. For instance, the region faced the challenge of controlling interference. If two adjacent jurisdictions decided to simultaneously power up their repeaters on the same channel, the interference would knock out the use of the channel. This problem was partially mitigated by adapting a commercial software package already in use by a majority of the communications centers to manually track the status of each county's repeaters. The software allowed only for manual updating because it was not connected directly to the communications system. The solution was makeshift, but effective for most everyday use.

Central Florida's Key Actions for COPS Grant Success:

- Work regionally by utilizing existing regional organizations (i.e., Florida's RDSTF Region 5).
- Share resources and responsibility (i.e., Orange County and Orlando shared grant responsibilities).
- Work with the state to share best practices and coordinate efforts.
- Use state or national interoperability channels to provide common denominator interoperability.
- Build out more than one band if possible.
- Look for ways to save money and increase cooperation (i.e., perform installation and use COTS software).

Despite the challenges, the success of Region 5's efforts has prompted the State of Florida to base a portion of its interoperability strategy called the Florida Interoperability Network (FIN)[15] on Region 5's innovative use of shared channels. Because of this, Region 5 worked closely with

[15] More information on the Florida Interoperability Network can be found at http://dms.myflorida.com/eits/public_safety/radio_communications/florida_interoperability_network_fin.

the State of Florida during the development of the strategy to ensure that its efforts were not duplicating or counteracting the state's newly created plans.

Overall, the region's solution is a resounding success. The region created a new level of interoperability through the relatively simple build out of conventional shared channels. Operationally, the channels are not used on an everyday basis, but units that respond across jurisdictional boundaries and out of radio range of their home system find the new shared channels effective. For larger incidents, the importance of providing a common denominator whereby any 800 MHz or VHF radio user can respond inside of Region 5 cannot be overstated; practically any emergency responder in the state could respond to an incident in Central Florida and could easily be patched over to the applicable tactical response talkgroup.

Current Usage

With the addition of shared channels, emergency responders in Region 5 now have access to a number of tools that allow for multi-discipline and multi-jurisdictional communications. However, for emergency responders in Orange, Osceola, and Seminole counties, shared talkgroups are the easiest and most effective way to communicate. Their partnership, made possible by the sharing of system keys, enables radios to roam across all of the systems and natively access the talkgroup resources of each system.

With this ability, the partner jurisdictions have decided to share a select number of talkgroups. By sharing their talkgroups, each agency allows users from outside their jurisdiction to access native talkgroups that have been specifically made available to all agencies. This ability creates seamless mutual aid response as emergency responders can respond across jurisdictional boundaries and easily switch over to a native talkgroup to communicate without the need for patching or gateways. It effectively gives the control of interoperable communications to the responders.

For example, the Orange County Fire Department's radio template gives firefighters access to the shared talkgroups of all neighboring fire departments, including Seminole and Osceola counties. Additionally, the radios have programmed talkgroups for all hospitals in Orange, Seminole, and Osceola counties; the main talkgroups for the Orange County Sheriff's Department; and, of course, the conventional 800 MHz Florida and National Interoperability Channels. Orange County firefighters have access to talkgroups in nine jurisdictions covering a population of over 2.2 million people, an enormous range and an excellent example of the regional cooperation in Central Florida.

The Orange County Fire Department has successfully used a radio template containing all of the partner shared talkgroups. However, Seminole County has adopted the best practice of creating a channel plan or standardized radio programming template for all of its law enforcement and fire services in the entire county. In Seminole County, each public safety radio is programmed using this template, giving agencies across the county access to each other's talkgroups. The channel plan includes all of the available shared talkgroups from across the seven partner radio systems as well.

The Seminole County channel plan has evolved a number of times since its introduction, but has settled into a stable layout. Zones 1-13 are dedicated to the primary channels of all the major agencies of Seminole County. Each zone represents one jurisdiction or agency in the county, including police, fire response, and public works, and contains all of the talkgroups for those agencies. To deflect any questions on primacy, zones are established alphabetically (i.e., Altamonte Springs is Zone 1 and Winter Springs is Zone 13). Zones 14-27 are dedicated to shared talkgroups from the six other radio systems, including Orange County's Metro talkgroups. Zone 28 is dedicated to the conventional 800 MHz Florida and National Interoperability Channels. Besides the ease of management and the improved interoperability, the channel plan also allows for standardized radio training across Seminole County's public safety agencies.

The sharing of talkgroups across the region is widespread, routine, and effective. The ability of emergency responders to easily switch over to a pre-programmed shared talkgroup during incident response is a valuable method of interoperable communications. Shared talkgroups can be used effectively not only for everyday incidents, but also for large-scale regional incidents, including possible terror attacks or natural disasters.

Lessons Learned

The region has learned and evolved through each successive step towards greater regional interoperability. Many of the unintended obstacles the region has encountered have been technical in nature as agencies across the region began to operate more frequently on other systems. As such, the need for further standardization of policies and training will become a major concern for the Region 5 governance group.

One such unintended obstacle has been the disparate handling of the emergency button function. Because the emergency button function is configurable by each agency, agencies have programmed the buttons to operate according to their own established SOPs. Some agencies prefer to send the emergency flag with the unit ID on the channel that the user has self-selected, while other agencies program the emergency button to revert back to the main dispatch channel before sending the emergency flag. Agencies may even program their Computer Aided Dispatch (CAD) system to provide a visual cue on the CAD screen whenever the button is pushed by a radio user. To avoid confusion and potentially harmful consequences, the region will need to develop a regional agreement for the standard handling of the emergency button when roaming across systems. The Region 5 communications subcommittee is currently exploring a solution that would be acceptable across the region.

Closely related to this problem is the management of Radio IDs. Each radio is assigned a specific ID that identifies that subscriber unit on the system. To allow users to roam across other systems, agencies need to exchange system keys as well as assign a system specific ID to the roaming units. To simplify this process, radio technicians normally

Why Interoperability is Successful in Central Florida:

- Leadership laid out a vision for public safety agencies in the region.
- Iterative steps towards improving interoperability were developed instead of waiting for a single, comprehensive solution.
- Strong relationships exist between communications technicians, emergency responders, and officials from different disciplines and jurisdictions.
- Agencies actively seek ways to coordinate communications plans, strategies, and solutions.
- A strong regional governance group meets regularly.
- Interaction between operational and technical staff is encouraged and can result in more effective strategies.
- Resources are shared among all agencies, providing a common denominator of interoperability across the region.

assign an entire block of IDs to the guest agency; however, this ID is specific only to one system, so radios will need a separate ID for each individual system they access. Not only can the management of the assorted radio IDs become cumbersome and time-consuming for technicians, but it can also be dangerous for the radio user.

The problem occurs because of the limited supply of radio IDs and the inability for the host system to correctly identify the emergency responder assigned to each guest ID. Radio systems are limited in the number of IDs they can assign and as more roaming partners are added, the availability of blocks of radio IDs dwindles, causing a management problem for the host system. As each radio ID is assigned to a roaming partner as a part of a block of IDs, when the emergency button is pressed or an emergency responder indicates he is in trouble, the dispatcher is unable to identify who is assigned that ID. For example, Orange County radios can roam across seven systems, so each portable radio has seven separate radio IDs. If an Orange County firefighter is responding to an incident in Seminole County and depresses his emergency button, the Seminole County dispatcher can correctly identify the radio as an Orange County unit, but is unable to ascertain the name of the emergency responder or even his discipline.

While a regional solution to this problem has yet to be put into place, individual agencies have created short-term solutions. Orange County has designed a simple database that displays all seven radio IDs for each of its radios and the emergency responder that is assigned to that radio. If an Orange County emergency responder indicates an emergency while responding on another system, the dispatcher for the host system can contact the Orange County dispatch center, which can then easily search the database to match an ID to an emergency responder. Another solution would be to program the systems to dynamically request and display the emergency responder information for each radio ID from the neighboring system. This would require the discipline of the technicians, database administrators, and system managers of each system to accurately update their independent systems with the database information.

Lastly, the region faces the challenge of common nomenclature for shared channels and talkgroups. As the COPS grant provided the infrastructure necessary to support interoperability across the entire region, the ability for emergency responders and dispatchers to quickly locate the correct interoperability channel or talkgroup to communicate is critical during incident response. For example, two firefighters can arrive on a scene and be directed to 8TAC92. On one of their radios, this channel is labeled MUTUAL1 and on the other ITAC1. They both have the required channel in their radios, but the firefighters are unable to talk. Wisely, subcommittee members are awaiting the Nationwide adoption of NPSTC's recommended channel naming convention before adopting a common channel nomenclature for the region.

The nomenclature issue extends into trunked talkgroups as well. In many ways, talkgroup name standardization across systems can be more difficult than shared channel naming because there is not likely to be an independent source such as NPSTC to reference. For example, Seminole County has a shared fire talkgroup that is named 9A2. However, in Orange or Osceola County radios this same talkgroup name would need to have some sort of system identifier (SE 9A2) so it could be differentiated from talkgroups belonging to other systems or counties. Since the names do not match exactly, it could still create an issue for emergency responders in the field. Several different solutions have been tried and the region continues to work on standardizing the shared talkgroup names.

Future

As always, the future holds both promise and challenge for communications interoperability in Central Florida. Perhaps the most pressing issue for the region will be the transition from analog to digital radio communications. The City of Orlando is currently in the process of upgrading its system to digital, and Lake County is procuring an advanced digital P25 trunked radio system. The Region 5 communications subcommittee will need to pay close attention to these upgrades

to guarantee backwards compatibility with the established shared talkgroups. The City of Orlando plans to reduce the possible negative effects of the transition by leaving a portion of its analog system running, thereby ensuring patching capability from analog devices to the city's new digital radios. The city is also procuring P25-compatible equipment, ensuring potential compatibility with jurisdictions that upgrade to P25 equipment in the future.

The region is also facing the FCC deadline for 800 MHz rebanding. As jurisdictions upgrade over the next year, the subcommittee will again be requested to coordinate the effort to ensure that the reprogramming does not compromise interoperability. The subcommittee is currently collaborating to ensure timetables for upgrades are synchronized and compatible with the region, however, all of the jurisdictions are encouraged to proceed as quickly as they need to, even if their specific rebanding schedule does not align with the region's timetable.

Lastly, as interoperable communications usage continues to increase in the region, there is a greater need for coordination of training and exercises. As the complexity and capabilities of public safety radios has increased in recent years, training for these devices has decreased. Unfortunately, most grant funding does not cover this type of training, and specifically prohibits using grant funding to pay overtime to replace the user being sent to training. This prohibition makes training dispatchers especially difficult. The region has identified user training as a top priority for grant funding requests and continues to work to establish training requirements for both basic operability and interoperability for dispatchers and field personnel.

Central Florida has experienced a number of natural disasters that have in some instances precluded or, in fact, prevented the region from completing large-scale exercises. As the region continues to recover and learn from these disasters, regularly scheduled comprehensive training exercises will serve to solidify the lessons learned. The region has established and has continued to develop an impressive array of technical interoperability tools. Now would be a good time to ensure all emergency responders in the region are trained to use these tools when it counts.

Spectrum Information

A shared channel solution for interoperability depends on the use, sharing, and management of spectrum resources. Because spectrum is a finite resource in great demand, its use and availability are highly regulated. This guide focuses on the use of channels located in spectrum licensed through the FCC.

The FCC issues licenses which are maintained in the Universal Licensing System[16] database, which is available to the public. There are some statewide networks under development that include channels located in spectrum under the control of the Department of Commerce National Telecommunications and Information Administration (NTIA) within the Office of Spectrum Management (OSM)[17]. The NTIA is the Federal body that controls radio spectrum in use by Federal government agencies such as the Department of Defense and DHS. The NTIA does not license spectrum; channels are allocated and authorized to the individual Federal agencies. The database that contains this information is the Government Master File, which is not available to the public. The NTIA has established channels within spectrum under its control that is made available for use by non-Federal public safety agencies.

There are two radio bands in use by the Federal Government; they consist of two 20 channel segments (total of 40 channels) that have been identified within the Federal 162-174 and 406.1-420 MHz bands. These channels are available to public safety, with certain restrictions, for law enforcement and incident response communications. Details are located within the NTIA Redbook[18] in the Redbook chapter 4.3.16. This section is under review by the NTIA with the intent of identifying unencumbered nationwide channels.

Table 4 displays public safety spectrum by band and range. The resources in the sections that follow provide other spectrum related information—including information on rules, regulations, and policies.

Frequency Band	Frequency Range
High HF	25-29.99 MHz
Low VHF	30-50 MHz
High VHF	150-174 MHz
Low UHF	450-470 MHz
UHF TV Sharing	470-512 MHz
700 MHz	764-776/794-806 MHz
800 MHz	806-869 MHz

Table 4: *Public Safety Spectrum by band and range*

[16] http://wireless.fcc.gov/uls/
[17] http://www.ntia.doc.gov/osmhome/osmhome.html
[18] http://www.ntia.doc.gov/osmhome/redbook/redbook.html

FCC Spectrum Information

FCC General Public Safety

The following link provides information on the spectrum used by the public safety community:
http://www.fcc.gov/pshs/public-safety-spectrum/

FCC Narrowbanding/Refarming

Narrowbanding, also known as "refarming," refers to rules developed by the FCC to ensure more efficient use of spectrum. Information on related rulemaking can be found at:
http://wireless.fcc.gov/services/index.htm?job=operations&id=private_land_radio

FCC 700 MHz Spectrum

The following site provides information on the 700 MHz public safety spectrum and the rules governing its use:
http://www.fcc.gov/pshs/public-safety-spectrum/700-MHz/

FCC 800 MHz Band Reconfiguration

The following sites contain information on the 800 MHz public safety spectrum, including rules of use and guidelines for reconfiguration:
http://www.fcc.gov/pshs/public-safety-spectrum/800-MHz/

FCC Rules and Regulations

FCC rules and regulations can be found at the site below. The site includes 47 C.F.R. Part 90, containing the rules and regulations for private land mobile radio services, which provide for the internal communications needs of emergency response organizations and other non-commercial users of two-way radio services:
http://wireless.fcc.gov/rules.html

FCC Frequency Coordination

The FCC has certified specific associations to perform the coordination process for those applying for spectrum licenses. A list of certified associations is available at:
http://www.fcc.gov/pshs/public-safety-spectrum/coord.html

NTIA Spectrum Information

NTIA Office of Spectrum Management (OSM)

The NTIA OSM manages Federal Government use of the radio frequency spectrum:
http://www.ntia.doc.gov/osmhome/osmhome.html

NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management (Redbook)

This manual includes narrowband requirements for land mobile spectrum allocated to the Federal Government:
http://www.ntia.doc.gov/osmhome/redbook/redbook.html

Other Spectrum Information

Association of Public-Safety Communications Officials (APCO)-International Spectrum Issues Page

APCO-International was established to enhance public safety communications. The following page provides information related to public safety spectrum issues:
http://www.apcointl.org/frequency/

National Public Safety Telecommunications Council (NPSTC)

NPSTC is responsible for implementing the recommendations of the FCC's National Coordinating Committee. Spectrum-related information can be found on its site:
http://www.npstc.org/

NPSTC List of All FCC-Designated National Interoperability Channels

NPSTC has released a list of all FCC-designated National Interoperability Channels in all bands including a national standard channel nomenclature at:
http://www.npstc.org/channelNaming.jsp

Computer Assisted Pre-Coordination Resource and Database System (CAPRAD)

The CAPRAD tool provides automated features to assist in management, assignment, and application for interoperability channels:
http://caprad.teqservices.com/

Standard Channel Nomenclature

OEC encourages all local, tribal, state, and Federal agencies to review and adopt the following standard channel nomenclature for all FCC-designated National Interoperability Channels as released by NPSTC in June 2007.

FREQ / FCC CHANNEL (SUBSCRIBER LOAD)		BASE,MOBILE, OR FIXED (CONTROL)	ELIGIBILITY / PRIMARY USE	COMMON NAME	LIMITATIONS (47 CFR Part 90)
RECEIVE	TRANSMIT				
MHz	**MHz**	**FCC 30 MHz Public Safety Band**			
39.4600	SIMPLEX	Base-Mobile	Law Enforcement	**LLAW1**	90.20(c)(3) [15]
39.4800	SIMPLEX	Base-Mobile	**Fire Proposed**	**LFIRE2**	Prop. 90.20(c)(3) [19]
45.8600	SIMPLEX	Base-Mobile	Law Enforcement	**LLAW3**	90.20(c)(3) [15]
45.8800	SIMPLEX	Base-Mobile	Fire	**LFIRE4**	90.20(c)(3) [19]
MHz	**MHz**	**FCC 150 - 162 MHz Public Safety Band**			
155.7525	SIMPLEX	Base-Mobile	Any Public Safety Eligible	**VCALL10**	90.20(c)(3) [80,83]
151.1375	SIMPLEX	Base-Mobile	Any Public Safety Eligible	**VTAC11**	90.20(c)(3) [80]
154.4525	SIMPLEX	Base-Mobile	Any Public Safety Eligible	**VTAC12**	90.20(c)(3) [80]
158.7375	SIMPLEX	Base-Mobile	Any Public Safety Eligible	**VTAC13**	90.20(c)(3) [80]
159.4725	SIMPLEX	Base-Mobile	Any Public Safety Eligible	**VTAC14**	90.20(c)(3) [80]
161.8500	157.2500	Fixed-Mobile	Allocated for Public Safety Use in 33 Inland VPCAs/EAs	**VTAC17**	90.20(g)
	SIMPLEX	Base-Mobile		**VTAC17D**	
161.8250	157.2250	Fixed-Mobile	Allocated for Public Safety Use in 33 Inland VPCAs/EAs	**VTAC18**	90.20(g)
	SIMPLEX	Base-Mobile		**VTAC18D**	
161.8750	157.2750	Fixed-Mobile	Allocated for Public Safety Use in 33 Inland VPCAs/EAs	**VTAC19**	90.20(g)
	SIMPLEX	Base-Mobile		**VTAC19D**	
154.2800	SIMPLEX	Base-Mobile	Fire	**VFIRE21**	90.20(c)(3) [19]
154.2650	SIMPLEX	Base-Mobile	Fire	**VFIRE22**	90.20(c)(3) [19]
154.2950	SIMPLEX	Base-Mobile	Fire	**VFIRE23**	90.20(c)(3) [19]
154.2725	SIMPLEX	Base-Mobile	Fire	**VFIRE24**	90.20(c)(3) [19]
154.2875	SIMPLEX	Base-Mobile	Fire	**VFIRE25**	90.20(c)(3) [19]
154.3025	SIMPLEX	Base-Mobile	Fire	**VFIRE26**	90.20(c)(3) [19]
155.3400	SIMPLEX	Base-Mobile	EMS	**VMED28**	90.20(c)(3) [40]
155.3475	SIMPLEX	Base-Mobile	EMS	**VMED29**	90.20(c)(3) [40]
155.4750	SIMPLEX	Base-Mobile	Law Enforcement	**VLAW31**	90.20(c)(3) [41]
155.4825	SIMPLEX	Base-Mobile	Law Enforcement	**VLAW32**	90.20(c)(3) [41]
MHz	**MHz**	**FCC 450 - 470 MHz Public Safety Band**			
453.2125	458.2125	Fixed-Mobile	Any Public Safety Eligible	**UCALL40**	90.20(c)(3) [80,83]
	SIMPLEX	Base-Mobile		**UCALL40D**	
453.4625	458.4625	Fixed-Mobile	Any Public Safety Eligible	**UTAC41**	90.20(c)(3) [80]
	SIMPLEX	Base-Mobile		**UTAC41D**	
453.7125	458.7125	Fixed-Mobile	Any Public Safety Eligible	**UTAC42**	90.20(c)(3) [80]
	SIMPLEX	Base-Mobile		**UTAC42D**	
453.8625	458.8625	Fixed-Mobile	Any Public Safety Eligible	**UTAC43**	90.20(c)(3) [80]
	SIMPLEX	Base-Mobile		**UTAC43D**	
CHANNEL	**CHANNEL**	**FCC 700 MHz Public Safety Band (TV 63 + 68)**			
39-40	999-1000	Fixed-Mobile	Calling Channel	**7CALL50**	90.531(a)(1)(ii)
	SIMPLEX	Base-Mobile		**7CALL50D**	
23-24	983-984	Fixed-Mobile	General Public Safety Service (secondary trunked)	**7TAC51**	90.531(a)(1)(iii)
	SIMPLEX	Base-Mobile		**7TAC51D**	
103-104	1063-1064	Fixed-Mobile	General Public Safety Service (secondary trunked)	**7TAC52**	90.531(a)(1)(iii)
	SIMPLEX	Base-Mobile		**7TAC52D**	
183-184	1143-1144	Fixed-Mobile	General Public Safety Service (secondary trunked)	**7TAC53**	90.531(a)(1)(iii)
	SIMPLEX	Base-Mobile		**7TAC53D**	
263-264	1223-1224	Fixed-Mobile	General Public Safety Service (secondary trunked)	**7TAC54**	90.531(a)(1)(iii)
	SIMPLEX	Base-Mobile		**7TAC54D**	
CHANNEL	**CHANNEL**	**FCC 700 MHz Public Safety Band (TV 63 + 68) (Cont'd)**			
119-120	1079-1080	Fixed-Mobile	General Public Safety Service	**7TAC55**	
	SIMPLEX	Base-Mobile		**7TAC55D**	
199-200	1159-1160	Fixed-Mobile	General Public Safety Service	**7TAC56**	
	SIMPLEX	Base-Mobile		**7TAC56D**	
319-320	1279-1280	Fixed-Mobile	Other Public Service	**7GTAC57**	
	SIMPLEX	Base-Mobile		**7GTAC57D**	
303-304	1263-1264	Fixed-Mobile	Mobile Repeater (M03 Use Primary)	**7MOB59**	
	SIMPLEX	Base-Mobile		**7MOB59D**	
223-224	1183-1184	Fixed-Mobile	Law Enforcement	**7LAW61**	
	SIMPLEX	Base-Mobile		**7LAW61D**	
239-240	1199-1200	Fixed-Mobile	Law Enforcement	**7LAW62**	
	SIMPLEX	Base-Mobile		**7LAW62D**	
143-144	1103-1104	Fixed-Mobile	Fire	**7FIRE63**	

FREQ / FCC CHANNEL (SUBSCRIBER LOAD)		BASE,MOBILE, OR FIXED (CONTROL)	ELIGIBILITY / PRIMARY USE	COMMON NAME	LIMITATIONS (47 CFR Part 90)
RECEIVE	TRANSMIT				
	SIMPLEX	Base-Mobile		7FIRE63D	
159-160	1119-1120	Fixed-Mobile	Fire	7FIRE64	
	SIMPLEX	Base-Mobile		7FIRE64D	
63-64	1023-1024	Fixed-Mobile	EMS	7MED65	
	SIMPLEX	Base-Mobile		7MED65D	
79-80	1039-1040	Fixed-Mobile	EMS	7MED66	
	SIMPLEX	Base-Mobile		7MED66D	
279-280	1239-1240	Fixed-Mobile	Mobile Data	7DATA69	90.531(a)(1)(i)
	SIMPLEX	Base-Mobile		7DATA69D	
CHANNEL	**CHANNEL**	**FCC 700 MHz Public Safety Band (TV 64 + 69)**			
681-682	1641-1642	Fixed-Mobile	Calling Channel	7CALL70	90.531(a)(1)(ii)
	SIMPLEX	Base-Mobile		7CALL70D	
657-658	1617-1618	Fixed-Mobile	General Public Safety Service (secondary trunked)	7TAC71	90.531(a)(1)(iii)
	SIMPLEX	Base-Mobile		7TAC71D	
737-738	1697-1698	Fixed-Mobile	General Public Safety Service (secondary trunked)	7TAC72	90.531(a)(1)(iii)
	SIMPLEX	Base-Mobile		7TAC72D	
817-818	1777-1778	Fixed-Mobile	General Public Safety Service (secondary trunked)	7TAC73	90.531(a)(1)(iii)
	SIMPLEX	Base-Mobile		7TAC73D	
897-898	1857-1858	Fixed-Mobile	General Public Safety Service (secondary trunked)	7TAC74	90.531(a)(1)(iii)
	SIMPLEX	Base-Mobile		7TAC74D	
761-762	1721-1722	Fixed-Mobile	General Public Safety Service	7TAC75	
	SIMPLEX	Base-Mobile		7TAC75D	
841-842	1801-1802	Fixed-Mobile	General Public Safety Service	7TAC76	
	SIMPLEX	Base-Mobile		7TAC76D	
937-938	1897-1898	Fixed-Mobile	Other Public Service	7GTAC77	
	SIMPLEX	Base-Mobile		7GTAC77D	
881-882	1841-1842	Fixed-Mobile	Mobile Repeater (M03 Use Primary)	7MOB79	
	SIMPLEX	Base-Mobile		7MOB79D	
801-802	1761-1762	Fixed-Mobile	Law Enforcement	7LAW81	
	SIMPLEX	Base-Mobile		7LAW81D	
857-858	1817-1818	Fixed-Mobile	Law Enforcement	7LAW82	
	SIMPLEX	Base-Mobile		7LAW82D	
721-722	1681-1682	Fixed-Mobile	Fire	7FIRE83	
	SIMPLEX	Base-Mobile		7FIRE83D	
777-778	1737-1738	Fixed-Mobile	Fire	7FIRE84	
	SIMPLEX	Base-Mobile		7FIRE84D	
641-642	1601-1602	Fixed-Mobile	EMS	7MED86	
	SIMPLEX	Base-Mobile		7MED86D	
697-698	1657-1658	Fixed-Mobile	EMS	7MED87	
	SIMPLEX	Base-Mobile		7MED87D	
921-922	1881-1882	Fixed-Mobile	Mobile Data	7DATA89	90.531(a)(1)(i)
	SIMPLEX	Base-Mobile		7DATA89D	
MHz	**MHz**	**FCC 800 MHz NPSPAC Band (Post-Rebanding)**			
851.0125	806.0125	Fixed-Mobile	Any Public Safety Eligible	8CALL90	90.16
	SIMPLEX	Base-Mobile		8CALL90D	
851.5125	806.5125	Fixed-Mobile	Any Public Safety Eligible	8TAC91	90.16
	SIMPLEX	Base-Mobile		8TAC91D	
852.0125	807.0125	Fixed-Mobile	Any Public Safety Eligible	8TAC92	90.16
	SIMPLEX	Base-Mobile		8TAC92D	
852.5125	807.5125	Fixed-Mobile	Any Public Safety Eligible	8TAC93	90.16
	SIMPLEX	Base-Mobile		8TAC93D	
853.0125	808.0125	Fixed-Mobile	Any Public Safety Eligible	8TAC94	90.16
	SIMPLEX	Base-Mobile		8TAC94D	

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