



Wireless Communications Interoperability

Awareness Guide



Homeland
Security

When a family is trapped in the fiery wreckage of an automobile accident, the seconds it takes to respond are measured in lives. Local, county, and state police officers all rush to the scene. Nearby firefighters and rescue personnel are quickly dispatched to aid in the rescue. Emergency medical technicians care for the injured en route to local hospitals.

No emergency response agency works alone. Joint response is critical. In fact, the ability of the emergency response community to provide a coordinated reaction to criminal activities, fires, medical emergencies, or natural disasters can mean the difference between life and death.

To provide immediate and coordinated assistance, the Nation's emergency responders must be able to communicate with each other effectively, swiftly, and securely. In the mobile environment where emergency response personnel work, radio communication is the lifeline. Without it, both life and property are at significant risk.

What Is Interoperability?

"Interoperability" is the ability of emergency response agencies to talk to one another via communication systems—to exchange voice and/or data with one another on demand, in real time, when needed, and as authorized. The foundation for interoperability, however, is basic communications within emergency response agencies—simple "operability." An agency's first priority must be to provide emergency responders with functioning, agency-specific, mission-critical communications systems. As jurisdictions build new systems or upgrade existing ones, another priority is the provision of reliable and interoperable communications across disciplines, jurisdictions, and levels of government. Emergency response agencies require three distinct types of interoperability—day-to-day, mutual aid, and task force, as described below.

Day-to-day interoperability involves coordination during routine emergency response operations—for example,

"A Message in a Bottle for the 21st Century" August 2005

The complete devastation of the communications infrastructure by Hurricane Katrina left responders without a reliable network for coordinating emergency response operations. Flooding blocked access to the police and fire dispatch centers in New Orleans; neither 911 service nor public safety radio communications worked at full capacity. In addition, Louisiana's 800 MHz radio system, designed as the backbone of mutual aid communications, stopped working, and repairs were delayed for several days. Louisiana State Senator Robert Barham, chairman of the State Senate's Homeland Security Committee, summed up the situation in Louisiana: "People could not communicate. It got to the point that people were literally writing messages on paper, putting them in bottles and dropping them from helicopters to other people on the ground."

“Recipe for Failure” August 2005

Communications problems negatively affected response efforts in the regions ravaged by Hurricane Katrina and hurt the overall national rescue and relief effort. Officials, from national leaders to emergency responders on the ground, lacked the situational awareness needed for prompt and effective response to the catastrophe. In fact, such inadequacy was a recipe for an inefficient response.

“Inaccurate Information Slows Down Rescue Efforts” August 2005

The day Hurricane Katrina hit the Gulf Coast, authoritative reporting from the field in New Orleans was extremely difficult to obtain because of the widespread destruction of communications infrastructure, the incapacitation of many state and local responders, and the lack of Federal representatives in the city. As a result, local, tribal, state, and Federal officials were forced to depend on a variety of conflicting reports from a combination of media, governmental, and private sources, many of which continued to provide inaccurate or incomplete information throughout the day, further clouding what was occurring in New Orleans. In fact, some uncertainty about the specific causes and times of the communications breaches persists to this day.

when firefighters from adjacent counties join forces to battle a structural fire, or when neighboring law enforcement agencies work together during a vehicle chase. It is estimated this form of interoperability makes up 90 percent of an individual first responder’s multi-agency activities.

Mutual aid interoperability involves a joint and immediate response to catastrophic accidents or natural disasters. It requires tactical communications among numerous groups of emergency response personnel. Such operations are usually not planned or rehearsed, but occur in reaction to a specific situation. Airplane crashes, terrorist attacks, forest fires, earthquakes, and hurricanes are examples of mutual aid events.

Task force interoperability involves local, tribal, state, and Federal agencies coming together for an extended period of time in emergency response. Task forces lead the extended recovery operations for major disasters, provide security for major events, and conduct operations in response to prolonged criminal activity.

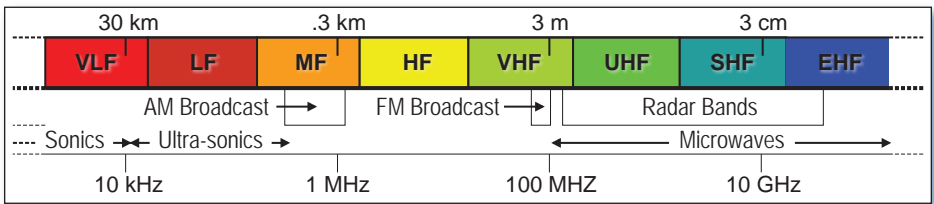
What Is the Problem?

Two 1998 surveys of more than 2,000 emergency response agencies document the major obstacles to interoperability. The law enforcement, fire response, and emergency medical service agencies surveyed rated spectrum and funding limitations as their biggest hindrances. They identified incompatible technologies and the lack of adequate systems planning as additional obstacles. In February 2003, the National Task Force on Interoperability released a 104-page report that verified the four obstacles identified in 1998 and added a human factor to the list—lack of coordination and cooperation.

Spectrum Limitations

Emergency response radio spectrum refers to the location of communications transmission channels, like those on a television. These transmission channels are a finite natural resource—they cannot be created or discovered. In many communities, not enough spectrum is available for emergency responder use in general. Even less is readily available for interoperability. Scarce spectrum results in congested radio channels and increased interference, limiting the communication ability of emergency responders.

Current emergency responder channels are located in several portions of the radio spectrum, resulting in separate spectrum “islands” that isolate emergency response operations and jurisdictions. This fragmentation of spectrum impedes interoperability and joint emergency response. Because no single radio can span all of the emergency response channels, agencies using different portions of spectrum cannot communicate with each other. Responders often must use multiple radios or other ad hoc means of linking communications.



Additional spectrum is needed to meet current communication needs and to support the deployment of new technologies.

Funding Limitations

Many existing emergency response communications systems are more than 10 years old. They cannot support the modern technologies needed for interoperability. Replacement of outdated systems or system expansions are also expensive, and funding limitations for upgrades often prevent emergency response agencies from purchasing the technology and equipment that can enhance interoperability and improve organizational effectiveness. To obtain the necessary funding, emergency response agencies must convince public officials and concerned citizens of the critical need for modern communications.

Incompatible Technologies

A variety of new radio technologies are becoming increasingly popular as agencies plan to replace or upgrade their existing systems. Despite these new technologies, competing equipment vendors continue to manufacture—and emergency response agencies continue to purchase—equipment that is not interoperable. Communications equipment from multiple vendors often uses proprietary and incompatible technology. These

“Lack of Interoperability Costs Lives of Rescue Personnel”

September 2001

After the collapse of the World Trade Center towers, all New York City police officers were ordered to evacuate the area. The fire and rescue personnel, however, did not receive the same order because of a lack of radio interoperability. As a result, while 60 police officers died in the collapse, which was tragic enough, 343 fire and rescue personnel perished. Of these 343, the U.S. National Task Force on Interoperability concluded that 121 were close to an exit and might have survived if they had received the same warning that police officers did in real time.

“Emergency Responders Replace Radios with Runners” April 1995

In the immediate aftermath of the 1995 Oklahoma City bombings, emergency responders used runners to carry messages from one command center to another because the responding agencies used different emergency radio channels, frequencies, and radio systems.

“Ambulance Circles Wounded Officer For 3 Minutes”

January 2002

Because a communications center was swamped, a Campbell County, Kentucky, police officer could not radio for immediate help for a fellow officer who had been shot in the head during an armed robbery. When an ambulance finally responded, the police officer on the scene could not effectively communicate with the driver for three vital minutes to establish the exact location of the incident and the downed officer.

incompatibilities prevent interoperability even when the radios operate in the same frequency bands. Without technical voice and data standards, vendors are producing “closed systems” that can create significant barriers to interoperability for emergency responders. Industry and the emergency response community must work together to foster the development of open standards and compatible equipment.

Lack of Systems Planning

A lack of adequate planning during systems development can also preclude interoperability. Thousands of jurisdictions throughout the Nation will procure replacement systems in the next 5 to 10 years. A broad range of complex architectural, operational, and organizational issues must be addressed in planning system upgrades, including coordinating and sharing resources to develop joint communications systems, developing operational requirements for coordinated emergency responses, and implementing system security measures. It is important that the many jurisdictions replacing their communications systems understand the effects their choices may have on the ability to interoperate with other emergency response agencies.

Lack of Coordination and Cooperation

Some agencies are naturally reluctant to give up any management and control of their communications systems, and this inclination can hamper fundamental coordination and cooperation among agencies and jurisdictions. During critical incidents, providing pertinent information to first responders and other emergency response officials can save lives. The lack of coordination exacerbates current disparities among the emergency response departments in equipment, training, and knowledge. Partnerships must be formed among agencies to share resources for the greater public good.

What Has Been Done?

Several initiatives from all levels of government have been established in recent years to improve emergency responder interoperability. The Presidential Spectrum Policy Initiative seeks to promote economic growth while maintaining U.S. global leadership in communications technology development and services. Emergency

Responder Spectrum Reform and Standards Planning efforts attempt to categorically improve and fully use current spectrum allocations. Communications Interoperability Planning Processes, the Public Safety Architecture Framework, Disaster Management (DM) Data Messaging Standards Initiative, and the Interoperability Continuum provide effective means to foster system planning and partnership. These activities are outlined on the following page.

Presidential Spectrum Policy Initiative

In 2003, the Spectrum Policy Initiative was established by the President to promote the development and implementation of efficient spectrum management. The Initiative has four main objectives: encourage economic growth; ensure national and homeland security; maintain U.S. global leadership in communications technology development and services; and satisfy other vital U.S. needs in areas such as emergency response, scientific research, Federal transportation infrastructure, and law enforcement.

Emergency Responder Spectrum Reform

In 1998, Congress reallocated 24 megahertz (MHz) of spectrum in the 700 MHz band from TV broadcasters to emergency responders. Seven years later, the Digital Television Transition and Public Safety Act of 2005 was signed into law requiring TV stations to vacate the upper 700 MHz band by February 17, 2009. The release of the spectrum will alleviate some of the serious communications congestion emergency responders face.

For years, emergency responder radio systems have experienced increasing levels of interference from commercial wireless carriers operating in adjacent frequencies in the 800 MHz band. Once the source of the interference was identified, the Federal Communications Commission (FCC) ordered the reconfiguration of the 800 MHz band to better organize the different wireless systems operating in it. This “rebanding,” which began in 2004, should eliminate interference to the communications systems of emergency responders.

In 2003, the FCC allocated 50 MHz of spectrum in the 4.9 gigahertz (GHz) band exclusively for emergency responder use. While the propagation characteristics in this band prevent its use in wide area communications

“First Responders Communicate By Yelling” 1995

As floodwaters from the Ohio River rose to record levels in 1995, the Department of Natural Resources, the Indiana National Guard, the State Emergency Management Agency, and local law enforcement agencies fought to protect the lives and the property of people in dozens of southern Indiana communities, towns, and cities. According to the Indiana Department of Natural Resources, communication among the responding agencies was crucial to the rescue effort. However, the only interagency communications were public safety officials literally yelling to each other across the flooded rivers because their radio systems were incompatible.

networks, emergency response agencies can deploy advanced broadband technology to aid in creation of on-scene wireless networks around a person or vehicle. Additional discussions on the configuration of spectrum in lower frequency bands, which would support wide area broadband communications, are ongoing among regulators, stakeholders, and industry officials.

Public Safety Architecture Framework

The Public Safety Architecture Framework (PSAF) provides an industry-validated enterprise architecture that serves as a tool to help the Nation's emergency responder agencies understand the technical requirements and migration path toward fully interoperable communications systems. The PSAF enables this understanding without imposing requirements that stifle innovation. Although the PSAF's fundamental approach will not change, the documents describing the PSAF will evolve as emergency responders provide additional input and as responders gain lessons learned through field application. Moving forward, best practices will be developed to support a variety of applications, including interoperability analysis, gap analysis, systems planning, system migration, business case development, and Request for Proposal development.

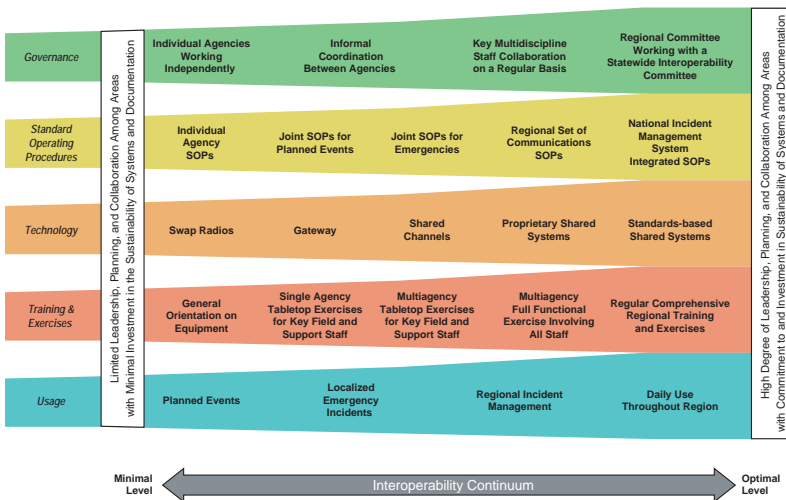


Standards for Broadband Emergency Response Communications

In the past, manufacturers heightened the existing interoperability problem by developing devices based on proprietary technologies. To prevent similar problems in the new 4.9 GHz band, the Telecommunications Industry Association (TIA) TR 8.8 Subcommittee was chartered to produce standards for broadband emergency response communications. These standards leverage existing broadband standards and related technologies to promote interoperability, mobility, and security, and to meet emergency responder expectations. Bandwidth modeling and simulation provides insight to the TR-8.8 Subcommittee and the emergency response community on the adequacy of different frequencies of operation and bandwidth requirements. Parameters for a particular standard, such as power and channel bandwidth size, can be altered in a simulation to refine the network architecture and improve the accuracy of the results. Thus, a more tailored and robust standard for emergency response operations can be formulated and adopted.

Communications Interoperability Planning Process

The Statewide Communications Interoperability Planning (SCIP) Methodology was modeled on a successful strategic planning process undertaken by the Commonwealth of Virginia. It presents a step-by-step process for developing a locally driven, statewide strategic plan for enhancing and promoting voice and data interoperability. The methodology identifies 10 phases and describes in detail the crucial tasks and key considerations for each phase. In addition, the SCIP Methodology offers tools and resources to meet the objectives of each phase.



Interoperability Continuum

The Interoperability Continuum was designed to help emergency response stakeholders address critical success elements as they plan, develop, implement, and broaden awareness for interoperability solutions. To develop robust solutions, officials should follow a framework of five critical elements—governance, standard operating procedures, technology, training and exercises, and usage. The Continuum encourages a shift from a technology-centric focus to a comprehensive operational focus on the key factors for interoperability success. Making progress in all aspects of interoperability is essential because all the elements are interdependent.

This Office for Interoperability and Compatibility initiative enables the emergency response community to

seamlessly share data across different software, systems, and devices by assisting in the development of data messaging standards for emergency responders. When these standards are incorporated into information sharing products, emergency responders are able to exchange vital data as needed, thereby reducing confusion and errors during incident recovery and response.

What Needs To Be Done?

Improving interoperability, and thus emergency response communications as a whole, is a multi-faceted challenge. Congress, regulatory agencies, state and local governments, and the entire emergency response community need to maintain a long-term focus on interoperability as planning and decisions on communications systems take place.

Decision makers must be educated about the need for additional and appropriate emergency responder spectrum, particularly to support interoperability. A continued push at all levels of government for funding is necessary to provide upgrades to interoperable technology and to enable shared systems development. Further, active participation in standard setting initiatives is needed to ensure compatible technology, thereby fostering an open and competitive market that meets emergency responder operational needs. Improved systems planning and the coordinated potential cost and spectrum efficiencies, and for resolving technical, operational, and organizational issues related to interoperability. Perhaps most important, active and constant coordination among emergency response officials and politicians from all levels of government is needed to share information and build on effective solutions.

Why Does It Matter?

Effective emergency response communications is an issue that affects us all. Our police officers, firefighters, and emergency medical services (EMS) must be able to communicate with each other to save lives and protect property. As the Final Report of the Public Safety Wireless Advisory Committee notes: “Unless immediate measures are taken to alleviate spectrum shortfalls and promote interoperability, public safety agencies will not be able to adequately discharge their obligation to protect life and property in a safe, efficient, and cost effective manner.”

For Additional Information

Federal Communications Commission (FCC), Public Safety & Homeland Security Bureau

The FCC's Public Safety & Homeland Security Bureau has information on: spectrum-related issues; hot topics; regulatory actions and decisions; Public Safety Wireless Advisory Committee reports; Public Safety National Coordination Committee reports; regional planning committee actions; radio services and licensing; frequency coordination; spectrum refarming; FCC rules; and other spectrum-related topics. To access such information, call 202.418.1300, or visit: <http://www.fcc.gov/pshs>

U.S. Department of Commerce, National Telecommunications and Information Administration, Emergency Planning and Public Safety Division

For information on emergency response-related spectrum and telecommunications programs within the Federal Government, and Public Safety Wireless Advisory Committee reports, call 202.482.4396, or visit: <http://www.ntia.doc.gov/osmhome/pubsafe/index.html>

National Public Safety Telecommunications Council

For studies, reports, or other information related to emergency response radio spectrum and interoperability issues, call 202.482.1830, or visit: <http://www.npstc.org>

U.S. Department of Justice, National Institute of Justice, National Law Enforcement and Corrections Technology Center

For studies, reports, or a video ("Why Can't We Talk?" When Lives Are at Stake. NCJ-172213) on emergency responder radio spectrum and interoperability issues, call 1.800.248.2742, or visit: <http://www.nlectc.org>

U.S. Department of Homeland Security, Office for Interoperability and Compatibility

For information on interoperability and emergency response communications please visit: <http://www.safecomprogram.gov>

The SAFECOM program absorbed the Public Safety Wireless Network and its initiatives in 2004. The Office for Interoperability and Compatibility's communications portfolio is currently comprised of the research, development, testing, evaluation, and standards aspects of the SAFECOM and Disaster Management programs.

OFFICE FOR INTEROPERABILITY AND COMPATIBILITY

Defining the Problem

Emergency responders—police officers, fire personnel, emergency medical services—need to share vital voice and data information across disciplines and jurisdictions to successfully respond to day-to-day incidents and large-scale emergencies. Unfortunately, for decades, inadequate and unreliable communications have compromised their ability to perform mission-critical duties. Responders often have difficulty communicating when adjacent agencies are assigned to different radio bands, use incompatible proprietary systems and infrastructure, and lack adequate standard operating procedures and effective multi-jurisdictional, multi-disciplinary governance structures.

OIC Background

The Department of Homeland Security (DHS) established the Office for Interoperability and Compatibility (OIC) in 2004 to strengthen and integrate interoperability and compatibility efforts in order to improve local, tribal, state, and Federal emergency response and preparedness. Managed by the Science and Technology Directorate, OIC is assisting in the coordination of interoperability efforts across DHS. OIC programs and initiatives address critical interoperability and compatibility issues. Priority areas include communications, equipment, and training.

OIC Programs

OIC programs address both voice and data interoperability. OIC is creating the capacity for increased levels of interoperability by developing tools, best practices, and methodologies that emergency response agencies can put into effect immediately. OIC is also improving incident response and recovery by developing tools and messaging standards that help emergency responders manage incidents and exchange information in real time.

Practitioner-Driven Approach

OIC is committed to working in partnership with local, tribal, state, and Federal officials in order to serve critical emergency response needs. OIC's programs are unique in that they advocate a “bottom-up” approach. The programs' practitioner-driven governance structures gain from the valuable input of the emergency response community and from local, tribal, state, and Federal policy makers and leaders.

Long-Term Goals

- Strengthen and integrate homeland security activities related to research and development, testing and evaluation, standards, technical assistance, training, and grant funding that pertain to interoperability.
- Provide a single resource for information about and assistance with interoperability and compatibility issues.
- Reduce unnecessary duplication in emergency response programs and unneeded spending on interoperability issues.
- Identify and promote interoperability and compatibility best practices in the emergency response arena.



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