



Can We Talk?

Public Safety and the Interoperability Challenge

*by Brenna Smith
and Tom Tolman*

In their routine day-to-day operations, many public safety agencies can transmit mug shots, fingerprints, and videos of crime scenes to their communications centers. But when agencies from multiple jurisdictions need to mount a coordinated response (for example, during a high-speed pursuit across geographic boundaries), they may not be able to talk to each other via their radios in real time because their separate radio equipment is incompatible. When disaster strikes—a bombing, plane crash, or natural disaster—they even may be forced to use hand signals or runners to relay messages.

In an era when news, data, and pictures can be sent instantaneously to the farthest reaches of the earth, it is hard to believe that police officers, firefighters, and emergency medical service personnel may not be able to talk to each other by radio.

Both the fairly common incident as well as the rare headline-grabbing event (such as the Oklahoma City bombing or Columbine shootings) test the ability of public safety agencies to coordinate and respond immediately. But in many cases, precious seconds can be lost while dispatchers translate and relay emergency communications.

Interoperability is the ability of two or more organizations to communicate and share information (voice, data, images, and video) in real or near real time.

about the authors

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The ability to share information in real time between agencies is called *interoperability*. The basic idea is this: Persons who need to exchange information should be able to do so, even when they are using different technologies from different manufacturers, without the need for custom hardware or software to integrate them all. It's a little like the incompatibilities between various computer operating systems (e.g., Windows, Macintosh, Unix)—but a lot more complicated. Broadly defined, interoperability refers to the ability to transmit all types of communications electronically, including voice, data, and images. This article focuses on one aspect: The ability of public safety agencies to talk to each other via radios.

Why Do We Have This Problem?

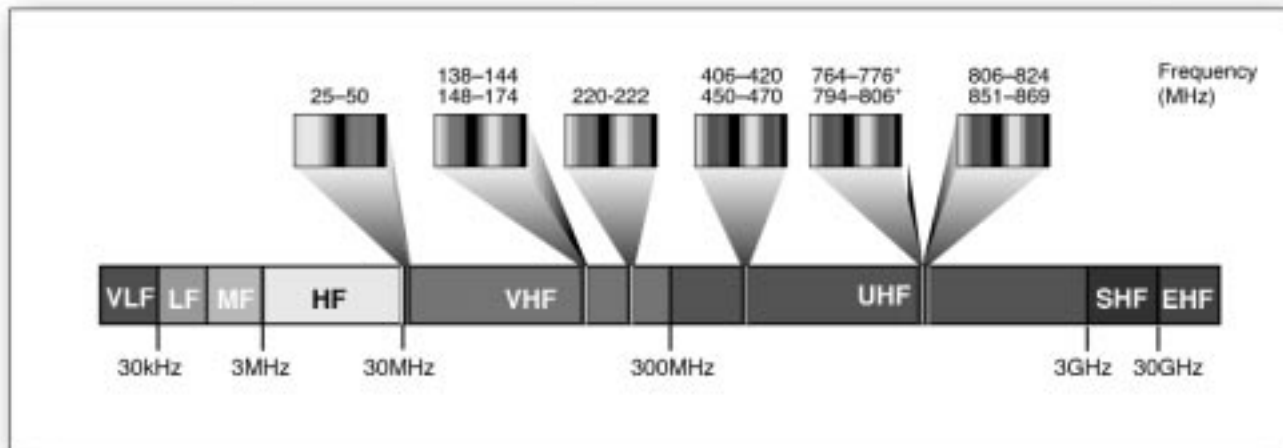
Many factors contribute to lack of interoperability. Public safety agencies report that incompatible radio frequency bands and limited

funding to update equipment are their biggest problems,¹ but John Clark, former Deputy Chief of Public Safety for the Federal Communications Commission, sees the issue in larger terms. Clark says, "The problem with public safety interoperability is a problem of management, leadership, institutional control, and institutional culture."

Limited Radio "Spectrum." In the early years of radio communication, public safety agencies used radio spectrum only for voice transmissions. Today, public safety agencies are using radio spectrum for much more than voice transmissions. Just as consumers can now use their wireless telephones to download their e-mail, so too can police officers use systems originally dedicated to voice transmissions to send crime scene data, videos, fingerprints, and mug shots. The trend toward wireless communications and the convergence of different telecommunication processes is causing more and more "traffic congestion" over the air waves.

Electronic transmissions are sent over a finite natural resource called radio spectrum. John Clark calls radio spectrum the "electromagnetic real estate in the sky." Spectrum is divided into bands, such as VHF and UHF. These in turn are divided into frequencies or megahertz (MHz). For example, 25–50 MHz resides at the lower end of the VHF band while 764–776 MHz resides at the upper end of the UHF band. (See figure 1, next page.)

Figure 1: Public Safety Spectrum Bands



This figure identifies the radio spectrum or array of channels used for communication. The bands used by public safety agency radios are spread widely across the spectrum, making interagency communication difficult. In addition, some contend that not enough spectrum has been made available to these agencies.

Illustration courtesy of the Public Safety Wireless Network (PSWN), from Public Safety and Radio Spectrum Guide. Copies of the guide are available from the PSWN by calling 800-565-PSWN or by downloading it from the Web site at <http://www.pswn.gov>.

Originally, public safety agencies were assigned the lower frequencies and bands. As the lower bands were becoming busy and congested, technology was improving to allow the use of higher bands, and the Federal Communication Commission, which assigns State and local radio spectrum, allotted more spectrum to public safety agencies.

Today, public safety agencies are assigned frequencies across 10 different bands of radio spectrum, from low to high. Unfortunately, affordable technology does not exist to allow one radio to communicate across all the frequencies. Hence, a city's police department may be assigned one frequency while the city's emergency medical services another. The result: They cannot talk to each other. In the Oklahoma City bombing, the city police operated on one frequency, the fire department on another, the county on another, and the State on still another. Mark Schwarz, an Oklahoma City Council member and former president of the National League of Cities, recounts

how at one point during the early minutes of the disaster, the fire department suspected that another bomb remained inside the building and ordered all personnel to evacuate. Only the firefighters got the message immediately. If there had been a second bomb, all the other first responders would have lost precious minutes while their dispatch centers received the fire department message and relayed it over their frequencies.

Diversity and Age of Equipment. More than 18,000 law enforcement agencies and 35,000 fire and emergency medical agencies operate in the United States. Of necessity, the vast majority purchase communications equipment independently of each other. Most of their components are old (20-year-old radios are not uncommon) and work well only with equipment made by the same manufacturer. But even agencies with the newest equipment find that their radios cannot work with equipment from other manufacturers.

Donald Appleby, Project Director of Pennsylvania's Statewide Radio Systems, tells of a jurisdiction that installed seven different types of radios in an ambulance so EMT personnel could communicate with other first responders, like fire and police. According to Appleby, "We had so many radios, we had to color-code the microphones to know which was which." The cost of the equipment rivaled the cost of the ambulance itself.

Coordination and Cooperation. Without doubt, one of the biggest challenges to solving interoperability problems is the organizational and political obstacles of making decisions that cross geographic and political boundaries. It is quite common for one jurisdiction's rules and regulations to conflict with a neighboring jurisdiction. Leaders who want to make strategic plans and cooperative purchasing decisions commonly find coordination to be extremely difficult because of political preferences, competing priorities in resources, and the complexity of varying and some-

times incompatible laws across jurisdictions.

Technical solutions can be attained, but without coordination, cooperation, and planning among agencies, the technologies cannot be implemented to their greatest potential.

Potential Solutions

Although there is no silver bullet or single solution to achieving interoperability, several approaches can foster enhanced communication among agencies. One such approach is the use of digital radio systems. Digital systems improve interoperability indirectly because they generally operate more efficiently with radio spectrum. Digital systems also offer more options or functionality, such as the ability to use “talk groups” that relay information to multiple users at once and improved encryption capability so that information transmitted over digital systems can be made secure. In addition, signals transmitted over digital systems are clearer over longer distances. Michigan is implementing a statewide effort to streamline communication by moving all of its public safety agencies to an 800 MHz statewide digital system. But digital systems only help if they are “trunked” so that users are automatically routed to an open channel and need not wait for an open channel.

Some public safety agencies are trying another approach: Using products and services that traditionally have been sold only to consumers, such as satellite paging systems, cellular phones, and personal communication systems (PCS's) that transmit both voice and data. These alternatives are helping to alleviate existing public safety spectrum congestion and to expand the geographic boundaries of signal areas.

Sharing radio towers is another approach. The city leaders of Upper

St. Clair, Pennsylvania, a suburb of Pittsburgh, have partnered with a commercial radio enterprise to improve interoperability for their public safety services. The city has allowed a commercial enterprise to build a radio tower on a site that would not otherwise be available to them. In exchange for permission to build the tower, the commercial enterprise has agreed to let the city use the tower for police transmissions.

Although there are many issues to be ironed out regarding the use of commercially available services for public safety, some agencies are already putting the benefits into practice. The Alexandria (Virginia) Police Department, for example, is using a commercially available product (called “Cellular Digital Packet Data,” or CDPD) to wirelessly transmit information to and from laptop computers in patrol vehicles.

NIJ's Effort to Support Solutions

The National Institute of Justice, with its history of developing standards for law enforcement products and its close working relationships with State and local public safety agencies, has taken steps to assist in solving interoperability problems.

San Diego County Integrates 12 Agencies. One of the earliest interoperability projects (operational since 1996) connected the dispatch centers (radio communication systems) of 12 agencies operating in San Diego County, including the Border Patrol, Immigration and Naturalization Service, California Highway Patrol, and San Diego Police Department. The Border Tactical Communication System, or BORTAC as the project is called, was undertaken jointly with the Office of National Drug Control

Policy and the U.S. Navy's Public Safety Center in San Diego.

Leaders of the participating agencies engaged in considerable early planning, significant negotiation, and substantial discussion of the tradeoffs before the project could become a reality. Territorial issues, personality differences, and legal and liability concerns all hampered the project. Eventually, off-the-shelf communications circuits and radio system software were used to link the agencies' various radio systems.

Now, with BORTAC in place, officers are able to speak directly to one another, eliminating the need for dispatchers to relay information. Officers in two or more agencies can talk together, and multiple, independent conversations can occur simultaneously. For example, the Border Patrol can talk to the San Diego Sheriff's Department about one matter while the Immigration and Naturalization Service, San Diego Fire Department, and Emergency Medical Service personnel are talking about something else.

Public safety agencies use BORTAC several times each month for an array of activities, including regional auto-theft task force operations, counterdrug sweeps, police pursuits, special cross-border events, and gang suppression. In one case, a felon who had threatened officers with a weapon tried to escape on a motorcycle. Three neighboring agencies were patched through BORTAC and apprehended the suspect without injury to the officers.

The BORTAC model is now being enhanced and replicated in Imperial County and Los Angeles County, California, and in Brownsville, Texas.

AGILE: A Comprehensive Effort. Created in 1998, AGILE (Advanced Generation of Interoperability for Law Enforcement) pulls together all

interoperability efforts within NIJ and serves as the point of contact for coordinating interoperability initiatives with other projects, both within the Department of Justice as well as with other Federal, State, and local agencies.²

AGILE has four main components: (1) supporting research and development; (2) testing, evaluating, and piloting technologies; (3) developing standards; and (4) educating and reaching out to end users and policymakers.

- **Supporting research and development.** AGILE is supporting or “seeding” research and development of interoperability technology in order to expand knowledge of the issues and spawn possible solutions. In 2000, the AGILE team plans to invest in the development and deployment of technologies such as high-bandwidth communications, security, software, wireless communications, and knowledge mining. NIJ anticipates release later this year of a focused interoperability solicitation to address technology research and development gaps.
- **Testing, evaluating, and piloting technologies.** Developing technologies is only the first step. (What’s needed next is to create pilot programs to make sure the technologies work as intended.) One of NIJ’s pilot sites is the Alexandria (Virginia) Police Department. Alexandria is an “operational laboratory,” which means the technologies have moved from the test lab into a real-life, day-to-day setting. The feedback and evaluation from Alexandria’s experience will contribute to a better understanding of the technologies’ impact on policies, procedures, training, organization, and operational readiness. In December 1999, NIJ deployed

a communications switch that links disparate radio systems so that over-the-air communication is now feasible among the Alexandria Police Department’s 800 MHz system, the District of Columbia’s Metropolitan Police Department’s UHF system, and the U.S. Parks Police’s VHF system.

AGILE team members are documenting Alexandria’s response to the requirements of the equipment and the ways the system accepts and manages the transmission of voice, data, and image information. NIJ anticipates that this and other pilot projects will provide information about the lessons learned—both good and bad—from the Alexandria experience.

- **Developing standards.** NIJ has a long history of involvement with the development of national standards for law enforcement.³ Building on that tradition, the AGILE team is identifying existing standards related to interoperability that can be adopted or adapted by manufacturers and public safety agencies. The team is evaluating competing or multiple standards as part of the process of developing standards to fill any gaps.⁴
- **Reaching out through education and outreach.** AGILE’s education and outreach component will entail a public awareness campaign aimed at decisionmakers to emphasize the urgency of the problem, propose solutions, and facilitate multi-agency cooperation.

AGILE also is probing ways to address the coordination and cooperation issues related to interoperability. The team is examining how the use of emerging communications technologies affects Federal,

State, regional, and local operations; documenting how the use of these technologies affects public safety agencies’ training, security needs and policies, procurement, and equipment replacement policies; and providing information to understand the financial impact.

AGILE is a big step forward in collecting, evaluating, and disseminating information about the lessons learned about interoperable technology from a living laboratory. AGILE will inform decisionmakers about issues related to funding, development of standards, and difficulties in procuring and maintaining equipment and will encourage the investment necessary to bring the public more fully into the information age.

The Future of Interoperability

Solving interoperability problems will require different levels of commitment from various user groups and close cooperation and open dialog between regulating officials and the manufacturing community. Solutions also must take into account the substantial embedded infrastructure currently being used by public safety agencies, their unique budgetary constraints, and the critical lack of additional funding available to most agencies.

A number of steps can be taken to enhance public safety communications. The first is a reallocation of spectrum from other uses to public safety use and a more efficient and cooperative use of present spectrum. Greater sharing of resources, such as radio towers and spectrum, both within the public safety community and with other users, will improve efficiency and enhance interoperability.

The creation of standards for communications equipment will go a long way toward fostering

interoperability. But the development of standards is a slow, time-consuming process that must be considered a long-term solution.

These critical areas will require further attention at all levels of government and by all public safety agencies and, as noted earlier by John Clark, a concerted effort to overcome institutional control and culture.

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Notes

1. Taylor, Mary J., Robert C. Epper, and Thomas K. Tolman, *Wireless Communications and Interoperability Among State and Local Law Enforcement Agencies*, Research in Brief, Washington, D.C.: U.S. Department of Justice, National Institute of Justice, January 1998 (NCJ 168945).
2. In addition to AGILE, the other primary Department of Justice interoperability projects include the Global Criminal Justice Information Network, a technology-based approach to helping the justice community share information globally, and the Public Safety Wireless Network, a joint Justice-Treasury Department undertaking to develop a nationwide, wireless telecommunications network for use by public safety agencies at all levels of government.
3. NIJ, for example, was responsible for the development of national standards for body armor and has now issued standards for products ranging from handcuffs to police cars.
4. NIJ is working with organizations dedicated to establishing standards in these arenas, including the Telecommunications Industry Association, the Institute of Electrical and Electronics Engineers, and the Internet Engineering Task Force.

For More Information

- For information about AGILE, contact NIJ staff Brenna Smith (202-305-3305) or Tom Coty (202-524-7683).
 - For information about BORTAC, contact Bob Waldron, Director, NLECTC—Western Region at 310-336-2124.
 - Taylor, Mary J., Robert C. Epper, and Thomas K. Tolman, *Wireless Communications and Interoperability Among State and Local Law Enforcement Agencies*, Research in Brief, Washington, D.C., U.S. Department of Justice, National Institute of Justice, January 1998 (NCJ 168945). This study surveyed thousands of law enforcement agencies; the data and analysis provide a valuable glimpse into the problems State and local agencies face.
 - “Why Can’t We Talk?” videotape. This 13-minute tape for high- to midlevel State and local public officials explores the issue and emphasizes the need for changing the way jurisdictions plan and coordinate the design of their communications systems. Emergency services personnel, police officials, firefighters, and public policymakers relate their experiences with interoperability problems—and their proposed solutions. Free copies are available from the National Law Enforcement and Corrections Technology Center by calling 1-800-248-2742.
 - National Law Enforcement and Corrections Technology Center—Rocky Mountain, *Understanding Wireless Communications in Public Safety*, Guidebook to Technology, Issues, Planning and Management. Obtain a copy by visiting <http://www.nlectc.org/nlectcrm> or calling 1-800-248-2742.
 - A discussion of costs and funding issues can be found in “Report on Funding Mechanisms for Public Safety Radio Communications” (December 1997) and “Report on Funding Strategy for Public Safety Radio Communications” (October 1998). Both reports were prepared by Booz-Allen & Hamilton for the Public Safety Wireless Network and are available at the Network’s Web site, <http://www.pswn.gov>.
- The Bureau of Justice Assistance (BJA) (<http://www.ojp.usdoj.gov/bja>) offers several programs to assist State and local municipalities interested in interoperability:
- The Edward Byrne Memorial State and Local Law Enforcement Assistance Program provides funds through two types of grant programs: Discretionary and formula. Discretionary funds are awarded directly to public and private agencies and private nonprofit organizations. Formula funds, which are awarded to the States, in turn make awards to State and local units of governments.
 - The Local Law Enforcement Block Grants Program provides funds to units of local government to underwrite projects to reduce crime and improve public safety. Public safety agencies have used these funds to upgrade radio systems and improve information sharing.

Web-Based Sources

- Visit the Justice Technology Information Network (JUSTNET) at <http://www.nlectc.org>, or call the National Law Enforcement and Corrections Technology Center at 1-800-248-2742.
- Visit the Public Safety Wireless Network (PSWN) program, a joint initiative of the Departments of Justice and Treasury at <http://www.pswn.gov>, or call PSWN at 1-800-565-PSWN.
- Visit the Federal Communications Commission’s Wireless Telecommunications Bureau at <http://www.fcc.gov/wtb/publicsafety>, or call the Bureau at 202-418-0680.