Executive Technology Brief

For Public Safety Executives and Elected Officials

A program of the National Institute of Justice

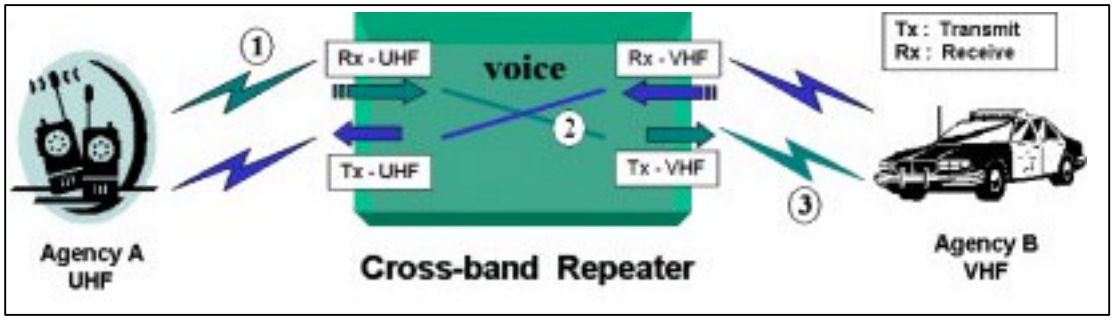
Crossband Repeater Systems

Key points:

- **Crossband repeater systems provide voice interoperability by receiving a radio transmission on one agency's frequency, and rebroadcasting the audio to one or more other agencies on their respective frequencies.**
- **There are two basic approaches to receiving and transmitting radio calls in a crossband repeater system: over-the-air or via a telephone connection.**

A critical issue facing public safety today is the inability to establish direct radio-to-radio communication with other agencies when responding to critical incidents (see the Executive Technology Brief on Communications Interoperability). One approach to addressing this challenge is through ***crossband repeater systems***. Such systems can range from simple mobile repeaters to complex gateway communications systems. They are all based on the general principle of using a system that receives a radio transmission on one frequency and transmits the audio to one or more other agencies using the frequencies of the other agencies' radio channels. (The term "crossband" indicates that these devices most commonly are used to rebroadcast a transmission in a different frequency band; however, such devices can also rebroadcast within the same frequency band. The concept of operation is basically the same regardless of whether the rebroadcast frequency is within the same band or in a different band.)

The simplest crossband repeater system is a two-channel crossband repeater. These devices connect two radios operating at different frequencies. As shown below, (1) transmissions are received on one frequency, (2) routed to the transmitter at the second frequency, and (3) rebroadcast. This is known as a ***connection*** between the radios. Each radio is set to a specific channel of that agency's system, which determines the actual frequency on which a transmission is broadcast. Some agencies use crossband repeaters in cars to link handheld radios that operate at one frequency (e.g., VHF) with car-mounted radios that operate at a different frequency (e.g., HF). Crossband repeaters are also used to link VHF systems with UHF systems.



Crossband repeater interconnect systems expand this capability to receive transmissions at any of several frequencies, and rebroadcast audio on one or more other radio systems operating at other frequencies. Connections can be made among three or more radio channels, for a "conference call" capability. Multiple connections can also be made concurrently (e.g., there is a connection between Agencies A and B, and at the same time there is a separate connection between Agencies C and D).

Crossband repeater interconnect systems can be deployed in mobile units, which is useful when multiple agencies are responding to a critical incident (such as a natural disaster, fire/explosion, or major planned event.) Radios for each responding agency are connected to the repeater interconnect system, allowing connections to be established among the responding agencies.

Repeater interconnect systems can also be established as part of a fixed communications infrastructure. The advantage of this approach is that it provides an ability to establish a connection without requiring the interconnect system to be deployed. This is an important capability for events that require immediate interoperability, such as a vehicle pursuit. A fixed-site system also can be used to support response to incidents listed in the preceding paragraph.

There are two basic approaches to fixed-site interconnection systems. The difference in the approaches is how the transmissions arrive/leave the interconnect system. One approach is over-the-air through radios that are connected to the interconnect system. This approach is similar to the mobile approach discussed above, but with the interconnect mounted in a fixed location and using existing communications infrastructure (repeaters, antenna sites).

The alternative approach involves connection with the central crossband device via landlines. Each agency connects to a central processing site via dedicated telephone lines, which connect the radio systems of the participating agencies. When one agency requests connection to another, the patch is made at the central hub connecting the dedicated circuits. Once connected, each agency dispatch center can link the circuit to a specific channel of the agency's radio system. Once these connections are made by each agency, officers of the agencies can communicate directly in the field without requiring relay of information by dispatchers.

For more information:

AGILE: Interoperability Strategies for Public Safety Website: www.agileprogram.org {the *Operational Test Bed—Alexandria (OTB-A) Communications Interoperability Gateway Subsystem Description Document* describes in detail a fixed site over-the-air deployment in Alexandria, Virginia}

Interoperability Resource CD-ROM, request via email askagile@ojp.usdoj.gov, or call 1-202-514-5687.

Information on a landline approach can be found on the Web site of the Office of National Drug Control Policy Counterdrug Technology Assessment Center at http://www.epgctac.com/wireless.htm.

Or contact a regional National Law Enforcement and Corrections Technology Center:

Northeast (Rome, NY)	888-338-0584

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Southeast (Charleston, SC)	800-292-4385
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The Executive Technology Brief series was created at the request of the Law Enforcement and Corrections Technology Advisory Council (LECTAC) to provide public safety executives and elected officials with a basic understanding of specific technology-related issues and activities. LECTAC is comprised of a cross section of public safety officials representing State, local, and Federal agencies that help to address the technology needs of their constituency. LECTAC's guidance and input was critical to the development of these briefs.