Section 1: The Framework: How You Fit In

Topic 4a

Partner Agencies and Organizations Communications Systems

Objectives

Welcome to Topic 4a.

Emergency communications volunteers may be asked to use the partner agency's own communication systems. This topic will familiarize you with some of the systems you are likely to encounter.

Student Preparation required:

Be familiar with the Continuous Tone Coded Squelch System (CTCSS), also known by various common trademarks, including Private Line (PL) and Channel Guard. (Private Line is a trademark of Motorola, Inc., and Channel Guard is a trademark of General Electric/Erickson.)

Introduction

Most partner agencies will have their own communications systems and equipment, ranging from modest to complex. In our ever-broadening role as emergency communicators, we may be asked to operate some of this equipment. If this occurs, you must become familiar with its operation. Your emergency communications group should work with the partners well in advance to determine whether the partner will need you to use its equipment, and under what conditions. Many of these radio systems are quite different from ham radio, and special training may be required. In addition to different equipment, on-air procedures will differ considerably. Training and drills may be necessary to make Amateur Radio emergency communications operators proficient.

State and Local Government Radio Systems

These systems include those licensed to police, fire, sheriffs, highway, and other state, county, or city departments. If you are asked to use any of these systems, be sure to learn their standard operating procedures and phonetic alphabet system (if one is used), and adapt accordingly.

Some departments may use familiar ITU phonetics, some will use APCO phonetics, and still others will make them up as they go along. A few departments still use a “10 code” or something similar, but most are moving away from special codes in favor of plain language. Be careful not to lapse into a ham radio operating style. Casual conversations are prohibited by FCC rules and are usually not permitted by the partner. All transmissions must be directly related to the partner’s mission.

You should be familiar with the established interoperability channels for public safety communications. Interoperability channels for police and fire exist in the VHF low band between 39.46 MHz and 45.88 MHz, and in the VHF high band between 151.1375 MHz and 159.4725 MHz, both near Amateur Radio bands. There are also interoperability channels in the UHF bands. More information on interoperability channels and public safety communications can be found in the National Interoperability Field Operations Guide (NIFOG), available through the Department of Homeland Security (DHS) Office of Emergency Communications.

Medical Radio Systems

In order to standardize emergency medical radio systems across the country, the FCC has assigned a number of dedicated frequencies. In theory, every ambulance in the country should be equipped to use all these frequencies. In practice, true compatibility is usually limited to a specific region.

The older system, often called “Med Star,” used 10 simplex VHF frequencies with a dial-type pulsed-tone encoder to signal specific hospitals. This system is still in use in some rural areas, but it is quickly being replaced by systems that are more modern. The newer Emergency Medical Radio Service uses 10 UHF duplex frequency pairs — one assigned to the hospital, the other to the ambulance and seven VHF simplex channels. The UHF channel sequence is designated “Med 1” to “Med 10.”

Other systems, such as ReddiNet, are found on the West Coast.

In some cases, the hospital's radio is located on a nearby mountain or tall tower in order to achieve the required coverage and connected to the emergency department by a radio or telephone link.

It's a good idea to learn what your area hospital uses before any emergency occurs.

American Red Cross (ARC)

ARC has a nationally licensed frequency (47.42 MHz) that can be used by all ARC chapters, and is intended primarily for disaster or emergency operations. This common channel ensures that ARC units responding from various chapters will be able to communicate with each other. Some chapters also use 47.50 MHz. In addition, certain chapters may rent space on commercial systems or license their own VHF or UHF systems for day-to-day operations.

Types of Served Agency/Partner Radio Systems

In larger jurisdictions, each partner will probably have its own radio system completely independent of all other radio users in the same area. This is especially true of large city and state police and fire radio systems. Many agencies have more than one channel, each assigned to a different purpose. For instance, a fire department might have a "dispatch" channel, and one or more "fireground" channels. This allows local operations at a fire scene to be kept separate from ongoing dispatch operations. A police department may have a separate channel for detectives, or one for each precinct. These systems may be on repeaters or use simplex frequencies.

The FCC allocates specific radio frequencies to different types of agencies, and some for multi-partner use. For instance, a frequency designated for use by police agencies may only be used for police business. The same is true of fire radio allocations. "Local Government" allocations may be used for any legitimate local government function.

In addition to "simple" systems in which each user group has its own frequency, there are two different types of systems that allow multiple user groups to share resources. These are known as "community repeater systems" and "trunked repeater systems".

Community Repeater Systems

Unlike Amateur Radio repeater systems, a "community" or "shared" repeater uses a different CTCSS tone for each of several user groups. For instance, a city might have one repeater shared by the water, public works, and sanitation departments, licensed as a single "local government"

radio system. Because each department uses a different CTCSS tone, they will not normally hear one another's conversations, but only one department can use the system at any given moment. Some very small rural towns may even combine fire and police department operations on the same system, on either a repeater or simplex frequency.

When using any shared frequency — repeater or simplex — it is important to press the "monitor" button for a moment before transmitting. This disables the CTCSS decoder, temporarily allowing you to hear any transmissions being made on the frequency. Some mobile radios automatically switch to "monitor" mode when the mic is removed from its hang-up clip. In this way, you can be certain that no one else is using the channel before you make your call.

In an emergency situation, these shared channel systems can quickly become overloaded. A common practice is to end all non-essential communications or perhaps move them to an amateur system instead.

Trunked Repeater Systems

Trunked systems provide an efficient means for several "low volume" users to share a single radio system. They use several co-located repeaters tied together, using computer control to automatically switch a call to an available repeater. When one radio in a group is switched to a new frequency, all the others in the group automatically follow. This is accomplished by having a computer controller move the conversation from frequency to frequency in accordance with a pre-established algorithm. The number of available frequencies in the system depends on its design and the number of different user groups. Channel switching and assignment data are transmitted on a dedicated channel. Unlike a shared single-frequency repeater system using multiple CTCSS tones, a trunked system will provide almost instant on-demand clear channels in normal usage. Amateur Radio does not currently use this type of system.

In emergency situations, however, most trunked systems suffer from a lack of reserve capacity. To keep designs cost-effective, there are always many more user groups than available channels. The number of available channels is designed to handle the normal day-to-day communications load. When an emergency occurs, these systems can be quickly overloaded with calls, and finding a clear channel can be difficult or impossible.

One "solution" to this problem is to assign certain users or user groups "priority" over others. If all the available channels are occupied, a higher priority user will bump the lowest priority user off the system and take over the channel. Priority status can either be full-time or turned on in an emergency, depending on the system's design.

APCO Project 25 Radio Systems

In the 1990s, a new public safety radio system was developed to deal with problems of interoperability between agencies with different radios. The Association of Public Safety Communications Officials (APCO) created the Project 25 working group, which created what has become known as the Project 25 (P25) Standard.

P25 radios are extremely flexible, with both forward and backward compatibility. This means that they can be configured to operate in both analog and digital modes, and as part of trunked and conventional radio systems. P25 radio systems are becoming more common across the country as federal funds become available.

The advantages of P25 systems are obvious. Radios from several manufacturers can be programmed to communicate with each other seamlessly, as can radios from different agencies and jurisdictions. Digital modes can offer excellent audio quality under the right conditions, and optional encrypted modes offer message and data security. The disadvantages are less obvious. While P25 digital systems work well in urban environments, they are not as effective in rural or mountainous areas. Some agencies have resisted the use of digital modes because of higher signal-to-noise-ratio requirements. While analog signals can fade in and out, digital signals are either there or they're not, just like a digital cellular telephone signal. Further, the lengthy development time of P25 has led to the deployment of numerous proprietary solutions by commercial manufacturers, a result that works against true interoperability.

Telephone Systems

Telephone systems in use by public service agencies vary greatly. The partners should be able to provide training in their use. Most telephone systems come with user manuals, and if possible, a copy should be included in your group's training materials.

Most business telephone systems allow the following basic functions, with which you should be familiar:

- Answering incoming calls
- Placing outside calls
- Placing and answering intercom calls
- Making "speed dial" calls
- Overhead paging
- Placing calls on hold, and then retrieving them
- Transferring calls to another extension
- Transferring calls to voice mail, if available
- Retrieving calls from a voice mailbox

There may be other, more advanced functions available, but in most cases, you will not need to learn them for temporary operations. However, it is always a good idea to keep the user's manual nearby. You should also try to determine the extent to which the partner's telephone system is dependent on or susceptible to fluctuations in commercial power.

Satellite Telephones

Satellite phones and data terminals are becoming more common among served agencies as the cost of ownership and airtime decreases. Satellite telephone/data service is offered by a number

of companies, including Inmarsat, Iridium, and Globalstar. Some of the services cover much of the Earth's surface, others only certain regions.

Some phones or terminals require that an antenna be pointed directly at the satellite, others do not, but all require line-of-sight to the satellite. Some are handheld; others are contained in briefcases and must be set up before operating. In addition to voice communication, some companies offer paging, fax, and data transmission, albeit at speeds slower than a typical land-based dialup connection. A few phones also integrate a terrestrial cellular phone in the same unit.

Calls are typically expensive, as compared to cellular telephone calls. All calls made through these systems are considered to be "international" calls, and each company has one or more "country codes." If you need to use one of these phones, keep conversations short and to the point. While most of the phones are fairly simple to use, due to the wide variety of phones and services, it is essential that users be fully trained in their use.

In addition, there is some concern that the number of satellite telephones sold far outstrips the number of satellite channels available, so system overload remains a real possibility in a widespread incident.

Satellite Data Systems

Satellite systems in use by public service agencies also vary greatly. Some are used for two-way data and voice communication, others for one-way reception of voice, data, or video. One popular system is the NOAA Emergency Management Weather Information System (EMWINS), which allows emergency management officials to obtain up-to-the-second weather maps and information. If you were trained on the system years ago, you will need to be retrained, as it has changed and upgraded. As with many other partners' systems, the partner will need to provide prior training in their use if they want you to be able to operate this equipment in a crisis.

Other Partner-Owned Equipment

In addition to radio and telephone systems, you may need to use fax machines, copiers, computers, and similar devices. Because many of us use these items every day at work, learning their operation should not be a problem in most cases. However, some copiers and computer programs are quite complicated and may require instruction in their use. Computer software used in public safety applications is usually specially written for the purpose and may require extensive training in the rare situation when you will be required to use the system.

Reference Links

APCO
https://www.apcointl.org/

FCC — Public Safety & Homeland Security Radio Service
www.fcc.gov/homeland/

FCC Rules — Ham Radio
http://www.arrl.org/part-97-amateur-radio

National Interoperability Field Operations Guide (NIFOG)
https://www.dhs.gov/publication/fog-documents

Project 25
http://www.project25.org/

Review

While some partners' systems may be familiar to Amateur Radio operators, others are not. Both equipment and procedures may vary greatly. If a partner expects its emergency communications volunteers to be able to operate any of its systems, specific training should be provided in advance.