The Future of Wireless Two Way Communications for Public Safety 101

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Abstract

Public safety agencies across the country are spending millions of dollars each year on new wireless communications systems. These systems can truly be the lifeline between a law enforcement officer, paramedic or firefighter and the rest of the world, while working under the most difficult of conditions. The failure of a radio transmission to get through can literally mean the difference between life or death. To better understand these complex systems, several systems by multiple vendors were examined to provide a basic, non-technical introduction for the public safety administrator or government official who may be considering the purchase of a communications system based on trunking technology.

Introduction

Just as the telephone is basic and vital to today's society, so too is the two-way wireless radio communications device of the public safety official. Wireless communications direct the paramedics to the sick or injured, as well as the law enforcement officers and firefighters to the scenes of emergencies. It serves as an equally important life-saving link to the rest of the world when things go wrong. In the same way that our communities grow and we find we must add telephone numbers and area codes, our need for advanced public safety communications grows.

Research Problem

The increasing demands placed upon public safety officials quickly diminish our ability to communicate. Radio systems currently used by public safety agencies are severely crowded, lack interoperability, have less than optimal transmission and reception quality, as well as limited service feature options (F.C.C., 1996). Commissioner Chong of the Federal Communications Commission has stated that "{t}his inability to communicate hinders cooperation and coordination between public safety agencies on a day-to-day basis as well as during emergencies. We believe that the present inability of public safety agencies to communicate with each other is one of the most critical deficiencies in today's public safety communications." In many jurisdictions wireless communications systems are being described as antiquated, overtaxed and unreliable. Jurisdictions throughout the country are unable to meet their communications needs of today, much less plan for the future.

A few agencies in the State of Florida have replaced their old systems with modern 800 megahertz (MHz) "trunked" equipment in an attempt to correct these deficiencies. These systems, complex in nature and expensive, require a careful step by step selection and purchase process to ensure that a government agency obtains the quality communications system it desperately needs. Terms such as "multi-cast", "simulcast", "analog", "digital", "trunking", "phasing", "telephone interconnect", and many others that are proprietary to specific manufacturers can leave a public safety official about to make a multi-million dollar decision confused and frustrated. These and other

terms used in describing the new technology are further explained in the attached glossary. Instead of technical terms, this glossary is written in layman's (public safety administrator's) terms.

One of the primary questions this research intends to answer is why agencies are spending millions of dollars to purchase these new radio systems. In response to a survey (appendix A), 89.5 percent of all public safety agencies have identified crowded frequency spectrums (lack of additional channels) and/or a lack of interoperability (direct communications between two or more public safety agencies) as their primary reason. During daily operations it is commonplace for one public safety agency to lack direct two-way radio communications with another agency that shares its border. Just as common are jurisdictions where the local public safety officials do not share interoperability within their own communities (F.C.C., 1996). Cross-agency communication is a necessity in events requiring massive response by multiple public safety agencies and personnel, e.g., a hurricane, a plane crash, hazardous material spill, or something as commonplace as a college football game. As stated in the August 8, 1996 joint press release of the Federal Communications Commission (F.C.C.) and the National Telecommunications and Information Administration (N.I.TA.), "not only does the shortages of spectrum jeopardize the lives and health of Public Safety officers, it threatens their ability to fully discharge their duty to protect the lives and property of all Americans". To overcome these obstacles many agencies have chosen to install two and three different radio systems in a single vehicle and require a field supervisor to carry multiple portable radios at the scene of an emergency. Although this solution partially addresses the need to communicate, it is far from practical or efficient. Public safety agencies, as with most government agencies, are unable to keep up with changing technology for many reasons, but the primary reason is cost.

This research will address some of the more frequent and common mistakes made by agencies when researching or implementing a new communications infrastructure. The traditional role of wireless communications in the eyes of the public safety official in the field is that when the official pushes the button he or she is able to talk to someone else. As technology has evolved, the distance of this conversation has been extended from a few blocks away, to city, county, statewide and beyond. Technology now takes us beyond verbal communications to include data, photographs and live images. The portable radio holstered to the belt of today's public safety official may include a digital display status screen, emergency beacon and locator, and the ability to change the official's work status with the push of a button. These devices incorporate advanced computer technology far beyond what was available just a few years ago.

With the technology and abilities 800 MHz trunking communications has to offer, it sounds like the panacea of our communications needs. Seemingly, all government has to do is to tighten its belt, save up the money and all of its communications needs are answered. Not so. No longer can you just push the button and start talking. In addition to the expense there are new requirements of the operators in field and communications centers that must be learned and accepted.

Another serious consideration for the public safety administrator is the incompatibility of one manufacturer's radio with that of another. Most radio systems in the field today using trunking technology are incompatible with those manufactured by

other companies. Simply stated, a Motorola 800 MHz trunking radio often cannot communicate with one that is manufactured by Ericsson or E.F. Johnson even though all three have the ability to transmit and receive on the same frequency. Although all three vendors manufacture a very capable product and are considered “big” in the public safety communications industry, they do not share the same operational technology. Although efforts are being made at the government and industry level to make systems intercompatible (in accordance with Association of Professional Communications Officials (A.P.C.O.) Project #25), it is still possible to buy a system and have no other alternative but to continue to purchase from that same vendor for all of your future communications needs.

Officials from throughout the country have expressed great concern for personal safety as a result of the switch to this new technology. Sensational newspaper headlines which read *County Radio System a ‘Lemon’* (Daytona Beach News Journal, September, 1996), *800 MHz Radio System Fails Firefighters Again* (Daytona Beach News Journal, March 1997), and *Chief chucks out new radio system* (Milwaukee Sentinel, March 1994) bring these multi-million dollar expenditures under great public scrutiny and cause public safety personnel on the streets of our communities to question the decisions of their bosses out of a fear for their own safety. Complaints of coverage deficiencies, delays in broadcast and missed communications are commonplace in many public safety agencies. Remove the system’s ability to facilitate a basic two-way conversation and the system becomes useless, regardless of how technologically advanced it may be.

It is sad to think that we live in a society which is so technologically advanced that we are able to control the actions of a robot on the surface of the planet Mars, but a law enforcement officer, firefighter and a paramedic all involved in the same emergency are often unable to communicate directly with one another. In total fairness other, although far fewer, articles praise the effectiveness of these same systems. As reported by the Daytona Beach News Journal in quoting Edgewater City Manager George McMahon, without the 800 MHz system “we’d have had chaos for hours” when describing the response to a tornado’s impact to his community (Daytona Beach News Journal, October 1996).

This research project will attempt to answer the following questions concerning this technology’s suitability to the public safety environment:

(1) Why should public safety agencies abandon their older radio systems for 800 MHz trunking technology;

(2) What are the most common problems being experienced when an agency switches to this new technology;

(3) Are cost overruns and installation delays commonplace or merely isolated aberrations/exceptions; and

(4) Are agency administrators and field personnel satisfied with the communications systems described as the latest in technology?

This research will describe the benefits and disadvantages of 800 MHz trunked communications in the public safety arena.

Background

Early forms of public safety two-way communications included ringing the fire bell to summon the firefighter or flashing the street lights to signal the police officer on the street to call his dispatcher. The earliest forms of wireless two-way radios quickly grew from what many considered a luxury item to one of necessity. Most public safety entities have traversed the spectrum of communications from VHF low band to high band, UHF high and low band, and now trunked communications. Some communications systems are over 30 years old and subject to frequent breakdowns, such as in Babylon, New York. The F.C.C.'s understanding is that a system should last for approximately 15 years (F.C.C., 1996).

Traditional radio systems require assigned frequencies to transmit and receive communications. When not in use these frequencies cannot be utilized by other agencies in the general proximity of the licensee without causing interference. Many systems require their own infrastructure which may include repeaters, towers and other support equipment. In most communities totally incompatible systems are duplicated for law enforcement, fire rescue, and local government operations. Trunked communications systems are better able to utilize each frequency by sharing them among many agencies or multiple departments in a single community.

Method

It was first necessary that the research identify a wide selection of current users of trunking technology. Although several companies are entering this area of communications this research focused on Motorola, GE Ericsson and E.F. Johnson (recently purchased by Transcript International) as three of the largest suppliers of public safety communications systems. All three manufacturers were responsive to the inquiry and supplied a list of their more recent public safety customers. Surveys were sent to 11 customers of each of the three largest vendors. Although the information in the response was found to be very helpful, the contact list it created proved to be most beneficial.

While conducting this research I was also afforded the opportunity to attend the 1997 International Conference of A.P.C.O. in Charlotte, North Carolina. Although much of this conference is directed to the technical staff, the break out sessions and access to manufacturers and private consultants was found to be extremely beneficial. Still, on site visits to several agencies within the State were found to be the most helpful in my endeavor to better understand this rapidly changing technology.

Technical documents and "experts" are bountiful in the communications industry and although they are vital they left me even more confused. Listening to a conversation between two of these "experts", you will feel as if you had landed in a foreign country where you do not understand the language or know the customs. Include a sales representative in the conversation and not only do you not understand what is being said, it may cost you a small fortune. The subtitle of this research could just as easily be "New Radio Systems for Dummies" (in which I can be included).

Results

Introduction to "Trunked Communications"

Trunked communications have been around for decades, the first systems being developed and deployed by the telephone industry. Unlike systems that assign a number of frequencies to each entity, fewer frequencies can be assigned as a group and are more efficiently utilized. Picture yourself making a telephone call. When you are through, the same telephone line used to carry your conversation is now available for your neighbors' call. Efficiency is greatly increased thus reducing the need for a separate phone line (or frequency) for each telephone call to or from a certain number (Rybicki/Taylor 1980). Trunked technology will allow entire units of government that may include law enforcement, fire rescue, public works, road departments, building inspectors, school boards, and so on to work off of a single infrastructure (repeaters, towers and control equipment) sharing common frequencies, thus increasing frequency efficiency while reducing incompatible duplication of multiple infrastructures.

Trunked communications systems are all designed in one of two formats. The first, a "Multi-Site", consists of two or more individual "cells" that operate independently of each other. For example, the Martin County, Florida, system has 14 assigned channels that are divided between 3 tower sites. Although these systems are considerably less expensive than their counterpart ("Simulcast") they do not provide the seamless, wide area coverage needed by most jurisdictions.

By comparison a "Simulcast" system duplicates each site (tower) with an equal number of repeaters operating on the same channels. In this design each tower site allows each transmission to be repeated simultaneously on the same channel throughout the system.

Radio system features found in trunking technology systems include telephone line access from the field, private or semi-private communications between two individual radios, and the availability of multiple levels of talk groups (formerly called "channels"), for as few or as many users as desired by the unit of government. A "talk group" can best be described as an old fashioned "party line" on the telephone systems of 20 or more years ago.

Mr. Ed Howard, Vice President of Hayes, Seay, Mattern and Mattern, Radio Consultants, outlined some of the many advantages for agencies considering a change to trunked technology. These include less noise (static), reduced external interference and the reduced likelihood of being monitored by scanner. Mr. Howard was also quick to point out that monitoring 800 MHz trunked systems that do not have encryption capabilities is not impossible (personal interview September 4, 1997). Other user options include a "panic button" which field personnel can use to transmit an emergency help signal.

Unlike conventional radio systems (1 frequency, 1 channel) access to a pooled frequency is determined by a computer when a user depresses their "push to talk" (PTT) button. Each time the PTT button is depressed the next available frequency is assigned to that conversation. The computer also identifies each user in a talk group and assigns the same conversation to those radios as well.

Using "talk groups" instead of traditional channels has also proven to be extremely spectrum efficient. Mr. Dick Williams, Radio System Manager for Pinellas County, Florida, described their system as a 43-channel system, operating from 8

transmit sites serving 5,600 radios in the field (personal interview June 1997). An additional 400 users will be brought on line within the coming year. With this many users there is always a concern that a channel will not be available when needed. Although this is possible, Mr. Williams does not recall the last time the system responded with a "busy" signal. Mr. Williams also stressed the importance of "system access priority". In layman's terms, all of the systems currently on the market are able to give users a level of priority when requesting a channel. For example, a public safety official's emergency indicator button would be assigned the highest access level to the system, and a road grader would have a lower priority access. If for some reason the system was operating at 100% capacity, access for the next available channel would be granted based on the users predetermined priority level.

A well-designed system should seldom if ever reach its maximum operating capacity. Daily operations should tax approximately 30% of a system's potential and reach approximately 80% during peak times (Forrest, 1992). The remaining 20% should only be needed to allow for disasters.

Why an administrator would want to seriously consider changing an agency's entire radio system is simple. Frequencies to allow an agency to add additional channels to their current radio system are simply not available. Administrators wishing to increase their radio system capabilities have little choice but to abandon their current system for one based on this technology. One of the biggest single advantages to trunked communications is that an agency or unit of government is able to greatly expand its ability to communicate. For example, a police department that currently operates off of 2 or 3 channels is able to expand their system to 10, 15 or even more talk groups with the trunked technology. These talk groups can allow additional car to car communications for field personnel, administrative and specialized group activity, and teletype communications while greatly reducing the volume of radio traffic on the primary dispatch channels.

Reduced interagency interference is another major benefit as a result of this technology according to Mr. Howard **(**personal communication September 4, 1997). Due to design specifications, power output, and tower location, an agency is less likely to hear the communications of another agency "bleeding over" onto their conversations.

Disadvantages of 800 MHz Trunked Communications

Of those agencies surveyed, 58.5% responded that they were "very satisfied" with their 800 MHz radio system. Unfortunately this equates to odds slightly better than that of a toss of the coin to gauge success. A few agencies responded that although they were satisfied with the system it still needs work. In two major systems currently under construction (and long past their originally contracted completion date) the level of confidence by the agency has greatly diminished over the past year. It is also important to examine who is expressing what level of satisfaction for the radio system. For the purposes of this research the percentages reflecting the level of satisfaction were based on the written "official" response of those agencies surveyed. However, in speaking with members of the different agencies operating at different levels within those agencies it was common to find that radio and information system managers, agency administrators and field level personnel often do not share the same level of satisfaction.

Those agencies responding with concerns focused their issues primarily on delays in installation and coverage deficiencies. It was also common for agency representatives to be hesitant in expressing their concerns, while maintaining optimism that the problems they were experiencing would be corrected by their vendor.

Credit must also be given to all three vendors for striving to deliver an acceptable system. Although deficiencies were identified in systems sold by all three vendors, insufficient data was collected to imply that any one system proves to be any more reliable than its competition. It was also common to find systems that were being expanded and modified all at the vendor's expense. Of those agencies responding to the survey only two exceeded the original budget estimate, both by a minimal amount when compared to the size of the project.

In every system there is a period of time needed for adjustment and fine tuning. Unfortunately some of these delays have continued for as long as three years beyond the originally contracted date of completion. In many cases this results in either an agency switching back and forth between systems, or if they failed to maintain their old system, relying totally on a system that is not fully functional to the users' satisfaction.

Discussion

Important Steps to a New Radio System

The following is not intended to address such things as the type of system, whether or not a consultant is needed or what design to use. Instead, it should serve as a reminder of mistakes made by other agencies that unfortunately learned the hard way.

The first step towards a new system is to conduct a complete evaluation of the current one, answering the following questions: Who needs to talk to whom? Where are the blind spots? Why are you considering making a change? Although these seem like simple issues all too often they are overlooked.

Just as important as the evaluation is who is performing it. Many radio systems are "managed" by individuals outside of the administrator's span of control. Others may be managed by in-house staff with little or no actual field experience. Each and every agency should survey its own needs and formally document these needs prior to meeting with other system users. Equally important is who participates. For this, most agencies use their "technical staff" or research and development personnel but overlook the most important users of the system, the street level personnel. Each officer, deputy, firefighter, building inspector, and dispatcher needs to identify weaknesses and blind spots in the current radio system. By doing so not only does an agency back up later technical studies, this process also clearly states that the end users and the job they do is the most important component of the system.

The next step should be to meet with the other agencies and establish a local users radio advisory group. In addition to the technical staff, representation needs to again include field level personnel. Not only will these steps help to instill "ownership" in the users but also it will greatly reduce rumors and misinformation from undermining the administrator's desire to provide a quality communications system.

Another common mistake is an agency "rushing" to convert to the new system. In many cases user equipment for the old system is removed from vehicles and communication centers prematurely. Although the loading and complete utilization of a new system is vital prior to acceptance, old systems should remain as a backup for as

long as possible. In some cases 3 years or more have passed since the 800 system was installed and "turned on" but local governments have yet to accept the final product.

System coverage is one of the great paradoxes of 800 MHz trunking technology. Every public safety official, from street level personnel to the chief, wants a radio system that will cover every square inch of their response area. In layman's terms, it seems simple to build higher towers and increase power output to saturate the area with as much radio signal as one could afford. If frequencies were unlimited and not duplicated in other areas this might very well be the solution. However this is not the case.

Under the guidance of the FCC, the National Public Safety Planning Advisory Committee (NSPAC) was tasked with the responsibility of developing a plan for utilization of the new 800 MHz frequency spectrum (Law Enforcement Communications Plan, 1995). Two broad objectives of this plan were interoperability between communications systems and efficient use of the spectrum. Part of this plan was to eliminate, to whatever degree possible, the interference on a radio system caused by another public safety system sharing common frequencies. The task of the radio system design then became that of providing the best coverage possible without interfering with other government agencies.

Experts in the field of public safety communications advise that it is not reasonable to expect any radio system to provide 100% coverage, 100% of the time. Mr. Mark Pallens, Radio Consultant and President of Pallens and Associates, Ft. Lauderdale, Florida, stated that, "Coverage is a function of the laws of physics and the cost to provide 100% coverage would be astronomical" (personal communications, 1997). To express this in layman's terms, how powerful would a radio system have to be to reach into all corners of a local hospital, jail, shopping mall, or the farthest reaches of your jurisdiction? We must also ask ourselves if we have ever truly had a radio system that provided constant communications in all areas such as these. When comparing the previous system with the coverage of the new it will be extremely beneficial to review the system evaluation you performed as one of your first steps in procuring a new radio system.

All is not lost. If communications is vital throughout a specific structure, local or regional signal boosters commonly referred to as " bi-directional amplifiers" (BDA) can be installed to help improve signal penetration. This type of signal booster is common in hospitals to aid in their communications of voice, pagers, and digital telemetry. Local governments need to also plan for future development. Consideration should to given to the passing of a local ordinance that will require the test of radio signal penetration in all areas of new construction (e.g., residential developments, shopping malls, hotels, and condominiums). If the local coverage for public safety communications is not sufficient, then the developer should be held responsible for the expense to purchase and install BDA's or other devices as is necessary to provide adequate communications.

System coverage is critical in any radio system. Most consultants and radio system vendors strive for a coverage that is expressed as "95/95" (95% coverage, 95% of the time). To avoid this being an arbitrary number, the test locations and testing procedures must clearly be identified and documented during the early stages of the system procurement. Again the data collected and documented on your current system

evaluation becomes extremely beneficial.

Training

User training is a major issue when attempting to transition to a trunked communications system. Failure to do so, and making the assumption that a "radio is a radio" is certain to cause the user problems. All system users need to have a basic understanding of how the system functions, what talk group works off of which tower and what the different tones and messages mean to the operator.

The roll of the dispatcher is also a key element of training. Although field users can be trained in a group as in role call training, dispatchers should always be trained "one on one" and with an actual working console. Dispatch consoles consisting of flashing lights, buttons and switches are a thing of the past. Most, if not all, trunked communications systems utilize personal computers instead of traditional consoles. A properly trained dispatcher is able to connect multiple talk groups, identify the caller by identification number and track active calls, frequently from a single computer screen.

Interoperability

A key benefit of the migration to trunked communications and 800 MHz systems is "interoperability", the ability for multiple government entities to communicate both on a daily basis and in the event of an emergency regardless of the manufacturer of their radio equipment. Unfortunately this is more of a concept than reality. APCO Project 25 and the standards it proposes will help to make interoperability a reality according to Mr. John Ramsey, Executive Director, APCO (personal communications, October, 1997). Although several elements of this project are still being finalized, he is aware of several radio systems that are currently being constructed with the understanding that they will meet the requirements of Project 25 and provide the user with a system that is capable of communicating with other systems built to these standards. APCO feels that this will create competition that will benefit the public safety agency by not locking an agency in to a specific vendor for the life of its radio system.

Some administrators may question the need for total interoperability and argue that the statewide conventional 800 MHz channels will provide sufficient agency to agency and car to car communications. These "conventional" channels operate on a fixed frequency and can be utilized by any 800 MHz public safety agency radio, regardless of its manufacturer. Although this system will no doubt handle the multi-jurisdictional pursuit or multi-agency narcotics investigation, as it is intended, there is little hope that these limited channels will handle the response to the next Hurricane Andrew. Under the APCO plan it will be possible for multiple public safety agencies to respond to the location of a major public safety event, quickly have their radios reprogrammed and be fully functional on the host agency infrastructure.

Unfortunately the optimism of APCO is not shared by some of the major players in the industry nor by some in the federal government. As reported in the May 9, 1997 edition of Land Mobile Radio News, the Department of the Interior has postponed contracts for APCO 25 compliant equipment. The article further states that the U.S. Air Force, under guidance from the Department of Defense, was no longer considering making APCO 25 a mandatory feature of future radio procurement (LMRN, May 24, 1996). What this means for the future of communications systems is unclear, however,

it should be noted that several companies including Motorola, E.F. Johnson, Relm, and Midland are continuing to develop systems in this direction to obtain compatibility with each other's equipment.

Do I Need a Consultant?

A major decision that must be made early on is whether to retain the services of an independent radio system consultant. Of the agencies responding to this survey, 70.5% used the services of a consultant. Of these agencies, 58.3% described the use of a consultant as vital in the success of the project, 8.3% as extremely beneficial and 25% as somewhat helpful. Although many agencies have chosen to chart the course of a new radio system without the aid of a consultant, any agency, regardless of how developed their technical staff may be, needs to carefully make this decision. Although the services of a good consultant can be costly, the expense is minimal in comparison to the cost of a new radio system or more importantly, the failure of a new system.

Conclusions

In many cases this research may have created more questions than answers. It is painfully clear that if a public safety administrator desires to increase the capability of a wireless communications system the administrator has little choice but to do so at considerable expense by investing in a trunked communications system. If this path is not carefully charted, very expensive mistakes can and have been made.

Two major benefits can be realized should an agency choose to transition to a new communications system based on this technology. The single biggest advantage is the considerable expansion in channels (talk groups), that will permit increased interagency communications while reducing the current level of radio traffic on primary communications channels. The second major advantage is the creation of common interagency communications at the local level of government. A countywide system will permit communications between law enforcement, fire rescue and other emergency management personnel. Include municipal level agencies and non-public safety local government in the system and most communities will be making a major step forward over current levels of communications.

Few agencies in the State of Florida, or the nation, have the in-house technical staff with the qualifications needed to lead their agency through the research and acquisition of one of these systems. Although an agency may be able to conduct much of the preliminary research and identify its communications needs, I personally believe that consultants should be utilized in all cases of system design and performance testing. Without question each major manufacturer dealt with during this research is committed to manufacture and install the most preeminent communications system possible. The consultant is able to supply the checks and balances needed to insure the user receives exactly what was requested. No competent radio system manufacturer would enter into a contract without it being reviewed and approved at some point by its legal staff or outside attorney and neither should a government entity. The use of a consultant is just as important as the legal advisor and relieves the public safety administrator from what can become tedious and extremely technical negotiations with the vendor.

Another resource that should never be overlooked is the support available

through APCO and its state affiliates. The resources available at APCO conferences are extremely valuable as well. In just two days I was able to make initial contact with no less than six (6) radio manufacturers and an equal number of radio system consultants.

In my meeting with Mr. John Ramsey, APCO Executive Director, he concurred that there is currently a lack of training available for the public safety administrator considering the purchase of a new communications system. Mr. Ramsey advised that his staff is currently researching just such a training program.

The size of the system is also a key indicator of the degree of difficulty an agency may encounter when implementing a system. An agency that is able to benefit from a single transmit site trunked system will likely end up with the most advanced communications system they have experienced. Unfortunately a single site system will only work for a relatively limited area of coverage such as a small city. Most city and county applications require multiple transmit and receive sites. Although Multi-cast systems are relatively easy to install and manage, they do not give the simultaneous wide area coverage demanded by most agencies.

The Simulcast system delivers wide area coverage and is without a doubt the most spectrum efficient. It is also the most expensive and when attempting to cover a wide area, is also the cause of most disappointments. Simulcast systems of two-tower sites work well. Unfortunately most counties in the State of Florida require more than just two towers. Many counties require four, five and in some cases more tower sites to provide the needed coverage. In these systems, timing a radio transmission to reach a single point simultaneously from multiple towers (known as “phasing”) is difficult to say the least. This problem is recognized by all of the manufacturers, and through continued research and development hopefully will be completely solved within the next few years (if we expect to continue to progress in the direction of trunked communications).

The final question concerning the transition towards this new technology is whether agencies are frequently required to return to their funding source due to cost overruns. Surprisingly the answer is, “NO.” Although two of the agencies responding to the survey did request minimal additional funding, most systems were delivered at or below the original agreed upon price. It was also pleasing to learn that each of the three vendors has, at their expense, supplied additional system components to deliver the best system possible. Although some agencies may one day be forced into litigation against a vendor for unresolved deficiencies of a system, to date this has not been necessary (in Florida), and hopefully never will be.

Afterthought

Throughout this research, one common thread continued to repeat itself in every public safety agency that already has transitioned, or presently is in the process of transitioning, to a new communications system. That common thread is the expenditure of millions of dollars to develop an infrastructure (the towers, repeaters and other hardware needed) to make a system work. With the continued development of private communications systems is it possible for government to lease this privately owned infrastructure, reduce capital expenses and still provide a high quality tool for the public safety professional in the field?

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Glossary

The following terms are defined in layman's terms as they apply to radio communications:

Access Time - the amount of time required from the pressing of the PTT switch until a repeater is assigned and the verbal transmission can begin.

Analog - the traditional radio signal as used in AM-FM radios.

APCO - The Association of Professional Communications Officials.

APCO 25 - the current project that is intended to ensure that the next generation of digital trunked radio systems are compatible with each other regardless of the manufacturer.

Digital - the conversion of traditional analog signal to computer binary code. Actual transmission time is shortened.

Interoperability - the ability for direct communications between two or more units of government via wireless communication devices.

Multi-cast - a communications system consisting of individual geographic areas or cells. These systems typically have limited cell to cell communications capability.

Mutual Aid Channels - these channels are assigned nation wide and are intended for interoperability regardless of the brand of radio used.

NPSPAC - National Public Safety Planning Advisory Committee

NPSPAC Channels - channels within the 821-824 and 866-870 MHz bands.

Simulcast - a communications system based on wide area coverage by synchronizing two or more transmitters on the same frequency.

System/Group - formerly referred to as "channels", a single system may have multiple talk groups.

Talk Around - also referred to as "simplex". A talk group that does not require repeaters or infrastructure to complete the communications but is restricted to a limited distance.

Trunking - The placing of available radio channels in a pool allowing the sharing of resources between an increased number of users.