Montgomery County, Maryland

Communications Interoperability Plan

July 2009

Background of this Report

This report was prepared by Montgomery County Department of Technology Services, Enterprise Telecommunications Services Division staff with the assistance of RCC Consultants, Inc.

Record of Change

Change Number	Date	Description	Change Date	Signature
0	**July 9, 2009**	**Draft 1.0 for review**		
1	**July 14, 2009**	**Draft 1.1 with graphics for review**		

Contents

I. Executive Overview

Strategic Situation

For over seven years the existing Motorola ASTRO SmartZone public safety trunked radio system has served Montgomery County ("the County") well, eliminating many deficiencies that existed in the previous conventional radio systems used by public safety agencies including the Department of Corrections and Rehabilitation (DOCR), Montgomery County Fire and Rescue Service (MCFRS), Montgomery County Police Department (MCPD), and the Montgomery County Sheriff's Office (MCSO). All County public safety agencies are now on a common radio platform, can and do communicate with one another on a routine basis, have better coverage than in the past, and have interoperability with most public safety agencies in the National Capitol Region (NCR) and beyond. That the County has benefitted from the existing system is beyond question, and its value has been demonstrated time and again when the public safety agencies have been on the front line of response to incidents as diverse as the Beltway sniper incidents, railway accidents, and a plethora of less publicized, but nonetheless urgent events.

Planning of the County's existing 800 MHz trunked radio system commenced in 1994, and a contract award for the network was signed with Motorola in December 1999. The trunked radio system was ready for operations in the spring of 2002, but owing to issues with the Computer Aided Dispatch (CAD) system and the Mobile Data Computer System (MDC), full operation was deferred until July, 20, 2003. At the time of implementation the system represented the current state of the art in public safety radio communications.

In the rapidly evolving telecommunications industry, generational changes in technology, standards, and electronic components tend to shorten the expected usable lifespan of network investments. Convergence between telecommunications and information technologies has rendered obsolete proprietary networking technologies and vestiges of circuit-switched telephony on which many mobile radio communications systems were based, including that of the County. Standards for digital public safety communications systems intended to improve interoperability and to stimulate competition among multiple suppliers have evolved since the County embarked on its system implementation. While beneficial in the long term, in the short term, these standards have introduced new incompatibilities that challenge the continuity of effective interoperability among public safety first responders and have hastened the obsolescence of existing systems, including that of the County. At present, the County radio communications system is nearing the end of the continuum of factory support, and little flexibility is provided for system infrastructure upgrade short of replacement.

Urbanization of segments of the County combined with increased noise levels in the 800 MHz radio frequency band has degraded the coverage performance of the existing radio system. Additional base station sites are needed in built-up areas to restore the level of coverage of the system to its original reliability. Obsolescence of the trunked radio system prohibits the needed increase in base station sites to upgrade performance of the system.

Other counties and cities in the National Capital Region with which the County public safety agencies interoperate on a routine basis have commenced system planning or implementation of radio system upgrades. To avoid incompatibilities that will affect public safety operations, it is necessary that interoperability partners make certain upgrades in, or nearly in, unison.

Montgomery County must commence planning and funding upgrades to its existing trunked radio system before factory support of the network deteriorates in the years beginning with 2012. Such upgrades will serve the dual role of maintaining the acclaimed interoperability that exists in the National Capital Region and correcting degradation of the reliability of the existing County system.

Goals and Objectives of the Montgomery County Communications Interoperability Plan

Goal

It is the goal of the Montgomery County Communications Interoperability Plan to ensure that the public safety first responders of Montgomery County can fulfill their missions safely and can respond promptly to the needs of the public in emergencies through the use of reliable, interoperable, and flexible voice and data radio communications to provide dispatch, coordination, and information in the mobile environment.

Objectives

Objectives of the Montgomery County Communications Interoperability Plan are to:

Provide reliable radio communications system performance in terms of coverage, network availability, and quality of service to public safety first responders.

Maintain and expand the highest level of interoperability between the County's public safety first responders and their mutual aid partners from within and outside of the National Capital Region to coordinate daily and emergency events by employing subscriber radios compatible with legacy and future digital technologies.

Provide access to and transmission/reception of data and video, and to permit access to dispatch, database, collaboration, and operational applications in the mobile environment with speed and reliability comparable to a wired office connection.

Ensure that system upgrades will meet the needs of the County for a decade and that the technology selected is in keeping with the overall trend of the telecommunications and information technology industry toward open architecture, data security, quality of service metrics, and interoperability.

Strategy

It is the strategy of the interoperability plan to continue the provision of a current technology trunked radio communications system that meets the current and future needs of the County public safety first responders while optimizing the utilization of current resources and through cooperation with interoperability partners. To the extent practical the County will employ resources made available by the Federal broadband initiative and other sources of interoperability funds.

Phased Implementation

A multi-phased implementation schedule is proposed over a minimum five year period. A three phase schedule permits expenses to be spread over multiple funding cycles and will allow certain industry standards and regulations to be that are in development to be finalized.

In the first phase, that spans three years, short term improvements will be made by upgrading portable and mobile radios assigned to public safety first responders to more capable software-defined radios. Such radios have the ability to operate in multiple modes, thereby bridging the generations of technology that will exist in the region without loss of interoperability. Such radios enable communications with new generation P25 Phase I and Phase II standard radio systems that are in deployment in the region and are also backward compatible with legacy systems.

Work on plans and specifications for the upgrade of the trunked radio communications system also must commence in the first phase. The objective of these plans is the development of goals and objectives for a system to meet the tactical voice radio communications needs of the first responders and to plan for the eventual use of broadband wireless network for data and video communications. Options for system sharing and/or participation in a network of networks will be explored in the planning process. A detailed implementation plan and budget for network infrastructure upgrades will be produced along with a procurement document for the upgraded voice radio system.

In the second, interim, phase beginning in the fourth year the procurement and installation of voice radio system infrastructure upgrades will commence. These upgrades will affect the radio system, its interconnecting network, and the public safety communications center console equipment. At the conclusion of the installation of the improved voice communications system, some legacy subscriber equipment will be passed on to non-public safety governmental radio system users. The second phase is estimated to take two years, with a projected completion date of 2014.

The third phase is a long term action plan for the implementation of wireless data and video applications on a broadband network. Such applications and the networks themselves are still only loosely defined and final regulations have not been promulgated. It is expected that clarity will emerge over the next two years from the extensive effort being expended by public safety and the private sector to jointly or singly develop a national broadband infrastructure for public safety. As presently defined, such a broadband network will reflect some of the convergence of voice, data, and video access to and from the mobile environment. An eventual progression to the provision of tactical push-to-talk voice communications over such networks may evolve over the next decade, but is not the primary driver of this technology.

Initiative	Short Term (Years 1-3)	Interim Phase (Years 3-5)	Long Term (> 5 Years)
Interoperability	Purchase subscriber units compatible with both legacy and next generation systems to maintain interoperability in NCR and to prepare for system replacement in Montgomery County	Transition subscriber units to next generation trunked system being installed by Montgomery County; cross programming or system of systems to provide interoperability with mutual aid partners	Continuing programming and networking to maintain interoperability with mutual aid partners.
Operability	Begin planning and specification of next generation trunked radio system for Montgomery County	Procurement and implementation of next generation trunked radio system	System in full operation and add subscriber units to reflect County growth
Data and video	Follow national	Definition of	Participate in

access and transmission	broadband initiative, FCC filings if necessary	advanced data and video applications to enhance public safety operations	shared national broadband network or buy services from operator

Funding

Phase I budget requirements are to fund portable radio upgrades for public safety first responders in years one through three and to commence preparation of detailed system plans and procurement documents for an upgraded network infrastructure, and to seek grants and other sources of funding for the upgrades.

Phase II budget requirements will be established in the first year of Phase I based on a detailed system design and that will be completed during the year. This design and budget will provide two years lead time to identify sources of funding before the procurement of the network upgrade commences.

Phase III funding requirements will be known by year five of the project. This phase of the project is dedicated to the provision of wireless broadband access by public safety agencies. It is likely that such service will be provided by some partnership between a wireless network operator and a regional or national public safety consortium. The form of such a consortium and the ratio of capital versus operating expenses will be determinable by year five.

Immediate Actions Required

Plans and specifications must be developed to ensure that any replacement system will meet the needs of the County for another decade and that the technology selected is in keeping with the overall trend of the telecommunications and information technology industry toward open architecture, data security, quality of service metrics, and interoperability. These plans will examine the network options available to the County, including a stand-alone system, a system that is a participant in a system of systems that permits resource sharing while avoiding the centralization of failures, and sharing of certain resources, such as antenna sites and backhaul networks with other governmental entities such as the State or adjoining counties and cities.

In the short term, the process of replacing subscriber units (mobile and portable radios used by first responders) with units capable of operating on legacy Motorola trunking technology and P25 Phase I and II systems, supporting roaming technology, operable on the 700 MHz frequency band and compatible with conventional analog operation.

II. Introduction

Reliable voice communications between public safety first responders and communications center personnel are essential to the achievement of their mission of protection of life and property. This document is intended to describe the current state of public safety communications in Montgomery County and the surrounding area and to provide a roadmap that contemplates continued improvement over the coming decade.

In the short term the County must address the obsolescence of its trunked radio system and take steps to maintain public safety communications interoperability within the National Capital Region and in the region as a whole.

Telecommunications and information technology are rapidly converging to provide access to video, data, and voice communications in a digital format in the mobile environment. Such convergence provides opportunities in the future for improved public safety services, and it is essential that the County be prepared in the long term to exploit that trend.

III.Background

A. History

In December, 1999, Montgomery County entered into a contract with Motorola, Inc., for the procurement from Motorola of a system of radio communications equipment, which would provide communications for the County's public safety agencies and certain other departments and agencies. The system was to be built around the Motorola SmartZone 3.0 controller and would include 11 radio transmitter-receiver sites, and would include approximately 3000 Astro Spectra mobile radios and approximately 3500 portable radios of the XTS 3000 family.

The system was delivered by Motorola, as contracted, and the infrastructure equipment was installed, tested, and ready for operations by the spring of 2002. A small number of County departments and agencies began using the equipment at that time. Owing, however, to delays in the computer-aided dispatch (CAD) and mobile data computer (MDC) systems which were purchased at about the same time from other vendors, Montgomery County was unable to put the Motorola radio communications system into full use until July 20, 2003.

When the radio system was ordered from Motorola in 1999, the SmartZone 3.0 controller systems were approaching the end of their designed life cycle. A

newer technology system was soon to be available, but the decision had been made to procure the SmartZone 3.0 system rather than wait for the advent of a newer and unproven technology (that proved to have limitations that were not favorable for the County).

Since the delivery of the Motorola system, the County has continued to procure from Motorola a number of technical support and system monitoring services. These services have been invaluable because the Motorola system is so dependable and so reliable that the County's technicians, despite their in-depth training, their expertise, and their many years of general radio maintenance experience, have had little opportunity to gain experience in repairing problems with the current system. It simply does not break often enough to give the technicians experience in repairing it. On those rare occasions that a malfunction has occurred, the Motorola technical support organization has been an invaluable backup resource. The same organization provides the repair parts that are needed when there is an equipment problem.

B. County User Agencies

The primary users of the system include the Police Department, the Fire-Rescue Service, the Sheriff's Office, the Department of Corrections and Rehabilitation, the Department of General Services, and the Department of Transportation. Other County Departments and Agencies also utilize the system, but in far fewer numbers. These would include, for example, public health agencies and hospitals, the Board of Liquor License Commissioners, and the County Executive and CAO.

Some agencies which are functionally related to the County, but not part of the County government, also are subscribers on the County radio system. Functionally related agencies include the Maryland-National Capital Park Police, the Montgomery County Public Schools (Security Officers only), and Montgomery College (Security Officers only).

C. State and Municipal Partners

1. The State of Maryland

Because of their geographic presence and their daily functionality in Montgomery County, a few agencies of the State of Maryland operate as subscribers on the Montgomery County radio system. These include the Maryland State Police (Rockville Barracks), the State Highway Administration, and the Maryland Transportation Authority Police. These user groups provide services to the citizens of the County and their presence on the County's radio system provides

a significant benefit, not only to the members of those agencies, but to the citizenry at large. For example the ability of the Maryland State Police officers patrolling the highways in Montgomery County to communicate directly with officers of the Montgomery County Police Department greatly enhances public safety as well as providing the ability to coordinate the law enforcement operations of both agencies. The ability of the State Highway Administration's local service vehicles to communicate directly with officials of the County enables both groups to avail themselves of each others' services and to respond more quickly to the needs of the motoring public.

2. Municipalities

The four incorporated municipalities located in Montgomery County are the City of Gaithersburg, the City of Rockville, the City of Takoma Park, and the Village of Chevy Chase. Each of these municipalities operates its own police department and each of their police departments interoperates to some degree with the Montgomery County Police Department. Gaithersburg, Rockville, and Chevy Chase utilize the dispatching services of the Montgomery County Police Department's Emergency Communications Center (ECC). All of their operational radio communications are integral to and co-mingled with the communications of the MCPD. The sharing of dispatchers and radio channels ensures that the nightmare of police officers interfering with one another or worse, of endangering one another, due to a lack of knowledge of the other individual or group's presence, does not ever happen in the County. If a Rockville officer is conducting surveillance, for example, and announces that fact to the other Rockville officers, he or she is simultaneously announcing it to the County officers in that district. The City of Takoma Park, does not use the County's dispatch services but provides its own dispatch service via the County's radio system. Takoma Park officers can and do communicate with County officers by switching to the County's talkgroups when operationally appropriate. Takoma Park officers can, and do, cooperate via radio during specific operations with County officers. All of the four municipalities' and the County's officers can, and routinely do, request assistance from one another.

Fire and rescue services are provided throughout the County by the County's Fire and Rescue Service, which is a major user of the County's radio system. Neither the State of Maryland nor any of the incorporated municipalities operate or provide their own fire or rescue services.

D. Regional Partners and Interoperability

The provision of mutual aid to neighboring jurisdictions and the ability to communicate directly via radio with personnel of other jurisdictions is called

"interoperability." This will be further discussed in the Methodology chapter, but will be defined here. Simply put, interoperability is the ability of first response agencies, whether fire, police, or emergency medical services, to work together and to communicate with each other during an incident, emergency, or disaster. Radio communications is integral and essential to this ability. During these events radios of personnel of both jurisdictions must be able to talk to each other. Operating procedures for communication and clear lines of authority must be pre-established and practiced.

The Counties which abut or are in proximity to Montgomery County and the District of Columbia operate daily as mutual aid partners. In addition to the District, these include Frederick, Howard, Carroll, Charles, and Prince George's Counties in Maryland, and Fairfax, Arlington, Loudoun, Stafford, and Prince William Counties and the City of Alexandria in Virginia. The Metropolitan Washington Airports Authority (MWAA) is also a mutual aid partner within the region.

Each of these jurisdictions provides law enforcement and fire-rescue services within their own boundaries. They also cross jurisdictional boundaries to provide public safety mutual aid to neighboring entities.

(Prince George's County, Maryland, does not yet have, as of this writing in July of 2009, the same ability to directly interoperate with Montgomery County as do the other neighboring jurisdictions, but has a new radio system under construction which in the near future will bring them up to and beyond the same capabilities of their neighbors.)

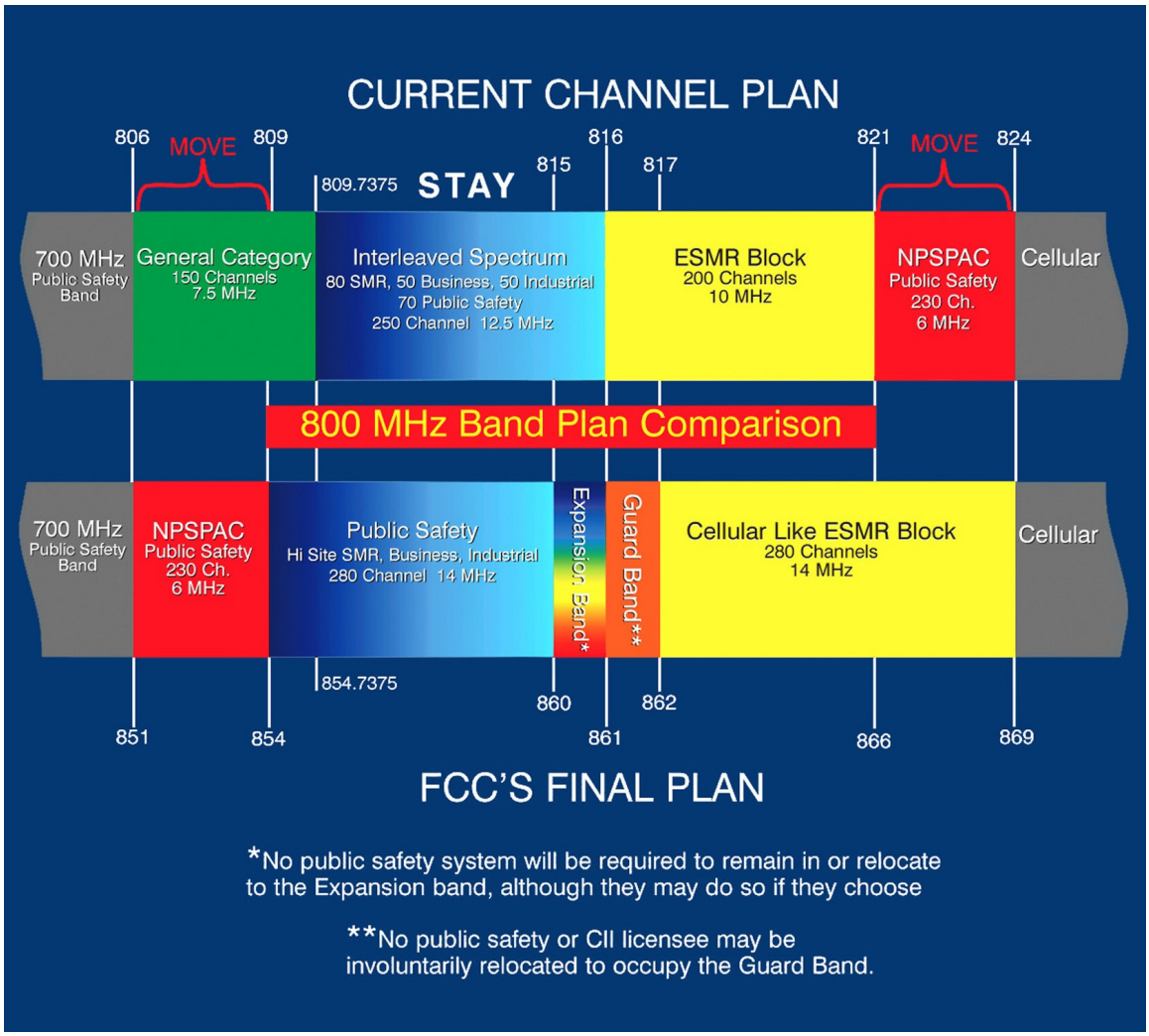
The National Capital Region has been cited by Michael Chertoff, the nation's previous Secretary of Homeland Security, as an example of how mutual aid ought to be provided and of how interoperability ought to work. In his words:

> ***"A great example of what a region can do with effective interoperable communications is right here in the national capital region. Today, as we speak, all first responders in the NCR, whether they're from Maryland, D.C., or Virginia, can communicate with each other, either directly or through the use of bridging or gateway technology. What this means in real life is that firefighters and police can talk to each other, not only within the same political jurisdiction, but across jurisdictions."***

Montgomery County has been and continues to be a leader in the development of the technology, the operating standards and procedures, and the use of inter-jurisdictional interoperability.

E. 800 MHz Rebanding

On August 6, 2004, the Federal Communications Commission ("the FCC" or "the Commission") issued a Report and Order that modified its rules governing the 800 MHz band. The stated purpose of the order was to reconfigure the 800 MHz band to eliminate harmful interference to public safety radio communications systems in the band. (The source of the harmful interference was the transmitters of Sprint-Nextel.) The requirement levied upon Montgomery County and all other public safety radio licensees, nationwide, operating in the 800 MHz band is to change the frequencies of most transmitters and receivers, both subscriber and infrastructure. This process is called rebanding. The requirements levied upon Nextel and its nationwide corporate structure, including its parent companies, are to pay the entire cost of the process of rebanding and to provide to the public safety licensees, after rebanding is completed, facilities and operations which are comparable to those which the licensees had prior to the start of rebanding.



800 MHz frequency band reconfiguration to reduce interference from commercial wireless operators

Certain rights were guaranteed to public safety radio licensees by the FCC Report and Order. In addition to the right to comparable facilities after the completion of rebanding, these also included a guaranteed right to continuity of service during the process, the right to avoid any more than a "minimal" disruption of operations during the process, the right to a redundant system, if rebanding was projected to entail more than a minimal disruption of service, and the right to full reimbursement of all reasonable costs.

The Commission appointed a "Transition Administrator" to oversee and administer the rebanding process. The Transition Administrator established a calendar which mandated, among other things, completion of all rebanding activities by June 26, 2008. That date was not met.

The Federal Communications Commission, the Transition Administrator, and Nextel have grossly underestimated the complexity of the rebanding process, have grossly underestimated its impact on the public safety radio licensees of the nation, have grossly underestimated the costs of the process, and have grossly underestimated the length of time necessary to accomplish the goals of the program.

One area in which the complexity has been underestimated is the impact of rebanding on the interoperability of the licensees in the National Capital Region. As was noted above the NCR has an extensive and highly developed system of interoperable communications. Rebanding without extremely tight coordination among the NCR members will destroy the ability of the NCR partners to interoperate effectively, which would constitute a disastrous impact on the public safety of the region.

On June 30, 2008, the FCC acknowledged that its deadline of June 26, 2008 would not be met.

On both national and regional levels, the entire program for the rebanding of the 800 MHz public safety band is so far behind schedule, that it is impossible to project when the County will be operating on its new frequencies. The Commission has not even chosen to set a new deadline, for fear (a near certainty) that it will miss that one, too.

The unpredictability of the rebanding program is significant to the timing of the procurement of new radio equipment for the County, because some equipment may need to be replaced as part of the rebanding process.

F. Radio Frequency Spectrum Issues

In June 2009, the digital television transition occurred wherein most analog television broadcasting ceased and broadcasters in the upper part of the 700 MHz frequency band relocated to lower frequency channels. When these broadcast operations finally cease, 24 MHz of that spectrum will be made available by the FCC for public safety operations. A number of public safety providers have been granted licenses to operate in these newly available bands, and others have applied for such licenses. Prince George's County and the State of Maryland are among those who will have significant operations in the 700 MHz bands. Montgomery County has applications pending and partially approved for 3 channels in the 700 MHz band, but will remain primarily a user of 800 MHz channels. The 700 MHz channels currently under application will be used only for specialty mobile repeater operations.

In the 700 MHz band, the FCC established thirty-five frequencies for nationwide interoperability. Thirty-two of the frequencies are for conventional operation (non-trunked systems or the use of trunking on a secondary basis) and three frequencies are for nationwide itinerant low-power use. The Maryland SIEC has recently commissioned a study to evaluate the use of these frequencies in Maryland with focus on the NCR area. Even if new 700 MHz interoperability channels were implemented in Montgomery County, there remains the practical problem that only a subset of its existing public safety mobile and portable radios can operate on those frequencies. Only the Motorola XTL5000/XTS5000 series of radios that comprise a small portion of the County's fleet is capable of P25 operation in the 700 MHz band. The TDMA (P25 Phase II) standard does not apply to the thirty-two (32) 700 MHz nationwide interoperability channels.

A common misconception is that Montgomery County is "moving" from 800 MHz to 700 MHz. This is false.

Montgomery County was an early licensee of radio frequencies in the 821 MHz band and was fortunate to secure 20 channels for trunked operation. As an early mover, the County secured sufficient channels to accommodate its public safety communications needs into the foreseeable future. In accordance with this plan, P25 Phase II technology will be adopted in the upgrade of the existing trunked radio system, doubling the capacity of the existing channels through the use of TDMA technology. This will negate the need for the County to compete for additional radio frequencies in the spectrum starved NCR and Mid-Atlantic states.

G. Manufacturer Support Issues

Motorola has a schedule for phasing out technical support for systems after they have reached the end of their life cycle. The scheduled date for the end of formal technical support for SmartZone 3.0 systems is December 31, 2009. Most importantly, Motorola has notified all SmartZone 3.0 customers that it can no longer guarantee repair of certain critical portions of the system's infrastructure at Motorola's factory depot. Motorola will attempt to repair or replace these parts only on a "best effort" basis. Montgomery County must be prepared to replace its infrastructure, as soon after that date as is economically possible, with a new system, for which guaranteed support can be obtained.

As of this writing a number of maintenance issues within subsystems of the voice radio system are beginning already to be problematic. These include:

- aging power systems (UPS's and their associated batteries, which are maintained by Motorola);
- satellite timing receivers, which are not manufactured by Motorola, and support for which has been discontinued by their manufacturer, Efratom;
- the optical fiber infrastructure (FiberNet) which is provided by the County to interconnect the Motorola systems various sites, and which is, itself, becoming more and more unstable as each day passes, due to its own obsolescence.

As each day passes we come a day closer to the failure of a critical component which we cannot repair or replace. As each day passes the costs of repairing failed components increase.

IV. Methodology

A. County Project Guidance

The County's radio systems have value only inasmuch as they serve the communications needs of the County's users. To meet those needs the system requirements must be clearly known, understood, and documented. Therefore a "steering group" of people representing the primary users of the communication systems must be convoked and chartered to establish the requirements and specifications for the communication systems of the future. At a minimum the following user Departments and Agencies must be included in the steering group:

Police Department (County Police)
Fire and Rescue Service

Sheriff's Office
Corrections and Rehabilitation
Maryland-National Capital Park Police (MNCPP)
General Services
Transportation

The Chief Information Officer or his designated deputy should chair the steering group to ensure that the user-established requirements are met with the optimum efficiency within the constraints of funding and technology and to ensure that conflicts are resolved in an optimum manner.

The MNCPP, while not a Department of the County Government, should be included because their Montgomery County Division operates as a police agency in Montgomery County, because their funding comes from the Montgomery County Council, and because the County's trunked voice radio system is the primary backbone for their voice communications.

B. Regional and Statewide Operations

Within the National Capital Region (NCR) there are many jurisdictions, such as cities, counties, states, and others, including quasi-jurisdictional agencies such as the Maryland-National Capital Park Police (MNCPP) and the Metropolitan Washington Airports Authority (MWAA). Maryland State's public safety agencies which operate with or in proximity to Montgomery County include the Maryland State Police (MSP), the Maryland Emergency Management Agency (MEMA), the Department of Natural Resources (DNR) Police, the State Highway Administration (SHA), the Maryland Institute for Emergency Medical Services System (MIEMSS), and others.

Each such jurisdiction or agency has its own specific radio communications requirements, missions, operations, facilities, and procedures. In the past many of these radio users have operated their own radio systems independently, with minimal interconnections to neighbors, other groups, or jurisdictions, or they intercommunicated by carrying multiple radios. For example, a Montgomery County fire engine operating along the Prince George's County border, would carry both a Montgomery County radio and a Prince George's County radio.

In today's environment most public safety agencies recognize the necessity of communicating with their neighbors with minimal intervention by dispatchers or technicians. Budgetary and economic conditions mandate the highest possible degree of sharing of facilities and of missions. Technology developments provide a means for the sharing of facilities and equipment. Within the NCR, between and among the cities and counties and some other entities, voice radio interoperability is highly developed, well planned, well documented, and well

practiced. Mutual aid operations, for example, between Montgomery County and the District of Columbia's Fire Department and between Montgomery and Fairfax Counties, take place on a daily basis. They are considered so routine that they merit mention only because of the fact that they are so routine.

State agencies, both in Virginia and Maryland, are not as well advanced as the local jurisdictions. However, because the counties, like Montgomery, Fairfax, Carroll, and Howard, have openly invited their respective local state agencies (police, highway maintenance and service organizations, etc.) to use the counties' infrastructures, the states have grown accustomed to the efficiencies of the counties' trunked radio systems. As the states begin to build out their own radio communication systems, they are looking to continue the cooperative efforts begun by the counties and cities, and to share facilities and equipment. They have learned already the value of interoperability.

C. Interoperations and Mutual Aid

One of the essential capabilities of a public safety voice radio system is the ability to communicate with one's neighboring jurisdictions. The news media are quick to report instances when interoperability has failed to occur. Television stations and networks are always ready to report on the building which burns down with a fire engine from another jurisdiction only a few blocks away, or a person dying from a heart attack when there is a potentially life-saving medic unit from another jurisdiction parked around the corner from the incident. Since the crash of Air Florida's flight 90, in 1982, an interoperability catastrophe, the various jurisdictions of the metropolitan Washington, D.C. region have built and have learned to operate – and do operate routinely, day after day – radio systems with interoperability capabilities unmatched anywhere in the nation, and perhaps in the world.

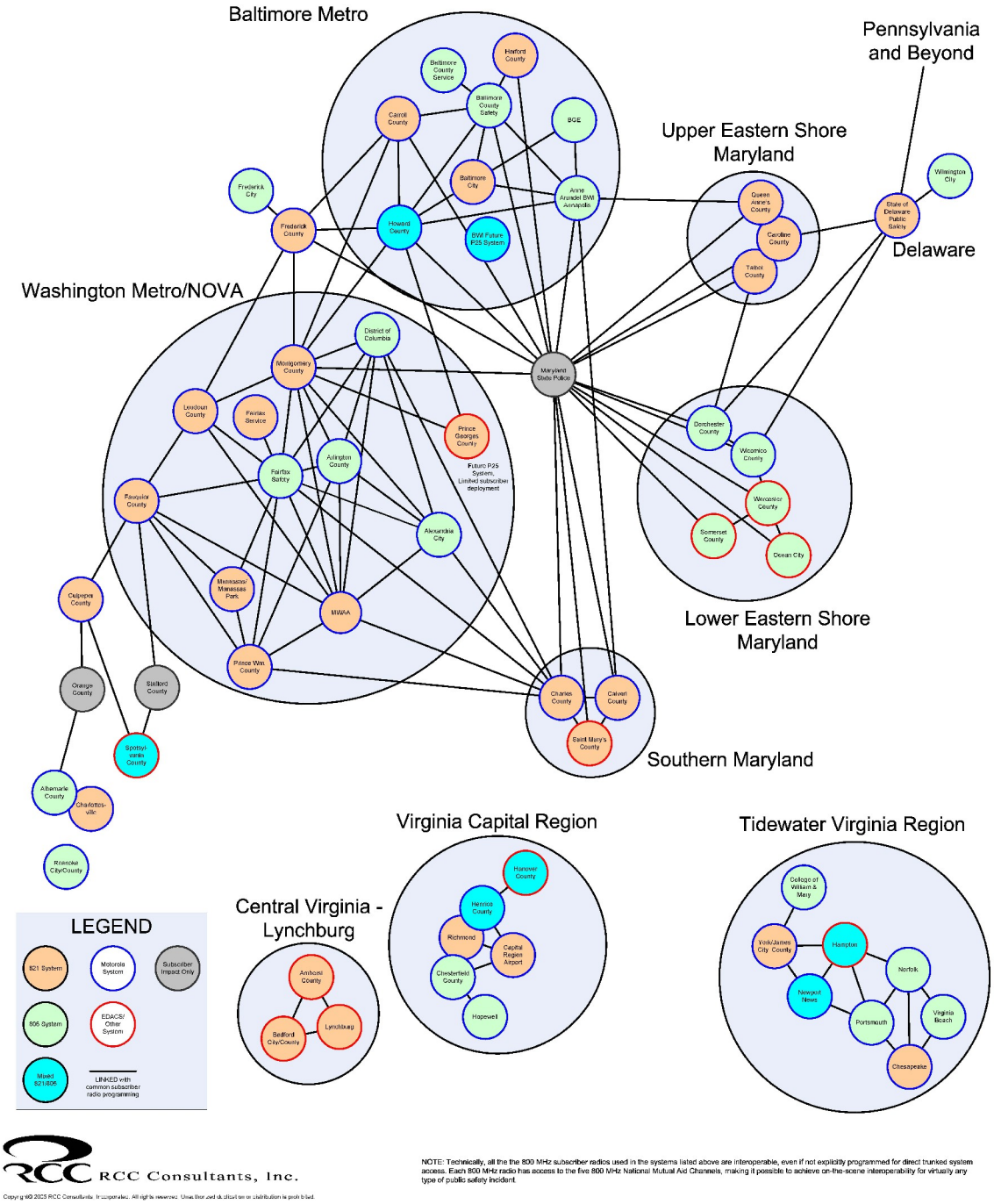
Compatible technology of trunked voice radio, with neighboring radio system operators sharing "system keys" permits subscribers from one system to operate as subscribers on the neighbors' systems. This interoperability is seamless, with no action required on the part of a dispatcher or system operator. A subscriber, whether a police officer or sheriff, a firefighter-rescuer, or other radio user, simply performs the switch from one radio system to another by pressing keys on his or her own radio. In this way a Montgomery County Fire-Rescue unit can respond to a call in Fairfax County and be in direct communications with the Fairfax County dispatcher in charge of the incident and with the other Fire-Rescue units being dispatched from Montgomery, Fairfax, and/or other jurisdictions, and vice versa. In this mode there is no need for field units to relay messages through dispatchers or to "patch" systems or circuits together to permit the communications. A Montgomery County ambulance, for example, simply "becomes" a Fairfax County asset for the duration of the incident, or vice versa.

The interoperation is direct and seamless. The incident commander is able to talk directly to all the units assigned to his incident.

This is the ultimate in interoperable voice radio communications.

On January 3, 2007, Homeland Defense Secretary Michael Chertoff gave a press conference discussing the *Nationwide Interoperable Communications Assessment*. This assessment was a scorecard of 75 urban and metropolitan areas all across the nation. Of the 75 areas scored, only 6 received the highest score in all three rating categories. Of the urban areas with perfect scores, only the National Capital Region crosses state lines. The scorecard assessed jurisdictions in three areas: governance, standard operating procedures (SOP's), and usage. The governance area assessed shared systems and solutions, the equipment and the technical side of things. The SOP area assessed planning and preparations. The usage area assessed the actual implementation of interoperable communications, how well did they do it in the field under live conditions.

Key to the success of Montgomery County's ability to interoperate with its neighbors is the cooperation among the various jurisdictions with regard to radio system technologies. With the availability of newer technologies than those of SmartZone 3.0 and with the advent of national interoperability protocols, such as APCO P25, it remains vitally important that Montgomery County continue to move forward in collaboration with its neighbors. Prince George's County and the Baltimore-Washington International (BWI) Airport in Maryland, and northern Virginia jurisdictions including Arlington County and Alexandria City are or will soon be on the air with P25 systems, with Fairfax County in the planning stages to follow soon. Montgomery County must make decisions in the very near future regarding its technology direction for the next decade.



A complex interoperability web connects compatible public safety radio communications systems across a broad geographic area of the Mid-Atlantic region.

The plan for the replacement of Montgomery County's radio system provides for the deployment of the newer technology equipment, first to the areas where it is most needed to provide interoperability with those jurisdictions which are the farthest ahead in their technology progress. For example the Third Police District, which abuts Prince George's County, will receive the newer technology radios first, so that their ability to communicate across that border will be assured.

1. NPSPAC

Each Montgomery County base station site is equipped with two National Public Safety Planning and Advisory Committee ("NPSPAC") Mutual Aid channel repeaters that operate in the conventional mode. These repeaters are used for voice communications with itinerant units from other jurisdictions that may not be equipped with access to the trunked radio system. The NPSPAC channels are also useful as a backup to the trunked radio system in the event of system failure, although they do not have the capacity to handle the full load of the system in a period of high activity.

The County's implementation of the NPSPAC channels meets the State of Maryland Communications Interoperability Plan (SCIP) objectives for the use of these channels as a method of communicating with mutual aid responders who may operate in or around the NCR in a major emergency. Nationally, most public safety agencies with 800 MHz radio communications systems program these channels in their subscriber units. These channels are also generally programmed into radios held in caches nationwide and can be ready to operate immediately upon reporting for duty in the "host" jurisdiction.

NPSPAC channels are programmed in Montgomery County subscriber units assigned to public safety personnel.

2. CMARC

The membership of the Baltimore Urban Area Workgroup (BUAWG) includes the Cities of Annapolis and Baltimore and the Counties of Anne Arundel, Baltimore, Carroll, Harford, and Howard. CMARC (Central Maryland Area Radio Committee) is a subcommittee of the BUAWG. As a means of providing interoperability among the members of CMARC and other first responders the Committee planned and implemented a regional radio communications system that employs the NPSPAC call and working channels in the 800 MHz band. The system employs 28 base station sites and is controllable from nine dispatch centers and the Maryland Emergency Management Agency (MEMA). According to the State of Maryland SCIP, Frederick County is considering installing equipment to be a participant in the CMARC system.

Montgomery County public safety subscriber units are equipped with the NPSPAC channels and are compatible with this network for emergency communications purposes.

According to the State of Maryland SCIP the region is considering the implementation of a P25 zoned trunked radio system on the 28 antenna sites presently used for the NPSPAC system.

3. State of Maryland Communications Interoperability Plan (SCIP)

The State of Maryland State Communications Interoperability Plan (SCIP) was required by the United States Department of Homeland Security (DHS) as part of the Public Safety Interoperability Communications (PSIC) program established in response to the requirements of Congress. The SCIP development process was a prerequisite for the issuance of PSIC grants for state and local governments. Following approval of the SCIP, the State of Maryland was awarded $22,934,593 pursuant to this process. Once accepted, all of the SCIPs as submitted and revised by the states were compiled and assimilated into the National Emergency Communications Plan (NECP).

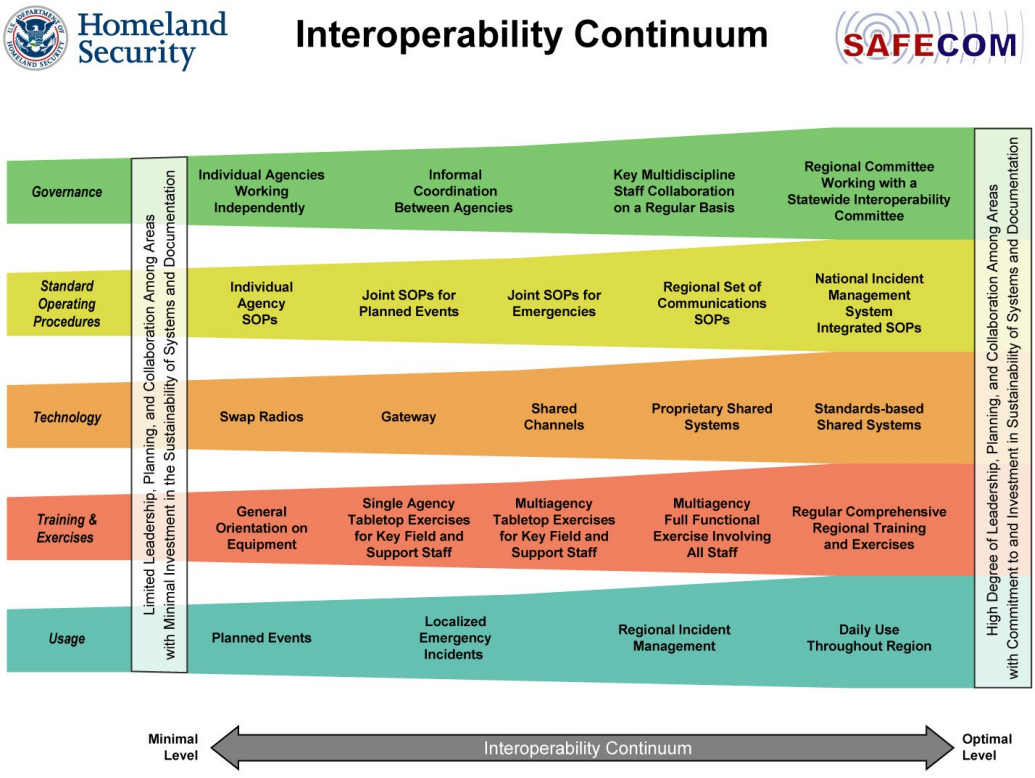
Maryland's SCIP was created under the auspices of the Statewide Interoperability Executive Committee (SIEC). The SIECs are designed to represent the interoperability interests of first responders serving at the state and local government levels. The Federal Communications Commission (FCC) encouraged each state to form a SIEC pursuant to the recommendations of the National Coordinating Committee (NCC), a body established by the Commission to assist in the development of guidelines for the 700 MHz public safety spectrum.

SCIP Goal: "The goal of this plan is to develop and implement a reasonable and feasible solution framework that provides statewide, secure, coordinated, real-time voice and data communications that can span jurisdictional and organizational boundaries".

The SCIP immediately adopts the important theme of public safety communications interoperability across the state, not just in a single area of Maryland such as the National Capital Region (NCR). For Montgomery County, its communications system already enjoys a high level of interoperability within the NCR. The SCIP begins to challenge state and local governments in Maryland to advance their systems to a higher level of interoperability thereby permitting the County's first responders to interoperate should they leave the NCR area. It also seeks a strategy that would allow the County's

communications center to interoperate with first responders from throughout the country who might be called into Montgomery County in the event of a disaster. This was the acute first responder communications deficiency identified after Hurricane Katrina.

Advancement of interoperability is reflected in the SCIP when it states, “One of Governor O’Malley’s top Homeland Security objectives is to achieve Level-4 interoperability in the near term, with the longer-range goal of achieving Level-6 radio interoperability within the first responder community throughout Maryland”. As indicated in the SCIP, “State wide Level-4 attainment, simply put, is when fire fighters, emergency medical responders, police officers, deputy sheriffs, state troopers, public works and transportation officials and others can go anywhere in the state and have immediate radio communications with each other using their own equipment on designated channels. Ultimately, a Level-6 attainment will achieve seamless interoperability statewide by using standards-based shared-systems technologies”.



DHS public safety interoperability continuum – the right column contains the definitions of Level 6 interoperability

The goal of Level-6 interoperability relates to the adoption of a standard that permits users that have purchased radio equipment from different manufacturers to interoperate seamlessly. Such a protocol has been developed and it is known as the “P25” standard. The P25 standard was adopted by the Association of

Public Safety Communications Officials (APCO) several years ago. The purpose of P25 is to overcome the lack of interoperability inherent with the proprietary radio systems that permeate the country, including the NCR. The Level-4 communications protocol limits interoperability to the users of a specific radio technology, such as Motorola's SmartZone 3.X Frequency Division Multiple Access (FDMA) architecture used in the NCR or requires the use of a communications bridge to facilitate communications between disparate radio technologies.

There are two varieties of P25 known as Phase I and Phase II. All technical standards for Phase I have been adopted and users can purchase P25 Phase I products from a number of manufacturers now. A national certification process has been adopted by the DHS and beginning in the summer of 2009, different manufacturers will be invited to test their products on the P25 land mobile radio systems of competitors. As an example, Motorola has invited competitors to its headquarters in July to test non-Motorola radios on the Motorola communications infrastructure to ensure proper operation pursuant to the adopted P25 standards. Once a radio demonstrates that it can meet all operational requirements of the P25 standard, the device will be certified as compliant.

P25 Phase II is still evolving as a finalized set of standards. It is widely believed that the P25 Phase II standards will be completely adopted by the Telecommunications Industry Association (TIA) in 2009 with equipment manufactured and sold using this technology in 2011. P25 Phase II is entirely different from Phase I; however, as part of the Phase II standard, a Phase II radio must be "backwards" compatible with Phase I standards. Through this backwards compatibility, a Phase II radio will be able to interoperate with either a Phase I or Phase II system.

The differences in the P25 phases are technically profound; however, easy to understand. Both technologies utilize a 12.5 KHz bandwidth. P25 Phase I uses the frequency to transmit or receive one talkpath (or conversation) at a time. Conversely, P25 Phase II typically permits two different talkgroups to be transmitted or received simultaneously on the frequency. Phase II accomplishes this task by dividing the digital transmissions into two "time slots" through a technology called Time Division Multiple Access or TDMA. TDMA has been utilized successfully in the cellular telephone world for many years. By combining two conversations or talkgroups on the same channel an "effective" bandwidth of 6.25 kHz is achieved. As noted earlier, the P25 Phase II standard is "backwards compatible" and if a non-TDMA P25 Phase I user affiliates (joins) with an active talkgroup, the entire talkgroup will maintain communications through the older technology used in P25 Phase I (FDMA). FDMA is the technology used in Montgomery County's current Motorola system. However, the current County radio system technology predates, and is not based on, the P25 Phase I standard.

Maryland's state government is reinforcing the Governor's call for Level-6 interoperability by issuing a Request for Proposals (RFP) for a new statewide communications system based upon the DHS adopted P25 Phase II standard. Additionally, most contemporary public safety communications systems are designed to support the P25 standard. As an example, Prince George's County is implementing a new Motorola ASTRO25 system in 700 MHz that will support P25 Phase I at the onset of operations and subsequently P25 Phase II. Both Loudoun County and the City of Alexandria, Virginia have also contracted with Motorola to upgrade their first responder communications systems to the P25 Phase I standard initially with an upgrade to Phase II in the future. Arlington County now operates a P25 Phase I system. Frederick County is considering procurement for a P25 Phase II radio system. Officials in the District of Columbia are also exploring the acquisition of a new public safety communications system for the Metropolitan Police in the 700 MHz frequency band based upon the P25 technologies. (Washington, D.C. Metropolitan Police currently operate on a system in the 490 MHz band). With respect to the users of 700 MHz equipment, these radios are designed to work in both the 700 and 800 MHz bands.

In any new land mobile radio system contemplated by the County, the P25 Phase II standard should be specified to reflect the most contemporary radio architecture. This is amplified in the SCIP when it states, "To ensure the long-term viability of this network, sufficient capacity must be maintained, open standards must be embraced, and maintenance programs must be established. Technologies that enhance the efficiency and value of existing radio/frequency channels (i.e., provide more than one talk path per channel) must be evaluated and, if deemed of value, utilized".

P25 Phase II addresses the "sufficient capacity" issue identified in the report as it doubles the number of talkpaths (simultaneous conversations) available without increasing the number of frequencies used. To put this in the simplest terms, today Montgomery County has an 800 MHz radio system with twenty frequencies permitting nineteen (19) simultaneous conversations (one frequency is used for network traffic management, not voice communications). With P25 Phase II, the same twenty frequencies could support thirty-eight (38) simultaneous conversations doubling capacity without adding to spectrum demand. Use of the P25 Phase II standard also addresses the "open standards" comment in the above paragraph. With respect to "maintenance" programs, RCC understands that the County has maintained an active maintenance program through Motorola and is satisfied with the results of that effort.

The Maryland SCIP was crafted to be a living document with continual revisions as needed. Updates to the Plan are made through the SIEC as noted in the Report when it states, "This plan promotes a collaborative approach with local jurisdictions, leveraging existing radio systems and builds on the existing public safety radio infrastructure in Maryland". This is an extremely important sentence in the SCIP as it acknowledges the importance of working with the State's local

governments collaboratively as opposed to a top down method of a state attempting to direct the activities of its political subdivisions. This top-down approach of directing results instead of forming consensus has been tried in other states; often unsuccessfully. The SCIP continues, “Maryland’s Statewide Interoperability Executive Committee (SIEC) along with Maryland and Regional Interoperability Groups (i.e. the National Capital Region (NCR) will have the responsibility of developing and implementing regional strategies to provide radio communications interoperability within the regions in accordance with the technical requirements of this plan”.

The uniqueness of the NCR is incorporated in the SCIP as it states, “The vision for Maryland is an achievement of a statewide system that will support communications interoperability, and will facilitate real-time communications across boundaries of agencies, jurisdictions, levels of government, and ultimately, across State boundaries with Maryland’s neighbors (emphasis supplied)”.

The NCR is now challenged to develop the regional strategies discussed in the Maryland SCIP. One of the unique issues impacting Montgomery County is the fact that as a member of the NCR, the County must work within the communications framework of the NCR which includes jurisdictions in the Commonwealth of Virginia and the District of Columbia. As NCR members adopt P25, new communications interoperability opportunities open; however, the limitations of older radios become a serious problem. Montgomery County has many Motorola radios that were acquired before development of the XTL5000/XTS5000 series of radios. Only the XTL5000/XTS5000 series of radios can operate in the 700 MHz band, which will be used in Prince George’s County, or support P25, which will be (or is) used in Alexandria, Arlington, Loudoun, or the State of Maryland systems. Even with the comparatively newer Motorola XTL5000/XTS5000 series of radios, these devices cannot support TDMA which is used within P25 Phase II. This becomes even more important if the County, like the proposed State system, elects to operate on 700 MHz frequencies. FCC Rules require compliance with regulations governing the 700 MHz band that go into effect on December 31, 2016 that will require increased spectral efficiency achievable by TDMA. Regardless of whether the County uses 700 MHz channels for its system or not it will need to employ subscriber units that are compatible with P25 Phase II to maintain interoperability.

The SCIP does continue Maryland’s cooperative tradition of sharing infrastructure assets such as communications towers. This is affirmed when the SCIP states, “The public safety community in Maryland has agreed that it is necessary to complete the build-out of the statewide infrastructure (i.e., towers, microwave, and fiber networks) and migrate applications running over it to an open, standards-based, system. A robust statewide system would provide a common platform to provide radio system coverage and wireless data to most

corners of the State using State, County, and Municipal towers and system components".

This is important for Montgomery County as citizens are often concerned with the erection of communications towers. Towers are important for reliable radio operation and to the greatest extent practical; the construction of towers should be optimized to limit the number actually needed within the County. As a part of the Prince George's radio system, the State and County elected to build the required towers as partners sharing this new infrastructure for the 700 MHz systems being developed by both entities. This strategy has the effect of minimizing the impact of new communications towers within served communities.

The Maryland SCIP indicates that the State will "fund a ten year program to construct all of the necessary towers, shelters, emergency generators, and digital microwave needed to implement a statewide communications system in the new 700 band". The State's strategy encourages agencies to "Form partnerships with Maryland counties to reduce the number of towers and overall cost and make use of the new towers and microwave to improve the existing communications systems until a new system is available" .The State of Maryland is in the procurement process for a statewide radio communications system to operate in the 700 MHz band.

D. Subscriber Units and Infrastructure

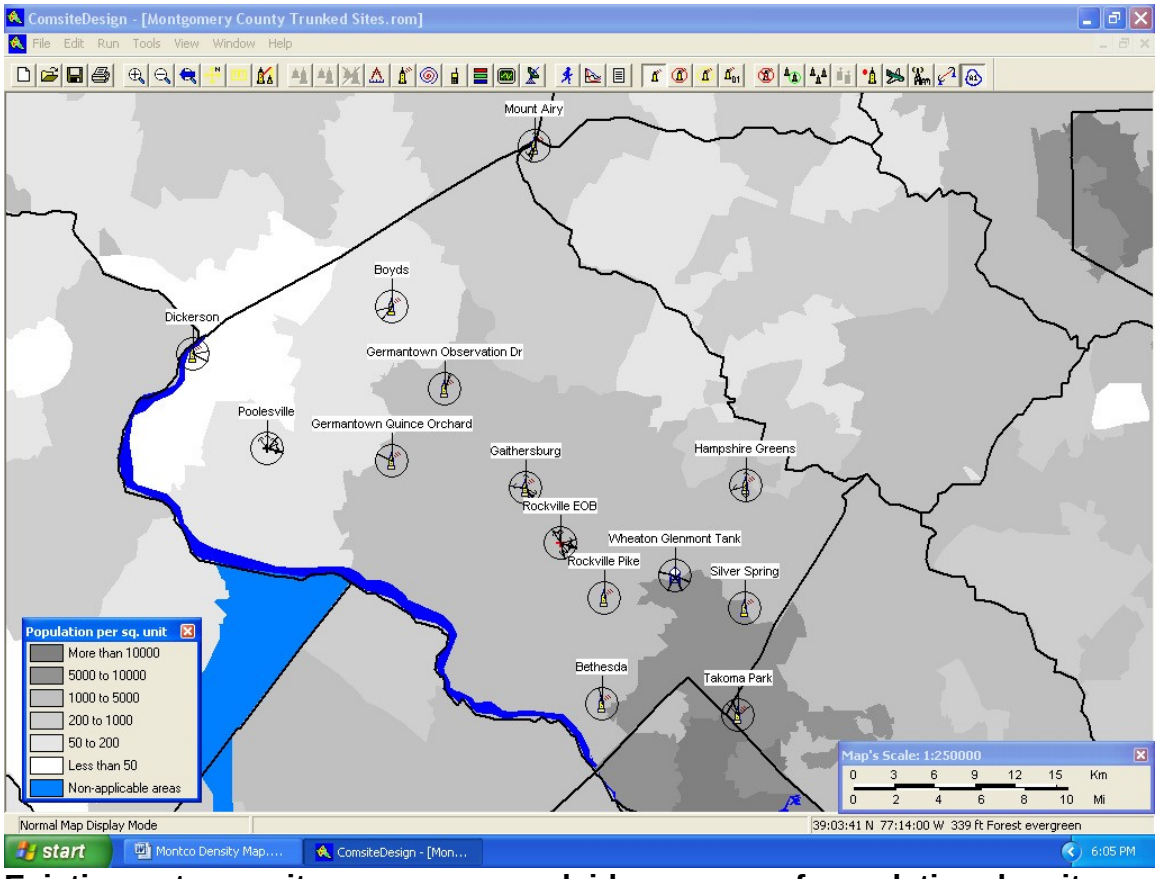
The County's radio system is a 20-channel, digital, trunked voice system, built around the Motorola SmartZone 3.0 architecture, simulcasting from 11 transmitter-receiver sites spread across the County.

The plan to replace the County's radio communications infrastructure requires that, first, the subscriber units (the mobile and the portable radios) be replaced. The subscriber units which form the overwhelming bulk of the County's inventory, the Astro Spectra mobile radios and the XTS3000 family of portable radios, are of the generation which predates the P25 technology systems. They are incompatible with the P25 and 700 MHz technology infrastructures. To accomplish an upgrade in Montgomery County the subscriber units must be replaced before the infrastructure to allow continuous operation and compatibility with both the new and legacy systems. The plan to spread the purchase of the replacement radios out over a three-year period is meant to provide a reasonable approach to the high budgetary impact of the equipment replacement cost. (The expectation is that, with a three-year procurement plan, the radio budget will be about $10 million per year for those three years.)

In the fourth year of the planned procurement, the infrastructure replacement should begin. This includes a new zone controller and network management

controller, new simulcast and prime site controllers, new base stations and comparator equipment, and more. The Gold Elite console equipment currently in use with the present system can be used with the new infrastructure, but will require significant software upgrades and new networking equipment to permit them to integrate into the IP-based architecture of the newer technology systems. The cost of the infrastructure replacement will be on the order of $30 to $40 million, depending on many design factors and deployment decisions.

One of the shortcomings of any radio communications system is the blockage of its signals by new and existing buildings. While it is a widely known fact that no radio system will ever have perfect coverage in 100 percent of the areas desired, except one funded with an infinite number of dollars, it is also a well known fact that, as new buildings are erected, coverage problems will increase unless efforts are taken to ensure that signal coverage levels will be provided for. The existing SmartZone 3.0 radio system was constrained by the architecture of the 6809 Prime Site Controllers, to which a maximum of 11 transmitter/receiver sites could be connected. Eleven sites in the County have provided an excellent level of coverage — better than 97%, when the system was built — but that was still less than 100%. Construction of new buildings has continued, and a concomitant degradation of signal coverage has also continued.



Existing antenna site resources overlaid on a map of population density

A replacement radio system, which will be built around new controller architecture, will not have the 11-site constraint. That system will be designed with a different placement of transmitter/receiver sites. While it is very likely that some of the existing sites can and will be reused in the new system, it is certain that the "concrete canyons" of the down-County areas (e.g., Bethesda and Silver Spring) will require a different placement of sites to provide improved signal coverage and reliability in areas where signals are presently inadequate or marginal.

The number and location of transmitter/receiver sites for the replacement radio system will affect the cost of the system.

E. Options

A number of options will be considered in the specifications for the replacement of the radio communications system. Evolving technology provides opportunities for more flexible network technology than in the past. Options include the ability to operate old and new technology on the same network to ease transition.

Continued cooperation with the State and adjoining jurisdictions which are implementing new generation systems will be explored for opportunities for sharing antenna sites, development costs in areas of common coverage, backhaul facilities, and sharing of network capacity or coverage.

The option of keeping some of the existing system in place will be explored:

1. It may be practical to maintain portions of the SmartZone 3.0 system that could provide an on-line "hot spare" backup system which could be used in the unlikely case of a catastrophic failure of the new system.

2. The need for Public Safety service providers — Police, Fire-Rescue, Sheriffs, Corrections and a few others — to transition to P25 compatible newer systems does not apply to all County radio users. For example, the DOT Highway Services vehicles and the DGS Customer Service providers (electricians, HVAC technicians, plumbers, etc.) have no such need. These agencies could remain on the existing radio system for as long as the SmartZone 3.0 system can be maintained or the functions might be integrated with the new system. A decision to not move non-Public Safety users to the newer system would be a decision to defer purchase of the newer subscriber radios.

Another option which will be investigated and considered concerns the inter-site backbone. As described above the current system uses a hybrid design of fiber optic circuits and microwave links. This may be the optimum for the new system, or it may not. All options should be considered.

F. Computer Aided Dispatch and Mobile Data Systems

The procurement of the current Motorola SmartZone 3.0 trunked voice radio system was only one facet of the Public Safety 2000 Project. Another main facet was the procurement of the Computer Aided Dispatch ("CAD") and Mobile Data Computer ("MDC") systems. These systems were placed into service in 2003. The move to next generation communication and data systems, all of which will be IP based, will provide additional opportunities for data sharing between these systems and therefore the County needs to focus particular attention towards system integration.

V. Current County Position

The County's current radio system is a 20-channel, digital, trunked voice system, built around the Motorola SmartZone 3.0 architecture, simulcasting from 11 transmitter-receiver sites spread across the County.

A. State of Current Fixed Infrastructure

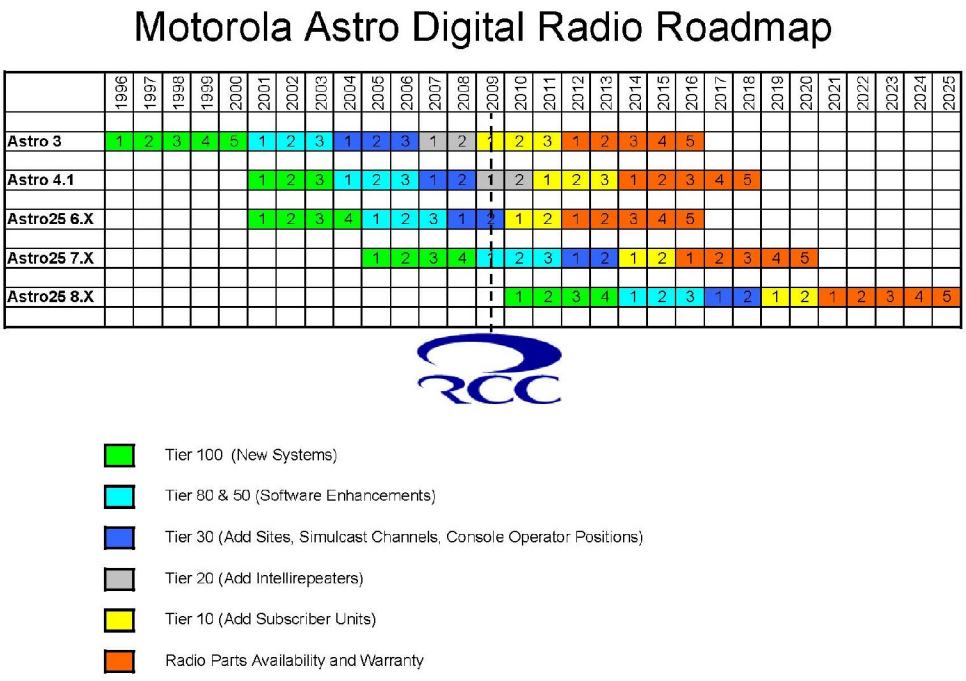
For over seven years the existing Motorola ASTRO Smart Zone trunked radio system has served the County well, eliminating many deficiencies that existed in the previous conventional radio systems used by public safety agencies including Police, Fire-Rescue, Sheriff, and Corrections. All County public safety agencies are now on a common radio platform, can and do communicate with one another on a routine basis, have better coverage than in the past, and have interoperability with most public safety agencies in the NCR and beyond. That the County has benefitted from the existing system is beyond question, and its value has been demonstrated time and again when the public safety agencies have been on the front line of response to incidents as diverse as, the Beltway sniper incidents, railway accidents, and a plethora of less publicized, but nonetheless urgent events.

Technology has advanced in the decade or more that has elapsed since the existing trunked radio system was merely a concept that required years of planning and procurement preparation before a contract was signed with a systems integrator. A three year implementation period, common for systems that require antenna site improvements, installation of backhaul transmission facilities, installation, training, and acceptance testing, ensued.

All the while newer generations of trunked radio systems were in development and introduced and a suite of public safety digital trunked and conventional radio standards were codified by the American National Standards Institute (ANSI).
Motorola, the dominant supplier of public safety communications systems in North America, enjoyed considerable success in the Mid-Atlantic region in the sale of trunked radio systems. Prior to ANSI recognition of the APCO 25 standard for digital public safety communications systems, Motorola had established a strong foothold in the region with its Astro systems. Digital trunked radio systems deployed in the timeframe of the County's contain Motorola proprietary functions and architecture that limit compatibility with the digital radio systems that were produced by others during the period. Such functions and features, while based on state of the art processors and communications protocols of the time, had the effect of creating a barrier to entry by competitors. This barrier was surmountable at the trunked radio level only at the cost of compatibility and interoperability amongst public safety agencies. While there was open competition for most of the trunked radio systems in the Mid-Atlantic

region, to provide full compatibility and interoperability Motorola was often the logical choice. To this date, full interoperability within the National Capital Region requires a subscriber unit radio that supports Motorola trunking functions, the source of which is limited to a few providers. The NCR enjoys one of the best and most complete interoperable public safety communications environments in the United States that is largely the result of using the equipment from this one supplier.

As standardization has progressed, new network versions have been introduced into the marketplace. Montgomery County employs SmartZone version 3.x in its network. The chart below depicts the placement of this version of SmartZone in the Motorola ASTRO technology Roadmap. This chart is based on information provided to RCC by Motorola in support of network upgrade strategies for other clients.



As can be determined from the above chart, another version (4.1) of ASTRO was introduced by Motorola in the 2001 timeframe. This version had limitations that were not present in version 3.1 (as purchased by the County) but which contained new limitations that were not optimal for the size and configuration of

the network needed by Montgomery County. Since 2001, Motorola has introduced major revisions of the network which do not provide for a seamless transition from one to another, and each of which has tradeoffs when compared to the existing and future versions.

The existing County system has passed the last stage of software revisions for Version 3 systems. System warranty and maintenance and expansion of the subscriber fleet is still provided. The current date for the end of the lowest level of support, radio parts and warranty, is 2016.

The most likely next step for an upgrade by the County is Motorola ASTRO 25 version 8.x which is compatible with the P-25 Phase II standard and has an IP based backbone. Version 8.x permits the use of Time Division Multiple Access technology that permits a 2:1 efficiency of simultaneous talkpaths per channel, thereby increasing the utilization of the existing radio spectrum and permitting future growth.

In summary, the County ASTRO 3.x system is in the twilight of its useful and fully supported life cycle. There are no intermediate levels of beneficial upgrades available for the network due to obsolescence of certain network subsystems, particularly the Motorola 6809 controllers.

Existing Trunked Radio System Configuration

Montgomery County's existing trunked radio system consists of major subsystems:

Public Safety Communications Center (PSCC) Equipment

PSCC equipment is composed of dispatcher workstations and electronics associated with control of the radio communications system. A total of thirteen police dispatch consoles, nine fire dispatch consoles, and five training consoles are installed and operational at the PSCC. Dispatcher workstations are connected to the radio communications network through central electronics banks and a switch (known as a Motorola Ambassador Electronics Bank). The Ambassador switch and central electronics banks are connected to radio channels, consoles, and the logging recorder system.

Other common equipment of the radio system is a Zone Controller that is an interface to the radio system, computer aided dispatch system, and dispatch equipment. Also located at the PSCC are switches that provide the selection of main and standby paths for control of the system, system management workstations and subsystems. These switches are Larus switches for selection of a main and alternate fiber path to the radio system and a Hadax switch that provides selection of main or standby trunking central controllers, voting receiver comparators, and other equipment at the prime site.

A redundant Motorola 6809 prime trunking controller is located at the PSCC that provides backup to two redundant controllers located at the prime site at the Shady Grove Road antenna site. Redundant voting receiver comparators are connected to the redundant trunking controller at the PSCC in the event the prime site is disabled.

An Alternate Emergency Communications Center is connected to the AEB and zone controller at the PSCC to the common radio network equipment to permit access to the radio system by communications personnel if the PSCC must be evacuated. This connection is made through the Montgomery County FiberNet.
Fire station alerting is provided through a Motorola MOSCAD system that is interfaced to the Computer Aided Dispatch system. This system is presently being replaced by a Westnet system following the obsolescence of the MOSCAD product.

Trunked Radio System Antenna Site Components

A total of eleven trunked simulcast antenna sites are employed in the radio communications system. The equipment configuration at ten of the sites is nearly identical. The method of interconnection with the prime site is either by microwave or by the County FiberNet is the only significant difference between these sites. The eleventh is the system “prime site” that houses the main and standby trunking controllers, primary voting receiver comparators, and other control equipment.

Existing Montgomery Trunked System Sites and Other Significant Sites

Trunked Radio Site Name	**Structure Type**
Kenwood (Bethesda)	Tower
MCCF (Boyds)	Tower
Dickerson	Stack
Shady Grove (Gaithersburg)	Tower
Germantown (Observatory Drive)	Tower
Quince Orchard (Germantown)	Tower
Hampshire Greens	Water Tank
Penn Shop Road (Mount Airy)	Tower
NRC – White Flint (Rockville Pike)	Building
Silver Spring (Berkshire Towers)	Building
Takoma Park	Tower
Other Sites with County Radio Equipment	
Poolesville	Tower
Rockville (Executive Office Building)	Building
Wheaton-Glenmont	Water Tank

Sites are located across the County and operate in the simulcast mode wherein the same audio and control information is transmitted simultaneously from all sites on one of twenty channels as selected by the prime trunking controller. This simultaneous transmission requires extremely precise control of the transmit

frequency and amplitude and phase of the modulating signal. Frequency is synchronized using Efratom frequency references that use the Global Positioning System (GPS) satellites as a time reference. Modulating audio is controlled by a special simulcast card installed in a TeNSR channel bank (now manufactured by Zhone) that connects to either the FiberNet or microwave radio system.

All sites are connected to the prime site trunking controller that manages channel access, control channel allocation, and other system access and monitoring functions.

As previously noted, each base station site is equipped with two National Public Safety Planning and Advisory Committee ("NPSPAC") Mutual Aid channel repeaters that operate in the conventional analog mode. These repeaters are used for voice communications with itinerant units from other jurisdictions that may not be equipped with access to the trunked radio system. The NPSPAC channels are also useful as a backup to the trunked radio system in the event of system failure, although they do not have the capacity to handle the full load of the system in a period of high activity.

Each base station site is also equipped with two VHF High Band base stations used for alert paging for the fire department. Also located at some base stations are Motorola RD-LAP mobile data base stations that are used in a multi-frequency reuse system. The RD-LAP system is largely unused having been replaced by leased service on a wireless carrier system.

Each trunked radio site is connected to the common prime and alternate prime sites by alternate routes of microwave radio or FiberNet fiber optic cable circuits. Larus loop switches are used to select between a main and backup path at each site.

Other equipment located at remote base station sites includes three uninterruptible power supplies (one for the frequency standards and network equipment and two for the radio equipment), digital cross connects, and standby electrical power generators with automatic transfer switches.

Radio Equipment Shelters

Pre-fabricated concrete/aggregate shelters are located at most antenna sites. Most shelters are single room 12ft X 27 ft structures mounted on concrete pad foundations. An exception is the Shady Grove prime site that employs a larger 12ft X 27 ft shelter.

In general, the shelters are in good condition and have been maintained since the system was installed. Configuration of the shelters follows the practices of Motorola at the time of installation.

There is little space available in the shelters to accommodate a full set of replacement equipment associated with a system upgrade. While some unused equipment might be removed, such removal will not result in an appreciable increase in space.

Legacy Motorola Quantar radio base stations at the remote radio sites will be replaced with newer technology linear simulcast base stations. This new generation of base station radios is much smaller in size, much more efficient in their power requirements, and much cooler to operate than the Quantar radios that they will replace. These may reduce recurring maintenance costs and require less physical space at all of our remote radio sites.

An overall system upgrade that involves replacement of the existing system must be performed without significant interruption of service. This will almost certainly require the expansion of the existing shelters through installation of a parallel structure or new shelter with separate power service and distribution panels.

Bi-Directional Amplifier Systems

To provide coverage inside of buildings, in the Metro tunnel system, and to fill in areas not otherwise covered by the eleven-site simulcast system, bi-directional amplifiers (BDA's) have been installed in numerous buildings, at four locations along the Potomac River, and in a number of locations in Metro tunnels. These devices amplify the signal received from a "donor" base station site and amplify it for retransmission by a local antenna or radiating cable system. Signals from portable radios in or close to the tunnel are received on the antenna or radiating cable system and are retransmitted back to the base station. BDA's are widely used for such coverage fill-in purposes by providing an economical solution for the problem of coverage in a confined area, such as a tunnel, underground mall, building basement, or other relatively limited area. They are not intended to provide wide area coverage in lieu of a full base station/receiver site. Existing BDA equipment can continue to be used in the radio frequency band and on specific channels in the County system. Some consideration will need to be given to these devices if a decision is made to employ as an upgrade to the existing system a TDMA (APCO P25 Phase II) system due to clock synchronization issues.

FiberNet

Most of the Montgomery County radio sites, other than those in the western end of the county, are interconnected by a County owned fiber optic system (FiberNet) carried over a combination of County installed fiber optic cable and fiber circuits provided by private vendors. The fiber installed by the County was initially part of a project by the Public Works and Transportation Department for traffic signal control systems. The system was initially implemented in the mid-

1990's with the intention to provide high capacity, high availability, carrier class services to mission critical users in County Government at an affordable price.

The system was installed and initially managed with the assistance of ARINC under contract. Presently, the system is managed by the County's Department of Technology Services, with ARINC providing field service personnel to assist in repair and troubleshooting.

Two generations of the network exist and are available. The first was initially referred to simply as "FiberNet" but is now distinguished as "FiberNet I". FiberNet I operates using single mode fiber strands, as an Asynchronous Transfer Mode (ATM) network with a basic transmission rate of Optical Carrier 3 (OC3), which is 155 Mbps. ATM networks are packet switched systems typically operating within a maximum overall data rate of 622 Mbps. ATM systems were developed to provide service with low latency and jitter, problems often encountered by high capacity data networks that affect "real time" services such as voice or video. ATM overcomes these problems by organizing traffic into 53 byte packets (cells), and routing them through pre-determined routes called virtual circuits. Each cell consists of 48 bytes of "payload" data and five bytes used for identification and routing.

Sites in the radio system are served by the FiberNet I wherever possible. Microwave radio links were implemented only where fiber service was not available, or was not economically feasible to install. RCC was advised there were some "timing issues" during the initial implementation of the radio system that had to be resolved with Motorola, but once they were addressed, the network has provided good support. Overall availability (reliability) of the FiberNet I system is said to be good. Each circuit has established for it, at least two paths through the "network cloud" and each site is served by two circuits (main and alternate) for each T-1 supporting the voice services on the radio system. For the remote sites, there is a main and alternate circuit back to the prime site at Shady Grove, and there is a network monitoring circuit to the PSCC and alternate ECC locations (two separate paths – not a redundant connection between the same two endpoints).

The technology is aging, but considered to be generally stable and reliable, once equipment and pathways are established. Network engineers are reportedly hesitant to make changes or work to optimize or make improvements to the older system because the changes sometimes introduce problems and cause the network to destabilize until after a period of adjustment and settling.

The FiberNet II system is a Multiple Protocol Label Switching (MPLS) network with much greater overall capacity and better performance. Data rates are generally greater than available with FiberNet I, varying up to gigabit speed for some links. Most services that could easily be moved to the FiberNet II system have been migrated.

It is desirable to identify and migrate to an alternate, or newer technology. FiberNet II is the logical replacement, but the requirements have not been established or researched, and no conceptual designs or transition plans have been developed.

For remote sites that are connected by fiber, the “drop” (from the site to the main fiber runs) typically consists of six strands of single mode fiber, of which four are used. Although FiberNet II service could be implemented on a site by site basis, it appears that service is either FiberNet I or FiberNet II, and both services could not simultaneously be served at remote site locations without the installation of additional fiber. The impact on network reliability and redundancy during such “site by site” transition has also not been discussed.

A good portion of the network fiber is installed overhead on utility poles. Although the system is very reliable and impervious to outages because of alternate routing, individual links have suffered extended outages of up to several days. These individual outages have been due to melted or burned cables caused by brush fires, and downed utility poles due to vehicle accidents. A few fiber breaks have also occurred with underground installation during excavation work by contractors.

Fiber in the “last mile” to remote sites, while redundant, is arranged in a collapsed ring topology, where a ring topology is used, but the two redundant fiber circuits follow the same physical path, or are in the same fiber bundle and both vulnerable to failure from a single hazard as mentioned earlier.

The present radio system is dependent on circuit switched technology, which is supported by time division multiplexing (dedicated bandwidth). Current and future systems technologies can usually be supported by packet switched network systems, as long as latency and jitter are well defined and stable.

An alternative approach for the next generation of system could be to develop network connectivity by a combination of fiber and microwave systems for diverse routing. Where practical, such a configuration raises system reliability as the two media are entirely separate and are not vulnerable to the same failures at the same time. By implementing microwave links, the transition from FiberNet I to FiberNet II may be easier as the system for an alternate path.

Obsolescence of Network Components

In the case of network infrastructure, as noted above, Motorola has notified its customers that there are components of our SmartZone 3.0 system that can no longer be covered under the infrastructure repair and replacement contract due to “end of life cycle” constraints. These network components are no longer made by the third party OEM that first sold these through Motorola and even the

considerable “last buy” stockpile that Motorola purchased when these vendors notified Motorola of their intentions to stop producing the items, have been depleted.

A number of these components are listed below:

1) UPS (Uninterruptible Power Supplies) at our remote radio sites

UPS’s are on line at all radio system sites. UPS’s are battery-based devices which ensure that, should commercial power be lost at a site, the load will be carried by a UPS until such time as the site’s generator can “spin up” and take the load. Without a healthy UPS at each site, the site would go down until the generator came on-line, and for a significant period thereafter, while computer equipment re-boots and re-synchronizes. Loss of a radio site for even a fraction of a second causes severe degradation of radio service for the geographical area that is served by that site.

2) Zone Controller

The Zone Controller (ZC) is the central call processing unit for the entire SmartZone 3.0 radio system. It is the “highest order CPU” in the system. The ZC is located at the “master site” (ECC). If the ZC fails, the radio system functionality degrades from “Wide Area Trunking” to a “Site Trunking” grade of service. Site trunking is a condition in which all subscriber radios function normally, but the dispatcher consoles are non-functional, requiring the dispatchers to fall back to a standby system of mobile-type radios.

3) Efratom GPS modules and antenna

The 800MHz radio system is based on a simulcast design, where every voice transmission is clearly received by each field subscriber unit at exactly the same time, no matter their location in the County. To accomplish this, the system utilizes Global Positioning Satellite (GPS) technology to acquire timing signals crucial to the whole operation of the radio system. The Efratom receiver units at each Radio Site, the Prime Site, and the Master Site are extremely critical to voice transmission and one of these units failing at any given site, will affect the quality of voice transmission throughout the system and eventually, the effective loss of all radio system traffic in the County.

4) T-BAR/Coronet/VEGA type switches

The Intelligent Protection Switch (IPS) is an automatic device that will switch most interfaces based on either manual or automatic control. In the automatic mode, it monitors selected interfaces and switches when specified conditions are met. The radio system utilizes a number of these switches. They can switch

between the active and standby Prime Site controllers. They can even switch the actual Prime Site location from the main Prime Site at Shady Grove to the standby Prime Site at the ECC. Failure of these switches removes our current levels of designed redundancy and may present a total loss of the Prime Site functions. Loss of the Prime Site effectively causes the complete loss of any radio communications in the County.

5) TenSr Channel Bank equipment modules

TenSr (Telecommunications Server) Channel Banks are the interface equipment between the Motorola radio equipment resident at remote radio sites and the "core" equipment at the Master and Prime Sites. Channel Banks are required at both ends of a link and these Channel Banks are provisioned with multiples of different specialty components that are necessary to carry out the various requirements of a given link and its voice and data traffic. Failure of a link will cause a loss of connectivity to that remote radio site with a corresponding degradation of service to the users that might be initiating radio calls from that site. Loss of Channel Banks between our Master and Prime site locations will cause severe degradation of functionality. The simultaneous loss of more than half of the system Channel Banks, could cause a complete loss of all radio system traffic in the County.

6) USCI and SDA modules

Both network components are only resident at the Prime and Master Sites. Loss of these components would cause a complete loss of simulcast and Failsoft mode capability, and a loss of all radio system traffic in the County.

7) LARUS loop switch controller cards

Loop switch controller cards allow for redundant T1 connectivity to our remote radio sites. Loss of a LARUS card results in the loss of this redundant capability.

B. Subscriber Unit Technology

Subscriber units currently in use on the County system include primarily the XTS3000 family of portable (hand-held) radios and primarily the Astro Spectra family of mobile radios. These constitute the overwhelming bulk of radios in County operation. Other radios in the system in smaller numbers include the MCS2000, XTS5000 family portables, and XTL5000 mobiles.

The Astro Spectra mobile radios and the XTS3000 family of portable radios, are of the generation which predates the P25 technology systems, having been supplied to the County beginning in 2000. They are incompatible with the newer

technology infrastructures and with newer interoperability standards and protocols. Operation in the 700 MHz band is not supported by these units. Therefore these subscriber units must be replaced before the infrastructure can be changed and to maintain interoperability within the NCR and State of Maryland.

Both types of radios limit the number of systems and digital identification numbers needed for access to mutual aid partners' radio systems. As other systems come on line with which the County will interoperate, this capacity will be needed. Examples of systems that are in planning or implementation that will require this functionality include Prince George's County, the State of Maryland, and CMARC.

Replacement subscriber units will need to support legacy protocols, P25 Phase I and Phase II modulation and protocol, and have sufficient memory to add new systems and talkgroups required for interoperability with new systems that are coming on line in the region.

Replacement radios must support operation in both the 700 and 800 MHz public safety communications bands. While the County is not migrating its operations to 700 MHz, neighboring jurisdictions and mutual aid infrastructure will employ this band.

C. Backbone Network Description

The backbone which provides connectivity for the various parts of the radio system infrastructure is a hybrid of two types of technology: an optical fiber network and a microwave radio network. Most of the system is interconnected through the County's optical fiber network (FiberNet), but three up-county sites predate the buildout of the fiber network to their geographic locations and so these are fed via redundant microwave links.

The FiberNet's ATM network is now also entering a new phase in its life cycle – the legacy phase. Many of these switches have been continuously operational for eight or more years. FiberNet has now begun to experience hardware failures. These cannot be ignored. FiberNet has an outstanding list of ATM switching hub problems that the County's Network Services staff are trying to work through in a controlled manner. Most important to note is the fact that, although most of the County's enterprise IT infrastructure has now been migrated to the new MPLS format, the Fibernet II network, the radio system cannot be migrated to this new platform due to its format. At the present time there is no plan for migrating the voice radio system off the original Fibernet backbone and this places the County's voice radio system at great risk of complete failure due solely to instability of the Fibernet ATM network and its aging components.

D. Equipment that Need Not be Replaced

Planning for the new radio communication system should take note of the fact that some equipment will not need to be replaced, because it is not needed in the newer technology systems. Additionally some equipment will not need to be replaced because subsystems in use in the current system can be reused in newer systems. Examples of equipment not needed in the new system would include the Digital Interface Units (DIU's), the Central Electronics Banks (CEB's), and the networking channel banks. The IP-based architecture of the newer technology systems does not require the use of these legacy families of equipment. Examples of equipment which can be reused in the new system would include the Gold Elite consoles, the newer subscriber units which may have been purchased with P25 compatibility after the acquisition of the SmartZone 3.0 system, microwave link equipment, and some of the fiber optic components of the County's FiberNet system.

Existing towers and antennas, shelters, power generation and storage subsystems, and other ancillary systems, such as air conditioners, may or may not require replacement, depending their current condition and on decisions made in the design of the replacement system.

VI. Strategy

A. Vision

Mobile communications functions required by the public safety users of the trunked radio communications system include:

- Push-to-talk voice communications between members of functionally associated user groups (talkgroups) throughout the County, including inside buildings

- Push-to-talk voice communications between County radio communications system users and peer users from other jurisdictions and agencies (interoperability)

- Non-voice communications to provide a machine-to-machine (M2M) interface for the purposes of Supervisiory Control and Data Acquisition (SCADA) used for network monitoring, security, alarms, activation/de-activation of remote devices (including fire station alerting), and automatic vehicle location (AVL)

- Wireless data communications to provide mobile access to sources of information including computer aided dispatch, status reporting and monitoring, databases, geographical information applications, messaging, collaboration tools, and certain types of file transfers

- Access to the public switched telephone network for standard voice telephony.

Public safety agencies are faced with a paradox in the provision of wireless communications services to their personnel. On the one hand, instant push-to - talk voice communications is the most used and highest priority form of communications. Such communications do not require wide bandwidth or a high data rate, rather they are better suited to narrow bandwidth systems that provide low latency and predictable transmission delays.

On the other hand, there is strong demand in public safety agencies for mobile access to the vastly improved information technology resources available to users of a “wired” network in the office environment. Such applications as the transmission and reception of video for surveillance and command purposes, transmission of fixed images such as digital photographs, and large files such as reports with embedded graphics or images requires an infrastructure that provides multi-megabit/second data throughput rates, a diversity of access

devices including PC cards, dongles to connect radio access devices with terminals, cameras, scanners or other inputs, and handheld application specific devices with integrated wireless access such as personal data assistants (PDA's), netbooks, or custom devices. Such operation is optimal on broadband systems that offer high data rates, systems that do not offer guaranteed latency or access times.

The third major function required by public safety, wireless telephony for access to the public switched telephone network, has commoditized to the point where it is most cost effective and efficient to simply purchase service from one or more of the several carriers who provide local, regional, and national access. In public safety wireless telephony and related services are not used as the tactical communications method of choice. The "one-to-one" nature of wireless telephony, the slow call set up times, and unreliability in severe weather and during major emergencies renders wireless telephony to a secondary service that is important, but not vital, to the coordination of public safety services.

No single network in the marketplace today provides all of the desired functions at an acceptable level of performance. Current technology public safety trunked radio systems are spectrum efficient, provide low latency and predictable waiting times, and are configurable to provide reliable coverage and system availability. The systems are not optimized for the transmission and reception of data at high rates and have limited application for this purpose.

Third and fourth generation broadband wireless systems to be deployed in the near future offer excellent throughput and raw data rates that will rival wired network performance for access to information. Such networks are, at the present state of the art, not optimized for push to talk communications with guaranteed latency and access times. Broadband wireless networks based on technology such as Wi-Max and Long Term Evolution (LTE) are natural progressions of the development of services by wireless carriers to a public subscriber base whose penetration equals or exceeds the population in some countries. Such networks are viewed as a method of providing high speed data and voice communications access to rural and under-developed areas and to provide the needed capacity to provide advanced services such as Internet Protocol Television (IPTV) with on-demand programming.

As discussed earlier in this report, a broadband initiative is in its formative stages to provide a national wireless network to support public safety, perhaps in collaboration or partnership with one or more wireless carriers. Clearly, the notion of building a national network is an ambitious project and one which will require an enormous investment and an extended deployment schedule. Regulatory, political, and financial hurdles remain in the path of realizing the needs and ambitions of the public safety community to provide improved services and security to the public.

While there are wondrous developments in the wireless broadband area that promise previously unheard of services to the mobile user, public safety agencies are faced with the reality that forward and backward compatibility will be needed in any technology procurement to preserve the hard fought gains in ease of interoperability amongst the many public safety first responder agencies in the National Capital Region and beyond.

Within this framework, Montgomery County is faced with short and long term decisions as to the direction to take to meet its obligations to the public safety first responders and the public for the delivery of services. The immediate and highest priority objective is to ensure that the tactical voice radio function that is vital to all public safety services remains reliable, provides excellent coverage, and offers the capacity to meet the routine and emergency needs of a growing community. Secondarily, the County must look forward to the provision of access to data and video from and to the mobile environment to provide the best and most timely information to first responders and to increase the efficiency of these paid and volunteer personnel in the performance of their duties.

B. Public Safety Technology Trends that Affect County Communications Options

Emerging standards, movement toward ubiquity of the use of the Internet Protocol and associated transmission standards for networks, and a movement toward fourth generation broadband wireless infrastructure all affect the County's options for communications systems going forward. Selection of technology is a rapidly moving target and plans beyond five years in duration must be constantly evaluated.

Emerging Standard – P25

In public safety the evolving P25 standard will drive procurements for at least the next five to ten years. The P25 standard was adopted by the Association of Public Safety Communications Officials (APCO) beginning in the 1990's. The purpose of P25 is to overcome the lack of interoperability inherent with the proprietary radio systems that permeate the country, including the NCR. Dissimilar protocols limit interoperability to the users of a specific radio technology, such as Motorola's SmartZone 3.X Frequency Division Multiple Access (FDMA) architecture used by the County.

There are two varieties of P25 known as Phase I and Phase II. All technical standards for Phase I have been adopted and users can purchase P25 Phase I products from a number of manufacturers now. A national certification process has been adopted by the Department of Homeland Security and beginning in the summer of 2009, different manufacturers will be invited to test their products on

the P25 land mobile radio systems of competitors. As an example, Motorola has invited competitors to its headquarters in July to test non-Motorola radios on the Motorola communications infrastructure to ensure proper operation pursuant to the adopted P25 standards. Once a radio demonstrates that it can meet all operational requirements of the P25 standard, the device will be certified as compliant.

P25 Phase II is still evolving as a finalized set of standards. It is widely believed that the P25 Phase II standards will be completely adopted by the Telecommunications Industry Association (TIA) as an ANSI standard in 2009 with equipment manufactured and sold using this technology in 2011. P25 Phase II is entirely different from Phase I; however, as part of the Phase II standard, a Phase II radio must be "backwards" compatible with Phase I standards. Through this backwards compatibility, a Phase II radio will be able to interoperate with either a Phase I or Phase II system.

The differences in the P25 phases are technically profound; however, easy to understand. Both technologies utilize a 12.5 KHz frequency bandwidth. P25 Phase I uses the frequency to transmit or receive one talkpath (or conversation) at a time. Conversely, P25 Phase II typically permits two different talkgroups to be transmitted or received simultaneously on the frequency. Phase II accomplishes this task by dividing the digital transmissions into two "time slots" through a technology called Time Division Multiple Access or TDMA. TDMA has been utilized successfully in the cellular telephone world for many years. As noted earlier, the P25 Phase II standard is "backwards compatible" and if a non-TDMA P25 Phase I user affiliates (joins) with an active talkgroup, the entire talkgroup will maintain communications through the older technology used in Phase I, FDMA. FDMA is the technology used in Montgomery County's current Motorola system. However, the current County technology is not based on the P25 Phase I standard.

Software Defined Radios

Greater intelligence is being implemented in the subscriber units employed by public safety first responders to provide a bridge across the gaps created by differing network protocols. Next generation radios are entering the marketplace that provide software definition of protocols, that operate in multiple radio frequency bands, and which offer substantial memory to allow access to multiple radio systems. The intent of SDR is to produce equipment that overcomes the limitations of frequency spread, differing modulation types, and different digital transmission protocols. Initially developed for tactical use by the military (which is vexed globally with the same incompatibility problems as public safety communications), these radios come at a relatively high price. Competition has been fostered by the adoption of the P25 standard and will tend to drive prices down as sales volumes increase.

Internet Protocol Networks

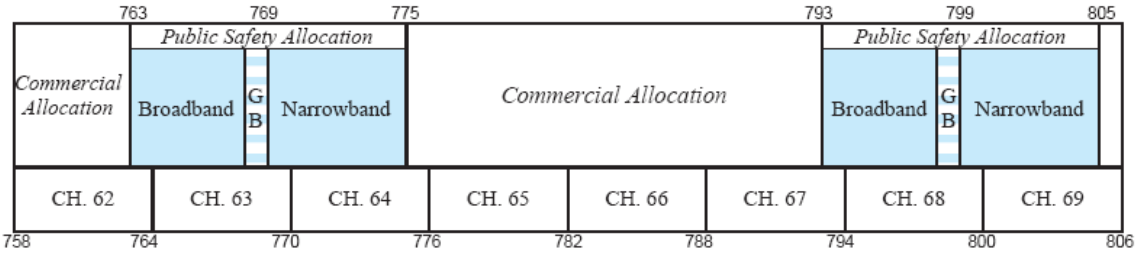
Internet protocol (IP) networks have enabled the use of commercial–off-the- shelf technology for the backhaul functions in radio networks, lessening reliance on protocols and hardware that are vestiges of circuit switched telephony. IP networks simplify the hardware requirements in the network and permit the networking of application servers. Such networking provides the future opportunity to provide networking of radio networks to provide automated roaming, to allow sharing of radio resources to provide coverage, and to provide greater network reliability than possible with central processor architectures.

Fourth Generation Broadband Wireless Networks

Demand for access to video, social networking, and access to the Internet in the mobile environment has driven wireless network operators and their suppliers to develop specifications and standards for broadband wireless networks that provide a mobile user an experience similar to connection to a wired network connection in the home or office. Such network capabilities will open new applications for public safety. In recognition of the fact that public safety will need these services and the fact that tactical operations require reliability and priority over the consumer use of wireless networks, the FCC initiated an inquiry as to how to meet these needs. Allocation of the 700 MHz spectrum created a block of spectrum wide enough to provide operation of a broadband network.

The FCC has chartered a roadmap for public safety wireless broadband as contained in its Second Report and Order adopted on July 31, 2007. This Order called for the licensing of ten megahertz of 700 MHz spectrum to a single nationwide licensee to act as a trustee of the spectrum on behalf of public safety. The selected licensee is the Public Safety Spectrum Trust (PSST) which is managed by a Board of Directors comprised from a consortium of nationwide public safety organizations.

Pursuant to the Second Report and Order, the FCC called for the creation of a public-private partnership to develop and manage twenty megahertz of spectrum used for wireless broadband services. The spectrum came from a reconfiguration of the 700 MHz band which placed ten megahertz of public safety spectrum in parallel with ten megahertz of commercial spectrum known as the “D Block”.



The "D" Block is adjacent to public safety broadband spectrum at 763 MHz and at 793 MHz producing a block of spectrum suitable for the Long Term Evolution (LTE) technology

The Congress had ordered the auction of the "D Block" spectrum as part of the Deficit Reduction Act of 2005 and the Digital Television Transition and Public Safety Act (Title III). Pursuant to the direction of Congress, the Commission held an auction for the D Block in early 2008 and only one bid was submitted. The FCC deemed the one submitted bid to be inadequate and a comprehensive review of the entire process was initiated. This review led to the Second Further Notice of Proposed Rule Making issued in the spring of 2008

Although there have been many filings in the FCC Dockets pertaining to the public safety wireless broadband, the Commission has not taken any definitive actions as there has been a substantive change in leadership following the 2008 presidential election.

Outside of the regulatory process, certain large cities or regions have contemplated changes to the FCC's approach and have filed several requests for waivers of the Commission's rules. The purpose of the waivers is to seek authority to implement new local government systems in the wireless broadband spectrum operating within the scope of nationwide standards. Subsequently, several of the waiver petitioners met with the PSST and received the concurrence of the Trust based upon the condition that the proposed systems would be constructed to national standards permitting the broadband interoperability envisioned by the Commission in the Second Report and Order.

The PSST has directed the National Public Safety Telecommunications Council (NPSTC) to lead the effort in the development of nationwide standards. NPSTC joined with the National Emergency Number Association (NENA) and the Association of Public Safety Communications Officers (APCO) in adopting the Long Term Evolution or "LTE" standard for wireless broadband. LTE has been incorporated by Verizon Wireless, AT&T Wireless, and several other wireless carriers as the technology to be used in their next generation systems. LTE also has the benefit of being an international standard.

One of the potential waiver filings may come from the District of Columbia's Office of the Chief Technology Officer (OCTO) which holds a Special Temporary Authority (STA) to operate a wireless broadband station in 700 MHz spectrum. The District had developed a proposed system prior to the Second Report and Order called the Regional Wireless Broadband Network (RWBN) utilizing Urban Area Security Initiative (UASI) funding made available to the NCR. The RWBN was envisioned as a network that would be implemented throughout the NCR in four phases. Montgomery County was included in the RWBN plan.

Due to funding cuts, development of the RWBN was limited to the District of Columbia. The STA under which the RWBN now operates is in 700 MHz spectrum assigned for narrowband voice operations, 769-775/799-805 MHz. This system must be rebanded into the 763-768/793-798 MHz spectrum which the FCC has designated for wireless broadband operations (please see Figure 1). There is some urgency as to the necessity to reband the operations of the RWBN as it now utilizes, on a secondary basis, spectrum that will be employed in the Prince George's County 700 MHz land mobile radio system. In addition, the Commonwealth of Virginia will be relocating operation of their State Agencies Radio System (STARS) to this spectrum.

In this unsettled regulatory environment, and in view of the enormous cost of deploying and managing a fourth generation network it is clear that it will take years to bring a public safety broadband network to fruition. While these networks have the capability for voice communications (telephony), they are not viewed as a short term solution to tactical voice communications in public safety. That such an evolution may occur in the long term is a near certainty, provided that the vision of such a network does not collapse under regulatory, financial, or political pressures.

C. Evaluation of Requirements

Upgrade of the radio communications network and subscriber units should be driven by user requirements and the correction of known deficiencies in the existing system. User requirements and steps to solve deficiencies will be identified and prioritized in the planning process. User requirements related to subscriber units are of the highest priority, as replacement of these devices is the first logical step in the interoperability project. An interview process associated with this report revealed a number of concerns expressed by public safety first responders regarding radio configuration, accessories, and battery life. These concerns can be addressed in the radio replacement contemplated in the first phase of this project.

Coverage Enhancement

A shortcoming identified by radio system users is the blockage of its radio signals by new and existing buildings. While it is widely accepted no radio system will ever have perfect coverage in 100 percent of the areas desired, short of proving the rule of diminishing returns through infinite funding, it is also a well known fact that, as new buildings are erected, coverage problems will increase or move around. Extraordinary effort is required to stay ahead of urban development to ensure that signal coverage levels will be stable.

The existing SmartZone 3.0 radio system was constrained by the architecture of the 6809 Prime Site Controllers, to which a maximum of 11 transmitter/receiver sites could be connected. Eleven sites in the County have provided an excellent level of coverage – better than 97%, when the system was built – but that was still less than 100%. Construction of new buildings has continued, and a concomitant degradation of signal coverage has also continued in areas of the County. Documentation of this degradation is a logical next step in the planning for a replacement system. This documentation, in the form of computer generated coverage predictions and field testing should be developed in advance of preparation of procurement specifications that define coverage requirements.

The replacement radio system is likely to be built around an IP backbone and a server based controller architecture that will not have the existing 11-site constraint. This will offer the flexibility of adding antenna sites to fill in coverage in recently developed areas. A placement of transmitter/receiver sites different from the existing configuration is likely in certain areas of the County. It is very likely that some of the existing sites can and will be reused in the new system. It is also certain that the “concrete canyons” of the down-County areas (e.g., Bethesda and Silver Spring) will require a different placement of sites to provide improved signal coverage and reliability in areas where signals are presently inadequate or marginal. The number and location of transmitter/receiver sites for the replacement radio system will affect the cost and schedule of the deploying the upgraded system.

D. Specification Development

In the short term the development of system requirements, specifications and user goals and objectives must be undertaken. Planning for a system upgrade is a multi-year process. It is suggested that a user committee be chartered with the objective of defining the requirements for the network. It is likely that a consultant will be needed to assist in the facilitation of the translation of user requirements into a procurement specification to which one or more proposers will respond.

E. Project Planning

The plan to replace the County's radio communications infrastructure requires that, first, the subscriber units (the mobile and the portable radios) be replaced. The subscriber units which form the overwhelming bulk of the County s inventory, the Astro Spectra mobile radios and the XTS3000 family of portable radios, are of the generation which predates the P25 technology systems. They are incompatible with the newer technology infrastructures. Therefore the subscriber units must be replaced before the infrastructure. The plan to spread the purchase of the replacement radios out over a three-year period is meant to provide a reasonable approach to the high budgetary impact of the equipment replacement cost. (The expectation is that, with a three-year procurement plan, the radio budget will be about $10 million per year for those three years.)

In the fourth year of the planned procurement, the infrastructure replacement should begin. This includes a new zone controller and network management controller, new simulcast and prime site controllers, new base stations and comparator equipment, and more. The Gold Elite console equipment currently in use with the present system can be used with the new infrastructure, but will require significant software upgrades and new networking equipment to permit them to integrate into the IP-based architecture of the newer technology systems. The cost of the infrastructure replacement will be on the order of $30 to $40 million, depending on many design factors and deployment decisions.

VII. Implementation

Over the long term the Montgomery County Communications Interoperability project is a major capital project. An investment of this magnitude requires a project organization and project plan that will require the involvement of a variety of internal and external stakeholders. Development of a detailed project plan is beyond the scope of this document. A general framework for the planning and management of the project is provided in the following subsections.

A. Project Organization

Collaboration and input from stakeholders in the design, specification, procurement, implementation, testing, and use of the radio communications system is required for a successful project. In the short term there is an opportunity to develop a proposed core project organization that will establish the processes needed to plan and manage the interim term project (implementation of the voice trunked radio system).

The core project organization will have as its responsibility the development of the project charter that defines the scope of the project and which defines the responsibilities of the participating agencies. The core project organization will include an executive sponsor who has overall responsibility for the guidance of the project and who is the liaison to the executive and legislative branches of the County.

Members of the core project organization will provide the channel for representation of the constituent users and stakeholders in the radio communications system and will manage the resources of their organization that are applied to the project.

B. Project Framework

The project involves a major capital expense on technology that crosses organizational boundaries within the County. First and foremost the goal of the project is to provide public safety first responders with the communications tools needed to accomplish their missions of protection of life and property.

A multi-disciplinary team will be assembled in a project organization that will grow and contract as the project progresses. Leadership and support will be required by team members, who over time, will include contractors, vendors, and/or consultants who are not County employees.

Best practices established in other public safety communications system projects of the scope of that contemplated by the County will be used in conjunction with the established practices of the Project Management Institute as embodied in the Project Management Book of Knowledge.

C. Project Management Team

Reporting to the Executive Sponsor of the project will be a project director who will coordinate, plan, and manage the project related activities of the core project organization. In the short term, the organization will focus on user requirements, system functions, implementation planning, performance metrics, and budgeting. In the long term the project organization will be heavily involved in procurement and implementation activities through project completion. Major constituent groups who should be represented in the core organization operation, technical, fiscal functions.

1. Operational

Operational members of the organization should represent the user groups from the public safety and public service agencies that are the dominant users of the radio communications system. Examples are Police, Fire-Rescue, Sheriff, Corrections, Park Police, and municipal jurisdictions.

2. Technical

Technical personnel who should be represented in the core organization include County radio engineering and maintenance personnel, information technology personnel with responsibility for backbone network operations, network manager, and consultants or technical advisors.

3. Fiscal

Representation will be needed from the organizations that manage the budget and cash flow of the project, contract administration, purchasing, and information technology for asset management and inventory control. Grant specialists and others who are skilled in obtaining public or private financial assistance should be part of the fiscal team.

D. Information Technology

Information technology support that will be needed to support the management of the project includes:

- Applications that provide financial and budget management reports that permit tracking of encumbered funds, project funding milestones, budget balances, and variance reports.
- Collaboration applications that permit the sharing of schedules, documents, and deliverables among the various committee members and participants in the project
- A project web site that provides information to stakeholders on the progress of the project
- Inventory and asset management application that allows incoming materials to be inspected and entered into inventory

E. Project Office

Once the development of plans, specifications, and needs assessments is completed and the project enters the procurement and implementation phase, it may be desirable to establish a project office to which key personnel are assigned for the duration of the project.

F. Procurement Processes

In the planning process decisions will be required as to the form of procurement(s) that will be employed that will provide the desired responsiveness to the needs defined by the users and the core project organization. Selection of the process will be an operational, legal, purchasing, and fiscal decision that is reflective of the needs of the user community.

VIII. Funding

In the short term the funding requirement for the Montgomery County Communications Interoperability Plan is to begin the first phase of subscriber unit upgrades and to fund the operation of the core project organization, including consulting assistance for the development of plans and specifications.

A multi-year funding schedule is contemplated for the later phases of the project and it will be the responsibility of the core project organization to develop a detailed budgetary plan within six months of its inception.

On an opportunistic basis, grant funds should be sought from the inception of the project to attempt to obtain assistance from initiatives that are currently being promulgated by the Federal Government.

IX. Conclusion

Montgomery County has a tradition of providing excellent support to its public safety first responders. It has expended substantial funds to provide a reliable voice communications system for the daily operation and interoperation of public safety services.

Maintaining the reliability of the voice radio communications system so that it enables the first responders to accomplish their missions requires periodic refreshment of technology. The County is a participant in daily coordination of public safety activities in the National Capital Region, and technology changes in the region have a ripple effect on all communities in the area. Technology refreshment of the voice radio communications system is urgent and must be commenced immediately, with a five year planning and implementation period.

Access to data enhances the efficiency of public safety operations, and increases the efficiency of first responders who face an ever increasing workload. Enhancements in technology offer heretofore impossible access to video, images and documents in the mobile environment. Such technological advances are evolving for public safety and will be the next logical step in the long term period of five to ten years.

This report outlines an approach to meet the short and long term needs of the public safety first responders. Over the next ten years it will be necessary for the County to continue to invest in its wireless communications infrastructure on its own and in collaboration with other public and/or private entities.

GLOSSARY OF TERMINOLOGY

APCO P25	See P25
ASTRO SmartZone	A digital trunked radio system designed by Motorola in the 1990s and acquired by the County that permitted the establishment of centrally connected “zones” of coverage
ASTRO Spectra	Motorola’s first generation 800 MHz trunked mobile radio compatible with ASTRO digital systems
ATM	Asynchronous transfer mode
Backhaul transmission	A transport layer designed to provide communications between the radio system’s prime and remote sites
Base station	A radio transmitter and receiver permanently installed at a fixed geographical location
Cache	A supply of radios that can be distributed to jurisdictions in the event of an emergency or other extraordinary event
Console	A personal computer based system that permits a user to manage a trunked or conventional radio system (operator console) or to send or receive radio transmissions (communications officer console)
Conventional radio	A non-intelligent system that transmits and receives radio messages on specific radio frequencies
Coverage	The geographical area in which a radio system provides reliable transmission and reception of user voice communications or data
DHS	United States Department of Homeland Security

Interoperability	An essential communications link within public safety and public service communications systems which permits units from two or more different entities to interact with one another by radio or data networks and to exchange information according to a prescribed method in order to achieve predictable results
IP	Internet protocol, a network layer protocol (Layer 3)
Latency	The amount of time delay associated with the processing of a transmission in a network
MOSCAD	A system control and data acquisition system produced by Motorola to provide the monitoring of radio system operations as well as related components such as alarms related to equipment shelters, microwave, power supplies and tower lights, etc. MOSCAD was also adapted to provide fire station alerting over trunked radio systems.
Mutual aid	An agreement between two or more governmental units to provide first responder resources when required
Network availability	A radio trunk available to transmit or receive a user's message
Noise levels	Electrical impulses generated by natural and manmade sources that may affect radio communications
NPSPAC Mutual Aid	Five 800 MHz radio frequencies identified by the National Public Safety Planning and Advisory Committee designed for nationwide interoperability (one calling and four tactical channels)
PSIC	Public Safety Interoperable Communications (program authorized by the Deficit Reduction Act of 2005, Title III of Digital Television Transition and Public Safety Act)

P25	An open architecture set of technical standards developed under the supervision of the Association of Public Safety Communications Officials, Inc. for the manufacture and operation of base stations, mobile, and portable radios as adopted by the Telecommunications Industry Association and recognized by the American National Standards Institute and encourage by the United States Department of Homeland Security
P25 Phase I	The first generation of P25 operating on a 12.5 KHz radio frequency and producing one talkpath through the use of the Frequency Division Multiple Access (“FDMA”) architecture
P25 Phase II	A developing generation of P25 operating on a 12.5 KHz radio frequency and producing two talkpaths through the use of Time Division Multiple Access (“TDMA”) architecture
Quality of service	A measure of the reliability of a voice or data network
Radio trunk	A pair of transmit and receive radio frequencies
Rebanding	Retuning all public safety land mobile radio systems from the 821-824 and 866-869 MHz frequency bands in 806-809 and 854-857 MHz to avoid radio interference from common carrier systems
Roaming	The ability of a mobile or portable radio to roam from one radio system to another radio system through programming of the mobile or portable device as well as the host radio management software
Satellite timing receiver	A receiver used at a trunked base station site to manage the frequency and launch times of simulcast radio transmissions
SCIP	State Communications Interoperability Plan
SIEC	State Interoperability Executive Committee

Simulcast transmissions	A system that permits the same radio transmission to be broadcast simultaneously from multiple transmitting sites without the generation of interference
SmartZone 3.0	A software release developed to manage the digital trunked radio system designed by Motorola in the 1990s and acquired by the County and which provided for multiple coverage areas to be networked
System key	The software code that permits subscriber mobile and portable radios to be programmed to operate on systems managed by other jurisdictions
TDMA	Time division multiple access. A available radio frequency channel bandwidth is divided by equal time intervals, synchronized by a time source, thus permitting the channel to be shared by more than one user simultaneously.
Trunked radio system	An intelligent computer controlled radio system that manages radio communications traffic by assigning system messages to available radio channels (trunks)
Software defined radio	A mobile or portable radio that contains digital signal processing under software control that permits various frequencies, modulation types and digital protocols to be programmed
Subscriber radio	A mobile or portable radio assigned to a user of the radio system
Wireless broadband	An advanced wireless technology that provides high speed data communications through private or commercial radio networks
Wireless network operator	A radio common carrier such as Verizon Wireless, Sprint, T-Mobile, AT&T, etc.
XTL5000	Motorola's first 700/800 MHz compatible mobile radio

XTS3000	Motorola's second-generation digital portable radio
XTS5000	Motorola's third-generation digital portable radio capable of P25 operation in the 700/800 MHz frequency band
6809 Controller	The trunking central controller used in Motorola trunked radio systems, including SmartZone 3.0. Its name comes from a Motorola microprocessor series used in the controllers.
700 MHz (data)	A group of frequencies in which base stations transmit between 763 to 768 MHz and receive subscriber device transmissions on frequencies between 793-798 MHz
700 MHz (voice)	A group of frequencies in which base stations transmit between 769 to 775 MHz and receive subscriber device transmissions on frequencies between 799-805 MHz
800 MHz	A group of frequencies from 806 to 817 MHz in which mobile and portable radios and control stations transmit and base stations transmit from 851 to 862 MHz