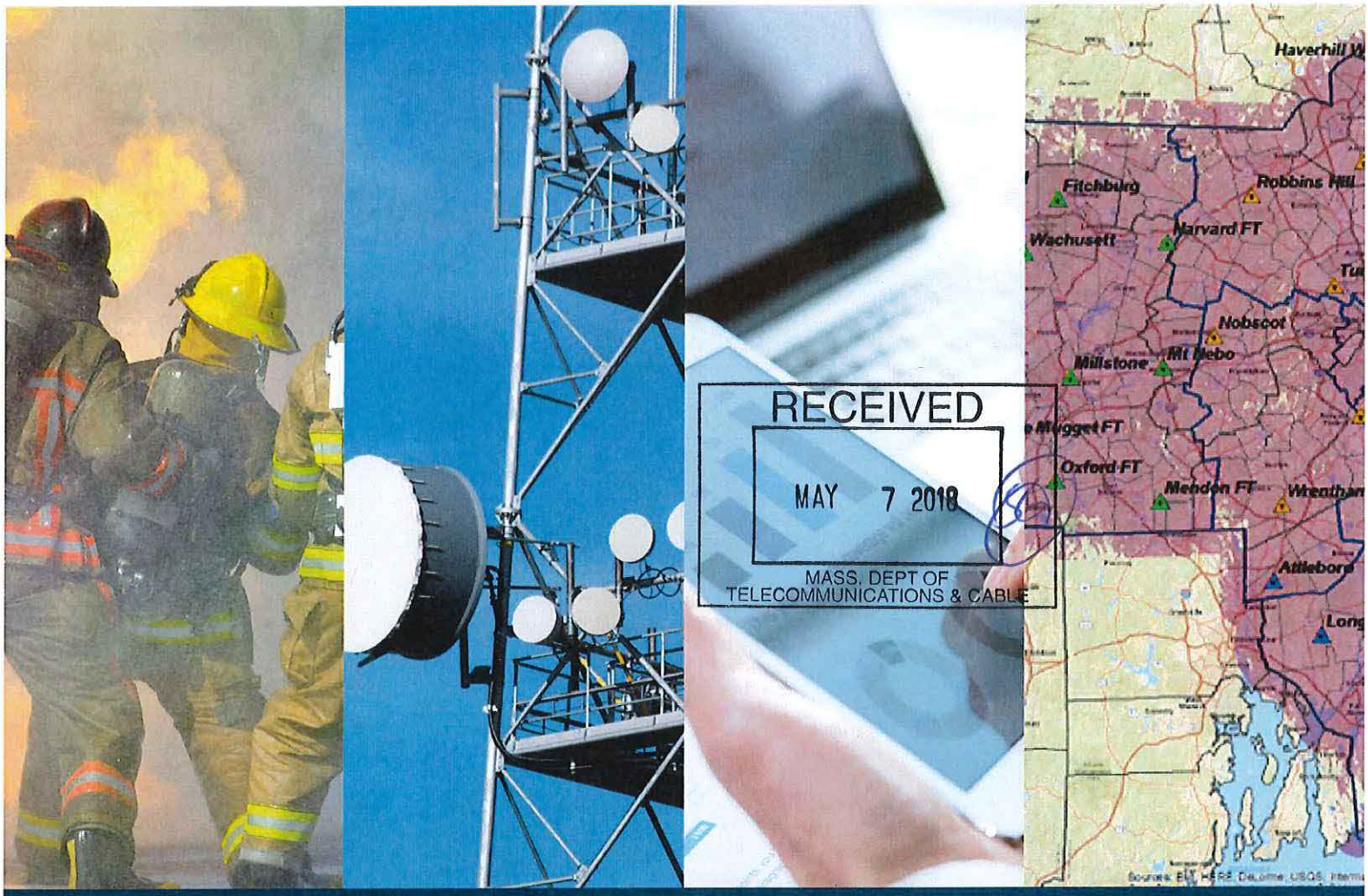

Commonwealth of Massachusetts Interoperable Radio System (CoMIRS)

1 Executive Summary

Version 1.0 (June 2017)

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1 EXECUTIVE SUMMARY

The Commonwealth of Massachusetts Interoperable Radio System (CoMIRS) is a statewide radio system that provides operable and interoperable communications for 245 public safety and transportation agencies throughout the Commonwealth. Of the nearly 30,000 radios active on the network, 18,856 are used for operable, or mission-critical daily, communications.

CoMIRS Operable Agencies and Radio Counts

The network also supports interoperable communication amongst numerous public safety entities:

Major Interoperable Agencies and Associations

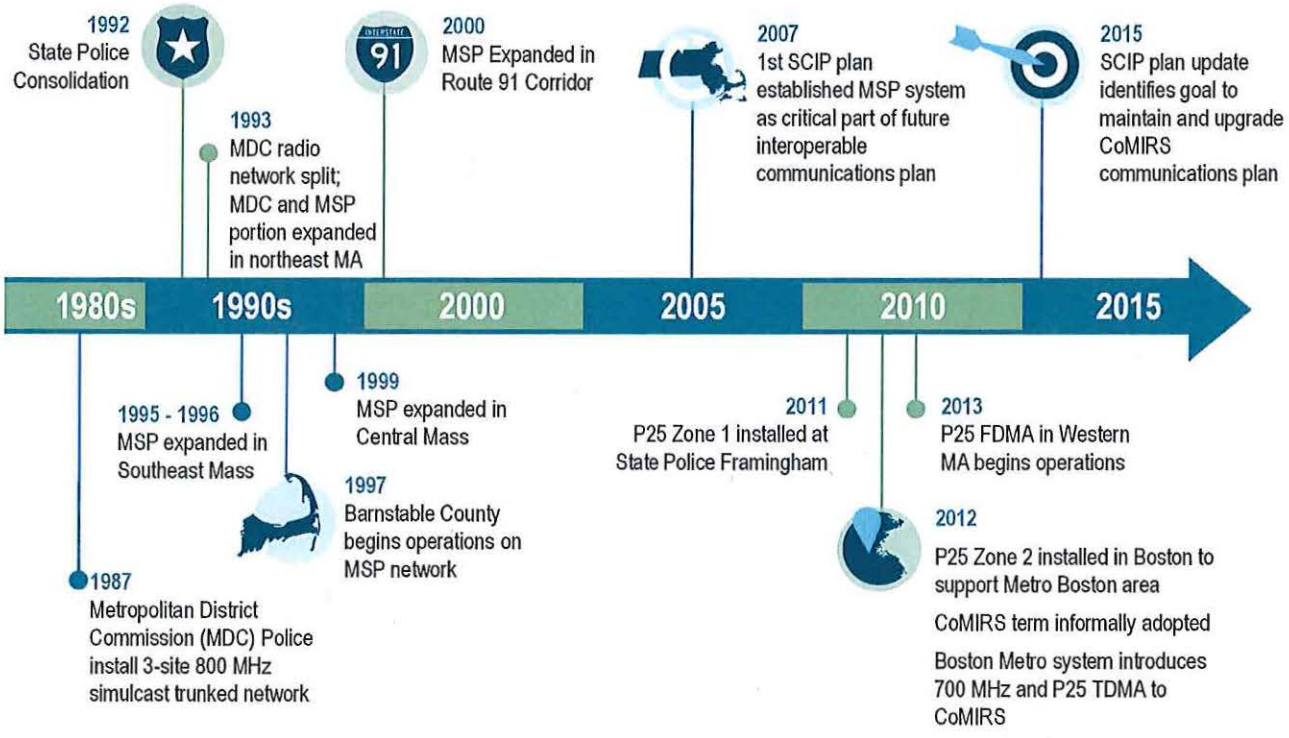
- Boston DOIT
- City of Cambridge
- City of Worcester
- MA Port Authority
- Boston Fire & Police
- Boston EMS
- UASI Cities & Towns
- Springfield Fire & Police
- Regional CC Middleton
- Fire District 6 Westford
- Fire District 14 Ashland
- Fire District 15 N. Andover
- BAPERN
- WMLEC
- Metrofire

Major components of the radio network are over 20 years old and use technology no longer supported by the manufacturer. This Strategy Report details how this critical infrastructure should be modernized to assure reliable, mission critical operable and interoperable communications for the years to come.

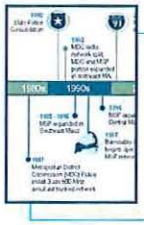
1.1 History of the Network

The CoMIRS radio network originated with the Metropolitan District Commission (MDC) Police 3-site 800 MHz simulcast trunk network originally installed in 1987. After State Police consolidation in 1992, a strategic decision was made to expand the regional 800 MHz analog system to be a statewide radio network. That expanded network covered approximately 75% of the state using 49 radio tower sites.

Over a decade later, the analog network was extended into western Massachusetts and the initial segments of a Project 25 (P25) digital network were built from 2007 through 2014. P25 is the standard for the design and manufacture of interoperable, digital, two-way wireless communications products. Developed in North America with state, local, and federal representatives and governed by the Telecommunications Industry Association (TIA), P25 has gained worldwide acceptance for public safety, security, public service, and commercial applications.



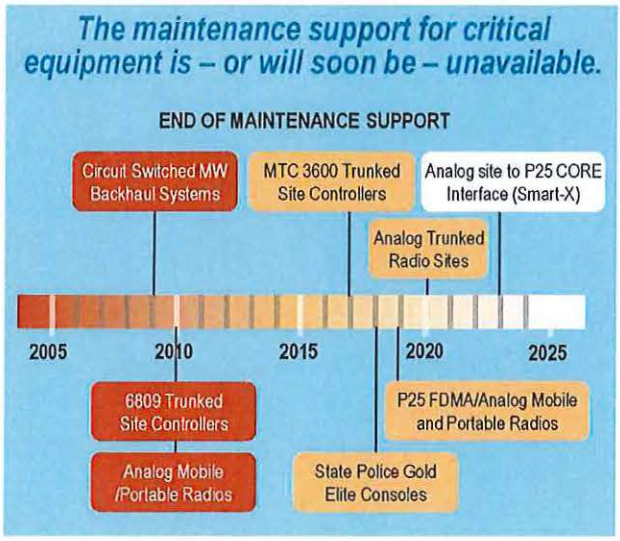
Over the years, the statewide radio system expanded to include multiple state and municipal agencies for mission-critical operable communications. It also serves as the primary communications infrastructure for statewide interoperable communications. Today, the CoMIRS network is mission critical to its operable agencies and is used by thousands of first responders each day in the protection of Commonwealth lives and property. The vision is to extend the P25 digital build-out to the rest of the statewide system, upgrading it to the new P25 standards.



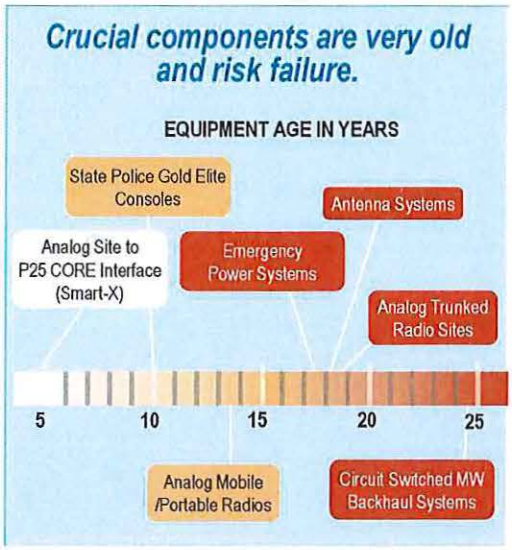
For more information about the history and usage of CoMIRS, refer to Section 2 Current State Assessment and Key Findings.

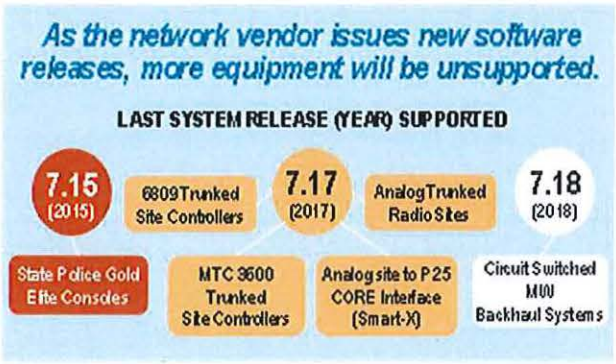
1.2 The Current State of the Network

The CoMIRS network was patched together over time with a variety of regional analog and digital expansions. Some of the analog subnetworks still in use are more than 20 years old and use technology that has been abandoned by the telecommunications industry for nearly a decade. Nationally, most owners of mission-critical analog radio networks have already replaced or are in the process of replacing those unsupported networks. Major challenges with CoMIRS include:



1. Major radio **manufacturers have moved away from proprietary analog systems**, like those used by CoMIRS, toward standards-based digital radio systems.
2. Systems using spectrum-efficient P25 TDMA (Time Division Multiple Access) Phase 2 standards have been in operation since 2011. **TDMA systems are four-times as spectrum efficient** than analog systems, like CoMIRS.
3. Despite the industry move to digital for radio communications, CoMIRS is **still heavily reliant on aging, outdated, and often unsupported analog technology**.
4. Critical analog system equipment is old and is no longer being manufactured. **Repairing and replacing parts is becoming increasingly expensive and time-consuming.**
5. **Immediate needs replacements or repairs are needed** for GPS reference clocks, MSP Gold Elite console systems, failing or obstructed backhaul connections, and other analog trunked radio site components.
6. Much of the CoMIRS backhaul network, which provides critical communications between radio sites, is nearly 25 years old and **uses circuit switched technology that that will not be supported** in future releases of the network operating software.





7. **No future system releases can be applied to CoMIRS (or its subnetworks like the City of Boston)** until all analog systems are decommissioned and all Gold Elite Console Systems are replaced.

8. Several CoMIRS partners have already implemented digital upgrades to their networks. These **partners cannot move forward with annual software upgrades without a major upgrade to CoMIRS**.

Failure to address this aging infrastructure threatens mission critical communications statewide.

In addition to its aging, unsupported, infrastructure, the current network **does not meet the operational needs of its current users**. As a patchwork network of analog and digital, users operating at the same incident often cannot communicate without the intervention of a system administrator or dispatch operator. When communications are established across analog and digital channels, voice quality is often degraded, and advanced features, like encryption, are not available.

1.3 The Business Case

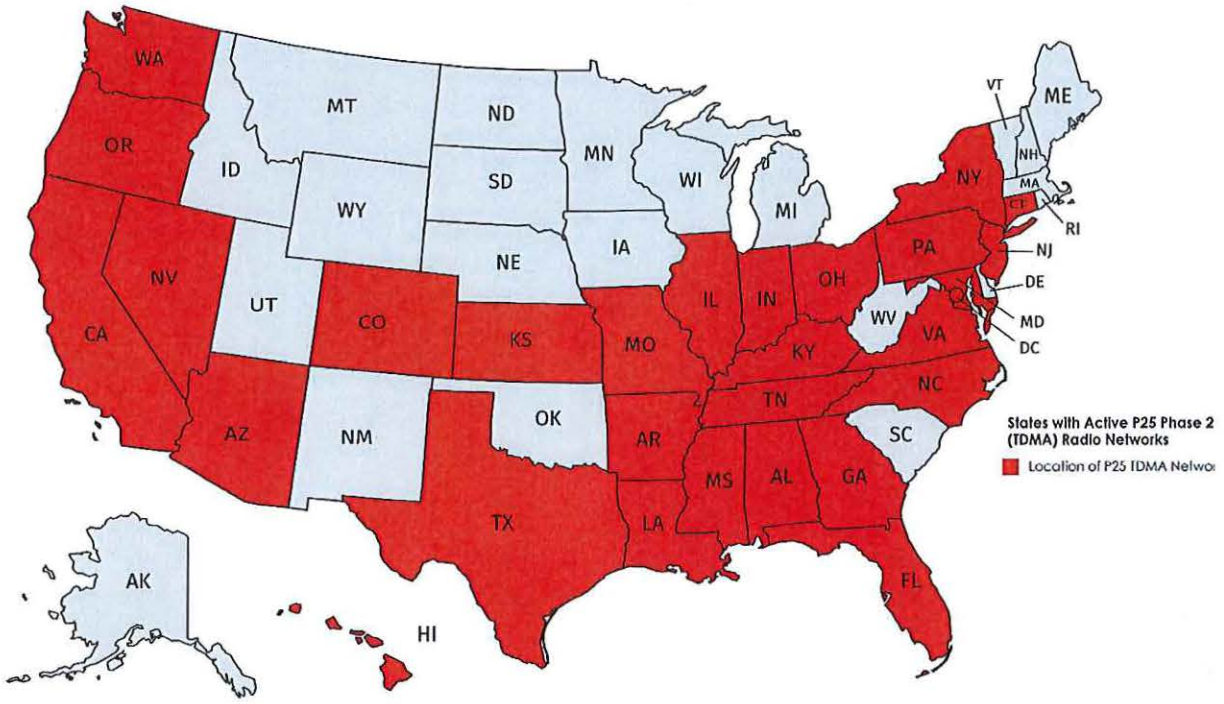
Enormous benefits can be obtained by replacing the CoMIRS analog network with a modern digital system. Analog land mobile radio technology has been in use in the United States since the 1930s. The Commonwealth has the opportunity to leap several generations of technology to vastly improve radio communications in Massachusetts. The adoption of a fully P25 TDMA radio network will:

- ✓ **Eliminate aging, unsupported components** that are prone to failure
- ✓ Significantly **improve radio quality and coverage** areas
- ✓ **Enhance interoperability**, with more channels available on the same frequencies
- ✓ **Provide needed advanced features**, like remote programming, location services, and encryption
- ✓ Vastly **expand the capacity** of the network, allowing more organizations to use the network
- ✓ **Provide an option for the Commonwealth to consolidate radio operations** on a single statewide network, avoiding the modernization and maintenance costs associated with separate networks
- ✓ **Assure the long-term availability** of mission critical, public safety voice communications throughout the Commonwealth

For more information about the current state of and the business case for CoMIRS modernization, refer to Section 2 Current State Assessment and Key Findings.

1.4 The Experiences of Other States

Currently, there are P25 Phase 1 (FDMA) radio networks in operation in 49 states (Vermont is the exception) and P25 Phase 2 (TDMA) radio networks in operation in 27 states.



P25 is the most widely used digital technology by public safety agencies across the nation and has been adopted by many Federal Government users. To encourage the adoption of the P25 standard by public safety agencies in the United States, federal grants for interoperable communications have been available to states and local communities for the use of P25 standards in new or expanded systems.

In 2010, the Association of Public Safety Communications Officials (APCO) adopted P25 Phase 2, which utilizes Time Division Multiple Access (TDMA) technology. The first commercially available P25 TDMA systems shipped to the marketplace in 2011.

As a component of this Strategy Report, four states – Colorado, Michigan, Minnesota, and Ohio – were selected for a detailed analysis of the implementation of their statewide P25 digital radio networks. The chart below compares the four states by population, geography, and user base to Massachusetts:

State	Size (sq miles)	Population	Pop Density (per sq mi)	Member Agencies	Active Subscribers
Colorado	104,094	5,456,574	52	1,000	92,000
Michigan	96,714	9,922,576	103	1,500	75,000
Minnesota	86,936	5,489,594	63	83 counties	89,000
Ohio	44,826	11,613,423	259	1,200	72,000
Massachusetts	10,554	6,794,422	644	245	30,000

Some of the key findings in the other state analysis include:

- Each state **invested significantly** in its digital radio upgrade (from $135 M for Colorado to $272 M for Ohio. These represent actual costs that have not been adjusted up for inflation)
- Each state radio system supports a **broad user base**, including agencies at all levels of government
- Each state radio system supports **larger numbers of active subscribers** than Massachusetts (ranging from 72,000 in Ohio to 92,000 in Colorado)
- Each state adopted a **formal governance board** to oversee key network decisions
- Each state selected a **combination of financing tools** to build out and support the radio network (see the table below for a summary of the selected financing tools)

State	Total Cost	Grants	State Appropriations	Subscriber Fees	911 Fees	Locally Funded	Membership Fee	Bonds	Activation Fee
Michigan	$230M		X	X				X	X
Minnesota	$236M	X			X			X	
Colorado	$135M			X	X	X	X		
Ohio	$272M					X			

In interviews with other state radio leaders, Minnesota was identified as a best practices model for implementing a statewide digital radio network.

The Minnesota statewide radio network, called Allied Radio Matrix for Emergency Response (ARMER), cost $236 million to build out and was funded by a state bond. The costs of ongoing maintenance, administration, and servicing the debt on the bond for ARMER are all paid by 911 fees. These fees are assessed by the state and included in the state's annual budget. Transition costs for local users who wished to migrate onto ARMER from their own networks were subsidized by the state's allocation of federal grant money that was available after September 11, 2001. This grant money covered 44.78% of transition costs for local users. While this source of funds is no longer available, Minnesota continues to subsidize this same percentage of transition costs for users migrating to ARMER as an incentive to join the statewide network.

For more information about other states networks surveyed, refer to Section 3 Market Analysis.

1.5 Implementation Considerations

Below is a summary of the technical, project planning, governance, and funding considerations for the successful implementation of the CoMIRS digital network.

Technical Considerations

Adopt P25 TDMA: This is the fundamental recommendation of the Strategy Report. The CoMIRS analog network is at end-of-life and needs to be replaced and decommissioned. The prevailing industry standard for the most efficient use of scarce radio spectrum is P25 Time Division Multiple Access (TDMA) channel access. TDMA allows multiple users to share the same frequency channel by dividing the signal into different time slots. Each user's communication is transmitted in rapid succession in segments, one after the other, each using its own time slot. TDMA is four times as spectrum efficient as the analog network and twice as efficient as the FDMA network deployed in western Massachusetts.

Adopt Smaller Simulcast Regions: Currently, CoMIRS operates with four analog simulcast regions and two P25 digital simulcast regions. A drawback of this limited number of simulcast regions is that each region is geographically large. When a local call is made between responders it occupies a channel for the entire simulcast region. Currently in central Massachusetts, a call between two responders in Fitchburg would use a talkpath throughout the entire simulcast region stretching all the way to the Connecticut border. This Strategy Report recommends the adoption of smaller simulcast regions, aligned with typical areas of operation for existing users.

Address Sub-optimal Tower Locations in Digital Buildout: The existing CoMIRS network has made use of available radio sites often based on where property was publicly owned and available for radio equipment. This often is on fire towers and municipal buildings. These sites are not always optimal locations for radio transmissions. The Commonwealth should use the modernization of CoMIRS as an opportunity to review existing radio site locations to improve overall coverage.

Improve Grade of Service (GoS) Target for Network Reliability: Currently the MSP network support staff maintains a GoS target of 2% for call reliability. That means that 98% of all calls are handled in less than the allowable delay time. Given the mission criticality of the network and the improvements planned for its infrastructure, an improved target of 1% GoS is recommended. This is more in line with other modern Land Mobile Radio trunked systems.

Project Planning Considerations

Start Soon: The rollout of a statewide radio network is logistically challenging. Site identification and acquisition can be time-consuming and present unforeseen obstacles. The initial steps for the CoMIRS

modernization should begin as soon as possible, even while funding for the overall system refresh is being identified.

Visit Each Radio Site: Once engineering professional services are procured, each radio site should be visited and a specific upgrade plan created for each site. In particular, technical expertise is needed to determine whether an existing site has sufficient resources and space to accommodate a second set of radio site infrastructure until the transition from analog to digital is complete. In addition, there may be unforeseen site issues that need to be identified early in the project.

Perform Proper Technical Planning Up Front: This Strategy Report is based on available planning and information. The next step is to elaborate this strategic plan with formal engineering designs for each radio site. Proper technical planning is needed at the beginning of the project to assure the anticipated coverage and capacity are realized. Technical changes are easier to accommodate early on in the modernization lifecycle.

Coordinate the Transition from Analog to Digital: There are 245 agencies currently using CoMIRS. The complete transition from analog to digital will require coordination with all of these agencies. Where radio replacement is required, there may be lengthy municipal budget and acquisition processes to take into account. Proper coordination and communications are needed throughout the planning and transition processes.

Clarify Governance and Oversight Responsibilities: Currently, EOPSS is the lead organization for decision-making and financing of the radio network. The MSP is the lead organization for support and maintenance of the network. As the network continues to grow to accommodate more agencies, the decision-making, funding, oversight, maintenance, and support responsibilities need to be clearly articulated. This is particularly important should additional large agencies seek to join CoMIRS operationally.

Formalize the Process for Agencies to Request Use of CoMIRS: Currently, the process for requesting and obtaining rights to use CoMIRS are informal. These decisions are largely made by EOPSS. As the network matures into a statewide shared service, a more formalized user request and acceptance process is recommended. This may also include user activation or other usage fees.

Approach MassDOT and Other Potential Users Now: There is expressed interest in the CoMIRS network from public safety organizations in Berkshire and Franklin counties as well as the Department of Correction. These organizations should be accommodated by existing or planned radio infrastructure without jeopardizing the Grade of Service for other users.

Additionally, a determination as to whether to support other large statewide organizations, like other divisions of MassDOT, needs to be made early on so that proper capacity can be planned and spectrum obtained, if needed. Currently, the MassDOT Highway Division Region 6 uses CoMIRS

operationally. Proper planning is needed if the remaining five regions or other divisions of MassDOT are to join CoMIRS operationally. This is true for the potential future use of CoMIRS by existing T-Band agencies as well. T-Band is scheduled to be vacated for use by public safety by 2022/23.

Finalize Intergovernmental Agreements: There is currently no process in place to memorialize the ongoing support requirements for Core connected trunked systems or radio control consoles. This has been a concern for State Police system administrators and user agencies. The shared use, maintenance, and support of existing and planned digital radio infrastructure needs to be clarified amongst the owners and operators of this infrastructure. This includes EOPSS, Massport, and the Cities of Boston, Cambridge, and Worcester, among others.

Identify How to Pay for It: This Strategy Report identifies the estimated total costs for the radio modernization and recommends different finance tools for funding the transition. The decision on the financing option(s) to use is a Commonwealth decision. This decision should take into account the funding required to buildout the statewide radio infrastructure, to replace subscriber units, and to support and maintain the network and its users. Financing for these funding needs may involve multiple agency budgets and shared financial responsibility across municipal, county, and state user agencies.

Fund Support and Maintenance like an Enterprise Shared Service: The existing network has limited downtime and a good track record for quality grade of service. Going forward, there will be more radio sites to maintain and more users to support. Currently, these responsibilities are performed by a relatively small network support team at the Massachusetts State Police.

End user and network support should be considered an enterprise service and funded accordingly. Other states fund portions of their operational costs with radio network usage fees. This should be considered to grow the support team that will be needed long-term. Additionally, an increase in support funding should be anticipated in the years before decommissioning the analog networks, since the support team and its maintenance vendor will be responsible for both networks simultaneously.

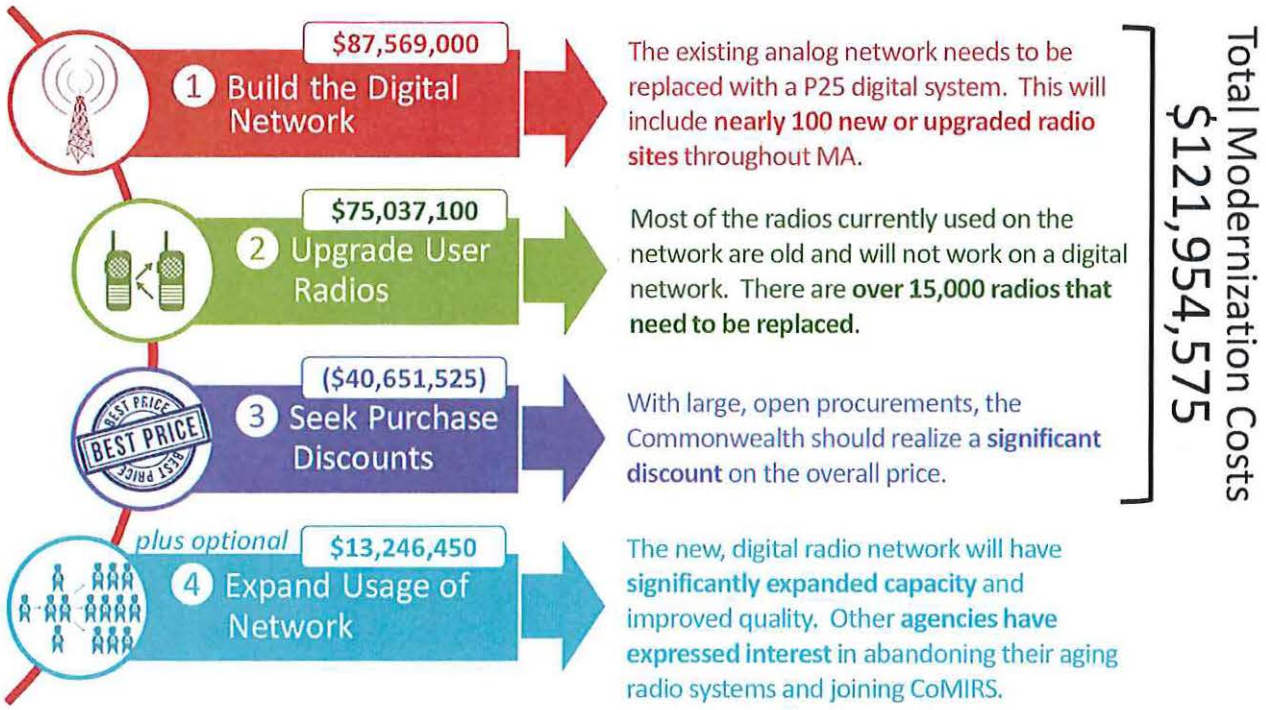
Consider Burden Sharing Early On: A significant cost in the modernization of the radio network will be the replacement of incompatible and aging user radios. Many of these radios are currently used by municipal first responders and public safety. The cost of radio replacement can be prohibitive. Early on, the Commonwealth should consider whether or not the State will assume a funding burden sharing role for the replacement of subscriber units and/or the ongoing purchase of new units.

For more information about implementation considerations, refer to Section 5 Recommendations and Section 7 Implementation Issues

1.6 The Costs of Modernization

As can be seen from other states' radio modernization projects, the move to digital radio is not cheap. The conceptual plan for the CoMIRS modernization includes more than a hundred radio sites and thousands of upgraded portable and mobile radios. However, as interviews with key stakeholders highlight: *the investment is needed and it is needed now.*

The estimated total cost of modernizing the CoMIRS radio network and upgrading incompatible radios for all current, operable users is $121,954,575. This total cost includes $87,569,000 to build the P25 digital TDMA radio network and $75,037,100 to replace antiquated radios that will not be able to communicate on the upgraded network. The combined cost of building the digital network and replacing subscriber units is discounted by an estimated 25% over published list prices for what can be expected from a large purchase discount in competitive procurements for hardware, software, and services.



With the modernized network, optional additional costs can be incurred to expand usage and avoid the modernization costs of other regional and statewide radio networks. This expansion can occur prior to the full modernization of the statewide network in areas of existing digital coverage (like western Massachusetts) and areas of discrete digital coverage needs (like Department of Correction campuses).

Looking at the categories of modernization costs, the greatest investments are in digital hardware, including Radio Site Digital Equipment ($52,220,000) and Subscriber Equipment ($75,037,100).

Modernization Cost Category	Estimated Total Cost
Radio Site Preparation The envisioned digital CoMIRS radio network will include 94 digital radio sites that will broadcast and receive voice and data communications from tens of thousands of users throughout the Commonwealth.	 **$16,222,000.00**
Radio Site Digital Equipment With the radio sites identified and properly prepared, the next major cost item is the digital equipment that is necessary to transform each radio site into a P25 Phase 2 digital radio site.	 **$52,220,000.00**
Central Switching Equipment This cost item addresses the equipment and software license costs associated with upgrading the central components of the CoMIRS radio network. These upgrades and licenses are required to properly manage each of the radio sites added to the digital network.	 **$2,000,000.00**
Dispatch Console Equipment Key among the immediate replacement needs are the aging and unsupported dispatch consoles currently in use by the MSP. These dispatch consoles must be replaced to install any more radio system network software updates.	 **$3,728,000.00**
Subscriber Equipment The Subscriber Equipment covers the replacement costs for portable, mobile, and desktop radios that are too old to be compatible with the planned P25 Phase 2 digital radio network. These costs estimates take into account the anticipated radio replacement needs for all operable users.	 **$75,037,100.00**
FDMA Radio Site Upgrades In addition to rolling out new digital radio sites in central and eastern Massachusetts, the existing P25 Phase 1 (FDMA) radio sites in western Massachusetts should be upgraded to Phase 2 (TDMA) to achieve the greatest capacity increase for the overall network.	 **$3,965,000.00**
Engineering and Project Management With any large communications project like the CoMIRS Modernization Project, proper planning, engineering, and project management is needed. Channel planning and site selection is critical. With nearly 100 radio sites, financial and project management will be challenging.	 **$9,434,000.00**

1.7 Paying for the Network

In evaluating the funding options available for paying for the network, this Strategy Report divided financing considerations into three main categories of funding needs:

- **Capital Funding for the P25 Buildout** – This funding need of $87,569,000 (prior to discount) is needed to modernize the analog radio infrastructure and implement a statewide P25 Phase 2 radio network.
- **Capital Funding for Radio Replacement** – This funding need of $75,037,100 (prior to discount) accounts for the radio replacement costs of all operational subscriber units that will not work on the new TDMA network.
- **Operational Funding for Maintenance and Enhancements** – This funding need accounts for the annual maintenance of the new network, including additional radio sites and the dual maintenance of both the analog and digital networks until the full decommissioning of the existing analog network.

Below is a summary of the recommended financing tools that best address each of these three funding needs. See Section 8.2 of this Strategy Report for addition information on the primary financing options evaluated for each need.

Recommended Options for Capital Funding of P25 Buildout	Recommended Options for Capital Funding of Radio Replacement	Recommended Options for Operational Funding
▪ Existing Capital Bond ▪ New Bond with Debt Service ▪ 911 Direct Funding	▪ Existing Capital Bond ▪ Federal Grants ▪ Locally Funded ▪ Local Aid/Matching ▪ New Bond with Debt Service ▪ 911 Direct Funding	▪ State Appropriations ▪ Subscriber/ Membership/ Activation Fees ▪ 911 Direct Funding

Each of the states examined as part of the Market Analysis (see Section 3 of this report) utilized a combination of funding instruments to finance their statewide digital radio networks. The final solution for financing the Massachusetts statewide radio network will likely use a combination of these financing tools. Differing financing tools are expected for the capital funding of the buildout, the financing of the subscriber unit replacement, and the on-going funding of proper support and maintenance.

For more information on estimated costs and financing options, refer to Section 8 CoMIRS Modernization Costs and Financing.

1.8 The Path Forward

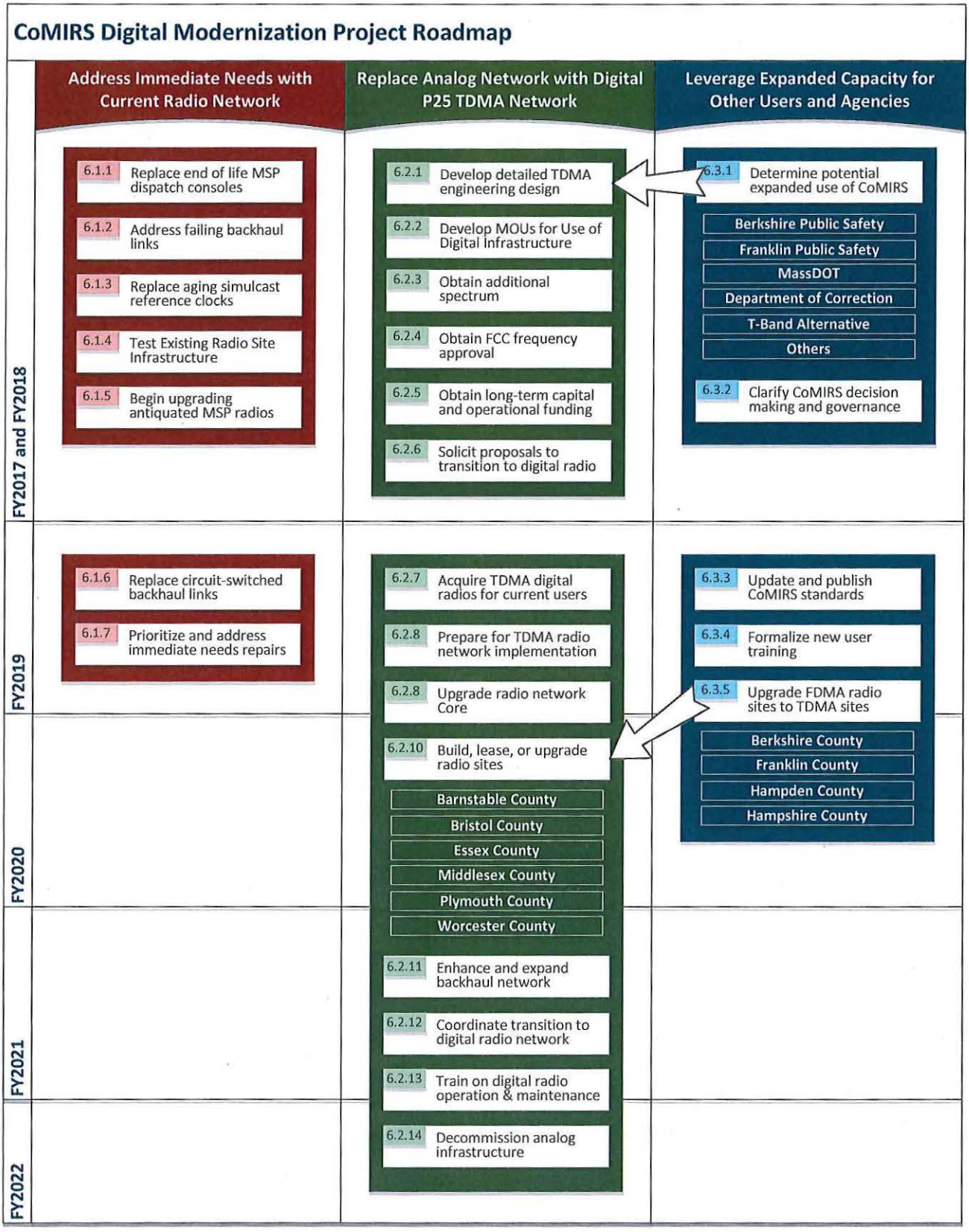
There are issues with the existing Massachusetts analog radio network that can only be addressed by fully replacing it with a digital equivalent. The CoMIRS Digital Modernization Roadmap is an action plan of the key activities the Commonwealth can follow to replace its aging system with a robust, modern digital radio network. This Roadmap is consistent with action plans that multiple vendors in the land mobile radio (LMR) industry have successfully implemented. Action on the Roadmap should begin immediately.

First, the Commonwealth needs to **address identified issues with the existing analog radio network** to maintain critical voice communications for public safety across the Commonwealth. Remedial action is needed now and for the next several years until a replace radio network is completed. EOPSS, MSP, and its network maintenance vendor have a strong track record in maintaining the availability of the analog network. This has become harder and costlier as analog components are no longer manufacturer supported and readily available.

Second, the Commonwealth of Massachusetts should **invest in a P25 TDMA land mobile radio network** to replace its aging and unsupported analog network. Moving to P25 TDMA will bring Commonwealth public safety communications up to par with industry standards and will significantly improve the capacity and reliability of the radio network. This move will entail infrastructure improvements on radio sites throughout the Commonwealth and will require the replacement of thousands of portable and mobile subscriber units within MSP and other users of the network.

Third and optionally but recommended, the Commonwealth should **plan how best to leverage the added capacity that a well-designed TDMA LMR network provides**. The move to TDMA opens the avenue for truly shared infrastructure and capital investments for Commonwealth agencies, regional organizations, and approved municipal organizations. Statewide organizations with mission critical voice communications needs, like the Department of State Police and the Massachusetts Department of Transportation, can utilize shared LMR resources that meet their operational needs, while avoiding duplicate investment in digital radio infrastructure.

The diagram below summarizes this Roadmap across its three main threads. The CoMIRS Roadmap is expected span six fiscal years and be completed by FY2022.


CoMIRS Digital Modernization Project Roadmap
Address Immediate Needs with Current Radio Network
Replace Analog Network with Digital P25 TDMA Network
Leverage Expanded Capacity for Other Users and Agencies
FY2017 and FY2018
6.1.1 Replace end of life MSP dispatch consoles
6.1.2 Address failing backhaul links
6.1.3 Replace aging simulcast reference clocks
6.1.4 Test Existing Radio Site Infrastructure
6.1.5 Begin upgrading antiquated MSP radios
6.2.1 Develop detailed TDMA engineering design
6.2.2 Develop MOUs for Use of Digital Infrastructure
6.2.3 Obtain additional spectrum
6.2.4 Obtain FCC frequency approval
6.2.5 Obtain long-term capital and operational funding
6.2.6 Solicit proposals to transition to digital radio
6.3.1 Determine potential expanded use of CoMIRS
Berkshire Public Safety
Franklin Public Safety
MassDOT
Department of Correction
T-Band Alternative
Others
6.3.2 Clarify CoMIRS decision making and governance
FY2019
6.1.6 Replace circuit-switched backhaul links
6.1.7 Prioritize and address immediate needs repairs
6.2.7 Acquire TDMA digital radios for current users
6.2.8 Prepare for TDMA radio network implementation
6.2.8 Upgrade radio network Core
6.3.3 Update and publish CoMIRS standards
6.3.4 Formalize new user training
6.3.5 Upgrade FDMA radio sites to TDMA sites
FY2020
6.2.10 Build, lease, or upgrade radio sites
Barnstable County
Bristol County
Essex County
Middlesex County
Plymouth County
Worcester County
Berkshire County
Franklin County
Hampden County
Hampshire County
FY2021
6.2.11 Enhance and expand backhaul network
6.2.12 Coordinate transition to digital radio network
6.2.13 Train on digital radio operation & maintenance
FY2022
6.2.14 Decommission analog infrastructure

1.9 Getting Started

To get started, activities are needed across all three threads of the CoMIRS Modernization Roadmap the Commonwealth should:

Address Immediate Needs: Whether or not the Commonwealth moves forward with the Roadmap presented in this Strategy Report, the Commonwealth needs to address the immediate needs identified during the current state review. These items are critical in importance and pressing in need. An increase in immediate needs funding items can be expected as additional aging CoMIRS infrastructure begins to fail.

Of the seven major activities identified for the "Address Immediate Needs with Current Radio Network" project thread, the following four are the most important to immediately address:

6.1.1 Replace End of Life MSP Dispatch Consoles

6.1.2 Address Failing Backhaul Links

6.1.3 Replace Aging Simulcast Reference Clocks

6.1.4 Test Existing Radio Site Infrastructure

Replacing the MSP Gold Elite dispatch consoles is a critical path item to upgrading the radio network operating system. Currently the entire system is operating on a software release from 2015. The current release cannot be installed until all MSP Gold Elite consoles are replaced. This impacts CoMIRS partners like the City of Boston and Worcester, who also cannot upgrade until the MSP replaces their unsupported console systems.

Immediate action and funding is also needed to address failing backhaul links in central and southeastern Massachusetts, as well as to replace aging simulcast reference clocks at radio sites throughout the Commonwealth. Addressing these immediate needs should also plan to accommodate the reuse of new components in the planned digital architecture.

Identify Long Term Funding Sources: A primary first step in modernizing the CoMIRS radio network is to identify long-term funding sources for the digital radio buildout. While large scale funding is not planned to be needed in the first year, securing financing for the five and a half year implementation window is paramount.

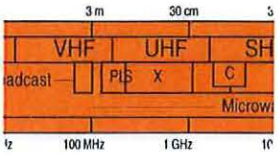
6.2.5 Obtain Long-Term Capital and Operational Funding

Begin Key Planning and Engineering Activities: While overall funding is being arranged, there are key planning and engineering activities that should start as soon as possible to set the stage for the CoMIRS modernization. Key to getting started is the development of a detailed TDMA engineering design, including site plans for each planned radio site.

This Strategy Report was based on best available information for the future channel plan, organization of simulcast regions, and location of planned radio sites. An essential first step is the confirmation and revisions of these plans, the initiation of site acquisition activities, and the development of detailed specifications for one or more large technology procurements. An engineering firm will also be needed to identify if additional spectrum is needed and to facilitate FCC frequency approvals.

6.2.1 Develop Detailed TDMA Engineering Design

6.2.2 Develop MOUs for Use of Digital Infrastructure



6.2.3 Obtain Additional Spectrum

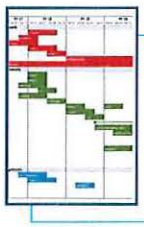
6.2.4 Obtain FCC Frequency Approval

Another important initial planning activity is the finalization of memorandums of understanding (MOUs) amongst the key partners in CoMIRS network. Planning and pricing in this Strategy Report are based on the assumption that digital radio coverage will be provided by CoMIRS partners in areas where digital radio infrastructure already exists. In short, this Strategy Report assumes that a separate buildout of radio infrastructure in the Boston and Worcester regions is not needed because agreements can be made with the owners of those radio networks for shared usage and proper support.

6.3.1 Determine Potential Expanded Use of CoMIRS

6.3.2 Clarify CoMIRS Decision Making and Governance

Determine Future Usership: In coordination with the engineering planning, there should be clarity as to the anticipated future usage of the CoMIRS network. If large additional user bases, like those operating separately at MassDOT, are to join CoMIRS, proper planning is needed to confirm that simulcast regions align with operational areas and that planned capacity is sufficient for the anticipated increase usage. While the details of these arrangements may take time to finalize, a general understanding of the planned future usage of CoMIRS by others agencies is needed in the short term. Finally, CoMIRS decision making and governance processes should be documented and adopted that account for current and future operational and interoperable users of the network.



For more details on each step on the Roadmap, refer to Section 6 CoMIRS Roadmap in this Strategy Report.

The road forward for CoMIRS is well-understood, achievable, and needed. The critical obstacle for the implementation of this vision is sufficient funding. There are options available that can overcome this challenge and assure mission critical communications throughout the Commonwealth for the years to come.