

MARIN EMERGENCY RADIO AUTHORITY

c/o Novato Fire Protection District
95 Rowland Way, Novato, CA 94945
PHONE: (415) 878-2690 FAX: (415) 878-2660
WWW.MERAONLINE.ORG

DATE: January 27, 2016
TO: MERA Next Generation Project Oversight Committee
FROM: Dave Jeffries, Deputy Executive Officer for the Next Gen Project
SUBJECT: AGENDA ITEM **B**: UPDATE ON THE NEXT GEN SYSTEM PROJECT

Recommended Action: Receive and file report on the Next Gen System Project Update

Background:

Since the last NGPOC meeting, several new items have been completed and the project is moving forward and on schedule.

1. **Site Surveys:** With assistance from Marin DPW, Federal Engineering (FE) reviewed the current sites as well as conducted on site surveys of several potential new sites. The report is 259 pages in length as therefore is not attached here. The new potential sites surveyed included:
 - a. Coyote Peak, Marshall Petaluma Road, Petaluma
 - b. EOF Water Tank, Skyview Terrace, San Rafael (For microwave link to EOC)
 - c. Golden Gate Bridge Toll Plaza
 - d. Martha, Lyford Drive, Tiburon
 - e. Muir Beach, Muir Beach Overlook, Muir Beach
 - f. Redwood Landfill, US 101 and San Antonio Road, Novato
 - g. Tomales, Shoreline Hwy, Tomales
 - h. Wolfback Ridge, Sundial Road, Sausalito

As part of the current proposal, Tomales, Martha, Wolfback Ridge and Muir Beach were recommended for inclusion in the project, with Redwood Landfill, Coyote Peak and Golden Gate Bridge Toll Plaza as additional recommendations, should funding permit. These are all recommendations with decisions expected to be part of the System Vendor detailed design process.

2. **FCC Frequency Review:** On 12/10/2015, FE, DPW and MERA Staff met to discuss the FCC Frequency Review and DPW worked with FE to provide needed materials and information. A summary of that meeting is attached.
3. **Lifecycle Recommendations:** On 12/28/2015, we received FE's draft Lifecycle Recommendations report, which was then reviewed by the Executive Board, NGPOC, and Operations Working Group in addition to MERA and DPW staff. The desire to identify ways of

extending the Next Gen system life was a topic of many discussions in past meetings. This report, attached, makes a number of recommendations and these recommendations will be reflected in the upcoming Request for Proposal.

4. Coverage Analysis Workshop: On 01/26/2016, a Coverage Analysis Workshop was held for MERA member agencies. This was an opportunity for MERA member agencies to learn about potential coverage options, ask questions and provide input. A verbal report will be provided at the NGPOC meeting.
5. Next Steps: We currently anticipate the March, 2016 delivery of a draft Request for Proposal (RFP) for the System Vendor. The draft RFP will be provided to the Operations Working Group, NGPOC and Executive Board for review and comment. This is an extensive document and we anticipate a fairly short review period in order to have a final RFP issued in April, 2016.

Attachments:

- Report #9 on Next Generation Project Oversight Committee (01/13/2016)
- FCC Review Meeting Outcomes (12/29/2015)
- Lifecycle Recommendations Report (01/18/2016)

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DATE: January 13, 2016

TO: MERA Executive Board

FROM: Dave Jeffries, Deputy Executive Officer for the Next Gen Project

SUBJECT: AGENDA ITEM B-3: Report No 9 on Next Gen Project Oversight Committee (NGPOC)

Recommended Action: Receive and file Report on the Next Gen System Project Update

Background:

Since the last report to the MERA Executive Board, several items have moved forward:

- a) FE/MERA Communications Plan – The draft was updated and finalized. We have started receiving monthly reports from Federal Engineering and using them as a foundation for a MERA Newsletter to keep MERA member agencies up to date.
- b) Site Surveys - Site Surveys have been completed and we have received a final report from Federal Engineering.
- c) The Next Generation Project Oversight Committee Meeting - This committee met on 12/09/2015 and received an update on the project, discussed the upcoming Coverage Workshop on 01/26/2016 and discussed the use of alternates for NGPOC members.
- d) FCC Frequency Review - On 12/10/2015, FE, DPW and MERA staff met to discuss the FCC Frequency Review and DPW worked with FE to provide needed materials and information.
- e) Lifecycle Recommendations Report - On 12/28/2015, we received FE's Lifecycle Recommendations report, which was then reviewed by the Executive Board, NGPOC, Operations Working Group as well as by MERA and DPW staff. FE will be providing a presentation on the updated report today.

Next Steps:

- a) Coverage Analysis Workshop on 01/26/2016 – This will take most of a day and it is important that all MERA agencies attend to learn about potential coverage options and to provide their input. RSVP's were requested no later than 01/08/2016 and a verbal update will be provided at your meeting.
- b) NGPOC Meeting on 01/27/2016 – Scheduled to immediately follow the Coverage Analysis Workshop, the NGPOC will be briefed on findings from that workshop as

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well as being updated on the FCC Frequency Review and Life Cycle Recommendations.

Attachments:

Report No 8 on Next Gen Project Oversight Committee (G.B. 12/09/15)

FCC Review Meeting Outcomes (12/29/2015)



"Unleashing the Power of Technology"

Federal
Engineering®

Federal Engineering, Inc.

10600 Arrowhead Drive
Fairfax, VA 22030
703-359-8200

MEMORANDUM

To: Pat Echols
Marin County DPW
From: Federal Engineering, Inc.
Subject: FCC Review Meeting Outcomes
Date: December 29, 2015

Marin County (County) on behalf of Marin Emergency Radio Authority (MERA) wishes to develop an RFP to design and deploy a 700 MHz Phase II Project 25 system to replace their current system which has reached End-of-Life status with the vendor. To assist them with this project, Marin County retained Federal Engineering (**FE**) to develop the RFP.

One of the tasks required by the project is a review of the issues and requirements for licensing the desired 700 MHz system. A meeting between Marin County personnel and **FE** to review salient points of the Region 6 700 MHz plan and their relevance to the project was conducted December 10, 2015. The following summarizes the discussion.

Topic 1: Current FCC licensing and spectrum assets	
Goal	<ul style="list-style-type: none">Review current FCC licenses and understand overall usage
Discussion Points	<ul style="list-style-type: none">How are current T-band licenses restricted with regards to coverage (e.g. ERP, geographic limitations, etc.)?How many are used for conventional purposes (e.g. talk-around, special-purpose, mutual-aid, etc.)?What other bands are used and what are they used for (e.g. low-band paging, VHF overlay, etc.)?Existing Jail and Tunnel bi-directional amplifiers (BDAs) to be taken into consideration for the new system
Outcomes from meeting	<ul style="list-style-type: none">Marin County has already provided shapefiles of current system coverage.Marin County has already provided information on antenna configurations. Specifically, any anecdotal information on any coverage areas that required special consideration for coverage through the use of directional antennas, downtilt, etc.FE team to use current FCC licenses and 601 forms as a guide for maximum ERP in new system.FE team to use Marin County provided shapefiles during coverage workshop to depict current system coverage.

Topic 2: Review of Region 6 700 MHz Plan	
Goal	<ul style="list-style-type: none"> Review current 700 MHz plan and the Marin County OA allotment
Discussion Points	<ul style="list-style-type: none"> Discuss 40, 60, and 5 dBμ contours and what they are used for What are potential problematic sites in terms of licensing under the current plan Review plan's Adjacent and Co-Channel users Discuss proposed changes to the plan and their impact to the Marin County OA Discuss requirements for licensing and getting the Marin County OA plan approved by the Region 6 committee
Outcomes from meeting	<ul style="list-style-type: none"> The entire project team gained familiarity with the 27 700 MHz frequencies allocated to Marin County in the Region 6 plan and the overall licensing process Project team reviewed co- and adjacent channel users and did not find a source of significant concern Project team understands that the Region 6 planning committee has been made aware of the use of Sonoma Mountain and Bay Hill in the new system and the fact that these sites are outside the boundaries of the MERA operations area.

Topic 3: 700 MHz Reserved Channels	
Goal	<ul style="list-style-type: none"> Develop strategy for understanding the potential use of 700 MHz reserved channels
Discussion Points	<ul style="list-style-type: none"> How will channels be requested? Developing a strategy for potential use Is there a potential for giveback of current plan channel allotment to gain access to reserved channel allotment?
Outcomes from meeting	<ul style="list-style-type: none"> The project team understands that the request for use of 700 MHz reserved channels will come after the submittal of the request of the main system's 27 channels. By having separate submittals, the main system license will not be impacted by any potential delays in the reserved channel submittal. The project team understands that these channels will likely be used for special purpose channels (e.g. knoxbox, volunteer paging, gates) as outlined in the RFP.



Topic 4: 700 MHz Itinerant and Talk-around Channels	
Goal	<ul style="list-style-type: none"> Develop strategy for understanding the potential use of 700 MHz Itinerant and Talk-around Channels
Discussion Points	<ul style="list-style-type: none"> Licensing requirements Contra Costa county is currently licensed for the low-power channels How many, if any, low power channels will be needed?
Outcomes from meeting	<ul style="list-style-type: none"> The project team understands that some coordination with Contra Costa County will be required regarding NAC and PL codes. The project team understands that it will need to get feedback from MERA operational users on how many itinerant and talk-around channels will be required prior to any licensing requests.

Regards,

Rajit Jhaver
 Project Manager
 Federal Engineering, Inc.





**Marin County on behalf of Marin
Emergency Radio Authority
(MERA)
*System Lifecycle Report***

January 18, 2016

Prepared by:



**Federal Engineering, Inc.
10600 Arrowhead Dr., Suite 160
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703-359-8200**

Executive Summary

The existing MERA public safety radio system has served public safety users over the past two decades. However, multiple system components are at or near end of life, which may result in the impairment or loss of mission-critical communication services due to failure of core system components. Furthermore, MERA agency operational needs require greater radio coverage within the County than is provided by the existing system.

Technological advances in radio system architecture require a different approach be employed to support and maintain the Next Generation MERA System over its lifecycle. Recognizing these factors, the County engaged Federal Engineering (**FE**) for assistance with a multi-phased approach for system planning, replacement and implementation culminating in the procurement and commissioning of a replacement standards-based Next Generation MERA System.

Based on stakeholder requirements and the results of our comprehensive analysis, **FE** recommends the Next Generation MERA System be based on Internet Protocol (IP) technology. This report provides lifecycle management planning information and takes into consideration the manufacturer's transition to IP-based network architecture and the increased reliance on third-party commercial off the shelf (COTS) equipment.

FE also provides the following key recommendations for MERA to achieve their communications system objectives and protect its capital investment over the life of the Next Generation MERA System:

1. Deploy a 700 MHz P25 Phase 2 standards-based system to enhance coverage, interoperability and capacity.
2. Implement an anti-virus definition and security update schedule (weekly).
3. Install system patches (monthly).
4. Update system software release (bi-annually): For example, vendor programs are available to keep the Next Generation MERA System software supported during the radio system lifecycle.
5. Refresh networking hardware (replace end of manufacture networking equipment every 3-5 years): For example, vendor programs are available to keep the Next Generation MERA System networking hardware supported during the radio system lifecycle.
6. Develop longer-term replacement budgeting for system technology refresh (10-15 years for subscriber radios, console equipment, etc.): MERA agencies



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- should evaluate vendor program offerings which incorporate major technology refresh cycles for equipment such as consoles and subscriber radios. Long-term lifecycle planning and budgeting should consider the potential benefits of these programs against setting aside funding to replace equipment that is at the end of manufacture over the life of the system.
7. Create functional system requirements for the radio system and the microwave system procurement and enter into detailed system lifecycle maintenance and support discussions with the vendors as part of the procurement and vendor negotiations process.

Federal Engineering provides these system lifecycle recommendations to assist MERA with fulfilling their public safety wireless communications requirements over the life of the MERA next generation radio system.

These recommendations will be an input into the RFP, the next phase of the project. The RFP will require vendors to propose extended support during the lifecycle and include one or more software and COTS hardware refreshes during the planned system life.



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Revision Record

Revision	Date	Editor	Notes
Original	12/18/2015	David Muniz	
Revision 1	12/21/2015	Rajit Jhaver	Made changes
Revision 2	12/21/2015	David Muniz	Accepted changes and added exec and conclusion language
Revision 3	12/22/2015	Rajit Jhaver	Made language changes
Revision 4	12/22/2015	Jerry Martin	Made language and formatting changes
Draft	12/28/2015	Rajit Jhaver	Final updates prior to client delivery
Final	1/15/2016	Rajit Jhaver	Finalize the report



1. System Lifecycle Introduction

Keeping pace with technological advances within the telecommunications industry, public safety radio systems have evolved from analog systems to digital systems, which operate over IP-based networks. System vendors' migration to IP-based network design topology forces a change in the radio system lifecycle management model to more closely reflect IT network lifecycle models.

Advances in digital radio system capabilities require increasingly interdependent system infrastructure and IP-based network architecture. The design of these extensive IP networks uses a mixture of Commercial off the Shelf Components (COTS) and vendor equipment comprising servers, routers, switches and base stations. In essence, an IP network with software applications running on servers and computers. Microwave backhaul networks use switches and routers to connect the various IP-addressed elements and components of the radio system. The lifespan for COTS equipment and operating system software is typically around 5 years. This relatively short lifecycle requires that system owners keep their systems up to date with current equipment running the then current operating systems. Vendors, being aware of this evolving environment, developed lifecycle solutions for their respective systems. Figure 1 illustrates a system lifecycle model.

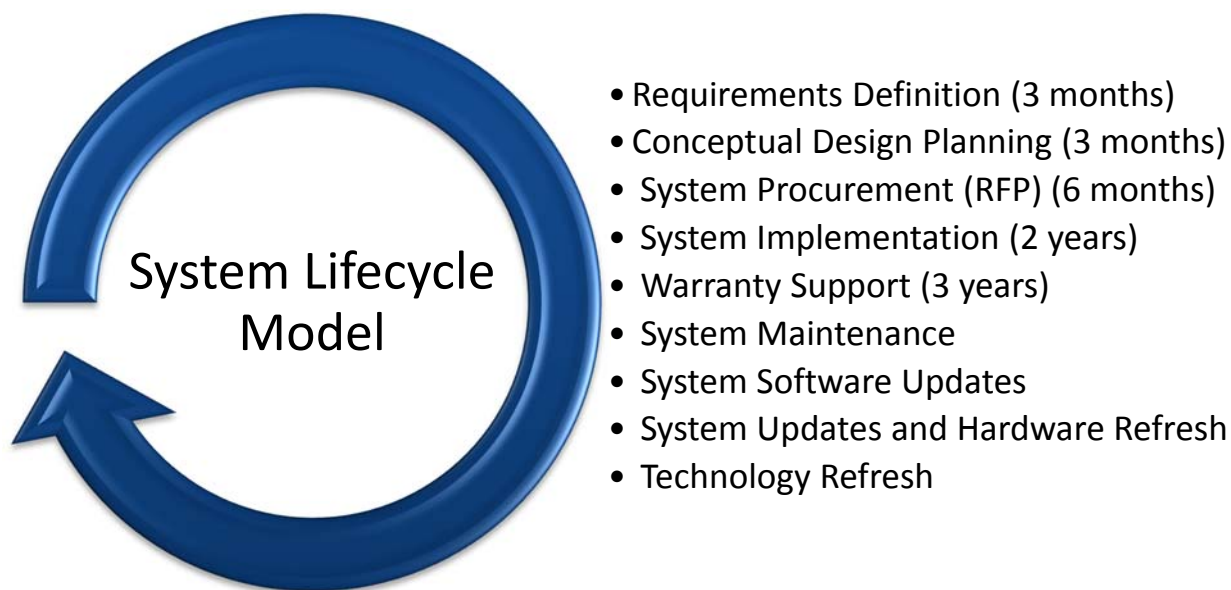


Figure 1 - Lifecycle Model



1.1 System Refresh Considerations

There are multiple layers to consider when evaluating system lifecycle planning. Figure 2 illustrates typical system lifecycle technology refresh intervals.

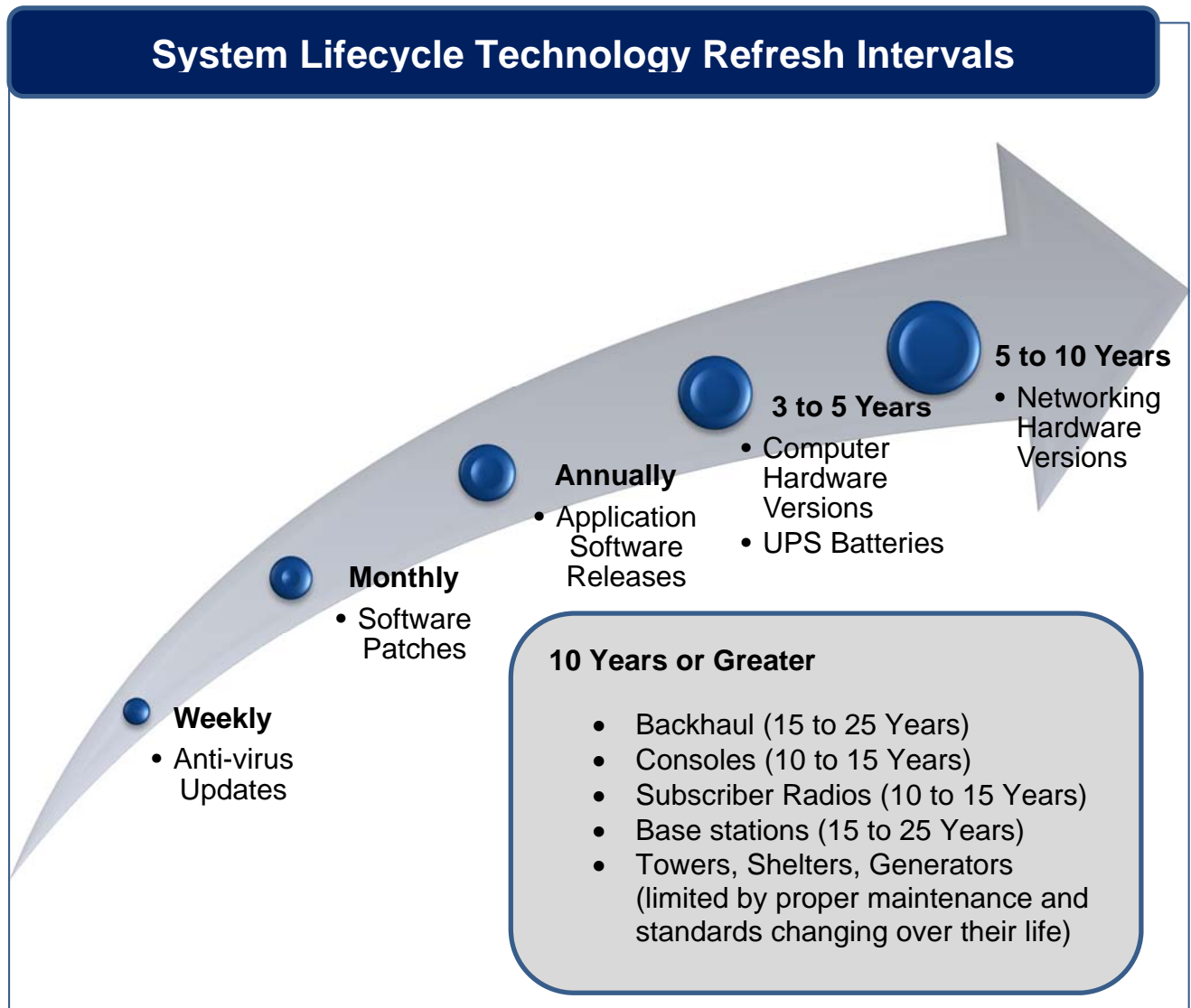


Figure 2 - Technology Refresh Intervals

Anti-virus Updates: Virus definition updates maintain system security on the IP network with the identification of new attacks or vulnerabilities. This requires implementation of updates on a recurring basis over the life of the radio system.

Software Patches: Software patches keep the vendor's operating system software operating as intended and remedy any issues identified between new software release intervals. Software patches and virus definition updates require implementation on a regular basis during the life of the system.



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Application Software Releases: Vendors typically release new versions of system operating software on an annual basis. Current public safety radio systems are heavily reliant on computer systems and IP networks. Like all other aspects of conventional IT network, many system features, enhancements, and compliance with evolving Project 25 (P25) standards are reliant upon periodic upgrades of the radio system's base operating software. Version or release upgrades are often sequential, building upon previous versions, thus requiring the installation of intermediary version upgrades. As part of the system lifecycle support, installation of the upgrades in a timely manner is critical to avoid extensive costs to bring the system up to the current supported version and potential downtimes.

Hardware Refresh: Hardware refresh lifecycle planning considers radio system servers, routers, switches, console PC's and IT hardware of the sites, which require periodic review to ensure that they are still capable of operating with the latest application software updates. Hardware no longer supported by the manufacturer, requires replacement.

Technology Refresh: Technology refresh lifecycle planning considers MERA radio system base stations, gateways, dispatch equipment, Agency mobile and portable subscriber and console equipment reviewed against manufacturer product lifecycle roadmaps. As manufacturers retire equipment from production, implementing an equipment replacement plan based on these product roadmaps allow for budgeting and equipment replacement prior to the end of manufacturer support.

System Maintenance: Getting the most serviceable life from the system mandates preventative maintenance conducted on sites and components on a regular basis throughout the life of the radio system.



2. System Implementation and Deployment

As shown in Figure 3, the system implementation lifecycle for the MERA next generation radio system begins with the implementation of the radio system.

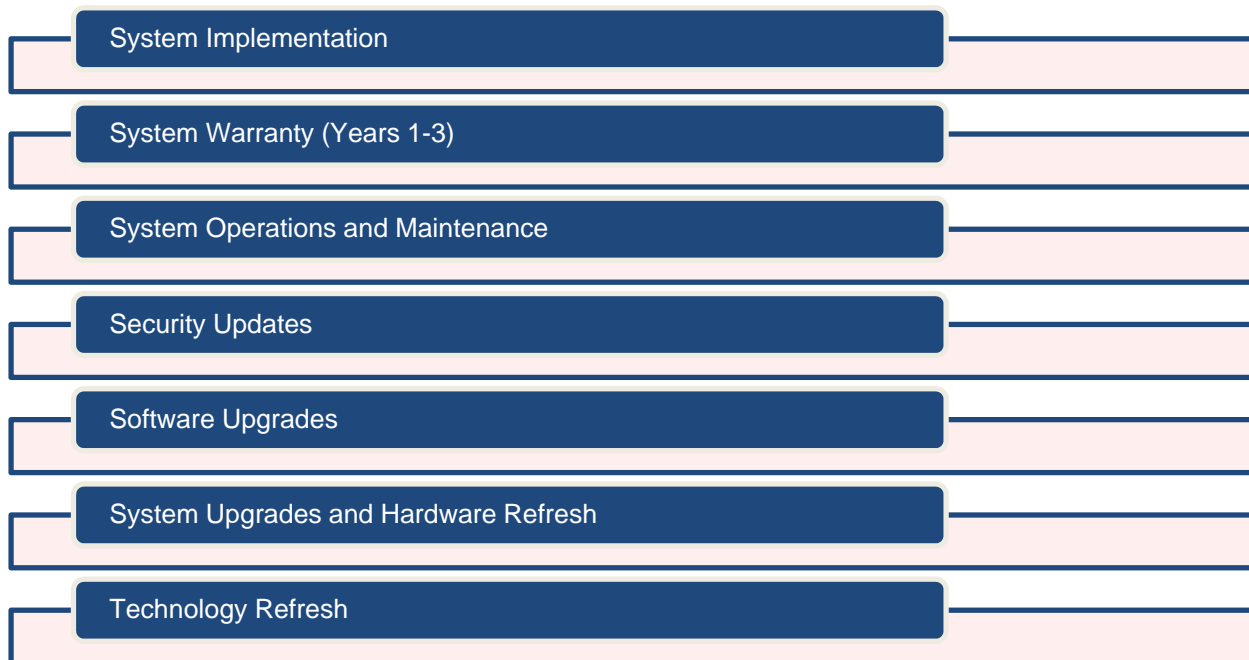


Figure 3 – System Implementation Lifecycle Phase

2.1 P25 System Infrastructure and Subscriber Lifecycle

Vendors' public safety radio system offerings typically follow similar lifecycle roadmaps. P25 system infrastructure (sites, core, security, consoles, and gateways) and the P25 subscriber devices (mobiles, portables and control stations) follow similar lifecycle stages in that they have a design phase, production period and support timeline. The primary difference between infrastructure and subscribers is the duration of manufacturer support beyond End of Manufacture (EOM). Vendors typically support infrastructure for 7 years post EOM and subscribers for 5 years post EOM. Upon product retirement and prior to the end of support, the vendors will continue offering service parts support and some software fixes for maintenance releases. The Infrastructure and Subscriber lifecycle models provide some typical timeframes for those product lines below.

Figure 4 shows a typical life cycle for system infrastructure.



Infrastructure Product Life Cycle



Figure 4 - Infrastructure Product Life Cycle

Replacement subscriber equipment procured during the life of the radio system will offer the next wave of capabilities and extend product support.

Subscriber Product Life Cycle

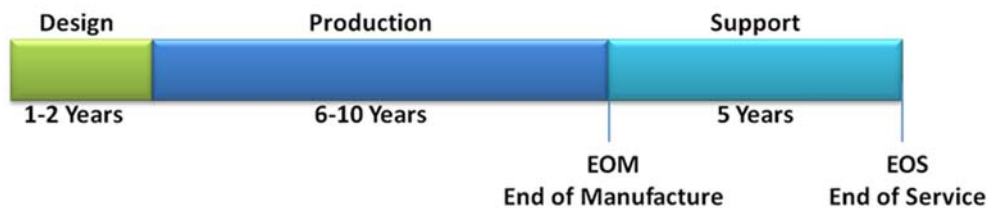


Figure 5 - Subscriber Product Life Cycle

2.2 P25 Overview and Proprietary Features

The P25 trunked system standard defines many open system interfaces to provide direction for multi-vendor operations and flexible system configurations.

P25 Phase 1 employs Frequency Division Multiple Access (FDMA) protocols and uses 12.5 kHz channels for data and voice communications. The P25 Common Air Interface (CAI) consists of a modulation standard, the channel-coding standard, and the vocoder standard (used to encode and decode the analog audio signals). The P25 CAI allows equipment from different manufacturers to operate with equivalent functionality in a basic communications mode. The standard defines both conventional and trunked infrastructure access algorithms, replacing vendor proprietary access methods.

P25 Phase 2 adds two-slot TDMA technology using a 6.25 kHz equivalent channel (two slots or “talk-paths” in a 12.5 kHz channel) creating an expanded CAI, which doubles the



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channel capacity of Phase 1 over the same bandwidth. P25 Phase 2 expands and refines the open interfaces between various systems. A significant portion of the standards focus on interoperability with legacy equipment, interfaces between repeaters and other subsystems, roaming capacity, and spectral efficiency/channel re-use. It provides for compatibility and interoperability with other P25 systems, across system boundaries, regardless of system manufacturer or infrastructure. MERA will be implementing a P25 Phase 2 system.

P25 Phase 1 compatible systems have been available for many years while P25 Phase 2 systems began deploying in 2011.

While the P25 standards have promoted interoperability and fostered a competitive landscape where multiple manufacturer's subscriber radios are programmable to operate on a P25 compliant system, not all features and capabilities are currently supported among vendors. The features that are not compatible among different vendors' radio equipment include:

- Over-the-Air Programming (OTAP) – different radio programming software required for various vendors to program radios over the air
- Wireless capabilities (e.g., Wi-Fi, Bluetooth, LTE, LMR) connectivity for OTAP-accomplished differently among vendors
- ADP Encryption (Motorola only encryption, not supported by other vendors)
- GPS Location – different interfaces required for interpreting data from various vendor radios



3. System Warranty Support

The system warranty phase commences upon successful system implementation, user cutover and after final system acceptance. The system warranty commences at system acceptance and typically includes all items required to maintain the proposed system infrastructure and subscriber devices operation at original manufacturer specifications for no additional cost over the first three years of operation. Warranty coverage requirements include:

- Remote Monitoring
- Parts
- Labor
- Technical and engineering support
- Return shipping



4. System Operation and Maintenance

Operating and maintaining communications systems requires a certain level of technical support assistance from the manufacturers and their associated service providers. This level of assistance depends upon the ability of the system owner to provide operational and maintenance duties themselves. Marin County under contract to MERA already has a dedicated team of skilled employees to maintain a public safety communications system. This means the manufacturer and their respective service providers will primarily provide technical support to Marin County Department of Public Works (DPW) staff for operating and maintaining the system during and beyond the system warranty period.

DPW staff will be responsible for first level response, general oversight and management of the new communications system. Management of the system would include:

- Upkeep of system user inventories
- Monitoring system alarms and alerts
- Making changes to system and subscriber devices
- Notifying service providers of any outages, or conditions requiring attention
- Providing system usage reports to agencies as required
- Weekly, monthly, quarterly, semi-annual site visits
- Notifying user groups of any upcoming planned outages

DPW staff should be familiar with and complete vendor training programs required to maintain the MERA next generation system RF equipment, networking and computer equipment, microwave backhaul equipment, dispatch equipment, and subscriber equipment. Facilitating the transition from UHF-T Band to 700 MHz radio system operation will require replacement of appropriate test and diagnostic equipment. Vendors will be required to provide system-training programs, spare equipment and associated diagnostic test equipment as part of the system procurement.



5. Post Warranty Maintenance and Support

Figure 6 depicts the lifecycle segments of Security Updates, Software Upgrades, System Upgrades and Hardware Refresh, and Technology Refresh and lists various aspects of each lifecycle segment.

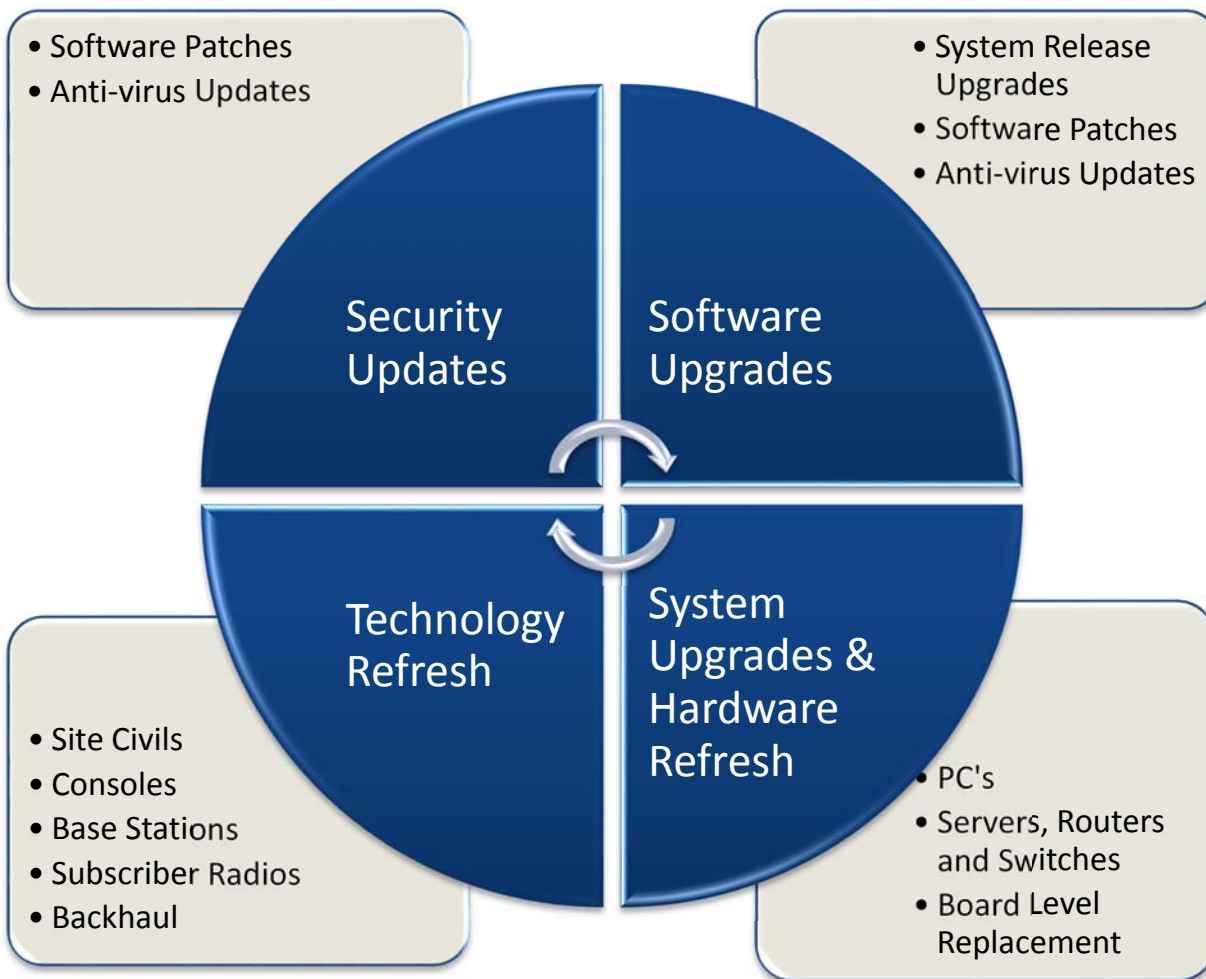


Figure 6 - Lifecycle Management Process

5.1 Security Updates

Vendors offer security update packages that maintain system security on the IP network with the identification of new attacks or vulnerabilities. This involves implementation of updates on a recurring basis over the life of the radio system.

5.2 Software Upgrades

Vendors offer software maintenance agreements. These agreements allow system owners to negotiate and purchase system software upgrades prior to release by the manufacturer. This ensures that the system's software will be up to date and supported by the manufacturer. Ideally, system owners can maintain their system with the latest revision of software to ensure that manufacturers can provide technical support if the need ever arises. Software upgrades also typically include enhanced system features. Older systems with outdated software may require a system upgrade prior to any modifications to the system, or troubleshooting system issues. Manufacturers often charge a premium for upgrading systems that are more than one software version out of date.

5.3 Hardware Refresh

In addition to software maintenance agreements, many vendors offer managed hardware replacement services. As previously stated, operating systems and COTS components are ever evolving. System owners who purchased software maintenance agreements may find that newer software is incompatible with system components purchased just a few years earlier. This will require that system owners purchase newer components compatible with the current software revisions. If system owners fail to budget for these life cycle purchases, the burden to upgrade a system can be tremendous. Vendors offer software and hardware upgrade services (COTS equipment such as networking and computer hardware), which keep the software up to date as well as replace any hardware that is incompatible with the latest revision of software. This allows system owners to effectively budget for sustaining compatible hardware and software throughout the system's life cycle.

5.4 Technology Refresh

In order to manage complete lifecycle costs, some vendors offer complete system technology migration or refresh programs. These programs are customizable to the MERA next generation system. The programs can be tailored to refresh or replace system infrastructure such as base stations, consoles, microwave radios and subscriber devices



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at predetermined intervals, which coincide with the service life of the vendor's system platforms.



6. Lifecycle Recommendations

The existing MERA voice radio system has supported public safety communications for Marin County users over the past two decades. County staff have effectively maintained and upgraded the existing system since its initial implementation and acceptance; however, it is at its end of life.

FE recommends that MERA continue to move forward with the development of a competitive request for proposal (RFP) to replace the existing system with a new 700 MHz P25 Phase 2 radio system to avoid any interruption in public safety radio communications due to system obsolescence. **FE's** current engagement with MERA includes the development of an RFP for the procurement and migration to a 700 MHz P25 Phase 2 radio system.

As part of the development of functional specifications for the RFP, **FE** will include sections, which detail system lifecycle maintenance and support requirements. The RFP will require vendors to provide details and pricing options for post warranty hardware and software support programs. It is possible to realize substantial savings over the life of the system if the County, on behalf of MERA, negotiates and procures these programs during the initial system purchase.

FE provides the following key recommendations for MERA to achieve their communications system objectives over the life of the MERA next generation system:

1. Deploy a 700 MHz P25 Phase 2 standards-based system to enhance coverage, interoperability and capacity.
2. Implement an anti-virus definition and security update schedule (weekly)
3. Install system patches (monthly)
4. Update system software release (bi-annually): For example, vendor programs are available to keep the Next Generation MERA System software supported during its lifecycle.
5. Refresh networking hardware (replace end of manufacture networking equipment every 3-5 years): For example, vendor programs are available to keep the Next Generation MERA System software and networking hardware supported during its lifecycle.
6. Develop longer-term replacement budgeting for system technology refresh (10-15 years for subscriber radios, console equipment, etc.): MERA agencies should evaluate vendor program offerings which incorporate major technology



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- refresh or replacement cycles for equipment such as consoles and subscriber radios. Long-term lifecycle planning and budgeting should consider the potential benefits of these programs against setting aside funding to replace equipment that is at end of manufacture over the life of the system.
7. Create functional system requirements for the radio system and the microwave system procurement and enter into detailed system lifecycle maintenance and support discussions with the vendor as part of the procurement and vendor negotiations process.

FE provides these system lifecycle recommendations to assist MERA with fulfilling their public safety wireless communications requirements over the life of the MERA next generation radio system.

These recommendations will be an input into the RFP, the next phase of the project. The RFP will require vendors to propose extended support during the lifecycle and include one or more software and COTS hardware refreshes during the planned system life.

