Land Mobile Radio (LMR) For Decision Makers

Part 2: Educating Decision-Makers on LMR Technology Issues

INTRODUCTION

Emergency responders must have consistent, resilient, and interoperable mission-critical voice communications systems to respond to citizen calls for services and to enhance personnel safety. LMR systems have been deployed since the 1930's to meet this critical need, and LMR continues to be public safety's primary means of voice communications. As communications technologies have evolved, LMR has kept pace with the introduction of new features, functionalities, and low-speed data capabilities. Additionally, adopted Project 25 (P25) standards help ensure LMR systems and equipment are compatible and interoperable with other P25 systems. In recent years, wireless data communication systems using different technologies and standards have been deployed to supplement traditional LMR capabilities. These systems enhance response by improving the capacity and speed at which critical data (e.g., medical assessments, maps, building plans) can be shared.

The federal government recognizes the value of advanced technologies and has committed over $7 billion to develop and deploy a nationwide public safety broadband data network (NPSBN), using Long-Term Evolution (LTE) standards and technology. The future NPSBN will offer a platform for public safety responders and government officials from all jurisdictions, disciplines, and levels of government to communicate, and will initially provide advanced data capabilities for all responders. While the NPSBN offers great potential to improve interoperability and data capabilities, mission-critical voice capabilities will not be immediately available through the NPSBN. As a result, public safety agencies need to maintain and sustain LMR systems to ensure access to mission-critical voice capabilities, and to support the development and deployment of the NPSBN in their state or region, which will be challenging. For more information on this topic, see FirstNet's statements on the need to sustain LMR systems for mission-critical voice at: http://www.firstnet.gov/network/lmr.

PROGRESSION OF LMR TECHNOLOGY

LMR systems have progressed over time from conventional analog systems that provide a basic platform for reliable two-way radio communications (e.g., push-to-talk, one-to-many communications), to the current digital trunked systems that offer more advanced features to emergency responders, including greater calling capacity (e.g., talk groups), enhanced voice clarity, higher quality coverage, longer battery life, and the availability of customized software applications. The adoption of P25 standards for digital systems has helped to standardize equipment requirements and ensure that systems are compatible and interoperable, regardless of vendor. Furthermore, digital LMR can support the use of IP communication protocols, functions, features and capabilities, which enable a "standardized" network interface protocol, and removes proprietary and/or legacy network elements from the infrastructure – elements that could hinder interoperability. The adoption and use of IP-based systems is emerging at a rapid rate. Investing in systems that could support the use of IP-based systems will enable agencies to connect more easily, promoting greater interoperability across disciplines, jurisdictions, and all levels of government.

Over the past 50 years, the public safety community has invested heavily in LMR infrastructure and equipment. As a result, responders are highly skilled in LMR use. LMR is an accessible, affordable, and reliable means of communications; it provides mission-critical voice capabilities, low-speed data capabilities, and functionalities that have been tried and tested in various response operations and environments. Today, there are an assortment of public safety agencies that operate on analog LMR systems and digital LMR systems, and some that have adopted advanced technologies to supplement LMR. Each technology offers different capabilities that can enhance emergency response.

LMR'S PROVISION OF MISSION-CRITICAL VOICE COMMUNICATIONS

Public safety LMR systems provide public safety responders with mission-critical voice communications and the best possible radio frequency coverage within a given geographical area of responsibility. These systems are designed to meet public safety's unique mission-critical requirements and support time-sensitive, lifesaving tasks, including rapid voice call-setup, group calling capabilities, high-quality audio, and guaranteed priority access to the end-user. Furthermore, the infrastructure equipment, user devices and methods of deployment are hardened, allowing for prolonged operation in rigorous and harsh environments with a higher level of user familiarity, availability, and accessibility. LMR system capabilities may include:

- Emergency alerting
- Encryption
- Audio noise reduction technologies
- Dedicated channels or talkgroups
- Priority access
- Highly reliable and redundant networks

While voice capabilities are offered through other technologies (e.g., Voice over Internet Protocol [VoIP], Voice over LTE [VoLTE], commercial voice push-to-talk (PTT) services), none of these voice offerings guarantee the level of reliability, expedience, and control needed for the demands of mission-critical voice exchanges. At present, there is no other more reliable choice to achieve the same level of mission-critical voice capabilities as that provided by public safety LMR systems. LMR provides the critical combination of quality, reliability, and assurance of access to priority communications that public safety officials need when responding to emergencies.

With the development of the NPSBN, there has been a great focus on defining public safety grade requirements, including the availability and reliability needed for mission-critical voice communications using LTE technologies. LTE voice protocols and standards remain under development. Furthermore, there is no date certain or firm commitment of when or if mission-critical voice services will be offered through the NPSBN. As a result, even as public safety agencies have integrated new technologies, they have stressed the need to maintain and enhance LMR systems to ensure access to mission-critical voice communications during day-to-day operations, emergencies, and disasters.
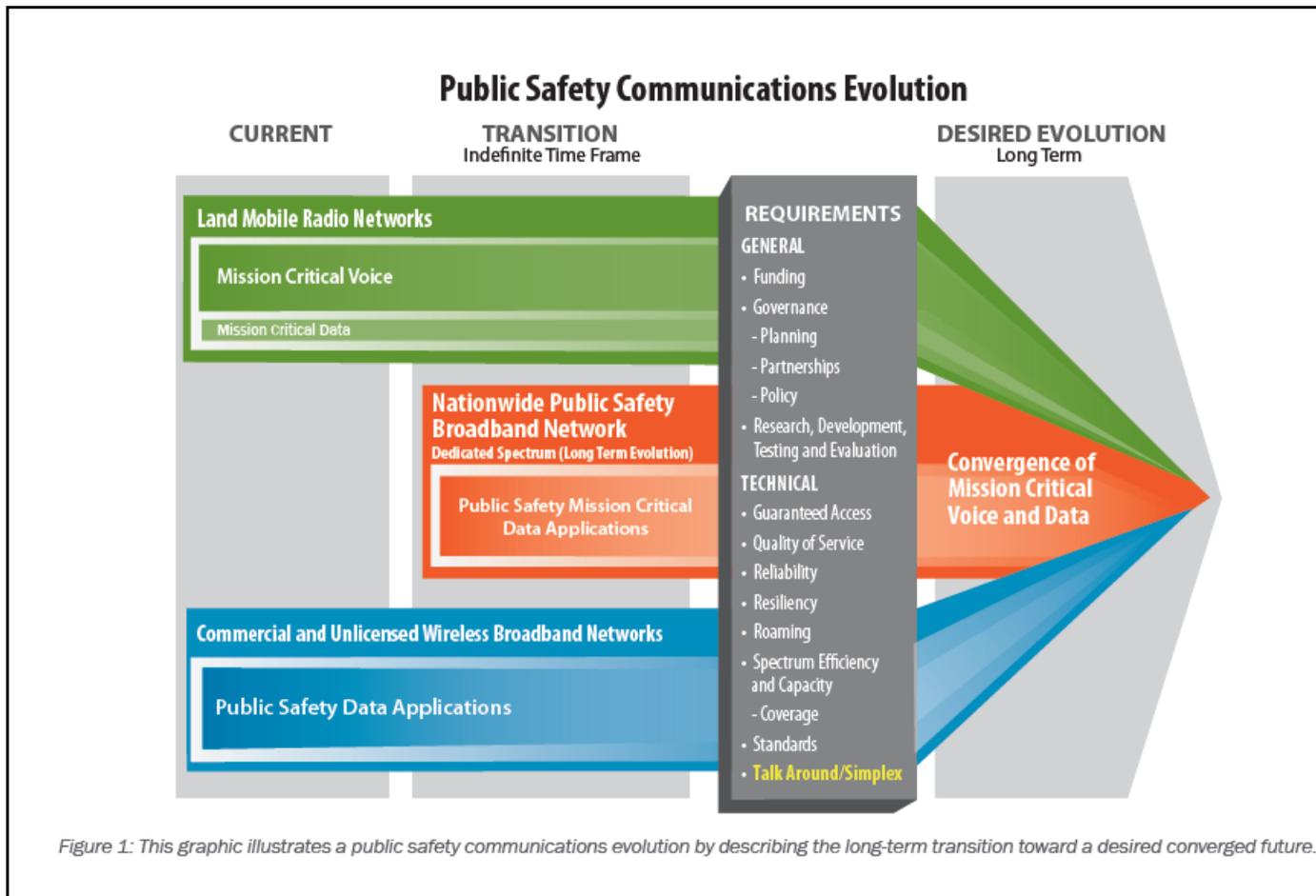
ADOPTION OF ADVANCED TECHNOLOGIES TO SUPPLEMENT LMR

In addition to using LMR systems, many public safety agencies are using commercial cellular data services or wireless broadband services to augment LMR capabilities. However, there are many drawbacks to using commercial services that are not designed and dedicated for public safety operations. The following table compares publicly-owned, dedicated LMR systems and offerings to privately-owned, commercial cellular networks.

Publicly-owned, Dedicated LMR Systems	Privately-owned, Commercial Cellular Networks
Intended to provide highest reliability at reasonable cost	Designed as "best effort" and offer no assurance of call completion or coverage; can become overwhelmed during major incidents
Designed to provide maximum coverage per base station site, and to service as many areas and people as possible	Designed to maximize the number of paying users on the system and to ensure the generation of revenue and highest profitability of infrastructure investments
Allows simultaneous communications with multiple users, across multiple jurisdictions and levels of government	Conversations are typically between two users
Based on dispatch operations from a centralized control center	Communications are typically linear, and between individual subscribers
Designed to be robust and resilient	Designed to support the generation of revenue
Developed by a state or local government or a single agency, which may or may not be a public safety agency; the system may be dedicated solely to public safety or shared with other agencies, utilities, or regional entities	Equally accessible to all. Intended to maximize system capacity and profit by allowing more users wireless access. Does not provide public safety priority over other users

Emergency communications are often accomplished through many technologies, each with varying capabilities, standards, and requirements. None is expected to replace the other; rather, they supplement capabilities already in place and to provide back-up or secondary means of communications in the event that the primary means of communications fails. The public safety community recognizes this reality and continues to reiterate that LMR remains the primary tool for emergency responders. As such, local, state, federal and tribal public safety agencies are planning for the NPSBN, while also sustaining LMR systems as the primary and only means of proven and effective mission-critical voice communications.

Most public safety agencies see a future in which LMR systems and wireless broadband services will converge to supplement one another. Other public safety agencies believe there will a convergence of technology, but it will take many years. In either case, the public safety community will need to support a multi-path approach to emergency communications, maintaining LMR systems' operability and interoperability while also planning for the deployment of new technologies. Figure 1 from the *Public Safety Communications Evolution Brochure* illustrates this multi-path approach and the eventual convergence of mission-critical voice and data.

Public Safety Communications Evolution

CURRENT **TRANSITION** Indefinite Time Frame **DESIRED EVOLUTION** Long Term

Land Mobile Radio Networks
- Mission Critical Voice
- Mission Critical Data

Nationwide Public Safety Broadband Network
Dedicated Spectrum (Long Term Evolution)
- Public Safety Mission Critical Data Applications

Commercial and Unlicensed Wireless Broadband Networks
- Public Safety Data Applications

REQUIREMENTS
GENERAL
- Funding
- Governance
  - Planning
  - Partnerships
  - Policy
- Research, Development, Testing and Evaluation

TECHNICAL
- Guaranteed Access
- Quality of Service
- Reliability
- Resiliency
- Roaming
- Spectrum Efficiency and Capacity
  - Coverage
- Standards
- Talk Around/Simplex

Convergence of Mission Critical Voice and Data

Figure 1: This graphic illustrates a public safety communications evolution by describing the long-term transition toward a desired converged future.

As these technologies continue to converge, interoperability becomes increasingly important. While the federal government has developed minimum interoperability standards for the NPSBN, technical requirements and protocols that ensure the integration and interoperability between systems in the network are still under development. For LMR systems, there are clear and established technical standards that ensure interoperability between systems. Therefore, public safety agencies that are recommending sustained investment in LMR systems, are also recommending the purchase of standards-based equipment to ensure interoperability between existing digital LMR systems and their thousands of users.

TO ENSURE INTEROPERABILITY AMONG RESPONDERS, PURCHASE P25 EQUIPMENT

P25 standards are developed and published by the Telecommunications Industry Association, a recognized American National Standards Institute standards development organization. P25 standards provide technical specifications for manufacturers building and providing digital LMR systems and equipment. The standards have helped to ensure that equipment is compatible and interoperable with other P25 systems. Before the advent of P25, various vendors were producing equipment built with proprietary features and functionalities. Public safety agencies owned and operated these vendor-specific systems. Often one vendor's equipment would not work with another's equipment, which greatly inhibited interoperability across agencies.

In order to promote interoperability, the federal government strongly encourages public safety agencies to purchase digital LMR systems and equipment that are compliant with the P25 suite of standards. While the federal government does not require investment in P25-only equipment, many federal grant administrating agencies will not approve requests for non-standards-based equipment unless there is a compelling reason for such a purchase.

The [SAFECOM Guidance on Emergency Communications Grants](#) provides recommendations, best practices, and resources for purchasing LMR equipment, including detailed information on P25 requirements. The *SAFECOM Guidance* recommends that grantees:

- Read the P25 technical standards for LMR
- Include P25 in Statement of Requirements and vendor inquiries
- Select P25 eligible equipment
- Obtain documented evidence of P25 compliance
- Ensure additional features purchased are P25-compliant
- Provide written justification required for non-P25 purchases

Purchase of P25 equipment ensures that digital LMR systems will be compatible with other, most importantly contiguous, P25 systems. Additionally, standards-based systems enable interoperable communications between emergency responders from various agencies, jurisdictions, and levels of government in the event they need to communicate during day-to-day incidents, large-scale emergencies, and disaster responses.

CONCLUSION

With the NPSBN development and initial early builder deployments underway, many local, state, federal and tribal public officials may wrongly believe the NPSBN will replace current LMR systems, and that LMR systems and funding can be phased out. Public safety agencies recognize that LMR systems provide a key capability during response operations—mission-critical voice communications—that will not be immediately available through the NPSBN. Additionally, completion of the NPSBN is remains years away. Therefore, public safety agencies must continue to seek funding for LMR systems, equipment, and enhancements in order to sustain and improve mission-critical voice communications among public safety responders. Decision-makers must consider the needs of public safety agencies and the impact of funding decisions on the ability of public safety responders to effectively communicate during day-to-day incidents, emergencies, and natural and man-made disasters. Without continued investment in LMR systems to sustain mission-critical voice communications, capabilities could be compromised during response operations.

The following list of resources is for public officials and public safety agencies investing in LMR. The *SAFECOM Guidance on Emergency Communications Grants* provides state and local project managers with recommendations, technical requirements, and best practices for planning, procuring, and sustaining an LMR system. To learn more on the current emergency communications ecosystem and the need to sustain two communications systems, decision-makers should read the *Public Safety Communications Evolution Brochure* and the *FirstNet LMR Fact Sheet*. Additional resources on P25 standards are available for LMR system planners.

ABOUT SAFECOM/NCSWIC

SAFECOM is comprised of more than 70 members representing federal, state, local, and tribal emergency responders, and major intergovernmental and national public safety associations, who aim to improve multi-jurisdictional and intergovernmental communications interoperability through collaboration with emergency responders and policymakers across Federal, State, local, tribal, territorial, and international partners. SAFECOM members bring years of experience with emergency communications during day-to-day operations, and natural and man-made disasters. SAFECOM members offer insight and lessons learned on governance, planning, training, exercises, and technologies, including knowledge of equipment standards, requirements, and use. SAFECOM members also provide input on the challenges, needs, and best practices of emergency communications, and work in coordination with OEC to share best practices and lessons learned with others.

The National Council of Statewide Interoperability Coordinators (NCSWIC) is comprised of Statewide Interoperability Coordinators (SWIC) and their staff from the 56 states and territories. NCSWIC assists states and territories with promoting the critical importance of interoperable communications and sharing best practices to ensure the highest level of interoperable communications across the Nation.

This document was developed by the SAFECOM/NCSWIC Funding and Sustainment Committee, with the support of the Department of Homeland Security (DHS) Office of Emergency Communications. This document reflects the expertise and knowledge of SAFECOM and NCSWIC members, and the coordination efforts of OEC in bringing stakeholders together to share technical information, best practices, and lessons learned in funding and deploying public safety communications systems.

For more information on SAFECOM, see: http://www.dhs.gov/SAFECOM
For more information on NCSWIC, see: http://www.dhs.gov/SAFECOM/NCSWIC

Resources for Public Safety Agencies Investing in LMR

2015 SAFECOM Guidance on Emergency Communications Grants
The SAFECOM Guidance provides information for grantees developing emergency communications projects for federal funding. Decision makers and grantees should read the SAFECOM Guidance, coordinate proposals with the Statewide Interoperability Coordinator, and encourage compliance with the recommendations contained therein. For Department of Homeland Security (DHS) grants, grantees must comply with the SAFECOM Guidance as a condition of funding.

Public Safety Communications Evolution Brochure
The DHS Office of Emergency Communications developed this brochure in collaboration with SAFECOM and the National Council of Statewide Interoperability Coordinators, with the support and input of public safety officials at multiple levels of government across the country. This brochure: (1) Helps educate the public safety community and elected and appointed officials about the future of emergency communications; (2) Describes the evolution of emergency communications and how traditional LMR communications used today may converge with wireless broadband in the future, if specific requirements are met; and (3) Discusses important requirements to achieve the desired long term state of convergence with LMR networks. Decision makers should review the brochure to understand the complexities of the FirstNet program and how it affects current and future investment in LMR.

FirstNet LMR Fact Sheet
This fact sheet discusses how FirstNet's Nationwide Public Safety Broadband Network will work with current LMR systems, and the need for continued investment in legacy LMR systems to preserve voice capabilities while the network is being developed.

P25 Technology Interest Group (PTIG)
The PTIG website provides information on all topics concerning P25 standards. Free registration is required to view content.

P25 Suite of Standards
The Telecommunications Industry Association's website contains P25 standards development activities that address all technical matters for private radio communications systems and services, including definitions, interoperability, compatibility, and compliance requirements. P25 standards documents are available for purchase. Government entities may obtain copies of P25 standards via the PTIG website.

P25 Compliance Assessment Program (CAP)
The CAP establishes a process for ensuring that equipment complies with P25 standards and is capable of interoperating across manufacturers. P25 CAP is helping emergency response officials make informed purchasing decisions by providing manufacturers with a method for testing their equipment for compliance with P25 standards.

Questions on this paper can be directed to the DHS Office of Emergency Communications at oec@hq.dhs.gov.