Funding and Sustaining Land Mobile Radio (LMR) Trio

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 citizens' calls for services and enhance personnel safety. LMR systems have been deployed since the 1930s to meet this critical need, and LMR continues to be public safety's primary means of voice communications (Figure 1). As communications technologies have evolved, LMR has introduced new features, enhancements, functionalities, and low-speed data capabilities to ensure system-level sustainment. Additionally, Project 25 (P25) accredited technical standards help ensure LMR systems and equipment are compatible and interoperable with other P25-compliant systems. In recent years, wireless data communications systems using different technologies have been deployed to supplement traditional LMR

Figure 1: First Responder Using LMR

capabilities. These wireless data systems enhance response by improving the capacity and speed at which mission-critical data (e.g., location, wanted persons/vehicles/firearms and criminal history information, medical records/assessments, maps, building plans, biometrics) 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, known as the First Responders Network (FirstNet). The network uses Long-Term Evolution (LTE) accredited technical standards and technology. FirstNet, as well as other broadband service providers, offer platforms for public safety responders and government officials to share information through wireless advanced data capabilities. While FirstNet offers enhanced interoperable wireless data capabilities, adjunct mission-critical voice services via the LTE network remain under development. As a result, public safety agencies need to maintain and sustain LMR systems to ensure access to mission-critical voice capabilities, as well as support the development and deployment of FirstNet in their state or region.

Progression of LMR Technology

LMR systems have progressed over time from conventional analog systems that provided 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 accredited technical standards for digital systems has helped to standardize equipment requirements and ensure that systems are compatible and interoperable across manufacturers' offerings regardless of vendor. Furthermore, digital LMR supports Internet Protocol (IP) communication protocols, functions, features, and capabilities, enabling the use of "standardized" network interface protocols, and minimizes the use of proprietary or legacy network elements from the infrastructure—elements that could hinder interoperability. The adoption and use of IP-based systems are ongoing. Investing in systems that could support 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 proficient in LMR use. LMR is an accessible, affordable, and reliable means of communication; it provides mission-critical voice capabilities, low-speed data capabilities, and features/functions that have been tried and tested in various response operations and environments. Today, many different public safety agencies operate on

analog or digital LMR systems, and some have adopted advanced technologies to supplement LMR. Each technology offers different capabilities that can enhance emergency responses and day-to-day operations.

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 requirements and support time-sensitive, lifesaving tasks, including rapid voice call-setup, group calling capabilities, high-quality audio, and guaranteed tiered/priority access to end-users. Furthermore, the systems are commonly designed to include infrastructure equipment, user devices, and deployment methods that are hardened, allowing for prolonged operations in rigorous and harsh environments with a higher level of resiliency, redundancy, user familiarity, availability, and accessibility. LMR system capabilities may include:

- Emergency call/alerting
- Dedicated channels or talkgroups
- Encryption

- Priority tiered access to resources
- Audio noise reduction technologies
- Highly reliable and redundant networks and equipment

While voice capabilities are offered through other technologies (e.g., Voice over Internet Protocol [VoIP], Voice over Long-Term Evolution [VoLTE], commercial voice push-to-talk [PTT] services), LMR will remain the primary voice communications service for public safety agencies for the foreseeable future. At present, LMR systems provide the combination of quality, reliability, and assurance of access to priority communications that public safety officials need when responding to emergencies.

With the development of FirstNet, there has been a significant focus on defining public safety grade requirements, including the availability and reliability needed for voice communications. LTE voice protocols and standards remain under development without a certain date or firm commitment of when or if truly mission-critical voice services will be offered through FirstNet and other broadband service providers. 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 use commercial cellular data services or wireless broadband services to augment LMR voice and data capabilities. However, there are many drawbacks to using commercial services that are not designed and dedicated for public safety operations. Table 1 compares dedicated LMR systems and offerings to commercial cellular networks.

Table 1: Dedicated LMR Systems vs. Commercial Cellular Networks

Dedicated LMR Systems	Commercial Cellular Networks
Intended to provide the highest reliability at a reasonable cost	Designed as "best-effort" and offer no assurance of call completion or coverage; can become overwhelmed during major crises or catastrophic 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 paid subscribers, revenue generation, 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 one or more centralized control centers	Communications are typically triangular in that they go through a network, and between individual subscribers
Designed to be robust and resilient	Designed to support the generation of revenue
Developed by a government entity or agency at any level of government; the system may be dedicated solely to public safety or shared with other agencies, utilities, or entities	Commonly, equally accessible to all with enhanced services to provide select public safety users with priority and preemption. Intended to maximize system capacity and profit by allowing more users wireless access

Effective emergency communications are often accomplished through many technologies, each with varying capabilities, standards, and requirements. None is expected to replace the other; instead, they supplement capabilities already in place and provide backup or a secondary means of communications if the primary means of communications fail. The public safety community recognizes this reality and reiterates that LMR remains the primary tool for emergency responders. As such, federal, state, local, tribal, and territorial public safety agencies are evaluating, planning, and implementing FirstNet and other broadband services, 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 integrate to supplement one another. Other public safety agencies believe there may be 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 planning for deployment and incorporation of new technologies. Figure 2 from the *Public Safety Communications Evolution Brochure* illustrates this multi-path approach and the eventual evolution of mission-critical voice and data.
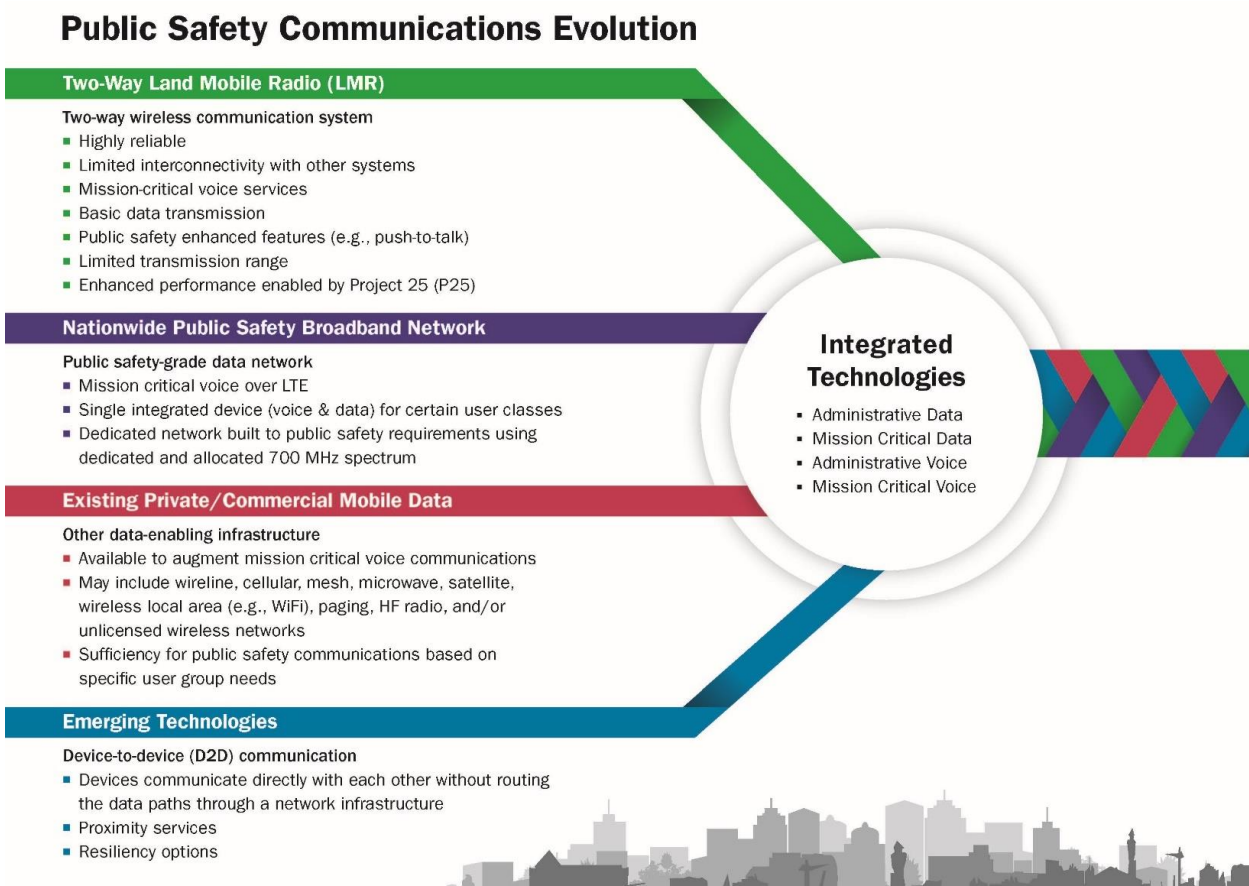

Figure 2: Public Safety Communications Evolution

As these technologies continue to evolve, interoperability becomes increasingly important. While the federal government has developed minimum interoperability standards for FirstNet, technical requirements and protocols that ensure the integration and interoperability between systems connected by 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 recommend sustained investment in LMR systems are also urging 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 (TIA), 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. One vendor's equipment would often not work with another's equipment, which significantly inhibited interoperability across agencies.

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 government does not require investment in P25-only equipment, many federal grant-making 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* (*SAFECOM Guidance)* provides recommendations, best practices, and resources for purchasing LMR equipment, including detailed information on P25 requirements. The *SAFECOM Guidance* recommends that recipients:

- Read the P25 technical standards for LMR
- Articulate specific P25 standards references, requirements, and expected results of features, functions, and services requested in *Requests for Proposals* and vendor inquiries
- Convey operability and interoperability requirements to prospective vendors with expected interoperability partners

- 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 disparate, 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

Although the federal government is allocating funding for FirstNet, elected officials and decision-makers must understand the public safety community will continue to rely on LMR as a primary means of communication. The community will likely integrate new or improved LMR capabilities, features, functions, and services for years to come to elongate the return on the sizable investments. Public safety agencies recognize that LMR systems provide a crucial capability during response operations—mission-critical voice communications—that will not be immediately available through FirstNet. 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 communicate effectively 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.

About SAFECOM/NCSWIC

SAFECOM includes 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, emergencies, and natural and man-made disasters. They 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 the Department of Homeland Security to share best practices and lessons learned with others.

NCSWIC encompasses Statewide Interoperability Coordinators and their staff from the 56 states and territories. The council assists states and territories with promoting the critical importance of interoperable communications and sharing best practices to ensure the highest level of interoperable communications within and across states and with their international partners along the borders.

Additional Resources

Public safety agencies can reference the following additional materials for more information:

- SAFECOM Technology Resources: This webpage provides guidance and recommendations on communications technologies used in the public safety environment, including multiple LMR and P25 encryption resources such as the *Statement of P25 User Needs*, *Operational Best Practices for Encryption Key Management*, *P25 Inter-RF Subsystem Interface (ISSI) and Console Subsystem Interface (CSSI) Primer*, and *Best Practices for Planning and Implementation of P25 ISSI and CSSI*.

- Public Safety Communications Evolution Brochure: This brochure: 1) helps educate the public safety community and elected/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.

- P25 Suite of Standards: TIA'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. Qualified government entities may obtain copies of P25 standards via the TIA website.

- Shared Communications Systems and Infrastructure (SCSI) Fact Sheet and SCSI Along the Southwest Border: This fact sheet and report inform the public safety community on the vision and benefits of SCSI. The materials outline the governance, risk management, resource sharing, and operations considerations that need to be addressed to ensure project success. Additionally, the report examines the opportunities, challenges, and actions required to create a SCSI project for federal, state, local, and tribal public safety organizations operating along the Southwest Border, serving as a case study for other regions.