

A Complete Guide to Replacing Your Radio System

Contact us for more information.

p. 412-201-4900 ext. 2274

w. www.kimballcorp.com

e. publicsafety@kimballcorp.com



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A Complete Guide to Replacing Your Radio System

Agencies around the country are encountering increasing pressure to upgrade or replace their radio system. Many users are facing a reduced availability of parts because their existing system is reaching the end of its product lifecycle. Population growth is requiring system expansion to address coverage and capacity. The Federal Communications Commission (FCC) mandate planned for the years 2011–2013 to narrowband wideband systems is gaining ground every day as deadlines creep closer. Interoperability pressures are mounting and new and more innovative technology with enhanced features becomes available every day.

To help our clients prepare for system replacement, expansion or upgrade, we've developed this white paper designed to investigate the radio system replacement process and provide guidance. It is based on what we've learned from our experience assisting hundreds of agencies around the county replace and upgrade their radio systems.

A key hint: Although they are not official steps in the upgrade process, funding and availability of radio spectrum are two important considerations for any system upgrade. A word about each of them:

Funding

Typically, the first and most urgent question that arises during the replacement or upgrade process is funding. This is a well-founded and critical question that requires a realistic answer based on your unique situation. Consider where you are today, where you want to be and devise a plan for how to get there.

Availability of Radio Spectrum

The second element that is crucial is radio spectrum availability. Do not assume that you can obtain enough clear spectrum to build a radio system, which is far too often the case. Address this component early in the upgrade and replacement process.



HIGHLIGHTS

Avoid a vendor that does not fully disclose what a system *will not do*, while placing too much emphasis on what the system *will do*.

Assessing your Existing System

To determine the right process and devise a plan for the future, we recommend you first assess your existing system and its capabilities. Use this checklist of items as a guide.

- ✓ Coverage
- ✓ Capacity
- ✓ Interoperability
- ✓ Radio dispatch console system
- ✓ Connectivity—microwave, fiber, leased lines, bandwidth
- ✓ Base stations/repeaters
- ✓ Frequency plan (this is very important and often overlooked)
- ✓ System loading and capacity requirements
- ✓ Talk group requirements
- ✓ Site facilities
- ✓ User equipment
- ✓ Data infrastructure
- ✓ System management systems
- ✓ Network security systems
- ✓ Cost of ongoing software and maintenance

A successful assessment is one that focuses not only on the technical aspects of the system, but also the operational needs of the users. Technology can be designed to serve any operational needs—if those needs are considered and defined. It is a common occurrence for manufacturers and service vendors to sell a technology that will not serve their customer's operational needs. Another common pitfall to avoid is aligning with a vendor that does not fully disclose what a technology or product *will not do*, while placing too much emphasis on what a technology or product *will do*.

Objective and meaningful surveys of the primary system users and stakeholders are a vital component in determining the operational needs of the users. The findings and interviews provide an understanding of the current equipment inventory, identify any special or unique system coverage issues current and future coverage requirements (locations, buildings, etc.) and coverage deficiencies experience with the current systems. In addition, user surveys determine feature and equipment requirements of future new systems.

The survey should be developed with a final goal in mind and the nature and tone of questions must be considered. It is important to be sensitive to a wide range of respondent dynamics. Dynamics can include anything from local politics to technical aptitude of the respondents.



HIGHLIGHTS

The biggest challenge during a radio communications project is properly managing all stakeholders' emotions.

An inventory of all system assets includes equipment, property, facilities, towers, vehicles, and frequencies and all should be part of the technical survey.

Frequencies are often overlooked and are the hardest to inventory, evaluate, and obtain. A complete frequency inventory consists of two primary elements—frequencies you are using and frequencies others are using. Without considering both, a proper analysis cannot be performed and environmental noise, interference, poor coverage, unusable equipment, and communications irregularities will eventually result. In the case of severe interference, systems or channels of systems should be shut down until new frequencies and equipment are obtained that do not interfere with in-place frequency spectrum users. It is important to emphasize proper frequency planning because it is a critical benchmark that will prevent project delays, reduce costs, and provide a superior final product.

The biggest pitfall often occurs when the expectations of end users are unmanaged. Educating the end users on what they can expect, and more importantly, what they cannot expect from their participation in the assessment, separates the science from the art of project management. Most projects take a straightforward technical approach when a logical approach should be used. The bigger challenge during a radio communications project is the proper management of emotions. Having a third party engaged without emotional attachments to the group dynamic is invaluable when soliciting and sorting opinions. Likewise, the absence of group buy-in can quickly stall a project and a third party that can facilitate, moderate, and drive consensus among disparate opinions will help minimize this risk.

Developing the Strategic Roadmap and Master Planning

Like any journey into the unknown, once you assess where you are, you can best determine where you want to go. A *strategic roadmap* should be developed after a thorough assessment has been completed. A strategic roadmap is constructed from data and analysis during the assessment. Benchmarks in current technology, system lifecycles, interoperability, and operational trends should be established and recommendations should be developed. Recommendations typically should provide more than one conceptual design, probable cost estimates, and the ongoing total cost of ownership.

Strategic roadmaps should include a gap analysis, which aids in identifying any unmet needs, coverage and capacity problems, reliability



HIGHLIGHTS

Most federal funding streams are qualified by the candidate's participation in P25 technology.

and usage issues, and desired improvements. Benchmarks are keys to identifying gaps and are created by comparing the current condition with the benchmark. In addition to specific voice and data technology wish lists identified through the gap analysis, the following factors should be considered before moving forward:

- ✓ Industry trends to standards (P25 and similar)
- ✓ Interoperability requirements and consistency with the statewide interoperability plan
- ✓ Redundancy and reliability improvements in the infrastructure
- ✓ Potential effects on operations and requirements of dispatch center
- ✓ Integration of mobile data and voice on the system
- ✓ Potential interconnectivity to Next Generation 9-1-1
- ✓ Ongoing operational problems for users
- ✓ Changing coverage requirements
- ✓ Interest in enhanced features
- ✓ Regulatory and spectrum requirements including FCC mandated migration from wideband (25 KHz) to narrowband (12.5 KHz/6.25 KHz) in VHF (150-174 MHz) and UHF (450-512 MHz) bands
- ✓ Frequency band characteristics
- ✓ Frequency availability
- ✓ The need for and availability of additional tower sites

Benchmark Element One – Standards-Based Technology

When selecting the best technology for building a new or upgraded radio communications system, owners need to consider the following factors:

- ✓ Standards-based technologies
- ✓ Proven effectiveness and reliability
- ✓ Maximum potential migrating to anticipate new and emerging standards
- ✓ Opportunities for efficiencies through reuse of existing equipment and infrastructure
- ✓ Interoperability

Today's standards-based technology is the Association of Public Safety Communications Officials (APCO) Project 25 - (P25 TIA-102) compliant system. P25 is a standard developed by APCO. The federal government has adopted P25 as the standard for all federal agencies. Most federal funding streams are qualified by the candidate's participation in P25 technology.



HIGHLIGHTS

Wireless communications interoperability specifically refers to the ability of emergency response officials to share information via voice and data signals on demand, in real time, when needed and as authorized.

There are some additional reasons to specify the P25 standard. These reasons are:

- Standards-based shared systems provide the highest level of interoperability.
- The competitive pricing of subscriber equipment from multiple manufacturers should reduce the cost of the initial purchasing of field equipment and replacing field equipment over the life of the system.
- P25 is a proven reliable technology for today's digital radio system to ensure a means of migrating to the P25 Phase 2 TDMA next generation of digital radio.

Benchmark Element Two – Interoperability Issues and Standards

One of the obvious goals of any emergency communications system is to provide interoperability for emergency response personnel. This is a critical element of any strategic plan for a public safety communications system. For this reason, it is worth providing an overview of the current standards for interoperability set forth by the federal government. State and local governments should use these standards and goals while planning and designing a communications system. They are also the standards used by federal grant programs to support interoperable communications.

In general, interoperability refers to the ability of emergency responders to work seamlessly with other systems or products without any special effort. For example, when communications systems are interoperable, police and firefighters responding to a routine incident can talk to each other to coordinate efforts. Communications interoperability also makes it possible for emergency response agencies responding to catastrophic accidents or disasters to work effectively together. Finally, it allows emergency response personnel to maximize resources in planning for major predictable events or for disaster relief and recovery efforts.

Performance Requirements and Procurement Documents

While the owner maintains control over the bulk of the fixed public safety infrastructure, there are many stakeholders that have vital interests in the procurement of a new system. Given the financial and operational interests of these various stakeholders in the future of a wireless voice and data communications system, it is prudent and appropriate to involve major system users when developing a new communications



HIGHLIGHTS

A forklift conversion is one that puts a new platform along an existing system.

system, including during the negotiation stage with vendors and during vendor selection. There are many ways to include the stakeholders in the decision-making processes. The most effective way is to select a representative group of financial and operational partners for involvement in system procurement.

Committee members should have both technical and operational knowledge and the ability to represent and make commitments on behalf of the organizations they represent. The committee should be relatively small with no more than 8-10 members and lead by a third party.

It is essential that detailed performance specifications be developed for a new system in the form of a Request for Proposal (RFP) to solicit solutions from multiple vendors. These should include coverage and capacity requirements as well as detailed specifications for system performance as well as a method by which the system will be evaluated and tested.

User requirements will help dictate coverage requirements when developing a system design. In the design process, users should assist with preparing grid maps of the owner's boundaries that identify where different levels of coverage are required, e.g., heavy, medium, and light constructed buildings, in-street portable coverage, etc. When approaching coverage requirements, the owner will want to address the critical areas identified by users as gaps for mobile and portable in-street coverage today.

The public safety service area may extend beyond the owner's borders and will need consideration as part of the design process. While it is not reasonable to expect that the owner's radio system will provide coverage to every possible location where mutual aid could be requested, areas of frequent mutual aid responses should be included. Other technological solutions may be required to provide interoperability for mutual aid beyond the owner's primary service area.

Implementation

The simplest conversion strategy to move to a new platform is to purchase and install the fixed site equipment alongside an existing system. This will make a clean, one-time cutover to the new system, commonly referred to as a "forklift" conversion. However, actual implementation would be considerably more complicated.



HIGHLIGHTS

A phased transition to a new system presents a number of challenges, including confusion, interoperability issues and pricing difficulties.

A new system may consist of separate regions or areas. This would permit the purchase or implementation of separate areas in phases. Any attempt to migrate in a gradual manner from a legacy system to a new system may be complex, confusing and could impose interoperability problems. Spreading the system implementation out over a period of years would also make vendor pricing difficult. The greatest disadvantage to a phased transition is that unless subscriber units are capable and programmed to work on both platforms, some subscriber equipment would be limited to the legacy system. On the surface, the biggest advantage to a phased transition is the spreading of cost over an extended period of time. While a phased migration scenario could spread the cost of implementation out over several years, it may not save money in the end. In addition, delaying full system implementation could delay addressing existing communications needs. This being said, a phased approach is necessary on some large-scale systems.

There are significant improvements in standards that include the Inter-RF Sub-System Interface (ISSI). This interface provides legacy systems a clear path to connect into a digital P25 system, clearing the way for a completely new turnkey system with back connection to legacy systems.

Project Timelines

One of the most overlooked elements of assessing, procuring and implementing a new radio system is time. More often than not, the assessment phase is under-committed to, resulting in a system that has not been built to provide for current, or future operational needs of its users. Because most systems are implemented in the midst of funding constraints, operational shortfalls and diverse opinions, the outcome is often a quickly designed and under-built system that may not support public and first responder needs during a time of crisis.

Take a restrained approach to the time required to assess, procure and implement a system. Time is really a clear and critical step to successful implementation.

Some realistic timeframes:

- System assessment — **90 Days**
- System procurement (if you have frequencies licensed) — **90 Days**
- System implementation — **12-18 months**
- New frequencies (if required) — **12-18 months**

In Summary

The key elements to any radio project include:

1.) Assessment

- Meaningful
- Managed expectations by a third party
- Benchmarked analysis

2.) Procurement

- A committee led by a third party
- Reflective of operational and technical needs
- Request for Proposal (RFP)—let the vendor explain their best method.

3.) Implementation

- Budget the proper amount of time.
- Avoid phased approaches. Phased systems never receive the proper funding to be completed.
- Develop methods to test and compare with written performance requirements.
- Enlist the assistance of a third party to avoid the chaos of disparate opinions.