Overview of Changes in Radio Technologies, Expectations, and Usage

For years public safety agencies have relied upon two-way analog land mobile radio systems (LMRS) for routine operations and incident management communications. As time passed legacy LMRS infrastructures have aged to the point that many are now beyond maintenance or repair. Consequently, replacement increasingly is no longer optional, it has become a necessity.

The rate of replacement of legacy LMRS is growing yearly. Estimates are that by 2020 $35 - $50 billion will be invested worldwide in radio systems – mostly in the United States. Adding to the trend is the adoption by the FCC of new standards encouraging and requiring transition from analog to digital systems. Major advantages of digital include greater bandwidth capacity, and use of Long Term Evolution (LTE) technology.

If the acronym LTE is a familiar one, it might be because of smart mobile phones based on LTE technology. LTE's fundamental differentiator is its ability to use digital signals. LTE integrates sounds, videos, text, pictures via computer programming. Just as LTE has overtaken plain old telephones (POTS), now it is transforming "plain old radios" into computerized communication devices.

Analog

Analog systems are broadly accepted by agencies and users because of their familiarity with the systems. Radio as it stands today has a long relevance to public safety agencies for meeting mission critical communication requirements. The combination of need and familiarity has led to a broad tolerance for the built-in limitations of analog.

And analog does have limitations that cannot be overcome. Its call capacity is often inadequate to meet the need, especially during incident response. As an outdated technology it has become difficult to procure new equipment and parts to sustain operations. Analog also has little to no ability to take advantage of GPS, transmission using Internet Protocol (IP); encryption; multiple band operation; or interoperability with systems used by other agencies.

In short, legacy analog systems are very difficult to maintain or update to meet ever changing communication opportunities and needs.

LTE

In essence LTE has all the capabilities analog does not:

- **Radio over Internet Protocol (RoIP)** – in which authorized users are able to directly call any other authorized user over a wide area network.

- **WIFI** – RoIP also supports other wireless transmission technologies (including Bluetooth).
- **Scalable Architectures** – P25 allows for constant growth in range and features.
- **Greatly increase call capacity** -- Analog allows for only one conversation at a time, digital transmission enables two to four simultaneous conversations through use of narrow banding.[1]
- **Call and data encryption** – is supported to protect sensitive data, such as protected health information, tactical information during operations, employee information and other forms of information that currently may be broadcast in unprotected modes.
- **Over the air programming (OTAP**) – Radios must be programmed with the frequencies, channels, talk groups, microphone settings, and virtually every aspect of their operations. Analog radios programming requires labor intensive manual intervention, while digital programming can be automated to occur over the air instantaneously.

Some of the downsides to the new technology are:

- It is less known by the user community which can lead to bumpy user acceptance. Voices tend to sound thin and more robotic; signals can be problematical – usually surpassing, but sometimes struggling to meet signal requirements; and selected options can tend to have unexpected outcomes – all of which can lead to "adoption confusion."
- The technical community is still developing the rich body of knowledge and lessons learned needed to ward off planning and delivery surprises. Project managers are also learning. Projects planning must be rethought because digital comes with new business and technical tolerances affecting everything from critical path planning, cost, scope, and risk and issue management.
- Lastly, the new features often significantly change radio use, especially during incidents. Public safety personnel depend upon learning how to use their equipment to the point of "muscle memory" in order to focus on events around them. It takes time to gain that level of practice with the new system.

A Final Thought

The greatest impact transition to the new technologies has on decision makers is the extent to which it is IT driven. The degree of the change and what it means to be LMRS can be a controversial topic. However what is undoubtable is adding the IT component is driving an unprecedented rate of radio development. Radio systems are now undergoing unceasing changes -- and sometimes unavoidable upgrade costs -- that will affect policy and operation decisions for years to come.

[1] The increased conversations relate to the two P25phases: Phase 1 which doubles the use of analog bandwidth, and Phase 2 which quadruples it.