



# 25

## Years of Project 25

Since its inception in 1989, the Project 25 (P25) standard has become the most heavily used digital technology by U.S. public-safety officials.

By James Downes and George Crouch

On a warm day in October 1989, the top technology experts from federal, state and local government agencies and organizations met in a conference room in the Herbert Hoover Building at the U.S. Department of Commerce for the “Advanced Technology Seminar” to address the future of public-safety communications technology. Little did they know how much of an impact they would have on public-safety communications for the next 25 years and for the foreseeable future.

At that time, mobile radio technology was just beginning to advance into the digital world. Cellular phones were still analog and LMR technology for business and government had been thrust into the digital world without much thought about standards. The Association of Public-Safety Communications Officials (APCO) International was determined to enhance its APCO Project 16A trunking recommendations that only described functional requirements to include cross-manufacturer interoperability through the development of a detailed technical standards suite. Another organization, the National Association of State Telecommunications Directors (NASTD) was also interested in devel-

oping the capability to provide additional procurement sources for radio systems and provide interoperability, especially for statewide public-safety and public-service systems. In a parallel effort, a federal government committee had been working to standardize digital radio technology for federal agencies.

A major concern was that digital trunked technology be standardized to allow for interoperability among systems provided by different vendors. This concern was exemplified in the 1980s when two major vendors provided incompatible digital technologies, although both solutions were compliant with the published encryption standards.

The common goal of all participants in the initial 1989 meeting was to provide an organized means for public-safety communications to migrate from analog technology to a digital conventional and trunked environment. Some manufacturers were already producing digital radio systems that were not interoperable. If that trend were to continue, many of the goals of this first meeting could not be realized. The results were promising as the participants agreed to continue to meet,

developing a partnership that has lasted 25 years. What began in 1989 is now known as Project 25 (P25), a successful suite of standards for interoperable digital voice communications.

The initial goals seemed intuitive, and the technology leaders believed it would be a process that would last four or five years, but the process quickly turned out to be quite complex. The five initial principles of P25 were:

1. Interoperability
2. Spectral efficiency
3. Competition in system life-cycle procurements
4. Graceful migration (backward and forward)
5. User-friendly equipment

The framework for the standardization of digital public-safety communications was developed at this initial meeting. As a user-driven effort, standards would be based on user requirements, rather than what current technology could provide. As the effort progressed, the manufacturing industry, through the Telecommunications Industry Association (TIA), became a key partner, providing necessary technical knowledge.

### The Early Years

Organizing partnerships was a key element in the early years of P25. After all, this was the first public safety user-driven LMR communications standards effort. The original partnership was formally organized into a Steering Committee. The Project 25 Steering Committee was composed of three representatives from APCO, three representatives from NASTD, and three representatives from federal government agencies (FED): one each from the National Communications System (NCS), the National Security Agency (NSA) and the National Telecommunications and Information Administration (NTIA). APCO and NASTD each

provided an additional representative to serve as co-chairs of the Steering Committee. A number of meetings were held during the next several months to further define the project. As in the first meeting, the manufacturing community was interested in assisting the Steering Committee with technical standards development.

The P25 Steering Committee worked closely with public-safety users and the manufacturing community for the next several years to develop a process and a validation method for creation of the required standards. Although the Steering Committee and its subcommittees were staffed by well-qualified and competent leaders and technologists, it quickly became evident that a formal partnership with the communications industry would be beneficial to ensure the success of the effort. In these early days, the partnership was formalized in a memorandum of understanding (MoU) called APCO Project 25 or APCO/NASTD/FED Project 25. About 10 years into the project, the name was shortened to Project 25, in recognition that the project had increased in magnitude significantly beyond just APCO.

**The MoU**

By 1992, the P25 Steering Committee participants, in coordination with other user and manufacturing represen-

tatives, had detailed how the public-safety user community could work with the communications industry to develop the suite of P25 standards. The effort was organized into the following committees and subcommittees to manage and staff the effort:

- **The P25 Steering Committee:** Responsible for managing the process, providing leadership and guidance.

- **The User Needs Subcommittee (UNS):** Responsible for developing user requirements.

- **The APCO Project 25 Interface Committee (APIC):** Tasked with developing collaborative recommended standards by working with users and manufacturers.

- **TIA 2 TR-8 Private Radio Engineering Committee:** Tasked with publishing the collaborative standards documents as P25 and American National Standards Institute (ANSI) standards.

These committees were made up of a number of subcommittees and task and work groups that addressed specific subjects, as required.

In April 1992, an MoU was signed between the co-chairs of the P25 Steering Committee, the respective presidents of APCO and NASTD, and TIA. The MoU formalized the process and procedures for the development and publication of a series of TIA-102 standards. The P25 Steering Committee re-

views and approves the standards as P25-endorsed documents.

The MoU defined the P25 standard as a cooperative effort between the users (APCO/NASTD/FED) and industry (TIA). It specified how the standards were developed from user-defined requirements, as well as the relationship between the user community and industry. It also addressed the important aspects of intellectual property (IP) rights essential to the development and adoption of an effective standard. A supplemental MoU in 1993 further clarified processes and procedures. After the MoU was signed, the P25 Steering Committee realized the project should be broken down into multiple parts to best address the user requirements. The committee created a multi-phased approach focused on baseline standards first, followed by advanced features.

**Phase 1**

The initial phase focused on the Common Air Interface (CAI) and voice encoder-decoder (vocoder) as its baseline, to be followed by advanced features and wireline interfaces. Phase 1 of the P25 standard defined the first step toward providing a standardized digital LMR technology. Phase 1 included the specifications for 12.5-kilohertz FDMA equipment and systems that could interoperate with multiple vendors' radios in conventional or



1989

**First meeting about a common digital standard**

**Committees and subcommittees established**

1992



1995

**Phase 1 Common Air Interface (CAI) standard completed**

trunked mode, as well as legacy analog FM radio systems.

Although the core of the Phase 1 standard is the CAI that defines how the basic radio operates over the air and provides the basis of interoperability, the initial task was the selection of the vocoder. Following the approval and publishing of the vocoder specifications, the CAI standard was completed in 1995. Since then, additional Phase 1 standards have been developed to address trunking; security services, including encryption and over-the-air-keying (OTAR); network management and telephone interfaces; and the data network interface. Additionally, there have been ongoing maintenance revisions and updates to the existing standards.

The P25 Steering Committee announced the completion of the Phase 1 standards in August 1995. P25 Phase 1 systems are now commonplace, enabling interoperability, competition among manufacturers, backward compatibility and spectrum efficiency to fulfill the original goals of the effort.

**Phase 2**

Phase 2 was designed to satisfy how public safety’s need to transition to a 6.25-kilohertz or equivalent occupied channel bandwidth and maintain backward compatibility to Phase 1 technology, allowing for graceful migration toward greater spectrum effi-

ciency. Although the need was identified for standards to address additional interfaces and testing procedures, the primary focus for the Phase 2 suite of standards was defined by a two-slot TDMA approach to spectrum efficiency as opposed to a 6.25-kilohertz FDMA technology.

The Phase 2 suite of standards addressing TDMA trunking technology was completed and published in 2012, but the standards allowing initial product development were published in 2010. Work continues on P25 to address revisions and updates to the existing standards, based on technology upgrades and to develop the necessary test procedures to confirm standards compliance.

A significant number of standards documents addressing the P25 Inter-RF Subsystem Interface (ISSI) have been developed and published. There are a number of public-safety agencies implementing or planning to implement the P25 ISSI to interconnect P25 systems. The standards for the Conventional Fixed Station Interface (CFSI) and Console Subsystem Interface (CSSI) have also been completed and successfully deployed. Additionally, standards have been developed and published to address a number of interfaces relevant to security services, to include the Inter-Key Management Facility Interface (IKI).

More than 94 documents are in-

cluded in the P25 suite of standards that have been approved by the P25 Steering Committee. These documents include specifications and standards for the applicable features and interfaces, as well as almost 30 documents addressing specific test procedures.

**P25 Compliance Assessment Program**

Both the user and manufacturing communities identified a need to establish procedures to confirm that P25 equipment and systems were compliant with the published standards. This led to the development of the P25 Compliance Assessment Program (CAP), a voluntary program that allows suppliers of P25 equipment to demonstrate that their respective products are compliant with P25 baseline requirements reflected in the suite of standards. The program, developed by the Department of Homeland Security (DHS) and the National Institute of Standards and Technology (NIST), provides the user community assurance that the communications equipment they are implementing meets the standards for performance, conformance and interoperability. The charter for the P25 CAP was executed in April 2008, and eight laboratories were accredited to conduct performance and interoperability tests relevant to the P25 Phase 1 CAI.

The user community has repeatedly

**P25 Compliance Assessment Program (CAP) charter executed**

**2008**



**2010**

**First commercial ISSI tests in Dallas**

**Phase 2 TDMA trunking standards published**



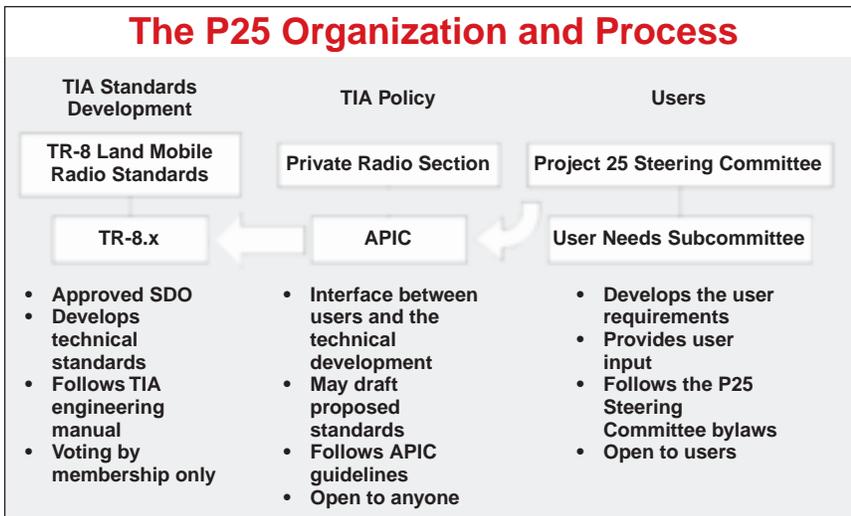
**2012**



**P25 radio programming spreadsheet published**

**2014**

## The P25 Organization and Process



emphasized the need for expanded P25 CAP testing. DHS is working with industry and users to identify the required procedures to validate compliance with Phase 2 equipment and systems, particularly for TDMA operation and the ISSI. In the meantime, users are encouraged to seriously consider the existing tests that are included in the P25 suite of standards for interim compliance testing and validation.

### The Future

There is no doubt that P25 is a success. P25 has met or exceeded its original goals of spectrum efficiency, backward compatibility, competition, and perhaps most importantly, interoperability. Furthermore, P25 is the predominant public-safety technology in the U.S. and is accepted as a primary public-safety standard in 83 countries worldwide. According to the Project 25 Technology Interest Group (PTIG), 38 vendors provide P25 systems and services available in all public-safety frequency bands with the exception of VHF low band. P25 has been selected by most U.S. federal agencies as their choice for interoperability, reliability and security. End users have realized that implementing P25 standards-based products results in cost effective and

spectrum-efficient systems and radios that are necessary to support our nation's public-safety communications requirements.

As Phase 2 systems are developed and deployed, the P25 Steering Committee continues to work closely with the user community and industry to address the future of LMR. Without a doubt, LMR will be prominent in public-safety voice communications for years to come.

### When Will P25 Be Completed?

Some officials have asked when P25 standards development will be finished. P25 is a "living" standards effort, which has continued to evolve alongside technology and user requirements. Therefore, the standards will continue to evolve. An example of this evolution is the recent realization by the vendors and users that a standard for Link Layer Encryption and Authentication supports a more robust security capability. A spreadsheet to import and export Project 25 (P25) programming data was also published in April.

Most standards development bodies, including ANSI and TIA, stress that "a completed standard is a dead standard," emphasizing the need to continually add technology enhance-

ments to maintain the relevancy of existing standards.

P25 continues to evolve to meet public-safety communications requirements, to include interfaces and interconnections to broadband technology. Broadband may be the wave of the future, but P25 is the rock public safety depends on for solid, reliable and secure public-safety digital communications. Let's celebrate P25's success and look to the future. ■

James Downes is a telecommunications manager with the Department of Homeland Security (DHS) Office of Emergency Communications (OEC). Prior to moving to DHS in 2003, he was the deputy director of the Wireless Management Office in the Department of the Treasury. He has worked for more than 40 years in wireless communications, primarily in the public safety and federal law enforcement environments. He has been involved in the Project 25 standards activity since 1994, representing the federal government user community and has been a voting member of the Project 25 Steering Committee since 1996. In 2011, he was elected chair of the Steering Committee. He also represents DHS OEC in the Telecommunications Industry Association (TIA) TR-8 standards development activities and was the chair of the Project 25 Technology Interest Group (PTIG) for more than four years.

George Crouch is vice chair of the P25 Steering Committee and serves as one of the National Association of State Technology Directors (NASTD) representatives on the committee. Crouch is the administrator for South Carolina's statewide radio system, Palmetto 800. He is also a member of the Association of Public-Safety Communications Officials (APCO) International and past state chapter president and Federal Emergency Management Agency (FEMA) Region IV Regional Emergency Communications Coordination Working Groups (RECCWG) past vice chair. Email comments to [editor@RRMediaGroup.com](mailto:editor@RRMediaGroup.com).