PROJECT 25 – A USERS’ PERSPECTIVE

Jim Downes
Chair, Project 25 Technology Interest Group

Department of Homeland Security, Office of Emergency Communications

August 3, 2010
Agenda

- Background
- P25 Process
- P25 Interfaces
- P25 Features / Functions
- P25 CAP
- P25 Procurements
- P25 Myths and Reality
- Resources
Background

• Project 25 (P25) is an unprecedented partnership between industry, the public safety community, and a standards development organization (Telecommunications Industry Association [TIA]), formed to develop next-generation digital land mobile radio (LMR) standards providing—
  - Interoperability
  - Spectral Efficiency
  - Backward compatibility and forward migration
  - Competition among vendors
  - Mission-critical encrypted voice and data capabilities for public safety agencies

• Developed under the guidance of the American National Standards Institute (ANSI) / TIA / Electronic Industries Alliance (EIA)-102 suite of standards to address the communications problems that arose when proprietary digital trunked LMR systems began to replace analog conventional LMR systems in the 1980s
Project 25 was created through a joint effort of the National Association of State Telecom Directors (NASTD), the Association of Public Safety Communications Officials (APCO) and the Federal Government (National Communications System [NCS], National Telecommunications and Information Administration [NTIA], and the National Security Agency [NSA]) in August 1989.

Project 25 was initiated in response to—
- Improvements in VHF/UHF efficiency mandated (narrowbanding)
- Plans for dedicated trunking spectrum announced
- Multiple implementations of APCO Project 16
- Public Safety organizes to support standards
- Parallel effort by NCS to develop standards within the Federal Government
- Advances in voice processing and digital technologies
Project 25 Development Process

- The P25 Standards are developed through a user-driven, consensus-based process.
- Users identify requirements and document those requirements in the P25 Statement of Requirements (P25 SoR).
  - The P25 SoR is revised as new requirements, clarifications to existing requirements, and new technologies are introduced.
  - The P25 UNS makes recommendations to the P25 Steering Committee.
    - The P25 Steering Committee publishes the P25 SoR annually.
- The P25 Steering Committee, in coordination with the APCO P25 Interface Committee (APIC) and the User Needs Subcommittee (UNS) sets the priorities.
- The APIC reviews the requirements and priorities and begins standards development.
- Once the standard is mostly completed, it is forwarded to the appropriate TIA TR-8.x subcommittee for completion, balloting, and publication.
Project 25 Process Flow

User voice
- P25 Steering Committee
- P25 User Needs Committee
- User Needs Task Groups
  - Define requirements for standardization;
  - Adopt or reject TIA work
  - Only Users vote
  - Develops concept documents for P25

Joint Participation
- APIC: TIA-P25 Interface via MoU
- APIC Task Groups
- APIC Working Groups
  - Develops user requirements into standards proposals
  - Serves as venues for needed clarifications
  - Manages documents
  - All organizations get a vote

Industry voice
- TIA TR-8 Committee
- TR-8 Committee Subcommittees
- Subcommittee Working Groups
  - Develop consensus standards with guidance from APIC and users
  - Only TR-8 members vote
  - Ballots and publishes TIA Standards
Background – Why Project 25

- Project 25 is the only Public Safety user-driven, land mobile radio standard that currently exists
- User participation includes all levels of government (federal, state, local, tribal and provincial)
- Project 25 defines messages and procedures for eleven interfaces as well as several key features and functions necessary to complete the public safety mission
- Project 25 is continually evolving to include more features and functions as well as new technologies as they become standardized
- US Federal grant guidance requires Project 25 compliant equipment for new implementations
- TIA has developed and published over sixty-four standard documents that define each interface. Over 125 documents have been developed and published supporting the standards and features offered in the Project 25 suite
P25 Interfaces

- Common Air Interface (CAI)
  - FDMA CAI
  - TDMA CAI
- Console Subsystem Interface (CSSI)
- Inter-RF Subsystem Interface (ISSI)
- Fixed Station Subsystem Interface (FSSI)
- Telephone Interconnect Interface (PSTN)
- Host and Network Interface (Data Interface)
- Network Management Interface
- Subscriber – Mobile Data Peripheral Interface
- Key Fill Device – Mobile Radio Interface
- Inter-Key Management Facility Interface
P25 Interfaces—Common Air Interface

• The CAI and the P25 voice encoder (vocoder) provide the baseline interoperability for P25, allowing users to communicate directly with or without the need of infrastructure.

• The CAI (Uₘ for FDMA, Uₘ₂ for TDMA) is the interface between base station transceiver(s) and the mobile subscriber units, and subscriber to subscriber units.

• This interface is used for communication with mobiles and portables within the P25 system.

• The P25 vocoder was selected through a lengthy competitive and evaluation process. The following criteria were some of the primary metrics used during the evaluation:
  - Intelligibility
  - Voice Quality
  - Performance
  - Fair and reasonable terms

• The CAI for FDMA was completed and published in 1995. Several iterations and revisions of the standard have been published since 1995.
P25 Interfaces—Common Air Interface

- The CAI provides direct communications between the RFSS and other subscriber units.
P25 Interfaces—Console Subsystem Interface (CSSI)

- The Console Subsystem Interface (CSSI) provides connectivity between a console subsystem and the RF subsystem.
- The CSSI is designed to allow users to implement multiple console systems from different manufacturers.
- From a user standpoint, the CSSI provides the ability to connect multiple manufacturers consoles to your infrastructure.
P25 Interfaces—Inter-RF Subsystem Interface (ISSI)

- The Inter-RF Subsystem Interface (ISSI) permits radio frequency subsystems to be interconnected into wide area networks.
- The ISSI uses industry standard protocols that allows enhanced interoperability at the network level between Project 25 systems.
- The ISSI may provide connectivity between
  - Different technologies (i.e. FDMA, TDMA)
  - Systems from different manufacturers
  - Disparate frequency bands
- From a user’s standpoint, the ISSI provides the ability to network multiple systems for enhanced interoperability between agencies and jurisdictions.
P25 Interfaces—Fixed Station Subsystem Interface (FSSI)

- The Fixed Station Subsystem Interface (FSSI) provides connectivity between a conventional fixed station and a conventional fixed station host, which may be part of either a RFSS or a console subsystem.
- This interface was designed to give the user the ability to add third party fixed station equipment to a specific system.
- Currently this interface only addresses conventional capabilities.
- From a user’s standpoint, the FSSI provides the ability to add multiple manufacturers base stations and repeaters to your system.
P25 Interfaces—Telephone Interconnect Interface

- The Telephone Interconnect Interface provides connectivity between the radio frequency subsystem and the public switched telephone network (PSTN).
- Project 25 supports analog and ISDN telephone interfaces.
- From a user’s standpoint, the telephone interconnect interface provides radio users and dispatchers the ability to initiate, receive and manipulate telephone calls in the same means as other P25 system calls.
P25 Interfaces—Host and Network Interface (Data Interface)

- The Host and Network Interface (Data Interface) provides connectivity between the RFSS and public or private data networks.
- From a user’s standpoint, this is the interface that allows a user to access databases and applications external to the RFSS (i.e., NCIC2000, Computer Aided Dispatch [CAD])
P25 Interfaces—Network Management Interface

- The Network Management Interface provides connectivity between the RFSS and an operations and maintenance center.
- The interface was designed to select an industry standard network management scheme that offers the ability to manage RFSS(s) with a variety of industry standard equipment.
- From a user’s standpoint, Network Management Interface provides the ability to monitor and remotely control the various RFSS components.
P25 Interfaces—Subscriber – Mobile Data Peripheral Interface

• The Data Peripheral Interface supports the interconnection of mobiles and portable subscriber units with laptops, terminals, or subscriber unit peripherals.
• Industry standard protocols are supported on this interface allowing application level data to be easily transported into TCP/IP computer networks at the Host and Network Interface on the fixed equipment side.
• From a user’s standpoint, this interface was designed to support peripheral devices such as mobile data terminals, fingerprint and retinal scan imaging devices.
P25 Interfaces—Key Fill Device – Mobile Radio Interface

- The Key Fill Device (KFD) – Mobile Radio Interface permits manual rekeying between a key fill device and a subscriber unit.
- This interface provides the ability to manually provision a subscriber unit with encryption keys or other key management related information.
- Key variables cannot be extracted from an encrypted radio.
- From a user’s standpoint, KFD-Mobile Radio Interfaces provides the user the ability to receive an encryption key from any KFD, regardless of brand or manufacturer.
P25 Interfaces—Inter-Key Management Facility Interface

• The Inter-Key Management Facility (KMF) Interface (IKI) supports the secure exchange of end-to-end keys between key management facilities in a P25 system.
• The IKI employs standards-based cryptographic techniques for key protection and exchange.
• The IKI leverages established and commercially available public key technologies.
• From a user’s standpoint, the IKI provides the ability to network multiple KMFs of different manufacturers to support over-the-air rekeying (OTAR) operations. For example, one agency creates an interoperability key, then shares it with another agency through the IKI.
P25 Features and Functions

Project 25 supports the following features and functions

- Trunked
- Conventional
- Voice calls
  - Group calls
  - Announcement calls
  - Individual calls
  - System calls
  - Emergency group calls
- Roaming
- Registration/Deregistration
- Affiliation
- Call restriction
- Call priority
- Dynamic regrouping
- Emergency alarm/alarm cancel
- Radio unit monitoring
- Security
  - Encryption
  - Authentication
  - Over-the-air rekeying
  - Manual rekeying
  - Secure trunking control channel
- Preemptive priority call
- Dispatcher audio takeover
- Dispatcher call interrupt
- Voice telephone interconnect
- Discreet listening
- Radio check
- Radio inhibit/uninhibit
- Packet data messaging
- Location services
- Status messaging
- Simulcast
P25 Compliance

• The Interoperability Process and Procedures Task Group (IPPTG) has been developing interoperability tests since the CAI was first published in 1995.
• The marketplace began to see increasing numbers of P25 “compliant” equipment from various manufacturers in the late 1990s, early 2000s.
• In the early stages, the responsibility of ensuring compliance and interoperability was left to the procuring agency working in coordination with the applicable vendor(s).
• Initial compliance and interoperability issues were identified and reported to the hosted manufacturer’s interoperability board (HMIB)
  - The telecommunications Industry Association (TIA) created a subcommittee within the TR-8 Private Land Mobile Radio standards development group to handle compliance related issues. The subcommittee is TR-8.25.
  - The Association of Public Safety Communications Officials (APCO) Project 25 Interface Committee (APIC) redefined the Interoperability Process and Procedures Task Group (IPPTG) as the Compliance Assessment Process and Procedures Task Group (CAPPTG)
P25 Compliance Assessment Program

- Recognizing a discrepancy in the various implementations of Project 25 hardware, Congress passed legislation creating the Project 25 Compliance Assessment Program (P25 CAP)

- The P25 CAP was implemented by the Director of the Department of Homeland Security Office for Interoperability and Compatibility (DHS OIC)

- A P25 CAP Governing Board was formed in accordance with the legislation and is limited to active tribal, local, state and Federal government employees

- A P25 CAP Laboratory Program Manager is provided by the National Institute of Standards and Technology – Office of Law Enforcement Standards (NIST/OLES)
P25 Compliance

- The Compliance Assessment Process and Procedures Task Group (CAPPTG, formerly the IPPTG) working with NIST developed the P25 CAP Lab Assessment in an effort to recognize labs that would be authorized to provide official P25 compliance documentation. That documentation includes:
  - The NIST 153 Lab Assessment Handbook
  - Supplier’s Declaration of Compliance (SDoC) template
  - Test summary reports
  - Detailed test summary reports
The P25 CAP Process

- Interface and feature standards are developed by the various TIA TR-8.x subcommittees.
- The standards are then balloted and published in accordance with the TIA Engineering Manual.
- As the standards are near completion and publication the subcommittees formulate the various performance, conformance and interoperability tests required to fully test the interface/feature.
- A subset of the performance, conformance and interoperability tests are identified as critical to demonstrating compliance with the P25 standards. These subset of tests are referred to as Recommended Compliance Assessment Tests (RCATs)
  - RCATs are published by TIA as Technical Service Bulletins
  - The Project 25 Steering Committee provides a recommendation to the P25 CAP Governing Board recommending the RCAT for adoption and publication as a P25 CAP Compliance Assessment Bulletin (P25 CAP CAB)
    - P25 CAP CABs are used by the approved labs to test and demonstrate compliance to the P25 standards
The P25 CAP Process (continued)

- Labs are assessed by NIST before becoming recognized by DHS
  - Assessments follow NIST Handbook 153
  - Applications are open to any test lab providing land mobile radio testing
- Once a CAB is approved by the P25 Governing Board, labs have 6 months to be assessed for the particular CAB.
- Once assessed, labs may begin publishing SDoCs, summary test reports and detailed test reports (on request).
- SDoCs are provided to the P25 CAP for review and acceptance
  - Once approved, the SDoCs and summary test reports are published on the Responder Knowledge Base (RKB) website: www.rkb.us
- From a user’s standpoint, the SDoC’s published on the RKB are the official documentation necessary to show P25 compliance for grant funding.
- One caution though, manufacturers may publish preliminary compliance documentation for interfaces, features and functions that are not currently covered by the P25 CAP.
**P25 Procurement Best Practices**

- The various interfaces and features of Project 25 are established in a multitude of Project 25/TIA standards. A generic procurement statement requiring Project 25 is not sufficient. Referencing Project 25 generically does not replace sound engineering best practices to ensure public safety requirements are met.

- When implementing an encryption algorithm, please remember that the only P25 supported algorithms are the Data Encryption Standard – Output Feedback (DES-OFB) and the Advanced Encryption Standard (AES). Proprietary encryption/protection schemes are not standardized and further complicate interoperability.

- When implementing proprietary solutions, include language in your procurement specification requiring a migration path to standards compliant technologies and feature sets. Remember to build the migration into your system life cycle costs for future standards based solutions.
P25 Procurement Best Practices

- Evaluate your current needs to include your surrounding jurisdictions. Optimal interoperability may be a multi-staged migration.
- Be mindful of implementing proprietary feature sets that may require a specific manufacturer’s service offering in future iterations. This is true for both infrastructure options as well as subscriber units.
P25 Myths and Reality

- Myth: “Project 25 is an old technology that has already passed its prime.”
  - Best Practice: Project 25 has been in development over 21 years, but during that time, the standards have been updated, reaffirmed, or completely revised several times. The TIA engineering manual requires that every published standard document be reviewed and reaffirmed, updated or withdrawn every five years at a minimum. TIA standard documents are often updated more often as new technologies, clarifications or user requirements change.

- Myth: “Project 25 is only available from a single vendor.”
  - Best Practice: Actually, that used to be a true statement for infrastructure. However, the following slide will give you an idea of the number of vendors that are participating in the Project 25 development process as well as their respective equipment offerings.
# Project 25 Equipment Manufacturers

<table>
<thead>
<tr>
<th>PTIG Manufacturer</th>
<th>Stations / Repeaters</th>
<th>Mobiles</th>
<th>Portables</th>
<th>Consoles</th>
<th>Networks</th>
<th>P25 Software</th>
<th>Test Equipment</th>
<th>Systems Integration</th>
<th>Consultant Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aecom</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aeroflex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avtec</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CadStar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobham - Wulfsberg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daniels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Datron</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVSI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EADS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E F Johnson</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Etherstack</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Dynamics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genesis Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harris</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iCOM America</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incident Specialists</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenwood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midland</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motorola</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pantel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PowerTrunk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raytheon JPS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RELM Wireless</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simoco</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survey Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAIT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technisonics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thales</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertex Standard</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zetron</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|   | 11 | 14 | 13 | 7 | 8 | 3 | 5 | 12 | 8 |
P25 Myths and Reality

• Myth: “It is sufficient to just reference P25 in my procurement document.”
  - **Best Practice:** When specifying P25 in your procurement documentation, make sure you include the specific P25 interfaces, features and functions you and your agency require.

• Myth: “The P25 CAP does not provide benefits to Federal agencies because their funding sources do not include grants.”
  - **Best Practice:** While the P25 CAP is heavily referenced in several grant guidance documents, it was developed to provide a baseline of P25 compliance. The P25 CAP CABs are beneficial to all levels of government regardless of their funding source.

• Myth: “The P25 CAP does not cover all of the interfaces.”
  - **Best Practice:** The P25 CAP has published a number of CABs covering the Common Air Interface for Project 25 Phase 1 and the ISSI. Additional Recommended Compliance Assessment Tests (RCATs) and CABs are being developed as resources become available. Ultimately CABs will be developed for each interface.
P25 Myths and Reality

- Myth: “Referencing the P25 CAP is all I need in my procurement documents.”
  - **Best Practice**: The P25 CAP CABs are only a subset of the performance, conformance and interoperability tests associated with a particular interface and/or feature. The P25 CAP does not replace sound engineering best practices to ensure public safety requirements are met. In some cases, P25 compliance may include the complete set of tests for your agency’s implementation. Additionally, your system may or may not implement multiple P25 interfaces which may or may not be covered by the P25 CAP.

- Myth: “I don’t need high level encryption. I’m only trying to prevent scanners from hearing my conversations.”
  - **Best Practice**: Low-tier encryption algorithms, or even digital privacy options, may create a false sense of security for users. NIST has shown that algorithms shorter than 112 bits in key length are prone to real-time exhaustive key search attacks. P25 supports both AES 256-bit keys (recommended algorithm) and DES-OFB keys for backwards compatibility and interoperability.
P25 Myths and Reality

• Myth: “P25 Equipment is cost prohibitive.”
  - Best Practice: P25 radios are available in a number of configurations ranging in price from your basic model all the way to the fully loaded feature set. Not all P25 radios require a full feature set to be P25 compliant. Proprietary solutions may end up costing you many times the expense if you are not careful.
P25 Resources

• Project 25 Technology Interest Group
  - http://www.project25.org/
  - Contact: Bill Pagones (director@project25.org)

• SAFECOM Grant Guidance
  - http://www.safecomprogram.gov/SAFECOM/grant/default.htm

• P25 CAP
  - Responder Knowledge Base: www.rkb.us

• Telecommunications Industry Association
  - Project 25 For Government Series
    • Contact Ronda Coulter: rcoulter@tiaonline.org

• Project 25 User Needs
  - Contact: Scott Bradford (sbradford@mt.gov)