Project 25 Interoperability Basics for Emergency Preparedness

Virginia APCO October 27-29, Roanoke VA

www.project25.org

Session Outline

Four focus areas

1

PTIG Overview

mission • resources • ecosystem

2

P25 Interfaces

systems model • CAI • ISSI • CSSI

3

New Capabilities

alarm • GPS • caller alias

4

Best Practices

governance • templates • exercises

Overview → Interfaces → Capabilities → Best Practices

Who is PTIG?

PTIG is an information forum for users and manufacturers

1 Mission

Advances the development, deployment, and applications of Project 25 industry standards.

2 What PTIG Provides

Education and training on P25 standards plus a forum for users and manufacturers to share operational and technical insight.

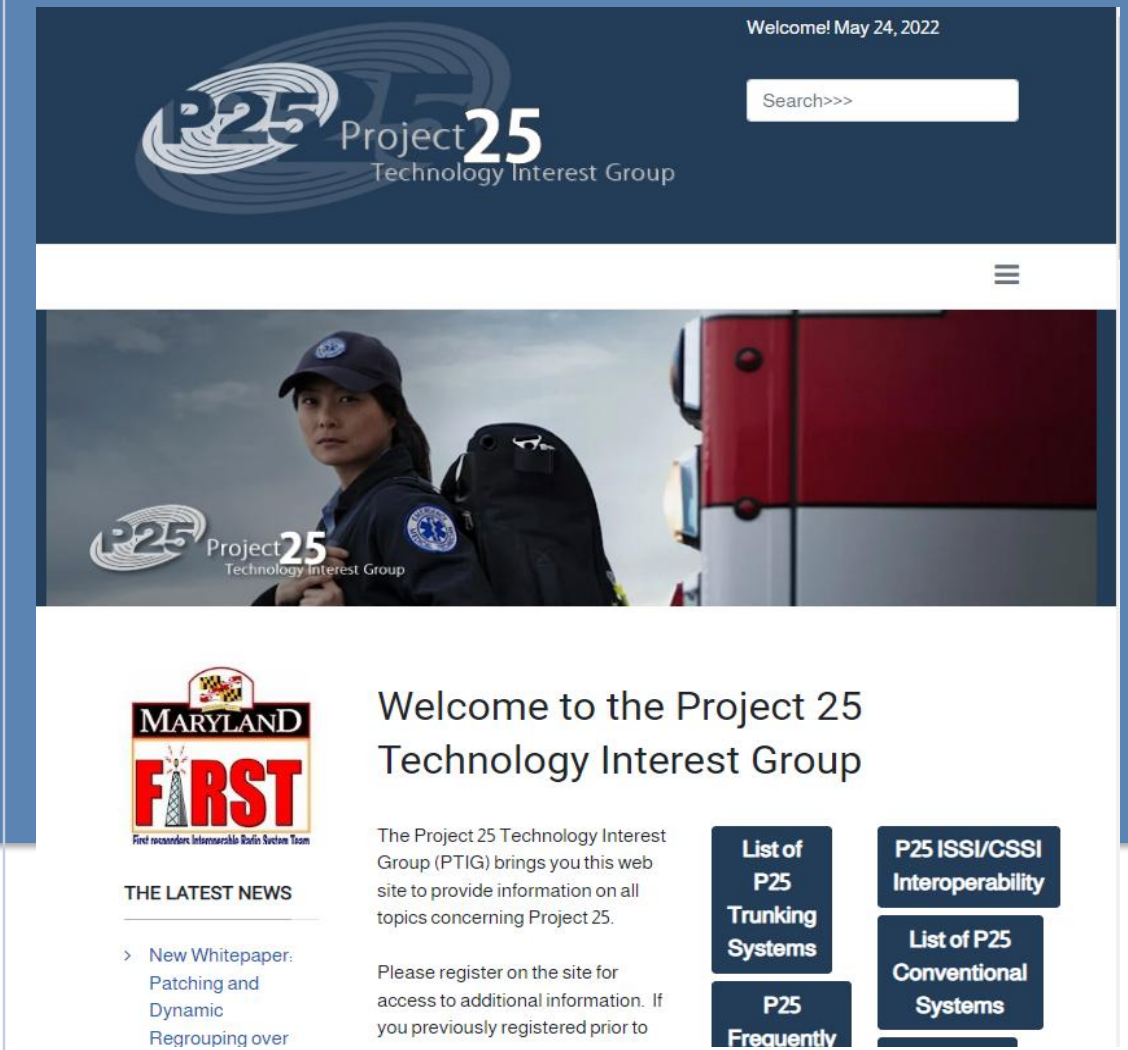
3 PTIG Members Include

- Radio communications subject matter experts
- Public safety and government professionals
- Equipment manufacturers and LMR engineers
- Service providers and consultants

PTIG connects users, government, and industry around practical adoption of P25 standards.

PTIG Online Resource Hub

www.project25.org centralizes standards, system lists, interoperability references, and training materials.



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Visit the site for:

system lists and standards updates
interoperability, security, and CAP references
case studies, FAQs, and conference presentations
commercial member contacts and new products

www.project25.org

P25 Resources Available on Project25.org

A practical library for system managers, trainers, and users

1 Systems & Standards

P25 system lists: trunking and conventional
latest standards update report
list of standards documents

2 Interop & Security

P25 basics and encryption videos
security and encryption links to the DHS library
ISSI/CSSI interoperability references and informal test data

3 Products & Testing

new products and services
PTIG commercial member primary contacts
CAP program library and approved equipment lists

4 Education & Case Studies

case studies and system-of-the-month articles
conference panel presentation slides
frequently asked questions and Benefits of P25

The PTIG website gathers operational references, technical guidance, and training material in one place.

Benefits of Project 25

Why public safety continues to adopt P25

1 Public-Safety Grade

High availability through redundant and resilient configurations

2 Direct Mode

Communications continue when infrastructure is not available

3 Interoperability

Multi-agency sharing of voice, data, and location

4 Security

Secure AES-256 encrypted communications

5 Installed Base

3,600+ known P25 systems including 44+ statewide systems

6 Cost & Choice

System sharing improves coverage while multi-vendor sourcing preserves options

P25 is a well-established suite of standards with user-driven, evolving technology.

P25 Ecosystem

Growth, consolidation, and statewide adoption continue across the P25 market.

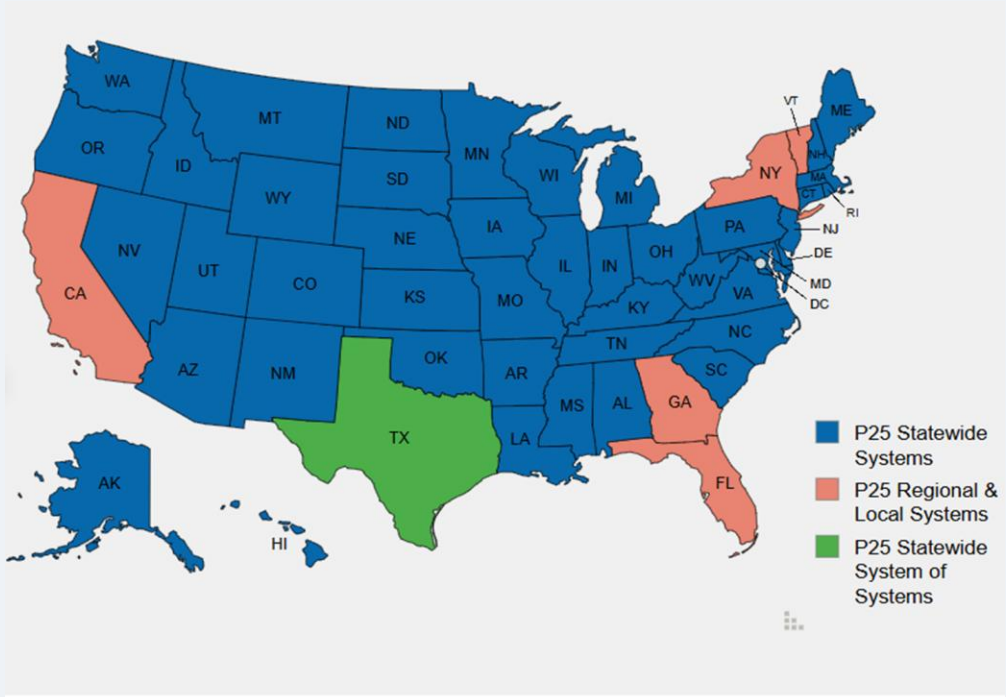
1,372
known P25 trunking systems

2,387
known P25 conventional systems (Sept 2023)

3,759
total known P25 systems

45
Statewide Systems in USA

83 Nations Worldwide



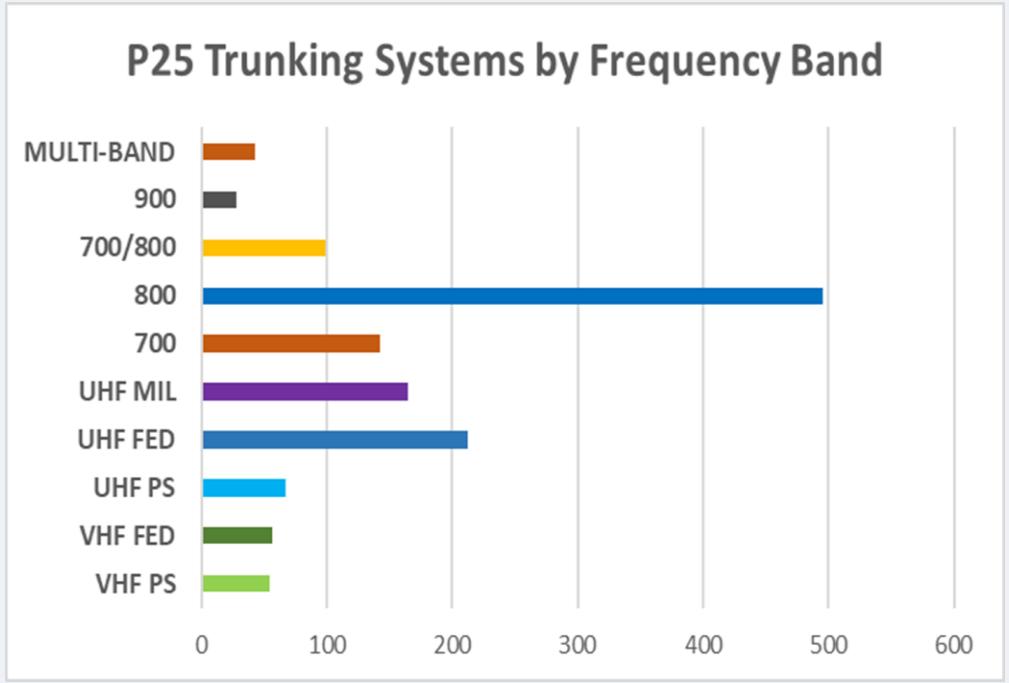
Current Trends

78 new P25 systems identified in the latest trunking update
Consolidation continues as local systems join regional and statewide networks
Phase 2 migration, military upgrades, and new amateur systems continue to expand the ecosystem

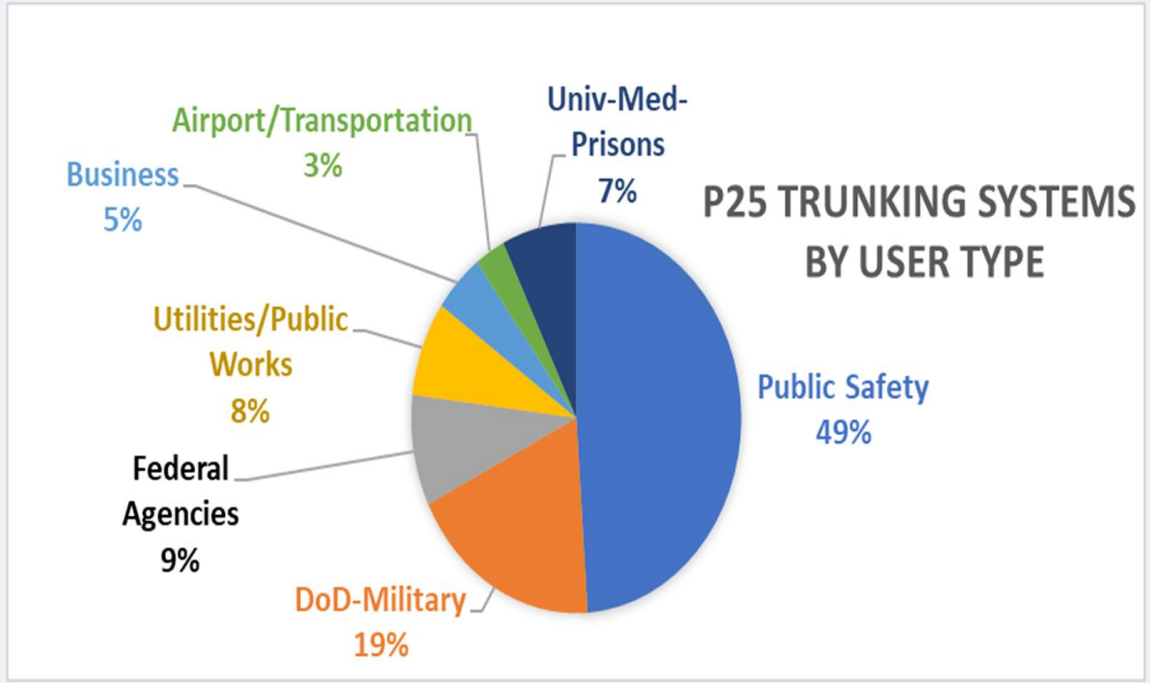
P25 Trunking Systems

Frequency-band mix and user-type distribution

By Frequency Band



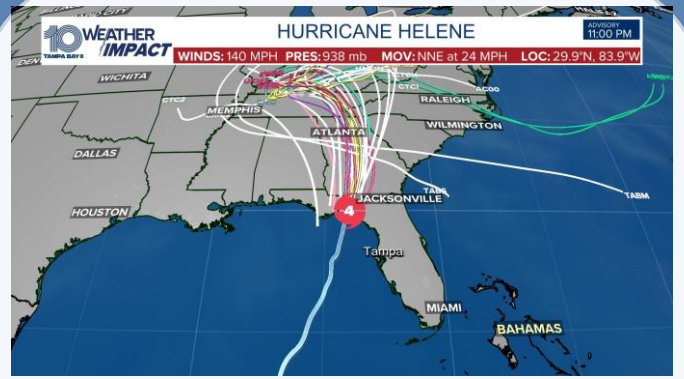
By User Type



700/800 MHz public-safety deployments dominate the current P25 trunking landscape.

What's Driving the Need to Interoperate?

Virginia examples that force cross-jurisdiction communications



Natural Disaster Response

Severe weather can pull together local, regional, state, utility, and mutual-aid partners.

Mutual Aid Incidents

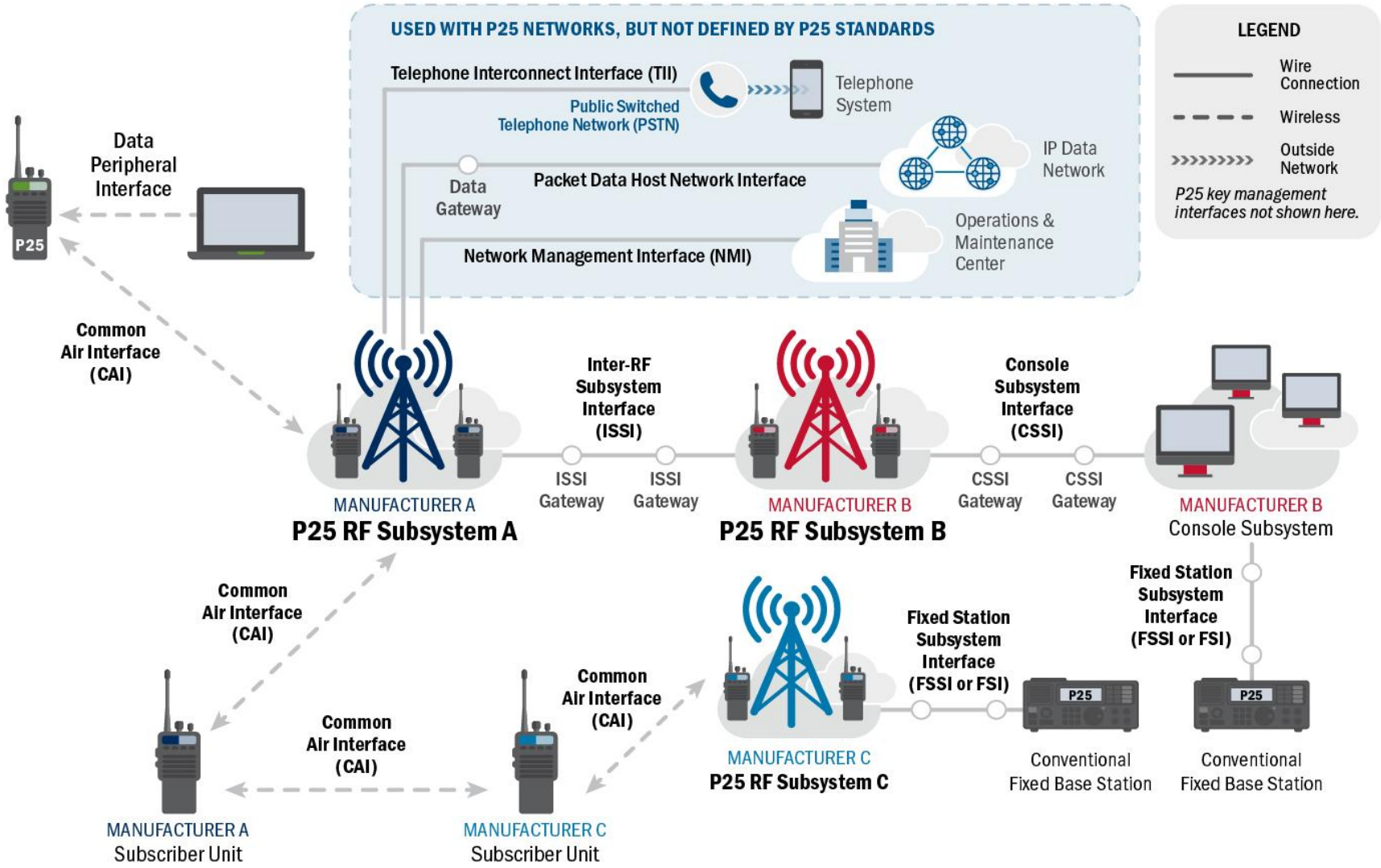
Violent incidents can rapidly cross municipal, county, and state law-enforcement boundaries.

Major Sporting Events

Virginia venues require interoperable law, fire, EMS, traffic, and event-security coordination.

Takeaway: in Virginia, disasters, mutual-aid incidents, and major events all create immediate requirements to communicate across agencies and jurisdictions.

The P25 Systems Model and Interoperability Paths

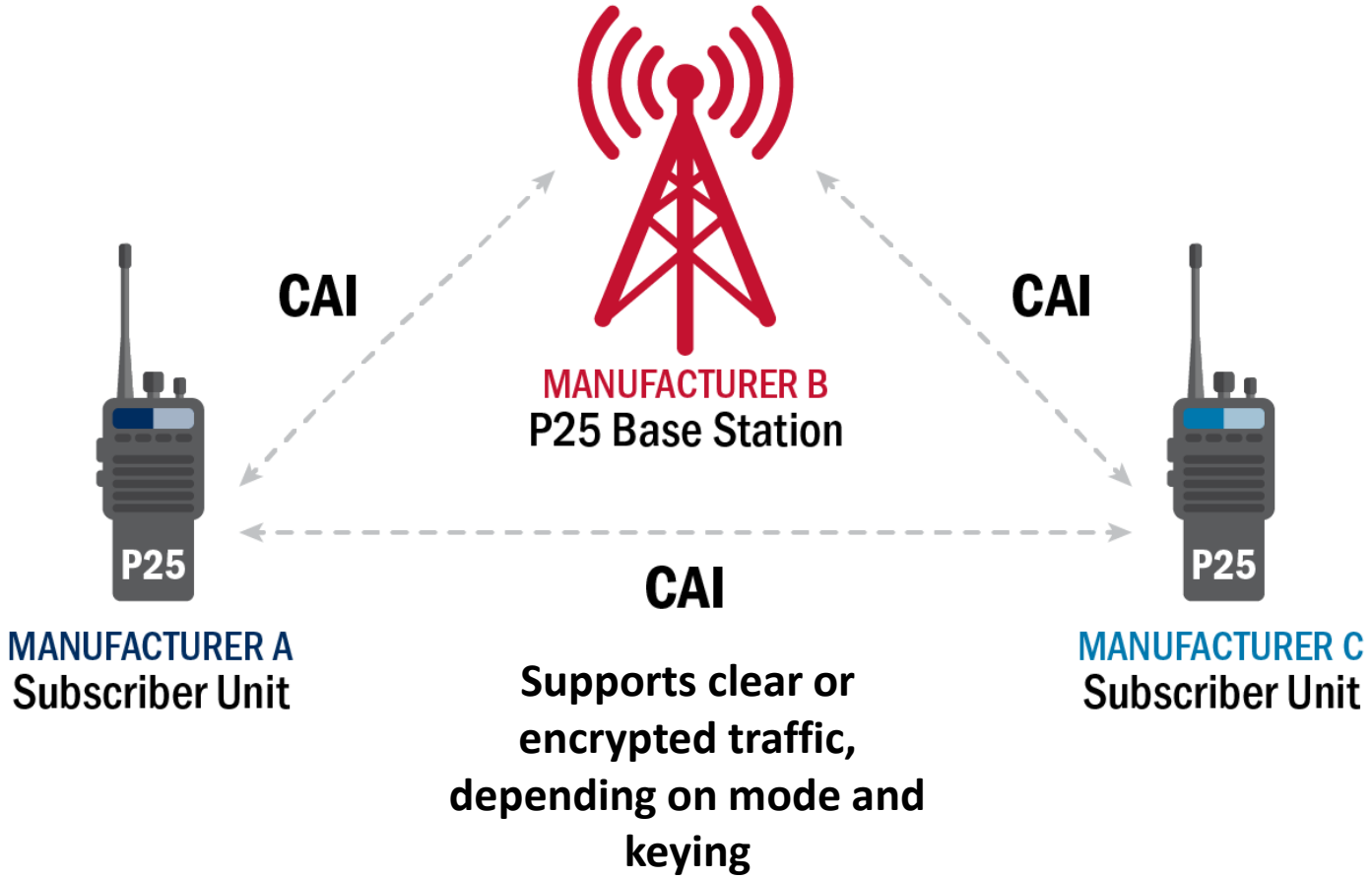


Source: Statement of P25 User Needs (SPUN) DHS CISA

Common Air Interface (CAI)

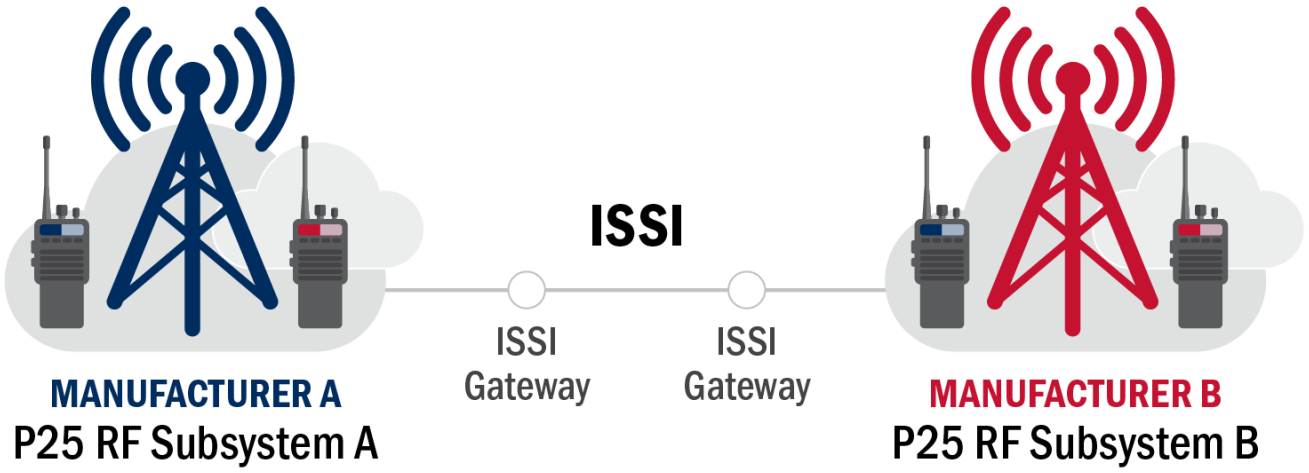
Standardized digital air interface between the subscriber unit and the RF subsystem

Critical for over-the-air operability and multi-vendor subscriber interoperability



Inter-RF Subsystem Interface (ISSI)

Provides the IP-based interface used to connect P25 networks into a standards-based system of systems

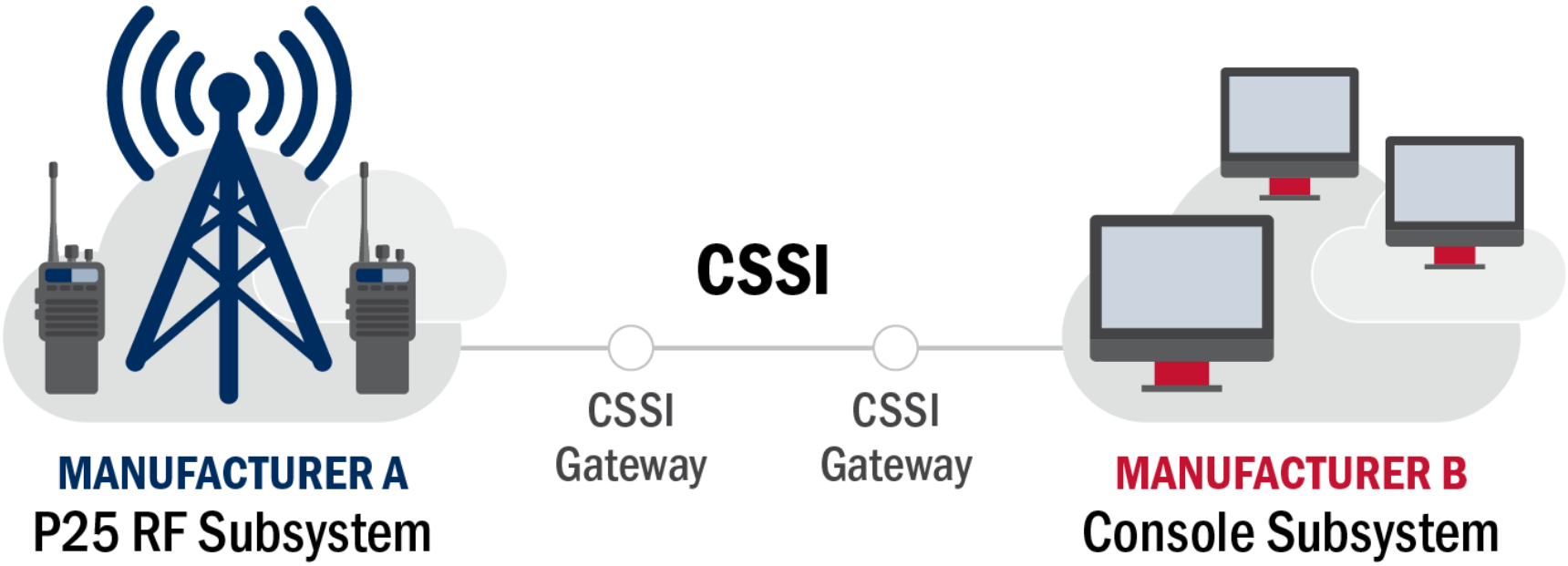


- Connects radio systems and associated resources among partnering agencies while preserving local control
- Supports home-system connectivity and talkgroup continuity while users roam onto foreign systems
- Lets dispatch maintain contact with roaming users across interconnected networks

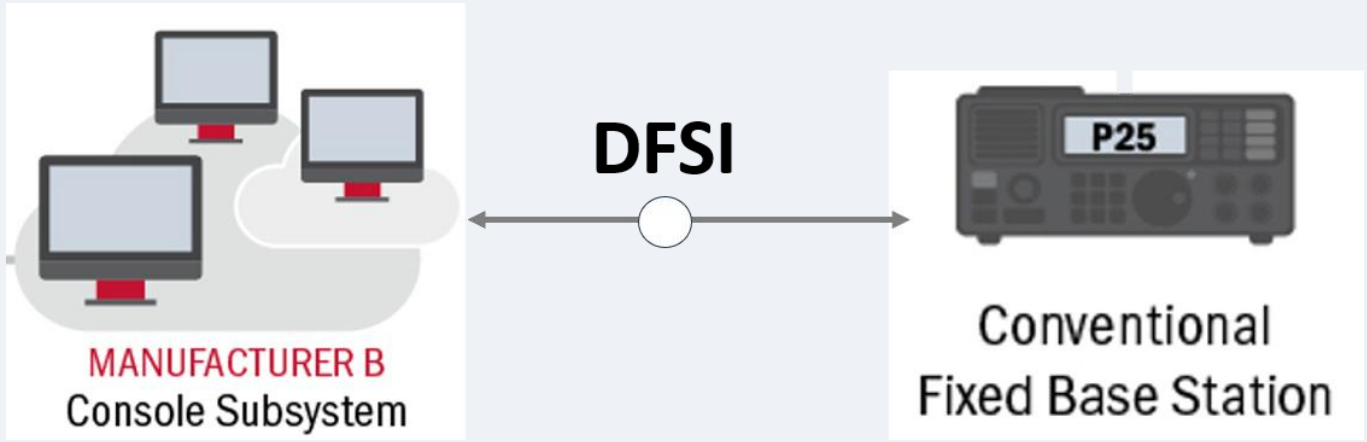
Console Subsystem Interface (CSSI)

Connects dispatch console subsystems to RF subsystems

Supports multi-vendor console interconnection inside a P25 system and across shared interoperability workflows



Digital Fixed Station Interface (DFSI)



Connects dispatch console subsystems and associated wireline resources to fixed station or base station equipment

Creates a standards-based path for backup dispatch, control-station operation, logging/recording, and gateway-based interoperability

P25 Standards Enable Interworking with 4G/5G Solutions

P25 Standard Interface	Type	Scope	Application for LMR/LTE interworking	Identified for IWF
Common Air Interface (CAI)	Wireless	SU-to-SU direct mode SU-to-RFSS Conventional and trunked Digital Only	Radio Gateway interface to LTE/LMR Gateway	
Digital Fixed Station Interface (DFSI)	Wireline	Console-to-RFSS Conventional including P25C and Analog FM	Conventional base station interface to LTE/LMR Gateway	☑
Console Subsystem Interface (CSSI)	Wireline	Console-to-RFSS Trunking and Advanced Conventional	Dispatch console interface to LTE/LMR Gateway	☑
Inter-RF Subsystem Interface (ISSI)	Wireline	RFSS-to-RFSS Trunking and Advanced Conventional	System core interface to LTE/LMR Gateway	☑

Takeaway: the specific use case dictates the best application of P25 standards for interworking between P25 and 4G/5G.

P25 Security Services

Defense-in-depth protects voice, signaling, and key management.

Security Service	User Benefit/Protection	Available?
End-to-end AES Encryption	Secure, interoperable exchange of voice and data	☑
Link Layer Authentication (LLA)	Authenticate subscriber units (SUs) and Infrastructure to ensure they are legitimate	☑
Link Layer Encryption (LLE)	Protect over-the-air signaling from interception	**Not Yet**
Over-the-air-Rekeying (OTAR)	Stage new key material over P25 common air interface	☑
Inter-KMF-Interface (IKI)	Transfer key material online or offline between separate systems/KMFs	☑
Key Fill Device (KFD)	Transfer key material securely from portable key fill to P25 subscriber units	☑

Encrypted Voice and Data (Security on P25)

Voice and data encryption enable secure operation

Encryption activation via a switch or “bound” to a particular talk group

Interoperability requires the same algorithm and key

- AES-256 (Advanced Encryption Standard) is the ONLY P25 standardized algorithm
- DES is deprecated / other proprietary solutions are less secure and not interoperable
- Single key and multi-key implementations available for subscribers

Standardized options for manual keyloading and over the air rekeying (OTAR)

Redundancy, Graceful Degradation, and Fallback

Layered resilience spans the core, RF sites, power, backhaul, dispatch, and control architecture.

1 Core & Controllers

call processing and core databases
controller failover where practical
geographic diversity where practical

2 Site Hardening & Civils

shelter, HVAC, grounding, and flood / wind protection
UPS / generator / fuel strategy
physical security and backhaul survivability

3 Dispatch & Wireline Paths

console redundancy and logging
CSSI / DFSI / control-station options
backup dispatch positions and facilities

4 RF Simulcast Site Redundancy & Reliability

overlapping RF site design and failure tolerance
simulcast control redundancy as one proof point
site trunking or degraded fallback if wide-area control is impaired

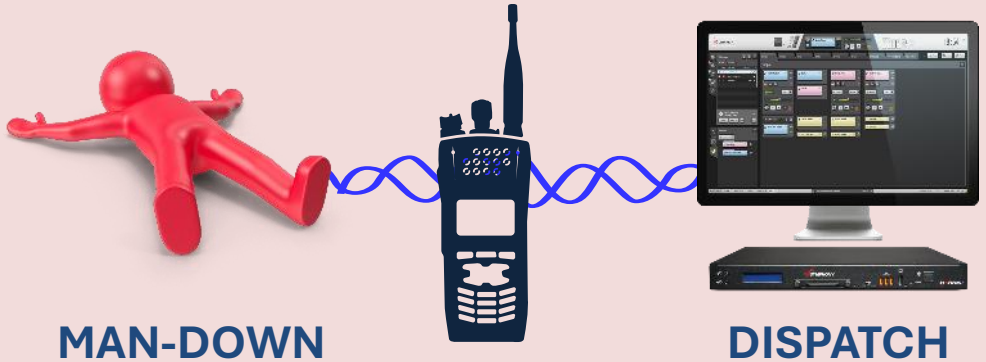
Design for layered resilience: redundant components first, graceful degradation second, and fallback paths when the wide-area system is impaired.

Emergency Alarm Signaling and Remote Activation

New reason codes and remote activation improve dispatcher awareness and responder protection.

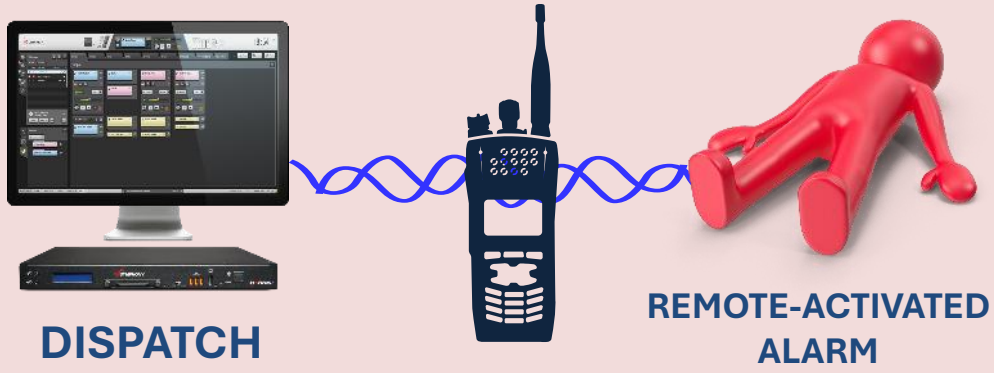
Updated Subscriber Emergency Alarm Signaling

New reason codes and remote activation improve dispatcher awareness and responder protection.



Remotely Activated Emergency Alarm

Use Case: Allows a telecommunicator (*or another privileged radio unit*) to remotely activate an emergency alarm for a subscriber who cannot activate their own emergency.



GPS on PTT Location

WHAT IS IT?

Allows a P25 subscriber unit to send its GPS location with each Push-to-Talk over the voice channel without using extra channel capacity or needing dedicated data channels.

KEY CUSTOMER VALUE

Telecommunicators are provided with refreshed locations while communicating with a first responder – especially in emergencies.

Caller Alias on PTT

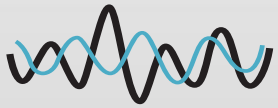
WHAT IS IT?

The new standard permits a P25 RFSS to **include Caller Alias in each PTT** for P25 subscriber units without using extra channel capacity, transmitting it over the air interface rather than just via ISSI.

KEY CUSTOMER VALUE

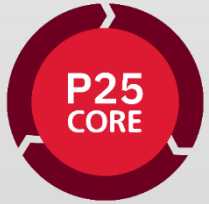
First Responders get **real-time Caller Alias** on their SUs without needing to manage alias lists. This works for P25 subscriber units, Dispatch Consoles and other types of callers.

Subscriber Units (SU)



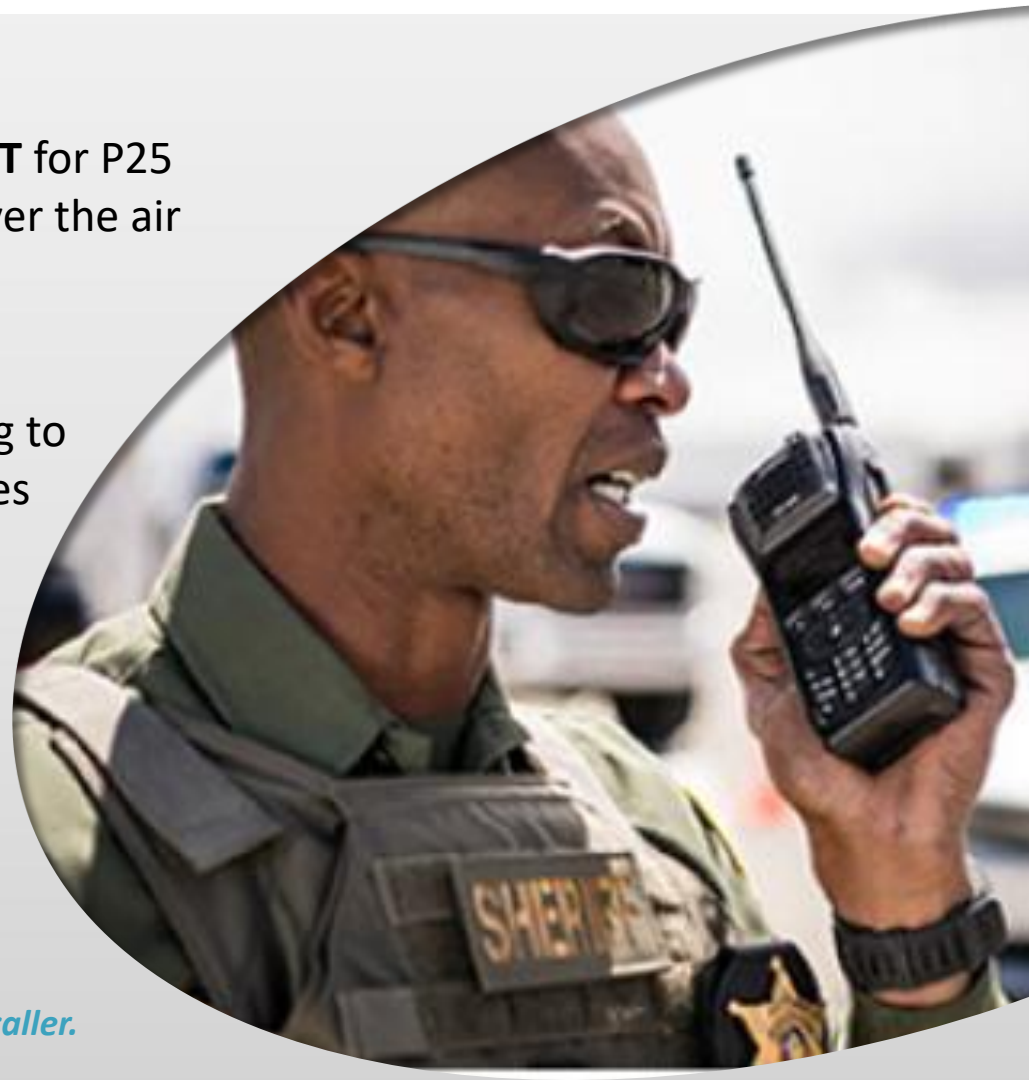
PTT: Voice + Caller Alias

P25 Trunked Site



P25 Core

Dispatch Console



Passes a name like "Jane Smith" vs. a complicated id number like "BEE00.1.1021" for the caller.

Interoperability Best Practices for System Admins & Telecommunicators

Four connected best-practice topics turn standards-based capability into repeatable operational interoperability.

1 **DHS SAFECOM Interoperability Continuum**

governance, SOPs, training, usage, and technology must align

2 **Virginia SCIP**

understand the statewide plan and implement it in system operations

3 **Virginia P25 ID Plan**

implement the existing RID plan in P25 provisioning and administration

4 **Deployable 700 MHz Trunked Systems**

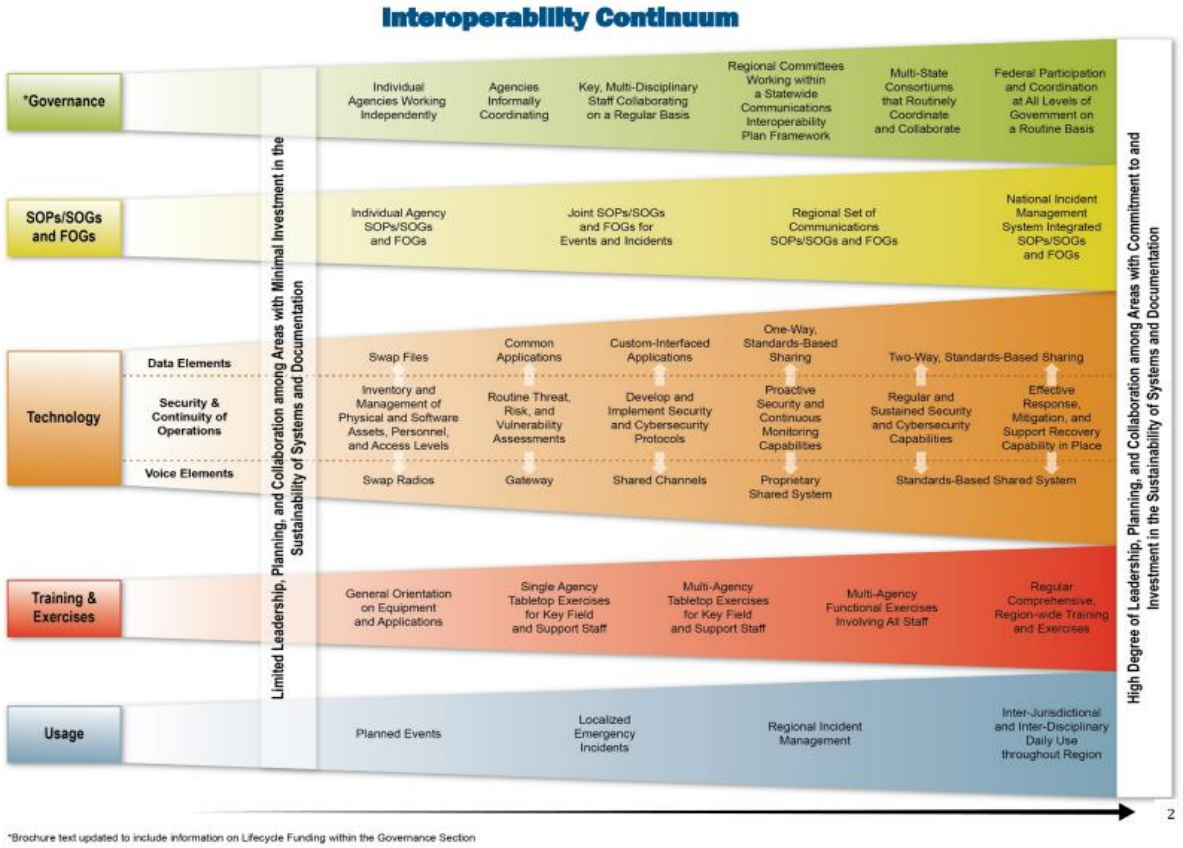
treat deployables as planned interoperability resources

These four best practices all work together to enhance interoperability.

DHS SAFECOM Interoperability Continuum

Best Practice 1 of 4

Framework for building and sustaining interoperability capability



*Brochure text updated to include information on Lifecycle Funding within the Governance Section

Key Learnings from the Continuum

Governance and leadership buy-in are foundational

Understand the use case upfront and tailor the solution

Training and exercises sustain capability over time

Technology is an enabler inside a broader operating framework

Takeaway: interoperability is built through governance, procedures, training, usage, and technology working together — technology alone is not enough.

Virginia Statewide Communication Interoperability Plan (SCIP)

Best Practice 2 of 4

1 Understand the Document

Virginia's 2024 SCIP lays out statewide emergency-communications goals, governance, and implementation priorities.

2 Translate It Into Operations

Align SOPs, interoperability channels, training, exercises, and event planning with the Commonwealth plan.

3 Use It in System Governance

System owners should use the SCIP during upgrades, after-action improvements, and coordination with Virginia's interoperability structure.

COMMONWEALTH OF VIRGINIA

STATEWIDE COMMUNICATION INTEROPERABILITY PLAN

2024 SCIP
Adopted October 2023

Governance • SOPs • Technology
Training & Exercises • Usage

Takeaway: system owners should understand the Virginia SCIP and turn it into day-to-day operating practice, not treat it as a shelf document.

Virginia P25 Radio ID Plan

Best Practice 3 of 4

1 Know the Plan Exists

Virginia already has a structured RID allocation workbook spanning regional, statewide, future-use, and cache blocks.

2 Implement Assigned Ranges

Apply the assigned RID blocks in subscriber provisioning, console aliasing, templates, and system administration workflows.

3 Protect Future and Cache Blocks

Coordinate growth, mutual-aid resources, and state cache assignments before issuing new IDs so uniqueness is preserved.

Begin	End	Example Allocation
3100000	3129999	**City of Alexandria**
3130000	3159999	**Arlington County**
3160000	3209999	**Fairfax County**
4000000	4109999	**Virginia State Police**
4130000	4229999	**VDOT**
5980000	5994999	**VA state cache blocks**

Workbook patterns include Northern Virginia regional blocks, statewide allocations, future-use ranges, and dedicated state cache IDs.

Takeaway: system owners should implement the Virginia P25 ID plan in their P25 systems so IDs stay unique and interoperable during shared operations.

Deployable 700 MHz Trunked Systems

Best Practice 4 of 4

1 Pre-Stage Channels and Access

preconfigure deployable channels, templates, and subscriber personalities before an incident

2 Document Interop and Startup

plan console connectivity, ISSI/CSSI/DFSI options, startup steps, and handoff procedures

3 Use the Current Standard

reference the APCO deployable trunking standard approved by ANSI on July 3, 2026

APCO INTERNATIONAL

700 MHz DEPLOYABLE TRUNKING STANDARD

ANSI approved July 3, 2026

APCO International Deployable Trunking Standards Committee
Chair: Don Root

Takeaway: deployables are strongest when they are preplanned, exercised, and aligned to the current APCO standard.

Project 25 Interoperability Basics for Emergency Preparedness Takeaways

Session Close

- PTIG offers valuable resources to help you learn more about P25
- Cross-jurisdiction communications are more important than ever, so P25 interoperability is more important than ever
- P25 provides standardized interfaces to support interoperability
- P25 continues to improve, enhancing security and operational effectiveness
- Best practices from DHS SAFECOM, Virginia SCIP, Virginia P25 ID Plan, and others fit together to help you enable interoperability

Interoperability readiness comes from standards, governance, planning, and disciplined system implementation working together.

THANK YOU!

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