



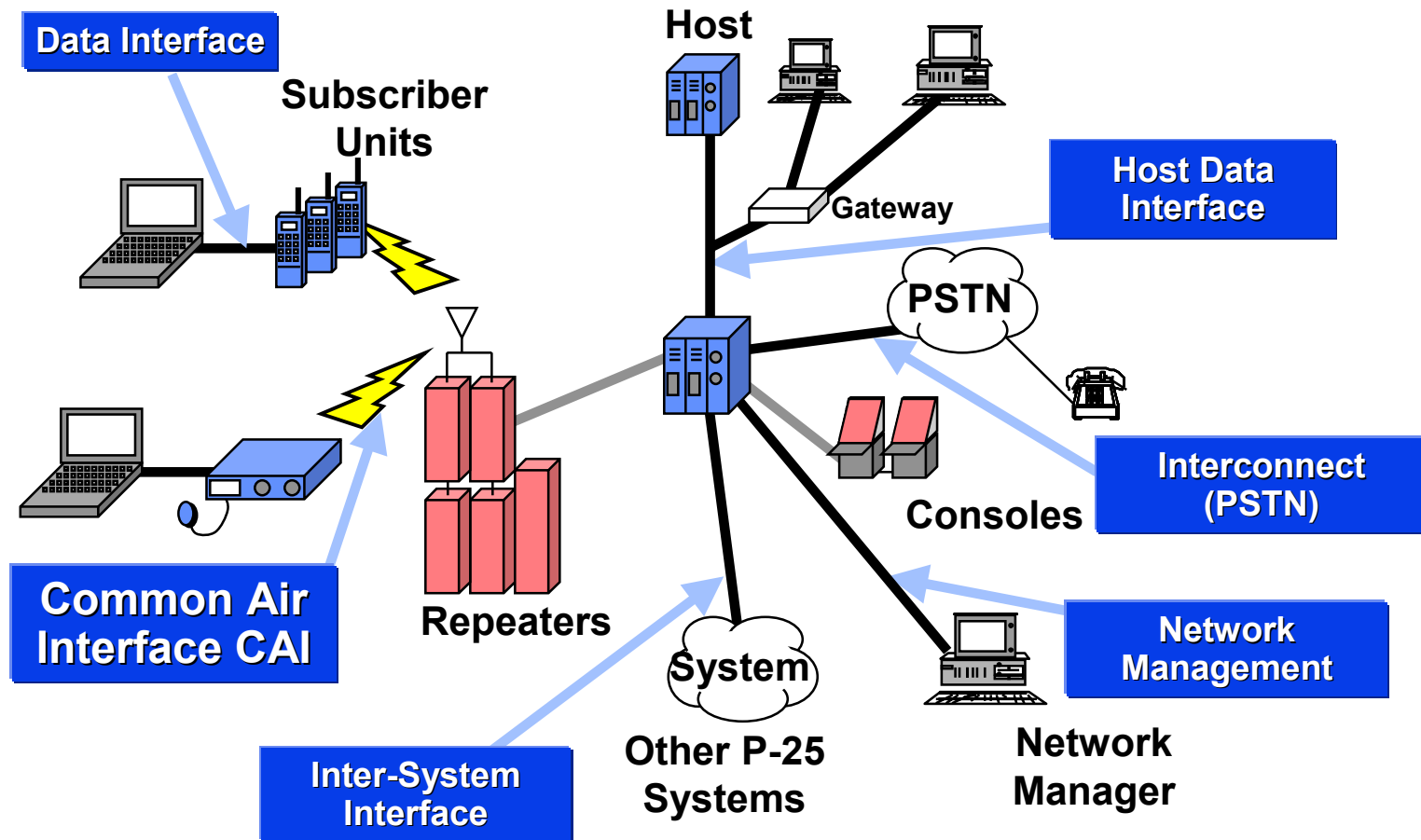
Public Safety's Interoperability Lifeline: **The Common Air Interface (CAI)**

Ray Bartik, President
Motorola Amateur Radio Club of North Texas



Project 25 System Interfaces

The CAI is one of 6 standardized interfaces for Phase I of Project 25.





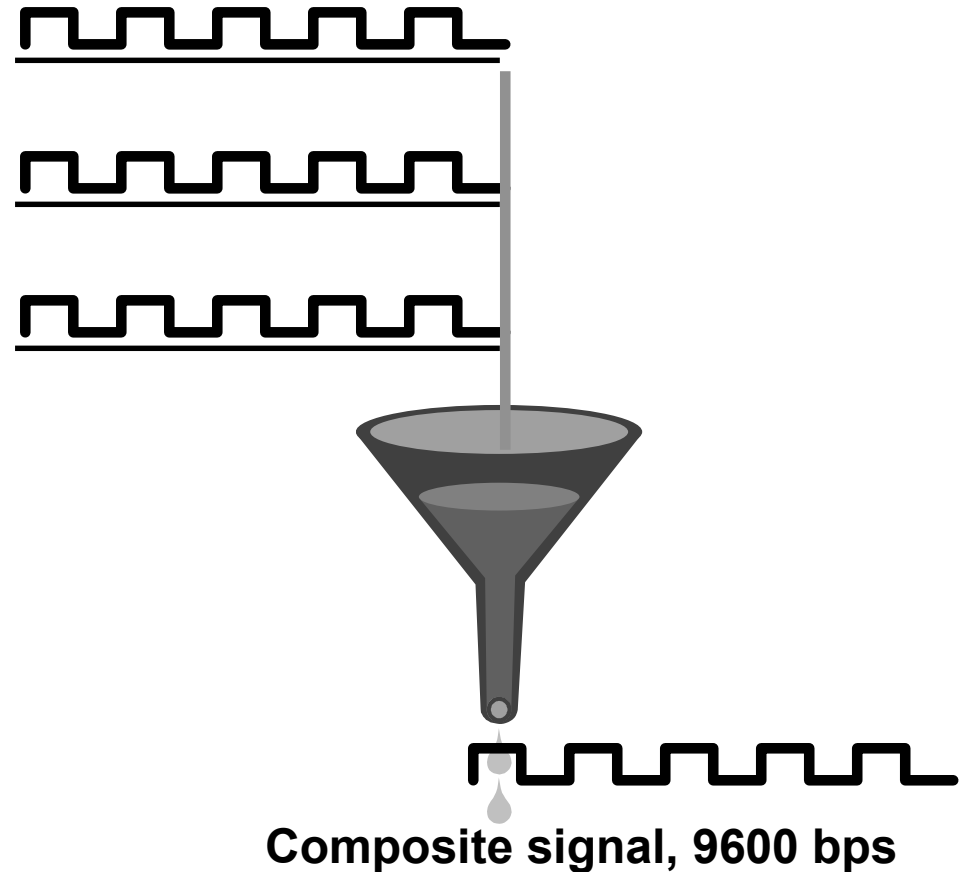
Common Air Interface (CAI)

- **Bandwidth 12.5 kHz**
- **Channel Bit Rate . . 9.6 kbps**
- **Modulation QPSK-c**
- **Channel Access . . . FDMA**
- **Frame Format Includes error correction**
- **Vocoder IMBE**
(Improved Multi-Band Excitation coder for voice)

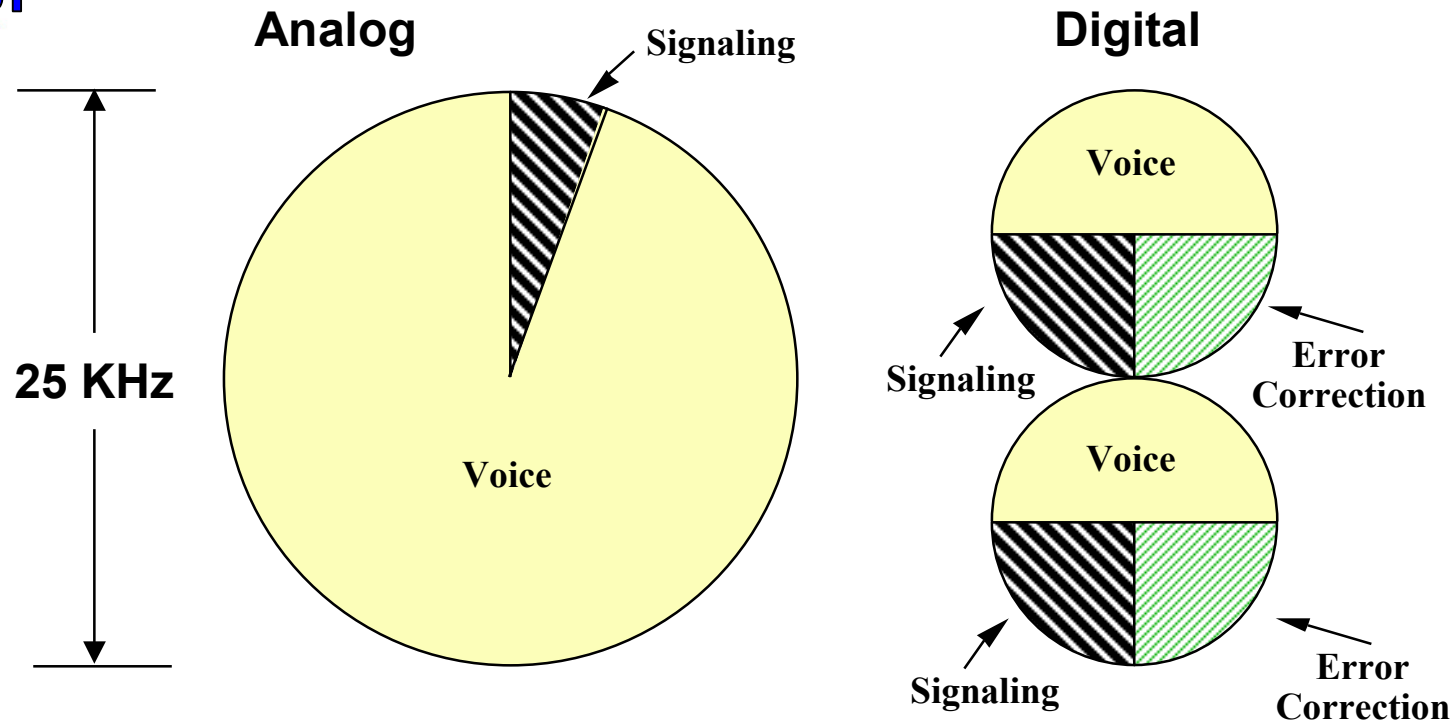


Aggregate Data Rate

- Digital voice, 4400 bps
- Channel signaling, 2400 bps
- Error correction, 2800 bps



Channel Efficiency

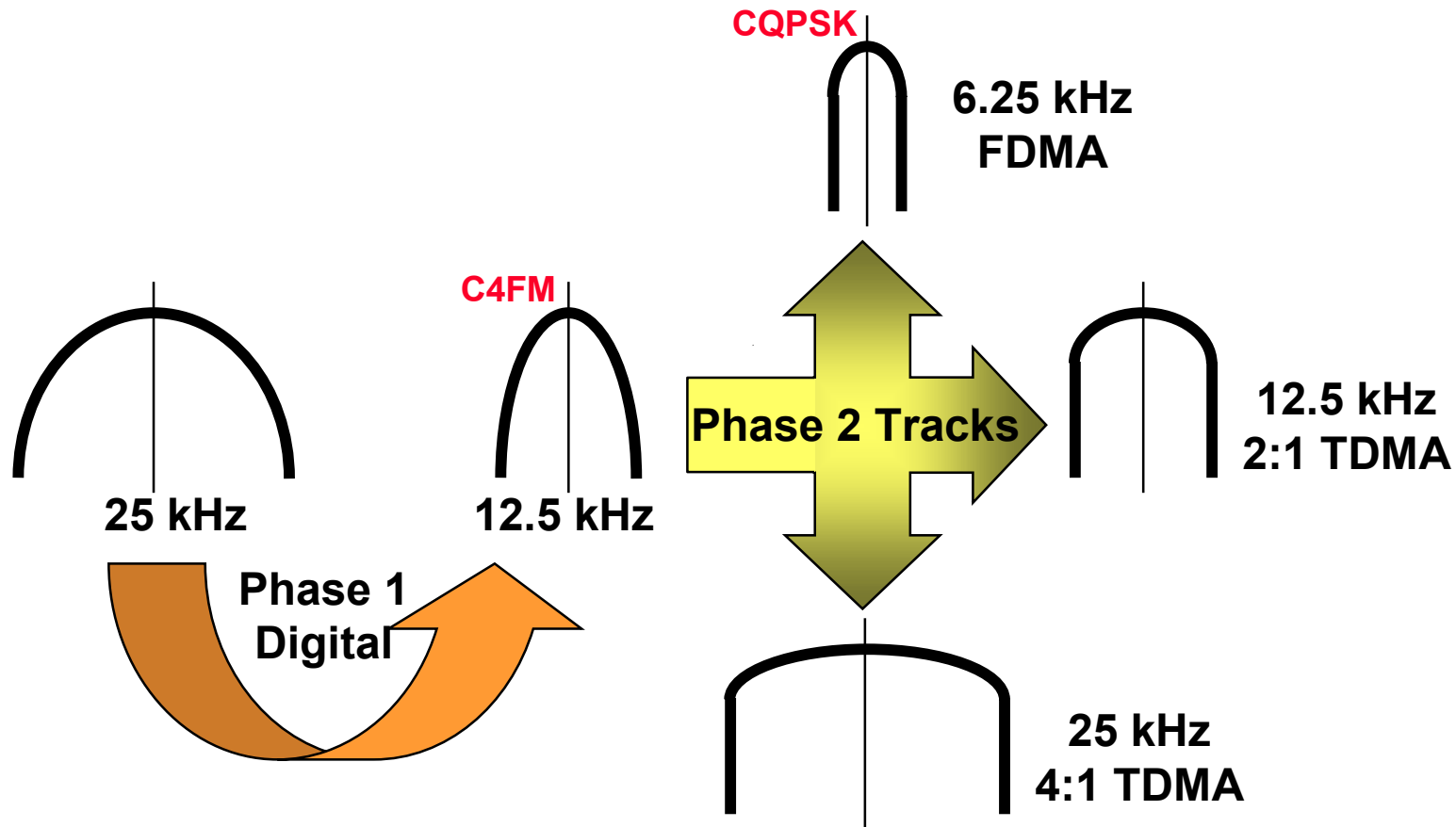


In the band width where one typical analog channel currently resides, with limited signaling, and no error correction, two Project 25 digital channels with expanded signaling and error correction can coexist.

Spectrum Migration



Migration from 25 to 12.5 to 6.25 kHz or equivalent



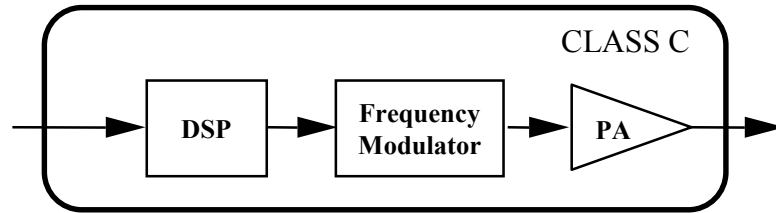


QPSK-c 6.25 kHz Migration

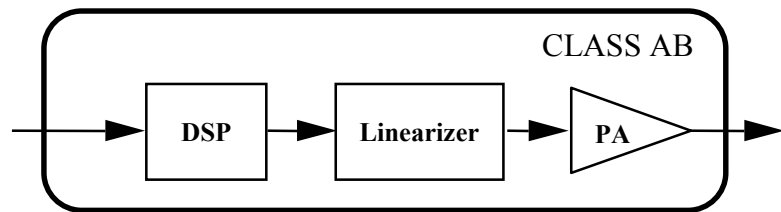
One Receiver for both Phase 1 CAI in 12.5 kHz and Phase 2 in 6.25 kHz FDMA.

QPSK-c TRANSMITTERS

C4FM VERSION

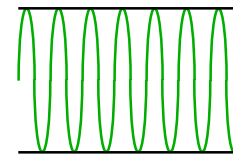


CQPSK VERSION

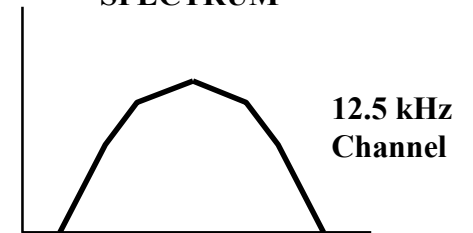


COMMON RECEIVER

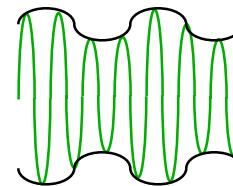
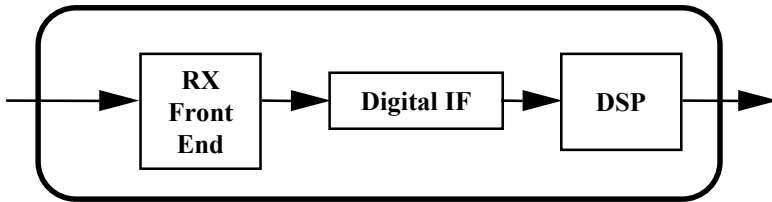
CONSTANT ENVELOPE



SPECTRUM

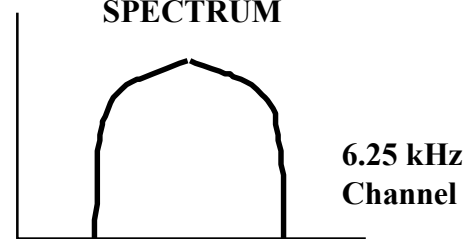


12.5 kHz Channel



TIME VARYING AMPLITUDE

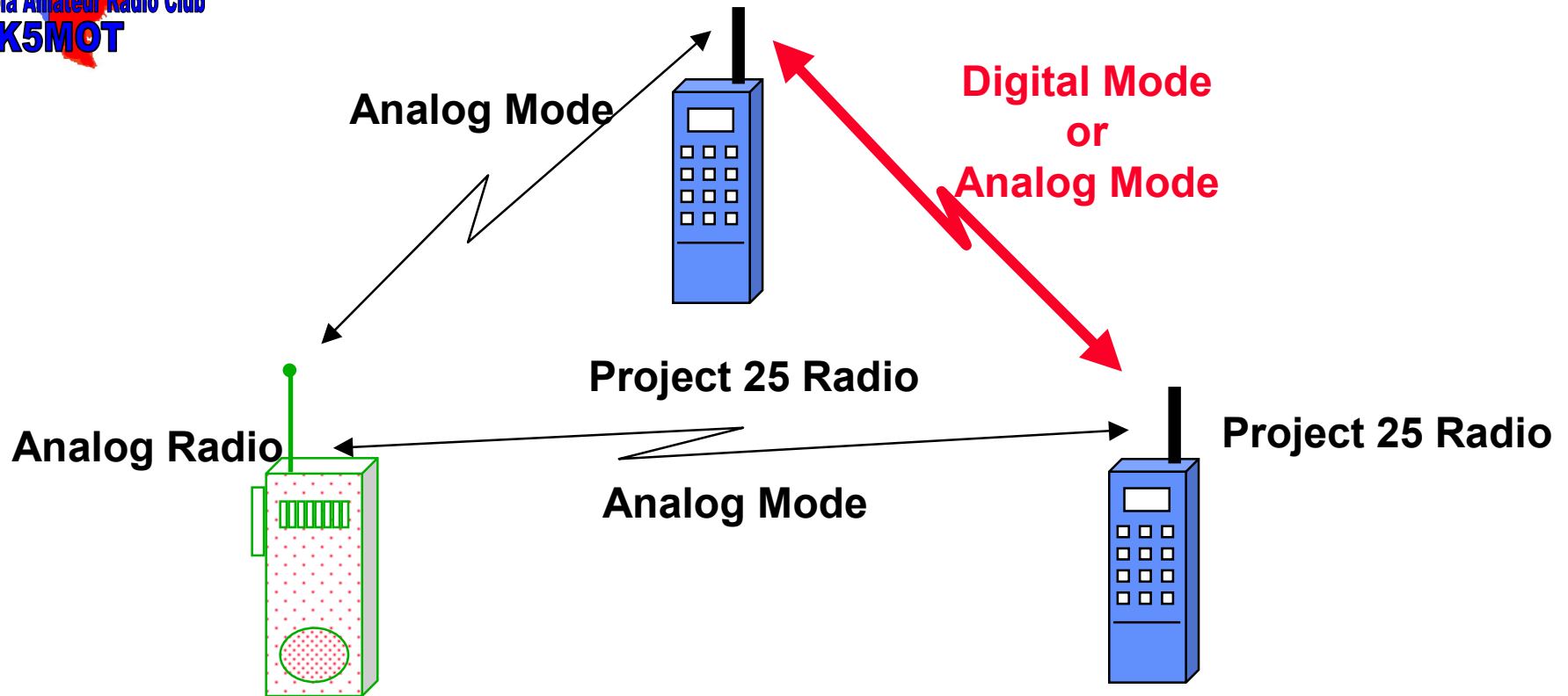
SPECTRUM



6.25 kHz Channel



Backwards Compatibility



Project 25 radios communicate in analog mode to older analog radios, and either digital or analog modes with new Project 25 radios.



Standard Signaling

	Analog FM Systems*	Project 25 Systems
• Unit ID	Proprietary	Standard
• Talk Group ID	Proprietary	Standard
• Network ID	Proprietary	Standard
• Emergency	Proprietary	Standard

Project 25 standardizes important and useful identifiers.

*** Conventional and APCO 16 Trunked Systems**



Defined Services

• Feature	Analog FM Systems*	Project 25 Systems
<ul style="list-style-type: none"> • Call Alert • Selective Call • Selective Inhibit • Status / Message • Radio Check • Interconnect • Mobile Data • Encryption • And much more... 	<ul style="list-style-type: none"> Proprietary Proprietary Proprietary Proprietary Proprietary Proprietary Proprietary Proprietary 	<ul style="list-style-type: none"> Standard Option Standard Option Standard Option Standard Option Standard Option Standard Option Standard Option Standard Option

Project 25 standardizes important and useful signaling features

*** Conventional and APCO 16 Trunked Systems**

Overlay Sub-Systems

Project 25 has defined the parameters for overlay subsystems, as options at the user's discretion, including:

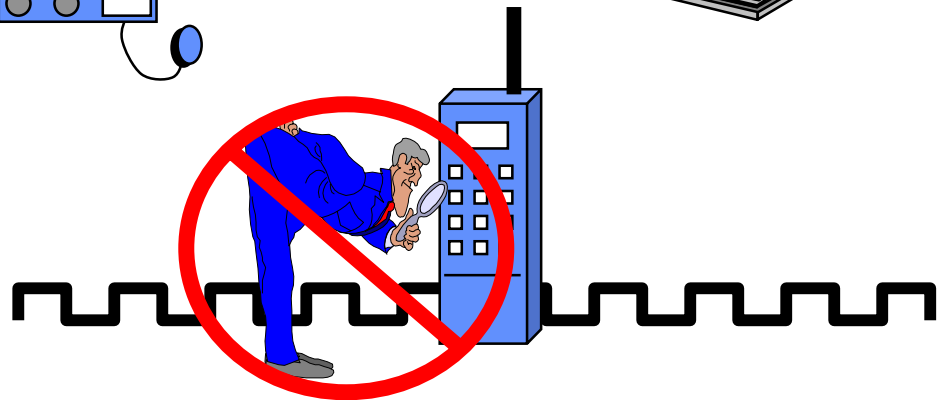
- Telephone Interconnect



- Mobile Data Support



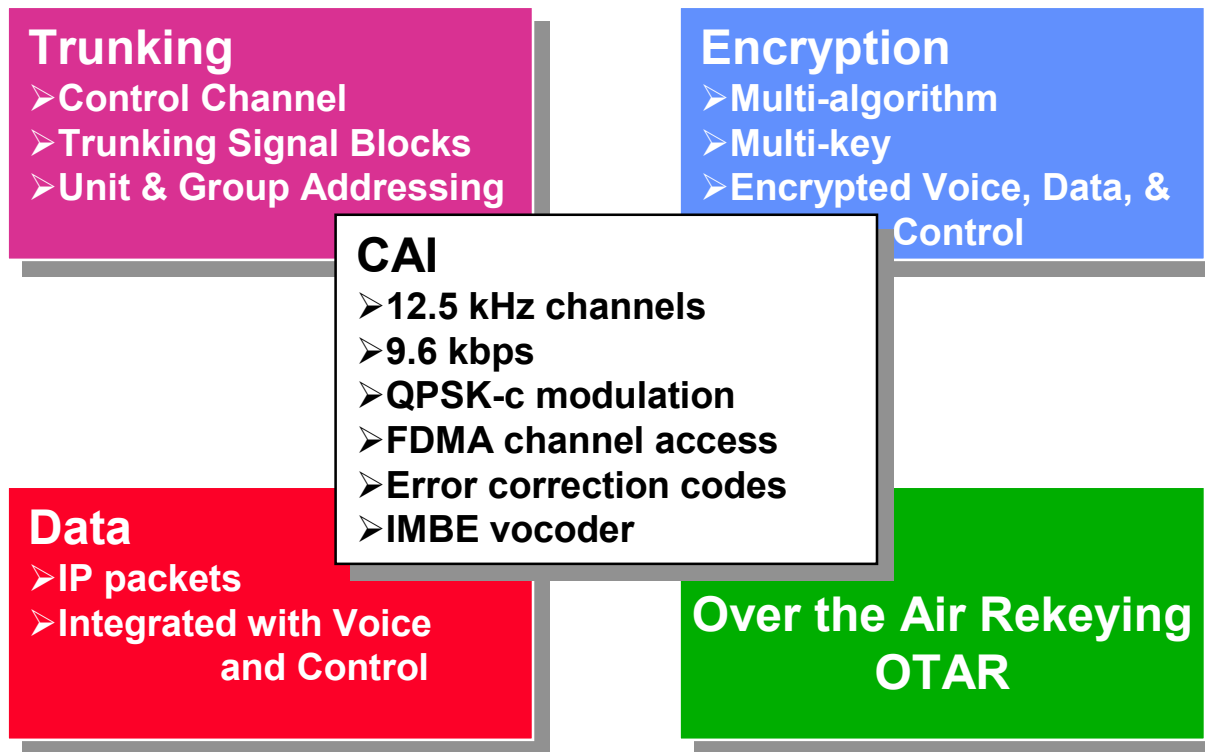
- Encryption





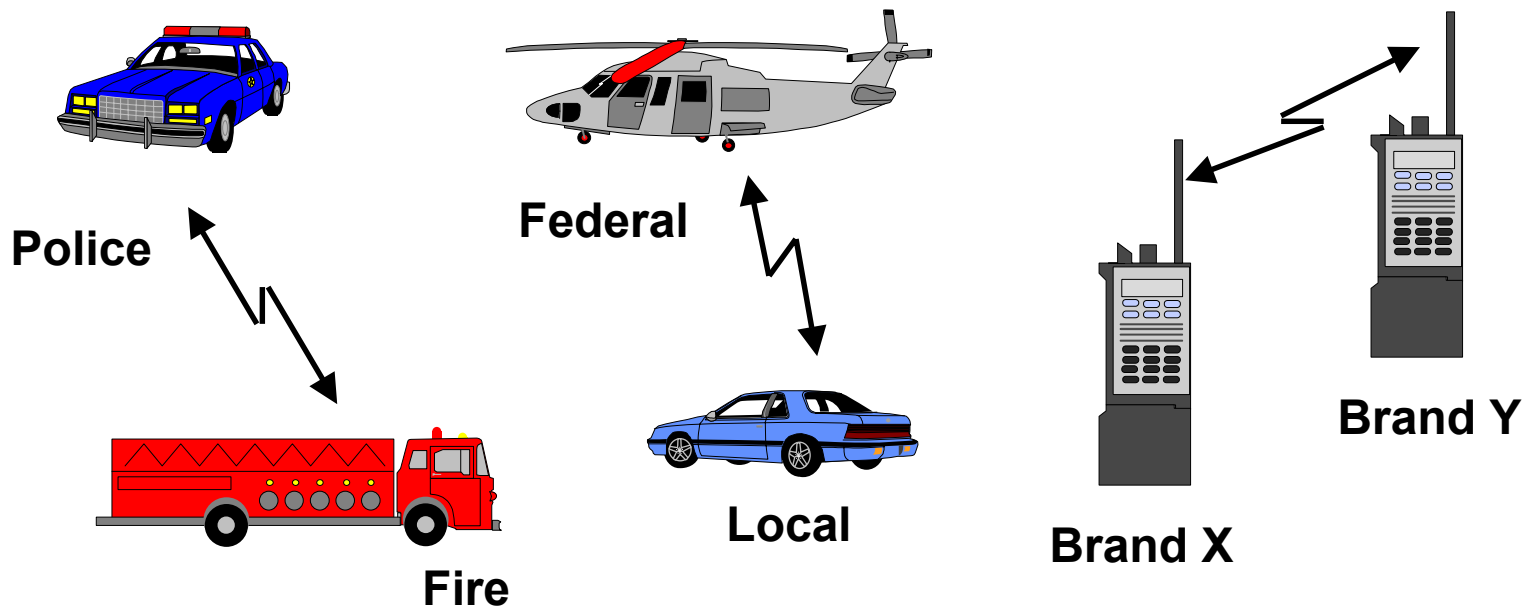
Air Interface Elements

The CAI integrates and combines all other aspects of the radio system such as trunking control, encryption, data, and over-the-air-rekeying.



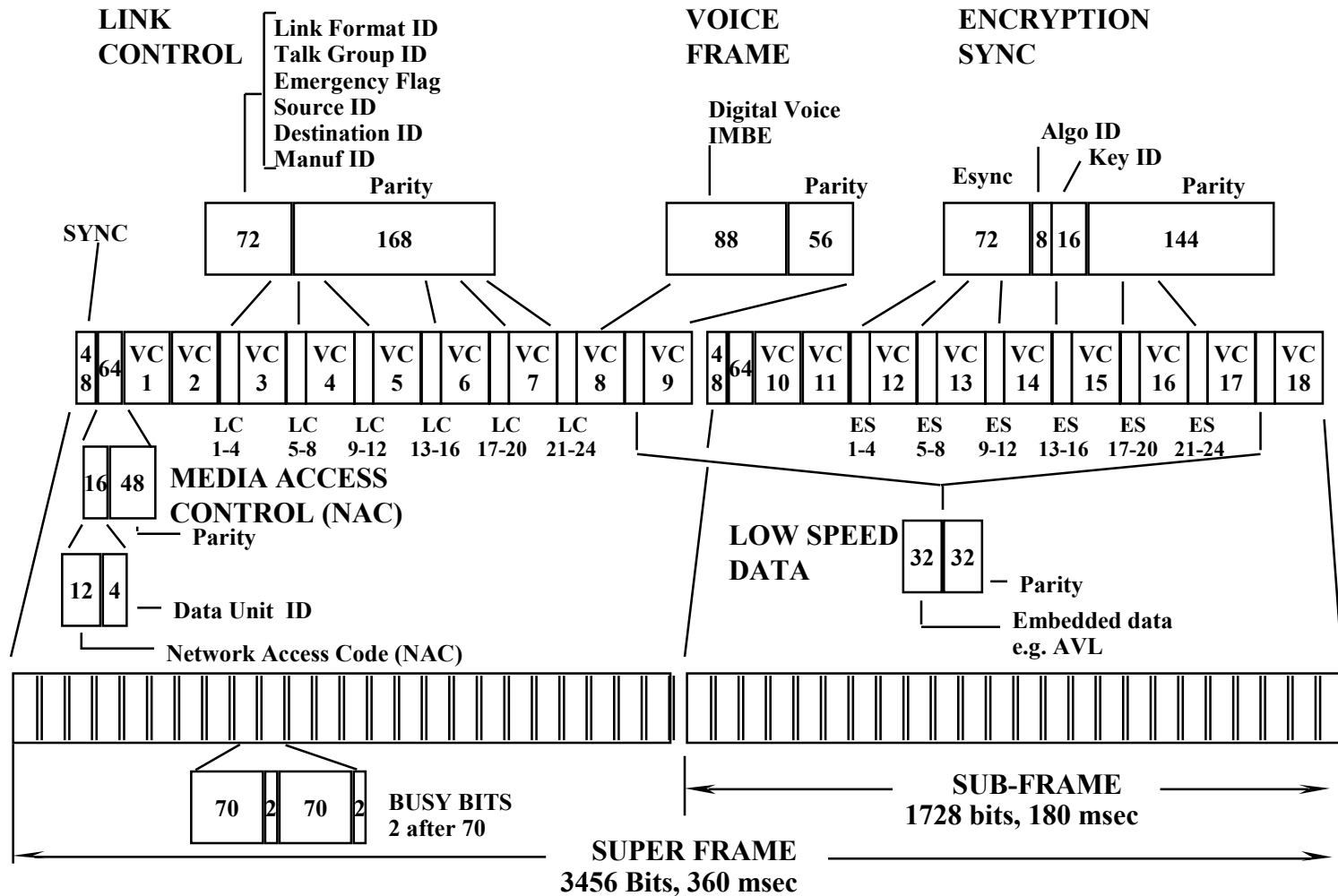
Project 25 CAI Impact

- **Ability To Meet In The Air**
 - Interoperability between agencies
 - Interoperability between vendors





Project 25 CAI Format





Conclusion

- **The Common Air Interface (CAI) defines the radio interface for Project 25 systems.**
 - 9.6 kbps air rate
 - 12.5 kHz channels, migrating to 6.25 on FDMA Track of Phase 2
 - QPSK-c modulation, includes C4FM and CQPSK
 - Frame formats for voice, data, and control
 - IMBE voice encoder
- **16 million Unit IDs (24 bits)**
- **65 thousand Talk Group IDs (16 bits)**
- **Trunking Control and Encryption are included.**



Equipment used in Demo

- **Motorola Quantar Repeater**
- **Spectra mobile**
- **XTS 3000 portable**



APCO 25 Equipment in Amateur Radio

- **MARC has used APCO 25 equipment since August of 2001**
 - First repeater in operation in Fort Worth (147.320)
 - Second repeater in operation in Dallas area in May
- **Advantages of Digital voice repeaters**
 - improved voice clarity
 - No background noise on voice
 - Increased effective range
 - Allows “talk groups” on a single channel
 - Narrow channel spacing allows more channels
 - Less susceptibility to interference on adjacent channels
 - Same repeater can support analog and digital modulation



Questions?

