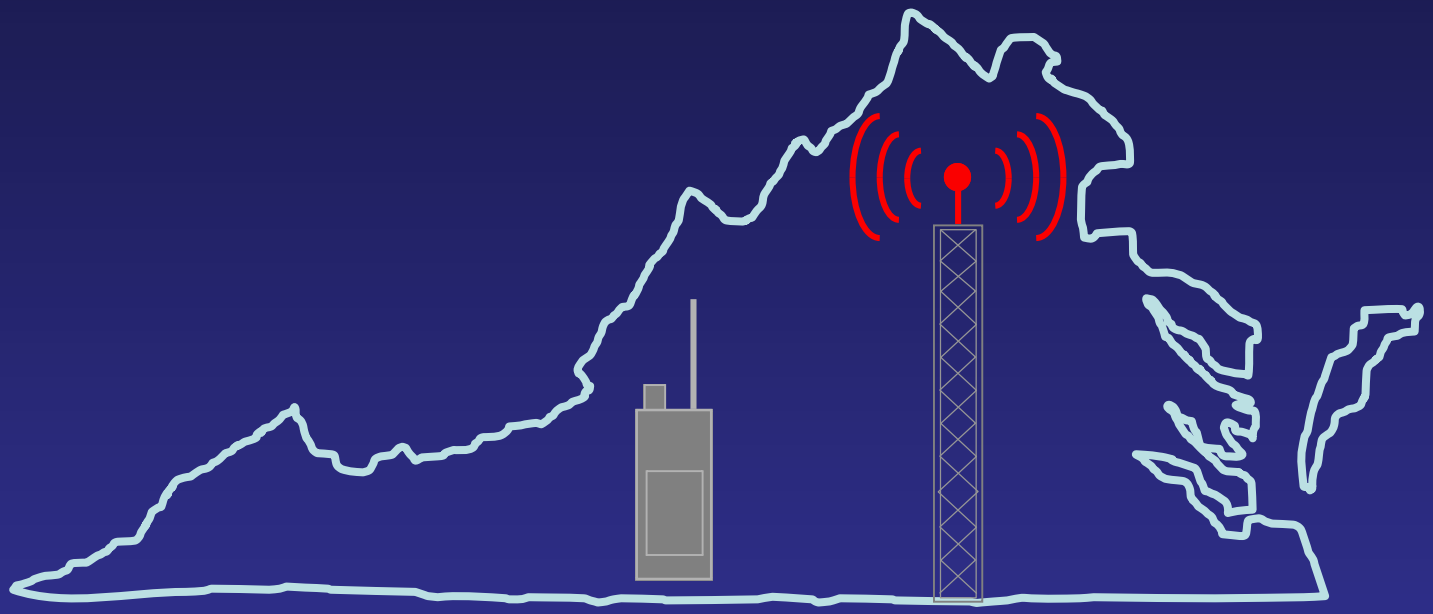


VIRGINIA
COMMUNICATIONS CACHE

V-TACH or *VTAC*…. Is *Interoperability* on Your Monitor?

A refresher for public safety emergency responders on modern interoperable communications strategies

Greg Hunter, COM-L
Deputy Program Manager
Virginia Communications Cache-Fairfax
Captain II- Fairfax County Fire and Rescue Department

THE VIRGINIA COMMUNICATIONS CACHE

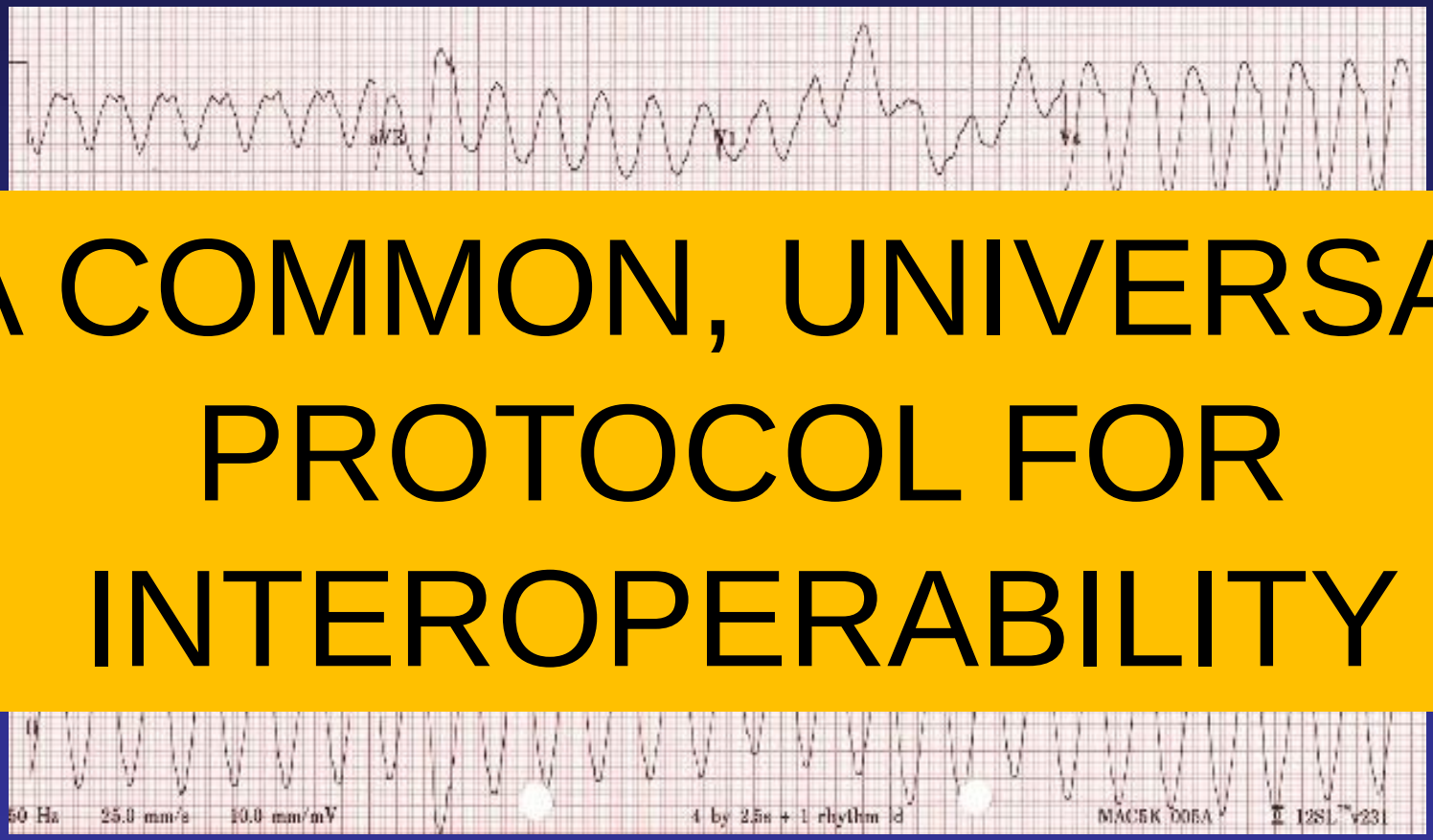
What is the NEED for Interoperability

- **September 11, 2001**
  - **2,700 people, including 343 Firefighters, died during the collapse of the World Trade Center**
  - **After the collapse of the South Tower**
    - **POLICE issued an evacuation order over the police channel**
    - **FIRE and 911 communications used a different radio channel**
      - **FIRE did not hear the message**
      - **911 continued to advise citizens to remain in place**

What is the NEED for Interoperability

- **August 2005**
  - In August of 2005, Hurricane Katrina hit the gulf coast with sustained winds of more than 125 mph.
    - Virtually every communication system failed: cell, internet, phone, radio, television and even satellite communications were disrupted by broken lines, power outages and destruction of base stations.
    - When limited communications were recovered, mutual aid channels available to responders were quickly overwhelmed and officials from different agencies and jurisdictions couldn't talk using proprietary radio systems.
    - Rescue teams ended up searching the same area multiple times and missing other areas altogether.

WHAT RHYTHM IS THIS?
HOW DO YOU TREAT IT?

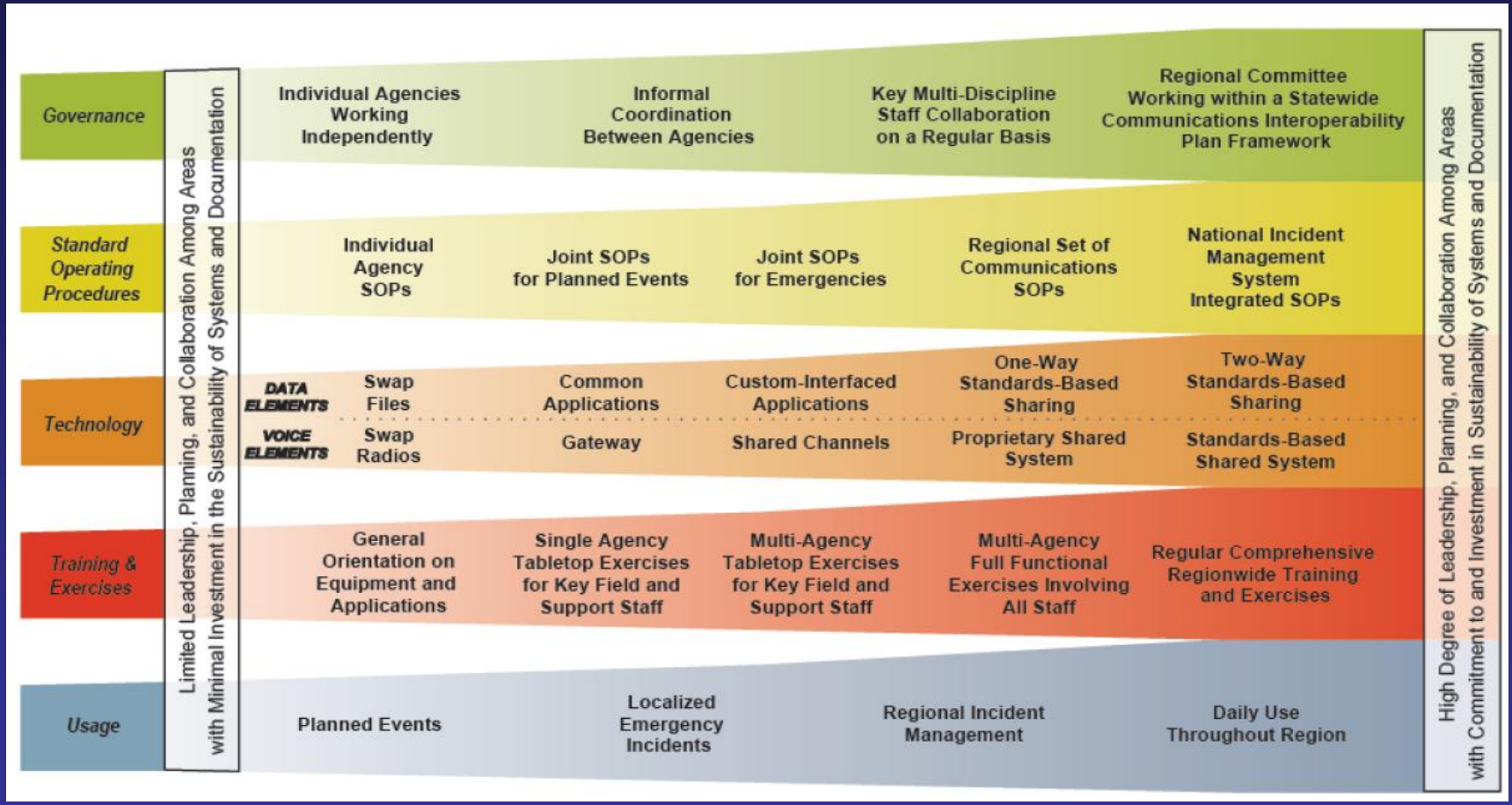


A COMMON, UNIVERSAL PROTOCOL FOR INTEROPERABILITY

So….What is interoperability?

The ability of Public Safety responders to share information via voice and data communications systems on demand, in real time, when needed, and as authorized.

SAFECOM Interoperability



- Have you (we) achieved interoperability?
  - If not, what is the barrier?
  - If so, what is the next step?

- Public safety communications **interoperability** can be achieved only by dealing first with the issue of **operability**.
  - Operability equals technology being in place and working correctly.
  - It requires users to know how to properly operate the technology.
  - Focusing on interoperability alone is unlikely to fully address many communication problems.

Challenges to interoperability include:

- Incompatible radio equipment,
- Lack of a common language,
- The use of different frequency bands by different agencies,
- Lack of effective governance

  (e.g., designated line of authority over who can talk and when).

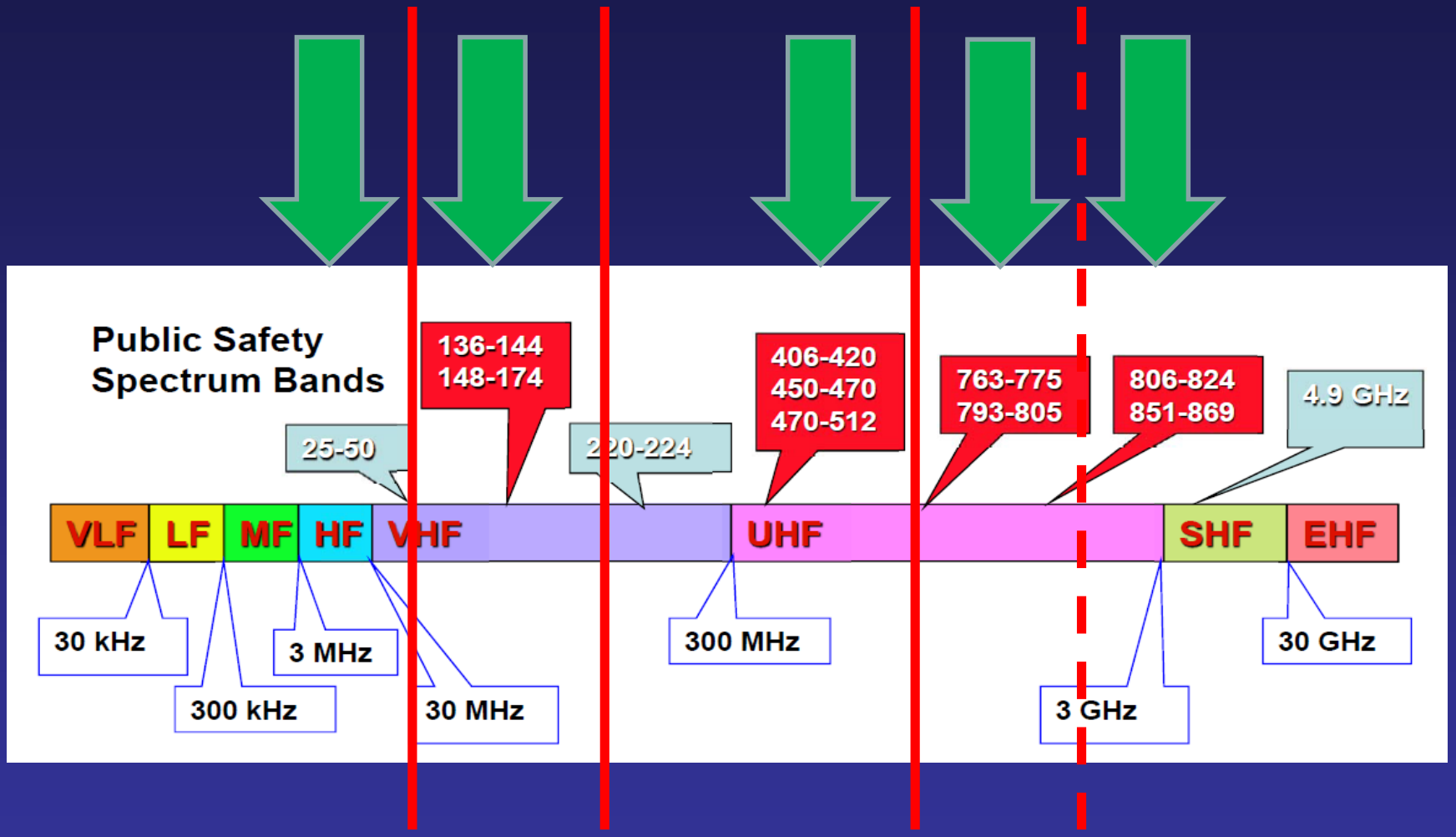
In two way radio, interoperability is composed of three dimensions:

- compatible communications paths (compatible frequencies, equipment and signaling),
- radio system coverage or adequate signal strength, and;
- scalable capacity.

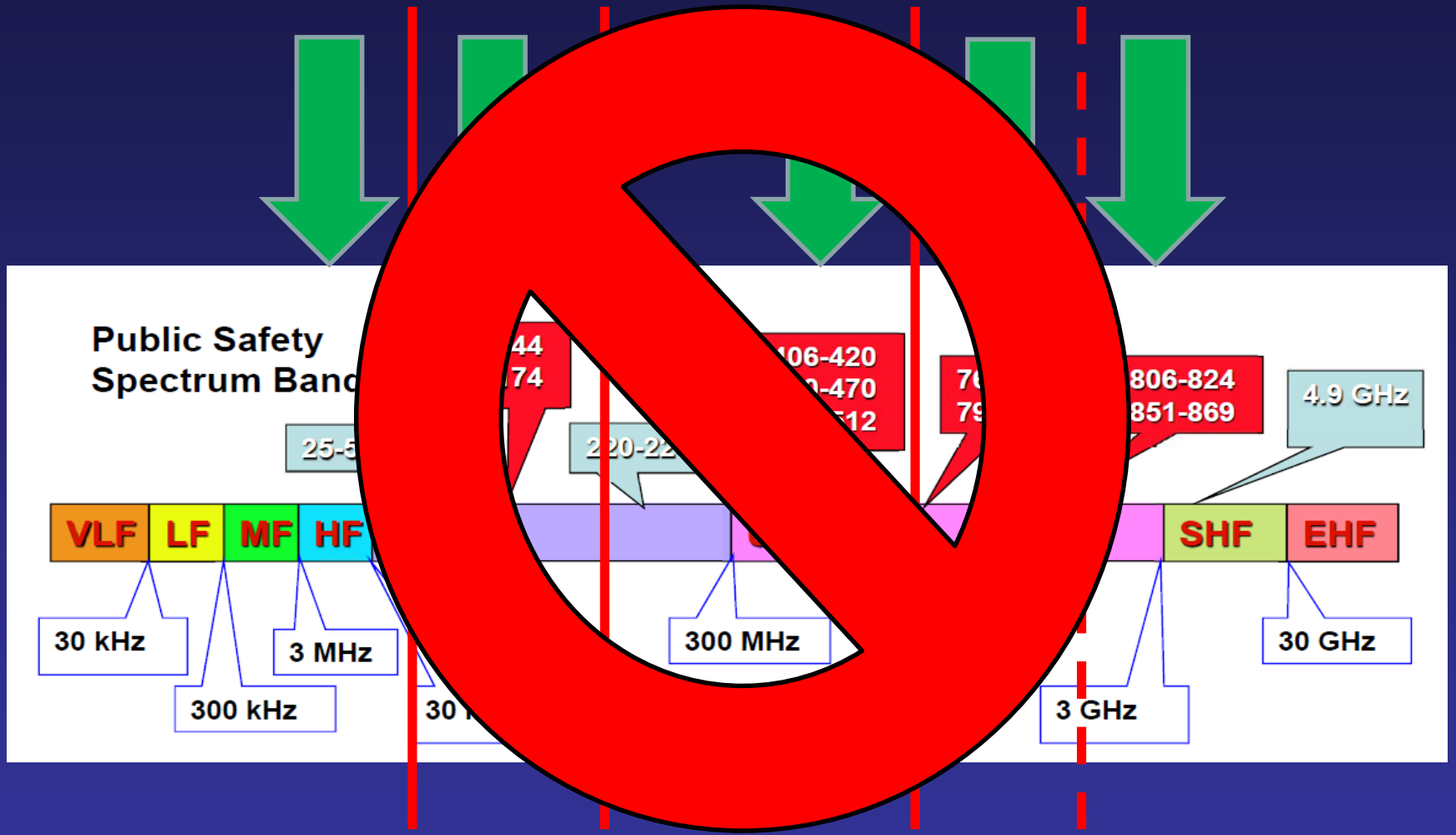
STEP 1- COMPATIBLE COMMUNICATIONS PATHS

- Frequency
  - Frequency Band
- Equipment
  - Compatibility
  - Standards- Project 25 (P25)
- Signaling
  - Analog
  - Digital
    - P25 or Proprietary limitations

What's in a Frequency??



Can we just talk ??



FIRST PROBLEM- TALKING IN THE SAME FREQUENCY BAND

Federal Incident Response (IR) Interoperability Channels

VHF Incident Response (IR) Federal Interoperability Channels				
Suggested Assignment (subject to availability & local plans)	**Channel Name**	**Note**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Incident Calling	NC 1	Calling	169.5375	164.7125
Incident Command	IR 1		170.0125	165.2500
Medical Evacuation Control	IR 2		170.4125	165.9625
Logistics Control	IR 3		170.6875	166.5750
Interagency Convoy	IR 4		173.0375	167.3250
Incident Calling (Direct)	IR 5	Direct for NC 1 Calling	169.5375	169.5375 (S)
Incident Command (Direct)	IR 6	Direct for IR 1	170.0125	170.0125 (S)
Medical Evacuation Control (Direct)	IR 7	Direct for IR 2	170.4125	170.4125 (S)
Logistics Control (Direct)	IR 8	Direct for IR 3	170.6875	170.6875 (S)
Interagency Convoy (Direct)	IR 9	Direct for IR 4	173.0375	173.0375 (S)

*See "Conditions for Use of Federal Interoperability Channels" on page 20 - page 22.
Default operation should be carrier squelch receive, CTCSS 167.9/CSQ transmit. If the user can enable/disable CTCSS without reprogramming the radio, the indicated CTCSS tone also could be programmed for receive, and the user instructed how and when to enable/disable.
All channels on this page are NARROWBAND only.

Non-Federal National Interoperability Channels - VHF

Non-Federal VHF National Interoperability Channels VHF Low Band				
Description	Channel Name	Mobile Receive Frequency	Mobile Transmit Frequency	CTCSS Tone ±
Law Enforcement	LLAW1	39.4600	45.8600	CSQ /156.7 (5A)
Law Enforcement	LLAW1D	39.4600	39.4600	CSQ /156.7 (5A)
Fire (Proposed)	LFIRE2	39.4800	45.8800	CSQ /156.7 (5A)
Fire (Proposed)	LFIRE2D	39.4800	39.4800	CSQ /156.7 (5A)
Law Enforcement	LLAW3	45.8600	39.4600	CSQ /156.7 (5A)
Law Enforcement	LLAW3D	45.8600	45.8600	CSQ /156.7 (5A)
Fire (Proposed)	LFIRE4	45.8800	39.4800	CSQ /156.7 (5A)
Fire	LFIRE4D	45.8800	45.8800	CSQ /156.7 (5A)
Frequency 39.4800 MHz is pending FCC assignment for exclusive fire intersystem use.				

± Default operation should be carrier squelch receive, CTCSS transmit. If the user can enable/disable without reprogramming the radio, the indicated CTCSS tone also could be programmed for receive, and the user instructed how and when to enable/disable.

Non-Federal VHF National Interoperability Channels VHF High Band				
Description	Channel Name	Mobile Receive Freq.	Mobile Transmit Freq.	CTCSS Tone
Calling	VCALL10	155.7525	155.7525	CSQ / 156.7 (5A) ±
Tactical	VTAC11 *	151.1375	151.1375	CSQ / 156.7 (5A) ±
Tactical	VTAC12 *	154.4525	154.4525	CSQ / 156.7 (5A) ±
Tactical	VTAC13	158.7375	158.7375	CSQ / 156.7 (5A) ±
Tactical	VTAC14	159.4725	159.4725	CSQ /156.7 (5A) ±
Tac Rpt	VTAC33 * •	159.4725	151.1375	CSQ / 136.5 (4Z)
Tac Rpt	VTAC34 * •	158.7375	154.4525	CSQ / 136.5 (4Z)
Tac Rpt	VTAC35 •	159.4725	158.7375	CSQ / 136.5 (4Z)
Tac Rpt	VTAC36 * •	151.1375	159.4725	CSQ / 136.5 (4Z)
Tac Rpt	VTAC37 * •	154.4525	158.7375	CSQ / 136.5 (4Z)
Tac Rpt	VTAC38 •	158.7375	159.4725	CSQ / 136.5 (4Z)

*VTAC11-12, VTAC33-34, and VTAC36-37 may not be used in Puerto Rico or the USVI.
±Default operation should be carrier squelch receive, CTCSS transmit. If the user can enable/disable without reprogramming the radio, the indicated CTCSS tone also could be programmed for receive, and the user instructed how and when to enable/disable.
• **VTAC33-38 recommended for deployable tactical repeater use only** (FCC Station Class FB2T).
• VTAC36-38 are preferred; VTAC33-35 should be used only when necessary due to interference.
All channels on this page are NARROWBAND only. Limited to 3 watts ERP above Line A or East of Line C.

Non-Federal National Interoperability Channels - UHF

Non-Federal UHF National Interoperability Repeater Channels			
Description	**Channel Name**	**Mobile RX (MHz)**	**Mobile TX (MHz)**
Calling	UCALL40	453.2125	458.2125
Calling	UCALL40D	453.2125	453.2125
Tactical	UTAC41	453.4625	458.4625
Tactical	UTAC41D	453.4625	453.4625
Tactical	UTAC42	453.7125	458.7125
Tactical	UTAC42D	453.7125	453.7125
Tactical	UTAC43	453.8625	458.8625
Tactical	UTAC43D	453.8625	453.8625

Default operation should be carrier squelch receive, CTCSS 156.7(5A) transmit. If the user can enable/disable CTCSS without reprogramming the radio, the indicated CTCSS tone also could be programmed for receive, and the user instructed how and when to enable/disable.
All channels on this page are NARROWBAND only. Limited to 3 watts ERP above Line A or East of Line C.

Non-Federal National Interoperability Channels – 800 MHz

Non-Federal 800 MHz National Mutual Aid Repeater Channels			
Description	**Ch. Name**	**Mobile RX (MHz)***	**Mobile TX (MHz)***
Calling	8CALL90	851.0125 (866.0125)	806.0125 (821.0125)
Calling – Direct	8CALL90D	851.0125 (866.0125)	851.0125 (866.0125)
Tactical	8TAC91	851.5125 (866.5125)	806.5125 (821.5125)
Tactical – Direct	8TAC91D	851.5125 (866.5125)	851.5125 (866.5125)
Tactical	8TAC92	852.0125 (867.0125)	807.0125 (822.0125)
Tactical – Direct	8TAC92D	852.0125 (867.0125)	852.0125 (867.0125)
Tactical	8TAC93	852.5125 (867.5125)	807.5125 (822.5125)
Tactical – Direct	8TAC93D	852.5125 (867.5125)	852.5125 (867.5125)
Tactical	8TAC94	853.0125 (868.0125)	808.0125 (823.0125)
Tactical – Direct	8TAC94D	853.0125 (868.0125)	853.0125 (868.0125)

Default operation should be carrier squelch receive, CTCSS 156.7(5A) transmit. If the user can enable/disable CTCSS without reprogramming the radio, the indicated CTCSS tone could also be programmed for receive, and the user instructed how and when to enable/disable.

*The frequency in parenthesis, which is 15 MHz higher, is the frequency used before rebanding - channel names were ICALL, ITAC1 - ITAC4. Wideband FM 20K0F3E before and after rebanding.

Non-Federal National Interoperability Channels – 700 MHz

700 MHz Nationwide Interoperability Channels

Primary Use	Channel Name	Mobile RX (MHz)	Mobile TX (MHz)
Law Enforcement	7LAW62		
Law Enforcement	7LAW62D		
General Public Safety	7TAC54		
General Public Safety	7TAC54D		
Mobile Data	7DATA69		
Mobile Data	7DATA69D		
Mobile Repeater	7MOB59		
Mobile Repeater	7MOB59D		
Other Public Service	7GTAC57		
Other Public Service	7GTAC57D		
EMS	7MED86		
EMS	7MED86D		

700 MHz Nationwide Interoperability Channels

Mode: P25 FDMA Common Air Interface
NAC: \$293 (659_{10})
Talk Group ID: \$00001 (1_{10})
Manufacturer's ID: \$00 (0_{10})

Message ID: \$0000000000000000000 (0_{10})
No encryption on calling channels:
- Algorithm ID: \$80 (128_{10})
- Key ID: \$0000 (0_{10})

Primary Use	Channel Name	Mobile RX (MHz)	Mobile TX (MHz)
General Public Safety	7TAC51	769.14375	799.14375
General Public Safety	7TAC51D	769.14375	769.14375
Calling Channel	7CALL50	769.24375	799.24375
Calling Channel	7CALL50D	769.24375	769.24375
EMS	7MED65	769.39375	799.39375
EMS	7MED65D	769.39375	769.39375
EMS	7MED66	769.49375	799.49375
EMS	7MED66D	769.49375	769.49375
General Public Safety	7TAC52	769.64375	799.64375
General Public Safety	7TAC52D	769.64375	769.64375

Common Channels

Commonwealth of Virginia

Commonwealth of Virginia

VHF Public Safety Mutual Aid and Common Channels			
WARNING: These frequencies are NOT covered by the blanket authorization for nationwide interoeprability channels. A valid FCC license for these frequencies is required. Availability subject to other licensed users in the same area.			
Frequency (MHz)	**Usage**	**Channel Name**	**Note**
155.1600	Search and Rescue Common (CTCSS 127.3 transmit & receive)	VSAR16 (a.k.a.SAR NFM & SAR160)	Not restricted to SAR by FCC; availability varies.
154.2650 mobile	Fire Mutual Aid	VFIRE22	Not available in Puerto Rico and the U.S. Virgin Islands.
154.2725 base/mob.	Fire Mutual Aid	VFIRE24	
154.2800 base/mob.	Fire Mutual Aid	VFIRE21	
154.2875 base/mob.		VFIRE25	
154.2950 mobile	Fire Mutual Aid	VFIRE23	
154.3025 base/mob.		VFIRE26	
155.3400 base/mob.	EMS Mutual Aid	VMED28	May be designated for EMS Mutual Aid.
155.3475 base/mob.		VMED29	May be designated for EMS Mutual Aid.
155.4750 base/mob.	Law Enforcement Mutual Aid	VLAW31	
155.4825 base/mob.	Law Enforcement Mutual Aid	VLAW32	
LICENSING REQUIRED - Rules for use of these channels are contained in 47 CFR 90.20 and NTIA Manual Section 4.3.11 & 7.3.6. See also "Non-Federal VHF National Interoperability Channels" and "Non-Federal VHF Inland Interoperability Channels" on page 25 - page 28 of this document.			

ALSO Licensed by Commonwealth of Virginia for Common/Shared use:

155.205
155.280
155.400

FCC Rules for Interoperability

90.407 Emergency communications.

The licensee of any station authorized under this part may, during a period of emergency in which the normal communication facilities are disrupted as a result of hurricane, flood, earthquake or similar disaster, utilize such station for emergency communications in a manner other than that specified in the station authorization or in the rules and regulations governing the operation of such stations. The Commission may at any time order the discontinuance of such special use of the authorized facilities. [49 FR 36376, Sept. 17, 1984]

What about the FCC??

Don't I need a license for these channels before programming them into radios?

If you are licensed under Part 90 of the FCC rules, you may program frequencies (other than maritime or aviation) that you are not licensed to use IF "the communications involved relate directly to the imminent safety-of-life or property" or "with U.S. Government stations ... in connection with mutual activities" (see FCC rules 90.427 and 90.417).

However, note that 90.403(g) requires that "[f]or transmissions concerning the imminent safety-of-life or property, the transmissions shall be suspended as soon as the emergency is terminated." Also, the *safety of life* provision of 90.417(a) makes it clear that the exception applies only when the communications involved "relate directly" to the "imminent" safety of life or property. Because one overriding policy concern of the FCC is the prevention of harmful interference, any exceptions to the general prohibition on using non-licensed frequencies are limited to responding to an imminent threat to safety-of-life or property.

See also 90.407 dealing with communications during an emergency which disrupts normal communications facilities and §90.411 dealing with civil defense communications.

Programming of maritime channels must be performed only by a person holding a first or second class radiotelegraph operator's certificate, a radiotelegraph operator license, or a general radiotelephone operator's license (47 CFR 80.203(b)(3). See also 80.203(b)(4) and §80.169(a).

A general radiotelephone operator must directly supervise and be responsible for all transmitter adjustments or tests during installation, servicing or maintenance of an aeronautical radio station - see §87.73.

There are no restrictions on programming frequencies into U.S. Government radios.

What about the FCC??

How can I use these frequencies if I don't have a license for them?

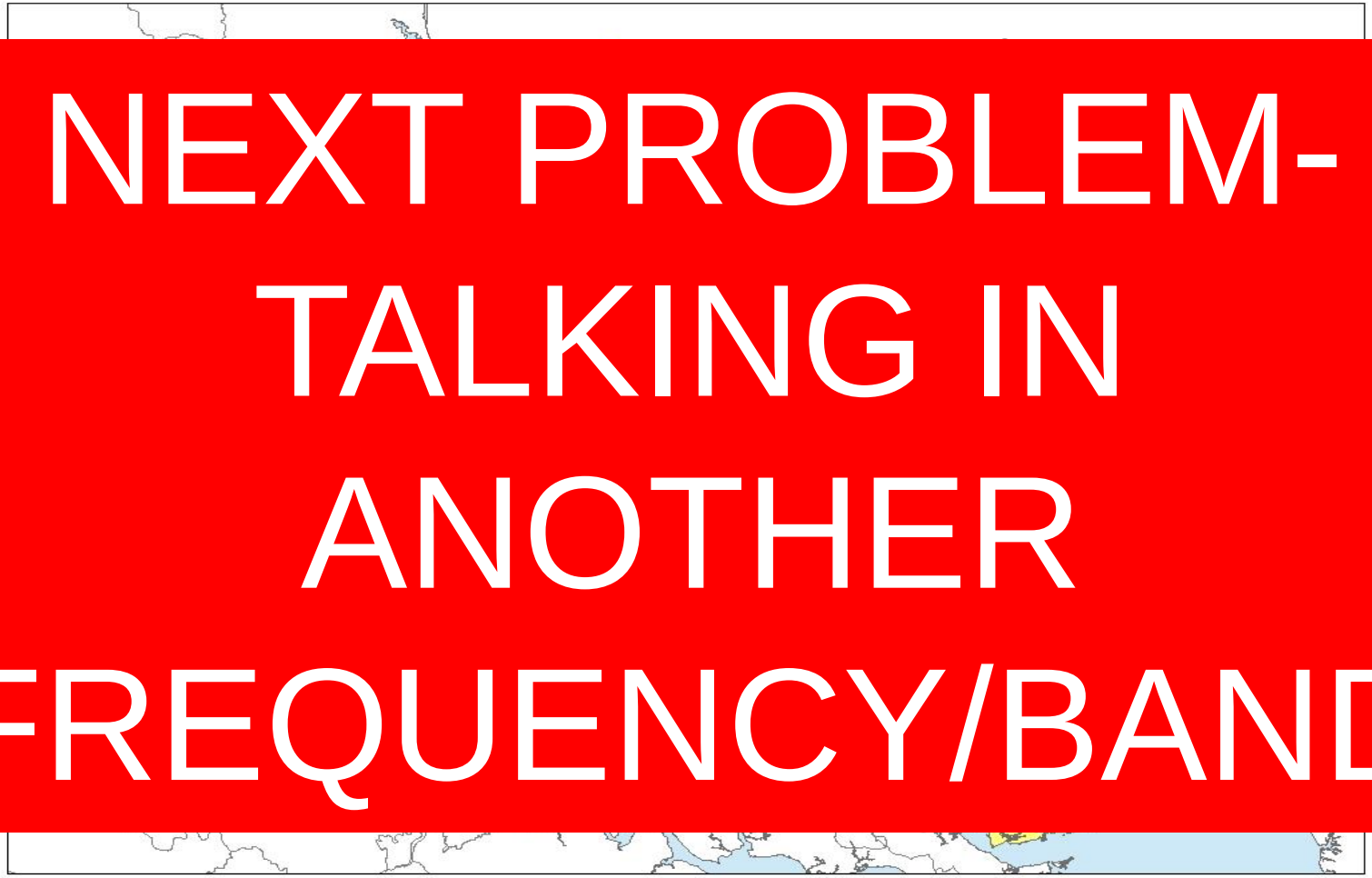
There are seven ways you can legally use these radio frequencies:

1. You or your employer may already have a Federal Communications Commission (FCC) license or a National Telecommunications and Information Administration (NTIA) authorization for some of the interoperability and mutual aid frequencies.
2. **For FCC licensees**, the non-Federal National Interoperability Channels VCALL10-VTAC14 and VTAC33-38, UCALL40-UTAC43D, the 800 MHz interoperability channels, and 8CALL90-8TAC94D are covered by a "blanket authorization" from the FCC - "Public safety licensees ... can operate mobile units on these interoperability channels without an individual license." See FCC 00-348, paragraph 90 (released October 10, 2000) for VHF and UHF; see FCC rules 90.421(a)(3) and 90.525(a) for 700 MHz; see FCC 87-112, paragraph 34 (released December 18, 1987), for 800 MHz. When above Line A or East of Line C the blanket authorization in paragraph 90 of FCC 00-348 applies only to mobile (including hand-held) stations operating with an effective radiated power (ERP) of 3 watts or less. At higher power levels, frequency coordination is required. Line A and C are defined in 47CFR90.7. You can check a location for Line A and Line C restrictions at http://wireless.fcc.gov/uls/index.htm?job=line_a_c
3. You may operate on frequencies authorized to another licensee when that licensee designates you as a unit of their system, in accordance with FCC rule 90.421.
4. In extraordinary circumstances, the FCC may issue a "Special Temporary Authority" (STA) for such use in a particular geographic area.

What about the FCC??

5. In extraordinary circumstances, the NTIA may issue a "Temporary Assignment" for such use in a particular area.
6. **If you are an FCC Part 90 licensee**, you may operate a mobile station on the Federal Interoperability Channels only when authorized by the FCC (by license or STA) and only for interoperability with Federal radio stations authorized by the NTIA to use those channels. You **may not** use these channels for interoperability with other State, tribal, regional, or local radio stations – these are not a substitute for your regular mutual aid channels. See FCC Public Notice DA 01-1621, released July 13, 2001.
7. When necessary for the IMMEDIATE protection of life or property, **FCC Part 90 licensees** may use prudent measures beyond the specifics of their license. See FCC rule 90.407, "Emergency communications". **U.S. Government stations** are authorized by NTIA rule 7.3.6 to operate on any Part 90 frequency with the permission of the FCC licensee when such use is necessary for communications directly related to the emergency at hand.

Compatibility of Frequency



NEXT PROBLEM- TALKING IN ANOTHER FREQUENCY/BAND

Compatibility of Equipment

- P25 developed to create an open standard for all manufacturers of subscriber equipment and systems.
- Intended to allow multiple manufacturers subscriber equipment to operate on any P25 system
- Intended to create competition that would result in competitive pricing
- Standard has provisions for proprietary functions.
- Common Air Interface-CAI
- The P25 Standard can be viewed at: http://www.project25.org/home

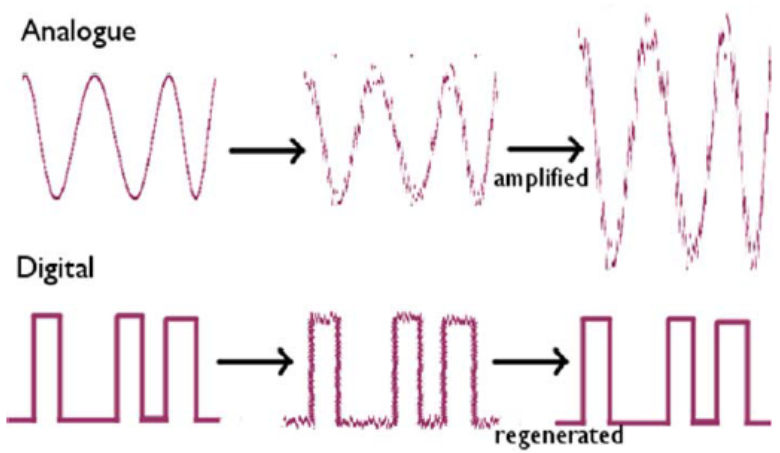
Signaling

Development of digital radios were seen as an advancement to:

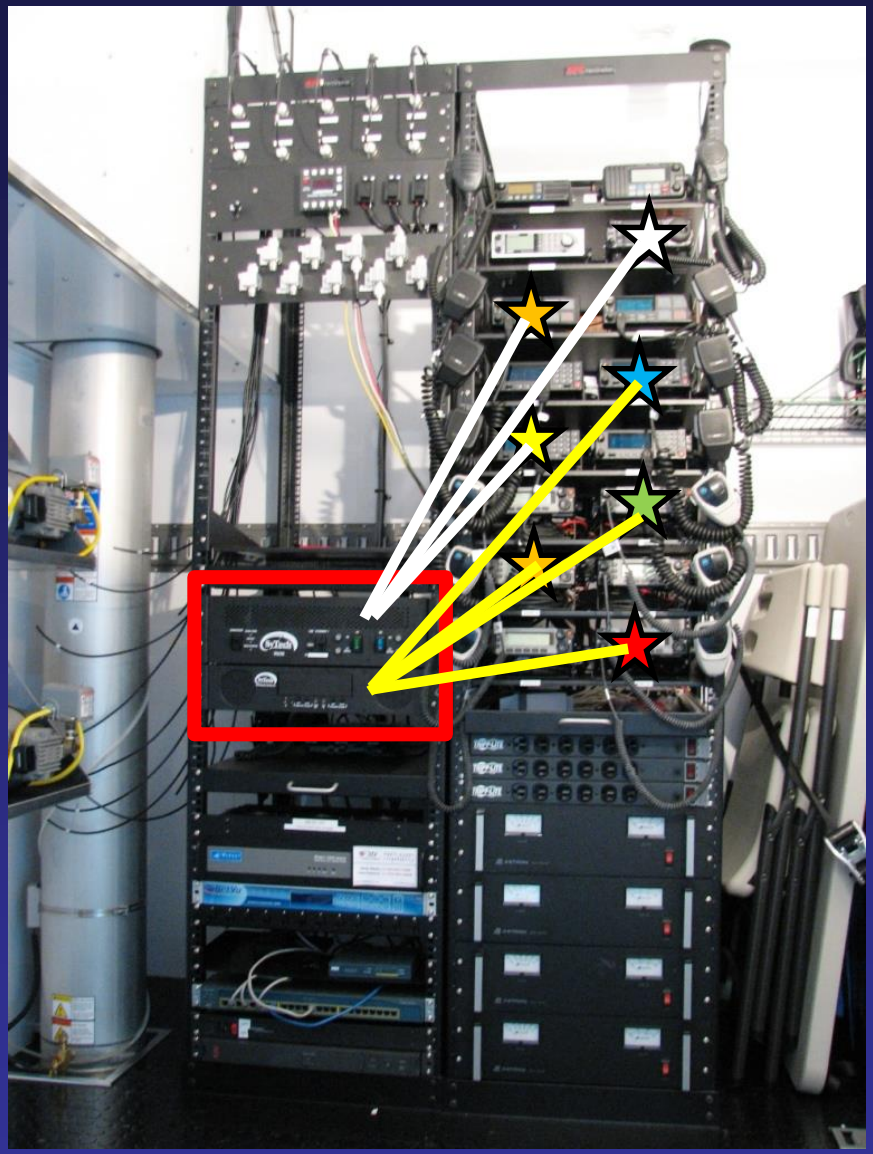
- Provide users with more intelligible audio.
- Add additional features without a degradation of performance.
- Provide a pathway to narrower bandwidths

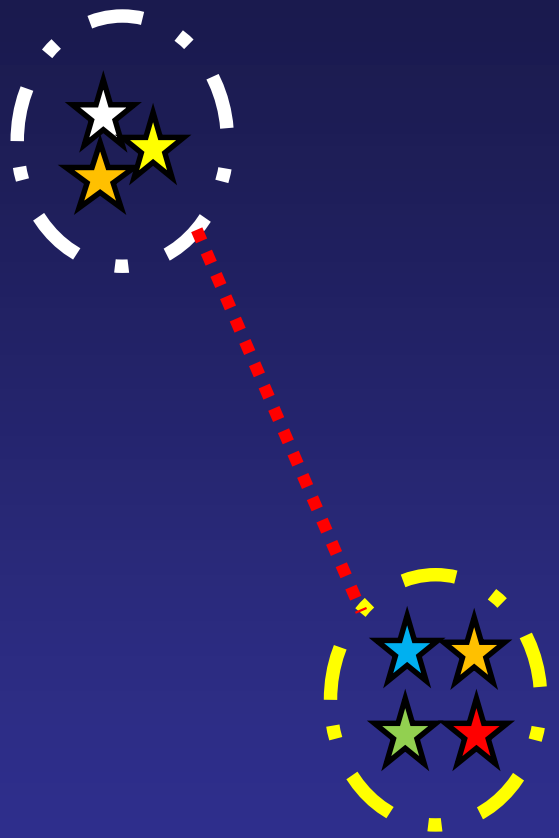
Multiple Manufacturers created proprietary formats

- EDACS, iDEN, Smartzone/ Smartnet, OpenSky

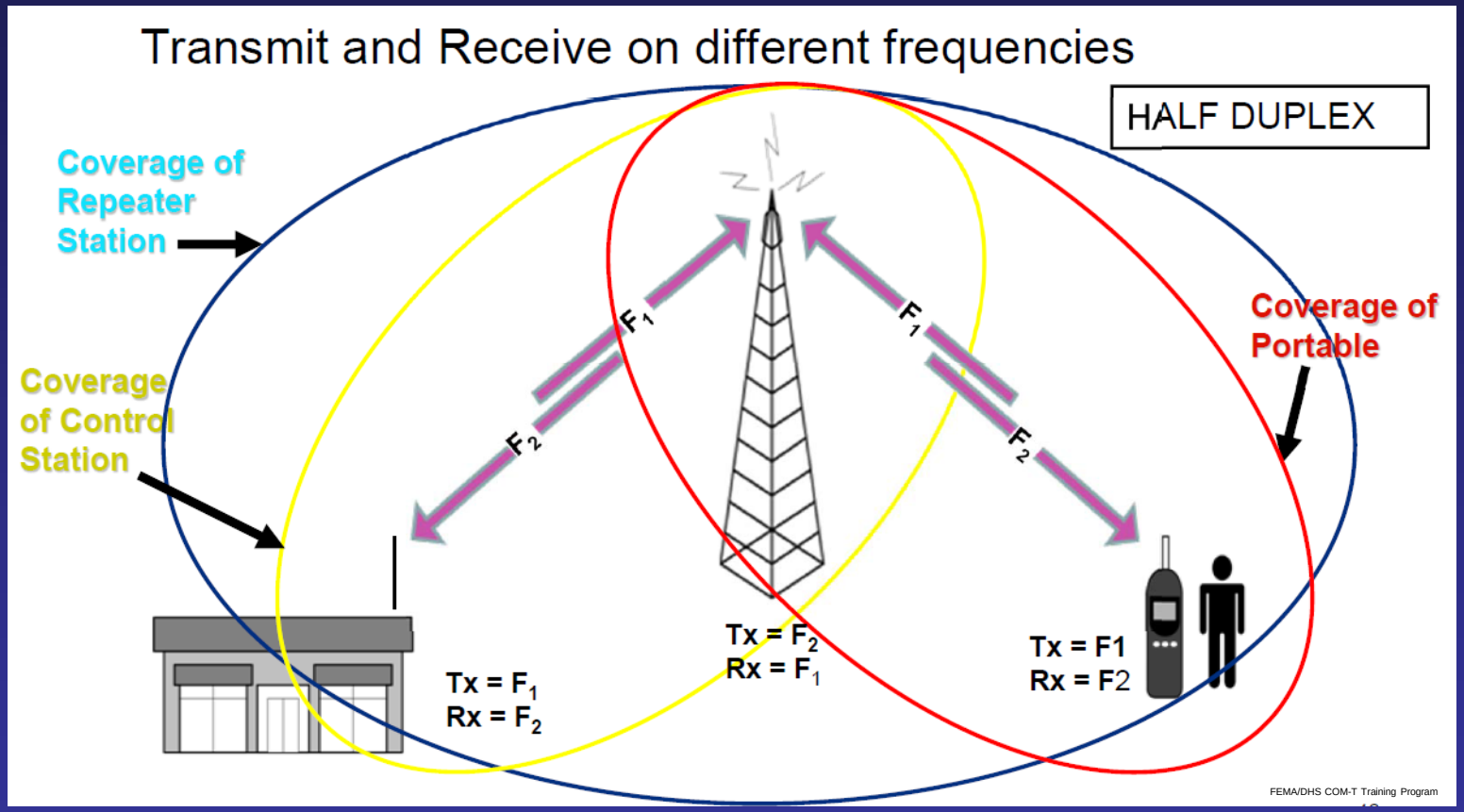


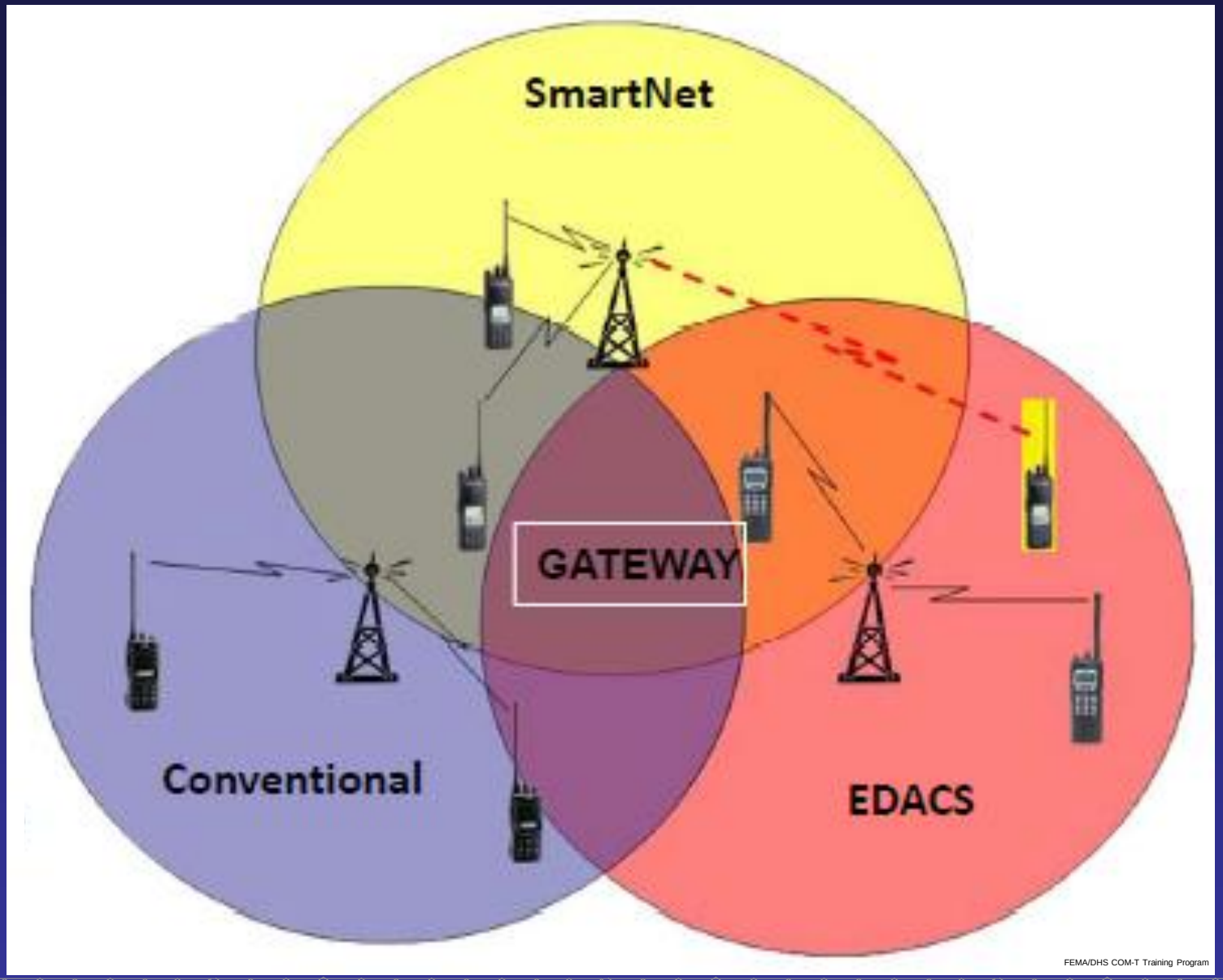
Gateways



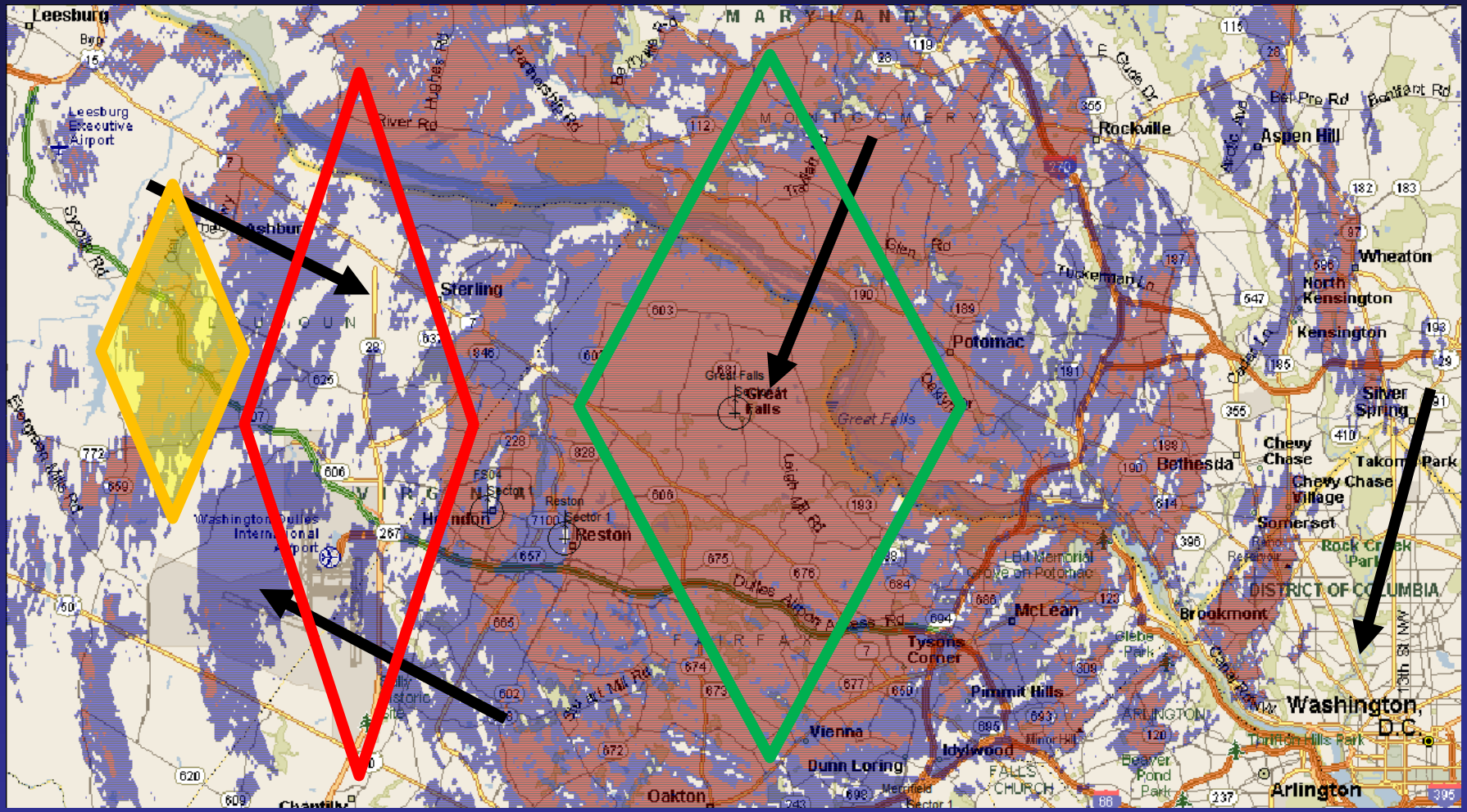


STEP 2- RADIO SYSTEM COVERAGE AND SIGNAL STRENGTH

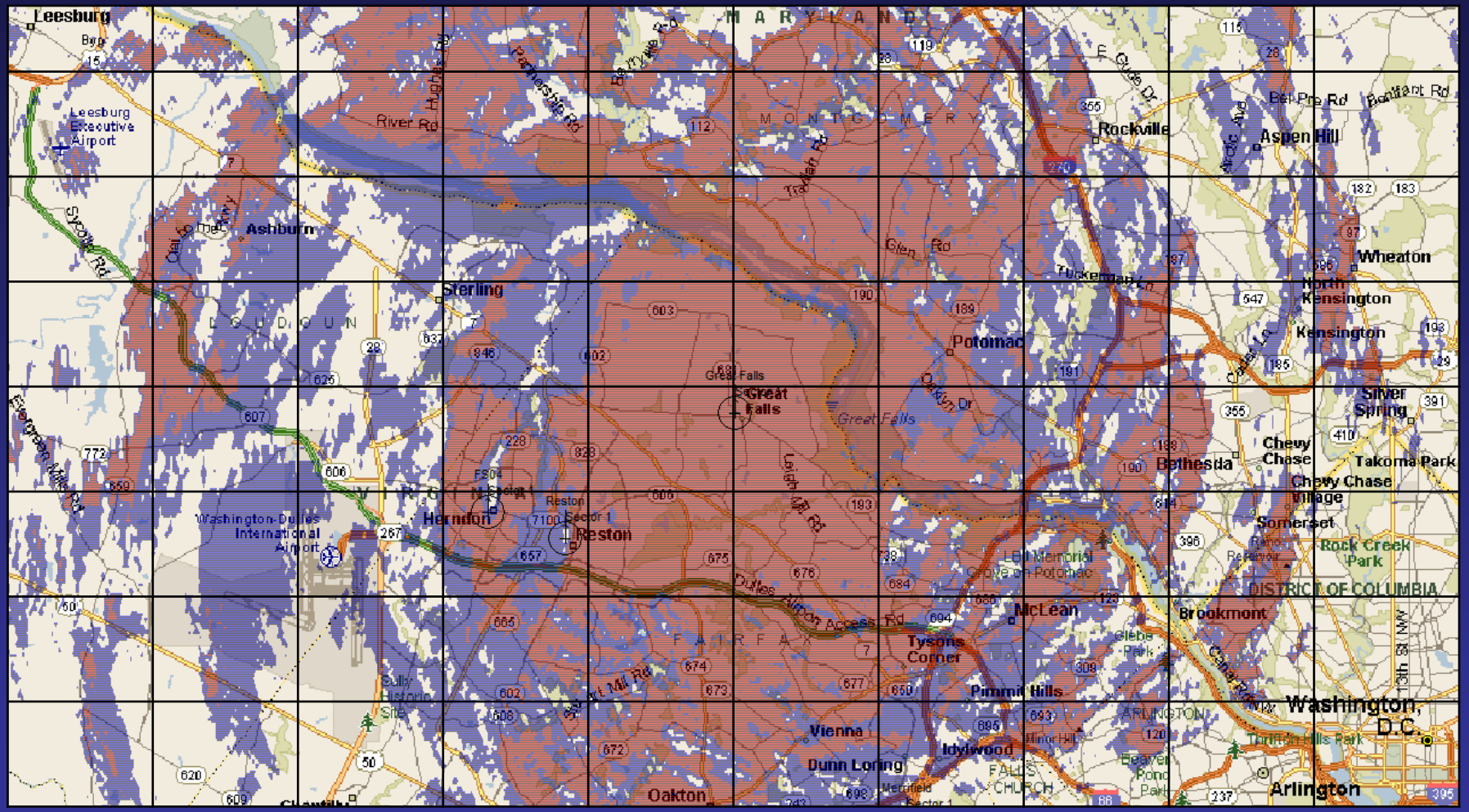



SmartNet
GATEWAY
Conventional
EDACS
FEMA/DHS COM-T Training Program

Am I under the umbrella?



Grid Testing for Coverage

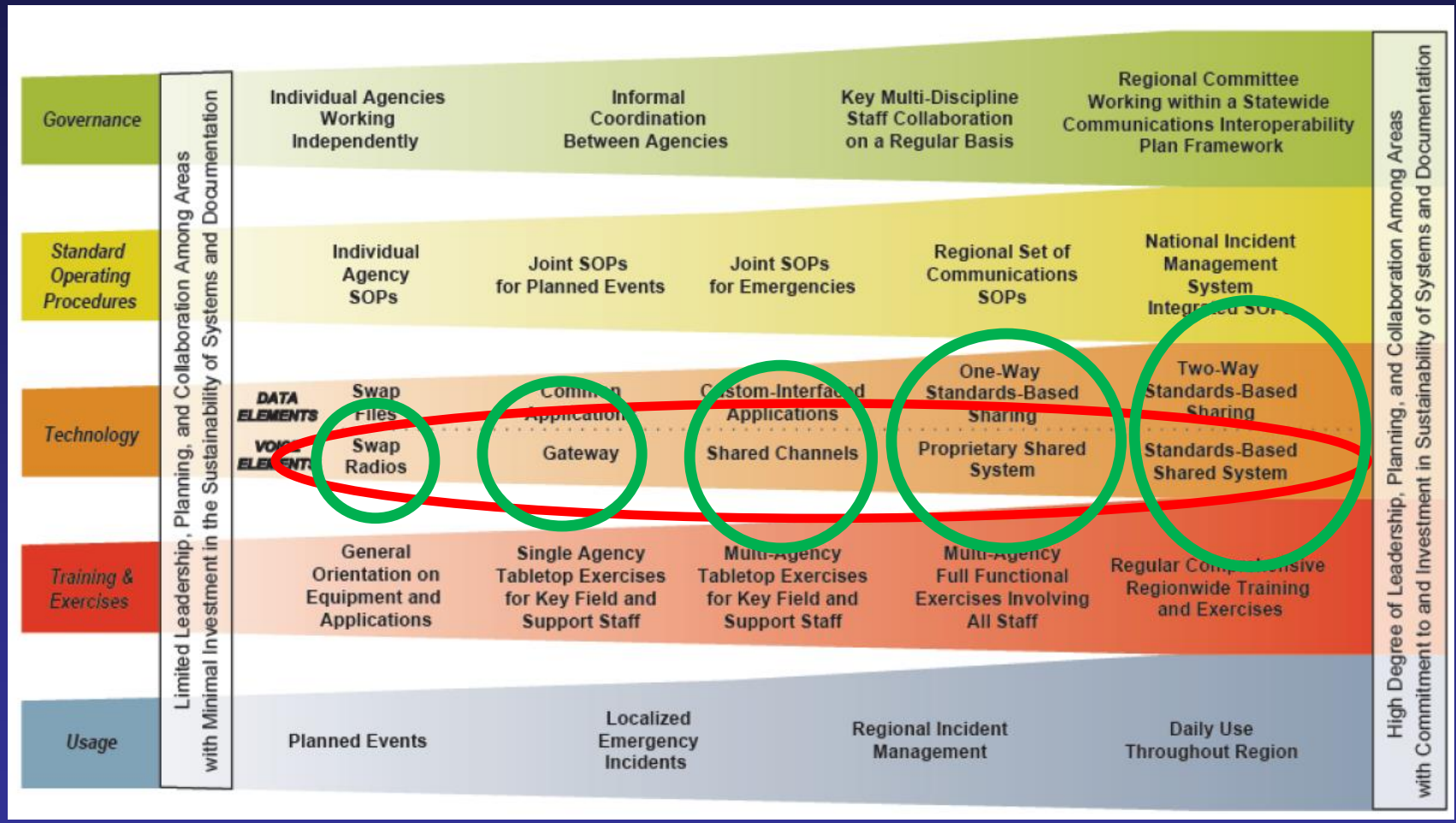


THE VIRGINIA COMMUNICATIONS CACHE

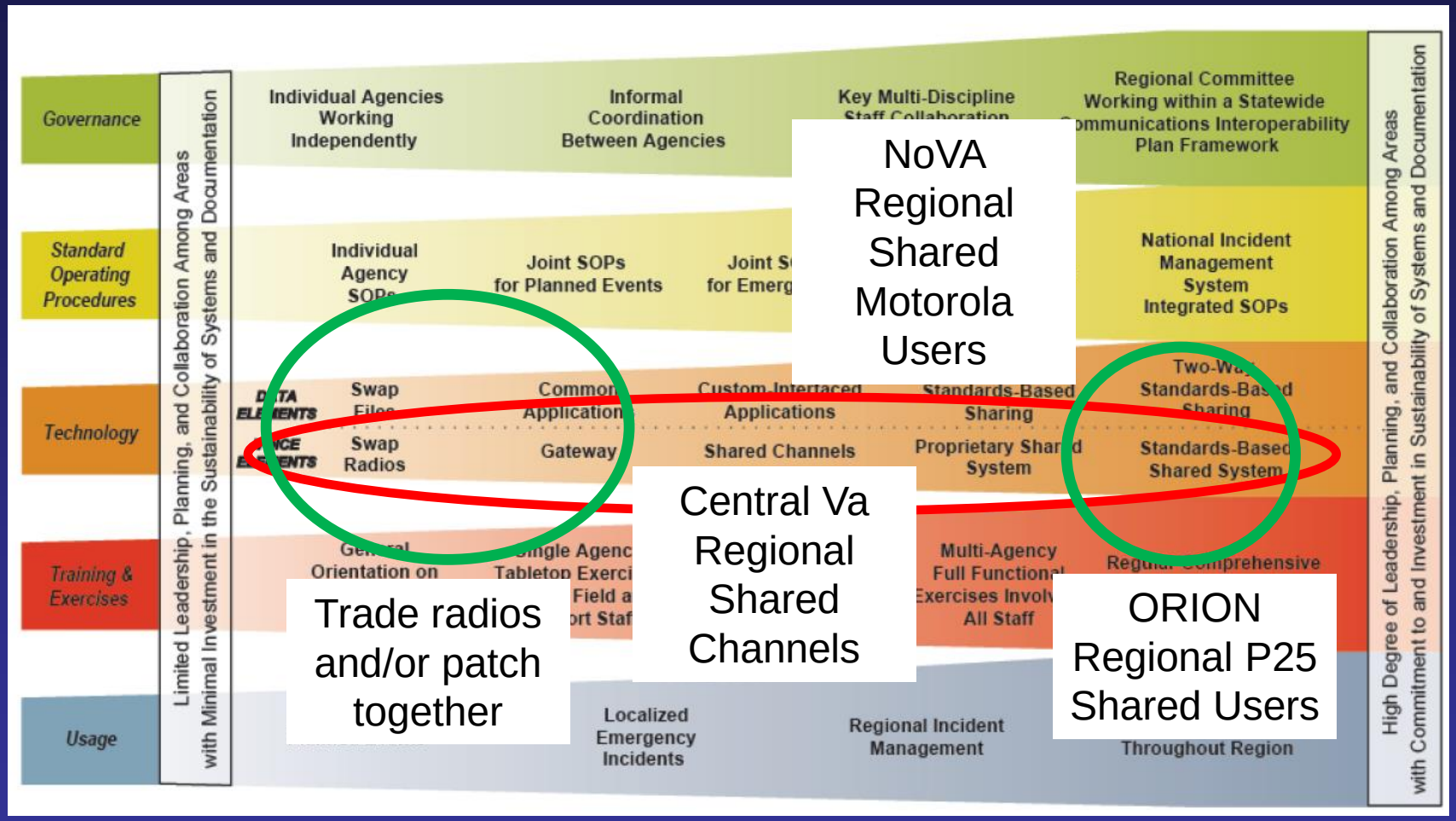
STEP 3- SCALABLE CAPACITY

- We all have heard of KISS….
  - Keep it simple

Scalable communications



Scalable communications



Virginia Gov

Lane # 1 – COMLINC

- COMLINC offers the most cost-effective method for bridgi
  eliminating the incompatibility of existing radio systems th
  Agencies Radio System (STARS) network to interface bet
  and jurisdictions. The COMLINC initiative has grown fr
  now encompasses 113 jurisdictions across the Commonv
  communication caches The Commonwealth recognizes th
  but supports the system as the path to interoperable commu

Lane # 2 – Communication Caches

- There are five regional radio caches strategically located t
  These resources have been deployed numerous times ov
  events across the state, proving the investment to be a sour

Lane # 3 – Planning, SOPs, Training and Exercises

- While the Commonwealth has taken significant str
  comprehensive planning, development of Standard Oper
  training, more remains to be done. Continued attention ne
  order to ensure proper use of the communications tech

Lane # 4 – Broadband

- Public Safety Broadband provides an unparalleled opportunity for the future of interoperable communications in the Commonwealth. It may result in a secure path for COMLINC, information-sharing initiatives, Public Safety Answering Points (PSAP), and Next Generation 911 (NG911) integration. Broadband will not replace existing Land Mobile Radio (LMR) systems in the foreseeable future, as the cost to implement broadband is extremely high. A cautious approach to this investment is needed. Therefore, robust requirements and innovative business practices are being developed for Broadband initiatives prior to any implementation. In order to maintain pace with the fast moving Broadband legislation, representatives from the SIEC have been brought together to serve as the interim Broadband Governance Committee, until such time as the Governor identifies a permanent governance structure.

Lane # 5 – Information Sharing

- As communication and information sharing opportunities continue to expand (examples of which include GIS, data and voice communications, CAD, NG911, and video-streaming technologies), the Commonwealth has centered information-sharing initiatives on the implementation of a statewide strategy, found in Appendix B, ensuring coordination across all information management plans and projects. In 2013, information sharing governance initiatives have been transferred to the Homeland Security Working Group, which will work in partnership with the SWIC to build on the foundation presented in this document and ensure coordination between the various stakeholder communities.

Lane # 6 – Shared Interoperable Channels and Common Language Protocol

To increase statewide interoperability, it is required that all radios are programmed with national and statewide interoperability channels. These channels have been published in the Virginia Department of Emergency Management's *Commonwealth of Virginia Tactical Interoperable Field Operations Guide*. All State and National interoperability channels, including but not limited to, 700 and 800 MHz, UCALL/UTAC, VCALL/VTAC, VTAC33-38, Fireground, EMS and Law Enforcement Channels must be programmed into all radios as applicable, and must remain in analog mode during use (e.g. VHF users should program VTAC channels). The use of Common Language during all incidents is required.

Lane # 7 – Regional System-of-Systems Approach

The Regional Systems-of-Systems approach incorporates targeting investments in order to allow jurisdictions to partner together in a cooperative manner in an effort to create regional communications capabilities that maximize existing investments and expand communications footprints. This includes the interconnection of existing systems through technology programs, the sharing of mutually beneficial infrastructure, and the development or expansion of cooperative governance structures. Examples of this

So…Where do we go from here

- Incompatible radio equipment
  - Have discussions with your users and neighbors
  - Gain understanding of standards based systems (P25)
- Lack of a common language
  - Ensure need for clear language usage is understood
  - Police yourselves away from codes and private talk

So…Where do we go from here

- The use of different frequency bands by different agencies
  - Program NIFOG and Common channels in all radios
  - Discuss with neighbors ability to share/swap radios
  - Strive toward regional approaches and standards based shared systems (ISSI interfaces)
- Lack of effective governance
  - Discuss communications at a “higher” level
  - Discuss how you will use communications devices
  - Create written agreements and practice them

VIRGINIA
COMMUNICATIONS CACHE

THE VIRGINIA COMMUNICATIONS CACHE

Overview

The Virginia Communications Cache is:

- A Tactical, Interoperable Communications Asset
- Part of the Virginia Strategic Technology Reserve Initiative
- Communications Cache is a consortium of five local government agencies:
  - owning the equipment and providing personnel
  - coordinated by the Virginia Department of Emergency Management

Vision

- Communication Caches originated from 2006 State Interoperability Executive Committee's (SIEC) Communication Planning
  - SIEC resolved to develop regional communication caches
- Five localities selected:
  - County of Fairfax;
  - City of Harrisonburg/County of Rockingham;
  - City of Chesapeake/City of Hampton partnership;
  - County of Lunenburg;
  - County of Montgomery

Mission

It is the mission of the Virginia Communications Cache consortium to own and maintain adequate reserve communications equipment and provide technically proficient personnel to respond to assist localities and state agencies when normal communications resources are inadequate or rendered unusable.

Cache Resources

- **Portable Radios**
- **Portable Repeaters**
- **Infrastructure Repeaters**
- **Deployable Towers and Antenna Masts**
- **System/Radio Interconnection (Gateways)**
- **Satellite Voice & Internet Communications**
- **Satellite Data Connectivity**
- **Local Wi-Fi Network**
- **Point–to–Point Networking**
- **Mobile telephone PBX and VOIP Communications**

Radios

- **Frequency Supported:**
  - **VHF High Band**
  - **UHF**
  - **700/800 MHz**
- **Technology Supported:**
  - **Conventional Analog**
  - **P25 Digital -Conventional and Trunked**
  - **Motorola & Harris Proprietary Analog/Digital Trunking Systems**
  - **Limited Encryption (ADP, DES, and AES)**

Repeaters

- **Portable**
  - **VHF High Band**
  - **UHF**
  - **700/800 MHz**
- **Infrastructure**
  - **VHF High Band**
  - **UHF**
  - **700/800 MHz**

- *Analog and P25 Conventional*

Deployable Towers & Masks

100 ft Mobile Tower

35 ft Mobile Mast

85 ft Mobile Tower

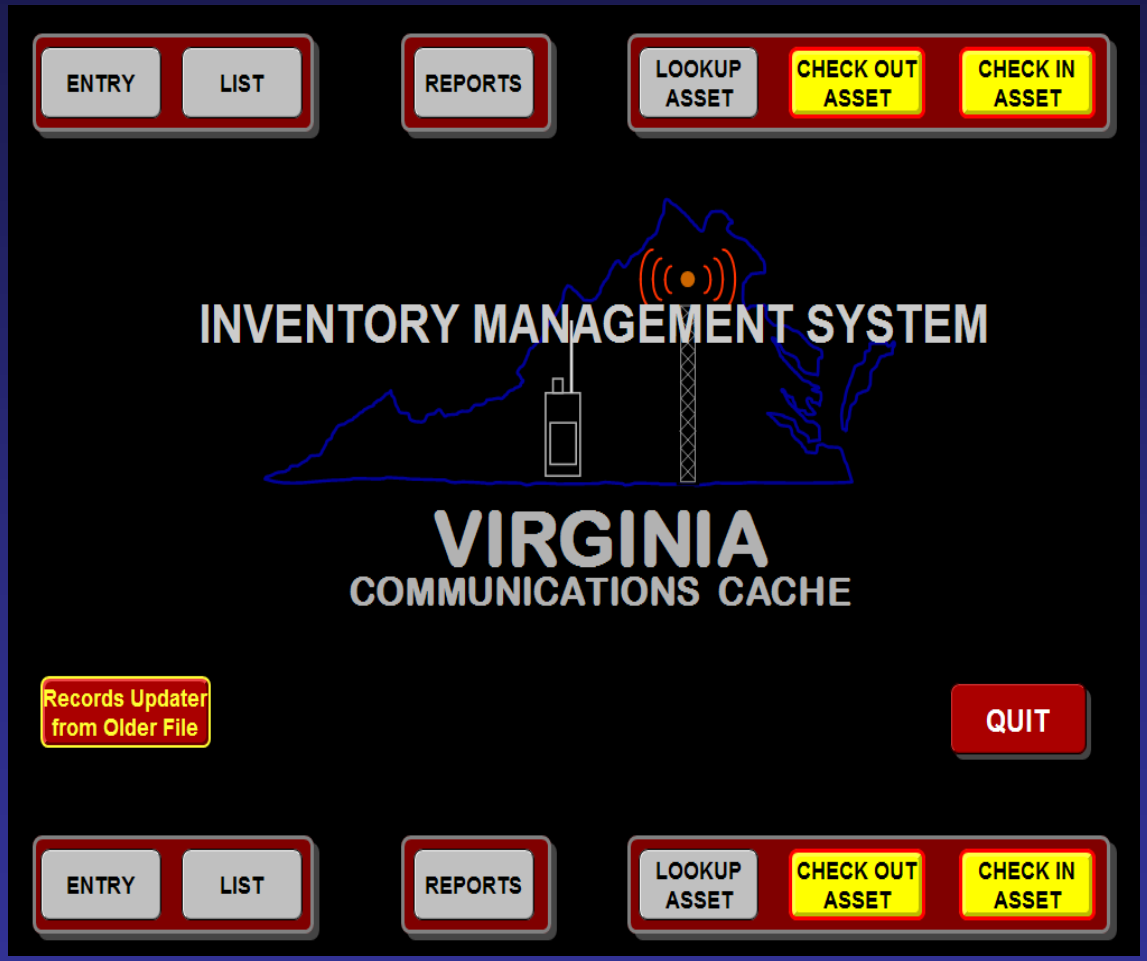
Radio Gateways

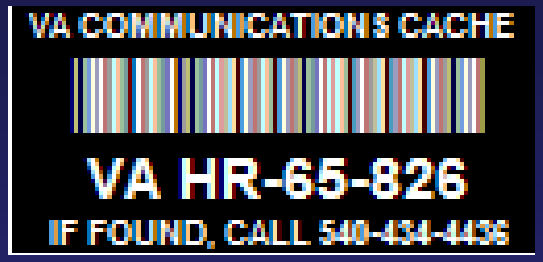
- VHF Low/High, UHF, 700/800:
  - Conventional
  - Proprietary Trunked
  - Digital
  - P25
- Aeronautical
- Maritime
- Amateur Radio
- Cellular
- Satellite Link
- ROIP, VOIP

Tactical 8 Port

System 16 Port

Automated Asset Tracking





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Satellite Communications

Mobile Satellite Voice

Satellite Internet

VOIP

ROIP

PTT Talk Groups

Self-Contained, Self-Supporting

Team Composition

- **Members are from various agencies within public safety organizations, helping the team to understand emergency responder needs**
  - Fire Department
  - Law Enforcement
  - Dispatch Communicators
  - Technical Specialists (Radio, Phone, IT services)
- **National Standard Trained / State credentialed**
  - Communications Unit Leader (COM-L)
  - Communications Technician (COM-T)
  - Radio Operator (RADO)
  - Technical Specialists (Gateway, IT/Data, Programming)

How to Request a Cache

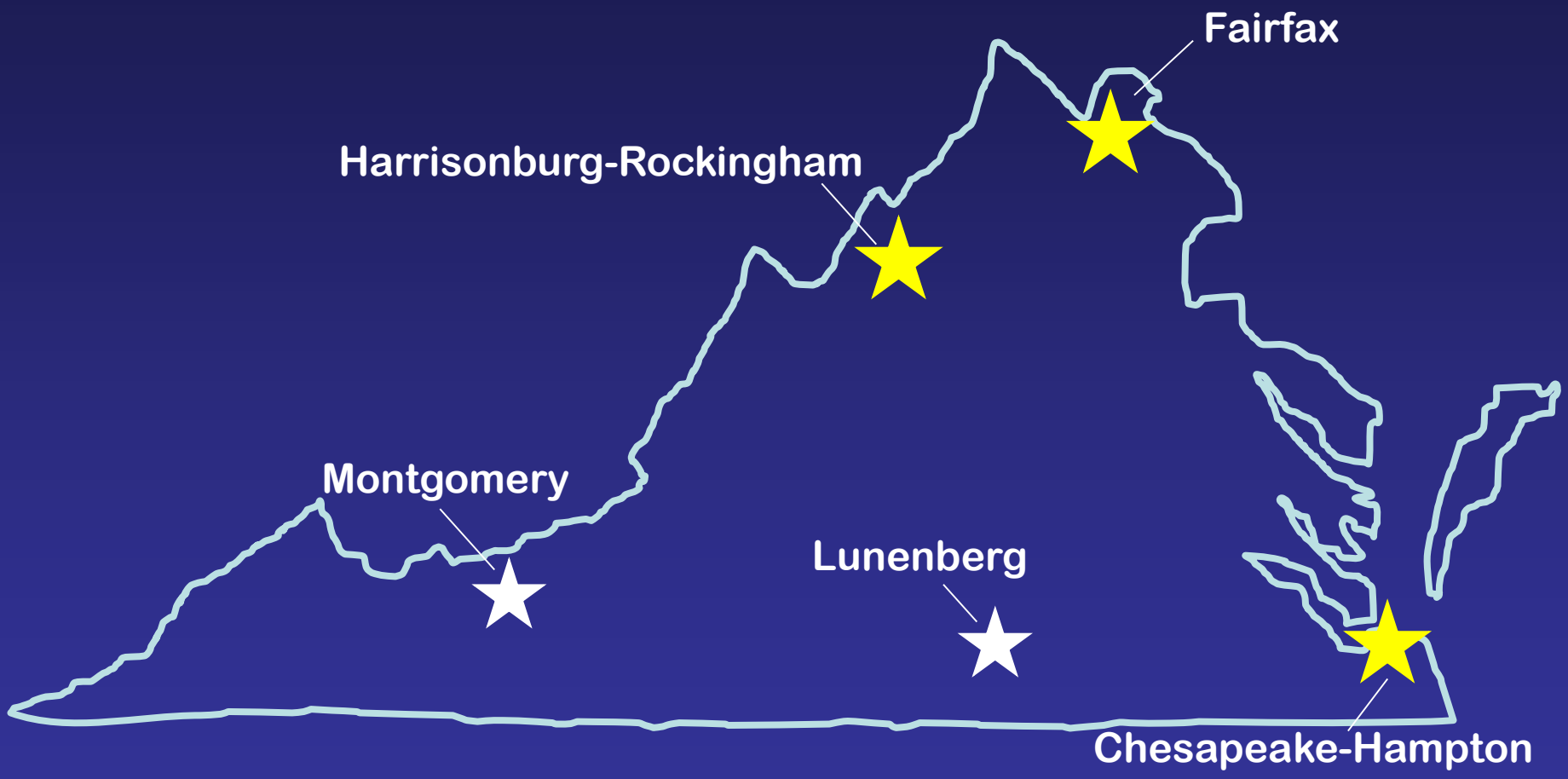
Emergency Incidents:

- Contact the Virginia EOC. Initial point of contact.
- Determine most efficient team/resource.
- Coordinate Planning and Response.

Planned Events:

- Contact Virginia EOC.
- Can make direct contact to local cache if known.
- Assist and source out best resource determination.
- Forward to local contact.
- Contact should be made 30-120 days prior.

Communications Cache Locations



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QUESTIONS ?