Radios Section – CERT Class 63

CERT Communications

Using FRS Radios

Presented by Julie Hill, EIT certified

Topics

- Understanding how FRS Radios work
- Using FRS Radios effectively for informal messages as a CERT team
- Understanding basic trouble-shooting solutions for operating the radio

Communications Systems for CERTs

Communicate by best means

Runners; notes; whistles; yelling; 2-way radios

3 types of radio systems for CERTS:

- FRS Radio under 2 watt radios
  - No license necessary.
- GMRS over 2 watt radios
  - Buy a license from FCC.
  - 10 year license, $35 per family
- Amateur radios
  - Flexible range options; 35 question test ($15 fee); $35 fee for FCC
  - Voice, Computer, Morse
  - Need to coordinate with existing ARES response!

Why use a two-way radio?

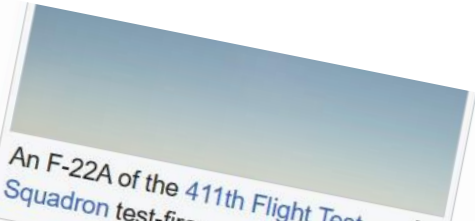
Walkie Talking = FRS (is a type of 2-way radio)

2-way radios are not defined as FRS

- Phone lines down for hours
- Helping with CERT response in the field
- Doing a damage assessment after a disaster

Why use a two-way radio?!

respectively. Concurrent with Increment 3.2, Update 5 in 2016 added automatic ground collision avoidance system (GCAS), datalink updates, and more.[87][88] Update 6, deployed in tandem with 3.2B, incorporated cryptographic and avionics stability enhancements.[89] Alongside 3.2B, an open mission system (OMS) processor module and architecture were added and an agile software development process was implemented to enable faster enhancements from additional vendors. The Multifunctional Information Distribution System-Joint Tactical Radio System (MIDS-JTRS) for Mode 5 IFF and Link 16 traffic was installed starting in 2021, and the airplane can also use the Battlefield Airborne Communications Node (BACN) as a two-way communication gateway.[90]



An F-22A of the 411th Flight Test Squadron test-fires an AIM-9X in 2015.

Lockheed Martin Conducts Successful In-Mine Test of Its ...

https://www.prnewswire.com/news-releases/lockheed...

Web Jul 21, 2010 · The system demonstrated successful **two-way** voice **communications** to a depth of 1550 feet and **two-way** text **communications** to a depth in excess of 1550 feet. ...

Basic Concepts

Channel (a named carrier Frequency)

A designated place to communicate

FCC allows for 22 channels between the frequencies: 462 MHz and 467 MHz

FRS Radio Useful Range

- Channel 1-7 (1-2 miles)
- Channel 8-14 (1/4-1/2 mile)
- Channel 15-22 (1-2 miles)

PTT/Push to Talk

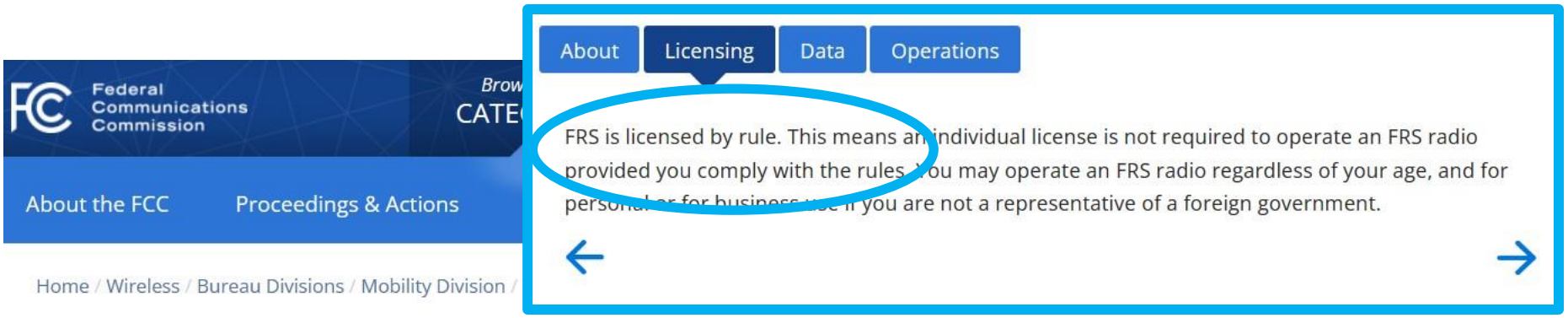
Press button to talk, can't hear

FCC Services

Mobility Division

- 218-219 MHz Service
- 3650-3700 MHz Radio Service
- 220 MHz Service
- 3.5 GHz Band
- 700 MHz Construction Notification Requirements
- 700 MHz Guard Bands
- 800MHz Cellular Service
- Air-Ground Radiotelephone Service
- Amateur Radio Service
- Aviation Radio Services
- Basic Exchange Telephone Radio Service (BETRS)
- Broadband Personal Communications Service (PCS)
- Cellular Service
- Citizens Band Radio Service (CBRS)
- Commercial Radio Operator License Program
- Contraband Wireless Devices
- Dedicated Short Range Communications (DSRC) Service
- **Family Radio Service (FRS)**
- General Mobile Radio Service (GMRS)
- Intelligent Transportation Systems (ITS)
- Industrial / Business
- Lower 700 MHz Service
- Low Power Radio Service (LPRS)
- Maritime Mobile
- Maritime Survivor Locating Devices (MSLDs)
- Medical Device Radiocommunications Service (MedRadio)
- Multi-Use Radio Service (MURS)
- Narrowband Personal Communications Service (PCS)
- Offshore Radiotelephone Service
- Paging
- Personal Locator Beacons (PLBs)
- Personal Radio Services
- Private Land Mobile Paging
- Private Land Mobile Radio Services
- Radio Control Radio Service (RCRS)
- Rural Radiotelephone Service
- Signal Boosters
- Specialized Mobile Radio Service (SMR)
- Wireless Communications Service (WCS)
- Wireless Medical Telemetry Service (WMTS)

FCC FRS Radio Allowance



Home / Wireless / Bureau Divisions / Mobility Division /

Family Radio Service (FRS)

Mobility Division

- 218-219 MHz Service
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About | Licensing | Data | Operations

The Family Radio Service (FRS) is a private, two-way, short-distance voice and data communications service for facilitating family and group activities. The most common use for FRS channels is short-distance, two-way voice communications using small hand-held radios that are similar to walkie-talkies. The service is licensed-by-rule so the general public can use the devices without having to obtain a license and channel sharing is achieved through a listen-before-talk etiquette.

Rule Part

47 C.F.R, Part 95

Other services that allow similar communications include the CB Radio Service, General Mobile Radio Service (GMRS) and the Multi-Use Radio Service (MURS).

The FRS is authorized 22 channels in the 462 MHz and 467 MHz range, all of which are shared with General Mobile Radio Service (GMRS) which requires an individual license for use.

Radio Etiquette for CERTs

Discipline

- Talk only when needed, keep the command channel clear
- Send only necessary messages to team leads/command post
- Check your team regularly (½ – 1 hr. period)
  Priorities! Can your message wait?
- Listen! Is someone using the frequency?
- Use a different channel for intra-team radio traffic

Radio Etiquette 2.0
What NOT to say

- Do not say or send: age, gender, race
- Victim's personal identifiable information
  Names, injury details, insurance, social security
- Inflammatory/Derogatory statements

FRS Radio is a publicly available feed

Your message could turn into Bad NEWS

A Word About Batteries

2 to 4 Wh

Batteries (AA) A normal “AA” size alkaline or NiMH battery contains about 2000 to 3000 mAh (or 2 to 3 Ah). This equates to **2 to 4 Wh** per cell with a cell voltage of 1.2 V to 1.5V.

current draw, are often designed to use larger batteries such as the AA battery type. AA batteries have about three times the capacity of AAA batteries. With the increasing efficiency and miniaturization of modern electronics, many devices that previously were designed for AA batteries (remote controls, cordless computer mice and keyboards, etc.) are being replaced by models that accept AAA battery cells.

As of 2007, AAA batteries accounted for 24% of alkaline primary battery sales in the United States. In Japan as of 2011, 28% of alkaline primary batteries sold were AAA. In Switzerland as of 2008, AAA batteries totaled 30% of primary battery sales and 32% of secondary battery (rechargeable) sales.[3][4][5]

Chemistry	IEC name	ANSI/NEDA name	Nominal voltage (V)	Typical capacity (mAh)	Typical capacity (Wh)	Rechargeable
Zinc–carbon	R03	24D	1.5	540	0.81	No
Alkaline	LR03	24A	1.5	860–1,200[6]	1.3–1.8	Some
Li-FeS_2	FR03	24LF	1.5	1,200	1.8	No
NiMH	½ AAA 10.4mm 22.7mm	GP35AAAH	1.2	~350 - 1,000[7]	0.42 - 1.2	Yes
Li-ion	⅓ AAA	10180	3.7	~100	0.4	Yes
Li-ion	⅔ AAA	10280	3.7	~200	0.8	Yes

Radio use problems

- Dead Battery
- Damaged Radio
- Accidental/Stuck PTT or “Radio in pocket”
- Out of Range/In a Hole
- Lack of Operator Discipline
- Malicious Interference
- Uncoordinated Operation, e.g. wrong channel

Basic Antenna Concepts

- FRS Radio is (nearly) Line-of-Sight
- Stuff (solid state and liquids) absorb (& reflect) Radio waves
  - Air doesn't!
- To avoid stuff, get higher.

FRS Antenna versus Amateur Radio Antenna

FRS Antenna versus Amateur Radio Antenna

Amateur Antenna

Demo FRS Radio Operation

Step 1 – Turn Power ON

1. MODE one long press: to turn Power ON/OFF

Bell indicates chime is ON

Large number indicates CHANNEL

Push to Talk

Small number indicates PRIVACY SETTING = 0

Press Music symbol to activate or deactivate chime

Demo FRS Radio Operation

Step 2- Adjust Volume

1. Press PLUS + to increase VOLUME
   Press MINUS - to decrease VOLUME

2. Press Push to Talk to Capture Settings

Press Music symbol to activate or deactivate chime

Demo FRS Radio Operation

Step 3 – Change Channel

1. Press MENU

2. Large Number Starts BLINKING

3. Press + or – to Change Channel from its current position

4. Press Push to Talk to Capture Settings

Demo FRS Radio Operation

Step 4 – Ensure Privacy Code is Set to 0

1. Press MENU button TWICE

2. Small Number Starts BLINKING

3. Press + or – to Change Privacy Code from its current position to “0”

4. Press Push to Talk to Capture Settings

Demo FRS Radio Operation

Step 5 – Resetting Radio Mode from NOAA

1. Press MODE ONCE to ACTIVATE NOAA Reports Mode

2. Press MODE ONCE AGAIN to DE-ACTIVATE NOAA Reports Mode

Other FRS Radio Tools (not used by CERTs)

PL/CTCSS/DCS – the private line mode – keep on (0)

Sub audible tone marks comms, CERT does not use

Squelch

Ignore weak signals, save battery, preserve sanity

Monitor

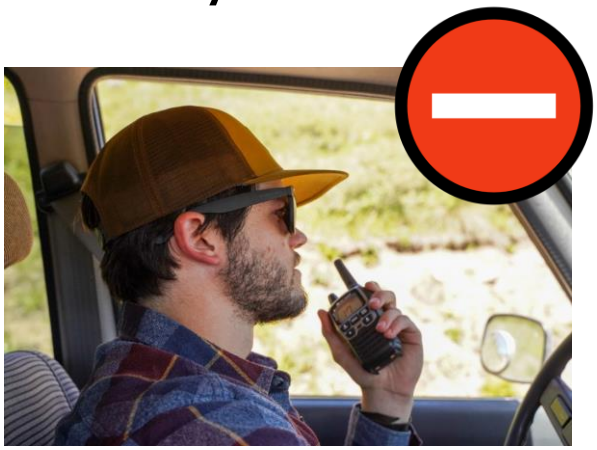
Defeat squelch to hear weak signals

ACTIVITY 1
Practice Transmit Only:
Say Your Name

1. Turn Radio on
2. Adjust the volume
3. Choose Channel 9
4. Make sure Private Line is on 0
5. Make sure NOAA is off
6. One at a time, transmit your name
   - Listen to each other for the quality of the reception
7. Transmit all at once
   - See how effective it is…n't!

To Transmit

- Listen
  - Wait for an opening
- Press PTT (Push to Talk Button)
- Breathe once
  - Let the radio switch from receive to transmit
- Speak across the microphone
  - (not at it, & don't drive while transmitting!)
- Say your message clearly and calmly
  - "Ghost write" messages for pacing
- Release PTT



To Receive

1. Listen

2. Notate by writing down
   -pertinent details only -

3. Acknowledge the transmission by summarizing
   -this is where the phonetic alphabet is helpful

-Ask for repeat if unclear

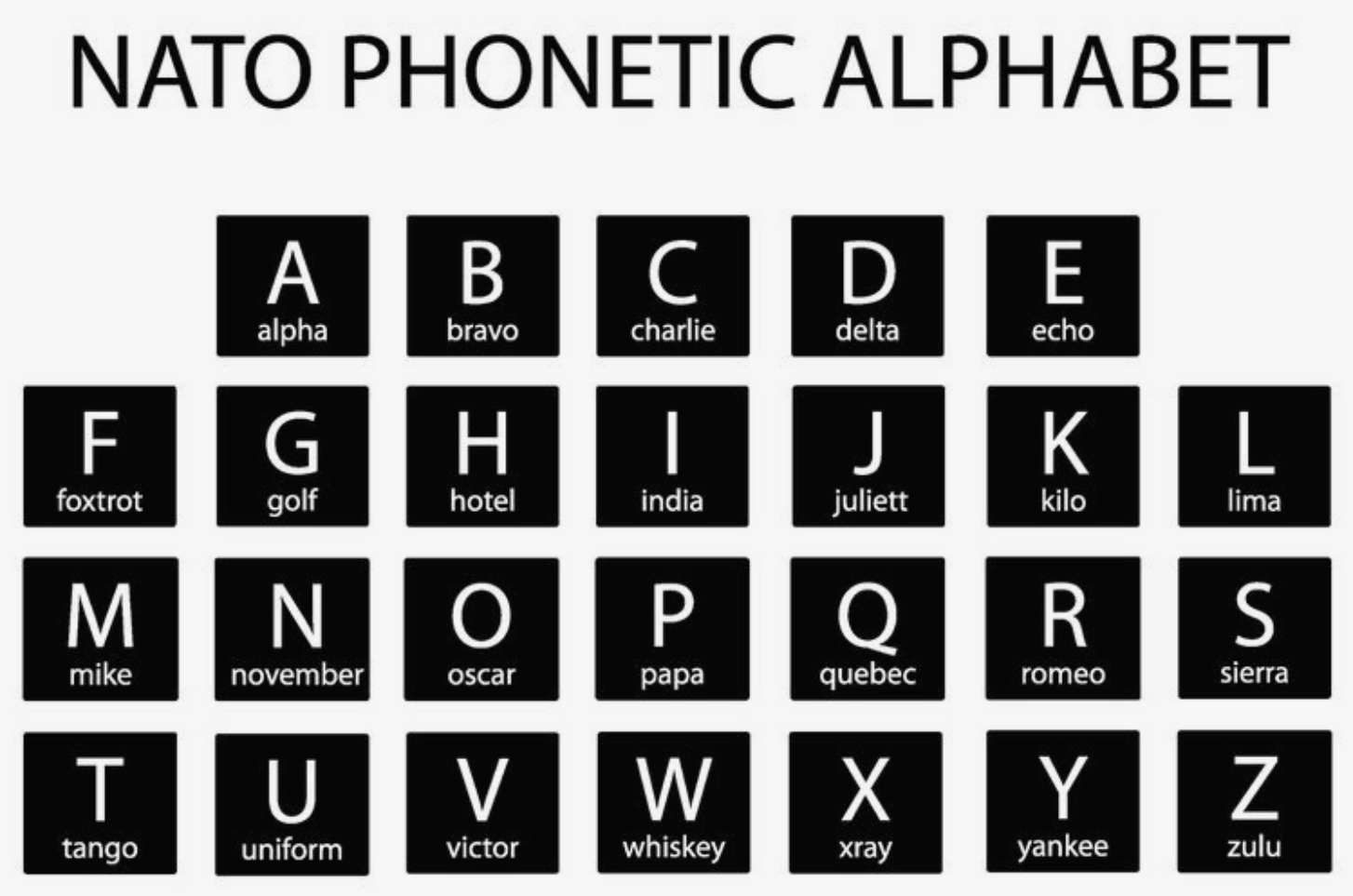
To Receive – Terminology

- "Stand by" = wait
- "Say again" = repeat
- "Break!" (&/or "Priority Message!") = to interrupt for urgent use of a channel. All other parties then immediately relinquish channel.
- "Roger" = confirming message, acknowledging that you will follow through as needed

To Receive – Confirming What Was Heard

- Say “I spell” before spelling out a word with the phonetic alphabet. (E.g., say: “Knot- I spell: Kilo, November, Oscar, Tango”).
- Spell out every proper name.
- Say “figures” before saying numbers. Say each number digit separately: E.g., say: “Figures: 4, 2, 3, 6 Main Street”. (not “forty-two, thirty-six”)
- Special Numbers: 3 (“Tree”); 5 (“Fife”); 9 (“Niner”)
- “Decimal” = dot (e.g. with an email address)

INTRODUCTION TO NATO PHONETIC ALPHABET



PHONETIC ALPHABET

A	**Alpha**	AL-fah
B	**Bravo**	BRAH-voh
C	**Charlie**	CHAR-lee
D	**Delta**	DELL-tah
E	**Echo**	ECK-oh
F	**Foxtrot**	FOKS-trot
G	**Golf**	GOLF
H	**Hotel**	hoh-TEL
I	**India**	IN-dee-ah
J	**Juliette**	JEW-lee-ett
K	**Kilo**	KEY-loh
L	**Lima**	LEE-mah
M	**Mike**	MIKE
N	**November**	no-VEM-bah
O	**Oscar**	OSS-cah
P	**Papa**	pah-PAH
Q	**Quebec**	keh-BECK
R	**Romeo**	ROW-mee-oh

S	**Sierra**	see-AIR-ah
T	**Tango**	TAN-go
U	**Uniform**	YOU-nee-form
V	**Victor**	VIK-tah
W	**Whiskey**	WISS-key
X	**X-Ray**	ECKS-ray
Y	**Yankee**	YANG-key
Z	**Zulu**	ZOO-loo
0	**Zero**	ZEE-roh
1	**One**	WUN
2	**Two**	TOO
3	**Three**	TREE
4	**Four**	FOH-wer
5	**Five**	FIFE
6	**Six**	SIX
7	**Seven**	SEH-ven
8	**Eight**	AIT
9	**Nine**	NI-ner

(there are some variations in other jurisdictions)

ACTIVITY 2
Practice Transmit & Receive

1. Call your partner
   "[Partner], this is [Your Name]. Over"
2. Use the "I spell" protocol.
3. Switch roles

Example:

"Steve, this is Julie. Steve. I spell: Sierra Tango Echo Victor Echo. Julie. I spell: Juliette Uniform Lima India Echo."

Class Members: "[Name1] this is [Name2]. [Name1]. I spell: _____. [Name 2]. I spell: _____.

ACTIVITY 3
Team Relays Outside
Demo Over-Air Radio Exchange

1. **Call**: "Operations, this is Quick Hazard Team. Over."

   Reply: "Quick Hazard Team, this is Operations, go ahead."

2. **Instructions** by Quick Hazard Team: "We are in front of 4 SNAP Drive and smell gas outside. Send a team with wrench to shut off gas. Over."

3. Operations gives a **summary** of what was said:

"Request is to send Team with wrench to shut off gas at address 4 SNAP Drive. That is figure 4; I spell: Sierra November Alpha Papa – Drive. Over."

4. **Conclude** Interaction: "Operations, that is correct. Quick Hazard Team Out."

"Operations Out." (End conversation with "Out")

Suggested On-Air FRS Radio Protocol

When calling and responding :

"Julie, this is Steve. Over."

"OVER" IN BETWEEN EXCHANGES

When you are done: Use your name and "out."

- "Steve: Out."
- "Julie: Out."

"OUT" AT THE END OF EXCHANGE

The key is who's turn is it after "Over" versus "Out" –

- At the end of "Over," your team is still transmitting.
- At the end of "Out," somebody else's team can start using that channel

Summary Points

Planning

- Decide where radios will be effective in your disaster planning
- Allow planning time & resources for radio maintenance
- Provide a flexible radio plan... to everyone

Communications drives the need for radios, Radios serve. So use effective communication.

Listen and think before talking

Politeness makes radios effective

Join SARES!

An entry level Amateur Radio license is easy and “Ham Radio” is fun!

Talk to a SARES member

For more information

https://www.sunnyvaleares.org

https://www.arrl.org/public-service

https://www.scc-ares-races.org/training.html

https://www.w4ava.org/races/FRSfactsheetRev1Oct016.pdf

Walkie-Talkies versus Two-Way Radios: What's the Difference? - GenComm | GenComm

Family Radio Service (FRS) | Federal Communications Commission (fcc.gov)


Questions

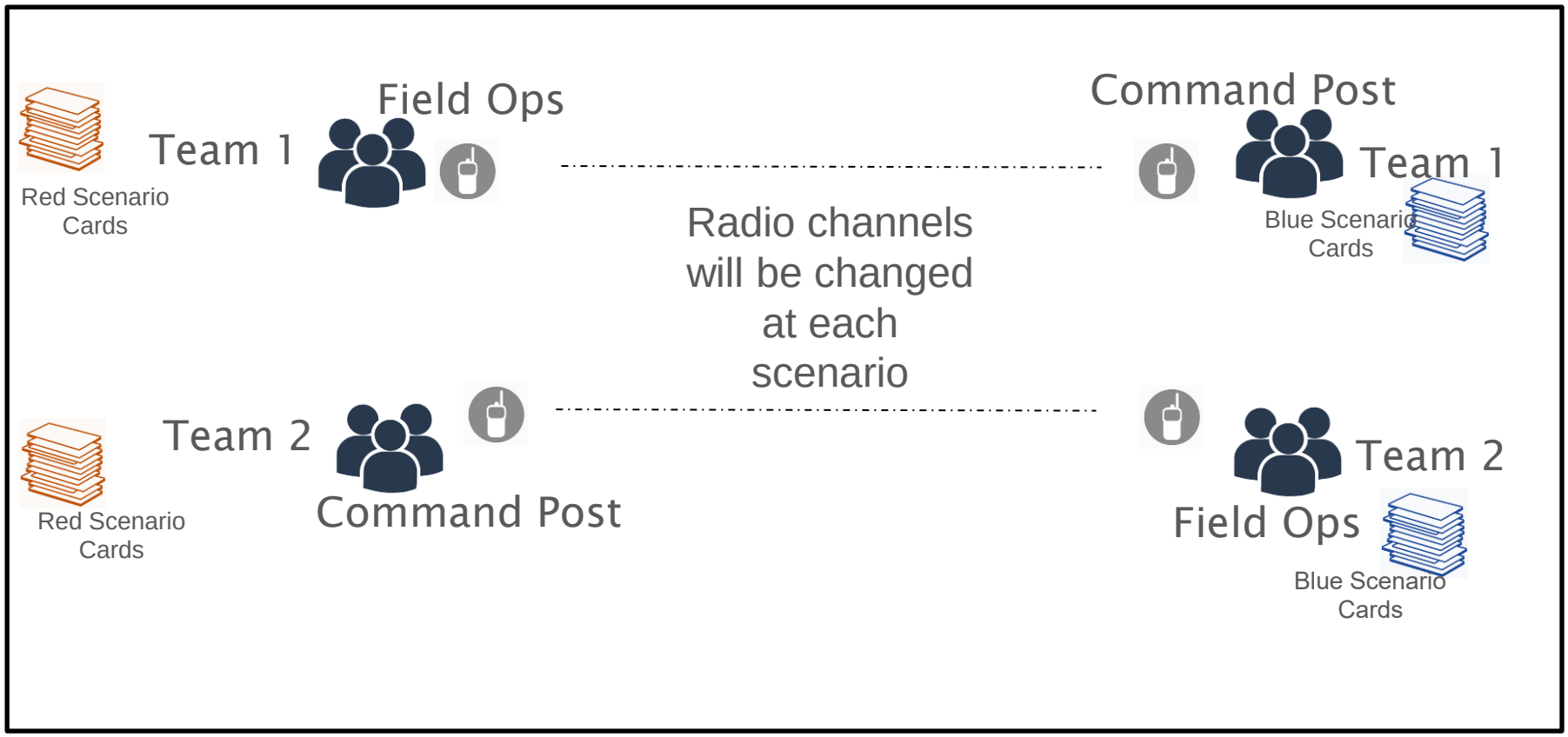
ACTIVITY 3
Team Relays

1. Divide Class into 4 groups (pairs+).

2. Four (4) Stations each switch off being an Operations Team or the Command Post.

3. Using Scenario Cards, we will practice transmitting sample hazard situations to each other.

Activity 3: Team Relays



Map of Fire Station 2
Activity 3
Relay Team locations

Practice Time!