

MURS Radio Training

- This material was shown at the San Jose Fire Museum on 7/15/2023 - Thanks for attending!
- P.38 (Examples of Radio Exchanges) has been corrected
- Please send your comments, feedback & suggestions

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MURS Radio Training

- Agenda
 - Why radios?
 - MURS Radio Training - Train the Trainers
 - You're trained - What to do next?
 - Why you need a GMRS radio?

- During this training - feel free to ask questions
 - There are no dumb questions

- This is not official CERT or FEMA training material

- Thank you to John Nourse for reviewing this material & providing suggestions
 - John is a great contributor & teacher to our CERT radio community

MURS Radio Training

- Agenda
 - **Why radios?**
 - MURS Radio Training - Train the Trainers
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CERT: Why radios?

- What do we use for communications in the US?
 - 80% of people have smartphones (wireless)
 - 80% of people have internet at home (wired & wireless)
 - 25% of homes still have landlines (wired, mostly digital/voip, traditional analog is going away)
 - Can also have “wireless” landline
- What happens in a big disaster? (natural or man-made)
- Disasters can disrupt the communications infrastructure
 - Equipment damage -> system goes off-line
 - Everybody calling everyone -> System overload & you cannot make or receive calls
 - Calls to Emergency Services cannot get through

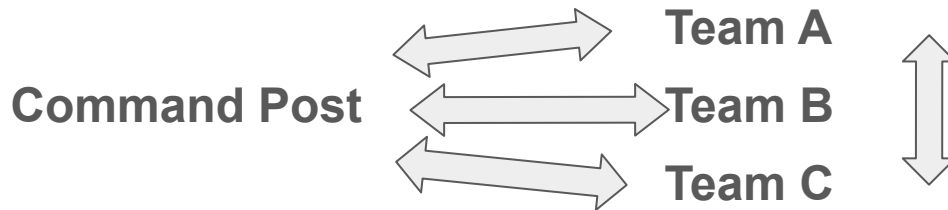
CERT: Why radios?

- CERT Training: We need to be self sufficient for at least 72 hours
 - Being prepared includes communications
 - Radios are a tool for CERT

- Use for emergency communications during a disaster
 - Traditional communications infrastructure may be down
 - Radios allow neighbors & neighborhoods to talk & share information

Radios for emergency communications (EMCOMM)

- Example: CERT & Radios during an Earthquake
 - Your CERT training kicks in
 - Make sure you & your family are safe
 - Next phase - Help our neighbors & the neighborhood
 - Setup CERT Command Post (CERTs & Neighborhood Leaders)
 - Organize Teams to assess situation in the neighborhood (Teams = CERTs + volunteers)
 - Check for injuries & building damage, do welfare checks
 - Use radios for communications between the Command Post & Teams on the ground



MURS Radio Training

- Agenda
 - Why radios?
 - **MURS Radio Training - Train the Trainers**
 - You're trained - what is next?
 - Why you need a GMRS radio?

Radio Training - MURS (Multi-Use Radio Service)

- This material is specific on the Retevis MURS RT21V radio
 - The RT21V is a good budget radio!
 - MURS = **Multi-Use Radio Service**
 - No license is required to operate a MURS radios
 - For more details, refer to the Retevis RT21V User's Manual (available on retevis.com)
 - Principles discussed here will apply to other radio models & types

- Purpose of this section
 - Train you (Neighborhood Leaders) on use of the MURS RT21V radio
 - Provide you with knowledge to train your neighbors & team members

Radios - MURS (cont.)

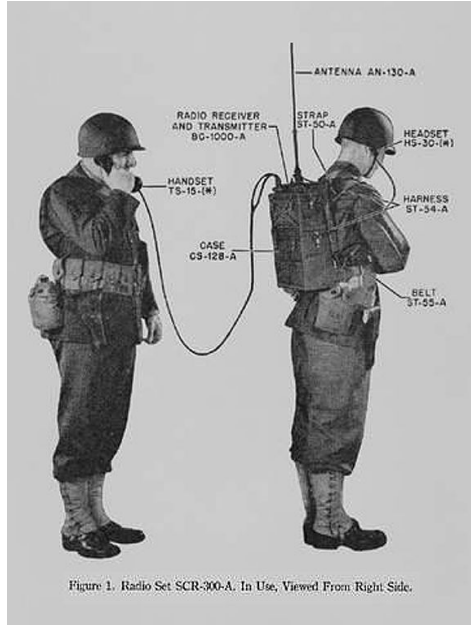
- MURS radios can be used for “short range” communications
 - Maximum range about 0.5 mile walkie-talkie to walkie-talkie
 - With a “base station” antenna -> can be up to 0.75-1 mile
 - Actual range will depend on terrain, structures, antenna, weather, etc.
 - Evaluate your radio in your neighborhood to know its capability
- This type of radio is also known as a 2 way radio
 - 1. Transmit (transmitter)
 - 2. Receive (receiver)
 - Also called a “transceiver” (trans = **trans**mitter & receiver = **recei**ver)
 - Other names
 - Walkie Talkie
 - HT (Handie Talkie or Handheld Transceiver)

Fun Facts about the “Walkie Talkie” Name

- These radios are usually known as Walkie Talkies by the public
- Amateur radio operators (aka Hams) call these HT’s, abbreviation for:
 - Handie Talkie - Motorola trademark
 - Handheld Transceiver
 - The first Walkie Talkie was developed for WWII by Motorola and was a backpack radio
 - Shortly after, they made a “handheld” Walkie Talkie (Handie Talkie)
 - Motorola trademarked the name: Handie Talkie
 - To avoid trademark issues, other manufacturers used the name Handheld Transceiver
- I call them: Walkie Talkies, HT’s, 2 Way Radios

“Walkie Talkie” Name (cont.)

First Walkie Talkie



Photos from wikipedia.com

Handheld Walkie Talkie



Radios - MURS (cont.)

- Some technical things about MURS
 - There are 5 MURS channels (151.82, 151.88, 151.94, 154.57, 154.60MHz)
 - MURS uses Frequency Modulation (FM)
 - MURS operates in “line of sight” propagation
 - Maximum transmit power is 2 watts
 - The RT21V radio has a removable antenna
 - Connecting the RT21V to a base station antenna will improved its range

- For specific rules & regulations concerning use of MURS radios, please go to the [fcc.gov](https://www.fcc.gov) website

MURS Radios

- What radios are compatible with MURS?
 - MURS radios can talk only with MURS radios
 - Cannot talk with other types of radios (GMRS & ham)
 - The radios must be on the same channel to communicate
- MURS radio privacy
 - Your communications are NOT private (same as GMRS & ham radios)
 - Other MURS radios can hear what you say
 - Do not say anything on the air you consider private & personal
- Radio assembly
 - Some “minor” assembly is required when you receive radio from the supplier
 - Suggestion: Have a “diy” person assemble the radios before distributing
 - Or assemble as a group under the direction of someone
 - Initial programming required -> already done on your radios

Assembly

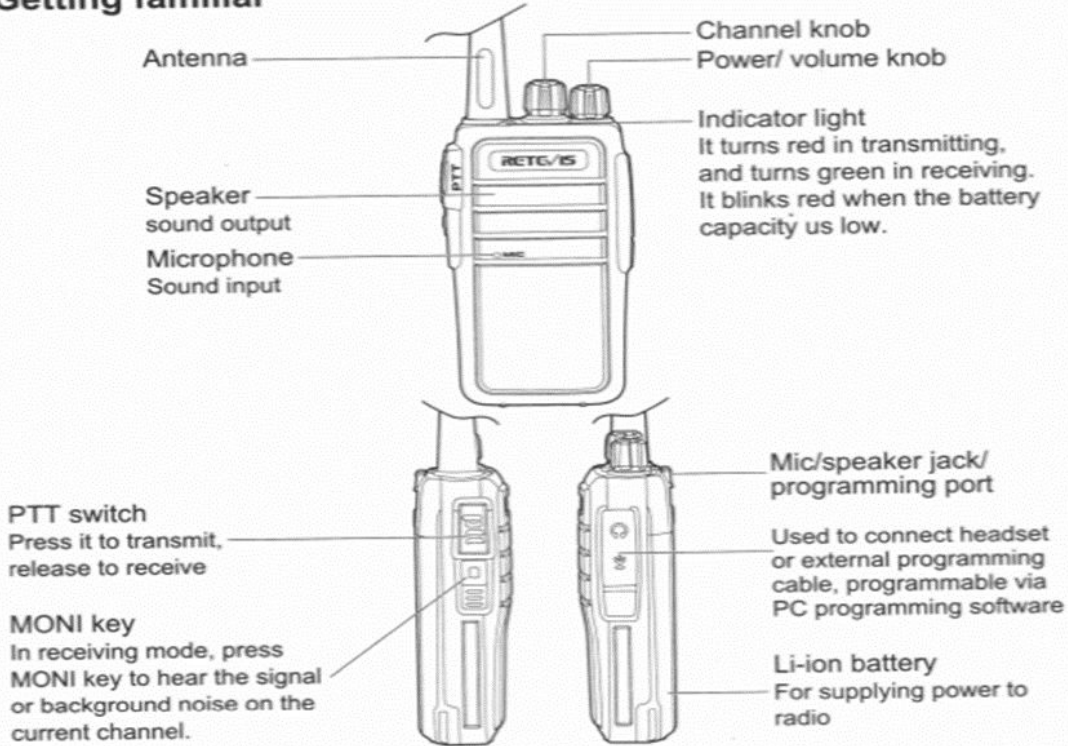


- Belt Clip - Attached to the back of the radio with 2 small screws (phillips screw head)
- String/Wrist Strap - Attach through the small hole on top of the belt clip
- Antenna - See later section: RT21V - Antenna

RT21V - Getting Familiar (retevis.com)

RETEVIS

Getting familiar



RT21V - Power/Volume Knob

- Power/Volume Knob

- To turn the radio off -> turn fully counter-clockwise until there is a “click”
 - Note: This radio does not have an indicator light to show that it is ON
 - Remember to turn the radio OFF after use -> otherwise the battery may become discharged
- To turn the radio on -> turn clockwise
 - Radio will beep and
 - Radio will announce the channel
 - If you don't hear anything, turn the volume higher
- Radio volume
 - To increase volume -> turn clockwise
 - To decrease volume -> turn counter-clockwise
 - Radio is off (no volume) at about 6 o'clock -> good place to start volume is at about 11 or 12 o'clock (after hearing radio transmission, you can adjust)

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RT21V - Channel Knob

- Channel Knob
 - There are 5 channels (MURS 1 - MURS 5)
 - Note: This radio does not have a visual indicator of the selected channel
 - When you change the channel, the radio will announce the selected channel (volume must be above minimum)
 - To communicate with another radio, both radios must be on the same channel
 - To communicate with your team, all radios must be on the same channel

RT21V - PTT Switch & Indicator Light

- PTT Switch (Push Io Talk)
 - Press PTT Switch to transmit on the radio
 - With radios, you cannot speak and listen at the same time
 - Press PTT to talk (transmit)
 - Release PTT to listen (receive)
 - Note Indicator Light located between Antenna & Channel Knob
 - It will tell you the radio is transmitting or receiving
 - Also will tell you if the battery is low
 - To transmit
 - Press & hold PTT switch (puts radio is in TRANSMIT mode)
 - Wait for 2 seconds before speaking -> Speak slowly & clearly
 - When you press PTT -> Indicator Light will turn RED
 - Release the PTT Switch after speaking

PTT / Indicator

- PTT Switch (cont.)
 - When PTT Switch is not pressed, radio is in RECEIVE mode
 - You can hear the other people speaking on the radio
 - Adjust the volume as needed
 - When the radio is receiving, the Indicator Light will turn GREEN
 - The Indicator Light also shows the battery status
 - If Indicator Light BLINKS RED, battery capacity is low & needs to be charged

RT21V - MONI Key

- On other radios: known as the Monitor Key (“MONI”tor)
 - If you do not hear anything on the radio
 - Press the MONI Key and you will hear the background noise on the current channel
 - There may be a situation where a weak signal is coming from far away
 - Pressing the MONI Key may allow you to hear the weak signal (will not be clear)
- A common beginner mistake is pressing the MONI Key instead of the PTT Switch -> easy to mix up because they are near each other
 - Reminder: The PTT Switch is BIGGER than the MONI Key
 - Press & hold the PTT Switch to **TRANSMIT**
 - Press the MONI Key to hear radio background noise (**RECEIVE**)
- Tip: Use nail polish or tape to highlight the area near the PTT

RT21V - Antenna

- Installing Antenna
 - Note: Do not transmit without antenna connected (may damage radio electronics)
 - The antenna is attached to the top of the radio
 - Slowly screw the antenna on the radio (clockwise)
 - Observe “space” between the bottom of the antenna and top of the radio -> once antenna touches the top of the radio -> stop
 - Then go down another $\frac{1}{2}$ turn (do not overtighten)
 - Caution: Do not hold the radio by the antenna -> you may damage the antenna or antenna connector

This radio is not water resistant

- The antenna may come with a plastic gasket/washer
 - Put the threaded portion through the inner hole of the gasket
 - Gasket helps to make the antenna connection water resistant
 - But the rest of the RT21V radio is not water resistant

This radio is not water resistant (cont.)



If you need to use the radio in a wet environment

- Put the radio in a plastic bag -> supermarket produce bag
 - Tie knot around the antenna (do not tie with anything metal)
 - Will be able to operate PTT & knobs through the bag
 - You may need to increase the radio volume & speak louder
-
- Will provide some water resistance -> don't go swimming with it!

RT21V - Speaker & Microphone

- Speaker

- Note the position of the speaker
 - If you don't hear anything, increase the radio volume
 - If you still don't hear anything, press MONI Key & you should hear static
 - No static? Your radio is off or battery is low

- Microphone

- Note the position of the microphone
 - Microphone opening is at the lower left of the speaker
- Speak toward the microphone when transmitting

How to use Radio for Best Performance - Tips

- Recap
 - These are 2 way radios
 - They TRANSMIT & RECEIVE (transceiver)
 - Press & hold PTT to TRANSMIT
 - Release PTT to RECEIVE
 - Radios must be on the same channel to “talk” with each other

- How to hold radio
 - Hold the radio with the microphone opening about 4 inches from your mouth
 - You may adjust distance depending on feedback from the receiving station
 - You may want to hold the radio slightly off-center -> to have speaker a little toward your ear

Tips (cont.)

- To speak (TRANSMIT)
 - Press & hold the PTT (Push to Talk) Switch to put the radio in TRANSMIT mode
 - Wait 2 seconds before speaking
 - Speak toward the microphone
 - Speak slowly & clearly
 - Keep your message short & concise
 - See section on Basic Radio Terms
 - When you finish speaking -> release the PTT Switch

Tips (cont.)

- To listen (RECEIVE)
 - When PTT Switch is not pressed, radio is in RECEIVE mode & you can listen
 - Adjust volume as needed (better to have volume higher than too low)
- Do not interrupt if you hear other people talking -> wait until there is a gap in the conversation
 - Exception: It is ok to interrupt if it is an emergency
- Use NATO Phonetic Alphabet to spell out words to increase clarity ...More on this later

How to get Maximum Radio Range

- Use the radio outdoors
- Fully extend your telescopic antenna
 - Do not use stubby/short antennas -> they provide less range than longer antennas
- Keep the antenna vertical
- MURS radios operate in “line of sight” propagation
 - Radio waves travel in straight line from transmitting antenna to receiving antenna
 - Changing your position & orientation may improve radio performance
 - Higher elevation
 - Clear view (no obstruction)
 - Caution: Be careful & safe when you move around for better reception/transmission
 - Be aware of your surroundings when you are moving to optimize your signal
 - Don't fall or walk into something

Radio Battery & How to Charge

- Before using a new battery
 - Fully charge a new radio battery before using

- Reminder: This radio does not have an indicator light to show it is on
 - Do not leave your radio on after use or the battery can become fully discharged over time
 - And the radio will not be available when you need it

Radio Battery & How to Charge

- How to charge the battery
 - Turn the radio OFF
 - Plug the charger to a 120VAC outlet (or a 5VDC USB outlet)
 - Insert the radio vertically to the charger base, make sure the battery & charger is making good contact
 - The light on the charger base will indicate the charging status
 - RED - charging
 - BLINKING RED - battery fully discharged (see next page)
 - GREEN - fully charged
 - It will take about 2-3 hours to fully charge the battery
 - Remove battery from the charger after it is fully charged
 - Do not leave battery in charger for extended period after it is fully charged
 - If charger light does not turn green after charging for 2-3 hours -> remove radio from the charger & re-insert to check battery charge status

Radio Battery & How to Charge

- How to charge a fully discharged battery
 - If the charger light is RED & BLINKING when you first insert the radio for charging -> this means the battery is fully discharged
 - Leave the battery in the charger
 - If the battery is good & can be charged -> charger light will go from BLINKING RED to SOLID RED in about 30 minutes
 - When it goes SOLID RED -> normal charging will start
 - It will fully charge in about 2-3 hours and charger light will turn GREEN
 - If the indicator light continues BLINKING RED after 30 minutes, the battery may be bad and needs to be replaced

Radio Battery & How to Charge

- How often should the battery be charged?
 - As a CERT, you want your radio charged and always ready
 - However: Do not leave the radio in the charger continuously
 - A charged battery will maintain a charge for about 2 months (if radio is off)
 - Charge the battery each time after using the radio
 - If the radio hasn't been used for 1 month -> charge the battery

- Keep the radio OFF when it is in the charging base

How to Charge when PGE is down

- How to charge the radio if electricity is not available
 - The battery charger needs 120VAC for the USB charger (5VDC) -> What to do if 120VAC is not available?
 - Many newer cars have a USB charger outlet which can charge your battery
 - If your car has a cigarette lighter socket -> you can get a USB charger which plugs into the lighter socket to charge your battery (you may already have one)
 - Other possibilities for charging the radio when PGE power is off
 - Some newer cars even have a 120VAC outlet
 - You may have a USB battery pack or a car jumper pack a with a USB outlet
 - Check the USB connector on your charging device to confirm that it is compatible with the radio cable (best to do before an emergency)

Radio Programming

- Your RT21V radio has been programmed & ready to go
- For this particular MURS radios: you will not require any re-programming in the future (most likely) -> we will let you know
- We do not recommend a untrained beginner to change the programming
 - You may make the radio incompatible with the other radios & not be able to talk with them

NATO Phonetic Alphabet (Spelling Alphabet)

A	Alpha	H	Hotel	O	Oscar	V	Victor
B	Bravo	I	India	P	Papa	W	Whiskey
C	Charlie	J	Juliet	Q	Quebec	X	X-ray
D	Delta	K	Kilo	R	Romeo	Y	Yankee
E	Echo	L	Lima	S	Sierra	Z	Zulu
F	Foxtrot	M	Mike	T	Tango		
G	Golf	N	November	U	Uniform		

The NATO Phonetic Alphabet is used to spell words over the radio for clarity. For example, the letters “B” (bee) and “P” (pee) can sound similar, especially if there is radio static. Using the phonetic alphabet you can say “Bravo” for “B” or “Papa” for “P” to avoid confusion.

Use the phonetic alphabet to spell out words clearly.

Example: You want to report there is an injured person at 123 “Park” Street -> spell “Park” as “Papa - Alpha - Romeo - Kilo” to avoid misunderstanding.

Talking on the Radio

- Static & Interference can interrupt a radio conversation
- For the person speaking (transmitting)
 - Speak slowly & clearly
 - Keep your message short & concise
 - Use NATO Phonetic Alphabet on critical information
- For the person listening (receiving)
 - Acknowledge that you heard the message -> say “copy” or “roger”
 - Repeat back critical information to confirm
 - Use NATO Phonetic Alphabet on critical information

Basic Radio Terms

Term

Affirmative

Negative

Radio check

Do you copy?

Loud and clear

Copy

Roger

Say again

Come again

Go ahead

Break

Stand-by

Over

Out

Clear

Meaning

Yes

No

How is my signal?

Can you hear me?

Your signal is good

Message Understood

Message Understood

Repeat your message again

Repeat your message again

I am ready to receive your message

Interrupting transmission with urgent matter

Your message received, but I am unable to reply
right away

My message is over, waiting for your reply

End of my transmission

End of my transmission

Avoid use of “coded” terms

Examples:

- *10-4 (Roger)*

- *QTH (What is your location?)*

Examples of Radio Exchanges - corrected 7/19/23

- Rover 1 Command Post, Rover 1
- Command Post Rover 1, go ahead
- Rover 1 Bernal Church shelter needs bottle water and blankets
- Command Post Roger, Rover 1

- Command Post All stations, Paseos net control, for health and welfare check. Please respond with your status. Rover 1, status?
- Rover 1 Rover 1 location is 1234 Sea, I spell Sierra echo alpha, Court. Continuing damage assessment

- Rover 1 Rover 1 with emergency traffic
- Command Post This is Paseos net control, go ahead
- Rover 1 We have a downed power line at Avenida Rotella and Via Del Oro
- Command Post Break. Any station in vicinity of the fire station, please advise duty officer of downed power line

MURS Radio Training

- Agenda
 - Why radios?
 - MURS Radio Training - Train the Trainers
 - ***You're trained - what is next?***
 - Why you need a GMRS radio?

You're trained on MURS Radios

What is next?

- You (Neighborhood Leaders) have received training on radios
 - What is next?
- 1. Train the people in your neighborhoods on how to use the radio
 - Use this material & make it hands on
 - Encourage your team & neighbors to get CERT trained
 - **PRACTICE, PRACTICE, PRACTICE!**

What is next? - 4 Things

- 2. Radio range test in your neighborhood -> how far can your radio can go?
 - Do this after training (you can do with a few as 2 people)
 - What range testing will tell you: Can the radio cover your neighborhood?
 - Things you want to decide & confirm:
 - Where will your CERT Command Post be?
 - Can the radios reach your Teams throughout the neighborhood
 - Do you need a base station antenna at the Command Post?
 - ...Be prepared, do this before an emergency
 - **PRACTICE, PRACTICE, PRACTICE!**

What is next? (cont.)

- 3. Use radios in neighborhood activities (for training & practice)
 - What we have done in D10 Los Paseos
 - National Night Out - CERT recruiting & radio demo
 - Dumpster Day - radio for traffic control & coordination
 - Lake Almaden 4th of July - CERT volunteers, event coordination
 - **PRACTICE, PRACTICE, PRACTICE!**
 - Other ideas for radio practice in your neighborhood
 - Neighborhood events (National Night Out, sports game, etc.)
 - Church or school festival
 - Any event where you have people

What is next? (cont.)

- 4. Schedule radio exercises
 - What we do in D10 Los Paseos
 - Radio exercise every 3 months
 - Morning & Evening session, 15 min. max/session
 - We have 13 homes with radios
 - Radio exercise participation: 50-65%
 - Why we do exercises:
 - Keep the radio team prepared
 - Remind team to charge their radio
 - Practice use of the radio
 - **PRACTICE, PRACTICE, PRACTICE!**

MURS Radio Training

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 - MURS Radio Training - Train the Trainers
 - You're trained - what is next?
 - ***Why you need a GMRs radio?***

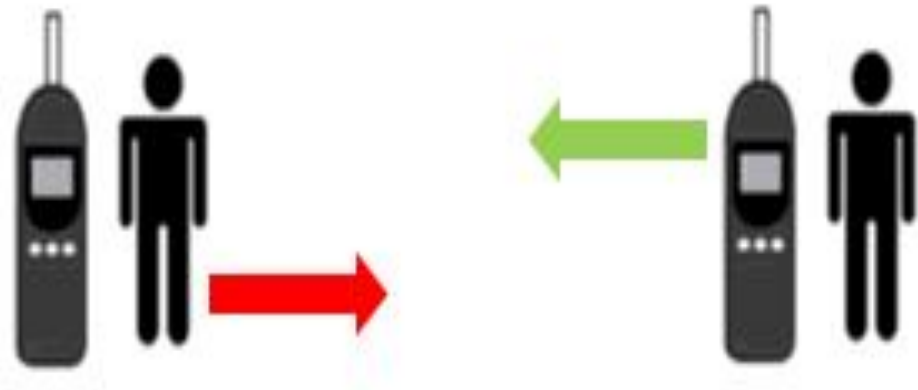
Why you need a GMRS radio?

- MURS is good for your local neighborhood
 - To talk with the Neighborhood Teams on the ground
 - To relay information between Teams & Command Post
 - Everyone can use MURS radios - license is not required
- MURS cannot transmit over long distances, because they are low power
- You will need higher power radios to reach outside of your neighborhood
 - These radios will be:
 - GMRS = General Mobile Radio Service
 - Amateur Radio (Ham)
 - MURS is not compatible with GMRS & ham radios
 - GMRS & ham radio both need a license, plus ham requires passing test

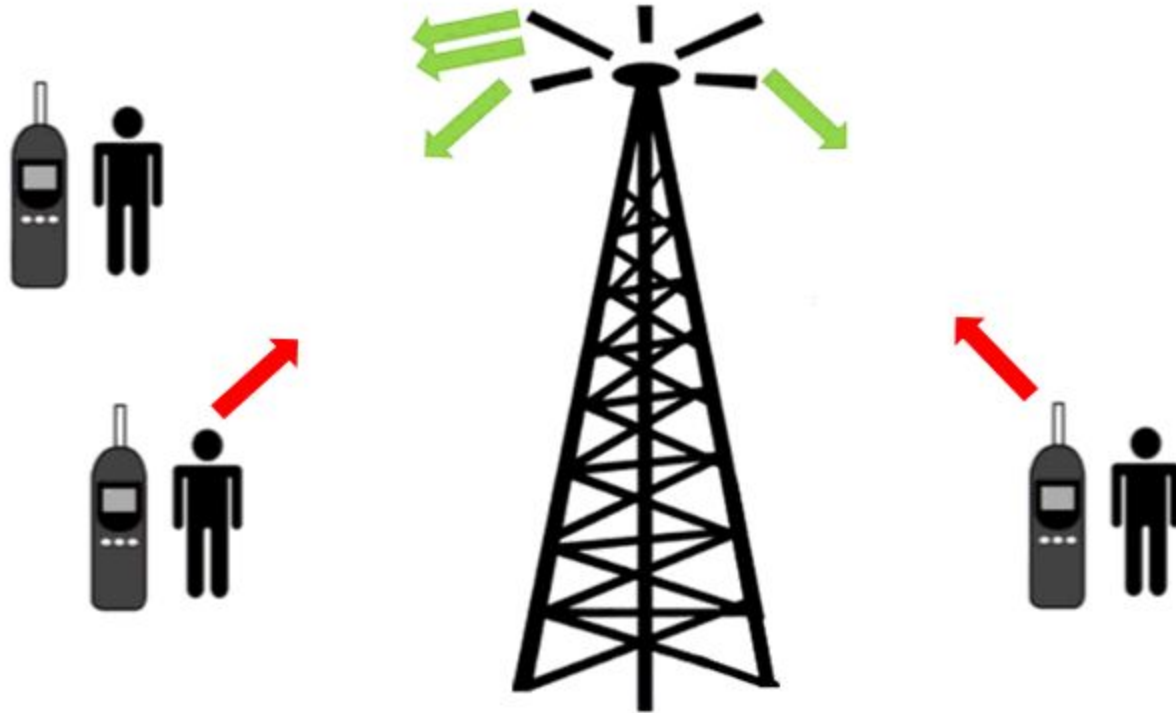
GMRS Radio

- In a major disaster -> Traditional communications may be DOWN
- Need to reach City emergency services (SJ DDO's & EOC)
 - DDO = District Disaster Office EOC = Emergency Operation Center
 - To provide information on neighborhood condition & status
 - To request for aid & support
- Having radios will not guarantee we will be able to reach emergency services
 - > but we need to be prepared
 - In addition: Many CERT & radio issues still need to be defined & implemented (more later)
- With a GMRS radio, you will be able to:
 - Reach other GMRS radios outside of your neighborhood (2-3+ miles)
 - Reach GMRS repeaters which can relay communications farther out
 - Repeater is a radio stations at higher elevation which receive your radio signal and “repeat” it from their higher elevation to other locations farther away (10+ miles away)

Radio to Radio (Simplex)



Radio Repeater



Radio Comparison: MURS vs. GMRS

- Your neighborhood will need at least one GMRS mobile radio (to reach Repeaters)
- GMRS radio is superior → Higher power, repeater capable & greater range
- License fee and higher radio cost may prevent widespread adoption in your neighborhood
- If you choose GMRS walkie-talkies only, will you be have enough people with radios?
- Option: Some GMRS with mostly MURS

	MURS	GMRS
License Requirement	License Free	License Required - \$35/10 yrs for individual+family No test required
Radio & Antenna Cost	Handheld \$20+ Telescopic antenna +\$5 Base antenna/cable +\$75	Handheld \$50+ Mobile \$120+ plus need Base antenna/cable +\$75
Transmit Power	Handheld 2W	Handheld 5W, Mobile 20-50W
Repeater Capable	No	Yes
Radio Range	0.5-0.75++ mile	Handheld 3 miles Mobile 10 mile w/repeater

CERT GMRS Repeaters

- GMRS Repeaters in San Jose for CERT Use
 - CERT1* - Mt Pleasant, East SJ
 - CERT2* - Willow Glen, West SJ
 - Zello** - Santa Cruz Mountains
 - Bandit** - Alum Rock, East SJ (new)
 - CERT3 - future City of SJ EOC repeater in under construction Office of Emergency Management (Senter & Phelan)

Notes: *CERT1/2 setup by J. Nourse

**Private repeaters - owners allow CERT use

SJ CERT Radio Frequency Assignments



San Jose CERT Radio Frequency Assignments

Ch	Name	Receive Frequency	Transmit Frequency	Tone Mode	Encode rToneFreq	Decode cToneFreq	Encode DTCS Code	Decode DTCS Rx Code	DtCS Polarity	Cross Mode	Mode	Skip	Comment
1	AVPSN			TSQ	100.0	100.0			MM		MEM		Private Business Band Channel

- CERT Radio Frequency Assignments -> Living Document
 - Updated & maintained by J. Nourse
 - In alignment with Almaden Valley CERT assignments
 - Include
 - GMRS CERT repeaters
 - GMRS District channels (D1-D10)
 - GMRS Tactical channels
 - ...Plus SJ RACES/ham, AVPSN, MURS, etc.
 - Your GMRS radio will come programmed with the GMRS channels

Unofficial DRAFT - CERT Radio Hierarchy

District 5 Command Posts

Neighborhood A (GMRS) —> }

Neighborhood B (GMRS) —> } -----> D5 DDO (GMRS) }

Neighborhood C (GMRS) —> } **District Disaster Office** }

} -----> EOC CERT3 (GMRS)

Neighborhood D (GMRS) —> }

} **Emergency Operation Center**

Neighborhood E (GMRS) —> } -----> D6 DDO (GMRS) }

Neighborhood F (GMRS) —> }

District 6 Command Posts - Within Neighborhoods would be MURS or MURS+GMRS or other radios

Many CERT & Radio Issues still need to be defined & implemented

-CERT3 not yet online & DDO's not defined

-Neighborhood progress varies -> need work

-Some areas will be supplemented by Ham, Ham data & other radios (AVPSN)

-Define how SJ RACES, CERT & EOC will communicate with GMRS, Ham & Ham data

Weekly CERT & EMCOMM Radio Check-ins

These are in place now - **PRACTICE!**

- Weekly GMRS Repeater Check-ins
 - CERT1* - Tue. 7:00PM
 - CERT2* - Tue. 6:50PM
 - Bandit - Tue. 7:15PM <- new started 07/11
 - Zello - Sat. 3:00PM

*Can also check-in with VARA FM (data over ham radio)
- Ham Repeater Check-ins
 - W6UU** - Tue. 7:40PM - SJ RACES (Radio Amateur Civil Emergency Service)
 - WA2IBM - Mon 7:00PM - ARC (Almaden Radio Club)

**Can also check-in with Packet radio (data)
- Almaden Valley AVPSN has daily check-ins on their private business band
- ...There are others

Conclusion

- You are now trained on the RT21V MURS radio
- Go out and train your team & neighbors
- PRACTICE, PRACTICE, PRACTICE!
- Conduct MURS radio range testing in your neighborhood to know how far your radios will work - Will help you decide:
 - Where to set up a Command Post in an emergency
 - If you need base station antenna for your Command Post
- Practice -> Use the radios in your neighborhood events
- Schedule radio exercises -> keep practicing
- Get your GMRS license (will provide info)
- Thanks! Contact me if you have questions/comments: rmacwhy@gmail.com