# Amateur Radio Communications

This presentation is intended to provide useful operating information to new amateur radio operators. The material has an emphasis on emergency operation and the Clatsop County region.

Slides were created by Dale Mosby, K7FW. Please bring any errors to my attention.

# Amateur Radio Communications

## The Useful Stuff

- Radio services
- FCC, Rules, what you can and cannot do
- Frequencies – local and long range (HF, VHF, UHF)
- Simplex and repeaters – Clatsop County Repeaters
- Frequency list for our area
- Equipment – handheld and mobile, antennas and batteries
- Programming your radio
- Digital communications
- FEMA
- Communications in a disaster
- Antennas – more about them, some options and examples

[ The latest version of this document may be found at www.archcape.com/radio/training ]



The intent of this talk is to provide information useful in every day radio operation as well as in an emergency. The slide set as well as slide notes are intended to serve as a useful reference.

This is not intended to be a training class to obtain an amateur radio license.

The latest version of this slide set along with other radio related resources can be found at: www.archcape.com/radio/training

Please report any errors to dale@archcape.com

## Radio Services

- FRS – Family Radio Service
  - No license, low power, short distance, simple radio
- GMRS – General Mobile Radio Service
  - License is $70 for entire family for 10 years, no test
  - Higher power, overlap channels with FRS, more options than FRS
- Public Safety Spectrum
  - Police, fire, etc.
- Amateur Radio (HAM)
  - Test required, 3 license levels with increasing privileges
  - High power allowed, many communication methods and options



The radio spectrum is measured by frequency. Typically a particular radio service has some range of frequencies within the radio spectrum. We use the term “band” to define a block of frequencies, usually with a specific function or behavior.

The amateur radio service has been allocated many sections of the radio spectrum where operation is allowed.

In addition to the services listed there are many others such as marine VHF, business band, television, cell phone.

## Radio Services - FRS

- Family Radio Service - FRS
- FRS is what CB (Citizens Band) would have been had simple FM technology existed in 1958.
- Unlicensed short range communication.
- Inexpensive radios $13 to $35
- 22 channels
- Fixed antenna and one half or two watts depending on channel.



Family Radio Service (FRS) radios are inexpensive and simple to operate. They have 22 channels and a fixed antenna. Range is very limited on level ground, likely less than a mile in “real world” conditions. An ad for a Motorola Talkabout T600 FRS radio states “range up to 35 miles”. This sort of range is only going to work if one radio is on a mountain top and the other radio has line of sight to the other radio. In a neighborhood environment a mile range would be optimistic.

## Radio Services - GMRS

- General Mobile Radio Service - GMRS
- 30 channels, 22 of which are shared with FRS.
- Can run higher power than FRS (other than 7 channels)
- 8 channels that allow a repeater
- Allow removable antenna – such as mag-mount
- License is $70 for 10 years covers all family members



GMRS is similar to FRS. They share the same frequencies. GMRS can use higher power and also use an external antenna which will give the best improvement in range.

FRS and GMRS advertising make statements such as 22 channels each with 121 Privacy Codes totaling 2,662 combinations". The "privacy code" only prevents a radio from opening squelch unless another radio uses the same code. There are still only 22 channels and anyone not using a privacy code will hear you talking even if you are using a code. There is nothing "private" about the conversation. Two people talking at the same time on the same channel will interfere with each other.

## Radio Services – Amateur (HAM)

- 3 license classes
  - Technician, General, Extra
- Increasing frequency range privilege with each advancing class
- Can use high power, depending on frequency up to 1500 watts
- Test required, about $15
- License good for 10 years, no cost to renew
- About 800,000 amateur operators in the USA



Amateur radio is constantly changing regarding testing requirements and licenses issued. The requirement for Morse code for some licenses was dropped in 2007. While there are technically 5 amateur radio license classes only 3 of those are now issued (Technician, General, Extra). Novice and Advanced classes are still valid but no longer issued.

Each class requires a test and grants the use of additional frequencies. The Technician license grants use of VHF and UHF frequencies common to hand held radios and mobile radios used for local communication.

## FCC Rules & Amateur Radio
## What You Can and Cannot Do

- Must hold a license – 3 license classes
- Depending on frequency up to 1500 watts – high power
- Can build your own equipment
- Cannot receive compensation – not for profit
- Cannot “broadcast” - no one-way transmission or music
- Must identify by call sign every 10 minutes and at end of last transmission.
- No assigned or exclusive frequencies – must share



Amateur radio operators cannot receive compensation and amateur radio frequencies cannot be used for business purposes. This means that as a ham you cannot charge for your communication services. This also means that if you own a business you cannot use ham radio to run the business – for example a delivery company cannot use the amateur radio bands to talk to their trucks.

You can volunteer for public service events and use amateur radio. For example the Hood to Coast race makes extensive use of amateur radio for course communications.

## Amateur Bands (Frequency Range)

- HF – High Frequency
  - "Short Wave" - long distance, around the world communication
- VHF – Very High Frequency
  - Line of sight – short range or extended by a repeater
  - Common handheld radio
- UHF – Ultra High Frequency
  - Line of sight – short range or extended by a repeater
  - Common handheld radio
  - GMRS and FRS frequencies near this ham band



What is known in amateur radio as "HF" or "High Frequency" is by modern technology standard actually fairly low frequency. This is in the "short wave" band and can be used to talk across the country or around the world. Antennas are typically fairly large and power levels high (100 to 1000 watts).

The amateur VHF band is 144 to 148 MHz.

The amateur UHF band is 420 to 450 MHz.

Signals in the VHF and UHF bands are generally line of sight meaning that communication is possible when the two radios can see each other. Repeaters on mountain tops extend the range.

In addition to HF, VHF, UHF frequencies amateurs can use microwave frequencies up to several gigahertz.

## Simplex Operation

- Simplex means direct communication between two radios.
- Both radios use the same frequency.
- One radio transmits and the other receives.
- Hand held range on level ground a mile or so.
- Mobile range on level ground a few miles due to better antenna.
- Best operating practice calls for using simplex when possible and at the lowest power level that allows communication.

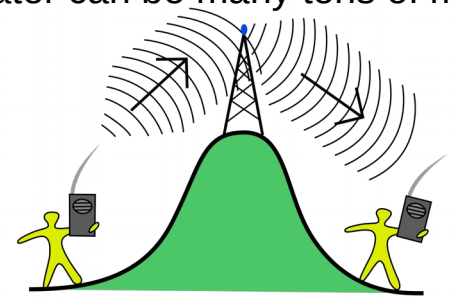


Simplex is radio to radio communication. With hand held radios the distance is limited by the things between the two antennas. If both handheld radios are on mountain tops the possible distance for communication can be quite a long distance. With both radios on the ground the range will be short, maybe a mile or so. If there are hills between the two radios the range will be quite limited.

With radios in automobiles the big increase in range will come from having a better antenna on the car. A simple magnetic mount (mag-mount) antenna will make a big gain in distance of communication. Mobile radios also run higher power than a handheld radio.

## Repeater Operation

- A repeater is an intermediate radio site located on high ground.
- A repeater listens on one frequency and transmits that signal on another frequency simultaneously.
- Users listen on one frequency and transmit on another frequency.
- Range with a repeater can be many tens of miles with line of sight.



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A radio repeater located on a hill tries to give both hand held radios line of sight communication to the repeater antenna. This greatly increases the possible communication range.

A repeater directory will give the approximate location of a repeater, often the nearest city. The directory also gives the output frequency, offset, and tone if any needed to activate the repeater.

Good operating practice is to make contact on a repeater and if both radios are close enough to talk simplex then move to a simplex frequency in order to free up the repeater for someone else to use.

## Repeater Operation

- You listen on one frequency – the repeater output.
- You talk on another frequency – the repeater input.
- When you transmit your radio automatically changes frequency.
- The difference between receive and transmit frequency is called the “offset” - a value added or subtracted from the receive frequency.
- The offset value depends on the frequency used – some conventions specify the value.
- The radio may add a very low frequency tone to activate the repeater.



The repeater consists of a radio receiver and a radio transmitter that are able to operate at the same time. Repeaters usually use a single antenna for both transmit and receive so the hard part is use of components called “cavities” or “duplexers” that allow this sharing of a single antenna.

Some radios know how to change frequency between transmit and receive when using a repeater. Other radios must be programmed with one receive frequency and one transmit frequency.

As the radio frequency spectrum becomes more crowded it is becoming common for repeaters to require a low frequency tone to be sent along with the voice signal to activate the repeater.

## Oregon Repeater Examples

| Name | Output (you listen) | Input (you transmit) | Offset | Tone |
|---|---|---|---|---|
| Arch Cape | 146.740 MHz | 146.140 MHz | - 600 KHz | 118.8 Hz |
| Megler | 440.925 MHz | 445.925 MHz | + 5 MHz | 118.8 Hz |
| Mount Hood | 147.120 MHz | 147.720 MHz | + 600 KHz | 100.0 Hz |
| Gold Beach | 146.740 MHz | 146.140 MHz | - 600 KHz | 88.5 Hz |
| Florence | 441.100 MHz | 445.100 MHz | + 5 MHz | DCS 125 |



A repeater directory provides a list of the available repeaters in each area. You can find repeater listings on the Internet and also in book form from the ARRL.

Normally only the repeater output frequency and offset direction (“+” or “-”) is given. Often your radio will compute the input frequency automatically by knowing the proper offset for that input frequency. If it does not you may have to compute the input frequency and enter that manually.

## Repeater Tone

- CTCSS, Tone, PL
  - Continuous Tone Coded Squelch System
  - A continuous sub-audible tone that activates a radio or repeater
  - Reduces repeater interference by preventing unwanted activation
  - Older system, most commonly used
- DCS
  - Digitally Coded Squelch
  - A three digit number sent by sub-audible tone
  - Newer system, more common on public service than amateur
- Privacy codes (tones) as they are sometimes called DO NOT prevent anyone from hearing you. They just prevent you from hearing others.



Most repeaters use a sub-audible tone to minimize interference. Because repeaters are typically on mountain tops with lots of other radio equipment they are in a place with a lot of RF interference. To prevent activating due to stray RF the repeater can be programmed to look for a low frequency tone on the incoming signal.

Motorola was an early developer of this technology and called it “Private Line” which is where the term “PL code” comes from.

Despite the term “private” anyone can hear you. A radio can be set not to activate unless a designated tone is used so while some people may not hear a conversation anyone not using a tone will hear it.

## Clatsop County Repeaters

- Linked together – W7BU
  - Megler – just across the Columbia River
    - 146.450 (-) Tone 118.8
    - 440.925 (+) Tone 118.8
    - EchoLink W7BU-R
  - Youngs River – 444.850 (+) Tone 118.8
  - Gearhart – 146.800 (-) Tone 118.8
  - Arch Cape – 146.740 (-) Tone 118.8
  - Wickiup – 442.500 (+) Tone 118.8
  - Nicolai – 146.76 (-) Tone 118.8
- Seaside – 146.490 (-) Tone 118.8
- Seaside – 443.875 (-) Tone 100.0/100.0
- Wickiup – 146.66 (-) Tone 118.8



Popular repeaters covering the Astoria area are located on Megler Mountain just across the river. This is also where KMUN has a transmitter.

Transmitting on any one of the linked repeaters allows communicating with a use on another one of those repeaters.

You can also operate the linked repeaters using EchoLink software on your cell phone from any location. You may hear some people on the Monday night ARES net check in with EchoLink.

# Repeater Offset Algorithm

- A repeater directory typically lists the repeater output, offset, and tone. Additionally “open” or “closed” and “autopatch” may be listed. The offset formula (for most) repeaters is:

| Frequency | Offset |
|---|---|
| 146.61 to 146.97 MHz | - 600 KHz |
| 147.00 to 147.39 MHz | + 600 KHz |
| 440 to 445 MHz | + 5 MHz |
| 447 to 450 MHz | - 5 MHz |

KHz = Kilohertz = thousand cycles per second
MHz = Megahertz = million cycles per second



The offset of 600 KHz for VHF meters and 5 MHz for UHF is quite standard. The positive or negative offsets are fairly standard but there may be an exception here or there. A repeater directory should indicate with a “+” or “-” the direction of the offset used.

The repeater directory will also indicate if there is an autopatch and emergency 911 access. Due to the now widespread use of cell phones autopatch and 911 connection is not as useful or widespread as it once was.

The repeater directory may also indicate if the repeater is “open” or “closed”. Most repeaters are open but some are considered closed meaning that they are not intended for public use.

## Repeater Use

- Allow linked repeaters about 2 seconds for the link to complete
- Talking too long will cause a timeout (“the alligator got you”)
- Brief transmission without identifying is “kerchunking” the repeater
- Squelch tail and courtesy tone
  - Courtesy tone indicates time out timer reset
  - Talking immediately after courtesy tone can prevent someone on a linked system from breaking in
- If two people talk at once then:
  - The strongest signal wins – or
  - You hear two mixed signals – a “double”
- PRACTICE
  - Clatsop County ARES (Amateur Radio Emergency Service) net every Monday evening at 7 PM on the W7BU linked repeaters.



A repeater needs a small amount of time to recognize a received signal with the correct tone and then activate the output transmitter. Give a slight pause after keying your radio before talking. Linked repeaters need a bit more time.

Repeaters have a time out timer often around a minute or so. Sometimes in nets you will here someone say “I will let this drop” they will stop talking and then after a pause begin talking again. They are letting the time out timer reset.

Some repeaters have a tone at the end of each transmission. This signals that the received signal has dropped and the timer reset. The other station can then begin talking. On a linked repeater you should wait longer to give other stations a chance to break in.

## Radio Net

- One person is “net control”
- In a directed net all traffic flows through net control
  - You give your call sign
  - Net control calls you
  - You request contact with another station
  - Net control tells you to call that other station (or wait)
  - You contact the other station and when done “back to net”
- Listen to how it is done on the Monday night ARES net



Most nets are “directed nets” in which there is a net control operator that “directs traffic”. If you want to call another station you tell net control the call sign you wish to contact. At an appropriate time the net control will have you call that station.

If you listen to the Monday night ARES net you will here stations saying they wish to make contact with another station after net or more often that they have an announcement they would like to make at the end of the net.

When checking into the net you are expected to remain for the entire net. If you cannot do this after checking with your call sign you would say “requesting an early out”.

## Frequency List

- Program your radio with local repeaters
- Program your radio with standard Clatsop County simplex frequencies
  - https://clatsopauxcomm.org
- Add repeaters for other areas of travel
- Keep a paper list of frequencies and names
- Keep instructions of how to program radio



Clatsop County has set of recommended frequencies for emergency communication use. These can be found on the web. It is recommended that these frequencies be placed at the beginning of radio memory to keep the channel numbers (memory locations) the same for everyone.

Clatsop AuxComm recommends a set of empty channels be left after their recommended set. I do not do this – my theory is that I will simply re-program my radio when the need arises and I do not want to have to skip over empty channels. I just place other useful frequencies after those recommended by the AuxComm team.

## Amateur Radio Frequencies in Clatsop County

| # | Name | RX Freq | TX Freq | Decode | Encode | Group/Notes |
|---|---|---|---|---|---|---|
| 1 | AMTAC1 | 146.52 | 146.52 | OFF | 100 | International Calling Simplex |
| 2 | AMTAC2 | 146.58 | 146.58 | OFF | 118.8 | Oregon Tactical Simplex |
| 3 | AMTAC3 | 147.58 | 147.58 | OFF | 118.8 | Clatsop County Simplex |
| 4 | AMTAC4 | 146.40 | 146.40 | OFF | OFF | Seaside-Simplex |
| 5 | ARCHCP | 146.74 | 146.14 | OFF | 118.8 | South Sounty Linked |
| 6 | GERHRT | 146.80 | 146.20 | OFF | 118.8 | Gearhart Filler Rptr |
| 7 | MEGLER | 145.45 | 144.85 | OFF | 118.8 | Prime Linked Repeater |
| 8 | NICOLI | 146.76 | 146.16 | OFF | 118.8 | East County Linked |
| 9 | U WICK | 442.50 | 447.50 | OFF | 118.8 | SE County Linked |
| 10 | YNGRVR | 444.85 | 449.85 | OFF | 118.8 | Lewis&Clark Filler Rptr |
| 11 | STARS R | 145.49 | 144.89 | OFF | 118.8 | Seaside-Repeater |
| 12 | AMTAC5 | 146.48 | 146.48 | OFF | OFF | Cannon Beach-Arch Cape Simplex |
| 37 | CERT 1 | 441.5625 | 441.5625 | OFF | 100 | Hams coordinating CERT |
| 38 | CERT 2 | 441.5875 | 441.5875 | OFF | 100 | Hams coordinating CERT |
| 39 | APRS | 144.39 | 144.39 | 100 | OFF | Autom Pacdket Reporting System |
| 40 | U CALL | 446.00 | 446.00 | OFF | 100 | UHF-calling frequency |
| 41 | NA1SS | 145.80 | 144.49 | OFF | OFF | Interntl Space Station-Voice |



The Clatsop County AuxComm frequencies can be found on the web at “clatsopauxcomm.org”.

Other useful frequencies can be found at “cbars.org”.

Many radios can display a frequency or a name for each memory location. Some radios display both frequency and name. It is a good idea to keep a paper list with the programming showing name, frequency, and comments for each memory location.

# Equipment – Handheld Radio

- Dual band handhand held is the common entry point for amateur radio
- Best accessory for emergency service is a battery pack that takes AA or AAA batteries plus a bunch of alkaline batteries
- Other useful items are better antenna and speaker/microphone
- All radios require practice to successfully use
- All radios need to be programmed with a computer to enter many frequencies with any success
- Less expensive radios may be harder to program for amateur use



The first radio most new amateurs purchase is a dual band handheld. These range in price from $25 to several hundred dollars. Some of the least expensive radios require you to program them with both the receive and transmit frequency making them a bit more difficult to use with repeaters.

In an emergency it will be difficult to recharge a battery, at least at first. Having a battery pack that accepts alkaline batteries is useful for emergency use (along with a cache of batteries).

All modern handheld radios are complicated to use. Each button is likely to have multiple functions. It is important to practice with your radio.

Programming frequencies with a computer and data cable is the only practical way to enter a large set of frequencies.

## Equipment – Mobile Radio

- Can be “mobile” in a car or fixed in a building
- Higher power than handheld
- Better antenna than a handheld
- Good speaker and microphone
- May have built in support for packet radio (data)
- Longer duty cycle than a hand held – use without overheating



Mobile radios can be either single band (VHF or UHF) or dual band (both VHF and UHF). They will have more power than a handheld and use an external antenna.

Most UHF/VHF mobile radios will be designed to operate on 12 volts for automobile use. Combined with a 12 volt power supply and outside antenna they work well in a building.

Some mobile radios have a fan to keep them cool while others just use a very large heat sink. Good practice is to run them at the lowest power that allows effective communication (as with any radio).

# Equipment – Antennas And Batteries

- The antenna is the the most important factor in hearing and being heard by others
- A simple mag-mount (magnetic mount) antenna is a huge improvement over a handheld radio antenna
- Consider a “roll up” J-pole antenna for your “go kit”.
- Important accessory is a battery pack that will take AA or AAA alkaline batteries – plus a big stockpile of those batteries
- Useful accessory is a 12 volt DC adapter for your radio



A good antenna is the most important item to increase your communication range and quality. Increasing power may help others hear you but it will not help you hear others.

Connecting a mag-mount antenna or permanent outside antenna to a hand held radio will greatly increase the useful range.

Remember that in an emergency you will probably not have easy access to power for recharging a radio battery pack so having the ability to run from batteries plus a supply of batteries is useful.

# Programming Your Radio

- Programming software
  - Manufacturer software
  - Chirp
    - https://chirp.danplanet.com
  - Rtsystems
    - https://www.rtsystemsinc.com
- Programming cable
  - From manufacturer or 3rd party
  - USB to microphone or data port – Look for FTDI chip
  - Check Amazon for a programming cable – read reviews



Modern radios have many memory channels which will store frequencies so you do not have to enter them manually. The only practical way to store frequencies in the memory channels is with a computer interface.

Manufacturers sell software and a programming cable for their radios. You can also use alternate software and programming cables found on Amazon or e-bay.

The free software “chirp” is popular and generally works well.

Caution: Some radios have firmware settings that can be set from a computer. It is possible to render some radios unusable by programming with improper settings. Use special caution if attempting to program outside the normal amateur frequencies especially if attempting to transmit outside the designed frequency.

# Programming Steps With CHIRP

- Most radios
  - Download current radio configuration, save if desired
  - Import spread sheet (.csv file) with local frequency list
  - Add any repeaters unique to your travels
  - Upload to your radio
  - Save file for future use
- Kenwood TM-V7
  - Some radios such as the Kenwood TM-V7 operate in “live mode” with any change made written to the radio immediately
  - Download current radio configuration
  - Select all (control-A), erase all
  - Import .csv file
  - At each step delay long enough for radio memory read/write to complete



Chirp is a popular radio programming program with versions for Windows, Mac, and Linux.

The first step is to connect a radio and download the radio configuration to chirp. Then enter the desired set of frequencies. Then save the image file with a name and also save the data as a .csv (spreadsheet) file. Finally upload the configuration to the radio.

The saved image file can be used later to easily make changes. The .csv file can be loaded into spreadsheet software in order to print a frequency list.

You can program a new radio by downloading the radio configuration and then importing the .csv file and then uploading the configuration to the radio.

# Digital Communications

- Packet radio – data transmission via amateur radio
- Software evolved to support e-mail over amateur radio
- Winlink – E-mail over radio networks
  - Able to bridge Internet and radio networks
  - Full featured – for example attachments and features of e-mail that users expect
- Need a radio and TNC (Terminal Node Controller) plus software
  - Some radios have TNC built in



Packet radio allows sending digital information over the radio by means of a series of audio tones. An external device called a TNC (Terminal Node Controller) will convert tones to data or data to tones. Some radios have the TNC built into the radio.

Software exists to send e-mail using this data transmission scheme.

## Emergency Communication in Cannon Beach

- Still planning – direction as of July 2019 is:
- GMRS hand held for CERT teams
  - Simplex covering small area of up to 1 mile
- GMRS repeater for CERT city wide
- 1 or more amateurs as part of each CERT team
- Amateur operator as link to city EOC and county amateur network
  - Amateur operators will have city-wide coverage
  - Will interface between city staff and CERT teams
  - Link to county EOC
  - Digital communication with county EOC



The plans for emergency communication in Cannon Beach are still in the planning state. The present thought is that GMRS will be used for local communication within CERT teams. This would be 1 mile or less on level ground – no hills separating team members.

Each CERT team would have one or more ham operators providing city-wide radio coverage.

A ham operator at some location in the city – cache site or EOC – would give city wide coverage and also a link to county amateur radio.

A GMRS repeater may be installed in Cannon Beach giving the CERT teams an ability to use GMRS for city-wide communication.

# FEMA – Federal Emergency Management Agency

- Will oversee activities during an emergency
  - Useful to know FEMA protocols for communication and structure
- ICS – Incident Command System
- NIMS – National Incident Management System
- ICSXXX – forms, plans, training
  - ICS100, ICS200, ICS300 – training courses
  - ICS213 – General Message Form
  - ICS213RR – Resource Request Message
  - ICS205 – Incident Radio Communications Plan



In a large disaster situation FEMA will be the agency in charge and anyone involved in disaster communication is likely to interact with FEMA protocols in some form.

It is useful to be familiar with the forms used for message passing and requesting resources.

The more familiar a person is with the Incident Command System (ICS) the more likely it is that the person can work at a high level with disaster communications.

# Useful FEMA Links

ICS Forms – https://www.nwcg.gov/publications/ics-forms
Notable forms
- ICS213 – General Message
- ICS205 – Incident Communications Plan
- ICS213RR – Resource Request Message

Fema Training Courses
- training.fema.gov/emiweb/is/icsresource/trainingmaterials.htm

- ICS-100 Introduction to the Incident Command System
- ICS-200 ICS for Single Resources and Initial Action Incidents
- ICS-700 National Incident Management System, An Introduction
- ICS-800 National Response Framework, An Introduction



FEMA has many training courses available on the Internet for those wishing to learn more or receive certifications.

## Communications in a Disaster

- The radio operator is a communication resource – transmitting information not creating information.
- The Health Insurance Portability and Accountability Act (HIPAA) set standards intended to guarantee privacy and confidentially of patient medical records – with stringent regulations on who can see medical records in any form.
- HIPAA regulations do not forbid the emergency transmission of patient information via Amateur Radio.
- If asked by a hospital employee to transmit a patient name with medical information you may alert the employee that absolute privacy cannot be guaranteed. It is the responsibility of hospital staff to make the decision to release names and patient information.
- To minimize the chance of protected health information being overheard use lowest transmit power that is practical and choose radio frequencies with minimal activity when available.



There are many discussions about transmitting medical information on the radio. A good guideline is to take any possible steps to minimize giving a persons name and medical information over the air but use common sense and do what is needed to save a life or preserve the welfare of someone.

The best information I can find is that patient information may be sent over amateur radio when necessary.

A radio operator is a means of communication. The decision of what is sent is up to the message originator.

## Communications in a Disaster

- Message origin gives a person name and title
- Message destination gives a person name and title
  - Use at least first name initial and full last name
  - Time in 24 hour clock, local time
- A request for materials or actions is coming from someone sending a message not from a radio operator.



As a radio operator you are never making a personal request for resources. You may send a message that states that person XXX with title YYY is requesting a resource.

Your job is to send messages. Do not make decisions as to what resources are needed or what actions need to be taken. The job of communications and decision making are two separate functions.

# Phonetic Alphabet – Memorize This

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 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 | Foxtrox | M | Mike | T | Tango | | |
| G | Golf | N | November | U | Uniform | | |



If you have perfect communications and the words spoken are common and easily understood then the phonetic alphabet is not needed when speaking over the radio.

If the communication link is poor or a word unfamiliar then using phonetics is needed. This works when everyone uses the same phonetic alphabet. It is very frustrating and error prone when someone does not know the standard phonetic alphabet and uses non-standard words to represent each letter.

In order to have effective communication with another radio operator you must both memorize and be familiar with the same phonetic alphabet and use it when necessary.

## Antennas

- The purpose of an antenna is to radiate radio frequency energy
- RF energy from a transmitter must do one of two things:
  - Radiate via antenna
  - Turn into heat
- If the antenna on your handheld radio is getting warm then it may not be working efficiently
- A better antenna will let you hear and be heard – while more power may only result in more people hearing you
- A transmitter requires an antenna matched to (resonant at) the frequency being used.



The best thing you can do to communicate with a distant station is improve your antenna. A larger antenna at a higher elevation is ideal.

An antenna that radiates a signal equally in all directions is called an “isotropic radiator”. This is typically not what you want as normally there is no one to talk to straight overhead. A stock handheld radio antenna is not too far removed from this although it may also be converting some of the radio frequency energy into heat – which is not useful for communication.

An after market handheld radio antenna is typically a bit longer than what is sold with the radio and will radiate more energy (less converted to heat).

## Antennas

- The stock hand held radio antenna is generally quite poor.
- An after market (longer) antenna may improve hand held efficiency somewhat.
- A ¼ wave antenna placed on a car or large metal surface will make a large improvement over a hand held radio antenna.
- By changing the direction of radiated RF energy you achieve “gain”, meaning an increase in power over an antenna radiating in all directions.
- Generally a longer antenna flattens the radiation pattern. This is usually good as usually there is no one over you to hear your signal.



A big improvement for a hand held radio is a magnetic mount antenna placed on a metal surface such as a car roof.

A “gain antenna” focuses available energy. A beam antenna is an easily understood example with most energy transmitted focused in one direction. The strongest received signals are in that same direction.

A tall antenna flattens the pattern with less signal radiated upward. Using “radials” (wires projecting outward from the antenna) the radiation pattern can be focused more downward.

# Antennas



This slide gives an illustration of some of the antennas mentioned.

## Antennas - Connectors

- Most handheld radios now use an SMA (SubMinature Version A) connector.
- Older hand held radios typically use a BNC (Bayonet Neill-Councelman) connector.
- Mobile radios typically use an SO239 connector (PL – plug, SO-socket)
- Many commercial radios and antennas use N connectors




Most modern handheld radios use an SMA connection. Common mobile radios use an UHF or PL259 connection.

Mag-mount antennas can be ordered with a PL259 connector or an SMA connector. A kit of antenna adapters is a useful item in an emergency communications kit.