

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]

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

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.

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

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

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 Bands (Frequency Range)

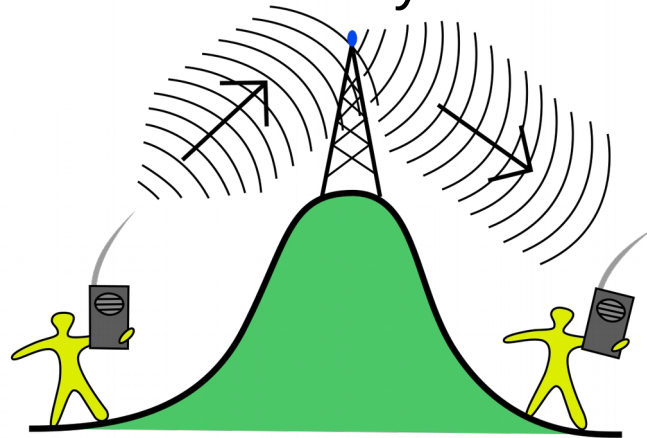
- HF – High Frequency
 - “Short Wave” - long distance, around the world communication
- VHF – Very High Frequency
 - Line of sight – short range or extended by a repeater
 - Common handheld radio
- UHF – Ultra High Frequency
 - Line of sight – short range or extended by a repeater
 - Common handheld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

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.

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.



V1.2 K7FW

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.

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

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.

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

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

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.

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

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

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 Souty 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

Equipment – Handheld Radio

- Dual band handheld 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

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

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

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

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

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

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

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

Useful FEMA Links

ICS Forms – <https://www.nwccg.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

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 confidentiality 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.

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.

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		

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.

Antennas

- The stock hand held radio antenna is generally quite poor.
- An after market (longer) antenna may improve hand held efficiency somewhat.
- A $\frac{1}{4}$ 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.

Antennas



Antennas - Connectors

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

