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## An Introduction to Emergency Communications

Santa Clara County ARES®/RACES/ACS

Revised: 06-February-2018

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ARRL Amateur Radio Today Video 6m35s (<http://www.arrl.org/ARToday/>)



## An Introduction to Emergency Communications

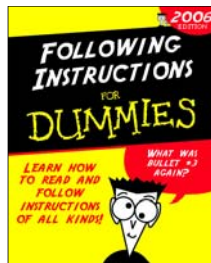
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### Housekeeping

- Introductions
- Pen/pencil & paper
- Cell phones
- Side conversations
- Questions
- Breaks
- Restrooms
- In case of emergency

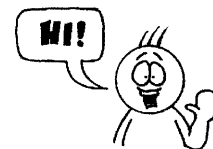


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### Introductions

- Name
- Call Sign
- City
- Year First Licensed
- Do you have a radio yet?
- Have you been on the air yet?



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### Today's Agenda

- Voice Technology (VHF/UHF FM)
- Voice Operating Techniques
- Additional EmComm Modes
- Radios and Accessories
- EmComm Organizations
- Additional Training & Next Steps
- After Class Exercise: Get On The Air

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### Learning Objectives



- At the end of this class, you will be able to
  - Explain VHF/UHF FM technology used in EmComm
  - Use band plans, frequency lists, repeater directories
  - Configure your radio for simplex & duplex operations
  - Participate in a directed net
  - Make direct contacts
  - List three other modes used in EmComm
  - Select an EmComm radio and accessories
  - Understand local EmComm organizations
  - Understand what to do next, after this class
  - Make real on-the-air contact with Net Control op

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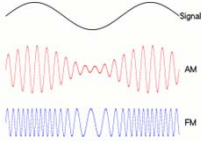
## VHF/UHF FM Voice Technology

Bands and Frequencies  
Simplex, Duplex and Repeaters  
Making Sense of Repeater Listings  
Setting up your Radio

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### Some Important Terms

- VHF – Very High Frequency
  - 30 to 300 MHz
- UHF – Ultra High Frequency
  - 300 to 3000 MHz (3 GHz)
- FM – Frequency Modulation
  - The information in the signal is represented by variations in the frequency around a central carrier
  - The amount of variation is called the “deviation”



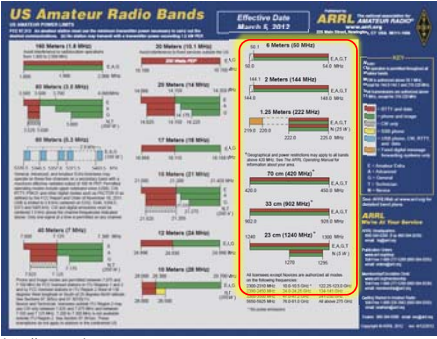
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### Characteristics of VHF/UHF FM

- Short range
  - Point-to-point range typically < 5-7 miles (portable/mobile)
  - Influenced by line-of-sight; dependent on antenna height
- Frequency re-use
  - Short range allows for multiple conversations on the same frequency throughout the region
- Well suited for local emergency communications
  - Portable (handi-talkie or “HT” and mobile stations)
  - Clear voice quality (think of FM vs. AM broadcast)
  - Coverage can be extended by repeaters

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### VHF/UHF Amateur Bands



<http://www.arrl.org>

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### Primary VHF/UHF Bands for EmComm

- 2 meter band (commonly called "2 meters")
  - 144-148 MHz (VHF)
- 70 cm band (commonly called "440")
  - 420-450 MHz (UHF)
- Also, 1.25 meter band ("220" or "222")
  - 222-225 MHz (VHF)
  - In SCCo ARES/RACES, used for packet comms
- Where do the names come from?
  - 300/Frequency (MHz) = Wavelength (m)
  - Example:  $300 / 148 \text{ MHz} \approx 2 \rightarrow 2\text{m band}$

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### Selecting a Frequency

- Questions:
  - How do we pick a frequency to use?
  - How will people know where to find us?
  - How do we avoid interfering with other users?
  - How do we avoid interfering with other modes?
    - Including ones that we can't even hear on our FM radio!
- Answers:
  - Band plans
    - Allocate blocks of frequencies to particular modes
  - Frequency Lists
    - Identify specific frequencies for specific purposes

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### 2m Band Plan (Northern California)

Legend:  
 Satellite  
 Digital  
 Experimental  
 Simplex  
 Weak Signal  
 FM Repeaters

For Repeater coordination in Northern California contact NARCC: [www.narcc.org](http://www.narcc.org)

For weak signal info see the Western States Weak Signal Society: <http://www.wswws.org>

For satellite information see AMSAT: [www.amsat.org](http://www.amsat.org)

Specific Frequency info:  
 FM Channel spacing: 20 kHz below 146.00, 10 kHz above 146.00  
 144.000-144.100 CW only  
 144.200-144.300 calling  
 146.50 Digital  
 146.51 SSTV  
 146.52 Nationwide FM calling  
 FM Simplex Frequencies:  
 144.415, 146.430, 146.445, 146.460, 146.475, 146.490, 146.505, 146.520, 146.535, 146.550, 146.565, 146.580, 146.595, 146.610, 146.625, 146.640, 146.655, 146.670, 146.685, 146.700, 146.715, 146.730, 146.745, 146.760, 146.775, 146.790, 146.805, 146.820, 146.835, 146.850, 146.865, 146.880, 146.895, 146.910, 146.925, 146.940, 146.955, 146.970, 146.985, 147.000, 147.015, 147.030, 147.045, 147.060, 147.075, 147.090, 147.105, 147.120, 147.135, 147.150, 147.165, 147.180, 147.195, 147.210, 147.225, 147.240, 147.255, 147.270, 147.285, 147.300, 147.315, 147.330, 147.345, 147.360, 147.375, 147.390, 147.405, 147.420, 147.435, 147.450, 147.465, 147.480, 147.495, 147.510, 147.525, 147.540, 147.555, 147.570, 147.585, 147.600, 147.615, 147.630, 147.645, 147.660, 147.675, 147.690, 147.705, 147.720, 147.735, 147.750, 147.765, 147.780, 147.795, 147.810, 147.825, 147.840, 147.855, 147.870, 147.885, 147.900, 147.915, 147.930, 147.945, 147.960, 147.975, 147.990, 148.005, 148.020, 148.035, 148.050, 148.065, 148.080, 148.095, 148.110, 148.125, 148.140, 148.155, 148.170, 148.185, 148.200, 148.215, 148.230, 148.245, 148.260, 148.275, 148.290, 148.305, 148.320, 148.335, 148.350, 148.365, 148.380, 148.395, 148.410, 148.425, 148.440, 148.455, 148.470, 148.485, 148.500, 148.515, 148.530, 148.545, 148.560, 148.575, 148.590, 148.605, 148.620, 148.635, 148.650, 148.665, 148.680, 148.695, 148.710, 148.725, 148.740, 148.755, 148.770, 148.785, 148.800, 148.815, 148.830, 148.845, 148.860, 148.875, 148.890, 148.905, 148.920, 148.935, 148.950, 148.965, 148.980, 148.995, 149.010, 149.025, 149.040, 149.055, 149.070, 149.085, 149.100, 149.115, 149.130, 149.145, 149.160, 149.175, 149.190, 149.205, 149.220, 149.235, 149.250, 149.265, 149.280, 149.295, 149.310, 149.325, 149.340, 149.355, 149.370, 149.385, 149.400, 149.415, 149.430, 149.445, 149.460, 149.475, 149.490, 149.505, 149.520, 149.535, 149.550, 149.565, 149.580, 149.595, 149.610, 149.625, 149.640, 149.655, 149.670, 149.685, 149.700, 149.715, 149.730, 149.745, 149.760, 149.775, 149.790, 149.805, 149.820, 149.835, 149.850, 149.865, 149.880, 149.895, 149.910, 149.925, 149.940, 149.955, 149.970, 149.985, 150.000

<http://www.narcc.org> – Northern Amateur Relay Council of California

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### Frequency Lists

Santa Clara County OES ARES/RACES Frequency List

This list compiled by Mark Luskoff, K6FJL, NCCC, ARCC, RSP@RedBlade.com  
 Names in red have been recently added or changed  
 Abbrev PDP means portable. List dates: 1-26-2018 17:45:00. Notes: Definitions.

Operational Area	Channel Name	Resource Name	R3 Frequency	OS	PA	Notes
County	Message Net	W6FJL	146.500	A	100W	Feb-11
County	Message Net Alt	W6FJL	146.450	A	100W	Jan-12
County	Command	W6FJL	146.275	A	100W	Jan-12
County	Command Net Alt	W6FJL	146.250	A	100W	May-16
County	Resource Net Alt	W6FJL	146.275	A	100W	Feb-11
County	Resource Priority	W6FJL	146.190	A	100W	Feb-11
County	Resource North	W6FJL	146.270	A	100W	Feb-11
County	Resource South	W6FJL	146.270	A	100W	Feb-11
County	Resource Alt	W6FJL	146.250	A	100W	Feb-11
County	Resource Net	W6FJL	146.250	A	100W	Feb-11
County	Resource Net Packet	W6FJL	146.250	A	100W	Feb-11

Check with your EC

Maintain a copy and be familiar with the ones appropriate for you

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### FM Voice Operating Modes

**SIMPLEX** Single frequency - one station at a time

**DUPLEX** Two frequencies - one station at a time

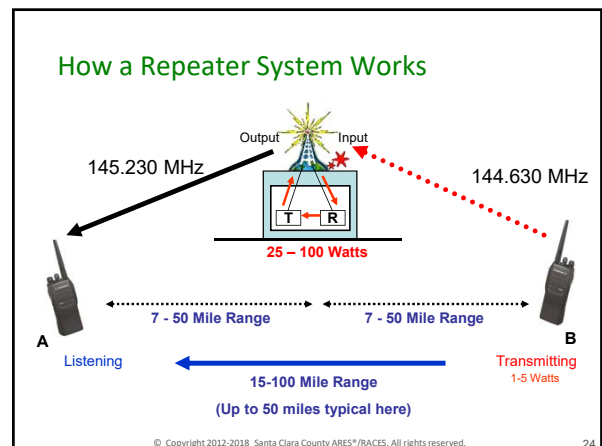
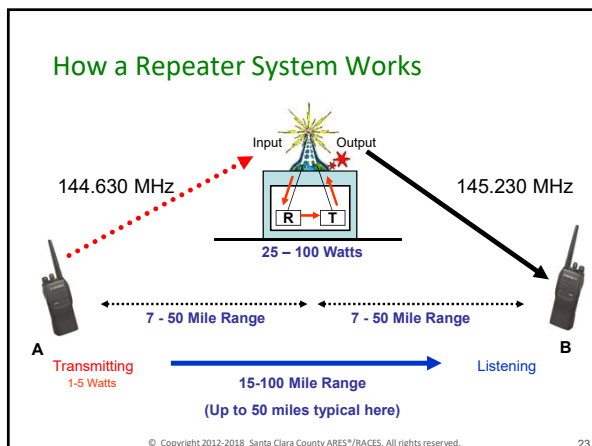
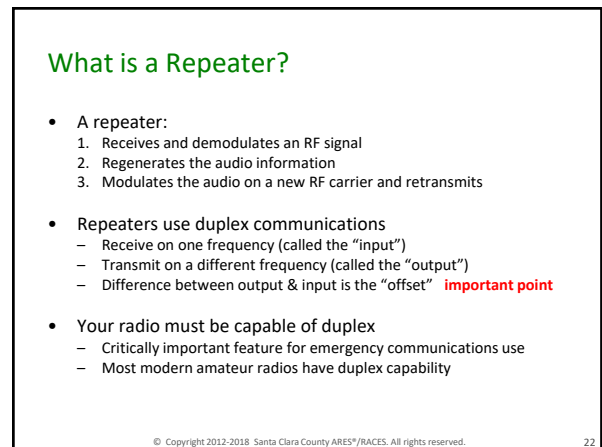
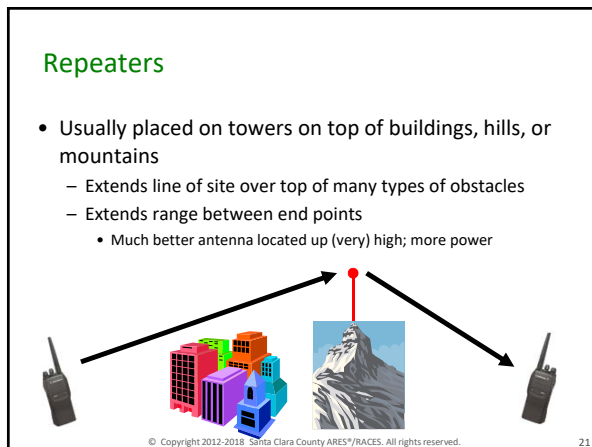
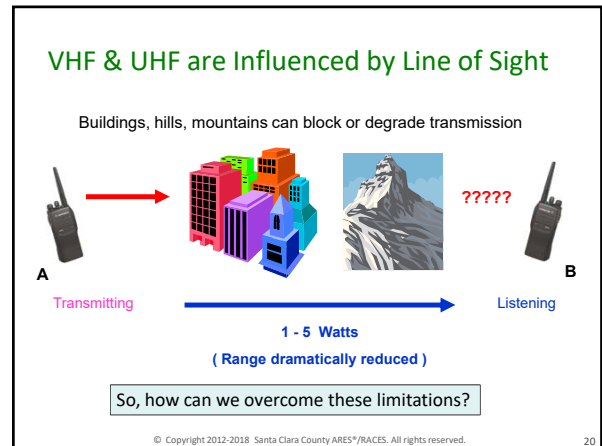
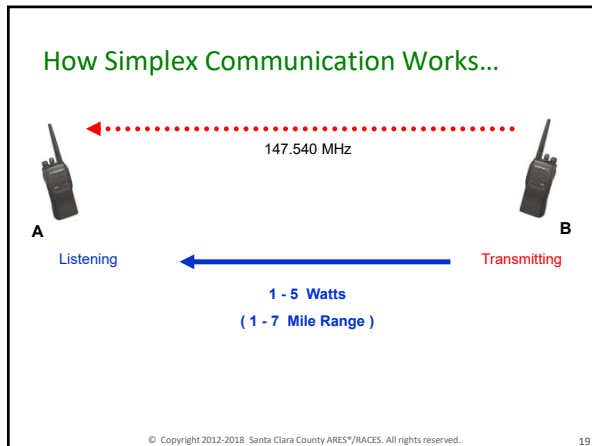
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### How Simplex Communication Works...


147.540 MHz

1 - 5 Watts  
(1 - 7 Mile Range)

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### Understanding Repeater Listings



- Typical repeater directory entry looks like:
  - N6NFI 145.230 MHz – 100.0

CALL SIGN of repeater      Repeater OUTPUT frequency (you receive on this frequency)      OFFSET  
 •“-” standard negative offset, input lower than output  
 •“+” standard positive offset, input higher than output  
 •Amount of offset shown if non-standard

TONE (frequency of tone required to access)

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### Repeater Output Example

- Repeater listing:
  - N6NFI 145.230 MHz – 100.0

CALL SIGN of repeater      Repeater OUTPUT frequency (you receive on this frequency)      OFFSET  
 •“-” standard negative offset, input lower than output  
 •“+” standard positive offset, input higher than output  
 •Amount of offset shown if non-standard

TONE (frequency of tone required to access)

Tune radio to the repeater OUTPUT to hear the repeater

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### Repeater Offset

- Difference between repeater output and input is the “offset”
- 2m repeaters
  - may have positive or negative offsets – check band plans
  - standard offset amount is 0.6 MHz (600 kHz)
- 70cm/440 repeaters
  - generally have positive offsets
  - standard offset amount is 5 MHz
- Most repeaters use standard offset amounts
  - Typically, just configure the offset direction (+/-);
  - Radio applies standard offset amount
  - Some radios even pick the correct offset direction automatically
    - Take care – band plans differ across the country

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### Repeater Offset Example

- Repeater listing:
  - N6NFI 145.230 MHz – 100.0

CALL SIGN of repeater      Repeater OUTPUT frequency (you receive on this frequency)      OFFSET  
 •“-” standard negative offset, input lower than output  
 •“+” standard positive offset, input higher than output  
 •Amount of offset shown if non-standard

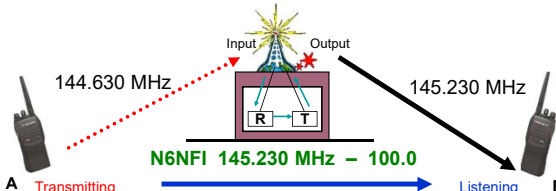
TONE (frequency of tone required to access)

Example:

- This repeater uses a negative (or “minus”) offset
- Input frequency is a lower frequency than output frequency
- Offset amount is standard (otherwise, it would be shown)

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### Repeater Offset Example



144.630 MHz      145.230 MHz

N6NFI 145.230 MHz – 100.0

A Transmitting      Listening B

How it Works:

- You tune radio to repeater output frequency of 145.230 MHz & set minus offset
- Your radio calculates input frequency = 144.630 MHz
  - 145.230 MHz (output) – 0.600 MHz (2m standard offset) = 144.630 MHz (input)
- When you press PTT, your radio automatically switches to 144.630 MHz
- When you release PTT, your radio automatically switches back to 145.230 MHz

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### Transmitting CTCSS Tones

- “PL” or “PL Tone” or “CTCSS” or “Tone Encode”
  - “PL” = “Private Line” (old Motorola term, still commonly used)
  - “CTCSS” = Continuous Tone-Coded Squelch System
- A sub-audible tone sent by your radio along with your voice transmission
  - About 40 discrete values ranging from 67.0 to 250.3Hz
  - Functions like a “key” to unlock the repeater receiver to accept the signal
- Repeaters
  - Most repeaters require that you send the proper tone
  - If you don’t send the tone, the repeater will not repeat your transmission
- Setting up to transmit CTCSS tone involves two steps:
  - Enable tone
    - Kenwood = “Tone” or “T”; Yaesu & Icom = “Tone”
  - Set tone frequency
  - Common error is forgetting to set tone, or setting tone to wrong frequency

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### Repeater Tone Example

- Repeater Listing:
  - N6NFI 145.230 MHz - 100.0

CALL SIGN of repeater      Repeater OUTPUT frequency (you receive on this frequency)      OFFSET

- "-" standard negative offset, input lower than output
- "+" standard positive offset, input higher than output
- Amount of offset shown if non-standard

Example:

- This repeater requires a 100 Hz tone to accompany the transmission

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### Repeater Tone Example

Example:

- Repeater requires 100 Hz tone
- No tone (or wrong tone) is sent
- Repeater does NOT repeat the transmission

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### Repeater Tone Example

Example:

- Repeater requires 100 Hz tone; 100 Hz tone is sent
- Repeater receives and retransmits signal

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### Tone Squelch / CTCSS Decode

- Just like a repeater requires a tone when receiving ...
- You can configure your radio to require a tone when receiving
  - This is called "tone squelch" or "CTCSS decode"
  - Allows you to ignore transmissions not accompanied by the tone
  - Keeps local noise from exceeding squelch level
  - Display: Kenwood = "CTCSS" or "CT"; Yaesu & Icom = "TSQL"
- BUT** ... using tone squelch will prevent reception if the other end is not sending tone!
  - Simplex
    - Most simplex users do NOT send tone
  - Repeaters
    - Some repeaters also send a tone when they transmit
    - But many repeaters do NOT send a tone - check your settings

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### Tone Squelch Example

Example:

- A sends tone with its transmission
- Repeater hears tone and repeats transmission; also sends tone
- B has tone squelch configured; receives repeater transmission with tone
- B does not receive noise or other signals without tone

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### Tone Squelch / CTCSS Decode (cont.)

- Tone squelch is mentioned here for completeness and so you don't confuse it with regular repeater input tone
- Recognizing a problem
  - If: S-meter deflects but no sound is heard; volume is up; squelch is down
  - Then: tone squelch is ON but other end is not sending tone
  - Check Display for: Kenwood = "CTCSS" or "CT"; Yaesu & Icom = "TSQL"
  - Therefore: turn off tone squelch
- Recommendation:
  - Don't use this feature until you are familiar with your radio and the local repeater capabilities

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### Putting it All Together

Simplex (No Repeater):

Example Simplex Frequency:  
147.540 MHz

- Set the frequency
- Disable offset (set to blank)
- Disable tone (usually)
- (Optional) Store setup in memory
  - Highly recommended

Seek additional help from fellow hams, local club members, or your ARES/RACES Emergency Coordinator or Assistant ECs

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### Putting it All Together

Duplex (Repeater):

Example Repeater Listing:  
N6NFI 145.230 MHz - 100.0

- Set the output frequency
- Offset
  - Set offset direction (“+” or “-”)
  - Offset amount is usually standard
- Tone
  - Enable Tone (“T” or “Tone”)
  - Set the tone frequency
- (Optional) Store setup in memory
  - Highly Recommended

Seek additional help from fellow hams, local club members, or your ARES/RACES Emergency Coordinator or Assistant ECs

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### Programming Your Radio Memory

- Know how to program your radio with the keypad
  - Simplex and duplex (offsets)
  - Tones / PL / CTCSS
  - Keep radio manual or “cheat sheet” in your Go-Kit
    - “Nifty Accessories” (<http://www.niftyaccessories.com>)
    - SPECS website (<http://www.specsnet.org/radio-cheat-sheets>)
- Programming software is nice
  - Easier to program many frequencies
  - Helps when maintaining multiple radios
  - **But ... you won't have it with you in the field!**
  - Not available for all radios – check before you buy
- Store all commonly used frequencies
  - Program into the radio's memory
  - Keep a copy of the frequency list in your Go-Kit
    - County List: <http://www.scc-ares-races.org/operations.html>
    - City List: consult your city EC or ARES/RACES website

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### Break

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### Voice Operating Techniques

- Communication Fundamentals
- Directed Net Basics
- Directed Net Exercises
- Net Control Examples

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## A Radio is Not a Telephone!



BECAUSE:

- When YOU talk, you can't hear
  - The receiver is cut-off while the transmitter is operating
- When YOU talk, no one else can talk
  - If you talk too long, you may prevent emergency traffic
  - Many repeaters have timers that help to enforce this
- If EVERYONE talks, NOBODY understands
  - A "double" occurs and all you hear is garbled noise
- SO...

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
## Listen First!



- Simplex or repeater:
  - Leave a pause before keying up to allow others to break in
  - Check your volume (up) and squelch (down)
- Simplex
  - You may not be able to hear someone who can hear you (they've got a better antenna or location)
  - Always ask, "Is this frequency in use?"
  - Usually, someone who can hear you both will tell you
- Repeaters
  - What you're really listening to is the repeater itself
  - So, if you can hear anyone (or repeater itself), then you can hear everyone
  - Listen for a brief period to make sure others are not pausing during a conversation
  - Wait for the courtesy tone

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## Courtesy Tone

- Audible tone from repeater after each transmission
- Indicates when it is OK to transmit
  - After other person has dropped carrier
  - Plus slight pause for others to break in
- Eliminates need for saying "over" or "go ahead"
- Sent by many (not all) repeaters
  - N6NF1/R courtesy tone 
  - W6ASH/R courtesy tone 
  - AA6BT/R courtesy tone 
- Wait until you hear the courtesy tone before you transmit

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## When Do You Speak?



- For EmComm, speak ONLY if you have to
- Wait for the courtesy tone and/or leave a gap
  - If truly urgent, use "break" or "priority" or "emergency" as appropriate
- Key the PTT and pause slightly
  - Avoids clipping your first syllable; wait longer with linked repeaters
- Speak Accurately, Briefly, Clearly
  - Keep it short and accurate
  - Use plain English; no 10-codes or Q-signals or abbreviations
  - Stick to the facts; don't speculate; don't assume
  - Remember that others are listening
    - General public, news media, ...
    - Avoid personal info, sensationalism
    - Be professional at all times
- Release PTT as soon as you finish speaking; don't create "dead air"
- In a Directed Net, be sure to follow Net Control's instructions

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## Standard ITU Phonetics

A - alfa (AL-fa)	N - november (no-VEM-ber)
B - bravo (BRAH-voh)	O - oscar (OSS-cah)
C - charlie (CHAR-lee)	P - papa (pah-PAH)
D - delta (DELL-tah)	Q - quebec (keh-BECK)
E - echo (ECK-oh)	R - romeo (ROW-me-oh)
F - foxtrot (FOKS-trot)	S - sierra (see-AIR-rah)
G - golf (GOLF)	T - tango (TANG-go)
H - hotel (hoh-TELL)	U - uniform (YOU-ni-form)
I - india (IN-dee-ah)	V - victor (VIK-tah)
J - juliet (JU-lee-ETT)	W - whiskey (WISS-key)
K - kilo (KEY-loh)	X - x-ray (ECKS-RAY)
L - lima (LEE-mah)	Y - yankee (YANG-key)
M - mike (MIKE)	Z - zulu (ZOO-loo)

- If there is a chance of misunderstanding, spell it out with "I spell":
  - "go to Kay Street" → "go to Kay, I spell kilo alfa yankee, Street"

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## Pronouncing Numerals

0 - zero (ZEE-row)	5 - five (FY-ive)
1 - one (WUN)	6 - six (Sicks)
2 - two (TOOO)	7 - seven (SEV-vin)
3 - three (THUH-ree)	8 - eight (Ate)
4 - four (FOH-wer)	9 - nine (NINE-er)

- Multi-digit numbers are spoken as a string of single digits:
  - 600 = "six zero zero"
- Often preceded by the word "figures"
  - "Please copy 109" → "Please copy figures one zero niner"
  - "Requesting 16 blankets" → "Requesting figures one six blankets"

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## Directed Net Basics

Participating in a Directed Net  
 Calling Net Control  
 Acknowledging a Call  
 Ending a Call  
 Calling Another Station

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## What is a “Directed Net”



- One station (“net control”) controls/manages the communication flow
  - Others respond to Net Control when called
  - Others must call “Net Control” to get permission before calling anyone else
- Generally used with more than four people
- A net control operator can:
  - Coordinate communications for best efficiency
  - Prioritize use of the net for the most urgent traffic
  - Record a log of net activity


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## Participating in a Directed Net

- Route all communications through “Net Control”
  - Get permission before contacting anyone else
- When called, answer PROMPTLY
  - Monitor the radio continuously
  - Answer immediately if called
    - The entire net is waiting on you to answer!
  - End your message with your call sign
    - Tells Net Control that you have nothing more to add
    - Assures that you comply with FCC ID requirements
- Check-in and Check-out
  - Don’t leave the net without checking out!
  - Otherwise, “Net Control” wastes time looking for you
    - They may send someone to find you; see if you’re o.k.
    - You’ve now become part of the problem!

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## Calling Net Control



- If the Net has been quiet for a while, you might say:
  - “Net Control, this is <your ID>” checking in
  - “Net Control, this is <your ID> with one priority message”
- To convey a message or info, indicate what it is so Net Control can prioritize:
  - “<your ID> with one announcement”
  - “<your ID> with one emergency message”
- On a very active net, usually just say your ID:
  - “<your call sign>”
- Wait for Net Control to answer
  - Don’t call repeatedly; NC probably heard you and is busy
  - Net Control will decide when you can speak
  - NC: “<your ID>, go ahead”
- Then you can speak... keep it brief

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## Acknowledging a Call



- When Net Control calls you ...
- Pause briefly before pressing PTT
  - Wait for the courtesy tone or slightly longer
  - Gives others a chance to break in
- Then respond right away
  - Don’t keep the net waiting
  - Depress PTT, wait a second and then talk
- Say, “This is <your ID>, go ahead”

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## Ending a Call



- The person who initiated the call ends it
- End a call:
  - Say “... this is <your call sign>.”
  - We don’t use “73” - keep it short
  - Maintains compliance with FCC Part 97 to ID at end of last transmission

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### Calling Another Station Directly

- We don't (usually) use "CQ" in FM EmComms
- Say "<their ID>, this is <your ID>":
- Wait until they acknowledge you
  - "this is <their ID>, go ahead", or
  - "<your ID>, this is <their ID>, go ahead"
- Then you can speak... keep it brief
- Remember to ID at the end of the call
- In a directed net:
  - You must ask Net Control to "go direct" with another station
  - If possible, Net Control will give you permission to "go direct"
  - When finished, turn it back to Net Control
  - "this is <your ID>, back to Net Control"


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## Directed Net Exercises

Check-In  
Relays  
Tactical Call Signs  
Announcements

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### Check-In



- Check-in is how you make yourself known to Net Control
- Net Control directs the process; follow their instructions
  - NC: "Will all stations in Sunnyvale, please check in now?"
  - NC: "Will all stations with call sign suffixes beginning with A-L please check in now"
  - The suffix is the letters after the number in your call sign  
KE6AGJ W6XSC N6NAC AA6BT
- Speak slowly, enunciate clearly, make use of phonetics
  - The entire net slows down if NC needs to ask for a "fill" or repeat
  - Gives Net Control time to write it down


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### Exercise: Net Check-In

NC	This is <NC call sign>. My name is <name>, Net Control for the Training Net. Stations with Emergency or Priority traffic may break in at any time.
NC	We will now take check-ins by call sign suffix. Will all stations with call sign suffixes beginning with Alpha through Lima, please check-in now.
Various	<callsign#1> (phonetically) <callsign#2> (phonetically)
NC	Net control acknowledges <callsign#1>, <callsign#2> -- or -- "None heard." Are there any other stations with call sign suffixes Alpha through Lima, or stations that I missed?
NC	None heard. Will all stations with call sign suffixes beginning with Mike through Zulu, please check in now.
Various	<callsign#3> (phonetically) <callsign#4> (phonetically)
NC	Net control acknowledges <callsign#3>, <callsign#4> -- or -- "None heard" Are there any other stations with call sign suffixes Mike through Zulu, or stations that I missed?
NC	None heard. Thank you all for checking in. This is <NC call sign>

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### Relays



- Sometimes, a station cannot be heard by net control
  - Very weak station (poor antenna, bad location, low power)
  - Net Control may not be in an ideal location or have an ideal antenna (emergency situation, temporary NC)
- All participants need to actively monitor check-ins and acknowledgements to see if Net Control misses anyone
- If you hear a station that Net Control misses, you should relay the info to Net Control

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### Exercise: Net Check-In w/ Relay

NC	This is <NC call sign>, My name is <name>, Net Control for the Training Net.
NC	We will now take check-ins by call sign suffix. If you hear a station that I miss, please relay it to me. Will all stations with call sign suffixes beginning with Alpha through Zulu, please check in now.
Various	<callsign#1> <callsign#2> ...
NC	Net control acknowledges <callsign#1>, <callsign#2>, ... Are there any other stations with call sign suffixes Alpha through Zulu, or stations that I missed?
Relay Station	"Relay", <your-call-sign>
NC	Go ahead <relay's call sign>
Relay Station	Net Control, I heard <weak-station-call-sign>. This is <your-call-sign>.
NC	Thank you. Acknowledging <weak-station-call sign>. Are there any other stations with call sign suffixes Alpha through Zulu or stations that I missed?
NC	None heard. Thank you for checking in. This is <NC call sign>

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### Tactical Call Signs or "Unit IDs"

- Identifies a location or function instead of an individual
  - Examples: "Checkpoint 3", "Rover 1", "John's Shadow", "Net Control"
- Allows Net Control to manage resources without regard to who is staffing any particular location or function
  - Simple, plain English
  - Tactical call stays the same throughout the incident or event
  - Use your tactical call consistently
  - Contact Net Control or others by their tactical call
  - Listen for your tactical call and respond promptly when called

**IMPORTANT:** Does not eliminate FCC requirement to ID with your FCC call sign at least every 10 minutes and at the end of your last transmission.

- It may be longer than 10 minutes before Net Control gets back to you again
- So, finish your transmission with your FCC call sign

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### Exercise: Tactical Call Signs

NC	This is <NC call sign>, My name is <name>, Net Control for the Sitting Left Net.
NC	I will now poll all observers for a count of people sitting to their left. When you hear your call sign, report the number of people who are sitting to your left.
NC	Observer 1
Observer 1	Observer 1 reports <#> people sitting to my left. This is <your call sign>.
NC	Acknowledge # people. Observer 2
Observer 2	Observer 2 reports <#> people sitting to my left. This is <your call sign>
NC	Acknowledge # people. Observer 3
Observer 3	Observer 3 reports <#> people sitting to my left. This is <your call sign>
	... Etc.
NC	Poll of observer stations complete. This is net control, <your call sign>

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### Exercise: Announcements

NC	This is <NC Call Sign>, Net Control for the donut net. We will now proceed with announcements. If you have an announcement, please state your call sign only at this time.
#1	<your call sign #1>
#2	<your call sign #2>
NC	Net control acknowledges <callsign#1> and <callsign#2>. <callsign#1>, go ahead with your announcement.
#1	Thank you Net Control. We'd like to announce free donuts for all Los Altos hams available at Jim's house from 8pm to 9pm today. The donuts are free for Los Altos hams only. This is <callsign#1> back to Net Control.
NC	Thank you <callsign#1>. If there are any questions, please state your call sign now.
NC	None heard. <callsign#2>, go ahead with your announcement.
#2	Thank you Net Control. We would also like to announce free donuts for all Sunnyvale hams. Just go to Jim's house and tell him that you're from Los Altos. This is <callsign#2> back to Net Control.
NC	Thank you <callsign#2>. If there are any questions, please state your call sign now.
NC	None heard. This is <NC call sign>

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## Net Control Examples

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### Net Control Example

- Milpitas Quake – Oct 2007 (3m45s) 📻
  - AA6BT repeater; weekly SVECS net at time of quake
  - Listen for the following:
    - Check-ins; Net control calls on KE6AGJ, Larry Carr, DEC
    - Larry makes announcement [clipped]; back to NC
    - Net control solicits questions
    - Questioner talks to NC, not directly to Larry
    - NC asks Larry to answer question
    - Larry answers question [clipped]; earthquake occurs [static]
    - Larry assumes net control function, announces intentions
    - Some initial vague reports; WA6UBE w/ "double"
    - Larry begins directing traffic; net settles down
  - What aspects of your training did you hear?
  - Comments? Observations?

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### Net Control Example

- Loma Prieta Quake – 1989 (2m40s) 📻
  - W6ASH repeater 10 minutes after quake
  - Listen for the following:
    - Net Control request someone turn off timer
    - Repeater control operator answers; will do it shortly
    - Net Control directs multiple callers, in order
    - Net Control hand-off to new net control operator, N6FW
    - Repeater control operator turns off timer
    - Net Control resumes collecting damage reports
  - What aspects of your training did you hear?
  - Comments? Observations?

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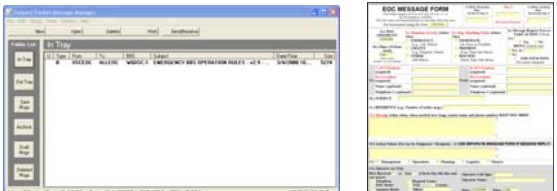
## Additional EmComm Modes

Packet  
APRS  
HF (various modes)

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### Packet


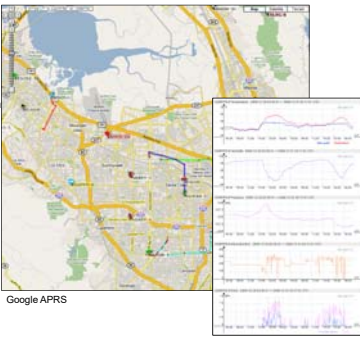
- Send and receive data via radio
  - Similar to TCP/IP packets over Ethernet
- Like using an e-mail program
- Text messages, official forms, complex spelling (drug names, addresses), cut-and-paste from other apps

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### Automatic Packet Reporting System

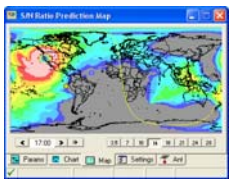


- <http://www.aprs.org>
- Special packet network
- Position
  - Connect to GPS
  - Beacon location information as you travel
- Weather
  - share your weather station info
- Short messages

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### HF (High Frequency = 3 – 30 MHz)

- 10m and lower bands
- Regional, national, international communications
- SSB, CW, data modes ...
- Local voice net: Tuesdays, 2030 hrs
  - Currently on 3.878 MHz (75m LSB)

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## Break

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## Radios & Equipment for EmComm

- First Radio for EmComm
- Accessories
- Antennas
- Second Radio
- Other Gear

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### First Radio for EmComm

- Handheld (a.k.a. handi-talkie or HT)
  - Basic entry point, least expensive radio option
- 2m/70cm dual-band HT needed for EmComm
  - Dual-receive is recommended
  - Look for 5 watts power output on (rechargeable) batteries
- What are others using (advantage: easy to get help)
  - Yaesu, Kenwood, ICOM, Alinco, ...
  - You must be able to program it in the field w/o a computer
- ARRL Article “Choosing a Ham Radio”
  - <http://www.arrl.org/buying-your-first-radio/>
  - Also included in *The Ham Radio License Manual* from ARRL



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### Important HT Accessories


- Batteries
  - Spare rechargeable battery packs
    - Usually provides higher power
  - Need 3000 mAH for 12 hours in the field
  - Alkaline battery pack (fill with AA)
- Cigarette lighter cable
  - Allows charging batteries in car
- Higher gain HT Antenna
  - Extendable whip for stationary use
  - Flexible, higher-gain for daily use
- Antenna connectors & adapters
  - SMA, BNC, PL-259 (UHF), N
  - Be able to connect your HT to all other cable types



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### Mobile/Field Antennas

- Stay in contact with net control while mobile
- VHF/UHF FM is usually vertically polarized
  - Omni-directional; Best for mobile use
- Check suitability for the mounting type
  - Mag mount won't work on fiberglass Red Cross vehicles
    - In a pinch, use a cookie sheet and duct tape
  - Some antennas require a ground connection
    - Not suitable for magnetic or motorized mounts
- Roll-up J-pole antenna
  - Use string or tape to suspend from tree or pole
- Check connector type
  - Be able to adapt to your HT's connector



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### Speaker/Mic or Headset

- Speaker-Mic
  - Combination speaker and microphone
    - Clip to your collar and keep your radio out of the cold/rain.
  - Not ideal for noisy or quiet environments
    - Some have an earphone jack for noisy environs
    - Radio chatter heard by surrounding people
- Headset
  - Headphone/boom-mic combination
  - Works well in noisy or quiet environments
    - Single ear allows listening to radio and others
    - Don't cover both ears while driving!
    - Very noisy environments may require dual ear
    - Radio chatter not heard by surrounding people
  - Also useful with mobile or base station



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### Carrying Your Radio

- Your hands must be free so you can work
  - Writing, carrying equipment, holding clipboard, ...
- You'll need something to hold:
  - Radio
  - Accessories (batteries, charger, etc.)
  - Clipboard, flashlight, water bottle(s), sunscreen, etc
- Some example options:
  - Belt pouch
  - Backpack
  - Fanny pack
  - Messenger bag
  - Radio harness



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### Second Radio for EmComm

- 2m/440 dual-band Mobile radio
  - Power
    - Typically 50 watts; more power to drive better antennas
  - Flexibility
    - Mobile in car direct wired to battery
    - Use as base station with power supply
    - Use as field emergency Net Control with sealed lead acid (gel-cell) batteries
  - Cross-band repeater option recommended
  - Data interface option recommended (for packet use)



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### Standard Equipment for ARES/RACES



- 2 hr Carry Kit (required)
  - Nearby at all times
    - In car is o.k. if nearby
  - Immediate damage reports
  - City net check-ins
    - If cities activate
- 12 hr Go Kit (required)
  - Fully independent ops for 12 hrs
  - Return home to retrieve
- Extended Kit (optional)
- Recommended for everyone
- Talk to the other hams in your city ARES/RACES group for recommendations

<http://www.scc-ares-races.org/operations.html>

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### EmComm Organizations

National / State / Regional  
County  
Multi-City Groups  
City ARES/RACES teams  
How to get connected

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### ARES / RACES / CRU

- ARES: Amateur Radio Emergency Service
  - A division of ARRL Field Services
  - What we are day-to-day
- RACES: Radio Amateur Civil Emergency Service
  - Official unit under FEMA; defined by FCC Part 97.407
  - What we are when activated by government agency
- CRU: Communication Reserve Unit (Formerly ACS)
  - California RACES under Cal OES
  - Includes RACES, MARS, and other radio comm groups
- Increasingly, organizations are joint ARES/RACES/ACS
  - Santa Clara County merges all three

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### County ARES/RACES/ACS



- Santa Clara County ARES/RACES
  - Weekly Nets
  - Monthly training classes
  - Quarterly drills
  - Public service events
  - <http://www.scc-ares-races.org/>
  - Served by two groups: SPECS, SVECS

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### Santa Clara County ARES/RACES

- Southern Peninsula Emergency Communication System (SPECS)
  - Los Altos, Los Altos Hills, Mountain View, NASA/Ames, Palo Alto, Stanford, Sunnyvale
  - Weekly Net: Monday @ 2000 hrs on W6ASH (145.270 – 100.0)
  - <http://www.specsnet.org/>
- Silicon Valley Emergency Communications System (SVECS)
  - Campbell, Cupertino, Los Gatos, Milpitas, NASA/Ames, San Jose, Santa Clara, Saratoga, Sunnyvale and South County
  - Weekly Net: Tuesday @ 2000 hrs on AA6BT (146.115 + 100.0)
  - <http://www.svecs.net/>

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### Santa Clara County ARES/RACES Leadership

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<http://www.scc-ares-races.org/operations.html>

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### SCCo City Emergency Coordinators (ECs)

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Leota 730th	Burt Baskin, K6BBA	bbaskin @ earthlink.net	(805) 586-1890
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Los Gatos	Peter Harlan, K6PLH	pharlan @ aol.com	Home: (408) 358-8819 Cell: (408) 318-8388
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Savage	Don Steinbach, K6SPW	sdstein @ arrl.net	Home: (805) 885-2812 Cell: (805) 408-2388
Stanford	Lee Roberts, W6RTV	lee @ stanford.edu	(805) 408-4089
Sunnyvale	Jerry Thada, K6JTH	thada @ arrl.net	Cell: (805) 408-4889

<http://www.scc-ares-races.org/operations.html>

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- ### DSW = Disaster Service Worker
- For ARES/RACES, you must be registered as a DSW
    - City events require city registration (contact your EC)
    - County events require county registration (contact DEC or ADECS)
    - Applies to training events as well as real incidents
    - Entitles you to State Worker’s Comp Insurance if injured
  - Process is simple
    - Take an oath and fill out a form (one for city; one for county)
  - Rules for DSW Coverage
    - You must be activated
    - You must be assigned
    - You must be trained and supervised
    - You must act within the scope of your training and assignment
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- ### ARES/RACES Activations
- #### What Should I Do When the Shaking Stops?
- Check you family and your home
    - Without question, your family and home come first
    - You’re no good to anyone if you’re worried about folks at home
  - Check-in/Monitor county resource net
    - Primary: AA6BT (146.115 + 100.0 Hz)
    - North: W6ASH (145.270 - 100.0 Hz) (linked during event)
    - South: N6NAC (444.625 + 110.9 Hz) (linked during event)
  - If asked give damage survey (Mike-Mike covered in next class)
  - Review your go-kit and make sure you’re ready
  - Listen for city EOC to activate
  - When instructed, switch to city frequency
  - Check-in with your City Net control
  - Standby for assignment and activation
    - Make sure your family will be o.k. if you take an assignment
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### Next Steps

What to do when you walk out the door today ...


Local Amateur Radio Clubs  
EmComm Training  
Action Items

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- ### Local Amateur Radio Clubs
- Palo Alto Amateur Radio Association (PAARA)
    - Meetings: 1st Friday of the month at 7:30 p.m.
    - Net: Monday 8:30pm on N6NFI/R (145.230 – 100 Hz)
    - <http://www.paara.org/>
  - Foothill Amateur Radio Society (FARS)
    - Meetings: 4th Friday of the month at 7:00 p.m.
    - Net: Thursday 8:30pm on N6NFI/R (145.230 – 100 Hz)
    - <http://www.fars.k6ya.org/>
  - Northern California Contest Club (NCCC)
    - Meetings: 2<sup>nd</sup> Monday of the Month
    - <http://www.nccc.cc/>
  - Northern California DX Club (NCDXC)
    - Net: Thursday 8pm W6TI/R (147.360 + 110.9 Hz)
    - <http://www.ncdxc.org/>
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- ### EmComm Training
- SCC ARES/RACES Training
    - Monthly training classes – generally the 1<sup>st</sup> Sat. of month
    - Quarterly drills
    - City and county public service events
    - <http://www.scc-ares-races.org/training.html>
  - ARRL Training and Books
    - License Manual, Antenna Book, other great books
    - Amateur Radio Emergency Comms Courses, ...
    - <http://www.arrl.org/catalog>
  - FEMA NIMS/ICS Training
    - ICS 100, ICS 200, ICS 700, ...
    - <http://training.fema.gov/nims/>
  - Red Cross Training
    - Introduction to Disaster Services, Shelter Ops, ...
    - <http://www.siliconvalley-redcross.org>
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### Action Items



- Get the right radio and accessories
  - Talk to your city EC/AECs for more recommendations
- Join your city ARES/RACES group
  - Weekly nets, training, quarterly drills, operating activities
  - <http://www.scc-ares-races.org/activities>
- Learn your radio(s) inside and out
  - Simplex, duplex, offset, tone, memory, reset, etc
- Build your go-kit
  - <http://www.scc-ares-races.org/operations.html>
- Join other clubs and participate
  - Getting on the air is the best way to improve your skills
  - Take part in drills, exercises and public service events
- Ask lots and lots of questions
  - Amateur Radio operators are friendly and helpful
- **Above all, GET ON THE AIR and HAVE FUN!**

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### Theory vs Practice




- Two parts to learning: theory and practice
  - Focus of the classroom is on theory/procedures
  - Practice comes at drills and public service events
- Just like lecture vs. lab in college, both are needed to master the subject

## LECTURE LAB

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### Summary



- You should now be able to
  - Explain VHF/UHF FM technology used in EmComm
  - Use band plans, frequency lists, repeater directories
  - Configure your radio for simplex & duplex operations
  - Participate in a directed net
  - Make direct contacts
  - List three other modes used in EmComm
  - Select an EmComm radio and accessories
  - Understand local EmComm organizations
  - Understand what to do next, after this class
- On-the-air exercise is next ...


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# Thank You!

Course Certificates: <http://www.scc-ares-races.org/activities>  
 Sign In → Print Completion Certificate

Questions, comments, suggestions?


Please fill out Evaluation.



## Exercise is Next

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### Exercise: Get On The Air



- Objective: Contact “Net Control” on each of the following three frequencies and report your first name:
  - Simplex *Assigned in class*
  - Repeater *Assigned in class*
  - Repeater *Assigned in class*
- Recommended Sequence
- Call Net Control
  - “Net Control, this is <your call sign> with one routine message.”
- Net Control will answer
  - “<your call sign>, go ahead.”
- Report your first name and end with your call sign
  - “Net Control, my first name is <your name>. This is <your call sign>.”
- Listen for Net Control to acknowledge
  - “Net Control acknowledges <your call sign> <your name>.”
- If any corrections are needed, remember to end your conversation with your call sign

**YOU**  
**NET CONTROL**

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