

EMERGENCY COMMUNICATIONS TRAINING CLASS: AMATEUR (“HAM”) RADIO

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Updated: July 27, 2002

What is Amateur Radio?

F.C.C. § 97.1 Basis and purpose.

The rules and regulations in this Part are designed to provide an amateur radio service having a fundamental purpose as expressed in the following principles:

- (a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.
- (b) Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.
- (c) Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communications and technical phases of the art.
- (d) Expansion of the existing reservoir within the amateur radio service of trained operators, technicians, and electronics experts.
- (e) Continuation and extension of the amateur's unique ability to enhance international goodwill.

Cal. Govt. Code § 3100.

It is hereby declared that the protection of the health and safety and preservation of the lives and property of the people of the state from the effects of natural, manmade, or war-caused emergencies which result in conditions of disaster or in extreme peril to life, property, and resources is of paramount state importance requiring the responsible efforts of public and private agencies and individual citizens. ...

The burning question: Why are Amateur Radio operators known as "hams"?

One explanation: The last name initials of the three founders of the first collegiate amateur radio club, the Harvard Wireless Club (WIAF), were "H", "A", and "M".¹

Why "Amateur"?

Amateur Radio stations may not receive compensation for operating on Amateur radio frequencies.

Table: Comparison of Citizens Band, Family Radio Service, and Amateur Radio Service

	Citizens Band	Family Radio Service	Amateur Radio
Frequencies	40 channels	14	thousands
Modes	AM/SSB voice ONLY	FM voice ONLY	All!
Power	5 Watts	1 Watt	> 1 kilowatt
FCC License Needed	NO	NO	YES

The purpose of Amateur Radio can be summarized:

- **Emergency Communications:** One of the key purposes of Amateur Radio is to provide a group of volunteers with skills to assist public safety agencies in the event of a disaster or other incident. These activities are an integral part of the purpose of Amateur Radio as defined by the Federal Communications Commission (FCC § 97.1(a); § 97.401(a)).
- **Improving Technology:** Innovation is a key purpose of the Amateur Radio Service. Radio amateurs have pioneered many of the improvements we see today, such as cellular telephones and RF data transmission technology.
- **International Relations:** Because Amateur Radio shortwave frequencies (HF), unlike regular AM/FM broadcast frequencies, travel throughout the ionosphere, hams have the ability to form friendships throughout the world. (Amateur

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¹ <http://madang.dacom.co.kr/HamRadio/whyham.html>

Radio also has VHF/UHF frequencies, similar to police and fire bands, that are short-range and are used for local, tactical communications.)

Introduction to Public Service Communications

- **Law Enforcement:** local police; county sheriff; state, regional, and federal law enforcement
- **Fire Departments and Medical:** fire dispatch; ambulance; hospital communications
- **Other Government:** public works; search and rescue; military
- **Private Service Entities:** Red Cross; Amateur Radio Emergency Service; Associated Public Safety Communications Officers (APSCO)

Problems:

- limited channels
- reliance upon telephone systems - landline & cellular
- Internet/intranet issues
- mutual aid challenges
- What happens to public service communications during an earthquake? No phones, fax, e-mail. Saturated primary channels.
- just a plain old lack of personnel! Ham radio personnel are "bodies" - can do more than just radio.



Amateur Radio Emergency Service (ARES)

Amateur Radio Emergency Service (ARES) & Radio Amateur Civil Emergency Service (RACES)

In the event of a disaster, ARES Emergency Responders perform a number of tasks to assist local fire, law enforcement, and other public service agencies:

- **Back-Up Emergency Communications:** Most public service communications today are heavily reliant upon land-line telephone, cellular telephone, and fax systems to conduct routine operations. In disasters such as earthquakes (or even power-outages), these systems fail. Subsequently, police, fire, and other public service radio channels become rapidly saturated. ARES Emergency Responders are capable of providing such agencies with a complete back-up radio communications system with many additional channels. Furthermore, ARES is capable of using radio frequencies instead of phone lines to transmit computer data (through radio modems, a.k.a. "packet radio").
- **Inter-Agency Communications:** Most agencies have dedicated frequencies and radios that operate only on those frequencies. ARES members can be assigned to "shadow" key people at different agencies' operations centers and in the field to allow inter-agency communication when the agencies are not able to communicate through normal channels. Furthermore, because of the special frequency and power-output privileges Amateur Radio Operators have, direct links can be established to locations out of range of normal public safety radios (such as California State OES in Sacramento or FEMA in Washington, D.C.).
- **Health and Welfare Information:** ARES members can collect and transmit health and welfare messages to the Red Cross and out-of-area family members on behalf of emergency workers and people in the community, freeing personnel to concentrate on priority matters.
- **Simulated Emergency Tests:** To maintain operator skill and to develop working relationships with the agencies they serve, ARES Emergency Responders participate in various disaster drills, exercises, and related activities. Such activities include weekly local "nets" (on the air meetings), county communications exercises, and the famous June Field Day.
- **Community Events:** In non-emergencies, ARES volunteers may assist local authorities by providing supplemental communications for various local events such as parades. ARES Emergency Responders also volunteer for special duty to supplement local agency operations. For example, the Redwood City Police Department uses ARES personnel every New Year's Eve as a part of their "Operation Silent Night" program.

ARES Operations

The Three Rs:

- **Receive** information from direct and indirect sources
- **Record** messages in proper format

One very good radio is the Yaesu VX-5 HT (hand-held) radio which covers 2 meters (144 Mhz), 70 cm (440 MHz) & 6 meters (50 MHz). These radios cost less than \$300 (but plan on spending around \$400 total when you get the accessories you will want with the radio).

You can purchase this radio from Ham Radio Outlet:
 408-736-9496 www.hamradio.com
 510 Lawrence Expressway #102, Sunnyvale CA 94085

You can also check out the various on-line radio dealers such as www.aesham.com.

Here are the accessories you should get for it:

IMPROVED BELT CLIP:

The VX-5R Clip:
 Send a check for \$15.50 to:
 Robert Dashoff (KN6GA)
 28731 Lemon St.
 Highland, CA 92346

SMA TO BNC ANTENNA ADAPTER:

Part # BGA-76 for Yaesu VX-5

Send a check for \$13.45 to:

STEPHEN G. GULYAS
 706 LALOR ST.
 TRENTON, N.J. 08610

(This part allows you to connect your radio to the more standard "BNC" antenna connectors. You can then get a better antenna to use with your radio than the "rubber duck" that comes with it.)

AVAILABLE FROM HAM RADIO OUTLET:

- Soft Leather Case for VX-5 (CSC73)
- Cigarette Lighter Power Adapter for VX-5 (EDC5B)
- Comet (or Diamond or Larsen) BNC "rubber duck" antenna (higher gain than your stock antenna -- use with the SMA to BNC adapter)

You can also get a "mag(etic) mount" (or permanent) antenna for your car. This will greatly improve the range of your H-T while using it mobile.

If you are in an extended emergency operation with your hand-held, the biggest problem will be batteries (presuming you're not near a car or A/C or generator and can just plug in). Solutions include:

- have a spare (charged) H-T battery
- have a battery pack that can use regular batteries (i.e., AA cells, etc.)
- have a sealed lead acid or gell cell battery (charged)

Here are some useful frequencies you should program into your radio:

RX_FREQ	OFFSET	TONE	NAME	DESCRIPTION
145.230	-	100.0	N6NFI	Palo Alto ARES & Santa Clara Co. Hospital Net
145.270	-	100.0	W6ASH/R	SPECS: So. Peninsula Comm. Sys. (Palo Alto; L.A.; Mt. Vw; Snyvale)
146.760	-	151.4	SCCMD1	Santa Clara County-Wide ARES Command 1
146.115	+	100.0	SCRESRC	Santa Clara County-Wide ARES Resource
147.540	S		PA ARES	Palo Alto & Red Cross ARES Tac
147.555	S	114.8	MNLOATH	Atherton & Menlo Park ARES Tac
147.450	S	114.8	CNTYCMD	SCARES County-Wide Command; + ARES Redwood City Tac
146.445	S	114.8	CNTYTAC	SCARES County-Wide Tactical (+ Belmont & San Carlos Tac)
444.500	+	100.0	SCARES	SCARES Repeater
146.865	-	114.8	OES 865	San Mateo Co. Sheriff OES ARES
146.925	-	114.8	OES 925	San Mateo Co. Sheriff OES ARES, W6TOW/R
146.850	-	123.0	OES 850	San Mateo Co. Sheriff OES ARES Alt., W6QFR/R
440.200	+	123.0	N6BDE/R	Stanford ARES Primary Repeater
147.315	+	151.4	BLK MTN	Black Mountain Repeater (San Mateo Back-Up)

If you're interested in meeting new folks and just "rag chewing" (chatting on the radio), the N6NFI repeater (a.k.a. "the '523 machine") is a great place to hang out. Located in the hills above Stanford, the coverage of this repeater is amazing ... you can use it from almost anywhere in the Bay Area.

Repeaters & Simplex:

A Repeater is a box that listens on one frequency (input) and transmits what it hears on another frequency (output). The difference between the frequencies is called the "offset". The offset will either be positive (+) or negative (-) and will generally follow a "standard" for each band.

Difference between Repeaters and Simplex:

Simplex is "direct" – one radio to another. All transmissions and reception are on the same frequency.

CTCSS or PL Tones:

PL tones are used to reduce interference by allowing the squelch (on a repeater or your radio) to open only when it detects a certain sub-audible tone (or sequence).

Autopatch (a.k.a. Phone Patch)

Some repeaters have autopatch capabilities which allow a radio operator to link to a telephone line. Commonly used to call police, fire, AAA, etc., autopatch provides an alternative for operators when cell phones are not operating or feasible.

Repeater Etiquette:

Bad operators are known as "lids" ... don't be a lid. ☺ Most fellow operators will be patient with you as a newbie, but always strive to be a good operator, of course.

Here are some tips:

- Remember, to let someone know you're available on a repeater, just give your callsign and say "monitoring", i.e., "This is KG6XYZ ... monitoring." (Calling "CQ" is for HF.)
- Always ID yourself legally: At the end of a transmission or series of transmissions and at least once every 10 minutes during the communications.
- Keep transmissions short and thoughtful; listen for "breakers" who might be trying to transmit.
- Use simplex whenever possible (to see if you are in range, listen for the other station on the repeater's input frequency).
- No need to say "over" on a repeater (many have a "courtesy tone" that beeps when the other station has stopped transmitting).

Standardized Emergency Management System (SEMS)

- Standardized Emergency Management System (SEMS) (Cal. Code § 8607).³
- Arose from problems in inter-agency mutual aid communication.
- Based on the Incident Command System (ICS)
- Amateur Radio is included as a component of SEMS (logistics - communications).

Under California state law and SEMS, the California State Office of Emergency Services (OES) is responsible for disaster planning and response. The OES divides the states into **operational areas**, which are the 52 counties in the state. Therefore, **counties** are the responsible coordinating entity for disaster recovery.

Disaster Service Workers:

- Identification
- Insurance
- Activation

Volunteer disaster service workers may be covered by workers' compensation insurance from the moment they leave their home until their safe return home. This is true only if they are dispatched for duty during an emergency by competent authority (i.e., any government agency) prior to departure and no route deviations are made for personal reasons. For example, Radio Amateurs from a non-impacted area may be covered while en route to a disaster response area if properly dispatched for mutual aid purposes by an official Emergency Coordinator or directly by the government agency. On the other hand, the same Radio Amateurs mentioned above,

³ SEMS is supposed to use "plain English" - however, public communications dispatchers, etc. will likely revert to their training, so it's a good idea to know the 10 Codes, etc. (see below).

traveling to the disaster impacted area on their own initiative without official orders or permission would not be covered by disaster workers' compensation insurance until they register (log-in) with the authorities at the disaster site or unless a pre-arranged automatic activation procedure is in place. Coverage may also be provided in specific cases of disaster service roles requiring automatic dispatch of key resources if each case is pre-arranged by competent authority on an individual, case-by-case basis. Coverage is also available for scheduled disaster preparedness activities including training, but not while en route to and from the reporting place for these activities.

Protocol and Codes:

Most of our "clients" (police/fire personnel) will have little familiarity with the Amateur Radio Service. To them, "a radio is a radio." You are considered an "expert" in radio. This is why it is good 1) to learn about public safety radio systems (since in an emergency, you could be asked to also use a police/fire radio) and 2) to educate your served agencies about the capabilities and limitations of ham radio (through the Emergency Coordinator).

SEMS is supposed to use "plain English" - however, public communications dispatchers, etc. will likely revert to their training, so it's a good idea to know the 10 Codes, etc. DO NOT use Q-signals or ham radio jargon!⁴

"Break": If you need to interrupt someone or break into a conversation, wait for a pause and say "break". Typically, this is used only for priority (emergency) traffic, although you can use it if you just want to get a word in edgewise. It is also used to let the repeater "drop" the carrier and reset its transmission limit timer so that it doesn't "time out". "Break" is also used when you have finished a message to one station and are immediately contacting another station or are pausing to get acknowledgement. For example: "This is Stanford DPS acknowledging the traffic from Palo Alto Fire - break - Menlo P.D., do you copy?"

Callsigns:

During disaster communications, operators/stations will generally be assigned *tactical callsigns*. A tactical callsign is simply a geographic- or function-based description, i.e., "Menlo Park EOC" or "San Fransquito Creek Flood Watch 3." Remember that unless an emergency situation is in effect, you are still obligated to comply with FCC identification rules (this can be easily done by incorporating your FCC callsign with your tactical callsign at the times you are required to ID: i.e., "Atherton EOC KB6OEN").

A SERIOUS POINT:

"Police and fire officials tend to be very cautious and skeptical concerning those who are not members of the public-safety professions. This posture is based primarily on experiences in which well-intended but somewhat overzealous volunteers have complicated, and in some cases jeopardized, efforts in emergencies. The amateur operator or other volunteer who wishes to be of assistance must be aware of this perception. ... How Amateur Radio volunteers are accepted depends on their establishing a track record of competent performance in important activities. This begins with convincing officials that amateurs offer a cost-effective (otherwise known as free) substitute for functions previously paid for by the taxpayer. Local radio amateurs also must demonstrate that they are organized, disciplined and reliable, and have a sincere interest in public service."⁵

Radio Nets:

A "net" (short for network) is any regularly scheduled get-together on a certain frequency. Locally, there are several training nets that you should consider "checking in" on to gain practice in using your radio and learn how emergency communications works.

During a net, one station acts as "net control" (much like a dispatcher). The net control station regulates the flow of radio traffic. In a "directed net", each station must make direct contact with the net control before calling any other station. The net control will generally conduct a check-in period and then ask if any stations have "traffic (for the net)". Then, once all stations are checked in, messages/traffic are passed.

Locally, there are a number of regular training nets where radio operators can practice their skills (and keep the dust off their radios).

- **The South County Amateur Radio Emergency Service (SCARES)** [covers southern San Mateo County] holds a net Mondays at 7:30 p.m. on 146.445 Simplex or 444.500 (-) PL 100.0. More info on www.k6mpn.org. If you are not yet a SCARES member, you can check in towards the end of the net as a "guest".
- **The San Mateo County Sheriff's Office of Emergency Services (OES)** holds a net every Tuesday at 8:00 p.m. on 146.865 (-) PL 114.8 and 146.925 (-) PL 114.8. The net generally takes check-ins from all San Mateo Cities, then from cities outside San Mateo County. In a non-emergency, this net is open to all stations who want to check in.
- **Southern Peninsula Emergency Communications System (SPECS)** [covers northern Santa Clara County] holds a net Monday evenings at 8 p.m. on 145.270 (-) PL 100. On this net, the Emergency Coordinators for each city are check in first. Then, each E.C. goes to their local ARES/RACES frequency to have individual members check in. If you live in San Mateo County, you can check in to this net when they give instructions for "Palo Alto and north".

⁴ Note: Some police/fire agencies do use Q-signals and other Amateur Service codes. This is historic: The pioneers in public safety radio systems were ham radio operators - so the departments simply adopted the protocol.

⁵ From www.arrl.org

Radio Clubs:

There are a number of radio clubs locally that should be of interest and benefit to you as a new operator.

- **South County Amateur Radio Emergency Service (SCARES):** SCARES is a club focused on emergency communications (ARES/RACES) and serves southern San Mateo County. Their Web page is: <http://www.k6mpn.org>
- **Palo Alto Amateur Radio Association (PAARA):** meets every 1st Friday of the month at 7:30 p.m. at the Menlo Park Recreation Center. Web: www.qsl.net/paara/.
- **Southern Peninsula Emergency Communications System (SPECS):** Similar to SCARES, but covers northern Santa Clara County. Web: www.specsnet.org.

Note: Being a member of a radio club is separate from being signed up as a volunteer with ARES/RACES. Be sure you 1) register to get your DSW card and 2) sign-up with your local Emergency Coordinator. (E.C.)

- If you live in San Mateo County, contact Peter Liljequist to find out who your local E.C. is: kd6bxy@arrl.net.
- If you live in Santa Clara County, find your E.C. on the Web: <http://www.scc-ares-races.org/cities.htm>

Summary Action Plan to Be a Radio Volunteer:

- your FCC radio license
- contact your local E.C. and sign up to be a ARES/RACES volunteer
- get your Disaster Service Worker (DSW) ID card
- participate in radio "nets"
- join one or more radio clubs
- participate in radio drills and exercises & public service events
- tell your friends about Amateur Radio

Stanford University has had a number of famous electronics pioneers - who were also ham radio operators: Professor Frederick Terman was the author of a number of seminal works in electronics/radio; "In 1934, Terman developed a ... headquarters-to-field radio system for Palo Alto police, making it one of the first forces in the nation to have an operating radio system."⁶ Bill Hewlett and Dave Packard were also ham radio operators. But there is much more to Amateur Radio than engineering and science. A huge range of interests are covered by the umbrella of this hobby. This is reflected by the diversity of Amateur Radio Operators (see below).

Other Famous Radio Amateurs:

EA0JC Juan Carlos, King of Spain

F05GJ Marlon Brando, actor

JY1 King Hussein of Jordan (SK)

K7UGA Senator Barry Goldwater (SK)

KA6UXR Dr. Alexander Comfort, Author ([The Joy of Sex](#))

KB2GSD Walter Cronkite, news anchor

KA7EVD Donny Osmond, entertainer

KD4WUJ Patty Loveless, alias Patty L. Ramey, country singer

KD6OY Garry Shandling, comedian

N6YOS Priscilla Presley aka Lou Lou Beaulieu, actress

VU2RG Rajiv Gandhi, Prime Minister of India (SK)

W4LAA Paul Kangas, host of "Nightly Business Report" (PBS)

W5LFL Owen Garriot, astronaut

W6EZV General Curtis LeMay, U.S.A.F. Strategic Air Command (SK)

W6FZZ Samuel F.B. Morse III (great-great grandson of the inventor of Morse code)

W6JKV James Treybig, CEO of Tandem (Stanford MBA '68)

W6QYI Cardinal Roger Mahony of Los Angeles

W6ZH Herbert Hoover Jr., grandson of US President

WA4CZD Chet Atkins, guitar player

WA4SIR Ron Parise, astronaut

WB4KCG Ronnie Milsap, singer

N6FUP Stu Cook, bass player for CCR (Credence Clearwater Revival)

HS1A Bhumiphol Adulayadej, King of Thailand

The entry-level radio exam is *easy* – only 35 multiple-choice questions.

Practice for it on the Web: <http://www.aa9pw.com/>

