



Simplex Operations

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Realistic disaster training anticipates that some or all local repeaters may be unavailable. After a storm, repeater battery power must be conserved. Don't hog the repeater to rag chew with your buddy or always expect the repeater to "be there" to compensate for your poor station. Amateur radio emergency plans must stipulate when simplex is appropriate and provide guidance on frequency coordination, to manage operations without depending upon repeater infrastructure.

Repeaters are appropriate for event "talk-in" and to reach into areas with poor simplex coverage, but don't rely on them for your primary working frequency. If an event covers a few miles radius, use simplex instead of tying up the repeater. Keep repeaters available as backup into difficult to reach areas, alerting, or other purposes where wide-area coverage is needed.

When using the repeater, pause between transmissions, to enable stations with priority traffic to break in or assist in providing relays.

Instruct new operators where the "reverse" button is on their radio, so they can listen on the input frequency. If someone has a poor signal into the machine and you can copy on the input, you can relay. If making a contact and both stations have good copy on the input, change to simplex to free up the machine.

Nets which normally meet on a repeater when the repeater is "down" should be called on the repeater output frequency simplex, because that's where people will be listening.

Establish and distribute a local communications plan. This informs operators which simplex frequencies to use for local nets and encourages operators to pre-program equipment to a standard list and to use their assigned simplex channels routinely. Simplex frequencies are not formally "coordinated," but should be arranged under "gentleman's agreement" by EmCom groups in your operational area.

New operator classes should include operating skills beyond the minimum needed to "pass the test." Teach the proper use of procedural words, ITU phonetics.

Stress Accuracy Brevity and Clarity in all modes of communications.

Teach messaging fundamentals using both ICS and NTS radiogram forms. Encourage new hams to participate in public service events, so they can practice, gain experience and confidence enabling them to become skilled, effective emergency communicators.

On simplex, it is important to open the squelch to listen for weak stations, instead of keeping it tight to reduce noise. Encourage use of simplex on weekly training nets as a reliability check of your emergency equipment, instead of using commercial power. New operators also need to be taught to use plain language, correct "pro words" and ITU phonetics on phone and how to program a new frequency, offset and CTCSS tone not already in memory.

Hand held transceivers are not adequate as primary rigs for emergency communications! If an HT signal is so weak that it cannot be copied, it takes double the air time and battery consumption from others to provide relays, repeats or fills. Having "only an HT" limits you to nearby repeaters or simplex within a few miles.

Stress the use of minimum power needed for reliable communication, but remember that with simplex, the emphasis must be on **RELIABLE!** New operators of driving age should buy 50w mobiles as first rigs. Today they cost no more than a HT, but they have better simplex performance. When you can afford a spare rig, THEN buy a sturdy dual-band HT! A portable is always useful to have as a backup, loaner and for use on solo foot assignments, such as damage assessment.

Guidance is necessary on appropriate battery power for working simplex versus local or distant repeaters. If a repeater goes off the air, your HT battery will run down more quickly, due to making higher-power transmissions. For EmCom your HT should be able to operate from its original rechargeable battery pack, an AA battery case, an auto cigarette lighter, or external gel cell battery.

If you have trouble getting through, improve your antenna system first. Mobile/portable VHF operators for county-wide nets need 25 watts output and a mast clamp to elevate a mobile 5/8 wave (3db) gain antenna 15 ft. or more above ground elevation. Hand held users in fringe areas need external battery power to maintain 5w into an elevated antenna with at least unity gain, such as a 1/2 wave J-pole, or better a 3-4 element Yagi.

HT users may augment their HT with a 25-30w brick amplifier. Use enough transmitter output to get your traffic through the first time, but don't waste your batteries with inefficient use of excessive power, which causes interference to distant stations you can't hear!

Home fixed stations should have an elevated antenna such as a discone in the attic, or an outdoor dual-band vertical at good height, and adequate battery power to last a minimum of 24 hours.

Don't depend on having a regular Net Control!

EmCom operators should all learn how to call up and run a net. In an emergency, your "regular" net control may be busy elsewhere! If the NCS of a scheduled weekly net misses his "sked", use the opportunity for a "wall flower drill." Somebody should just jump in there and do it. A suggested script is available at www.w4ava.org for groups that want to start their own local training net.

All directed nets follow a similar procedure.

NCS comes up on the working frequency and asks if it is in use. If the frequency is clear, call the net. State its purpose and note that it's a directed net. Ask if there is any emergency or priority traffic. If there is, then deal with it now! Call for liaisons from other nets, stations with traffic or any who need relays.

Emergency nets don't take check-ins to build a roster, but to match up needs with assets.

NCS asks who has traffic or information, determines which stations can handle the traffic or task, assigns stations to handle it, deals with it as it comes and moves on. If the net is not busy, traffic may be passed on the net right immediately. When traffic is heavy, NCS should direct stations off frequency to pass their traffic while the net proceeds. Stations sent off-frequency should check back into the net when finished. Moving an entire net in unison to an alternate frequency should be done only as a last resort, because some stations WILL get lost in the shuffle.

A "weak signal" rig is recommended for the primary NCS

because its improved sensitivity brings in fringe stations those typical FM mobiles can't even hear. All-mode transceivers that don't receive outside the 2-meter band are less susceptible to intermodulation distortion. EmCom must be able to operate in high RF environments in close proximity to emergency services, hospital paging and other users. CTCSS reduces interference, but when the squelch is open RF mixing products can still get in.

In our experience Par Electronics notch filters <http://www.parelectronics.com/amateur.htm> work better for IMD suppression in typical EmCom applications than the DCI helical cavity band pass. These are compatible with dual-band rigs, with low VSWR, transparent UHF pass-through, and are effective when a strong near-field source desenses typical mobile transceivers. In tests conducted at the Washington, DC area 2-meter simplex contacts were reliable to 15 miles away, impossible with the DCI "can" used in the same high-RF environment.

Low-loss UHF pass-through enabled UHF simplex contact between hospitals within a ten-mile radius of the "Command hospital" during the Dulles Disaster 2000 Exercise.

Dual-band rigs are desirable, because UHF is more effective than VHF in built-up urban areas. Use dual-band mobiles in cross-band repeat with CTCSS as access control to conduct nets from within shelters or hospitals and to reach into low areas with poor simplex coverage.

The 220 MHz band is quiet, less affected by intermodulation than 2 meters. It gets out of buildings well and has good simplex propagation. If you have enough operators with 220 capability, you include it in your operating plans.

The importance of increasing antenna height cannot be stressed highly enough. A 4-element Yagi elevated 15 ft. with 25w from an HT+brick amp out performs 100 watts into a typical mobile whip mounted on the car trunk lid. If you don't use a portable mast, at least drive to high terrain away from power lines to operate. Using a portable mast mounted base antenna or Yagi enables you to use less power to save your batteries. Some of our operators use a ground radial adapter, which enables a mobile antenna to be attached with hose clamps and elevated on a portable mast. The rest use a small dual-band base antenna with at least 3db gain.

Antenna Recommendations: Cushcraft's AR-270 dual-bander is only 3.75 feet high, 5/8 wave on 2m and collinear on 440. The Diamond X-50N is another compact dual-band antenna that fits into an SUV. Their performance and VSWR are also acceptable for low power 220. Both are ideal either for portable use or attic installation where outside antennas may be restricted.

Most mobile VHF operators use 5/8 wave 2-meter whips. These will also work as a 1/4 wave whips on 6 meters if you feed both rigs through a diplexer. If you use a dual-band radio the Larsen NMO-2/70 is hard to beat. Serious 2-meter mobile simplex operators like the Diamond SG7900, Hustler CG144 or the Lakeview 2m Hamstick.

Bicycle / motorcycle/ marine mobiles, fiberglass van or ambulance bodies without a ground plane require half-wave antennas (Diamond SG7200 or Comet CX-224) which provide unity gain without a vehicle ground. The Radio Shack window-clip mount enables attaching a BNC whip to your HT while having a clear RF path outside the vehicle.

For simplex operation from fringe areas, small Yagis such as Cushcraft's A148-3S or 124WB are compact, have good gain and a wide useable pattern. Short Yagi antennas of about 1/2 wavelength with up to five

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elements can be used in fixed position without the frequent re-aiming required of long "boomers." Color-code elements, use wing nuts to ease reassembly and store the antenna in capped PVC pipe.

It is basic to emergency operation that stations have sufficient batteries or other auxiliary power to operate for at least 24 hours.

One amp-hour of battery capacity per watt of transmitter output is the minimum recommended. "Barefoot" HT operators need at least a pair of 12-volt, 2ah gel cell batteries, extra NiCd pack, AA battery case, plus a gain antenna such as a telescoping half-wave, "tiger tail" counterpoise, a mobile magnetic mount or wind-up J-pole.

Powering a mobile rig from the car battery works OK for only a few hours. It is wasteful of scarce gasoline in a real emergency to run the engine for 10 minutes out of every hour to keep the battery charged, when there may not be electricity to run the pumps!

A better technical solution is to equip a vehicle with dual batteries and an isolator obtained from a boating or RV supplier so that both batteries are charged by the vehicle alternator, but isolated when discharging. If the vehicle is not driven regularly, connect solar panels equal to 1-1/2 to 2% of the battery capacity to maintain the battery banks against self-discharge when the vehicle is idle. If the solar panels don't exceed 2% of battery capacity, they are self-regulating and no charge controller is then needed.

A lower-cost option is to carry a boxed deep cycle battery and automatic, low amperage AC charger such as a Schumacher Electric Mod. SE-1-12S (Wal-Mart, \$39).

Despite their popularity, gel cells are not "the answer" because they are not deep cycle and depth of discharge over 25% significantly reduces their life! They are unusable below -20°C, in the engine compartments of vehicles or other uses subject to temperatures above 50 degrees. C. Gel cells must never be charged at over 14 volts or with unregulated current exceeding 1/10 of their capacity. Gel cells larger than 10 amp/hours can be left continually on an automatic, low amperage charger without harm, but should not be allowed to "float" endlessly without shut-off.

For portable operations requiring movement in support of SAR or wildfire suppression, a 15-18ah gel battery such as those used in fire alarm panels and emergency lighting fit in a brief- case or backpack and power a 5w HT, laptop, GPS and

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TNC all day. Better for extended "portable ops" is a Group U1 33ah AGM battery, used in wheel chairs. These weigh 25 pounds, fit in a military .50 cal. steel ammunition and run a 25w mobile or laptop, TNC and separate voice and data HTs all day. Two U1's power a dual-band mobile on 10w cross-band repeat for 48 hours. For continuous operation alternate between two batteries, recharging in 8-hour rotations. If unable to recharge, the primary net control needs a BCI Group 27 (95 ah) battery to go around the clock at 25w with a decent antenna.

Flooded batteries are cheap and plentiful...

However, they must be boxed, stored upright and lose half of their capacity below freezing. Better, for severe service, high vibration, extreme temperature environments are valve regulated AGM batteries used in military or public safety vehicles and by the US Coast Guard. A Group 27 Concorde Lifeline (65 lbs., \$199) has aircraft-type cell construction and is UPS shippable from West Marine, (1-800-BOATING). It can power a 100w HF rig through Field Day! Lifeline batteries come in the small U1 size as well as the popular Group 24, 27 and 30 marine sizes.

The usual failure mode of dry NiCds in hand held transceivers is not "memory" effect, but either deep discharge causing cell reversal or diminished capacity caused by excessive charge current or prolonged slow over charging. Safely charge dry NiCds using rated voltage + 15% to overcome internal resistance, at current equaling 10% of the battery capacity, times ten hours.

Prepare a "Go Kit" with Essential Equipment.

Carry basic emergency equipment in your car to include essential tools; first aid kit; some emergency cash (enough for a tank of gas, hot meal, and a room); coax and antenna; battery, power cords and wall charger; a ABC fire extinguisher; three days supply of nonperishable food and drinking water; sanitation supplies (baby wipes highly recommended!) medications; rain gear, sturdy shoes and a change of warm clothing.

We do not recommend for EmCom the use of magnetic mounts constructed using RG-58 coax having a solid center conductor. This cable is suitable only for permanent vehicle installations where it will not be subjected to repeated flexing.

Factory installed crimp-UHF connectors on magnetic mounts should be reinforced behind the reducer with heat shrink or tape. Frequent flexing eventually causes failure of the shield at the connector, at the worst possible time.

Best simplex performance results from using an efficient antenna, elevated as high as you safely can above surrounding ground elevation, using the shortest

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run of low loss feed line, providing the highest effective radiated power for the least battery consumption.

Use RG8-X only for HF runs less than 100 ft, jumpers and short VHF runs to 30 feet and for mobile installs. Use RG-8 or RG-213 for HF or 6 meters for runs up to 200 ft. or 2 meters up to 50 ft. Use LMR400 for VHF runs over 50 feet and all uses above 200 MHz.

By training to operate effectively on simplex, EmCom is more flexible and able to maintain emergency communications independent of repeater infrastructure.

Visit the Arlington County, Virginia RACES web site: <http://www.w4ava.org> for more information.