Section 4: What Happens When Called

Topic 17

Equipment Choices for Emergency Communication

Objectives

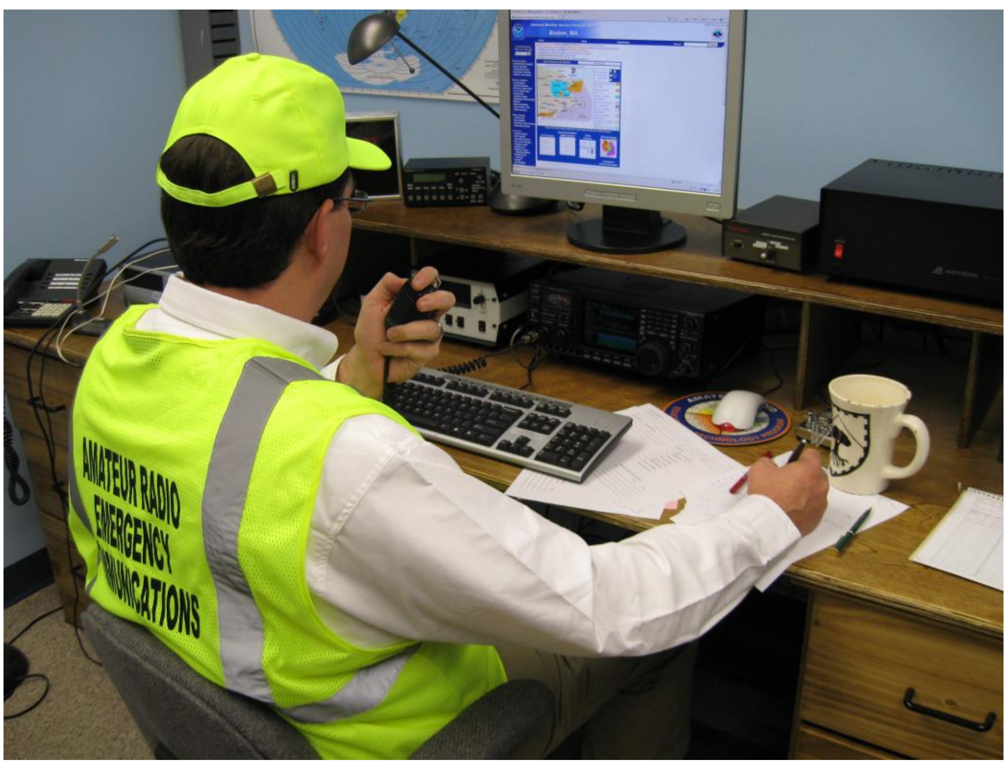
Welcome to Topic 17.

There is no one "best" set of equipment that will ensure success for every assignment, but the principles outlined in this topic will help you to make intelligent choices.

Student preparation required:

None.

ARRL — ARES® Branded Apparel Standard



There are many articles of ARES-branded clothing on the market. Some is from ARRL itself, but much more is from other manufacturers and sellers with the ARES logo added.

There is a strong need for ARES volunteers to have a uniform look when they are on actual deployments. Other organizations have instituted standards for volunteers that provide identity, support public relations, and comply with new emergency communications standards (the American Red Cross [ARC] is an excellent example of this). ARES volunteers, however, continue to appear in all sorts of garb, are not easily recognized, and may fail to meet the increasing clothing and ID requirements of National Incident Management System (NIMS) applications.

This recommended standard (specifics in following pages) does not affect or change the availability or marketing of ARES-branded clothing in non-deployment uses. It refers only to periods when ARES volunteer personnel are deployed for public service or emergency response situations. The result is easier identification, better recognition of the services that ARES performs by and for the public, more professional and peer acceptance, and an esprit de corps across ARES groups that surpasses localized identities.

Apparel Specifics

Garment Colors

Safety Green (many people call it yellow) with silver reflective tape that meets ANSI Class 2 standards.

Garment Types

Three types to accommodate climate conditions:

1. T-shirts — long- and short-sleeve, 50/50 cotton/poly.
2. Vests — Velcro or zip front, break-away, 100% polyester, solid or mesh.
3. Jacket or coat.

The Backs of Garments

All garments shall be imprinted on the back with 2-inch-tall Arial Black font, black in color, three lines, center justified:

AMATEUR RADIO
EMERGENCY
COMMUNICATIONS

If the size of the vest does not allow for that size font, the next closest Arial Black font size that fits should be used.

Those in a leadership position may add their title (SEC, DIRECTOR, EC, PIO, etc.) below Emergency Communications in not less than 3-inch-tall Serpentine font, black.

The Fronts of Garments

Front left chest shall be imprinted with the ARES logo, no less than 3.5 inches, and black in color. If the vest size is such that it does not allow room for that size logo, the closest size to it that fits there shall be used.

The right chest area of the garment shall be left blank to allow wearer to affix their name/call badge or official ID badge.

Adding Organizational Names to Garments

Local jurisdictions may elect to add their organization name in the either or both of two places:

1. On the front below the ARES logo, Arial Black font, black in color, in not larger than ½-inch lettering.

2. On the back by adding the organization name (such as SUSSEX COUNTY, DELAWARE ARES) above Amateur Radio Emergency Communications with no larger than 1-inch Arial Black font, black in color.

Implementation of Apparel

The current safety apparel items that are being manufactured are ANSI/ISEA 107-2004 Class 2 compliant, a design and performance criteria for vests worn by police officers, firefighters, emergency medical services, and other public safety personnel.

ARES volunteers in deployments, both emergency- and community service-related, will be encouraged to wear outermost garments meeting these standards.

Clubs and other groups are encouraged to make group buys through ARRL, which may provide discounts for such purchases for ARRL-affiliated clubs and groups. Garments available through the ARRL store are described at www.arrl.org/shop/Public-Service/.

ARES members who may note merchants still selling ARES deployment clothing (intended for outerwear while on actual deployment) not meeting these standards are requested to politely inform the merchant of the new standards.

VHF/UHF Transceivers

The most universal choice for emergency communications is a dual band FM 35- to 50-watt mobile transceiver. Radios in this class are usually rugged and reliable, and can operate at reasonably high duty cycles, although an external cooling fan is always a good idea if one is not built in. Handheld transceivers should be used only when extreme portability is needed, such as when “shadowing” an official or when adequate battery or another dc power is not available. Handheld radios should not be relied upon to operate with a high duty cycle at maximum power, since they can overheat and fail.

Both portable and mobile dual-band radios can be used to monitor more than one net, and some models allow simultaneous reception on more than one frequency on the same band (sometimes known as “dual watch” capability). Some mobiles have separate external speaker outputs for each band. For high-traffic locations, such as a Net Control Station (NCS) or Emergency Operations Center (EOC), a separate radio for each net is a better choice since it allows both to be used simultaneously by different operators. (Antennas must be adequately separated to avoid “de-sensing.”)

Many dual-band transceivers also offer a “cross-band repeater” function, useful for linking local portables with distant repeaters, or as a quickly deployable hilltop repeater. True repeater operation is possible only if all other mobile and portable stations have true dual-band radios. Some so-called “dual” or “twin” band radios do not allow simultaneous or cross-band operation — read the specifications carefully before you purchase one.

HF Transceivers

Operation from a generator-equipped Emergency Operations Center can be done with an ac-powered radio but having both ac and dc capability ensures the ability to operate under all conditions. Most 12 V HF radios fall in either the 100-watt or low power (less than 5 watts, also known as “QRP”) categories. Unless power consumption is extremely important, 100-watt variable output radios should be used. This gives you the ability to overcome noise at the receiving station by using high power, or to turn it down to conserve battery power when necessary.

Do not use dc-to-ac inverters to power HF radios. Most use a high-frequency conversion process that generates significant broad-spectrum RF noise at HF frequencies that is difficult to suppress. Direct dc powering is more efficient in any case.

Voltage Tolerance and Current Drain

Some transceivers nominally powered using 12 V dc actually have a rather narrow range of voltage (e.g., 13.0 to 13.8 volts) over which they will operate properly, and even a high-quality battery part way through its discharge cycle can easily fall below such a tolerable range. Transceivers with a wide range of acceptable input voltages (e.g., 11.5 to 15 volts) are preferable in limited-power situations; they will keep operating as the external battery discharges.

Similarly, some transceivers draw much more power than others during receive. If your chosen rig has a current drain on the high side, look for menu settings that will lower the overall drain, especially if you will be operating from a limited power source.

Radio Receiver Performance

For radios on all bands, several aspects of a radio receiver's performance can affect its suitability for emergency communications. These include sensitivity (ability to receive weak signals), selectivity (ability to reject signals on adjacent frequencies), and intermodulation rejection (ability to prevent undesired signals from mixing within the receiver and causing interference). If you are inexperienced at comparing radio specifications, be sure to ask for guidance from another more experienced ham radio operator. An in-depth discussion of radio performance specifications is beyond the scope of this topic.

When operating near public service and business radio transmitters, an FM receiver's "intermodulation rejection" is important. Mobile radios generally have better intermodulation rejection than handheld radios, but you should review each individual radio's specifications. External intermodulation (band-pass) filters are available, but they add to the expense, complexity, size, and weight of the equipment. Band-pass filters will also prevent you from using a broadband radio to monitor public service frequencies. Some older "ham bands only" FM mobile radios have better front-end filtering than newer radios with broadband receive capability, making them more immune to intermodulation and adjacent channel interference. Receiver filters are important for effective HF operation. Choose appropriate filters for the types of operations you are most likely to use, including CW, RTTY, and phone.

Digital Signal Processing (DSP) may be the single most important filtering feature available. Internal or external DSP circuits can allow clear reception of signals that might not otherwise be possible in situations with heavy interference.

"Noise blankers" are used to reduce impulse noise from arcing power lines, vehicle and generator ignition systems, and various other sources. While most all HF radios have some form of noise blanker, some work better than others. Test your radio in suitably noisy environments before designating it for emergency communications use.

Please read the article in the link below for more information regarding *QST* Product Reviews:
http://www.arrl.org/files/file/Technology/tis/info/pdf/QST_Aug_2004_p32-36(1).pdf

Antennas

VHF/UHF

A good antenna, mounted as high as possible without incurring large feed line losses, is more important than high transmitter power. Not only does it provide gain to both the transmitter and receiver, but a higher gain antenna may also allow output power to be reduced, thus prolonging battery life. In relatively flat terrain, use a mast-mounted single- or dual-band antenna with at least 3dBd gain. If you are operating in a valley, the low angle of radiation offered by a gain antenna may actually make it difficult to get a signal out of the valley. Low or “unity” gain antennas have “fatter” radiation lobes and are better suited for this purpose. Unity gain j-poles are rugged, inexpensive, and easily built. For directional 2-meter coverage with about 7-dBd gain, a three- or four-element Yagi can be used. Collapsible and compact antennas of this type are readily available. For permanent base station installations, consider a more rugged commercial two-way collinear antenna, such as the well-known “Stationmaster” series. Most 2-meter versions will also perform well on 70 centimeters. Commercial open dipole array antennas will work well for a single band and are more rugged than a fiberglass radome-encased collinear antenna.

A magnetic mount mobile antenna is useful for operating in someone else’s vehicle. They can also be used indoors by sticking them to any steel surface, such as filing cabinets, beams, or ductwork, even up-side down.

Handheld radio antennas, known as “rubber duckies,” have negative gain. Use at least a 1/4-wave flexible antenna for most operations and consider a telescoping 5/8-wave antenna for long-range use in open areas where the extra length and lack of flexibility will not be a problem. “Roll-up j-pole” antennas made from 300-ohm television twin lead wire can be tacked up on a wall or hoisted into a tree with heavy-duty string. In addition to unity gain, the extra height can make a big difference. Even a mobile 1/2-wave magnetic mount antenna can be used with a handheld when necessary.

HF

There is no single perfect antenna for HF operation; however, when possible, choose an antenna resonant on the band you will be operating, a compromise antenna also means compromise performance. Your choice depends on the size and terrain of the area you need to cover, and the conditions under which you must install and use it.

For local operations (up to a few hundred miles), a simple random wire or dipole hung at a less than 1/4-wavelength above the ground works well and is easy to deploy. This is known as a “Near Vertical Incidence Skywave” (NVIS) antenna. The signal is radiated almost straight up, and then bounces off the ionosphere directly back downward. During periods of high solar activity, NVIS propagation works best on 40 meters during the day, switching to 80 meters around sunset. During low parts of the sunspot cycle, 80 meters may be the most usable daytime NVIS band, and 160 meters may be needed at night. The new 60-meter band is also ideal for NVIS operation.

An antenna tuner is necessary for most portable wire antennas (especially for NVIS antennas) and is a good idea for any HF antenna. The antenna’s impedance will vary with its height above ground and proximity to nearby objects, which can be a real problem with expedient installations. An automatic tuner is desirable, since it is faster and easier to use, and many modern radios have one built in. Include a ground rod, clamps, and cable in your kit since almost all radios and tuners require a proper ground in order to work efficiently.

For communication beyond 200 miles, a commercial trapped vertical may work, although it has no ability to reject interfering signals from other directions. Mobile whip antennas will also work, but with greatly reduced efficiency. The benefits of a mobile antenna are its size and durability.

Directional (beam) antennas offer the best performance for very wide area nets on 10 to 20 meters, since they maximize desired signals and reduce interference from stations in other directions. This ability may be critical in poor conditions. Beam antennas also have a number of limitations that should be considered. They are usually expensive, large, and difficult to store and transport. In field installations, they can be difficult to erect at the optimum height, and may not survive storm conditions. One strategy is to rely on easily installed and repaired wire dipole antennas until conditions allow the safe installation of beam antennas.

Feed Lines

Feed lines used at VHF and UHF should be low-loss foam dielectric coaxial cable. For short runs of 30 feet or less, RG-58 may be suitable. For longer runs, consider RG-8X or RG-213. RG-8X is an “in-between” size that offers less loss and greater power handling capability than RG-58 with far less bulk than RG-213. If you wish to carry only one type of cable, RG-8X is the best choice.

On HF, the choice between coaxial cable and commercial (insulated, not bare wire) “ladder” line will depend on your situation. Ladder line offers somewhat lower loss, but more care must be taken in its routing, especially in proximity to metal objects or where people might touch it. Coaxial cable is much less susceptible to problems induced by routing near metal objects or other cables.

Operating Accessories

Headphones are useful anywhere and are mandatory in many locations. Operators in an Emergency Operations Center or a Command Post where multiple radios are in use must use headsets. They are also beneficial in locations such as Red Cross shelters, to avoid disturbing residents and other volunteers trying to get some rest.

Some radios and accessory headsets provide a voice operated transmit (VOX) capability. During emergency communications operations, this should always be turned off and manual “push-to-talk” buttons used instead. Accidental transmissions caused by background noise and conversations can interrupt critical communications on the net. As an alternative to VOX, consider using a desk or boom microphone and foot switch to key the transmitter. A microphone/headset combination and foot switch also work well.

Batteries

Battery power is critical for emergency communications operations, as ac power cannot usually be relied upon for any purpose, and portable operation for extended periods is common. Batteries must be chosen to match the maximum load of the equipment, and the length of time that operation must continue before they can be recharged.

NiCad, NiMH, and Li-Ion Batteries

For handheld transceivers, the internal battery type is determined by the manufacturer. NiMH batteries store somewhat more energy than NiCad batteries for their size. Many smaller radios are using lithium-ion (Li-Ion) batteries, which have much higher power densities, without the so-called "memory effect" of NiCad's. Many handhelds have optional AA alkaline battery cases and are recommended emergency communications accessories. Common alkaline batteries have a somewhat higher-power density than NiCad batteries, are readily available in most stores, and may be all you have if you cannot recharge your other batteries. Most handheld radios will accept an external 13.8Vdc power connection for cigarette lighter or external battery use.

External batteries of any type can be used with a handheld, as long as the voltage and polarity are observed. Small 12- to 15-volt gel cells and some battery packs intended for power tools and camcorders are all possibilities. For maximum flexibility, build a dc power cable for each of your radios, with suitable adapters for each battery type you might use. Molex plugs work well for power connections, but Anderson Powerpoles can withstand repeated plugging and unplugging without deterioration and have become the standard used by most ARES units. This standardization allows easier swapping and sharing of equipment if needed.

Lead-Acid Batteries

There are three common types of lead-acid batteries: flooded (wet), Valve Regulated Lead Acid (VRLA), and Sealed Lead Acid (SLA). Wet batteries can spill if tipped, but VRLA batteries use a gelled electrolyte or absorptive fiberglass mat (AGM technology) and cannot spill. SLA batteries are similar to VRLA batteries but can be operated in any position — even up-side down. All lead-acid batteries are quite heavy.

Lead-acid batteries are designed for a variety of applications. "Deep-cycle" batteries are a better choice than common automotive (cranking) batteries, which are not designed to provide consistent power for prolonged periods and will be damaged if allowed to drop below approximately 80 percent of their rated voltage. Deep-cycle batteries are designed for specific applications and vary slightly in performance characteristics. For radio operation, the best choice would be one specified for uninterruptible power source (UPS) or recreational vehicle (RV) use. For lighting and other needs, a marine type battery works well. For best results, consult the manufacturer before making a purchase.

Sealed lead acid (SLA) or "gel cells," such as those used in alarm or emergency lighting systems, are available in smaller sizes that are somewhat lighter. These batteries are also the ones sold in a variety of portable power kits for Amateur Radio and consumer use. Typical small sizes are 2, 4, and 7Ah, but many sizes of up to more than 100Ah are available. SLA batteries should never be deeply discharged. For example, a 12-volt SLA battery will be damaged if allowed to drop below

10.5 volts. Excessive heat or cold can damage SLA batteries. Storage and operating temperatures in excess of 75 degrees F. or below 32 degrees F. will reduce the battery's life by half. Your car's trunk is not a good place to store them. Storage temperatures between 40 and 60 degrees will provide maximum battery life.

Battery "Power Budgeting"

The number of ampere/hours (Ah — a rating of battery capacity) required, called a "power budget," can be roughly estimated by multiplying the radios receive current by the number of hours of operation, and then adding the product of the transmit current multiplied by the estimated number of hours of transmission and by the duty cycle for that mode. For a busy net control station, the transmit current will be the determining factor because of the high percentage of transmit time. For low-activity stations, the receiver current will dominate. The value obtained from this calculation is only a rough estimate of the ampere/hours required. The Ah rating of the actual battery or combination of batteries should be up to 50 percent higher, due to variations in battery capacity and age.

Don't confuse the percent of time transmitting with "duty cycle," which is mode-specific (e.g., 100 percent for FM and digital, 50 percent for CW, and 30 percent for uncompressed SSB).

Estimated 24-hour power budget example:

Receive current: 1-amp x 24 hours = 24 Ah
Transmit current: 8 amps x 6 hours = 48 Ah (figuring 6 hours as the 25 percent transmit time)

Total AH: 72 Ah estimated actual consumption
Actual battery choice 72 x 1.5 = **108** Ah (figuring 50 percent higher due to variations)

Battery Management

If you are operating on battery power, you will eventually need to recharge your batteries. As discussed earlier, some batteries need more time to recharge than others, and this time needs to be taken into account in your planning. Deep-cycle marine batteries, for instance, can require a full day or longer to fully recharge. Sealed lead-acid (SLA) batteries require up to 18 hours to recharge, depending on the size of the battery. NiCad, Li-Ion, and similar batteries can be recharged quite quickly, although repeated rapid charge cycles can reduce overall battery life.

If you are using slow-charging batteries, you may need to have enough on hand to last the entire length of the operation. If your batteries can be charged quickly, some means must be provided for doing so. Some chargers can be powered from a vehicle's 12-volt system and are a good choice for emergency communications. If no local means of charging is available, your logistics team may need to shuttle batteries back and forth between your position and a location with power and chargers.

Chargers, Generators, and Solar Power

Battery Chargers: You should have two or more batteries so that one can be charging while another is in use.

NiCad and NiMH Batteries: The type of charger required depends on the battery — for instance; most NiCad chargers will also charge NiMH, but not Li-Ion batteries. Several aftermarkets "universal" chargers are available that can charge almost any battery available. A rapid-rate charger can ensure that you always have a fresh battery without waiting, although rapid charging can shorten a battery's overall life span.

Lead-Acid Batteries: Always consult the battery's manufacturer for precise charging and maintenance instructions, as they can vary somewhat from battery to battery. It is best to slow-charge all batteries, since this helps avoid overheating and extends their overall life span.

In general, automotive and deep-cycle batteries can be charged with an automobile and jumper cables, an automotive battery charger, or any constant-voltage source. If a proper battery charger is not available, any dc power supply of suitable voltage can be used, but a heavy-duty isolation diode must be connected between the power supply and the battery. (This is important, since some power supplies have a "crowbar" overvoltage circuit, which short-circuits the output if the voltage exceeds a certain limit. If a battery is connected, the crowbar could "short-circuit" the battery with disastrous results.) The output voltage of the supply must be increased to compensate for the diode's voltage drop. Take a measurement at the battery to be sure.

Wet Batteries: These should be charged at about 14.5 volts, and VRLA batteries at about 14.0 volts. The charging current should not exceed 20 percent of the battery's capacity. For example, a 20-amp charger is the largest that should be used for a battery rated at approximately 100 Ah. Consult the battery's manufacturer for the optimum charging voltage and current whenever possible.

Deep-cycle batteries do not normally require special charging procedures. However, manufacturers do recommend that you use a charger designed specifically for deep-cycle batteries to get the best results and ensure long life.

SLA or "Gel Cell" Batteries: Gel cell batteries must be charged slowly and carefully to avoid damage. All batteries produce hydrogen gas while recharging. Non-sealed batteries vent it out. SLA batteries do what is called "gas recombination." This means that the gas generated is "recombined" into the cells. SLA batteries actually operate under pressure, about 3 psi for most. If the battery is charged too quickly, it generates gas faster than it can recombine it and the battery over-pressurizes. This causes it to overheat, swell up, and vent, which can be dangerous and will permanently damage the battery. The charging voltage must be kept between 13.8 and 14.5 volts. Wherever possible, follow the battery manufacturer's instructions. Lacking these, a good rule of thumb is to keep the charging current level to no more than a third of its rated capacity. For example, if you have a 7Ah battery, you should charge it at no more than 2 amps.

The time it takes for an SLA battery to recharge completely will depend on the amount of charge remaining in the battery. If the battery is only 25 percent discharged, then it may recharge in a few hours. If the battery is discharged 50 percent or more, 18 – 24 hours may be required.

Solar Panels and Charge Controllers: These are readily available at increasingly lower costs. These provide yet another option for powering equipment in the field when weather and site conditions permit their use. When choosing solar equipment, consult with the vendor regarding the required size of panels and controller for your specific application.

dc-to-ac Inverters: While direct dc power is more efficient and should be used whenever possible, inverters can be used for equipment that cannot be directly powered with 12Vdc. Not all inverters are suitable for use with radios, computers, or certain types of battery chargers. The best inverters are those with a "true sine-wave" output. Inverters with a "modified sine-wave" output may not operate certain small battery chargers, and other waveform-sensitive equipment. In addition, all "high-frequency conversion" inverters generate significant RF noise if they are not filtered, both radiated and on the ac output. Test your inverter with your radios, power supplies, and accessories (even those operating nearby on dc) and at varying loads before relying upon it for emergency communications use.

Effective filtering for VHF and UHF can be added rather simply (using capacitors on the dc input, and ferrite donuts on the ac output), but reducing HF noise is far more difficult. Inverters should be grounded when in operation, both for safety and to reduce radiated RF noise.

As an alternative to an inverter, consider a mid-size 12 V computer uninterruptible power source. Smaller, square-wave UPS units are not designed for continuous duty applications, but larger true sine-wave units are. Most true sine-wave units use internal batteries, but with minor modifications can be used with external batteries. The larger commercial UPS units run on 24 or 48 volts and require two or four external batteries in series. UPS units will have a limit on the number of depleted batteries they can recharge, but there is no limit to the number of batteries that can be attached to extend operating time.

Generators are usually required at command posts and shelters for lighting, food preparation, and other equipment. Radio equipment can be operated from the same or a separate generator but be sure that co-located multiple generators are bonded with a common ground system for safety. Not all generators have adequate voltage regulation, and shared generators can have widely varying loads to contend with. You should perform a test for regulation using a high-current power tool or similar rugged device before connecting sensitive equipment. A voltmeter should be part of your equipment any time auxiliary power sources are used.

Noise levels can be a concern with generators. Some are excessively noisy and can make radio operations difficult and increase fatigue. A noisy generator at a shelter can make it difficult for occupants to rest and can result in increased levels of stress for already stressed people. Unfortunately, quieter generators also tend to be considerably more expensive. Consider other options, such as placing the generator at a greater distance and using heavier power cables to compensate. Placing a generator far from a building can also prevent fumes from entering the building and causing carbon monoxide poisoning, an all too common problem with emergency generators.

Several other devices may be helpful when dealing with generators or unstable ac power sources. High-quality surge suppressors, line voltage regulators, and power conditioners may help protect your equipment from defective generators. Variable voltage transformers (“Variacs”) can be useful to compensate for varying power conditions.

Generator and Power Safety

Take some care in the placement of generators so that they will not be a problem for others. Engine noise can make it difficult for shelter residents and volunteers to get much-needed rest. Exhaust fumes should not be allowed to enter the building or nearby tents or vehicles. Carbon monoxide tends to settle, so exhaust components should be carefully located so that fumes cannot settle into inhabited basements or other enclosed areas below the generator. A position “downwind” of any occupied location is best. Even when vehicles are not included, internal combustion engines are still the number one cause of carbon monoxide poisoning in the United States. Propane-powered engines produce as much or more CO as gasoline or diesel engines. Earth grounding of portable or vehicle-mounted ac generators is not required as long as only plug and cord connected equipment is used, and the generator meets National Electrical Code (NEC) standards listed in Article 250-6. The main exception is for generators that will be connected, even temporarily, to a building’s permanent electrical system. For further details on grounding ac electrical systems, please refer to Article 250 of the NEC.

Ground Fault Interrupters (GFIs) add a further degree of safety when working with generators and portable power systems. GFIs detect any difference between the currents flowing on the hot and neutral conductors and open the circuit. Also, be sure to test any GFI device to be used with or near HF radios to be sure that the GFI will function properly while the radio is transmitting.

Ac extension cords used to connect to generators or other power sources should be rated for the actual load. Consider radios, lights, chargers, and other accessories when calculating the total load. Most extension cords are rated only for their actual length and cannot be strung together to make a longer cord without “de-rating” the cord’s capacity.

For example, a typical 16-gauge, 50-foot orange “hardware store” cord is rated for 10 amps. When two are used to run 100 feet, the rating drops to only 7 amps. Choose a single length of cord rated for the load and the entire distance you must run it. If this is not possible, you can also run two or more parallel cords to the generator in order to reduce the load on any single cord. For more information on portable power cord requirements, consult Article 400 of the NEC.

While some groups have used “Romex”-type wire for long extension cords, this is actually a violation of the National Electrical Code (NEC), and a dangerous practice. Repeated bending, rolling, and abrasion can cause the solid copper conductors and insulation to break, resulting in a fire and electrocution hazard. Use only flexible insulated extension cords that are UL rated for temporary, portable use.

Equipment for Other Modes

If you plan to operate one of the digital modes (packet, APRS, AMTOR, PSK31, etc.), then you will also need a computer and probably a TNC or computer sound card interface. Some newer radios have built-in TNCs. Be sure to identify all the accessories, including software and cables, needed for each mode. Include the power required to operate all of the radios and accessories when you are choosing your batteries and power supply. The internal battery in your laptop computer will probably not last long enough for you to complete your shift. Be prepared with an external dc power supply and cable, or a dc to ac inverter. If you need hard copy, then you will also need a printer, most of which are ac-powered.

Scanners and Other Useful Equipment

In addition to your Amateur Radio equipment, you may find a few other items useful.

- Multi-band scanning radio (to monitor public service and media channels)
- FRS, GMRS (separate license required), or MURS handhelds
- Cellular telephone (even an unregistered phone can be used to call 911)
- Portable cassette tape recorder with VOX (for logging, recording important events)
- AM/FM radio (to monitor media reports)
- Portable television (to monitor media reports)
- Weather Alert radio with "SAME" feature (to provide specific alerts without having to monitor the channel continuously)
- Laptop computer with logging or emergency communications-specific packet software

Testing the Complete Station

After making your equipment selection (or beforehand if possible), field-test it under simulated disaster conditions. This is the fundamental purpose of the annual ARRL Field Day exercise in June, but any time will do. Operations such as Field Day can add the element of multiple, simultaneous operations on several bands and modes over an extended period. Try to test all elements of your system together, from power sources to antennas, and try as many variations as possible. For instance, use the generator, and then switch to batteries. Try charging batteries from the solar panels and the generator. Use the NVIS antenna while operating from batteries and then generator. This procedure will help reveal any interactions or interference between equipment and allow you to deal with them now — before proper operation becomes a matter of life and death.

Leaving Your Equipment Behind

You are exhausted and ready to head home, but the emergency communications operation is far from over. You brought along a complete station, and when you leave, the next operator is not nearly as well equipped. Should you leave your equipment behind for the next operator?

You have several options here — and they are all yours to choose from. No one can, or should, tell you to leave your equipment behind. If you feel comfortable that someone you know, and trust will look after your gear, you may choose to leave some or all of it behind. If you do, be sure every piece is marked with at least your name and call sign. Do not leave behind anything that the next operator does not truly need. Also, remember that even if you leave the equipment in the possession of someone you know, you still have the ultimate responsibility for its operation and safety. Emergency stations are difficult places to control and monitor. If your equipment is stolen, lost, or damaged, you should not hold anyone but yourself responsible. Conversely, if someone leaves their equipment in your care, treat and protect it better than you would your own, and be sure it is returned safely to its owner.

Reference Links

Anderson Powerpole connectors
www.westmountainradio.com/kb_view_topic.php?id=ST166

Deep-cycle battery tips
www.batteryfaq.org/

Molex 1545 Series connector data
www.molex.com/molex/

Review

All equipment chosen should be flexible and easy to use, rugged, and capable of being battery-powered. Antennas should be compact, rugged, and easily erected. Directional or omnidirectional gain antennas for VHF and UHF are essential in many locations, and the higher they are mounted, the better, as long as feed line losses are kept low. Battery power is essential, as is a means of charging batteries. Testing equipment under field conditions before assigning it to emergency communications uses ensures fewer surprises in an actual deployment. All equipment should be tested periodically for proper operation and inspected for damage or deterioration.

Activities

1. Evaluate the equipment you now own to see if it is suitable for emergency communications operation. Make a list of equipment you already own and make a second

list of the items you will need to complete a basic emergency communications package appropriate to your needs. Describe this evaluation.

Welcome to Topic 17 Knowledge Review

Please review the following questions to improve your understanding of this topic:

Question 1:

In considering power sources for HF radios, which of the following is *true*?

a) dc-to-ac inverters are often used to power HF radios.
b) Standard automotive batteries last longer than deep-cycle batteries.
c) ac-powered HF radios are suitable for all emergency communications use.
d) Whenever possible, use deep-cycle batteries to power HF radios.

Question 2:

In considering antennas for VHF/UHF radios, which is the *best* rule?

a) High transmitter power is more important than having a good antenna.
b) Transmitter power and antenna selection are equally important.
c) A good antenna is more important than high transmitter power.
d) If properly used, "rubber ducky" antennas can compensate for low transmitter power.

Question 3:

Beam antennas have many advantages. Which of the following is the *best* reason for selecting a beam antenna?

a) They are inexpensive and easy to transport.
b) They are easy to erect and very stable in storm conditions.
c) They are compact and easy to store.
d) They maximize desired signals and reduce interference from other stations.

Question 4:

Which of the following statements about ARES deployment clothing is true?

a) Three years (until January 1, 2013) are being allowed to “wear out” and replace older clothing.
b) The recommended standards increase recognition and acceptance of ARES units.
c) The recommended standards apply only to clothing worn on actual ARES deployments.
d) All of the above.

Question 5:

In comparing the 30-amp Anderson PowerPole connector with the 10-amp Molex connector, which of the following statements is *true*?

a) The Molex is better for high-power applications.
b) The Molex is better for heavy-duty cycles.
c) The Anderson handles only low-power applications.
d) The Anderson is capable of being plugged and unplugged a greater number of times without deterioration.