## Back-up Battery for the home station

Many hams consider the radio in their vehicle as their "emergency radio". The vehicle power supply is independent of the power company, and as long as there is gas in the tank, reliable over a number of days. For some, however, having a back-up power supply for the ham shack is important. When all else fails, it is comforting to know that at least communications will be available at home. The most common back-up system is a battery supply.

This is a serious consideration. I have two deep-cycle batteries in a well-ventilated area under my radio room. They are outside the shell of the house and sitting on a board on the ground. Things to consider here are: (1) batteries contain acid and give off corrosive acid fumes, (2) when charging they can give off hydrogen gas, which is lighter than air, and potentially a fire and explosion hazard if it collects, (3) batteries need to be inspected and maintained periodically, so you need access, and (4) batteries need protection from the elements. One very good option is to put the battery(s) in a plastic battery box.

Our radio equipment runs on "12-volts". Well, not really. It is designed to run on 13.8 volts, what you would get from the electrical system in a vehicle underway. This is the 'charging' voltage. As soon as the vehicle is shut off, the voltage settles down to around 12-volts, already 1.8 volts or 15% lower than the equipment is meant to run on. If the voltage gets below 11 volts, most radios will throw in the towel. There will be an additional voltage drop from resistance in the wires from the battery to the radio.

The cables from the battery to the shack need to be short and large size to reduce losses. While a 2-volt drop in a 120-volt circuit in negligible, in a 12-volt circuit it is significant enough to no longer support the radio. My batteries are directly under the shack so the cables are barely 5-feet to the breakers. The wire itself is #8. In my case I have three wires, one for the shared negative from both batteries and one from the positive side of each. The positive wires each go directly to individual 30-amp DC circuit breakers (switch type).

A battery box outside the shack can be set up similarly close. If the batteries are to live inside the house, I recommend venting to the outside.

I have three circuit breakers, one from each battery and one from my power supply. The breakers then feed a Buss Bar for the positive connections to each piece of equipment in the shack. There is a second Buss Bar for all the negative connections. The third battery wire (negative) connects to this.

The purpose of the circuit breakers is to prevent a catastrophe in the case of a short circuit. They are a very important item. If a short circuit were to happen in the shack, the wires could become hot enough to catch the surrounding materials on fire. There is also a real possibility that the batteries could explode. The breakers (or fuses) will prevent that. The (30 amp) DC breakers are available at Englund Marine Supply and other sources.

Charging the batteries is a subject all by itself. The two methods are to use a dedicated battery charger, or use a DC power supply in parallel. Most battery chargers have a sense circuit that checks the battery voltage. If the voltage is above a certain level, the charger switches off. Once the voltage drops below that level, the charger pumps pulses of charge

into the battery to charge it. These are raw, rectified AC, so the pulses are usually 60 per second. The charger delivers its full whammy in each charge pulse. In between the pulses, it looks at the voltage again. This is a good way to keep a battery fully charged without overcharging it.

The problem with having a battery charger on your battery while you use the radio is, as soon as you key the microphone, the radio draws power from the battery and the voltage drops, turning on the charger. Your signal will have a loud buzz on it from the charger. You won't hear it, because as soon as you go back to listening, the charger turns itself off again. The best way to solve this problem is to use a little plug-in timer, like those you use on a lamp to make your house looked lived in while you are away. You set the timer to turn on from, say, 1:00AM to 4:00AM and plug the charger into it. That is plenty of time for the charger to top up the battery for 24 hours of radio use. Then the charger is off while you are using it. If you are a night owl, adjust times accordingly...

The other approach is to use a station power supply in parallel with the batteries. The power supply will act like a charger that is always on, but its output is filtered so as not to cause any buzz. There are two important considerations to make this work.

First, you need to add a "reverse protection diode" on the output of the power supply. Power supplies are designed to take 120 volts out of the wall socket and supply 13.8 volts DC to the radio. They incorporate some sort of electronic regulation to keep the output fairly constant even as the radio draws more or less current. The problem is, when the 120 volts fails (the PUD goes dark), letting the battery pump 12 volts back INTO the power supply will usually cause bad things to happen. The regulator circuits are not designed to have power flow "backwards" through them and you may "let the smoke out" of the regulator circuit.

A Diode is a one-way valve for electricity. There is a small (0.7-volt) drop as the current passes through it, and a unit that will handle 20 amps is fairly sizable and not necessarily cheap, but it's a good deal cheaper than a power supply replacement. The diode goes between the power supply and the "Positive Buss"; the common point between the Power Supply and the batteries.

The second important detail is to precisely adjust the output voltage of the power supply. If the supply is to charge the battery(s) but not overcharge them, it should be set to 13.6 volts (measured at the battery connection). At 13.4 the batteries won't fully charge, and at 13.8 they will start to overcharge. Power supplies come from the factory set at anything from 12.5 to 15 volts, but generally have a voltage adjustment, usually inside the cabinet.

I have done both, use a charger and a power supply, and presently have the second option. The power supply can be smaller than otherwise, because the batteries will help with momentary large loads. This is particularly true with a Single Sideband HF rig where the current draw from the power supply follows the voice waveform, fluctuating rapidly. The battery tends to provide a smooth solid power source.

I installed the original back-up with one battery, but planned for two. Then, two years later, I added a second battery. Every two years I replace one of the (now four year old) batteries. Nothing lasts forever, and I'd rather do this than to find out (on the one day I need them) that my batteries had died... I have nearly the entire ham station running off the batteries. I also have the DSL modem and router hooked up so I still have Internet service as long as the DSL hangs in there. The only items not presently powered from the batteries are the HF Amplifier, the rotator for the HF Yagi, and the IRLP computer. These all go down when the power goes off, at least until I fire up the generator.

A generator is certainly capable of running the ham station, if you have one. A battery is still nice, since most people don't run their generator all day. We generally run ours during breakfast, until the freezer and fridge have cycled off. Keeping the freezer cold and running the well pump for water are our priorities. Of course this charges the batteries up too. Then we crank the generator up in the evening for supper and showers. That tops the batteries up again.

Batteries can also be charged using a vehicle. If they are sited in a convenient spot, you can drive a vehicle up to them (if not, the batteries may have to be moved) and use a pair of jumper cables to charge them up. This is an important consideration if the power is going to be out for several days. It takes less than 20 minutes to fully charge a battery.

Even "deep cycle" batteries don't like being flattened. Never let the resting voltage on the batteries drop below 11-volts (or 10.5-volts under load).

A photovoltaic solar electric panel (or two) could certainly be pressed into service to keep the ham station batteries charged. If you have thought about experimenting with this technology, this is certainly an appropriate excuse to do so. In addition to the panel(s) you will need a "charge controller". This device increases the efficiency with which the solar supply charges the batteries and prevents overcharging. Of course wind power could also fill this bill.

For 120-volt AC loads, an inverter can be added to the system. This is a device that takes 12 volts DC and converts it into 120-volts AC to run small loads. My antenna rotator has caused me to consider this option from time to time. The problem with inverters is they use your battery charge up relatively quickly. If you want to include an inverter, be sure to look carefully at the power consumption and capacity figures for your particular system.

Emergency communications is an important part of Amateur Radio. That can mean different things to different hams. A battery back-up option for the home station is one option to consider.