

Newcomers and Elmers Net: Battery Options Now and in the Future 9/7/14 Robert AK3Q

Portable and Emergency Power

The most common portable or backup power source is the battery.

Batteries used to be the only way to power any radio

Alkaline Batteries

- Depending on the radio and the power requirements, alkaline batteries can last a long time. They are plentiful, easily obtainable, and easily stored.
- there are a number of radios including HTs, scanners, marine and standard AM/FM radios capable of running on AA batteries.
- most HTs offer an alkaline battery case as an option – get one for each radio you can
- not only are they useful for emergencies, if you do any public service work it is nice to have a cheaper option than having multiple rechargeable packs
- rechargeables are great if you use your radio portable a lot because they will be cheaper in the long run – but, occasional use alkalines are cheaper, and they don't depend on power to be recharged in an emergency
- Radios like the Yaesu 817ND, the Yaesu 897D, Elecraft KX3 and others offer wide HF coverage along with VHF/UHF coverage either built in or as an option.
- These radios can be easily portable as well as requiring low power, and they make an ideal emergency radio solution.
- solar power recharging stations for recharging batteries are another good alternative. These units are becoming plentiful and reasonably priced, so it is worth considering such a unit just for this purpose.

There are various battery technologies available for both disposable and rechargeable batteries; while each have their strengths and weakness, my recommendation would be to stick with one or two choices to avoid confusion

- for example, lithium ion batteries cannot be charged (or mixed) with nickel cadmium batteries or nickel-metal hydride batteries
- a lot of things are lithium-ion now, but they can overheat and explode in higher voltages/loads

Nickel-metal hydride batteries are probably the best right now for rechargeables

- as for disposable, it really comes down to price vs. performance; some of the newer extended life batteries are good, but usage will determine what is best for you
- if you want to use off-brands like harbor freight, walmart etc., test them to see if they give you the longevity in use that you want/need

- I have found them to vary over a wide range; sometimes the prices are so good you can take less performance, but sometimes the need to replace them often gets to be a hassle
- that's what I have found with radio shack batteries
- what I tend to do is wait for sales on Duracell or energizer batteries from places like Amazon or Walmart, and then buy a bunch at a time
- to be fair, I am also thinking about using more rechargeables since the technology has gotten better, but again, I encourage you to get the same brands or at least the same ampere values so that charging them does not become a hassle
- you don't want to charge an 1800 mAh battery with a 2500 mAh – one will either not be charged enough or the other will be over charged to satisfy the needs of the larger capacity battery

12v Battery

This is the most obvious choice because it is the most common.

- A car battery, a marine deep cycle battery, or an AGM (Absorbent Glass Mat) battery make good short/long term options depending on how they are used.
- With low power TX a fully charged Marine deep cycle battery (my preferred choice) will last a long time.
- These can work both for emergency situations and for portable work (or for home operation just for the cleaner energy source

Power ports (cigarette lighter sockets) can offer battery power for HTs and low power mobiles up to 25 watts, but it is often a noise source of power

-- if using power from the car battery a lot, you might want to think about running a direct line to the battery terminals some place convenient for plugging in; just make sure both positive and negative/ground wires have fuses inline near the battery for safety

- ideally the ground should go to the car chassis rather than the battery terminal, but either way will work

- For short-term options simply keep a cigarette lighter connector available to connect to your radio of choice, and power it through the car.

- Just keep in mind the load restrictions of your cigarette lighter plug— usually no more than 12-14 amps can be safely pulled through the circuit

- Keep TX below 50 watts, and FM TX below 30-40 watts since it is a continuous signal.

- For mobile radios like this it is better to be connected directly to the battery with fused power lines if possible

Useful but less-common portable or emergency low power options

- 12 volts can be achieved a number of ways; the real limitation is in how long you can operate before exhausting your power source.
- Some of these include: lantern batteries in series; automobile jump-start batteries (these can usually handle higher power units like mobiles or base stations)
- DVD/Laptop extended operation batteries (commercial product like Eveready and others) which output 12v
- UPS units which have been modified to output 12-14 volts
- Anything designed to provide power at 12 volts; as long as you can reach the terminals in some way, it can be used!

Start a collection of connectors such as alligator clips, ring terminals, Anderson power poles, and power splitters where one connection to a battery can handle several units

The main thing is to have battery backup and portable options that work for you – be creative

- I always keep my eyes out for things which may be re-purposed for my amateur radio/emergency needs
- and most importantly, have a really big supply of alkaline batteries on hand since they will last for years and years these days!
- Radio shack and other places sell project battery cases where you can make up your own power sources
- using "C" or "D" batteries in a case like this can last a whole lot longer than "AA" batteries, and lantern batteries even longer; you get the idea!

The Future

Three university labs have announced major advancements in thin, flexible batteries and supercapictors, two with and one without lithium.

Flexible materials for batteries and electronic devices could signal the next electronics revolution, much like the development of the transistor which launched a wave of miniaturization for electrical circuits.

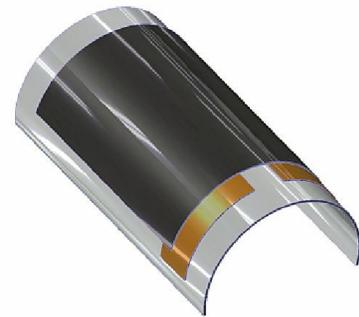
Researchers at Rice University in Texas have developed a flexible material coated with nanoporous nickel-fluoride electrodes. These are then layered



around a solid electrolyte, creating a high-energy battery/supercapacitor. The battery does not need to rely on lithium, and is extremely thin, coming in at about one-hundredth of an inch. Capacity can be increased by enlarging the material or by adding more layers.

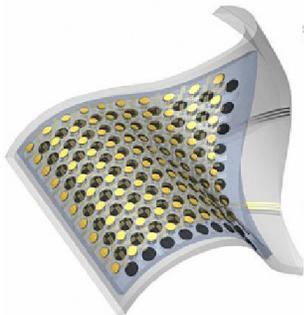
Testing showed that the material could retain 70% of its charge after 10,000 cycles and 1000 bending cycles

Meanwhile, researchers at Korean Advanced Institute of Science and Technology (KAIST) have developed a different type of flexible battery using lithium-ion technology (see a video of this technology [here](#)).



The firm material allows for good separation between cathode and anode, while still being porous enough to allow the flow of ions without short-circuiting. These film batteries allow for higher output voltage, higher energy concentrations (thus less energy-to-weight ratios), and longer life spans. The firm substrate also allows for stacking of the films to increase power output without taking up significant room.

At some point the film-based batteries will be able to be manufactured on a roll basis which will greatly reduce production costs, not to mention extremely minimal material costs by comparison to traditional batteries.



Stretchable Batteries

Last year researchers at Northwestern and the University of Illinois at Urbana-Champaign created a stretchable, flexible lithium-ion battery that can be stretched to 3x its normal size. (Image courtesy U. of Illinois)

The stretchable wires also allow for antenna circuitry to allow for wireless charging through induction.

I doubt we really want to be able to roll up our tablets like a newspaper, but we would like a device which has some flexibility to survive a fall, bump, or other pressure when thrown into a suitcase. The ideal product would be firm when held but maintain some flexibility if needed.

Following a Thread

Along similar lines, several universities have collaborated to produce a supercapacitor material which is like a thread, and indeed may be woven into cloth for wearable energy storage.

That the material is like thread means that it could be formed into almost any shape desired, which could have huge implications for any number of needs.

Up until now, supercapacitors could charge quickly and give a boost of power, but their longevity was very short.

Batteries have the opposite traits: high energy density and low power density, which means their longevity is good, but they do not deliver a large amount of energy very quickly.

The supercapacitor developed here may solve this problem by providing both a high-power source and one which, because of the very large surface area (relatively speaking) provided by the fiber, can also store large enough amounts of energy to significantly increase longevity.

Even more impressive, the researchers say they have tested the fiber device for 10,000 charge/discharge cycles, and the device retained over 90 percent of its original performance.

The Benefits to Us

What are the implications for our side of things such as amateur radio, antennas, and related areas of interest? Only time will tell, but it is sure to be exciting! Weight reduction, smaller, more portable radios, tuners, and accessories now so dependent on batteries with relatively short life-spans and slow/limited recharging cycles, may one day be a thing of the past. Tired of batteries discharging rapidly whether in use or sitting idle? Help may be on the way sooner rather than later. Portable operations limiting due to weight considerations of the batteries involved? Maybe in the not too distant future all the power one would need for a weekend trip would fit in a small carrying bag with room to spare.

Even better, supercapacitors are being developed right now which harvest energy from movement such as vibrations and other simple movements, called nanogenerators

Imagine walking around with a radio at a public service event and all the while it is recharging as it moves with you from place to place—no more dead battery packs or need for multiple packs in the go-kit!

The Future is (Almost) Here

Specific applications for amateur radio operators and radio hobbyists in general will have to wait for specific applications when such devices as flexible batteries and antennas become available, but this future technology is right around the corner.