THE EXPERIMENTER

The Official Technical Newsletter of The ARRL West Central Florida Section

Editor: Geoff Haines, N1GY, Email: N1GY@ARRL.NET
Technical Coordinator, ARRL West Central Florida Section

Well, spring is here again and it looks like it might be a fairly active hurricane season this year. With that in mind, here are a couple of projects that might come in handy later in the season.

An Emergency Radio Package
Or
The Radio in a Box II
By
Geoff Haines, N1GY

Several years ago, I constructed a "Radio in a Box" for use while engaged in ARES deployments and also for use when I just want to go do a little Ham Radio at the beach. I chose an Icom 706 Mk II G as the transceiver and added an LDG automatic antenna tuner and an MFJ 4125 switching power supply. These were mounted on a pallet made of ABS sheet and aluminum. The whole thing was packaged in a suitcase like container that also had space for the HF antenna, the coax and all the little parts that complete any ham radio station, including a laptop computer. I still use it frequently, but lately I began to see a need for something a little more suited to the kinds of ARES deployments we see more often here in the southern US.

I wanted to have, in one package, a dual band VHF/UHF radio, battery power, and the paperwork that is necessary for most deployments. I also wanted to include the antenna, but as it turned out that would have to be a second, although relatively small package. I also wanted to build it as inexpensively as possible, using materials and equipment I already had on hand. This sounds, at first glance, like a tall order, but it turned out to be relatively easy.

The first order was to select the radio. I already had a Yaesu FT-7800R that was underutilized in my radio room. It also was dual-band and had plenty of memory. The second task was the power source. As luck would have it, I happened to have a pair of 12 volt, 7 AH gel cell batteries on hand. By using both in parallel, I would have 14 AH of suitable power for the FT-7800R. I also had on hand a 1 Amp wall wart that was rated at 13.5 Volts DC and specifically designed for charging and maintaining gel cell batteries. This would make charging the batteries easy. As the batteries approach 13.5 volts charge, the current flowing from the wall wart's transformer switches to a "float" mode to keep the batteries topped up. The next item on my list was a way to monitor the battery voltage. I decided that a simple 0 to 15 volt DC voltmeter would suffice. Indeed, the FT-

7800 I used for the project displays the input voltage on initial start-up, so the voltage meter is in some ways "just because I had one to put in".

Now that I had the major components, the next thing was to find a container to put it all in. I searched the workshop cabinets and found an unused tool box about 9" x 18" x 9". It even was bright "Home Depot" orange, a good color for emergency gear. Called a "Tough Box", I think they are still available. I have had mine for several years.

OK, I have all of the major components and I still haven't spent penny one. Just by looking around my house and shop, I found I already had most of the materials to build the project.

By trying various layouts of the radio, power and meter, I came up with a design that makes the package easy to set up and use. The batteries were placed at the opposite ends of the box and secured with simple aluminum straps that bolt through the sides and back of the box. One end of each strap is secured with a wing nut to make changing out the gel cells relatively easy when the time comes.

The main body of the radio was secured to the bottom of the box by sandwiching the mounting bracket between the box bottom and a scrap of ABS sheet that was then bolted to the box bottom. My reason for doing it this way was that otherwise the radio would have to be removed from the bracket to bolt the bracket in place directly. Once the bracket was secured, it would then be difficult to re-install the radio in the bracket because of the limited space available on either side of the bracket. The control head was screwed to the top panel and connected to the main body by a home-made remote cable. Actually, the cable was not home-made. I just used a 6-conductor cable with RJ-12 connectors at both ends. It turned out to have the perfect configuration for the FT-7800R and needed no modifications at all.

The top panel was constructed from a scrap piece of the same ABS plastic sheet. This stuff is fantastic. It comes in sheets up to 4 feet by 8 feet and is about 1/8" thick. The normal users of this stuff are sign makers. Check with your local signage shops and they probably will sell you some leftovers quite cheaply. By the way, when I say signage shops, I am not talking about the kind that can print stick-on or magnetic signs with a computer. I mean the people who make the big signs that stand outside a restaurant or a hotel. Check your local industrial park for these companies.

I cut the top panel to size and rounded the corners slightly to fit the interior of the tool box. I cut and drilled a suitable sized hole to mount a speaker. The speaker was wired through a 1/8" mono jack that will automatically route the receive audio to the

earphones if they are plugged in, otherwise the audio goes to the speaker. A mounting bracket for the FT-7800R's control head was screwed to the top panel and a switch to control the DC power to the radio was also installed. Finally a pass-through UHF connector was mounted to the top panel and a short coax jumper was connected from it to the main body of the radio. This brings the connection point for the coax to the antenna out to the top panel, making it easier to set up.

Having mounted all of the major components, it was then time to wire them all together. The two batteries were wired in parallel with a DPST switch that removes the batteries from the circuit if the radio is being run on external power. Overcharging of the batteries is thus avoided. The wiring then runs through the on-off switch to the radio. Another pair of wires were run to the top panel to allow the wall wart to be connected for recharging the batteries. This pair of wires was eventually run through the side wall of the box to allow recharging without having to open the box. Another pair of wires was run to the meter to allow monitoring of the battery voltage. Since these wires are connected to the circuit after the on/off switch for the radio, the meter only monitors the voltage while the radio is in use. Finally, a single wire was run from the case of the radio through the top panel. This allows for the grounding of the transceiver when in use. All of the necessary connections where any component might have to be removed or replaced were made with "Power Pole" connectors using the standard ARES format. The grounding connection uses a single "Power Pole" connector with a green housing. The others use the standard red and black housing colors and all use 30 Amp rated connectors.

In order to mount the top panel to the tool box, I purchased some aluminum angle stock at the local home improvement store, along with some "Pop Rivets" and some stainless steel bolts, nuts and screws. By cutting the aluminum angle to appropriate lengths, a narrow shelf was installed about where a tool tray used to fit inside the box. The angle stock was secured with the "Pop-Rivets" and the top panel was placed onto this shelf and secured using self tapping sheet metal screws. These can be removed easily with a suitable nut-driver to gain access to the interior of the box. Insetting the top panel like this not only protects the radio control head and speaker but allows for the storage of the antenna coax and paperwork in the lid of the box.

I should point out that the term "top panel" may be a little confusing. When the box is stored, it is indeed on "top", however, when in use the box is usually laid over so the panel is now on the "front" of the box, just as the radio would normally be used at home or in the car. This way the radio display will be easier to read and adjust. Another point is that the radio is set up with a hand mic and an external speaker for normal use. In a high-noise environment, a headset can be used in place of the hand mic, or earphones can be used to keep the receive audio intelligible. The various components that are mounted on the top panel were identified with small labels as to their function and/or the proper setting for the desired function.

With the project almost complete, attention turned to the material that would be stored with the radio. These include the operator manual for the radio, shelter and frequency lists, and several copies of the message forms that we use in our local ARES group. Your list may be different, and I suspect that all our lists of paperwork will evolve and change with time and the particular needs of the organization. Also stored in the lid is a 75 foot run of RG-8X coax. This should allow optimum placement of the antenna high enough and far away enough from the operator. The charger wall wart was also placed

inside the lid along with a ground wire that can be clamped to a pipe or ground rod or plugged into any convenient electrical outlet. The plug for this function has had the neutral and "hot" blades removed, leaving only the safety ground prong to be plugged into the outlet. A flexible handle was secured to the plug to facilitate unplugging when desired. Also connected to the wire in a "Y" configuration with the plug, is a medium size clamp, kind of like a super-sized alligator clip to attach the wire to a pipe or ground rod.

Once the package was constructed and tested, there was one last thing to do. Since this package is likely to be loaned out to other operators when needed, it was important to make sure that it came back to its owner when the mission was completed. To ensure this, I painted the lid of the box with my name, call sign, and both my home phone number and my cellular number. I also lettered the lid with "VHF/UHF" to indicate the bands covered by the radio.

This setup has everything included in the box except the antenna and some kind of antenna support. If one were to use a roll-up twin lead J-Pole type antenna, it could be carried in the box as well. Since tall trees are less common in my area, I chose to go with a portable antenna and support that while collapsible and portable, would not fit inside the box. For the antenna itself, I modified the design of the Off-center Fed Sleeve Dipole, about which I have written before, to allow the upper element to be removed for storage. This makes the antenna a two-piece package about 26" long. For the antenna support mast I used an aluminum telescopic mast made up of 24" sections left over from an earlier mast project. The sections vary from 3/4" diameter up to 1 1/2" diameter in 1/8" increments. They are clamped to each other with hose clamps. Fully extended, the mast is over ten feet tall. The antenna is designed to slip over the top section when deployed making the total length of the antenna and support almost 15 feet. The bottom of the mast can easily be secured to almost anything, a chair, a tripod, or even simply poked into the soil at the site. I plan to find some kind of base that will be a small enough package to add it to the mast/antenna lash up. As with the "radio in a box", the cost of the antenna and mast was $0, since I had all of the parts and materials on hand already.

I thoroughly enjoyed building this emergency radio package and the cost was amazingly low, primarily because I used components I already had on hand. If one had to purchase all of the components for this project, it could get a bit pricey, but by making use of components already in the house, the cost gets much more favorable. This is one of the reasons, as the Technical Coordinator for my section; I counsel my fellow hams in our section never throw any aluminum tubing away. Even if the old antenna is totally shot, the aluminum tubes that make up the antenna are very useful when building other projects. The same goes for those scraps of PVC pipe left over from the last plumbing repair. The result is a handy package for deployment in or after a disaster. I keep the "radio box" in my vehicle, along with the mast and antenna, easily available when the local ARES Emergency Coordinator calls our group out to support the community after some form of disaster or special event.

A Slick Dual Band Antenna
by
Geoff Haines, N1GY

Right away, I must tell you that I did not design this antenna. It was featured in the May, 2004 issue of QST and was written by Ray Abraczinskas, W8HVG. Ray's design originally was a tri-band design for 144, 220, and 440. Since the takeoff angle of a two meter antenna used on 70 centimeters is rather high, I modified the design slightly by changing it to 144 and 440 only. You can find the original article in the ARRL web site archive at : http://www.arrl.org/arrl-periodicals-archive-search Just plug in Ray's call and the date of the QST issue (May, 2004).

The changes I made were to shorten the small end of the radiator to around 6" and to shorten the radials for that band to 6" as well. I also added two more 6" radials for the 70 centimeter band. Construction was straightforward. I did separate the radials into six individual pieces, four of them 6" in length with a 1"tab added to mount the radial to the antenna for a total of 7". The other two radials are each 20" long overall, 19" radiating element plus 1" for the mount. I used a standard mending plate from the home improvement store, bent into an "L" shape. All six radials were bolted to the mending plate in the usual manner.

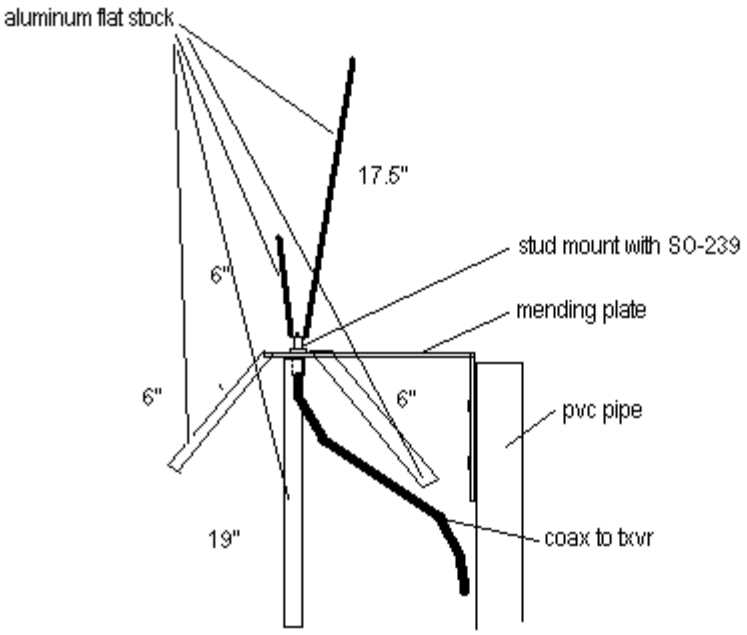
Feeding the radiating elements is a standard 3/8" x 24 stud mount. The stud mount is secured to the mending plate through a 1/2" hole with the normal insulating shoulder washer keeping the center conductor of the mount in contact with the long nut on top and insulated from the outer shell which is in contact with the mending plate and the six radials. A 3/4" long 3/8"-24 bolt secures the radiators to the other end of the long nut. The vertical portion of the bent mending plate is screwed to a length of PVC as an expedient mast. This 1" diameter PVC pipe can be slipped over an aluminum mast or other device to attain whatever altitude you require. Sorry, but I have no pictures as yet, but the testing was a thoroughly pleasant experience. On 2 meters, the SWR was less than 1:1.2 over the entire band. On 440, the SWR was a little higher, but still well within a useable range. I may try trimming the radiator about 1/4" to see if that will bring it down to the same level as the 2 meter side.

The materials list is pretty short.

1 8' length of 1" x 1/8" aluminum flat stock
6 stainless steel bolts 10-24 x 1/2"
6 " " locknuts 10-24
6 " " lock washers #10
1 galvanized mending plate 6" x 3" approx.
1 SO-239-3/8"-24 stud mount
1 3/4" long 3/8"-24 stainless steel bolt
1 3/8" lock washer.
1 length of PVC pipe suitable for your particular mounting sit.

This antenna was so easy to construct and is so durable that I would recommend it to anyone looking for an inexpensive dual band antenna for the house. The 1/8" thick aluminum flat stock is almost bulletproof as far as weather is concerned. The stud mount is available at any truck stop or Radio Shack. The aluminum and the rest of the hardware is available at any hardware or home improvement store. The one caveat I will point out is that 1/8" thick aluminum does not take kindly to abrupt bending. When you bend the mounting tabs on each piece, use a vise and take it slow. The radials need to have the tabs bent to 45 degrees, the radiators almost to 85 degrees. The aluminum will break if you try to bend it too fast.

Check out Ray's article in the May 2004 QST. As I mentioned before, any ARRL member can download the article from the Periodicals Archive and build this antenna in either its original form or the variation I used. Here is a rough sketch of my version.



Well, that's all I have for this edition.
73