What in the world is kitbashing? Why would I want an antenna for 60 meters? What's a PD-8010? Read on to solve all of these mysteries...

Kitbashing the PD-8010 Antenna For 60 meters

BY WILLIAM M. RILEY,* N3SNU

Years before I got my ham license I was a model railroader. The model-railroad hobby has a grand tradition of "kitbashing," meaning to take one or more kits and use the parts to make a model of a locomotive, railcar, or structure for which there is no kit available. Just about every issue of a model railroad magazine contained a kitbashing article. In this same tradition, I found a need to modify the Van Gorden Engineering PD-8010 antenna to include the 60 meter band.

No, I'm not just doing this in anticipation of approval of the proposed amateur allocation in that band. I'm also a member of the U.S. Coast Guard Auxiliary. The Auxiliary has access to some government-only frequencies, and my Region holds a high-frequency net twice a month on 5.4225 MHz. My MARS-modified ICOM IC-725 will transmit on this frequency, but I needed an efficient antenna.

Since earning my amateur license in 1994, I have been through several antennas, working my way up the learning curve. My first HF contact was made with a Heathkit HW-8 transceiver and a Spiro Manufacturing LC-80 shortened dipole for 80 meters. When I got the used IC-725 at a hamfest, I connected it to a Shakespeare "Big Stick" CB antenna and made my first DX contact on 10 meters. Later I put together a triband dipole for 80, 40, and 15 meters from ladder line as described in the antenna chapter of *Now You're Talking*. Somewhere along the way I obtained an MFJ-971 tuner, and I was able to find settings that would allow me to work with the LC-80 dipole on just about all bands except 10 and 160. What I didn't realize was that the balun at the feedpoint of the dipole was really taking a beating during out-of-band operation. It eventually failed. My first few check-ins to the Coast Guard Auxiliary net may have been the last straw. It was difficult to find a tuner setting for that frequency, and the correct setting had a very narrow bandwidth. I needed a new antenna.

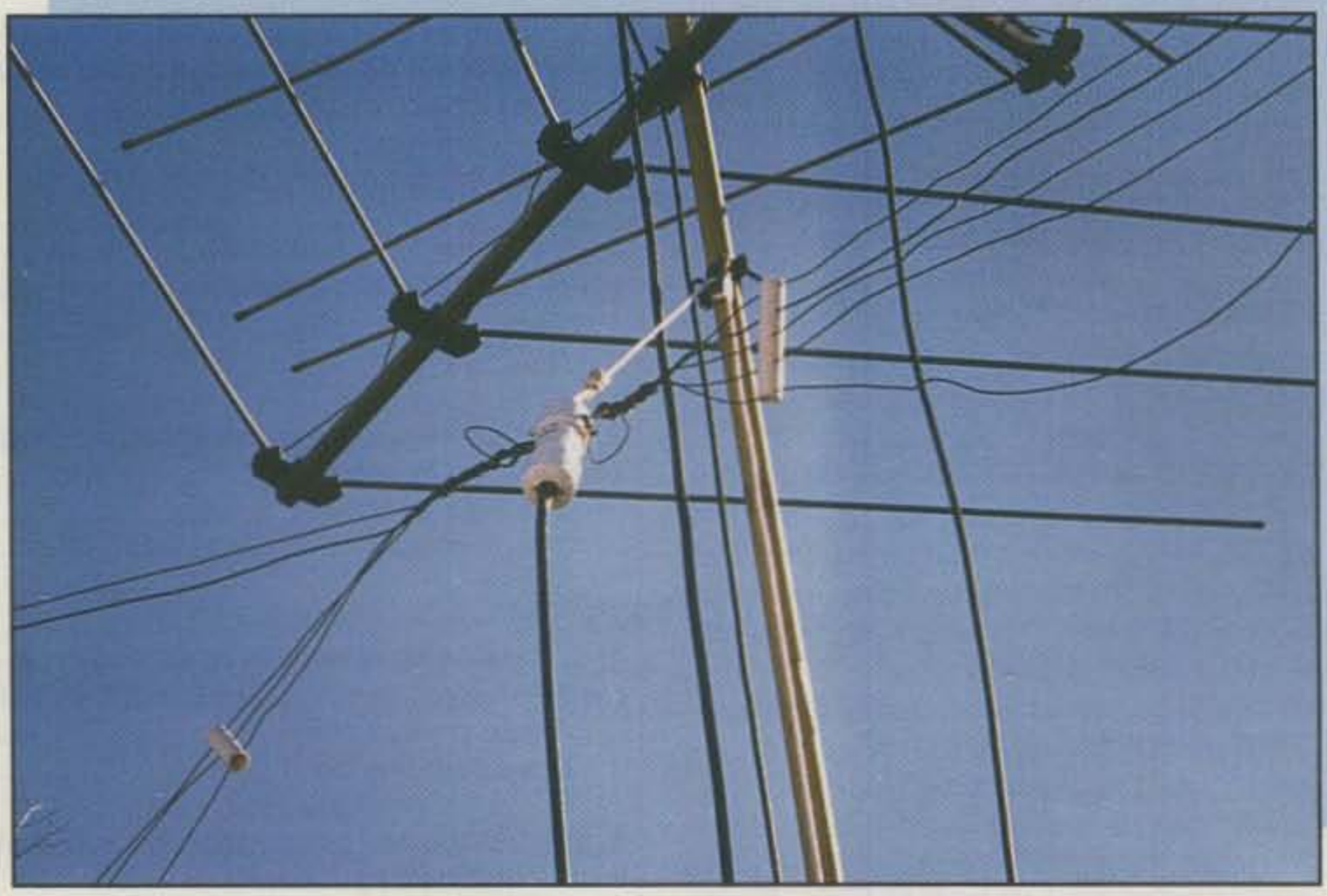

Photo A– The balun of the PD-8010 multiband dipole accepts a single feedline for all four bands of operation—or in the case of the author's "kitbashing" project, five bands. (Photos by the author)

The PD-8010 Kit

After some browsing through catalogs, I decided that the Van Gorden PD-8010 would be my best bet. It's a parallel dipole with four conductors, each cut to resonance on a different frequency, and center-fed with a single feedline (photo A). It's still fed through a balun, allowing me to use coax feedline. I considered using a dipole fed with ladder line, but all the literature warns against running the ladder line too close to metallic objects. The feedpoint of my dipole is supported by a steel mast bracketed to my chimney (photo B), and the feedline hangs straight down alongside this mast. The coax for the PD-8010 would simply be looped under the eaves, through an opening in the soffit, and across the attic to my den, where it would drop down through a wall cavity to a neat jack box. I was not sure what RFI problems I'd create following this route with ladder line.

At any rate, the Van Gorden PD-8010 seemed like the most versatile antenna for the money. Priced at only $44.95 in the Ham Radio Outlet catalog, it was almost like buying the balun and getting the rest of the parts free. Therefore, the antenna kit went on my birthday wish list, and was happily presented to me by my wife Pam, N3XFL.

The PD-8010 kit contains the balun, 280 feet of #14 stranded copper wire,

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100 feet of nylon rope, eight spreaders, and four ceramic insulators. With Pam's help I measured and cut the four pairs of wires to a different length for each band as specified in the instructions. The instructions tabulate cutting lengths for several frequencies in each band. I cut mine to the length specified for the midpoint of each band. Knowing what I now know, I would have cut to the *longest* of the tabulated lengths. I found the antenna elements a bit short on almost all bands when I started fine-tuning. More on that later.

The 60 meter Mod

Now for the 60 meter modification: I calculated the dipole length for 5.4225 MHz using the formula in the antenna chapter of *Now You're Talking* (L = 468/f). I also calculated this theoretical length for the 80 and 40 meter bands, and compared that to the cutting lengths in the PD-8010 instructions to see how much they added for connections, etc. There wasn't enough of the wire leftover from the antenna kit to make this additional conductor, so I went to my local hardware store for more.

Funny thing about that; it's hard to find 14-gauge, uninsulated wire, either stranded or solid. After trying not only my favorite small hardware store, but also two "big box" home centers, I settled for a 100 ft. spool of Type THHN, #14, solid, multi-purpose wire with black insulation. I later found that Radio Shack does have 70 ft. coils of #14 stranded wire available under part number 278-1329, but I didn't make that discovery until I had already assembled the antenna. Oh, well. The solid wire actually turned out to be easier to work with in some ways. It holds its shape after being straightened out for measuring, unlike the stranded wire, which insists on springing back into a Slinky-type coil, or kinking badly.

The spreaders in the PD-8010 kit are white plastic bars about 6 inches long, pre-drilled with four, three, or two holes, depending on where they belong in the antenna assembly. I would have to make up another pair of spreaders with five holes to accommodate my fifth antenna element. While shopping for the wire, I also looked for things similar to the original plastic bars to make additional spreaders. Eventually, I decided that the most economical material would be 1/2 inch PVC pipe. I cut the pipe with a tubing cutter, clamped it in my vise, and drilled the holes with an electric drill. The dimensions are not critical; the holes are not uniformly

spaced on the original spreaders. Since I had to buy a whole length of pipe, I decided to replace all the spreaders rather than just insert one different pair (photo C).

With the wires threaded through the spreaders and the whole assembly laid out in a V across the back yard, I next had to make the common attachment of all the antenna elements to the balun. I had arranged the antenna on the ground with the feedpoint on the brick patio for soldering ease and safety. There was an outdoor electrical outlet nearby, and the working surface would be non-combustible.

The next problem was the size of the bundle of wires that had to be soldered together. The Van Gorden Hi-Q Balun has an eye-bolt on each side that is intended to be a mechanical support only. There is a solder lug to make the electrical connection. The instructions, written and illustrated with a simple dipole in mind, call for threading the antenna wire through the eyebolt, wrapping it back on itself with a 2 inch tail left over, then soldering this tail to the solder lug. However, with the PD-8010, each of the four sets of wires must be connected mechanically and electrically. There isn't room to solder all four original wires to the solder lug, let alone a fifth for my modification. It's tough even getting all these wires through the eyebolt.

The best solution I could come up with was to thread the bundle of wires through the eyebolt, and while twisting them back on themselves, introduce still another wire which would then be soldered to the lug (photo D). The bundle of five wires twisted together was so bulky that there was no way my electric soldering iron could ever heat it up enough. Therefore,

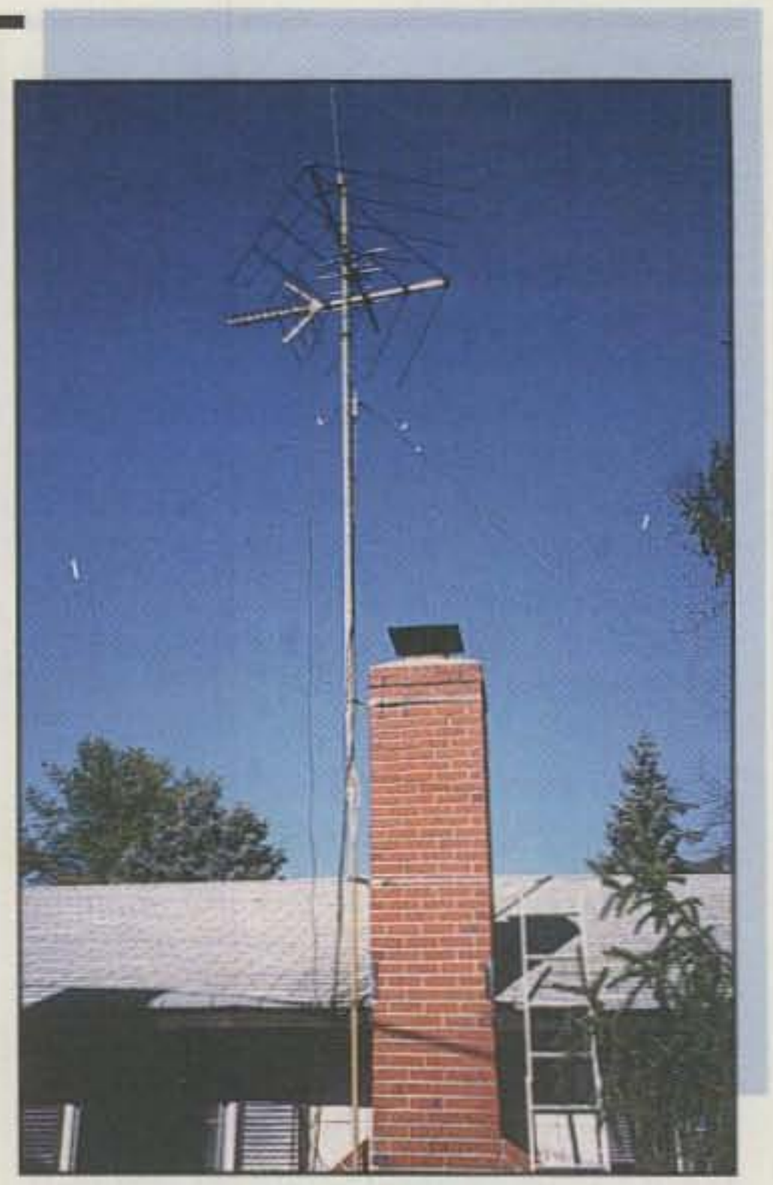

Photo B– Sharing space on a metal mast attached to the chimney made it essential to use a coax feedline instead of open-wire line, which might have been more tolerant of mismatches. However, ladder line could interact with the metal mast, causing it to radiate.

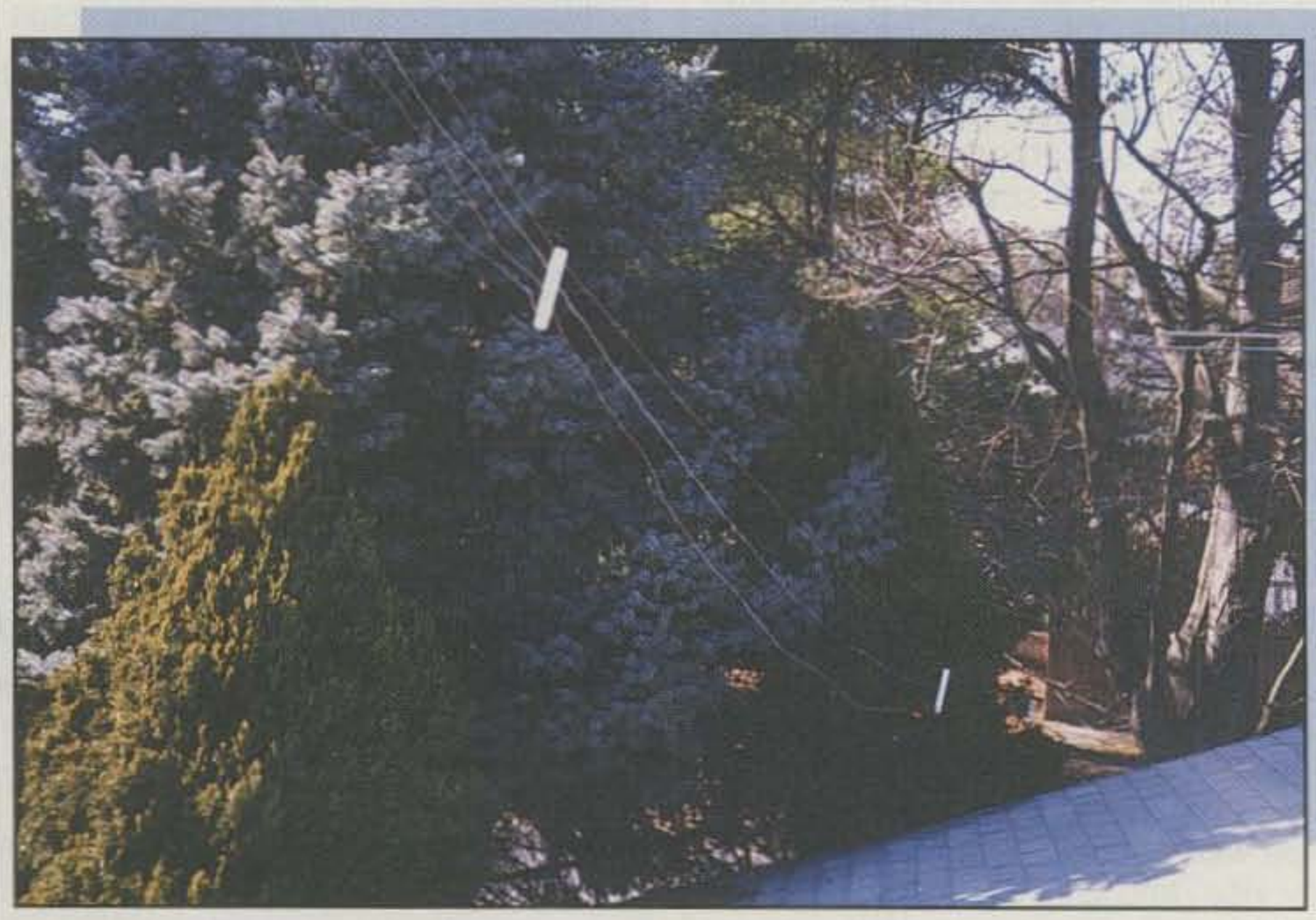

Photo C– This detail of the antenna leg heading toward the front yard shows the different length elements plus the author's redone spreaders.

I did the soldering with a propane torch, much like sweat-soldering a pipe joint. I heated the bundle of wires, touched the solder to it, and watched the solder melt and soak into all the cavities by capillary action. I kept my fingers crossed that the heat would not be too much for the balun. (It's hard to hold a propane torch with your fingers crossed, by the way.) By comparison, soldering the single wire to the lug with a soldering iron was no trouble at all.

I like to use wire rope clips for attaching the egg insulator to the end of antenna wires. I guess that's a throwback to my training as a merchant seaman. I use three clips on each end connection. The number of clips needed to achieve 80% of the strength of a wire rope is greater for larger sizes, but we're not talking about making up a mooring line or towing hawser here. The clips should be installed with the U-bolt on the bitter end of the wire and the saddle on the standing part. The distance between clips should be at least six times the diameter of the wire. The 1/16 inch clips available at my local hardware store are about the right size for this antenna wire. The clips also make adjustments to the length of the antenna easy. Just loosen the clips, shorten the antenna element by adjusting the amount of wire used in making the eye, and tighten the clips. If you're going in the right direction, you can cut off excess wire. If you've gone too far, you have some opportunity to lengthen the element a bit by shortening the eye.

In retrospect, wire rope clips might have been a better way to make the mechanical connection to the balun as well. The individual wires could have been twisted together, opposite to their individual twist, to form one "wire rope" which then could have been looped through the eyebolt and folded back on itself, secured with a set of larger wire rope clips. There would still have to be one conductor some 2 inches longer than the others for attachment to the solder lug. The whole assembly could still be sweat-soldered if necessary for good RF conductivity.

Final Tuning

When it comes to the final tuning, the PD-8010 antenna is perfect for someone who has more time than money. I have already pointed out that the kit is inexpensive. However, the trial-and-error process of trimming all four elements (five with my modification) is quite tedious.

I have the antenna feedpoint sup-

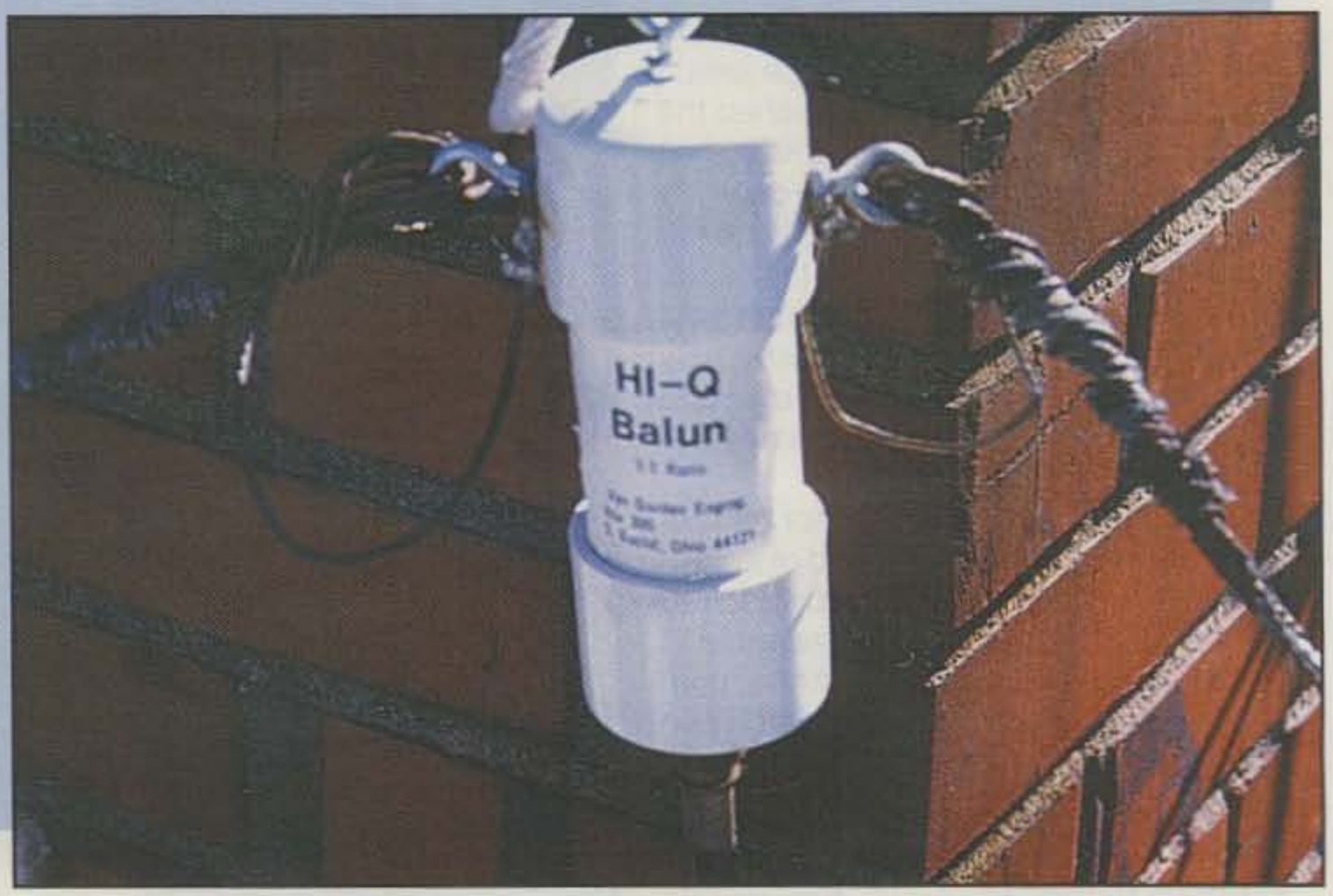

Photo D– A close-up of the balun shows both the mechanical and electrical connections of the wire elements.

ported by a rope and pulley attached to a 30 ft. mast bracketed to my chimney. The same mast also supports my 2 meter vertical and two TV antennas (A/B switch instead of a rotor), so the dipole is only about 25 ft. up at the center. The ends are tied off to trees in the front and back yards, between 10 and 15 ft. off the ground. I have no idea how many trips I made up and down the ladder to the roof and the three trees involved. This was the first time in almost ten years my neighbors actually got curious enough about my "aerial" antics to ask what I was doing. As I carried the ladder around the house, I kept thinking that it might be worth the cost of two more ladders to have one up against the back-yard tree, another at the front-yard tree, and yet another up to the roof.

I thought I remembered reading something within the past few years about the correct order in which to tune the elements of a parallel dipole, but I couldn't find any such advice. I arbitrarily started with the 80 meter element. Using a Radio Shack #21-524 SWR meter and the rig on low power, before long I had the antenna resonant near the 3.717 MHz frequency of the Maryland Slow Net. I decided to leave that as it was until later. If the interaction between elements made any difference, it would either move closer to the midpoint of the 75/80 meter band, or I would be able to trim it further if it went the other way. It eventually was resonant at 3.675 after all the others were adjusted. As it turned out, the 80 meter element was the only one that I could adjust by shortening it. I had to splice some extra length onto all the others.

After fighting with the soldering iron out in the yard several times trying to duplicate the neat splice illustrated in *Now You're Talking* and other textbooks, I hit on an idea many people will find blasphemous. I attached an extension to each element using wire nuts. I started with a 1 ft. piece of wire, and if that didn't work, I replaced it with a 2 ft. length, and so on. The shorter pieces that didn't work on the longer elements were useful later on the shorter elements, where a smaller change in length makes a greater change in frequency. With the wire nuts I could easily untwist the nut, snip an inch off the wire, and twist the wire nut back on. I repeated the process on the other leg of the antenna, hoisted everything back up, went inside, and tested the SWR again. I also found a bamboo pole handy for untangling the wires if they got crossed in the process of hoisting aloft.

Once I got the 60 meter element resonant close to the Coast Guard Auxiliary net frequency, I was able to confirm its performance by checking into the net, with Auxiliary Radio Facility CAROLINA BEACH II (Dan, WB4DHU) as net control. The 60 meter element still seems to have a narrow bandwidth, perhaps as a result of the insulated solid wire, but for now I only need it on the net frequency.

The 40 meter element is also intended to work on 15 meters, but I still

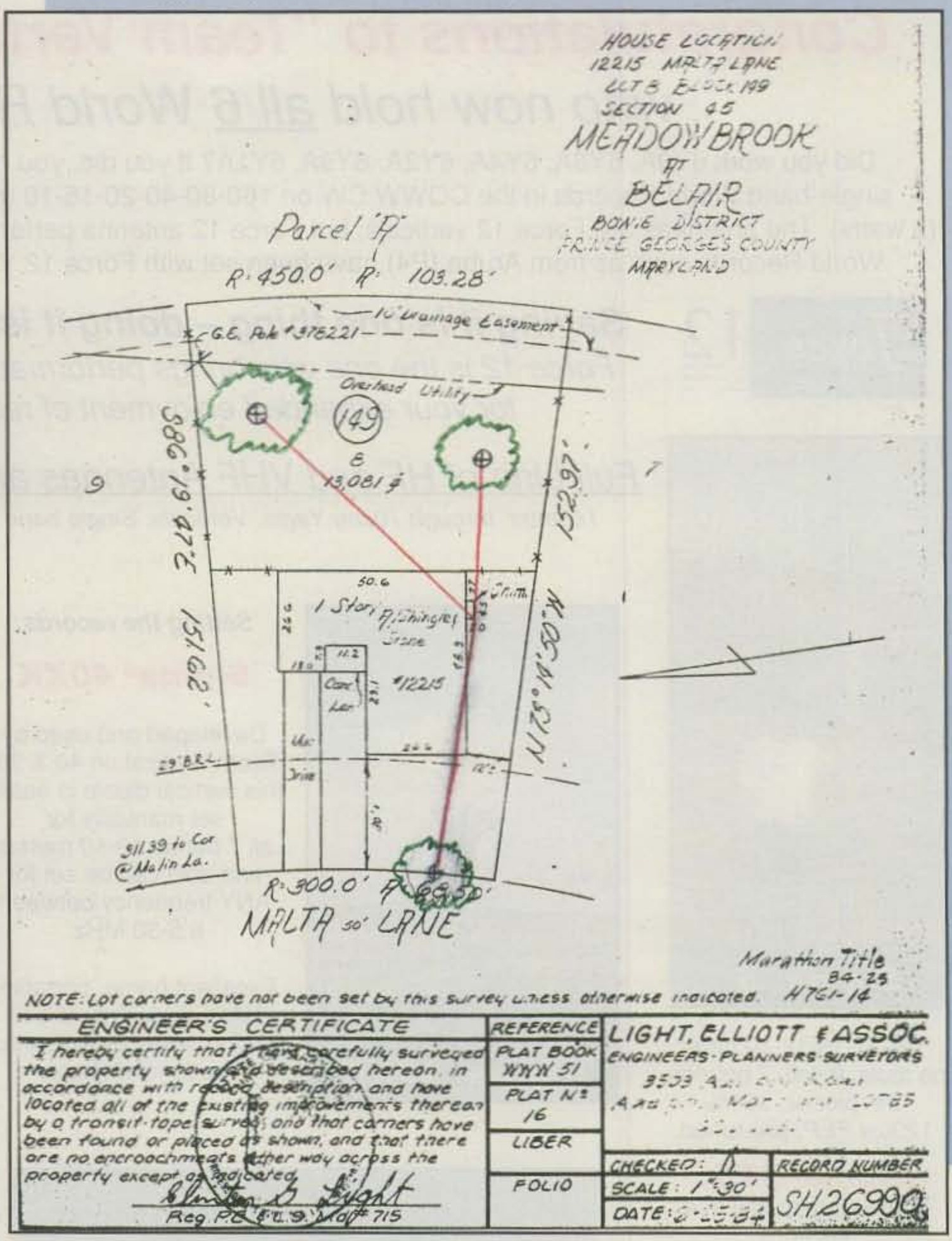

Fig. 1– Anyone who buys a house or has a mortgage probably has a survey map put away with other important papers. Having a few photocopies on hand can be very helpful in planning and plotting additions such as antennas.

haven't managed to tune it so that both 40 and 15 are resonant. Maybe if I was confining my efforts to the Novice CW subbands it would be possible. I'll keep trying. Meanwhile, it's resonant at 7.240 MHz and usable on significant portions of 40. When I got to the 40, 20, and 10 meter elements, I realized that I could separate these three and lead them to a different tree in the back yard for a more straight-line configuration. See fig. 1 for the final layout of the antenna on my property. Surveyors' plot plans such as this are useful for planning or illustrating the layout of your antenna farm. Just photocopy the plot plan you got when you purchased or refinanced your home and add the antenna details.

The 20 meter element was probably the second easiest element to adjust, and it has been the most useful. It's now resonant at 14.228 MHz. I check into the Maritime Mobile Service Net every chance I get, and now I'm trying to get on the air with PSK31 and a RigBlaster, not to mention all the other activity on this band.

The 10 meter element was a bit of a challenge. The SWR was too high to read accurately and almost flat across the band. At first I tried shortening the elements, looking for improvement, but it soon became evident I was not getting anywhere and the length was way too short. I spliced on an extension and started over, confident I was now beyond the correct length in the other direction. However, I still had that almost flat SWR curve close to infinity. Finally, I connected a CB radio and

Photo E– Crimped, solderless butt connector used to extend antenna length on 10 meters, for which the wire was originally cut too short. Antenna purists probably won't like it, but it meets marine standards.

found that the SWR was still high, but better at the low end of the 11 meter band. I kept trimming the antenna in small steps until I had good results on CB channel 40, and then went back to the 10 meter band. Now I had readings on 10 meters that made sense.

I continued to trim the antenna until the resonant frequency was 28.3 MHz, the transition between the CW and phone subbands, and the SWR was within acceptable limits on the Ten-Ten International Alternate (Novice) Net frequency of 28.380 MHz. The primary net frequency of 28.800 MHz has close to a 3:1 SWR. As it turns out, my Wilson Alpha V58 CB antenna still works better on 10 meters. During the Walt Disney 100th Birthday special event, I contacted WD4WDW in Florida using the PD-8010, but I had to switch to the 5/8-wave vertical to reach WD6MM in California.

The whole tuning and tweaking process took over a month after I had the antenna assembled and erected. It seems like a long time, but this is a hobby, and I only worked on it when I had time, and even then I tried to avoid the times of day when the band I was working on would be most active. I considered whether one of the fancy antenna analyzers would help, but aside from the cost, I thought the device might be hopelessly confused by all the parallel elements. Also, from what I could see in the catalogs, the 60 meter element would have been between the ranges covered. Since then I obtained a used MFJ-207 SWR analyzer at a local hamfest, and that will help with further adjustments of this and future projects.

As for those offensive wire nuts, don't worry. I replaced them after I finished tuning each element. The purists probably still won't like what I used. I replaced the wire nuts with crimp-on, solderless butt connectors (photo E). However, I installed these connectors using an Ancor Double Ratcheting Crimper, Model 70217, used by marine electricians and available at BoatUS for $42.99. It's a ratcheting device that will not release until the jaws are fully closed. When you are done, the splice is electrically and mechanically reliable to American Boat & Yacht Council standards (ABYC E-9.17.12.4 calls for a tensile strength test of 30 pounds on a connector for 14-gauge wire.). Add some heat-shrink tubing if you are still concerned about weatherproofing.

Conclusion

I learned a lot from this project. On most of the bands the bandwidths are narrower than advertised, but I attribute this to the fact that my antenna is not elevated even a half-wavelength above ground. If an ice storm takes this antenna down or the balun burns out, maybe I'll try something different next time. Meanwhile, I'm having fun, and I've proven to myself that this kitbashing project works. ■