Beginner's Corner

BY PETER O'DELL, WB2D

For the Newcomer to VHF

Simple Wire Antennas for HF

Welcome to "Beginner's Corner." My goal in this column is to give the newcomer simple information that can be put to use immediately. I'll keep theory and jargon to a minimum, as we confront common problems the newcomer faces. Ham radio is more than a license or "owning" a callsign; it's more than a bunch of dry formulas and techniques found in *The ARRL Handbook;* and it's fun—it has always been for me, anyway. It's okay to laugh as you read this column, as from time to time I'll be telling you about dumb mistakes I made.

In keeping with the editorial theme of this January 2000 issue, I would like to look forward to what the new year and new millennium will bring for newcomers to amateur radio. For starters, it's going to be much easier to get a ham license that allows significant HF phone privileges. (You don't have to call a 1-900 number to figure out that one.) This, of course, has its positive and negative aspects. On the one hand, the bands are going to be more crowded. Ham radio has a long tradition of courtesy and common sense, and surely those virtues will be called upon in the months and years to come. Technology may come to our aid here by developing some new modulation system that frees up bandwidth, but that's down the road.

In the meantime, non-voice modes requiring little bandwidth may become more popular. It would be ironic if CW became the mode of choice not because it is required (or at least any significant proficiency with it), but because narrow bandwidth and relative lack of crowding make it more attractive. Who knows? Once it's not being forced upon the new ham, it may be a lot easier to fall in love with it. Time will tell.

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Simple Wire Antennas For HF

Getting started on HF is pretty easy these days. Virtually everyone buys or borrows a rig; home construction is left to those stalwart souls who take great joy in such pursuits. Most people, I suspect, buy their antennas, too. That's a shame. Wire antennas are easy to assemble and inexpensive—and they perform well.

The simplest resonant antenna is the dipole, which is a 1/2 wavelength of wire fed in the middle, usually with 50 ohm coax. You can install this antenna in almost any configuration. When this antenna is installed so that the radiator is parallel to the surface of the earth, it is a dipole. Position it so that the center connector is the highest point above the ground and the legs slope down in different directions, and it's called an *inverted-Vee.* Orient it so that the radiator slopes down toward the earth from one end to the other, and it's called a *sloper.* Although it's not commonly done, you can also install it perpendicular to the surface of the earth as a *vertical.* (We'll take a look at vertical antennas in a future column.)

Most books and articles imply that the legs of the dipole have to run in a straight line. Well, they don't. Is it "better" if they run in a straight line? Sure. However, it's not necessary. I've had both indoor and outdoor antennas where space limitations forced me to bend the legs. I still made contacts. The radiation pattern may have been skewed a bit (so what?). Or maybe the SWR curve changed some. The point is that it still worked. If you have the space to make the legs go in a straight line, then do it. If not, then bend it.

How long should the dipole be? The magic formula is 468/f, where f is the frequency in MHz. The exact length of the antenna is probably never going to be exactly equal to that formula, and that's the fun of playing with antennas. Nothing ever works quite the way the formulas predict. This formula is a good place to start, though. Why? Because all sorts of things influence the exact length of a dipole, including soil conductivity, nearby objects, the size of the wire, and the characteristics of the insulating material on the wire (if any). For all anyone knows, the alignment of Jupiter's moons may have a subtle impact on the SWR curve of an 80 meter dipole.

Suppose you want to cut a dipole for 3920 kHz. That comes out to a few inches less than 120 feet using the formula. Is that going to put the minimum SWR of the antenna at 3920? Maybe, but maybe not. Go ahead and cut it for this length. Then put it up and test the SWR at several spots throughout the band (I usually use 50 kHz

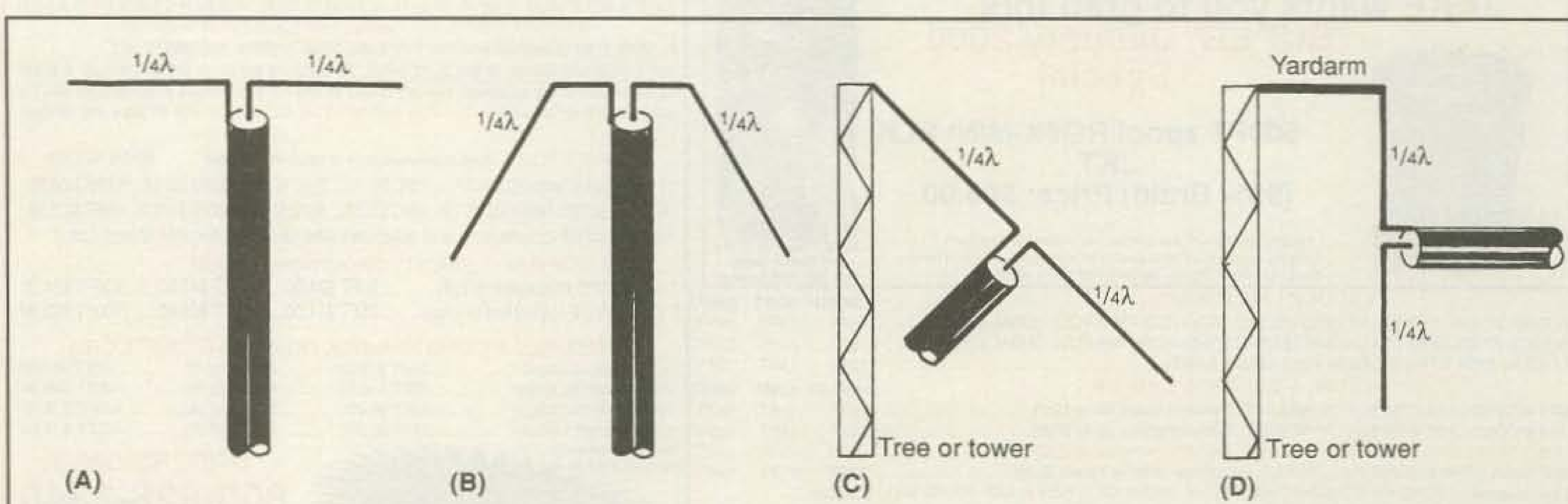

Fig. 1– The half-wave resonant antenna in its various configurations. (A) With the elements parallel to the earth, it is a dipole. (B) Slant the legs down from the center connector, and it becomes an inverted-Vee. (C) Anchor the end of one leg to a tall object and slope the whole antenna down and you have a sloper. (D) Hang the antenna from a tall object by the end of one leg, and it becomes a half-wave vertical.

increments until I zero in on minimum area.). If the minimum SWR is at a frequency that is higher than the intended one (3920 kHz in this example), then you need to make the legs a little longer. If it's at a lower frequency, then the legs should be shortened.

"Oh, no!" you shout. "I'll just buy it precut and assembled." Guess what? You still have the same problem if you buy a commercial wire antenna. I usually use #14 or #12 stranded copper wire for antennas. (Incidentally, #14 is the smallest size wire to use for antennas that is okayed by the National Electrical Code. Use something smaller, and the antenna police will come and carry you away.) The ends are attached to ceramic insulators by looping the ends through the insulator and soldering. What a pain to unsolder and resolder each time you want to adjust the length an inch or two.

After a few hours wasted with the propane torch and lineman's pliers, I finally figured out an easy way to handle this situation. I deliberately cut the leg about a foot shorter than what I expect the final length to be. For instance, with the above example, I would cut both legs to exactly 59 feet. Then I would assemble the insulators and solder the wire. However, I would also add a 15 inch "tuner" piece of wire to each leg. After attaching the rope to the insulator, I would loosely twist the "tuner" around the rope. Next I would raise the antenna to position and check the SWR.

Suppose the minimum SWR now occurs at 3860 kHz. I know I have to trim each leg, but how much? I can just guess, or I can do a little math and get real close on the next cut. If I multiply 120.5 (the actual length of the antenna) by 3.86 (actual resonant frequency), I get 465.13. Now if I use this figure instead of 468, I can calculate the exact length of an 80 meter dipole for my particular installation. Thus, 465.13 divided by 3.92 comes out to 118 feet 8 inches. That means I have to trim 1 foot 10 inches off the overall length, or 11 inches off each leg.

It is a simple matter to lower each leg and using a pair of cutters to clip 11 inches off each "tuner" section. No unsoldering. No mess. Five minutes and it's done —until the wire stretches! Sure, copper wire will stretch, and some alloys worse than others. However, it takes a while, and besides, it's strong and resilient. When I lived up north, I checked the SWR curve on my wire antennas each spring after the last ice storm. Once a year is probably enough for almost any installation.

You will need some sort of rope or nonconductive line to attach to the insulators to hold the antenna in place. I use nylon because of its availability and strength. Also, it tends to hold up well over a period of time (usually two or three years before noticeable deterioration). Nylon does stretch somewhat. Polyester rope is about 10% weaker than nylon, but it stretches very little. You will find it sold under brand names such as Dacron® or Terylene®. Polypropylene is the least costly of the synthetic ropes, but it is probably the least desirable for anything other than a temporary installation. Although it's strong and very lightweight, it deteriorates rapidly in sunlight. I used it once or twice on 80 meter dipoles. In each case there was noticeable deterioration after only a few months, and I had to replace it. Nylon will cost a little more, but it will last a lot longer. Cotton rope is okay, but it stretches a lot. Also, some varieties have a steel wire in the center to add strength. Obviously, you want to avoid this.

Finally, there are two major concerns with the center insulator: weatherproofing and mechanical stability. If the inside of the coaxial cable is exposed to the elements, you soon will have water inside the coax. At that point, the line will start to act like a big resistor. You probably will have a low SWR, but you won't work very many stations—about the same as what you would get trying to use your dummy load as your antenna!

I've seen a lot of solutions over the years, but my favorite has been to solder the center conductor of the coax to one leg and the braid to the other. I then fashioned a mold out of an ordinary tuna can by cutting slits for each leg and the coax. Also, I added an eye bolt for attaching a line. After putting the connection point inside the mold, I sealed it around the slits with tape. I then filled the mold with a resin product that is used to repair fiberglass boats. It sets in short order, and it's strong and waterproof. One such antenna I made like this lasted for over 15 years. This is just one technique. *The ARRL Handbook* shows examples of numerous other methods.

Finally, keep in mind that coax is heavy. Suppose you have a dipole elevated 50 or 60 feet with the coax dropping straight down to the ground. That's a lot of weight putting a lot of stress on the center connector. Add a little ice, and . . .

Next time we will continue with other simple antennas for the beginner.

Peter O'Dell, WB2D, was first licensed in 1963 and holds an Amateur Extra class license (since 1977). He holds WAS and DXCC, among other awards. Over the years he has participated in most phases of amateur radio. He was on the staff of both the ARRL and CQ Communications for several years. At the ARRL, he was deeply involved in promoting W5LFL's historic first ham radio operation from the Space Shuttle. Currently he lives in south Florida, where he owns and operates the Success Easy NLP Hypnosis Center.

Call for Photos and Stories

We'd like to hear from you about your experiences as a newcomer. If you have questions, we'll try to incorporate them into future columns. If you have photos (color prints or slides okay) of your station or antennas, please send them along and we'll publish the best ones. If you have a solution to a common problem that new hams experience, we'd like to hear about it so we can pass it along. You can contact me at <wb2d@cq-amateur-radio.com> or Peter O'Dell, WB2D, Beginner's Corner, 123 NW 13th St., Suite 313, Boca Raton, FL 33432.

Looking Ahead in CQ

Here are some of the articles that we're working on for upcoming issues of *CQ:*

- "The Grid Dip Oscillator," by K8WPI
- "A Weathernode Paging System," by KC5RTH
- "Unusual Propagation," by WB2AMU
- "Build Your Own Laser Station," by GM4RJX

Plus...
- "A Tale of Three Continents," by K5MAT
- "A Vacation DXpedition to Bermuda," by WB2AMU/VP9
- "The Why and How of CW," by W6BNB
- "Wilderness Ham Shack," by WA6NGH

Authors wanted! If you've got a ham radio story to tell, we'd like to hear about it and consider sharing it with our readers. If you'd like to write for *CQ*, please send a request for writers' guidelines, along with a self-addressed, stamped envelope (SASE), to: *CQ* Writers' Guidelines, 25 Newbridge Rd., Hicksville, NY 11801. We plan to have an online version available soon on our website <http://www.cq-amateur-radio.com>.