El Cheapo

Rub shoulders with the big boys on 20 meters, without shelling out megabucks!

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c/o *73* Magazine

The forgotten collinear will do the trick for you. All you need is a single mast to raise it at the center (inverted-vee style) and a couple of trees to tie the ends to. A bit of real estate is necessary as well, but the 20m version is three-quarters the length of an 80m dipole. Of course you can't rotate it, but those receiving your big signal will never know (unless you tell them).

I say "forgotten," as information about this skywire appears in old handbooks and magazine articles, but in the last 20 years I've seen no mention of it. Of all the stations I've contacted, nobody on the other end of the QSO has reported using a collinear. A few old-timers do know what I'm talking about when describing the antenna, but that's it. So, in the interest of exploiting the past and possibly adding something to it, I take pleasure in re-presenting the horizontal collinear antenna for HF.

The collinear is used widely today in its vertical version for VHF and UHF applications, such as the Ringo Ranger™ and other base and mobile antennas that combine more than one radiating element in line with another (col-*linear*) to give a radiation pattern to the sides with little radiation at the ends. The vertical jobbies have a low angle of radiation, concentrating the signals at the horizon, with little wasted into the sky above while maintaining an omnidirectional pattern—but that's another story.

Fig. 1 shows a diagram of the single-band three-element collinear. (The center section is interrupted in the middle by an insulator and becomes the feedpoint.)

The phasing stubs delay the current in the end elements by 180 degrees from that flowing into it from the center element, so that all three half-waves are working in phase. That causes their wavefronts to join together, making a very strong broadside radiation pattern. Thus the antenna radiates with excellent directivity at right angles to it, receiving consistent signal reports equal to those received with a three-element yagi. Whereas the yagi is unidirectional with a theoretical three-dB lobe of 60 degrees' width, the collinear is bidirectional with two 36-degree three-dB lobes.

My collinear is stretched from the northeast to the southwest, giving me major lobes to the northwest (for great signals into Europe, North America and long path to VK/ZL) and southeast (for South Asia and Oceania). For DXers in North America, I'd recommend stretching it from the northwest to the southeast for good sigs to Europe and the Mid East in one direction and VK/ZL in the other. Of course, your wants will determine how you hang it.

Feeding the antenna

The feedpoint impedance for a three-element collinear is around 300 ohms. It may be fed with a 4:1 balanced-to-unbalanced balun into coax for simple single-band operation, for the band for which it was cut.

For multiband operation, use a balanced feedline directly from the feedpoint of the collinear into the balanced output terminals of an antenna tuner in the shack. In this configuration, a 20m antenna tunes like a breeze for 20, 17, 15, 12, and 10 meters, and has been also successfully tweaked to work

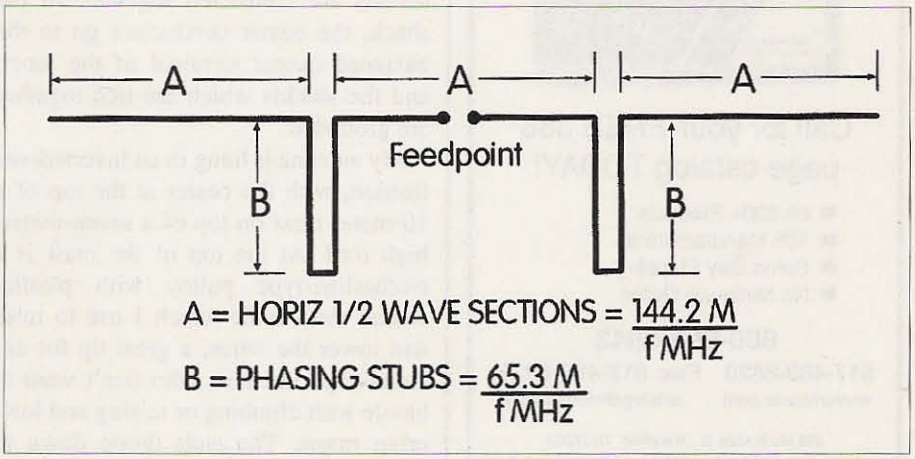

Fig. 1. Construction diagram.

acceptably on 30, 40 and 80. My 20m collinear also gave excellent results on 17 meters into North America. Although on other bands I felt no advantage, the antenna functioned well—at least as well as a simple dipole or random wire. But there was nothing spectacular on those bands for which it wasn't intended. On those bands it is what used to be called a centerfed zepp.

I highly recommend the use of a balanced coaxial transmission line instead of open-wire feeders (see **Fig. 1**). The advantages of the balanced coaxial transmission lines over open-wire are:

1. No extraneous radiation, thus less TVI, BCI, and other "I"s.

2. Less pickup of extraneous signals from computers, TV sets, and the like.

3. The feedline, unlike the open-wire feeders, is not affected by precipitation or proximity to metal objects like your tower, etc.

4. Ease of construction: There is no need to keep the conductors at a constant distance from each other. For aesthetic reasons you may wish to tape the two coaxial cables together at intervals, but this is not necessary.

The balanced coaxial transmission line is constructed from two *equal length* coaxial cables, the shields of which are electrically connected to each other at each end. Any cable will do, no matter what impedance. Incidentally, the impedance of the line is twice the impedance of the individual cables. That means that if you're using 50 ohm coax, the feedline will have an impedance of 100 ohms. But since you're using an antenna tuner, it will take care of such mismatches. At the antenna end, each center conductor of the coax is connected to one of the legs of the collinear. The shields are connected together. In the shack, the center conductors go to the balanced output terminal of the tuner, and the shields which are tied together are grounded.

My antenna is hung in an inverted-vee fashion, with the center at the top of a 10-meter mast on top of a seven-meter-high roof. At the top of the mast is a clothesline-type pulley with plastic-coated steel cable which I use to raise and lower the wires, a great tip for antenna experimenters who don't want to hassle with climbing or raising and lowering masts. The ends droop down to about eight or 10 meters above ground, the extended wires from the end insulators tied onto conveniently located trees.

This configuration may be not quite theoretically ideal, and the antenna might operate possibly better if the ends were be higher up. But I don't think the effort is worth it, judging by the good comparative reports on 20m over the last few years of operation with this wire. After all, 20m is a crowded band, and here the men and women are really separated from the boys and girls.

This antenna costs next to nothing to construct. All you have to do is measure accurately, and hoist it up. I've used various very long wires and vee beams over the years, but on 20m, this baby beats them all. No longer do I feel in the back seat on that band—in the final analysis, it can be truly said that the wire collinear antenna for HF delivers the biggest bang for the bucks!

Adding collinears in parallel

I was quite satisfied with the performance of this skyhook on 20m, the band of my preference for long-haul QSOs; for the forays into the other bands, it worked acceptably. Nonetheless, I found I wanted better performance on 15m, and thought of adding a 15m version at the feedpoint. In all the literature at my disposal I found nothing about connecting antennas of this sort in parallel.

The time had come to be a true ham, and experiment. A 15m version was constructed and connected at the feedpoint, drooping below the 20m antenna somewhat. Since both collinears were made of insulated wire, there was no problem where the phase-delay stubs crossed the 15m wires. It is a bit tricky hanging one under the other, and it's important that the wires of the two collinears don't twist around each other at any point.

The wire I use is stranded copper in a PVC jacket, the cross-sectional diameter being 1.5 square millimeters, roughly equivalent to AWG #18 wire, the type which is used in automobile wiring. I like this wire because it does not kink as does solid wire, and always stretches straight, easily. In North America, I would think that stranded copperclad wire for antennas is readily available, which doesn't slowly stretch over the years as does the soft copper that I use. It's possible that there just may be an ad or two in this magazine for companies selling antenna wire.

The results were rewarding: It worked fine on 15, just as expected. However, there is a certain amount of interaction between the two antennas, and here the antenna tuner and balanced line proved their worth. I don't know how you'd make out here with just a 4:1 balun and a single coaxial line for dual-band operation. I expect it would work, but with poorer SWR.

Stub construction

The multiplicity of ladderline-type stubs (four of them now), is rather a bit unsightly (even in a ham's eye) and makes it rather awkward to manage. A single-band collinear is easier to manage with but two stubs, but when there are high winds, the 15m and 20m stubs have been known to tangle with each other. Twinlead stubs should be more manageable, but you might have to experiment with the length as the velocity factor will be somewhat different than what I used here.

Incidentally, in order to duplicate my stubs, I used the same 1.5-square-millimeter PVC-jacketed stranded copper spaced 2.5 cm (one inch) apart with home-fabricated Plexiglas™ spacers. I constructed the stubs by stretching the two wires between two points, then moving the spacers along the line, fabricating the ladder as it were. Then I dropped epoxy cement at the points where the wires go through the holes in the spacers and let the glue set thoroughly before removing the wires from between their temporary stretching points. However, if you can locate ladderline or twinlead, save yourself the time wasted reinventing the wheel. It's just that in my neck of the woods ladderline is not available.

What's left to be done

In my mind, the stubs are the downside of this skywire. There must be a better way of doing it. Possibly substituting a tuned circuit to effect the 180-degree delay, or maybe hanging pieces of coaxial cable like RG-58 or -59 shorted at the far end instead of the ladderline stubs. The coax, having a 66% velocity factor, should be around 70% the length of stubs I used. No doubt a collinear without the droopy stubs would be more aesthetic in the eyes of a non-ham. (Any antenna is a work of fine art in ham's view!) I'd love hearing from anybody with experience in the stub business in order to further refine this skyhook!

Suggested reading

Dick Silberstein WØYBF, "Collinear Antenna for 20 Meters," *Ham Radio,* May 1976.

ARRL Antenna Handbook, 1972.

John S. Belrose VE2CV, "Tuning and Constructing Balanced Transmission Lines," *QST,* May 1981. 73

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some research. I would like to see an article on the construction of the magnetic pulse generator. Even though it is quite easy for some of us to make them without detailed instructions, there are many who cannot get them going. I took my flash gun to a camera technician who made a neat connection to the zener tube without wrecking the gun. I did wreck another flash gun and mounted the PC board and a more powerful zener tube into a neat case and I drive it with a six-volt power pack. It kicks a washer two feet into the air. An excellent method of cleaning the silver electrodes is to use a soft pencil eraser. It polishes and shines them quickly and easily. Keep up the good articles on health in your editorials. I have been a health nut for 50 years and now at age 79 I look no older than 55, and am still as fit as a teenager. On the question of Morse code, I love it. Anyone who takes the time to master Morse code will also be hooked on it—ask any CW buff.

Sure, Frank. I love raw liver, so let's make a law requiring everyone to eat raw liver. Anyway, how about some articles on pulse units? ... Wayne. 73