# The ZED LOOP Special

## An inexpensive HF beam with a new twist.

by Jim Gray W1XU

The "ZL Special" antenna, named after ZL3MH who first designed it, is well-known to enthusiasts who want a simple, easy-to-build, inexpensive, high-performance wire beam. Basically, the ZL Special consists of two folded dipoles fed out of phase to provide a strong radiation lobe in one direction, and signal cancellation off the back. It is a slightly different version of the famous "8JK" antenna designed and published by John Kraus W8JK in the 1930s. John's articles appeared in *QST* between 1935 and 1938, and more recently in 1989. Another tried-and-true version of the ZL Special appeared in "Broom Handle Beam," written by John J. Scultz W4FA in the January 1989 issue of *CQ*.

### The Ideas Click

My own experience with the ZL Special goes back to 1958, when I built one from twin-lead, using vinyl tape to attach the elements to some bamboo poles. These, in turn, I attached to a small wooden framework that could be rotated by a light-duty TV rotator. I fed the beam with 75 ohm coaxial cable and used it with remarkable success on 15 meters.

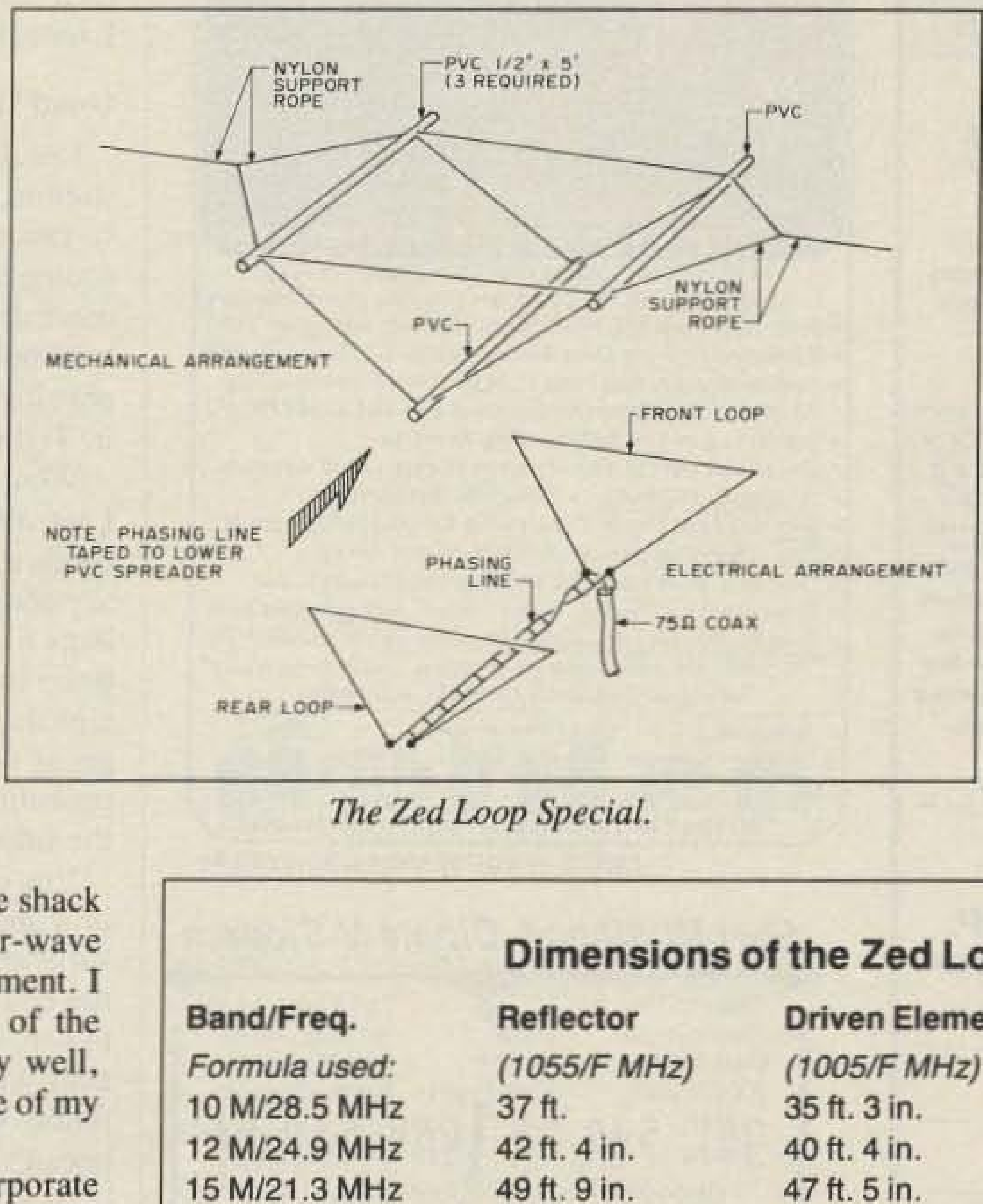
With the advent of the new sunspot Cycle 22, and the sudden and drastic increase in 10 meter activity, I decided that I'd need a beam for my QTH, which is on a small, tree-covered lot with no tower or possibility of one at present. I considered using a 20 meter delta loop beam I'd made for DX back in New Hampshire.

That one had quarter-wave spacing between the elements and a neat design for changing direction from the shack by merely switching an extra quarter-wave length of coax into the feeder arrangement. I could instantly change the direction of the beam by 180 degrees. It worked very well, and got me some new countries in spite of my 100 watt transceiver.

Then the idea clicked: Why not incorporate the best of both antenna systems—a delta loop pair, separated and phased in the ZL Special manner? I devised (on paper) a suspension system for making it into a fixed-direction antenna—the better to work those elusive Europeans from Arizona, and also to enable me to work my old friend N1DQM back in New Hampshire. The result is shown in the figure.

### A 10 Meter Version

I used the formula of 1005/F (MHz) for the forward element and 1055/F (MHz) for the rear element. Obviously, both elements are "driven." I used a physical spacing of 5 feet between delta loops, and a 6-foot length of 450-ohm ladder-line as the phasing section. *Formula = 150/f for 450 Ω line length and 120/f for loop spacing*. (If you wish, you can make the phasing line from 300 ohm twin-lead, although it will have a slightly shorter length.)




*The Zed Loop Special.*

As you can see, the coax cable is attached without a balun (although you may use one if you wish) to the junction of the forward loop and phasing line. You will notice that the phasing line has a half-twist in order to place the antenna currents in the proper phase relationship to give forward gain and backward rejection. I reasoned that the loop arrangement would give slightly more gain than the folded dipoles and provide the inherent quietness of a loop, plus the broad-banded nature provided by their low *Q*. The dimensions of the loops themselves turned out to be 35′ for the forward element and 37′ for the rear element, at 28.5 MHz.

The design, sketching, and calculating took about two hours in the evening, and the construction, assembly and erection took two hours in the afternoon of the following day. I used ½″ PVC pipe from the hardware store for the spacers (at a cost of $4.34 including tax) and nylon line for the supporting ropes. The wire for the loops and the 450 ohm phasing line were salvaged from other antennas. If you have to buy everything new, you can put this antenna together for 10–15 dollars.

After hoisting the beam to its resting height of 25 feet in a hammock-like position, I connected the transceiver and listened. Wow! Signals were pouring in from all over the Northeastern U.S. with strengths of at least 1 to 2 S-units greater than my vertical antenna. A few calls produced as many replies, and those with whom I spoke all wanted more information—hence this article.

**Dimensions of the Zed Loop Special**

| Band/Freq. | Reflector | Driven Element | Phasing Line | Spacing |
|---|---|---|---|---|
| *Formula used:* | *(1055/F MHz)* | *(1005/F MHz)* | *150/F MHz* | *123/F MHz* |
| 10 M/28.5 MHz | 37 ft. | 35 ft. 3 in. | 5 ft. 3 in. | 4 ft. 4 in. |
| 12 M/24.9 MHz | 42 ft. 4 in. | 40 ft. 4 in. | 6 ft. | 5 ft. |
| 15 M/21.3 MHz | 49 ft. 9 in. | 47 ft. 5 in. | 7 ft. 1 in. | 5 ft. 8 in. |
| 17 M/18.1 MHz | 58 ft. 3 in. | 55 ft. 6 in. | 8 ft. 3.5 in. | 6 ft. 9.5 in. |
| 20 M/14.2 MHz | 74 ft. 4 in. | 70 ft. 9 in. | 10 ft. 6.75 in. | 8 ft. 8 in. |

The feedpoint impedance was such that I had a VSWR of 1.4:1 at the 28.500 MHz design frequency. This was maintained all the way down to 28.000 MHz. The VSWR increased to 2:1 at 28.8 MHz—yielding an effective bandspread of about 800 kHz for this antenna. Perhaps by "centering" it a bit higher, I could have easily covered the entire 10 meter band with an acceptable VSWR. As a matter of fact, I have used it on 12 meters (with an antenna tuner) and received excellent reports. It does appear to have almost equivalent directivity on 12 meters, but this has not yet been fully determined. For best results, I would recommend a version cut especially for 12 meters. See the table for dimensions.

The length of the phasing line depends on the velocity factor of the material used. For example, the velocity factor for 450 ohm ladder-line is taken to be about 0.92. The formula 150/F as shown in the table is empirically derived, and seems to work well.

You may try different lengths of phasing line to change the F/B ratio or the forward gain of the beam—or even the feedpoint impedance.

Loops may be triangular (delta loop), square (quad loop), round (circular loop), or any other regular, convenient polygon. You may wish to try feeding your loops at a different point to take advantage of polarization diversity. Both loops should be fed at the same point, however. Feeding the vertical side of a quad loop gives vertical polarization, while feeding the horizontal side gives horizontal polarization. If you use a true delta loop (point up), feed one bottom corner; if you use an inverted delta loop (point down), feed the point or the middle of the top side. Experiment for best results.

### Good Gain, Easy Mount

Results so far are very encouraging; the stations I've worked have given me extremely favorable S-meter reports. I only have a problem when I want to beam a signal in the other direction. This requires unfastening the hammock from its end support ropes and physically turning it around and re-hoisting it. Tedious, yes, but not all that bad, really.

What is the gain? Compared to my vertical, I see about a 2 to 3 S-units improvement on receive. That's ridiculous, I know, so let's say about 4 to 5 dB relative to a dipole—perhaps a tad more. The front-to-back ratio appears to be phenomenal—I haven't heard any signals off the back as yet. My conservative guess would be 25 dB. Front-to-side ratio is probably about 25 dB or more, as signals off the sides are practically nulled out.

You can build your own easily and cheaply in a short time. I think you'll be pleasantly surprised. Naturally, if you don't have trees for end supports, you can use your house, a tower, a couple of zoom-up masts, or whatever you find handy. Ready to raise, the antenna weighs less than five pounds, and doesn't require a major support. 73

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