two delta loops fed in phase

Another version of this popular antenna eliminates the suspension boom

Many months ago Ken Bale, W7VCB, sent me a copy of an antenna article describing a "ZF Special" antenna by ZF1MA in Grand Cayman, B.W.I. It used a pair of connected delta loops suspended from a 20-foot boom, as in **fig. 1**. Once in a while I would look at this idea and discard it, because 20-foot booms are pretty difficult to come by, not to mention to erect.

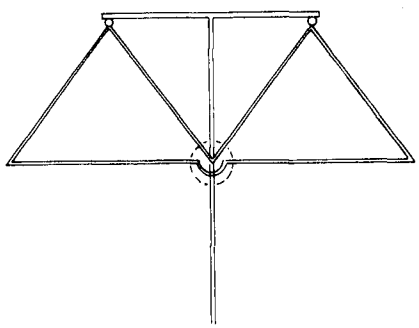

fig. 1. The "ZF Special uses pair of delta loops suspended from a 20-foot boom. Antenna is vertically polarized, since it is fed at one corner.

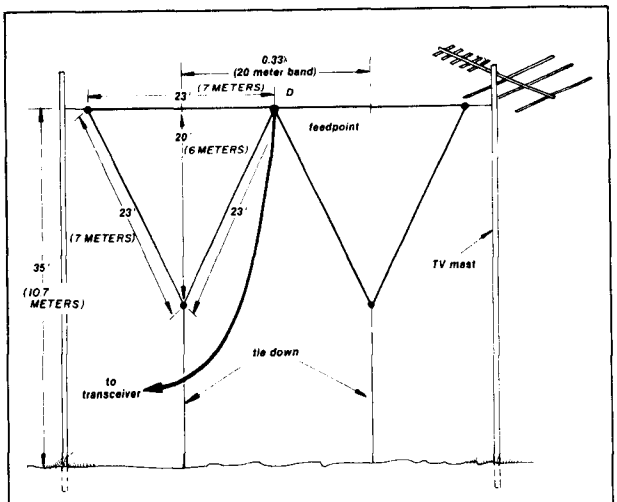

fig. 2. The improved phased delta-loop array is suspended by nylon line, thus eliminating the boom. Antenna is fed at the top, which keeps the high-current point as high as possible.

Then one day I said to myself, "Why a boom?" I turned the page upside down and mentally suspended the antenna from a nylon rope running from my 50-foot TV tower to a mast 48 feet away. It looked interesting. I'd often used both 20-meter and 15-meter loops suspended this way, but never two of them at a time.

I decided that what ZF1MA had was two full waves in phase, and that the array was vertically polarized, since they were fed at a corner.

improved phased delta-loop array

Fig. 2 shows the result of my efforts. I changed the feed point to the flat top to keep the high-current point at the top. Feed-point detail is shown in **fig. 3**.

So what do we have? A single delta loop has a gain of close to 2 dB referenced to a dipole. A pair of them at the close spacing shown will add another 2 dB. The pattern will be as in **fig. 4**.

If the antenna is oriented so that one lobe is toward Europe, the other lobe will be toward the South Pacific. Or you can orient the antenna so that Japan and the South Atlantic are covered.

My antenna is aimed at Antarctica in one direction and European USSR and the Persian Gulf in the other. It has provided excellent results with phone-patch traffic between my location and McMurdo Station, Antarctica. It has also performed well with many other DX stations on the 20-meter band.

If I had more space, I'd use the feed system in **fig. 5**, which provides horizontal polarization. (Incidentally, Bill Orr's *Antenna Handbook* shows that a delta loop fed in this manner yields a substantial, low-angle, vertically polarized signal.)

element-spacing considerations

Although the elements of my antenna are spaced as closely as possible without overlap (0.33 wavelength, or 23 feet, center-to-center, for the 20-meter band), wider spacing would increase gain, as shown below.

For two elements (20-meter band):

spacing wavelength	feet	(meters)	gain (dB)
0.33	23	(7)	2.0
0.40	27	(8)	2.8
0.50	34	(10)	4.0
0.65	44	(13)	4.8

The gain numbers shown are in *addition* to the 2-dB gain for a delta loop over a dipole.

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For more than two elements, with half- and three-quarter wavelength spacing, here are the gain figures (from the ARRL *Antenna Book*):

number of parallel elements	half wavelength spacing gain (dB)	3/4 wavelength spacing gain (dB)
3	5	7.0
4	6	8.5
5	7	10.0
6	8	11.0

other arrangements

I can picture some lucky ham who lives on a farm and who could stretch out a series of six elements with half-wavelength spacing for 10-dB total gain; or with 3/4-wavelength spacing for 13-dB gain, suspended from trees or a row of telephone poles. Or how about two arrays at right angles to each other, with the intersection at a cross point of two fence rows, using no farmland space?

With an antenna gain of 13 dB, you'd have a power gain of 20, which would make a 2 kW PEP signal sound like 40 kW!

For two band operation, spacing for the 15-meter band at 3/4 wavelength would be the same as half-wavelength spacing for the 20-meter band. And you could suspend the 15-meter-band loops inside each 20-meter-band loop.

Each delta loop has a feed-point impedance of about 120 ohms, so a pair is about 60 ohms, which is what mine measure. For more loops, the impedance should be as follows, with each feed line being the same length:

Four loops, 30 ohms with an SWR of 1.7:1 and six loops with a 2.5:1 SWR. None of these will be difficult to match.

It would probably be well to use a 1:1 balun at each feedpoint.

concluding remarks

Stations from the South Atlantic, the Caribbean, and South America really pound in here during the day, with many pinning my meter at 60 dB over S9. At night, the Antarctic stations are often over S9 and are easy phone-patch quality both ways.

Oh, yes — if you want to make a unidirectional beam, you can stretch a director or reflector element, or both, about 8 feet from the center of the array. Use a single wire 31 feet, 2 inches for the director and 34 feet, 6 inches for the reflector. This arrangement will, of course, reduce the feed point impedance, making some sort of tuner or matching section necessary to reduce the SWR. This is especially important if you have one of the new solid-state rigs, which are intolerant of high SWR.

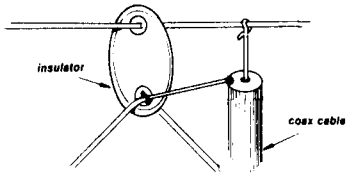

fig. 3. Feed-point detail of the phased delta-loop array.

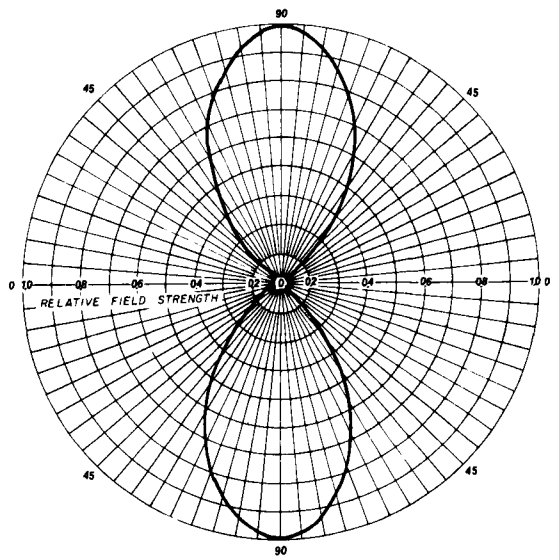

fig. 4. Radiation pattern of two collinear elements.

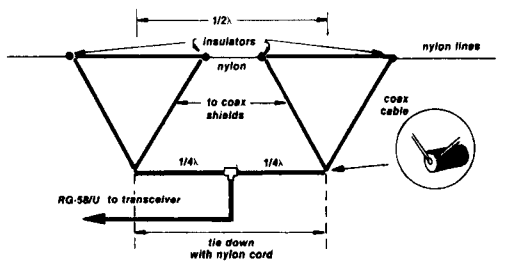

fig. 5. Another version of the phased delta array using one-half wavelength spacing.

Antennas are great fun. They are much more inexpensive than amplifiers. Let me know how you make out — I'm always interested in what my antenna ideas do for others.

One caution: if you use a really high-gain array, a polar map is essential for pointing directions. I read about a ham who put up a ten-element Bruce array, and used a regular orthogonal map and completely missed his objective.

ham radio