Having a pair of 80 foot towers spaced enough apart presents some interesting possibilities and a great opportunity.

A Switchable Delta Loop Array For 40 Meters

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I've always enjoyed tinkering and experimenting with different kinds of antennas. I also consider myself a devoted, avid amateur and spend considerable time on the bands from 20 meters up through 2 meters. For a number of years the thoughts of 40 meter DXing kept popping up, and I decided to explore antennas for that band.

The first antenna I tried was a two-element fixed quad which was adapted from an article in *QST* called "A 40 Meter Quad the E-Z Way." The article appeared sometime in the late 1970s. The antenna worked fairly well, but was fixed in the north-south direction. However well the antenna worked, this was not the orientation for a 40 meter antenna in south central Kentucky.

I then decided to try a delta loop array, but I wanted the option of being able to switch directions (from Africa to the Pacific) without having to rotate the entire system. The solution turned out to be a common reflector array with switchable driven elements and two director elements

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Design Frequency:	7.175 MHz
Number of Elements:	7 total, 4 elements per direction
Gain:	10 dB
Front-to-Back Ratio:	25 dB
Spacing:	0.125 wavelength, or 17 feet 1½ inches
Difference Factor:	+5% reflector, −5% directors
Wire Size:	#10 stranded copper insulated
Driven Element Feed:	¼ wavelength, 75 ohm stub

Table I– General specifications.

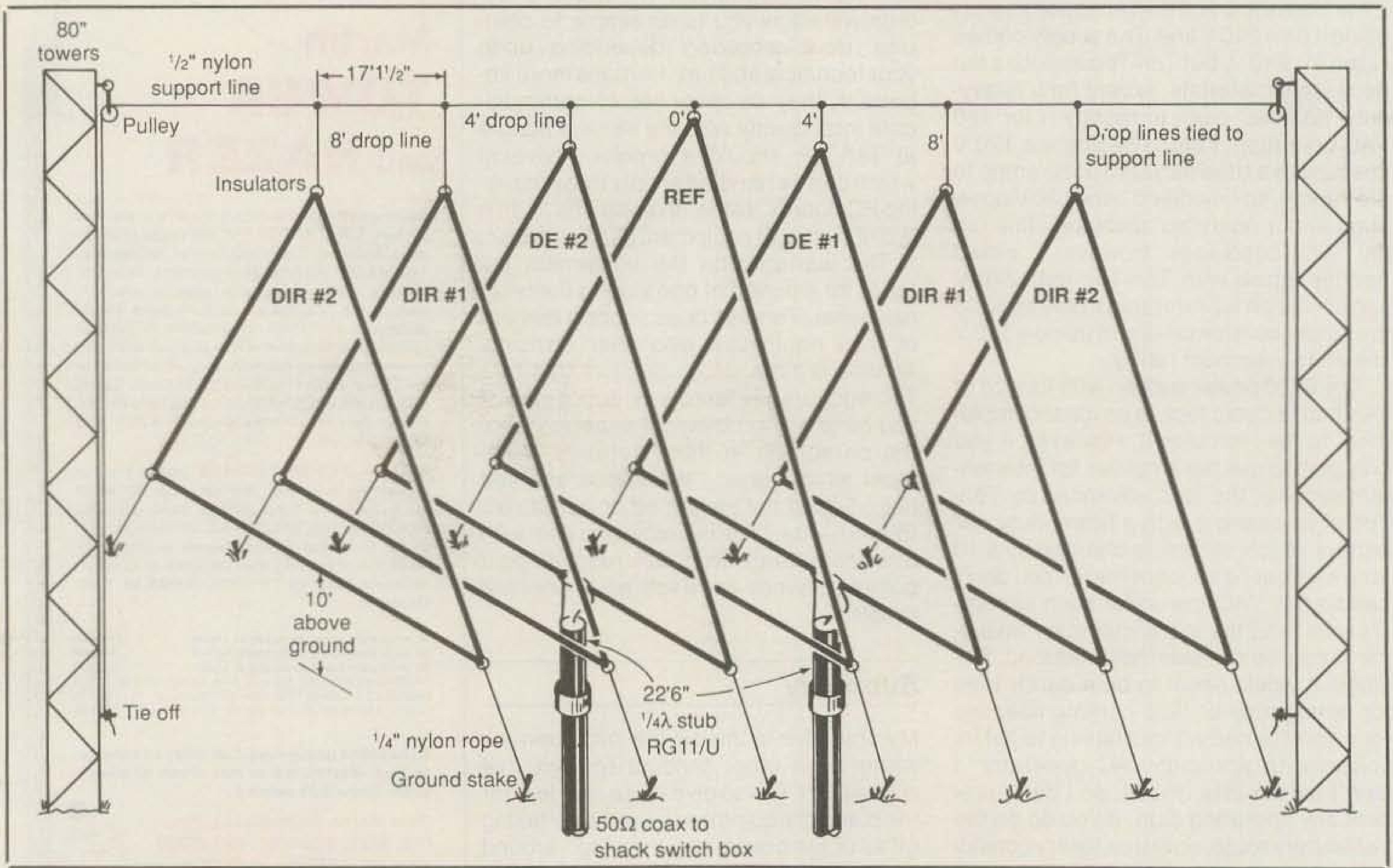

Fig. 1– The overall plan for the switchable array.

Driven Element: The driven element is cut to a frequency of 7.175 MHz using the formula

$$\frac{984}{\text{Freq. MHz}}$$

$$\frac{984}{\text{Freq. MHz}} = \frac{984}{7.175} = 137.142 \text{ overall length, or}$$

$$\frac{137.142}{3} = 45.71 \text{ feet per side}$$

Reflector:

$$\frac{1030}{\text{Freq. MHz}}$$

$$\frac{1030}{7.175} = 143.554 \text{ overall length, or}$$

$$\frac{143.554}{3} = 47.85 \text{ feet per side}$$

Directors 1 & 2:

$$\frac{935}{\text{Freq. MHz}}$$

$$\frac{935}{7.175} = 130.314 \text{ overall length, or}$$

$$\frac{130.314}{3} = 43.44 \text{ feet per side}$$

Phasing Line: RG11/U, 75 ohm coax (see note)

$$\frac{246\text{VF}}{\text{Freq. MHz}} = \frac{246 \times 0.66}{7.175} = 22 \text{ feet } 6 \text{ inches}$$

Note: RG11/A (polyethylene) has 72 ohm impedance with a velocity factor of 0.66.

Table II– Construction of the antenna array.

fixed on each end of the twin array. The completed array consisted of a pair of four-element delta loops, one fixed on Africa and the other on the Pacific.

Construction

The delta loop has three equal sides, each side being one third of the overall length. Three insulators are slid onto the wire and fastened to the wire when it is bent into the triangular shape. The insulators are held in the corner angles by wrapping a couple of turns of #12 wire on each side of the insulator and then taping over the wrapped wire. Each element in the array is formed in the same manner.

Since I was fortunate in having two 80 foot towers already in place, the problem of supporting the array turned out not to be a problem. Trees or other structures might do as well. I installed a pulley system at the top of each tower to raise and lower the array and used ½ inch nylon line as the support "wire" from which the array is suspended.

The center reflector element is hung directly from the support "wire." The driven elements are suspended down from the support wire 4 feet, and the directors hang 8 feet down from the same "wire." The spacing between elements is 17 feet 1½ inches. The triangular shape of the loops is fixed by the use of wooden stakes driven in the ground as shown in fig. 1. Nylon rope is used to secure the corner insulators to the ground stakes.

After the elements are in place, the ¼-wave stubs are attached to the driven elements. The stubs are made of 22 foot 6 inch lengths of RG11/U with a coax connector at the end. The end then connects to another connector with 50 ohm coax feedline (use an odd number of ¼-wavelength feedline for 7.175 MHz) from the shack. I use a two-position coax switch in the shack to "change" direction, or if you want, you can install some sort of remote switch at the site and only use one run of coax. The important consideration is to maintain the element spacing of 17 feet 1½ inches by keeping the ground stakes spaced exactly the same.

Results

I have been using this array for over two years and have been very pleased with it. I did, however, install a two-element beam at 100 feet and did some rough comparisons between antennas. Even though the bottom of the reflector loop was only about 20 feet off the ground, both antennas behaved pretty much the same. The delta loop array was certainly worth all the work (and #10 wire) it took to get it up, and the results are well worth the effort.