



## No. 33: The Cheapest 2-Element Beam?

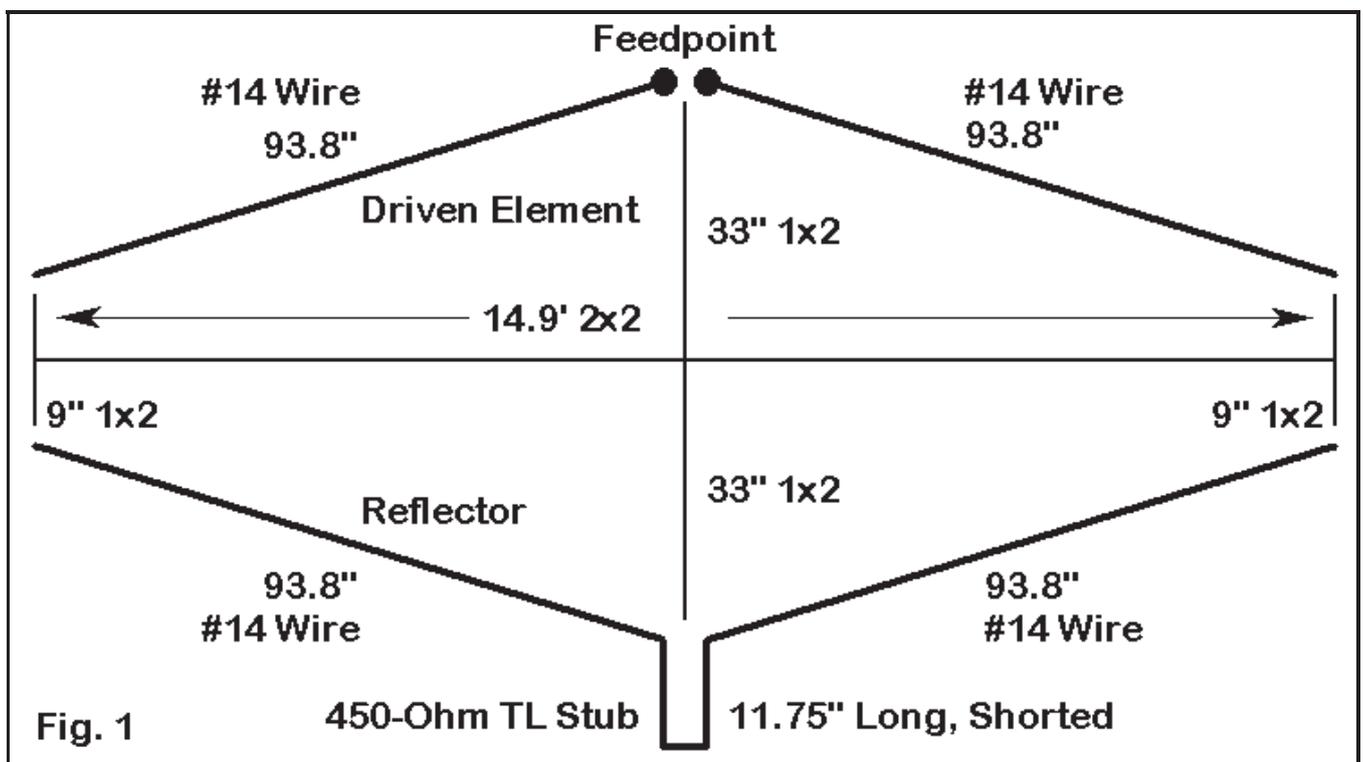


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"Can I build a small directional antenna for less than \$20?" That was the challenge presented to me. The answer is yes. However, remember that this is a project designed for the dollar sign, so the gain and directivity will be modest. Here is what we need:

- 32' #14 copper wire (Radio Shack and elsewhere)
- 15' 2x2 (good quality)
- 7' 1x2 or similar size Schedule 40 PVC
- 1' 450-Ohm parallel feedline
- SO-239 coax connector
- Boom-to-mast bracket/hardware

The antenna is a 2-element wire parasitic beam with the ends tapered back toward each other. The elements are the same physical length, but the reflector is stub loaded to increase its electrical length. (See the last column for information on stubs.) Gain is about half an S-unit over a dipole, and the front-to-back ratio is about 2 S-unit. Feed is a direct coax match, and coverage is about 900 kHz of 10 meters.



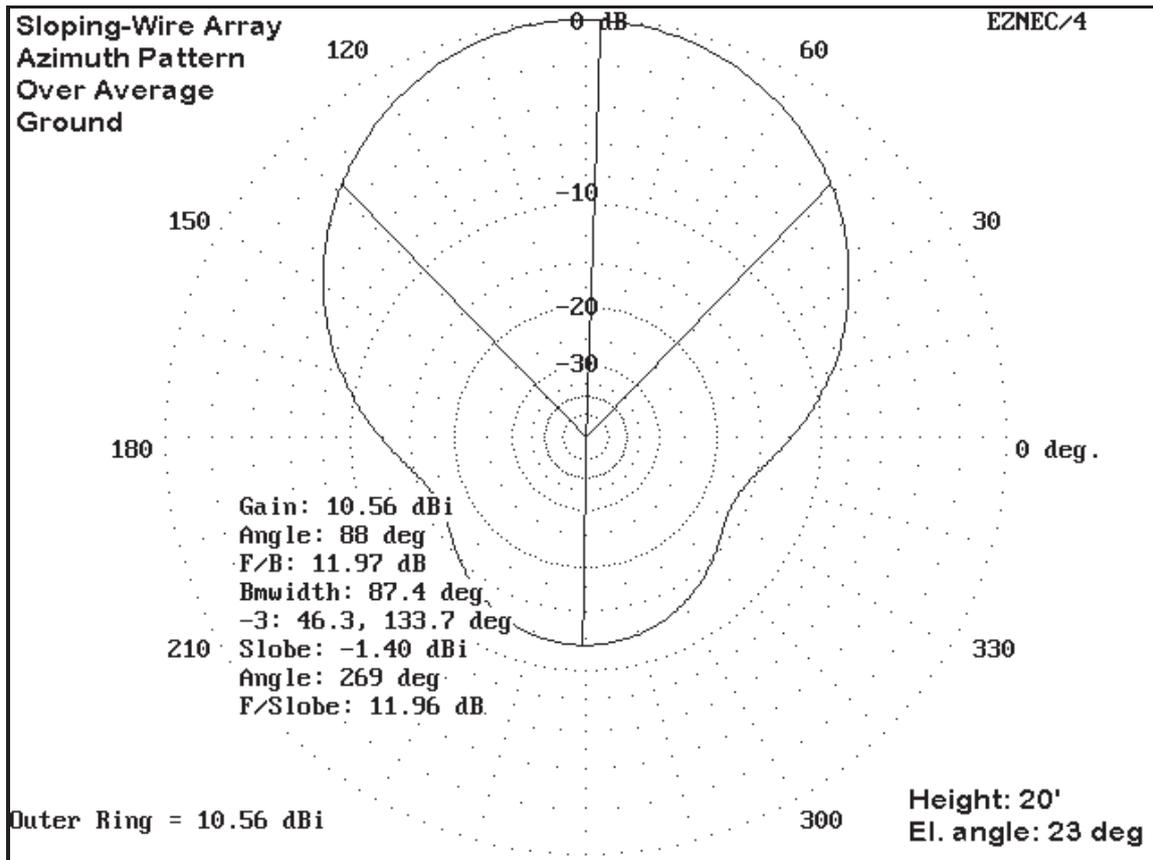
**Figure 1** shows both the wire and support frame dimensions. The 2x2 determines the side-to-side dimensions, while the cross piece determines the maximum front-to-back dimension. The end cross pieces keep the wire ends 9" apart.

Use a good marine (spar) varnish (or modern poly equivalent) on all wood. Expect to re-varnish the wood

annually. Be sure the 2x2 does not sag a lot. The cross pieces can be PVC or 1x2. If wood, give it the same spar varnish treatment.

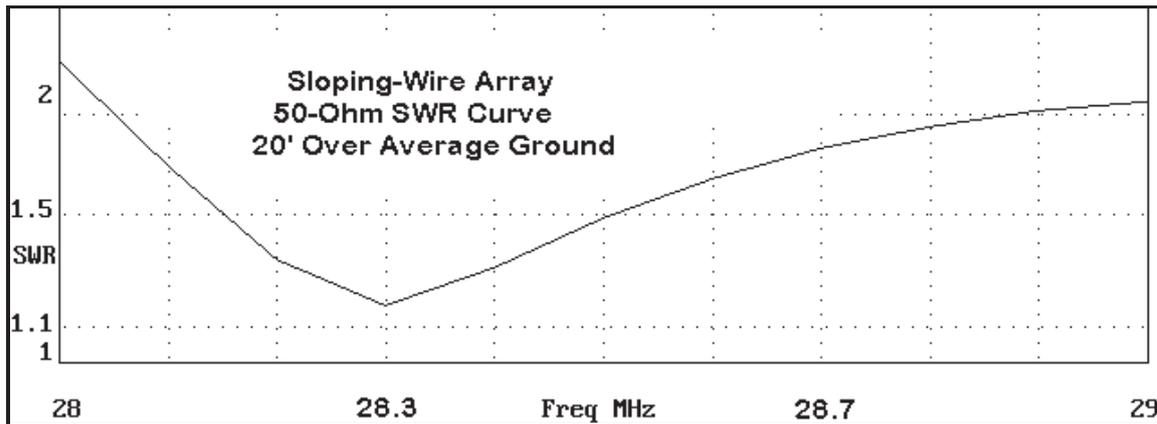
Details of coax connector mounting, wire termination, and mast support are subject to many variations, so I shall bypass them here. Check with any handbook for many different ways to achieve the same goals. Likewise, mast details are omitted here.

The figure shows the stub dangling, but you can tape it to the center cross piece. Not shown is the 1:1 choke balun at the antenna feedpoint that I use on all antennas to reduce RF on the outside of the coax to the shack.



**Figure 2** shows the azimuth pattern with the antenna at 20' over average ground. 20' is the height of two sections of TV masting, which makes an adequate support system for hand rotating the beam. Whatever system you use to elevate the antenna (which I shall assume is as inexpensive as the antenna itself), be certain that the mast is well guyed or bracketed for safety.

The antenna pattern is not a paragon of gain or rear nulling, but it does have some nice features. The forward beamwidth is wide enough so that a single twist of the mast will cover all of Europe or all of the VK-ZL area--or from each of these places, a single setting will cover all of the USA and Canada. The rear has only one lobe, so that there are no antenna positions susceptible to QRM from some quartering rear direction.



**Figure 3** is the modeled SWR plot across the first MHz of 10 meters. The antenna was designed for 28.35 MHz to provide a low SWR for the most popular segment (28.3 to 28.5 MHz). You can shift the SWR curve downward by increasing the length of both wires equally about 2" or so--or shorten them by the same amount to move a bit up the band. However, keep the wire end separation at the prescribed 9" with the end cross pieces.

The antenna is related to the standard Yagi, although the elements are not exactly parallel. The element end coupling also relates the design to the Moxon rectangle, but the sloping wires prevent us from achieving the high front-to-back ratio of that design while still having any forward gain worth using.

So while the performance is modest, the price is attractive. The sloping wire array is a fun antenna to play with, since the cost is so low. However, the most important aspect of the design is that in an emergency--perhaps after some natural disaster has knocked down all of the regular antennas--this design can be fabricated from scraps from the rubble. You can make the electrical elements from house wiring that is no longer functional and lash together a frame with bailing wire.

If you have no inclination to play with the design at this time, you may wish to file this column away in your notebook labeled "In the event of emergency or disaster. . ."