No. 9 Fans and Bow Ties

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Can you use a simple antenna that has an SWR of less than 1.5:1 all the way from 28.0 MHz up to 29.7 MHz? Then you need something stylish in the way of a fan or a bow tie.

Fanning the ends of a dipole or spreading them into a bow about the middle of each side of the element is an old trick for increasing the SWR bandwidth of a dipole. The fatter the element, the broader the bandwidth of the antenna without any significant loss of performance. Ten-meter fans have been around a long time, but folks have almost forgotten them. Let's restore the memory. Remember that there is a good bit of activity at the upper end of 10, what with satellites, repeaters, HF packet and the like. An antenna that will let you work both the repeaters and the CW end of the band is worth remembering.

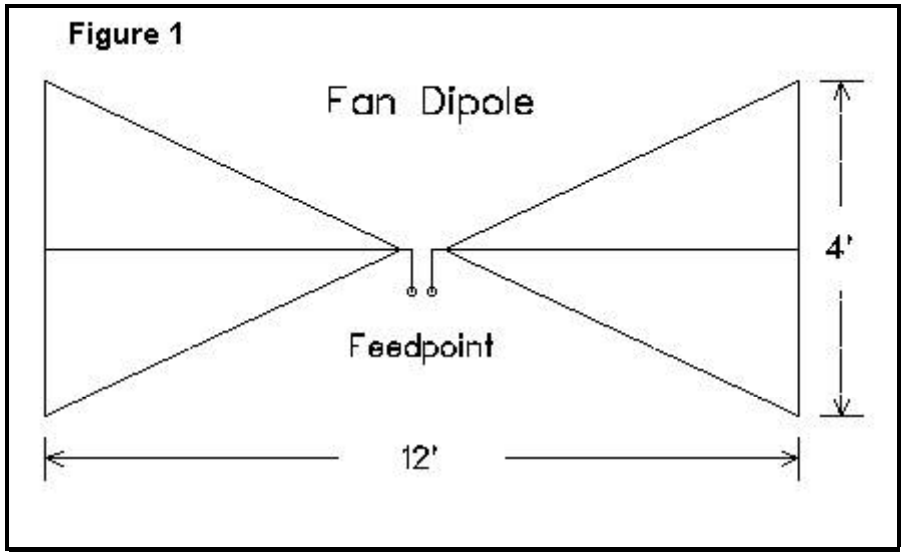

Figure 1. A fan dipole for 10 meters.

Figure 1 captures the essence and the dimensions of a fan dipole for 10 meters. It is a resonant dipole for 10 with a feedpoint impedance of just about 50 ohms resistive at resonance (about 28.75 MHz). A fan can be built with or without the center bar across the middle. However, if the middle bar is removed, the resonant point actually goes down in frequency to about 28.25 MHz with the dimensions given. So some shortening of the structure is in order.

The bandwidth of the antenna increases almost linearly as the vertical dimension is increased. Four feet is a good compromise between performance and ease of building the antenna. At this size, the gain is about the

same as a wire or tube dipole having a narrower bandwidth. With the right construction, the antenna will slip the wind easily and be a very long-lasting antenna. It may even look odd enough to fool your neighbors into thinking it is not a ham antenna.

Building the fan begins with a centerplate: plywood with a coating of the epoxy used for fiberglass repairs works fine. Make the horizontal element 0.75" diameter aluminum from the hardware store. While you are there, pick up an 8' section of aluminum rod or tubing about 0.375" (3/8") diameter and cut it in two. These are the end verticals. You can drill a 3/8" hole in the end of the tube or use some other clamping system. I just slid the rod into the hole and locked its position with two tiny hose clamps, one above and one below the tube. A pair of bolts, with nuts on either side of the tube wall, press on the rod for electrical contact. Be sure to use lockwashers on the bolts for a good bite into the aluminum tube.

#14 stranded wire runs from the rod ends to the center of the dipole. Another set of hose clamps locks the wire in place at each end. Mount the plate on a mast, turn it by motor or hand, and the job is complete.

Be sure to use stainless steel hose clamps and hardware. A little conductive "butter" helps preserve contacts, especially where the metals are dissimilar.

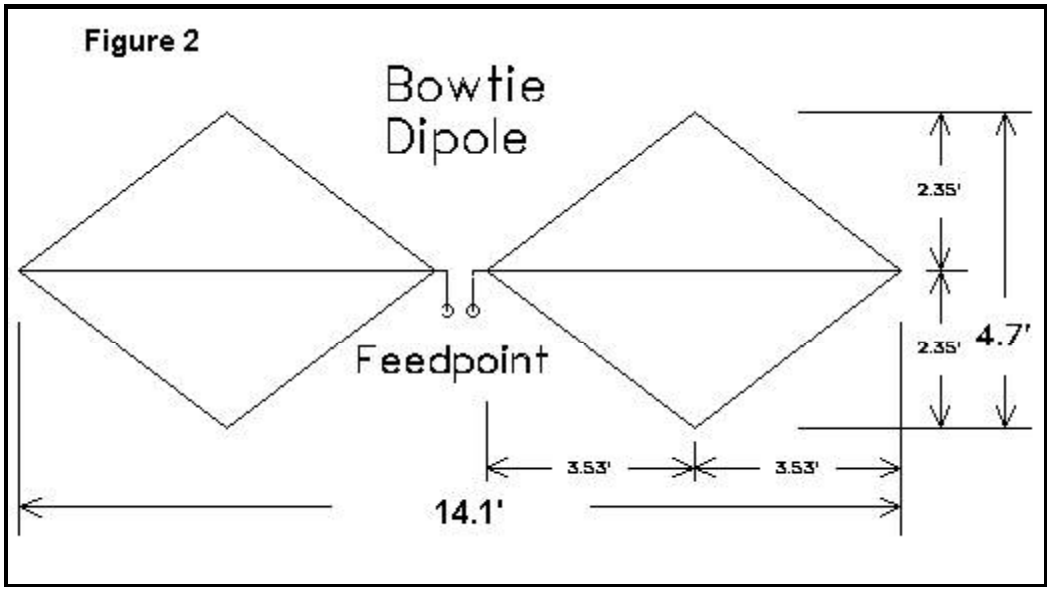

Figure 2. A 10-meter bow tie antenna.

An alternative to the fan dipole is the bow tie. Instead of spreading the antenna at the ends, we spread it in the middle of each half of the dipole. For the same bandwidth, we must have a longer antenna, spread a bit wider at maximum. However, the ends come back to the center tube, which makes construction a bit simpler for some folks. The same principles apply. However, notice that no vertical element is showing in the diagram. Use something nonconductive for this spreader. A length of Schedule 315 PVC (thinner wall) may do the job. The wire tension will keep the tubing from bowing, and a simple set of brackets will hold it to the center tube.

The SWR bandwidth of the bow tie is just as good as it is with the fan. If you think you can hear the difference made by 1/10th of a dB gain, then computer models say the bow tie is that much better than the fan. (Before you get caught up in the idea, forget trying to hear a 0.1 dB difference in anything; you cannot do it.) So the difference comes down to this: which antenna is easier for you to build.

Fans and bow ties used to be built from bent tubing, getting rid of the center horizontal tube. Personally, I do

not recommend this construction. Even if you are an expert tubing bender and do not weaken the tubing by crimping it, the wind will transform your fan or bow tie into a crumpled scarf in very little time. Some modification of the suggested construction method, adapted to what you have in your shop, makes the strongest assembly.

Fans and bow ties, especially fans, lend themselves to 2-element beams quite readily. Ask the folks at Butternut, where they make a multi-band beam from 2 fans slightly larger than the dipole described above. They call it a "Butterfly" beam, so if you make a beam from two bow ties, you can call it a dragonfly beam.

Actually, a monoband beam for ten is not too difficult to build. With the basic fan dipole as a guide, you will have to lengthen the back element by about 5% or load it with a coil at the center. The driven element will be long, just about long enough to add the right inductive reactance for creating a beta match with a capacitor across the feedpoint terminals. You can experiment with a variable capacitor and then replace it with a fixed capacitor of the right value. About an eighth wavelength of spacing (about 4.3') will give the same performance as a "full size" 2-element Yagi, such as the "simplest" Yagi described in an earlier column.

While 10 is so marginal for everyday activity, I suppose I will not break any taboos by mentioning the fact that you can apply the same fan principle to wire antennas for the lower bands. With all the variables that go into wire antennas for 80, 40, and 30 meters, it likely makes no great difference if you connect the ends of the fan together or leave them separate. If you add a fan wire to an existing antenna, be prepared to shorten the antenna, since the spread wire will act like a thickening agent. Some hams have strung wires cut for the low end of the 80-meter CW band, the Novice portion of the band, and for 75 meters, all with one feed. However, 80 is so wide a band (as a percentage of the frequency), that these wires tend to act like 3 independent antennas with a common feed. So you can expect to see ups and downs in the SWR pattern rather than one single low point.

The fan and the bow tie are distant relatives to the cage antenna, a series of wires spaced apart along their entire length by special nonconductive spacers. The original theory was that the radiation from each added up, but actually, the only benefit was getting the equivalent of a fat wire from thin ones. You do not have to go that complex route to get a wide-band dipole for 10. The fan and the bow tie will do the job, and they are much easier to rotate the 90 degrees it takes to put a maximum face on the station you want to work.