No. 29: Some Larger 10-Meter Yagi Designs

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Occasionally, I am asked to recommend some larger Yagi designs that one might build for 10 meters. I can do little better than recommend the designs by Dean Straw, N6BV, that appear in the K6STI, Brian Beezley, program, YA, which has been distributed with The ARRL Antenna Book. In past columns, we have noted other designs originating from YA/YO. We have also featured various 2-element and 3-element Yagis of interest.

The present designs use 4, 5, and 6 elements. Each has been optimized for stable gain, front-to-back ratio, and impedance across the first MHz of the band. I have cross-checked each of them on other antenna modeling programs to confirm the numbers, and all appear to be very promising designs for the home builder.

The gain of a Yagi depends more on the boom length than on the raw number of elements. Therefore, each design will use a longer boom in conjunction with the increasing number of elements to achieve its objectives. Merely adding more elements within the same existing boom length will rarely produce any significant additional gain.

The element listings use a combination of 5/8" (0.625") and 1/2" (0.5") diameter tubing. Only one side of the antenna, relative to the boom, is listed, with the other side being a mirror image. Both the outer segment length and the total half-element length is listed for convenience. The smaller diameter element sections should be at least 3" longer than the lengths listed for insertion into the larger diameter element sections. All dimensions will be in inches. The decimals in the tables correspond the 1/8" increments of length.

The element assemblies are considered medium duty for maximum winds just over 90 miles per hour. For structural details of large Yagi construction, consult one or more of the many handbooks on antenna building. These beams are not casual projects, since they represent a considerable outlay for materials and result in large structures. Their weight may require a larger rotator and other improvements to your tower. Even the smallest of them should not be mounted on something so light as a telescoping mast.

4-Element, 14' Boom Yagi

Distance from Reflector	Length of 0.625"	Length of 0.500"	Total (1/2) Element Length
0.000	36.000	70.000	106.000
36.000	36.000	63.875	99.875
72.000	36.000	62.250	98.250

162.000	**36.000**	**53.125**	**89.125**

The mid-band free-space gain of this antenna is about 8.4 dBi, with an excellent (greater than 20 dB) front-to-back ratio.

5-Element, 20' Boom Yagi

Distance from Reflector	Length of 0.625"	Length of 0.500"	Total (1/2) Element Length
0.000	36.000	71.375	107.375
36.000	36.000	63.375	99.375
72.000	36.000	62.750	98.750
140.000	36.000	61.500	97.500
234.000	36.000	56.375	92.375

The mid-band free-space gain of this antenna is about 9.7 dBi, with an excellent (greater than 20 dB) front-to-back ratio.

6-Element, 36' Boom Yagi

Distance from Reflector	Length of 0.625"	Length of 0.500"	Total (1/2) Element Length
0.000	36.000	70.875	106.875
37.000	36.000	62.875	98.875
80.000	36.000	62.375	98.375
178.000	36.000	60.125	96.125
305.000	36.000	59.250	95.250
426.000	36.000	55.250	91.250

The mid-band free-space gain of this antenna is about 11.6 dBi, with an excellent (greater than 20 dB) front-to-back ratio.

All of these antennas have feedpoint impedances that are designed for a beta or similar matching system. The resistive part of the impedance is in the low-20s, with a comparable amount of capacitive reactance. You may lengthen the driven elements to resonance without adversely affecting antenna performance. A resonant driven element of about 25 Ohms can be matched to a 50-Ohm coaxial cable with a quarter wavelength section of 35-Ohm coaxial cable. Such cable can be purchased for about $3.00 per foot. You may also fabricate a satisfactory line using parallel lengths of 75-Ohm cable with the braids and the center conductors each soldered together at each end.

The smallest of these monoband 10-meter beams will generally outperform the 10-meter section of all but the very largest tri- banders. The longest of the beams is a serious DX-hunting machine. To obtain the maximum performance from any of these beams, place them at least 1 wavelength above ground and preferably closer to 2 wavelengths.

Installing large beams at considerable heights above ground is not a casual process. First, there may be zoning and other legal restrictions or permissions to consider. Second, proper tower installation may cost many times more than the materials in the beam. Safety for yourself, your family, your property, and your neighbor's property are of paramount importance. So too is durability of the performance of the whole system, including the tower, coax, rotator, guys, grounding system, and the antenna.

Before moving to large beams and complex tower installations, learn all that you can about every

aspect of the task. If you have any doubts, consult professional tower installers for answers and for help. Do not violate or ignore applicable laws and ordinances. Do not settle for any installation that does not measure up to good engineering standards. And, for heaven's sake, do not rely on luck to keep your antenna in the air and lightning in someone else's yard.

As you can see, a big antenna--even for 10 meters--is only the beginning and not the end of a much larger enterprise. If you have all the other pieces in place, then one of the N6BV designs may be the answer to the antenna part of the puzzle. Other designs, some with feedpoint impedances in the 35 to 50 Ohm range are also available from various ham magazines. Collect lots of designs and ideas before you start cutting aluminum. The more design articles you read, the more you will learn about the art of building big beams.