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Beam your signal in, Scotty!

When Captain Kirk gives the command, "Beam me up, Scotty," Scotty responds by throwing the switch on a marvelous device which utilizes a beam antenna to send a signal containing matter through space. Of course, beaming humans through space is presently possible only in science fiction. But on the other hand, we do now have antennas which can "beam radio signals in" from specific directions.

The Nice Thing About Beams

A very nice thing about beam antennas is that most of them also have gain, which means increased sensitivity to the signals which you want to hear. So beam antennas are useful for weak signal work, and for communications with stations in specific directions from your location.

Another plus is that interference from all directions except the direction of the beam heading will be suppressed. And the beam described in this month's column is economical, light-weight, and easy to build.

This antenna's unique boomless construction is allowed by the use of a strong monofilament line which supports the "ultra-light" aluminum elements as shown in Figure 1. The monofilament is attached at its ends to whatever happens to be handy for holding the antenna elevated. Thus, the antenna can be mounted from hooks on the walls in a room or attic in a house. For temporary or portable use, it can also be used outside, hung between trees, towers, buildings, or whatever is handy.

If you want to mount this antenna outside on a long-term basis, substitute light aluminum tubing for the wire of the elements, and use light nylon or dacron rope in place of monofilament. I've made the antenna both ways (wire elements and tubing elements) and it works well.

So, if you'd like to monitor some of those weak elusive signals better, or concentrate on signals from a particular direction, or even to reduce interfering signals or noise from off-beam directions, then this month's Yagi-Uda beam may be just the thing for you!

Constructing the Antenna:

1. The beam's elements are made from eight gauge aluminum ground wire available from Radio Shack. The lengths of the elements for two different beams, with their respective band-centers at frequencies of 146 MHz (two-meter ham band) and at 153 MHz (utility band) are given in Figure 1.

Also given are formulas for finding lengths of elements for other bands if you wish. The formulas are easy to use. For instance, if you want a beam centered on 115 MHz, the table in Figure 1 says divide 444.6 by 115 MHz to get the length in feet (which is 3.87 feet, or about 3 feet 10-3/8 inches) for the reflector.

Each element for the beam consists of a single piece of wire, except for the driven element, which is made in two halves. Cut each half of the driven element to one-half the length shown for the driven element in Figure 1.

Take each half and flatten one end with a hammer for about an inch until the wire is about one and one-half times its initial width. Then two holes are drilled in the flattened portion, as shown in Figure 1B, to accommodate one-half inch long number three round-head machine screws.

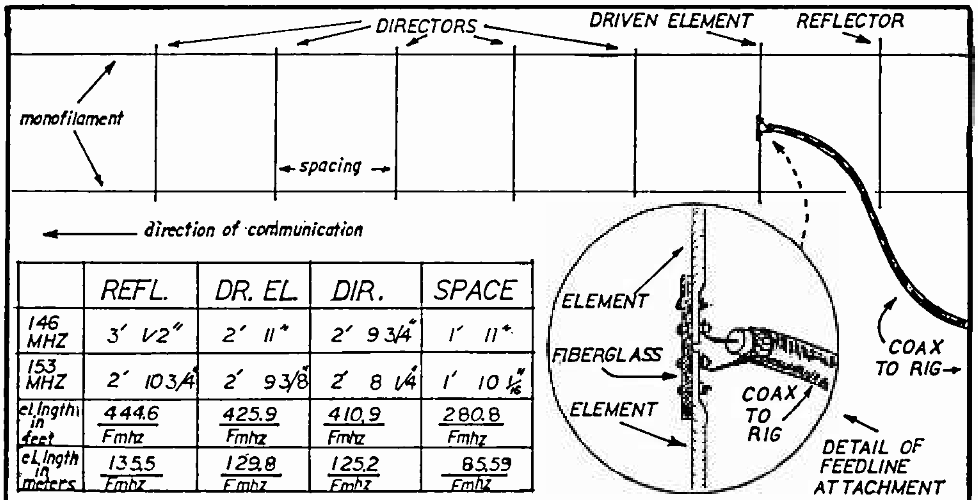
2. The drilled ends of the element-halves are then bolted, with their ends separated by about 1/8 inch, to a 4-1/2 inch by 1/2 inch strip of fiberglass. The fiberglass can be salvaged from a printed circuit board which has been stripped of metal foil. Plastic is okay too.

Drill four holes in the fiberglass to accommodate four screws as shown in Figure 1. Bolt the element-halves to the strip, putting a lockwasher and then a nut on each.

3. Once the element-halves are bolted firmly in place, put two plain flat washers followed by another nut onto each of the two innermost screws. These two screws will be the terminals for connecting the feedline.

4. When the driven element is completed, cut the other elements to length (see Figure 1) and drill a hole for the monofilament support line in each end of each element, 15-1/2 inches from the element's center. These holes will be near the element's outer end (see Figure 1).

5. The monofilament line (I used 30 pound test) is then threaded through the



	REFL.	DR. EL	DIR.	SPACE
146 MHZ	3' 1/2"	2' 11"	2' 9 3/4"	1' 11"
153 MHZ	2' 10 3/4"	2' 9 3/8"	2' 8 1/4"	1' 10 1/8"
el. lngth in feet	444.6 / Fmhz	425.9 / Fmhz	410.9 / Fmhz	280.8 / Fmhz
el. lngth in meters	135.5 / Fmhz	129.8 / Fmhz	125.2 / Fmhz	85.59 / Fmhz

FIG. 1 A 7-ELEMENT YAGI-UDA ANTENNA CAPABLE OF 12.7 DBi GAIN. THE TABLE GIVES ELEMENT LENGTHS AND SPACING.

elements, one at a time. Tie and knot the filament in place at each hole, so that the elements stay at the proper separations given in Figure 1.

6. Attach the center connector of a 75-ohm coaxial cable to either of the screw terminals on the driven element, and connect the shielded braid of the cable to the other screw terminal (see Figure 1). Although no balun is used, the system performs well.

7. Mount the antenna so that the elements are vertical, and attach the lead-in cable to your rig. The antenna is then ready to use.

Using the Beam

Best-practice tradition has it that the feedline should come away from the vertical driven element at right angles (horizontally). I find, however, that the antenna still works fine with the feedline hanging limply near the driven element. Another rule is that generally, the higher you mount the antenna, the better it will perform.

If you've never used a beam antenna before, the gain of this skywire may surprise you. Using my HT (1 watt power output) with nonbeam antennas, I usually have trouble working into my favorite repeater in a city about 40 miles away. Using this beam, I get reports which say that my signal sounds like a local mobile rig (95 percent quieting). And I still get decent reports (50 percent quieting) when I cut the power from 1 watt to 1/4 watt. For the little effort and expense involved, this is quite an antenna.

RADIO RIDDLES

Last month: I asked you why the early radio pioneers, like Marconi, first developed the less useful longer waves and ignored the more useful short waves (HG), very short waves (VHF), and ultra short waves (UHF) for so many decades. Well, it was all coincidental to Marconi discovering the grounded quarterwave vertical antenna, the dominant antenna design of his early work.

The longer (taller) he made his vertical antenna, the farther he found he could communicate. The most important reason for this was that the longer the antenna, the lower the frequency the old spark-coil transmitters would radiate. In those days the only tuned circuit in the transmitter was often the antenna itself! The longer waves thus produced tend to travel well along the surface of the earth, and therefore will extend beyond the line-of-sight limitations of the shorter wavelength bands.

So longer, taller antennas, producing their longer wavelengths, accidentally led radio pioneers, who were seeking to cover greater distances, to avoid short waves and microwaves for a long time. I feel sure that those early radio pioneers would be quite pleased today, if they could just hear our long-distance ionospheric-skip shortwave communication and the long-distance microwave links now possible via communication satellite!

This month: The antenna described above is properly referred to as a "Yagi-Uda" antenna. Often, it is mistakenly called simply a "Yagi." Why is this a mistake? Would it be okay, or even more proper, to call it a "Uda"?

Find the answer to this month's riddle, and much more, next month in your copy of *Monitoring Times*. Till then, Happy Holidays, Peace, DX, and 73.

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