A Two-Element Duoband Beam

Explore the 12- and 17-meter bands with this small, lightweight Yagi.

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Soon after the 12-meter band opened to US amateurs, I built a two-element beam using dimensions taken from Bill (W6SAI) Orr's *Beam Antenna Handbook.* The antenna worked much better than the dipole I had been using and I enjoyed many DX contacts.

The opening of the 17-meter band presented me with a dilemma. The 12-meter beam and tribander on my tower left no room for another beam antenna. I didn't want to give up my 12-meter beam, so the answer was a good duoband design.

I remembered my past success using traps made by Unadilla[1] on the 160, 80 and 40-meter bands. It occurred to me that I could use Unadilla's KW-12 coils on my 12-meter beam to get 17-meter coverage as well.

I took the 12-meter beam down and installed the KW-12 coils at the element ends. I added adjustable stubs for 17 meters to the outer ends of the coils. Then I temporarily mounted the antenna 5 feet above the ground—about as far from the ground as it would be mounted above the triband beam on my tower—and tuned it to resonance (more on this later).

Construction

Study Figs 1 through 4 as you read the construction details. Use electrician's conductive paste to prevent corrosion where the element sections overlap, and stainless-steel and brass (or nickel-plated brass) hardware in construction. A coating of clear plastic spray (such as Krylon) protects the finished antenna.

I bought the aluminum tubing at a hardware store. *QST* advertisers also stock it. The original 12-meter beam was built on a 6-foot length of 1¼ × 1¼-inch square stock with 1/16-inch wall thickness. I cut this piece from an 8-foot section and attached the leftover 2-foot piece at the bottom of the boom at the antenna's center of gravity for additional strength and greater boom-to-mast clamping area. A boom made of round tubing with a traditional boom-to-mast clamp would work fine too. Use what's most readily available to you and don't be afraid to substitute materials (within reason) and modify the design accordingly.

To support the elements, I mounted two 3-foot lengths of 1/8-inch-thick 1- × 1-inch aluminum angle stock to each end of the boom and installed ceramic standoff insulators for the element supports (see Fig 2). The inner sections of the driven element consist of two 3-foot lengths of 7/8-inch tubing mounted to the ceramic standoffs, with a 3-inch gap between the adjacent ends. Before mounting them, slot the outer ends of the tubing to permit the 3/4-inch tubing to slide freely, and for the compression clamps to work properly.

The center section of the reflector is a 7-foot, 4-inch length of 7/8-inch tubing, centered on the boom. For additional support and good grounding, drill and bolt the driven-element support and reflector to

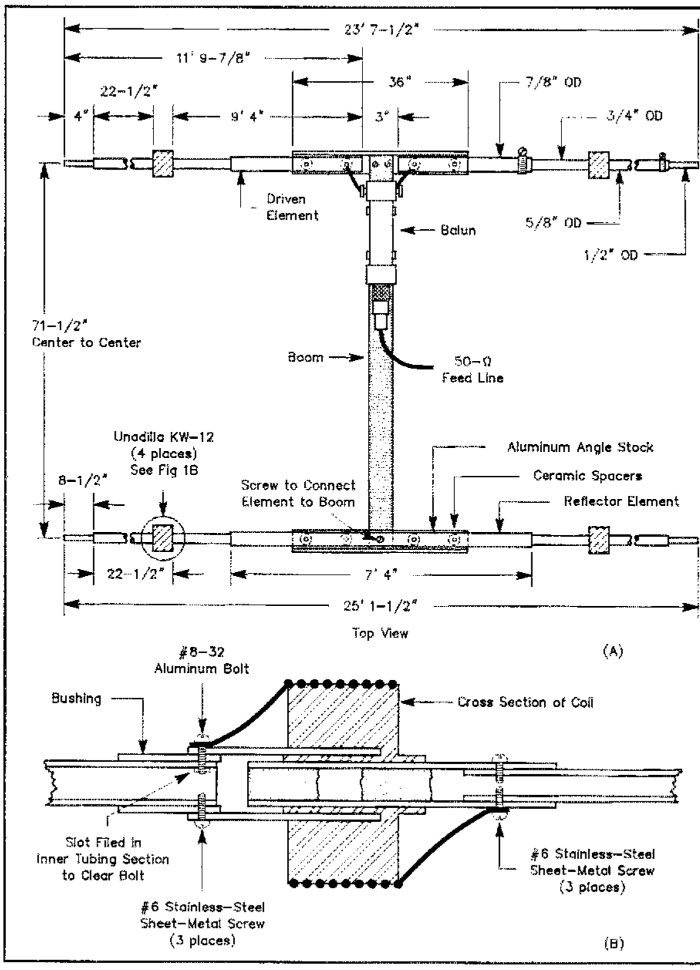

Fig 1—Physical layout of the 12- and 17-meter Yagi. Table 1 lists the necessary parts. Note that the clamps are shown only on half of the driven element for simplicity. Reflector tubing diameters are the same as those of the driven element. At B, a detail of the loading-coil attachment to the element tubing.

[1]Notes appear on page 37.

the boom where they cross. Also slot the outer ends of the reflector tubing.

Mounting the Coils

Cut a section of 7/8-inch tubing into four 2-inch lengths, and cut a slot lengthwise through each piece with a hacksaw. These will form bushings at one end of each coil. On the larger ends of the coils, locate and temporarily remove the #8-32 aluminum bolt. Push each of the slotted 2-inch pieces of 7/8-inch tubing into the larger end of the coils. Using the coil-bolt holes as a guide, drill through the tubing and loosely replace the aluminum bolt.

File a 1/2- × 1/8-inch slot into each end of the four 8-foot, 3/4-inch-OD tubing sections. Push the slotted end of each piece of the 3/4-inch tubing into the slotted sleeves on the coils. Align the 1/2- × 1/8-inch slot so it passes under the aluminum bolt in the coil, then tighten the bolt. Drill three small holes through the existing holes on the coil tubing, through the aluminum sleeve, and into the 3/4-inch element. Place three #6, 3/8-inch stainless-steel, pan-head sheet-metal screws in these holes and tighten them.

Mount the four 2-foot lengths of 5/8-inch tubing to the outsides of the coils as follows. First file a 1/2- × 1/8-inch slot into one end of each piece of tubing. Loosen the bolt on the small end of the coils and push the tubing inside it until the slot is aligned under the screw. Tighten the screw. Drill three small holes through each element to allow the stainless-steel pan-head screws to secure the element-to-coil connection. I used heat-shrink tubing over the coil ends to protect the hardware and connections (see Fig 3).

Final Assembly

Mount the coil assemblies to the 7/8-inch tubing. Slide the 3/4-inch tubing into the 7/8-inch tubing. Use aircraft-grade stainless-steel hose clamps at these junctions.

I used a commercial 1:1 balun at the feed point, as shown in Fig 4. [A coaxial choke balun would work as well.—*Ed.*] Connect the balun terminals to the driven-element halves with short pieces of wire.

Table 1
Duoband Yagi Parts List

- 8-foot length of 1 1/4 × 1 1/4 × 1/16-inch square aluminum tubing (boom).
- 8-foot length of 7/8-inch-OD aluminum tubing.
- Two 3-foot lengths of 7/8-inch-OD aluminum tubing.
- Four 8-foot lengths of 3/4-inch-OD aluminum tubing.
- Four 2-foot lengths of 5/8-inch-OD aluminum tubing.
- Four 1-foot lengths of 1/2-inch OD aluminum tubing.
- Two 3-foot lengths of 1 × 1 × 1/8-inch aluminum angle stock.
- Six 1 1/4 × 1-inch ceramic standoff insulators (preferably threaded).
- Eight stainless-steel hose clamps.
- Small container of electrician's conductive paste.
- 1:1 balun.
- Four Unadilla KW-12 antenna coils.
- Two boom-to-mast U clamps.
- Four 5/8-inch caps for element ends.
- Twelve #6 × 3/8-inch pan-head, stainless-steel sheet-metal screws.
- Twelve #6 × 1/4-inch pan-head, stainless-steel sheet-metal screws.
- About three feet of heat-shrinkable tubing.
- Assortment of stainless-steel and brass bolts, nuts and washers.

Alignment

Adjustment for 12 meters comes first. Leave off the 17-meter stubs and the balun during this step. Check the resonant frequency of the driven element using a dip meter coupled to it with a one-turn loop of wire across the feed point.[2] I set my antenna to 24.960 MHz by sliding the 3/4-inch tubing to the appropriate positions in the 7/8-inch elements. Install the coils and 17-meter, 1/2-inch-diameter stubs and adjust the driven element to 18.120 MHz by sliding the stubs into or out of the 5/8-inch tubing.

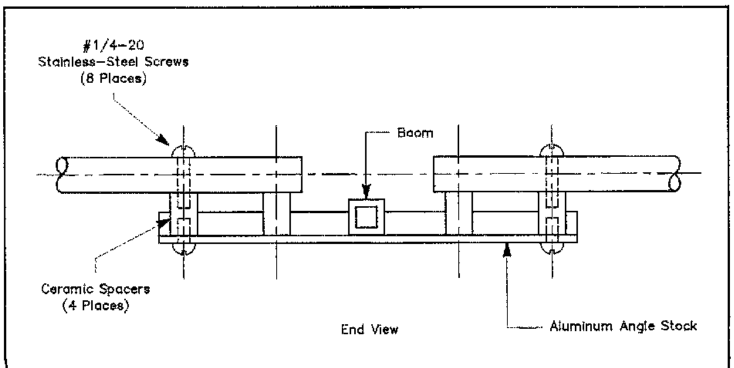

Fig 2—Element-to-boom mounting detail showing how ceramic insulators support the driven element on the angle stock. See Fig 4.

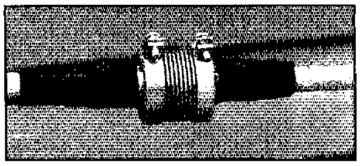

Fig 3—After assembly, the loading coils are exposed, but their connections are protected from the weather by heat-shrinkable tubing. This antenna has served for more than four years with consistently good performance and minimal maintenance.

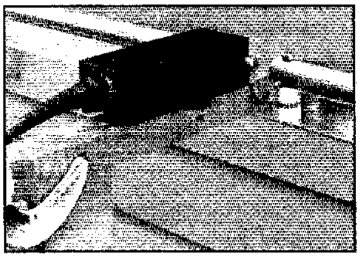

Fig 4—Feed-point detail showing one of the ceramic insulator, angle-stock support and inner driven-element ends.

Set the 12-meter portion of the reflector element (between the inside edges of the coils) to 19 feet, 8 1/2 inches (see Fig 1). The Unadilla coils are equipped with adjustable straps to allow resonant-frequency adjustment. Adjust these straps until your dip meter shows resonance at 18.120 MHz for each coil. The reflector is 18 inches longer than the driven element, but its coils are resonant at the same frequency as the driven element.

On-the-Air Results

The beam typically exhibits a 5 to 6 dB signal-strength advantage over my dipole antennas. The front-to-back ratio is more than 10 dB and front-to-side attenuation is about 25 dB. The antenna doesn't seem to interact with my tribander, as its SWR and patterns haven't changed since I put up the new Yagi.

For only around $100 in parts and a few hours of time, you can make an antenna that covers two great HF ham bands that conventional tribanders don't. It's also small and light enough to put on the same mast. Try building one yourself—you'll be pleasantly surprised at the variety of propagation these bands offer and how many people use them!

Notes

[1]Unadilla Antenna Manufacturing Company, PO Box 4215, Andover, MA 01810.

[2]When you use a dip meter for antenna work, factors like the instrument's age and calibration and the degree of coupling can affect your readings. It's best to verify the dip-meter frequency with a counter or receiver. QST