butterfly beam

This interesting little 15-meter antenna, which is called the butterfly beam, is small, light, and easily made from ordinary hardware store materials. It's also inexpensive. The butterfly beam weighs less than 10 pounds (4.5 kg), it's less than 12 feet (4 meters) square, and cost me less than $20 to build. But despite its small size and low cost, this antenna has given me excellent results on both CW and SSB.

The heart of my butterfly beam is the Lexan spider hub sold by Van Gorden Engineering, P.O. Box 21305, So. Euclid, Ohio 44121. The hub is solidly put together and rugged, and the first time I saw one I thought: *antenna*. The central hole is perfect for the supporting mast. Tubing can be easily attached, and there's even a molded-in socket suitable for an SO-239 chassis connector.

construction details

Four 8-foot (2½-meter) lengths of 1-inch (25.4 mm) diameter aluminum tubing are needed, along with a 50-foot (15-meter) roll of soft aluminum ground wire and four 1-inch (25.4 mm) hose clamps.

It was necessary for me first to calculate the appropriate lengths for the wire elements, based on the 8-foot (2½-meter) tubing I intended using to build the X frame. Not having a capacitor for tuning the director, I reasoned that a close-enough approximation to the desired lengths could be made on a cut-and-try basis, using the starting points calculated (see **table 1**). **Figs. 1** and **2** show the schematic and general arrangement.

I used some light nylon line to tie the ends of the wire together. It's a good insulating material, and also offers the springy support needed to put the elements under slight tension. The socket connector bolts right into the spider hub, and an extra pair of

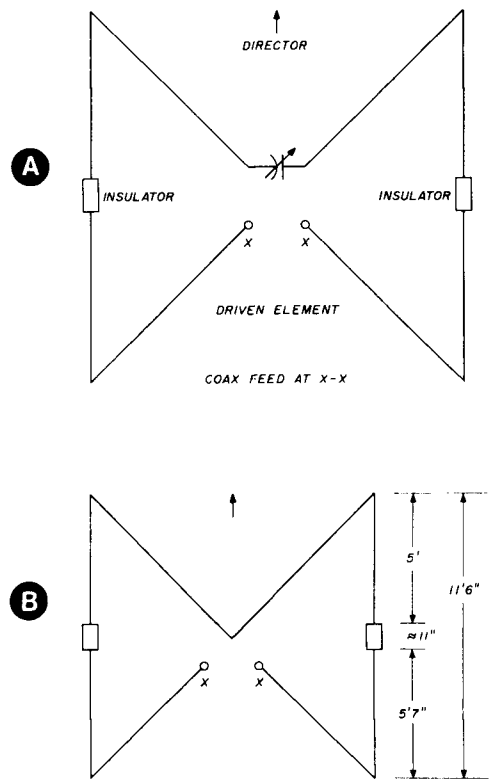

fig. 1. Schematic representation of the "butterfly" beam (A) showing the 'M'-shaped director, tuned by a capacitor, and the 'W'-shaped driven element with feedpoints X-X. It looks a bit like a quad loop, but lies flat instead of standing vertical. B shows dimensions of typical 15-meter version, constructed for lower band edge (21.0 MHz). In this figure, capacitor has been eliminated (see text).

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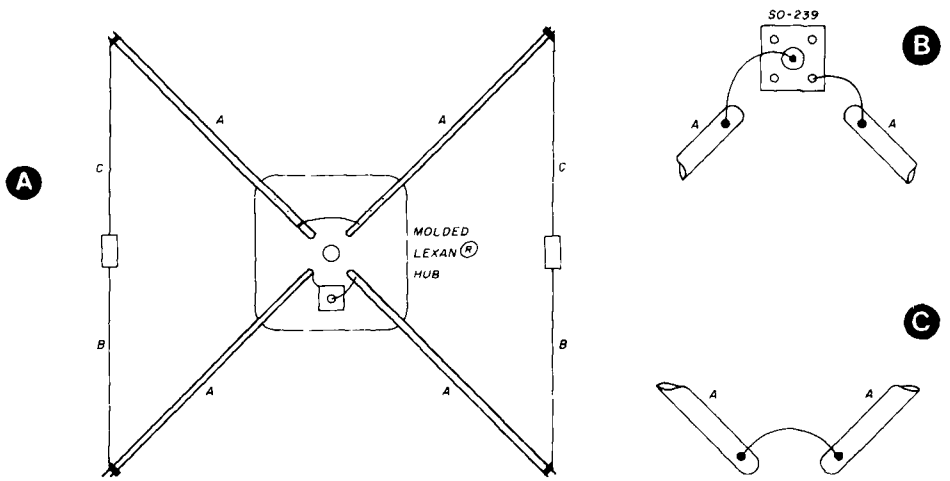

fig. 2. General arrangement of the "butterfly" beam as constructed by the author (A). B shows the SO-239 chassis connector with a wire from the center terminal to one leg of the driven element, and a wire from the shell to the other leg of the driven element. Make the connecting wires short, and use self-tapping screws and radio hardware. Solder connections, where possible. C shows bridge of wire between legs of the director. Variable capacitor could be substituted at this point (see text). Special molded hub available from Van Gorden Engineering (see text).

hose clamps can be used to couple the hub to the mast.

I used a short length of wire to bridge the inner ends of the director element. It's possible to use a tunable capacitor here, the rotor affixed to one leg of the director and stator to the other, because the Lexan hub makes a good insulator. Variable capacitor values would be 250 pF (for 20 meters); 175 pF (for 15 meters); and 125 pF (for 10 meters).

The overall size of each side of the antenna is approximately 11 feet 6 inches (3½ meters) on 15 meters, 17 feet (5 meters) on 20 meters, and 8 feet 6 inches (2½ meters) on 10 meters. The feed point is connected to the SO-239 chassis connector by means of some lengths of copper wire, the center terminal to one leg of the driven element and the ground, or surrounding part of the connector, to the other. The coax is attached to the connector and then waterproofed with a liberal coating of bathtub caulk.* A quarter-wave matching section is shown in **fig. 3**.

When mounting the butterfly beam on its mast, remember that the side wires, not the X-frame tubing, should be aligned with the direction of fire. The proper direction is a bisector of each X angle at the hub.

table 1. Dimensions for the Butterfly Beam (based on lower band edge).

dimension	band 10 meters	15 meters	20 meters
A	6′ (1.8 m)	8′ (2.4 m)	12′ (3.7 m)
B	4′3″ (1.3 m)	5′7″ (1.7 m)	8′6″ (2.6 m)
C	3′7″ (1 m)	5′ (1.5 m)	7′3″ (2.2 m)
D*	5′10″ (1.8 m)	7′9″ (2.4 m)	11′8″ (3.6 m)

Materials: X-arms are 1-inch (25.4 mm) diameter aluminum tubing; wire is soft-drawn aluminum ground wire, approximately 1/8-inch (3 mm) diameter; insulators are plastic, nylon cord is suitable. Hub is Lexan (see text).

*Assuming coaxial cable velocity factor = 0.66 Formula = 164/f(MHz).

SWR has been 1.5:1 or less across the 15-meter band, and I've received excellent reports from all sorts of DX, both CW and SSB. When compared with my 14AVQ on the same signals, the butterfly has resulted in a reported average improvement of two S-units, with some reports running as high as 3. Assuming 3.33 dB per S-unit, my butterfly beam

*A better alternative is COAX-SEAL available from Universal Electronics, Inc., 1280 Aida Drive, Reynoldsburg, Ohio 43086.

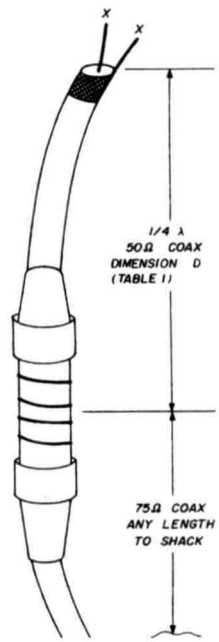

fig. 3. Typical means of constructing a quarter-wave matching section from coax. The feedpoint impedance of the beam (about 30 ohms) is transformed to the feedline impedance (72 ohms) by means of a quarter-wave transformer of 50-ohm coaxial cable. Accompanying table and notes show dimensions for various bands. Center connector consists of two male connectors joined by a female (barrel) connector, for convenience. Joint should be taped and waterproofed after completion.

represents a gain of 6 to 7 dB, and sometimes as much as 10 dB!

The front-to-back ratio runs only 10 to 15 dB, although the front-to-side ratio is considerably better, running about 30-40 dB. There seems to be a very deep notch in the position between side and back of the beam, although I have not made any pattern plots to verify this. A considerable improvement in front-to-back ratio might possibly be made by director tuning. Another interesting possibility is that of using a coaxial capacitor as a director tuning capacitor.

bibliography

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