The Boom-Excited Beam Antenna

Here's a great way to put your beam on 10 MHz or below — and cheaply, too!

By Edward C. Pienkowski,* W8BEB

With decreasing sunspot activity and the recent addition of the 30-meter band, many of us would like to operate in the lower frequencies. And we'd prefer to do this without any extra strain on our antenna budget. Why can't we use an existing Yagi?

Yagi as Dipole

Boom-exciting is a way of operating a Yagi on an additional band. It can be done without impairing correct operation on the original band. This technique is accomplished by treating the boom and the elements at the ends of the boom (usually the reflector and "last" director) as a half-wave dipole. The half wavelength is measured from the tip of the director to the boom, along the full length of the boom to the center of the reflector and then out to the end of the reflector.

My 20-meter beam is a HyGain 204BA (Fig. 1). The length from one end of the director to the boom is 15 ft 7 in. The boom is 26 feet long, and it is 18 feet from the boom to one end of the reflector.[1] This gives a total length of 59 ft 7 in., slightly less than the ideal 64 to 68 ft for a 40-meter dipole. But there is another consideration: The configuration is not a straight piece of aluminum. Electrically, it is an end-loaded dipole, in which the boom acts as the center of the dipole and the reflector and director serve as end-loading elements. It may be resonant on 40 meters, even though it is physically a little shorter than it "should" be. End loading gives it the extra electrical length that is needed.

Although end loading may not sound familiar, perhaps top loading does.[2] Top loading a vertical antenna requires placing a horizontal wire or grid work at the top of the antenna so the vertical section can be made shorter. It loads the antenna and shortens the required height by increasing the capacitance between the top of the vertical section and the ground. In our case, end loading is essentially the same thing, and results from bringing the dipole ends closer together — increasing the mutual

*40 W. 938 Whitney Rd., St. Charles, IL 60174

[1]Notes appear on page 15.

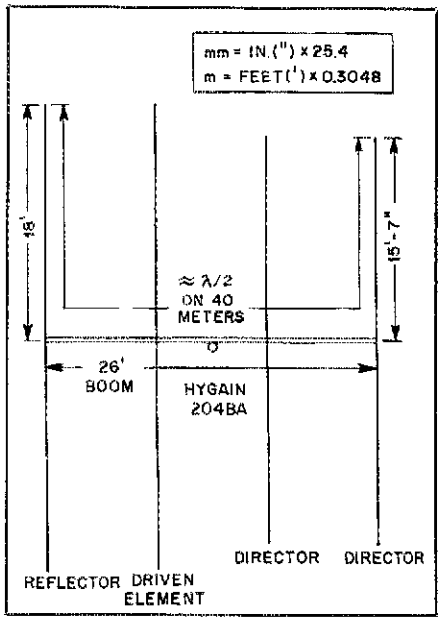

Fig. 1 — Example of how another amateur-band resonant length may be found on a Yagi.

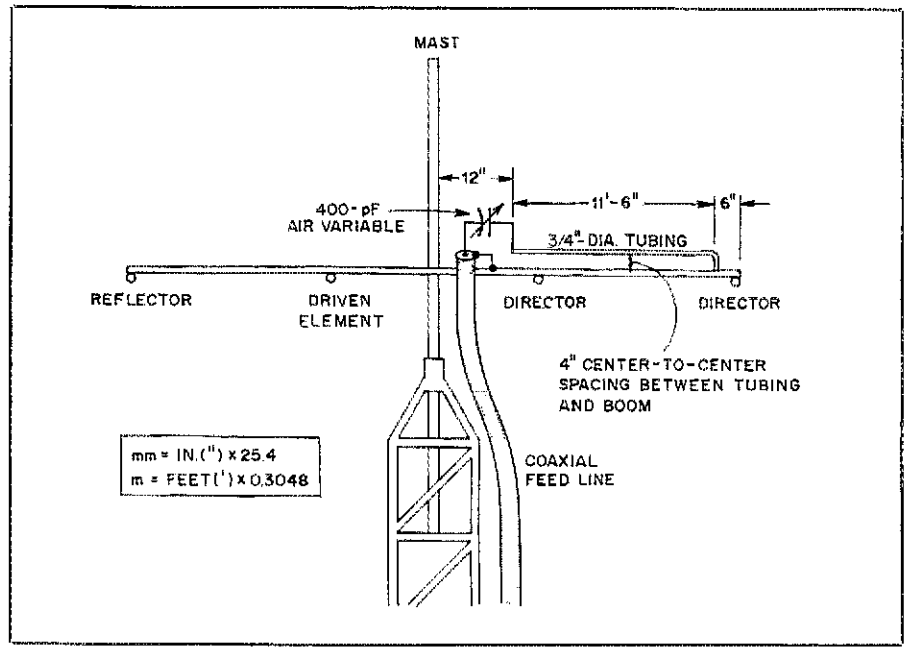

Fig. 2 — Gamma-match feed system used on the author's 20-meter Yagi.

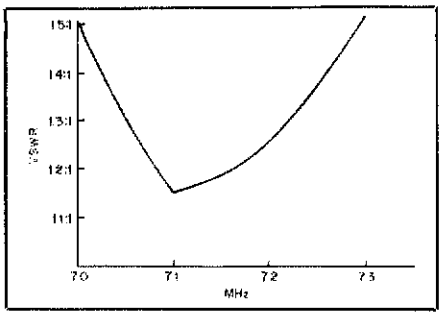

Fig. 3 — SWR curve of the boom-excited 20-meter Yagi when used on 40 meters.

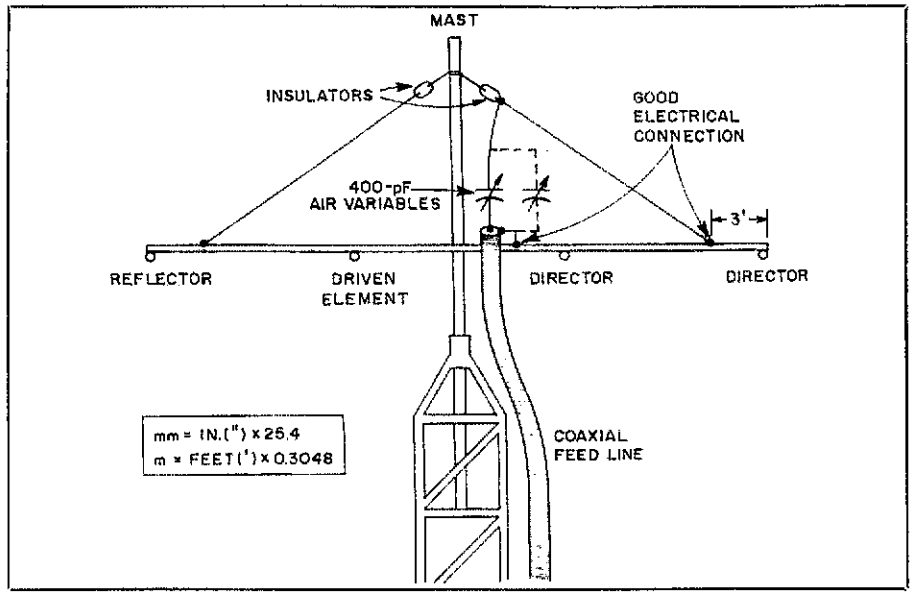

Fig. 4 — Alternative method of boom-exciting a Yagi, using the boom truss wire as part of the matching system. Capacitor in dashed lines is optional, but may be necessary to obtain a match in some systems.

capacitance. Additional capacitance or loading is provided by the other elements in the array.

Feed Systems

The first question is, "What's the best way to feed power to this system?" It's impractical to place an insulator in the center of the boom. Instead, I mounted a gamma match along the boom (Fig. 2). A delta match, a T match or an omega match should also work well.[3] I chose a gamma match because it was a simple technique for my antenna. The resulting SWR curve is shown in Fig. 3.

Another feed method that works well on a 1/12 scale model of my Yagi is to insulate the boom truss wires at the point where they attach to the mast. One of these is connected to the center conductor of the coaxial feed line through a series capacitor, as shown in Fig. 4. To obtain a good match, it is necessary to adjust the length of the truss wires and the series capacitor value. Also, care must be used in making a good electrical connection between the boom and the truss wire. On some antennas, a second capacitor connected in an omega match configuration might help. Experimentation will help determine your individual needs.

If your antenna is not the correct physical length for the desired band, the electrical length can be adjusted in various ways. One way is to insulate the outermost elements from the boom. Inductors (to lengthen) or capacitors (to shorten) the antenna can then be connected between the boom and the center of the elements. (I believe it is possible to develop a combination of coils and capacitors allowing operation on more than one additional frequency.)

Antenna length can also be adjusted through the addition of boom extensions. Based on a 1/12 scale model, a 10-foot extension on each end of the boom makes my Yagi resonant on 30 meters. This provides a trapless tribander on 20, 30 and 40 meters!

Another possibility involves adding boom extensions for 80-meter operation. Because of size limitations, this would unfortunately involve the use of lossy loading coils.

Performance

As with all antennas, there are some disadvantages to the boom-excited beam. Maximum radiation from this antenna is at right angles to that from the Yagi. There is no front-to-back ratio because the antenna is essentially a dipole, which has little gain at best. On the other side of the ledger, the boom-excited beam *does* have nulls off the ends (as all dipoles do), and they can be pointed at an interfering station. On my antenna, the nulls are about 15 to 20 dB in depth. Because there are no lossy loading coils and the antenna has heavy conductors (the boom) in the area of maximum antenna current, efficiency seems to be very good. The full length of the antenna is at one height, which helps to lower the overall radiation angle. On-the-air tests have yielded good signal reports.

All these techniques are bound to raise questions about boom-exciting other types of antennas. I am sure this is possible, but it will take some experimenting to obtain the answers. If you decide to experiment, I'd be anxious to learn of your results. Perhaps additional findings will be reported in a future issue of *QST*.

If nothing else, after boom-exciting your antenna you can impress your friends by telling them you now have a 4-element, trapless 40-meter beam. Well, that's sort of true....

Notes

[1]mm = in. × 25.4; m = ft × 0.3048.

[2]G. Hall, ed., *The ARRL Antenna Book*, 14th ed. (Newington: ARRL, 1982), Chapter 2, p. 25.

[3]*The ARRL Antenna Book*, Chapter 5.

Strays

INTERCONTINENTAL PACKET RADIO A REALITY

☐ A successful two-way 10-meter packet-radio QSO took place between the U.S. East Coast and New Zealand on May 27, 1983 at 2300 UTC. Tom Clark, W3IWI, in Maryland, and Ian Ashley, ZL1AOX, near Auckland, made this record 13,850-km contact. The Tucson Amateur Packet Radio (TAPR) terminal node controller (TNC) was used at both ends, running at a speed of 1200 baud and using amateur AX.25 link-level protocol. On May 30, Vern Riportella, WA2LQQ, joined W3IWI and carried on a one-hour contact at 600 baud.

THANKS, ICOM

☐ Icom America, Inc., recently donated an IC-251A 2-meter multimode transceiver to the ARRL Technical Department. This unit will be used as an i-f source for developing and evaluating transverters for a book on uhf and microwaves. The ARRL expresses its gratitude for this gift.

AMTOR PHOTOS NEEDED

☐ The ARRL Technical Department is looking for good-quality B & W photographs of AMTOR stations, especially homebuilt ones. Those accepted would be used in *QST* or the *Handbook*, with appropriate photo credit given. Please send the photos to the attention of Paul Rinaldo, W4RI, at ARRL Hq.