Dave Ingram K4TWJ
Eastwood Village 1201 South
Rte. 11, Box 499
Birmingham AL 35210

Hustler Minibeam: the Mobileer's Secret Weapon

—two-el beam fits in your trunk

One of the most useful and convenient accessories of interest to many amateurs is a fold-down minibeam antenna. A portable and efficient gain antenna solves numerous signal radiation problems for traveling amateurs, weekend vacation enthusiasts, or amateurs with limited space. Most minibeam antennas suffer two distinct problems which limit their use by today's "on-the-go" radio amateurs. Either they are too large to be easily transported and quickly erected by one man or they require a large number of parts to be assembled before each period of use. Consequently, many amateurs merely use simple dipoles or mobile whips for their portable activities. The Hustler Minibeam was devised to provide a solution to this dilemma.

This antenna described in this article provides up to 5 dB forward gain, may be operated on the 20-, 15-, or 10-meter bands, and will fit comfortably in one corner of an auto trunk. The vacationing amateur can unpack, assemble, and erect the antenna in less than fifteen minutes, and the approximate cost of this array can be under forty dollars. This two-element beam also may be operated as a rotary dipole for the 40- or 80-meter amateur bands, if desired.

Theory of Operation

Basically, this antenna is a two-element yagi of reduced proportions. Center loading of each element is provided through the use of Hustler mobile resonators, and most of the beam's aluminum tubing is salvaged from an old CB beam antenna. While this small array may be fed directly with 50-Ohm coaxial cable, a 50-Ohm unbalanced-to-balanced balun transformer will substantially improve overall performance.

Photo A. The knock-down Hustler minibeam can be removed from the trunk of a compact auto and be in use on a moment's notice.

The requirements for a two-element yagi are relatively simple: The driven element must be ½ wavelength long, and the parasitic element must be either 5% longer if it is used as a reflector or 4% shorter if it is used as a director. The close-spacing distance between driven and parasitic elements should be approximately .15 wavelengths for a reflector and .1 wavelengths for a director. As we have learned through the use of triband minibeams, however, less-than-optimum element spacing is often quite acceptable.

New-Tronics mobile antennas have proven their outstanding ability through numerous years of service, and this minibeam antenna performs with almost the class of its full-sized counterparts. Band changing is accomplished by exchanging resonators as necessary. Additionally, 40-meter or 80-meter resonators may be used with the driven element proper to afford the rotary dipole option. Resonators used with this antenna are not subjected to the stress of mobile activities, so damaged and electrically restored resonators should work very well in this array.

Rather than adjusting element length for resonance at the desired frequency, the beam's resonators are tuned by moving their tip rods and monitoring resonant frequency with an antenna noise bridge or indicator. Once these positions are located, a notch is filed in the resonator's tip rod for future reference. The antenna's driven element may be adjusted for operation by merely tuning for a 1-to-1 swr at the desired frequency. Assuming 20-meter resonators are employed, the driven element should be tuned to approximately 14,250 kHz. As shown in Fig. 1(a), this equals an approximate length of 32.84 feet. A comparable reflector element will be approximately 5% longer, or 34.48 feet in length. In Fig. 1(b), we find that this length equals a resonant frequency of 468/34.48, or 13,570 kHz. Since this frequency is below the resonator's range, each side of the reflector's elements must be extended slightly. This is accomplished by varying the screw-stock length for

$$\text{1/2 wavelength (ft.)} = \frac{468}{F_Q \text{ (MHz)}}$$

Fig. 1(a). Determining element length.

$$F_Q \text{ (MHz)} = \frac{468}{\text{1/2 wavelength (ft.)}}$$

Fig. 1(b). Determining resonant frequency.

coarse adjustments and adjusting resonator tip rods for fine tuning. While the parasitic element may be adjusted to act as a reflector (lower resonant frequency) or as a director (higher resonant frequency), a slightly higher forward gain will be produced when using a reflector element.

Concept of Construction

Rather than presenting a step-by-step-duplication procedure here, I will describe this antenna in a manner which will allow personal ingenuity and available parts to be used to maximum benefit. You can "mix and match" ideas as you like.

The dipole (driven) element should be constructed first, since it may be used independently or as a reference to ensure that the other element is properly adjusted to its respective frequency.

As shown in Fig. 2, the driven element should be insulated from the boom by whatever means you find convenient. If you can't salvage these parts from a damaged CB beam, a short length of PCV plastic pipe may be used. An old boom-to-mast plate may be incorporated for element mounting, and it will serve double duty should you also desire a rotary dipole arrangement for 80 or 40 meters. A section, or sections, of aluminum tubing totaling 53.75 inches (the length of the New-Tronics Mobile Mast, M01 or M02) can then be inserted and secured to the PCV plastic pipe.

Each end of these aluminum sections is fitted with screw stock (from any hardware store) which mates with Hustler resonators for the desired band of operation. Holes may be drilled through the PCV pipe and aluminum tubing, and sheet metal screws with balun or feedline connection lugs inserted. In order to ensure portability, my driven element is broken into three sections, each slightly less than 3 feet in length. Each section is marked at its insertion length, and screw-type compression clamps are used to secure the element when assembled.

The parasitic element, complete with boom mounting assembly, may be secured from an old CB beam. Many of these arrays employ swaged elements which mate perfectly with the screw stock which is inserted in their outer ends. Since these element sections are not insulated from the boom, they may be removed at that point for transportation and rapid reassembly. Each end of the screw stock-fitted sections should be slotted with a hacksaw and fitted with screw-type compression clamps. Approximately 12- to 16-inch lengths of screw stock should then be inserted and the clamps tightened only enough to hold them securely. A final tightening will be accomplished after the element is tuned to frequency and its position marked with a laundry marker pen. A construction procedure similiar to the above is satisfactory for conventional aluminum tubing assemblies, also.

The boom may be salvaged from a CB beam, or a piece of aluminum shower curtain rod may be utilized. As I have learned from a variety of minibeams marketed in recent years, several variations of boom lengths may be acceptable. I, however, have realized good results using a 6.5-foot

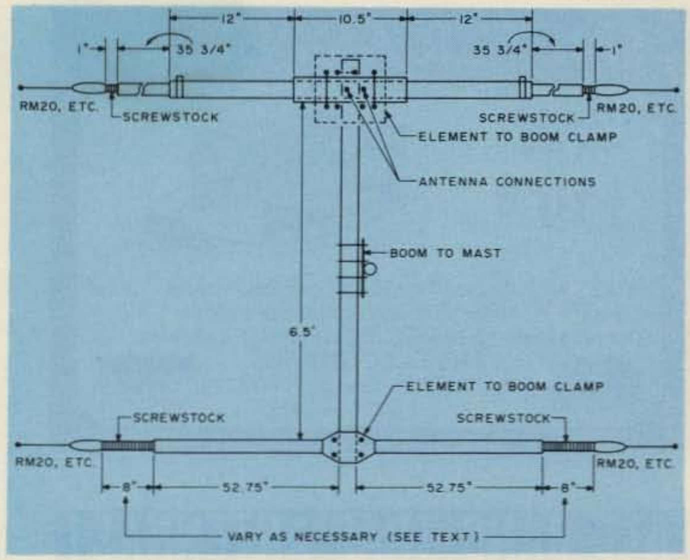

Fig. 2. Electrical/mechanical details of the Hustler minibeam.

boom. This length is approximately .15 wavelengths at 21,300 kHz: a reasonable compromise for 20-, 15-, or 10-meter operations. The boom may be cut in the middle and fitted with a connecting sleeve and mast-mount assembly for portability. (Due to lack of time, I haven't yet added this feature to my minibeam.)

Tuning and Adjustment

Once the antenna is constructed, it may be tuned and marked for later reassembly and use as needed. Each end of the driven element should be adjusted to measure 53.75 inches from center to tips of screw stock. Resonators for the desired band should be fitted and tuned for minimum swr. Next, resonators and screw stocks for the parasitic element should replace those on the driven element, and they, too, should be tuned to their respective frequencies—about 5% lower than the chosen operating frequency. Since the Hustler resonators may not quite reach the parasitic frequency, screw-stock length should be varied in 2-inch increments until tip-rod adjustment range is acquired.

After parasitic resonators are tuned to the calculated frequency, they are marked and inserted into their respective parasitic element sections. The driven element is then reassembled with its pretuned resonators, and the basic tuning is complete. A final tweaking may be accomplished with the aid of a field-strength meter. The parasitic resonators are then carefully adjusted while monitoring forward gain. This procedure is identical to any beam antenna adjustments, so it need not be repeated here.

Additional Notes

The easiest and quickest way to tune all elements of

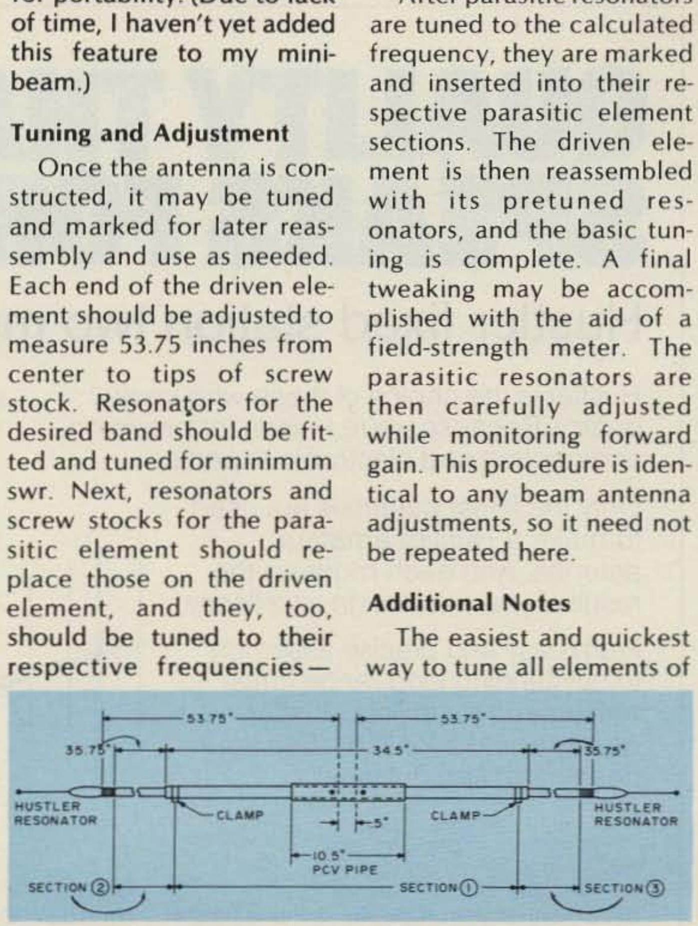

Fig. 3. The three-section breakdown of the driven element (see text).

this antenna involves using an antenna noise bridge and general-coverage receiver. The noise bridges manufactured by MFJ Enterprises and Palomar Engineering are ideal for this operation. Complete antenna tuning procedures are included in the MFJ and Palomar instruction manuals.

Assuming band-to-band color coding is used to mark element positions and resonator tip rods, the collapsed beam can be reconstructed within a matter of minutes. Mobiling amateurs carrying an antenna similiar to this array in their autos are thus ready for hilltop DXing.

While I haven't (yet!) investigated the possibility of using an extended boom and trying a 40-meter beam, the concept looks very promising.

Sections of aluminum tubing salvaged from a 6-meter or CB antenna may replace parasitic element resonators when this array is used on the upper part of 10 meters. Merely calculate their approximate lengths and install tubing in the place of the resonators.

Conclusion

The pint-size beam antenna described in this article is an outstanding performer for any amateur setup. This little gem can be stored and used as required, with minimum assembly and tuning time required. The beam will substantially outperform a dipole or vertical, and its cost is quite reasonable.

I would like to thank Erskine Jackson W4CEC for his clever ideas in the construction of the beam's driven element. Jack operates mobile and portable quite often, and this fold-up concept was his ideal solution.■