Hints and Kinks

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TRY A SIGMA BEAM ON YOUR SMALL LOT!

[Editor's Note: An article describing JG1UNE's Sigma beam appeared in the Feb 1980 issue (p 280) of Japan's *CQ Ham Radio* magazine.]

□ A full-size beam antenna is great—if you have the space for one. Many of us, however, live in apartments and just don't have that space. Figs 1 through 4 describe the results of my experiments with a miniaturized beam antenna in a Σ (sigma) configuration. My antenna is mounted at the top of a tower, about 15 m above the building roof.

The Sigma beam is a compact antenna shaped like the Greek letter sigma; it is a

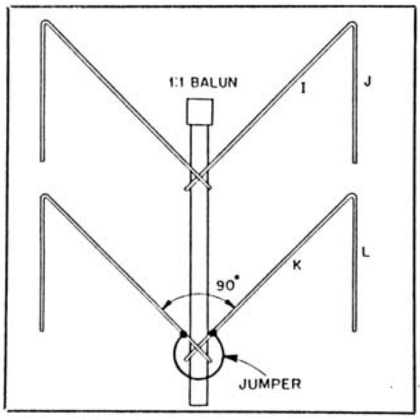

Fig 1—JG1UNE's Sigma beam. Tube sizes and lengths appear in Table 1.

V beam with the element ends bent to reduce its size. A list of materials for a 28-MHz antenna, constructed of aluminum tubing, appears in Table 1. Be sure to flatten the tube joints *(after assembly!)* to keep the element ends from rotating (see Fig 3B and Section A-A).

My beam was a little heavy when all elements were made of metal tubing. Also,

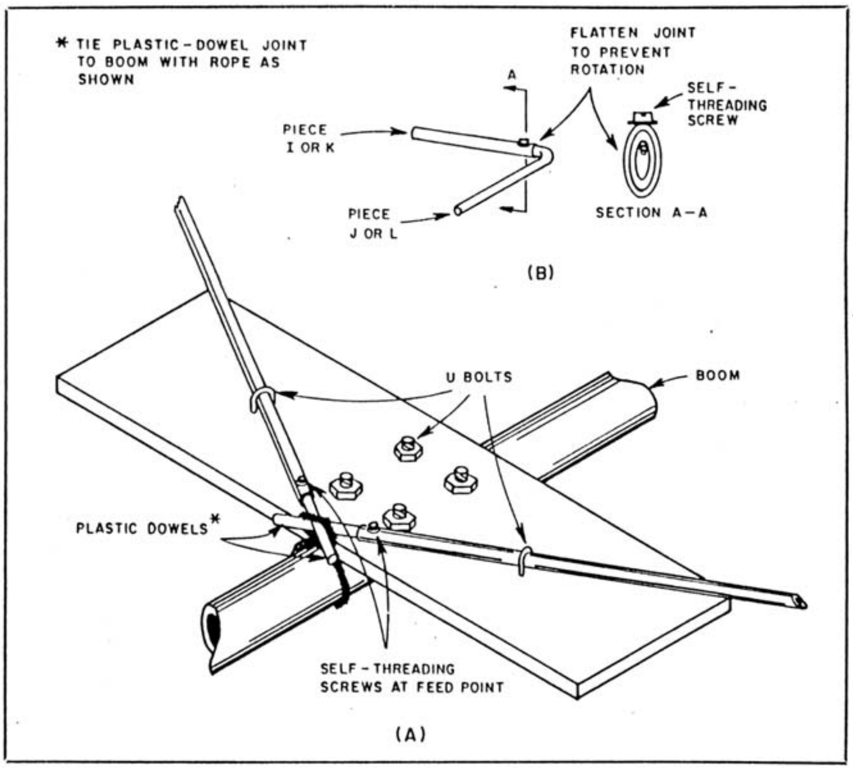

Fig 3—Details of the mounting-plate assembly (A) and element joint (B). Flatten the joint slightly after assembly to prevent rotation.

the tube joints are weak points, which are threatened by strong winds. The antenna weight can be reduced, and construction simplified, if we use straight bamboo or fiberglass spreaders to support wire elements. Two such antennas are shown in Fig 4. [This also eliminates any overlap problems where the element centers cross at the boom. Use nylon twine or some other insulating material for the lines at the element ends.—Ed.]

An SWR plot of my Sigma beam compares well with that of a full-size, two-element V beam. The two curves are nearly identical, with the SWR less than 1.7:1 from 28 to 29 MHz. The folded element ends seem to have little effect on the antenna impedance. My Sigma beam is fed through a homebuilt 1:1 balun.

I have contacted many Americans and Europeans while using this antenna and 40 W of output power. The V antenna has

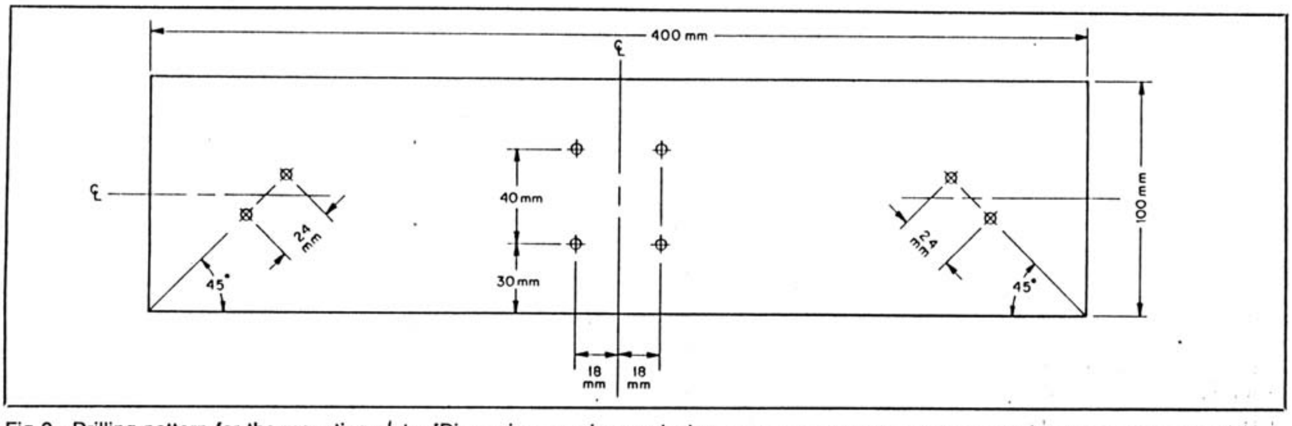

Fig 2—Drilling pattern for the mounting plate. [Dimensions are in mm; inches = mm × 0.0394. Size holes and adjust locations to fit locally available hardware. The mounting plate may be hardwood rather than plastic, or plastic sleeves may be used to insulate the elements from a metal plate if a plastic plate is not available.—Ed.]

Table 1

Construction Materials for the JG1UNE Sigma Beam

Aluminum tubing:

- 2 pcs (I) —12 mm × 1.6 m†
- 2 pcs (K) —12 mm × 1.7 m
- 2 pcs (J) — 9 mm × 0.83 m
- 2 pcs (L) — 9 mm × 0.88 m

Boom: 32 mm × 1.0 m

Plastic dowel: 6 mm × 1.0 m

Acrylic plates: 2 pcs—100 mm × 400 mm × 5 mm

U bolts:

- 4 pcs—12 mm diameter
- 4 pcs—32 mm diameter

Self-threading screws: 6 pcs

Rope: 1.5 m

†Letters in parentheses are part identifiers as shown in Figs 1 and 4.
Inches = mm × 0.0394; feet = m × 3.2808.

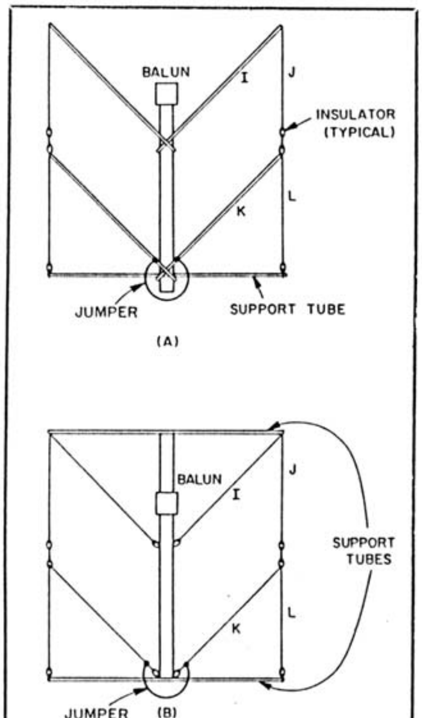

Fig 4—Variations on the Sigma beam that increase strength by reducing weight and mechanical complexity. Wire is used for the element end sections at A, while all conductors are wire at B. Wire lengths are the same as the tube lengths given in Table 1.

slight gain over a dipole, and I feel that the Sigma beam provides the performance of a V beam in a very compact package. There's no need to give up DXing because you live in an apartment. Try a Sigma beam! *—Aki Kogure, JG1UNE, Tokyo, Japan*

A SIMPLE, MULTIBAND VERTICAL ANTENNA

□ The antenna in Fig 5 is based on a multiband vertical antenna described by Arthur S. Gillespie, Jr, W4VON, in the eighth edition

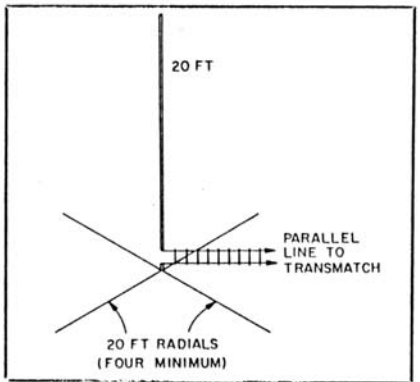

Fig 5—WB6AAM's multiband vertical-monopole antenna. Estimated gains for various amateur bands are shown in Table 2.

of *Hints and Kinks for the Radio Amateur.* I have used some alternative construction techniques and greater length to provide better multiband operation than W4VON's original.[1]

Monopoles radiate in a toroid, or doughnut-shaped, pattern. The vertical radiation pattern of a λ/4 monopole is round; a large portion of the signal is radiated skywards at relatively high angles. A 5/8 λ, or λ/2 monopole has a flattened-toroid pattern, with corresponding gain over the λ/4 at low angles. This gain is about 3 dB for 5/8 λ and 1.5 dB for λ/2. A 3/8 λ monopole shows little gain over λ/4.

It may look wrong—feeding an asymmetrical, traditionally coax-fed antenna with parallel feed line, but radiator and radials are all the same length and the circuit is very similar to a vertical dipole or an extended double "Zepp" with center feed. Parallel lines have far less loss than coax, especially under high-SWR conditions.[2]

The radiator can be any conductor: flagpole, round or square aluminum stock, wire and standoffs on a dry wooden pole, or TV-mast sections to name a few. A military set with mast sections, whip sections, insulator, base and guys would be a good field antenna.

Someone who lives where only TV antennas are allowed could try this idea: Use two 10-ft sections of TV mast and add a plastic insulating section (of a similar color) with a small TV antenna on the top. To add realism, add some TV standoff insulators and fake twinlead. (Remove the wire from the ribbon cable so that it does not interact with the antenna.) The radials can be thin wire or TV ribbon, close to the roof on standoffs. (Short each end of the TV ribbon—Fig 6.)

[1][Apparently, WB6AAM chose 20 ft as a convenient length from available materials. Antenna length, as shown in Table 2, is given with respect to a free-space wavelength. Since a Transmatch is necessary, the actual radiator and radial lengths are not critical.—Ed.]

[2][The line will not be balanced, however, so we can expect some feed-line radiation. Remember that parallel feeders should be kept away from the earth, and other objects, with standoffs. Also, the feed-line length in an unmatched system is significant: If you experience difficulty matching the system on a given band, change the feed-line length by λ/8 for that band. Continue experimenting until you find a line length that can be matched on all bands.—Ed.]

Table 2

Estimated Performance of WB6AAM's Antenna†

Band	*Antenna Length*	*Estimated gain over λ/4*
10 m	0.58 λ	3 dB
12 m	0.51 λ	2 dB
15 m	0.43 λ	1.5 dB
17 m	0.36 λ	1 dB
20 m	0.28 λ	0.5 dB
30 m	0.20 λ	
40 m	0.15 λ	
80 m	0.08 λ	

†Gain shown is with respect to a λ/4 vertical monopole over a similar reflecting surface.

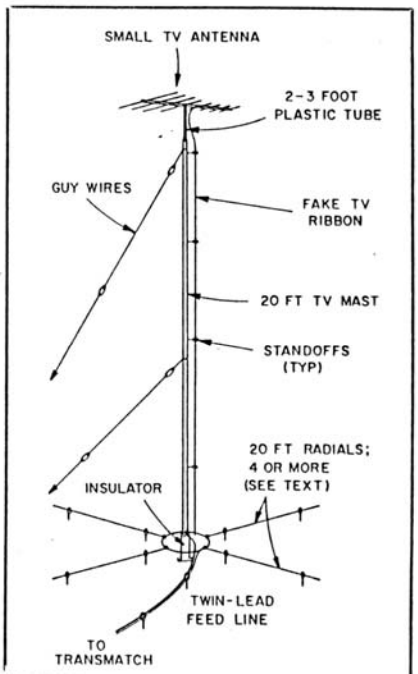

Fig 6—WB6AAM's antenna can be camouflaged easily as a commercial-TV installation. (For clarity, only one set of guy wires is illustrated.) [One could eliminate the top plastic tube and bond the TV antenna to the mast top as capacitive loading. This would make the antenna electrical length slightly longer than 20 ft.—Ed.]

My version of W4VON's antenna is 5/8 λ on 10 meters as I prefer the 10, 12 and 15-meter bands. The design could be changed for 5/8 λ on some other band. Remember, however, that the take-off angle steepens quickly as antenna length exceeds 3/4 λ. As the length increases to λ, the vertical radiation pattern becomes more complex—resembling a cloverleaf, rather than a toroid. Multiple lobes of energy appear skywards as the length increases, with only minor lobes near the horizon. A 10-meter OSCAR user might take advantage of such a pattern, but terrestrial contacts won't be very strong.*—James G. Coote, WB6AAM, Los Angeles, California*