By Kent Britain,* WA5VJB

Connecting the Radio to the Sky

D-Star Antennas

As many of us know, the VHF/UHF repeater slots are pretty full in the metropolitan areas. At the same time, it takes a lot of local activity to support new technologies. The end result is that many of the new D-Star repeater systems are showing up on 1200 MHz. This month we will cover the three antennas designed for these new D-Star systems (photo A). Keep this quiet, but they also work on AMSAT L-band, 1200-MHz ATV, and SSB, and the little one makes one heck of a quick dish feed.

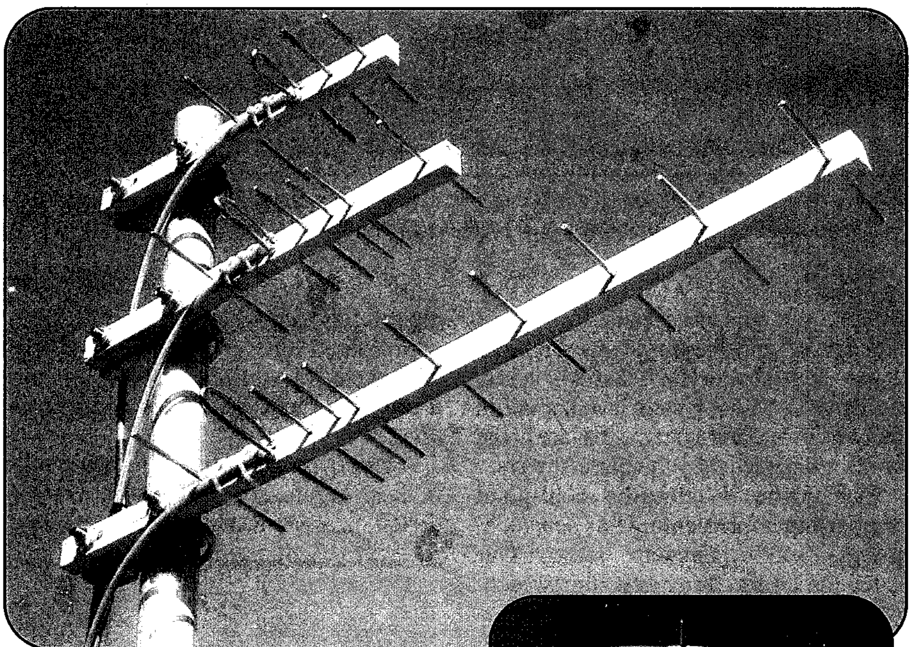

Photo A. D-Star 1200-MHz antennas.

Mobile Antenna

Photo B is a simple 1200-MHz mobile antenna. Have you priced any of the commercial 1200-MHz mobile antennas yet? Have you gotten over the shock? The one shown in photo B will cost you an old mag-mount antenna and a length of stiff wire. Vintage 800-MHz cell-phone antennas work well here as a source of parts. This is a simple vertical collinear antenna with about 5 to 6 dBi gain.

Start with about 16 inches of stiff wire. I used 1/16-inch bronze welding rod, but an old stainless-steel whip can be used—if you can bend it!

You do not want to use a magnetic mount that contains any loading or matching networks in the base. Just use something that is a plain magnet. Also, it doesn't have to be a magnetic mount; it can be a threaded new Motorola type antenna mount, but watch the total height.

After you form the whip per figure 1, mount it such that the bottom of the phasing section is 3.5 inches above the ground plane. I'll bet you never had to allow for the thickness of your mount or magnet before. Welcome to 1200 MHz!

Tweaking SWR

Built per the dimensions, SWR should be well under 2:1. However, if you are one of those people who can't stand any SWRs crawling around on your antenna, and you can measure SWR (we tend to call it return loss on these frequencies), Do your tuning by expanding and compressing the coil. The coil is really a delay line that keeps the top and bottom sections of the antenna in phase. It's not a loading coil like you would see on HF.

The one place to be very careful is in the choice of your magnetic mount. Many CB mounts have tuning caps in their base and stand too high. You want a mount with a pretty low profile. You also want your coax long enough to do its job and not much longer. Small-diameter coax has a lot more loss at these frequencies than it does at 2 meters or 440 MHz. So again, just long enough to do the job is best.

Simple Yagis

If you are a fair distance from the repeater, a little gain and getting the antenna up a bit higher can help a lot. These Yagi antennas are part of a family of simple and inexpensive antennas we affectionally call "Cheap Yagis." The antennas are designed a bit differently. We start with the driven element, which has about a 150-ohm impedance. As other elements are brought close to the driven element, they load down the driven ele-

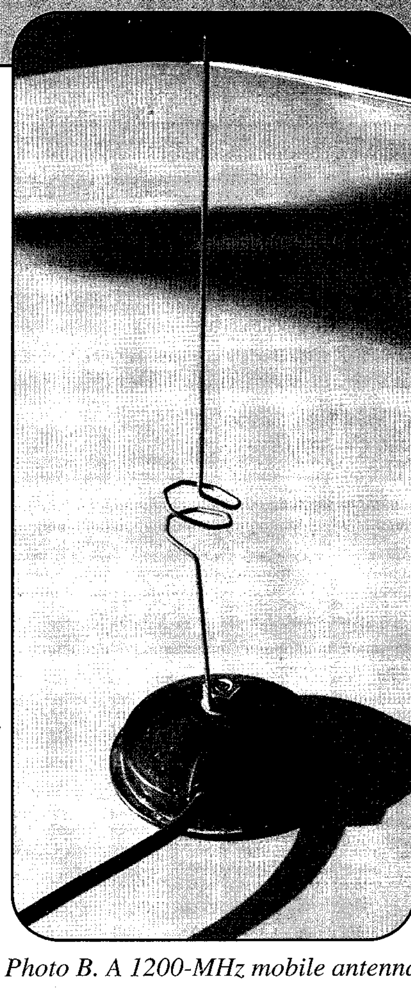

Photo B. A 1200-MHz mobile antenna.

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ment. By spacing the other elements at just the right distance, we end up with a 50-ohm match. You don't need any baluns, chokes, matching stubs, or gamma rods. Just build and go.

If you were careful in measuring the boom and elements, the SWR should be well under 1.5:1. In figure 2 we have the return loss, or SWR plot, of the 4-element Yagi (photo C). The –10 dB line is about a 2:1 SWR. The –20 dB line is a 1.1:1 SWR.

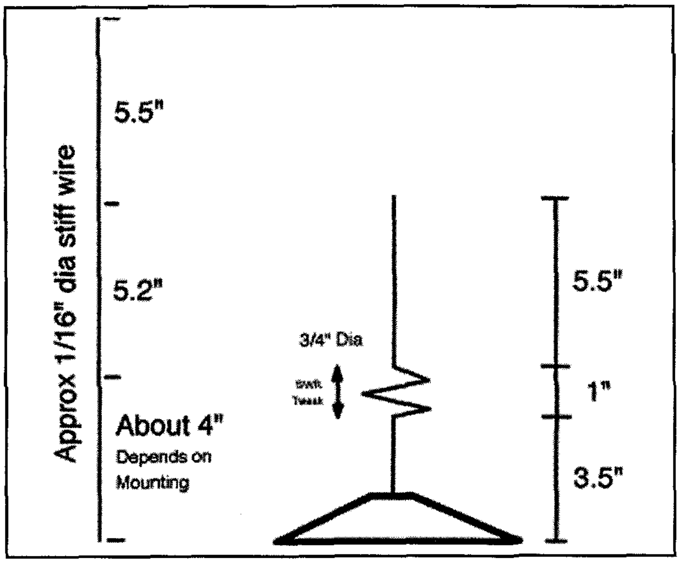

Figure 1. Dimensions for the 1200-MHz vertical.

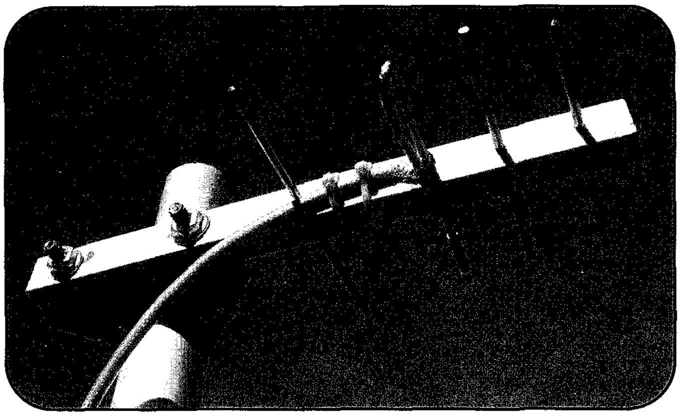

Photo C. The 4-element 1200-MHz Yagi.

The wood should not be more than 3/4 inch thick, but just about any kind of wood can be used. I used 1/2-inch by 3/4-inch wood, but 1/2-inch by 1/2-inch or even round dowel can be used. However, square wood is much easier to drill!

At 1200 MHz the wood does have some effect on the element—not much, but not zero effect either. For the elements you can use almost any 1/8-inch diameter material. I usually use bronze welding rod, but #10 copper wire, hobby tubing, or even aluminum ground-rod wire works. However, something such as brass or copper is good for the driven element so you can more easily solder the coax to the driven element.

The driven element (photo D) is similar to a folded dipole antenna, but it is looped on only one side. The very center of a Yagi element is a voltage null, so you can solder the coax shield directly to the center of the driven element. In this case it's near the center, but close enough. The tip of the coax goes to near the tip of the J in the driven element.

All three versions use the driven element shown in figure 3. For two of the antennas I used #10 copper wire, and for the third I just bent one of the pieces of bronze welding rod into the J shape.

These antennas work well when attached to a rafter in the attic of a house. If you want to mount it outside for a few years, a little weather proofing is in order. Spar varnish seems to work best, with spray epoxy paint coming in second. I like to use a light gray color, which helps them blend in with the surroundings. You can even use latex house paint and camouflage it using the same color as your house. Water does tend to wick back down the coax braid, so a good coating of RTV-type sealant, or even plenty of paint, helps to waterproof the coax.

4 Elements

This is the smallest of the designs. The antenna has good gain, about 8 dBi. It has good SWR from 1240 MHz to 1300 MHz, so you can use it with 1200-MHz ATV, AMSAT, SSB, and D-Star applications. It's also not a bad dish feed.

	Spacing (in.)	Length (in.)
Reflector	0	4.5
Driven element	1.75	see fig. 3
Director 1	2.75	4.0
Director 2	3.75	3.5

6 Elements

This one is a little bit longer and has a bit more gain (photo E). With the 6-element version the gain peaks at about 10 dBi

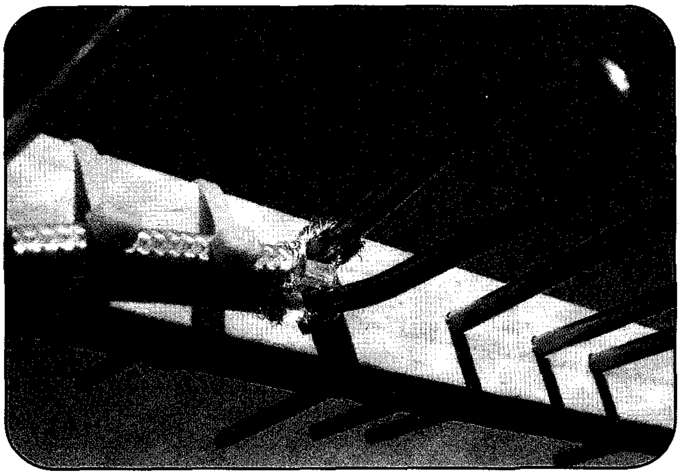

Photo D. Driven element and coax.

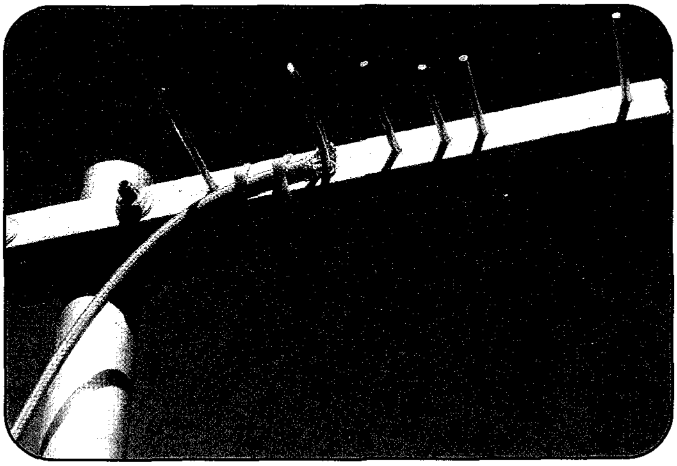

Photo E. The 6-element 1200-MHz Yagi.

at the upper portion of the band, with the cleanest pattern around 1280 MHz. But again, the antenna is usable over the entire 1240-MHz to 1300-MHz band.

	Spacing (in.)	Length (in.)
Reflector	0	4.5
Driven Element	1.75	see fig. 3
Director 1	2.75	4.0
Director 2	3.5	3.75
Director 3	4.0	3.75
Director 4	6.0	3.75

10 Elements

Now we have the "big gun" among these small antennas (photo F). The 10 element's gain also peaks in the upper part of the band at nearly 13 dBi. The cleanest pattern is still 1270–1280 MHz, and again the antenna is usable over the entire 1240–1300 MHz ham band. Designing the antenna for such a wide bandwidth does cost nearly 1 dB of gain, but with a wide frequency range, the antenna is far more forgiving if the construction is a bit sloppy. Thus, many Yagi designs give dimensions such as 3.6913 inches. It is not an accident that most dimensions are either even inches or to the nearest 1/4 inch. You don't need a micrometer to build these antennas, as for some designs out there. A yard stick will do just fine.

	Spacing (in.)	Length (in.)
Reflector	0	4.5
Driven Element	1.75	see fig. 3
Director 1	2.75	4.0
Director 2	3.5	3.75
Director 3	4.0	3.75
Director 4	6.0	3.75
Director 5	8.0	3.75
Director 6	10.0	3.75
Director 7	12.0	3.75
Director 8	14.5	3.5

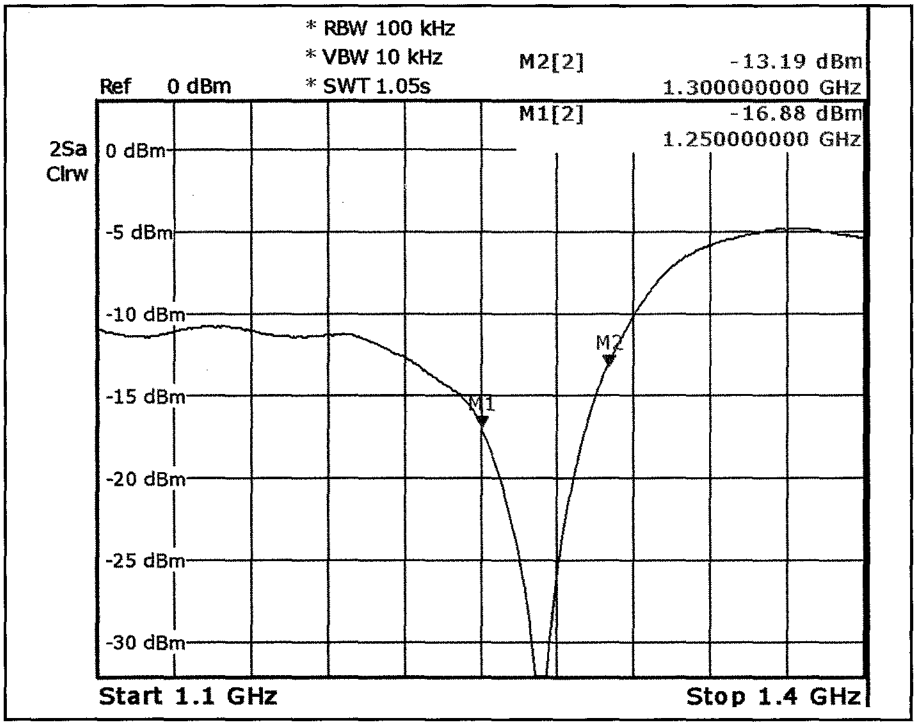

Figure 2. Return loss or SWR plot of the 4-element Yagi.

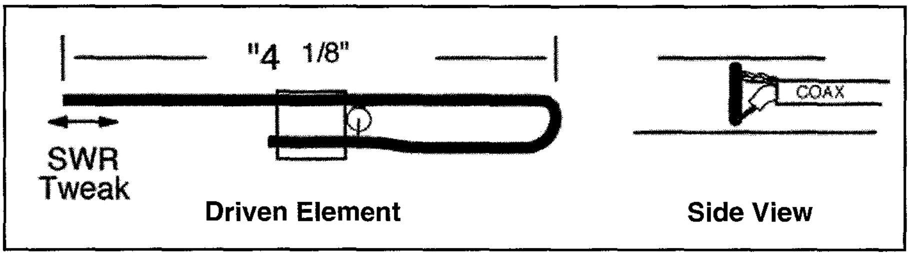

Figure 3. Dimensions for the driven element used on all versions of the Yagis.

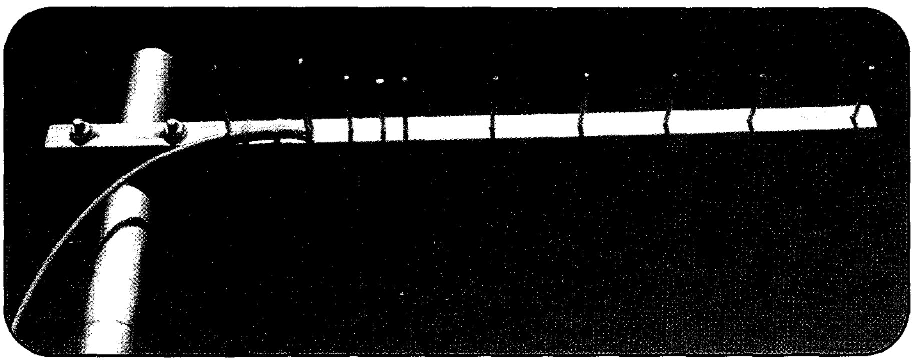

Photo F. The 10-element 1200-MHz Yagi.

Conclusion

For my next column I am working on the mechanical aspects of some 6-meter antennas. As a parting thought, though, can you tell what is wrong with the antenna in photo G? It took me a few days to figure it out, but gain at the horizon is very poor. We will cover why next time.

As always, we welcome your technical questions and suggestions for future topics. Just drop me a line at <wa5vjb@cq-vhf.com>, or you can visit my website, <www.wa5vjb.com> for more antenna articles, perhaps download some vintage VHF newsletters, and coming soon, view a virtual museum of Tecraft VHF converters and radios. 73, Kent, WA5VJB

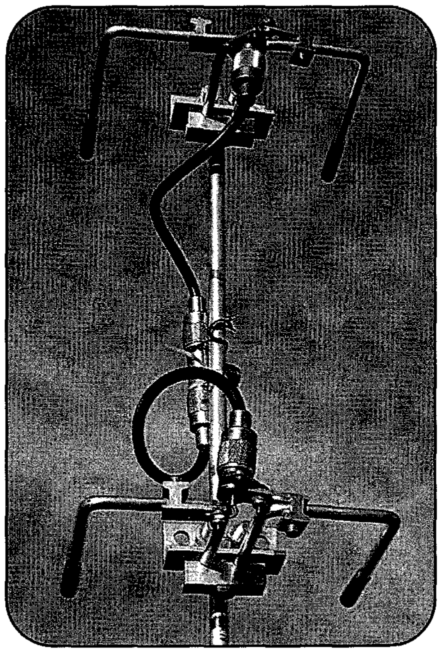

Photo G. What's wrong with this antenna? We'll explore this more next time.