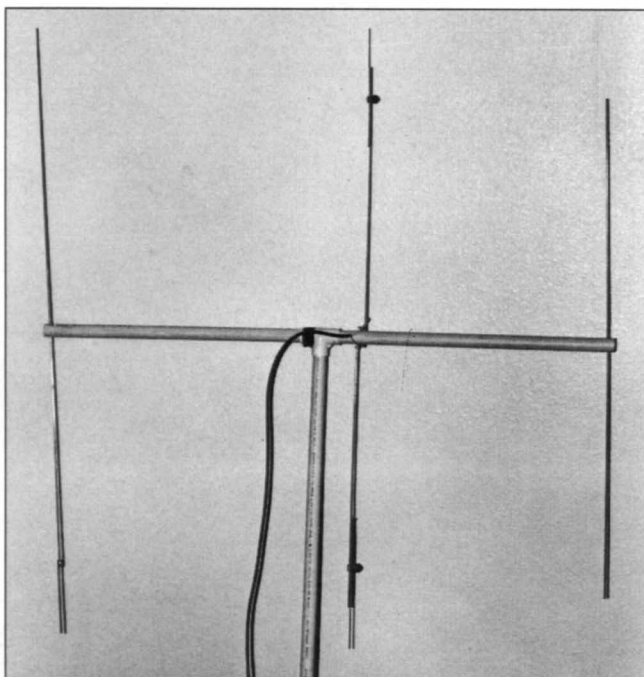


# 7 dB for 7 Bucks

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*Need a 2-meter beam antenna,  
but you're short on cash?  
You can build this antenna for the  
cost of a fast-food meal!*

**W**hen I became active on 2-meter FM, I soon discovered that I needed a beam antenna to hit some of the local repeaters. "Local" in Crosby, North Dakota, means 50 to 60 miles as the crow flies!

I knew there were plenty of VHF antenna projects in *QST* and other ARRL publications. Although many are easy to build, their matching systems are almost incomprehensible for beginners. Just take a close look at a typical matching network and try to figure it out. It's either some kind of a *balun* transformer (that you must wind yourself), a clumpy, slidy stub match, or a nightmare of various coils and capacitors! I decided it was time to design, build and test my own beam antenna.

## A Little Theory

My three-element beam is really nothing more than a half-wave dipole antenna (the *driven element*) mounted between two other elements known as the *reflector* and the *director*. Typically, the reflector element is about 5% longer than the driven element, and the director is 5% shorter. By spacing elements about 0.15 to 0.25 wavelengths from each other, you end up with a beam antenna with about 7 dB of *gain*. That is, the reflector and director act to shape the energy in a particular direction. By focusing the radio energy in this way, you concentrate the power in the direction you desire (just like a spotlight). That's gain!

To figure out the correct length of my driven element, I used the simple formula for a half-wave antenna above 30 MHz:

$$\text{Length (in feet)} = \frac{475}{\text{Frequency (in MHz)}}$$

At the feed point of a half-wave dipole,

the impedance is about 72 ohms—close enough for an acceptable match for typical 50-ohm coaxial cable. Of course, we're talking about a beam antenna, not a simple dipole, so the impedance may be different. Armed with this basic information, I went to work!

## Construction

The construction is simple and cheap. I recommend 3/4-inch PVC plumber's pipe for

the supports. Two 18-inch pieces become the *boom* where the elements are installed. A 36-inch piece is used for the *mast* (see Fig 1). The boom and mast pieces are held together with a PVC T joint. Three small holes are drilled in the T as well as the boom and mast pieces. Insert the booms and mast into the T and rotate them until you align the holes. Now use screws to secure everything in place. You'll notice that my antenna is vertically polarized. This is best for FM work. If

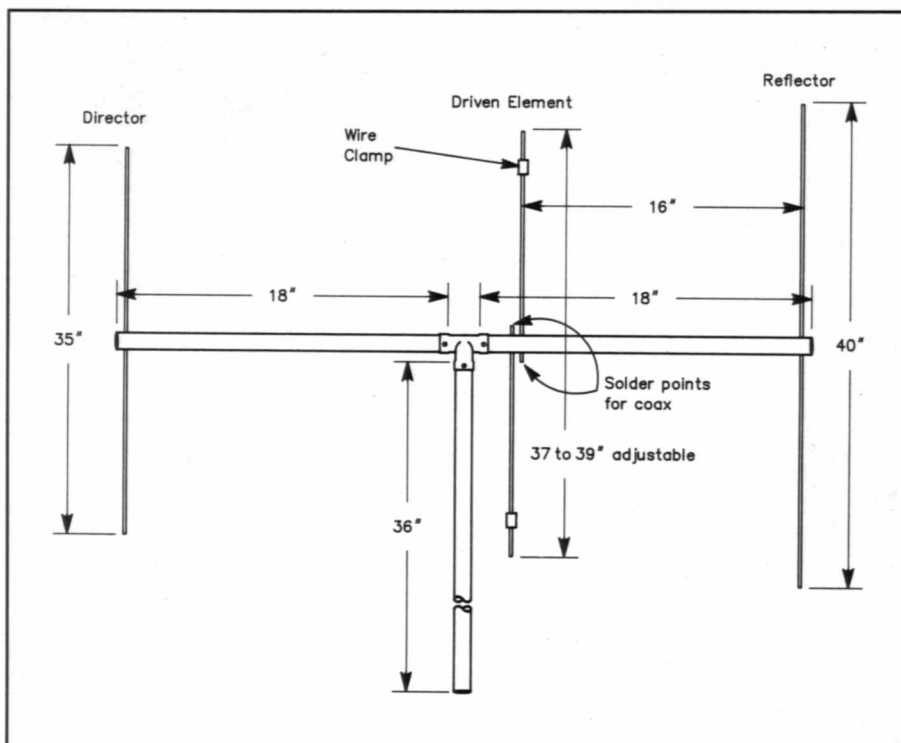


Fig 1—Construction diagram for the 2-meter beam antenna. A few sections of PVC pipe and a handful of welding rods are all you need.

you want to use this antenna for 2-meter SSB and CW, just assemble the boom so the elements are *parallel* to the ground, not perpendicular.

You can make inexpensive elements from steel oxyacetylene welding rods. Hobby stores often carry brass rods that are suitable, too. Cut the director and reflector elements to the lengths shown in Fig 1. (If you can't find a 40-inch rod for the reflector, don't worry. You can solder small pieces at the ends to achieve the total length.) Drill holes in the boom about 1/4 or 1/2-inch from each end. I suggest you use a yardstick to draw a straight pencil line along the boom, marking an X for each hole. The idea is to keep the hole positions aligned as you drill them. Choose a hole size that offers a snug fit when you push the rods through.

After drilling, slide the director element through the holes and adjust it until you have an equal length on each side of the boom. Use solder or epoxy cement to hold it in place. Do the same with the reflector element.

Now for the driven element and matching network. But wait! This is too simple. It can't work! Well, my matching device uses a special gimmick. (Those of you from the old school know what I mean.) To construct the driven element, measure and mark the boom about 16 inches from the reflector. Drill two holes about 1/8 to 1/4 inch apart. Cut two rods, both 20 inches in length. Push the rods through the holes until 1/4 inch protrudes from each side of the boom. You've just made the driven element *and* the matching device!

Solder your coaxial cable directly to the protruding stubs as shown in Fig 2. Use solder and/or epoxy to secure the rods to the boom. Apply electrical tape or use a silicon compound to weatherproof the solder joints.

### Tuning

To make tuning the antenna easier over a wide range of frequencies, I clamped

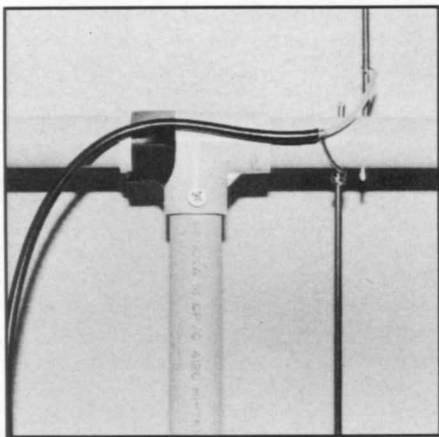


Fig 2—Solder the coaxial cable to the driven element stubs as shown. If the distance from your antenna to your radio is greater than 15 feet, use a low-loss cable such as RG-213.

4-inch pieces of welding rod to each driven element with #12 or #14 jam screws (electrical connectors). By loosening the screws and adjusting the rod sections equally, I can quickly tune the antenna for my favorite parts of the band.

Use a *wooden* step ladder to get your antenna at least five feet off the ground. Another approach is to tie a string to the antenna and use the nearest tree branch to hoist it 5 to 10 feet in the air. Once you have your antenna elevated and away from any nearby metal objects (such as aluminum siding and automobiles), place an SWR meter in the line between your transceiver and the antenna. Make sure to use an accurate SWR meter that's rated for operation on the 2-meter band. Now transmit and check the SWR reading. Adjust the clamp sections as necessary to get the lowest reading.

If you want to dedicate the antenna for operation on a relatively narrow set of frequencies (for a particular repeater, for example), don't use the clamp method. Just trim the driven element rods a small amount at a time until you get your lowest SWR reading.

After the antenna is tuned, mount it on the highest point possible (on the chimney



or vent pipe, for example). Point the antenna in the direction of your favorite repeater, or use a TV antenna rotator to change direction remotely. If the distance from your radio to the antenna is more than 15 feet, use a low-loss coaxial cable such as RG-213.

That's all there is to it! It's simple, portable, tears down quickly, and best of all, it requires no complicated matching. What more could you ask of an antenna—for just seven bucks?

*Nathan Loucks, WB0CMT, is a North Dakota native. He has been a ham for more than 20 of his 38 years. He graduated from the North Dakota State College of Science in Wahpeton. Nathan previously worked for GTE and Motorola in Illinois as a laboratory technician and engineer. He is currently living in Crosby, North Dakota, where he runs a computer sales, telemarketing and consulting business.*

QST

### Radio Tips: Sending Packet Bulletins

If you've tried packet radio, you know what a fascinating mode it is. Through packet radio you can access your local bulletin board (PBBS) and tap into the streams of messages that flow from every corner of the nation and the world. Most of the messages you'll see are *bulletins* intended to be read by many amateurs.

Packet bulletins are terrific tools for gathering or distributing information. If you have something important to say, the packet network can spread your message over a wide area. This is particularly useful if you need advice to solve a problem.

Let's say you have a question and you live in the state of Florida. Here's how you'd address your packet bulletin:

#### SB ALL @ FLBBS

This means, "Send this bulletin to all packet bulletin boards in Florida." Note that your two-letter state abbreviation is tagged onto the letters "BBS". If you lived in Connecticut, it would be CTBBS.

Depending on your question, this should be sufficient to net several replies. Wait a week or so and see what

responses you receive.

If no one responds, you can resend your bulletin with a *regional* distribution:

#### SB ALL @ SEBBS

This means, "Send this bulletin to all packet bulletin boards in the southeast (SEBBS)." Once again, wait a couple of weeks for the replies to trickle in.

Your last options are to address your bulletin to "USBBS" (every PBBS in the country), or even "WW" (every PBBS in the world). Please use these distribution options with great caution! Ask yourself, "Is my bulletin so important that *everyone* must see it?" Most of the time, the answer will probably be "no." You should reserve the use of USBBS and WW distribution until all else fails.

The packet network is plagued by bulletins unnecessarily addressed to USBBS and WW. These bulletins clog the packet forwarding systems, slowing the movement of more important traffic. By limiting the circulation of your bulletins, you'll be doing a big favor for yourself and your fellow packeteers!—WB8IMY