2 Meter 4 Element Quad

A properly built and tuned quad is truly a high performance hunt antenna. It may be the only vhf hunt antenna you'll ever need. With a suitable mount it can hunt horizontally or vertically polarized signals. It excels for weak signal work and does fine with an attenuator for strong signals. It's easy and inexpensive to build, and can cover more than one band and of course you can transmit through it.

Hunters fine that the quad has several advantages over the yagi at 2 meters:

1. For the same boom length, the quad has about 2 db more gain than the Yagi.
2. The quad seems to be less affected by proximity to the vehicle. It can therefore be mounted closer to the car roof, making it unlikely to hit trees,
3. For vertical polarization, it is only half as tall as a yagi (see Fig. 1). Again, this helps to keep it away from an tenna-eating trees.
4. It can often be mount of from a right side window without exceeding the legal overhang requirements with either horizontal or vertical polarization.

Quad Building Details:

You'll find that constructing quads is easy and fun, They aren't tricky, so build carefully and you can be assured of having good results. There are plenty of good designs around, and all will work. We think, the following design is better than most, because:

Wider spacing, many designs call for only eight inches or so between elements on 2 meters. Though short spacing gives less weight and shorter turning radius than the following design, it also gives significantly poorer gain and beamwidth characteristics. A short spaced four element quad maybe little better than a wide spaced three element quad of the same length. There is also less element interaction with wider spacing, which simplifies tune-up.

Gamma match. The quad works with the coax directly connected to the driven element loop but the time spent installing and tuning a gamma match is well spent.

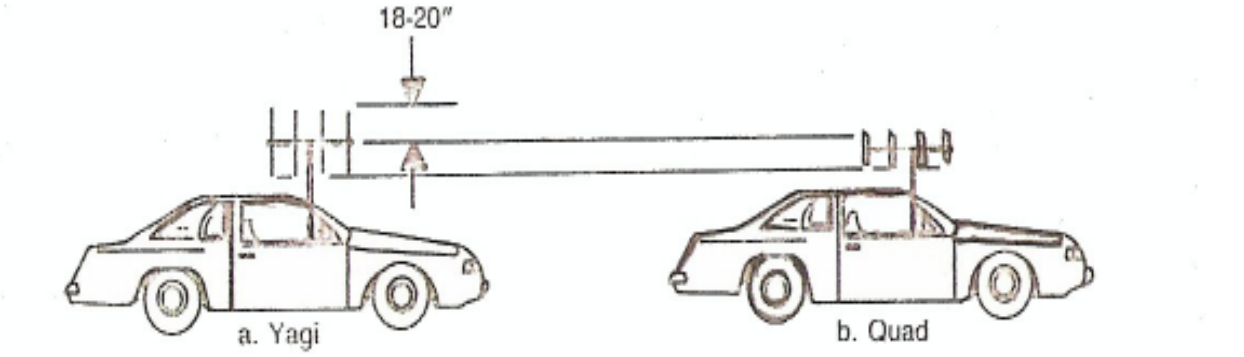
Dimensions given here are for the upper end of the 2 meter ham band. Scale both the element sizes and spacings as required for other vhf/uhf frequencies, consulting one of the many ham antenna texts if necessary.

Before diving into the construction details, some words of caution for builders who aren't familiar with plastic pipe.

If you choose to glue any antenna elements together for a permanent setup, be careful with the glue. It sets up very rapidly once the pieces are pushed together. Coat both pieces with the glue and slide them together with a twisting motion. Be absolutely sure that the elements are aligned and level. The glue will set up in ten or fifteen seconds.

PVC pipe is easy to find at local building supply and hardware stores. Like lumber, the indicated sizes are far from exact. Tubing marked as 1/2 inch actually has an outside diameter of more than 13/16 inch, and so-called 3/4 inch tubing is closer to 1-1/16 inches on the outside. This is true for both Class 125 pipe which has thin walls and for the thick wall Schedule 40 pipe. Fittings are also marked 1/2 inch or 3/4 inch and can be used with either wall thickness. Read the markings carefully on both the pipe and the fittings when shopping. Do not buy threaded pipe or fittings.

Figure 4.5 A full sized 2 meter quad is much shorter than a similar Yagi



The Strung Wire Quad

This 2 meter strung wire quad is based on a design by the late Clarence R. Mackay, K60PS, who began experimenting with vhf quads in 1956. His work, along with the kit making and instructional efforts of WA6VQM WA6TEY, KF6GQ and many others have made strung wire quads the most common 2 meter T-hunting antennas in Southern California.

The mechanical configuration shown in Fig. 4-6 uses 1/4 inch fiberglass rod as the spreaders. Use 3/4 inch schedule 40 pvc pipe for the boom and mast. You will need a 3/4 inch TEE fitting and a can of pvc glue, along with the mast and boom pipe. Rod for the spreaders is available at plastic supply houses. Another source is masts from safety flags for bicycles, available in toy stores and bicycle shops. This material is great for small quad spreaders because it's very stiff and strong.

Cut each pair of spreaders about a half inch longer than the dimension S (see Table 4-1), and drill holes in each end for the loop wires. These holes should be spaced S inches apart. Set these pairs aside for the moment. The total spacing between the elements is 40.1 inches, so the boom length should be a little over 41 inches total. Trim the two boom pieces so that the boom is 41 inches or longer with these pieces installed in the mast TEE fitting. Mark the boom at each element position and remove the two boom pieces.

The actual hole positions on the boom must be offset each direction by .125 inch (assuming quarter-inch rods) so they clear each other (see detail in Fig. 4-6). Drilling of the boom is much easier if done with a drill press, but good results can be achieved with a hand drill if care is used. Drill one hole and push one of the spreaders through it. Clamp the boom section so that this spreader is parallel to the bench or drill press table. The second hole can then be drilled exactly perpendicular to the first.

After drilling all the holes, fit each pair of spreaders in the boom, making sure that the right pair is installed in the right holes and that they are centered in the boom. The loop lengths shown in the figure are exact for the spacing of the holes in the spreaders so when cutting the wire allow about two inches extra to allow for twisting the ends together before soldering.

Table 4.1 Element Lengths & Spacing

	Loop Length	**$\frac{L}{4}$**	**Spreader Length**	**Element Spacing**
Reflector	84.1"	21.0"	29.7"	
				16.1"
Driven Element	82."	20.5"	29.0"	
				12.0"
Director 1	79.6"	19.9"	28.1"	
				12.0"
Director 2	78.8"	19.7"	27.9"	

If you can find it, 22 AWG Copperweld™ wire is best for this antenna. Copperweld has a steel core with a very heavy layer of copper on the outside. It may stretch a little when you hit a tree but it's less likely to break than all-copper wire. Some hardware stores carry ordinary copper covered steel wire which may work fine at first, but the copper layer is thinner and it could eventually rust. If you use it, keep an eye on it for rust as it ages. Common 18 AWG enameled wire can be used if you can't find anything better and are willing to risk damage.

The gamma match, shown in the detail, is built on a small block of plastic. Drill a hole the size of the spreader on one side of the block and mount a BNC connector on the other. A small trimmer is mounted on the edge of the block. Glue the block on the end of the spreader and connect the center of the loop to the ground side of the connector and the center conductor of the BNC to the trimmer. The other side of the trimmer goes to the gamma match stub. With the match on a side corner as shown, the antenna has vertical polarization.

Put the quad on its mast and get it up in the clear. Nearby objects can cause mistuning. Some hams point the antenna at the sky for SWR measurements to prevent any possible reflection effects. Connect the feed line to a SWR meter and transmitter and adjust the trimmer for lowest SWR. The shorting stub distance may need to be varied from the specified two inches to get the SWR to be 1:1. Move the stub and readjust the trimmer until you get a 1: 1 SWR.

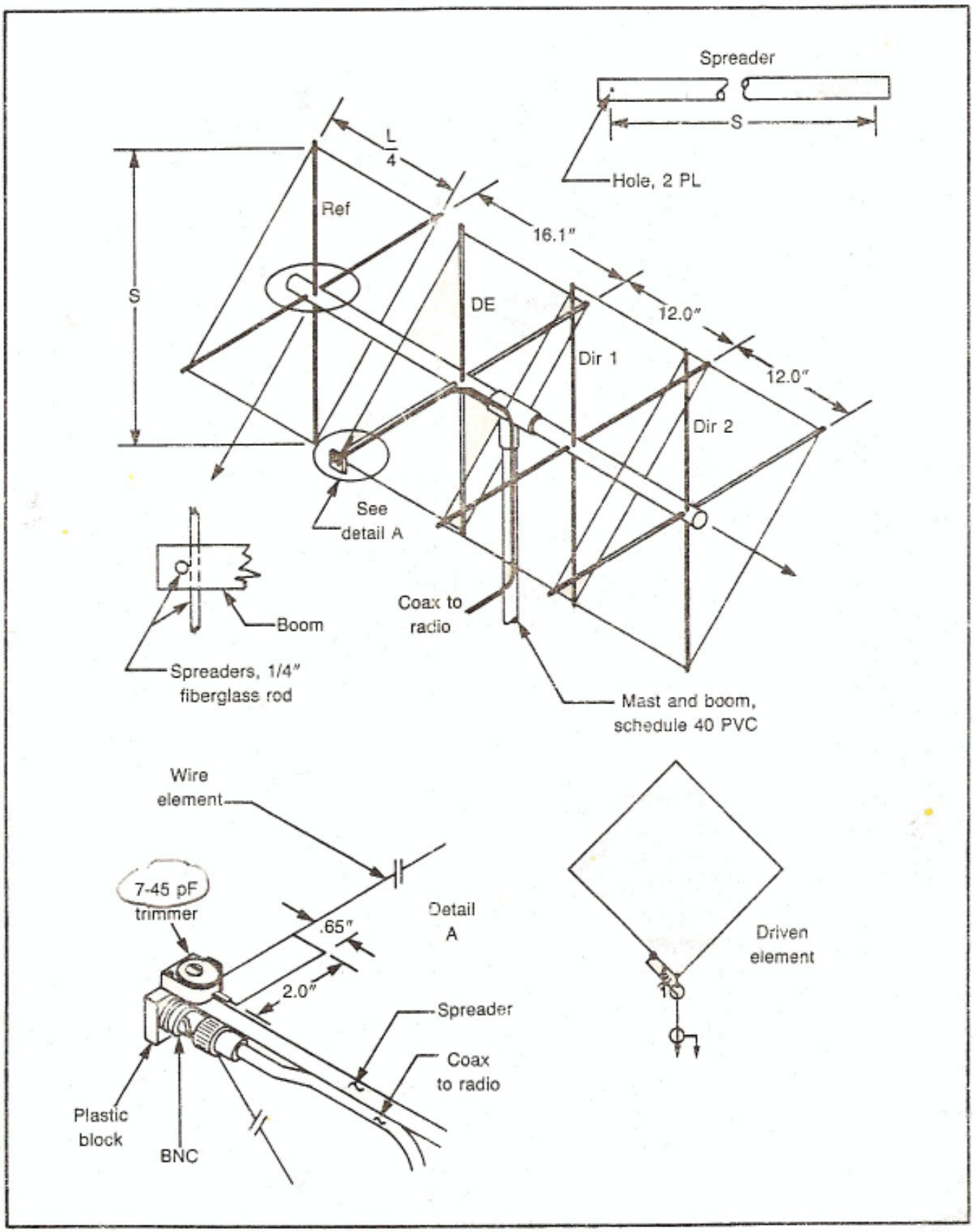


Fig. 4-6. Design details of a strung wire quad, shown vertically polarized. Design center frequency is 147 MHz.

Figure 4-7 shows how to build a collapsible version of this quad. It comes apart readily for transport to from the hunt. Each pair of spreaders is mounted on a PVC pipe coupler. Drill each coupler for spreaders as you would the regular pipe boom, and install the wire elements as before.

Cut the boom pipe into four pieces instead of two, and glue the two short pieces into the TEE connected to the mast. The two other pieces go between the reflector and the driven element and between the two directors.

The notch keeps the elements lined up. Trim the boom pieces until the notches line up the elements and the element spacing is correct. File an extra set of notches 90 degrees away on the boom section connected to the mast TEE (the one that connects to the driven element). Then by pulling out the driven element, turning it 90 degrees, and pushing it back in you can easily change the antenna polarization from vertical to horizontal and back again.

If you don't trust friction to hold the quad together, use an elastic cord to hold the quad together. Sometimes called bungie cords, they have hooks on the end and are sold in hardware, bike, and automotive stores.

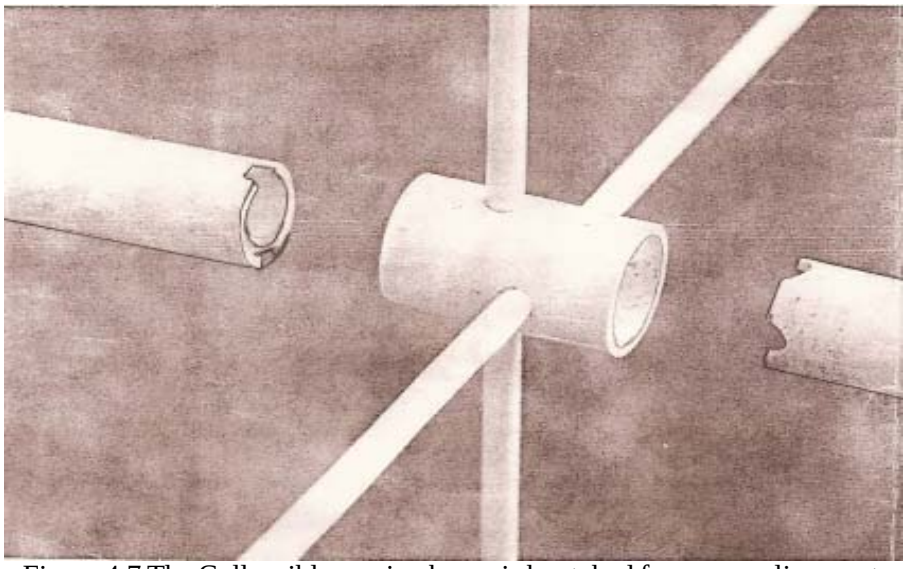


Figure 4.7 The Collapsible version boom is knotched for proper alignment

Note: When completing your "PVC" Quad whether you chose the rigid design or the collapsible unit, paint it. PVC and the Sun are not friends at all and if you elect not to protect the PVC from the Ultra Violet Sun Rays it will crystallize and with any sudden impact it will break like glass. The Paint Job will not make it perform better but it will sure improve the appearance and make it last longer.