The K4MMG 2 METER QUAD
CONSTRUCTION
TIPS FOR BUILDING BETTER QUADS

2 Meter 2 Element Quad shown mounted above another antenna with
coax feed nearest you on left spreader rod.
The antenna that is below the quad is a 6 meter moxon that is made from TV tray legs!
Ham Ingenuity at it's finest!

OBJECTIVE:

Construct a professional looking and great performing quad
for the two meter band, or higher frequency.
The intent of the article is to demonstrate how to build a mechanically symmetric quad, using pvc materials

"Like most of you, I have built a lot of Quad antennas, from HF through UHF.
It has always bothered me that the HF quads looked neat in construction,
but my higher frequency quads did not.
While the higher frequency quads worked well, they just did not look good."....Steve

After struggling with this phenomenon I finally discovered a way to build a quad that is neat, durable, portable and that will support both horizontal and vertical polarization across the entire two meter band. As it turns out, the antenna is easily constructed.

The construction of this antenna uses readily available materials, from your local home building store such as ½ " pvc, schedule 40 , associated components, and 7/16" dowel rods usually 3 feet

long.
The coax and quad wire will be described in the construction section.

There are photos below that will be referenced as the details progress.
PLEASE REVIEW ALL PHOTOS PRIOR TO BEGINNING

CONSTRUCTION:

This is a two element quad, the mechanical construction applies to both the director and reflector. The location for the quad wires for each element are obviously going to be different, so this part of the construction will be described later.
It should be noted the pictures show the quad in the vertical configuration.

OK, let's prepare the support rods. There will be four used, so select any two, and mark the center,
as you can see in the photo below:

The purpose is to remove some material so that the rods are almost flush
when placed over each other as shown in photo above and below.

Do not cut the rods to length yet.

Now, let’s make the part that contributes to the neatness of this quad, "the end caps" and the center "cross" sections used to support the outer elements.
They can be seen clearly in the second picture below and near the end of the article in other photos.

What you want to do now is to find the center of the end cap and drill a pilot hole through 4 (four) of them.

A technique that I have used is to look inside and find the molding connection, center punch this and drill the pilot hole. Another technique use a flat wood drill, (wide enough so that it touches the end cap walls), and insert it into the end cap, and mark a center point for the pilot drill. Use some method of measuring the diameter of the support rod. Select a drill that has a diameter less than the support rod.

When drilling the final diameter hole, make sure the end cap is level, secured mechanically, and most of all apply drill pressure slowly.
DO NOT HOLD IN YOUR HAND WHILE DRILLING.

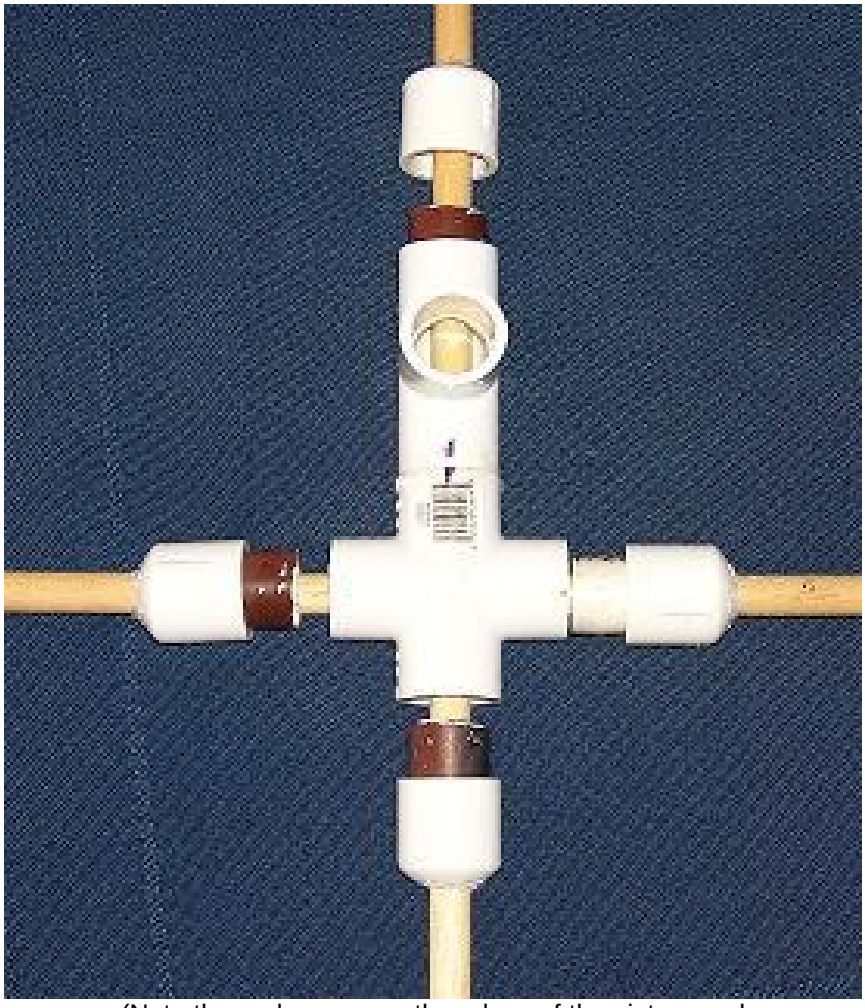
Next, (picture above), cut 10 pieces of PVC tubing, 1,1/8 inches long.

Locate a PVC "T", a PVC "CROSS", 2 prepared support rods, (5) 1,1/8" cut pieces of tubing and (4) prepared end caps.

Using the pvc cross, (see picture below), insert one prepared support rod so that the center cut is centered. Next insert the other prepared support rod 90 degrees to the other one.
Align the support rods over each other in the center of the cross .

Onto this, insert a pvc tee, into this, insert a cut piece of pvc, onto this place an end cap over the support rod and push together. On the opposite side insert a cut piece of pvc into the cross, place an end cap over the support rod and push together. Using the two remaining end caps, complete the assembly. Since there is no precise measurements made, the remaining end caps will have mechanical interference.
This is part of the key to holding all this rigid.

In the picture below, you should notice the PVC "cross" in the center with a "T" next to it.
This is where the 5th 1,1/8" piece of PVC goes inside the "cross" and the "T". There are (5) 1,1/8" pieces per element, (one in each end cap and one between the "cross" and the "T".
See photo below.



(Note the end caps near the edges of the picture and
the 1,1/8 inch PVC lengths extending from inside them.
One length of 1,1/8" PVC is hidden from view inside the joint
between the "cross" and the "T" where the two black marks come together!)

Repeat this process for the remaining element. All of the PVC can be cemented together if you like,
but I recommend that you wait until the entire quad is assembled and tested. It also would be a good idea to weatherproof the dowel, (support), rods if the quad is to be permanently mounted outside.

Next you will drill 4 holes in the reflector element support ends of the quad. From the center of the PVC cross, measure 15, 3/8", on all 4 support rods. Laying the quad element on a flat surface, drill a hole in each rod parallel to the pvc "CROSS". The hole size depends on the size wire that you use. A large variation in the wire size that I have used will affect the quads tuning. Using a wire length of 86 inches, thread the wire through each hole. Strip the ends of both wires, take out slack, and solder the wires together making one continuous loop of wire.

Now for the driven (director) element.
LOOK AT THE PHOTOS.
From the center of the cross, measure 13,7/8" on all 4 support rods.
Again lay the quad element on a flat surface. Drill 4 holes parallel to the pvc "CROSS" on the rod that is coming out of the "T". Drill another hole 3/16 inch below the previously drilled hole. This is where the coax will attach. Using a wire length of 76 inches, place one end through the "T" dowel, tie a knot so that it won't come out, thread the remaining wire through the holes, ending at the other hole in the "T" thread the wire through this hole, and tie a knot in it as well.
Make sure the wire is not sagging.

Attaching the elements to the boom:
To attach the quad elements to each other using a,"boom", cut 2 pieces of pvc tubing 6,3/4" long,

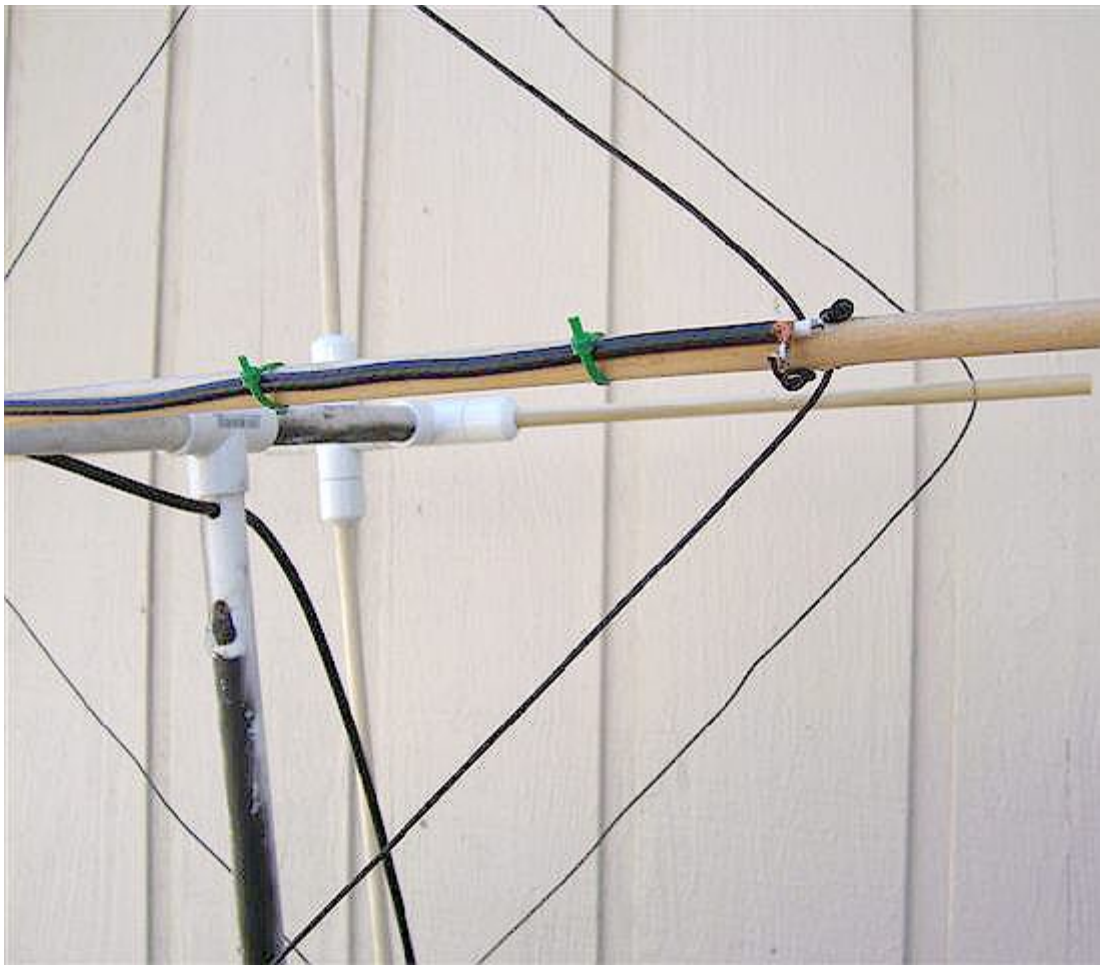
and insert into a pvc "T".
See picture of "boom" assembly below and the previous picture above:

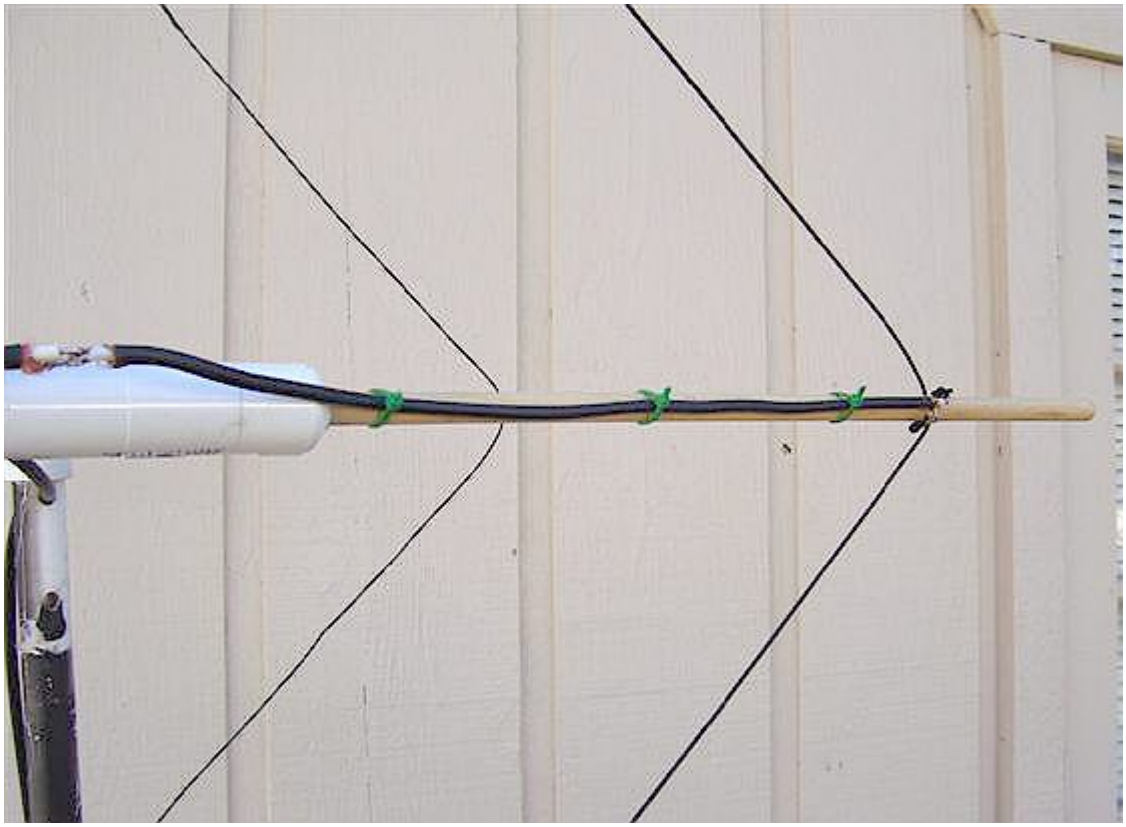
The "boom" is the horizontal length of PVC in the picture above
which is attached to each quad section on the ends. The support for the quad leading to the mount
is at the top in the picture but in final assembly will be on the bottom.

The method of how you mount the quad from this point to
your set up is left up to you.

With the quad element " T'S" facing each other, slip the element sections onto the ends of the quad boom while aligning up the driven and reflector. Refer to pictures.
If you are going to use this as a portable device, and are going to use both horizontal and vertical ,
I recommend that after the quad is tuned, marking your location of the "T's" on the boom, drilling a small hole, and inserting a nail in both ends to hold your place. If you don't do this, after use and ,
if you use it portable, the pvc will loosen. If the quad is to be permanent, pvc cement it,
ONLY AFTER IT HAS BEEN CHECKED OUT.

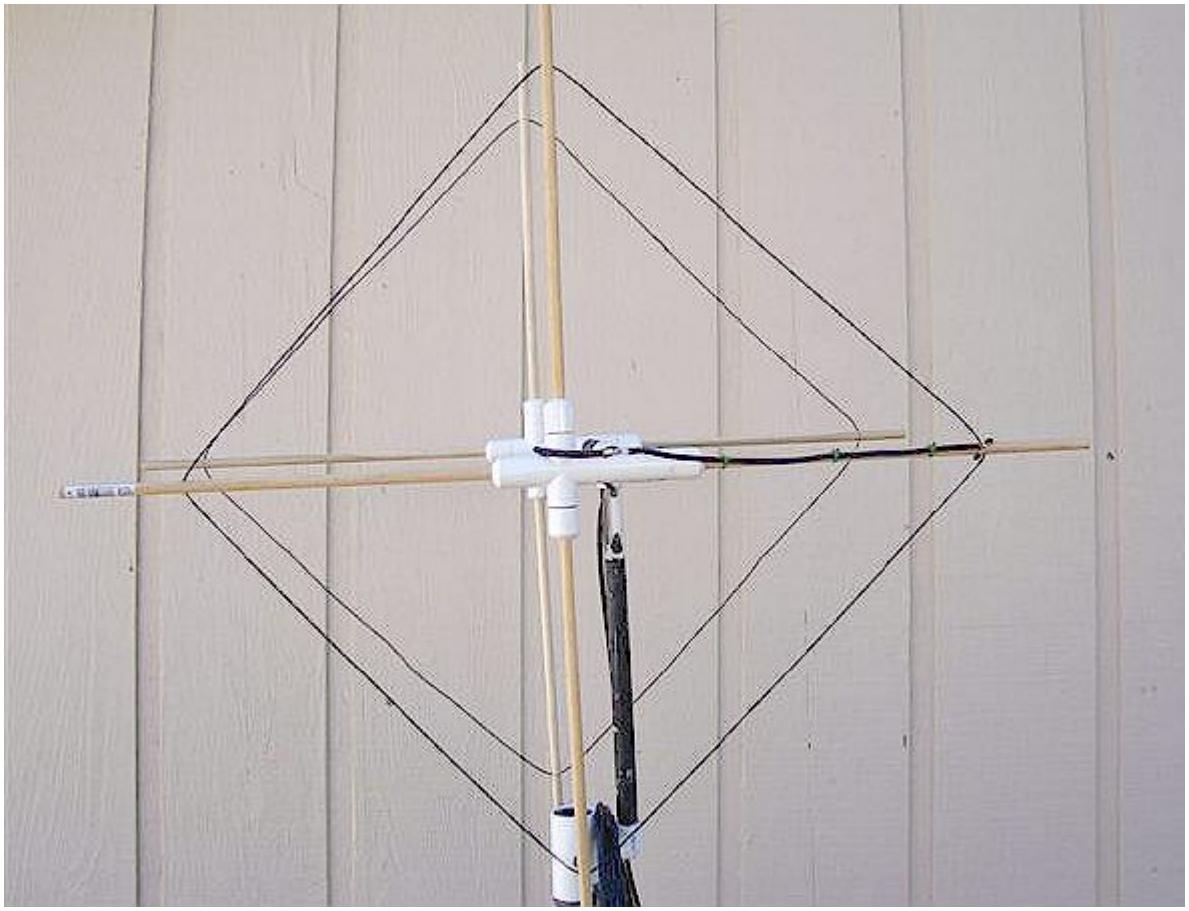
ATTACHING THE MATCHING COAX
(See photo below)
Cut a piece of RG59 (75 ohm non foam) coax to 13.34 inches. Strip both ends ¼ inch. At the driven element, where the two knots are, solder the center conductor to one wire, and shield to the other wire. Tape the coax to the outside of the dowel, on the side opposite the boom. Now attach a length of low loss 50 ohm coax, RG8X , or better. Shield to shield, center conductor to center conductor. Prior to sealing these connections, check the antenna out first. Route the coax over the CROSS and along the boom and down your own vertical mounting method.
Use either tape or tie wraps, (not to tight).





Matching section connection to feed line can be seen at left in the photo.

Your quad should look like this:



CHECKING IT OUT:

Mount your quad at least 6 feet off the ground, away from large metal objects.
My results were <1.5/1 across entire two meter band using a MFJ 269 analyzer. Forward gain about 5dB, (S meter), noise on F/B and complete null side/side. As with all antenna projects, your tests results will vary depending on your particular location, construction methods, and distance from other stations, etc.

If you want to cut the extra length from the end of the dowel rods, this would be the time.

Weather proofing should be done at this time.

MATERIALS

10 ft. of ½ pvc, schedule 40

3- ½ " T s"

2- 1/2 "CROSS's"

8- ½ end caps

4- 7/16 x3' dowel rods

1- ____ RG 59 coax, (non foam)

1- A/R___ RG 8X coax " your length"

1- Length of quad element wire, #18 gage,13.5 feet total feet
Note: this is great wire for a lot of antenna projects.
Vendor = You can find PolyStealth 18 under Antenna Wire at http://www.therfc.com/antenna.htm
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Formulas used:
(See notes about formulas below)
Director length = 79 inches,
246/146 x12x4= 80.8 inches
(Actual length for use is 76 inches for proper matching)

Reflector length= 82.6 inches
246/146 x12 x4 =80.8inches + 5%= 85.05 inches
Actual length for use is 86 inches for forward gain,
front to back attenuation

Element spacing =
1005/146x.2=16.52 inches
(Note, (.2) in formula above is 2/10 of a wave length)

Coax matching length =
246/146x12x.66=13.34 inches of 75 ohm non-foam coax
(Note, (.66) in the formula above is the velocity factor of the coax I used. Yours may be different. Look it up and use your velocity factor.
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Formula notes:
The above formulas were used to begin, but the wire that I used resulted in the above noted lengths. Also I have used these formulas for many years with repeatable results.

CONCLUSION:

This should be a fun experimental project for all, and is intended to both continue and to expand the interest of amateur radio antenna projects.
Constructors should use all known safety precautions.
As with all experimental projects, there are no guarantees.
With this in mind I hope you enjoy the project and its results.

Please direct any questions or comments to Steve , k4mmg@hotmail.com