

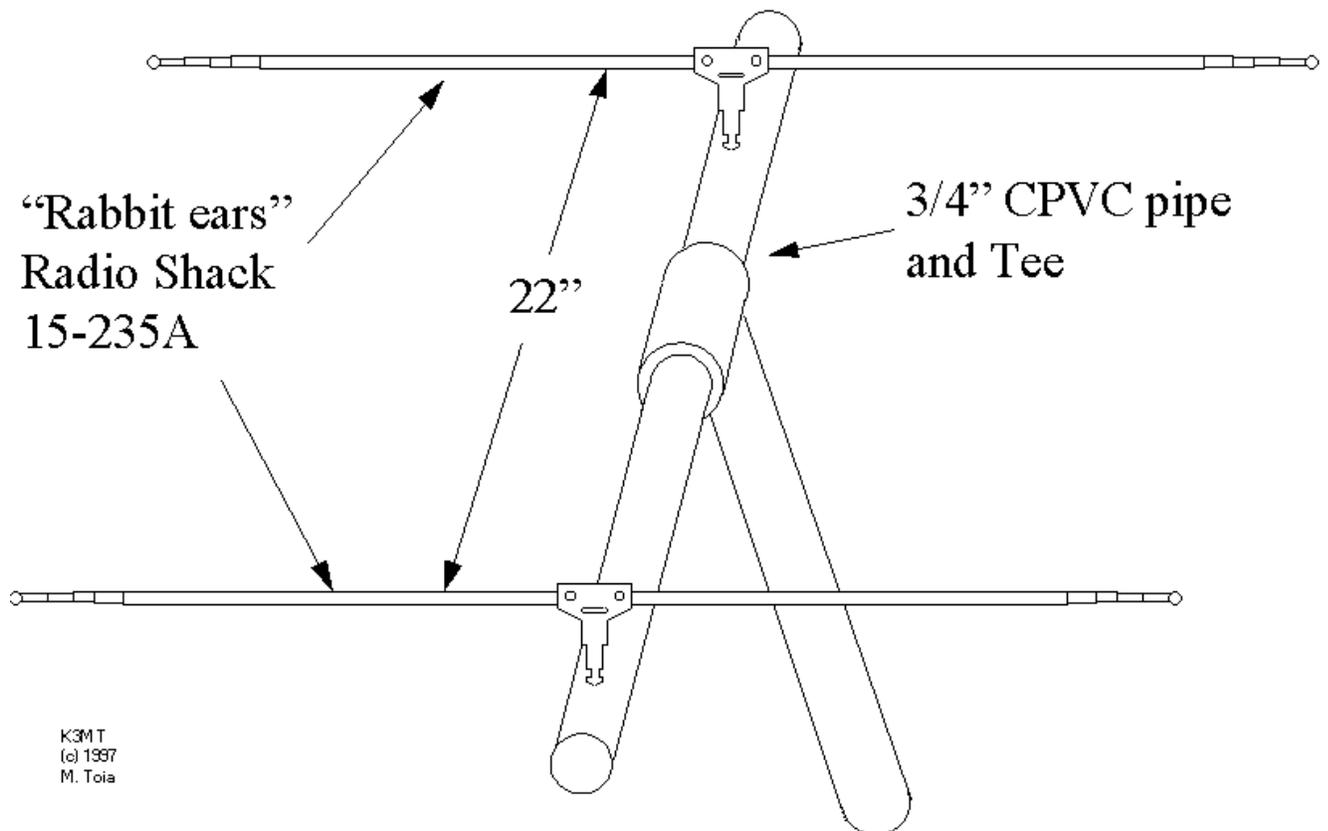
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presents . . .

A portable 2-element VHF yagi

May, 1997

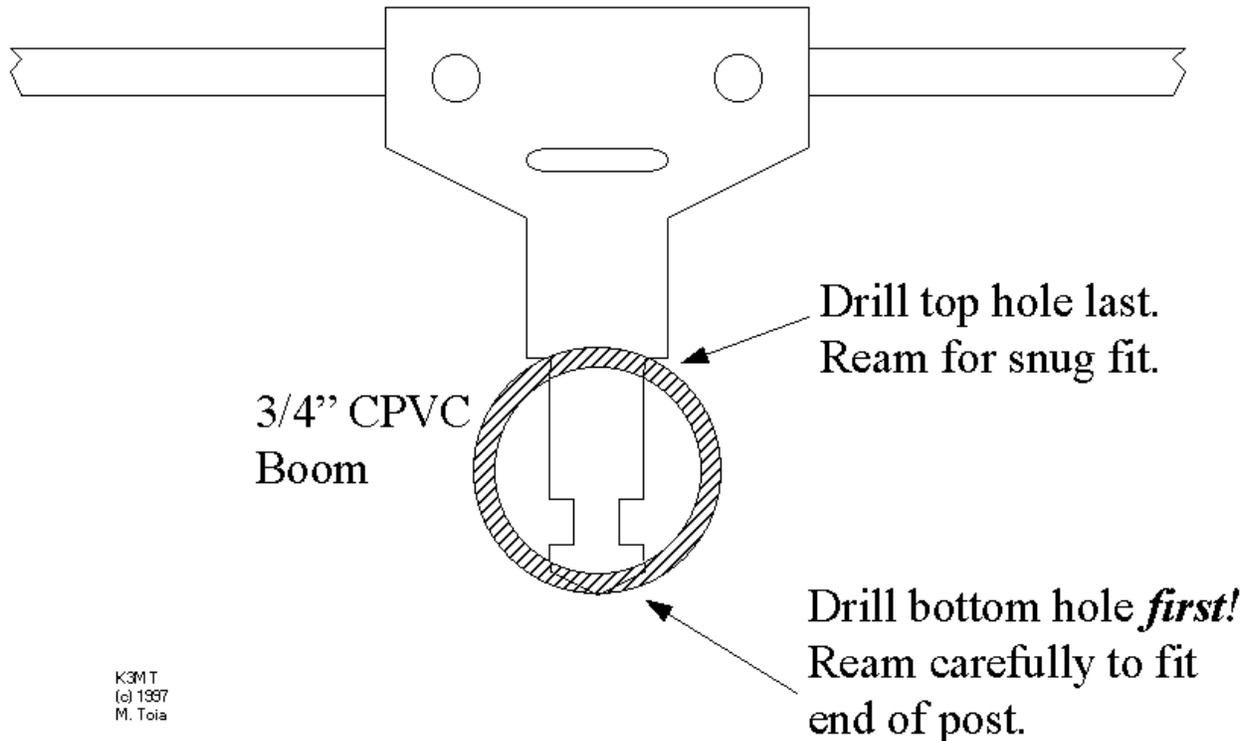
Here's a simple Saturday project: build a portable VHF yagi antenna for 2 meters. All you need is two rabbit ear antennas from Radio Shack, two CATV baluns, four feet of 3/4" CPVC pipe with one tee, and a bit of time.

This sketch shows a semi-exploded view of the antenna.



Prepare the antenna's boom from two pieces of 3/4" CPVC plastic plumbing pipe. PVC can also be used. Each half of the boom should be about 10 3/4" long, with a mounting hole drilled and reamed through a diameter, one inch from one end.

I recommend you drill and ream the *small* hole first: if you oversize it, you can easily make the bigger hole, and start another hole as the small one. The two holes should be diametrically opposite one another. This is an end view of one end of the boom:

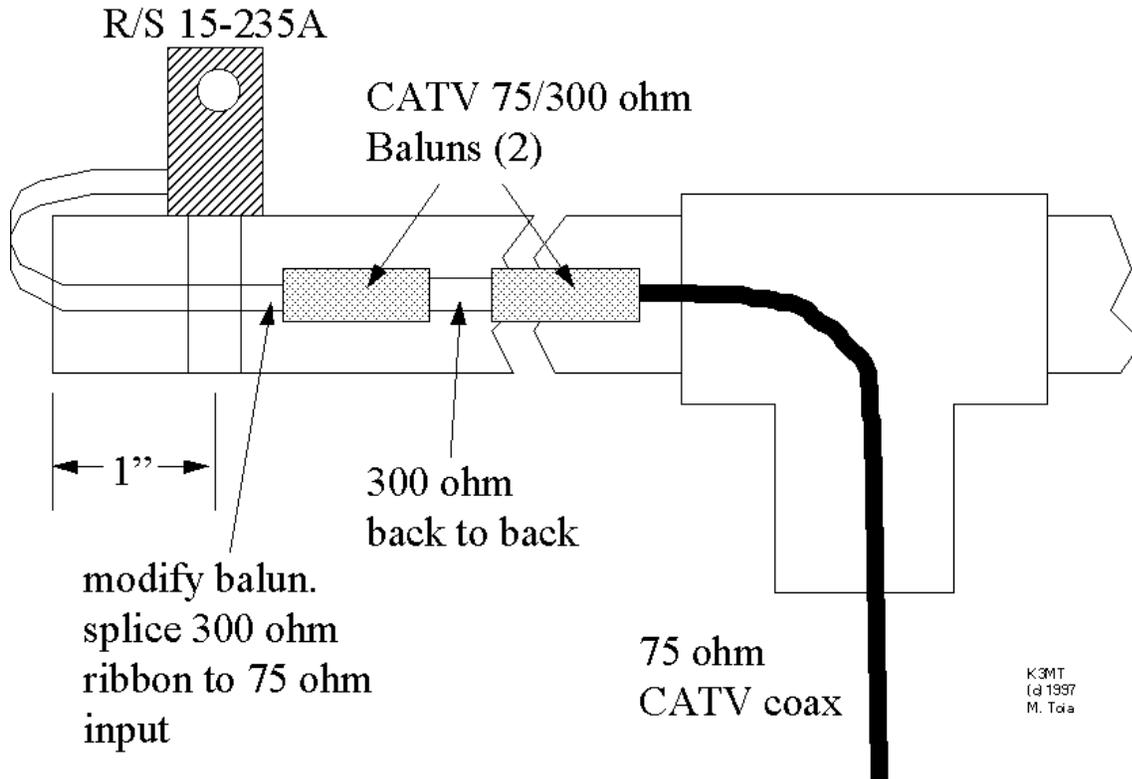


Drill the smaller hole. Ream it carefully until the antenna's mounting post can just snap into the hole. Then drill another hole diametrically opposite the first. Ream it until the mounting post can pass through the boom and enter the small hole. Ream the larger hole for a snug fit. Don't assemble the rabbit ears to the boom yet.

Two Radio Shack 15-235A rabbit ear TV antennas are used. One is the driven element. The other is used as a reflector. These antennas come with a few feet of 300 ohm twin lead attached. Cut off all but 1" of ribbon on one rabbit ears. Expose the two conductors and twist them together, to make a short circuit. This rabbit ears is the reflector. It doesn't connect to anything else.

For the driven element, cut off all but 5 1/2" of twin lead from the other rabbit ears. Strip it so 1/2" of bare wire is available for connections. This will be the driven element

Now attach the two baluns to the driven element. The baluns I use are tubular, with an "F" coax fitting on one side, and about 3" of twin lead on the other. Cut the twin lead of both baluns to a length of 1 1/2" or so, and splice them together, 300 ohm to 300 ohm sides. Examine this figure as you prepare the baluns:



Take the twin lead from the driven element and solder a few pieces of solid wire about 3" long to each conductor. Trim one wire to make a pin that enters the center hole of one balun's F connector. Wind the other wire around the outside of the F connector (the grounded part) and fasten it securely. You probably will want to use a good deal of electrical tape to keep this jury-rig connection from coming undone.

Connect regular CATV type RG-59 coax to the other balun's F connector. Thread the coax through the boom, down the center of the Tee, and down the mast. Its far end will attach to a receiver or low-power transmitter/transceiver. Pull the baluns into the boom far enough that the driven element's mounting post won't hit the balun.

Assemble the yagi. You will need to displace the driven element's twin lead to insert its mounting post in the boom. Pull the rabbit ears out to these dimensions:

- reflector - 21", tip to center of the insulator assembly

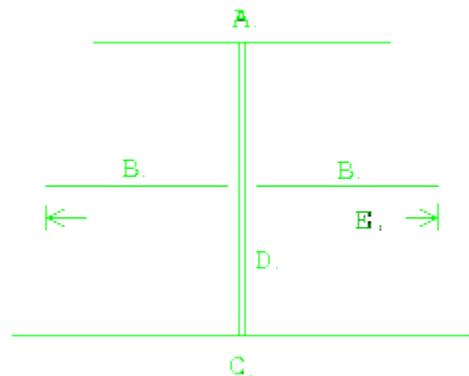
- driven element - 18 1/2", tip to center of the insulator assembly

This should resonate in the 146 - 148 MHz band. Check the antenna against a known signal source. Adjust the *reflector* for best front/back ratio or best gain. Then adjust the driven element for best VSWR.

This antenna can be used on other frequencies as well. The rabbit ears pull out to about 41", and collapse to about 10 1/4" which gives a tuning range of approximately 76 to 260 MHz. Of course, to use the antenna over this wide a range, a longer boom with additional through-holes for the mounting posts will be needed. The dimensions shown here are those that are approximately correct for 2 meter use. I have found this antenna to be useful with my low power mobile rig, which delivers about 5 to 10 watts to the antenna. I have *not* examined what the CATV baluns do to the signal - whether they saturate, clip, or anything like that - but only note that I can successfully use this antenna with low power ransceivers.

For more unusual antennas, visit my [web page](#).

And check out my [Books](#)



BUILD THE J BEAM FOR 2 METERS AND UP!

Condensed from an article by Ed Bathgate, N3SDO as published in CQ VHF Magazine July, 1988 and used with his permission. Thanks Ed!

"Recently, while going thru some of my older Ham magazines, I ran into this article by Ed, N3SDO on the J BEAM antenna.

It struck me that some of you out there may not have seen this fantastic project or maybe you do not get CQ VHF magazine, which is back now better than ever!

A little research on the web indicated that there is not much information on how to build the J beam antenna that is useable with clear graphics and good plans, so I contacted Ed, and after signing my XYL, car, home, bank account with \$73.73 in it and all my good looks over to him he finally gave us the needed permission to put the plans on this site for all of you to enjoy. HI!.....

Thanks again Ed!".....**N4UJW**

LET'S GET STARTED

Now you've probably heard of a beam antenna, and maybe you've heard of a J-Pole.

But what's a J BEAM?

It's a vertical directional antenna made of 1/2 inch copper pipe and wood or PVC. It uses a standard J-pole antenna as the driven element and center support, with two parasitic elements-----a reflector and a director, to provide directivity and gain. See J Beam pattern below. It can be built for around \$15.00 (1998 prices) and you can use your old Jpole as a basis for the JBeam. You'll probably need to shorten the main 1/2 wave element by 1 to 2 inches, as the reflector and director tend to couple and lower the resonance of your original jpole toward the lower part of the band. See formulas for cutting to your desired frequency of operation or band . A small amount of trimming on the tip of the main active 1/2 wave element may be needed to get the SWR as low as possible.

You shouldn't have to adjust the 1/4 wave matching stub, as this is not strongly affected by the parasitic elements.

Design Details and Drawbacks

The element lengths and spacings are a combination of info from the ARRL Antenna Book section on 2 meter Yagi antennas, and from experiments with a field strength meter and different length elements and spacings.

The reflector and director element spacings are equal at 16 inches. Slightly

higher gain with reflector spacing at 18 inches from driven element and director spacing of 14 inches can be had but the antenna may tend to lean with unequal spacings if strong mast mounting is not used.

The bandwidth is not as wide as that of the standard jpole by itself. The SWR tends to rise faster toward the ends of the band, but you get an estimated 7dB gain and 20 dB F/B (front to back ratio).

High wind loading could potentially break off the jBeam at the bottom joint since the entire structure is supported by that point. You may want to reinforce it.

CONSTRUCTION

The lengths used in these plans are for the upper part of 2 meters and you can use the formulas to design it for your frequency.

1/2 inch copper pipe is used for all elements and standard soldering made with a small blowtorch. A soldering iron is just not hot enough!

Longest element = 58 1/2 inches (add about 2 feet for mast mounting)
matching 1/4 wave stub = 20 1/4 inches

Position matching stub toward director for a bit of added gain reflector = 40 inches
director = 32 inches

Stub and main element spacing = 3 inches

Coax feed point = 3 to 5 inches from bottom
(use hose clamps for feed point coax attachment connections for easy repair/adjustment)

Center boom is 1/2 inch by 1-inch wood or PVC and about 36 inches long

Measurements should be made as close as possible but are not extremely critical!

Element to boom mounting variations depend on your particular situation and construction materials at hand but insure that element centers are at center of boom Use your own imagination! (see pics for better details)

"One fellow built one with five elements-----just cutting the extra directors shorter by eye-----and was able to work a repeater 35 miles away, with a 5-watt HT holding the antenna, from a valley that's hard to get out of with 50 watts and an omnidirectional antenna at 30 feet!"Ed Bathgate N3SDO

>FORMULAS<

J Pole Long element (in Inches) = $8568 / F$ in mhz

J pole Stub (in inches) = $2952 / F$ in mhz

Reflector (in inches) = $5880 / F$ in mhz

Director (in inches) = $4704 / F$ in mhz

Spacing (in inches) = $2352 / F$ in mhz

Some examples for other bands:

224 mhz

DE: 38.25"

STUB: 13.17"

REF : 26.52"

DIR: 21"

SPACING: 10.5"

444 mhz

DE: 19.29"

STUB 6.6"

REF: 13.24"

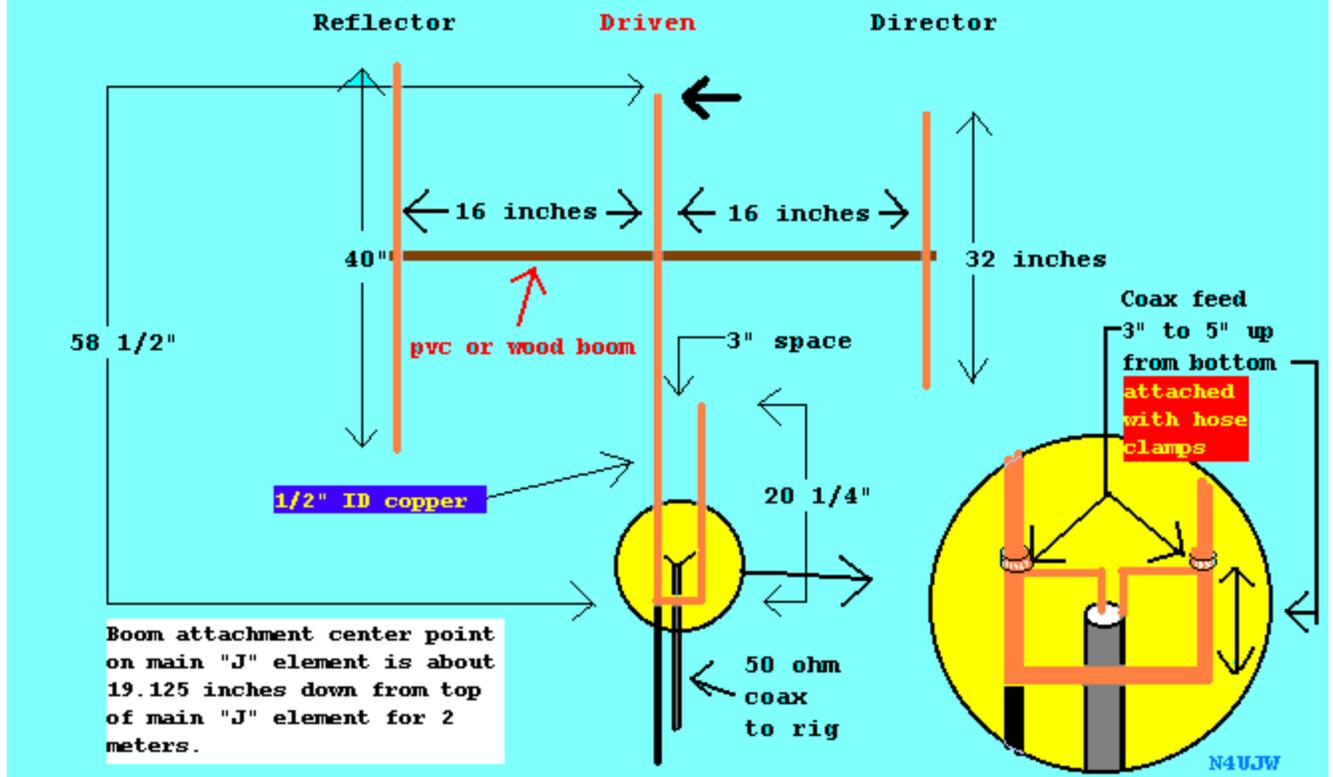
DIR: 10.59"

SPACING: 5.29"

"A PICTURE IS WORTH A THOUSAND WORDS"

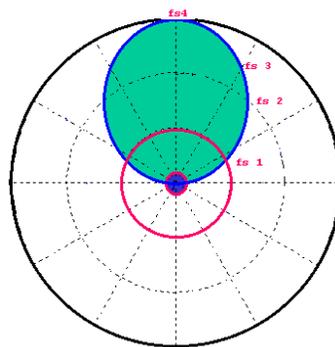
Here are two thousand words!

The N3SDO J BEAM PROJECT



Notes: Make driven element about 2 feet longer at bottom for mast mounting.
Center conductor of coax to longest element, shield to shortest element

J BEAM PATTERN



Red circle is pattern of standard omni J Pole
Green area is estimated pattern of JBEAM
using field strength meter readings

The 2m Portable Pocket Beam

By Richard Price BSc, MSc, GW0VMW

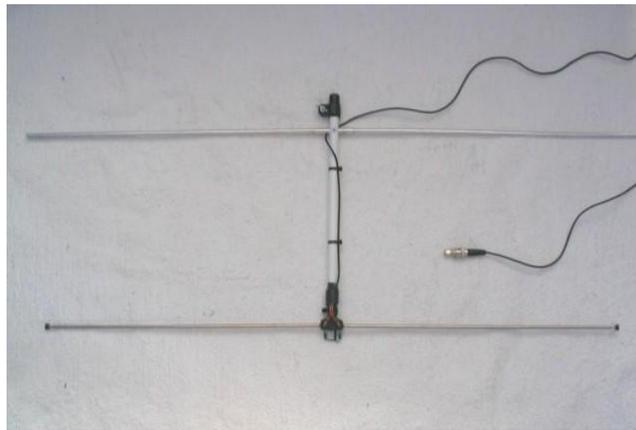


Reflector



Feedpoint

2m Portable Pocket Beam



After a number of successful SOTA expeditions around Snowdonia with my portable multiband vertical and IC706 it was decided to look for a lighter weight alternative. As 2 metres is the most popular SOTA band used, a lightweight antenna for use with a handheld transceiver and providing some useful gain was sought.

A small 2 element Yagi (Plate 1) seemed to fit the bill quite well and could be easily mounted on my telescopic trekking pole that I use for walking, thus eliminating the need to carry a separate mast. The design problem however was how to keep simplicity, lightness, compactness, speed of assembly and a good match to coax all together. My complete  Pocket

Beam antenna is just 20" long and 2" wide when dismantled and can be assembled in less than a minute. It weighs in at just 6oz complete with feeder! and is optimised for 5Dbd gain and a high front to back ratio. Most importantly SWR was measured at 1.1 to 1 when mounted either horizontally or vertically.

The critical dimensions are-

Driven Element 94cm

Reflector 104cm

Spacing 26cm

Materials-

Boom 30cm long 15mm diameter plastic tube and plastic end cap

Feeder 50 Ω coaxial cable (9ft of RG174)

Inducto-match 2 turns of 14SWG 1/2" dia. by 1/2" inch long (Equates to 8 turns per inch spacing)

1m x 6mm diameter hollow aluminium tube plus 2" 8mm diameter hollow aluminium tube

Self tapping screws, Cable ties and PVC tape

Plastic clamp and wing nuts

In view of the short length of coax needed and the desire to keep the system low in weight and as compact as possible I decided to use RG174. RG58 could be used instead and would reduce losses but may require elimination/alternative design for the choke balun. The driven (split dipole) element

I used was actually a telescopic (adjustable) set top portable TV antenna that usually come supplied by the manufacturer (also available from Sandpiper Communications for \$2) and was a good push fit into the 15mm diameter plastic tube (Boom). The folding whips are attached at the base, by small machine screws and here the coax is connected on one side and the inducto-match on the other using ring connectors. Six turns of RG174 are made close spaced around the boom near to the feedpoint to act as a choke balun thus preventing stray RF affecting SWR and distortion of the radiation pattern.

The feeder and inducto-match are secured with cable ties to the boom (Plate 2). The feeder cable is then run along to the back of the boom and secured with more cable ties as this must exit away from behind the reflector element to avoid SWR and radiation pattern distortion problems. The reflector is made from 2 pieces of 0.5m long 6mm diameter hollow aluminium tube, into which a 3/16" Dowel screw has been inserted to provide a threaded end and make up the length

required.

A small 2" length of 8mm diameter hollow aluminium tube (6mm internal dia) is used, inserted through the plastic tube and secured in position with a self tapping screw (Plate 3). The elements are a sliding fit into this, but to make them secure the threaded part needs a thread. To make the thread I used a small amount of chemical filler (fast setting exothermic stuff).

The threaded element makes the thread by first smearing with Vaseline to prevent adhesion and then after filling the tube with some filler pushing the elements in each end until they meet in the middle. Once the filler has sufficiently set (20-30mins) the elements can be carefully unscrewed and ♦Voila♦!

Mount the antenna from the back of the boom with whatever clamps you like (I used bike accessory clamps with wing nuts) with one clamp on my trekking pole. My pole (Leki Makalu) has a basket on the base so once it is pushed into soft ground it stays upright even with the beam attached and can be easily turned around. The handle is also detachable to allow a camera to be mounted on the top and provides a suitable guying point for use in windy conditions.

Antenna tuning is done by extending the telescopic elements to the given dimensions followed by tweaking for lowest SWR. Once the best position is found the elements can be marked with a file. On air testing revealed the expected cardioid radiation pattern with two deep nulls and a minor lobe to the back. Signals were often readable/workable where they were not on my ♦ wave vertical. This is now my favourite portable antenna for SOTA operations. As the yanks say ♦It gives the biggest bang for your buck♦.

By Richard Price BSc, MSc, GW0VMW

The "I DX" 3 Element Portable Yagi for 2m

by MW0IDX



When I started using 2m for activating SOTA summits, I found getting contacts difficult using just the short flexible whip "Rubber Duck" antenna. So I was on the lookout for a simple gain antenna suitable for portable use.

I used a design based on an article in the ARRL handbook 1998/9. I use a plumbers overflow pipe which comes in 21.5mm X 2m from a local DIY store (B & Q) for the boom.

For the elements, I used three 6mm X 1m hollow aluminium rods also from the same store.

The reflector should be 40" - you can add a stub of aluminium rod to make this length up if you wish, I just ignored it, and left it at the 1m length as it came.

Connect coax directly to end of driven elements. I used a small bolt through the end and attached short insulated wires to the bolt. At the other ends I attached spade connectors to enable quick and easy connection to coax. Keep the wires short, otherwise this could affect the SWR. Banana plugs can be used to connect the wire as these fit the aluminium rods perfectly.

18.2" from the reflector, I attached an "omega" shaped plastic pipe holder designed for this pipe to allow a fishing rod (G3CWI's ideal) or pole to go through this holder to support the yagi.

Placed over the top of the fishing rod, it comes to rest conveniently three quarters of the way up below the apex of my dipole. I use vertical polarisation, as most contacts I make are on 2m FM.

Using the antenna vertically only allows only one stopper or connection of the elements to hold the element halfway through the boom without the need to fix both sides. I use a cable tack with the nail removed, which happens to be 6mm and snaps onto the element, which I then glue and secure with a piece of electrical tape. For the + side of the driven element I just clip on one and temporarily hold in place with tape again.

The completed yagi weighs only about ½ pound, the elements can be packed inside the boom which can then fit into a rucksack or attached to the outside.

Hope this works as well for you as it does for me. Please Email for further info if required. Struggling to make the 4 QSO's will be a thing of the past, but don't quote me on that hi!!

Roger Dallimore MW0IDX K3IDX February 2003

3 Element 2m Yagi

