2 Meter (2 Element) Bobtail Beam Project

Updated May, 2010
(See 70cm Bobtail feedback at end of article)

The 2 Meter 2 Element Bobtail Beam is a high gain antenna yielding about 10dB compared to a single 1/4 wave vertical antenna or about 13 dBi + in free space according to computer models and much research on the web and various antenna book references.

According to our research, the Bobtail antenna was invented by Woodrow Smith, W6BCX around 1948. We have compiled data from various sources to present this project in condensed form so you won't have to wade into all that theory, graphs, tables, etc when all you want to do it to get a project up and running on the air in as minimal time as possible and start having some more fun on the 2 meter band. 10db gain compared to a simple 1/4 wave vertical from a 6 element antenna is well worth the time, effort and fun in constructing this antenna!

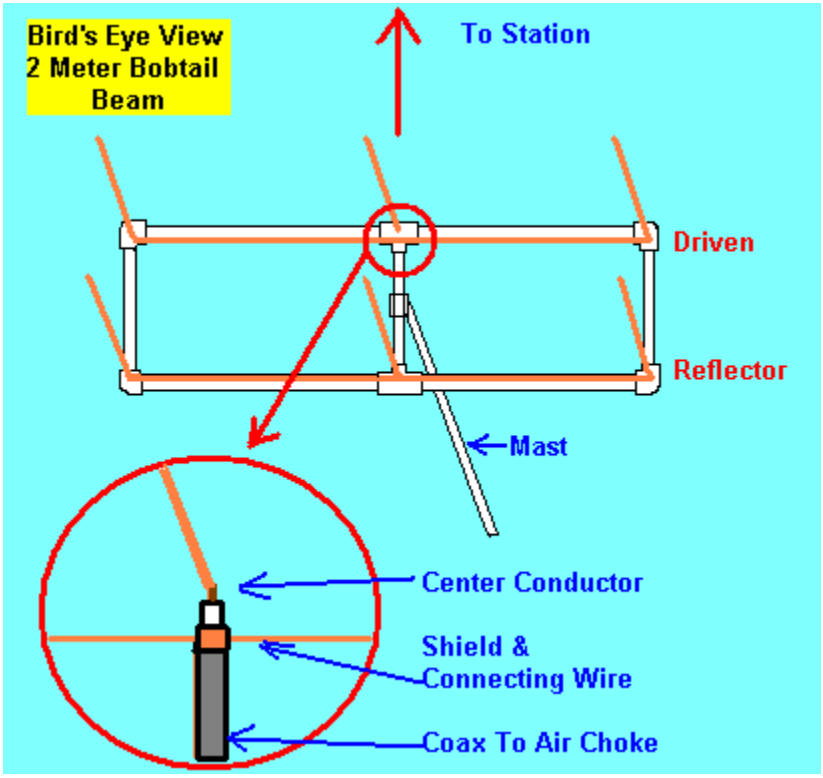
The 2 meter Bobtail beam is patterned after the Bobtail Curtain which is well known for it's very narrow pattern and high gain down on the HF bands. Just do a search on Google or any good search engine to learn more about the Bobtail Curtain from others who have experimented with it.

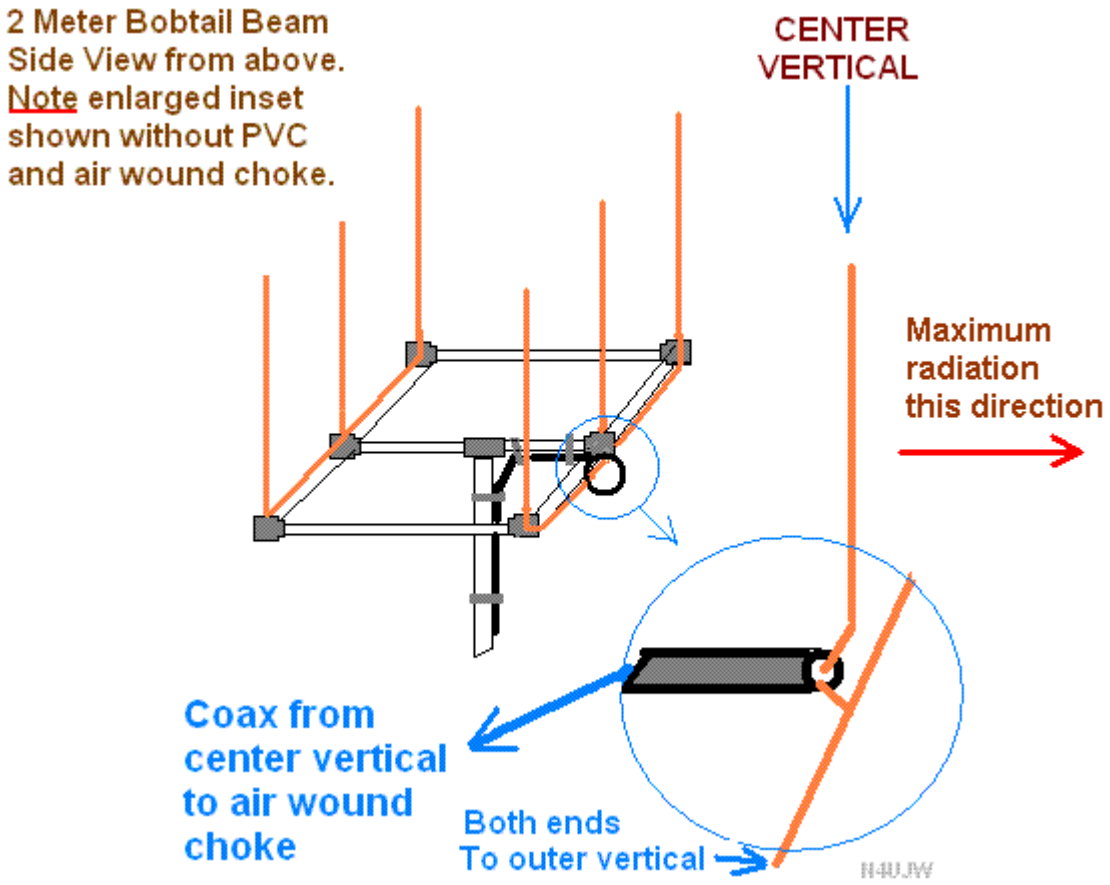
The pattern of the standard Bobtail antenna is very narrow. The Bobtail beam is even more narrow off the front (driven section) with only minor backside radiation giving you a front to back ratio of around 17 to 19 degrees and a feed point impedance of about 50 ohms! These numbers may vary slightly with your final building outcome.

At 2 meters, the entire antenna is only about .15 wavelength (12 inches)deep and about 81 inches (1 wavelength) wide and is fed directly with 50 ohm coax. The separation between the front and rear elements may be changed to suit your building requirements and the .15 wavelength (12 inches) is a good starting point and may have to be widened by experimentation. At some point, all of the lengths and separation between the front and back elements may start to interact with each other and change the feed point impedance. Experiment!

In general, the SWR is very near 1:1 when tuned properly and according to research is wide banded.

Depending on your construction materials, this beam can be made very lightweight and can be turned with any small TV type rotor or by hand if needed!
The drawings below are shown using PVC pipe as the support for the antenna however, you can use most any non-conductive element support in a frame such as wood. A non-conductive mast may help to keep the pattern as designed.





Description, details, formulas and lengths (Refer to Drawing)

Element lengths:

Formulas below are a combination of several formulas found in doing research on the Bobtail and may need tweaking but are a good starting point. Your lengths may be somewhat different as with any antenna project.

The results from the foumulas below may be long which should help in tuning for lowest SWR and good match for direct coax connection.
Driven Section each = 20.4 inches (20 13/32 inches)
Reflector Sections each = 21.6 inches (21 39/64 inches)
Note: These lengths should be very close to final lengths.
Some length adjustment may be needed for lowest SWR.

Formulas: Note - These formulas seem to be very close. Adjust as needed.
Front Elements~~~ 248 / freqmhz = length in feet (multiply by 12 = inches)
Reflector Elements~~~ 263 / freqmhz = length in feet) multiply by 12 = inches)
Spacing = .15 X one wavelength at 146mhz (one wave aprox 80.32inches)
Example for 147.00mhz:
Front elements------248 / 147 = 1.68 feet X 12 = 20.24 inches
Reflector elements-----263 / 147 =1.78 feet X 12 = 21.46 inches
11808 / 147 = 1 wavelength = 80.32 inches (both front and rear equal)
.15 wavelength spacing = 80.32 X .15 =12.04 inches
As stated earlier, these formulas are not exact but should be close.

Yes....you should be able to "scale" this antenna for just about any frequency desired depending on the final size of the antenna and your support structure using the formulas above! Going up in frequency is most likely your best bet as this antenna will get very large as you go down in frequency and supporting it may be a problem depending on your location.

As an example for 10 meters, 28.400mhz, the width of it would be about 34 feet plus; with over 9 feet reflector lengths. Also remember, the bobtail beam is 1 wavelength wide at your design frequency and requires that you fashion 2 supports for the vertical elements and some way to keep them separated!

Description:
The project is shown here using a combination of ideas but is shown using PVC pipe as a support for the vertical elements.

The 2 meter Bobtail beam driven section is basically a stand alone center 1/4 wave vertical with 2 more 1/4 wave verticals the same length as the stand alone section on each side that are connected to each other independent of the center vertical which acts as the driven element in a 2 element (2 section) beam.

The outside elements are 1/2 wavelength from the center element on both the driven section and the reflector, yielding an antenna about 81 inches wide at 2 meters.

The rear elements (the reflector section) are about 6% longer than the vertical elements on the front side (station side) of the beam and ALL 3 are connected together.

All 3 front elements are the same length and all 3 reflector elements are the same length. Don't get confused here. The reflector lengths are all the same length and about 6% longer than the front elements. All front elements are the same length and about 6% shorter than the reflectors. As with most beams, the front section elements are shorter than the reflector elements.

Both front and rear sections are 1 full wavelength wide from side to side.

The center (driven) vertical (on the front section) is fed directly, using 50 ohm coax as an air wound choke and the shield of the end of the air wound choke coax is connected to a 1/2 wavelength wire or other conductor on each side to the outside verticals on the driven section. Center conductor from end of choke to the center driven element. See drawing.

There is no electrical connection between the driven or the reflector section.

Spacing between driven and reflector section is about 12 inches.
(not critical)

The 2 Element Bobtail Beam is very broadbanded and usually is easily tuned for best match to 50 ohm coax.

Construction lengths are not critical except that all of the front side (driven section elements) are exactly the same length (20.4 inches in the example above) and the rear (reflector) elements are all exactly the same length (21.6 inches).
The diameters of all elements should be the same.
1/8 inch welding rods make good lightweight elements if you can get them long enough or you may use aluminum tubing, small diameter copper tubing, etc or stiff wire of small size for better stability.

The Bobtail Beam is fed with a simple air choke consisting of 6 or 7 turns of feedline coax wrapped around a suitable form such as PVC Pipe. One end to feed point on the Bobtail Beam and the other end to

your rig.
Mount it as close to the center vertical radiator as possible.

Editors note:
There are numerous ways to build this antenna using PVC, wood, fishing poles and other non-conductive materials for the support and aluminum tubing, welding rods, old TV antenna elements, large diameter stiff wire, brazing rods and other materials for the verticals. Use your imagination!

It is suggested that the front section and the rear section be insulated from each other...in other words....separated by a non-conductive boom support structure.

One other note of interest is the fact that the orientation of the beam towards the station of interest is at 90 degrees to the parallel supports and not off the end as in standard beams or yagi's. See drawing for reference.

Experimentation with various methods of construction should give you a high gain beam for 2 meters loaded with lots of fun for an inexpensive price compared to a commercial beam of comparable gain! Remember, the computer models show about 10dB gain compared to a 1/4 wave vertical!

Even if you can't get 10db over a 1/4 wave vertical, this project should improve your signal greatly!

Feedback from Builders!

70cm version- Photo courtesy of Rich, K2RRF

"I had very good luck on a 70cm model using 5" front to back spacing and 12" side to side spacing the driven elements were 6.5 inches and the reflectors were 7". The only reason I used 5" front to back and not 4" was it was the closest I could get the pvc t's together but it worked out.Thank you for sharing this antenna project with us and I hope this helps someone who wants to build a 70cm model." 73 K2RRF Rich in Trenton NJ

See other versions below by other builders:

2 METER BOBTAIL BEAM ROVER

2 METER BOBTAIL BEAM (Attic Version)

2 METER BOBTAIL BEAM KD8JZP

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