ANTENNAS GALORE!

http://www.extremezone.com/~nk7m/ant1.htm

A 2-Element Yagi

Probably the easiest rotatable beam is a 2-Element Yagi, both in the mechanical and the electrical sense. While the gain won't be "up there" with the big tri-banders & the like, a useful amount of gain can be realized without breaking the bank. Below is a "sketch" of a 2-Element Yagi.

```
      Reflector               Driven Element

              !               !
              ! <-----S-----> !
              !               !
              !               !
              !     Boom      !
              !===============: <--Coax Connection
              !               !
              !               !
              !               !
              !               !
              !               !

              Beam Direction --------------->

                Gain is about 5dBd
```

Although the Reflector and the Driven Element are "sketched" as being the same length, in actuality, the Reflector is 5% longer than the Driven Element. The formulas for the element lengths are listed below:

DE (ft) = 470/F(MHz) [HF] : DE (in) = 5600/F(MHZ) [VHF]

REF (ft) = 494/F(MHz) [HF] : REF (in) = 5880/F(MHz) [VHF]

The Spacing (S) can vary from 0.15-Wave to 0.25-Wave, with little change in the array gain. According to the charts in the "ARRL Antenna Book", 14th Edition, the variation in gain is less than 0.5dB.

What does change is the feed impedance. Depending on how you want to feed the array will determine the spacing. The closer the spacing, the lower the feedpoint impedance. At 0.20-Wave, the impedance is around 40-Ohms, resulting in a 1.25:1 SWR, and at 0.25-Wave, the feedpoint impedance is around 60-Ohms, resulting in a 1.17:1 SWR. This is with direct feed with 50-Ohm cable. The feed can be direct, or through a 1:1 balun, and will show very little variation either way.

Construction of the 2-Element Yagi

Various construction methods can be used for a 2-Element Yagi. The most common is to take a length of rigid tubing, cut to the desired boomlength, and mount the elements with U-bolts, pipe clamps, muffler clamps or what-have-you. The boom can also be wood or a lattice-like structure, or even PVC pipe. The main consideration is mechanical strength. The elemenst can be any conductive material that will support its own weight, or a suitable length of wire or braid that is supported by a rigid non-conductor. One of the really inexpensive antennas I saw in a publication used lengths af #14 house wire, taped to bamboo poles. Of course, the author lived in the South, and just went out in his backyard and cut his own canes! Some people have all the luck!

Below, I have dimension for some of the HF and VHF bands, and some construction "tips":

Freq.	REF.	DE.	Spacing
14.1 MHz	35.04'	33.33'	13.95' - 17.45'
18.1 MHz	27.29'	25.97'	10.87' - 13.59'
21.2 MHz	23.30'	22.17'	9.28' - 11.60'*
24.9 MHz	19.84'	18.88'	7.90' - 9.88'
28.4 MHz	17.39'	16.55'	6.93' - 8.66'*
29.3 MHz	16.86'	16.04'	6.72' - 8.40'
50.4 MHz	116.90"	111.33"	46.96" - 58.69"
52.5 MHz	112.00"	106.66"	44.99" - 56.23"
146.0 MHz	40.27"	38.36"	16.18" - 20.22"
223.5 MHz	26.31"	25.06"	10.57" - 13.21"*

* - Good Novice Antenna, also

Let's say, for example, that you need a 10 Meter beam. Looking at the chart, the longest element is just under 18', and the boomlength would be about 7' to 8.66'. The elements could be DIY aluminum tubing (expensive), or it could be EMT (conduit), which is heavy, but inexpensive.

The boom could be a length of TV mast, Chain-link fence rail or a 2 x 4. The least expensive would be the heaviest (2 x 4 boom & EMT elements), but the total cost would only be $20 - $25. With about 5dBd gain, and a 25 watt rig (Uniden or Radio Shack), this would be like going with a 75 watt amp, at $0.33/watt, and if you were running 100 watts, you would have effectivly 300 watts for $0.08/watt, plus tha cost of the rig, of course. Any way you look at it, it's a big bang for the Buck!

If you wanted to make the Yagi for, say, 20 Meters, the "boom" could be a ladder, (No, I'm not kidding!), or a lattice-construct made with 2 x 2's or 2 x 4's. It would be HEAVY, ... but the price of 20 Meter beams are HEAVY, also. It might be feasable to do the ladder boom, and beef up the mast instead of depleteing your budget.

For the VHF beams, the boom could be PVC pipe, 2 x 2's, TV mast or whatever. One suggestion that was in "73" Magazine awhile back was to use threaded elements, drill holes in the PVC pipe and "bolt" the elements through the pipe wall. This would provide the mechanical support and the insulation for the feedpoint all at the same time. For vertical polarization, the boom could be extended back beyond the Reflector, and the beam then end-mounted, putting the mast out of the field of the antenna. This would allow the antenna to even be side-mounted on an exsisting mast.

The beamwidth of a 2-Element Yagi is about 110-Degrees, so aiming is not critical, however, the front-to-side ratio and front-to-back ratio is 10 - 20 dB, providing a high degree of rejection to unwanted signals. To put this in perspective, say you lived in Brockport or somewhere in the Western edge of Monroe County. The 2 Meter version of this antenna could be mounted up in the clear, and "sited" on the center of Rochester. You would have gain from the North Greece area, all the way around to Rush, and would reduce the VE3 repeaters by a couple-or-3 "S"-units. Not bad for a few chunks of wire & a piece of PVC.

The possibilities are limitless. Consider a 2-Element Yagi this Antenna season.

The following note comes from Jerry Haigwood W5JH as a result of his Yagi building experience:

1. Use a director as the passive element and not a reflector. You will get a greater F/B ratio. Typical F/B using a director and CLOSE spacing is 18-20 db. The typical F/B using a reflector is 10-12 db.

2. I typically use a spacing of .09 wavelength. At that wavelength the F/B will be 18/20 db, gain will be 4.5 dbd, and the impedance will be approximately 18 ohms.

3. This yagi can be matched by shortening the driven element to raise the impedance (reactance) and adding a "hairpin" match to remove the reactance. It is fed with 50 ohm coax and a choke balun.

4. Because of the close spacing, construction costs are reduced, weight is reduced allowing the yagi to be turned by a light rotator. On my 17 meter yagi I used a 1.5 inch diameter boom and .875 inch diameter elements.

Just thought you might like my comments. See you field day. I'll be setup on FR751B or off one of the logging trails.

73, Jerry W5JH

72/73, Keith, FD '97 Chair, QRP-L #582
Trustee, KB2YTW/B 10 Mtr Milliwatting Beacon (250 mW @ 28.2870 MHz)
"In the Depths of the Great Bergen Swamp...FN13ac"

(Psst...Wanna double your power, for Free?)

Well, not for free, but almost so. Let's look at how one can "double" one's power. How, first of all, are we looking at your "power". One way is to look at the output of your rig. If you increased your output from 5 watts to 10 watts, there could be no argument that you had doubled your power. But, if your antenna had a gain of 2 [3dB], at the other end of your contact, it would LOOK like you had increased your power.

Now, about the "FREE" part of this discussion. The simplest, and least expensive antennas are wire antennas. To double your Effective Radiated Power [ERP], you need a gain of 3dB over your former antenna. Using a dipole as the reference, this would be expressed as 3 dBd, or 3 dB over a dipole. So, what "FREE" wire antenna will give us 3dBd?

One of the easiest, and cheapest is the Extended Double-Zepp, or EDZ. What it is, is two elements, fed in a collinear fashion, with each element extended from 1/4-wave long to 5/8-wave long. Many of the Antenna Books show this antenna fed via a 0.11-wavelength stub, which results in a 150-ohm feedpoint impedance. Nice, but when was the last time you saw 150-ohm feedline? So, you say, 'How do I feed my EDZ?' If you feed it directly with ladder line, either 300-ohm, or 450-ohm, the SWR on the line will be 2:1 or 3:1. With the inherent low loss of the ladder lines, this will never be noticed. The ATU you are using will tune out this mismatch, and make the transmitter happy. If you really insist on a 'flat' line for the antenna, then a 1/4-wave shorted line should be attached to the feedpoint, and your feedline should be tapped down to the correct spot on the line to match it. Using this method, you could even feed the EDZ with 50-ohm line. This would make the antenna a single-band antler, whereas the resonant feed with the ladder line will allow you to run the antler on multiple bands.

The formulas used to calculate the lengths in an Extended Double Zepp are as follows:

```
Leg length (feet):            L= 600/F(MHz)
Stub length (feet):           l=108/F(MHz)
```

```
[-------------L--------------]     [---------------L-------------]
------------------------------o[ins]o------------------------------
                               \   /    :
                               !   !    :
                               !   !    :
                               !   !  [ l ]
                               !   !    :
                               !   !    :
                               o   o  -----
                             Feedpoint
```

***NOTE: [ins] is the center insulator for the wire.....

If you want your EDZ to be the single band version, and not use an ATU, then the stub length, [l], should be equal to 246/F(MHz), and the bottom of the stub should be connected together, with the feedline tapped up to the correct matching point. This point would need to be determined empirically, also known as "cut-and-try".

HOW BIG IS IT??

This is a good question, and might be the disqualifying factor for some. Here is a listing, in tabular form with dimensions. I am listing it for the bands from 160 meters up, but I don't have the room for the lower bands, myself. [Wish I did, though].

FREQ (MHz)	L (Ft)	l (Ft)	Flattop Length (Ft)
1.85 MHz	324.3'	58.4'	648.6'
1.95 MHz	315.8'	56.8'	631.6'
3.60 MHz	166.7'	30.0'	333.3'*
3.90 MHz	153.8'	27.7'	307.7'
7.15 MHz	83.9'	15.1'	167.8'*
10.10 MHz	59.4'	10.7'	118.8'
14.20 MHz	42.3'	7.6'	84.5'
18.10 MHz	33.1'	6.0'	66.3'
21.20 MHz	28.3'	5.1'	56.6'*
24.90 MHz	24.1'	4.3'	48.2'
28.40 MHz	21.1'	3.8'	42.2'*
29.50 MHz	20.3'	3.7'	40.7'
50.20 MHz	12.0'	2.1'	23.9'
52.50 MHz	11.4'	2.1'	22.9'

* - Very Good Novice Antenna(s), also

As you can see from the chart, many of the dimensions for an EDZ are the same as a dipole for other bands. This helps explain why a center-fed antenna, fed with ladder line, will work so well on multiple bands. It is a 1/2-wave on one band, 1-wave on others, and EDZ on yet others. Another principle that allows one to "get away" with the ladder line feed system is the good old "Gootches' Principle", which states that "RF Gotta go SOMEWHERE!"

So, if you have the real estate, the time and the inclination, try out an EDZ in your Antenna Farm, or for Field Day,and see what sprouts up in the bands, and in your log...

72/73, Keith, FD '97 Chair, QRP-L #582
Trustee, KB2YTW/B 10 Mtr Milliwatting Beacon (250 Mw @ 28.2870 MHz)
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A Tilted Off-Center Fed Long-Wire

In the December, 1995 "QST", there is an article on a tilted (sloped) long-wire array called "The Super Sloper", by Roger Sparks, W7WKB. What Roger had done was to model a tilted long-wire with a parasitic director with his computer. What he found can be applied to a simpler array utilizing just the long wire with an offset feedpoint.

A basic long-wire will have a pattern that differs from the classical 1/2-wave antenna. The radiation will be more off the ends of the wire instead of the sides, with the major lobes lining up closer to the wire direction as the length in increased. The major lobes form a squashed cloverleaf pattern, with the center of the pattern partially filled with the minor lobes. (By definition, a minor lobe is any lobe that is -10dB when compared to the strongest major lobe...) These lobes run from 45-degrees off-axis for a 1-wave long-wire, to 25-degrees off-axis for an 8-wave long-wire. Most amateurs don't have room for anything greater than 8 wavelengths long, even on 10 Meters, so we won't discuss them here.

One thing that is overlooked is that these major lobes also display a radiation angle, (vertical angle), equal to the offset angle. By tilting the wire, the major lobes can be depressed to the horizon, which will make the antenna more unidirectional. A good compromise angle is 30-degrees, although even a 15 - 20 degree angle will produce a front-to-back ratio. This angle can be achieved with a 40-foot high support at one end, and a 10-foot high support at the other, with overall lengths of 70 - 150 feet.

The offset feed point is used to enhance the unidirection characteristics and to feed the antler at a current node, which brings the feedpoint impedance down to a more manageable level. Basically, the feedpoint is 1/4-wave from the high end of the wire, with the total length of the wire being equal to an integral multiple of 1/2-wave, (1-wave, 1 1/2-wave,2-wave, etc...) For the example, I will model this antler for 20 Meters, with a 1-wave version, and a 1 1/2-wave version:

1-Wave Tilted Wire		1 1/2-Wave Tilted Wire	
Frequency	= 14.200 MHz	Frequency	= 14.200 MHz
Total Length	= 67.5 feet	Total Length	= 101.5 feet
Feedpoint	= 16.5 feet	Feedpoint	= 16.5 feet
Approx. Gain	= 2.5 dB	Approx. Gain	= 3.0 dB

The length of the 1 1/2-wave Tilted Wire may look familiar, and it should. A G5RV is 1 1/2-waves at 20 Meters, but is fed in the center. By moving the feed to the end, the feedpoint impedance will fall in the range of 130 - 170 Ohms, which, when fed through a 4:1 balun, and 50 ohm coax will yield an SWR of 1.6:1 or lower. This is easily in the range of even the most basic ATU's, and may be usable without a tuner at all.

The forward pattern will be about 90 - 120 degrees wide, with a F/B ratio of 6 - 20 dB, depending on tilt, height, etc... The 1-wave version, if fed directly with RG-8X or other 50-ohm coax, will have an

SWR of about 2.5:1, and will need a tuner in line for most operations. The lightest weight feedline for the Tilted Wire would be 1/2-wave of twinlead from the feedpoint to the balun, and then coax to the ATU. The 1/2-wave section will bring the same impedance down to the balun, and you won't have the weight of the balun at the feedpoint.

The principle can be extended out as far as you have room. Just keep the total length at an integral multiple of 1/2-wave, and the feedpoint at a 1/4-wave or 3/4-wave point from the end. Keep this design in mind for Field Day!

73, Keith, WB2VUO

Andy, N2TUK left this for me, and I thought that it might be of interest to all in the Klub... Keith, KE2DI

From: N2TUK@WB2VPH.#WNY.NY.USA.NOAM
To : KE2DI@KE2DI

Original from W1FYM to ANT@ALLUSA
Keith this sounds like somrthing we could try possibly
73 es CUL de Andy
N2TUK @ WB2VPH.#WNY.NY.USA.NA
Bergen, New York 14416
Date 02.07.94, Local time 14:19
****

This text describes a **terminated-vee horizontal multi-band antenna** with excellent bandwidth - used for 80 through 10 meters at Field Day, it outperforms Delta-Loops, dipoles, and inverted vees significantly. Used at 5-watt level, made of thin wire, costs under $5.00. If you can hear 'em, you can work 'em.
...

The 'W1FYM VEE antenna' consists of two legs, each approximately 270 feet long, spreading approximately 110-120 degrees, and terminated at the open end. For Field Day, a rope was strung between two trees to provide a 'feed end' support. The station was located near the midpoint of this rope. Thin, #24 magnet wire is used because it's cheap, available, lightweight, and therefore easy to tension. Mason's line is used for all other support and tensioning.

Tensioning of #24 wire is easily done by tying a series of half-hitches around the wire and pulling firmly enough to bend the wire. All strain is taken up by using mason's line.

The horizontal line and support lines should be installed slack before the wire is run. Tighten the horizontal line after the wire has been installed.

The feed line is the wire itself, between the horizontal rope and the antenna tuner. If the wires are separated about two feet when they drop from the horizontal rope, no separating insulators will be needed.
Be sure to leave plenty of wire for the feedline - that tiepoint is going to be about 20 feet up!

Each wire will leave the tent via stitching holes (no mosquitoes!), travel up to the horizontal support rope, bend to a horizontal position, and extend to a support point about 250 feet away. The far support point is thin rope or heavy string (we used Mason's line) which comes down from a nearby tree.

The wire passes through a loop at the end of the support line and bends down at a non-critical angle (45 degrees). Where it hits the ground defines the ground rod location.

The ground rod goes in at whatever angle the rocks will permit - try for at least 2 feet. Tie a mason's line around the stake, then use a series of half-hitches around the #24 wire to take up the strain. Leave a couple of feet of loose wire.

The terminating resistor can be about 1/4 of the transmitter power, and should approximate 600 ohms. One end goes to the ground rod, the other end is connected to the loose end of the antenna wire. Be sure to strip the end of the antenna wire. Soldering is not necessary for short-term installations. Note that the resistor takes no strain.

Raise the support loop to the desired height before proceeding to the next step.

A second leg is run at about 110 degrees to the first using identical techniques.

Raise the horizontal support rope at this time, which should pull the entire antenna tight.

The antenna pattern is broad and directed down the centerline of the vee, radiating towards the wide end.

A useful variation of this antenna uses a third leg. By selecting two adjacent wires you can select your antenna pattern.

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