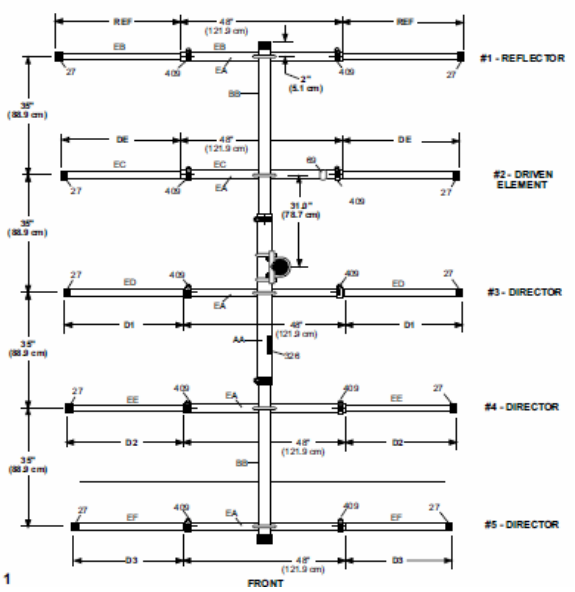
Okay, Just One More 6 Meter Light Yagi for DE and RI N6MW 10/27/2019

My last 'ultimate' 6 m yagi failed to find DE and RI over the 2019 season. Briefly thought of actually buying another but my support facility is not up to the weight. Scouting around I ran across the Cushcraft A50-5S which is a 5 el 6m yagi with a 12' boom at a weight of 11 pounds.

Now my prior yagi has 4 el and 10' boom so it naturally occurs to use the parts of the prior one to make a light weight version (knock-off) of the A50-5S since the analysis of element lengths, spacing and gain optimization has already been done. Would need to get tubing for another element but that's okay.



A catch is that the matching for the Cushcraft is done by the dreaded gamma match method - a complication best avoided for the builder, especially if you plan to run higher power. This builder is a fan of the direct feed, where possible, or the Hairpin as a second choice, again if possible. It is not obvious that either of these can be made to work for the A50-5S element configuration.

So first step is to find out what the raw input impedance of the given configuration. EZNEC makes quick work of this and it appears that it is about Zant ~ 15-j10 on the low end of 6 meters so direct feed is out. The good news is that such an impedance, perhaps with adjustment of the length of the driven element, could be matched with the Hairpin Match.*

So, after some hairpin calculations, an inductor with XL ~ 40 ohms is placed across the feed point in the EZNEC model. The inductance is varied and then the driven element length adjusted and it is found to be possible, in theory, to get SWR under 1.5 over a frequency range of interest (CW->FT8).

So 2 new tubes are ordered for the driven element and all four of the elements from the old 'ultimate' 4 el beam will be reused. The tubing/rods that make up the new five elements are an odd mix of 3/8, 1/4 and 1/8" lengths which will not be provide here since your junk box may vary. However, it is well known that the resonance frequency of a length of tubes of different diameters changes with the mix. EZNEC can provide an estimate of this.

So the resonance of each of the A50-5S elements, with their appropriate diameters, was estimated by EZNEC. Then EZNEC was used with the tubing size mix for my existing elements and the lengths of

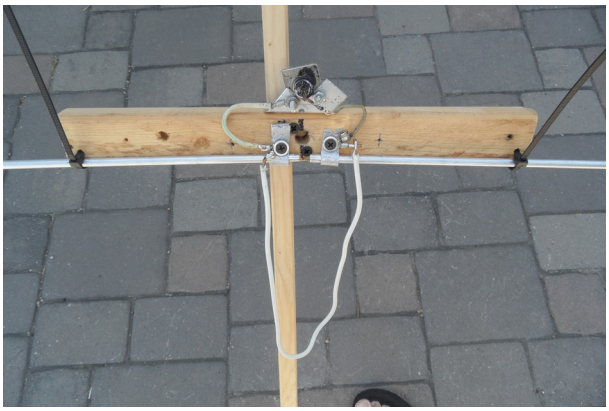
the physical elements were then adjusted give the same EZNEC resonance as the corresponding A50-5S elements. At this point the needed length of the driven element is TBD since adjustment will be required, along with a hairpin element, to match the impedance empirically.

The physical construction is very similar to that for the prior 'ultimate' case with 1X2 boards (carefully selected to be straight) for the 12' boom with less than half of that doubled with 1X2s for center strength and to support the elements. The first director, D1, was constructed from the prior driven element (DE) and the gap was bridged with an aluminum strip.

For the final tuning, the antenna was assembled with the DE length at a nominal test value. The antenna was then raised to ~ 5 feet and the SWR/Impedance measured with the sometimes trusty MFJ using a short length of coax but no hairpin yet. The result was a SWR that was, remarkably, ~ 2.0 or bit less over the low end of the band. The MFJ will not divulge the sign of the imaginary component of the impedance but it can be found by adding a known highish inductance across the feed point and comparing the two impedances by calculation. Thus the raw impedance near 50.1 MHz was found to about 50-j33, which is not terrible but also not very close to the EZNEC estimate (so be cautious in using the EZNEC estimate for complex conditions). Due to the negative sign of the imaginary part, the SWR can be improved with a hairpin addition and possible tuning of the length of DE. A none too beautiful hairpin white wire loop, pictured below, with a reactance of ~ 100 ohms was added and the antenna raised to 10' and the SWR measured through a 50 ohm 100' coax was found, amazingly, to be less than 1.1from 50.1 to 50.3 MHz. This may change a bit at full height when the season comes again.

This antenna weights less than 5 pounds and the element lengths (YMMV) are compared with those of the A50 listed first are, in inches, below. As expected, the smaller diameter elements force the elements to be longer to get the same resonance.

REF	123 125.5
DE	109.5 111+long leads
D1	108 111.5
D2	107 110.5
D3	106 109.5



See you starting in May 2020.

* The Hairpin Match, Jun 2013 - QST (Pg. 30) by N6MW. A version is available on N6MW webpage.