Add 6 Meters to Your Triband Trap Yagi

This approach is almost painless, stealthy and gets the job done.

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Back in the 1950s, HF transceivers were just starting to replace separate receivers and transmitters and our DX bands were 20, 15 and 10 meters. The triband trap Yagi became a very popular antenna for those who wanted to work DX but couldn't swing separate monoband Yagis for each band. Many amateurs also operated on 6 meters in those days, but the equipment was usually separate from the HF gear — the focus of VHF specialists, in many cases.

Fast forward to 2011 and almost all current "HF" transceivers also cover MF (160 meters) and VHF (at least to 6 meters), with similar performance, power and features as on the HF bands. A look on the towers of many amateurs will yield a view of the same type (or even the same) trap tribander from the '50s.

That Was the Situation at W1ZR

In my case, the triband Yagi was a relic from the '80s I obtained for a price too good to pass up. I didn't actually have a tower to put it on, and after getting the neighborhood acclimated to the driven element tied to the top of my chimney for a few years, I took the plunge and sunk a pipe mast next to the chimney, put on a rotator, and — one piece at a time — the Yagi grew in place of the solo driven element.

During the same period, I retired my old 160-10 meter transceiver to replace it with a modern unit that covered 160 through 6 meters. Now my radio had outpaced my antenna farm. I could operate 6 meters using my 100 foot center fed Zepp, but I had nulls every few degrees all the way around — something had to be done.

The Mast Thickens

My challenges were twofold. First, because my rotator was mounted on top of a mast, rather than inside a tower, I had to derate the rotator's wind load capability by 50%, and avoid any bending moments resulting from loads above the rotator. That put the tribander right above the rotator. To add 6 meters, my first thought was to investigate the low wind load Moxon we reviewed in 2004, secured a few feet above the tribander.[1] Unfortunately, my modeling indicated that installing them just a few feet apart would result in significant degradation of the gain and pattern of both antennas — back to the drawing board.

I had been very pleased with the results of my 40 and 20 meter skeleton sleeve dipole described in a recent *QST* article — could I use the same technique to add 6 meters to my Yagi?[2] *EZNEC* modeling indicated that it could indeed work — and work very well.[3]

This gave me two significant advantages:

- I had sidestepped the wind loading and bending moment concerns. The added elements were right above the rotator and the thin elements were largely in the shadow of the tribander's elements or boom, depending on relative wind direction.
- Perhaps even better — I did not need an additional feed line. The HF feed line, going to the split driven element, would also feed power to the 6 meter Yagi. This occurs through parasitic coupling, so no connection to the tribander is required.

The Details

Before I proceed, I should give credit where due. Following publication of my two band "skeleton sleeve" dipole article, I found that the parasitic coupling to a single element was presented in an antenna article in *The ARRL Antenna Compendium, Volume 5* by Gary Breed, K9AY, also the developer of the low frequency receiving loop that bears his call letters.[4] Gary called it a *coupled resonator* antenna — perhaps more descriptive a name. There's nothing new under the sun — it would seem.

Design Approach

The usual issue with Yagi design is that there are many variables as well as many objectives. The primary variables are element length and spacing while the objectives are generally forward gain, front-to-back ratio (F/B) and bandwidth. They tend to fight each other to some extent, and others may find different combinations that are better in one respect or another.

My goal was to achieve reasonable Yagi performance with elements comfortably between those of the tribander. Using *EZNEC* modeling, I was able to find a set of dimensions that were predicted to work well starting from the National Bureau of Standards (NBS) baseline of 0.2 λ parasitic element spacing.[5] The modeled forward gain was within about 1 dB of a similarly sized three element Yagi in the same space but without the tribander — not a bad trade, in my view.

The loss in a mismatched transmission line is a particular problem at VHF, so it is important to match to whatever impedance the Yagi offers. In a traditional VHF Yagi, the low impedance is generally transformed to a matched value through an adjustable matching arrangement. For the coupled resonator with no direct connection this is accomplished, as predicted by Breed's formula, by adjusting the spacing between the HF driven element and our coupled resonator. I found that adjusting the center-to-center spacing from about 4 inches (the minimum possible with the mounting hardware) to the 10 inches shown, I could increase the impedance of a single element coupled resonator from 45 to 120 Ω. The same adjustments resulted in a reduction of element resonant frequency

[1]Notes appear at end of article.