A Modest Antenna Rotor Installation

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Last winter I lost my VHF "tower" to a wind storm. The tower was actually nothing more than a four section push-up TV antenna mast. These things used to be available from numerous sources, but are now becoming hard to find. My old installation consisted of the mast extending through a U bolt at about the 22 ft point on my house, near the peak of our second story. I rotated the entire tower by hand at the base. The antenna system consisted of a three element Yagi for Six meters (Cushcraft) and nine elements on Two Meters (M-Squared 2M9, 9 element horizontally polarized.)

The damage was interesting. The position of the beams was such that the fall drove the elements of the 6M antenna right into the ground. While they were buried for a couple of inches, the beam was not damaged. Further, the 6M antenna almost kept the 2M antenna from hitting the ground. The only damage was a slight bend in the driven element, which was easily bent back to the original shape. But the push up mast did not fair so well. The upper section was bent enough that all I could do with it was to saw it off. And once I tried to put the three remaining sections up, I found that the remaining upper mast piece was bent enough that I didn't want to use it. I was able to find a three section telescoping mast to use as a replacement at Lowe's, although it took a couple of trips. The folks on the floor told me they didn't have such a thing.

I vowed that the replacement system would not blow down, at least in any "normal, modest storm." I also decided that it was time for a rotor. This led to some interesting results. I didn't really want to go so far as putting up a real tower, although that would have been nice. Rather, I wanted to continue with a more modest structure based on a push up mast. But I wanted to turn my modest VHF "Christmas Tree" stack, so I decided to bite the bullet and purchase a normal rotor. One was ordered, and while I was waiting I downloaded the manual. Study of this provided specific data about a ham type rotor when mounted with an adapter plate to a push-up mast. The data was extremely discouraging. The result was that the rotor was not capable of any wind load if even the modest antennas that I had planned were to be mounted on a mast section of 6 ft or so above the rotor. A single antenna was not a problem so long as it was only a few inches or a foot above the rotor. The situation was virtually identical with data I found on the web for Yaesu and Hy-Gain Rotors. I canceled my order.

This is not a condemnation of the products from either company. I suspect both would be more than ample for any antenna I would ever consider, if the rotor was mounted on the inside of a tower with a thrust bearing above the rotor. The thrust bearing transfers the wind load that is parallel to the ground to the tower and isolates the housing of the rotors from the forces that would otherwise cause cracks in that housing.

I concluded that if I was going to be dealing with a compromise system, I may as well use a simple TV rotor. My thinking was that if such a thing failed because of wind, it

would at least not be a major investment. I was in the process of looking at such rotors when Rick, KK7B, suggested I also look into a thrust bearing that could be used with TV rotors. I had never heard of such a thing, but soon found a listing on the web. I ended up ordering a TV rotor (NTE model CB-105) and a thrust bearing (ECG Model TB-105) from Amateur Electronic Supply in Wisconsin. Even with shipping from their Nevada store, the price came in at about one third the cost of the higher performance ham rated rotor.

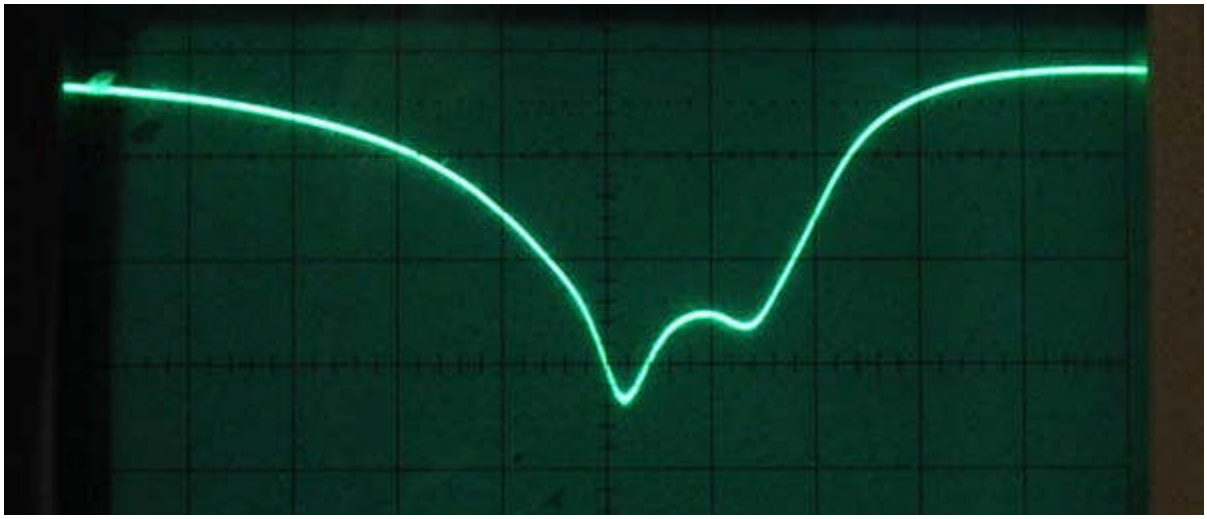
This photo shows the M^2 2M9 on top of the new push-up mast with the thrust bearing several feet above the rotor. The rotor is only about 1 foot above the peak of the roof , which is only a foot above the point where the push up mast is bolted (FIRMLY) to the house.

One minor hiccup was encountered during installation. I had planned on using a 1.25 inch diameter TV mast section above the rotor. I then discovered that the thrust bearing is designed for use with a 1.5 inch OD pipe. Fortunately, I found a 7 ft piece of 1.5 inch aluminum pipe in my stash in the garage. That not only saved the project, but provided me with ammunition for discussions with my better half. "Yes, there is a reason for saving all of those pieces of metal....." The thrust bearing required quite a bit of work with a file, but it eventually fit on the pipe. (Many thanks to KB1T for the contribution of the old beam part when he left the northwest.)

 The thrust bearing sits about a foot below the Yagi boom. Transmission line loops down from the antenna with a loose section around the effective rotation point, which is now the thrust bearing.

 The rotor is bolted to the top 1.25 inch OD piece of the push up mast while the 1.5 inch OD rotating mast sits on top of the rotor. The bottom of the loop of transmission line (a 50 foot piece of LMR-400 with N connectors) is held to the fixed mast with cable ties.

The view to the east from the "eyes of the Yagi." Those trees have got to be a propagation problem. The shot to the north is not as bad. The coax loop is evident in this view.



This plot, taken with a return loss bridge, spectrum analyzer, and tracking generator, shows the impedance match at the shack end of the feedline. The center frequency is 144.0 MHz and the span is 1 MHz per division. The return loss at the bottom of the band is 30 dB, while it degrades to about 16 dB at 146 MHz. This performance is exactly that specified for the antenna. Moreover, this is the result obtained "out of the box" with no additional tuning.

Conclusions: What Next?

Now that the 2M antenna is in place, the next step is the addition of a 6M antenna. This is shown below.

The three element 6M Yagi is now mounted about 4 ft below the 2M antenna. It is fixed, pointed east. No transmission line is attached to the 6M Yagi. The driven element will be removed and modified tomorrow so a piece of LMR-400 with an N-connector can be used instead of the 30 year old piece of RG-213 that had been on the antenna. I have periodically measured the line for insertion loss and it met spec the last time I measured it 3 or 4 years ago. Like people, lines don't always need to be discarded with age.

This is a pretty casual and lame offering for the web and we won't keep it up if the memory is needed for something else. On the other hand, some folks may not be familiar with the availability of cheap thrust bearings. They have the capability, in concept, of turning an inexpensive TV rotator into something that could handle small ham antennas with more reliability than normally attributed to such an implement. It would be wonderful if a suitable thrust bearing and an offset mounting scheme was available for the modest ham rotators. This would then allow them to be used with less expensive masts while retaining much of the performance that they would offer when mounted inside a tower.