

My Tower Project 2022 (or "How I spent my summer vacation") -Rick VE3ORY

The tower project is finished for this summer.

Phil may be slightly disappointed since, both the tower and the antenna, are a mere shadow of their former selves.

For the time being, I installed only two tower sections on top of part of a third section which is imbedded in the concrete. Another 10 foot section is ready to install, once I have the antenna configuration finalized. At the existing height I can work on the antennas from the garage roof, rather than having to do it from the tower. This puts the antennas high enough above ground that there is minimal effect on antenna tuning, and still leaving them somewhat accessible. With about 7 feet of mast above the top of the tower, this puts the 2 element tri-band antenna at about 23 feet above ground and the 6-meter Yagi is at about 27 feet.

Adding another 10 foot section will be doable, although it will require some dismantling of the tower top section and antennas. But it would be good to get everything up at least another 10 feet.

Most of the work I have done myself, other than advice from Tim VA3TIC and Greg VE3PJ, and some assistance from Tim in getting the second section on the base. Tim was also great in helping me with final routing of the coax cable loops between the fixed top section of the tower and the rotating mast, so that the coax is not damaged while rotating the antennas. It was really handy to have someone who has done a lot of this himself. Tim stood back, looking at the big picture, and gave me instructions on where to place the cables, while I was at the top of the tower.

If possible, I wanted to make the tower self-supporting and not requiring any bracing to the garage roof. Here in the 'Limestone City', digging a hole deep enough to accommodate that using just a pick and shovel was a real treat. Actually the digging was pretty easy until I got down below the roots of the grass, at which point I started running into numerous chunks of rock...some actually the size of small boulders, that I was barely able to lift out of the hole by hand. Now I know why Kingston is called 'The Limestone City'.

So I only got down about 30" deep with a hole that was about 4 feet wide and extending out about 6 feet from the garage foundation. I built an enclosure around the section that I wanted to fill with concrete and after getting the base piece of tower positioned, I mixed 10 bags of concrete (in my wheelbarrow, with a shovel) and poured that around the tower legs to keep that piece in place while pouring the rest of the cement.

Calculations based on the dimensions of the pad indicated that I was going to need another 0.6 cubic meter of cement...which works out to about another 70 bags of pre-mix concrete. So I added a bunch of re-bar around the tower legs and put in an order with 'Bestcrete' here in Kingston, to have them come and pour the rest. (There is a limit as to how much I will attempt to do myself).

I decided that I did not want the concrete pad butted right up to the garage foundation. So I used some of stone and earth from digging the hole to fill in the space between the pad and garage. Reasoning was to avoid any shifting of the tower pad from damaging the garage foundation. I'm not a structural engineer, but it seemed like a good idea to me. Then again, I think the concrete pad is not likely going to shift much. Anyway this is what I came up with.

By the way...what you are looking at here is some of Phil's handy work. Years ago, he fabricated and welded two sections of tower to add another 20 feet of height to the existing tower sections. I hope Phil is not too disgusted with me for having cut up one of his fabricated sections and buried it in concrete. At least your handy work is still performing a useful purpose, Phil.

Phil also pointed out that this tower, now erected next to my garage, has travelled around the world courtesy of our Canadian Forces. So I am honored to now have a tower with some history, even though it is now camouflaged to look like a maple tree (my signature paint scheme for antenna structures to make them less conspicuous for those who don't appreciate ham radio antennas).



The larger rocks are some of those that came out of the hole. At the point where I gave up digging there was even larger boulders than these. This hole was not going to get any deeper without calling in some heavy equipment. So at that point, I decided it was "deep enough".



Waiting for 'Bestcrete' to come with their cement truck to pour the rest of the concrete...



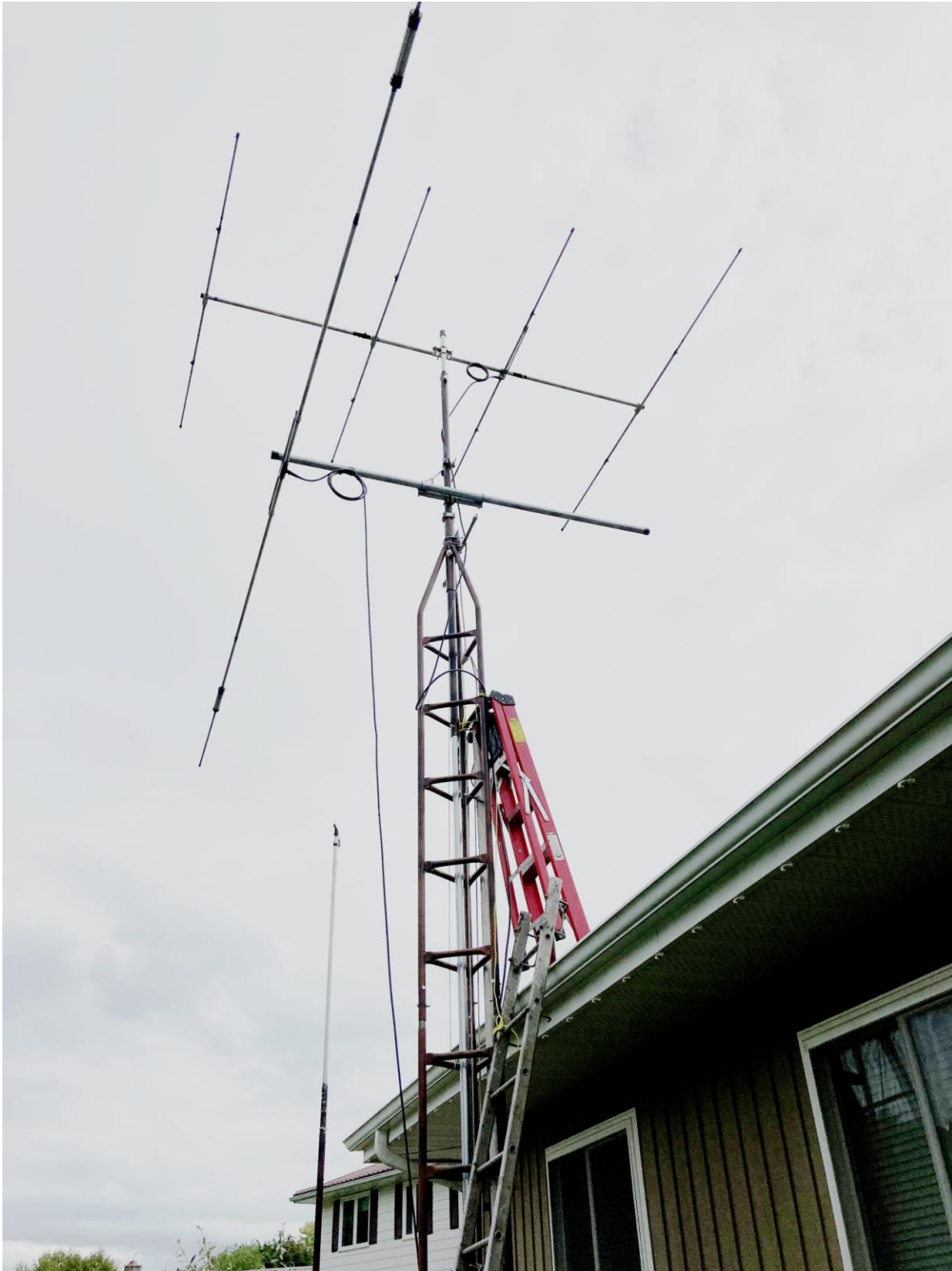
The new concrete pad and the first 10 foot tower section bolted to the base.

Initials in the cement of all the persons that helped me in getting this far.

The threaded rod imbedded in each corner of the pad are there in case I decide at some point to modify the base to create a tilt-over tower. Knowing me that won't probably happen. But if I change my mind there is provision for bolting a sturdy mount to the concrete pad. The only problem with this arrangement, is that I keep tripping over the threaded rod while working at the base of the tower...



Two sections of tower erected, and installing antennas and hardware. This is where being able to work off of the garage roof is pretty convenient. Although, I did need to purchase a safety belt and lanyard for working above the top of the step ladder. At this height I can rotate the HF Yagi so that I am able to reach the traps and outboard tips of the elements while standing on the garage roof...handy for adjusting tuning of the antenna elements.



Telescoping sections of the antenna mast sleeved together and pinned... extending all the way from the base of the tower up to 6 meter Yagi. Pinning sleeved sections allows me to uncouple them and slide a section down out of the way to accommodate installing additional hardware (rotator / thrust bearing) or for disassembly to accommodate adding another section of tower. This turned out to be a convenient arrangement, when it came time to install base plates for the thrust bearing and rotator. Also, by removing a lower section of the mast, I can slide the top part down through the thrust bearing to allow access to the antennas.



A Yaesu GS-065 thrust bearing mount just below the top of the tower. I designed a pattern for both the thrust bearing and the rotator base plates, and then had them fabricated for me by 'Emmons Welding & Fabricating' here in Kingston.

The sleeved/coupled sections of mast running up inside the tower allowed me to un-pin a lower portion of the mast and drop it down far enough out of the way to allow me to slide the thrust bearing and its' base plate up into position, without having to disturb the antennas. I love when my projects work out as planned (which isn't always the case)...



The tower has a nice 2-foot long sleeve welded at the top of the tower. This provides a lot of lateral support for the antenna mast that slides through this sleeve and extends another 8 feet above the top of the tower. The short piece of stainless pipe attached just below the top of this sleeved section is actually a piece that I kept from our old Chris Craft yacht. Its' main purpose is to provide a convenient place to wrap my safety belt lanyard around, so that I can stand on the top wrung of the tower with my safety belt tied off at waist height. From that position, I can safely reach up to a few above the top of the tower.



The trickiest part of mounting the thrust bearing and rotator was in getting the base plates positioned accurately enough so that the mast is centered all the way down through the tower sleeve / thrust bearing / rotator assembly, so that there is no binding as the mast rotates. It worked out well though. Weight of the mast and antennas is completely supported by the thrust bearing, such that I can actually remove the rotator at the base of the antenna. And it rotates smoothly enough that I can turn the antenna by hand.



The rotator mounted 4 feet above ground, at the base of the tower. If necessary to perform maintenance on the rotator, I can un-couple the bottom portion of the mast and move it up out of the way, to allow easy removal of the rotator.



Before filling in around the pad, I buried a 10 foot piece of 3/4 inch copper tubing that wraps around the outside of the concrete pad to provide an electrical ground. Research recommended that the ground rod not be imbedded in the concrete, but rather in contact with the earth around it. Seemed to make sense to me, so that's how I installed it.



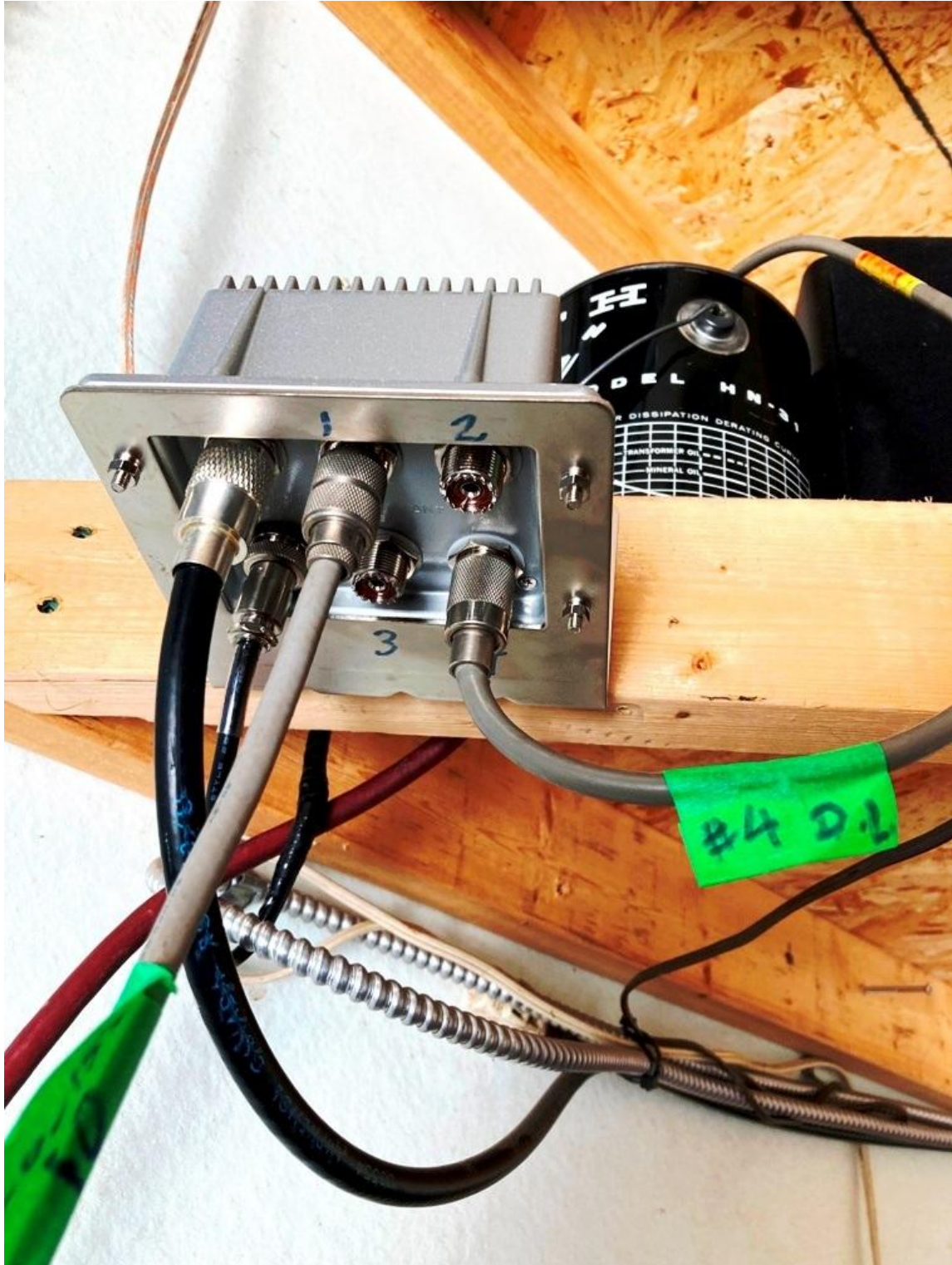
And the tower bonded to the buried copper ground...



Coax and rotator cables come through the wall and into the garage via an LB just above the foundation.



Coax cables from each antenna on the tower are connected and selected via a Yaesu FAS-1-4R remote antenna selector relay switch mounted overhead, immediately above where the cables come through into the garage. This is a nicely designed relay switching unit, with a good quality weather enclosure. In spite of that, I really like being able to house the relay unit inside the garage, rather than out in the weather. It is capable of switching 4 antennas, so there is room for further expansion. Currently, I have one of the unused antenna positions connected to an old Heathkit 'Cantenna' on the shelf above the relay unit.



My shack is at the complete opposite end of our house from where my tower is mounted next to the garage. Fortunately there is a panelled ceiling throughout the downstairs that provides access for a convenient way to run cables from the garage over to my shack. However, that cable run from my radios out to the remote antenna switch in the garage, is roughly 80 feet. So for that I used a 100 foot length of 1/2 inch Heliac, that I purchased from an estate sale a couple of years ago. The Heliac has short pigtailed of RG-213 for the connections at the radio end and out in the garage for input to the relay switching unit. The Heliac provides minimal losses and complete shielding, although the 1/2 inch stuff is somewhat awkward to work with, and requires pretty large radius bends. However now that it is installed, I should never need to replace it. And it is all indoors.

This is the transition out in the garage from the 1/2 inch Heliac to a short run of RG-213 going to the input of the remote antenna relay unit.



The Yaesu FAS-1-4R remote antenna selector unit was originally marketed by Yaesu to be used in conjunction with one of their high-end external antenna tuners. And the relay unit was designed to be plugged into, and controlled from, the antenna tuner. Both the tuner and the antenna relay switch are now discontinued by Yaesu. My relay switching unit was purchased via an add that I saw on KWARC , and was in like new condition. However I needed to come up with a control unit for switching the relays.

Fortunately the design of the Yaesu relay unit uses a clever 12 volt, 4-wire connection between the control unit and the relays. So it was easy enough to modify the control head from an old Heathkit antenna switching unit to work in conjunction with the Yeasu relays. This one I also found on KWARC for \$25. I needed to replace the rotary wafer switch and re-wired it completely to suit the Yaesu relay switching unit. And also had to run another multi-conductor cable between my shack and the garage at the other end of the house. The old drop-panel ceilings aren't very attractive, but certainly are handy when it comes to running cables into one's ham-shack.

This little Heathkit control box looks almost stock. Even the terminal strip on the rear of the enclosure was able to be re-wired for the cables running out to the relay unit. Externally, the only thing that I changed on this enclosure was the knob on the switch, and a 12V D.C. power cable to replace the original which was wired for 120V AC input to a transformer inside the enclosure. I have a long history of modifying radio equipment :)



And the classic 'hy-gain' rotator control unit. I modified this too! But, only to replace the illumination for the meter. I don't even remember where or when I bought this rotator. I think it was from one of the estate sales that Ron VE3GO handled. But I lucked out with this one. I took the rotator apart completely, cleaned and inspected it. Then after cleaning and re-lubricating the bearings and race, I put it back together and it has worked beautifully. Even the problematic wire-wound resistor that provides direction indication was in excellent condition, and has worked without any issues.



Did I mention that I like to modify everything? My antennas haven't escaped that obsession either. My two element HF tri-bander was originally a Mosley CL-33. In fact Phil is likely somewhat disgusted with me in this regard as well, since we think that this was once his antenna also.

These were great performing antennas. But unfortunately the fiberglass coil forms used inside the traps were stressed in the design, and prone to flexing which eventually results in the coil form breaking. Wire used for the coil windings was very robust however. So when the coil forms break, the end result is that the coil windings spread, meaning that the inductance changes and the traps then become detuned. So I dismantled and repaired 4 of the 6 traps from this antenna (all of which were broken) by installing a wood dowel down the center of the coil forms to stiffen them and epoxy to hold the coils back in place. It seems to have worked reasonably well as the traps appear to be pretty well tuned to the proper frequencies.

The 18 foot boom for this antenna was also damaged. And I had concerns about the antenna extending out further away from the house than I wanted. So I cut it down to a 10-foot boom and used only the driven and reflector elements. Again my apologies to Phil for doing this to his old antenna. I'm calling it my 'Urban Mosley'.

The antenna still works pretty well, even with only 2 elements. Experiments with rotating the antenna while monitoring a strong signal shows about a 4 S-Unit difference when rotated so that the station is off the side of the antenna. And about a 2 S-Unit difference in front to back signal ratio. So about all that I could expect from a 2 element beam that is only about 23 feet above ground. First 20m contact with it was with 5K0C in San Andres & Providencia on FT8, and SWR is reasonably good on 20-15-10 meters.



So far, no complaints from the neighbours...only the usual questions..."Is that one of those old TV antennas?"..."No"..."But it would work for that, wouldn't it?"...No, it is a ham radio antenna"..."Oh!?, Ok well have a good day". I'm OK with those kind of questions. The ones that I fear are the "Could your antenna be the reason that my internet isn't working at our house?" type question.

And, because it is on the far side of our garage, my wife can't see it most of the time. So she is able to pretend that it doesn't exist... except for when we are driving down the street and approaching the house from the north. During those times I try to distract her by pointing out something else at one of the neighbour's houses. I've also told her that if I get the antenna up another 10 feet, it will be even less visible...unless she looks up at it.

