

ROY'S ANTENNA FARM

When I was stationed at Davis Monthan Air Force Base, Tucson Arizona, I got my call sign, **W7YRV**, in January 1954. I hold this call to this day. I had been thinking about a big antenna for a long time so I built a *multi vee beam antenna system* on my dad's ranch 100 miles south of Tucson and a few miles north of the Mexico border. From the center tower I pulled seven wires spaced 30 degrees apart and 600 feet out and 40 feet high. On the center tower I have a relay box that allowed me to select any of the six antennas and bring it down on a 600-ohm transmission line to the shack. There I had a globe scout running 40 watts with a 6146 in the final amplifier. This was a great antenna and I used it on weekends for over a year till I was transferred overseas again. Fellow hams would accuse me of running too much power and I really liked being patted on the back like that. This antenna worked just great on all bands from 80 meters thru 10 meters. It was especially good on the higher bands with a gain of about 10 dB.

During my Air Force career I had the good fortune to work on some really big transmitter sites and I always yearned to have a big antenna farm some day. Anyway, I was 70 years old before I could afford to buy a nice ranch and I thought, "I am going to build some of the biggest and best wire antennas ever made." I started off with a *bigger and better Vee beam antenna system* than the first one. The main tower had to be climbable so to start, I built a 65 foot steel tower using 3/4 inch water pipe that I happen to have a lot of laying around. I used 3/4 inch flat steel spaced 12 inches for the ladder rungs and 1/2 inch flat steel for the diagonal pieces. This was my center tower that all the wire would pull from. I pulled 10 wires spaced 20 degrees apart and 600 feet out and all were 65 feet high. The relay box allowed you to select an apex angle of 40, 60, 80 or 100 degrees and all of the unused wires were grounded. Also, you were able to rotate this antenna in 20 degree increments, full circle, on any selected apex angle. This was a great antenna and I had a lot of fun with it but a few months later I decided to make some improvements.

The Vee beam is like one half of an un-terminated rhombic. The rhombic has a gain of three dB more so I pulled 8 more wires making 18 total. It was possible to modify this un-terminated rhombic in a diamond shape fed on either end into to an X shape, fed in the center, and both have the same characteristics. So now, with a new relay box, I could connect the open wire transmission line to the center of this array, one wire to the two wires on the left side of the X and the other to the two on the right side. Now, I was able to rotate this reconfigured rhombic full circle in 20-degree steps and select any of four apex angles depending the frequency I wanted to use. That was about the most versatile antenna anyone could ever want. The relay box is a very complex circuit and it took me quite a while to get it right. I used this antenna for about two years and it was great fun. It has about 6 dB of gain on 80 meters and about 15 dB on 10 meters. To improve the antennas low angle of radiation it could be made much higher. I learned later that you could use the chain link fence corner post pipe, which is much heavier and then have heights up to 120 feet. That would have upped the cost somewhat and doubled the labor time, but if I had it to do over again that's what I would have done. One of the shortcomings of this antenna is that you have a lot of minor lobes. This is great if you have only one or two antennas, but with 18 major lobes it is kind of distracting compared to antennas like the Sturba Curtain that has two clean major lobes. Another problem is that during thunderstorms, it does a lot of hissing and sparking, although I never got a direct hit from lightning, it did seem like a good time to wait for better weather. There were a lot of lightning hits later with my taller towers so maybe all that wire in the air makes it less likely to be hit. I just don't know. *In hindsight, this is by far the best antenna I ever built.* However, I wanted to experiment with much taller antennas like rhombics, Sturba Curtains, and collinear arrays. At that time I thought 120 feet was high but later I got into 200-foot towers. That antenna covered the whole forty acres and it was not high enough to build other antennas underneath so it grieved me a lot to tear it all down.

The next big antenna was *three rhombics, 120 feet high, 600 feet per leg* using only six towers. I had an open wire transmission line connected to both ends of all three antennas and routed them back to my relay box. That relay box allowed me to select any of the six directions and connect the termination resistor to the opposite end. These were great antennas, but not any better than the reconfigured rhombic system. The antenna was more impressive on the low bands. The shortcomings of this antenna system were the lack of major lobes. It also took up the whole 40 acres.

During that time, I tried a 24-element Sturba curtain at 120 feet on 20 meters. Now this antenna was real impressive. It had super high gain in two directions and no side lobes. So a few months later, I tore them all down and built *six Sturba curtains at 120 feet high* supported with only five towers. There were 24 elements; three were 12 elements and they were all fed with open wire line brought down to a location near the shack and fed with 4-1 baluns. All six coax lines came into the shack. This is the ham's dream antenna. You have over 12 dB of gain in twelve directions with no side lobes. Its hard to imagine what its like to have a 20 over 9 signal off the end of your antenna and you switch just 30 degrees in either direction and have the signal fall by about 40 dB (Of course this is only under ideal conditions). When you hear a DX station, no matter how weak he was, your chance of getting him was almost certain. This antenna is so good that you soon get tired of working twenty meters because you don't like to hear the guys say "Tnx for the QSO, you're 5 & 9 plus. QRZ." and not even give his name. Twenty meters is the pits.

My next antenna was for 80 and 160 meters, because I am a dedicated rag chewer. I used the same towers that the Sturba curtains were on. This antenna had *six 3- element 80-meter wire beams and 3 two-element 160-meter wire beams* supported on six 120-foot high towers. The wire beams were full size with 1/4 wavelength spacing in the 80-meter antennas. Two of the 80-meter beams were facing opposite each other, used a common reflector, and when looking down on them they looked like a rectangle. The wires used to hold up these two antennas were also the 160-meter two-element beams.

The two other antenna assemblies like the one just described were placed in a triangle and when looking down on them, there were six 80 meter antennas looking in six directions and the three two-element beams looked three directions. This whole assembly was held up 120 feet by the six outside corners and it did sag in an unsymmetrical manner. So, I let it down and tied the inside of the 80 meter directors to look like 3 spokes to hold the inside triangle symmetrical once it was raised up. It still sagged some but it did not affect the performance. The antenna preformed beautifully on 80 meters, but it was not better than the reconfigured rhombic. It was fun to say you had a full sized, wide spaced, 3-element beam, 120 feet high on 80. The two element beam on 160 was very impressive also and it was on par with the rhombics in their given directions. I had a friend Brian, K7ON, who came down one day during a 160 meter CW contest and won the highest score in Arizona even though he slept thru a good part of it.

I used this antenna for about a year. It was fun but I thought I would try a Sturba curtain on 80 meters. I *started building cheap steel towers using 1 1/4 inch thin wall tubing*. The ladder rungs are spaced one foot apart and they are 3/4 inch flat steel and the diagonal pieces are 1/2 inch flat steel. For the tubing, I bought seconds that had a little rust on them because I wanted to paint them black. I don't recommend galvanized because its more expensive and it looks bad when you're done and you still have to paint it. The total cost of these towers was about \$1.50 a foot, not counting the paint.

Here's how. First, build a wooden rack by putting seven 4 X 4 posts 10 feet apart, 1 1/2 foot in the ground. With a chalk line, snap a line about three feet above the ground and then saw off the tops of these posts. Then, nail an eighteen-inch 2x8 board on top of each of these posts. This gives a flat working bench to build the towers on. Use the chalk line and snap two lines 14 inches apart. Next, lay out the tubing on top of these two lines, putting in two guide screws to hold the tubing in place. Then, weld the tubing together. It takes a little practice welding material this thin, but it becomes easy once you got the hang of it. I used a small Lincoln wire welder, however, you could use gas but its more expensive and a lot more work. Weld three of these together and when you get the first 60 or 70 feet of the steps done. Lift one side up 120 degrees and then put the third one on the line. You need about eight 1 X 6s about 18 inches long with notches cut on one side to hold the tower in place for the next welds. When you get that side done, turn the tower another 120 degrees and slip on the wooden guides and do that side. The next step is to weld the diagonal pieces on and then paint it.

Now, move the tower to the desired location. The tower is light enough for one man to lift one end, so, move the tower to a clear spot. Stack up a bunch of cinder block about 6 feet high and put one end of the tower on top. Make another stack on the other end and set the tower on it. If this is high enough, park your pickup underneath. Put enough blocks in the bed of the truck near the tailgate to be a few inches higher than the cab of the truck. Then, stack more blocks on the front bumper till you are above the cab. Now, pull the tower down on both ends with a come along. This should get you out in the pasture if you take it easy.

After you have three of these laid out end to end in the pasture, get them as straight and level as you can. To splice the tower, you use a piece of tubing a few feet long and slice it a little more than half then cut these half s in two inch pieces. Take the two halves put them over the leg to be spliced weld them. Raising the tower will be explained later.

I built three of these towers and I hung *two eight-element Sturba curtains*. The first antenna used # 8 Aluminum wire and it lasted for about a week and it came down due to metal fatigue. The next one used #12 copper weld wire for the top wires and #14 for the bottom and #14 flex weave for the phasing lines. The top four elements had about a 150-pound pull and the bottom ones has about 50 pounds pull. The insulators on the top elements are made from one inch white plastic PVC pipe and they are two feet long. The insulators on the lower elements are two-inch black plastic sewer pipe. The phasing lines come straight down with no insulators and they are transposed on this black two inch two foot long insulator. The reason I used two foot spacing for the phasing lines is because, even in high winds they won't tangle and it would take a very large bird to tangle them. I also use two foot spacing on the transmission lines and they seem to work great. Some of the transmission lines are quite long (like 500 feet or so) and the only spacers are the ten-foot poles that held the transmission line up. These lines came fairly close to the shack where I connected a 4 to 1 balun and ran the coax into the shack.

These two antennas worked really great and I think they out performed the reconfigured rhombic in their given directions. I used these antennas for about six months. The 80-meter hams are a little different than the rest, being a little clickish, and I didn't get the pleasure all the time as I get on the other bands. I tried a 14 element collinear on 40 meters and I decided this is the band for me.

One day there was a wreck on a road about a half mile from my QTH and a helicopter came in real low on his way to this wreck and clipped the top of one of my 200-foot towers. He came back to see what he hit, but he returned to the accident. I immediately noticed that my

antenna was no longer in the air. I drove over to the accident location but the helicopter had taken off already. They called me and ask about the damage but I told them that I was glad he didn't get hurt and I had lots of insulators. When I re hung the antenna I noticed that he hit the tower about 1/2 inch from the top and had he hit one inch lower he would have taken down the tower and maybe him too.

My next antenna project was *four, forty meter, 14 element Sturba curtains* spaced 45 degrees apart and 150 feet high using five towers. It took a while to put the five towers together with what I had and what I had to build. However, in about three months it was up and running. This was the most fun antenna I ever had. This antenna had only two lobes and when you have about 15 dB of gain, you hear off the front or back and very little else. If there is DX coming in, you get to work it. The disadvantage is, in a round table you have to use your reference antenna during transmitting a lot, other wise they all would not hear you.

I had a lot of other antennas that I used when I had the space for them, such as a 150-foot tower that I had two 80 meter bi-squares perpendicular to each other plus two forty meter bi-squares inside it. I also had a full-sized four square that I used for a few years. The four square is the best there is for the money. On 80 meters, it is only 65 feet high, has a footprint of only 65 feet square plus a little room for radials and has a gain of about 4 dB. That's a lot for 80. I also had loop antennas on 80 and 160. I tried collinear arrays, they worked well, but if you can go higher, the Sturba curtain is better. I also tried the beverage antennas, but they didn't help much with my high gain antennas.

This antenna work is a lot of fun, I am almost 80 years old and I have a lot of time on my hands. To have this kind of fun, you need a lot of perseverance. You have to be physically able, you have to be an amateur antenna engineer, a mechanical engineer, a welder, and have lots of extra money plus a wife that will put up with these extreme and time consuming projects. I did almost all of this work by myself. When you have a lot of help, you are wide open to more mishaps due to communication misunderstandings. My wife helped some, for example, carrying the first aid kit and the camera. For me, I've never had it so good.

We decided to sell half of our land and that was where my three 200 foot towers were located. I tried to take them down without dropping them. I got one down safely, but we had mishaps while taking down the other two. I have video of some of that event.

Roy – W7YRV