

HOW I DID MY TOWER

Presented by:

Morris Farmer AD7SR

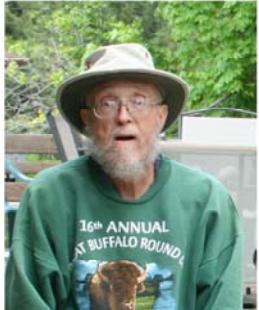
Chuck DeWitt W7DTO



Explain that this is how I did my tower, it does not necessarily represent the state of the art, nor even the right way to do any particular aspect of the tower. I invite those more experience to make comments as we go along or at the end.

Talk about why I wanted to put up a tower. Other than the radio itself your antenna is the most important part of your station. In order to put up antennas with gain you need to have a tower so you can rotate them AND the higher the better. My location is in a bit of a dip.

SPECIAL THANKS TO:



Steve Olsen AE7AC (SK)
John Stodt
Pat Redington
Bill Rouleau AE7UI
Randy Kohlwey WI7P
Jim Mallon WC7X
Dave Williams WA7GIE
Bob Kaefer K7EWC
John Farmer KF7CLN
Dallin Farmer
Carol Farmer KF7JWX



MY TOWER - STEPS

- Visit City Building codes - Permit
- Site Survey
- Antenna(s) selection
- Tower Selection
- Dig Hole & fill w/cement & rebar
- Tower Parts & Tools
- Safety Gear
- Erecting Tower
- Attaching Antennas
- Rotator & Thrust Bearing
- Cabling
- Lightning Protection
- Grounding



BUILDING CODES & PERMITS

- Visit local City Hall - City Planning office to see what hoops you have to jump through.
- Holliday wanted \$1,000,000 bond
- Tower must be 62 feet or shorter
- Must be built according to Mfg. specifications.
- Neighborhood covenants



Turned out to be easy to work with. I didn't post bond. I explained to them about Federal law requiring accommodation and that tower has to be of adequate height to accomplish communications.

SITE SURVEY

- Power Lines
- Trees
- Guy Wires
- Blue Stakes
- Visit Your Neighbors!
 - Explain What Your Doing
 - Discuss Emergency Communications
 - RFI?
- Talk to your Insurance Agent
- Potential RF Exposure issues



ANTENNAS

- Antennas help determine what tower you need.
 - HF Beam(s)
 - VHF Beam(s)
- My choices
 - Cushcraft ,40-10 meter beam
 - Comet, 5 element 6 meter beam
 - M2, 7 element 2 meter beam
- Calculate Wind load
- <http://www.championradio.com/county.windspeed.data.html>



EXTREMELY IMPORTANT!! Wind load – see ch 22 of ARRL antenna handbook. Needed to determine which rotator to buy. More than just ant sq ft and wind velocity. You also need to calculate the antenna “K” factor, or cumulative “K” factor for the antennas on your tower. It takes into effect the distance the weight is from the mast. Google ‘antenna K factor’ for more info. Also see info on Yaesu rotators on their site. I ended up buying an inadequate rotator by just going by the square feet. Fortunately a friend bought it from me because it fit his needs.

TOWER SELECTION

- How Tall?
 - Site restrictions
 - Wind zone
 - Wind loading
 - Ability to Guy
 - Dollar\$



Site restrictions include neighbor distance, power lines, height above local terrain / foliage.
Remember higher is better!

TOWER SELECTION

- Wind Zone is 70 MPH
 - [http://www.championradio.com/
county.windspeed.data.html](http://www.championradio.com/counties.windspeed.data.html)
- My chosen site > 60 feet from power
- No room for guy wires
- Wanted at least a 40' tower
- Antennas & wind load meant I required Rohn 45G class tower
- Now you can actually start putting tower up.



SELF-SUPPORTING TOWERS SS

SELF-SUPPORTING G-SERIES FOUNDATIONS

ELEVATION VIEW
25G (shown), 45G & 55G
SELF-SUPPORTING TOWER FOUNDATION

Tower Section or Short Base Section
Grade
0' min. projection above the finished concrete
#7 Bars 12" on Center Each Way
1' 0" to 3' 0" Top to Bottom
2" min. projection required for proper drainage
#7 Bars 12" on Center Each Way
Top to Bottom
Sand & Gravel Drainage Bed - not required for 45GSB

CONCRETE BASE PLATE WITH ANCHORS
25G
FOR USE WITH SELF-SUPPORTING 25G TOWERS.
ALTERNATE BASE PLATE FOR 25G BASE,
BASE BOLTS & TEMPLATE MUST
BE ORDERED SEPARATELY.

BASE BOLTS & TEMPLATE
KHBT75A
FOR USE WITH 25GUB
IN 30' > H > 40' TOWER
APPLICATION KIT INCLUDES (1) T
EMPLATE & (4) BASE BOLTS.

Tower	Max Width (W)	Concrete Volume (Cu. Yds.)
25G	4'-0"	2.4
45G	5'-3"	4.1
55G	6'-0"	5.3
45GSB 65G	7'-9"	8.9

PLAN VIEW

C_L
Tower Axis & Center of Pad
C_L
W
Square

ELEVATION VIEW
45GSB
SELF-SUPPORTING TOWER FOUNDATION

Grade
0' to 3'
#7 Bars 12" on Center Each Way
Top to Bottom
2" min. projection above the finished concrete

ELEVATION VIEW
65G
SELF-SUPPORTING TOWER FOUNDATION

Grade
0' to 3'
#7 Bars 12" on Center Each Way
Top to Bottom
2" Min.

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ROHNER 169

Note that 45G requires hole 5' 3" square w/ 4.1 cu yd concrete and #7rebar on 12" centers

DIG A HOLE



DIG A HOLE





Be sure to talk about how critical making base level is. Talk about conduit into elevator shaft – next slide

CONDUIT



PARTS & TOOLS

- Tower is in 10' segments + 5' base
- Bolts, nuts, washers, lock washers
- Thrust bearing plate
- Rotator & Rotator base
- Mast
- Gin pole
- Pulley(s)
- Rope
- Tools, carabiners, drift pin, tapes
- Tool Bucket



Mast – I bought a 20', 2" OD aluminum mast. I wanted to get .25" thick tubing, but it weighed too much and cost a LOT too much. So I settled for heavy wall tubing. So far it's stood up to everything Mother Nature could throw at it.

Need 3 types of tape – regular electrical, forming tape, and coax seal. AND BLACK WIRE TIES. Black wire ties are UV resistant BUT wrap with electrical tape to protect. Unfortunately I didn't.

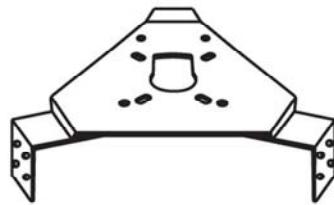
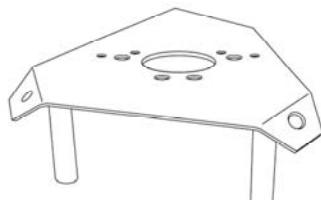
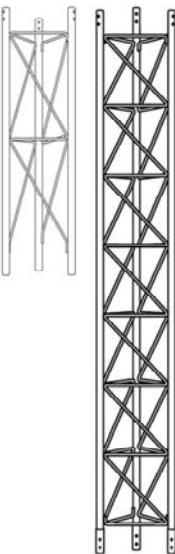
SAFETY EQUIPMENT



- Hardhat
- Climbing harness
- Safety straps
- Gloves
- Steel shank shoes
- Hardhats for ground crew



TOWER PIECES



Tower base, 5'. Tower section, 10'. Thrust bearing plate (tower top), Thrust bearing, Yeasu GS-50. Drift pin/ aligning punch = most important tool!

ERECTION TOOLS



Gin pole. Tube was one we had lying around. Might have been better to buy a new, stronger one.

Drift pin used on ground to align and swage holes, then mark for alignment. May nor be needed as much with newer ones.



Base is in and first 10' section. Now set up gin pole to add upper tower sections.



Pulley at bottom of tower – just above NEMA box. Rope goes from piece being lifted up to pulley at top of gin-pole down thru pole to this pulley then to my wheelchair for hoisting.



2nd and third sections have been erected, now at 30'. Gin pole set up to add final section.



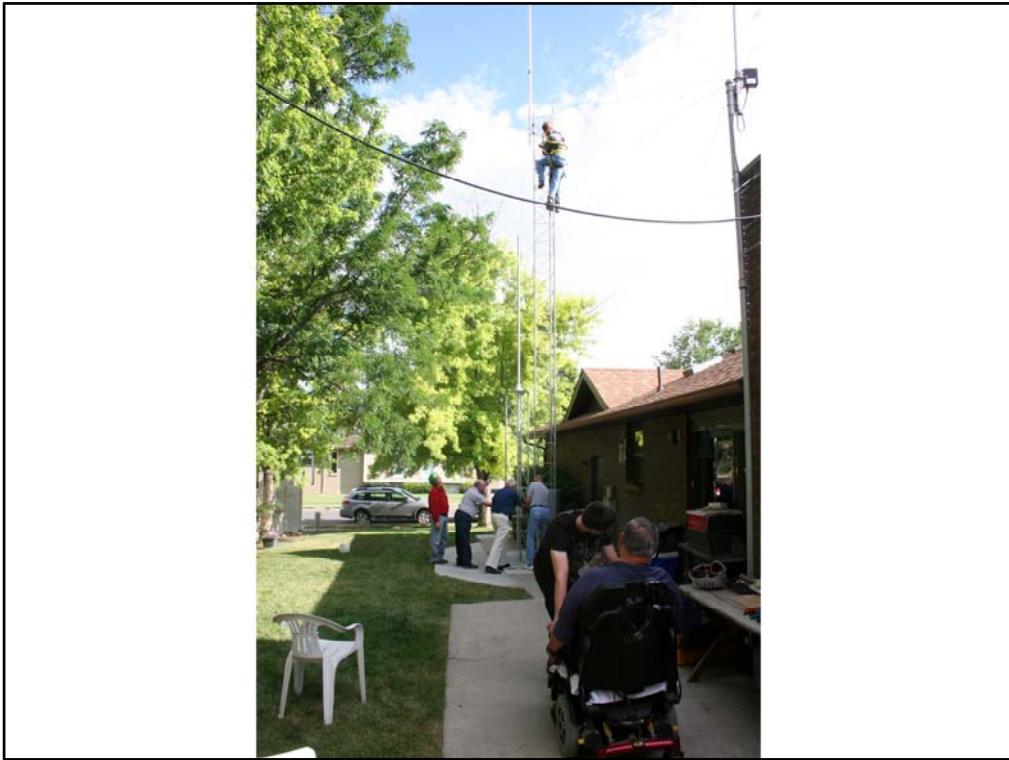
Final section on ground. Note rope to gin pole, rotator base, top plate with thrust bearing, and mast. Can just see other end of rope attached to my chair.



Heave my maties – HEAVE!! Each 10' section weighs about 70 lbs, plus other pieces brings total to 90-100 lbs



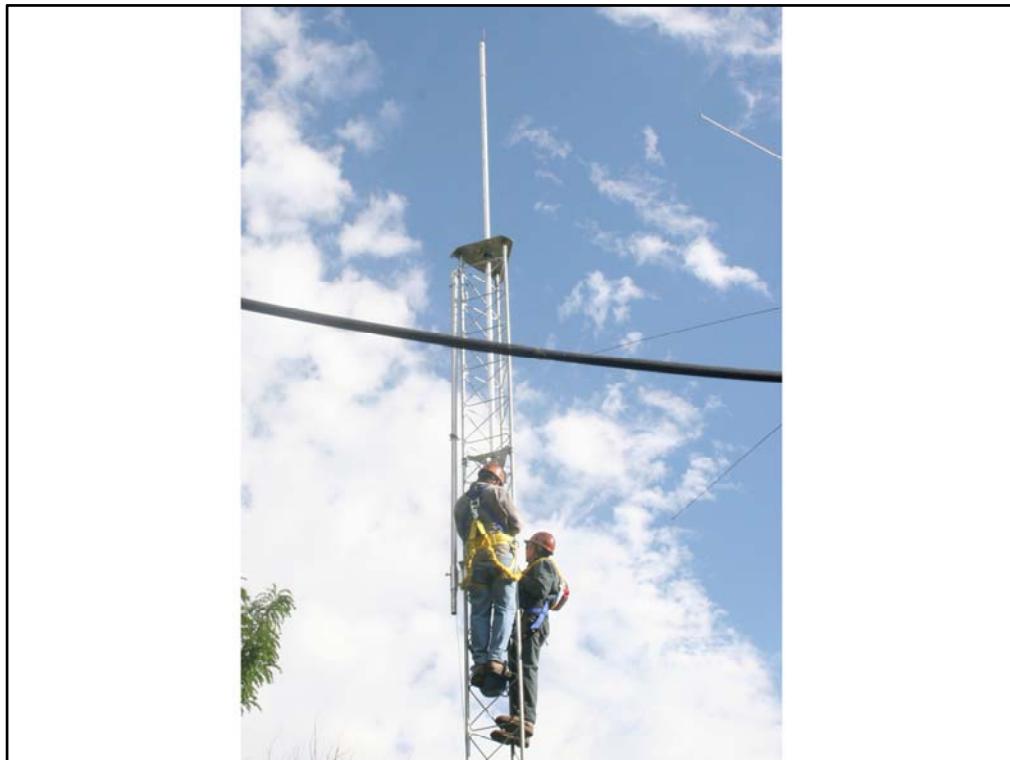
Almost there!



Tower section upright, note my grandson Dallin preparing to help me raise the section. Plenty of power in the chair, but not enough traction.



Section is up and at limit of gin pole. LOTS of tension on rope, you can pluck it like a guitar string. Now just a matter of lining up the tower sections.



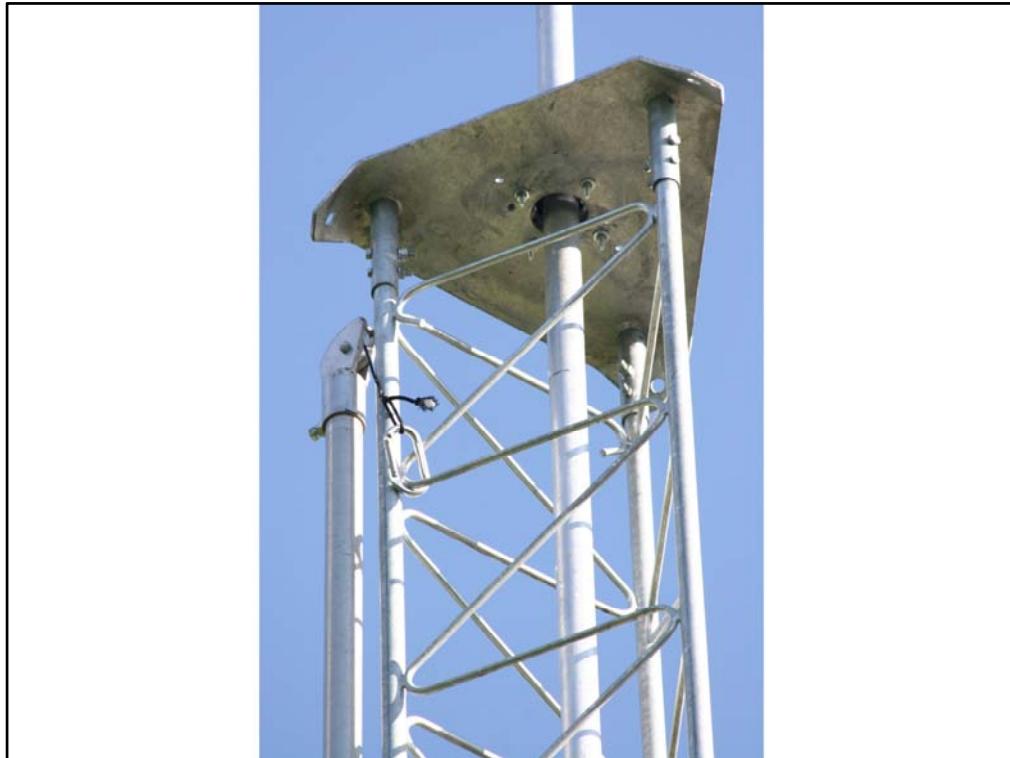
Sections aligned and dropped in. Align bolt holes and put bolts in.



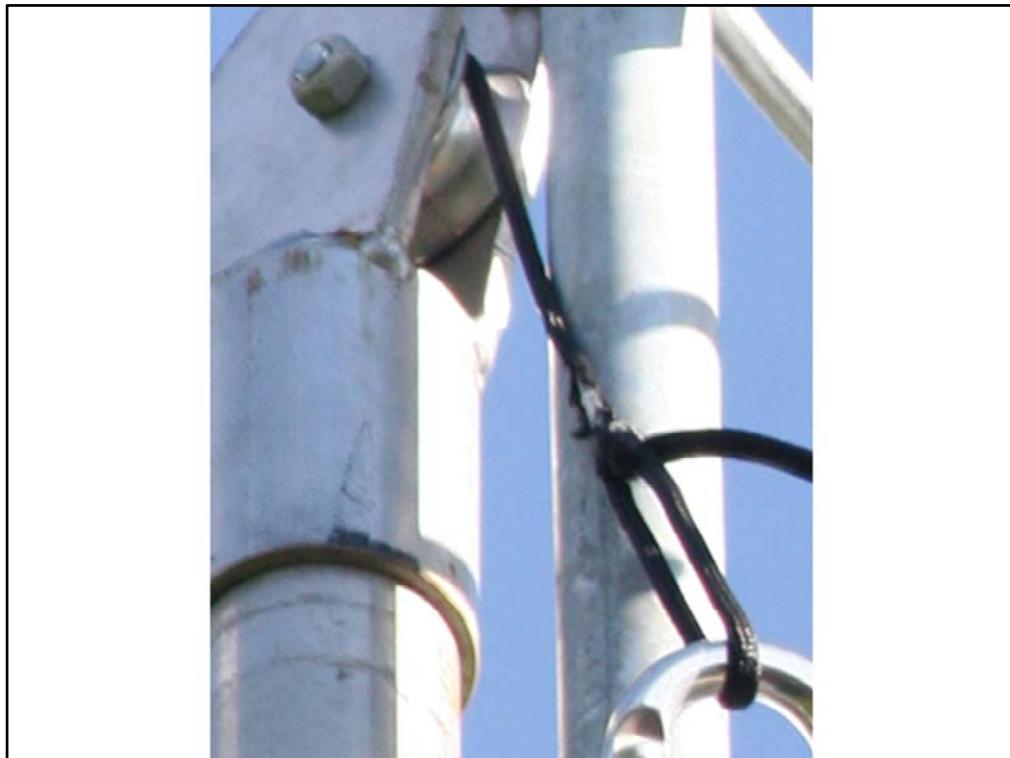
This is where the drift pin really earns its keep.



Tighten the bolts



View of top, thrust bearing plate. Note how short gin pole line is.



Close up of top part of gin pole and rope. Note fraying – thank God this was the last lift!



Now the “simple” matter of adding the antennas to the mast, starting with the lowest – and biggest – quad band 3 element beam. Note lines hanging over elements to guide it on the way up. Also note that the coax was attached to the beams when we raised them.



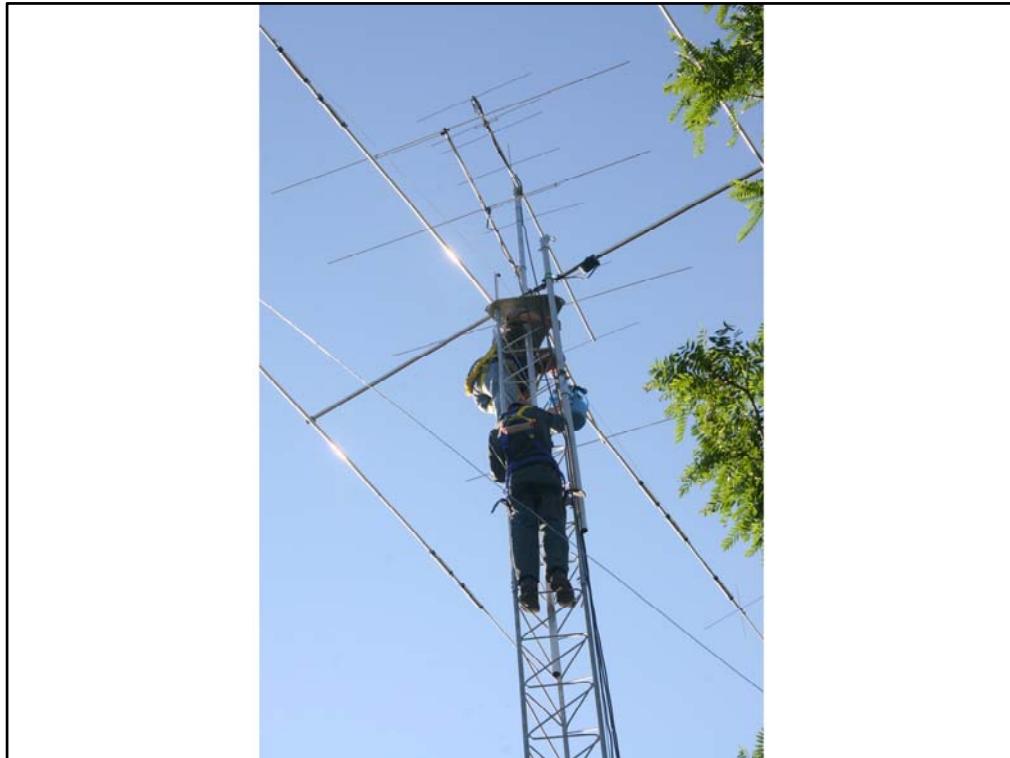
Now thread the 5 element 6 meter beam past the big guy and mount it on the mast.



And finally the 7 element 2 meter beam.



Get that sucker up and don't bend any of the elements!



All of the beams have to be spaced out on the mast and aligned with one another. AND keep the coax straight.



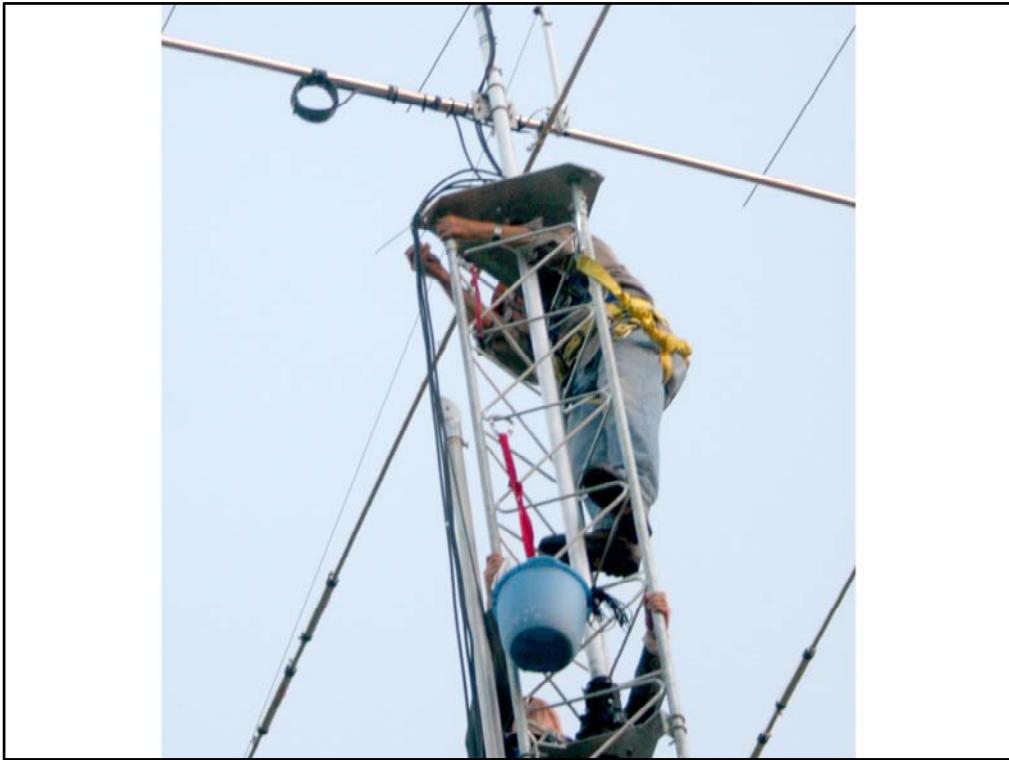
Pat feeds the mast up while John tightens and aligns each antenna with lots of shouting from the ground – very hard for them to hear people on the ground. We marked the mast where we wanted each antenna while the mast was on the ground. Each step involves loosening the thrust bearing while Pat holds the entire weight, pushing the mast up to the next mark, tightening the thrust bearing, then aligning the antenna with the others and tightening it on the mast. Nylox nuts are wonderful!!!!



Wow! Looks like we got them aligned pretty well.



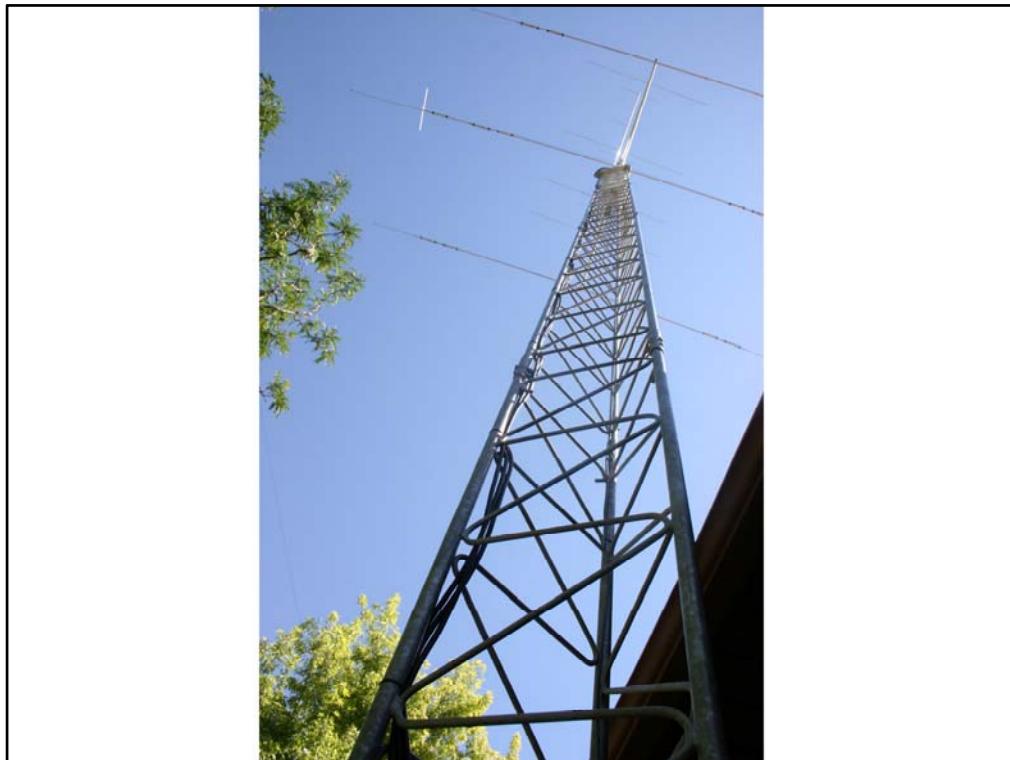
Final steps are to attach coax to mast then push the mast up high enough to mount the rotator, mount it, lower mast into rotator, put bolts in holding rotator on mast, put bolts in attaching rotator to mast. NOTE: rotator does NOT carry weight of mast and antennas, thrust bearing does.



Note that the rotator is now installed. Wrap coax around top of tower plate so won't bind or chafe when antennas go round and round. We took about 2 $\frac{1}{2}$ turns and tied off carefully at corner of tower. Haven't talked about mast itself. Wanted to use 2" OD with $\frac{1}{4}$ " wall but was both too expensive. Mast is 8' in tower and 12' above the tower. Left pulley at top with 2X height of tower line.



Note how coax is connected and sealed to antenna, thrust bearing, and coax wrap.



Attaching the coax down the tower.

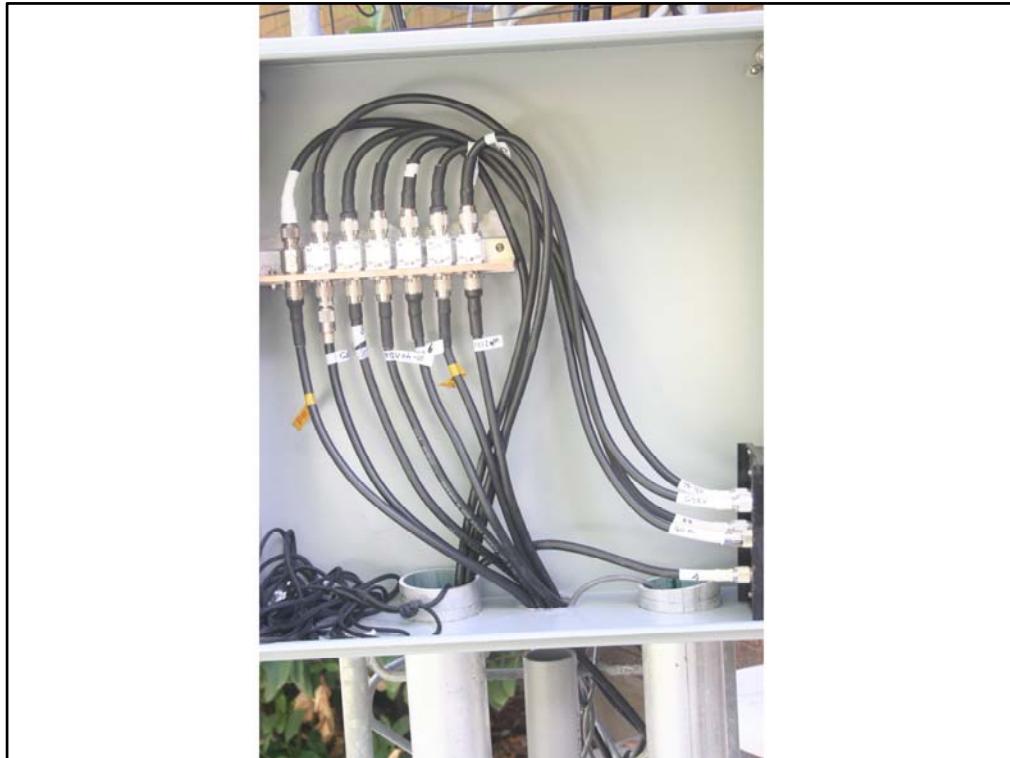


Note ground wires – talk about bonding to tower.

Lots of wire tie cleanup. Note cleanup is an on-going PM item. So far so good though – 3 years. Bird droppings!



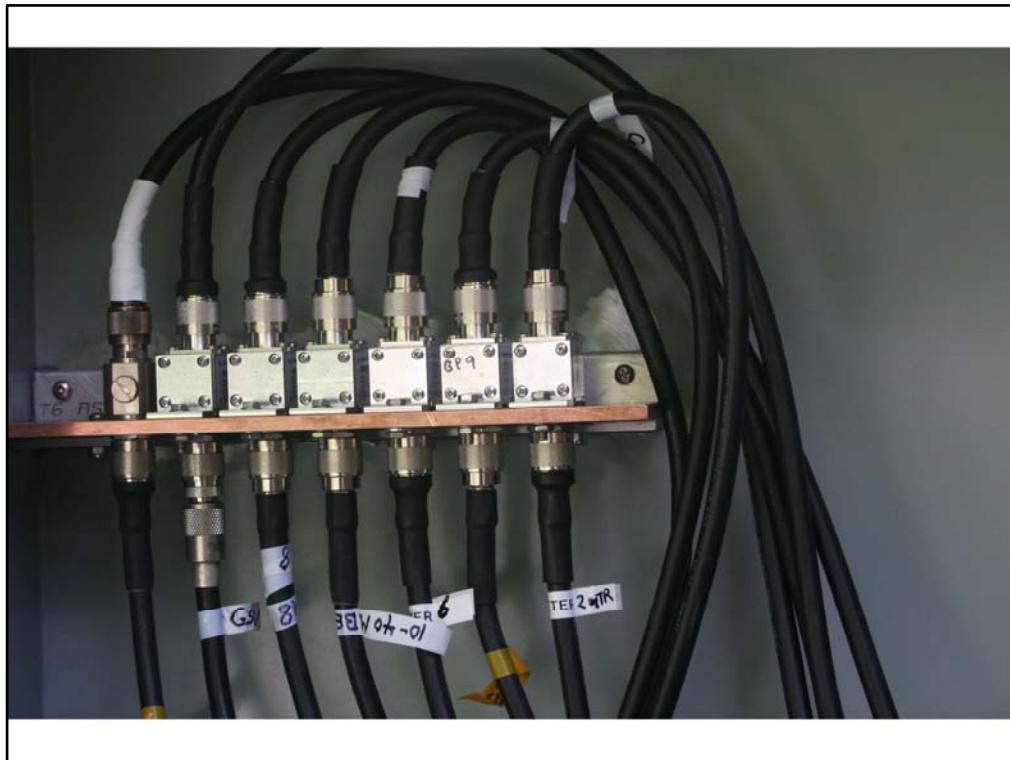
Coax lightning arrestors and coax distribution.



Lightning arrestor panel.

Note cable labels

Note fish lines.





HF antenna switch box

And That's How We Did It!

*So... how does
it work?*

Exit and run video