60 ft Tilt Over Tower Project

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Preface

- There is nothing “standard” about this project
- It’s a great challenge from the “get go”
- It will put ALL your skills to the test , welding, planning, scheduling, machining, fabricating , painting, climbing , assembling you name it

How the project came about

- Needed a replacement tower for HF and Microwave antennas, some sections of my original tower dated back to 1972
- In 25+ yrs at my location trees grow fast ! All of my loop yagi's were now dwarfed by the trees.

More thoughts on the project

- Evaluated my needs in terms of wind load and ease of future accessibility
- Wanted access to antennas in a matter of minutes without climbing especially all year round
- Needed a safe and easily executable plan
- Had to be able to do this on my own for the most part

Considerations

- Do not be afraid to reach out to others and ask for advise
- Survey terrain, plan for guy anchors , feed lines, concrete base , ready mix access, boom truck ect
- Build it to last a lifetime and plan to have extra anchor bolts in concrete
- Do not skimp on materials

More considerations

- Plan so that tower " swing" as it raised doesn't hit buildings or trees and keep it on your own land!
- Plan for catastrophic failures , where will tower fall what will it hit if ever it comes down.
- Plan for easy assembly and disassembly.

Preliminary thoughts

- How much of an investment was it going to be?
- Can I realize this project
- Is it safe?
- Will it be exactly as I see it in my mind?
- Good thing was.. I had no time restraints

Planning List

- Grounding
- Guy material
- Concrete form/rebar
- Conduits for control, Ac, Dc & feedlines
- Building permit
- Xyl sign off !

Safety

- Have a personal fall arrest system in place
- Plan to have a tether if winch cable fails
- Have a smooth freefall arrest system in place – could be rubber tires , you need something to absorb the shock to minimize damage to the structure

Safety

- If tower (mast) crashes into ground or into vertical fixed tower make sure to inspect everything , this might mean climbing tower to visually inspect
- Pay attention to noises from winch cables
- Operate winch and cables within their rated loads

Load Safety

- Especially if you are always adding new equipment to the mast the load varies quite a lot.

Safety Con't

- Climber and ground crew must wear safety helmet
- If and when you climb make sure helpers are out of drop zone, one tower height away
- First aid kit wasp
- Wasp spray

Tower shopping list

- First I acquired 60Ft of 24” aluminum tower , this would be the tilt over section
- Secondly I acquired several sections of commercial steel welded L&R 20 tower (125 lbs per 10 ft) this would be used for vertical pivot point

Finding a suitable tower 130ft L&R 20









Timing is everything

- Spoke to a local who had a small excavator mid September 2013 about the possibility of renting machine and operator to dig the tower foundation, weeks slipped by until one day we spoke again and reminded him , 2 days later end of November by then it all started.

Excavation






CASE



Positioning the form





Leveling form





Finishing up backfilling





Rebar cage and J anchors



Form and rebar cage



Adjusting “J” anchors



Concrete pouring





Concrete

- Chose to have it " mixed on the spot"
  Reasons are….
- No waste
- Proper mix for the application and temperature
- Can actually schedule the delivery almost to the closest 15 minutes, no additional delivery fees

More on concrete

- December 3rd delivery needed to have calcium added
- Costs abt 15-18% more all in all
- No mess or clean required
- No excess concrete to have to dump on site when premix has overages.
- I had 4 months for concrete to set and cure before I would work on it!

Concrete mixed on the spot



Tower “sandals” to stop 125lb section from digging into sand



After the pour





Preparing for “ flex” test 60ft of tower supported 18” off the ground at each end



100lb teen jumping at mid point of 60ft of aluminum tower



Flex test

- The idea behind flex test was to evaluate just how flexible the aluminum tower sections are once bolted together.
- I was trying to eliminate as much “ free play” as possible.

Aluminum tower preparation, eliminating all free play

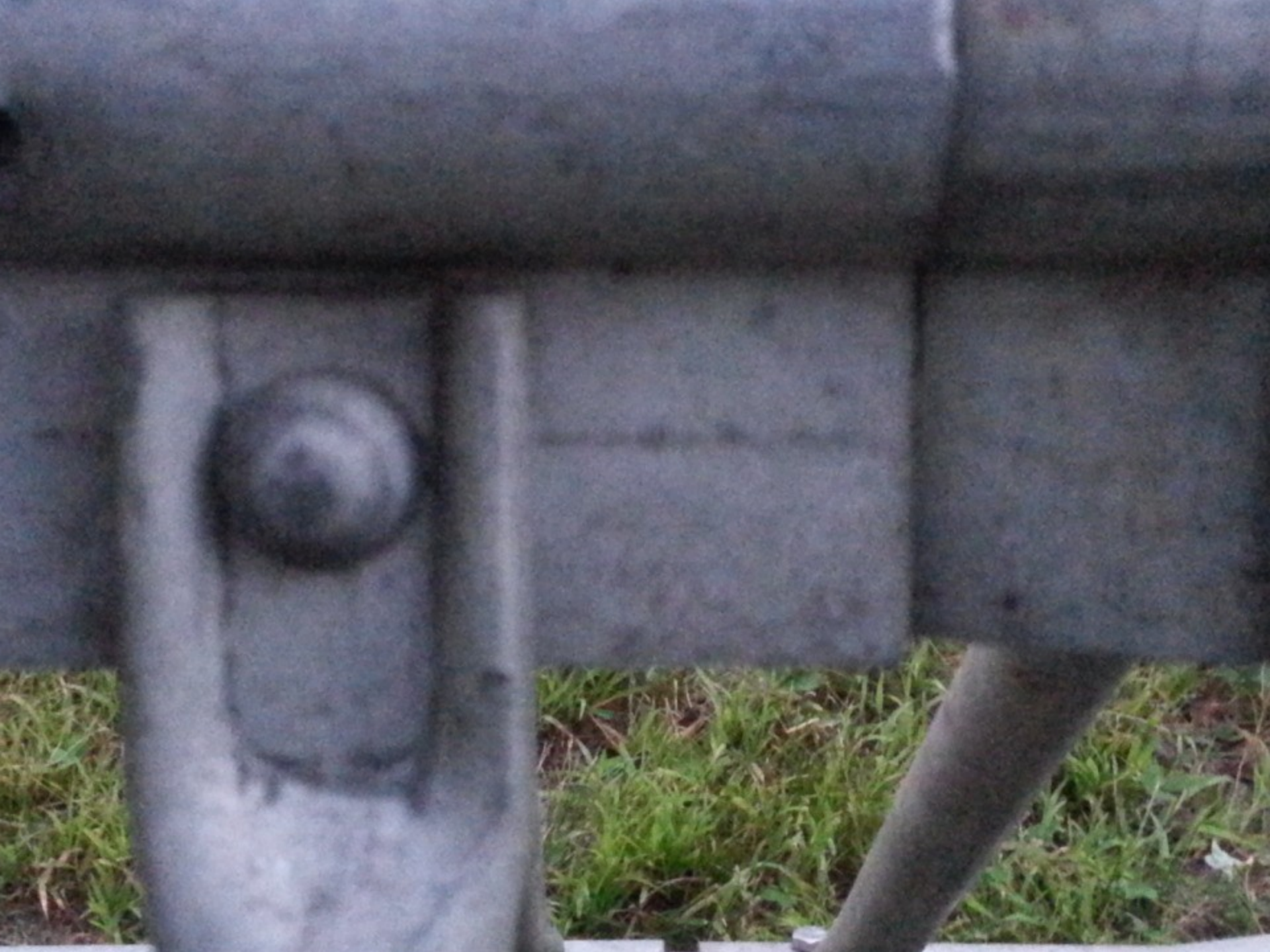


Eliminating free play

- Using a come along to close gap in each section and re-drilling holes which had been elongated with time. I used stainless hardware coated with RED 262 Loctite.

Closing the “ gap”





Preparing top section of fixed tower







Making the Hinge





Hinge



Hinge preparation for welding





Hinge cradle fitting



More adjustments

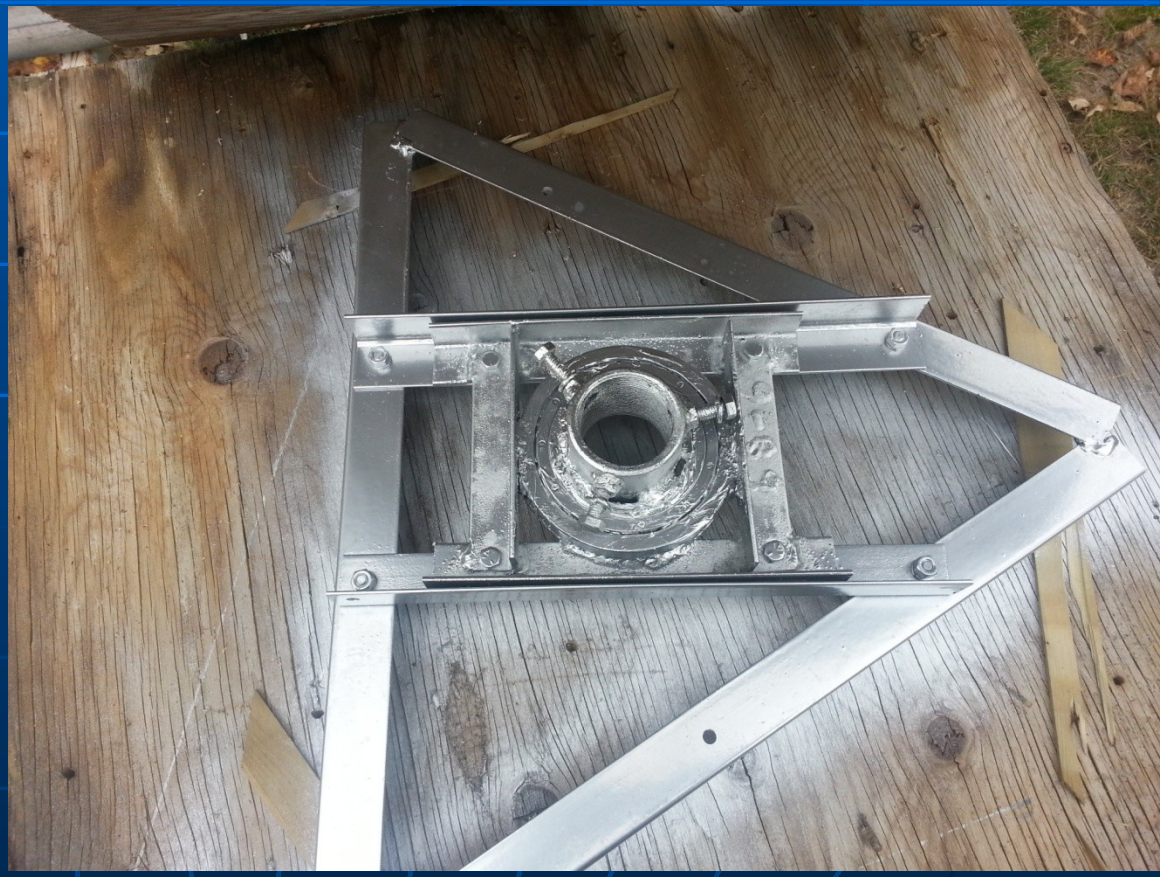


Top plate bearing mount



Completed bearing





Hinge cradle and strut assembly



Assembling fixed tower



Strut installed with turnbuckles





Finalizing both towers before assembly



Lifting tower in place



Positioning

- The boom operator was truly amazing, able to line up the hinge fingers from 50ft away. He lifted the structure with a chain and positioned it , I climbed up and put a 5/8” piece of rebar as a place holder in the hinge. As I hammered in the actual hinge pin the rebar slipped inside the hollow tube it provided 100%contact at all times.



Sanity check??

- As insane as it looks there is a 5/8” rod as hinge pin securing the structure !!











1296 Looper and Hf beam



Added winch



Control and feedlines

- And after your done and the tower is up and tilts over then you can have more fun… feeding hard line inside the tilt over sections, figuring just how much of a bend you can have in 7/8 heliax and mounting antennas pointed the wrong way they are supposed to go because the tower is upside down at this point!

Adding cables inside the tower is a major task

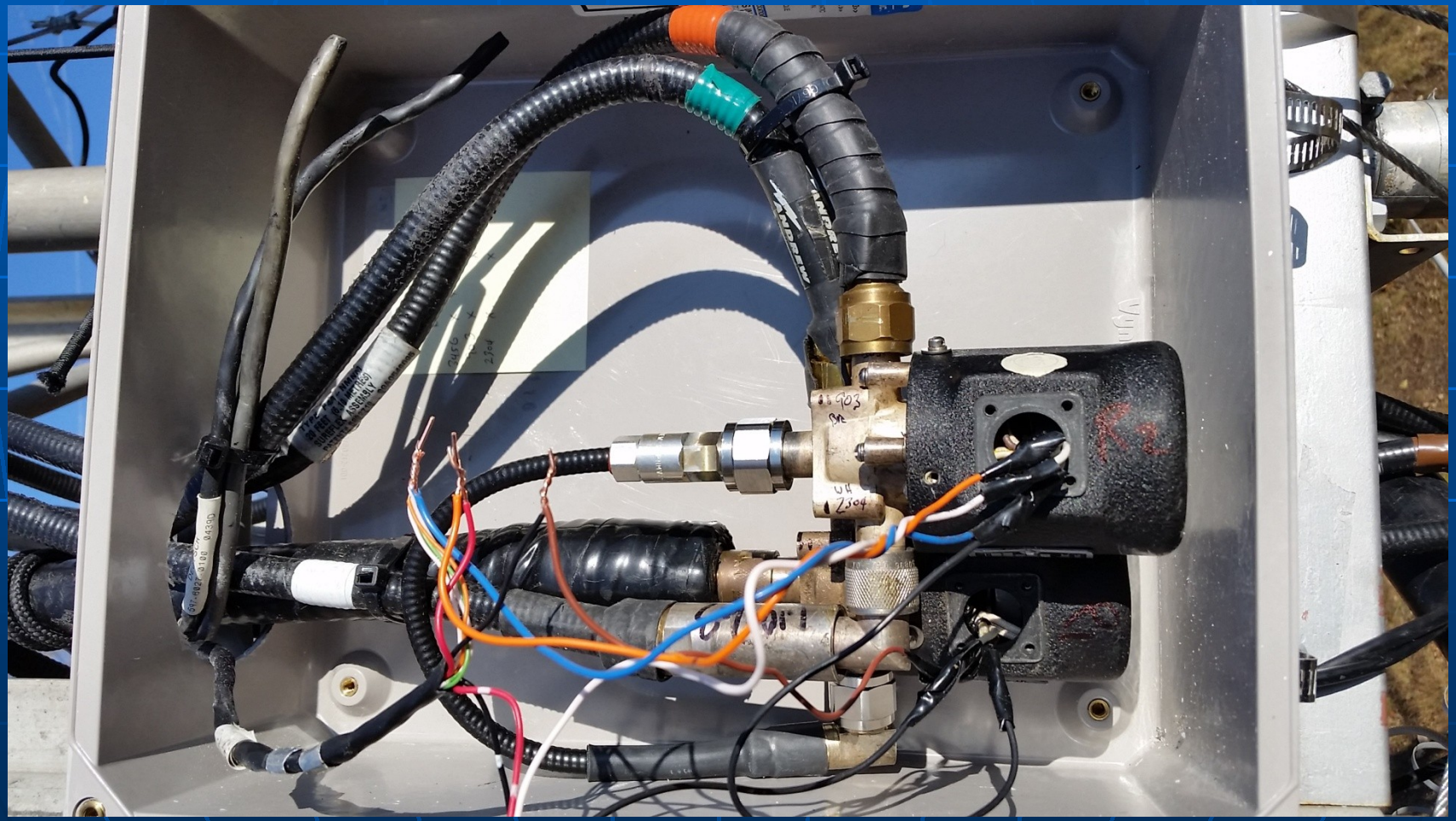


More loopers being added





Relay controls



Tether your tools!!



Get the right “ stuff”



Lets remind ourselves why we do this.. Most of us do it for the view….



Some for the laughs



Mostly for the camaraderie and friendship.



But above all because we can!



Closing comments

- It’s a great project full of unexpected issues
- Lots of fun, guaranteed
- Getting your ham friends to help out builds genuine interest in the hobby
- Having no timeline was great
- To see it standing year after year

Closing continued

- A great addition to any ham station that's constantly wanting to evolve and improve his system without a ground crew always present to help out
- Once its up and running , it's a one man show!

Thank you to those who helped me realize the project Wb2ona, K5km, Ve2ug, Ve2lc, Ve3ax and my neighbor Denis for his constant help and my son Jeremy for taking most of the pictures.

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