Two Ideas for Skyhooks

I - A Rotatable Mast for 6M

II - A 34’ Mast for HF Dipoles

Concept, Design, Implementation

Some practical ideas for construction that you may be able to use yourself.

This is NOT a “how to” talk.
It’s an “ideas” talk.

Larry Banks, W1DYJ

First licensed: 1962 (KN1VFX)

W1DYJ since 1966 – Amateur Extra

33 Blueberry Hill Road Woburn MA

9B-DXCC 8B-WAS-MA 6B-WAS-ME
6m-VUCC [565+ Grids]

INDEXA

Abstract

Have you ever wanted to put some kind of antenna up, but you didn't know how to keep it up? Perhaps this talk is for you. This is not about antennas; its about keeping those antennas in the air.

In 2008 Maren and I bought a 2nd home in Harpswell ME, south of Brunswick. I threw up some simple HF dipoles just to get on the air. By 2013 I was ready to upgrade these.

- First a mast for a 6m yagi (part I of this talk)
- Then a mast for an HF fan dipole (part II).

This is an "ideas" talk with some practical ideas for homebrew construction.

Part I - A Rotatable Mast for 6M

- **Concept**
  - Background, Constraints, Futures
  - Location
  - Mast Concept
  - Result
- **Detail Design and Implementation**
  - Antenna Choice
  - Mast Design
  - Rotator Mount
  - Brackets

I – A Rotatable Mast for 6M

Concept

Background

- Maren and I purchased a 2nd home in Harpswell, ME in 2008
- The first few years were aimed at HF using simple dipoles
- 6M has always been one of my favorite bands → *I needed SOMETHING on 6M*

I – A Rotatable Mast for 6M

Concept

Background

- Maren and I purchased a 2nd home in Harpswell, ME in 2008
- The first few years were aimed at HF using dipoles
- 6M has always been one of my favorite bands → *I needed SOMETHING on 6M*

Constraints

- **We were there only 1/3rd of the time – *not there for UPS deliveries (or mail)***
- **I wanted to build and erect this *by myself***
- **I did not wish to put up a tower**
- **I only had a table saw, a drill press, and hand tools**

I – A Rotatable Mast for 6M

Concept

Background

- Maren and I purchased a 2nd home in Harpswell, ME in 2008
- The first few years were aimed at HF using dipoles
- 6M has always been one of my favorite bands → *I needed SOMETHING on 6M*

Constraints

- We were there only 1/3rd of the time – *not there for UPS deliveries (or mail)*
- I wanted to build and erect this *by myself*
- I did not wish to put up a tower
- I only had a table saw, a drill press, and hand tools

Futures

- **I wanted something that would handle a SteppIR DB-11 in the future**

I – A Rotatable Mast for 6M

Location

- **Summer 2013: Experimented with a yagi at 18’**
  - **Too low - Need to have the antenna above the roof line**

I – A Rotatable Mast for 6M

Location

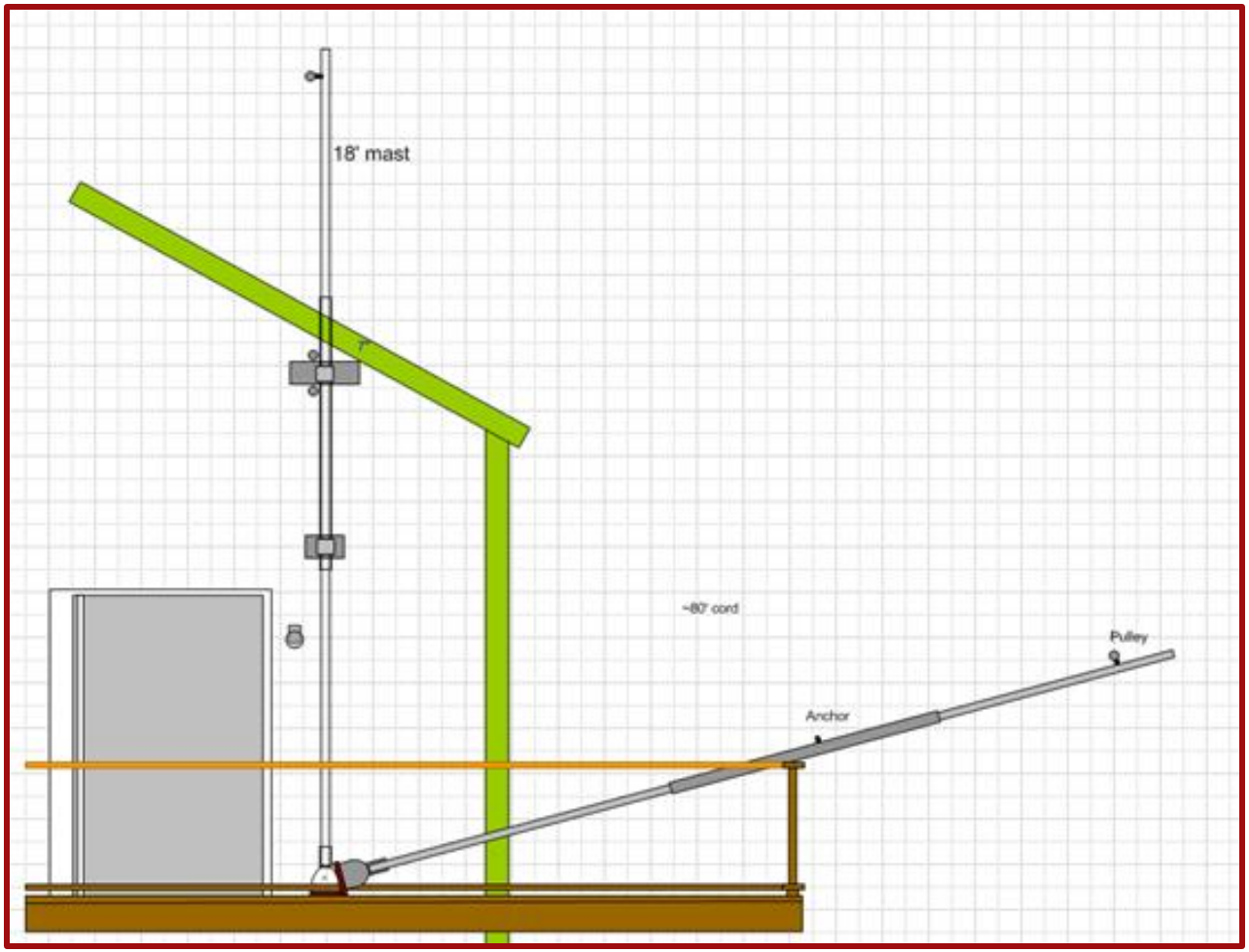
- Summer 2013: Experimented with a yagi at 18’
  - Too low - Need to have the antenna above the roof line
- **One “obvious” location: a mast on the 2nd floor deck**
- **But the yagi had to be *easy to access***

I – A Rotatable Mast for 6M

Mast Concept

Tilt-Over

Mast

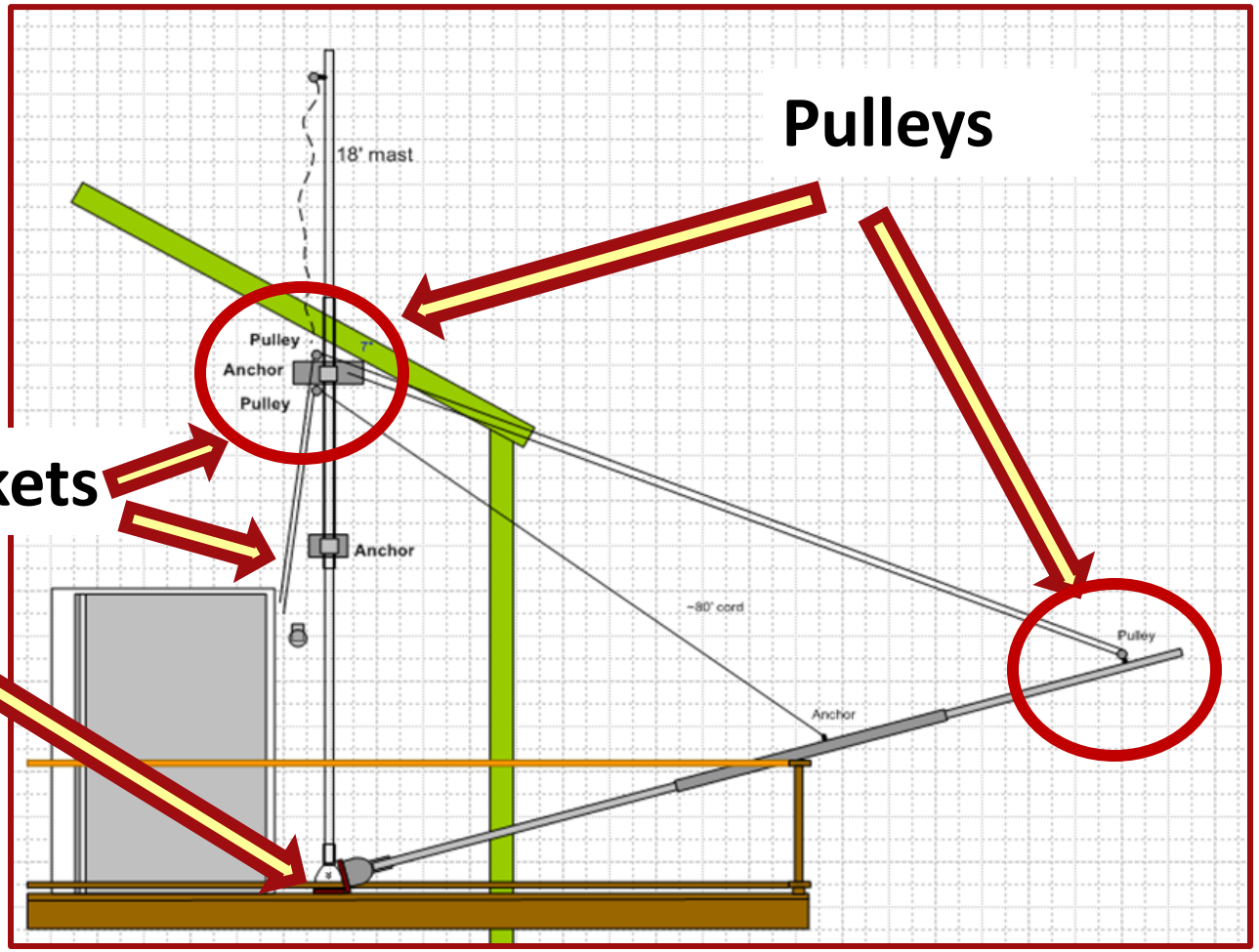


I – A Rotatable Mast for 6M

Mast Concept

Tilt-Over

Mast



I – A Rotatable Mast for 6M

Result

I – A Rotatable Mast for 6M

Result

I – A Rotatable Mast for 6M

Detail Design and Implementation

- Antenna Choice
- Mast Design
- Rotator Mount
- Mast Brackets

I – A Rotatable Mast for 6M

Antenna Choice

Start with 6M → ***Start small, SteppIR DB-11 later***

I – A Rotatable Mast for 6M

Antenna Choice

Start with 6M → *Start small, SteppIR DB-11 later*

- **Needs to be reasonably small: 3 EL is optimum between gain / F-R / mechanical**
- **Decided to purchase, not build from scratch**
- **Investigated many choices:**
  ***M²* 6M3-SS**
  ***Force12* LFA-306**
  ***Cushcraft* A50-3S**

I – A Rotatable Mast for 6M

Antenna Choice

Start with 6M → *Start small, DB-11 later*

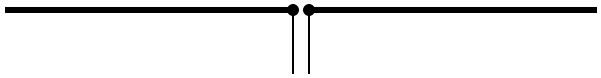
- Needs to be reasonably small: 3 EL is optimum between gain / F-R / mechanical
- Decided to purchase, not build from scratch
- Investigated many choices:
  M² 6M3-SS
  Force12 LFA-306
  Cushcraft A50-3S
- **Chose:**
  InnovAntenna 50-LFA-3
- ***LFA → Loop Fed Array***

I – A Rotatable Mast for 6M

Antenna Choice

Why an LFA? A little antenna theory

- **Dipole in free space = ~73 Ω**

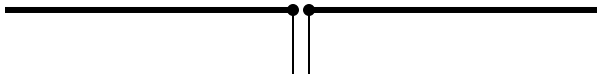


I – A Rotatable Mast for 6M

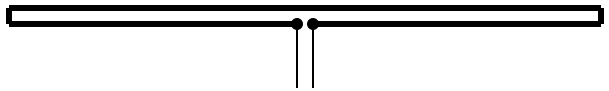
Antenna Choice

Why an LFA? A little antenna theory

- Dipole in free space = ~73 Ω



- **Folded dipole in free space = ~4x73 = ~300 Ω**
  → 300 Ω twinlead FM antenna

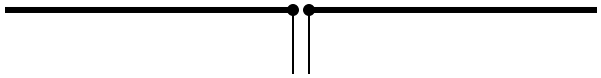


INDEXA

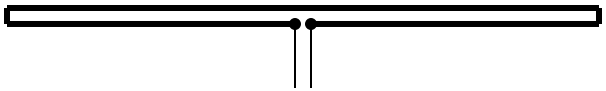
Antenna Choice

Why an LFA? A little antenna theory

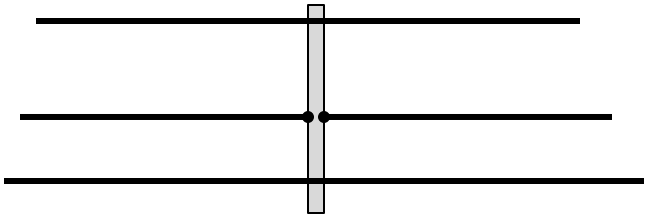
- Dipole in free space = ~73 Ω



- Folded dipole in free space
  = ~4x73 = ~300 Ω
  → 300 Ω twinlead FM antenna



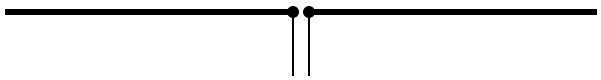
- **Dipole on yagi, *[driven element]* loaded by reflector & director = ~12.5 Ω**



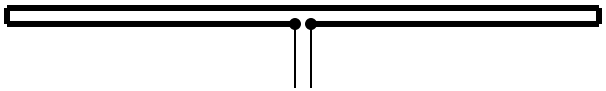
Antenna Choice

Why an LFA? A little antenna theory

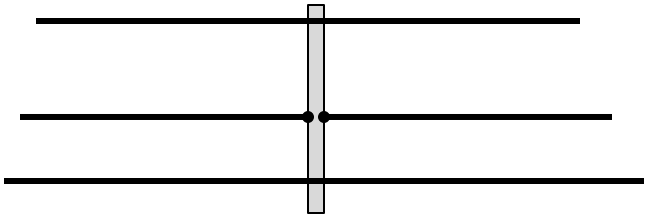
- Dipole in free space = ~73 Ω



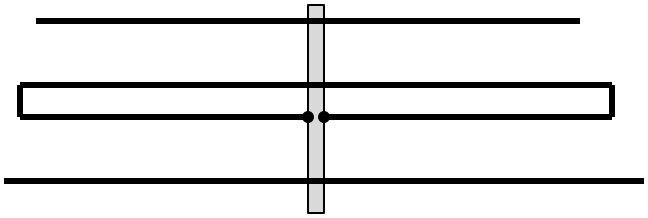
- Folded dipole in free space
  = ~4x73 = ~300 Ω
  → 300 Ω twinlead FM antenna



- Dipole on yagi, *[driven element]* loaded by reflector & director
  = ~12.5 Ω



- **Folded dipole on yagi:**
  4x12.5= ~50Ω



Plus: no matching network and it is broadband

I – A Rotatable Mast for 6M

Mast Design

- **Need to be able to raise by myself**
- **Need to rotate – but rotator cannot be at the top: *too heavy* → *rotating mast***
- **Needs to be strong enough for DB-11 → *thick wall tubing***
- **Needs to be about 18' tall → *too long and heavy to ship cheaply***

I – A Rotatable Mast for 6M

Mast Design

- Need to be able to raise by myself
- Need to rotate – but rotator cannot be at the top: *too heavy → rotating mast*
- Needs to be strong enough for DB-11 → *thick wall tubing*
- Needs to be about 18' tall → *too long and heavy to ship cheaply*

- ***Multiple coaxial thin wall tubing = thick wall tubing***

→Telescoping sections of thin (0.058") wall 6' Al tubing

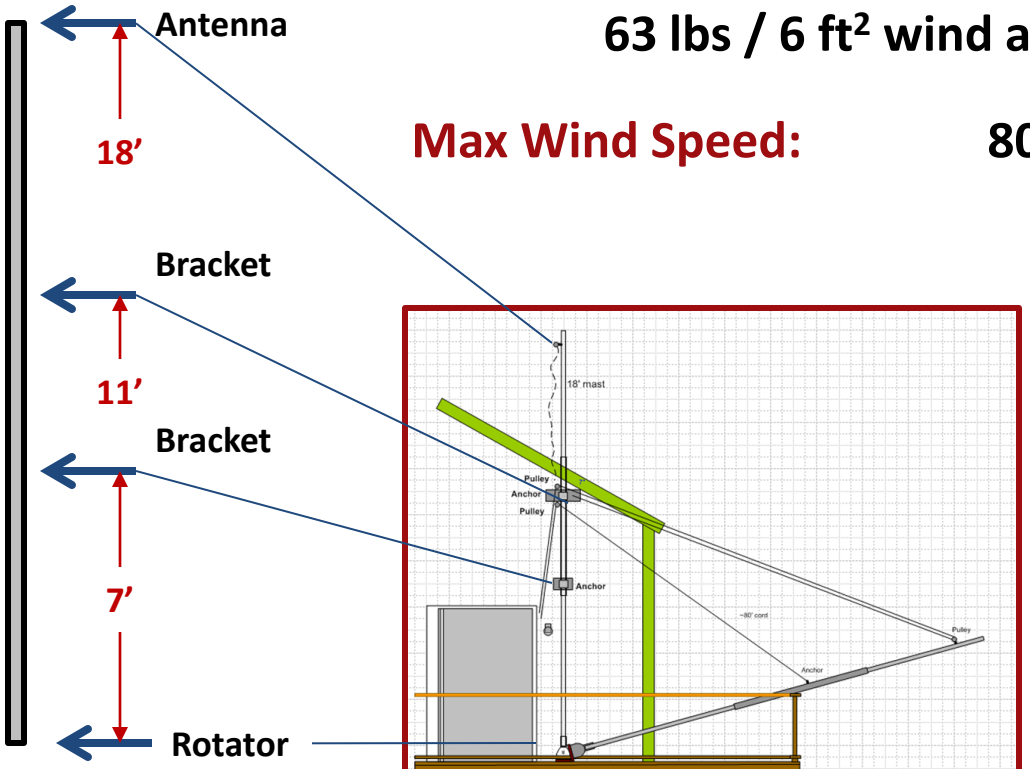
→But How Thick???

I – A Rotatable Mast for 6M

Mast Design

How Thick? — Assumptions

Mast Dimensions



Target Tribander: SteppIR DB-11

63 lbs / 6 ft² wind area / 11’ Turning Radius

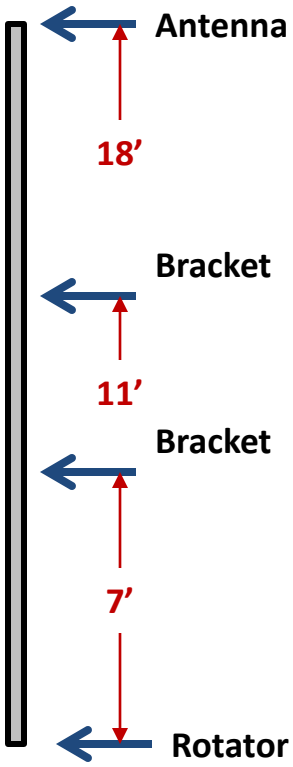
Max Wind Speed: 80 MPH

I – A Rotatable Mast for 6M

Mast Design

How Thick? — Assumptions

Mast Dimensions



Target Tribander: SteppIR DB-11
63 lbs / 6 ft^2 wind area / 11’ Turning Radius

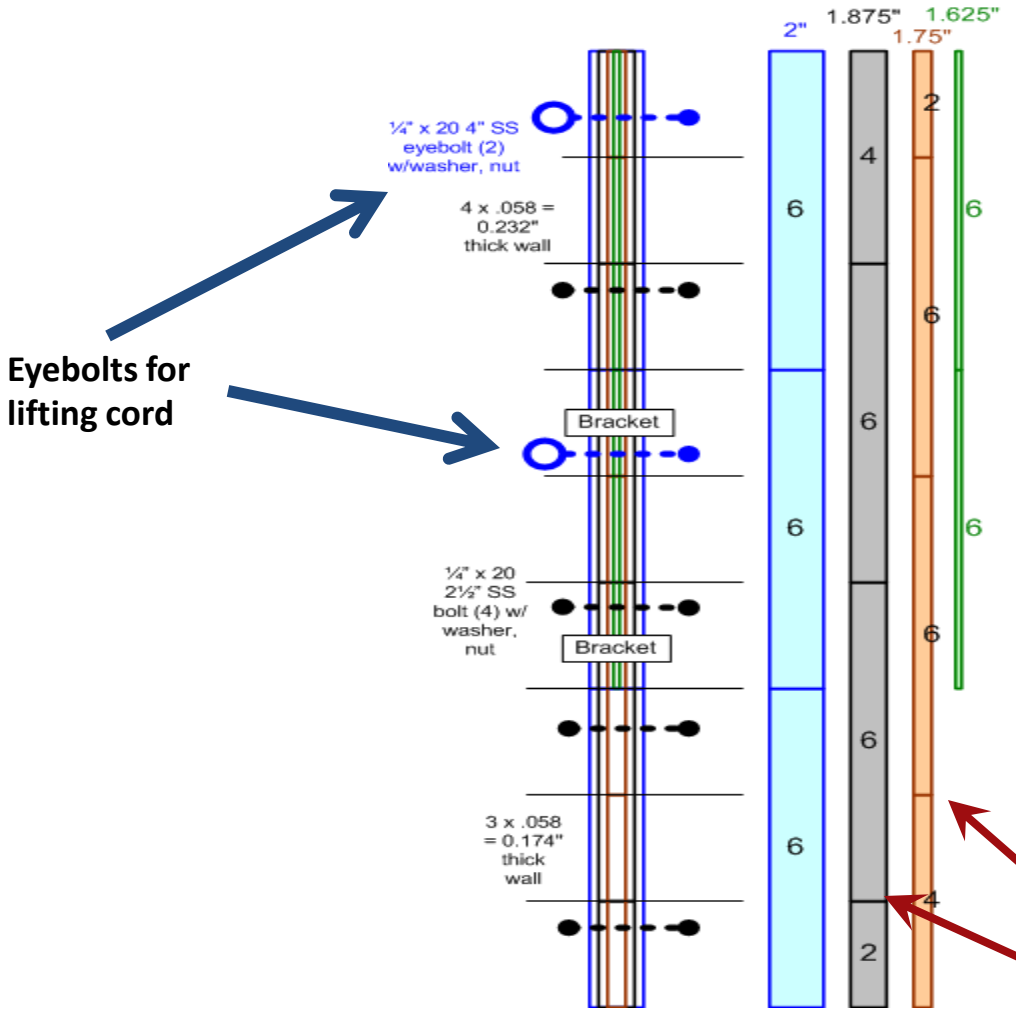
Max Wind Speed: 80 MPH

From your favorite Mast Calculator → 0.188” wall
[Champion Radio Products:
MARC *Mast, Antenna and Rotor Calculator*]

→ Requires four (4) coaxial 0.058” aluminum tubes
4 x 0.058 = 0. 232 3 x 0.058 = 0.174

I – A Rotatable Mast for 6M

Mast Design



6’ tubes can be shipped by UPS. (And I could fit them in my car to take to Maine.)

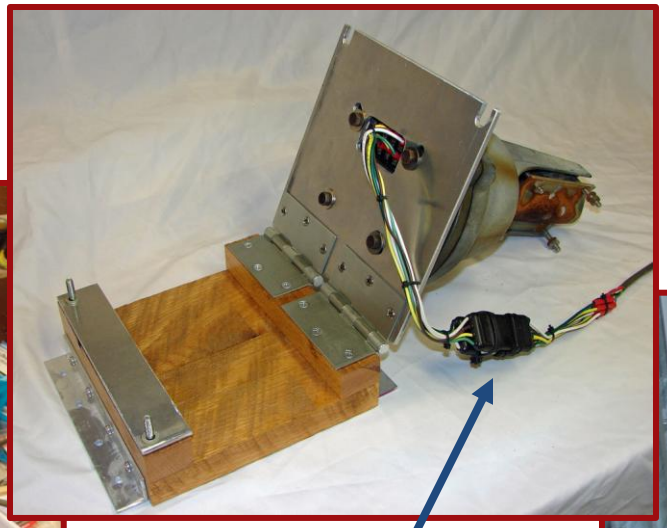
Four concentric 0.058’ AL tubes -- NESTED TOGETHER

2”	(3)
1.875”	(3)
1.75”	(3)
1.625”	(2)

Tubes must be cut and cleaned carefully!!!

I – A Rotatable Mast for 6M

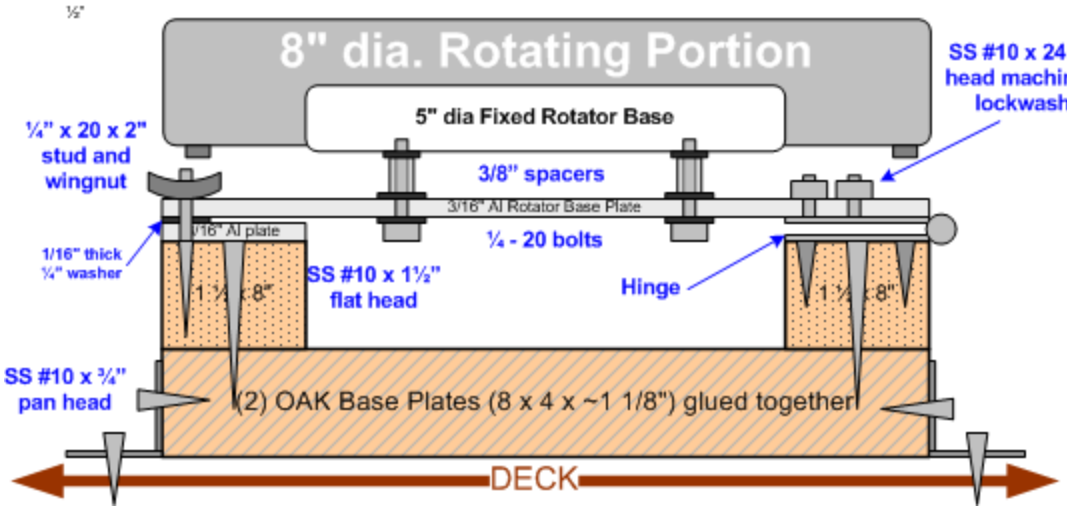
Rotator Mount

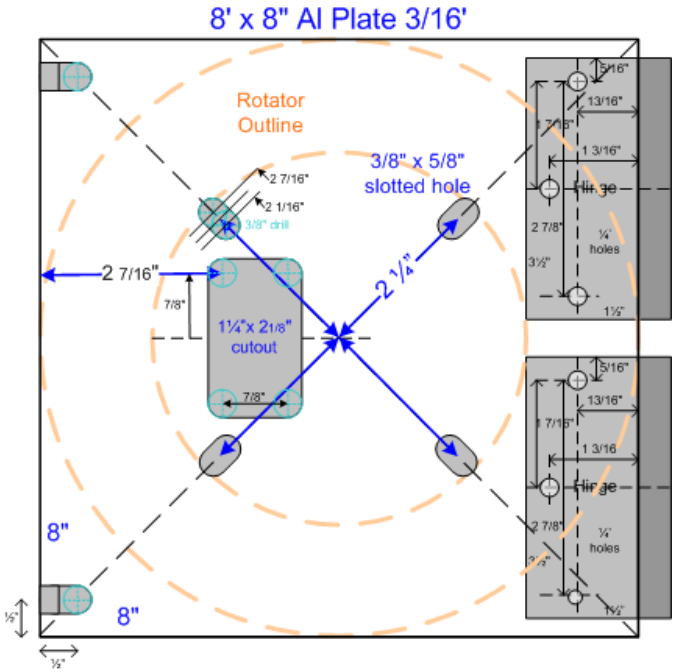


Trailer Connectors

I – A Rotatable Mast for 6M

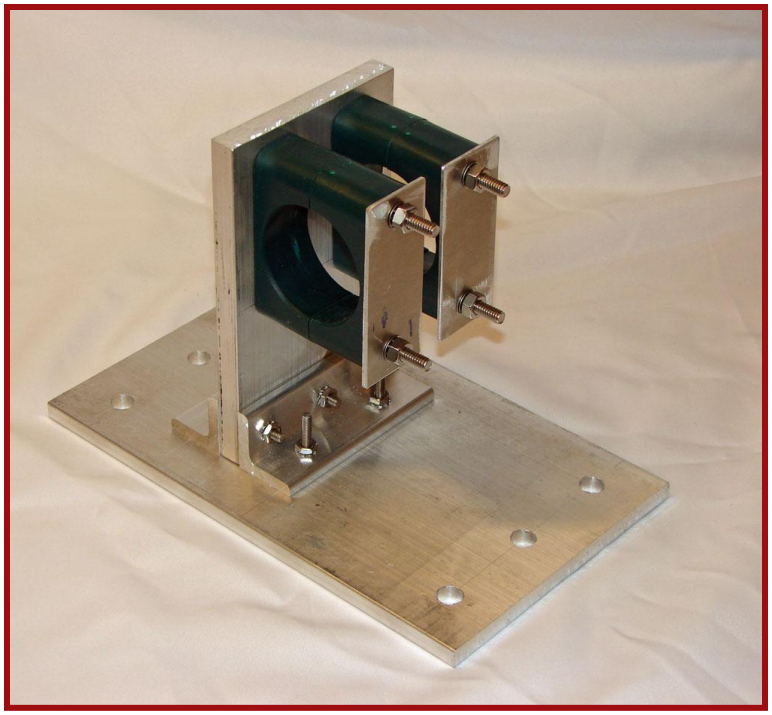
Rotator Mount





I – A Rotatable Mast for 6M

Mast Brackets

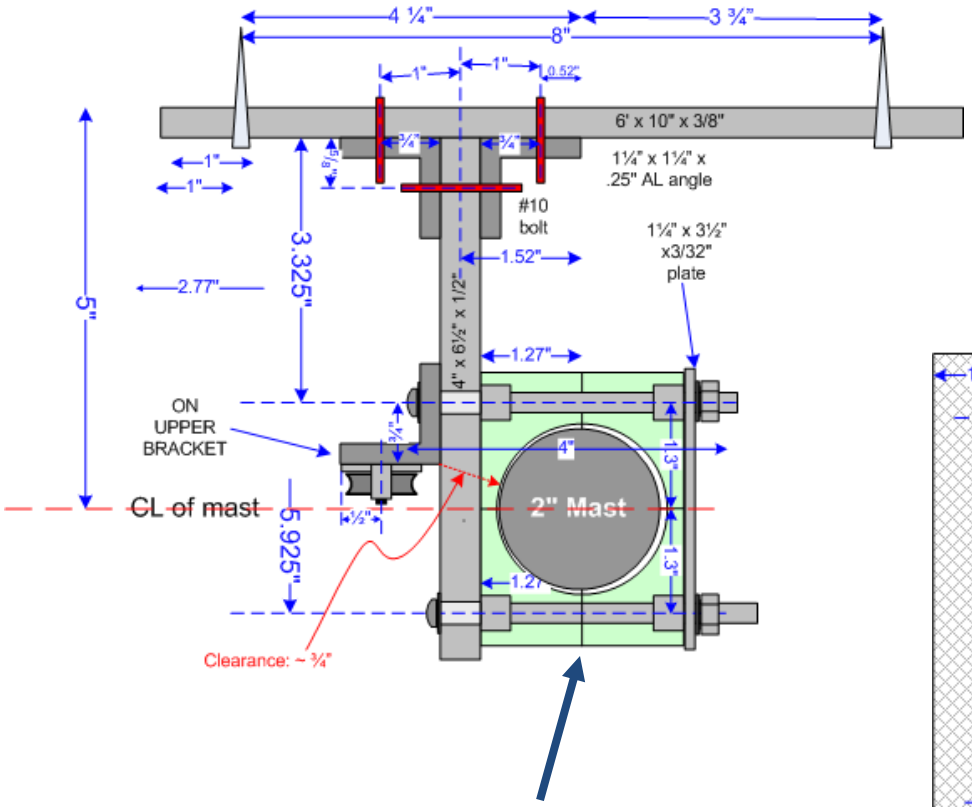


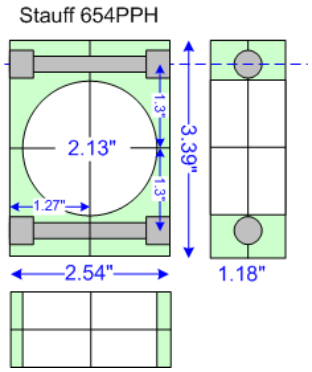
Lower Bracket

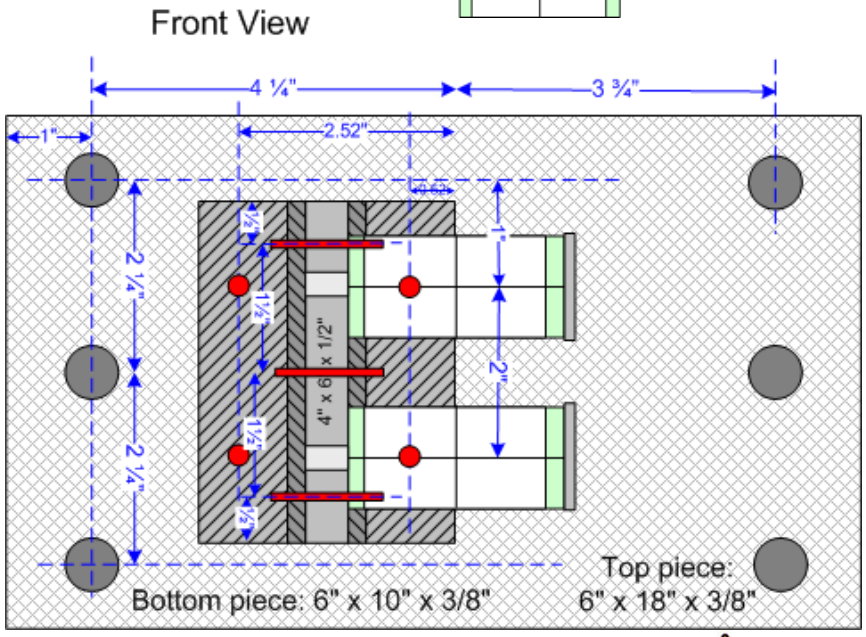
Upper Bracket

I – A Rotatable Mast for 6M

Mast Brackets







Stauff Blocks

Oversized to allow rotation

I – A Rotatable Mast for 6M

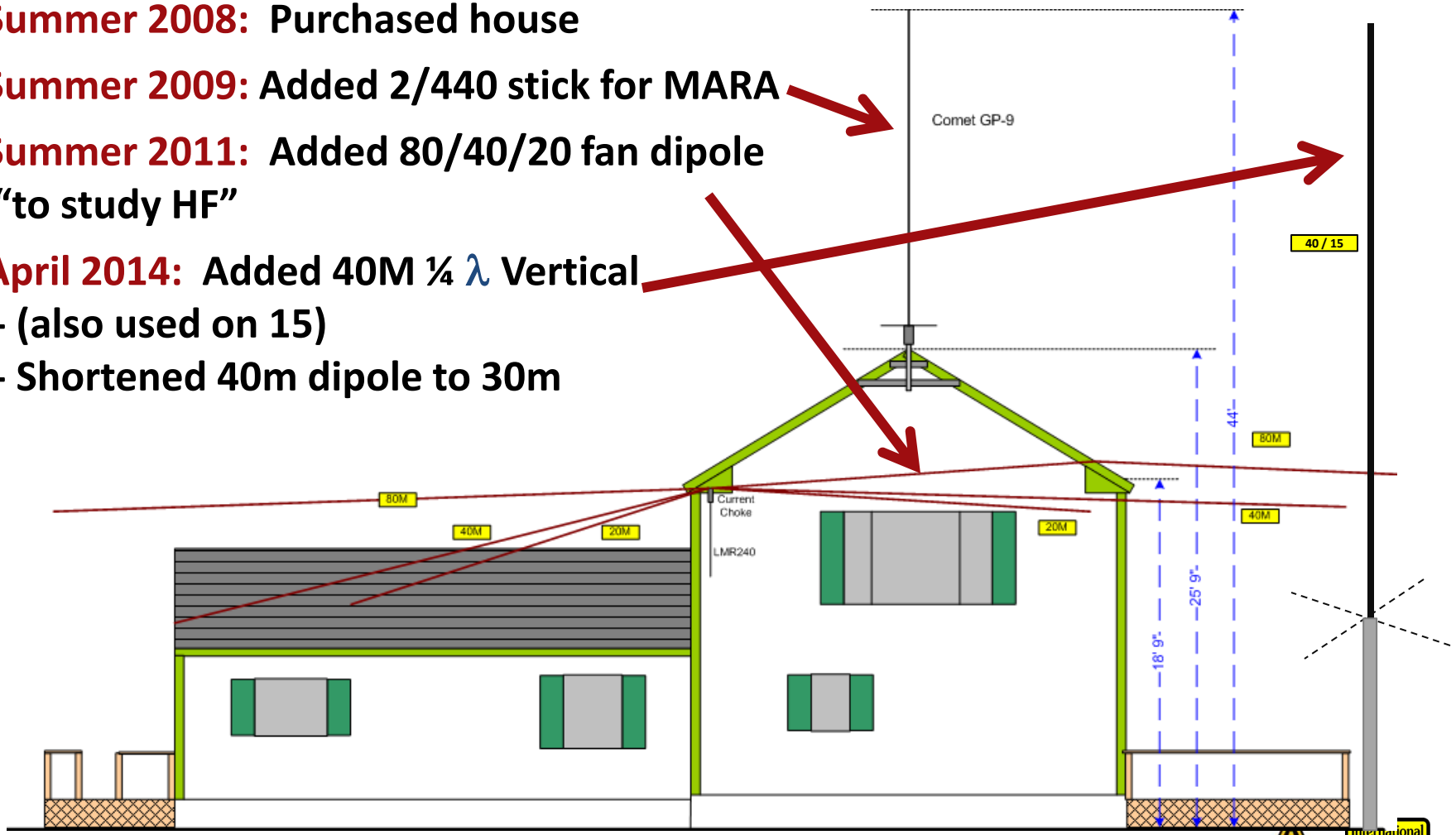
Result

Part II - A 34’ Mast for HF Dipoles

- **Background –** initial antennas
- **Concept -** replace existing dipoles / easy to raise with just me
- **Design -** mast / pulleys, etc
- **Implementation –** mast / brackets / “DDA”

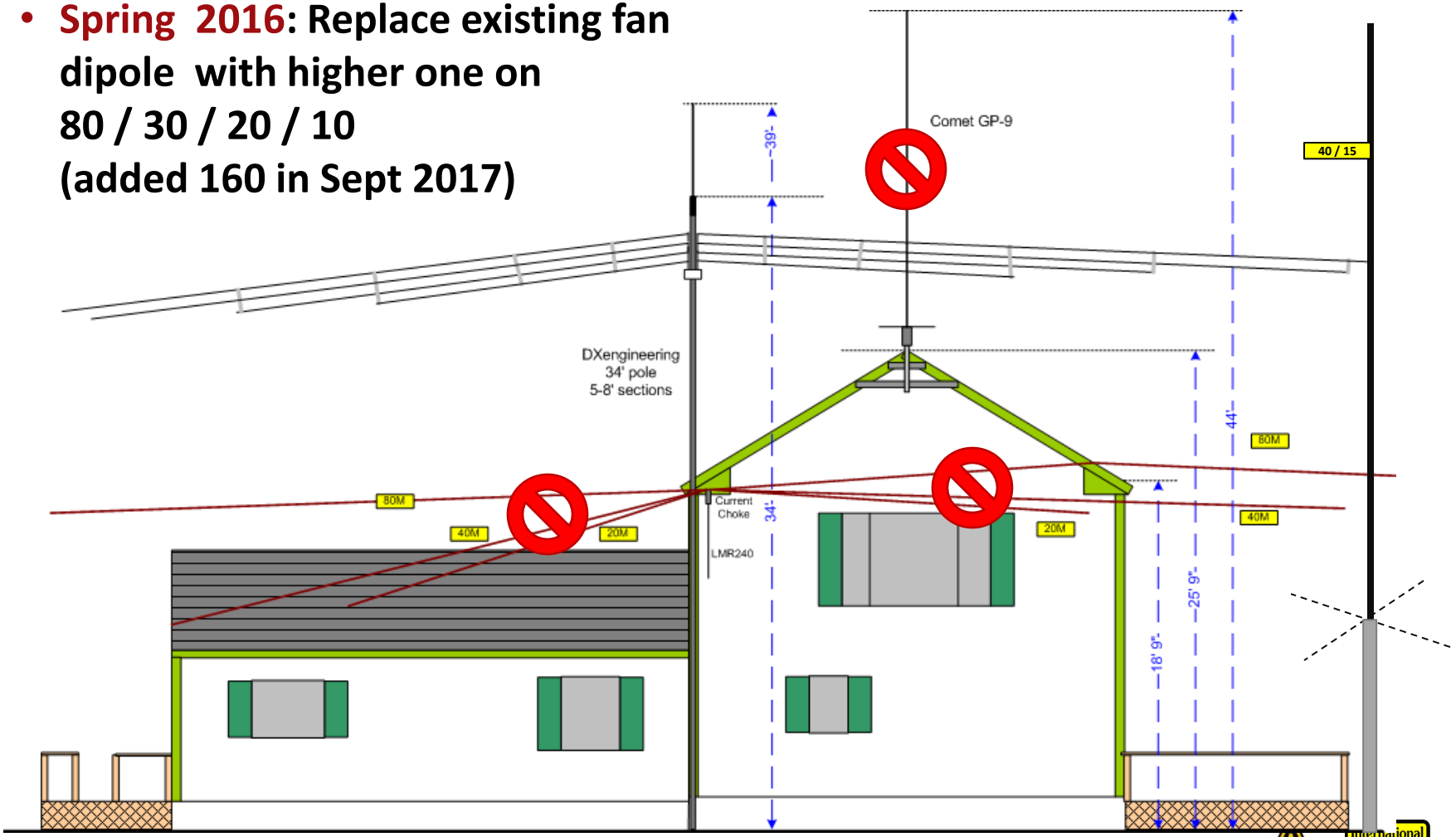
II - A 34’ Mast for HF Dipoles Background

- **Summer 2008:** Purchased house
- **Summer 2009:** Added 2/440 stick for MARA
- **Summer 2011:** Added 80/40/20 fan dipole
  “to study HF”
- **April 2014:** Added 40M ¼ λ Vertical
  - (also used on 15)
  - Shortened 40m dipole to 30m



II - A 34’ Mast for HF Dipoles Concept

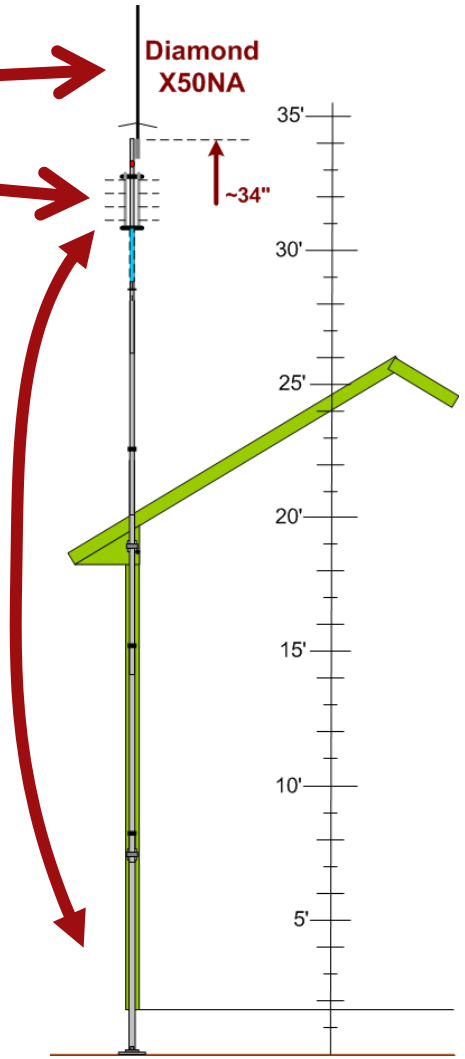
- **Spring 2016: Replace existing fan dipole with higher one on 80 / 30 / 20 / 10 (added 160 in Sept 2017)**



II - A 34’ Mast for HF Dipoles

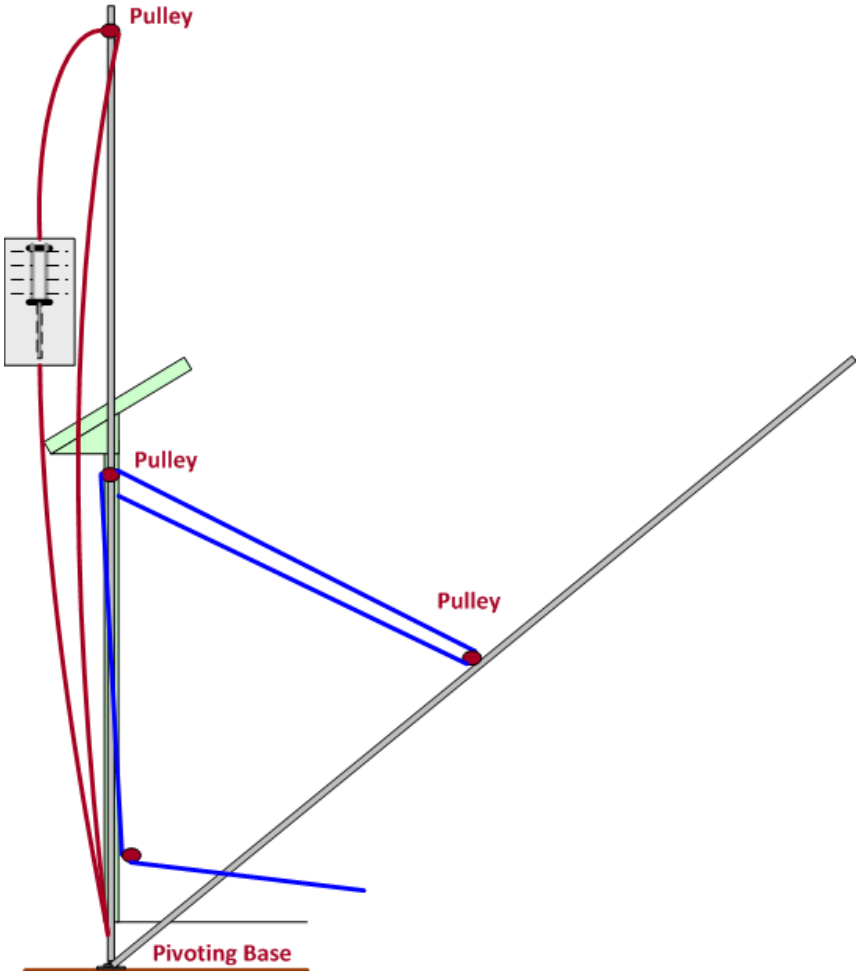
Mast Concept

- Allow for a 2/440 stick on top
- Allow for a 4-wire fan dipole
- Allow for antenna experimentation,
  i.e., this must be raise and lower
- Mast needed to be both strong and light weight so I could raise it myself

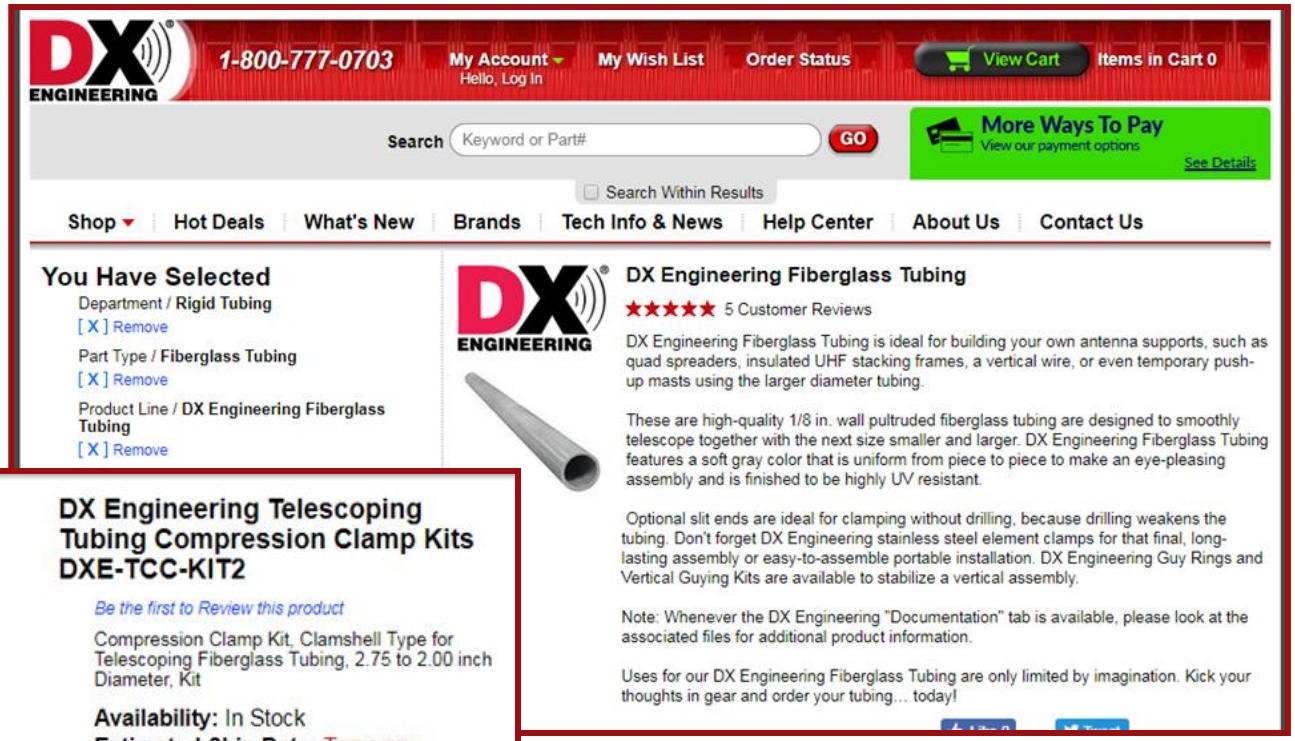


II - A 34’ Mast for HF Dipoles Mast Design & the DDA

“DDA”
Dipole Distribution Assembly



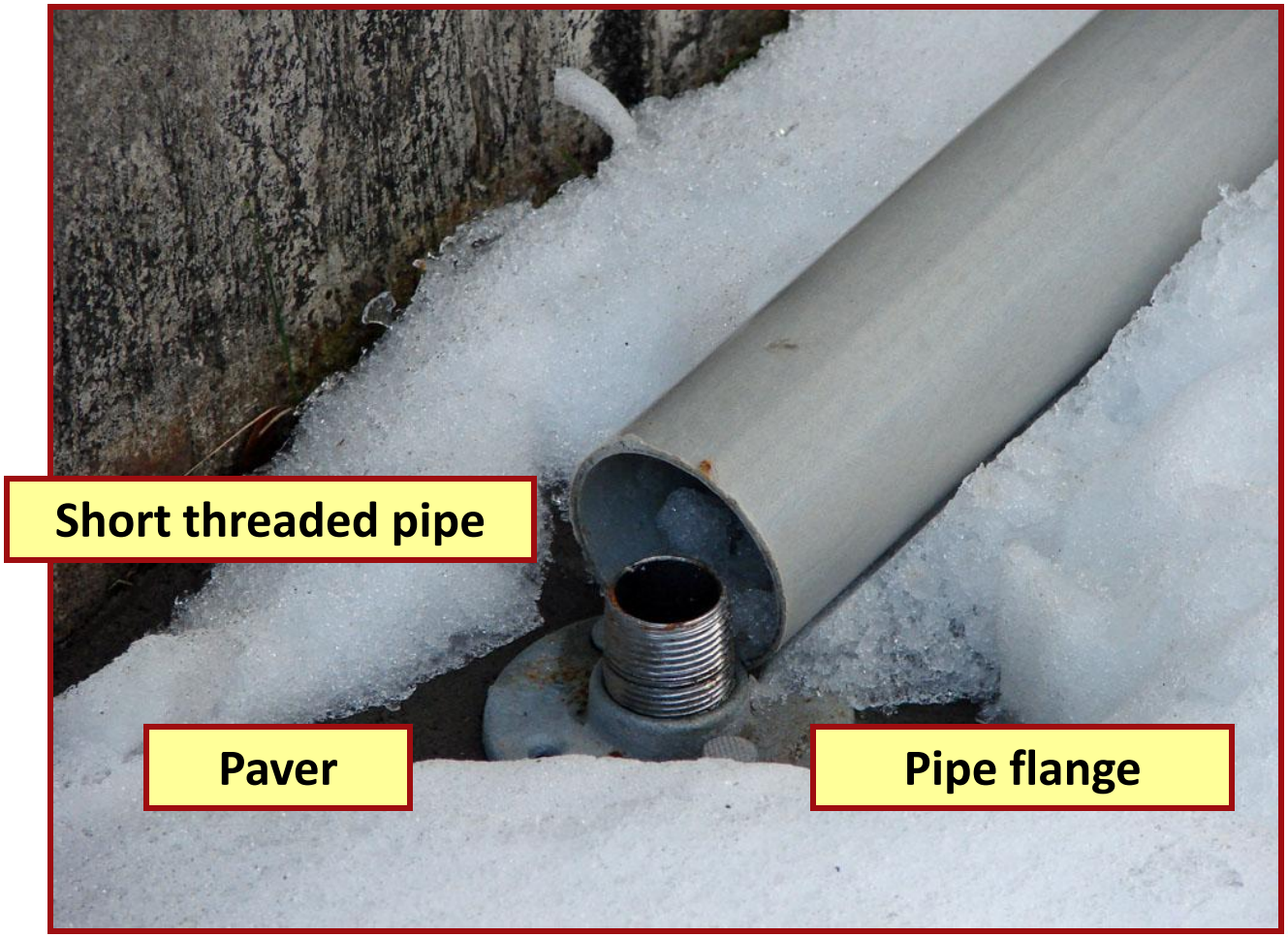
II - A 34’ Mast for HF Dipoles Mast Material



(5) 8’ tubes: 2.75”, 2.5”, 2.25”, 2”, 1.75” + Clamps = ~$190

II - A 34’ Mast for HF Dipoles Mast View [the day I raised it}

II - A 34’ Mast for HF Dipoles Mast Base



II - A 34’ Mast for HF Dipoles

Mast Base ~ NO!

This was not good enough!

The mast was not captured by the base.

Next time: *a solid pivot base.*

Learn from your mistakes!

II - A 34’ Mast for HF Dipoles

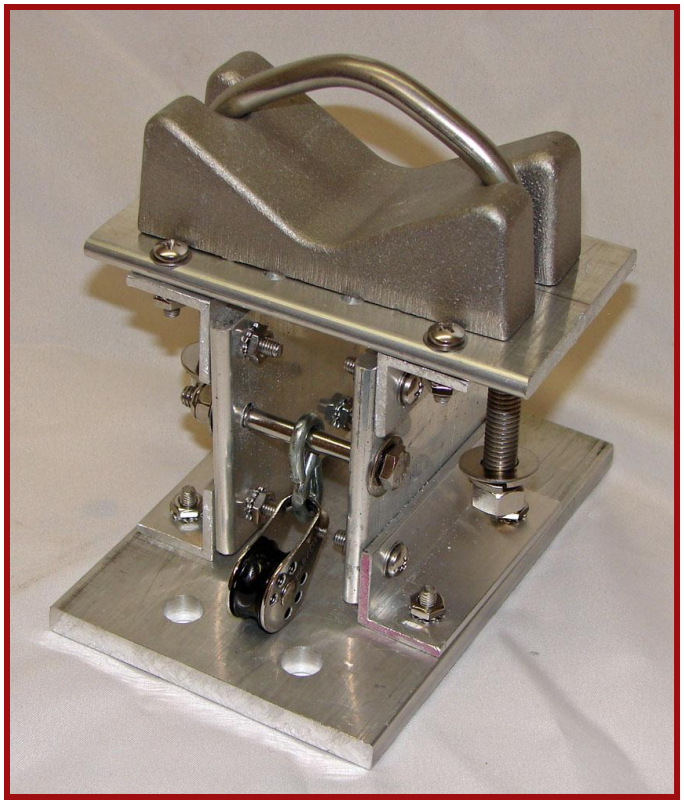
Mast Base ~ Next Time!

When we sold our place in Harpswell in 2021, I brought back to Woburn all of my ham stuff.

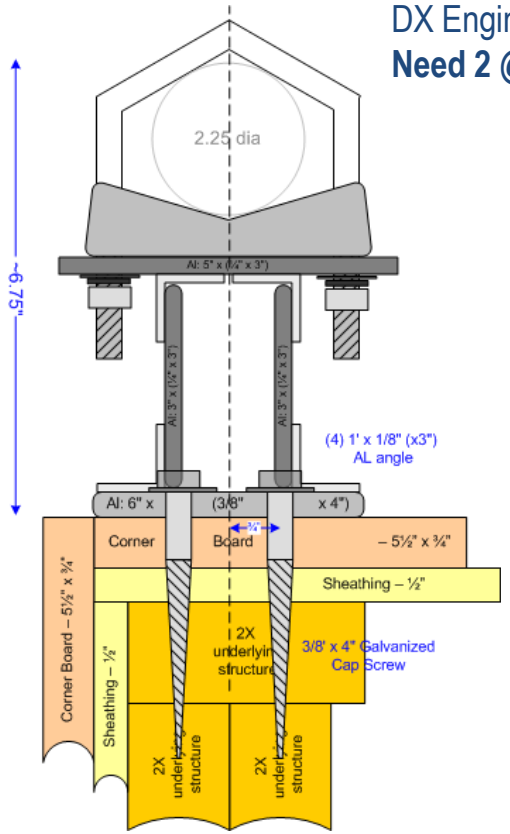
When I erected this same mast in Woburn, I designed/built a new base that captures the mast properly.

The details are not part of this talk.

II - A 34’ Mast for HF Dipoles House Brackets



II - A 34’ Mast for HF Dipoles House Brackets



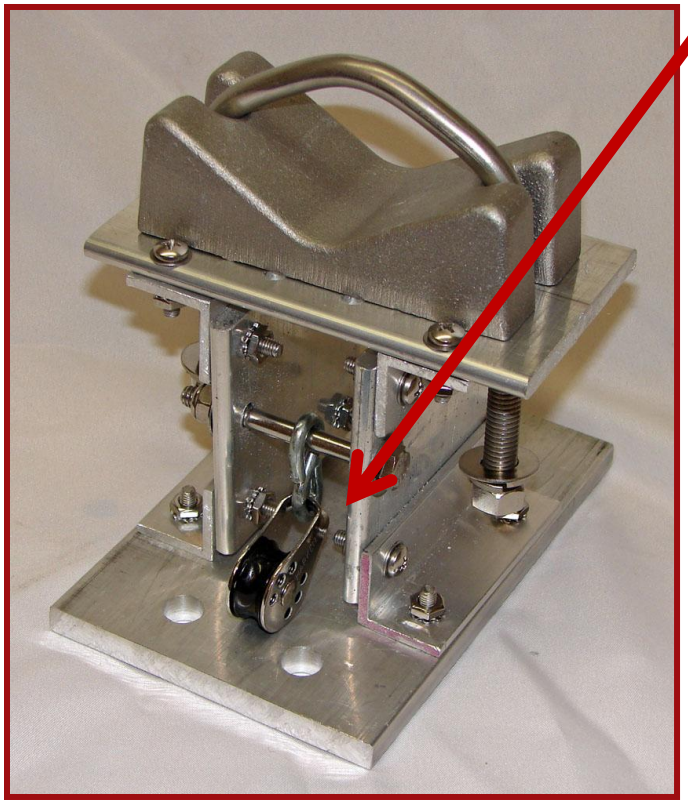
V-Bolt
DX Engineering # DXE-CAVS-3P
Need 2 @ $18.95

Aluminum Bar: ¼” x 3" x 22"
Online Metals 6101-T61
4' = $13.86 + $18.53 shipping

SS Hardware
McMaster-Carr

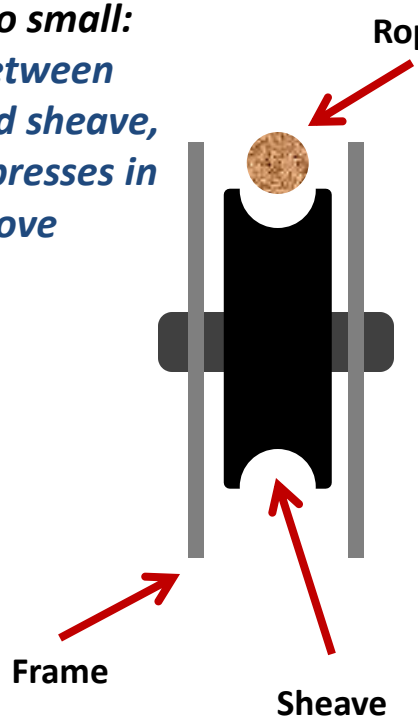
House Brackets

Marine grade blocks



Sizing a pulley

Rope too small: ***falls between frame and sheave, and compresses in groove***

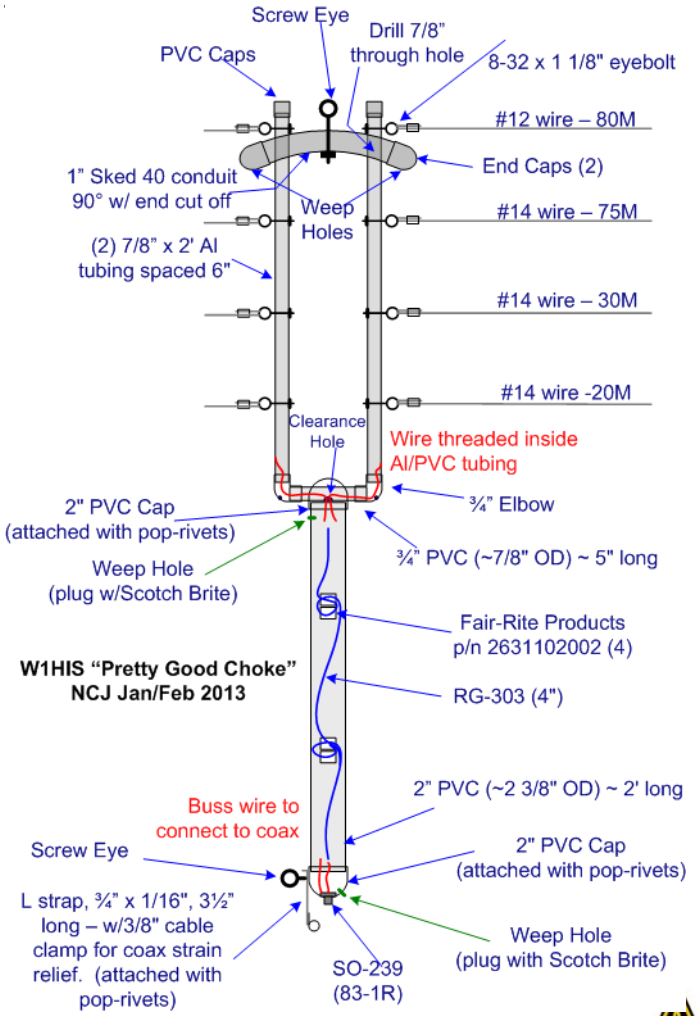


Rope too large: doesn’t fit in groove

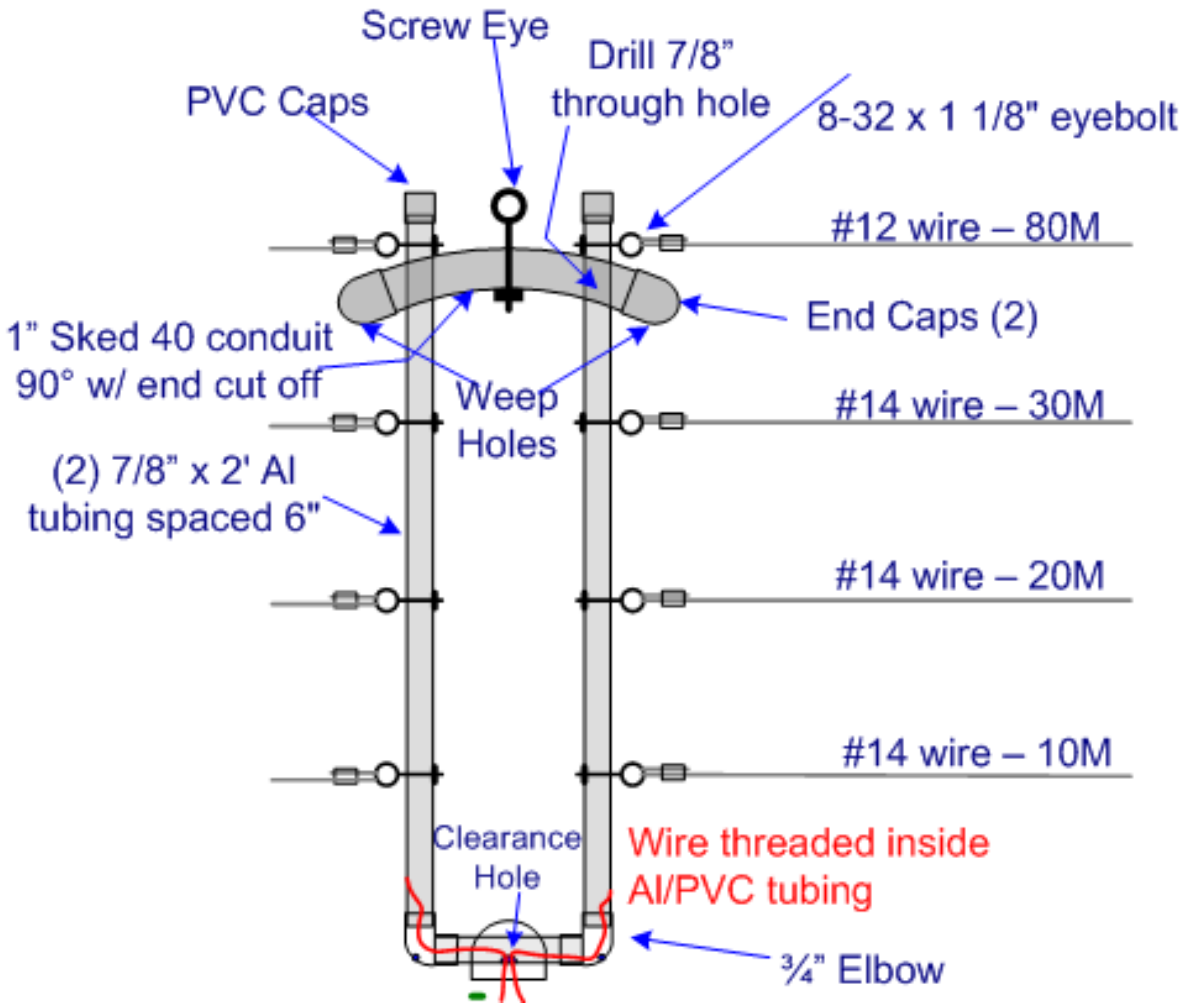
II - A 34’ Mast for HF Dipoles The “DDA”

Dipole Distribution Assembly

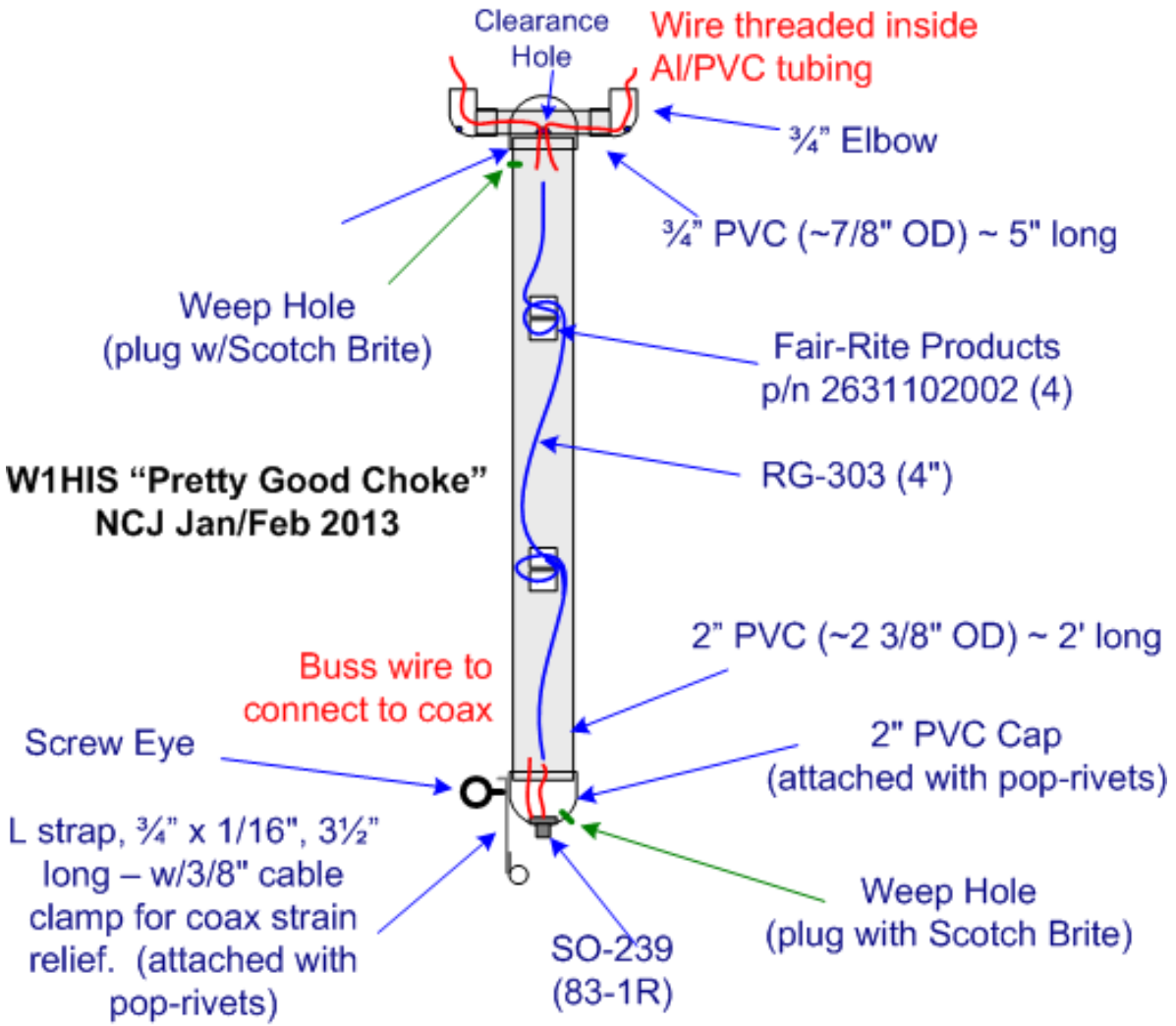
- **Fan dipole design literature shows that all wires should be parallel for best modeling**
- **Provide attachment points for four dipoles spaced 6”**
- **Include integral common mode rejection**



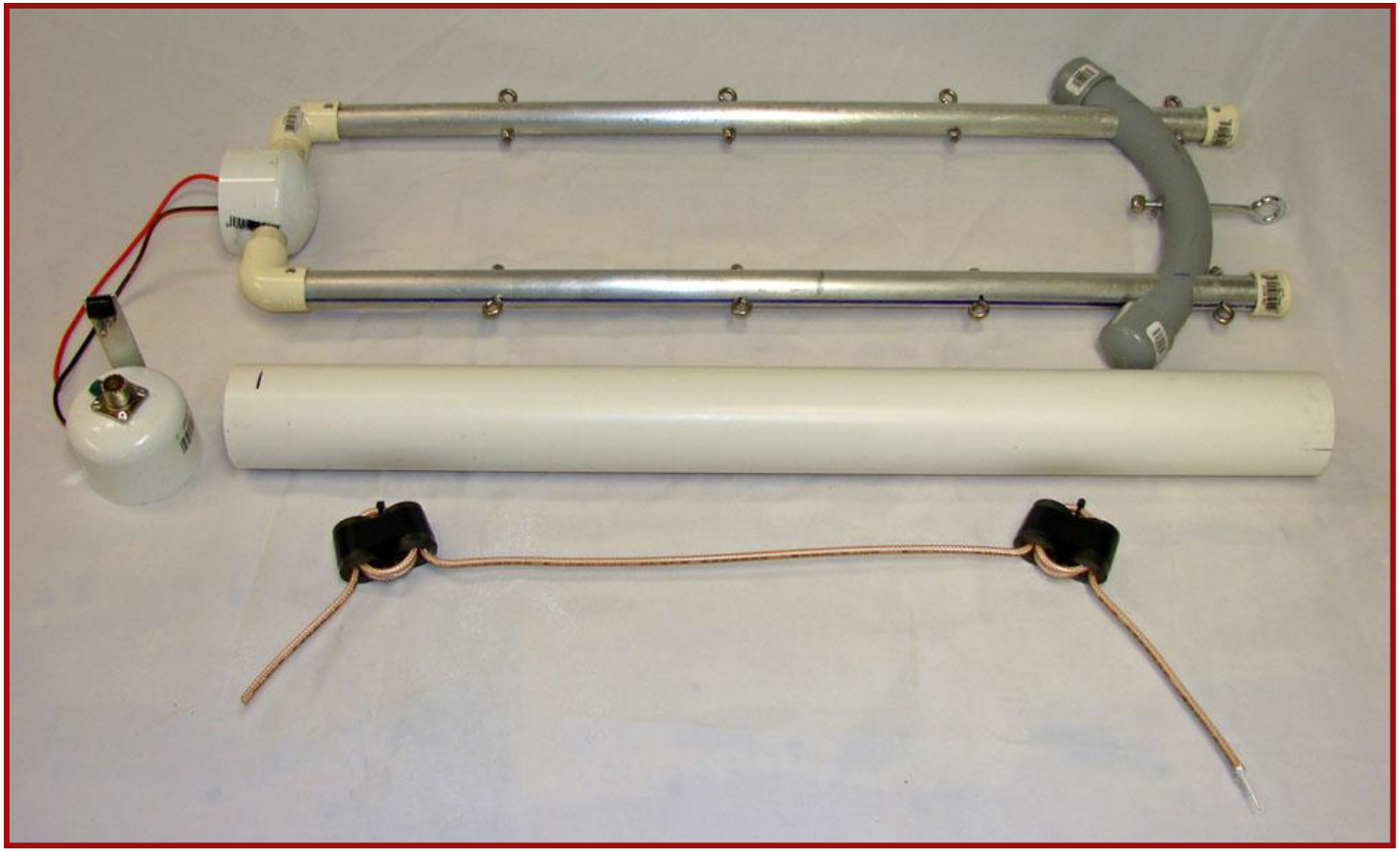
II - A 34’ Mast for HF Dipoles The “DDA” ~ Top Half



II - A 34’ Mast for HF Dipoles The “DDA” ~ Bottom Half



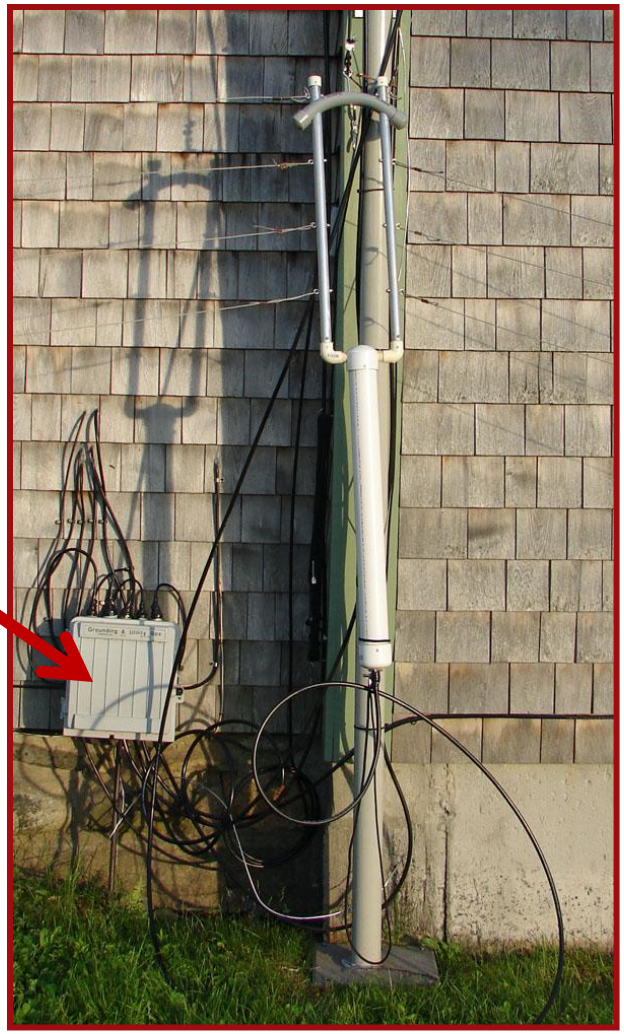
II - A 34’ Mast for HF Dipoles The “DDA” ~ Parts



II - A 34’ Mast for HF Dipoles

The “DDA” ~ In Place

Connection Box full of Polyphasers



II - A 34’ Mast for HF Dipoles Results

Two Ideas for Skyhooks

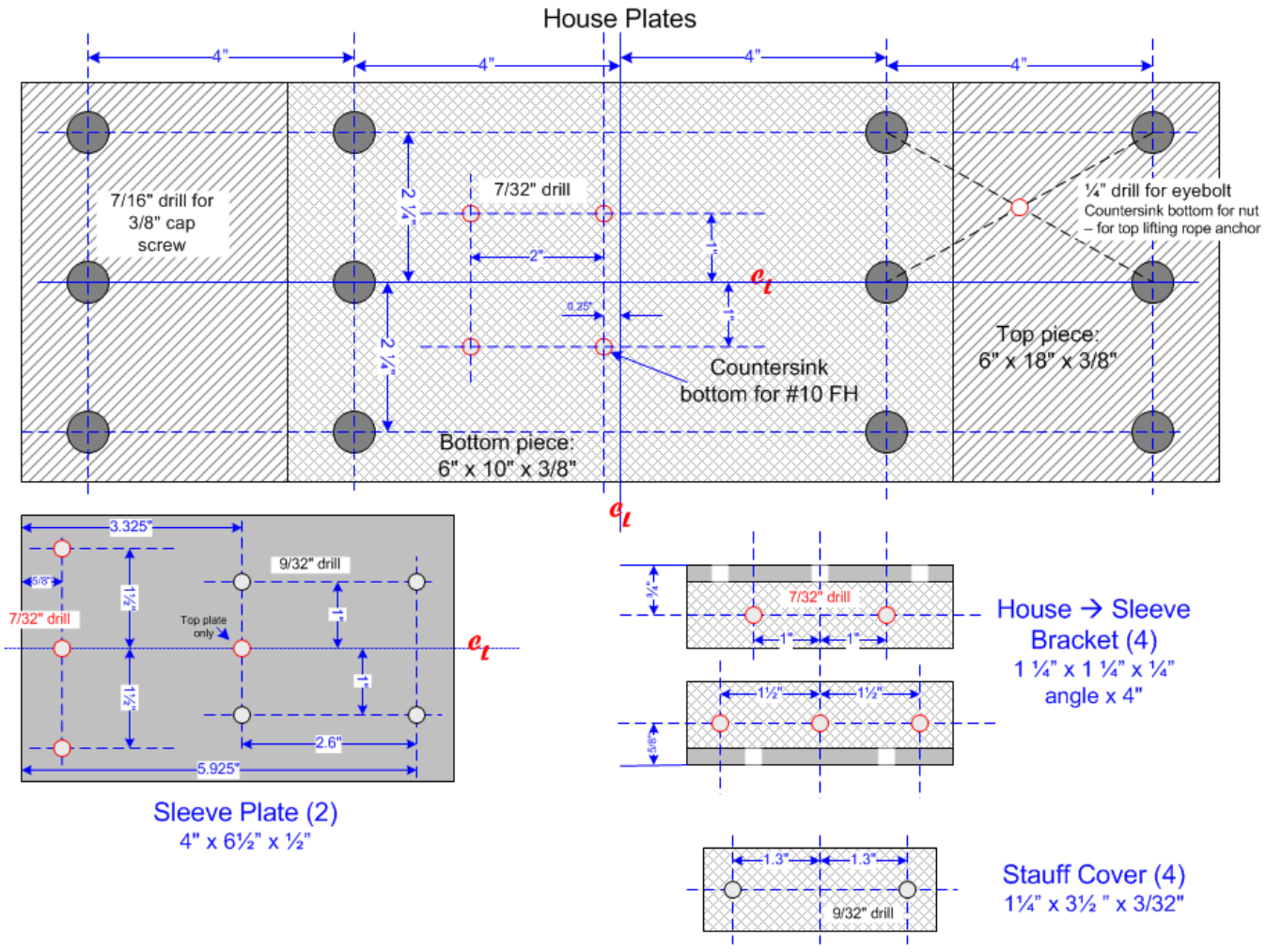
Thank You!

www.qsl.net/W1DYJ

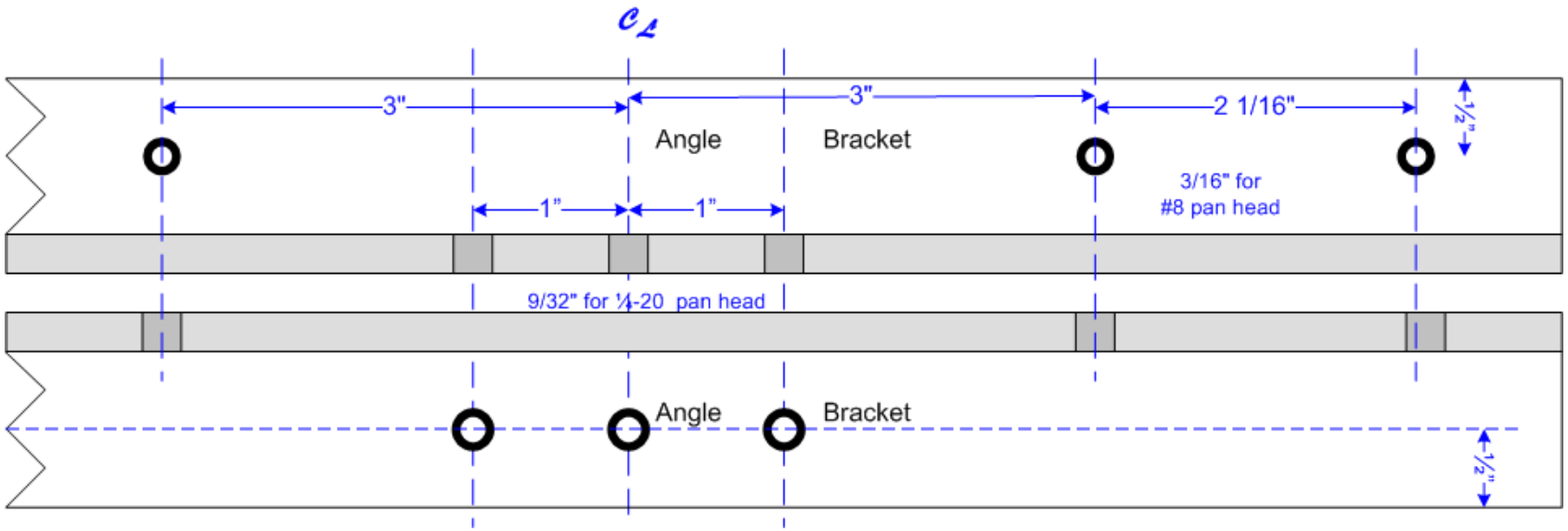
Appendix

Detailed Drawings

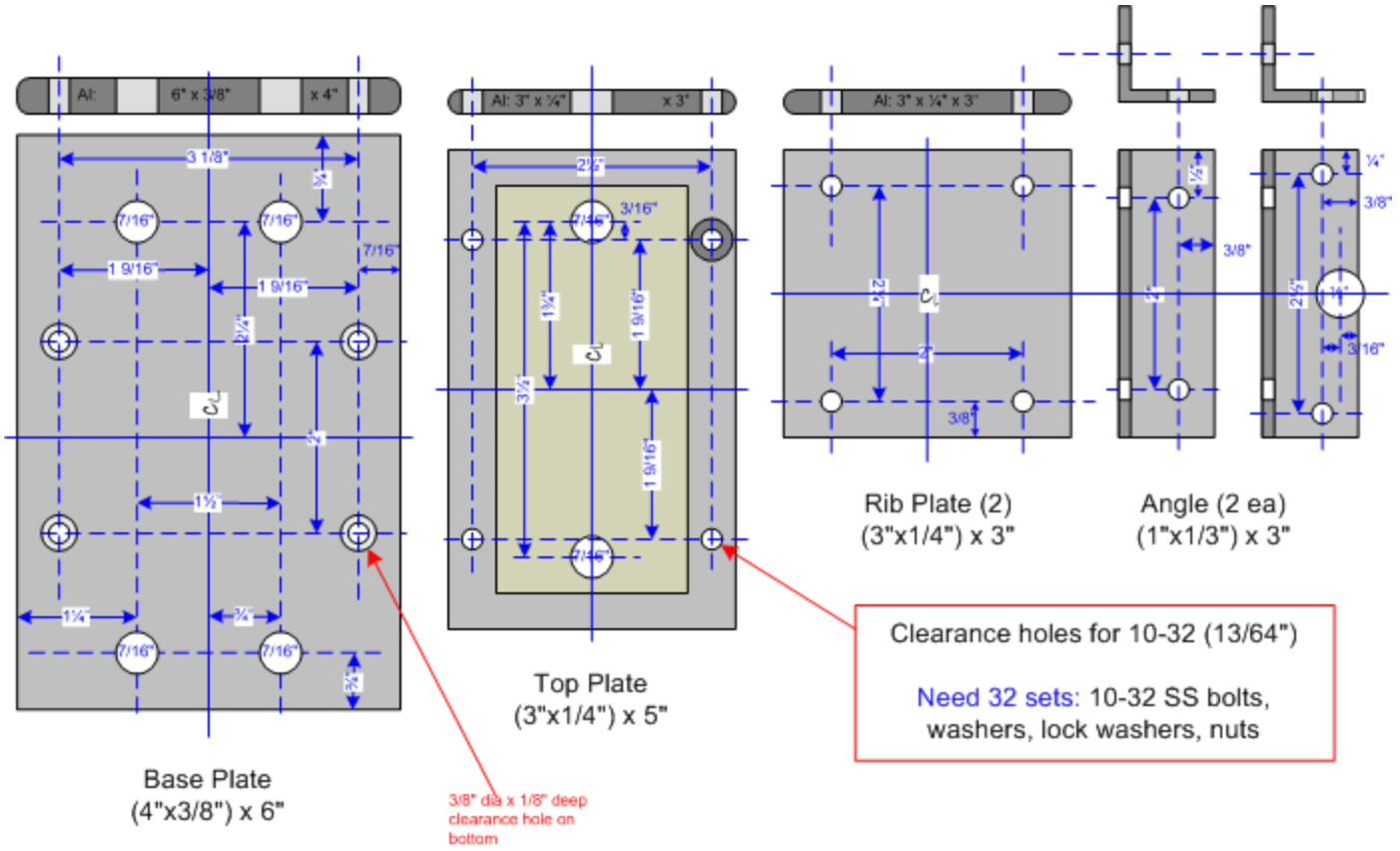
Appendix 6M Bracket Parts



Appendix 6M Pulley Template

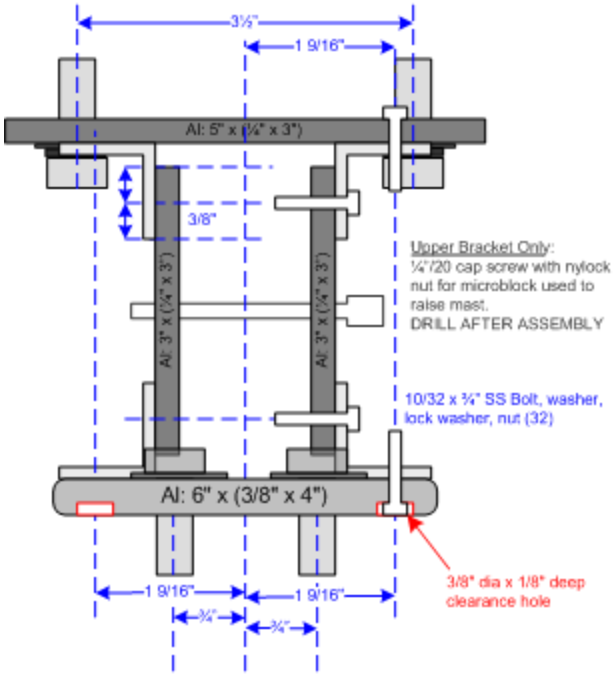


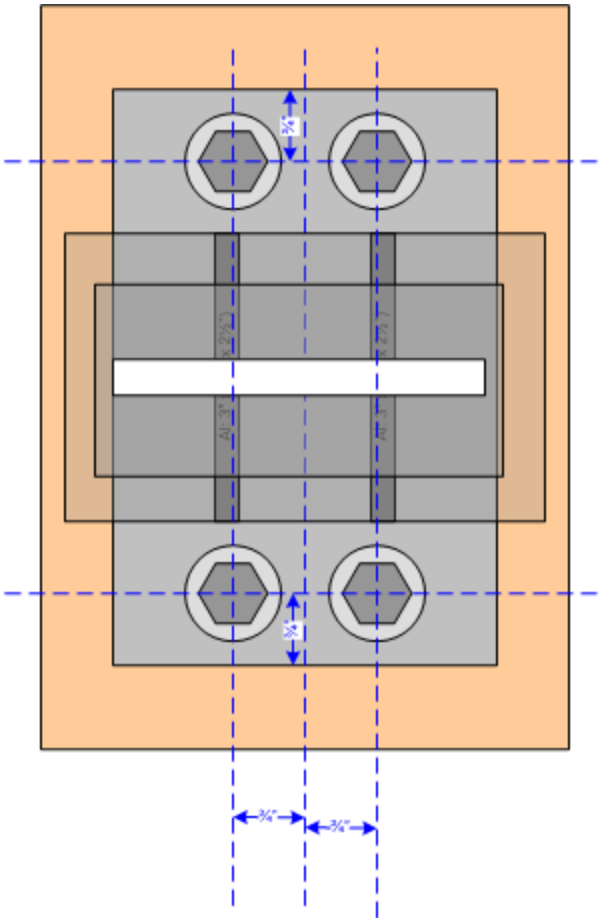
Appendix HF Bracket Parts



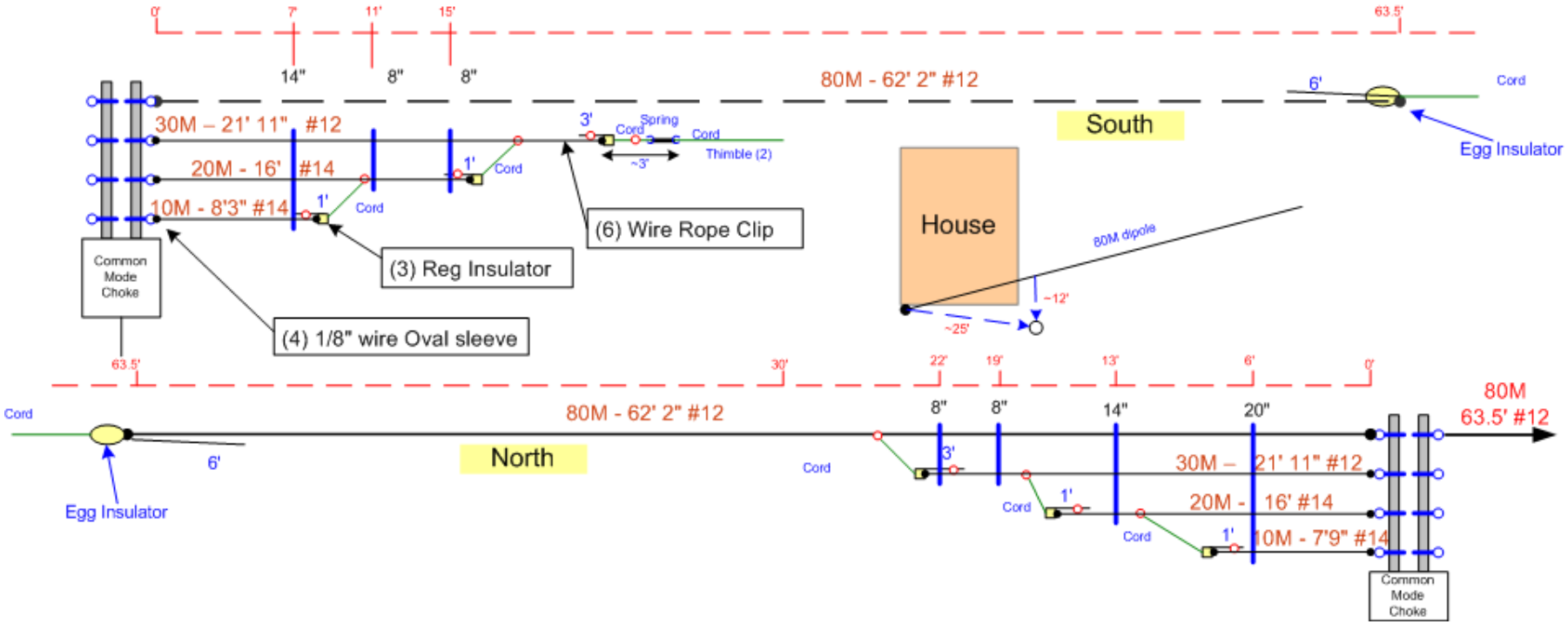
INDEXA

Appendix HF Bracket Parts





Appendix Fan Dipole



Abstract

In 2008 Maren and I bought a 2nd home in Harpswell ME, south of Brunswick. I threw up some simple HF dipoles just to get on the air. By 2013 I was ready to upgrade these. First a 6m yagi (part I of this talk) and then an HF fan dipole (part II). This is an "ideas" talk with some practical ideas for homebrew construction.

Bio

Larry was licensed in 1962 as novice KN1VFX and became W1DYJ in 1966. He was an engineer and project manager in Hewlett-Packard Medical's cardiac lab in Waltham and Andover MA starting in 1969. In 1985 he started the cardiac R&D lab's CAD and the SW Testing groups. He moved to HP Medical Education in 1993, responsible for technical and project management training. When Agilent split out of HP in 1999, he became Agilent Technology's global program manager for their Learning Management System. "Retiring" in 2005, he then consulted for Avago (now Broadcom) on eLearning technologies through 2012. Larry holds three degrees in EE from MIT. He spends his time chasing DX and contesting in Woburn, traveling with his wife Maren, and attending many jazz and classical concerts. He is the net manager and newsletter editor for the MMRA, publications editor for HamXposition, and a member of the YCCC.