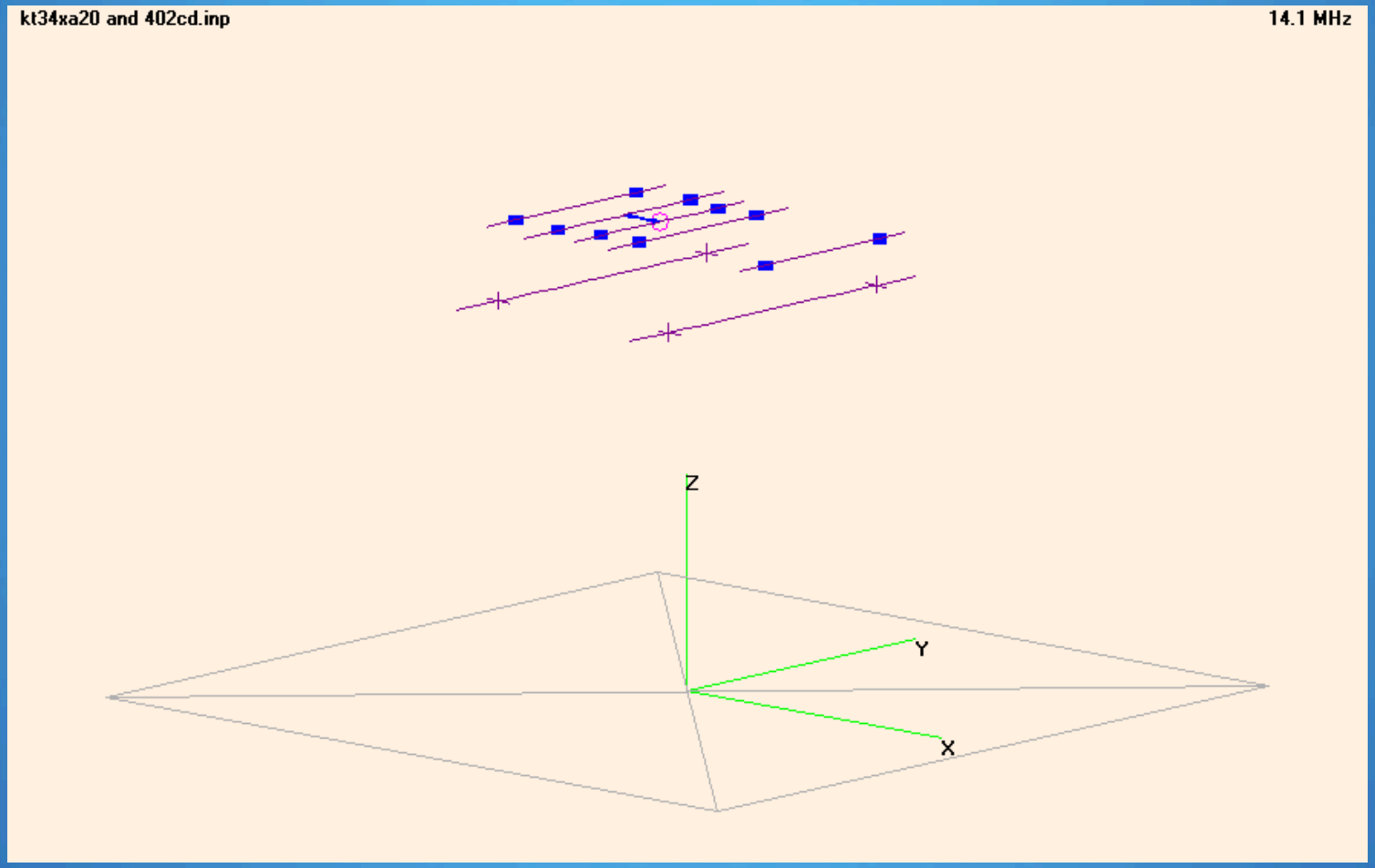
2011 Antenna Projects at K1KP- A Tale of Two Models

Tony Brock-Fisher, K1KP

May 2012

K1KP Tower Setup



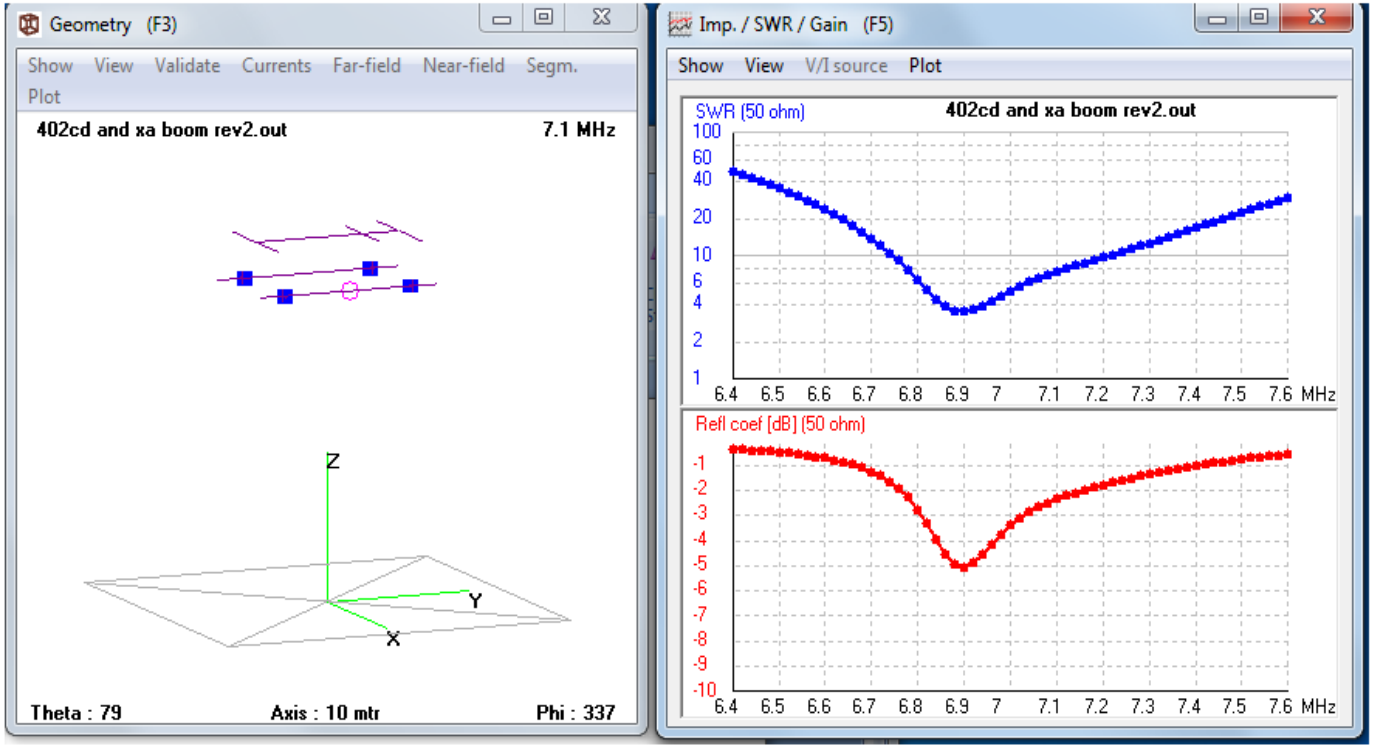
KT36-XA @ 78’ and 40-2CD@70’

Band most in need of improvement: 40 meters

- Load impedance variations on 40m requires constant amp retuning.
- Without amp retuning, often output power drops way down.
- SWR on 40meters high/variable with antenna positions.
- SWR bandwidth of 40-2CD too narrow.

Root Causes:

- New KT-36XA design has elements connected to boom, causing boom to resonate in 40 meter band
- Loaded design of 40-2CD is inherently narrow bandwidth

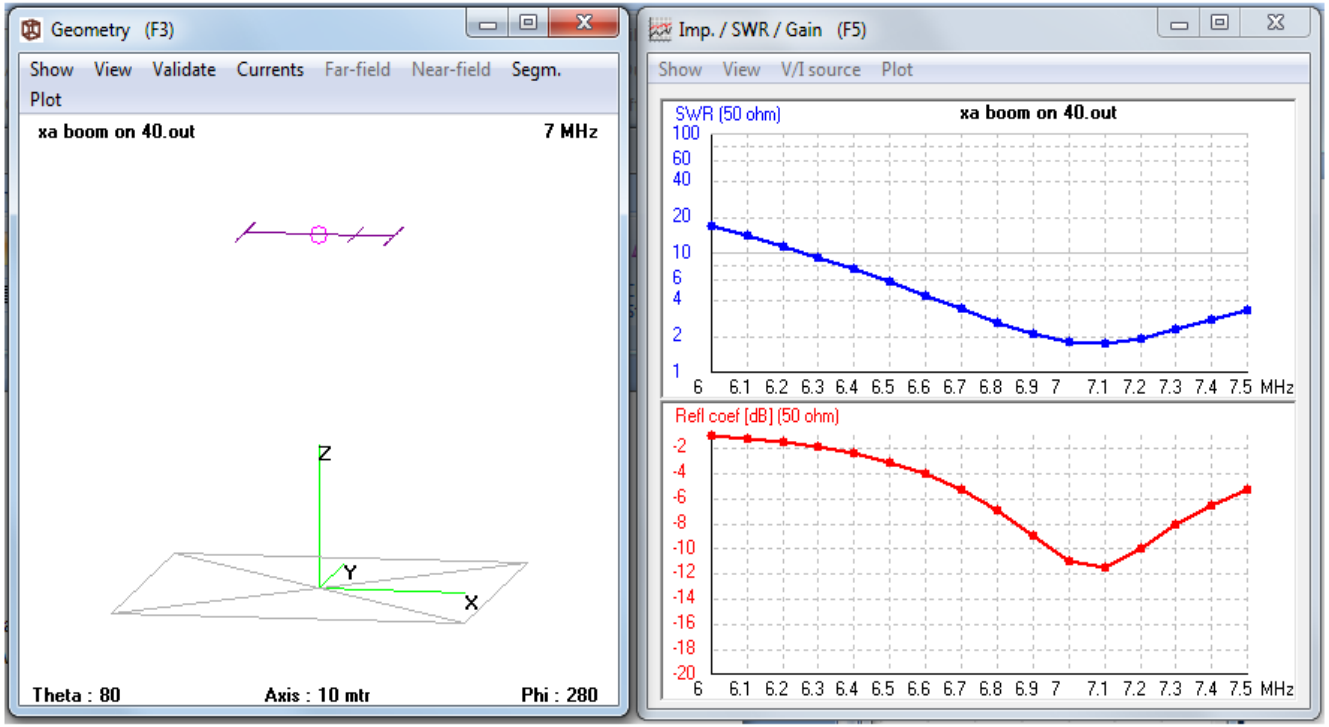


KT-36XA over40-2CD

Note High SWR on 40m beam

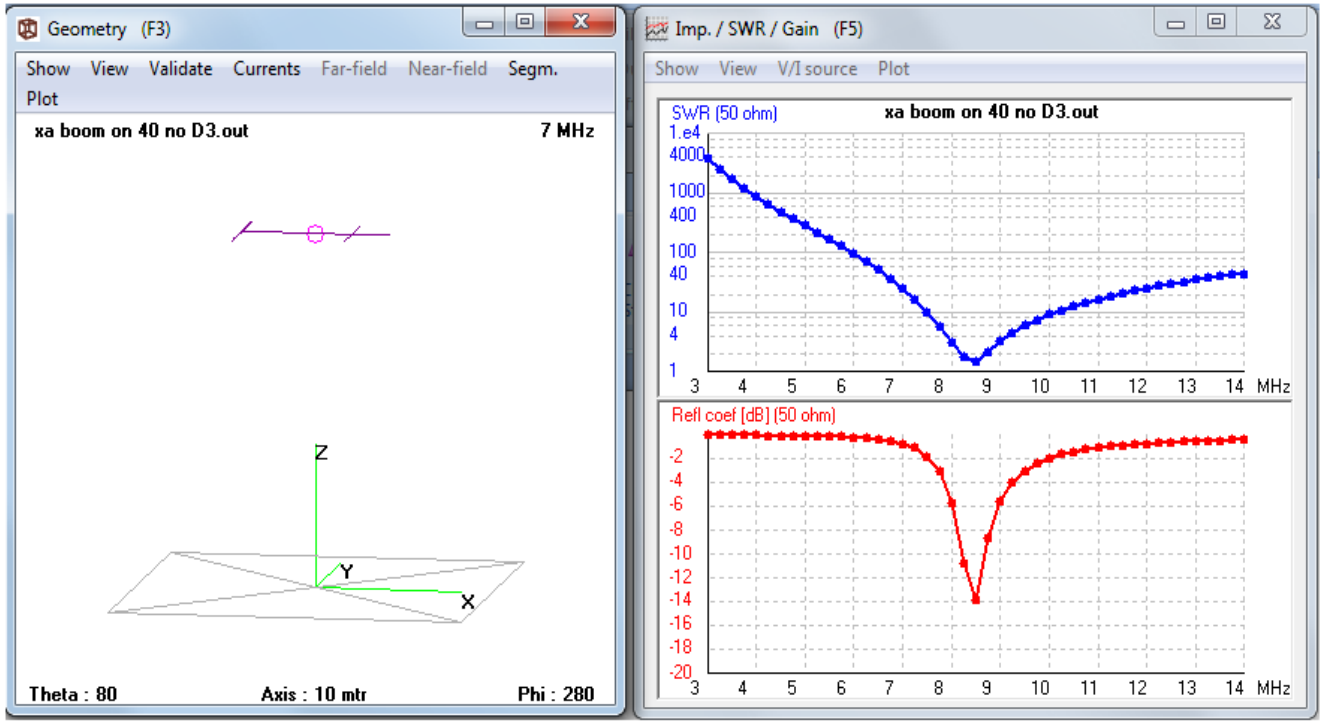
Fix 1: Eliminate 40m boom resonance on KT-36XA

- Modeling showed resonance.
- Tried breaking connection at many elements but found reflector had greatest effect.
- Driven elements not included in modeling because they are already isolated from boom.



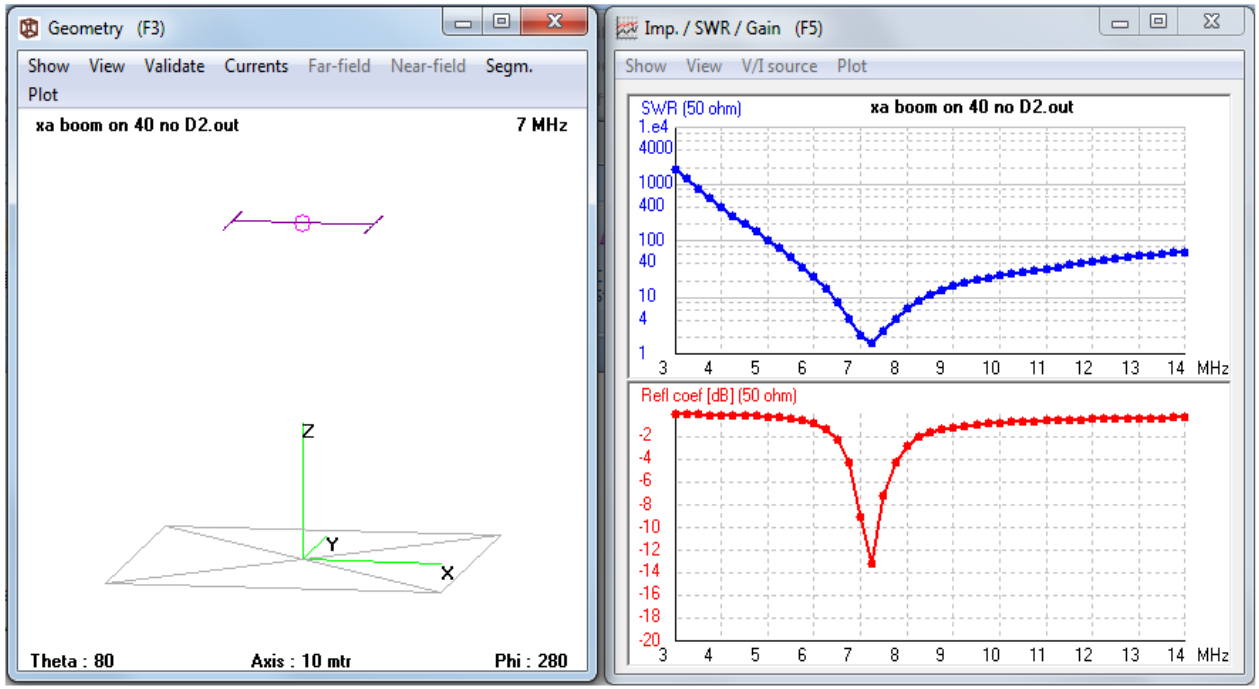
KT-36XA over40-2CD

Note XA boom is resonant on 40m – Would make a nice dipole!!



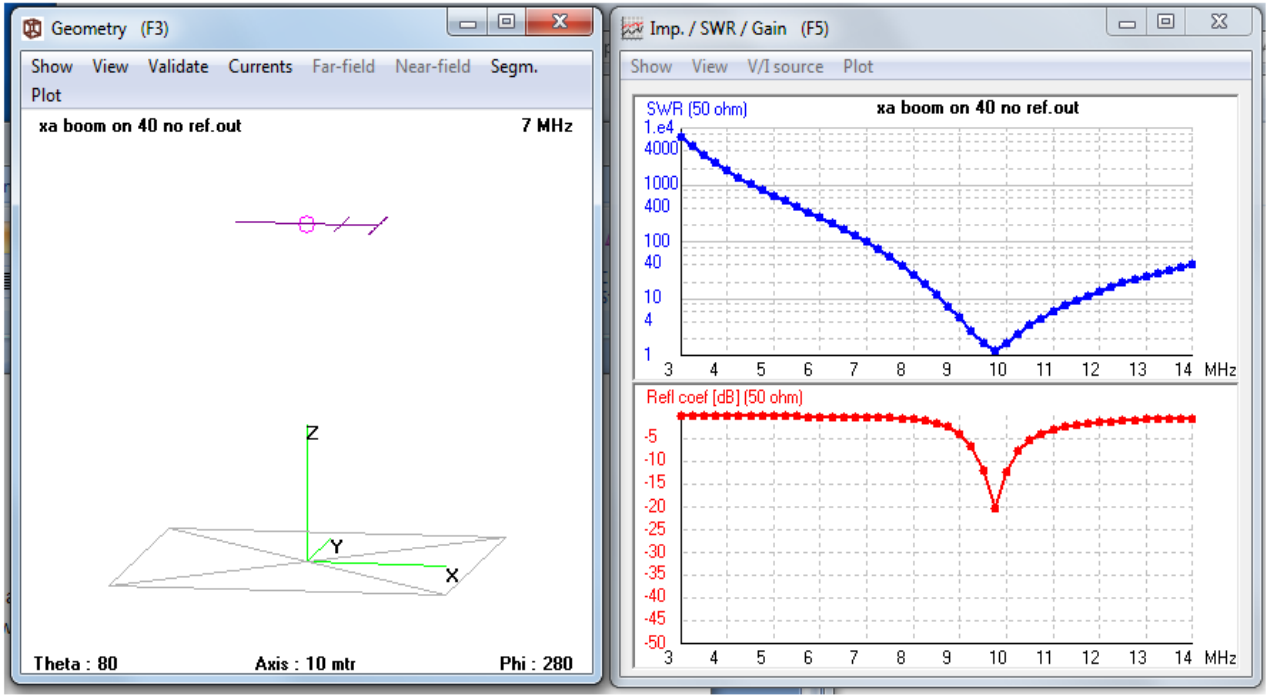
KT-36XA over40-2CD

Removing D3 moves resonance up to 8.5 MHz – progress!



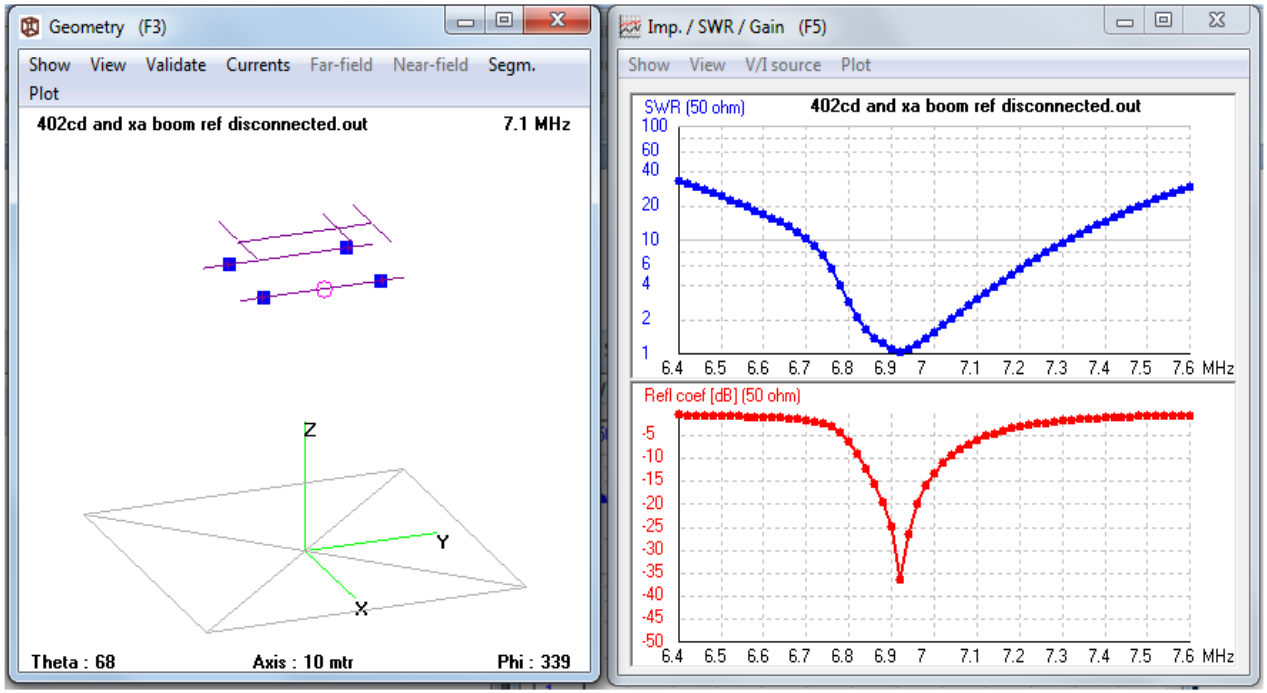
KT-36XA over40-2CD

Removing D2 has very little effect – Reflector and D3 still provide loading



KT-36XA over40-2CD

Removing reflector has greatest effect – resonance moved to 9.75 MHz!

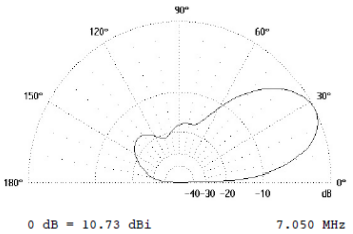


KT-36XA over 40-2CD

SWR on 40m beam is now back to 1:1 !! Success!

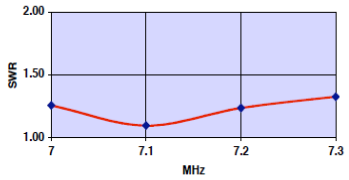
Fix 2: New antenna on 40m

- Found ‘modification’ by W6NL to 40-2CD/XM-240 design.
- Eliminates loading coils.
- Increased gain, efficiency, and SWR bandwidth.
- Between efficiency & directivity, new moxon models 4.4db better than 40-2CD.



0 dB = 10.73 dBi 7.050 MHz

- **99.5% Efficiency**
- **High F/B**
- **300+ kHz VSWR BW**



- 1 -

W6NL ‘mod’ to 40-2CD/XM-240

Eliminates loading coils, increases SWR bandwidth, efficiency and gain

Details of W6NL Moxon

- Reuses parts from XM-240. No published info on converting 40-2CD.
- Uses 2’ and 4’ tubing - but ALL vendors sell antenna tubing in 3’ and 6’ lengths!

Scratch built vs. Rebuilt

- Cost savings from reusing 40-2CD was less than a used 40-2CD is worth.
- Could be difficult to reuse parts due to corrosion, wear, deformation.
- Would require removing 40-2CD in separate tower job from installation of new antenna (double tower work).
- Saving old 40-2CD means I have a ‘spare’ backup antenna available.

Scratch Built Design

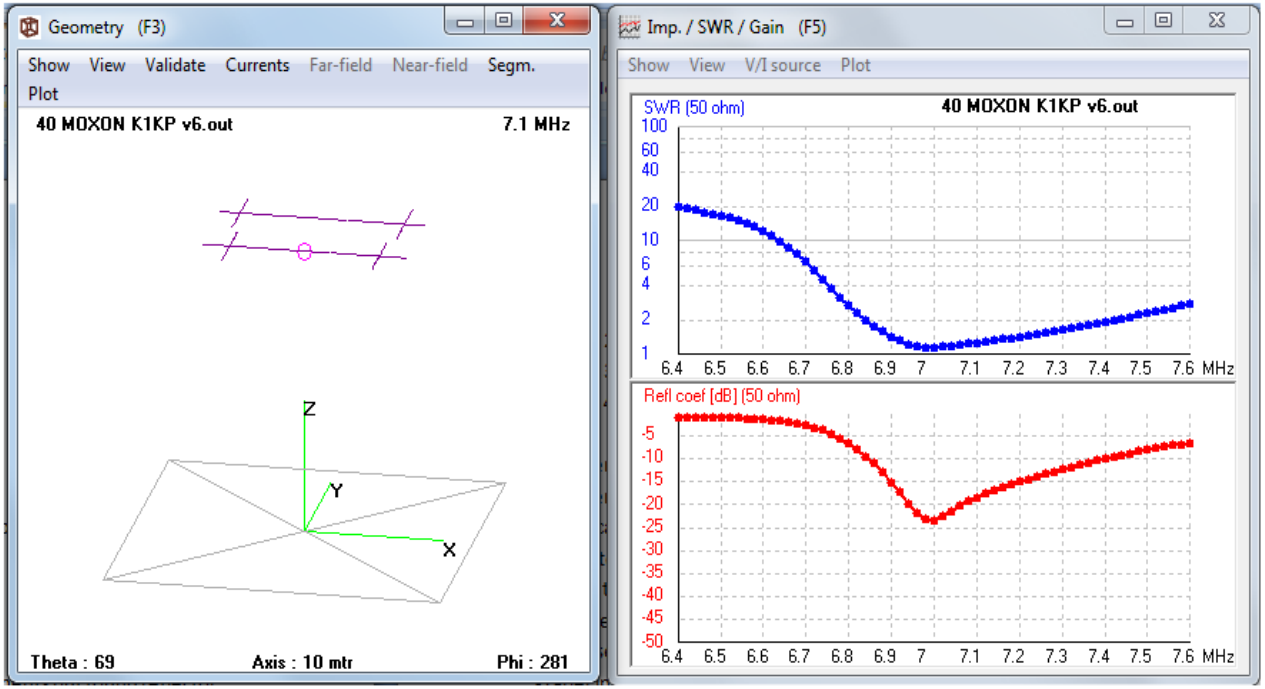
- Uses W6NL data as starting point, designed new antenna from ground up.
- Uses 3’ and 6’ tubing lengths.
- Uses XM-240 boom-element mounting scheme.
- Mechanical Modeling with YM
- Electrical modeling with 4Nec2, NEC4

Modeling Disagrees with Real World

- Electrical modeling showed Peak Gain, Min SWR way below 7.0 MHz!!
- K5GO Repeated modeling with NEC4 (in 2011), got same results.

“Talk to the Man That Owns One”

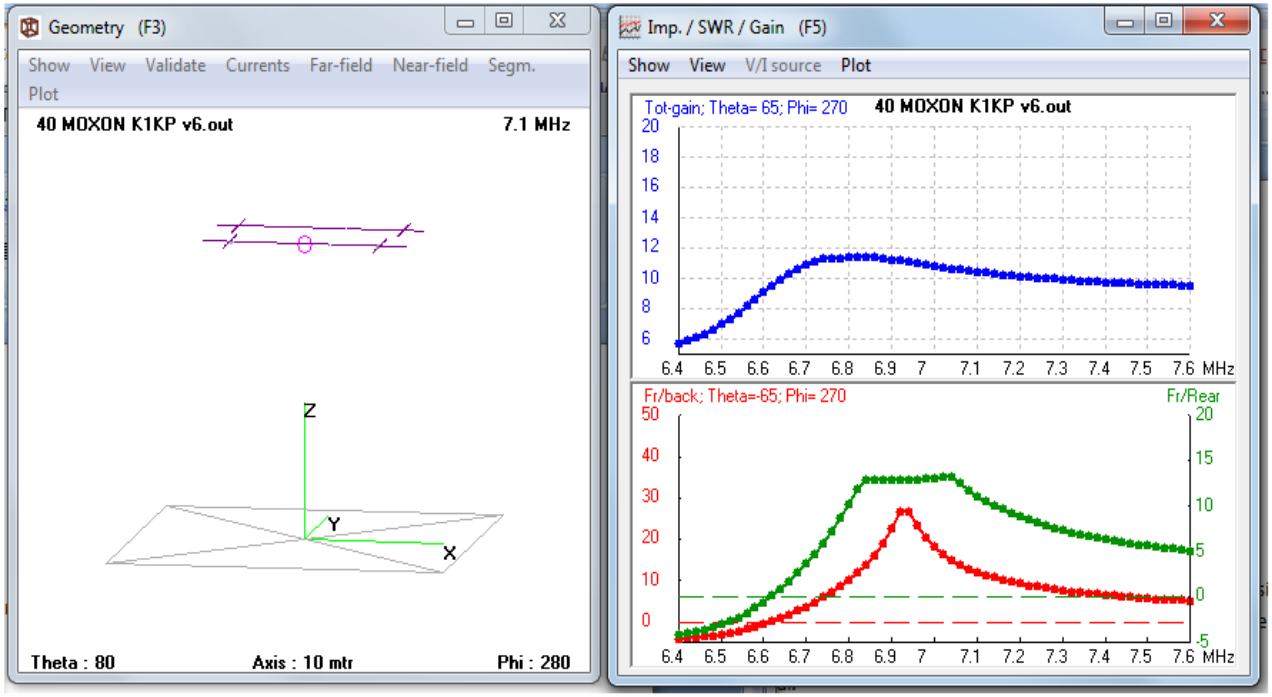
- Talked to K1GU, K3LR, who have built this antenna.
- They both said “Build it to the W6NL dimensions; it will work”.



W6NL Moxon Modeled with 4Nec2

SWR minimum is at very bottom of band; would prefer to center min SWR at 7.150

-Get a load of that bandwidth!!!



W6NL Moxon Modeled with 4Nec2

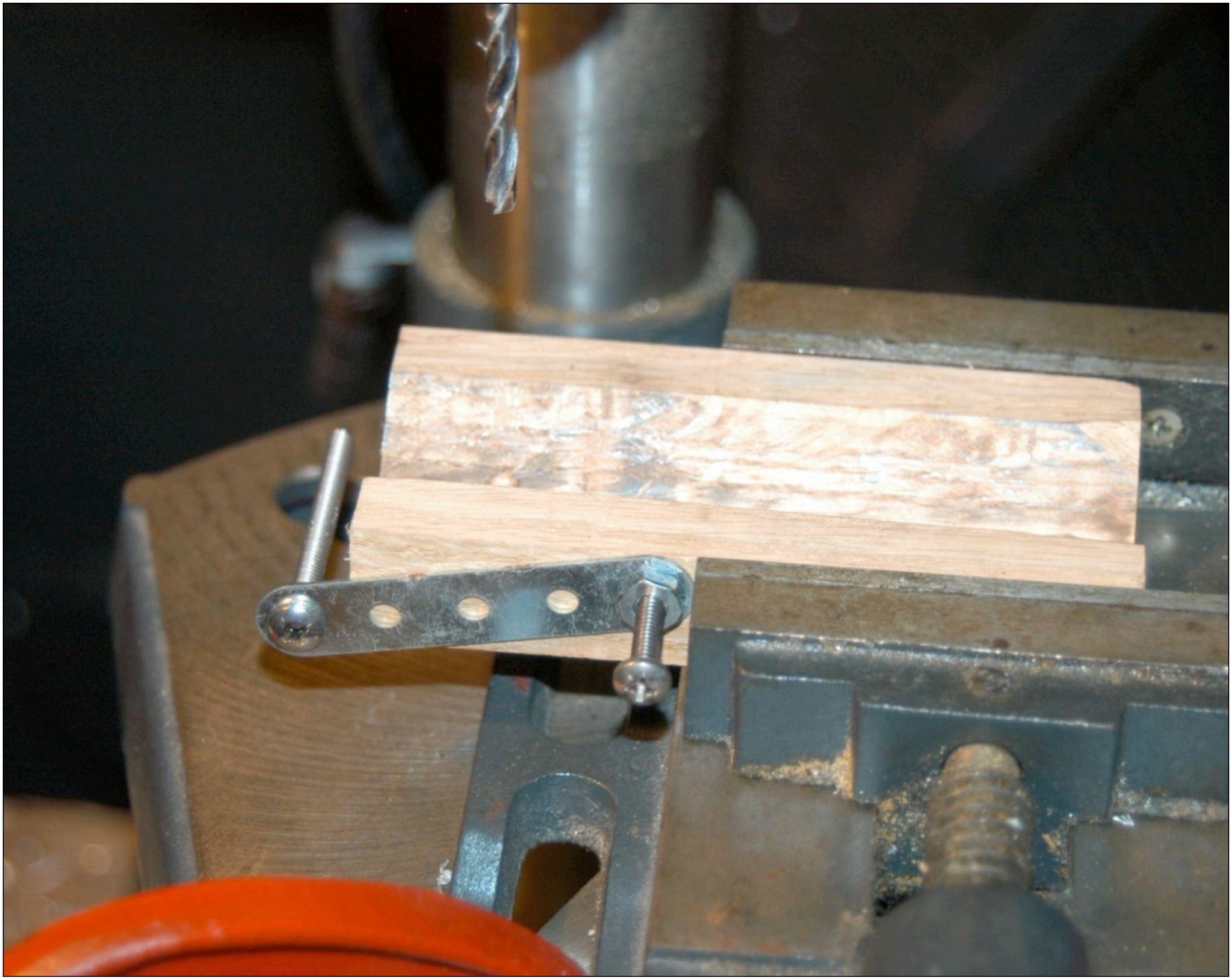
Gain peaks around 6.8 MHz!

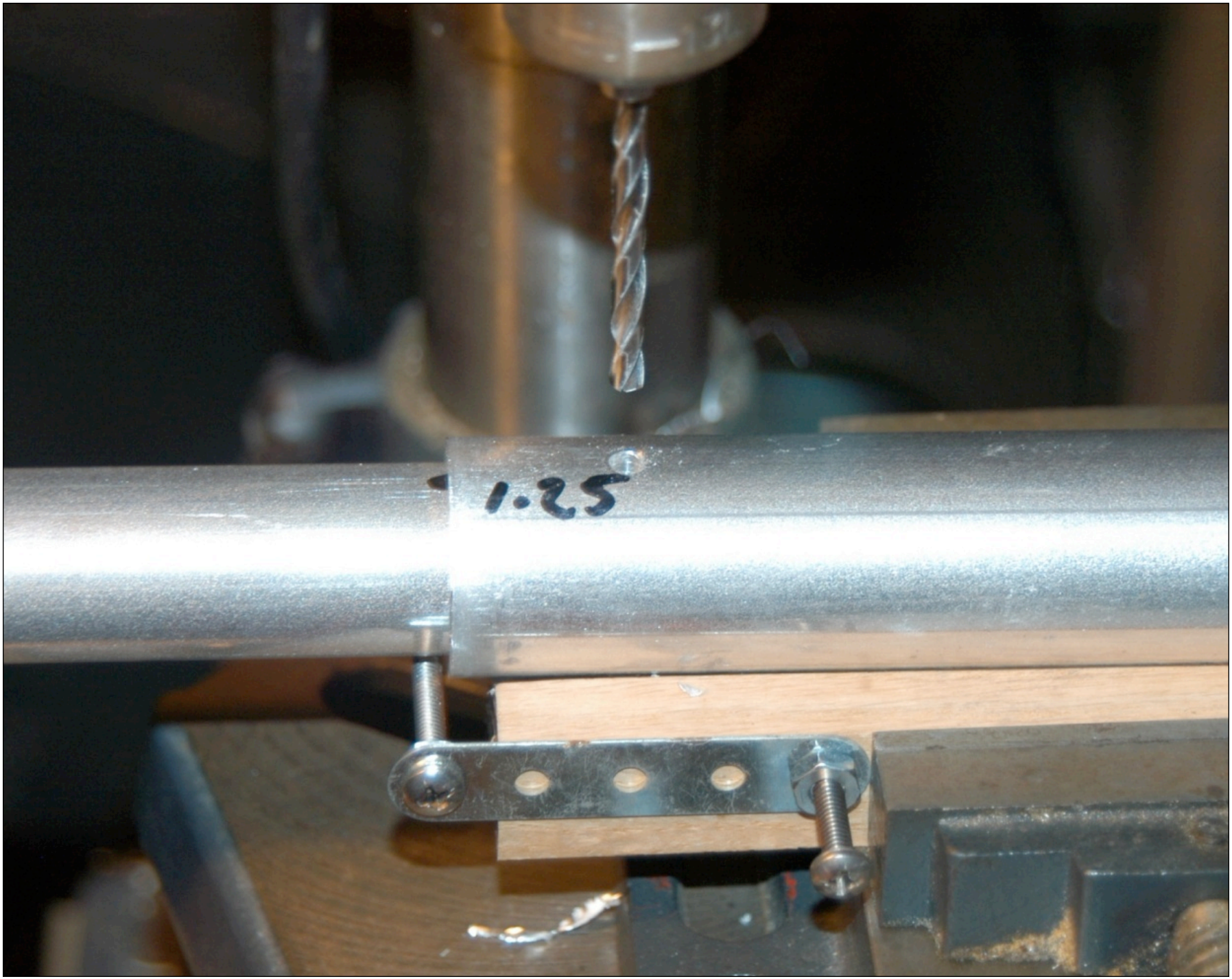
Modeling to Show Trends

- Different tubing lengths → different taper schedule.
- Different taper schedule → possibility of detuning antenna from W6NL design.
- Modeled different tapers, found that greatest effect of changing taper was in the Tee sections – which makes sense because there are 8 of them!
- Taper in elements less critical.
- Decided to copy W6NL Tee sections exactly, despite tubing costs. $$ Difference was minor.

Committed to Build It!

- Took the plunge, bought aluminum from Cycle-24, many parts from DXE, rest of stuff from Rocky's Ace and HD.
- Hoped to build it without element trusses but that didn't work, had to add trusses at last minute.

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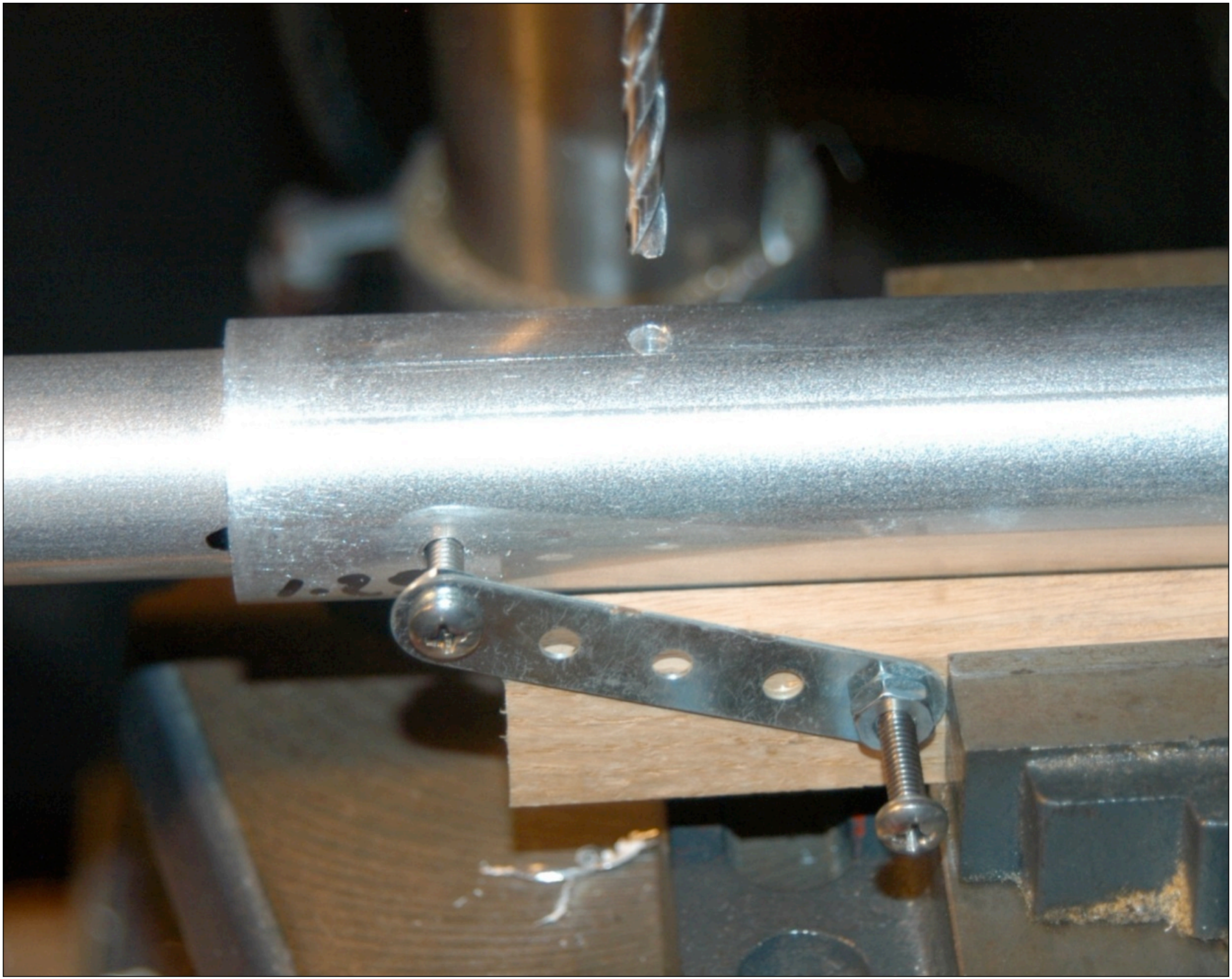
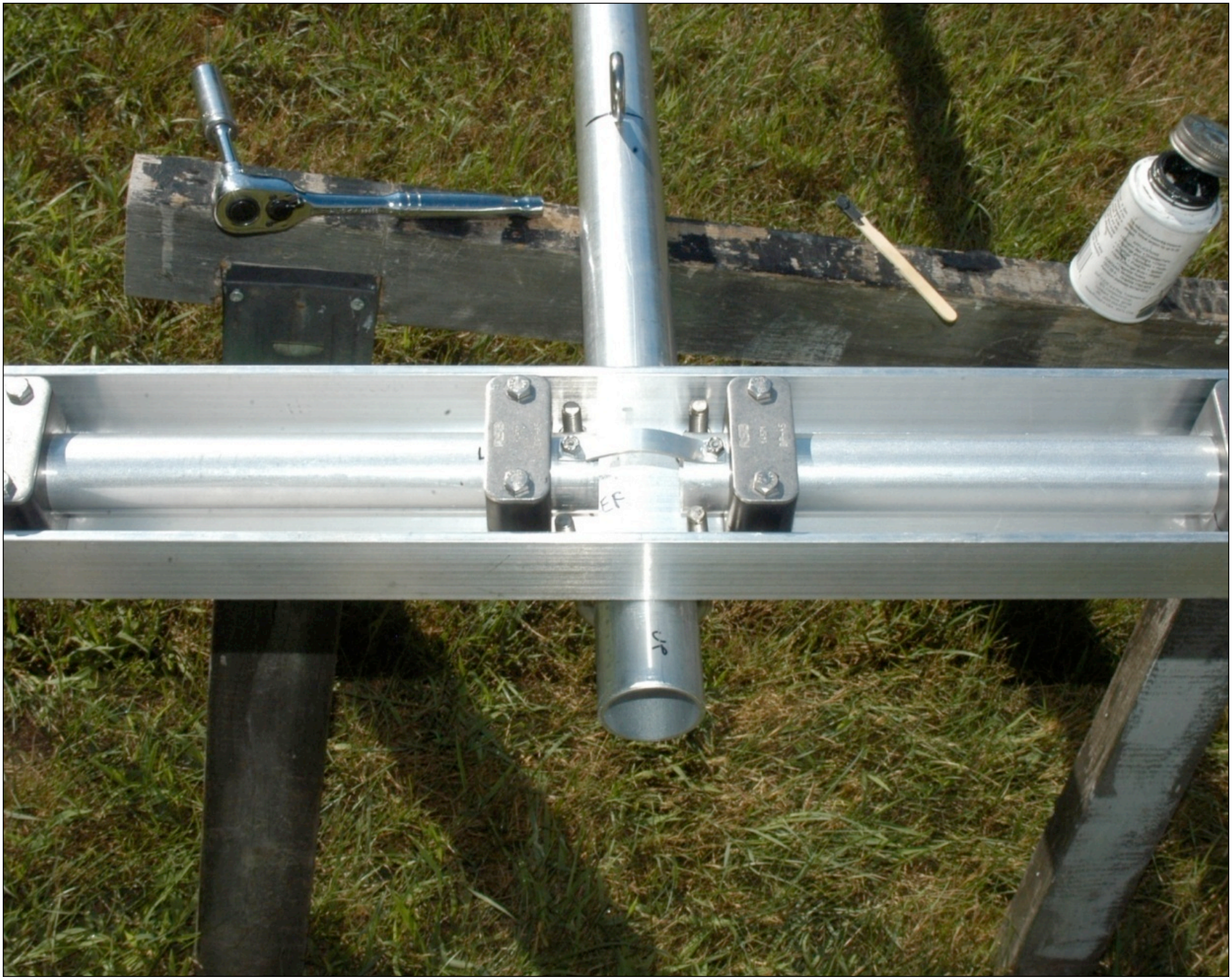
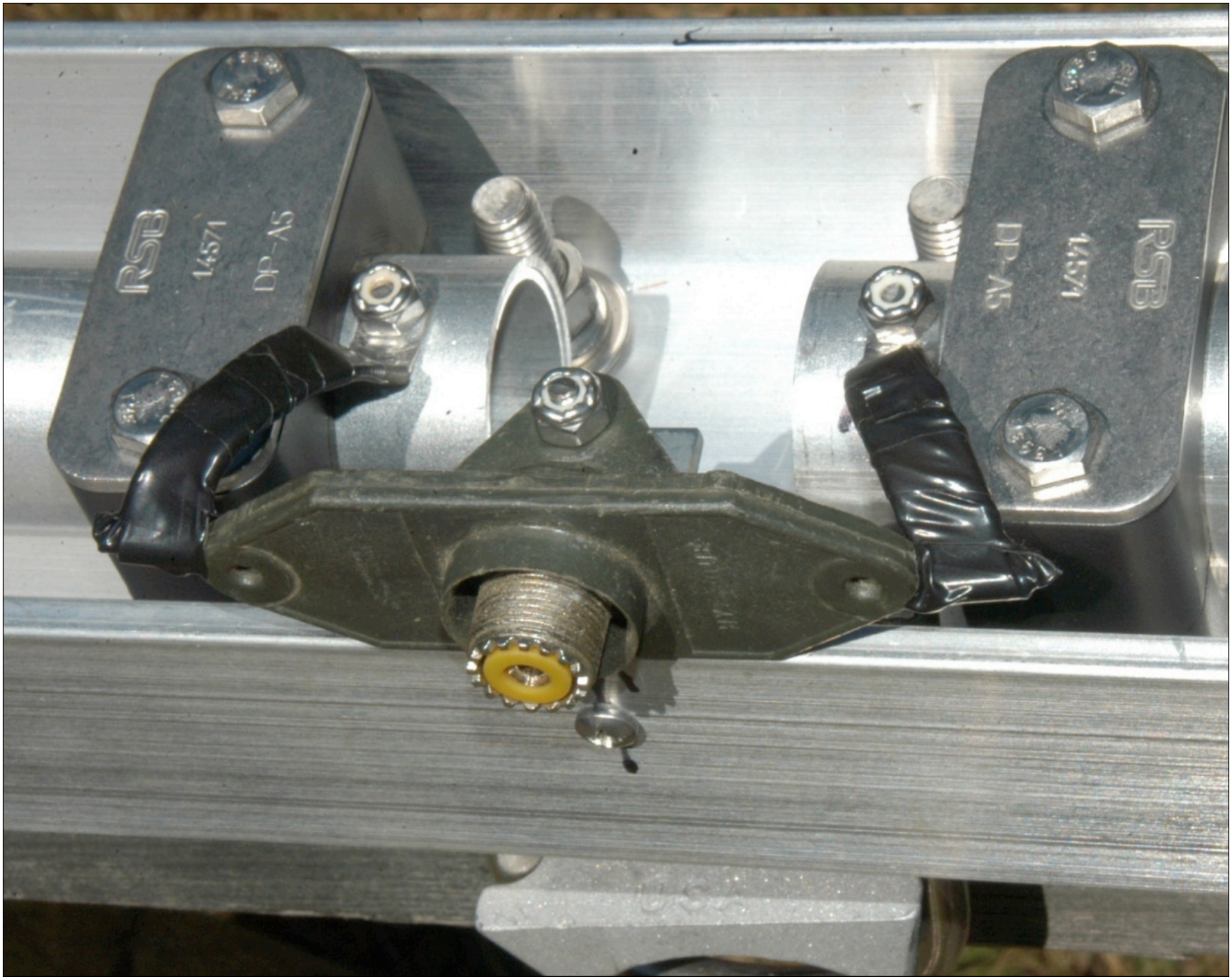
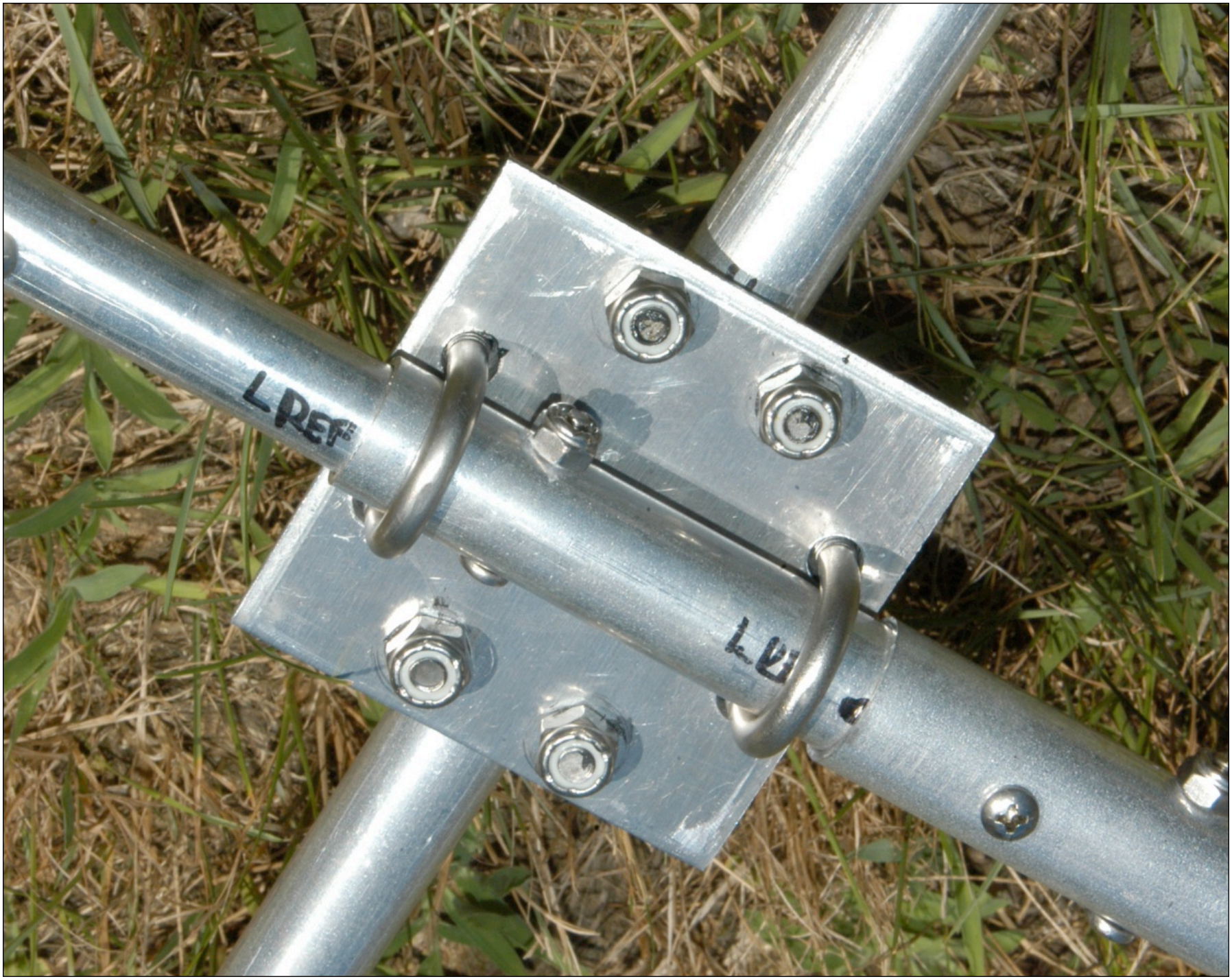





RSB
1457
DP-A5
RSB
1457
DP-A5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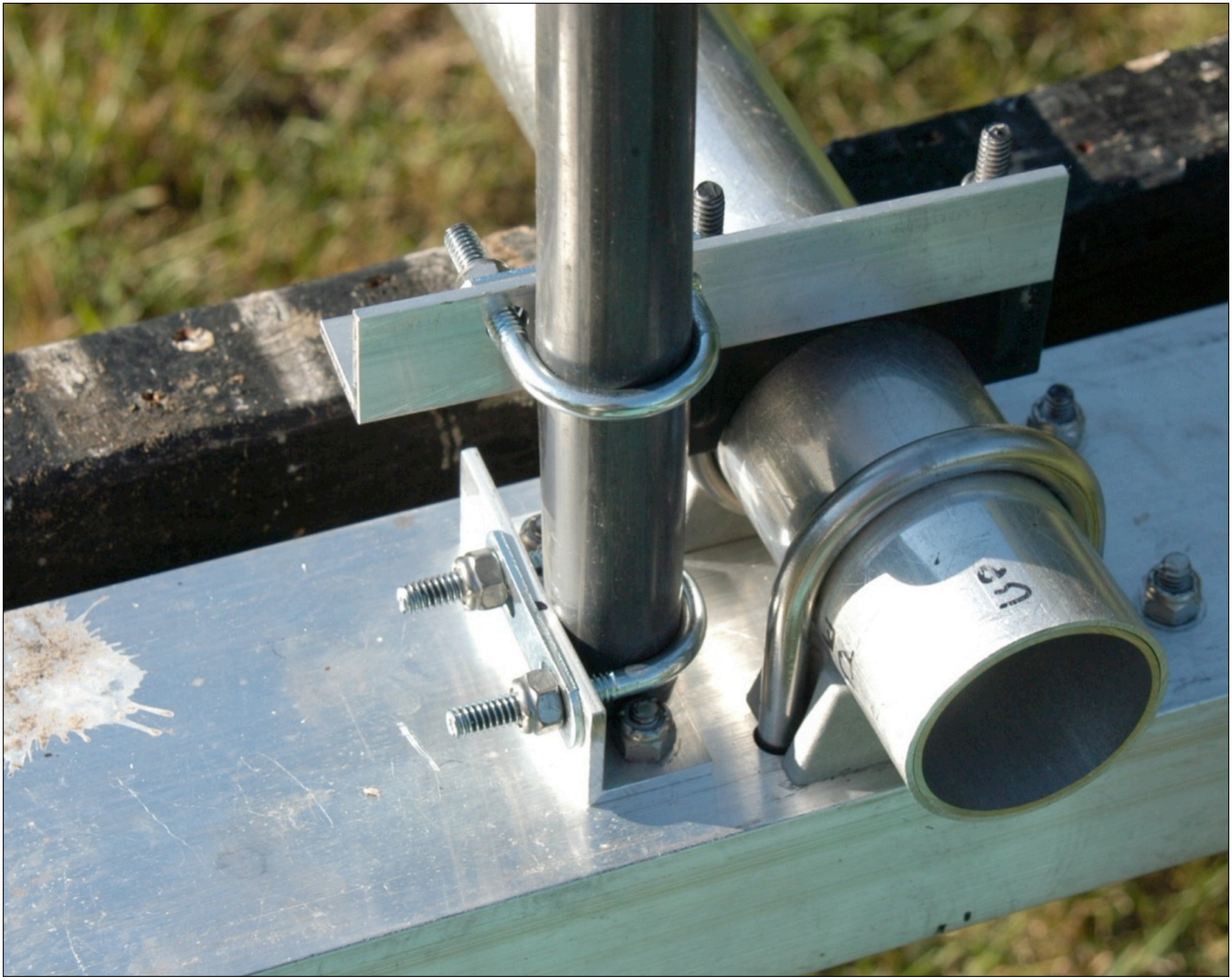

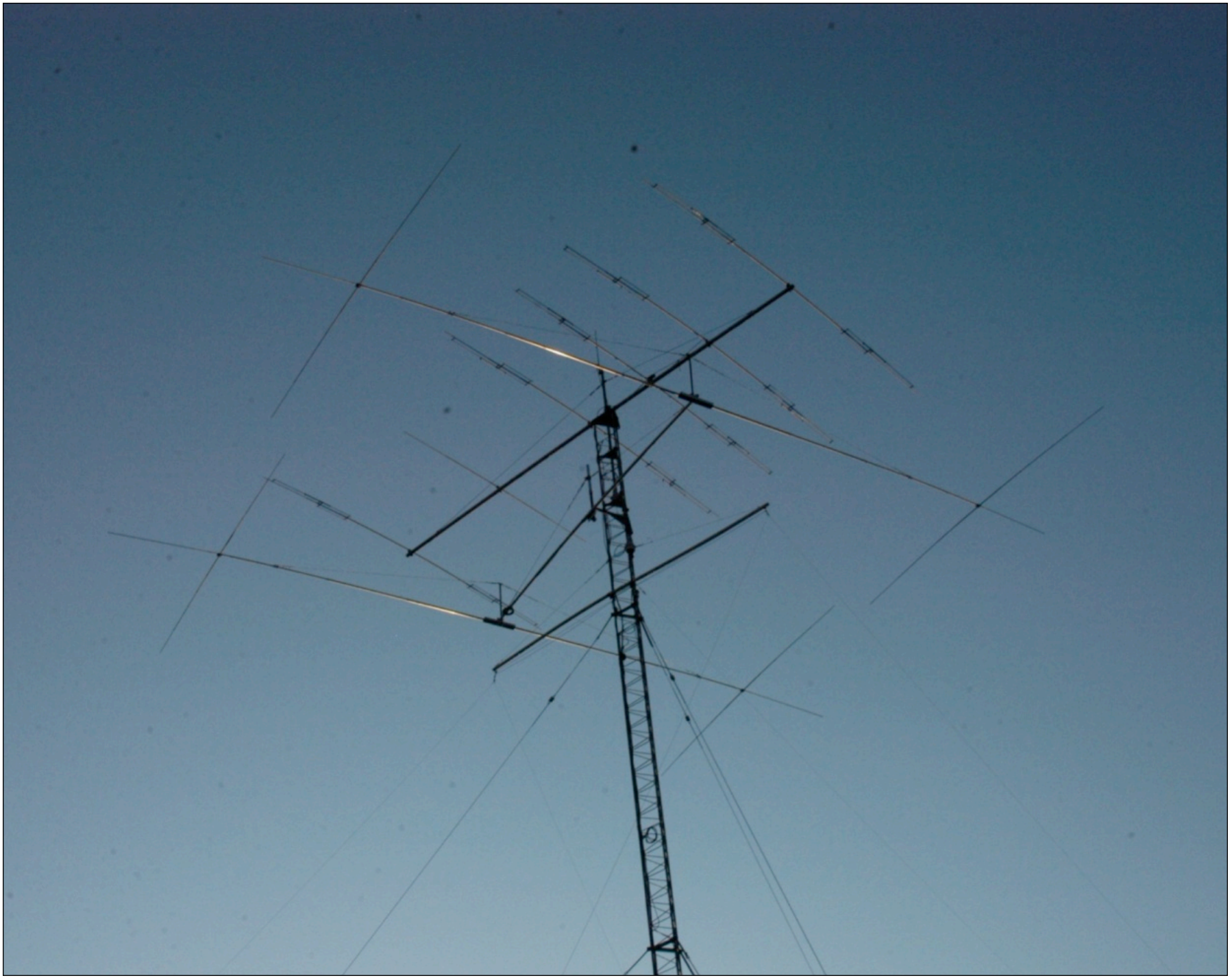

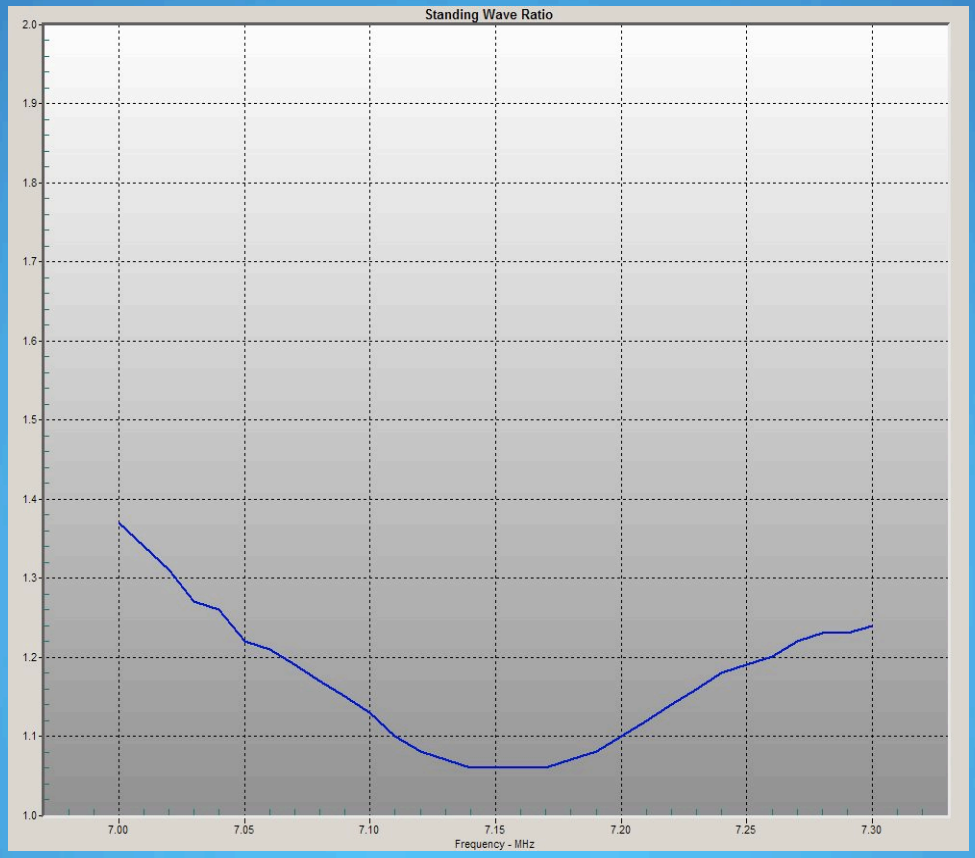

SWR was PERFECT !!

-No Interactions with XA

Results

- *Measured* F/B in CW end >20db!
- K1KP 1-called entire 40m band first night of CQWW SSB.
- W1UJ (same antenna) 750 Qs in SS CW.
- K1KP 902 Qs in SS phone
- K1KP 1111 Qs in CQWW CW

Conclusions

- Modeling showed how to eliminate boom resonance on XA
- Modeling did not get frequencies right on Moxon, but did give useful info on taper & trends.
- Can tune up amp on 7.150MHz to 1500W; output never drops below 1300W anywhere in band, regardless of antenna positions

Latest Updates

- Many have attempted modeling since my efforts
- W1JR – better success with segmentation changes, NEC4
- K5GO – NEC4
- W8WWV – Highlights issues with taper correction in NEC2

Modeling the W6NL 40m Moxon
Greg Ordy, W8WWV
April 13, 2012
V1.01

- “Re-design of a Moxon rectangle that employs a stepped-diameter taper schedule is not a task for NEC-2. Because the stepped-diameter correction of NEC-2 implementations does not operate for non-linear elements, the program will not correctly handle the bent Moxon elements. Re-design should use either NEC-4 or a highly corrected version of MININEC 3.13, such as the one sold as Antenna Model”.

For More Details, visit:

http://w1uj.net/Moxon/K1KP/readme.html

(thanks to W1UJ for hosting)