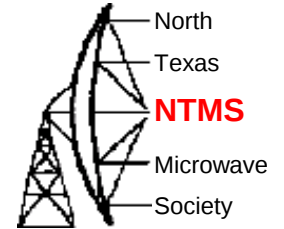


Design & Build 23 cm Yagi Using Simple Tools

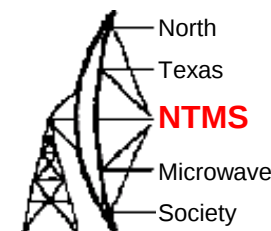
WA5TKU
Wes Atchison

DL6WU Yagi Design



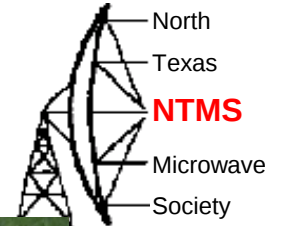
- Design Presented in 1982 Article
 - Published in UKW-Berichte January 1982 Issue
 - Titled “Extrem Lange Yagi-Antennen”^{1,2}
- Elements Shorted to Boom
 - Hole in Boom Drilled Smaller Than Element
 - Element Driven Into Hole With Hammer
 - Cold Welding Element to Boom

WA5TKU Antenna

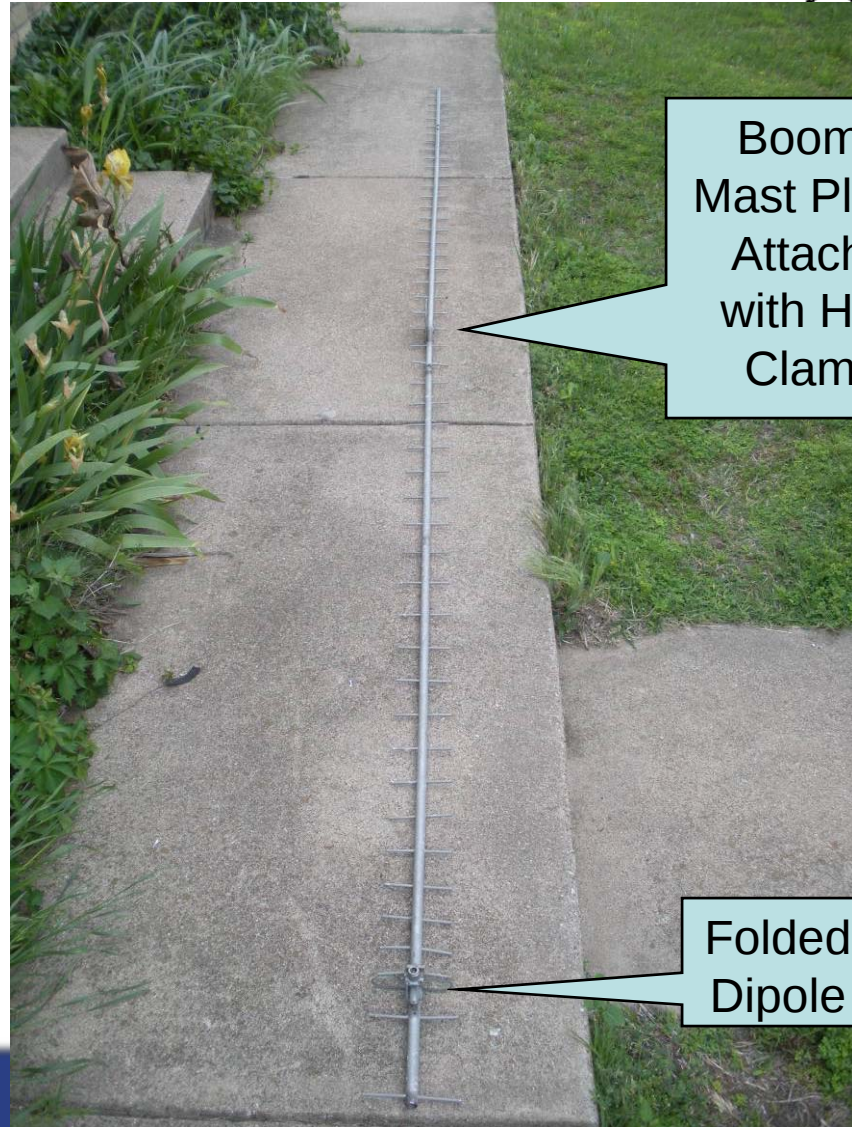


- Built DL6WU 1982 Article Based Antenna in 1986
- Gain Measured at Central States VHF Society Meeting in St. Louis
- Converted All Measurements from Metric to Decimal English Units
- Boom Was Split to Fit in Back of Van
- Antenna Installed on Tower For August 1986 UHF Contest – Taken Down April 2009 to Repair Broken Boom

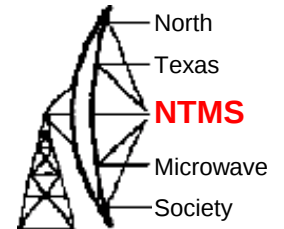
WA5TKU Antenna



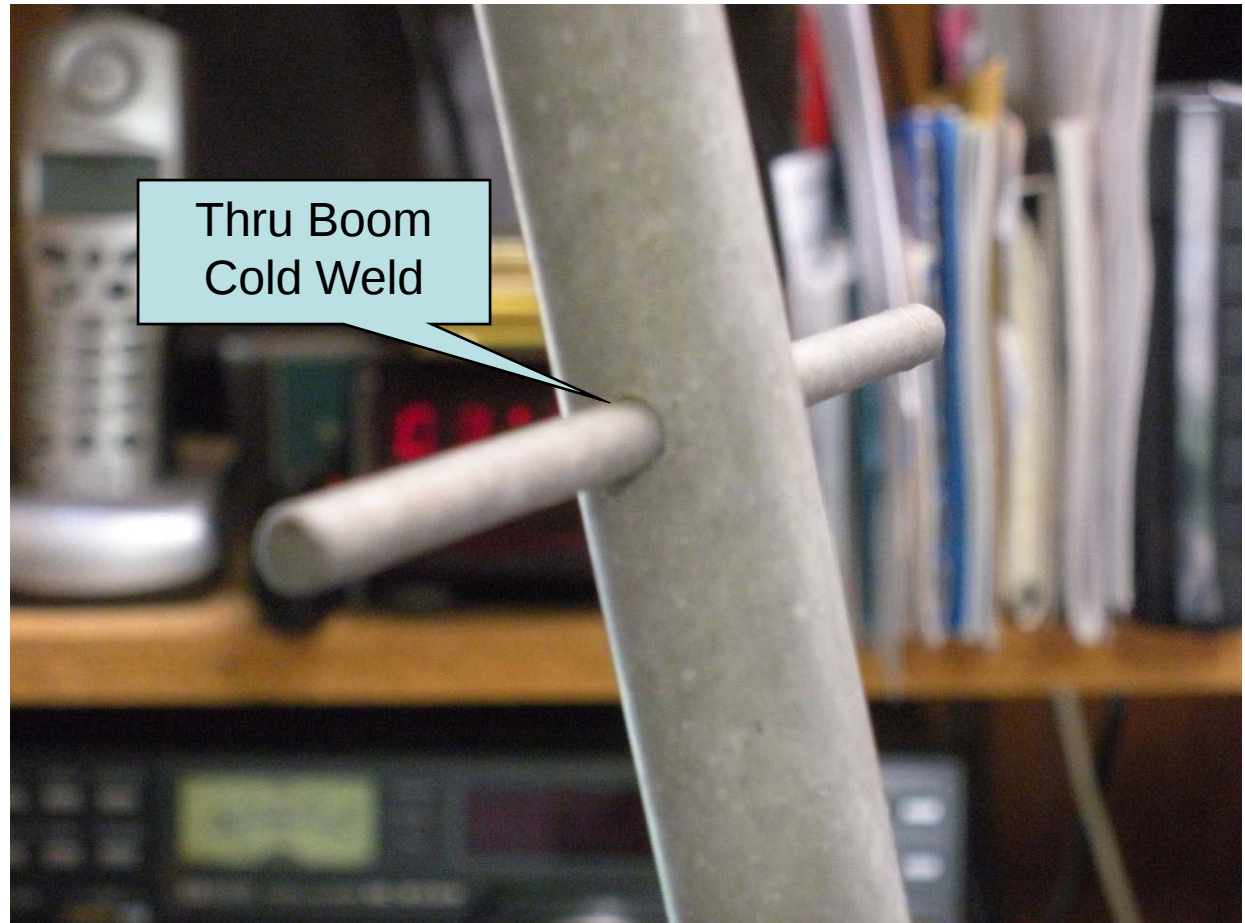
- 13.5 Foot Boom
 - 5/8" Diameter
 - 0.058" Wall Thickness
 - 3/16" Element
- Folded Dipole
 - 1/8" Brass Welding Rod



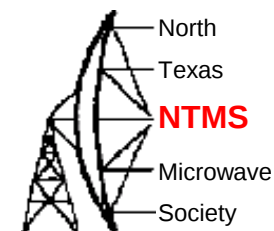
WA5TKU Antenna



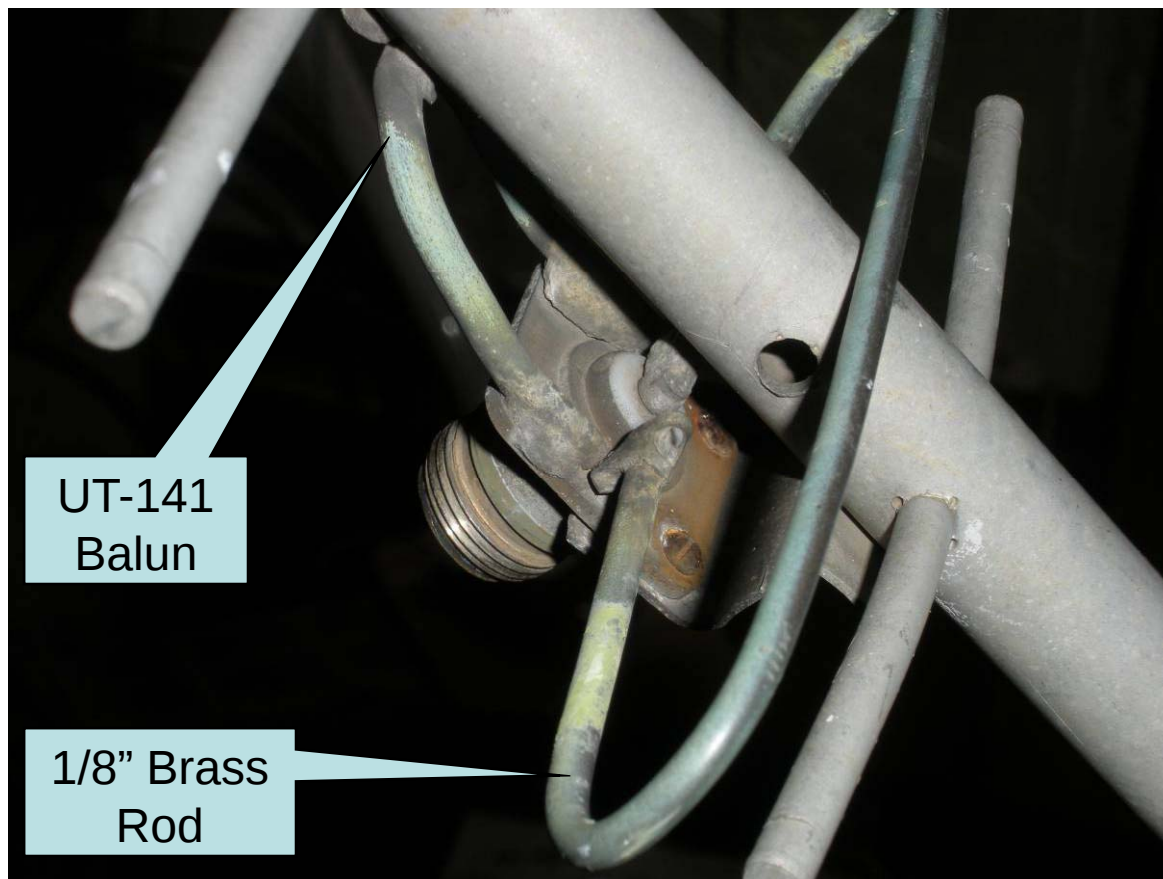
- 3/16" Elements Cold Welded to Boom
- No Elements Lost After 23 Years
- Boom Joint Gave Way



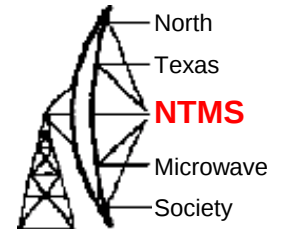
WA5TKU Antenna



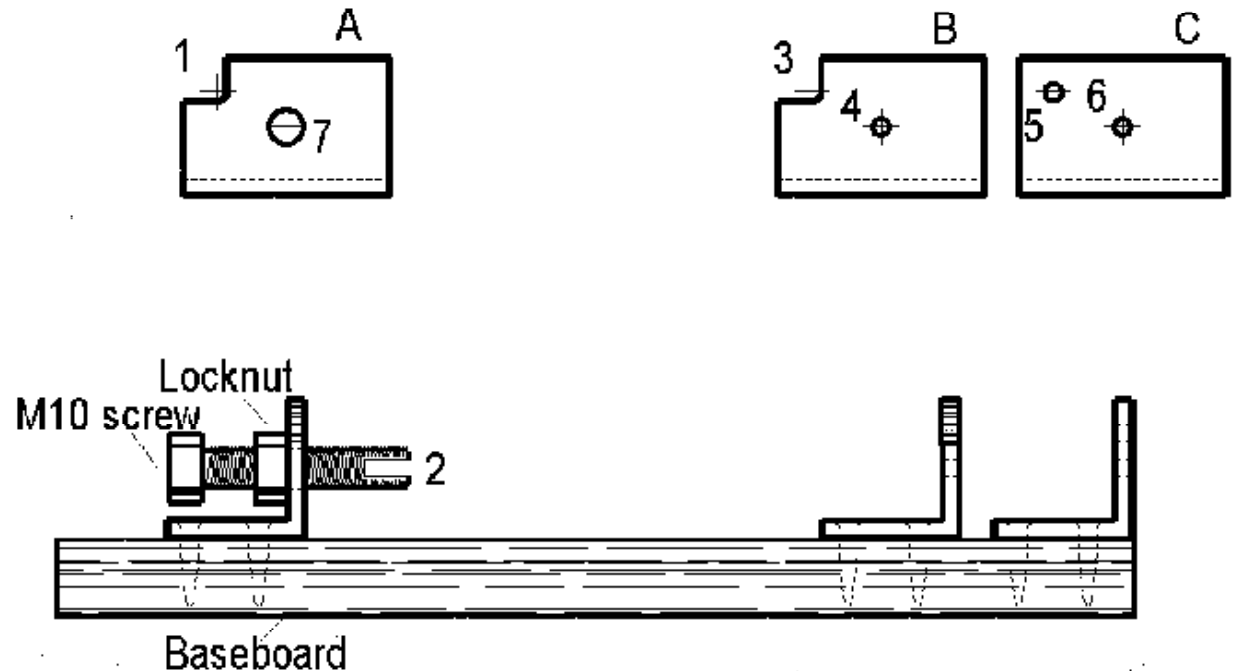
- Folded Dipole Feed
- Balun - UT141 Semi-Ridged Coax
- N Type Coax Connector
- Tuned By Bending 1st Director



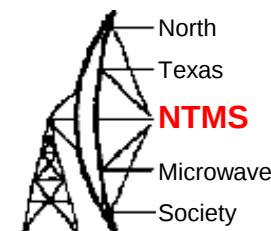
Element Cutting Jig



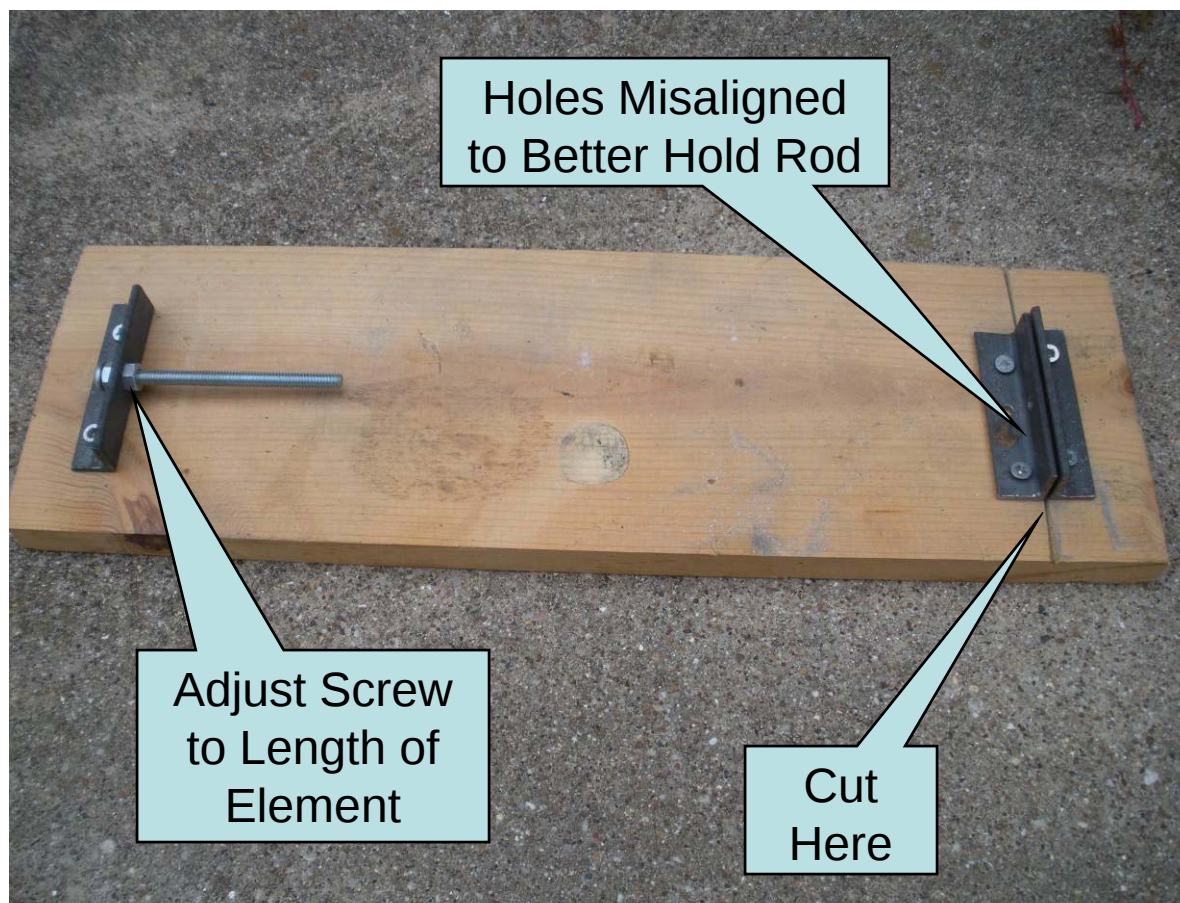
- Holds Element Material³
- Adjust Length
- Cut



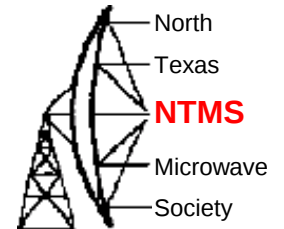
WA5TKU Element Cutting Jig



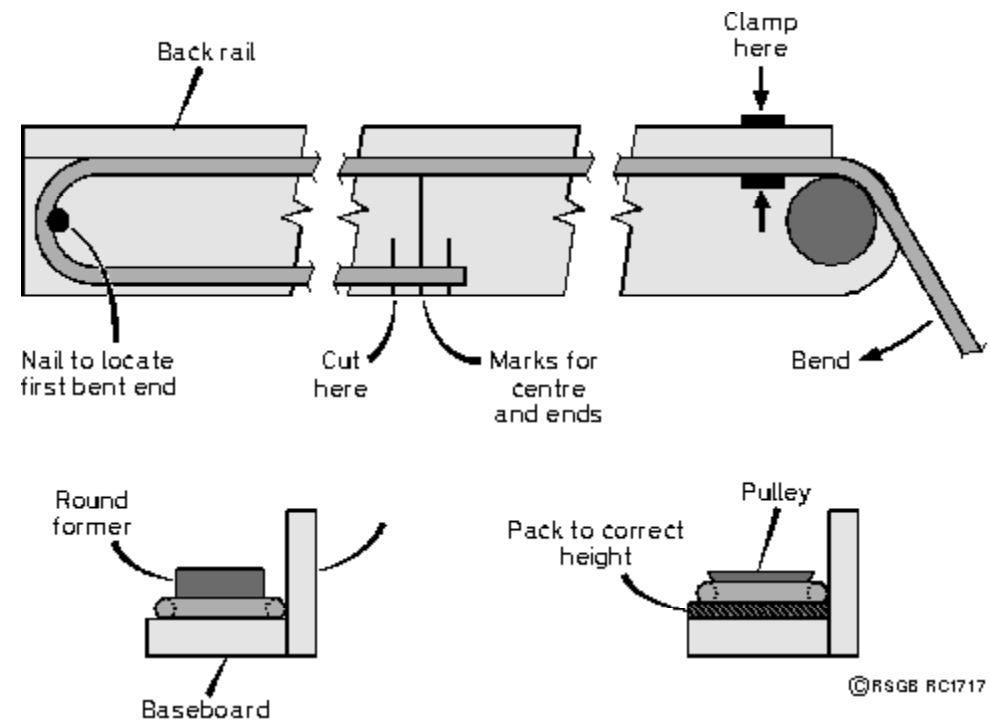
- Modified Jig
- Placed Rod Holder Back to Back
- Used English Screw
- Measured Each Length Change With Rule
- Chamfer Element Ends 45° With File or Sander



Folded Dipole Bending Jig

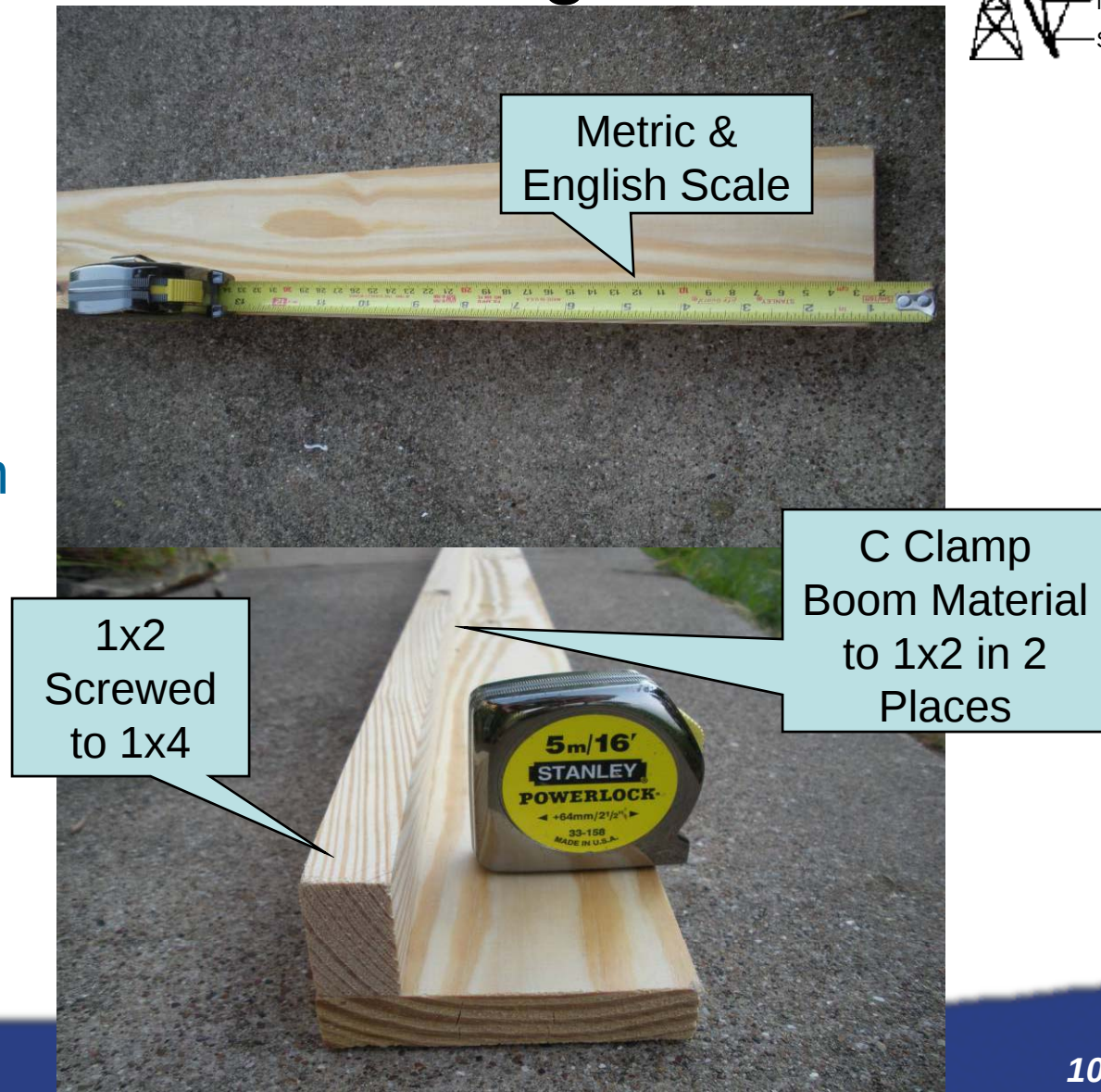


- Use Dowel Diameter of Dipole ID³
- Dowel Space to Dipole Length

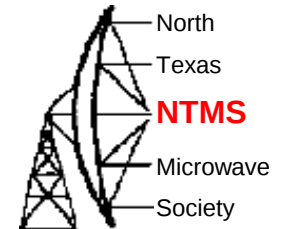


Boom Drill Jig

- 1x4 & 1x2 8'
 - Right Angle Mount
- C Clamp to Drill Press Bed
- C Clamp Boom Material to Jig
- Use Small Finishing Nail to Pin Boom While Sliding Jig on Drill Press Bed



Software Example



- VK5DJ Software⁴
- 41 Directors
- Round Boom
- Bonded Thru Boom
- Used UT141 Semi-Ridged Coax for Balun

Design Yagi

Help

Entry screen for yagi details

Yagi Calculator

ALWAYS enter frequency before other data

Frequency in MHz
1296.1

Diameter of dipole bend mm
25

Dipole gap at feed point mm
5

Number of directors
41

Cross-section of boom mm
15

Boom type
☐ Square section
☒ Round

Construction of directors/reflector

Metal shape
☒ Round
☐ Square
☐ Flat ribbon

Directors/Reflector mounting
☒ bonded through metal boom
☐ insulated through metal boom
☐ non metal boom (or standoffs)

Diameter of element (mm)
4

Construction of Dipole

Metal shape
☒ Round
☐ Square
☐ Flat ribbon

Folded Dipole mounting
☒ Same as Dir/Reflector
☐ Fully insulated

Diameter of element (mm)
4

Calculate

Back

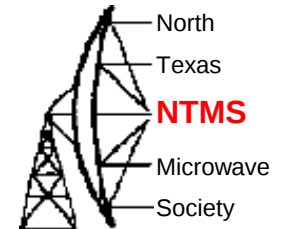
No coax selected for 4:1 balun

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Start V-UHF QSO real time m... Yagi Calculator - Windo... Inbox - Microsoft Outlook CC Cluster User WAST... Microsoft PowerPoint - ... Yagi Calculator

7:56 AM

Software Example



- Calculation
- Gain is Calculated with Each Element
- Folded Dipole Construction

Yagi Results
Help

Yagi design frequency = 1296.10 MHz
Wavelength = 231 mm
Parasitic elements contacting a round section metal boom 15.00 mm across.
Folded dipole mounted same as directors and reflector
Director/reflector diam = 4 mm
Radiator diam = 4 mm

REFLECTOR
122 mm long at boom position = 30 mm (IT = 53.5 mm)

RADIATOR
Single dipole 106 mm tip to tip, spaced 46 mm from reflector at boom posn 76 mm (IT = 45.5 mm)
Folded dipole 119 mm tip to tip, spaced 46 mm from reflector at boom posn 76 mm (IT = 52.0 mm)

DIRECTORS

Dir (no.)	Length (mm)	Spaced (mm)	Boom position (mm)	IT (mm)	Gain (dBd)	Gain (dBi)
1	105	17	94	45.0	2.6	4.8
2	104	42	135	44.5	5.3	7.5
3	103	50	185	44.0	7.1	9.2
4	102	58	243	43.5	8.4	10.5
5	100	65	308	42.5	9.4	11.5
6	99	69	377	42.0	10.2	12.4
7	99	73	450	42.0	10.9	13.1
8	98	76	526	41.5	11.5	13.7
9	97	80	606	41.0	12.1	14.2
10	96	83	689	40.5	12.5	14.7
11	95	87	776	40.0	13.0	15.1
12	95	89	865	40.0	13.4	15.5
13	94	90	955	39.5	13.7	15.9
14	94	91	1047	39.5	14.1	16.2
15	93	93	1139	39.0	14.4	16.5
16	93	93	1232	39.0	14.6	16.8

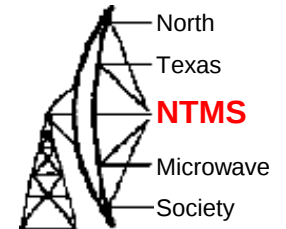
Print results
Create YO
Balun
Back

Folded dipole measuring points

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Software Example



- Folded Dipole
- All Element Spacing From End of Boom

Yagi Results

Help

Yagi Calculator

35	88	93	2990	36.5	17.8	19.9
36	88	93	3082	36.5	17.9	20.0
37	88	93	3175	36.5	18.0	20.1
38	88	93	3267	36.5	18.1	20.2
39	88	93	3360	36.5	18.2	20.3
40	88	93	3452	36.5	18.3	20.4
41	88	93	3545	36.5	18.3	20.5

COMMENTS
The abbreviation "IT" means "Insert To", it is the construction distance from the element tip to the edge of the boom for through boom mounting

Spacings measured centre to centre from previous element
Tolerance for element lengths is +/- 1 mm

Boom position is the mounting point for each element as measured from the rear of the boom and includes the 30 mm overhang. The total boom length is 3575 mm including two overhangs of 30 mm

The beam's estimated 3dB beamwidth is 19 deg

A half wave 4:1 balun uses 0.70 velocity factor UT141 (PTFE) and is 81 mm long plus leads

FOLDED DIPOLE CONSTRUCTION
Measurements are taken from the inside of bends
Folded dipole length measured tip to tip = 119mm
Total rod length = 261mm
Centre of rod = 131mm
Distance HI=GF=44mm
Distance HA=GE=64mm
Distance HB=GD=84mm
Distance HC=GC=131mm
Gap at HG=5mm
Bend diameter BI=DF=25mm

If the folded dipole is considered as a flat plane (see ARRL Antenna Handbook) then its resonant frequency is less than the flat plane algorithm's range of 10:1

Print results

Create YO

Balun

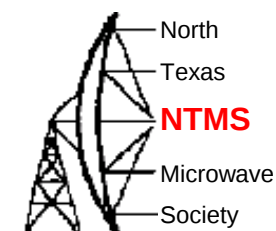
Back

Folded dipole measuring points

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Software Example



- Balun Construction

Yagi Results

Help

Yagi Calculator

35	88	93	2990	36.5	17.8	19.9
36	88	93	3082	36.5	17.9	20.0
37	88	93	3175	36.5	18.0	20.1
38	88	93	3267	36.5	18.1	20.2
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The beam's estimated 3dB beamwidth is 19 deg

A half wave 4:1 balun uses 0.70 velocity factor UT141 (PTFE) and is 81 mm long plus leads

FOLDED DIPOLE

Measurements are

Folded dipole length

Total rod length = 131

Centre of rod = 131

Distance HI = GF = 4

Distance HA = GE = 4

Distance HB = GD = 4

Distance HC = GC = 4

Gap at HG = 5mm

Bend diameter B1

If the folded dipole plane algorithm's

Print results

Create YO

Balun

Back

4:1 Balun Construction

$Z_1 = Z_2 / 4$

UT141 (PTFE)

81 mm

Unbalanced to TX

Z_1

Z_2 Folded dipole

Folded dipole measuring points

less than the flat

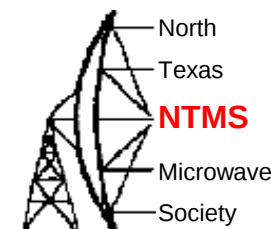
Print

Back

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References



- 1: Gunter Hoch, DL6WU, "Extrem Lange Yagi-Antennen", UKW-Berichte 1/1982, pp 3-11.
- 2: Rainer Bertelsmeier, DJ9BV, DUBUS 2/1994, pp.46-52, <http://www.qsl.net/ok1cdj/dj9bv23.pdf>
- 3: "Folded Dipoles for VHF/UHF Yagis", *In Practice*, RadCom (RGSB), April 1998, <http://www.ifwtech.co.uk/g3sek/diy-yagi/dipoles.htm>
- 4: Yagi Calculator by John Drew, VK5DJ, <http://vk5dj.mountgambier.org/Yagi/Yagi.html>