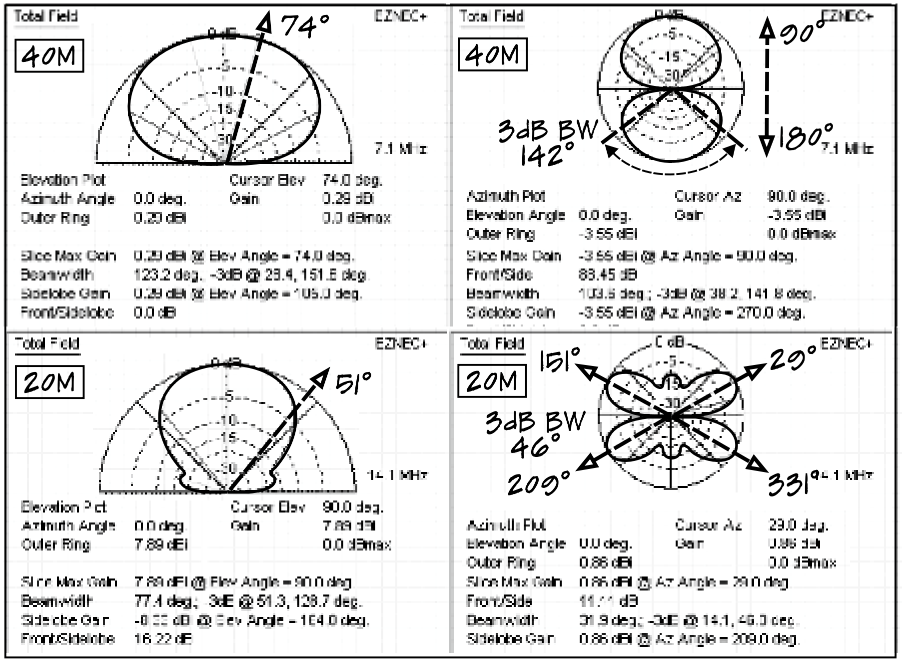
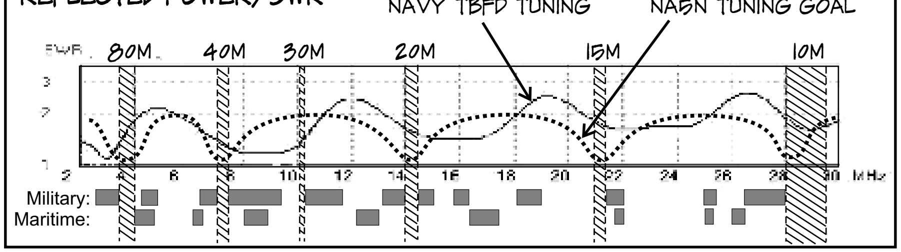
THE NA5N TFD ANTENNA
BASED ON

U.S. NAVY – TACTICAL FIELD ANTENNA
TERMINATED BROADBAND FOLDED DIPOLE (TBFD)
FOR MILITARY AND MARITIME FREQUENCIES 3–30 MC/S (WWII)
NAVSHIPS 900121, MIL-W-17211 1942, REVISED 1952
FIELD, SHIPBOARD, AND SUBMARINE DEPLOYMENT



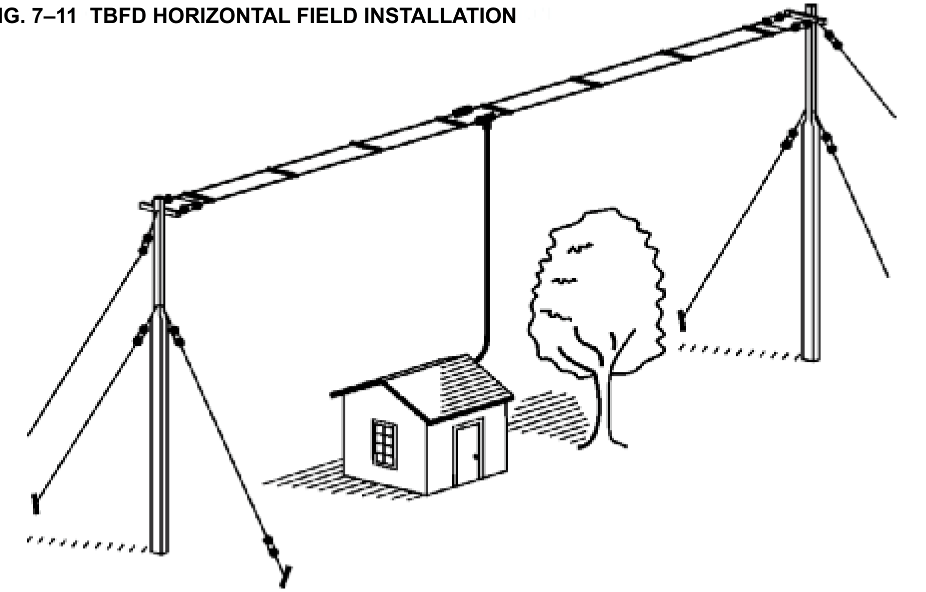
REFLECTED POWER/SWR



NOTES:

1. NAVY WWII TFD BROADBAND ANTENNA FOR NO-TUNE QUICK FREQUENCY CHANGES
2. NAVY SPECS: 300R FEEDLINE, 390R TERMINATION RES., L=90 FT. (1 /2=5 MHZ)
3. NAVY DIMENSIONS BASED ON OPTIMIZING SWR ON MILITARY & MARITIME FREQUENCIES. AND ARE NOT OPTIMIZED FOR THE HAM BANDS
4. RADIATION PATTERNS LITTLE EFFECTED BY HEIGHT OR ORIENTATION
5. ADJUST L= FOR MIN. VOLTAGE NODE ON TERM. RES. FOR MIN. LOSS & HIGHER GAIN

FIG. 7–11 TBFD HORIZONTAL FIELD INSTALLATION



GATO CLASS SUBARINE DEPLOYMENT

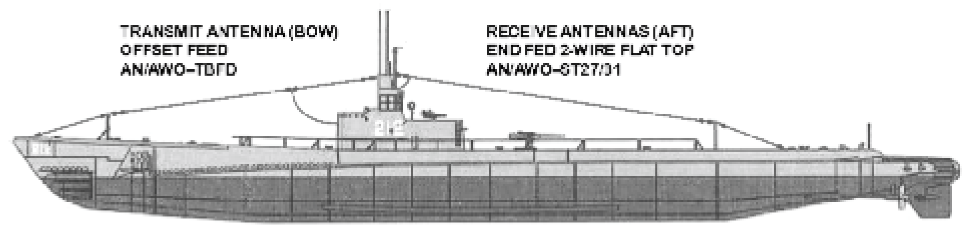
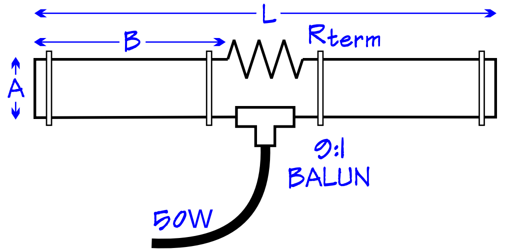


FIG 3-7 TRANSMIT AND RECEIVE ANTENNAS, GATO CLASS FLEET SUBMARINE (MOD 4 1944)

SHT 1

PROJECT	TITLE	DATE
TFD PAUL HARDEN NA5N	NA5N TFD ANTENNA PROJECT 133 FT. 80-10M TFD SCHEME GENERAL INFORMATION	OCT 2023 SHEET 1 of 5

MILITARY DESIGN VERSIONS



NAVY TFD/TBFD

Rterm = 600W   BALUN = 9:1

$A = p \cdot \frac{3}{F_{MHz}} = p \cdot \frac{3}{3.55} \times p = 2.7' = 32''$

$B = p \cdot \frac{50}{F_{MHz}} = p \cdot \frac{50}{3.55} \times p = 44.2'$

$L = 2 \cdot B = \boxed{88'4''}$

ANTENNA RESONANCE (F_r)

$F_r = \frac{468}{L\ ft} = \frac{468}{88.4ft} = \boxed{5.3MHz}$ MILITARY FREQ.

BUXCOM MILITARY/K4ABT TFD

Rterm = 450W   BALUN = 9:1

$A = \frac{30}{F_{MHz}} = \frac{30}{3.55} = 8.45' = 32''$

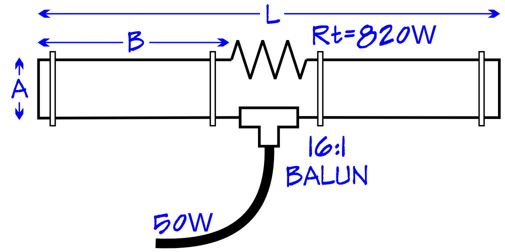
$B = \frac{166}{F_{MHz}} = \frac{166}{3.55} = 46.8' = 46'10''$

$L = 2 \cdot B = \boxed{93'7''}$

ANTENNA RESONANCE (F_r)

$F_r = \frac{468}{L\ ft} = \frac{468}{93.6ft} = \boxed{5.0MHz}$ MILITARY FREQ.

B SQUARED ENGINEERING TFD



Rterm = 820W   BALUN = 16:1

$A = \frac{9.5}{F_{MHz}} = \frac{9.5}{3.55} = 2.67' = 32''$

$B = \frac{234}{F_{MHz}} = \frac{234}{3.55} = 65.9' = 65'11''$

$L = 2 \cdot B = 132'$

80M 3.55MHz

LENGTHS FOR RESONANCE

80M $L = \frac{468}{F_{MHz}} = \frac{468}{3.55} = 131.8' = \boxed{131'10''}$

$B = \frac{L}{2} = \frac{131.8'}{2} = 65.9' = \boxed{65'11''}$

NA5N VERSION

Spacing based on U.S. Navy design:
(Based on existing 40M 16 in. spacing)

$A = p \cdot \frac{3}{F_{MHz}} = \frac{3}{7.05} \times p = 1.34' = 16''$

Folded dipole resonance at 3.55 MHz

Standard 1/4 length (B) plus 9" length of feed point tee and balun (T)

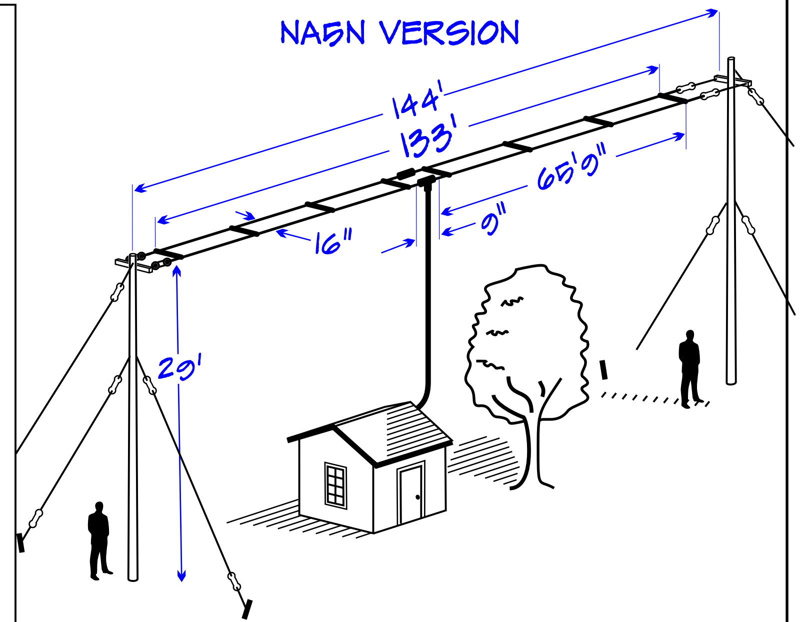
$B = \frac{234}{F_{MHz}} + T = \frac{234}{3.55} + T = 65.9' + .8' = 66.7'$

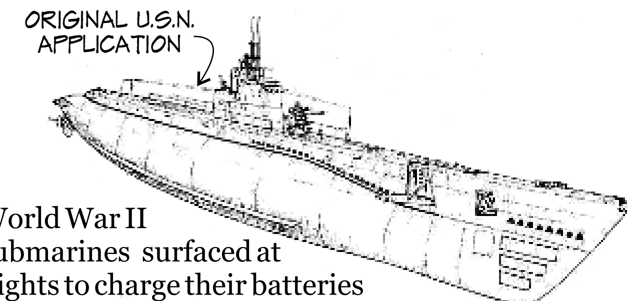
Total TFD folded dipole radiator length:

$L = 2*B = 2*66.7 = 133.4 = 133'5''$

Placed TFD masts 144 ft. apart for the 133 ft. TFD wire length plus 5 ft. of non-conductive support ropes each end to isolate transmit radiation from steel tower.

NA5N VERSION



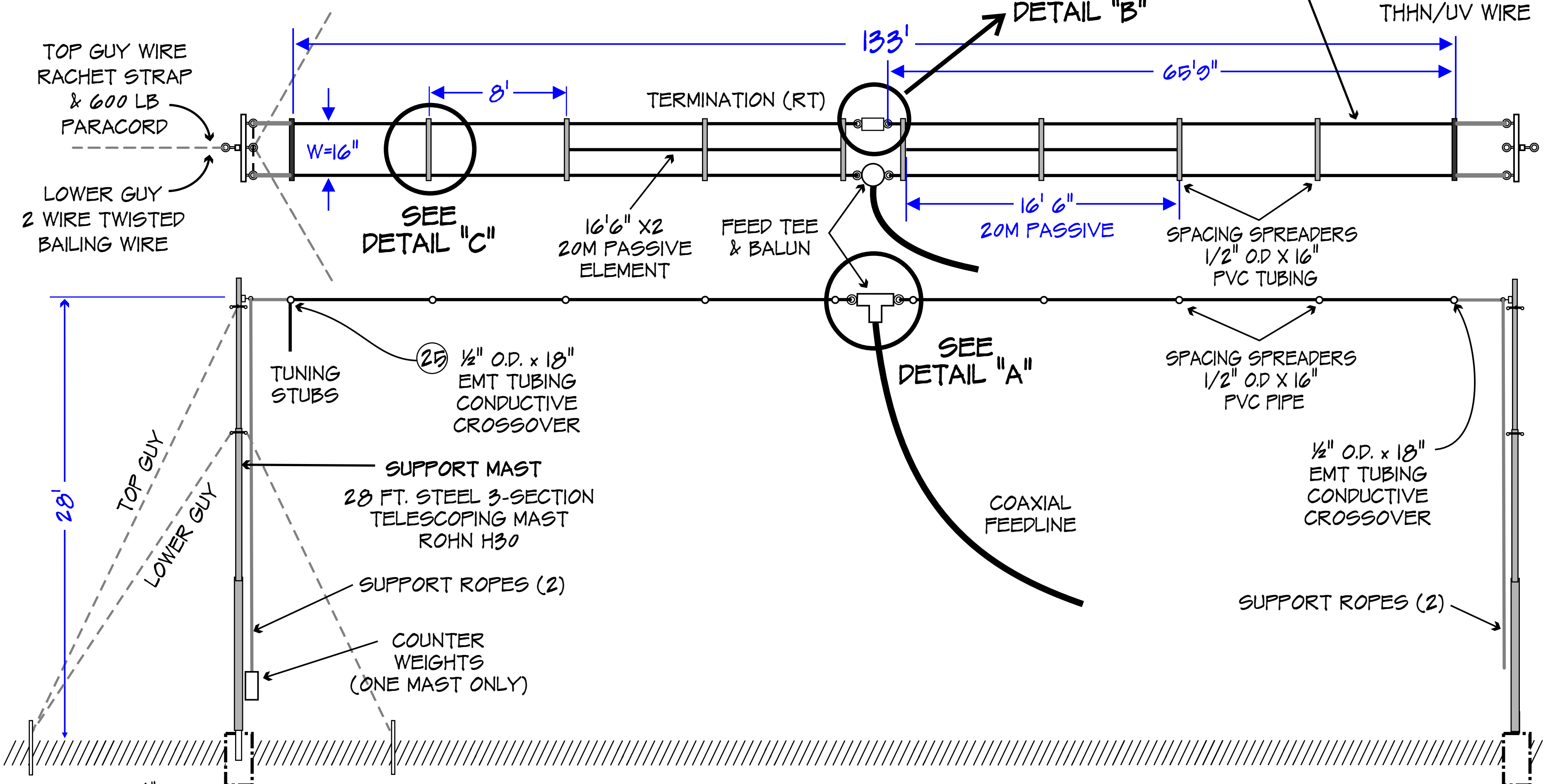


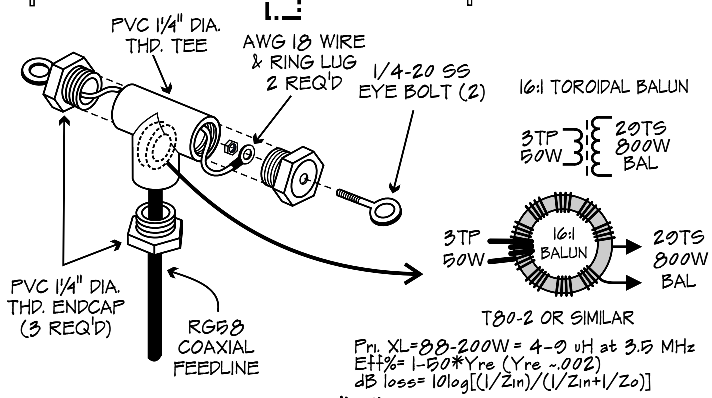
World War II submarines surfaced at nights to charge their batteries and transmit their position and operations reports ... making them very vulnerable to radio detection by enemy direction finding networks. The solution was to change frequencies often to evade detection, but this took time to retune the antennas to each new frequency. The TFD antennas were deployed as a no-tune broadband antenna to allow for the quick frequency changes, allowing the "silent service" to remain hidden. This same feature is beneficial to ham radio for quick band changes without a tuner.

SHT 2

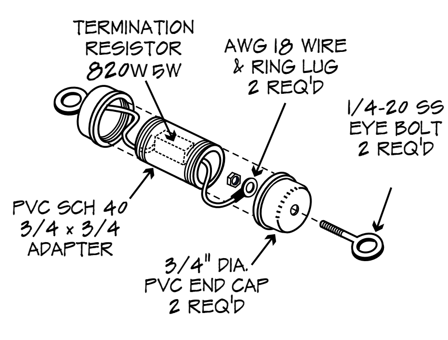
PROJECT	TITLE	DATE / SHEET
TFD PAUL HARDEN NA5N	NA5N TFD ANTENNA PROJECT 133 FT. 80-10M TFD SCHEME CALCULATION DETAILS	DATE: OCT 2023 SHEET: 2 of 5

80M–10M TERMINATED FOLDED DIPOLE (TFD)

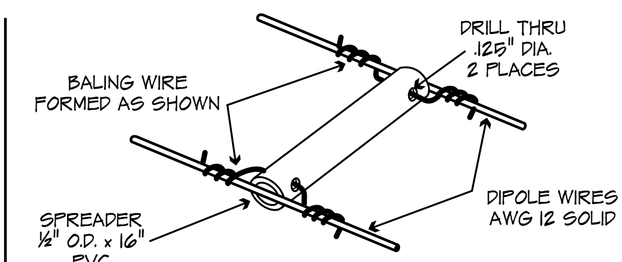




DETAIL "A" - BALUN



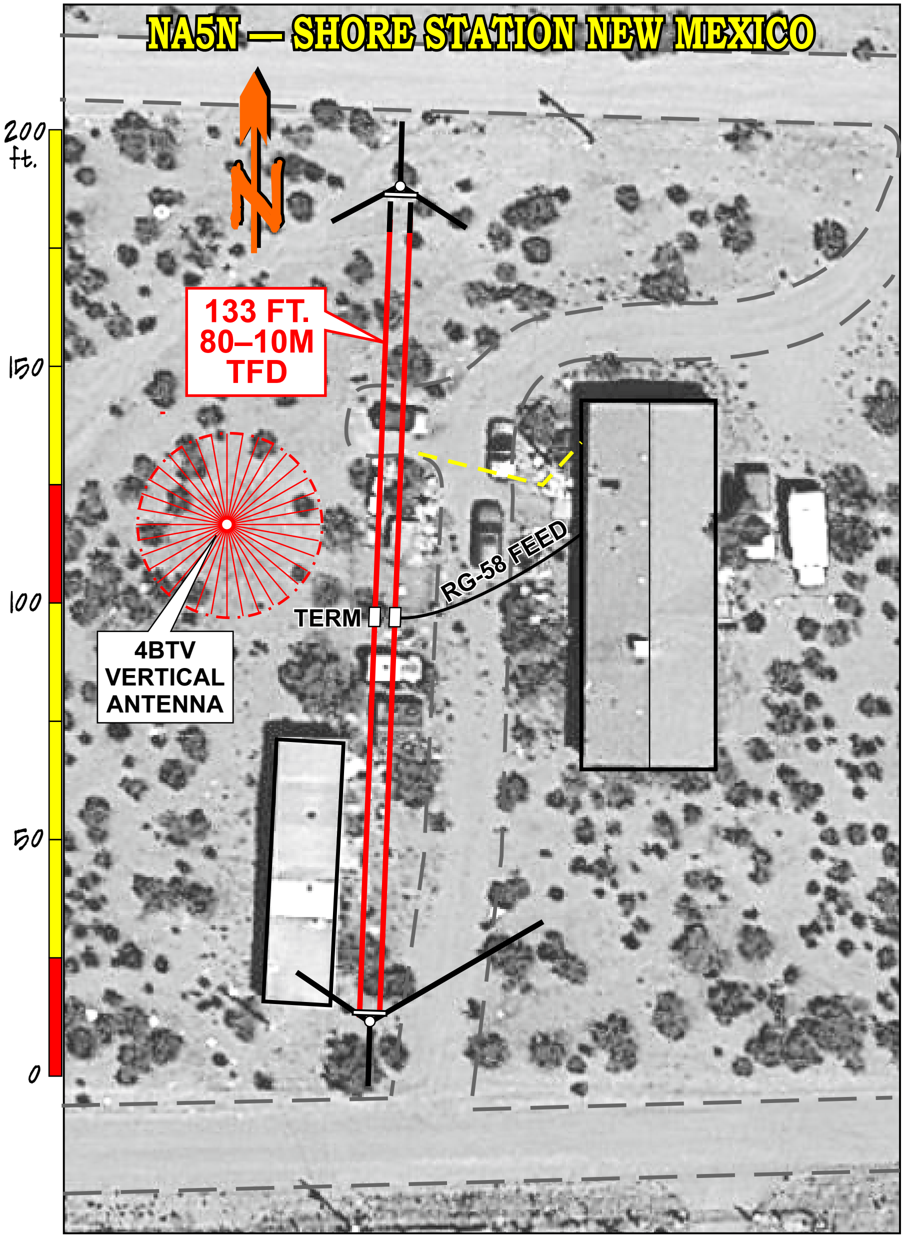
DETAIL "B" - TERMINATION

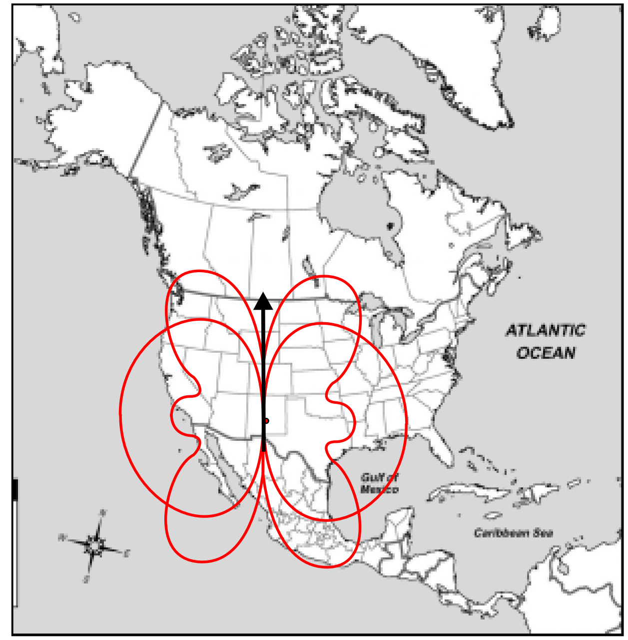


DETAIL "C" - SPACING SPREADERS

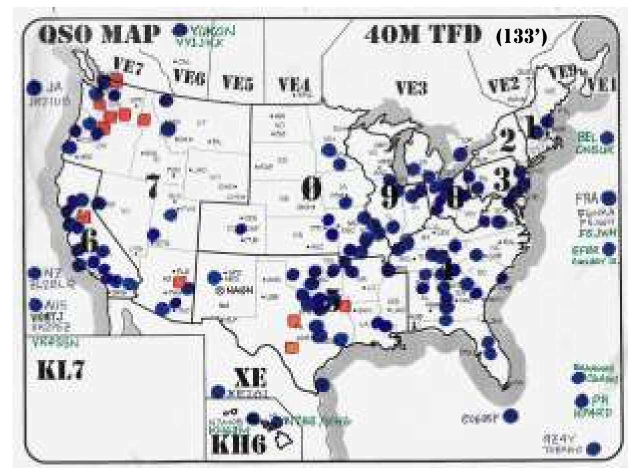
SHT 3

PROJECT	TITLE	DATE
TFD PAUL HARDEN NA5N	NA5N TFD ANTENNA PROJECT 133 FT. 80-10M TFD SCHEME & CONSTRUCTION DETAILS	OCT 2023 SHEET 3 of 5





The TFD is reportedly similar to the radiation pattern of a 1/4 wave dipole at resonant points with multiple lobes where the antenna is "long" for the frequency.



Plotted CW 5W QRP contacts with the TFD during the ARRL SS Nov. 2023. An even distribution of coverage and DX stations worked shown. Other bands similar.

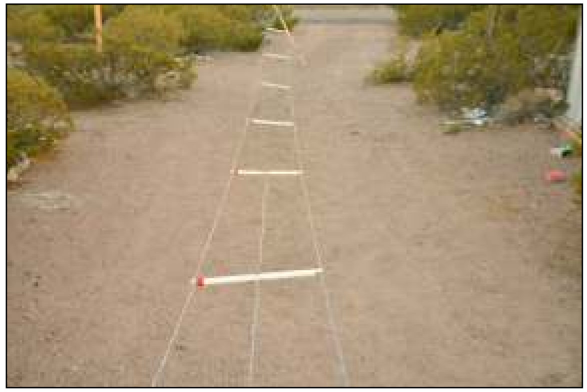
SHT 4

PROJECT	TITLE	DATE
TFD PAUL HARDEN NA5N	NA5N TFD ANTENNA PROJECT 133 FT. 80-10M TFD SCHEME INSTALLATION DETAILS	NOV 2023 SHEET 4 of 5

STEP 1: Dig holes for the masts. Try to avoid hitting rocks! Cement mounting pipe into place. Use level to ensure perfectly vertical.

FEED: "Tee" made from 1¼ in. O.D. PVC. 16:1 balun (50R:800R) on T80-2 toroid 3TP:29TS inside "tee." Fed with RG-58 via SO-239

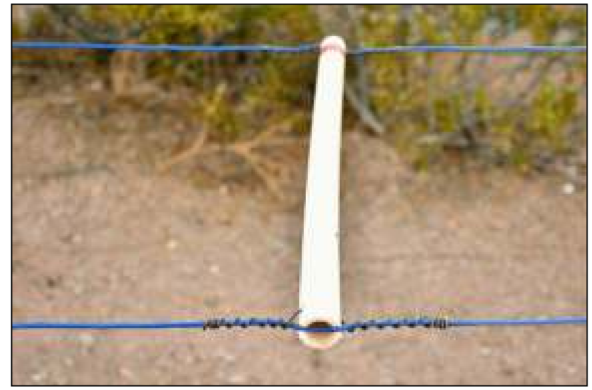
TERMINATION: 1 in. O.D. PVC with termination resistor inside. (2W 820R) tested at 100W.



Building 133 ft. long folded dipole on the ground with PVC spacers every 8 feet. Red tape to show feed side as TFD easy to get twisted when building or raising up on the masts.

TFD CENTER FEED showing feed "tee" with balun and feed line. Termination resistor on opposite side.

An LED was placed across the terminating resistor to visually indicate voltage across the resistor. LED did not illuminate until about 50 watts applied, and only dimly on the WARC bands, indicating minimal voltage at feed and terminating resistor. Resistor is not a dummy load. With P=IE, minimum voltage indicates very little power dissipated across the resistor when TFD properly tuned for the ham bands.



Showing method of mounting the spacers to the folded dipole elements. Spacers are 1/2 in. PVC, 16 in. in length, placed every 8 ft. Wire used was 12 ga. insulated solid copper.

Sunset view of the deployed TFD in service. Yellow support ropes for raising and lowering antenna.

PROJECT	TITLE	DATE
TFD	NA5N TFD ANTENNA PROJECT	OCT 2023
PAUL HARDEN NA5N	CONSTRUCTION PHOTOS	SHEET 5 of 5