Why I Chose Buddipole

Harold C. Fleischer, III
AE5AS

Basic Antenna Principle

- **Basic Antenna Principle:**

There is no such thing as a Perfect Antenna.

- **Corollary to Basic Antenna Principle:**

All Antennas are a compromise.

Antenna Frequency Band Requirements

- **Use of Amateur Extra License with respect to frequency bands**
- **Use of frequencies on radios owned or planned**
  - **Kenwood TH-D7A HT – 70CM, 2M**
  - **ICOM 751A – 10M, 12M, 15M, 17M, 20M, 30M, 40M, 80M, 160M**
  - **ICOM IC-W2A (2 each) HT – 70CM, 2M**
  - **Yaesu FT-991A – 70CM, 2M, *6M*, 10M, 12M, 15M, 17M, 20M, 30M, 40M, *60M*, 80M, 160M**
  - **Yaesu FT2DR HT – 70CM, 2M**
  - **(future ?) Kenwood TH-D74A – 70CM, *1.25M*, 2M**
  - **(future ?) Yaesu FTM-400XDR – 70CM, 2M**

Standing Wave Ratio (SWR)

SWR measures the impedance matching of a load to the characteristic impedance of the transmission line.

- **In Amateur Radio, the impedance of the transmission line is 50 ohms.**
- **Mismatches between the load and the transmission line result in standing waves being reflected back and the loss of transmission power.**
- **The objective is 1:1 and represents a perfect match.**
- **The point of an antenna tuner is to add impedance to get a match although some power is loss in the impedance added to the transmission line.**

SWR Objective

- The SWR objective was to get an antenna with the lowest possible SWR for each frequency band.
- Ideally, resonance across each frequency band was preferred.
- Absent resonance across each frequency band, low SWRs, defined a <3:1 across each frequency band was to be sought.
- Own or will own 2 antenna tuners that can match greater 3:1, but all impedance added to obtain a match will take some transmission power.
- The implicit tradeoff is the power to match impedance is less than the power absorbed by the standing wave.

Resonance

- **Resonance exists when the impedance of the load matches the impedance of the transmission line.**
  - **Natural 1:1**
  - **All power is radiated.**
- **Adding impedance to obtain a 1:1 match or low SWR can be a part of antenna design:**
  - **Matching units**
  - **Traps**
  - **Capacitance hats**
- **Added impedance uses power so less power is radiated**

Original Antenna Plan

Problems with Original Plan

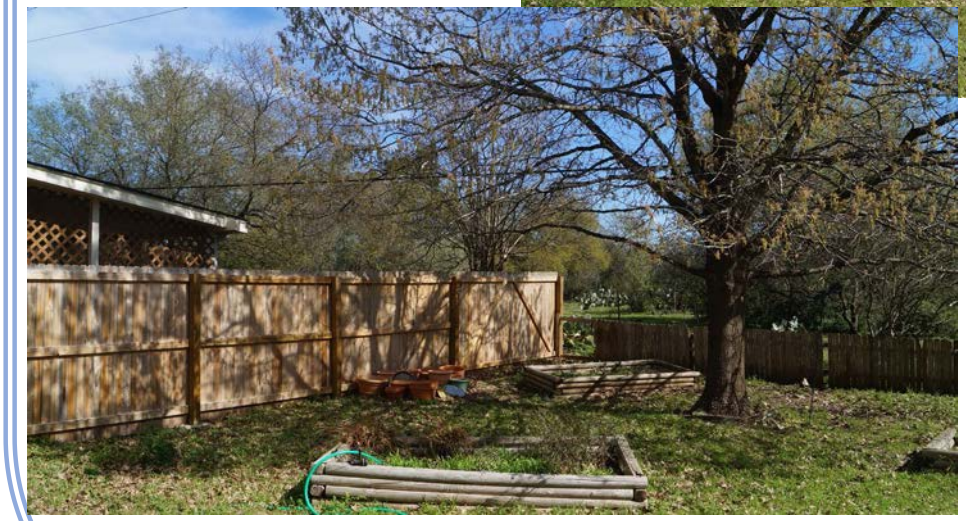
- **Live in an HOA**
  - **Can not totally hide antennas in backyard from street**
  - **HOA not world renown for flexibility on antennas**
  - **Not moving**
- **Radio Shack not possible on back of house**
  - **Downstairs left is family room**
  - **Downstairs right is breakfast nook/dining room**
  - **Upstairs right is being used as a bedroom**
- **Radio Shack in the front of house a non-starter**

Current Radio Shack Plan

Probably some room for improvement.

Back Yard Layout

Views of Back Yard



2X Safety

- Antenna and mast height a concern.
- The base of an antenna and mast combination should be twice the distance from a power line then the total length of the antenna and mast that can fall over.
- Wind can blow an antenna and mast over and then can blow an antenna and mast towards a power line.
- Power line along the back fence is roughly 30’ off of the ground. Cable TV or telephone line on the same poles is roughly 20’ off of the ground.

Constraints

- **No Tower with Beam Antenna**
  - **HOA**
  - **Too Close to Power Lines**
- **No permanent antenna**
  - **HOA**
  - **Portable radio shack**
- **Radiation study**
  - **100W of power on HF and 50W power on VHF/UHF okay**
  - **Tall tower really need to get separation between people and 1500W.**
  - **Therefore, no linear amplifier so antenna needs to handle 100W.**

The Search

- Antenna(s) (system) to support ham bands from 70CM to as low as possible, i. e., 80M or 160M.
- Antenna(s) (system) to support 100W of power.
- Must be portable and reasonable in terms of time and effort to set up and take down by 1 person.
- Affordable.

Inverted V Dipole

- Have Wire Dipoles
- Approximately 60’ run to corners of backyard
- Would cover to 60M
- Would need multiple dipoles
- Would radiate towards power line
- Would have radiation masked by house in opposite direction

Inverted V Dipole (Cont'd)

- Back fence is 3'
  - Lets us see deer and cattle
  - Does not keep deer out
- Wire in backyard like this not a solution

QST Ads, eHam Reviews, and Internet Search

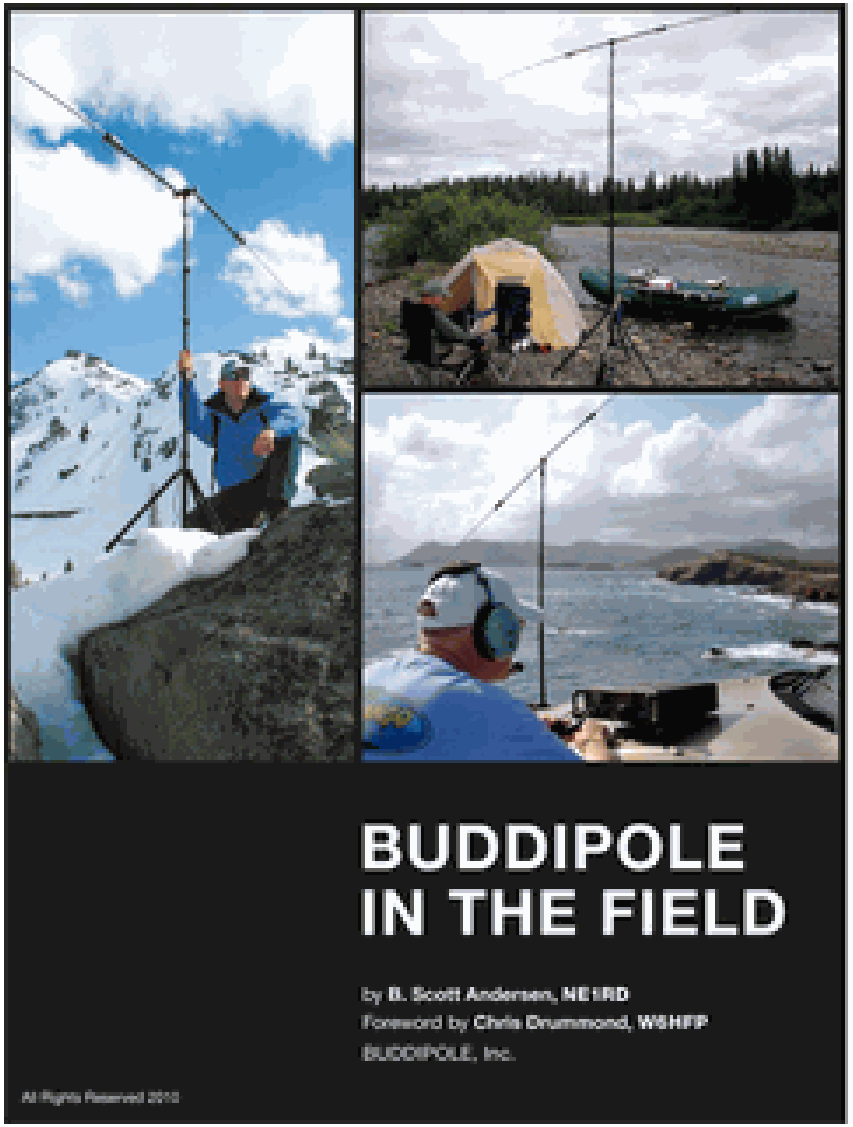
- **Looked at a number of verticals**
  - **Those with matching unit really needed masts**
    - **Push poles a possibility**
    - **Ruled out by 2X safety factor**
  - **A number with vertical dipoles**
    - **Ground mounts in these cases**
    - **Radial wires needed**
    - **Ruled out because can not leave on ground untended for even short periods**
  - **OCF was another type of wire ruled out for that reason**
  - **End wire feed was another type of wire ruled out**
- **Yagis or beams skipped for band coverage reasons and not enough height to really use one**

QST Ads, eHam Reviews, and Internet Search (Con't)

- Search narrowed down to mast supported dipoles
- Several companies had mast supported dipoles
  - Alpha Antenna
  - Alpha Delta
  - Buddipole
  - Hi-Q-Antenna
  - iPortable
  - MFJ
  - Super Antenna (actually a vertical)
  - Transworld (monoband oriented)

Buddipole Information

- **Written by Buddipole Steve NE1RD**
  - **User uses, as shown on the cover, in the field**
  - **Illustrates Buddipole's orientation towards the lightweight, modular components for backpack and portable use**
- **$15 each, but download of PDF is FREE**
  - **I read the PDF.**
  - **So impressed, I bought the book**



Buddipole

- This is a center mast supported dipole.
- Has a 2M-40M frequency range in Basic version
- Can add 60M-80M coil to the Basic version
- Resonance solutions for 2M and 6M in Basic version
- Can add components to get resonance solutions for 2M-20M and increase resistance portions of 30M & up

- A portion of the book addresses how to add components to do a great part of this

- Buddipole is an Antenna System

Buddipole Fits in Backyard

- Height even with 18’ mast and tripod is below power line
- Some clearance of house and fence on each side
- Radiate perpendicular to house and power line (WSW to ENE)

Buddipole Antenna Components (Basic)

Item	Buddipole
Versatee	1
Anodized Aluminum Arms - 22"	2
Coils	2
Coil Clip	3
6" Tap Cable - red	1
6" Tap Cable - black	1
5.5 ft Telescopic Whips w Knurled Sleeves	2
Choke Balun w removable BNC/PL259 Adaptor	1
25' coaxial cable	1
black thermoplastic carrying case	1
nylon backcloth carrying bag w stretch velcro strap	1

Buddipole Antenna Components (Basic vs. Deluxe)

Item	Buddipole	Deluxe
Versatee	1	1
Anodized Aluminum Arms - 22"	2	2
Coils	2	2
Coil Clip	3	6
6" Tap Cable - red	1	1
6" Tap Cable - black	1	1
5.5 ft Telescopic Whips w Knurled Sleeves	2	3
Choke Balun w removable BNC/PL259 Adaptor	1	1
25' coaxial cable	1	1
Tripod	0	1
Portable Mast - extends to 9' 6" H	0	1
Rotating Arm Kit	0	1
black thermoplastic carrying case	1	0
nylon backcloth carrying bag w stretch velcro strap	1	1
Antenna System Bag	0	1

Buddipole Antenna Components (Basic vs. Deluxe vs. Deluxe Long)

Item	Buddipole	Deluxe	Deluxe Long
Versatee	1	1	1
Anodized Aluminum Arms - 22"	2	2	2
Coils	2	2	2
Coil Clip	3	6	6
6" Tap Cable - red	1	1	1
6" Tap Cable - black	1	1	1
5.5 ft Telescopic Whips w Knurled Sleeves	2	3	3
Choke Balun w removable BNC/PL259 Adaptor	1	1	1
25' coaxial cable	1	1	0
50' coaxial cable	0	0	1
Tripod	0	1	1
Portable Mast - extends to 9' 6" H	0	1	0
Portable Mast - extends to 19' H	0	0	1
Guying Kit	0	0	1
Rotating Arm Kit	0	1	1
black thermoplastic carrying case	1	0	0
nylon backcloth carrying bag w stretch velcro strap	1	1	1
Antenna System Bag	0	1	0
Antenna System Bag - 49" Long	0	0	1

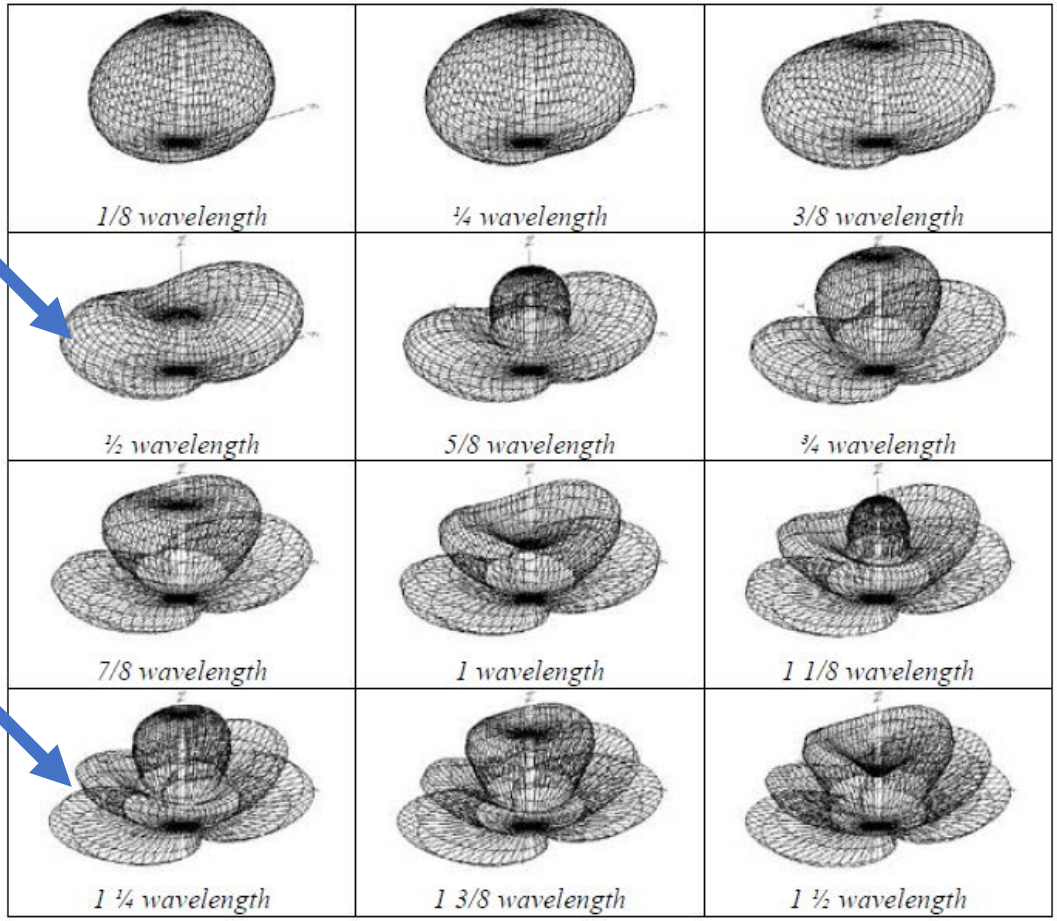
Buddipole Antenna Components AE5AS

Plus some other things added.

Item	Buddipole	Deluxe	Deluxe Long	AE5AS
Versatee	1	1	1	1
Anodized Aluminum Arms - 11"	0	0	0	2
Anodized Aluminum Arms - 22"	2	2	2	4
Anodized Aluminum Arms - 32"	0	0	0	6
Coils	2	2	2	2
Coil Clip	3	6	6	6
6" Tap Cable - red	1	1	1	2
6" Tap Cable - black	1	1	1	2
5.5 ft Telescopic Whips w Knurled Sleeves	2	3	3	6
9.5 ft Telescopic Whips w Knurled Sleeves	0	0	0	6
Choke Balun w removable BNC/PL259 Adaptor	1	1	1	0
Triple Ratio Switch Balun	0	0	0	1
Extra BNC Pigtail (TRSB to Versatee)	0	0	0	1
25' coaxial cable	1	1	0	0
50' coaxial cable	0	0	1	1
Tripod	0	1	1	1
Portable Mast - extends to 9' 6" H	0	1	0	0
Portable Mast - extends to 19' H	0	0	1	1
Guying Kit	0	0	1	1
Rotating Arm Kit	0	1	1	1
Wire Assembly 33' w CWA	0	0	0	2
Yagi Set	0	0	0	1
IT adapter	0	0	0	1
Knob from RAK	0	0	0	1
black thermoplastic carrying case	1	0	0	0
nylon backcloth carrying bag w stretch velcro str	1	1	1	1
Antenna System Bag	0	1	0	0
Antenna System Bag - 49" Long	0	0	1	1
Winders (paracord and sanp hooks added)	0	0	0	4

Dipole Characteristics

- At < ½ wavelength, almost omni-directional
- At ½ wavelength, classic perpendicular pattern
- Approximately every ½ wavelength a better low angle pattern emerges



On What Frequencies can Buddipole get ½ Wavelength

With Buddipole's 18' Mast and 1' of ground clearance on the Tripod, reality is:

- **½ wavelength off ground is best that can be done for 10M and 12M**
- **Multiple wavelengths off ground for below 10M:**
  - **~ 2 wavelengths for 6M**
  - **~ 5 wavelengths for 2m**
- **For 15M and 17M wavelength off ground is ~ 0.30 wavelength off ground**
- **At 20M and above wavelength is ¼ wavelength off the ground and less – Near Vertical Incidence Skywave**
- **NVIS is better at 40M – 160M**

Buddipole Book has "Cookbook"

- Scott NE1RD includes examples on how to build antennas.
- It will usually show models built with standard kit components.
- It will show models built with extra components.

15m horizontal dipole

A 15m dipole is 11 feet on each side (approximately 133 inches). It can be constructed from standard *Buddipole* components with only a few turns on each coil. The 15m dipole can also be made from the combination of a single antenna accessory arm and a 9.5 foot *Buddipole* whip extended to 9 feet. An additional arm, along with the standard *Buddipole* configuration, makes a nearly full-sized antenna. All antenna configurations provide better than 2:1 SWR bandwidth across the band.

Standard 5.5 foot whips

Red whip: 6 sections (all out)
Red coil: tap 4 (red)
Black whip: 6 sections (all out)
Black coil: tap 6 (black)

With 9.5 foot whips

Red whip: 9 feet (all but 6 inches)
Black whip: 9 feet (all but 6 inches)

Standard 5.5 foot whips (2 arms) with coils

Red whip: 6 sections (all out)
Red coil: tap 2
Black whip: 6 sections (all out)
Black coil: tap 4

The best height for a 15m horizontal dipole is approximately ½ wavelength above ground—7.5m (24.6 feet). Figure 16 contains far field plots at various heights for a 15m dipole. Deploying the antenna above 25 feet induces a deep null at about 45 degrees in the far field. For this reason a 15m horizontal dipole should not be deployed more than 25 feet above the ground.

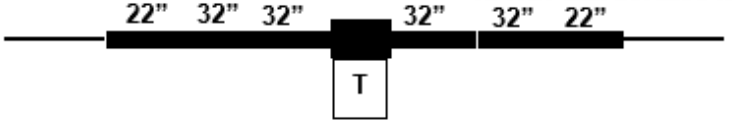
AE5AS's "Cookbook"

- Build's on Scott NE1RD concept
- Incorporates the Buddipole components that AE5AS has.
- It does retain basic models in case space restricted.

20 Meter (14.00-14.35 MHz)
(200.5714-198.0952-195.6794 inches ¼ wave)
(16.714.3-16.5079-16.3066 feet ¼ wave)

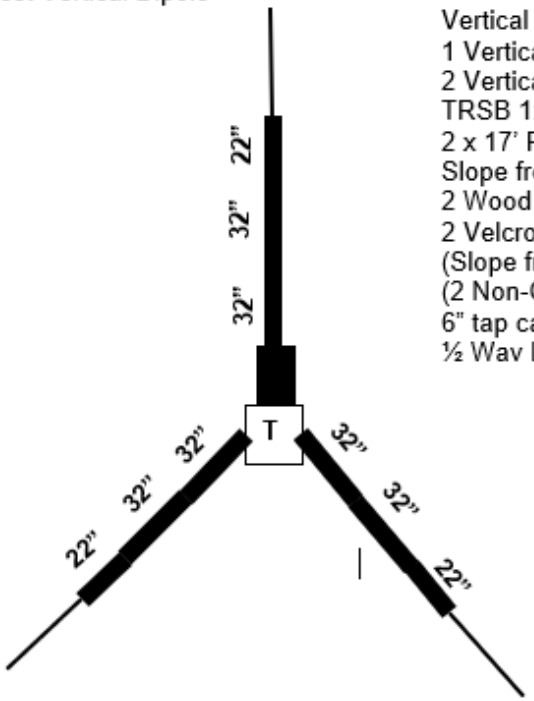
Best Horizontal Dipole

Whips at 114 in
2 22" Arms
4 32" Arms
TRSB 1:1
½ Wav Len 33.4286 ft



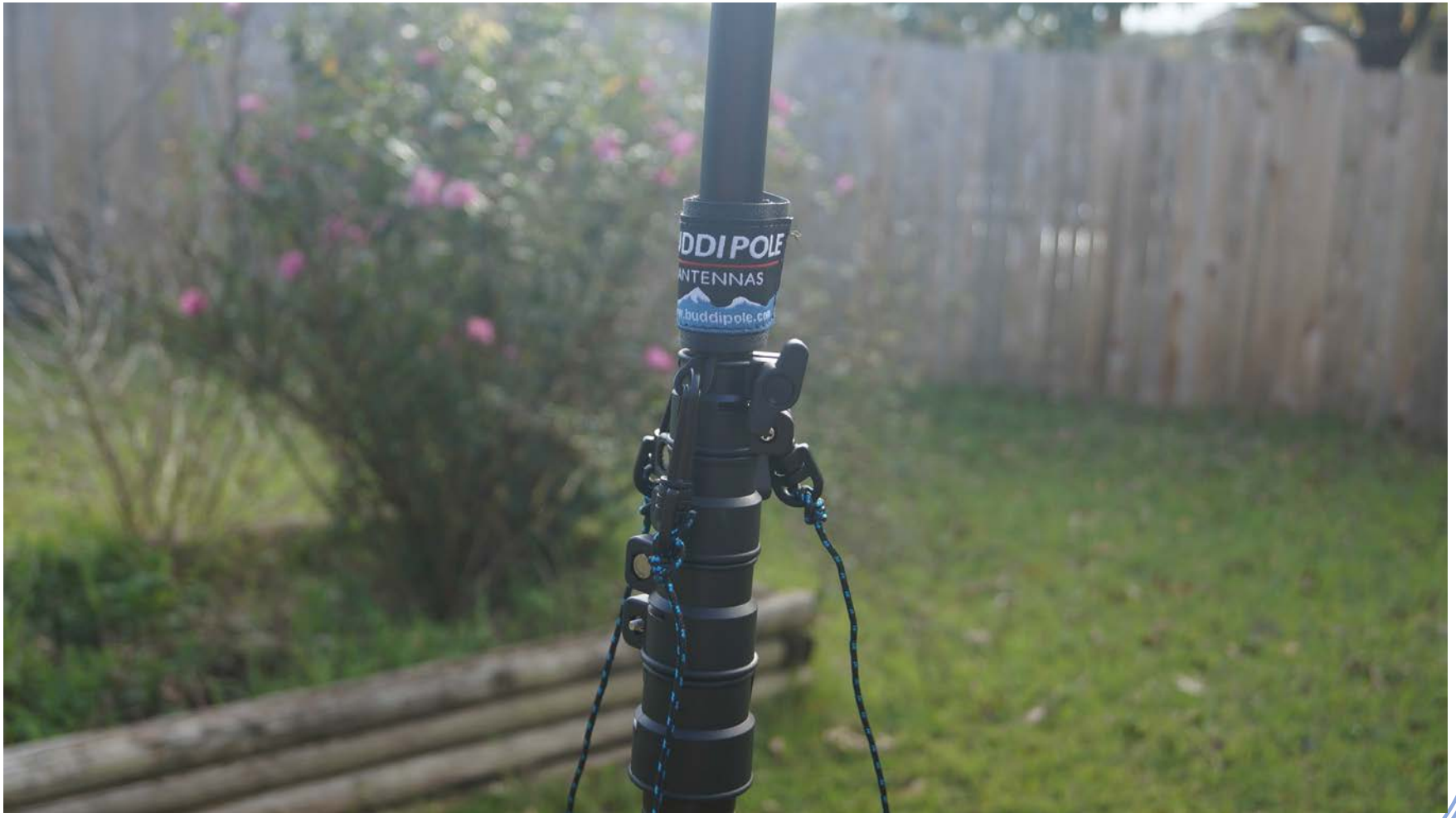
Best Vertical Dipole

Vertical Whip at 114 in
1 Vertical 22" Arm
2 Vertical 32" Arm
TRSB 1:1
2 x 17' Radial Wires
Slope from 8' to 3'
2 Wood Stakes 4'
2 Velcro Wraps
(Slope from 17' to 12')
(2 Non-Cond Poles 12')
6" tap cable to join sides
½ Wav Len 33.4286 ft



Basic Tripod and Mast Setup Start

Basic Tripod and Mast Setup
Guy Ropes



Basic Tripod and Mast Setup At Full Extension

This will give instantaneous support when you put on antenna components and then run up the mast!

Versa Tee and TRSB

TRSB Triple-Ratio Switch Balun

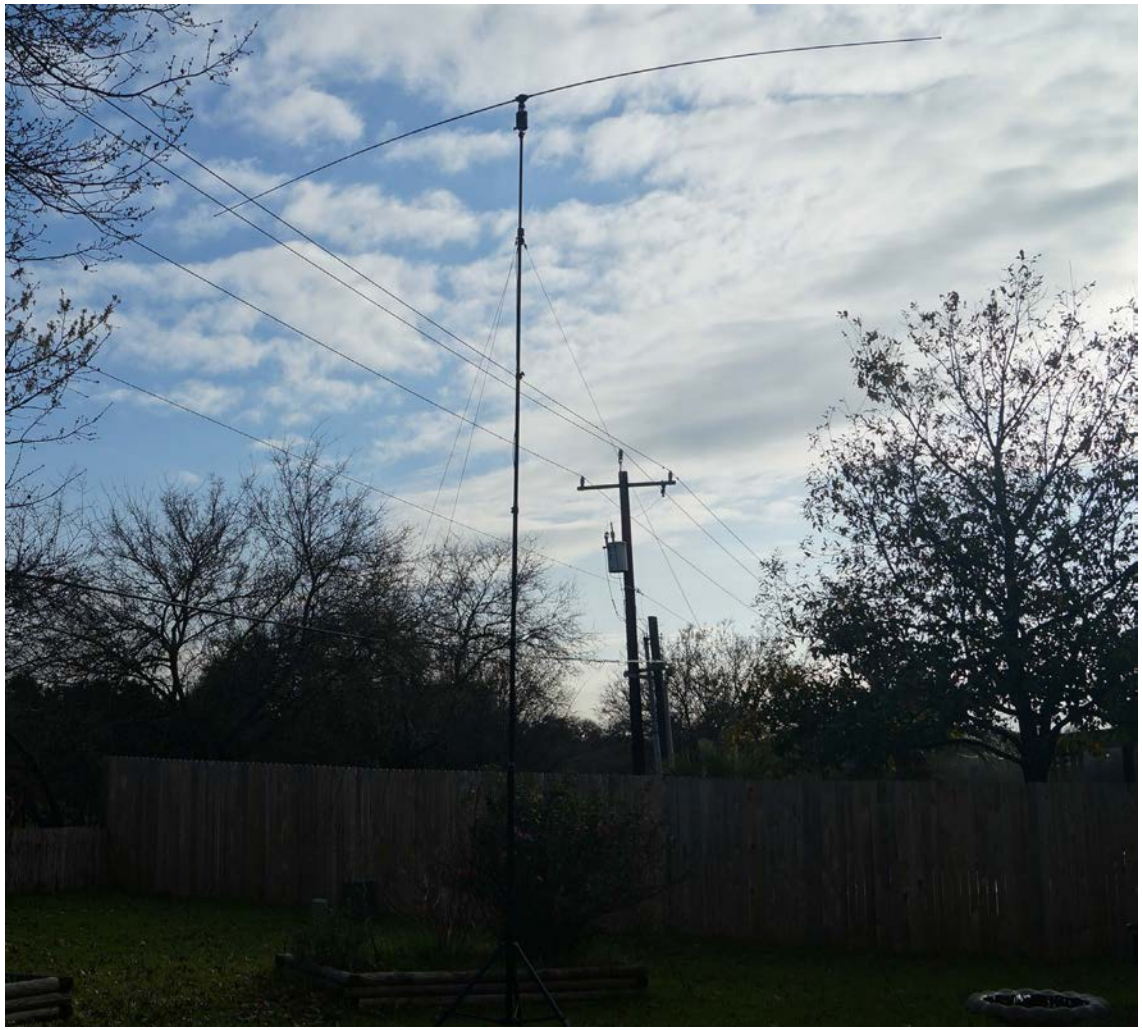
2M Dipole Ready

2M Dipole

6M Dipole

Same 5.5 ft telescopic whips as 2M. They are just pulled out more.

10M Dipole



Changed from 5.5 ft telescopic whips to 9.5 ft telescopic whips.

12M Dipole

Same 9.5 ft telescopic whips as 10M. They are just pulled out more.

15M Dipole

Includes 22” arm on each side.

17M Dipole

Includes 2 each 22” arms on each side.

20M Dipole

Includes 2 each 32” arms and 1 each 22” arm on each side.

30M & 40M Dipole

Includes coil on each side. Different taps for 30M and 40M.

70CM Dipole

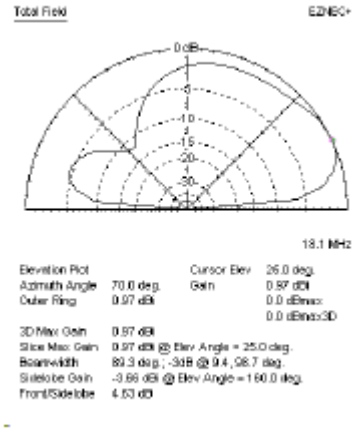
70CM Dipole?
How can this be?

1.25M Dipole

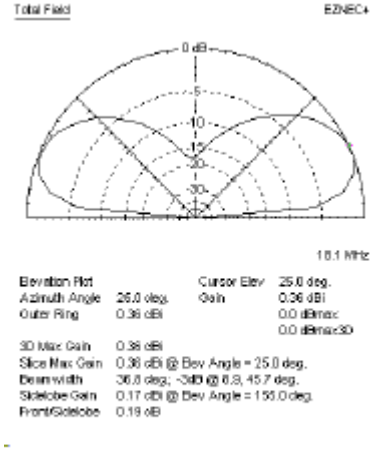
Buddipole does Vertical Dipoles

- The Versa Tee can handle a vertical element.
- The Versa Tee can handle two radials using a Rotating Arm Kit (RAK).
- The RAK adds a RAK connector to each side.
- The red from TRSB connects to the vertical element. The black connects to one RAK connector.
- An additional tap wire is needed. It connects the two RAK connectors together.
- This gives a vertical with two radials.

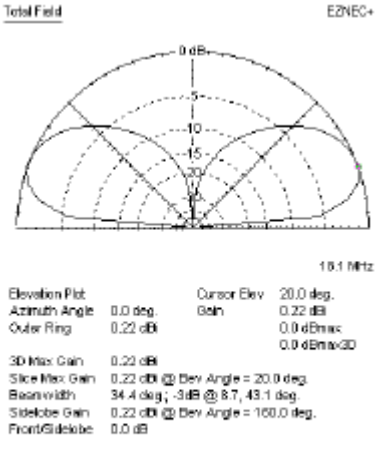
Impact of the Number of Radials



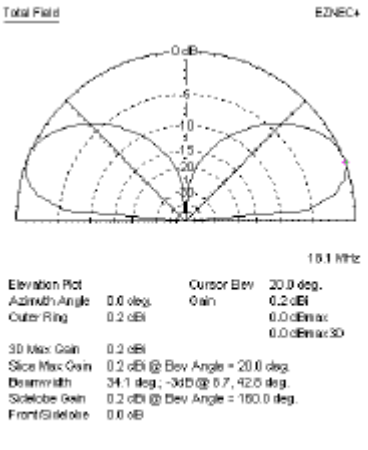
Far field plot for 17m w/ 1 radial



Far field plot for 17m with 2 radials



Far field plot for 17m with 4 radials



Far field plot for 17m with 16 radials

- On the left, there is only one radial. There is a dead side to the antenna.
- On the second from left, the second radial has eliminated the dead spot.
- On the third from left, four radials bring improvement. Scott NE1RD achieves this with wire.
- On the right, 16 radials bring even more improvement.

- The issue is what to choose. I chose two radials as it eliminates the dead spot and I can do most radials without any wire.

Connection Changes for 2M Vertical

2M Vertical Dipole Ready to be Raised

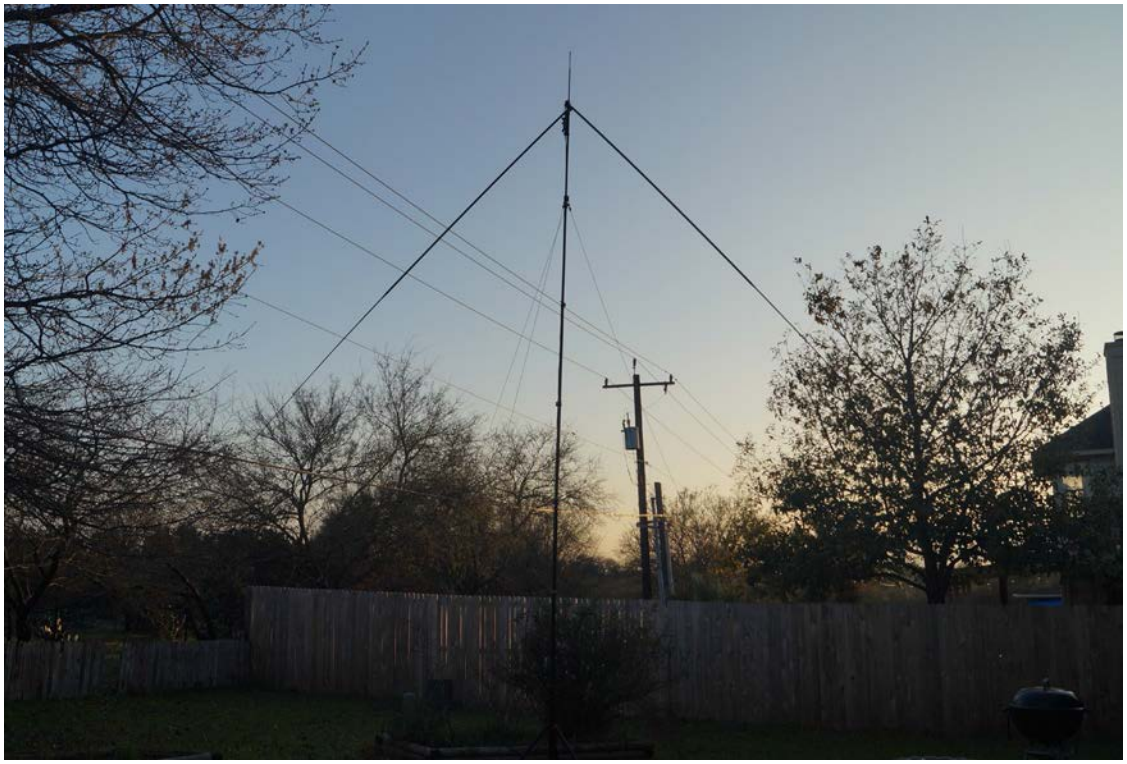
2M Vertical Dipole

6M Vertical Dipole

70CM Vertical Dipole

1.25M Vertical Dipole

2M Vertical Antenna Wanting to be 20M



For 2X Safety reasons, no vertical dipole antennas over 6M in the backyard. This was a proof of concept that arms and whips could be used for 20M radials on a 20M Vertical Dipole Antenna.

Buddipole will do Yagi Antennas

- **Buddipole has a Yagi kit.**
  - **It will do 2 element Yagi Antennas.**
  - **With a few more parts, it will do 3 element Yagi Antennas.**
- **Some Yagi calculators:**
  - **Set boom length at ½ wavelength**
  - **Set the elements apart by ¼ wavelength**
  - **Make the Driven Element at ½ wavelength**
  - **Make the Reflector slightly longer than ½ wavelength**
  - **Make the Director slightly shorter than ½ wavelength**
- **Some Yagi calculators want all dimensions of everything and then produce refined output.**
- **Buddipole Yagis are pretty much done with the simple calculations (Remember, we are in the field doing the best we can.)**

AE5AS's "Cookbook for 6M 3 Element Yagi Antenna

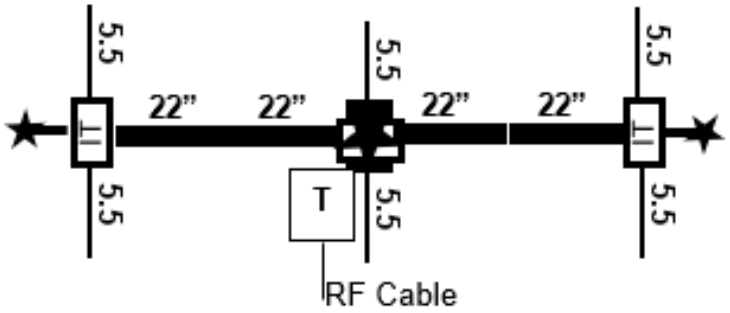
- There is a lot of rounding in all Yagi Antennas, but the Buddipole components get us close on distances between elements.
- Cookbook includes 2 and 3 element Yagi Antennas for 2M, 6M, 10M, and 12M.
- Beyond that, it is not expected that balance can be maintained.

Harold C. Fleischer, III AE5AS — Issue 2
Buddipole Guide — June 25, 2018

6 Meter (50-54 MHz)
(Continued) (56.16-54-52 inches ¼ wave)
(4.68-4.5-4.33 feet ¼ wave)

Best Three Element Yagi
2 Whips in Director at 53.2 in
2 Whips in Driver at 56 in
2 Whips in Reflector at 58.8 in
4 22" Arms

TRSB 1:1
3 IT Adaptors
3 RAK Knobs
½ Wave Len 9.36 ft

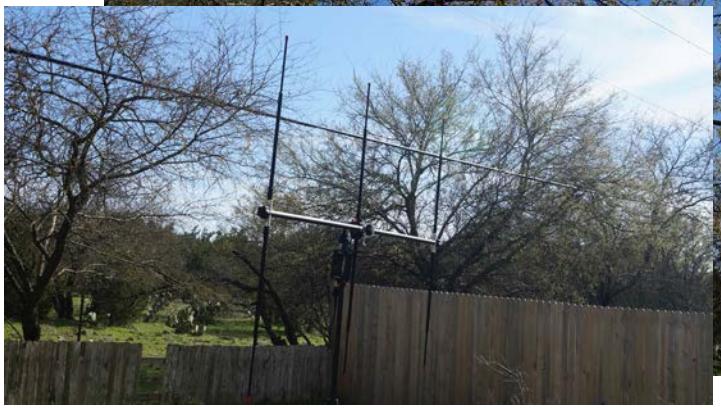


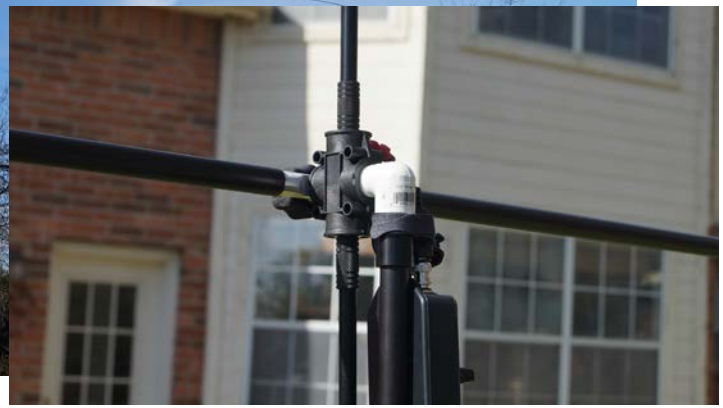
May substitute 9.5 ft whips.

2M 3 Element Yagi Antenna Ready to be Raised

2m 3 Element Yagi Antenna Raised up

2m 3 Element Yagi Antenna Vertical Polarization





2m 2 Element Yagi Antenna

6m 3 Element Yagi Antenna

6m 2 Element Yagi Antenna

10m 3 Element Yagi Antenna

10m 2 Element Yagi Antenna

12m 3 Element Yagi Antenna

12m 2 Element Yagi Antenna

Buddipole will do Near Vertical Incidence Skyway (NVIS) Antennas

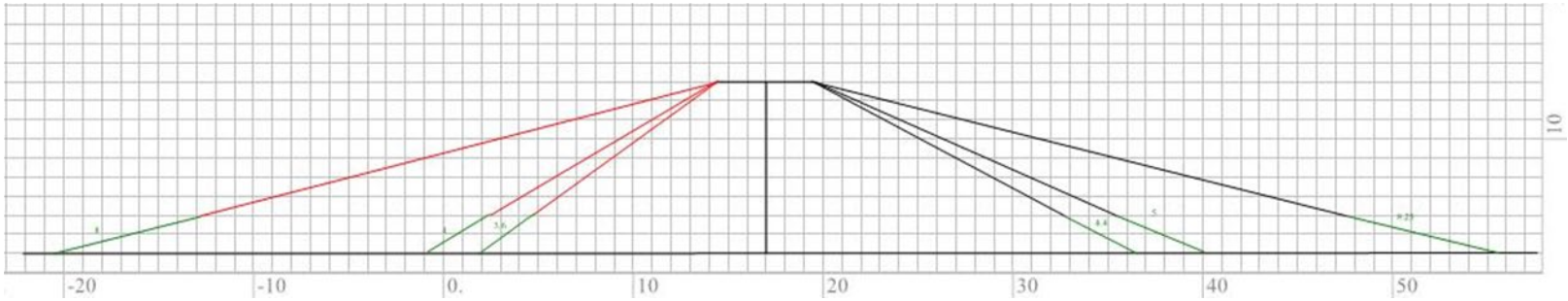
- They provide a “manual” (1 page) on setting up the standard Buddipole as a NVIS.
- NVIS is good for 400-500 miles.
- ARES uses NVIS to get out of a disaster area.
- The “manual” gives settings for 40, 60, and 80 meters.

- AE5AS has not done this yet.
- AE5AS has procured guy ropes (paracord), snap hooks, and winders to replace the stakes.
- AE5AS has used a graphical technique to determine guy rope length.

Extract from Buddipole NVIS "Manual"

SETTINGS				
	RED SIDE		BLACK SIDE	
Bands	*Wire length*	*Tap*	*Wire length*	*Tap*
80 METERS	28'	No	29'	No
60 METERS	12'	Tap 37	15'	No
40 METERS	14'	Tap 16	17.5'	Tap 20

Miscellaneous on NVIS



Guy Ropes to handle the NVIS in order to keep the ends 2’ off the ground without using stakes need only be 10’.

- **The use of more arms, 22” and 32”, should change the parameters on NVIS.**
- **Large coils for low bands should change the parameters on NVIS.**
- **Could these changes extend NVIS to 160M? Unknown.**

160M on Buddipole

- AE5AS asked the manufacturer.
- The manufacturer did not say Buddipole can do 160M, but his words implied some people have experimented with it.

- Experimentation with large coils in place of normal ones on 30-40 dipole configurations are in order to see how low that can go.
- Experimentation with large coils, more arms, and wires in NVIS are in order to see how low that can go.
- No odds on whether either approach will work.

Advantages of Buddipole

- **Buddipole is a system.**
- **Buddipole can do:**
  - **Dipoles from 70CM to 40M with normal coils.**
  - **Dipoles from 60M to 80M with large coils.**
  - **Vertical dipoles from 70CM to 40M with normal coils.**
  - **Vertical dipoles from 60M to 80M with large coils.**
  - **Yagi antennas, 2 element and 3 element, from 2M to 12M.**
  - **NVIS antennas from 40M to 80M.**
- **Incorporate 3rd Party parts.**
- **Be configured for true backpacking**
- **Hide behind the house and fly by night – HOA avoidance.**
- **Almost affordable.**

Disadvantages of Buddipole

- Every change of frequency requires that the mast be lowered and components changed by hand.
  Mitigated by having a “cookbook”.
- Every change of directions requires that the mast be loosened and turned by hand.
- Not real cheap, but a good value for what you get.

Acknowledgement

- **Richard Elder, WB5ACN, was my Elmer on this.**
- **His up front advice was his best:**

<u>Get an antenna analyzer.</u>

- **He has helped on troubleshooting other problems including this winter.**