

Flagpole Antenna



Designs For The Villages

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Practical Considerations



Safety

Restricted Community Standards

Appearance

On Air Performance

Antenna Element Options

Tuner Options

Ground System

Cost Breakdown

Construction

Safety



Prevent direct contact with radiating element

Control Zone = 2+ Feet

Uncontrolled Zone = 4+ Feet

- Assumes; 100 W Transmitter, CW, 50 Feet RG-8X, VSWR 1.5, 10 M

**Worst Case cited
most installations will
be ½ these distances**

Design for Safety



Radiating element inside PVC pipe to prevent direct contact
Control Zone established by planter
Operator monitors site during transmissions

Restricted Community Standards



Located on private property

Not allowed in easements

Less than 22 Feet Tall

Requires Architectural Review Committee approval

- Application Form with Site Plan indicating location

Community Friendly Design



Location astatically pleasing on private property not in easement
 Less than 22 Feet Tall
 ARC application Form with Site Plan indicating location (kiss)

VC DD Architectural Review Committee (ARC)
 Home/Property Alteration Application Form
 (PLEASE PRINT)

Homeowner Name: _____
 Address: _____ Zip Code: _____
 Phone Number: _____ Unit _____ Lot _____

(check one) Lake Co. (check one) Courtyard Villa
 Sumter Co. Patio Villa Villa Community Name _____
 Marion Co. Home Village of _____

Briefly describe the modification or alteration (please attach additional sheet if needed)
Installing Flagpole

Homeowner will pick up original application
 Contractor will pick up original application
 Original application to be mailed to homeowner
 Contractor Business Name (if picking up) _____
 (Address if different than above) _____

Please Note - For all projects (with the exception of existing roof re-shingle, existing driveway painting or pavers, existing walkway painting or pavers) the following are required (please check):
 Site plan showing placement of house on property
 A complete list of materials and proposed modification/project highlighted.
 (copy of site plan is available from the County Building Department)

Please read and acknowledge by initialing in the box:
 It is the homeowner's responsibility to obtain all necessary permits and governmental approvals and maintain compliance with all applicable building, zoning, permitting, and subdivision restrictions (collectively, the "Restrictions").

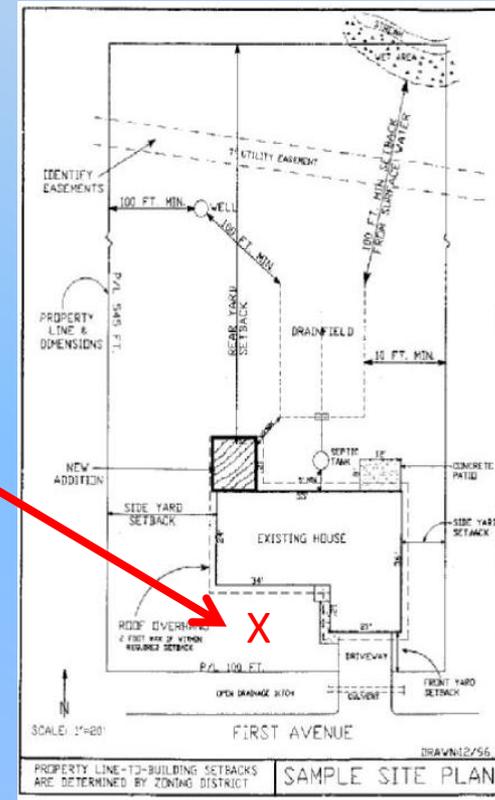
HOMEOWNER SIGNATURE _____ DATE _____
 APPLICATION VOID IF NOT STARTED WITHIN 2 MONTHS AND COMPLETED WITHIN 6 MONTHS OF DATE OF APPROVAL

[For ARC Committee use only. Please do not write in the space below.]

ARCHITECTURAL REVIEW COMMITTEE ACTION:
 Approved as submitted Approved with stipulation Denied for reason(s) below

Date ____/____/____ Committee Member Signature _____

(Rev. 11/2010)



Appearance Considerations



Look and function as a flagpole

Withstand the neighborhood inspector review

External Pulley, Rope, Ring & Cleat

Include compatible planter suggestions



Appearance Details



Flagpole with flag, rope, pulley, cleat, etc.

- Flagpole parts can be purchase separately or as kits

Paint flagpole to color desired

Include planter control zone and hide tuner



Performance



Flagpole Antennas provide:

80 M to 10 M >>> VSWR less than 2

80 M to 10 M >>> Better than 90% Efficient

Ground Plane quality is biggest factor in DX reach

TVARC Project Objectives



80 M to 10 M operation *

Best at 40 M and 20 M

Tuner solution

Interface to a wide range of Ground Plane options

** No one requested 160 M*

Antenna Element Options



Two approaches were developed for the $\frac{1}{4}$ WL Vertical

Both are 22 Feet Tall

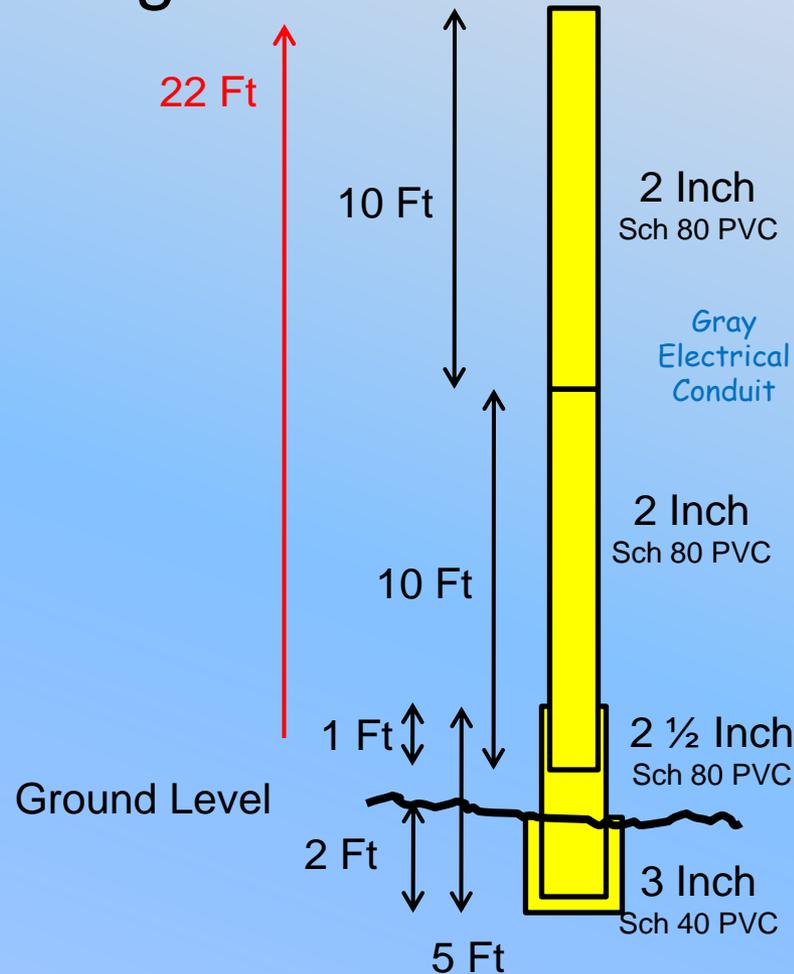
Both can be painted to desired color

- DIY using PVC Pipe
- Purchased 2 Inch Aluminum Flagpole Kit

Antenna Element Options



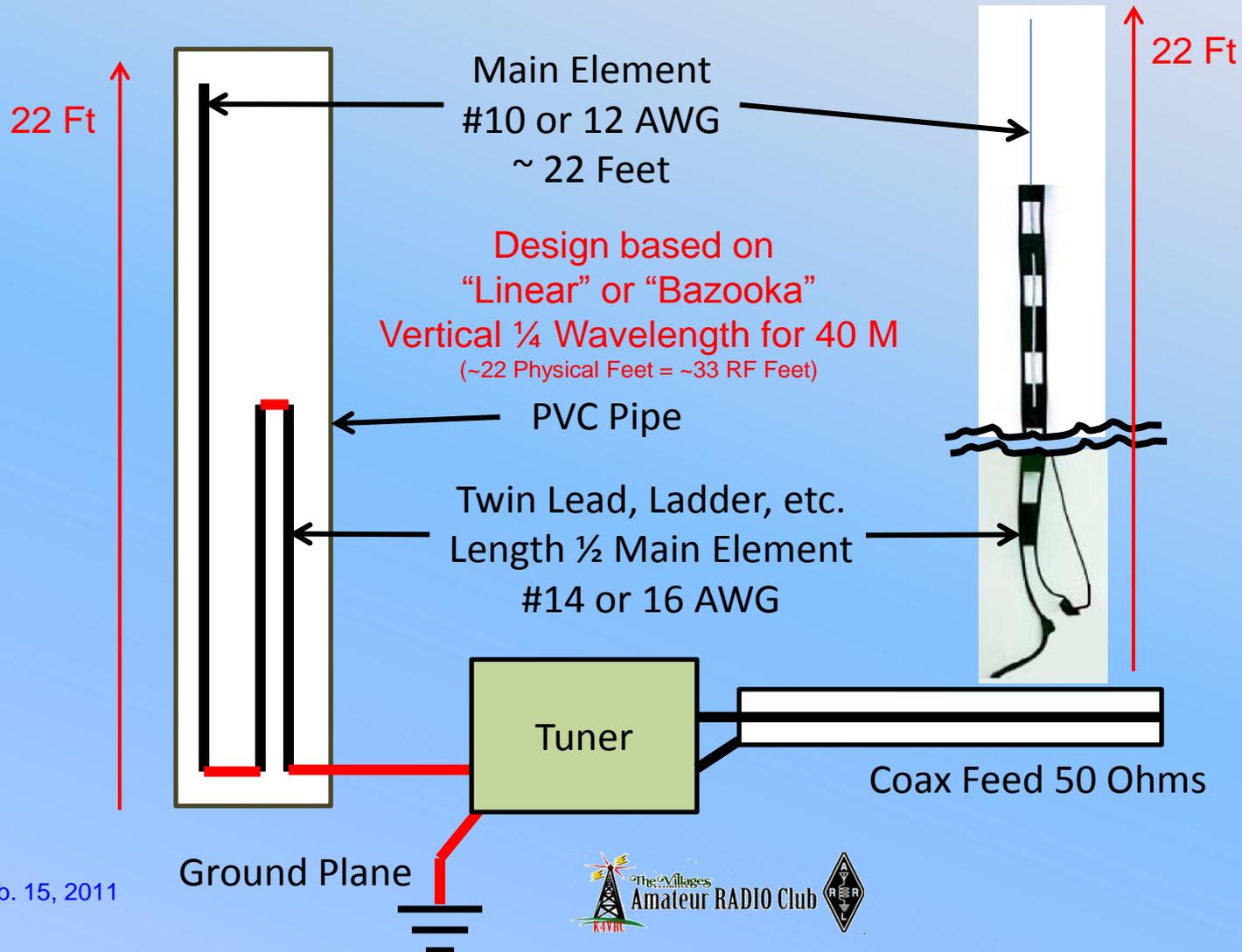
DIY using PVC



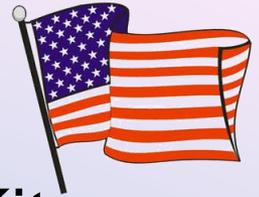
Antenna Element Options



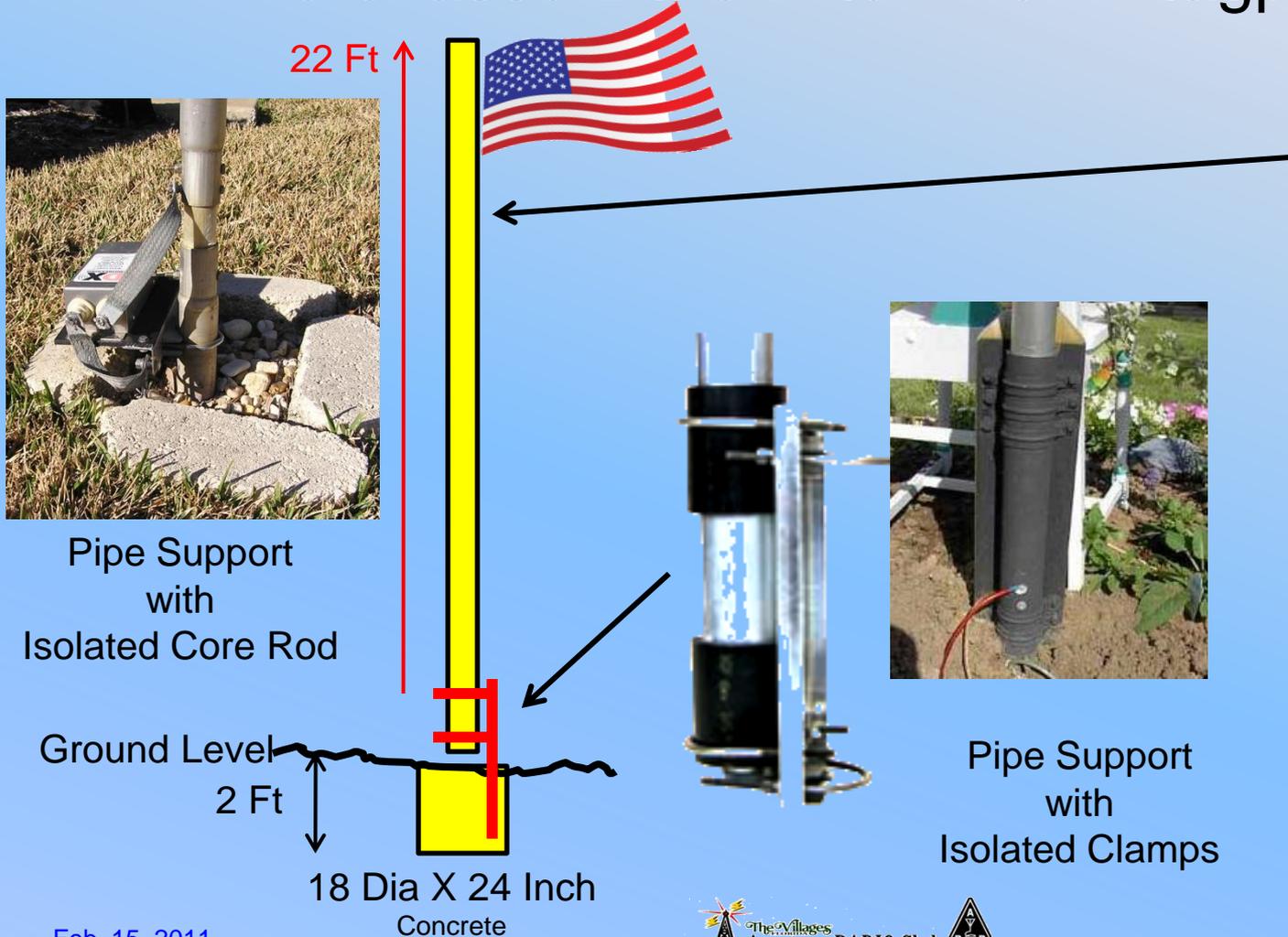
DIY using “longer” 33 Foot inside PVC



Antenna Element Options



Purchased 2 Inch Aluminum Flagpole Kit



Pipe Support with Isolated Core Rod



Pipe Support with Isolated Clamps



Tuner Options



Three approaches were considered for the tuner

Two are located at the antenna and require power

One did not require equipment at the antenna

- Indoor tuner with isolation BALUN at antenna
- Purchased remote tuner
- DIY tapped load coil with remote control

The 40 M $\frac{1}{4}$ WL antenna design presented is dependent on the coaxial feed length

Use COAX lengths of 40-50, 70-80, 100-110 or 130-140 feet

Do NOT use COAX lengths of 30, 60, 90, 120 feet

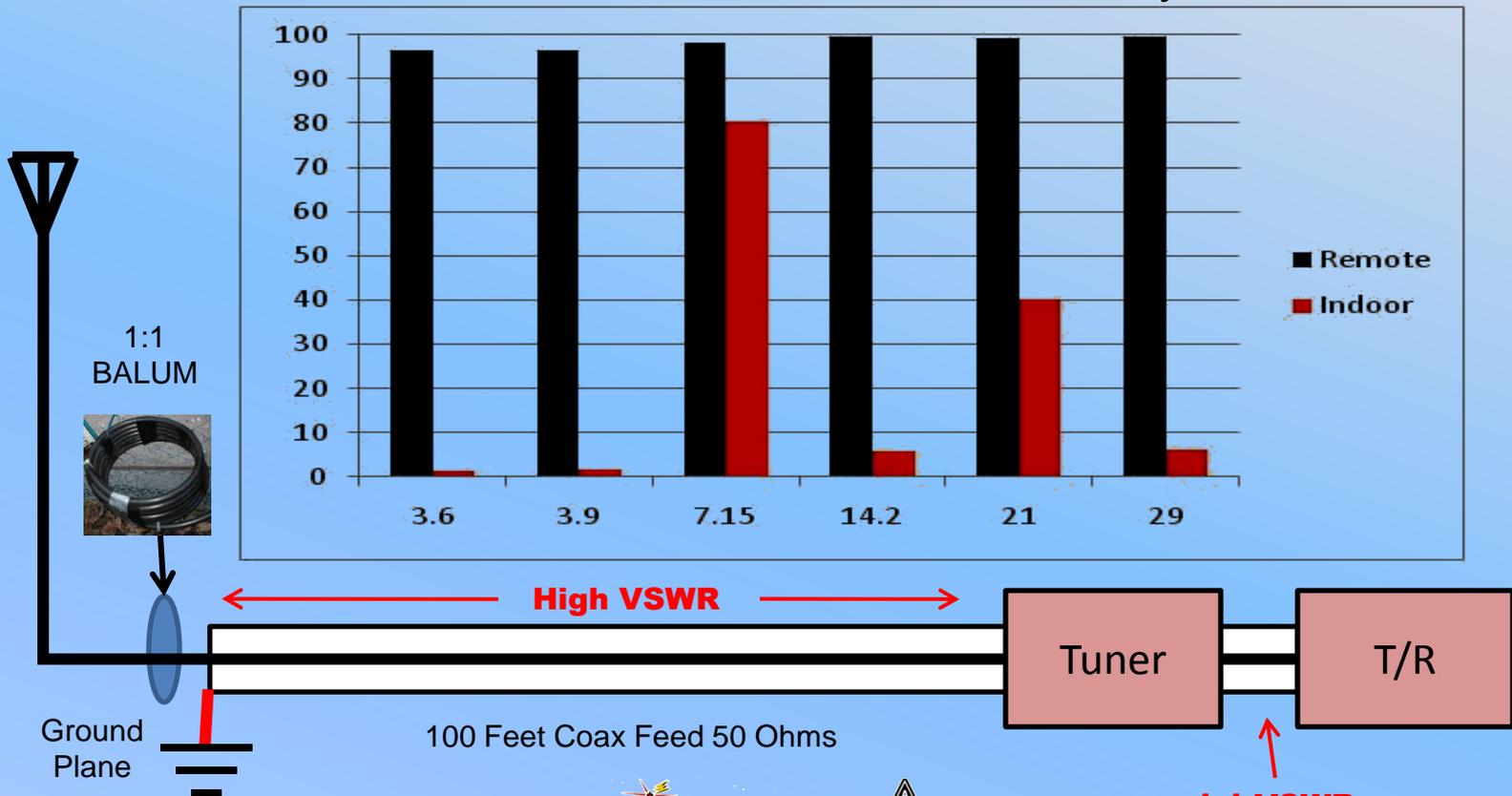
Tuner Options



Indoor match was **rejected** due to high losses

Mono-band and 3rd Harmonic are 80% & 40% efficiency

Five-band resulted in most bands at 5% efficiency



Tuner Options



ANY purchased remote tuner (here is a sample)

Vendor	SGC	MFJ	CG
Model	SG-230	MFJ-927	CG-3000
Power Input (PEP watts)	200	200	3-100
Input Capacitance maximum	6400pf	3961pf	6300pf
Inductance maximum	64μH	25μH	64μH
Size Overall (inches)	16Dx12Wx3H	7Dx6Wx9H	10Dx12Wx3H
Weight (pounds)	8	3	1
Case Construction	Plastic ABS Waterproof case	ALUM Base with Plastic ABS Cover Rainproof	Plastic ABS Waterproof case



Paint SCG Remote Tuner



Camo Painted

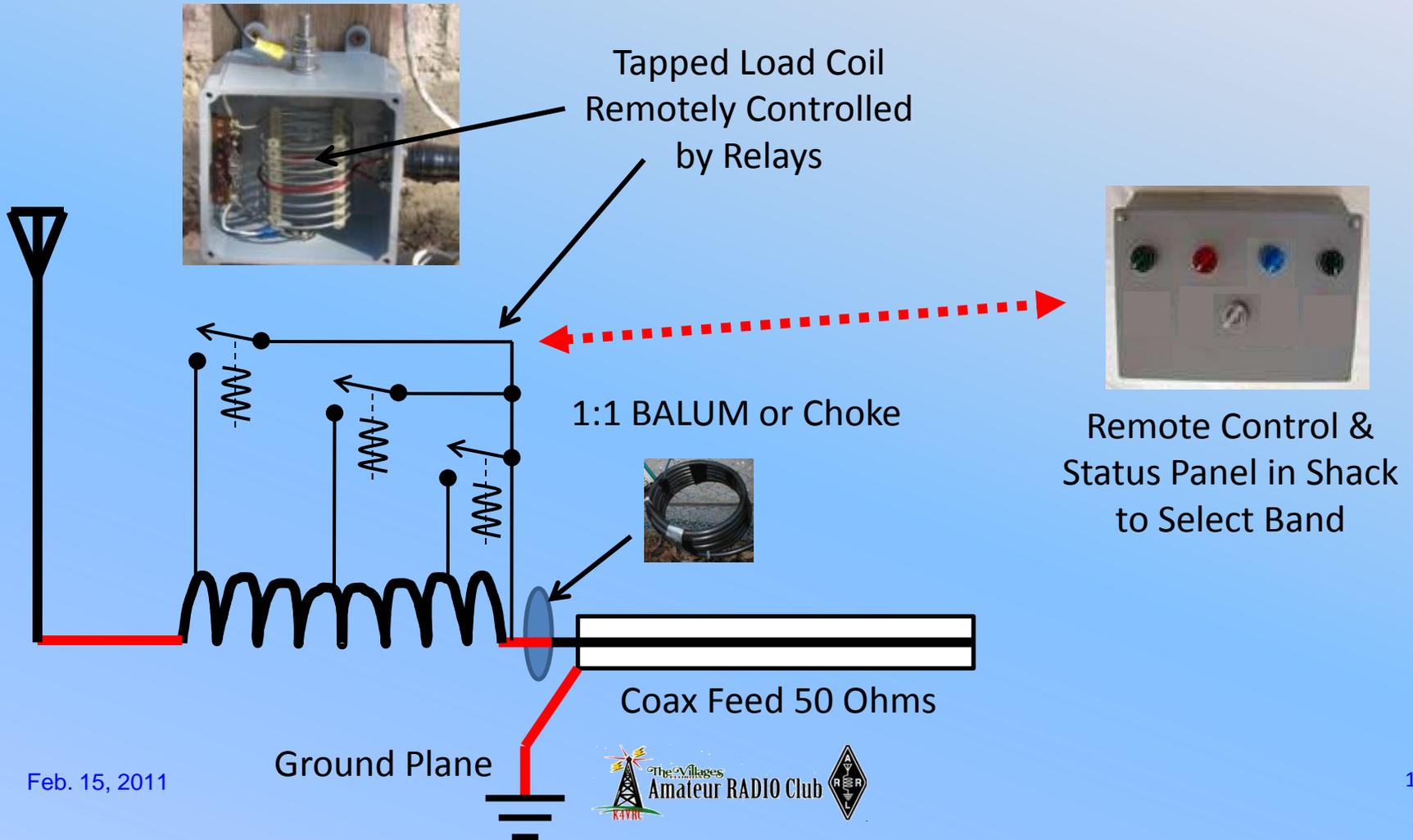


Naked in front yard

Tuner Options



DIY using a tapped load coil with remote control



Tuner Options



DIY using a tapped load coil with remote control

80 M taps have 200 KHz BW set at 3.6, 3.7 & 3.9 MHz

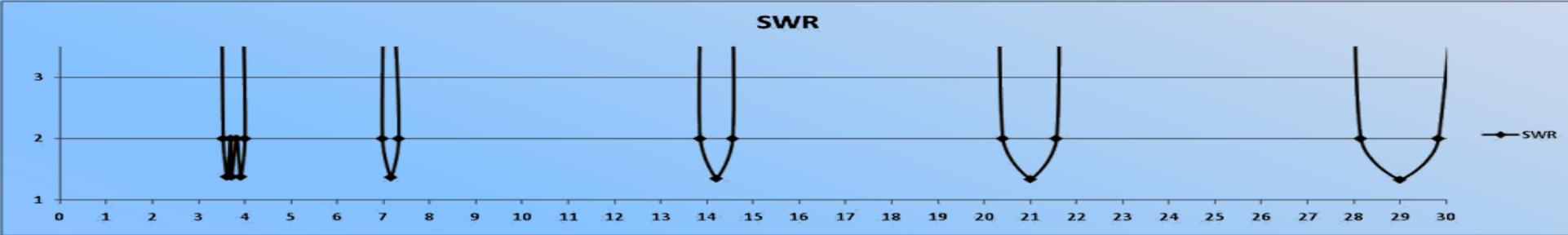
40 M tap has 330 KHz BW set at 7.15 MHz

20 M tap has 700 KHz BW set at 14.20 MHz

15 M tap has 1,100 KHz BW set at 21.00 MHz

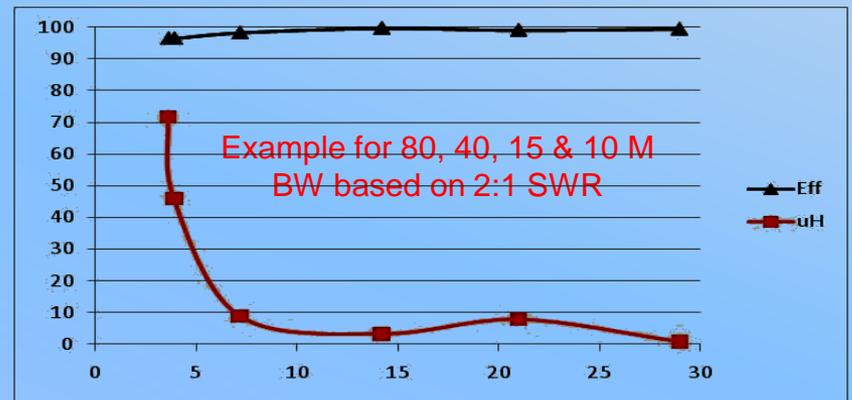
10 M tap has 1,700 KHz BW set at 29.00 MHz

**Taped load coil
performance equals remote tuner
BW based on 2:1 SWR**



22 Foot Element		
Freq MHz	Match Eff %	Series Coil uH
3.6	96.5	7.17
3.9	96.5	4.6
7.15	98.3	0.89
14.2	99.7	0.32
21	99.1	0.78
29	99.5	0.07

33 Foot Element		
Freq MHz	Match Eff %	Series Coil uH
3.6	96.5	7.02
3.9	96.6	4.4
7.15	99.6	0
14.2	99.6	0.48
21	99.3	0.6
29	99.2	0.09



Ground System



Guidance for your Ground Plane

Local soil resistance is high & more than a rod is required

Use 16 or more radials

Length is more important than Number

cut to $\frac{1}{4}$ WL for lowest frequency

Radials can be “bent” around house if needed

Connect radial ends

DIY using 14 AWG

Copper, Galvanized or Aluminum

Cut slit in grass with edger

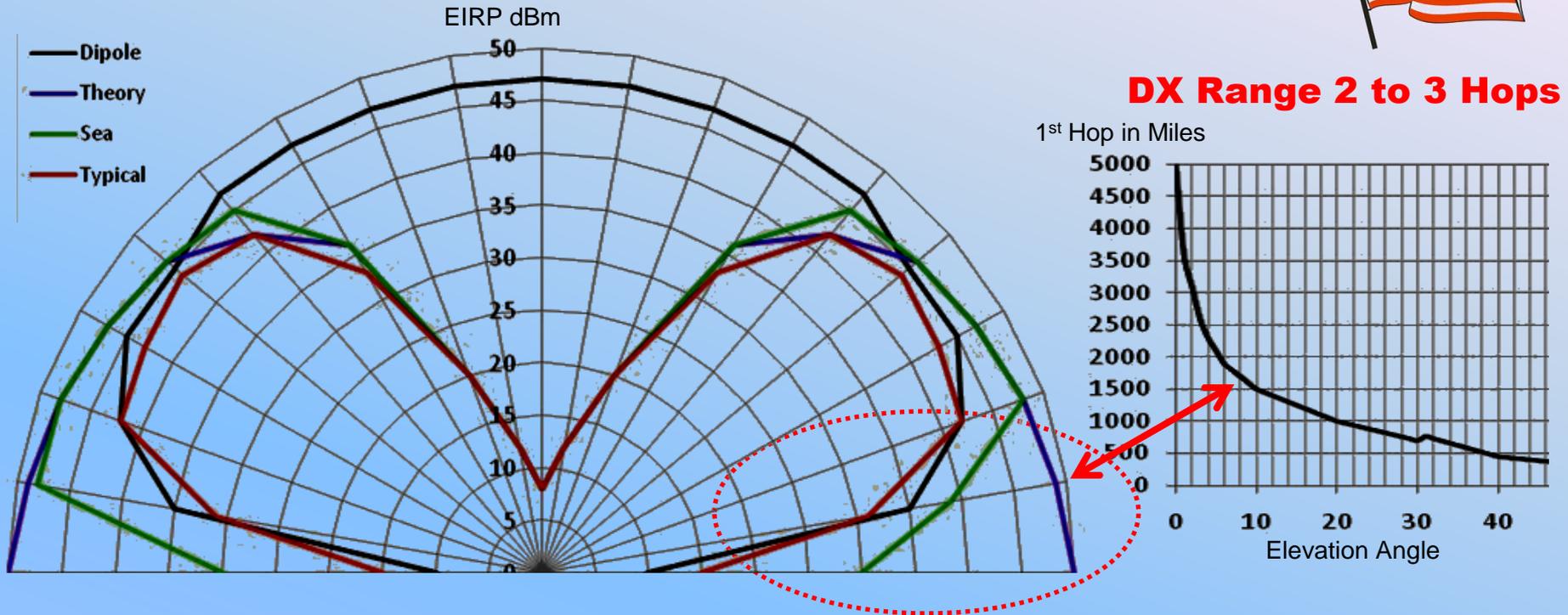
Electrical “Main” Panel Ground Buss

Purchased

Hidden Dog Fence vendor will charge \$150 to \$200 for 16 Radials

Ground Radial Plate Kit

Why your Ground Plane is Important?



Your typical 100W T/R on 40 M shown above with four different antennas

Dipole is less than 20 Feet above ground level

Theory is a computer model perfect ground plane

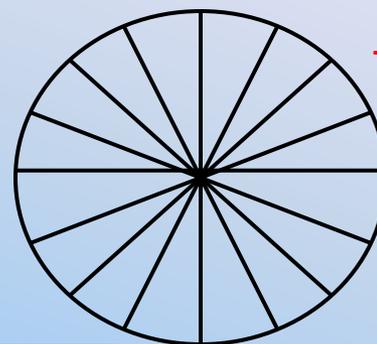
Sea is a ¼ WL Vertical Antenna measured over Sea Water the best Ground Plane

Typical is a ¼ WL Vertical Antenna measured over ground much better than our sandy soil

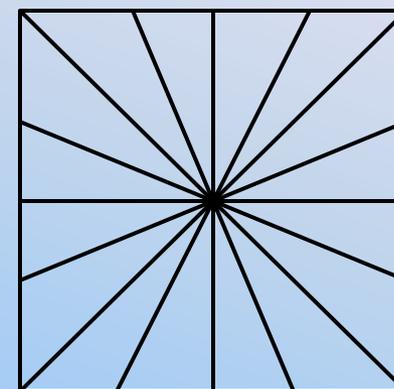
Multi-band Ground Plane



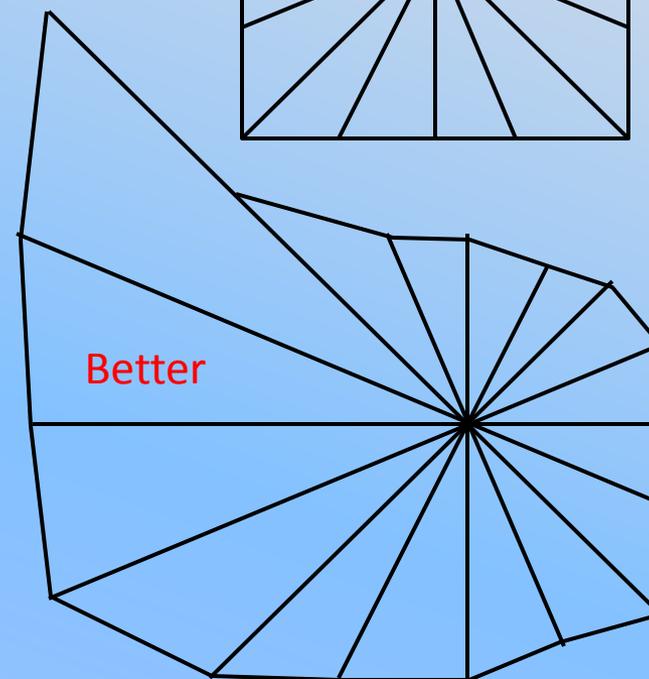
Shape is "Freeform"
 Long & More are better
 Connect ends as practical



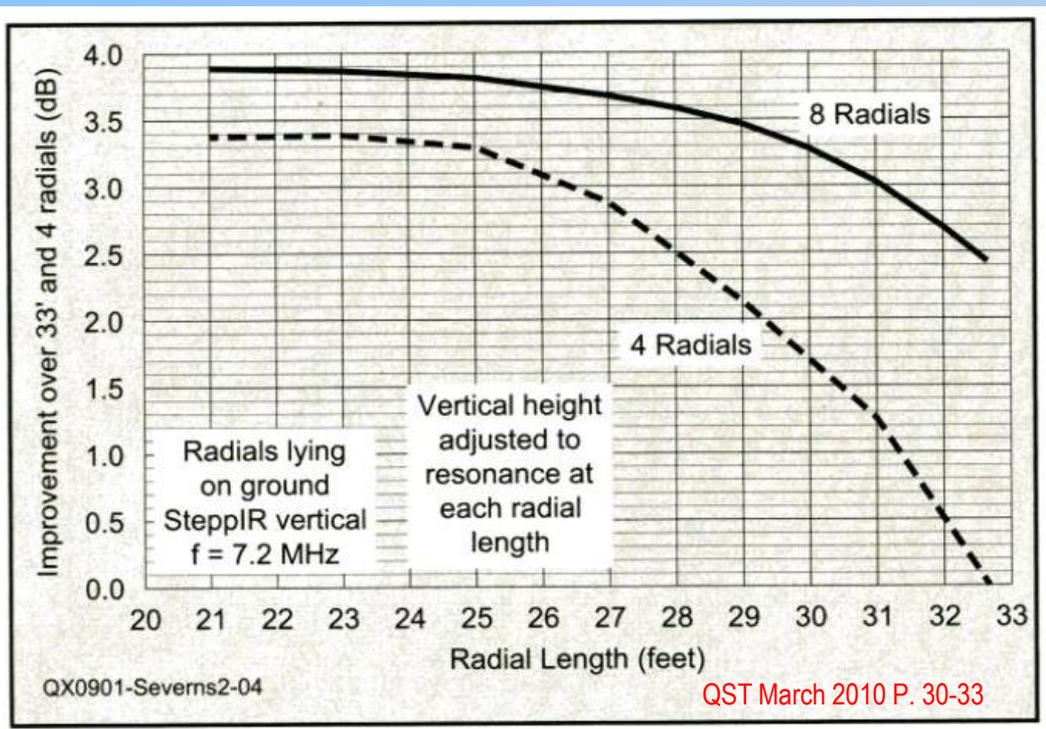
Theory



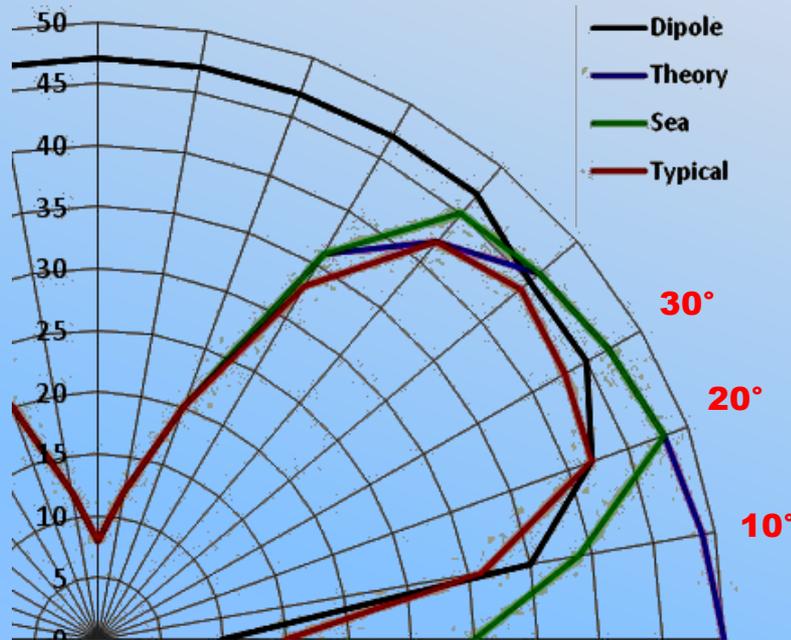
Good



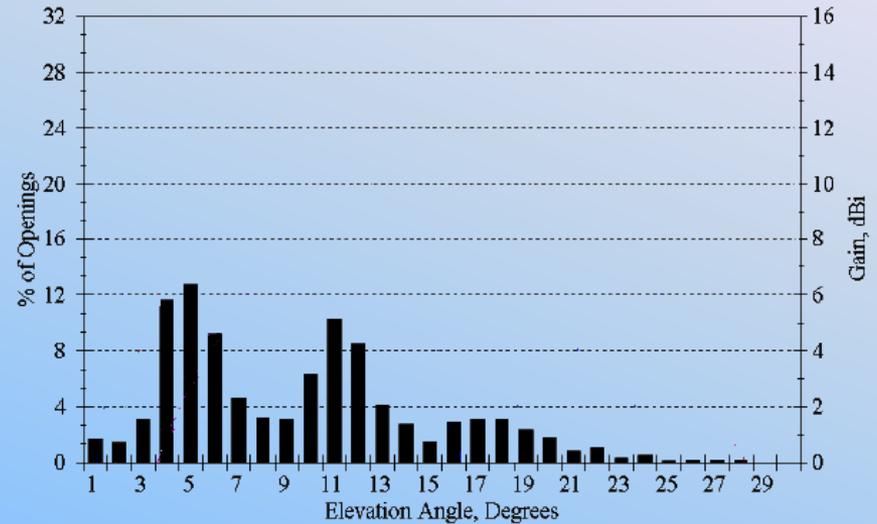
Better



Ground Plane what can I do?



Antenna Response Versus Height
14 MHz, Boston to Europe



DX openings are few above 15° Elevation, improvements can be realized by;

Increasing the height of the antenna 🙄

Raising the ground plane 1 to 5 Feet above ground 🙄

Use a Vertical Dipole or J-Pole that do not require Ground Plane, but are 2X, 3X taller 🙄

Put in 16 (or better 32) Radials if not an attic dipole will be a better DX antenna choice ✓

Increasing the height of the antenna using a balloon *our next project!*

Ground Connections

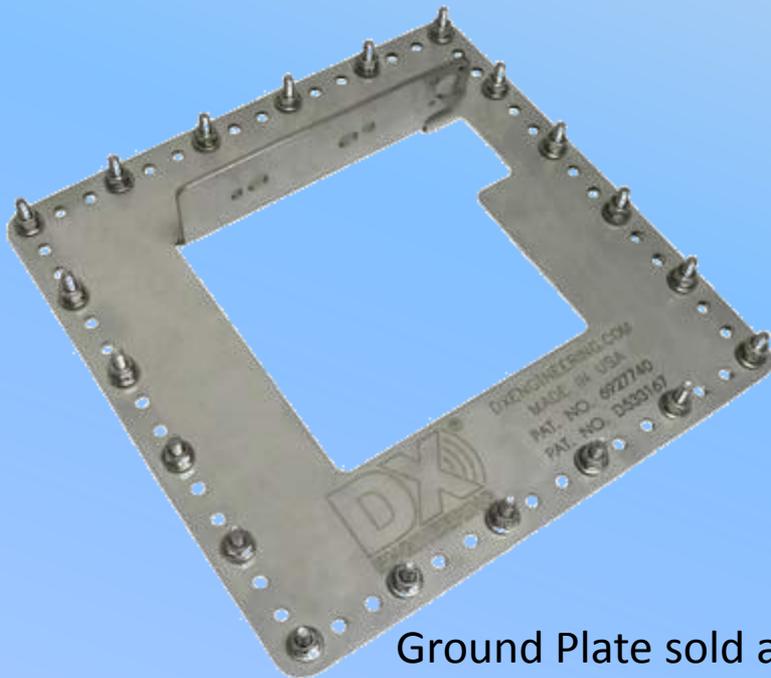


Bond mechanically and electrically

Use anti-corrosion paste

Keep dry

Main Ground Buss sold as repair parts



Ground Plate sold as kit



Split Bolt used for cable slicing



Power Panel w/o Cover

Cost Elements



Item Description	ALL DIY	ALL Buy
US Flag	\$20	\$120
PVC, Rope, HW	\$40	na
Concrete Base & HW	\$15	\$60
RF Element	\$10	na
Tuner	\$40	\$300
Ground Plane	\$25	\$175
Planter	\$50	\$150
100 Feet Coax	\$75	\$75
100 Feet Control Wire	\$15	\$50
Total	\$290	\$960

Trade Space to Consider

PVC vs. Alum Flagpole Kit

\$70 vs. \$120 = Δ of \$50

DIY vs. Purchased Tuner

\$40 vs. \$300 = Δ of \$260

DIY vs. Purchased Ground Plane**

\$25 vs. \$175 = Δ of \$150

** Quote from Hidden Dog Fence Installer



PVC Flagpole Construction

A gathering of materials for TVARC Flagpole Antenna Project. I started with an assortment of stainless steel fasteners. 2 snap hooks, a rope cleat, stainless eyehook, a pulley, rope and of course a Flag.

Most all items purchased at Home Depot

Swivel ring = \$2.98

Snap rings = \$1.94

Rope Cleat \$1.98

Eyebolt = \$1.98

Rope = \$4.24

Flag = \$5.00*



*Marion flea market

PVC Flagpole Construction



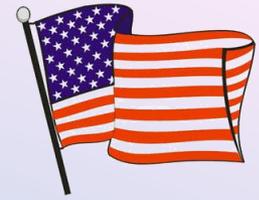
The real Antenna

I used solid #10 copper wire

My first prototype used ladder line. This was changed later

This was excess wire from my collection which my XYL calls junk

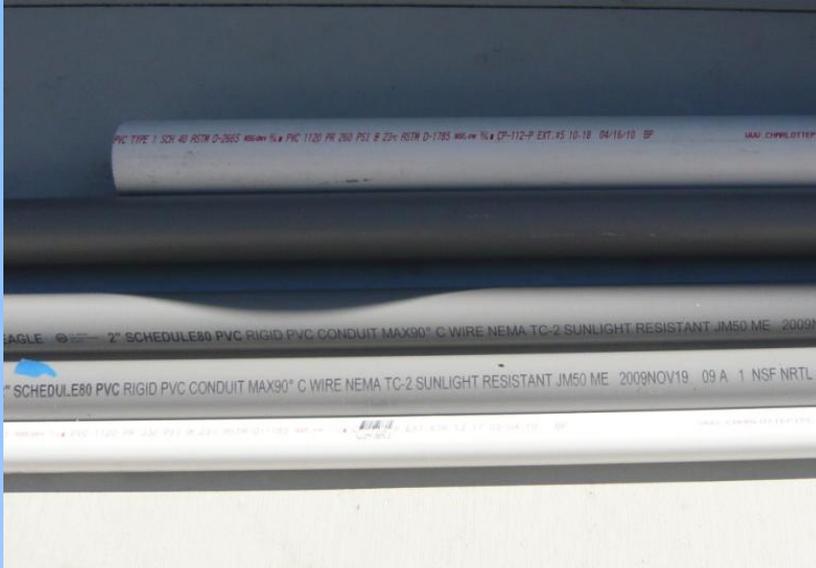




PVC Flagpole Construction

Pipe Galore

I used 2- 10' lengths of electrical 2" schedule 80 PVC conduit. Schedule 80 is thick walled and sunlight resistant. There is 1 length of 2-1/2" schedule 40 conduit.



A piece of scrap 1-1/2" plumbing PVC pipe

A piece of scrap 3" plumbing PVC pipe

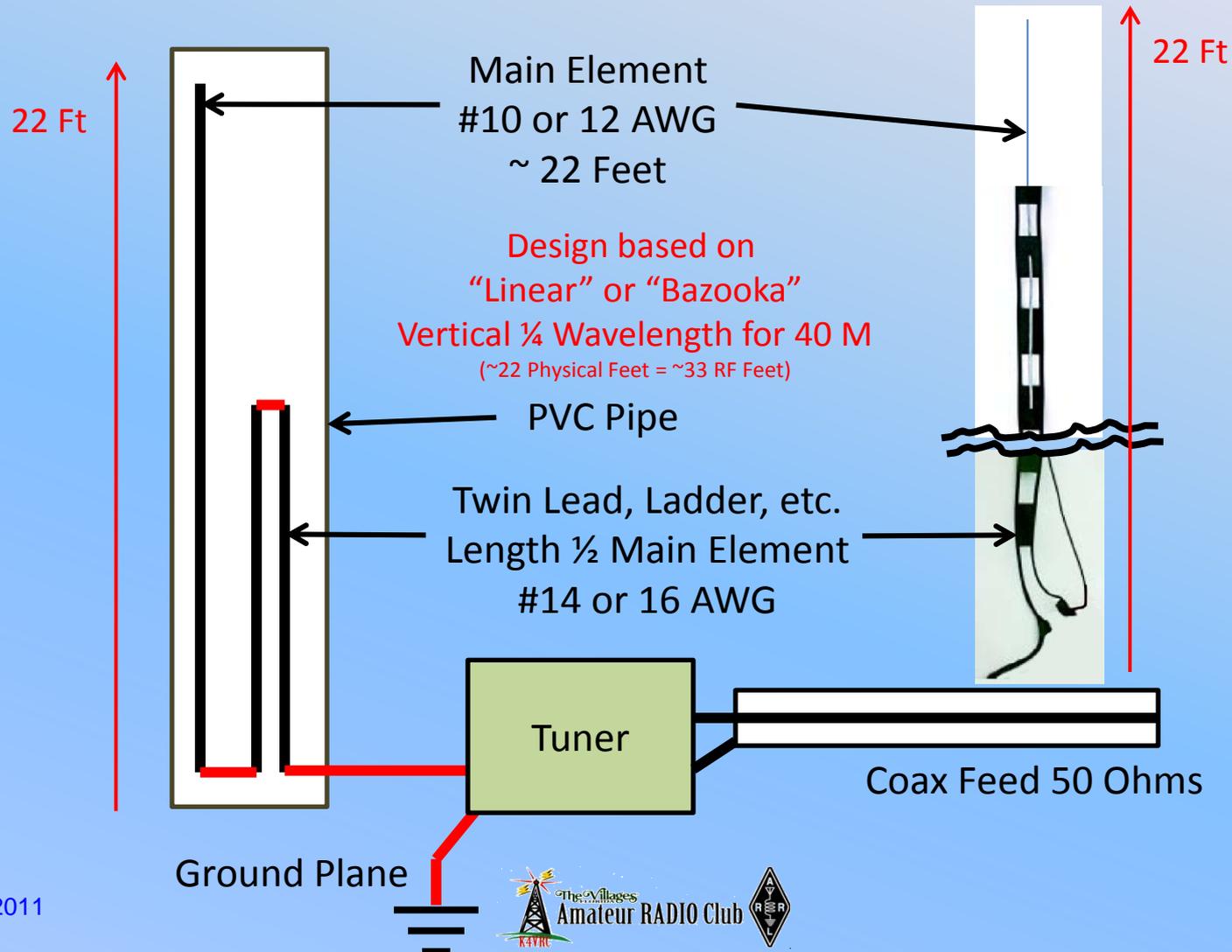
The schedule 80 2" pipe was \$6.47 per 10'

The 2-1/2 schedule 40 was \$7.04 per 10'

The 3" and 1-1/2" plumbing pipe will cost about \$6.00 (Home depot sells 3' shorts)



PVC Flagpole Construction



PVC Flagpole Construction



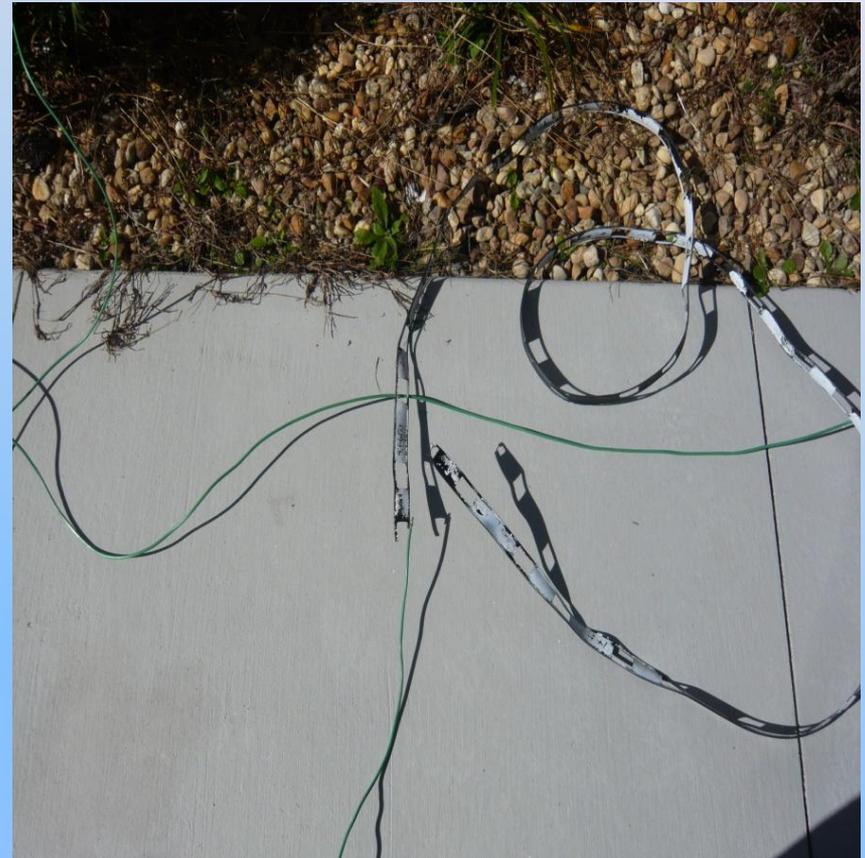
The # 10 solid wire is 22'.

The Ladder Line is 11'.

I soldered together the both sides of the ladder line at the top.

One side of the bottom of the ladder line is soldered to the # 10 wire.

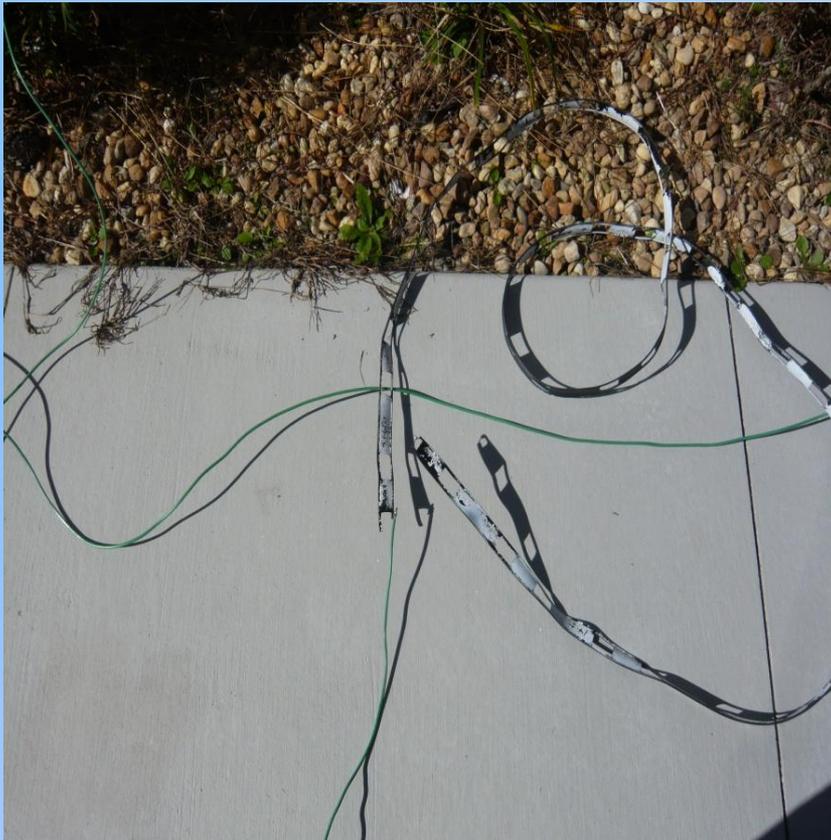
I soldered a piece of # 14 stranded copper wire on the other lead of the bottom ladder line to serve as the connection point to the tuner.



PVC Flagpole Construction



Close up of solder joints.



PVC Flagpole Construction



I used a 2" pipe cap on the top of the antenna. I painted this a bright gold.

I was going to couple the 2 pieces of 2" together but used the bell end on the conduit instead.



PVC Flagpole Construction



I positioned the 2 pieces of 2" conduit and about 2' of the 1-1/2 pipe.

The 1-1/2 will serve as a sleeve to strengthen the coupling of the 2 pipes.



PVC Flagpole Construction



I marked the center of the 1-1/2" to insure that there would be equal lengths in each side of the joint.



PVC Flagpole Construction



I drove the 1-1/2" into the bell end of one piece of 2" and the slide in the other side. I did use PVC glue on this joining.



PVC Flagpole Construction



I attached the screw eye taking care to be just below where the PVC cap will rest. I then attached the pulley to the screw eye.



PVC Flagpole Construction



This the top end of the coax. The shield and the center wire are soldered together. Be careful when you solder. I now have a large patch on one of my golf shirts.



PVC Flagpole Construction



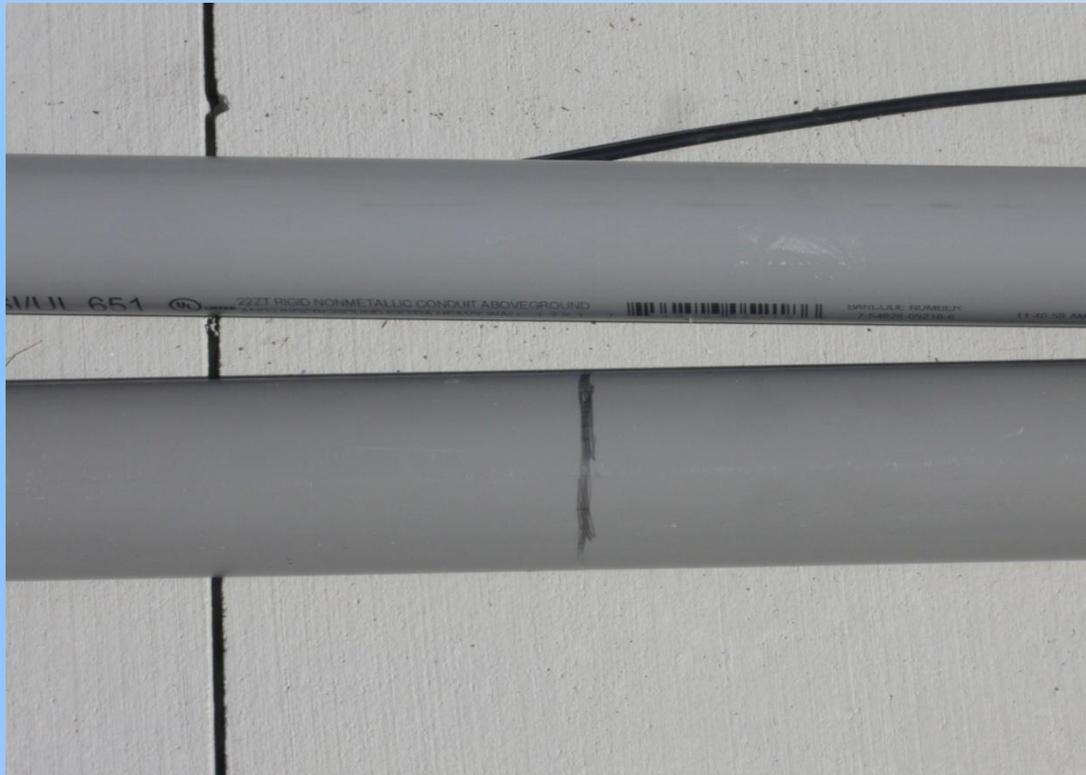
This is the assembled antenna stretched out, ready to be assembled.



PVC Flagpole Construction



Approximately 1-1/2' of the bottom 2" will slide into the 2-1/2" conduit for extra support. Measure your cuts with care.



PVC Flagpole Construction



The total length of the Antenna is 22'. You must allow for the slide in length.



PVC Flagpole Construction



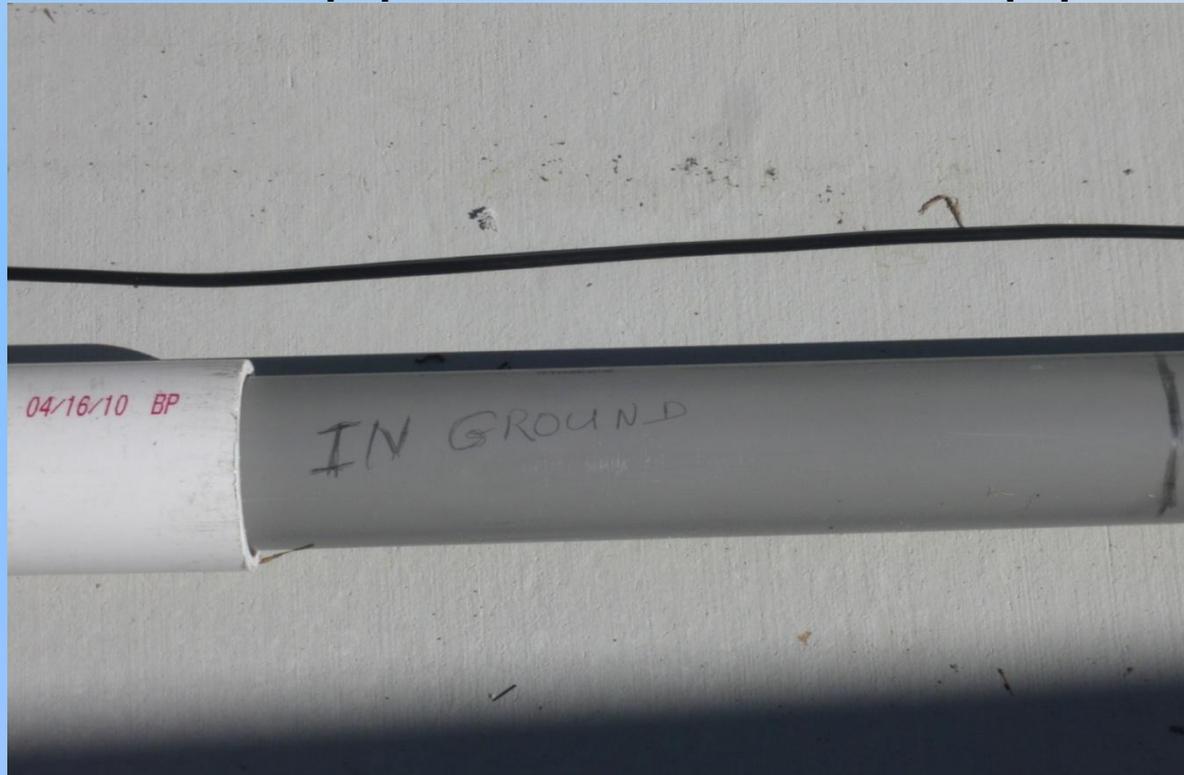
Approximately 30" of 2-1/2" conduit will slide into the 3" pipe. The 3" will be encased in concrete.



PVC Flagpole Construction



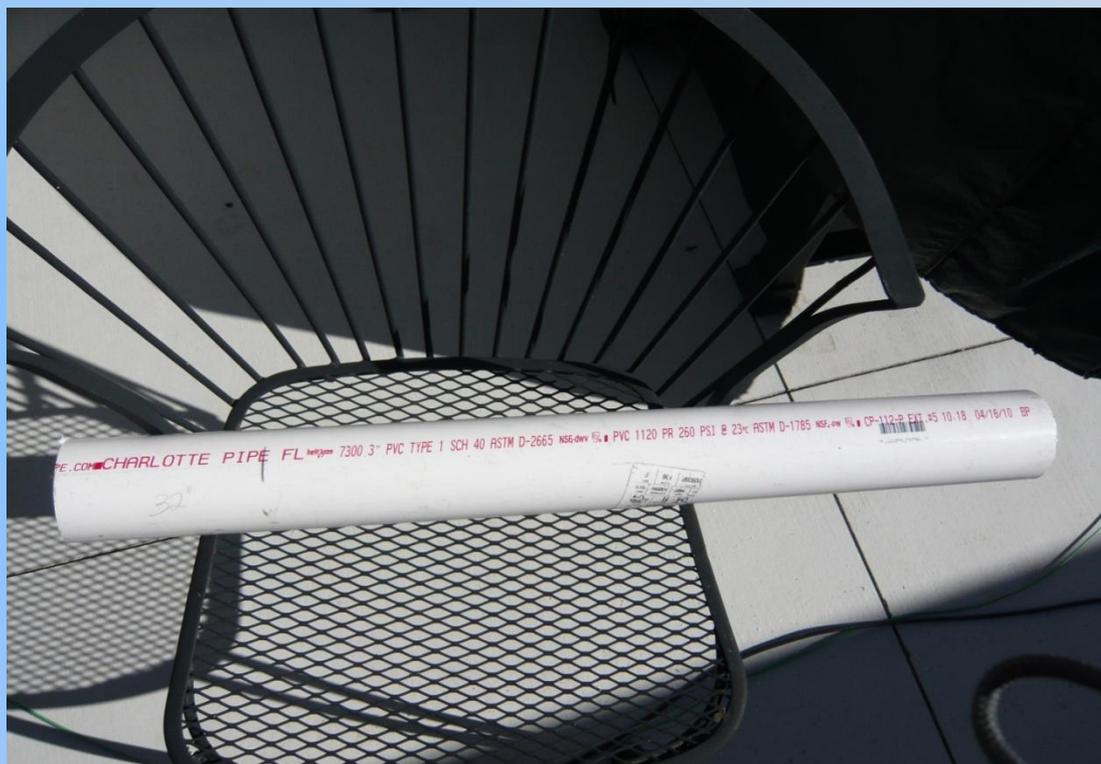
Again. Please measure and mark your cuts accurately.
30 Inches of 2-1/2" pipe slides into the 3" pipe.





PVC Flagpole Construction

32 Inch Length of 3 Inch Sch 40 pipe. Home Depot sells 3 Ft. shorts in the plumbing department.



PVC Flagpole Construction



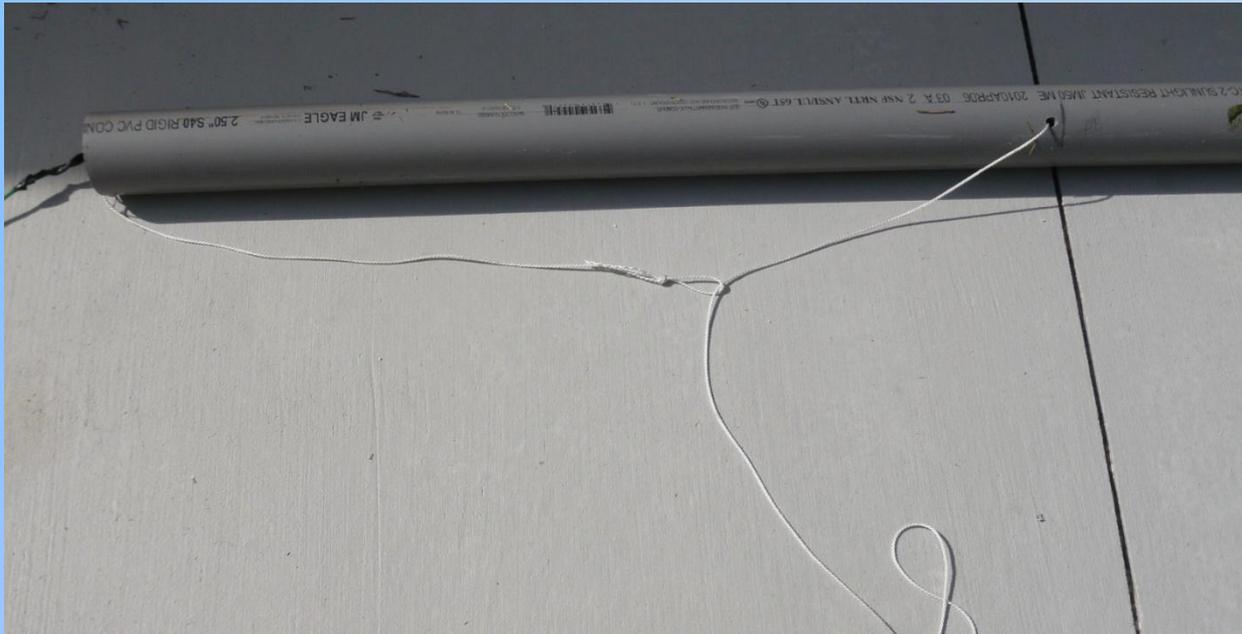
This is the finished flag pole cut to the proper length



PVC Flagpole Construction



Drill a 1/2" hole at approximately 22-1/2" from the bottom of the flag pole. Fish a piece of twine in the hole and out of the bottom of the 2-1/2" pipe. Tie the twine to keep it in place and to prevent it from disappearing when you pull in the antenna.



PVC Flagpole Construction



Push the solid #10 and the attached coax up the pipe.

You may need to run a fish line to do this.

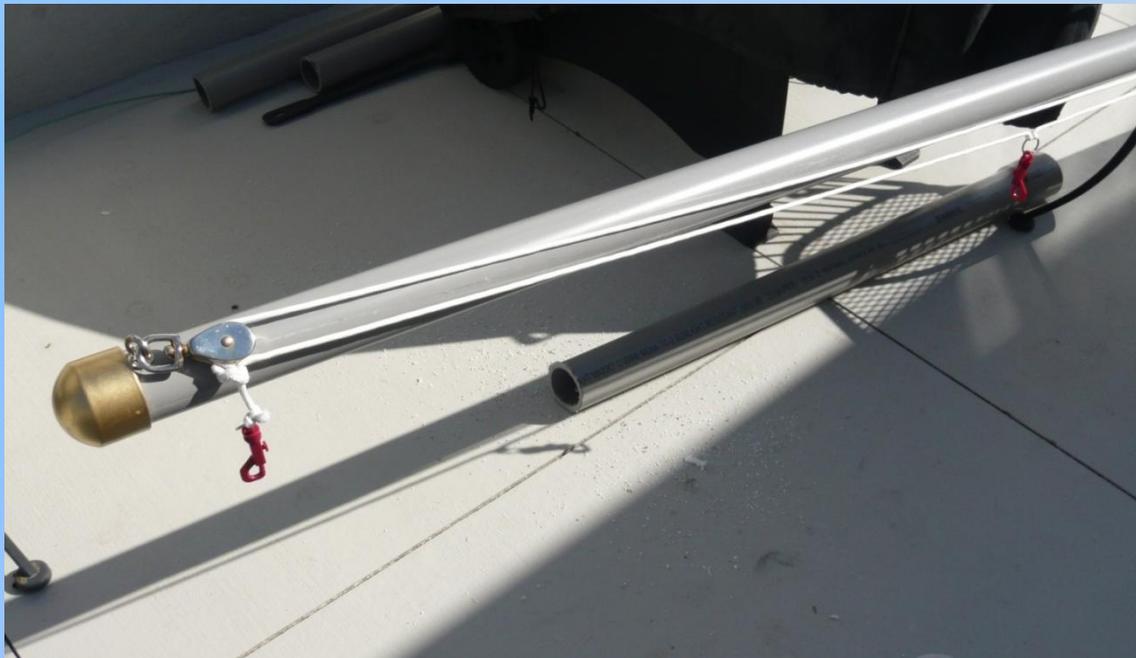
Tie the antenna lead (24" of 14 stranded wire) on to twine and when the antenna is at the top of the flag pole, pull the antenna lead out of the hole.



PVC Flagpole Construction



Attach cap and pulley. The rope goes through the pulley and down to where the cleat will be mounted. Leave about 4" extra in this loop.



PVC Flagpole Construction



Attach the cleat with (2) 3" 1/4- 20 ss bolts. Make sure that the bolts pass through the 2-1/2" and the 2" conduit. If you need to detach the pipe, this will be of great value.



PVC Flagpole Construction

Time for Erection!



It is a wise idea to enlist the help of friends to install the finished antenna.

PVC Flagpole Construction



View of the finished antenna from Lake Sumter.



PVC Flagpole Construction



Antenna on a very windy day.
(15 to 20 MPH winds)

The antenna will flex in heavy winds. It is best not to fly your flag under these conditions (as with all flag poles) you will not harm the antenna and it will stand straight in light winds.

Flagpole Construction



Light it up!

A solar powered light cost \$19.95 at Home Depot.
It gives just enough light and last about a year.



Flagpole Construction

