THE
W7LPN
AIR DIELECTRIC
COAX COLLINEAR

http://www.mgs4u.com/fiberglass-tube-rod.htm

www.hy-gain.com Pg 85 in the catalog for aluminum elements

I am not an engineer. I don't claim to be an Antenna Guru. This is a fun hobby to me and as you might guess, I've learned a lot from my early assumptions. The following projects have been very fun for me and I wish to share them for that reason alone. They have been good performers and were well within the abilities of most "Shade Tree Mechanics" or "Home Brew Enthusiasts". I am not trying to lessen the importance of the projects of any other ham. Enjoy & share & e-mail me with comments at callsign at yahoo(dot)com. The next one I build will have 1" PVC inside 1.5" PVC and I will check it's durability in wind & weather. YD2WPE Eko Promono used this configuration in Java Indonesia, atop a 40ft tower with good results.

New Model

The W7LPN Collinear 2m/440

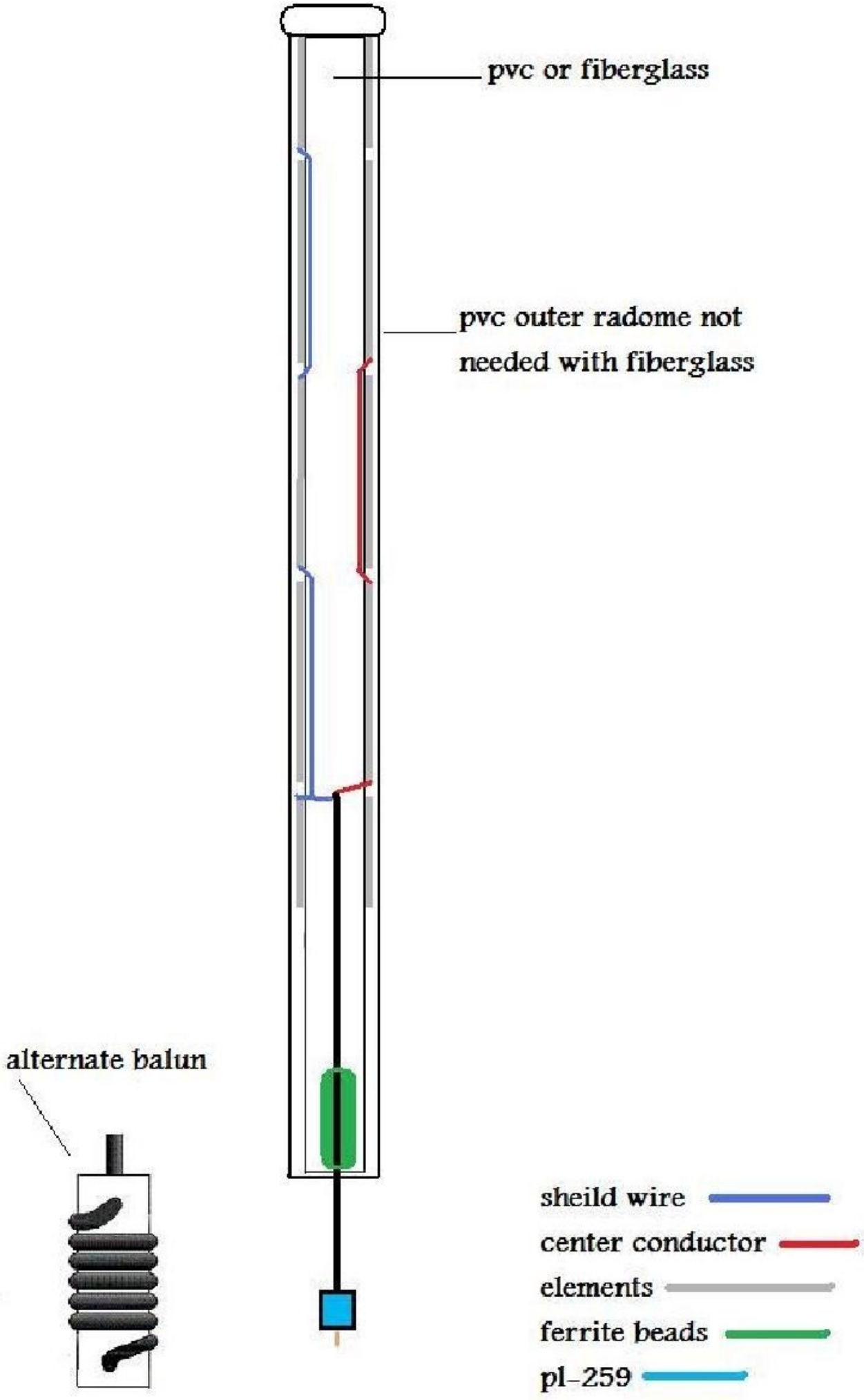
The drawings depict a antenna design constructible with a wide variety of materials, from PVC and copper tubing, galvanized conduit, aluminum tubing, even foil or mesh hardware cloth. It is a very forgiving design as to construction materials and slight dimensional variations. For this design I have used PVC and aluminum. The drawing depicts 5 separate sections of PVC. This is not necessary. Two 10 ft X 1" lengths will work for the inner section. The diameter of the outer radome will have to be decided after the inner is finished depending upon materials and construction techniques. It is a simple vertical sleeved dipole with #1 and #5 elements each being ¼ wl and the three additional ½ wl adding gain and becoming the collinear. However you figure gain, dB or dBi, it is 4x a full size dipole. The thin wire runs through the center and of course the tubing is outside. This configuration allows the natural phase shift to occur at **½** wavelengths by alternating element sizes instead of wasting RF energy in the form of heat by using capacitors at each element or loading coils. Since the thin wires do not

radiate, they may run inside and skip the element fed by the other side of the vertical dipole. Hence, the center conductor of the coax starts @ element #2, the shield @ element #1. Each side skips one element and is attached to the next, alternating contact with each energy source. It may be advisable to cut element #5 a bit long as it serves as a tunning stub if necessary. I have not had tuning trouble, but during his first build of this model, Eko Pramono YD2WPE Java Indonesia extended his #5 element to obtain suitable swr. Before the extension, he was centered at 150MHz. After trimming he states, "Right in the middle of the band". http://home.comcast.net/~ross_anderson/sc.htm

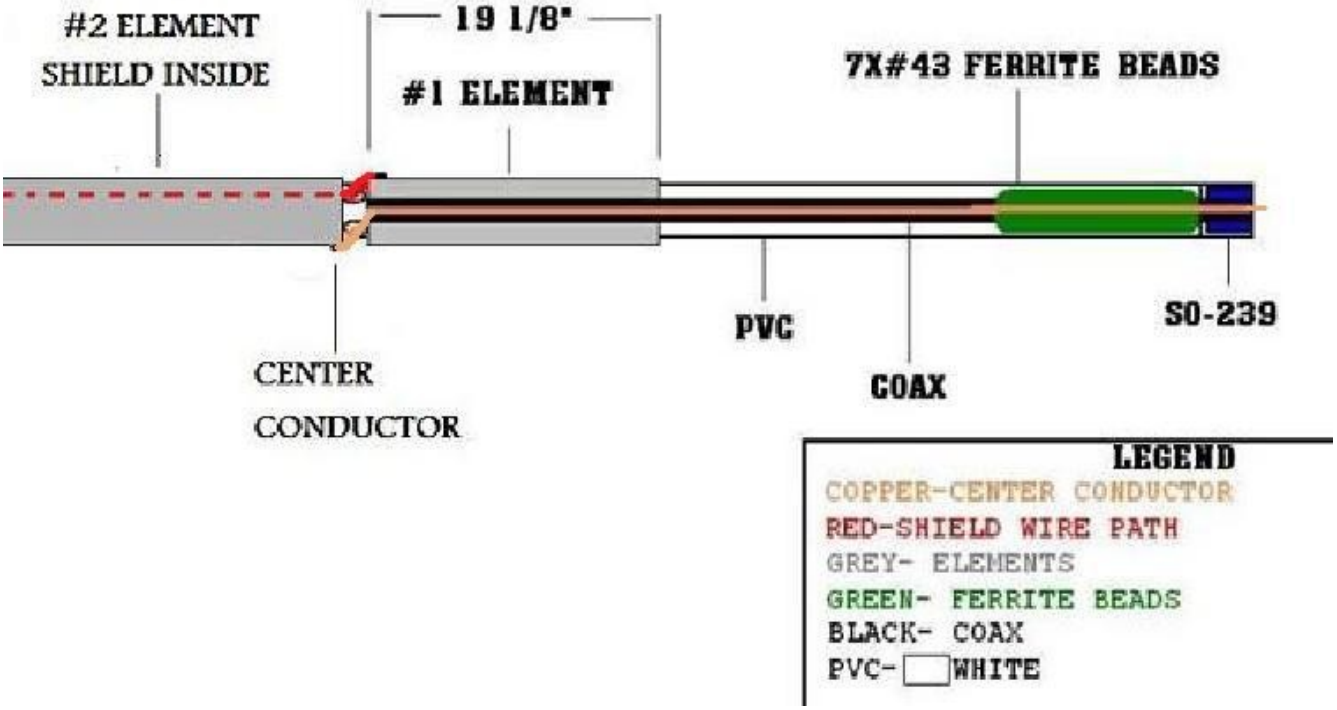
Joel Hallas W1ZR wrote
"...I believe that what you have is an adaptation of the collinear that was in early ARRL Antenna Books (for example 13th edition, p 248). That antenna used sections of alternating RG-8 coax as the elements. If this is the architecture you followed, I believe your approach may be an improvement since the relative velocity of your mostly air dielectric "coax" will be close to 1.0 and thus the element lengths work out better from an antenna perspective.... The way coaxial cable works is that if the current on the outside of the inner conductor are equal and opposite to the current on the inside of the outer conductor, they cancel outside the outer conductor. Note that due to skin effect the current on the outside of the outer conductor (the antenna current) is a different matter and has nothing to cancel it. This, the cancellation effect, has nothing to do with diameters, except that the outer must be larger than the inner, so the inner can fit inside....By not being centered, the characteristic impedance will vary somewhat, but that is not a big deal, IMO. The thinner wire will be okay, however, the loss will be somewhat higher due to the additional resistance. Also not a big deal."
The large diameter models may be broader banded but will be more gangly and in need of support. I used fiberglass outer radomes and this proved to be very strong. A single support at the base was sufficient. Eko Pramono used two layers of PVC bonded with the elements in between. This added rigidity and proved successful on his 45' tower in Yogyakarta, Java, and said “Its performance compares closely to the Hustler G-7”. After placement of the elements and thin wire, the most critical part of the design is the balun. I used 7 X #43 ferrite beads, sealed and fixed securely in place @ 38 1/2” from the tip of the lower element as seen in the first drawing. If the balun slips, it will detune the antenna. http://www.hamuniverse.com/balun.html An "Ugly Balun" may be a better choice for you. Lastly, if you are on a tight budget and want to experiment, get some scrape tubing, or thin sheet metals/foils, some PVC and go for it. I have used galvanized tin, wire mesh, copper, aluminum & foils, without notable change. A hairpin match was suggested, instead of a ferrite balun, by a colleague, but without the ferrite beads, sleeved verticals tend to send stray RF down the shielding, so the ferrite balun serves a combined purpose. I have not noted problems with bead saturation & detuning. Try it on other bands. Make one for your volunteer fire department, etc.. I hope you have fun with this antenna, and come up with a combination that works for you, in the most economical way.

Caution-- Read this first before beginning assembly
RIGID TUBING AND COPPER WIRE

Things I've learned along the way... Start with 2 X 10ft X 1" sections of pvc. There is no pvc coupler joint, which fits inside the PVC allowing for a smooth exterior without changing the diameter. I cut a 4" section of 1" pvc and split it with a hacksaw to make it able to be squeezed to a smaller diameter and used as an internal joint coupler. It will hold enough to assemble the antenna. You must thread the thin wire the full length of the tubing while joining these sections. It is very difficult to do afterward. Leave a couple feet hanging out each end and secure to the end of the pvc so you don't pull it all the way in. I also use a length of coax with enough extra for a coax balun if I choose to use one, and no PL-259 yet, so it can be place near the end of the pipe when finished. Split the coax and braid, and gently tin the braid all the way around the coax and to the tip. This will give you something secure to grab at the feed point holes. The Feed-point- Drill holes in opposite sides of the pvc big enough to reach in with a hemostat(medical clamp) or small long tip needle nose pliers. Pull the center wire out one side to attach to #2 element, and pull the shield out to attach to #1 on the other side. Then alternate with thin wire elements and large tubing. When you have assembled the desired # of elements trim the excess pvc from the tip leaving a couple inches to secure with a screw to the outer radome. Yes, you can add to, or subtract elements to make it higher or lower gain....much longer will require guy wires.

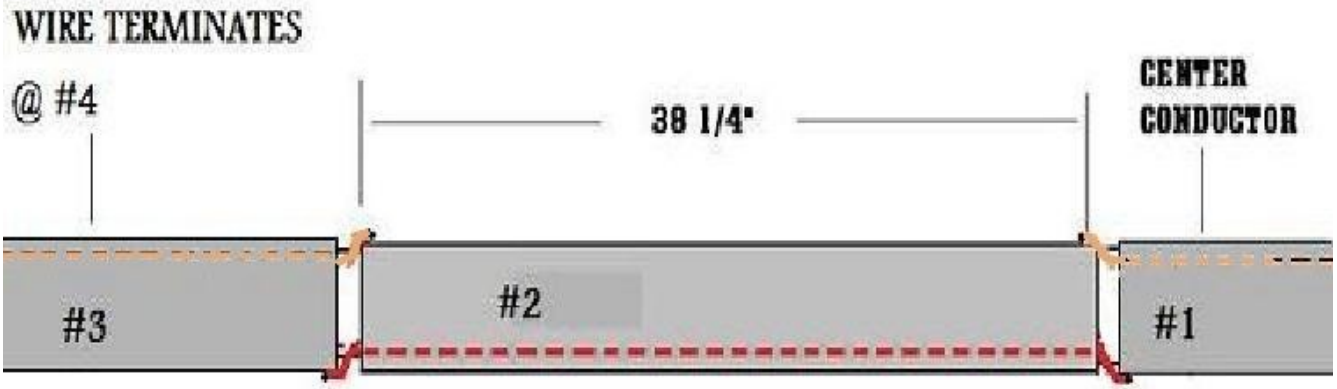

pvc or fiberglass
pvc outer radome not
needed with fiberglass
alternate balun
sheild wire
center conductor
elements
ferrite beads
pl-259

ELEMENT #1


#2 ELEMENT
SHIELD INSIDE
19 1/8"
#1 ELEMENT
7X#43 FERRITE BEADS
PVC
SO-239
CENTER
CONDUCTOR
COAX
LEGEND
COPPER-CENTER CONDUCTOR
RED-SHIELD WIRE PATH
GREY- ELEMENTS
GREEN- FERRITE BEADS
BLACK- COAX
PVC- WHITE

ELEMENTS # 2-4

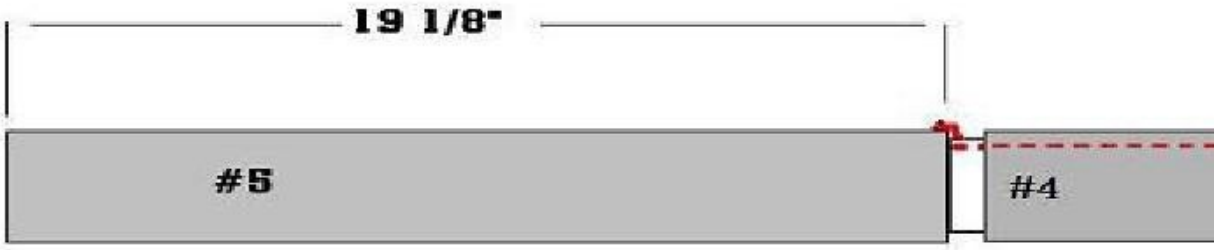
ATTACH CENTER
CONDUCTOR HERE
FROM ELEMENT #1



CONTINUE ALTERNATING SEQUENCE
UNTIL ELEMENT #5

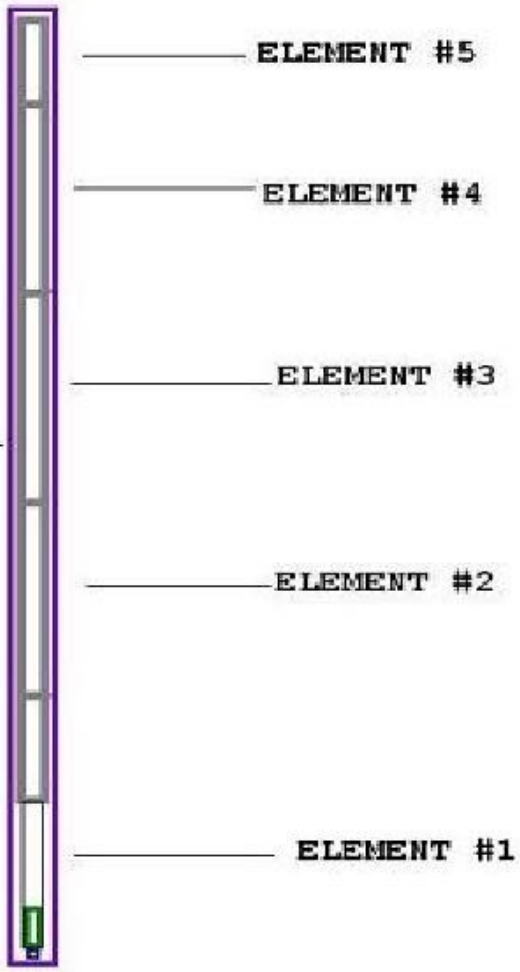
TUBING ELEMENTS 2-3-4, 38 1/4" & 1-5, 19 1/8"
ALL THIN WIRES THRU ELEMENTS ARE 40 7/8"
SPACE ELEMENTS TO KEEP THIN WIRES TOUGHT
ABOUT 1.3" AT EACH END OF EACH 1/4 WAVELENGTH

ELEMENT # 5



COMPLETED ANTENNA NEEDS TO BE SUPPORTED BY GUYS, OR SLIDING IT INSIDE A RIGID FIBERGLASS RADOME AVAILABLE HERE:
http://www.mgs4u.com/fiberglass-tube-rod.htm

CONSTRUCTION SEGUENCE




02/27/2005

Aluminum Foil-- One of the better performers and definitely the least expensive versions so far. Total expense, minus supplies already in hand was <$25.00. I used heavy duty butcher grade aluminum foil and bare aluminum electric fence wire. I used #40 pvc 1" x 10' x2 pieces with 1.5" x10' x2 pieces. The 1.5" completed tubing is capped and laid aside. The 1" pieces are joined as described below. the feed point and spaces between the elements are taped off with masking tape. Starting at either end, tape off the spaces between elements, lightly spray adhesive where you intend to afix the aluminum foil. Measure and cut aluminum foil in existing width and the lengths of the elements in the drawing. Pull the wrinkles out of the foil and align it vertically so it can be wrapped around the pvc. when 3/4 wrapped around, lightly spray adhesive on the dangling foil. Then finish wrapping around. Cont to each subsequent element. When finished, drill access holes in opposite sides of the PVC to run each leg of wire vertically. I drilled a 3/8" hole near the #1 element, fed the split and finished coax ends from the base of the 1" pvc up to the feed point, pull out the shielding, and secure it to the outside temporarily. Drill a second hole on the opposite side near element #2 and pull out the center conductor and secure it. Remember you are going to run in & out skipping contact with every other element and laying the exposed wire atop the foil. Drill the hole near the element you intend to feed (have contact with the foil). Pre-measure and cut the electric fence wire two full antenna lengths. insert the first at the shield feed point hole, push it in to skip #2 element and exit near #3 on the shield side of the pvc (hemostats work great for pulling the wire out). Just past #3 element drill another hole and insert the tip there, push it through #4 to exit near #5 to terminate in contact with it. Anchor the shielding and aluminum wire with a self tapping screw, gently, to the foil. Work the slack toward the tip and start the screw. If you pull the wire around the screw you can keep it taught while securing the screw. It's a good idea to use battery grease, ox-guard etc. on all contacts to prevent oxidation especially where copper meets aluminum at the feed point. Repeat this method on the opposite side, feeding the center conductor to the elements by-passed on the previous side. Wrap the finished elements with plastic box tape, the cheap stuff. I had my wife turn the tubing while I kept the roll tight and spun my way to the tip. Insert the finished elements into the finished outer radome and secure with a screw near the tip and one at the base penetrating the inner pvc enough to secure it's placement. I used snap on ferrite beads because i had some on hand, 7 each at the base, 38 1/2" from the lower tip of element #1. It stormed last night with wind and rain and it survived just fine. I will not secure the inner pvc permanently in case of need for repair or adjustment, as this was a new method. Once proven it will be filled with injectable foam insulation between the elements and radome. I mounted the base extension to my mast with 3 hose clamps. If a short stub of PVC is lined up in the groove between the mast and antenna, it prevents the antenna from turning, twisting, and leaning to one side as seen in the photos. So? Do you want to have fun building an easy high gain antenna you built yourself, for a few bucks, or buy an antenna made in a sweat shop in China, pay $200 and the Manufacturer only got $30, and the kid got $1.00? Not Me!!