

NVIS HF Antennas

I became interested recently with the concept of NVIS (Near Vertical Incidence Skywave) Antennas. The NVIS antenna is ideal for local and emergency communications on HF.

Portability and their unique performance envelope make them worth looking at for any amateur serious about reliable HF communications. Probably the biggest users of NVIS antennas are the military and FEMA.

What is NVIS?

"NVIS, or Near Vertical Incidence Skywave, refers to a radio propagation mode which involves the use of antennas with a very high radiation angle, approaching or reaching 90 degrees (straight up), along with selection of an appropriate frequency below the critical frequency, to establish reliable communications over a radius of 0-300 miles or so, give or take 100 miles. Although not all radio amateurs have heard the term NVIS, many have used that mode when making nearby contacts on 160 meters or 80 meters at night, or 80 meters or 40 meters during the day. They may have thought of these nearby contacts as necessarily involving the use of groundwave propagation, but many such contacts involve no groundwave signal at all, or, if the groundwave signal is involved, it may hinder, instead of help. Deliberate exploitation of NVIS is best achieved using antenna installations which achieve some balance between minimizing groundwave (low takeoff angle) radiation, and maximizing near vertical incidence skywave (very high takeoff angle) radiation."

The paragraph above is an excerpt from an excellent source of technical information on NVIS principles which can be found [here](#) thanks to James Glover, WB5UDE. Another special thank you is due Dr. Carl Jelinek, N6VNG whose NVIS antenna construction article written in 1998 is the basis for this project.

The most famous of the NVIS military antennas... recently in use during the War in Iraq by US Forces... is the [AS-2259 NVIS](#) antenna, manufactured originally by Collins Radio (Model 637-K1) and Telex (Model 1990) - Telex recently sold it's antenna line to Associated Industries in North Hollywood, CA and the fate of the Model 1990 is unknown at this time. Harris Communications manufactures the antenna as the ([Model RF-1936](#)). The most interesting thing about the AS-2259 is that the hollow 1.25" tube that makes up it's mast also serves as a low loss feed line. Here is the [Army Technical Manual for the AS-2259/GR Antenna](#).

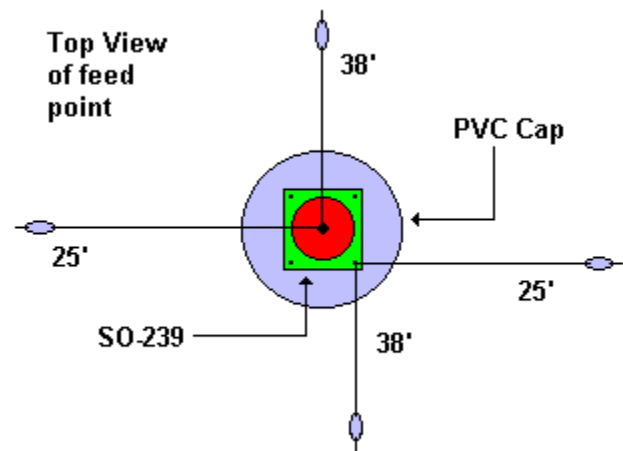
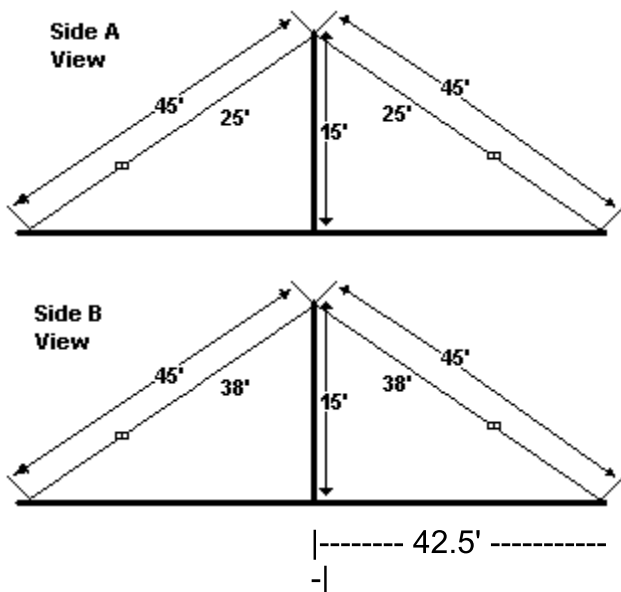
In the pages that follow I'll walk you through construction of a "homebrew" version of the famous AS-2259 !

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Build Your Own AS-2259 Type NVIS Antenna

Parts List

- 3 ea 1.5" PVC pipes 5' long
- 2 ea 1.5" PVC coupling
- 2 ea 1.5" PVC cap
- 4 ea egg type insulators
- 3 ea brass round head screws (1/2" 6-32)
- 2 ea brass round head screw (1" 6-32)
- 4 ea lock washers for 6-32 screws
- 6 ea brass hex nuts (6-32)
- 4 ea flat #6 brass washers
- 1 ea SO-239 chassis connector with solder pot center pin
- 1 ea SO-239 coax crimp on type
- 4 ea stakes
- 1 ea round metal stake 3/4" by 18"
- 4 ea heavy solder lugs to fit brass screws (you "could" use crimp on type)
- 4 ea plexaglass pieces, 1" X 3", hole drilled through each end
- ~150' copper antenna wire (braided/woven type like Davis Flexweave works best)
- ~60' nylon rope (Parachute type cord works great and is inexpensive)
- ~17' RG-58 (coax for center mast feedline)



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Construction Details

Drill a PVC Cap to accept SO-239 (7/8") and 4ea #6 screws, lock washers and nuts. Make sure to center the SO-239 in the hole before drilling the 4 screw holes. Lock washers go under the nuts. 3 screws are 1/2" and the other is 1".



Cut off the head of a 1" #6 brass screw and solder it in the center post of SO-239

Cut antenna wires to length plus a little

Fit one end of each wire with solder lugs

Fit the other with the egg insulators and parachute cord or other non conductive rope which serves as guy ropes on the ends of the 4 elements. Two guy ropes should be at least 7.5' long for the 38 foot antenna wires and 20.5' long for the 25 foot antenna wires. Locate the 4 Plexiglass pieces and drill 3/8" holes on each end. Slip the guy rope through one hole and tie it to the other. See picture on last page if you have trouble visualizing this... These pieces allow you to pull the plexiglass piece up the guy to shorten it and adjust the tension of each guy. The total length of each element... wire and guy... is about 45 feet.

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Drill hole in center of second end cap (3/4") and run round steel 18" X 3/4" rod through the center. I purchased the rod at Menard's Home Center and it would also be available at Home Depot, Lowes or similar home centers. This is the bottom section and the center stake helps when setting up the antenna.



Drill a 3/4" hole near the bottom of one end of one of the 5' pieces of pvc pipe. After drilling the hole run one end of 17' of RG-58 coax through the pipe and out the hole. Crimp a SO-239 on this end. Crimp a PL-259 on the other end. The long end is run through the pipes before erecting the antenna as a coax feed. Alternately you can just run a long piece of coax to the top but I thought this was quicker and easier. I leave the coax in the bottom section and feed to the connector in the top when I assemble the antenna. You may find it easier to leave the coax in a coil and feed from the top through the bottom.



Install pipe coupling to one end of the pipe as seen above. Install a coupling to the remaining pipe as well. The couplings need not be glued... in fact I didn't glue any of the caps or couplings and they seem plenty sturdy for the purposes of the support mast.

Put the top cap with SO-239 on top of what will be the top section of PVC pipe. Attach wire elements to the top cap as shown in the drawings, also illustrated below...



Drive the section with the bottom cap and spike into the ground. Assemble the other two sections together and then hoist onto the lower section. This is MUCH easier with two people but with practice you can assemble it yourself. Just be careful in case it falls over.... hehehe.

Extend the wires as in the diagrams and attach the guy ropes to the stakes. The stakes should be located 42.5 ft from the center mast of the antenna so the wire elements form crossed dipole-like antenna sections. Thread the Plexiglass pieces onto the guy ropes. Snug up the guy ropes to straighten the antenna mast using the Plexiglass pieces you made earlier... they make it easy to adjust the guys. Check out the photos which follow and you'll get a better idea of how to make the Plexiglass tensioners. I bought power cord holders at a home center to wrap the wire and guys on and labeled each (38 or 25)... they were 2 for a dollar so it was really a deal. Using these for guy and antenna wire storage really helps things stay neat when I break down the antenna and store it in it's bag.

The antenna works NVIS mode from about 3.5 to 11 MHz. It's generally necessary to use a tuner with this type of antenna... then it's useful from 2 - 30 MHz.... the high bands are not NVIS however. If you build this antenna let me know how it works for you. I use a LDG Z-11 auto tuner with my Argonaut V and it works great !





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