40 Meter NVIS Antenna

Steve Brumagin, KI4VGA

What is a NVIS antenna?

- NVIS is an acronym for Near Vertical Incidence Skywave.
- It is an antenna has quite a history with military use. This is due to the NVIS antenna's attributes of being portable, easy to set up and take down, effective in mountainous areas, and will make reliable contacts from 30 to 400 miles away with 100 Watts or less.
- Although there are several designs, many NVIS antennas are simply dipole antennas deployed horizontally or as a slopers at an elevation less than ¼ wavelength above the ground. In addition, the NVIS may or may not include wires on the ground surface working as reflecting elements.

So how does NVIS work?

- Due to design the NVIS antenna transmits radio waves vertically (75-90 degrees from earth's surface)to the ionosphere where they are reflected back to earth in a circular pattern centered around the antenna. This propagation is for those frequencies that are most likely to be reflected by the ionosphere. Specifically, frequencies from 1.8 to 8 MHz. Frequencies above 8MHz become less likely to be reflected and frequencies above 30MHz, have little or no reflectivity.
- Due to this reflectivity, NVIS antennas typically use 40M for daytime contacts and 80 M for nighttime contacts.
- This circular radiation pattern resembles an upside down half grapefruit and is sometimes referred to as a cloud warmer. Since this pattern is circular, signal strength is fairly equal transmission in all directions and directing your signal is not required and topography (hills and valleys) have little effect on transmissions.

So why would you want an NVIS antenna?

- A NVIS antenna is very portable.
- A NVIS antenna can be easily set up by one person and does not require trees or extensive supports (masts). So a NVIS antenna can be set up almost any where on the ground that is level.
- The NVIS allows you to make reliable contacts from 30 to 400 miles away.
- The NVIS antenna, due to its proximity to the ground, reception is fairly quiet and free of noise (QRN & QRM).
- Because of all theses characteristics, the NVIS makes a great emergency HF antenna or simply an antenna you take with you for a field operation or when camping.
- Please be aware, the NVIS is not a DX antenna!!! This antenna system was developed for reliable communication (within 400 miles) with 100 Watts or less power.

So you want to build a 40M NVIS Antenna….

Start with cutting the radiating and reflecting elements. I used a 100 ft roll of 18 gauge twin speaker wire.

- Radiating element will be a dipole that is ½ wavelength for the frequency. In this case I cut a 33.5 ft. length of dual wire-stranded stereo speaker wire and separated the wires & joined them to a SO-239 connector. No need to remove the insulation. This wire can then be trimmed to resonant 40 M frequency (antenna analyzer recommended).
- Reflectors were made from the remaining spool of speaker wire. The two wires will need to be separated and can be trimmed to approx. 73 to 75 feet in length, but must be longer than radiator.

Radiator Element Details

- This shows the radiator at the top of photo with SO-239 connector in the ¾” PVC Tee. It is in a Tee so it can be attached to a 5 foot section of ¾” PVC (center support)
- At the bottom of the phot is the two wire reflector. The two wires are separated by a six inch long section of ¾” PVC with the wires separated by four inches.

Radiator Continued

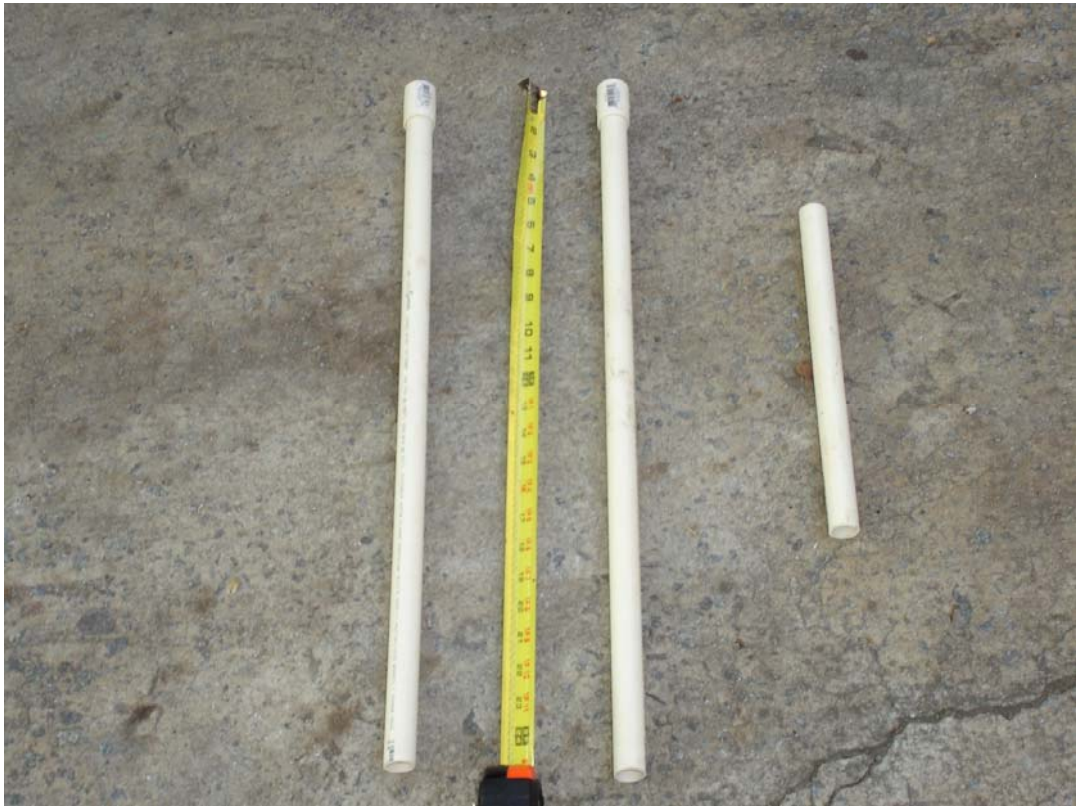
- This is one end of the radiator wires. I have drilled a hole through a 3/4” PVC connector, put the wire through the hole, and knotted the end. This connector will go on top of one of the five foot PVC supports that is end of the radiator.
- I also drilled two holes opposite the director wire and inserted a zip tie for the guy line.
- Once set up this will look just like a 1/2 wave 40 M dipole that is five feet above the ground (less than 1/10 wavelength above ground).

Reflector Details

- The reflector is placed parallel to the radiator directly under the radiator wire on the ground. The reflectors must be centered under the dipole. The reflector is designed to be longer than the radiator wire and be in direct in contact with the ground. These reflector wires are not connected to each other nor the radio. The simply work as reflecting elements directing signals upward.
- Some designs include attaching the reflectors to driven ground rods, however this design does not include grounding of the reflectors. But feel free to experiment….

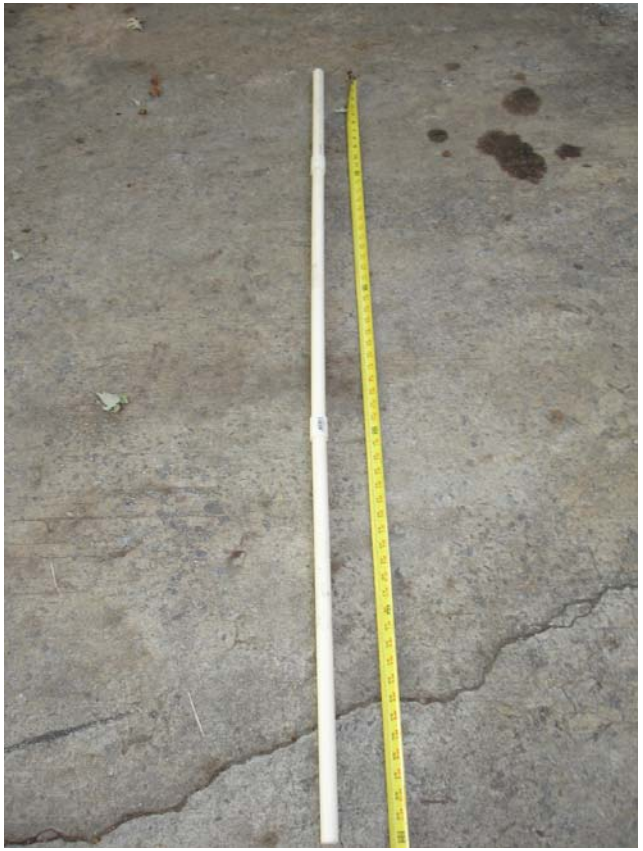
NVIS Supports

- Due to materials I had on hand, I designed my NVIS antenna supports to be five feet above ground. If you make supports taller than 5 or 6 feet, you may want to use PVC that is larger than ¾".
- I cut my supports to be no longer than 2 feet in length so that they would fit into the carrying bag that I had. Just remember that if your supports are multiple sections, that you will need a PVC connector for each joint.
- Due to portability, I did not glue any of the connections. If you are concerned about losing connectors, you can always just glue one side with PVC cement.



NVIS Supports Continued

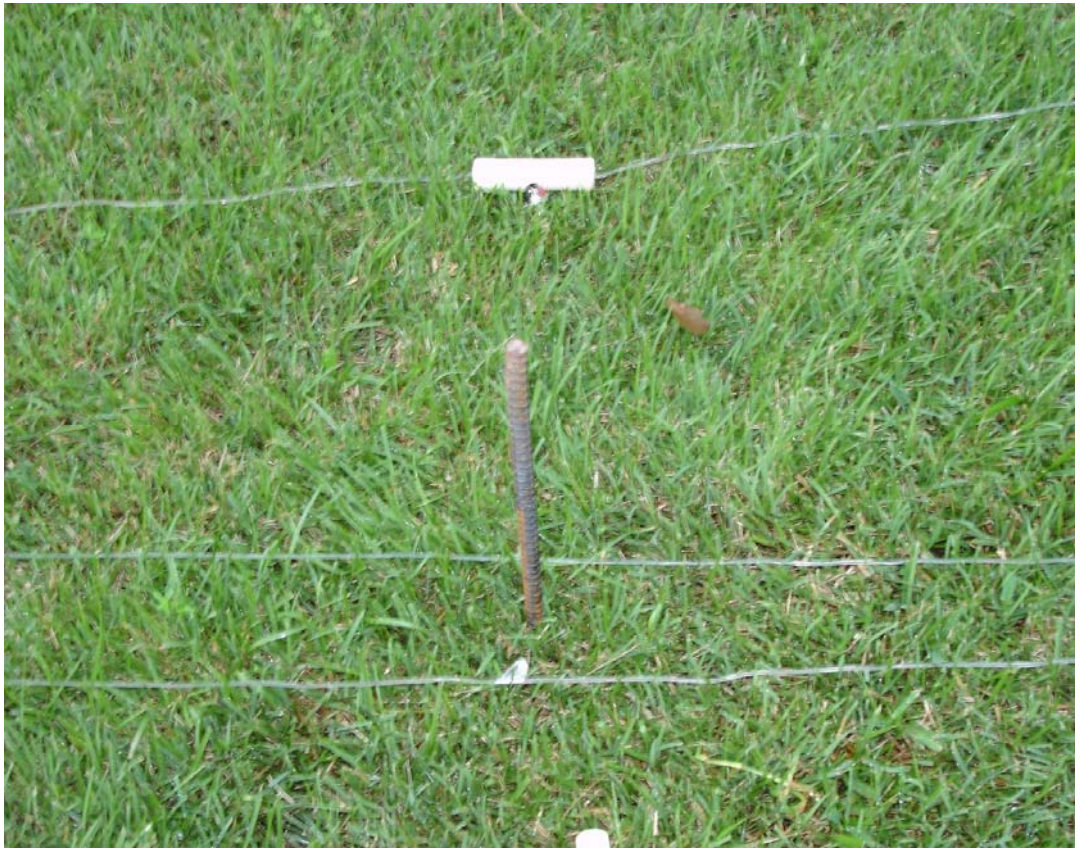
- Here is a photo of all sections of one support connected together. My design has two 2-foot sections an a single 1-foot section at the top.
- This design uses a single center support and two end supports. For each PVC support, I utilize single 2-foot long section of rebar that I drive into the ground (about 1-foot) and then I place the support over the rebar. The center support is stabilized by the tension on the radiator wire. And the end supports utilize guying for stabilization.



Setting Up the NVIS

Find an area (at least 80 feet) preferable in a mown area

- Deploy the reflectors and find the mid point (marked with tape). I place the rebar for the center support at this location between reflector wires.
- Then I next to the radiator wire parallel to the reflectors.
- I then put together the center support, attach it to the Tee and place the support on the rebar.



Deploy the NVIS

- Here is the center support/radiator wire in place with the radiator wires sloping toward either end.
- At this point, I repeat the process of assembling the supports for each end, driving rebar, and guying the supports. The end supports should be slightly angled away from the center support (to help with assembly prior to guying).
- Once guyed, there should be enough tension on the radiator wire so that the radiator does not droop excessively, but not so much tension to stress the connections at the center.

Assembled NVIS

- Here my NVIS is up and almost ready for operation.
- In this photo you can see the guyed end support in the foreground, the reflector on the ground (centered under the radiator), and the center and far end supports.

How to feed your NVIS

- It is important to bring feed line straight down the support and away from the antenna at a 90 degree angle. This is critical in the area adjacent to the NVIS to minimize feedline/transmission issues.
- I utilize a 50 foot-long coax with a 1:1 choke balun. This includes 18-24 feet (10 wraps) of coax around a 4” diameter piece of PVC pipe.
- When using NVIS, I utilize an antenna tuner since I did not have an antenna analyzer when I constructed this antenna and planned to operate through out the entire 40 M band (SSB and digital).

Questions?