

NVIS Antennas:

a primer for ARES ARO training

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Introduction

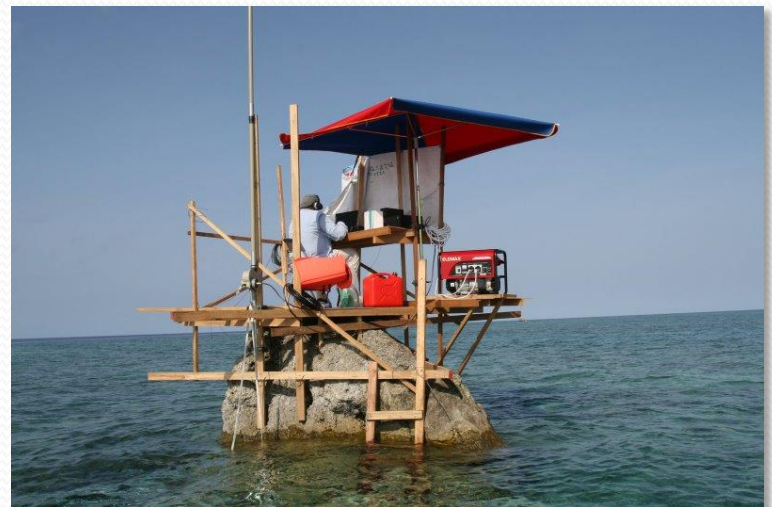
- What is NVIS ?
 - Near Vertical Incidence Skywave
 - Great, what the heck is that, and more importantly, why do I care?
 - Important for HF Emcomm work, Getting information from all corners of your state to your state OEM office!
- In order to understand what this is, we need more background in the propagation of radio frequencies below 30 MHz, (also known as “HF” frequencies)



What is propagation?

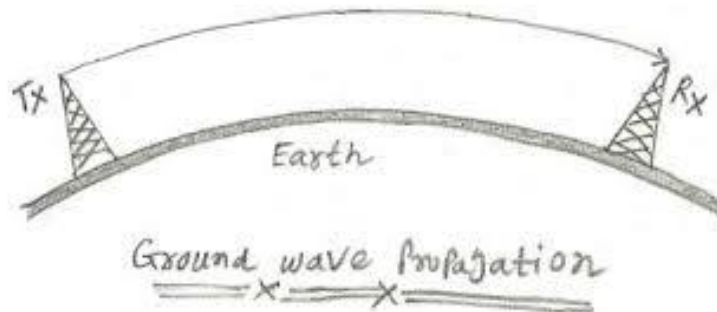


- One definition: “the spreading of something...”
- What we are referring to are the spreading of radio waves
- One thing we all know as hams is that radio waves can bounce off the ionosphere, and give us world wide communications, and lots of DX!



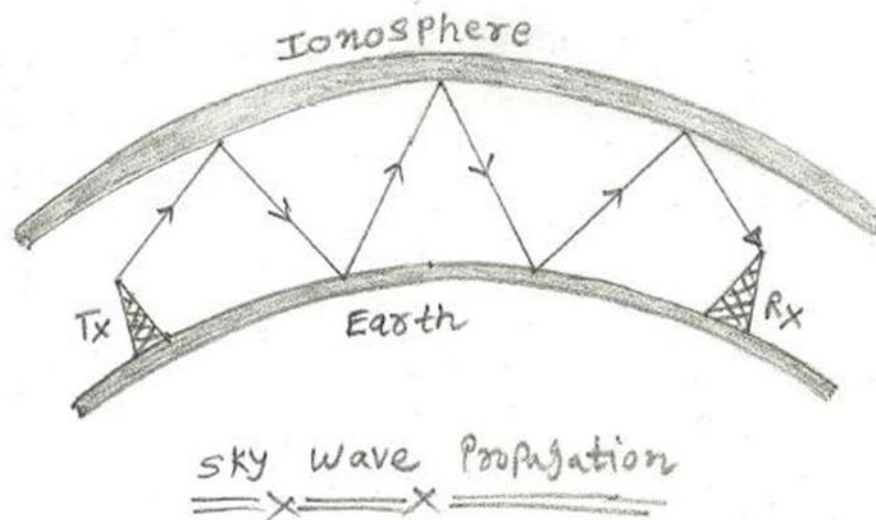
Propagation

- There are two main types of radio propagation of interest to us:
 - Skywave
 - Groundwave
- **Groundwave**= Radio waves travel from point-to-point, cling to the ground and do not bounce off ionosphere
 - Good for only about 20 miles, stations must be close together
 - Think of an AM radio station during the day



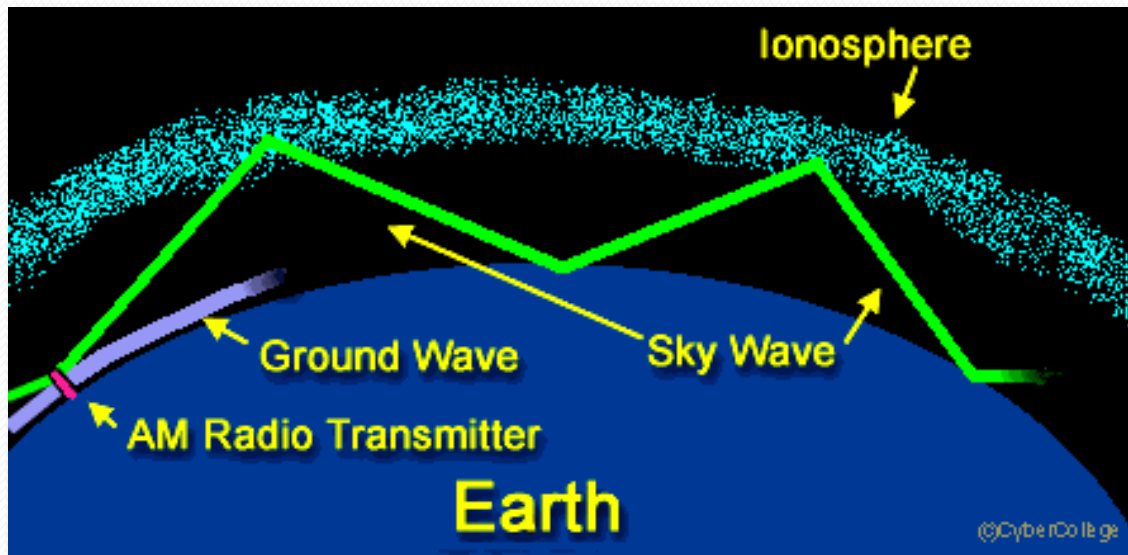
Propagation

- Skywave= Signals bounce off ionosphere, back to earth, and up again.....
- Usually great for long distances, not so good for short ones. How “DX” is made!
- Distance varies with what is called the “take-off angle”



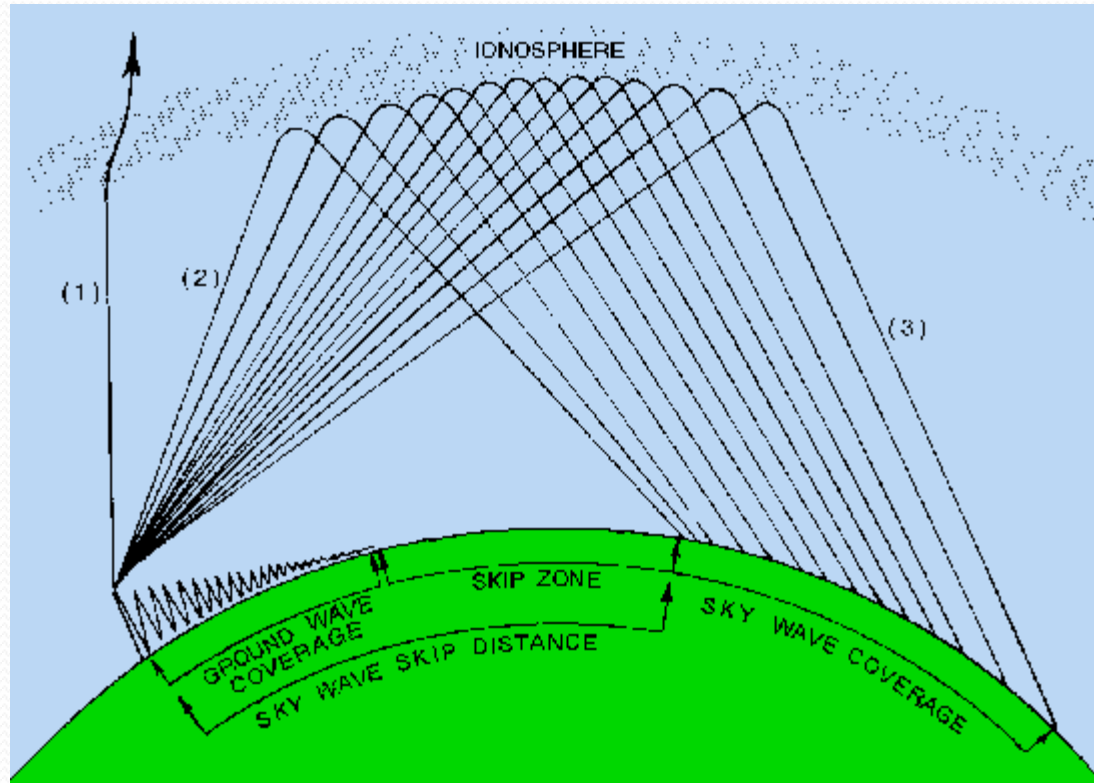
Propagation

- What happens in between the Groundwave zone, and Skywave zones?
 - This called the “skip zone”, because it is “skipped”
 - Signals from source are not heard within this “zone”
- How do we overcome this obstacle?



Propagation

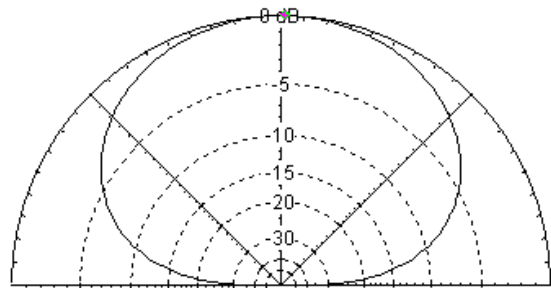
- What happens if we manage to raise the skywaves to steeper “take-off” angles?



Enter the Near Vertical Incidence Skywave (NVIS) antenna!

- NVIS antennas radiate most of the energy almost straight up, giving coverage from 20-400 miles

Total Field EZNEC+

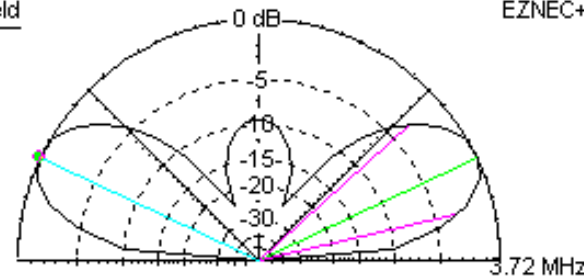


3.6 MHz

Elevation Plot	Cursor Elev	89.0 deg.
Azimuth Angle	Gain	4.81 dBi
Outer Ring		0.0 dBmax
		0.0 dBmax3D
3D Max Gain		4.81 dBi
Slice Max Gain		4.81 dBi @ Elev Angle = 90.0 deg.
Beamwidth		103.4 deg.; -3dB @ 38.3, 141.7 deg.
Sidelobe Gain		< -100 dBi
Front/Sidelobe		> 100 dB

NVIS antenna

Total Field EZNEC+



3.72 MHz

Elevation Plot	Cursor Elev	155.0 deg.
Azimuth Angle	Gain	8.55 dBi
Outer Ring		0.0 dBmax
		0.0 dBmax3D
3D Max Gain		8.55 dBi
Slice Max Gain		8.55 dBi @ Elev Angle = 25.0 deg.
Beamwidth		28.8 deg.; -3dB @ 13.1, 41.9 deg.
Sidelobe Gain		8.55 dBi @ Elev Angle = 155.0 deg.
Front/Sidelobe		0.0 dB

"DX" antenna

Some advantages of NVIS antennas

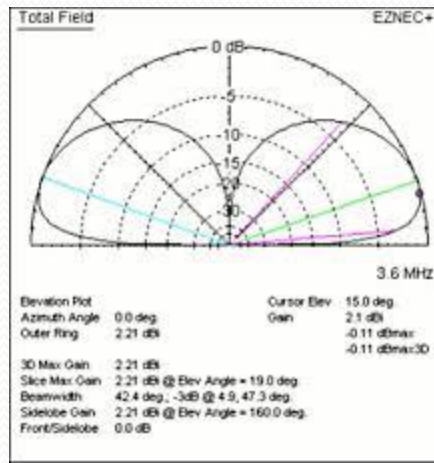
- NVIS covers the area which is normally in the skip zone, that is, which is normally too far away to receive groundwave signals, but not yet far enough away to receive skywaves reflected from the ionosphere . Great for EMCOMM, works throughout the state or region!
- NVIS requires no infrastructure such as repeaters or satellites. Two stations employing NVIS techniques can establish reliable communications without the support of any third party
- Pure NVIS propagation is relatively free from fading
- Antennas optimized for NVIS are usually low. Simple dipoles work very well. A good NVIS antenna can be erected easily, in a short amount of time, by a small team (or just one person)
- Low areas and valleys are no problem for NVIS propagation

Some disadvantages of NVIS antennas

- For best results, both ends should be optimized for NVIS operation. If one station's antenna emphasizes skywave propagation, while another's emphasizes NVIS propagation, the results may be poor
- NVIS doesn't work on all HF frequencies, it works best on the 40 meter band and below. Care must be exercised to pick an appropriate frequency
- Bands that are good for NVIS are also the noisiest
- Due to differences between daytime and nighttime propagation, a minimum of two different frequencies must be used to ensure reliable around-the-clock communications (Often 40 meters and 80 meters is used.)

Examples of NVIS antennas

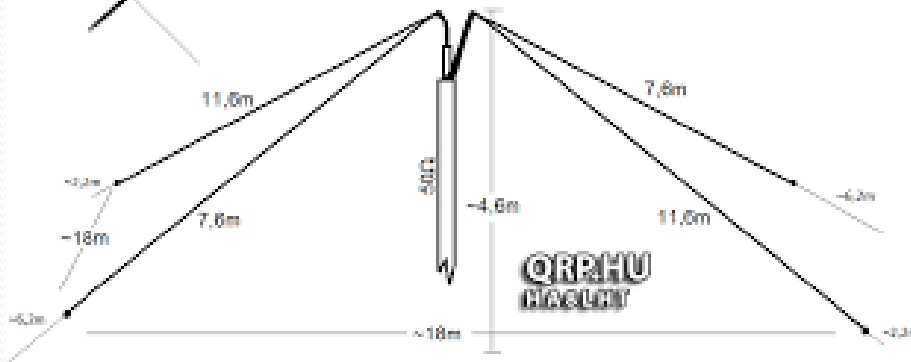
- Very low dipole or fairly steep inverted vee
- Low horizontal Loop
- Low tri-bander antenna (Less than or so 20 feet high)
- Not good: Vertical, which by nature has a low angle of radiation.



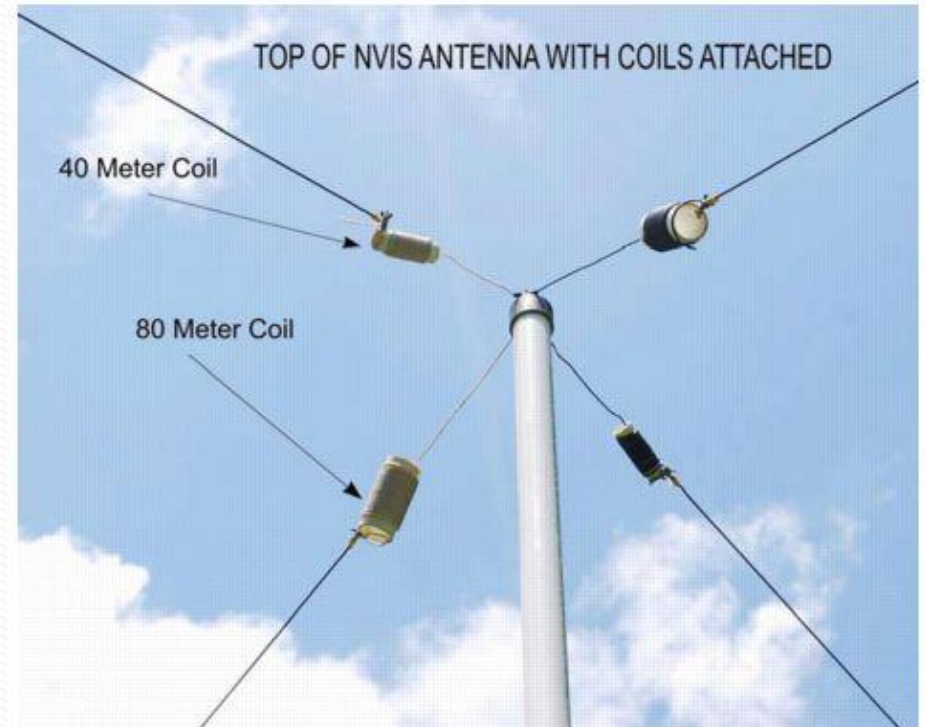


What you don't want! (Unfortunately!)

Military NVIS antenna (AS2259/GR)



What you do want: low inverted vee or low dipole

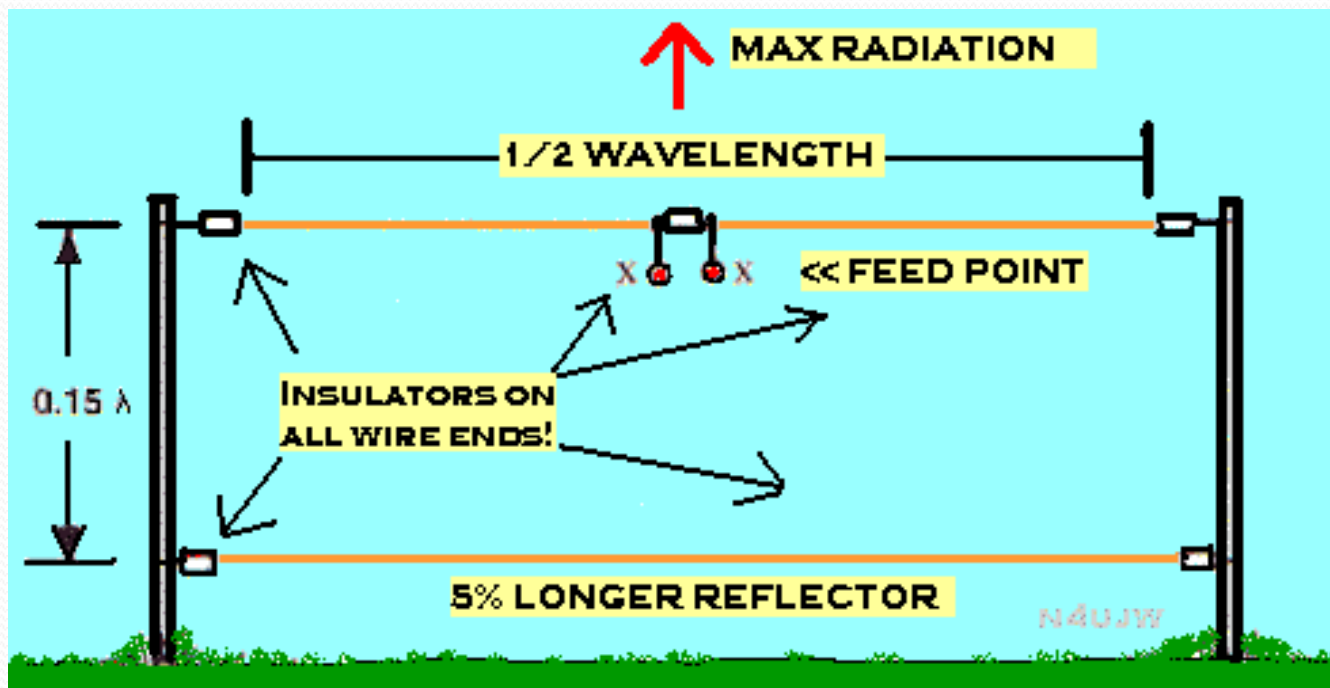




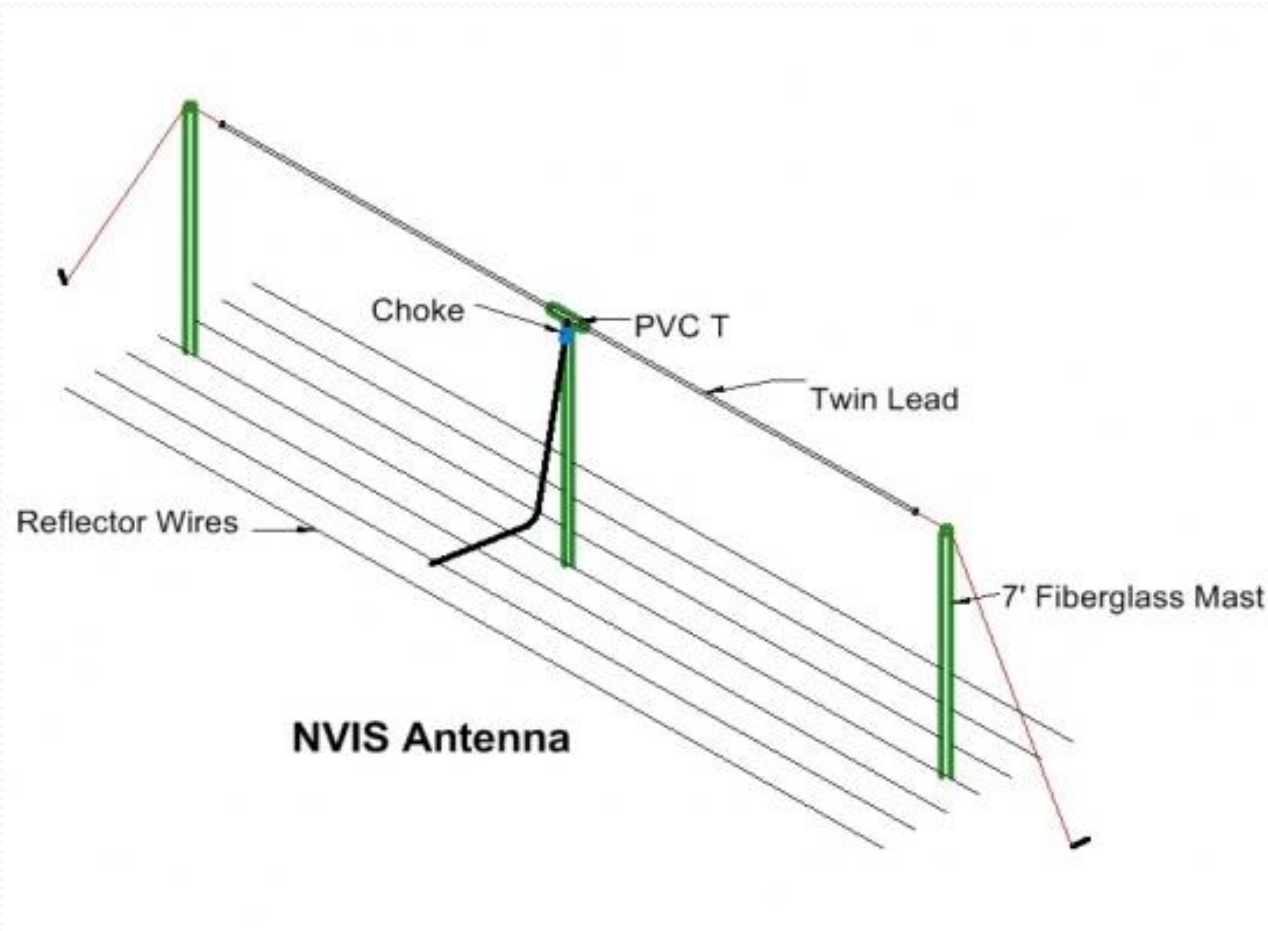
DX Engineering
(commercial)



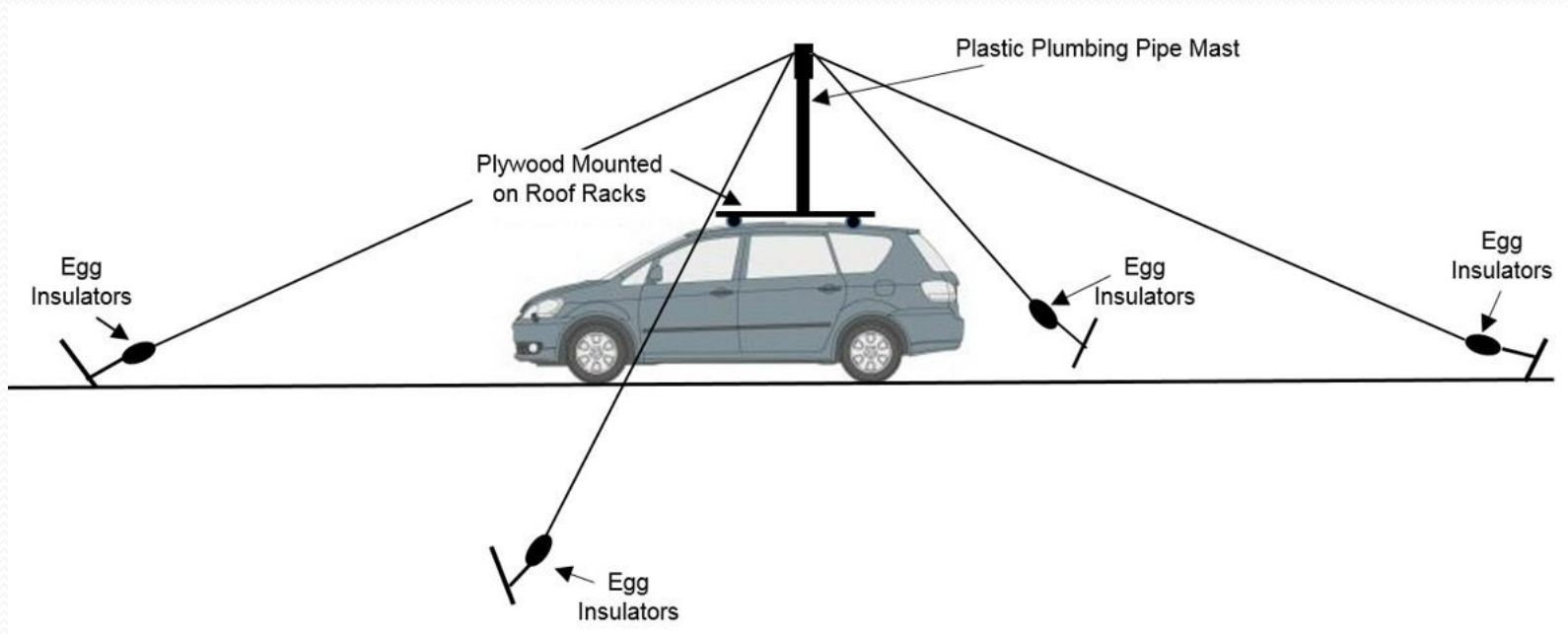
Buddi-Pole (Commercial)



Homemade with PVC Pipe and wire



Reflectors on ground version



NVIS Mobile!

tnx de w7vo

