

## 2024-09-10 Hamlet Net - NVIS

### Announcements:

- Test Session Info
  - Next VE session is September 28th in the Clover Building at the Boulder County Fairgrounds, and starts at 9 am. It is a PVET session, so there is no fee to test. For more info, and to pre-register, see the Licensing/Testing page on the club web site, <https://w0eno.org/>, under the Education menu.
- Next meeting will include voting on Club Bylaw amendments as well as Club officers. We do have a minimum quorum requirement, so if you are a club member, please plan on participating, either in person, via Zoom, or by submitting a proxy on the Club web site.
- We are still looking for volunteers for Santa on the Air - we can use elves who act as net control, as well as Santas. We've got a script for the elf, and a list of questions for Santa to keep the net going when Santa doesn't have anyone to talk to. No experience is necessary. You can even participate over Echolink as well.
- We have some volunteer opportunities available where you can help out LARC:
  - Photographer / videographer - record team activities and upload to web site / YouTube
  - Newsletter Editor - put together the monthly Splatter newsletter
  - Social media manager
- You can start earning your 2024 membership or future renewal by acting as NCS for at least 5 nets this year. You can run either this Tuesday night net or the Thursday night net (or both). We have scripts available for both, so all you need is a good connection into the repeater, and somewhere to keep track of names and call signs as people check in. If you're going to be on the net anyway, why not save some dough at the same time! There are four free memberships available for 2023, so don't wait to get started!
- Chuck has set a goal for the Club of running at least one activity a month. This can be a hands-on construction activity, an operating activity like Field Day, a fox hunt, or a special event station. The goal is to get people together to have fun with amateur radio! We have multiple locations at our disposal, as well as lots of Club equipment, so if you have an idea for something you think others hams would like to do, please let us know, and if you're willing to run it, even better!
- The Club is also looking for presentation topics for 2024. If you have any ideas, or better yet, would like to present, please let Chuck know and we'll get you on the schedule!

- All club activities are open to anyone - members and non-members. If you have questions, ask them on a net or **send email to [elmer@w0eno.org](mailto:elmer@w0eno.org)**

**Presenter: Bryan, AF0W**

**Topic: NVIS**

- If you are in a situation where you need to use the solar information from last week's net, it is possible that the local repeater infrastructure is impacted as well.
- Normally, hams using HF want to make long-distance contacts to other states or countries
- These contacts frequently rely on skywave propagation, which is where RF waves emanating from an antenna encounter the various layers of the ionosphere and are bent or refracted back down toward the Earth to the receiving station
  - a. Some contacts even make multiple such "hops"
- There are times when you are looking for a closer contact - for example, if you are working a site for ARES in Longmont and need to contact the EOC in Boulder, having a setup that will let you talk to Europe is not going to be too helpful.
- Or maybe you're in a mountainous area where line-of-sight propagation is ineffective due to being blocked by the terrain
- Luckily, it is possible to utilize something called near vertical incidence skywave, or NVIS.
- This occurs when radio waves are sent straight up and get refracted straight down in a circular area up to about 400 miles from the transmitter
- As with regular skywave propagation, the frequency makes a difference
  - a. If it is too high, the signal will continue up through the atmosphere and not be bent back down toward the earth
  - b. If it is too low, the signal will be absorbed in the D layer, or lowest layer of the atmosphere, and again not make it back down to earth
- The most reliable NVIS frequencies are between 1.8 and 8 MHz, which correspond to the 160, 80, 60 and 40 meter HF bands
- The exact usable frequencies of course depend on ionospheric conditions, such as time of day, season, sunspot activity, etc.

- Optimum NVIS frequencies tend to be higher towards the tropics and lower toward the arctic regions
- I found references to NVIS coverage extending out anywhere from 22 to 155 miles and also extending to 400 miles
  - a. By comparison, non-NVIS ionospheric skip distances can range up to around 2500 miles per hop
- NVIS requires a slightly different antenna than your typical skywave station
- A horizontally polarized antenna provides the best NVIS propagation
- Usually, you want an antenna with a radiation pattern that focuses the RF energy at a low takeoff angle, meaning it is directed toward the horizon as opposed to the sky
  - a. This results in maximum distance per hop (a hop being defined as the signal originating on the earth, refracting off the ionosphere, and returning to earth)
- But remember, that's not what we're looking for with NVIS
  - a. For NVIS, you want the radiation to be as straight up as possible - at least 75 to 80 degrees or more
- This behavior is typically bad - such a setup is referred to as a "cloud burner" or "worm warmer" - not too useful for long distance communications!
- A good example of an NVIS antenna is a half wave dipole oriented horizontally mounted close to the ground - somewhere in the neighborhood of  $1/20$  to  $1/4$  wavelength above the ground, with around  $1/4$  wavelength being optimal
  - a. Being this close to the ground causes most of the radiation to go straight up
- Another characteristic is that as a dipole is lowered toward the ground, the feedpoint impedance also drops
  - a. An ideal dipole in free space will have a feedpoint impedance of around 72 ohms
  - b. Lowering the dipole will get closer to the 50 ohm coax feedline impedance, potentially resulting in a usable SWR without the use of a tuner
- Performance can be increased by placing a slightly-longer wire along the ground directly under the antenna - likely providing 2 - 3 dBd of gain, especially over soil with poor conductivity, such as rocky or sandy and dry soil
  - a. Remember that 3 dBd of gain represents a doubling of effective radiated power.

- A horizontal full wave loop antenna is another effective NVIS antenna
- An inverted V is another useful NVIS configuration, as long as the angle between legs is kept at or above around 120 degrees
- Antennas such as these are useful for both transmitting and receiving NVIS, again due to this enhanced vertical radiation pattern
- One other benefit of such an antenna is in the area of atmospheric noise, such as thunderstorms
  - a. Because an NVIS antenna is "listening" primarily to waves propagated from very nearby areas, it will tend to ignore noise from distant thunderstorms or static crashes
- Some other advantages of NVIS are:
  - a. Covers an area which is usually between VHF/UHF repeater range and in the skip zone for HF skywave propagation
  - b. NVIS requires no infrastructure such as repeaters or satellites
  - c. NVIS is relatively free from fading
  - d. The path to and from the atmosphere is relatively short, resulting in lower path losses
  - e. Since the reflected signal is coming almost straight down, irregularities in the earth's surface will not create "shadow areas" that cannot be reached
  - f. NVIS works well with low power due to its resistance to atmospheric interference and low path loss
  - g. Since NVIS antennas are used low to the ground, they are not as obvious to neighbors and HOAs
- Of course, NVIS has some disadvantages:
  - a. If both stations do not have antennas configured for NVIS operation, results may be very poor
  - b. NVIS doesn't work on all HF frequencies, and the frequencies it does work on are those where atmospheric noise is normally a problem, antenna lengths are long, and bandwidths are relatively small for things like digital communications
  - c. 24-hour NVIS communication would generally require the use of two different bands due to the difference between daytime and nighttime propagation

- d. An antenna cut and tuned for mounting a half wavelength above the ground will not be cut correctly when used closer to the ground.
  - Chuck and I observed this while tuning a pair of hamsticks at a LARC event.
  - We had a rope tossed over a branch and used it to haul the antenna up and down.
  - We lowered it to about 5 feet over ground and adjusted the hamsticks until we got close to a 1:1 SWR, but when we hauled it back up, the SWR changed dramatically.
  - The moral of this story is that with any antenna, you should try to tune it in the location it will eventually be installed.
- Another interesting characteristic of NVIS propagation is that it is more difficult to find the location of the transmitter than for VHF and UHF
  - a. Not useful for normal emergency operations, but if you find yourself in some sort of Red Dawn (<https://www.imdb.com/title/tt0087985/>) scenario, it could come in handy!
- Due to the many specifics of operating NVIS, it will likely take time and experience to use it effectively.
  - a. Determining the proper frequency and antenna to use will likely involve experimentation.
- I believe BCARES attempted to use NVIS communication in an exercise in the past few years unsuccessfully, but am not aware of what they tried or what issues they ran into.
- NVIS is just one more facet of amateur radio operation. If you are up for the challenge, give it a try sometime!

#### Questions:

- **The question for the week is:** Have you ever operated NVIS? What is the nearest HF contact you have made?
- **In my case,** while I've never purposefully operated NVIS, my primary HF antenna is a G5RV Junior dipole installed about 25 feet or so in the air, which is lower than the ideal dipole height of at least a half wavelength
  - a. As an example, for 40 meters, that would be 20 meters, or 65 feet.

- b. I've managed to make digital contacts as far away as Japan, so that just goes to show that even if you can't have an ideal antenna setup, you can still get out and have fun!
- I don't have my logs consolidated since moving to a new shack computer, so I can't easily take a look to see where my closest HF contact has been
- If you don't have HF equipment, the club has a GoBox that members can check out free of charge. It doesn't have an NVIS antenna normally, but I believe the club owns a few wire dipole antennas that you can experiment with.

**More Info:**

- Why Hams Care About the Ionosphere:  
<https://newhams.info/2019/02/20/why-hams-care-about-the-ionosphere/#more-7637>
- NVIS Propagation: Near Vertical Incidence Skywave:  
<https://www.electronics-notes.com/articles/antennas-propagation/ionospheric/nvis-near-vertical-incidence-skywave.php>
- Near Vertical Incidence Skywave (NVIS) - includes DIY NVIS antenna:  
<https://www.hamradioschool.com/post/near-vertical-incidence-skywave-nvis>
- DX Engineering: A Practical NVIS Antenna for Emergency or Temporary Communications: <https://static.dxengineering.com/pdf/wp-nvis-rev2.pdf>
- Army AS-2259/GR manual:  
[http://www.radiomanual.info/schemi/Surplus\\_Accessories/AS-2259\\_antenna\\_serv\\_user\\_TM11-5985-379-14P\\_1986.pdf](http://www.radiomanual.info/schemi/Surplus_Accessories/AS-2259_antenna_serv_user_TM11-5985-379-14P_1986.pdf)
- DIY AS-2259 Antenna: <http://n3oc.dyndns.org/homebrew%20as-2259%20gr.pdf>

**Notes:**

- If you have ideas for net topics or general meeting topics / presenters, please let us know! Tell us on a net, or send email to [k0itp@w0eno.org](mailto:k0itp@w0eno.org)

**Email to [elmer@w0eno.org](mailto:elmer@w0eno.org)**

1. K0DBL - Don - Mead
2. AE0DO - John - N of Longmont
3. AF0W - Bryan - Longmont

End: 7:40pm