NVIS ANTENNAS

There has been what can be called more than somewhat mild excitement in Northern California emergency communications circles over a form of high frequency radio propagation. It's not new, but I venture to say that very few have used and understood it. "It" is called NVIS -- Near Vertical Incident Skywave.Patricia Gibbons, WA6UBE, presented a paper on NVIS at the 1990 Pacific Division ARRL convention in San Jose. It caused quite a stir. She quickly ran out of handouts and has since received dozens of requests for more. The handouts included reprints of articles from military communications magazines reporting the results of many tests.

Near vertical incident skywave means forcing your radio signals to travel straight up (i.e., 80-90 degrees) and back down. This achieves radio coverage in circle having a radius of 300 miles and more. Stop and think about that for a moment. Complete coverage within such a circle on frequencies between 2 and 10 or 12 Megahertz. Some readers may wonder what's so good about this. So now is a good spot to say that if only DX (long distance) is your thing, skip on and read one of the other fine articles in this publication. We are talking about dependable local area high frequency communications -- the type we need for tactical public safety communications in the Radio Amateur Civil Emergency Service, the Civil Air Patrol, SECURE, search and rescue, forestry, pipeline and similar services. In tactical communications we don't want DX.

How frustrating it was in years gone by to drive away from, say, a 4585 KHz base station, only to lose a good 400 watt signal a mile from the transmitter! All the while receiving, loud and clear, a 50 watt transmitter some 200 miles away. Very frustrating. We really didn't know why. When VHF-FM radios and repeaters came along, most of us retired HF mobile radios for tactical communications.

The reasons we haven't enjoyed good HF tactical communications, whether AM or SSB, have been the base and mobile antennas. The classic dipoles, a quarter to a half wave up in the air. The mobile antennas, designed for use by Amateur Radio operators, have the same general propagation characteristics -- low take off angle for DX. Virtually every Amateur Radio mobile HF antenna is unsuitable for day-to-day tactical communications. They are variously bulky, mechanically weak, won't survive continual whacks from limbs and low overheads, look like Neptune's trident or a misshapen coat rack. They may be fine for hobby communications but not for tactical public safety use. In that type of service we want one, simple antenna that is permanently installed and we don't have to think about or fuss with again.

So how do we achieve NVIS? By getting those sky hooks down near the ground. Let's start with the base station antenna. Horizontal, of course. Dipole or long wire. Place the antenna as low as two feet above the ground but no higher than about thirty feet without a counterpoise. Use an appropriate and sturdy antenna tuner; you will use the one antenna for all frequencies between 2-12 MHz.

A longwire antenna is suitable in field setups but not recommended on office buildings or other urban environments. The reason is that unbalanced antennas frequently create interference problems with telephones and other communications and electronic equipment. These problems are substantially reduced or eliminated with a balanced antenna system.

The antenna tuner of preference is one that is automatic. Such tuners are available now that do not require any control cables; they require only the coaxial transmission line from the transceiver and a 12 volt DC cable. The tuner is placed at the far end of the coaxial cable. There are then two basic options: a longwire or a balanced (dipole) antenna. The longwire can be any length -- the longer the better to approach the lowest operating frequency. A very good ground connection is necessary and often quite difficult to obtain on a rooftop. (When we are talking about running ground connections we mean the shortest possible runs of 2 to 3 inch copper strap -- never wire or braid.) For a balanced antenna, you can place a 4:1 balun on the output of the antenna tuner, thence to a 450 ohm feedline to the dipole antenna. Any NVIS antenna can be enhanced with a ground along the surface that is 5% longer than the antenna and separated by .15 wavelength at the lowest frequency to be used.

For the HF-SSB mobile radio, a sixteen-foot whip is probably the best. Such a whip may be both costly and difficult to find. For NVIS, the antenna is used folded down, both in motion and at rest. That's right, it is not released to go vertical. Most us use the heavy duty ball joint mount, heavy duty spring, and readily available 106 inch whip. To further improve the NVIS propagation at rest, the mobile whip is adjusted to go parallel to the ground and away from the vehicle. A further enhancement is to remo