

Near-vertical-incidence skywave (NVIS)

by Lt. Col. David M. Fiedler

The poor performance of our HF-RATT and HF-SSB voice equipment in supporting fast moving, widely dispersed operations is not only the result of inadequate training and doctrine but of inadequate equipment.

In two previous articles in ARMY COMMUNICATOR, I have advocated the use of the near-vertical-incidence skywave (NVIS) for communicating beyond groundwave range—up to a distance of 400 km. With the NVIS technique, energy is radiated at a low enough frequency so that it is reflected back to earth at all angles by the ionosphere. This results in the energy striking the earth in an omnidirectional pattern without dead spots (without a skip zone) if an efficient short-path antenna such as a doublet is used. I had hoped that the Signal Corps would use this technique to solve some serious operational problems. I am still hoping. As a further argument, I would like to point out in this article that the Soviet Union has already seen fit to incorporate NVIS technology into their communications doctrine. Can we afford not to?

Historical background

Due to the huge size of the USSR and the problems they encountered in establishing land line systems over vast distances with sparse population, long range radio circuits early on became an attractive alternative to the Soviet military. This, coupled with the military situation during and after the Russian Revolution in which large land areas were constantly being contested, gave Soviet communicators a great impetus into HF radio systems just at the time when early HF technology was providing equipment and techniques that would do the job. Soviet reliance on HF systems has continued to this day, and their capabilities include very good mobile tactical communications and over the horizon HF RADAR applications.

On the other hand, with the advent of satellite communications in the 1950s and 1960s, we in the west believed that HF radio systems had lost their military potential. Studies

were conducted that concluded that satellite systems with their high reliability, huge bandwidths, and tremendous channel capacity would eventually replace all HF systems, even at the lowest tactical levels. This led to a virtual halt in HF equipment development in the 1960s and 1970s and is the reason why our forces still use equipment such as the AN/GRC-46, AN/GRC-26D, AN/GRC-122/142, and AN/GRC-106. It is also the reason why until recently most of our technical and doctrinal literature bore dates from the early 50s, and why the training of operators deteriorated to a very marginal level. The Soviets, who had our resources in neither space nor electronics at this time, and who did not share our belief in the invulnerability of satellites (with good reason since they were developing a satellite destroying weapons system), continued to develop HF radio technology.

The Soviets and NVIS today

Soviet Lt. Col. V. Natetov, writing in the military journal, *Tekhnika I Vooruzheniye (Technology and Armament)* No. 11 - 1985, outlined the Soviet view of NVIS training, operation, and doctrine. He also discussed a mobile NVIS capability not presently available to U.S. forces. According to Natetov, "Radio network operations are usually set up for communication over short distances (up to 300 km). Non-directional antennas or those with poor directivity and Zenith Radiation [the Soviet name for NVIS] should be used in this case. The most widely used antennas for this kind of communications are the horizontal or slanted symmetrical dipoles. For symmetrical dipoles there are also frequency limitations of use depending on operating conditions.

propagation: the Soviet approach

Therefore, this shortwave radio antenna set usually includes no fewer than two dipoles to establish communications in the different sectors of the set's band of frequencies. Generally speaking, in communicating at ranges up to 300 km, horizontal dipoles can be oriented arbitrarily in the area; however, it is best to set up the dipole perpendicular to the direction of the most remote correspondent."

What he says up to here tracks item for item with the data presented in my previous articles on HF communications. The more significant and disturbing part of Natetov's paper came later when he went on to say, "Ionospheric communication in motion and during brief stops at distances up to 200-300 km is conducted using Zenith radiating and receiving antennas arranged on top of the operating vehicle." Though this mobile NVIS antenna is a capability unheard of in the U.S. Army,* it is not surprising that the Soviets, who are the masters of mobile/mechanized war and HF radio communication, would combine the two if possible.

Natetov's article raises serious questions about the ability of the U.S. Army to provide its mobile forces with communications support comparable to that of the Soviet Army. (Interestingly, on page 24 of the Fall 1983 issue of AC, in an article by Maj. Charles H. Hill III, there is a photo of a Soviet BTR-60 displaying a unique "railing-like antenna array." I believe that this array is in fact an NVIS mobile antenna, exactly like the one Natetov describes, further evidence that the Soviets do indeed have the

**No unit that I know of except the New Jersey Army National Guard even attempts to use a crude form of mobile NVIS. The NJARNG tries to use whip antennas bent at a 45 degree angle in order to get some useable vertical skywave radiation and is presently experimenting with another NVIS mobile antenna.*

hardware necessary to communicate with NVIS while on the move.)

This glimpse of the Soviet view of NVIS has led me to conclude the following:

- We are on the right track when advocating the use of NVIS using dipoles located close (.1-.25 wavelengths) to the earth for communication beyond groundwave range. Our communications doctrine and training must incorporate NVIS, and the reluctance of certain portions of the U.S. Signal community to change their thinking must be overcome.

- We have fallen short in supporting the combat/mechanized mobile force. The poor performance of our HF-RATT and HF-SSB voice equipment in supporting fast moving, widely dispersed operations is not only the result of inadequate training and

doctrine but of inadequate equipment. We need, and we must develop with all deliberate speed, a mobile NVIS capability along with the training and doctrine to support it. If we don't, tactical commanders will be tied to line-of-sight communications (HF and VHF) and area systems, which will not respond adequately to high-mobility battle situations.

Since the technology is known, a mobile NVIS capability can be developed and deployed quickly. I call upon the Signal Corps to recognize the military potential of mobile NVIS techniques—as the Soviets have—and make the effort to develop the necessary equipment and training to use it.

A summary of Col. Fiedler's background appears on p. 20.

