Vietnam Era Commo — Present Day Systems

How The Vietnam Experience Helped To Evolve Modern Military Communications Equipment

BY HAROLD A. ORT

Army tactical and strategic satellite communications link operational commanders with Pentagon officials. Multichannel terminals provide secure voice and data transmissions around the globe. While once only a dream in the minds of electronics experts and military commanders, today's reality of advanced battlefield communications had its origins two decades ago during the Vietnam War.

"Electronics has never been so vital in a war as it is here in Vietnam," were the words of then Brigadier General Walter Lotz, Assistant Chief of Staff for Communications and Electronics for the U.S. Forces in South Vietnam. In Southeast Asia our forces blanketed the entire area with communications, some of which were heard thousands of miles away. Many factors contributed to this deliberate blanketing theory at the time. For instance, soldiers never knew where the "front" was; it could be in a small hamlet, a hole in the side of a hill, or on a path at night near a small village. To successfully watch all the hills and trees in a country as large as Florida, it took a large, organized, complicated commo system.

Another factor that led to the large complex communications system in Vietnam, was that tactical and smaller decisions were often made at the Pentagon or the White House, instead of on the field as in other wars. The need to transmit large quantities of data over long distances was an important consideration.

The Vietnam conflict was as bewildering electronically as it was strategically. Five basic operations comprised the system:

- The backbone communications system—

a large operation tying together all the bases in the area.

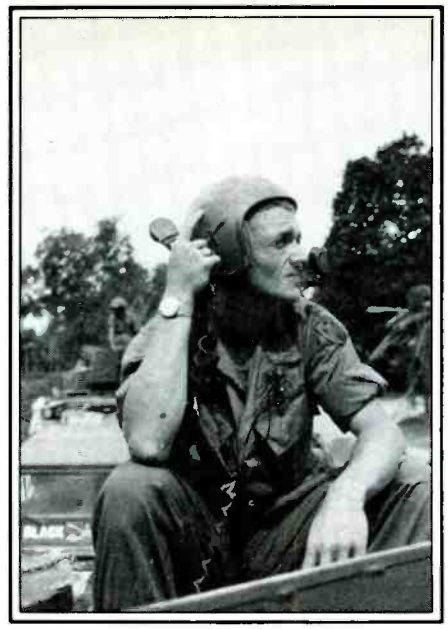
- Air support—a very complex command/control network that enabled a myriad of Air Force or Army airborne units to call for fire on a target. Used by armed helicopters and jet fighters.
- First Air Cavalry Division and Special Forces—used a large variety of forces, both land-based and helicopter-borne. These folks were the most heavily dependent on reliable communications. Every possible communications available was used to keep these isolated GI's from being overrun and killed by the Viet Cong.
- Mobile Air Traffic Control Units.
- Research and Development—The unique environment of Southeast Asia required special on-location research that couldn't be done anywhere else.

Unlike Korea, in Vietnam our commo system had to be built. This problem was compounded by the fact that the Viet Cong controlled the mountain tops (which were ideal for microwave set-ups), HF signals being plagued by the physical peculiarities of the country, and the constant shortage of spare parts. General Lotz had said it was clearly the biggest communications challenge ever presented the military services.

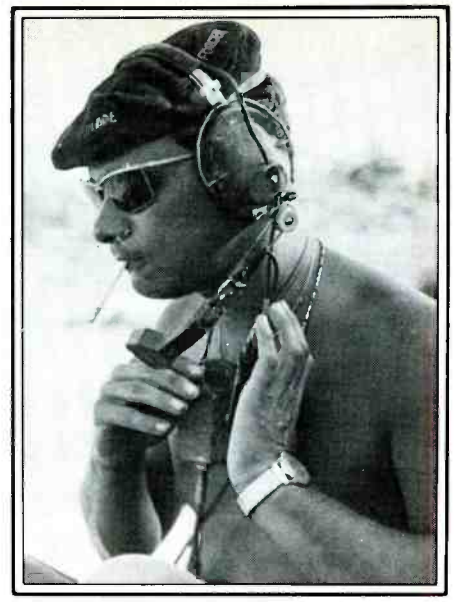
The official name for the backbone system mentioned earlier was the Integrated Wideband Communications System. The tropo link, at the time the largest in the world, operated between Saigon and Bangkok, a distance of more than 450 miles. Reception, however, wasn't always dependable and new equipment had to be installed in 1966.

South of the capital, microwave was used where line-of-sight terrain was available. Where fewer channels were used, there were radio relay towers. Lotz commented, "This is actually tactical gear, but it is used to tie the countrywide system together." HF radio allowed our soldiers to communicate with Manila and Okinawa as a backup to the tropo link with Bangkok. The main link with mainland United States was a submarine cable installed in early 1965. Computers were in use rather extensively even then, with information being fed into computers giving transmitter site location, distance to the next site, a profile of the terrain, power radiated, size and type of antenna, and orientation of the antenna.

The Defense Department, in a news release dated June 9, 1960, announced implementation of a 6,500-mile commo system that "made the Pacific area virtually trouble-free network for the Armed Forces." The new network, designed to provide reliable links from the U.S. to the Far East was called the Pacific Scatter Communication System. The release went on to say "it uses advanced propagation techniques known as ionospheric and troposcatter propagation to give over 99 percent reliability." The technique involved transmission of a signal upward to the ionosphere, where it was reflected back to earth in scattered fashion, picked up by a number of receivers. If the signal faded at one, another would hopefully receive a clearer signal, assuring a constant stream of trouble-free communication. The system was designed for communicating distances of 600 to 1,200 miles.



This platoon leader stayed in constant contact with other track units he was working with. His communications helmet, which permitted radio monitoring in a noisy track, remained on his head even when he took a breather near one of the machine guns on his armored personnel carrier. (U.S. Army photo by PFC Laszlo Kondor.)



A U.S. Army engineer kept in contact with his superiors by radio while he worked on a land clearing project on the coastline, 35 miles south of Chu Lai. More than 200 Marine and Army engineers and AMERICAL Division infantrymen were involved in the project aimed at destroying enemy sanctuaries in the area along the South China Sea. (U.S. Army photo by Laszlo Kondor.)

The troposcatter communications used in Vietnam consisted of the AN/MRC-98 parabolic antenna system, which carried 60 channels and a reflector system, and the AN/MRC-85, capable of 72 channels. A number of companies built the sets, but they were actually maintained by Page Communications. In early 1966, plans had called for the eventual permanent installation of communications sites, replacing the mobile ones in existence, but, of course, all this was to no avail with the American pullout in 1973.

One unusual aspect of communications in Vietnam was the use of civilain electronics technical representatives; about 400 of them worked alongside our military men. A Page Communications technician from Pleiku once commented that the main problem was trying to get more sensitivity out of the system, which called for realigning the circuits almost every night.

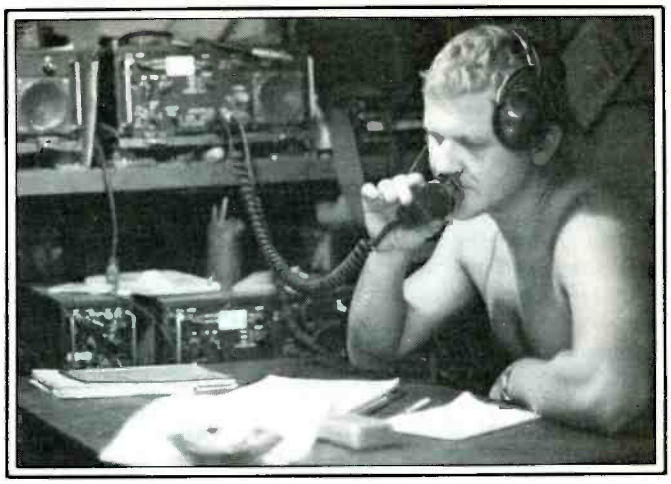
With American planes taking off from nearby Thailand, the mushrooming communication terminals clearly showed our presence there too. Tropo equipment was fast going to double to nearly 120 in early 1966. The AN/LRC-3: equipment used parabolic antennas in three sizes 30, 40, and 60 feet in diameter, with frequencies ranging from 1,800 to 2,400 MHz. At the time, generators were giving poor performance and weren't even standardized.

The tropo gear worked well up to a point, usually about 150 miles, beyond that, reception was poor. One official said, "Microwave works well. We've had some good results with it over distances of 100 miles. We use all the single sideband we can get—equipment by Collins Radio Company, the Radio Corporation of America, Japanese sets—anybody's."

The tactical systems could all be patched into the backbone system if needed. Although it might never be done, a soldier caught in crossfire along a Viet Cong trail could talk on his AN/PRC-25 manpack radio to the Pentagon. He could conceivably talk with his forward area base, which would then patch him in to the nearest backbone terminal. From that point, his message could be relayed to Saigon and on to Washington. In actual use, air strikes were coordinated and other large-scale operations were patched into the backbone network to communicate with other commands. The transistorized PRC-25 replaced the PRC-8,-9 and -10, used during the Korean War. These earlier sets are successors to World War II walkie-talkies.

Although much of the tactical equipment used in Korea should have been broken in there, actually much of the gear was still plagued with many bugs. For example, even on newer equipment, the AN/MRC-95 SSB radio antenna selection switch corroded and sometimes broke off when wet. The MRC-95 included provisions for phone patch, termination of two field phone lines and operation of a teleprinter, and was mounted on jeeps replacing the GRC-26. The HF AN/VRC-47 used by forward air controllers was fastened to its case by a simple screw on the bottom. When put on the

Private First Class Walter Tharp, Analysis Division, U.S. Army Tropic Test Center, Fort Clayton, Canal Zone, operated a portable, manpack radio set in tests to determine frequency propagation of this radio while under heavy jungle canopies and in dense vegetation. (U.S. Army photo.)



The radio telephone operator (RTO) repeated the grid coordinates that a forward observer called in for a fire mission. A vital link in the chain of artillery support, this AMERICAL Division RTO with C Battery, 3rd Battalion, 82nd Artillery, worked a 12-hour shift, eating on the spot, ready to answer all the calls from the infantry. (U.S. Army photo by SP5 A.C. Barnett.)

wet ground, water seeped into the hole and the set would simply stop working. Yet the family of AN/VRC-12 FM radios was termed "superb" by the men who used and maintained it. So was the Motorola AN/TRC-87, five-channel UHF transistorized set. It was reported that it "held the station and was sensitive with excellent reception." There were many other good examples of fine engineering.

Forward Air Controllers (FAC's) normally flew from seven to ten missions a week. One report published 21 years ago said the UHF radios failed on half the missions. Besides the AN/ARC-73, a VHF model used for communicating with Korean, Australian and New Zealander Allied fighters, and the AN/ARC-44, an FM VHF radio for talking to ground forces, most of our fighter aircraft were equipped only with UHF; the ARC-45 radio was therefore a critical radio for the tiny Cessna O1-E. It was a 12-channel crystal-controlled set. Fighters had these, as well as manually-tunable channels covering the entire UHF band.

FAC's in Army UH-1D choppers also used the ARC-44 radios that had the same dust problems that plagued many other types of gear in Vietnam. Often the soldier found that even the way certain equipment was installed created problems. Take for example the ARC-44's FM antenna coupler on the aircraft's tail section that frequently worked itself loose because of vibration. Range would then be severely limited to less than one mile from the normal 15 to 20 miles needed to talk to ground troops that were using the AN/PRC-25.

The PRC-47 was used primarily by FAC's to communicate with Tactical Air Control Parties. It had good power output—100 watts on HF (2-12 MHz) and weighed 75 pounds; with a watertight case, 175 pounds. The light PRC-25, a transistorized set, had plenty of fans and only a few detractors. It was a VHF manpack radio capable of a range of from anywhere from 2 km to 15 km without an auxillary antenna. A 1961 news release from the Department of Defense, announcing the $9 million contract to RCA for the PRC-25, said, "compact and versatile, the new walkie-talkie is well suited to the type ground action foreseen in any possible future combat, from 'bush-fire' wars on up to general conflict involving large numbers of troops."

Relatively good, sensitive reception was provided by the Motorola AN/TRC-87, used for air-ground communications. This was a new, solid-state UHF radio, as was the AN/TRC-32. Point-to-point communications was accomplished with the AN/TSC-15 radio, an HF, AM/SSB set capable of up to 900 watts; the AN/TRC-61, UHF FM radio; an AN/TRC-35, a UHF FM radio; the AN/MRC-62 radio relay; the AN/TRC-27, a super high frequency pulse-position modulation set; and a Collins HF, SSB KWN-2A.

A ground maintenance supervisor reported that "the biggest communications problem in Southeast Asia is frequency interference. The spectrum is so crowded that only a digital system will solve it and we don't have any." One squadron commo officer, also an Air Force captain, said there were other design problems. "All our UHF equipment specs call for a 5-MHz separation between channels. This is ridiculous. With the spectrum already crowded, we should have equipment with much better discrimination than 5-MHz separation." With the Viet Cong a few hundred yards away, our Control reporting Centers on mountaintops *had* to put everything close together. The same commo officer continued, "The way equipment is designed, we get interference and cross talk. I wish some electronics genius would solve this one . . . ."

All the testing in the world never really duplicated what was discovered in Vietnam. Radios that performed very well state-side did strange things in Southeast Asia. The dense vegetation acted like a large wall, blocking horizontal propagation and actually funnelling vertical propagation upward, increasing it six decibels and more. Stanford Research Institute, on contract with the government, found many oddities. For example, the whip (or dipole) antennas that should produce circular horizontal antenna patterns in clear areas, produce multilobed, starfish patterns in heavy vegetation. The nulls between the lobes were areas of complete radio silence. So, two GI's only two to three miles apart were often unable to talk with each other.

A Skytrooper of the 3rd Brigade, 1st Cavalry Division, installed an antenna for a tactical operations center in Bien Hoa, Republic of Vietnam. (U.S. Army photo by SP4 Larry Buehner, Army News Features.)

Out of Vietnam came other interesting

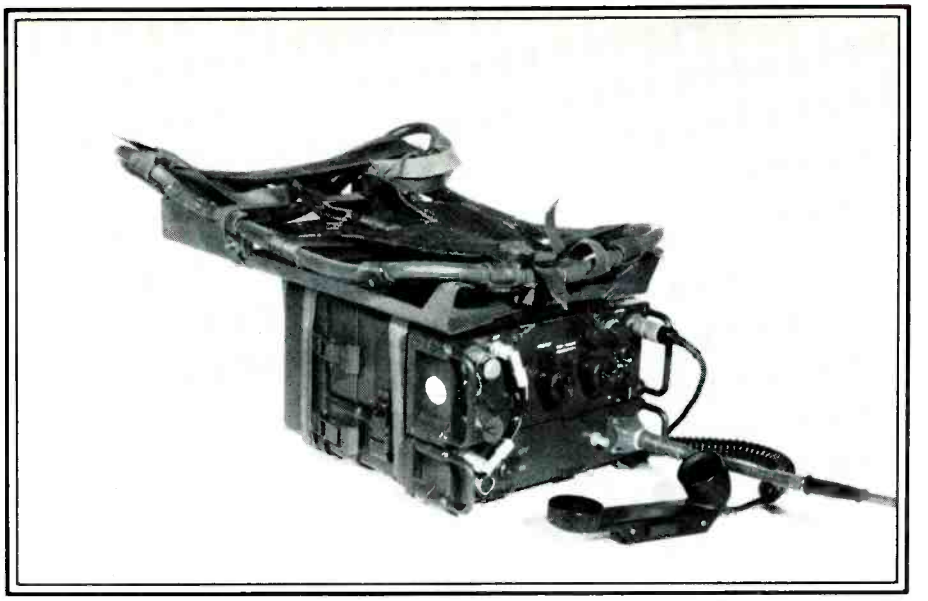
discoveries. It was well known that dipoles are set up to face each other, but one officer found that when the dipoles were aligned north and south, regardless of where the two units were, he got better propagation. When he added dipoles that faced east and west to the north/south pair, propagation improved even more. Engineers also learned that the antennas didn't have to be as high as they once thought. Dipoles at one-tenth of a wavelength produced signals nearly as good as the standard quarter-wavelength.

In 1968, solid-state equipment was finding its way into Vietnam. Although this newer equipment was slow at first to arrive on the battlefield, many officials were reporting it badly needed, but as one GI put it, "a fancy piece of equipment in the field is only as good as the length of time you can keep it on the air." This was true for most commo setups where adequate maintenance was only good until the first breakdown. Ingenious Ninth Division soldiers were actually hoisting their PRC-25's up 500 feet by a balloon, which provided considerably increased range in talking with division headquarters. Normal range was about 5 km, but hoisting it provided reliable coverage up to 18 km in jungle terrain and up to 50 km in the open.

Other methods, including using helicopters to raise the radio were implemented, but at $77 an hour to operate the choppers it became quite costly. The balloons were lowered daily for radio maintenance, a battery change and to put additional helium in the balloon. "Little Joe," as the set-ups were known, were actually quite widely used.

While testing communications is an integral part of all major military exercises, our systems haven't been put to the real test since the days of Southest Asia, with the exception of Grenada. Today, a whole new breed of military communications gear is being introduced around the world, with newer, more sophisticated radios popping up all the time. One of the Army's latest entries is called the Single Channel Ground and Airborne Radio System (SINCGARS-V). This lightweight family of VHF-FM radios is capable of providing both voice and data transmission and also has an electronic counter-countermeasures feature, known to most of us as simple frequency hopping. Weighing only 22.5 pounds, it's capable of 2320 channels at 25 kHz spacing, and will replace five current radios and reduce the maintenance burden.

A new transceiver, the AN/PRC-74 and -77, was fielded in late 1983. This superb commo system looks like a portable video game. The soldier punches in a code, and a pre-recorded message is shot out simultaneously to his headquarters. Imagine a squad easing its way through enemy lines that sights hostile troops passing through nearby brush. A message is transmitted in this manner by the commo man with the simple push of a button. The digital message unit also receives messages that the soldier can copy later in his safe, cozy hut. Its main components are the multi-mode receiver, a hand-cranked generator, a 100-volt power source and the Digital Message Device Group (DMDG).



RF Amplifier AM-6206/PRC showing equipment assembled with components of radio set AN/PRC-77 on carrying frame in manpack radio set configuration. (U.S. Army photo.)

Prior to the new AN/PRC-70, two radios were needed for maximum communications capabilities. With this new digital system, the device has a readout screen which allows the sender to review the message before sending. With the old system, anyone tuned in could hear the transmission, but with the current system, the sender can program who is to receive the message and they will be the only one to receive it. It has the ability to store up to eight messages and because of high speed transmission, resists directional finding devices.

The Army's Mobile Subscriber Equipment (MSE) is a tactical mobile radio telephone system that not only satisfies the military's expanded needs, but promises large cost savings over systems previously planned for acquisition. When fully fielded (five Corps, 26 divisions and 16 separate brigades) all active and reserve units will have standard tactical commo systems that are fully interoperable, encrypted, jam-resistant and mobile for the first time in history. The contracts include software support, as well as spare parts for 15 years after introduction into the field in 1993.

The MSE will give our tactical forces a most secure mobile commo system. It is capable of handling data, voice and facsimile transmission. It uses the latest microelectronics, digital switching and cellular radio technologies. Applications of the system will greatly reduce the need to install great quantities of wire and cable when establishing command posts. The MSE system is composed of multiple communications nodes with network features which will automatically bypass and reroute communications around damaged or jammed nodes. GTE is the prime contractor for $63 million with annual options totalling $4.3 billion.

The lessons learned from past conflicts and realistic field training exercises have resulted in state-of-the-art communications for today's soldier. While much of our gear is still too immobile, too expensive and ties us to wires and cable, MSE improves this system. Whether a soldier is in his jeep or command post, he can be in constant contact with the entire corps system. Best of all, the MSE system is used by 13 other nations worldwide. For today's soldier on the battlefield, MSE is best described as the "Bell System of the Army."

In addition to the MSE equipment, Trailblazer is another new entry in the military communications package. It's a mobile tactical commo intercept and RDF system. In specially protected Kevlar shelters, these systems provide a highly mobile tactical system for secure data link and voice command and control communications. The outfit is mounted on tracked vehicles and includes 60kW, 400 Hz power systems. Total set-up/tear down time is only 20 minutes. The Soviets have no known counterpart to either this or the MSE system.

News from the Army's Communications Electronics Command includes a series of multiplexing devices that will double the communications capability of radio terminal sets now used by the 9th Infantry Division at Fort Lewis, Washington. The contract, valued at $8.3 million, will insert commercial multiplexers into the existing military AN/TRC-145 sets. The resulting multichannel shelters will provide twice the communications capacity of the AN/TRC-145 assemblages.

The process for finding systems like these started 20 years ago. Though it took that long to arrive on the battlefield, the soldier now has the ability to communicate faster, further, and easier, than ever before. PC