

# BEGINNER'S GUIDE

All you need to know but were afraid to ask . . .

## Fun with VHF—MilCom Equipment

**S**ometimes we tend to forget that amateur radio is a hobby, something to have fun with. All too often we collectively take ourselves way too seriously. With this in mind, this column is dedicated to having some fun with VHF. Along with the fun we will hopefully entice some of you to try something a little different in the radio hobby—a road less traveled, if you will, but filled with rewards nonetheless.

If you have been reading this column since the beginning, you will remember that your author (that would be me) has an extensive military background. Having spent 20 years in the U.S. Air Force in (what else) Comm Command, I have had a lot of experience with military communications (MilCom) equipment. Only within the last several years, though, has the bug bitten to start obtaining some of this classic military radio gear and use it on the air.

Now I know what you're thinking: Military gear smells funny, is a nasty shade of green, is big and heavy, takes funny voltages and weird connectors, and isn't very easy to work on when things go wrong. Well, the vacuum-tube and solid-state military equipment is basically no different than any other commercial vacuum-tube and solid-state gear as far as voltages are concerned. Of course, how the military power supplies develop those voltages can be somewhat convoluted, depending upon dynamotors (huh?) and vibrator power supplies (say *what!*)

Well, the good news is that these power supplies are readily available on the used market, and since they are extremely rugged and relatively easy to repair, seldom will you have to do any troubleshooting in order to make things work. As far as connectors are concerned, they are also available from various sources at reasonable cost. Concerning maintenance, a little known fact among non-military folks is that the Technical Manuals (TMs) and Technical Orders (TOs) are written on about a sixth-grade level and are very detailed, including extensive troubleshooting information. OK, the smell: That is an anti-fungal shellac that is sprayed on the older military gear (WW II through Viet Nam era equipment) and many of us "Green Radio Guys" actually love the smell of the gear! Hey, one snort of that stuff and you know you have your hands on a piece of "real" radio equipment! As for big and heavy, yes, some of it is, but that is due to the stringent engineering that is needed to meet military specifications (mil spec) and survive in combat. In short, you can't really go wrong buying and using MilCom gear if you have the TM/TO for each particular piece of gear you own. There are many sources of TMs and TOs, so finding the right tech info is a no-brainer.

For the last 41 years I have been a proponent of QRP, low-power (5 watts and under), ham radio. Believe it or not, the U.S. military is also a big proponent of QRP and has been using it since WW II. The most familiar squad radio from the WW II

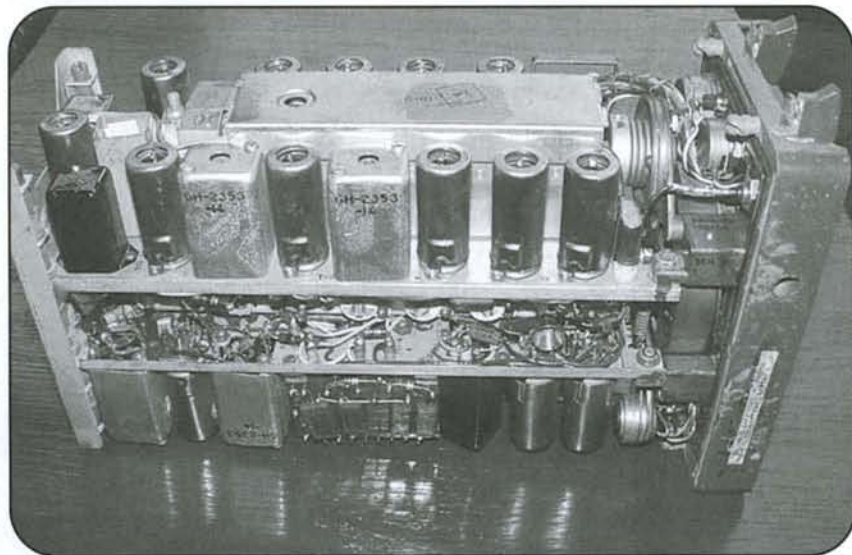
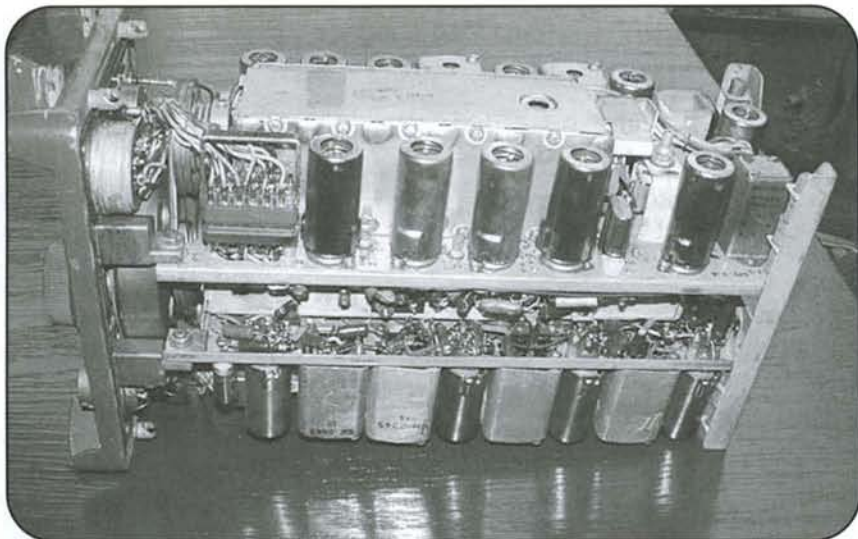
era is the BC-611 handheld radio designed by Galvin Manufacturing in 1940. Galvin Mfg. later became Motorola, so the lineage of the BC-611 is pure thoroughbred all the way!

Often misidentified as a "walkie-talkie," the BC-611 was about the same size as a quart milk carton with a 39-inch pull-up whip antenna (that turned on the radio when it was extend-



*This is the venerable RT-70 transmitter/receiver (middle) coupled to its 24-volt power supply/audio amplifier, the AM-65. The loudspeaker atop the RT-70 is an LS-166, which is common among most MilCom units of this vintage. This set was used from the Korean War well past the Viet Nam era by the U.S. military in jeeps, trucks, command posts, and about anywhere tactical VHF FM voice communications was required. The RT-70 is connected to the AM-65 by spring clips on the sides of the case. Power to the AM-65 is accomplished by a cable in the lower left socket. The voltages necessary to run the RT-70 along with audio transmit and receive are coupled between the two units via a "dog-bone" connector on the right side of the radio/PSU. This unit weighs in at around 35 pounds.*

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Here are shots of the top and bottom of the inside of the RT-70. As you can see, this radio set was built to last. Rugged? You have no idea!

ed to full length). With a short whip one would think that the BC-611 was a VHF radio. Not so. The BC-611 was an amplitude-modulated, 80-meter radio that put out somewhere between 100 and 300 milliwatts! Most of them were rocked up on 3885 kHz at the depot and that is where they stayed for the duration.

The Army quickly found out that 80 meters was not the most effective frequency on which to conduct battlefield operations. They moved to low-band VHF (30-76 MHz) during WW II using wideband FM and carried on the tradition through the Viet Nam War.

From the end of WW II onward, the move to low-band VHF/wideband FM was not only a wise choice, it was to become a boon for frugal ham radio oper-

ators needing well-made VHF gear at reasonable cost. You have to remember that military comm gear was state of the art or slightly beyond during the time the gear was designed and fielded. Not only that, MilCom gear is unbelievably rugged. It has to be, especially when you are bouncing it all over the place while getting shot at! Therefore, especially if you were on a strict budget, procuring some surplus MilCom VHF gear, restoring it, and using it was not all that outlandish as ideas go. That is still the case today.

### What's Out There

Now that we have broken the ice with a short history lesson, let's see what is actually out there that you might want to

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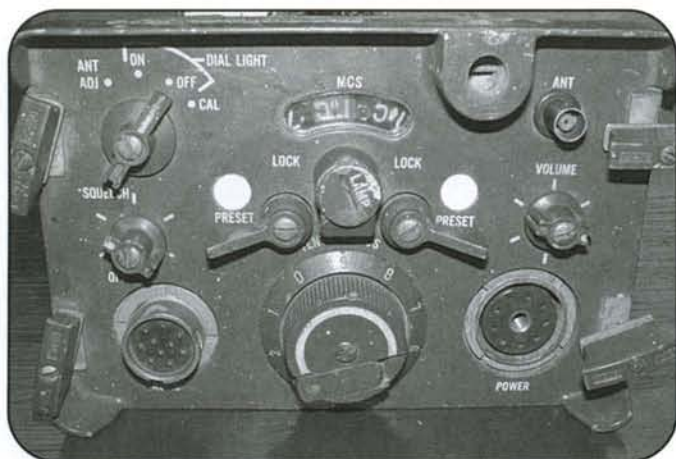
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Here is a better shot of my other RT-70, which cosmetically is in better shape than the one mounted to the AM-65. Cosmetics matter very little in the grand scheme of things. Often the more beat up the rig, the better it works! Don't ask; I don't understand it either!

obtain and use. Since this is a VHF magazine, we will dispense with the run-of-the-mill HF gear (of which there is a multitude of rigs to be had) and concentrate on some of the more common low-band VHF gear available on the used market.

Since ham radio is a technical hobby, we will endeavor to learn a little bit along the way. One of the really nice things about restoring and using MilCom gear, especially some of the older gear that uses vacuum tubes or hybrid (combination solid-state and vacuum tubes) designs, is the historical significance of the equipment itself. For instance, the AN/PRC-6 was designed around the Korean War timeframe. It was the ultimate in vacuum-tube technology of the 1950s, using the small "pencil tubes" which had no pins like normal vacuum tubes, but instead had wires extending from the glass envelope. These leads were soldered into the circuit, negating the need for sockets, which often proved unreliable under the extremes of combat. One additional benefit of not using tube sockets was miniaturization. No sockets meant that the overall package could be made much smaller physically. The PRC-6 had a long run and was used by all NATO nations and the Israeli military. As a matter of fact, the most common PRC-6s currently found on the used market are ones that were released from the Israeli army, complete with Israeli markings! They are a neat piece of history, and you can make them work with ten 9-volt transistor batteries connected in series for the plate voltage supply, three AA cells for the 4.5-volt bias supply, and two C or D cells for the filament supply. All of these batteries fit inside the PRC-6 case and will supply the necessary voltages to put the rig on the air.

Speaking of "on the air," 51.0 MHz is the 6-meter defacto squad radio frequency for ham radio operators. Of course, the PRC-6 is a crystal-controlled radio set, but the crystals are readily available on the internet at very reasonable cost. As initially designed, the PRC-6 was a single-channel radio set. However, leave it to the Germans: They produced a six-channel version that is virtually the same size and uses the same case. Sometimes these PRC-6 clones can be found on MilCom radio lists and auction sites on the internet.

Another Korean War era VHF radio set that is quite common on the used market is the PRC-10. It is one of a series of radio sets that included the PRC-8, 9, 10, and 28. All are wideband



The AN/PRC-6 Walkie-Talkie is a single-channel, 250-milliwatt output, low-band VHF (44–55.4 MHz), wideband FM transceiver. This unit uses "pencil tubes" and was pushing the state-of-the-art in the 1950s for compact design. It weighs 3.5 pounds without batteries. Since you can no longer obtain military batteries for these radios, you will have to make your own using 9-volt transistor-radio batteries (about ten in series for 90 volts B+), three AA cells for bias supply, and two C or D cells in parallel for tube filaments. The antenna is a flexible tape antenna about 2 feet long. Typical range is about 1/2 to 1 mile depending upon terrain.



Always one to lend a helping hand, my 5-year-old grandson, K.C., is posing with Pop-Pop's PRC-6 walkie. This photo gives some indication of size. If there were a full set of batteries in this radio, K.C. would have his hands full just trying to pick it up!

FM radio sets that cover various frequencies in the low-band spectrum between 27 and 54.0 MHz.

The PRC-10 is the one we want for 6 meters, and since it is fully tunable from 38 to 54 MHz, you can select any number of 6-meter frequencies. However, don't forget, 51.0 MHz is the place where all the MilCom aficionados congregate. The PRC-10 radio set is a true pack-set or man-pack radio. It is designed to be carried on the back of a soldier (the RTO—Radio Telephone Operator) and has two different length antennas—a 38-inch tape whip and a 10-foot 1-inch tubular whip. The radio weighs in at 11 pounds without battery, 20-plus pounds with battery and all accessories (H-33 handset, LS-166 speaker, H-63 headset/boom mic, and/or GSA-6 Chest Set).

The power output of the PRC-10 is about 1 watt, and, as with the PRC-6, you will have to build your own battery pack, which is easily done using D, AA, and 9-volt transistor-radio batter-



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ies, or 45-volt batteries available on the internet and from specialty radio stores such as Antique Electronic Supply ([www.tubesandmore.com](http://www.tubesandmore.com)) in Tempe, Arizona. A search on the internet will also yield several sources of DC-to-DC converters that are available commercially. These converters will take a 6- or 12-volt sealed lead-acid (gel-cell) battery and present the proper operating voltages for the vacuum-tube MilCom gear at the output. To date I have seen DC-to-DC converters for the PRC-6, PRC-10, BC-611, PRC-25 & 77, along with the AN/GRC-9 (HF CW/AM transmitter/receiver). Although initially expensive, these are probably the way to go in the long run, since making battery packs can become quite time consuming and bothersome.

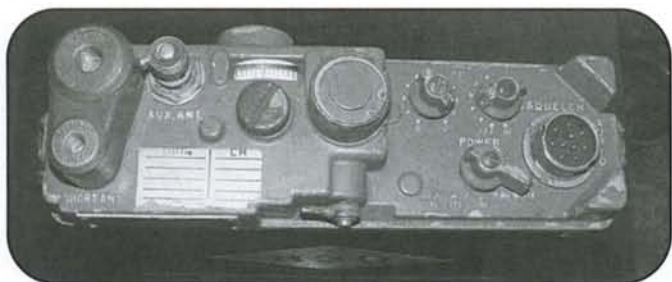
Costs are reasonable for the PRC-6 and PRC-10s; plan on spending between \$50 and \$90 for the former and around \$35 to \$75 for the latter, depending upon cosmetic condition, accessories, etc. Recently I procured a pair of PRC-10s, in working condition, with two sets of pack hardware, two H-33 handsets, and two each of the long and short antennas for a grand total of \$95, which included shipping from Louisiana. Not a bad deal at all. Internet auctions lately have had an over abundance of the AM-598 power supply/audio amplifier which mates with this radio set to provide vehicle or command-post (fixed station) operations. Prices for these accessories have been running around \$50-60 without shipping.

One word of caution: Most of the military gear we will be looking at uses power supplies that take a 24-volt DC input, since that is what most military vehicles have for internal power. The easiest way to provide 24 VDC for your power supplies is to connect two 12-volt deep-cycle batteries in series and use

them to power the power supply. Ultimately, the best solution would be to build a 10- to 15-amp 24-VDC supply that uses AC mains on the input. But to initially get the gear on the air, there is nothing wrong with strapping a couple of 12-volt storage or deep-cycle batteries in series to get the necessary 24 volts to run the radio gear.

Another Korean War/Viet Nam War classic transceiver that is seeing plenty of use on 6 meters is the RT-70. These radio sets were designed for vehicular mounting and for use as fixed-station assets in command posts. The AM-65 power supply/audio amplifier powers the radio set and provides audio inputs and outputs and will drive a speaker. The RT-70 is my kind of radio. It is about 7.5" x 5" x 13", weighs about 15 pounds, and covers 47 to 58.4 MHz using wideband FM. Made like a tank, these rigs are great starter radios for the newbie in MilCom radio. The transceiver is fully tunable over the 6-meter band, so you don't have to buy any expensive crystals. Power output on the RT-70 is only about 500 milliwatts, so it definitely is a QRP rig! Of course, you can feed the output of the RT-70 into a 6-meter "brick" RF amplifier (and it does not need to be a "linear amp," since we are working with FM) and boost the power to much higher levels. However, I find it kind of neat to play at the 1/2-watt level with a good antenna and have some real fun on the bands. Prices for the RT-70 are \$35-50 for the radio set and about the same for the AM-65 PSU/AF amp.

The PRC-6, PRC-10, and the RT-70 all saw active use well into the Viet Nam era. They were replaced by the AN/PRC-25, a 1-2-watt, tunable (30 to 76 MHz) radio set that was a hybrid design using transistors throughout the radio except for the RF power amp, a 2DF4 vacuum tube. The PRC-25 used a self-con-



Here is the AN/PRC-10, a 1-watt, low-band VHF (38–54 MHz) wideband FM pack-set from the Korean War era. These radios were also used in Viet Nam until they were replaced by the AN/PRC-25, which subsequently was replaced by the PRC-77. The military quickly found that low-band VHF FM communications were well suited to battlefield operations. The PRC-10 is one of a family of pack-sets that covered from 27 MHz (PRC-8) through 54 MHz (PRC-10). The main tuning knob is almost in the center of the front panel, with the analog-dial frequency readout above and to the left. These sets can be carried by one individual using the ST-120A/PR carrying harness, a combat pistol belt, and the M-1945 suspenders. The battery box clips onto the bottom of the radio set. Original BU-279/U batteries are no longer available for this set. However, you can home-brew a battery pack for this radio set using something similar to the one built for the PRC-6.



This photo shows the PRC-10 with its case removed. Note the solid construction. There are a number of modules in this radio which made troubleshooting much easier. The two round connectors on the extreme left of the front panel are two antenna connectors, one for the short (29.5 inches) tape whip and the other for the much longer (10 feet 1 inch) tubular whip antenna. Obviously, the longer antenna made for more reliable communications. However, it also made a bigger target!

tained 15-volt battery in a battery box that clipped to the bottom of the radio chassis. Many guys my age “humped” a PRC-25 in the jungles of Viet Nam. Depending upon whom you talk to, reliability was fair, but coverage suffered. Batteries were always dying about the time an air strike or artillery fire mission was needed!

Enter the AN/PRC-77. This was basically the same radio as the PRC-25, but it was entirely solid state. The 77 had the same physical dimensions as the 25 but used different batteries. These tactical FM radios incorporated a 150-Hz tone squelch system that provided the RTO in the squad with some relief from listening to all the “chatter” on the primary tactical frequency.

Today you can obtain an operational PRC-25 or 77 from various sources on the internet. Prices vary, so be prepared to spend between \$350 and \$600 for a 77 (less for the 25), depending upon cosmetics and accessories.

## Where to Start

There is quite a market for MilCom gear out there, with lots of places to buy from and, surprisingly, prices do vary quite a bit. The best thing to do is to start prowling a MilCom reflector such as <armyradios@yahoogroups.com>, <milpac@yahoogroups.com>, or one of the many military collectors clubs, for example <mrc@mailman.qth.net> (my local group here in the northeast U.S.). Start watching the postings, ask questions (believe me these guys and gals know *everything* about MilCom gear and they are only too glad to help out the newcomer to this facet of the radio hobby), watch the various internet auction sites, and, in general, do your homework before jumping in with both feet.

Procuring, restoring (in some cases), and using these old warhorse radio sets is quite a learning experience. You will have to learn how to speak “Green Radio” language, become conversant using the various acronyms associated with the mili-

tary, plus you may have to learn a bit about vacuum-tube and solid-state technology in the process. All in all, that’s not a bad deal. After all, this radio hobby is a technical one, so why not enjoy the ride, so to speak, and learn a little electronics theory along the way.

Another positive aspect of MilCom radio gear is that by using this gear you are keeping alive a piece of history. Remember these radios were at or beyond the state of the electronics art when they were first designed. They are rugged beyond your wildest imagination. If they could only talk, think of the all the stories they would have to tell. In addition, most of these radio sets and accessories cost thousands or tens of thousands of American tax-payer dollars to produce and field. You can buy these rigs for literally pennies on the dollar and still have a great time using them on the air.

## Wideband vs. Narrowband FM

Now a word about wideband FM versus narrowband FM. The military has, up until fairly recently, depended upon wideband FM for its tactical communications. All it takes to make a wideband set compatible with our narrowband ham radio gear is to limit the amount of audio ahead of the modulator. This is done by padding the audio input to the radio, either at the handset/mic or inside the rig near the audio input connector. The best plan is to place a 5K-ohm pot in the transmit audio line of the wideband radio set and listen to the wideband rig with a 6-meter ham band radio while transmitting. Adjust the 5K pot for the best-sounding audio in the narrowband receiver. It’s that simple. On the receiving side, turn up your audio gain when listening to a narrowband ham rig on your MilCom radio. Problem solved.

## Summary

What I have attempted to do this time around is introduce

you to a facet of the radio hobby that, while not really main stream, is intensely interesting to many thousands of hams worldwide. MilCom radio collecting/usage is not limited to the U.S. amateurs. Not hardly. MilCom radio has a worldwide following, with some of our European ham friends being in the very envious position of having access to a lot of old NATO comm gear that we, here in the U.S., would love to get our hands on. Besides, most of this stuff works on 6 meters quite well, and we all have heard the mantra that we need more activity on 6.

So what are you waiting for? Grab your duffle bag, put on your BDUs, blouse your boots, and get moving, maggot! (Sorry, lost control for a second!)

Tune around 51.0 and 51.6 MHz and listen for some of the MilCom folks using their Green Gear. With the big fascination over the last couple of years being pedestrian mobile operating on HF, how about doing it with a PRC-74, 515, or 1099 attached to an ALICE packframe? Add an HF whip antenna and you're in business! Like I said, this stuff is really habit forming, so be forewarned! In the meantime, get on 6 meters and give it a try.

If you are interested in MilCom, the one book you absolutely need to obtain is *Mil Spec Radio Gear*, by Mark Francis, KIØPF, published by CQ Communications and available directly from them in Hicksville, NY (\$27.95 plus s&h). Mark's done a tremendous job of pulling together a lot of gear that is readily available, both HF and VHF, for the MilCom hobbyist. There are chapters on all sorts of gear, including the RT-70.; PRC-8, 9, & 10; PRC-6.; BC-611; PRC-41; and others. Each rig is described in detail, with how to best get it on the air, hints and kinks regarding problem areas on restoration and/or conversion to ham frequencies, what to do if the rig is DOA, etc. In all, *Mil Spec Radio Gear* presents a wealth of first-hand knowledge compiled and written by someone who has been in the hobby for many years. Mark's down-to-earth writing style makes for an easy read. He takes the newcomer by the hand and explains things in detail. If this column has piqued your interest in MilCom gear, get Mark's book. You'll be really glad you did.

73, Rich, K7SZ

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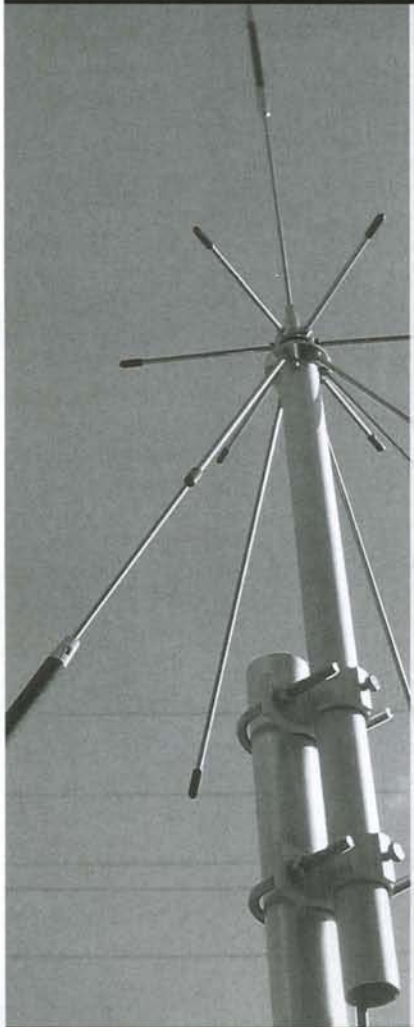
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