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ELECTRIC RADIO

celebrating a bygone era

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Jay Miller, KK5IM

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Electric Radio is published primarily for those who appreciate vintage gear and those who are interested in the history of radio. It is hoped that the magazine will provide inspiration and encouragement to collectors, restorers and builders.

We depend on our readers to supply material for ER. Our primary interest is in articles that pertain to vintage equipment/operating with an emphasis on AM, but articles on CW and SSB are also needed. Photos of hams in their hamshacks are always appreciated. We invite those interested in writing for ER to write or call.

Regular contributors include:

Walt Hutchens, KJ4KV; Bill Kleronomos, KDØHG; Ray Osterwald, NØDMS; Dave Ishmael, WA6VVL; Jim Hanlon, W8KGI; Chuck Penson, WA7ZZE; Dennis Petrich, KØEOO; Bob Dennison, W2HBE; Dale Gagnon, KW1I; Rob Brownstein, K6RB; Don Meadows, N6DM; Lew McCoy, W1ICP; Kurt Miska, N8WGW; Warren Bruene, W5OLY; Brian Harris, WA5UEK; Thomas Bonomo, K6AD and others.

Editor's Comments

The New Millennium

We start off the new millennium with a restructuring of Amateur Radio licensing. On December 30 the FCC released its report and as expected the licensing requirements have been considerably relaxed. There will now be only three classes of licences and the code speed requirement for each will be only 5 WPM. My reaction to the restructuring is: a) I expected something like this to happen and b) it's bad for Amateur Radio. I won't belabor the issue—see KW1I's comments in his AMI Update and also an article on page 5 reprinted from the ARRL website.

In his AMI Update Dale Gagnon, KW1I, AMI President, makes the comment that "All things considered, the best course of action is to hold our operating standards high and attract people who come through the new license system to our quality audio, homebrew mentality, and classic radio appreciation." I entirely agree with Dale, and would like to climb up on my soapbox and respectfully offer a suggestion on how we might improve our operating practices—after all this is a "New Millennium".

The suggestion that I'd like to make is that we retire the notion that "Old Buzzard" transmissions fall under the heading of "good operating practices". If we're in a roundtable maybe it would be a good idea for all of us to limit our time at the mic so others might have a chance to transmit without having to wait an interminable amount of time. I think newcomers are "turned off" by the "old buzzard" part of AM operation. I hope everyone will consider this suggestion and I welcome comments.

The Annual N2KSZ Memorial 160-Meter Jamboree

So far I've only received two or three logs but my initial impression is that this year's event has been a bust. Propagation was not good and I think the turnout was low. Next month I'll have a full report. If you haven't sent in your logs please do so as soon as possible. And Happy New Year to all. N6CSW

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Cover: Jay Miller, KK5IM, well-known Collins historian and writer. His latest book, *"A Pictorial History of Collins Amateur Radio Equipment"* is reviewed in this issue. ***Photo by Jim Galloway, N5MDI.***

Looking Back

by Lew McCoy, W1ICP
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I don't think I have ever written about Field Day and what it was like working at Headquarters and taking part in this annual event.

I started my ham career in Chicago and had joined the Tri-Town Radio Club. I was there two years and took part in Field Day both years. I then moved to Missouri and the Ozark mountains. There was no radio club in that area so there was never a Field Day event for me to participate in. We lived in Missouri for a little over a year and then I left to work at ARRL. I was hired as the Assistant Communications Manager in charge of "phone" activities. As I have written previously phone men were not welcome at ARRL Headquarters in those days and I mean REALLY not welcome. But being a naive young ham, just the thought of having a job at THE headquarters of amateur radio was like going to heaven.

There were two radio clubs at Headquarters, the South Lyme Beer and Chowder Society and the Connecticut Wireless Association. The South Lyme club consisted of the general manager (Budlong), a few of his people from the secretarial department, and then three guys from the technical department—George Grammer, By Goodman and Don Mix.

The South Lyme club always won the one transmitter class in field day and it took a while to figure out how they did it. It is all past history now so it can be recounted. The rules said that in the single transmitter class they could only have a single transmitter on the air at one time. Having a spare transmitter or two on the sight was OK but they took several transmitters and several receivers and concocted a switching arrangement that made it possible to switch from one station to another. The advantage of this was that they didn't have to lose time tuning up when they changed bands. The rules were later changed so that such operation would really be impossible.

Now the other club consisted of not only Headquarters people but other hams in the area. Not that they were stupid but they never could compete with South Lyme simply because they never visualized that there could be more than one transmitter and receiver in the one transmitter class. They finally did wise up and one of the smarter guys invented a thing called the octopus whereby several transmitters could be operated in the same time period (ALMOST) but it did have problems.

Several people at Headquarters, hams, were not invited to either group, particularly yours truly, because I was by title-a "phone" man. So we outcasts formed a club and we went up on the mountain and set up in a cow pasture. We actually did very well. We did not win the single transmitter class but we did score very high. As I recall, there was Ellen and Bob White—Bob of DX fame because he handled DXCC at ARRL. He was very popular with the DX men and one very fine contest operator. Ellen was also an excellent operator but she had one serious problem working at ARRL in those days—she happened to be a woman and the League was very male oriented. I suppose I am being very critical of the League but they tell me it is not like the old days there now.

We, even though working at ARRL, were really not honest in our intent but finally, being members of the contest committee, we rewrote the rules for field day so that the single transmitter class really meant a single transmitter. W1ICP

AMI January 2000 Update

by Dale Gagnon, KW1I, President

AMI Membership

All membership applications received prior to December 20 were processed and certificates mailed to new members. The membership is now over 1200.

FCC Amateur Licensing Restructuring

Since sending in our comments last year we have been waiting for the FCC to speak on this issue. Most AM ops have not been in favor of relaxing licensing requirements because it might lead to overcrowding and result in pressure on AM as a wider communications mode. We also have been concerned that individuals, who didn't have to work as hard for a license, might not value it as highly and might bring lower operating standards to the bands. Now it appears that passing a 35 question test will earn Technician privileges, passing a 5 wpm code test and an another 35 question test will earn the General class license and passing an additional 50 question test will earn the Extra class. Just how low the licensing requirements have fallen depends upon what the future question pools look like and how the code tests will be conducted. It is not clear how much more attractive amateur radio will become to the general public with these new license requirements. The amount of study and the code proficiency required have been reduced, but not eliminated. What will this mean for AM? Overcrowding of the amateur frequencies in the short term is not likely, especially with improved propagation. Amateurs are now spread all over the HF bands up to 30 MHz. By the time propagation diminishes again with the sunspot cycle, there could be increased pressure on the lower frequencies, but the decrease in propagation may reduce the incentive to operate and may reduce potential new amateurs' motivation to get licensed in the first place. One benefit may be the opening of the low end of the 10 meter phone band to the AM mode when the Novice license is eventually discontinued. We may all benefit from reallocation of other Novice subbands as well. All things considered, the best course of action is to hold our operating standards high and attract people who come through the new license system to our quality audio, homebrew mentality, and classic radio appreciation. [Ed. For more information see the article on page 5 that we've reprinted from the ARRL webpage.]

Thanksgiving AM Jamboree Wrap Up

There was quite a bit of AM activity over the Thanksgiving Weekend. The long awaited opening of the 10 meter band during an AM operating event was experienced to good advantage. Abe, W3DA, worked 50 stations during the Jamboree. He commented on the superb 10 meter conditions and noted that he completed WAC and worked several new countries. Bill, KE7KK, worked 31 stations. Gerald, K6QY's log included 35 entries. Ashtabula Bill, W8VYZ, worked 41 stations. AMI Headquarters' certificate production facility is up and running. If you made a good showing in the Jamboree and would like some wallpaper for your shack, send in your log!

Dayton Hamvention 2000 Plans

The Hamvention has given the AM Forum a time slot of 3:15 on Friday afternoon on May 19. This should be a much better position than the Sunday slot we had last year. The forum program is still under development, but the major segment will be a "Meet the AM'ers 2000" slide show, an update of the program that was featured at the first AM Forum almost 10 years ago. As I look through my pictures in those old slides I realize how much my shack has changed, and I guess, how I have changed, too. It's sad to see how many

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Postscript: The BC-610 Revisited

by Robert E. Grinder, K7AK
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I became cognizant of three conspicuously under-reported dimensions of the BC-610 saga while I was researching facts for my BC-610 article. Consider: (1) the myriad instances during WW II when reliance upon the BC-610 facilitated military maneuvers; (2) the tribulations of postwar amateurs who either overcame or are overcoming daunting circumstances procuring and operating BC-610s; and (3) the improvisations, technical improvements, and other practical ideas [akin to those in the "Hints and Kinks" sections of *QST*] that would, if publicized, augment efforts to restore and maintain BC-610s.

As I noted in Part 1, Hallicrafters initiated in October, 1943, a letter-writing contest, in which prizes were awarded monthly for noteworthy descriptions of SCR-299s in battle. Nearly every submission warranted a reply, for all "serious" entrants were promised a $1 consolation prize. Unfortunately, this voluminous accumulation of correspondence has disappeared. Nobody today knows what happened to that invaluable documentation of wartime communications. To compound the depth of the void, we do know today that Hallicrafters never published a single prize-winning letter.

I am hopeful, nonetheless, that individuals are available throughout the country to recount some of the feats that might have been described in the letters, e.g., Hutchens' (ER, 1992, #34) report of a serviceman's escapades with BC-610s in France. I am hopeful, too, that amateurs who have wrestled with BC-610s in the postwar years are available to extemporize on their experiences and improvisations. For example, Gary Willey, W4ZXS, indicated to me recently that after twenty years of diligent toil, he will soon have a once-dilapidated BC-610 back on the air. Further, Thekan (ER, 1999, #124, p.4) reflects on the dubious prospect of restoring a BC-610E that looks "like it had been retrieved from the San Francisco bay at low tide."

I would like to develop from comparable reports mosaic presentations of under-reported aspects of the BC-610 story. Therefore, I invite ER readers to contact me with their vignettes. And I urge, also, that readers send to me names and addresses of persons who might be willing to share BC-610 interactions of whatever nature. The material that I obtain will be summarized eventually in Electric Radio. Such a collective effort may enable us to both extend and preserve a viable history of the incomparable BC-610.

I am by profession an academician. I have spent the past four decades, mainly at Arizona State University, teaching and writing about the psychology of human development and the history of psychology. My involvement with amateur radio began during WW II, and as opportunities arose, I have written also about historical aspects of both broadcast and amateur radio.

I was aware of SCR-299s and BC-610s in the 1940s. When I was in the Navy during the early 1950s, I think that a BC-610 was part of the amateur radio station that I operated briefly at Guantanamo Bay; I cannot recall with certainty. In my youth I was focused

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Amateur Restructuring is Here: Three License Classes, One Code Speed

Reprinted with permission from the ARRL webpage

NEWINGTON, CT, Dec 30, 1999--Amateur Radio will get a new look in the new millennium. The FCC today issued its long-awaited Report and Order in the 1998 Biennial Regulatory Review of Part 97--more commonly known as "license restructuring." The bottom line is that starting April 15, 2000, there will be three license classes--Technician, General, and Amateur Extra--and a single Morse code requirement--5 WPM.

"We believe that an individual's ability to demonstrate increased Morse code proficiency is not necessarily indicative of that individual's ability to contribute to the advancement of the radio art," the FCC said.

Besides drastically streamlining the Amateur Radio licensing process, the FCC said its actions would "eliminate unnecessary requirements that may discourage or limit individuals from becoming trained operators, technicians, and electronic experts."

Although no new Novice and Advanced licenses will be issued after the effective date of the Report and Order, the FCC does not plan to automatically upgrade any existing license privileges. The ARRL had proposed a one-time across-the-board upgrading of current Novice and Tech Plus licensees to General class, but the FCC declined to adopt the idea. This means that current licensees will retain their current operating privileges, including access to various modes and subbands, and will be able to renew their licenses indefinitely.

Starting April 15, 2000, individuals who qualified for the Technician class license prior to March 21, 1987, will be able to upgrade to General class by providing documentary proof to a Volunteer Examiner Coordinator, paying an application fee, and completing FCC Form 605.

The FCC's decision not to automatically upgrade Novice and Tech Plus licensees means the current Novice/Tech Plus HF subbands will remain and not be "refarmed" to higher class licensees as the ARRL had proposed. The FCC said it did not refarm these subbands because there was "no consensus" within the amateur community as to what to do with them.

As it had proposed earlier, the FCC decided to lump Technician and Tech Plus licensees into a single licensee database, all designated as "Technician" licensees. Those who can document having passed the 5 WPM Morse code examination will continue to have the current Tech Plus HF privileges. "If documentation is needed to verify whether a licensee has passed a telegraphy examination, we may request the documentation from that licensee or the VECs," the FCC said.

In addition to reducing the number of license classes from six to three and eliminating the 20 and 13 WPM code tests, the FCC also will reduce the number of written examination elements from five to three, authorize Advanced Class hams to prepare and administer General class examinations, and eliminate Radio Amateur Civil Emergency Service (RACES) station licenses. RACES will remain, however. "After review of the record, we conclude that we should eliminate RACES station licenses because RACES station licenses are unnecessary for amateur stations and amateur service licenses to provide emergency communications," the FCC said.

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Polyphase AM
Generates AM In The Antenna Field

by Warren B. Bruene, W5OLY
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Polyphase AM is a unique system for generating and radiating AM whereby the carrier and sideband power are radiated from separate elements of the antenna system. The **field strengths** of the carrier and sidebands **add** in the far field of the antenna producing the amplitude modulated signal.

This ingenious scheme was invented by Collins Radio engineers in the 1938/39 time period. Objectives were (1) higher over all transmitter efficiency, (2) higher radiated power with the tubes available at that time, and (3) no high power Class B modulation transformer.

The basic concept was tried in the 75 meter phone band at a carrier power of 100 watts. Tests proved that the concept was valid. The system and principles of operation were published in *Electrical Engineering*[1], which was the official Journal of the AIEE, in July 1939. Then Collins Radio and the Central Broadcasting Company, which owned WHO Des Moines, Iowa, installed a 1000 watt test transmitter using the WHO halfwave vertical antenna with extra elements added. (WHO operated on 1000 kHz at that time with a carrier power of 50 KW.) They performed their tests in the late night hours. The description of this improved system and the results of the tests were published in *The Proceedings of the IRE*[2] in May 1942. They called the system Polyphase Broadcasting.

Polyphase Broadcasting requires a special antenna system consisting of three co-located but electrically isolated antennas. The center vertical tower is fed carrier power only. The other two antennas are fed DSBSC (double sideband suppressed carrier) power. The phase of the audio modulation fed to one pair lags the phase of the other by 90 degrees. **Figure 1** shows the basic antenna concept. One of the DSBSC antenna pairs is shown in the side view which we will call the E-W (east-west) pair. Another identical pair was installed on the N-S sides of the central tower as illustrated by the top view. **Figure 1** also illustrates the antenna terminals (of the carrier and E-W pair) and the relative current phases when positive modulation is to the right (east). Each pair is fed in series so the element currents are equal but opposite in phase.

The two DSBSC pair antennas have no RF coupling to each other nor to the central tower. Each DSBSC pair produces a figure-eight radiation pattern with 3 dB gain. The elements of each pair need to be close together to produce the desired figure-eight radiation pattern, but placing them too close together reduces their radiation resistance which increases the Q of the antenna and narrows the bandwidth.

The element pairs were hung from guy wires connected to the top of the central tower. In the WHO installation, the top ends of the sideband pairs are slanted inward using part of the guy wires for the top ends of the antenna pairs.

The central tower is fed carrier power only. DSBSC is fed to each of the other antennas. The phases of the two suppressed carriers are the same as the carrier, but the audio of the E-W pair lags the audio of the N-S pair by 90 degrees. **Figure 2** illustrates the three RF waves fed to the three antennas for 100% sine wave modulation. Note the RF phase reversal when the audio changes polarity.

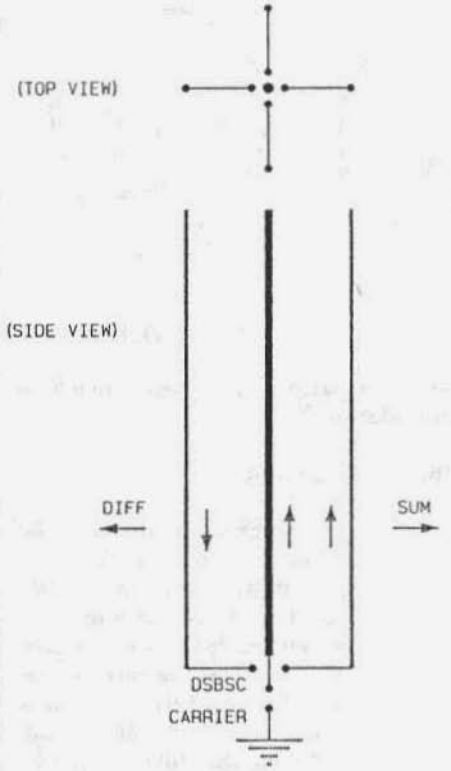

Figure 1. Top & side view of carrier and DSBSC antenna system.
DSBSC elements spaced 1/16 wavelength from carrier antenna.
No coupling between carrier and DSBSC antennas.
Carrier antenna is omnidirectional, DSBSC are bidirectional.

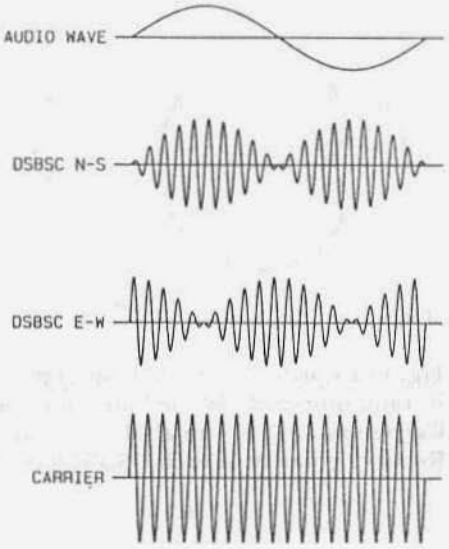

Figure 2. RF waves in three antennas for 100% sine wave modulation.

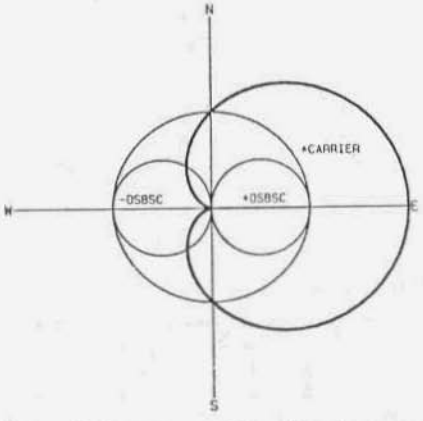

Figure 3. Antenna pattern for sine wave modulation peak East.

Figure 3 illustrates the addition of one DSBSC peak combined with the carrier in the field of the antenna to produce a modulation peak to the east. The sum of the carrier and the E-W DSBSC antennas produces a cardioid pattern when the modulation percentage is 100%. The current in the N-S pair is zero at this instant. **Figure 4** shows the antenna patterns 45 degrees (of the audio tone) later. The amplitude of each DSBSC antenna pair is 0.707 the amplitude of the carrier when the radiation peak is on a 45 degree diagonal. Note that the cardioid radiation pattern has rotated 45 degrees. Thus the radiation pattern produced by the combined radiation of the three antennas for 100% sine wave modulation is a cardioid pattern which rotates at the modulating frequency. **Figure 5** illustrates the instantaneous variation of the RF field strength (at a receiver located north of

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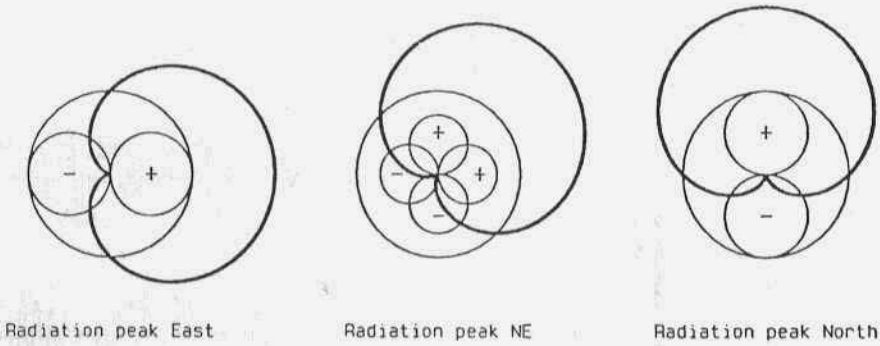
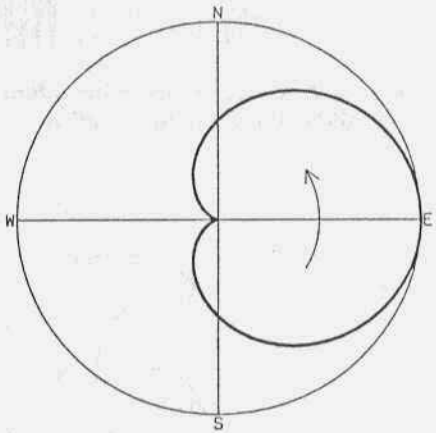
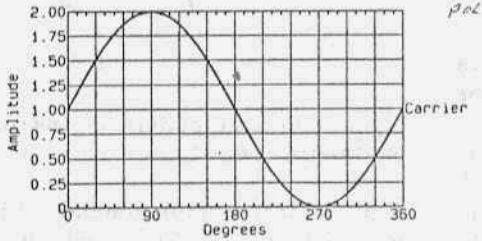


Figure 4. Carrier and DSBSC antenna field strength patterns and their sum which is a rotating cardioid for 100% sine wave modulation.
Carrier polarity is + in all directions.
Relative polarity of each DSBSC lobe is labeled inside lobe.



a) Rotating antenna pattern with sine wave modulation.



(B) One cycle of AM envelope with sine wave modulation.

Figure 5. Variation of field strength as cardioid rotates.

the antenna) as the cardioid rotates one revolution.

Note that when a receiver located east of the antenna is receiving the positive peak of the sine wave, a receiver located west of the antenna is receiving the negative peak of the modulating wave. As a result, the total power delivered to the antenna is constant over the entire audio sine wave cycle. For 1000 watts carrier power, the PEP of each sideband pair is 500 watts and the average power of each is 250 watts for 100% sine wave modulation. Thus the total **average** power to all three parts of the antenna system is 1500 watts. The signal as detected by a receiver is the same as would be produced by a conventional transmitter with 1000 watts carrier power and 4000 watts PEP!

Figure 6 shows the block diagram of the initial 100 watt transmitter system. Each linear amplifier was capable of delivering 50 watts PEP. The balanced modulators provided enough power to

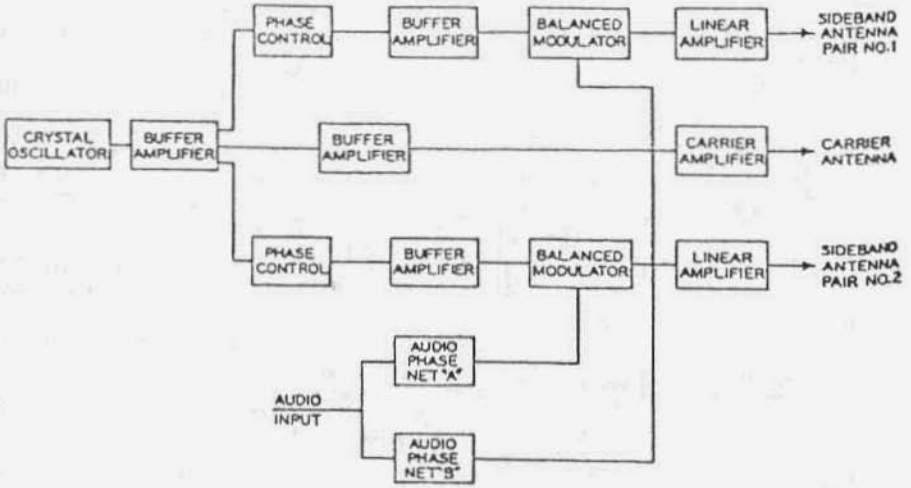


Figure 6. Block diagram of prototype transmitter used on 75-meter phone.

drive the linear amplifiers. The two audio phase delay networks, at the bottom of the diagram, are designed to have audio phase delays which differ by 90 degrees across the audio band. It is similar to those used in SSB exciters which employ the phasing system of SSB generation. Each delay network had only three sections therefore the maximum error was approximately +/-5 degrees over the broadcast band of 30 to 10000 Hz. The phase error could have been reduced by using four-section filters or by limiting the audio bandwidth. For SSB, the phase error must be less than one degree for acceptable opposite sideband rejection. More phase error can be tolerated for Polyphase AM because it just affects the percentage modulation at each audio frequency in different directions. The suppressed carriers should be in phase with the carrier. Any phase difference causes amplitude distortion.

The cardioid azimuth radiation pattern only exists for 100% modulation with a single tone. For 70% modulation, the figure-eight radiation patterns are only 70% the amplitude, as illustrated in **Figure 7**. When the audio consists of many frequency components, such as

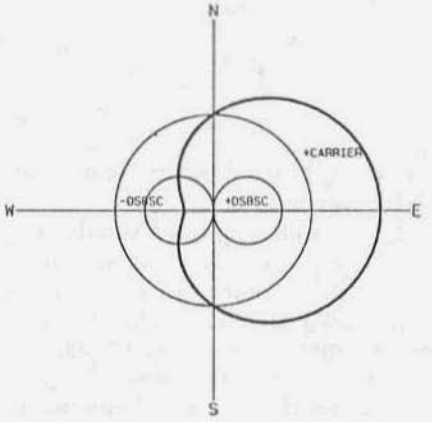


Figure 7. Antenna pattern for 70% modulation peak East.

speech, each frequency component produces a pattern which rotates at the frequency of that component. Thus, there are many small "radiation patterns" rotating at different speeds (but all in the same direction). The field strengths of their phasors add in the direction of any receiver to produce the AM modulation envelope we are used to seeing on an oscilloscope.

The 1000 watt transmitter installed at WHO is more sophisticated as shown in **Figure 8**. It generated upper single

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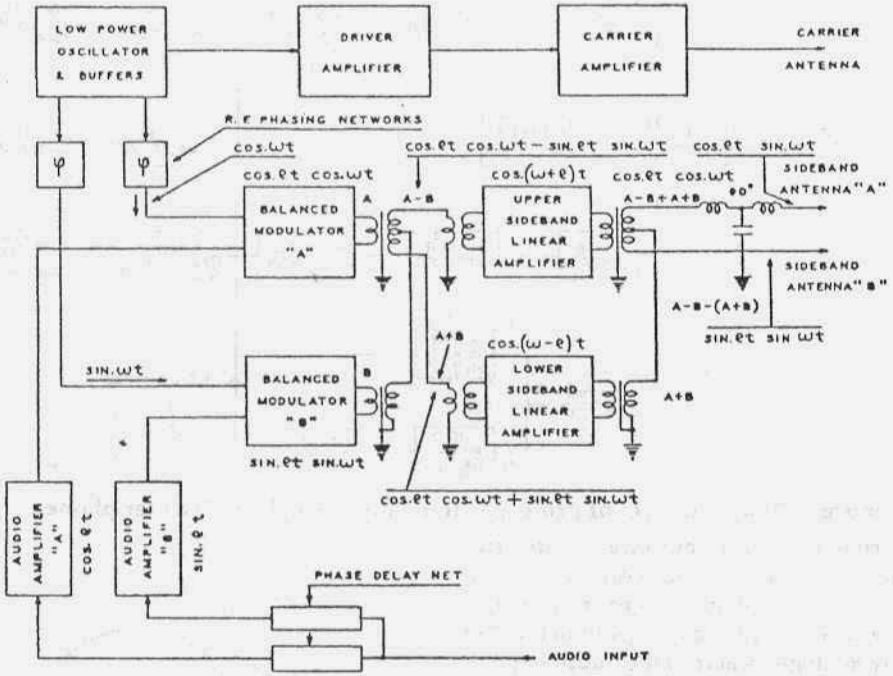

Figure 8. Block diagram of the 1000 watt polyphase transmitter tested on the WHO antenna.

sideband and lower single sideband signals using the phasing scheme. The two SSB linear amplifiers each had an output of 250 watts PEP. Their RF outputs were combined in passive RF networks to produce the two DSBSC signals needed for the antennas. Note that the suppressed carriers of the two SSB signals were generated in phase quadrature. After combining, the DSBSC signals are still in phase quadrature. Therefore, a 90-degree T-network was used to bring the USB back in phase with the LSB. The RF power to each of the sideband pairs was 500 watts PEP but it was accomplished using two 250 watt PEP linear amplifiers.

The IRE article[2] didn't show the coupling circuitry between the three RF outputs of **Figure 8** and the antenna. The input impedance to each antenna element must be high because each element was a half wavelength long. I suspect that they used inductive coupling to a balanced parallel resonant circuit. Each element of a sideband pair would be connected to the opposite ends of this parallel resonant circuit. The transmitter was installed in the phasing network house located just a few feet from the base of the antenna tower. Therefore, no transmission lines were needed.

THE MONITORING SYSTEM

Since the AM wave is generated in the antenna field, the monitor receiver was located one mile away on a 45 degree diagonal to the sideband antenna pairs. Thus it picked up equal strength signals from each sideband pair. The demodulated audio wave was brought back to the transmitter location by means of a twisted pair transmission line. An oscilloscope was used to observe the waveshape of the demodulated wave. They also installed a measuring system in a truck which they

could drive to different locations around the antenna.

They measured frequency response and distortion across the audio band at 95% modulation. They found that they could adjust the transmitter to bring the distortion below the error of the measuring equipment at any one audio frequency. But it was best to adjust it for lowest distortion in the middle of the audio band for best performance overall.

THEIR CONCLUSIONS

They concluded that Polyphase Broadcasting was capable of high-fidelity operation and that the expected gains in tube and power economy could be realized.

MY OBSERVATIONS

These tests were made at the time when several other AM modulation systems were in existence or being tested, such as the Doherty system (used by Continental Electronics) and Outphasing modulation (used by RCA). High level Class B modulation was used to some extent at lower powers but the modulation transformer engineers hadn't quite discovered how to control leakage inductance and stray capacitance at higher power levels. The 500 KW transmitter at WLW in Cincinnati, Ohio, used Class B plate modulation, but they invented a scheme to do it using just modulation reactors.

The two main disadvantages of the Polyphase Broadcasting system were that (1) it was inherently omnidirectional and (2) that the tuning requirements were rather complex.

Collins Radio abandoned this system and developed a line of Class B plate modulated transmitters. It took Thordarson seven tries before they produced a satisfactory modulation transformer for the 5 KW 21A Broadcast Transmitter. The Collins 21A was largely responsible for Collins selling more broadcast transmitters during the year before WW II than all other transmitter manufacturers combined.

I started working for Collins in Nov. '39 when this work was going on. I was not privy to any details then, but I knew the principle players involved.

Walt Wirkler was very interested in SSB since the little flurry of ham activity in 1935. He had a couple of patents on phasing modulation methods of generating SSB. He was the "absent minded professor type" but was very innovative and practical minded. John Byrne was a broadcast consultant and was the inventor of the Polyphase Broadcasting System.[4] L. Morgan Craft was Chief Engineer and designed the audio phase shift networks. Paul Loyet wrote the article on the testing at WHO and was probably Chief Engineer at WHO. He was not a Collins employee. Art Collins' name was not mentioned in the published papers, but he undoubtedly closely monitored the project and contributed to the development of the system.

Are Any Of The Polyphase AM System Concepts Worth Resurrecting?

1. There appears to be a means to overcome the 1500 watt PEP limit[3] on amateur transmitter power emission. The sum of the PEP power to the three antenna inputs would just add to 1500 watts for a 750 watt carrier power transmitter. Actually, the two DSBSC envelopes do not peak at the same time, therefore the output of an instrument which added the "instantaneous" powers of the two DSBSC inputs would not be any higher than the PEP of either DSBSC input alone.

2. The following are two concepts for testing this idea of generating AM in the antenna field. The basic idea of each is to use a bidirectional antenna system and bi-polar modulation (instead of polyphase modulation). This eliminates one of the DSBSC linear amplifiers and the need for generating the two audio signals 90 phased degrees apart. The suppressed carrier of the DSBSC signal would be generated in-phase with the

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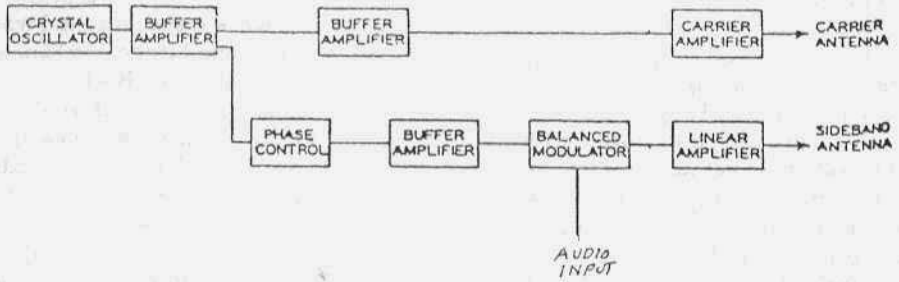

Figure 9. Block diagram of bipolar AM tranmsitter.

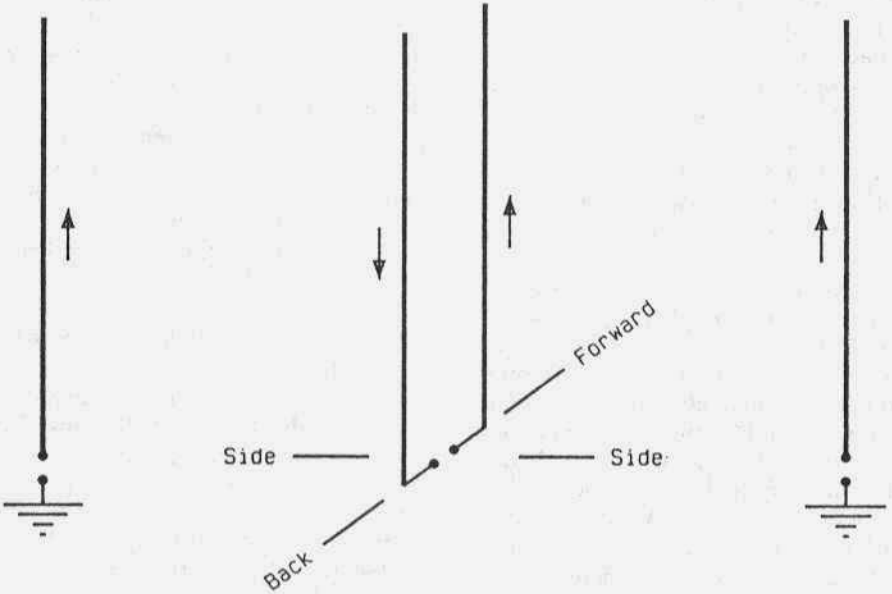

Figure 10. Perspective view of Carrier and DSBSC antenna elements.
DSBSC elements spaced 1/8 wavelength apart.
No coupling between carrier and DSBSC antennas.
Both antennas should have identical bidirectional patterns.
Carrier antenna radiates some phase in both directions.
DSBSC antenna radiates opposite phases in forward and back directions.

carrier. **Figure 9** is a block diagram for a simpler bi-polar AM transmitter using the technology back then. Today we would probably choose to generate the DSBSC signal at a lower power level as in a SSB transmitter. Audio signal processing or band limiting should be done on the audio signal and not after the DSBSC generator in order to keep the sidebands symmetrical.

Ideally, the carrier antenna should have the same figure-eight azimuth and elevation patterns as the one sideband pair but, the radiation polarity must be the same in both directions (the DSBSC antenna radiates opposite phases in opposite directions) and it must be orthogonol to the sideband pair so as to avoid coupling to it. This antenna would provide 3 dB gain at the peak of the

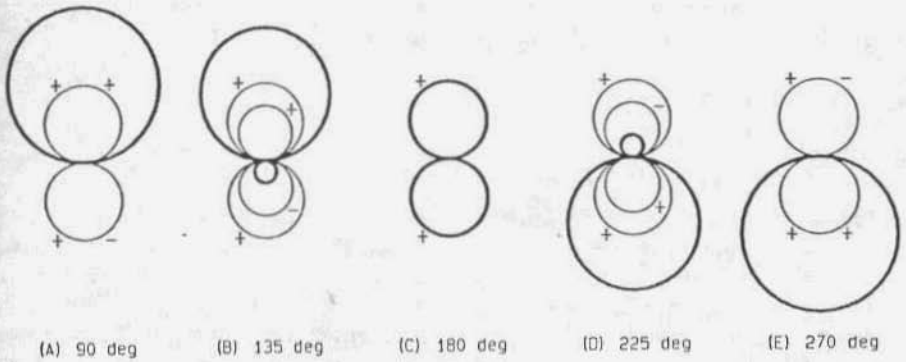

Figure 11. Carrier and DSBSC antenna field strength patterns and their sum. Degree lables are at 45 deg steps along audio wave.
+/- to left of center is phase of carrier radiation.
+/- to right of center is phase of DSBSC radiation.

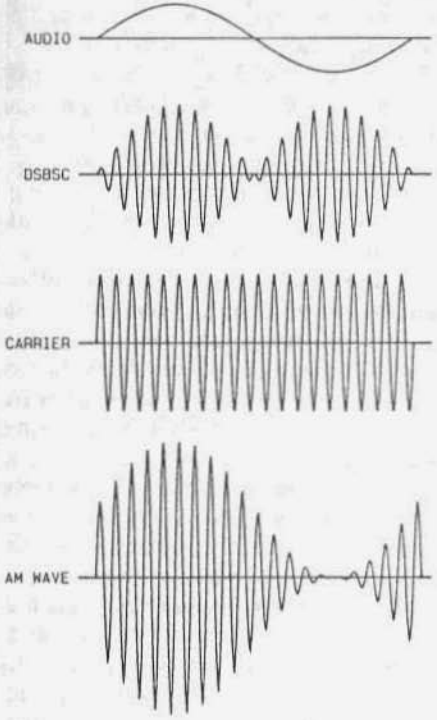

Figure 12. Steps for generating bi-phase AM in the antenna field.

radiation lobe in both the forward and back directions.

One idea is to use a pair of quarter-wave verticals spaced a half-wave apart and fed in-phase for the carrier antenna. **Figure 10** shows a perspective view of this antenna configuration. The sideband pair is shown in the center. Another set of elements oriented 90 degrees from the first would permit switching direction by 90 degrees for omnidirectional coverage. The gain would only be down 3 dB at the cross-over points of the azimuth patterns (which would still be the same gain as an omnidirectional system.) **Figure 11** shows the carrier and DSBSC radiation patterns and their sum by the wider lines. Since it is a bi-phase system, the pattern doesn't rotate.

Figure 12 illustrates the steps for generating the AM wave. The PEP of the sideband linear is the same as the carrier power. The average power with 100% sine wave modulation is half of the carrier power.

A remote monitor receiver may not be necessary if antenna current sensors are placed in the antenna leads so that the carrier phases can be adjusted to be the same. Also a peak reading directional wattmeter could be used to as-

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RCA Aircraft Radio System

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This is an article about a very elusive radio system designed by Radio Corporation of America. Its primary function was to be a miniature package with ease of operation and provide basic radio communications from air to ground. This set was first built about 1939 and was designed to be used with a 6, 12 or 24 volt power source. It consisted of three units, a transmitter, receiver, and power supply. Along with an antenna this made up the complete 29.5 pound aircraft radio package.

The system never had a part number or a name assigned to it but the components are AVT-112 for the transmitter, AVR-20 for the receiver and the power supply was AVA-126. A recommended antenna is the AVA-120. This is a trailing wire antenna that could be cranked out to a maximum length of 125 feet.

This little aircraft radio system was manufactured to be installed in light aircraft of the 1938 era and would also work well in larger multi-engine aircraft.

The transmitter is a very basic design with a 6V6 oscillator, 6V6 power amplifier, a pair of 6V6 modulator tubes, a 6SL7GT tuning indicator amplifier, and a 6AF6G dual eye tube indicator. A 991 was used as a signal limiter across the crystal to prevent crystal fractures and act as a voltage regulator. The transmitter used only crystal control over a frequency of 2500 to 6500 kilocycles or 2.5 to 6.5 megahertz. The antenna output network would load anything from a paper clip to a piece of wire but is designed to deliver 6 watts into a resistive load of 20 ohms. The unit could be operated from a 6, 12 or 24-volt power supply but the change-over was a permanently wired situation. The high voltage required is a nominally 320 volts at 110 milliamperes. Modulation was a little shy but with a high output carbon button mic like the T-17 or any of the commercial amplified mics such as the Motorola series of Micro, Motrac, there will be plenty of audio.

An Interphone Communication System (ICS) is incorporated in the transmitter and is switched on by the fourth position of the antenna switch. When using the interphone system the radio portion of the transmitter is completely disabled and the modulator can be used for interphone communication between the pilot and observer. The electron eye operates only during actual transmissions and thus serves as a warning against accidental transmission of interphone transmissions.

An antenna relay is in the transmitter and thus allows one antenna to be used for transmitting and receiving. All power connections are made available on the rear apron of the transmitter in the form of a basic 10-pin male Cinch-Jones plug.

The transmitter is roughly a 6-inch cube in size and weighs 6 pounds. The position for mounting is not critical but should be in easy view by the user.

The AVR-20 receiver is about the same size and weight as the transmitter and comes from the factory wired for 6 or 12-volts and can be modified for 24 volts. The tuning range is from 2300 to 6700 kilocycles and has provisions for crystal control. A CW oscillator is provided to permit CW reception or to use as an aid in tuning in weak signals. The

RCA AVR-20-A receiver and AVT-112-A transmitter. Note government inspector's stamp above and to the left of the tuning eye tube.

output circuit of the receiver has sufficient audio to drive a speaker if properly matched with a high quality 500 or 600 ohm to voice coil transformer. The receiver is a single conversion superheterodyne type with the injection on the high side and an IF frequency of 455 kilocycles. Provisions are made for the use of RCA AVA10 or AVA53 crystals and the FT-243s will work well. Power connections are made through a Amphenol PC-4F connector.

The tube lineup for the receiver is a 6S7 RF amplifier, a 6K8 1st detector (mixer), a 6F7 for a single stage IF amplifier CW oscillator, and a 6B8 for the 2nd detector, AVC, and audio output amplifier. High voltage required is 250 volts at 57 milliamperes but I have run mine at the same level as the B+ for the transmitter with no problem. Since noise figure is not a factor here a little more gain will not make much difference especially on AM.

The AVA-126 power supply is made to operate from 6, 12, or 24-volts and this is not an easy change. In addition to changing the vibrators for the proper voltage a minor amount of wiring is required to the transmitter and the receiver and some changes to the power supply to go from one voltage to another.

When WW II started a few of these sets were procured for training aircraft of the biplane family and manufacturers as Waco and Curtiss offered these radio sets as an option for military training.

Later in the war the ferry pilots were using these as a carry radio which could be used flight after flight by pilots needing a radio to deliver planes from factories to modification centers.

continued next page

A set of equipment could be mounted any place where available in the aircraft and be preset on one of many frequencies and even changed enroute if necessary. At times the sets would be tied in the rear seats or even mounted to a piece of wood for easier removal and installation for the next flight. Temporary power connections were made with battery clips or terminal lugs if power was available readily on the same types of aircraft. One ferry pilot told me that at times a long wire would be strung up inside the plane in the case of aircraft where there was a lot of fabric covering and sometimes where the plane was large like a B-17 and had large holes for gun emplacements. A lot of B-17 aircraft were delivered form Seattle, Washington to various modification centers in the US for the installation of specialized equipment using this little radio set.

RCA had managed to sell the government many sets of this equipment at the beginning of the war but as a result of them not having a committed contract for the sets a shortage of parts forced the Signal Corps to order 150 sets by 1943 so that allotments could come into play from the War Assets Department. On April 15, 1943 RCA at Camden New Jersey was issued contract number W-2126 SC-1269 order number 7894-WF-43 from the US Signal Corps at Wright Field Ohio. At this time RCA had Continental Radio and Telephone Corporation start production of the sets for not only delivery portables but as a lightweight communications set to be used by ordnance spotter aircraft. The sets caught on all at once and another order was cut to be used with glider aircraft and another 500 sets were ordered on US Signal Corps Contract # W-2126 SC-2195 on June 30, 1943 order number 12062-WF-43. Equipment ordered on these contracts were "A" models and previous to this were plain models. You may even find some of the sets with the second contract number markings. Fair Radio Sales had some of the receivers and transmitters new in the box with these numbers on it a few years ago. The complete sets were in the price arena of about $500 each without the antenna but did include a microphone and headset with a kit of hardware to mount them. Standard cables were included in 10 feet lengths with connectors and lugs pre-installed so that it would mount in almost any needed situation. The excess cable would be coiled up and placed out of the way.

Very few made their way to the glider fleet as Galvin Manufacturing had managed to complete a modification of their BX-611 to fill this bill at a considerable weight saving.

This radio made an excellent portable rig as it was small and compact and would work on random length antennas. A small power supply could be easily constructed to use the equipment from 110 volts AC. Friends of mine, Robert Hough, W8ESQ and Bill Aull, W8YGL (SK) used to keep in contact with each other when on vacation and used them for Field Day in the late 1940s through 1950s.

In 1997 I decided to get myself a AVT-112 or A model to go with a AVR-20 receiver which I was using with a Ranger Aircraft Transmitter made by Electronic Specialty Company of Los Angeles California about 1940. It took almost two years to find one of these elusive transmitters and it no longer cost $12.95 but I had to pay $100 to get it. I had spent almost that again in fax costs and postage for wanted posters but to no avail. It finally turned up at the Barryville Hamfest in 1999 on the table of N4QNX who had got it from the Dayton Hamfest earlier in the year. I felt lucky to have found it. They are very rare compared to the command sets that were made by the tens of thousands.

The first portable package I had made consisted of the receiver, transmitter and a power supply mounted in a BC-375 tuning unit case with the power supply capable of working on 12 volts DC or 110 VAC by changing the power core.

I sold this little set to a ham in Martinsburg, West Virginia about 1965 and today I wish that I had kept the system, as the power transformer was really unique. I stole the idea from Gonset with their Communicator power cords changing a lot internally as well as changing the power source. The total weight of my package was about 18 pounds and I had a very small 400 cycle generator which used what I considered to be a model airplane engine. It produced 300 watts . This little generator was a screamer and you wanted a 300 foot extension cord to get away from the noise but you could carry the whole station with both hands into the field and this included a dipole antenna and a quart canteen full of gasoline.

Many hours of fun were had with this little radio years ago. I like the package so well that if another one appears at a bargain basement price you can bet I will do it again. This time I will make it to run from 12 volts DC as I have in the ready a nice DC to DC power transformer ready to go.

RCA must have been happy with this radio set as I have a letter from them from 1958 and they were still providing a lot of spare parts for the equipment at that time. This letter came with a complimentary copy of the manual and the parts list. There was also an order form to obtain parts from RCA on West Olympic Boulevard in Los Angeles, California.

Transmitter pin connections are:

1 PTT from mike jack
2 Filament voltage source
3 Microphone high
4 Supplied 12 volts to power supply
5 Sidetone control (ground)
6 Sidetone audio or ICS audio
7 Paralleled with pin 2
8 PTT relay in power supply
9 B+ approximately 320 volts
10 Ground.

The receiver connections are very simple as well and they are:

1 Filament connection to tubes
2 High voltage 250 - 320 volts
3 Filaments through on off switch
4 Ground.

Most of the parts of the system are common items of that time period and if failures occur replacements will be easy to obtain. I highly suggest that all of the capacitors in the receiver which have high voltage across their terminals be replaced. There are only about seven but this will really improve the performance and allow you to drive a well-matched speaker with audio to spare. Good luck in the world of quasi-military electronics and I hope to hear some more AVT, AVR rigs on the air soon. ER

Correction to the article "K7BDY PTT Unit Update" that appeared in last month's ER, #128

Several sharp-eyed ER readers have advised me that there was an error in the wiring pictorial that accompanied this article. The filter cap leads were shown connected across the power xfmr output leads instead of across the + and - leads of the bridge rectifier.

I apologize for the oversight and promise that it will never, ever happen again. Ed.

3-way DX on 10 Meters and a Ford V8

by Bill Rieke, K8DBN
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Although three way conversations on 10 meters are not that rare, they are relatively unique on AM and especially so if all the participants are widely separated and a DX station is involved. Recently I had the pleasure of this kind of QSO on two consecutive days.

On December 26 (1610Z) I heard Fred, KFØOW, in Grand Junction, Colorado in QSO with Fernando, EA4EAP, in Madrid. My QTH is near Cleveland, Ohio and I had the beam pointed to Spain. Since I was copying both of them quite well, I took a chance and asked Fred if he was hearing me off the back of my beam. He was, and the three of us had an enjoyable contact for about twenty minutes. After that we both said 73 to Fernando and left him to work other AM enthusiasts.

The next day, December 27 (1905Z), I heard Andy, W5QXX near San Antonio in QSO with Doug, KH6U in Honolulu. I read the mail for about 20 minutes and the signals stayed strong. I thought that this time I would have an even better chance of a three way contact since the antenna was pointed west and they were both off the front of the beam. I asked if they were able to copy me, and both were hearing me well. The three of us talked for about 25 minutes before the band began to change and both Doug and I were not able to copy Andy. However, Doug and I carried on for another 30 minutes - Cleveland to Honolulu — and had a very interesting conversation. The best phone QSO's are on AM.

EA4EAP was using a solid state rig, but the rest of us were all using vintage equipment. It is interesting that Fernando remarked how nice it would be to understand and maintain all that vintage equipment.

On both days my set up for 10 meters was an R-390A and a Johnson Ranger using a Mosley TA32 Jr. two element tri-band beam. The TA32 Jr. also has a "Boatanchor" heritage of the mid 50's. The "Jr." signifies that the traps are limited to 250 watts.

When I went off to Kent State University in 1961 (just a few years before the National Guard and the students had a small disagreement) I had a 1951 Ford V8 with dual exhaust and Hollywood mufflers. I really could not afford a car while at school. I hated the thought of selling it but when you come from a modest background and pay your own way through school, a car would be an extravagance that was absolutely out of the equation.

Unfortunately I had no offers for the car (It could have been that I didn't put it up for sale until a week or two before school started—understandable, of course, because without a car there would be no dating and besides, I loved the sound of the Hollywood mufflers).

Anyway, a few days before I left for school one of my friends offered to trade a Globe Scout 65B and the TA32 Jr. for the car. The car was worth about a $150 and it was a good trade for both of us. That was 1961.

I don't know what happened to the Globe Scout. Probably some of my younger brothers pitched it out while I was in the service since I left it in a small closet that all five boys shared. To this day they disavow any knowledge of its whereabouts.

The TA32, on the other hand, was disassembled and placed in the top of the family garage and there it stayed for 11 years until I finished college and spent some time in the Navy. It has been up at the present QTH for 24 years and at my previous house for two additional years.

I don't know what happened to the '51 Ford, but I would gladly give up my vintage antenna for a black '51 Ford V8 with dual Hollywood mufflers. ER

VINTAGE NETS

Arizona 40M AM Group: Meets on 7293 kHz at 10:00 AM MST (1700 UTC) on Sat. and Sun.
West Coast AM Net **meets Wednesdays 9PM Pacific on or about 3870kc. Summer conditions have moved the net control to California with John, W6MIT and Tom, K6AD as net controls. In the winter months Randy, KK7TV usually runs the net.**
California Early Bird Net: Saturday mornings at 8 AM PST on 3870.
California Vintage SSB Net: Sunday mornings at 8 AM PST on 3835
Southeast Swap Net: Tuesday nights at 7:30 ET on 3885. Net controls are Andy, WA4KCY and Sam, KF4TXQ. This same group also has a Sunday afternoon net on 3885 at 2 PM ET.
Eastern AM Swap Net: Thursday evenings on 3885 at 7:30 ET. This net is for the exchange of AM related equipment only.
Northwest AM Net: AM activity daily 3 PM - 5 PM on 3875. This same group meets on 6 meters (50.4) Sundays and Wednesdays at 8:00 PT and on 2 meters (144.4) Tuesdays and Thursdays at 8:00 PT. The formal AM net and swap session is on 3875, Sundays at 3 PM.
K6HQI Memorial Twenty Meter AM Net: This net on 14.286 has been in continuous operation for at least the last 20 years. It starts at 5:00 PM PT, 7 days a week and usually goes for about 2 hours.
Arizona AM Net: Sundays at 3 PM MT on 3855. On 6 meters (50.4) at 8 PM MT Saturdays.
Colorado Morning Net: An informal group of AM'ers get together on 3876 Monday, Wednesday Friday, Saturday and Sunday mornings at 7AM MT.
DX-60 Net: This net meets on 3880 at 0800 AM, ET, Sundays. Net control is Jim, N8LUV, with alternates. This net is all about entry-level AM rigs like the Heath DX-60.
Eastcoast Military Net: It isn't necessary to check in with military gear but that is what this net is all about. Net control is Ted, W3PWW. Saturday mornings at 0500 ET on 3885 + or - QRM.
Westcoast Military Radio Collectors Net: Meets Saturday evenings at 2130 (PT) on 3980 + or - QRM. Net control is Dennis, W7QHO.
Gray Hair Net: The oldest (or one of the oldest - 44+ years) 160-meter AM nets. It meets on Tuesday nights on 1945 at 8:00 PM EST & 8:30 EDT. http://www.crompton.com/grayhair
Vintage SSB Net: Net control is Andy, WBØSNF. The Net meets on 14.293 at 1900Z Sunday and is followed by the New Heathkit Net at about 2030Z on the same freq. Net control is Don, WB6LRG.
Collins Collectors Association Nets: Technical and swap session each Sunday, 14.263 MHz, 2000Z, is a long-established net run by call areas. Informal ragchew nets meet on Tuesday nights on 3805 at 2100 Eastern and on Thursday nights on 3875. West Coast 75M net that takes place on 3895 at 2000 Pacific Time.
Collins Swap and Shop Net: Meets every Tuesday at 8PM EST on 3955. Net control is Ed, WA3AMJ.
Drake Users Net: This group gets together on 3865 Tuesday nights at 8 PM ET. Net controls are Criss, KB8IZX; Don, W8NS; Rob, KE3EE and Huey, KD3UI.
Swan Users Net: This group meets on 14.250 Sunday afternoons at 4 PM CT. The net control is usually Dean, WA9AZK.
Nostalgia/Hi-Fi Net: Meets on Fridays at 7 PM PT on 1930. This net was started in 1978.
K1JCL 6-Meter AM Repeater: Located in Connecticut it operates on 50.4 in and 50.5 out.
JA AM Net: 14.190 at 0100 UTC, Saturdays and Sundays. Stan Tajima, JA1DNQ is net control.
Fort Wayne Area 6-Meter AM Net: Meets nightly at 7 PM ET on 50.58 MHz. This net has been meeting since the late '50's. Most members are using vintage or homebrew gear.
Southern Calif. Sunday Morning 6 Meter AM Net: 10 AM Sundays on 50.4. NC is Will, AA6DD.
Old Buzzards Net: Meets daily at 10 AM Local time on 3945. This is an informal net in the New England area . Net hosts are George, W1GAC and Paul, W1ECO.
Canadian Boatanchor Net: Meets Saturday afternoons, 3:00 PM EST on 3745.
Midwest Classic Radio Net: Sat. mornings on 3885 at 8AM Central time. Only AM checkins allowed. Swap/sale, hamfest info and technical help are frequent topics. NC is Rob, WA9ZTY.
Boatanchors CW Group: Meets nightly at 0200Z on 3579.5 Mhz (7050 alternate). Listen for stations calling "CQ BA" or signing "BA" after their callsigns.
Wireless Set No. 19 Net: Meets the first Sunday of every month on 7.175 +/- 5 kHz at 2000Z (3760 +/- 5 kHz alternate). Net control is Dave, VA3ORP.
Hallicrafters Collectors Assoc. Net: Sundays, 1730-1845 UTC on 14.293. Net control varies. Midwest net on Sat. on 7280 at 1700 UTC. Net control Jim, WB8DML. Pacific Northwest net on Sundays at 22.00 UTC on 7220. Net control is Dennis, VE7DH.

Nets that are underlined are new or have changed times or frequency since the last issue.

The Viking Mobile

Part One

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Introduction

Are there any readers that haven't heard the near hi-fidelity audio of the much lauded Johnson Ranger? Since they appear to be everywhere, I suspect not. What about Viking I's and II's, Valiants, 500's and Kilowatts? Surely most of these popular transmitters have graced every serious AM'ers logbook. Can the same be said about the Johnson Mobile?

As an avid Johnson collector and user, I have often reviewed the EFJ production numbers published in ER. Doing so always prompted the question, "Why have I never heard a Viking Mobile on the air?" Considering the number produced (1,837), common sense told me there should still be hundreds lurking out there however their lack of presence on-the-air (at least to me) seemed a statistical anomaly begging further investigation. As such, I set out to determine what the little Mobile was all about.

Description

If one assumed the Viking Mobile to be a repackaged fixed station transmitter design, they would be wrong. Front to back, top to bottom, this was a ground up engineering effort that specifically addressed the challenges of mobile operation. For example, the gang tuning of the oscillator, driver and amplifier stages makes for fast band changes and the novel antenna coupling circuits allow for broad frequency excursions without retuning. Additionally, the transmitter needs but a single high voltage supply, thus allowing a simple power supply. As with their other transmitters, Johnson sold the Mobile assembled, tested and aligned or in kit form.

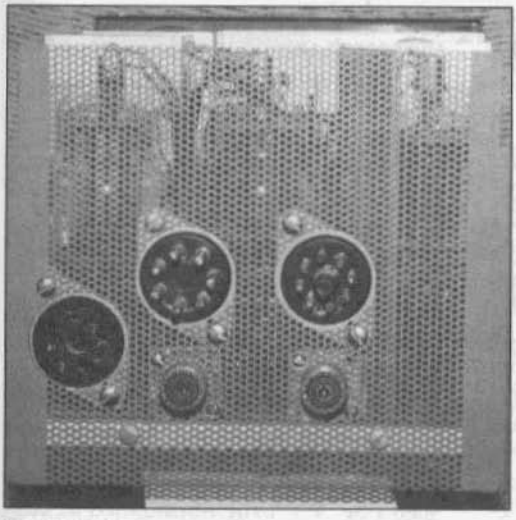
Built more for function than eye appeal, the Mobile falls aesthetically short of all but one of Johnson's other transmitters, the exception being the Adventurer. As might be expected, the front panel has the well-known maroon and grey paint scheme with light green lettering. The cabinet, which is perforated over about 80% of its area, is also grey. That said, the cabinets of my multiple Mobiles all appear to have original paint but each is a different shade and none actually match the grey of the front panel. Except for the three small aluminum knobs associated with the crystal/VFO selector, plate tuning trimmer and audio gain, the other rotary controls utilize the popular, white-pointered knobs.

At 6-7/16" high, 7-1/8" wide and 10-5/16" deep, the Mobile does not appear overly large when held under the dashboards of my '52 and '57 Bel Aires. On the other hand, when compared to the petite G-66, the success Gonset enjoyed with their twins is no surprise. With the exception of perhaps a truck, installation of a Mobile in today's vehicles would present an interesting challenge. In spite of having steel front, rear and bottom panels and a steel cabinet, the Mobile tips the scale just under 13 pounds.

Although the front panel silk-screen would have you believe the Mobile covers only 75, 40, 20 and 10 meters, the 10 meter position supports 11 and 15 meters. The illuminated front panel meter monitors the cathode currents of the oscillator, buffer, amplifier and modulator, along with the grid current of the PA. To facilitate use in right or left hand drive vehicles, the locations of the meter and the crystal/VFO selector may be easily exchanged.

The front panel controls are (left to

Front view of the Viking Mobile transmitter



Rear view

round the Crystal/VFO switch. Noticeably absent is provision for CW operation.

At first glance the rear panel appears to have more connectors than would be necessary. Upon closer inspection one finds all but three of the twenty-three pins contained in the three octal connectors have a distinct purpose. An 8 pin male brings power into the Mobile and a 7 pin male provides control of the receiver and antenna relay. Should operation with a remote VFO be desired, an 8 pin female offers the necessary power.

In addition to the 6 Volts needed for the filaments and in spite of what I said earlier about a 'single high voltage supply', the Mobile actually requires two other DC voltages; one called 'high' and one called 'low'. Since the current demand on the low voltage supply is nearly constant, the low voltage can be derived with an appropriate dropping resistor fed from the high voltage source. Regardless of origin, the low voltage supply must be capable of providing from 250 to 300 Volts at 55 to 70 mA. Any supply capable of 300 to 600 Volts at 130 to 150 mA will satisfy the high voltage requirement.

Circuit Details

The Mobile sports a different tube lineup than one might expect for a rig introduced in 1953. Frankly, I expected to see a trio of 6AU6's as in a Viking II. Rather, they have been replaced with the same number of 6BH6's, the first of which is configured as a Pierce oscillator that is electron coupled to allow frequency multiplication. On 75 meters the oscillator plate tank is tuned to 75

right, top to bottom): Crystal/VFO, Gang Tuning, Antenna Coupling, Bandswitch (the Plate Trimmer is centered, just above the bandswitch), Drive, Receive-Send, Filament On/Off, Audio Gain, Meter Selector. The phone jack for a microphone sits between the filament switch and the audio gain control. Four sockets for FT-243 crystals sur-

continued next page

meters. In the 20 and 40 meter positions the tank resonates on 40 meters and in the 10 meter position, the tank is tuned to 20 meters.

Like the Viking II, a 6AQ5 serves as a buffer or frequency multiplier. On 40 and 75 meters the pentode operates 'straight through', whereas it doubles in the 20 and 10 meter positions. Variable PA grid drive is obtained by adjusting the screen voltage of the 6AQ5 with the front panel potentiometer.

The oscillator/buffer/frequency multiplier design yields a fair degree of latitude in crystal (or VFO) choice. For example, on 75 meters one may use either 160 or 75 meter crystals. On 40 meters, crystals for 160, 80 or 40 meters are acceptable. On 20 meters one can supposedly use 160, 80 or 40 meter rocks. Because tripling is not an option, the use of 40 meter crystals won't yield 15 meters. On this band either 5 or 10 MHz crystals are required. On 10 meters the user is advised to use 40 meter crystals, although 80 meter units are reported to work in some cases.

As with many rigs of the era, an 807 serves as the PA. Protecting the 807, should the stage lose its RF drive, is a negative bias supply provided by a circuit not typically found in amateur transmitters. Additional bias is provided by the grid current that passes through the 10K grid resistor. The manual admits the PA is operated with less grid current and bias voltage than the manufacturer suggests but states that these variations were found to provide the most efficiency considering the wide voltage range over which the Mobile is specified to operate. A screen dropping resistor, the value of which is chosen based on the available high voltage, feeds the screen from the secondary of the modulation transformer in an attempt to achieve 100% modulation.

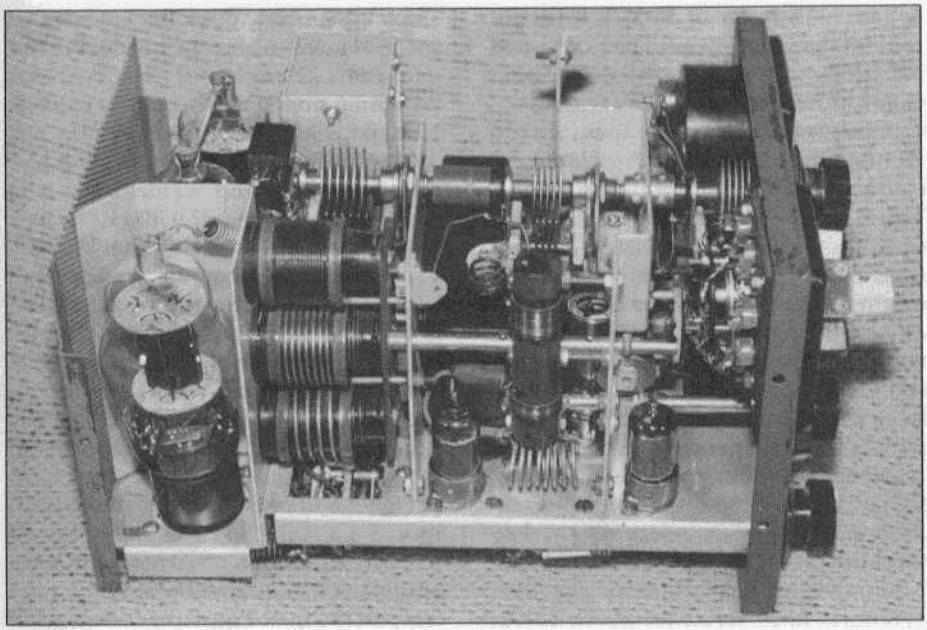
The gang tuned main and the plate trimming capacitors resonate one of three DC-fed tank coils. Each of the three tank coils has an associated concentric coupling coil, the proximity of which is adjusted axially by the front panel coupling control. One tank coil spans 75 and 40 meter operation, a second serves on 20 meters and the third covers 15, 11 and 10 meters. Intended for mobile operation, the output coupling circuits, which consist of a coil and a series capacitor, were specifically designed for the somewhat lower impedances one sees looking into a typical mobile antenna through 15 feet of 50 ohm feedline.

As with Viking I and II modulators, the Mobile also uses a AB1-biased pair of push-pull 807's. These are transformer coupled and driven by another 6BH6. A third RC-coupled 6BH6 forms the speech amplifier. Use of either a crystal, dynamic or carbon microphone is allowed. When a carbon mike is used, the required DC current for the microphone is actually the cathode current of the speech amplifier and the gain of the speech amplifier is much reduced by component changes.

One of the more intriguing aspects of the Mobile is its bias supply. In support of the single supply premise, one half of a 12AU7 forms a 4.5 MHz Hartley oscillator. This RF is rectified by the other half of the dual triode before it is filtered and distributed to the 807 final and modulators and the 6AQ5 buffer.

Supplying Power

A Mobile buyer had several power supply options available. Although E.F. Johnson offered two turn-key supplies (6 and 12 Volt versions), I have never seen one. With the abundance of surplus dynamotors available after the war, I suspect most operators opted to build their own supply. Along that line, Johnson also offered a dynamotor base assembly that would accept the popular PE-103 or its equivalent. All three of these supply foundations contained the heavy duty relay required to control current flow to the dynamotor. They also housed the required voltage drop-



Side view of the Viking Mobile

ping resistor/s, provided fusing and had large terminals for attaching cables to the battery. Another option was to build or purchase a vibrator type supply although Johnson never offered one.

Sorting out the seemingly endless ways to connect power to the Mobile was more difficult than understanding its simple RF and audio circuitry. This difficulty stems from the wide high voltage range the transmitter accepts and that certain installations might use transmitter power for the receiver (in most cases a converter) while others might borrow power from the receiver to provide the low voltage requirement of the Mobile. Adding to this complication are choices concerning how to power a remote VFO and whether or not to power the Mobile's oscillator stage for increased signal strength in the receiver during the tune or zero beat mode. Since I suspect most readers will not likely use a Mobile 'mobile', I'll leave further mobile power supply study to those readers intent on recreating the early 50's in motion.

Restoration and Initial Operation

With four Mobiles gathering dust and needing restoration, I certainly did not lack study nor work material. I decided to restore the next-to-the-best looking one first, hoping it would prove worthy of driving my Thunderbolt. If I could get one Mobile to play well then I would take on the others. Wouldn't you know it, shortly after I began my search for information beyond which a manufacturer normally provides, a 'parts rig' was offered to me at an irresistible price. Now, faced with five examinees, this examiner was ready to get busy.

As usual, any rig that's been mobile is worse-for-wear than one that 'dodged' that bullet. This postulate applies to my quintet. Seemingly random holes of varying size and having no apparent purpose dotted four of my five cabinets, bearing witness to earlier molestations. I found it amusing that the recently received 'parts rig' was the only one whose cabinet had no non-original holes. As I was more concerned with how Mobiles perform than how they

continued next page

appear, the tasks of hole filling and cabinet repainting would be postponed until long after the electrical and mechanical restorations were complete.

Before I abandon appearance I should mention that three of the five front panels of my Mobiles rate an eight or above. The exceptions are one that looks as if it served as a door stop at beachfront bar for the last thirty years and another that might rate a three or four by the visually challenged. Since I doubt anyone is waiting in the wings to repaint and silk-screen Mobile front panels, I can only hope a couple of real parts rigs or front panels find their way to my door as a result of this article. Otherwise my worst will ultimately end up with a solid maroon panel with white lettering and so might another.

Removal of the cabinetry revealed my units bore serial numbers 50191, 50637, 50685, 50839 and 51121, placing them in the first three of nine years' production. Henceforth I'll refer to them as #1 through #5, respectively. All but #3 were wired for a carbon microphone. Except for #4, which had apparently been the rig of a 6V die-hard, all the Mobiles had been converted to 12V operation with wiring and, in one case, tube changes. That #4 was the next-to-the-best looking transmitter and that it was also the only one wired for 6V operation seemed no accident since the 300V power supply I intended to power the rig with only had 6V available for the filaments.

The first item on #4's agenda was to exchange the four paper capacitors with new polyester film replacements. Thinking a .001 uF was on the small side for coupling low frequency audio to the 1M ohm grid leak of the audio driver stage, I increased its value to .047 uF. A pleasant surprise was finding that none of the micas were leaky even though three have high voltage across them during transmit. Being frugal, I contemplated trying to reform the dual 15 uF electrolytic but I abandoned that route for want of a more reliable rig, using new 22's as I was fresh out of 15's. About a dozen resistors that either started life high or drifted up more than 10% were replaced with new ones. After the resistor replacement the next step was to connect the 807 PA screen resistor array to provide the 5K Ohm value specified when using a 300 Volt supply. Since this example will serve in my shack with a squeeze-to-talk D-104, I configured the speech amplifier accordingly, opting for a 5.1M ohm microphone load resistor instead of the called-for 1M. After a thorough cleaning, lubrication and treatment of the switches and pots I made a few continuity and short checks before applying 6V to verify correct filament and pilot lamp operation. With the tubes and the pilot lamp in the meter glowing, I connected the 300V supply. This is when the fun began.

With a 3835 crystal installed and the rig in the 75 meter position I connected the high voltage. Let's just say I quickly discovered #4 was fraught with major problems, not the least of which was that it appeared to have been built by an intellectually challenged individual. For example, there was a missing contact on the final bandswitch. While this was not the builder's fault, because of his mis-wiring, a fixed padding capacitor that is required on 75 meters remained connected on 40 meters, preventing the tank from ever resonating on that band. Had this problem/mistake not been present, the rig would never have worked on 40 meters anyway, for another capacitor that was supposed to be switched in series with the link coupling on 40 meters was also missing, thus creating an open link. Another serious problem was that the bandswitch shaft was mis-oriented by one position causing the oscillator and buffer switches to be in their 40 meter positions when the final switch was in the

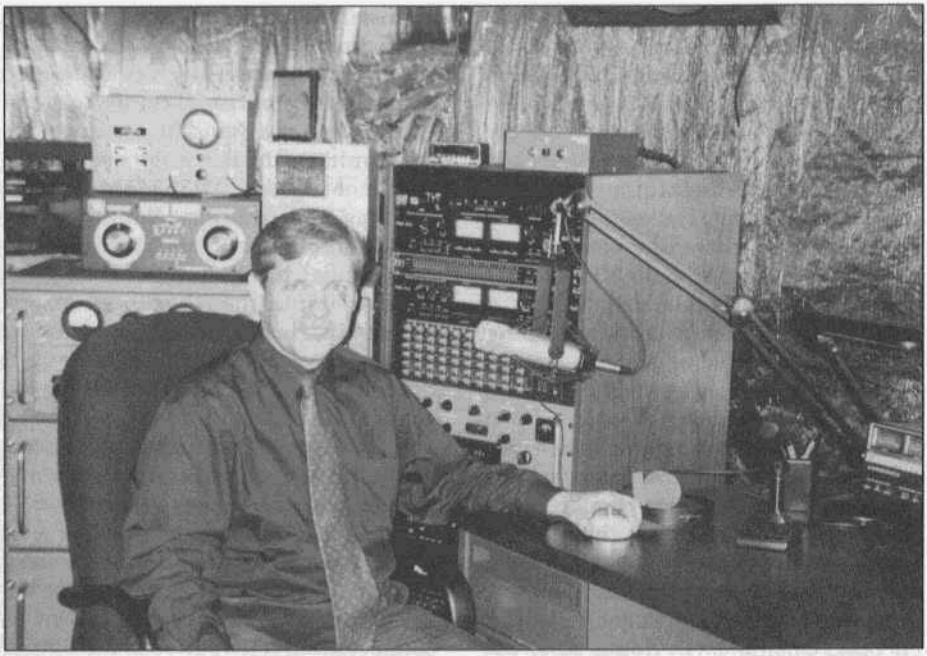
80 meter position. Of course the other bands had similar offsets. Also missing was a padding capacitor and de-Q'ing resistor required for 40 meters that would have prevented the rig from ever being aligned on 40 meters. The bottom line is that it is doubtful any RF ever came out of this rig. That being the case, I wonder why the front panel edges were so scratched and why the cabinet had all those darned holes!

In addition to these show-stopping problems, I discovered several components and wire connections that were either never soldered or soldered so poorly that they may as well have never been touched by an iron or gun. After resoldering nearly every connection in this Mobile and installing the missing components, which included adding the missing contact on the final bandswitch, I eventually managed to get RF out in all band positions. In doing so it became obvious that, without an alignment procedure, getting the three stages to track each other from band edge to band edge and from band to band was going to be extremely difficult. While discussing this project with KØEOO, Dennis offered to make and send a copy of his assembly manual which contained the rather complex alignment procedure. I hoped this manual would be more accurate than the Operating Instruction Manual, which I found to contain numerous errors and deletions.

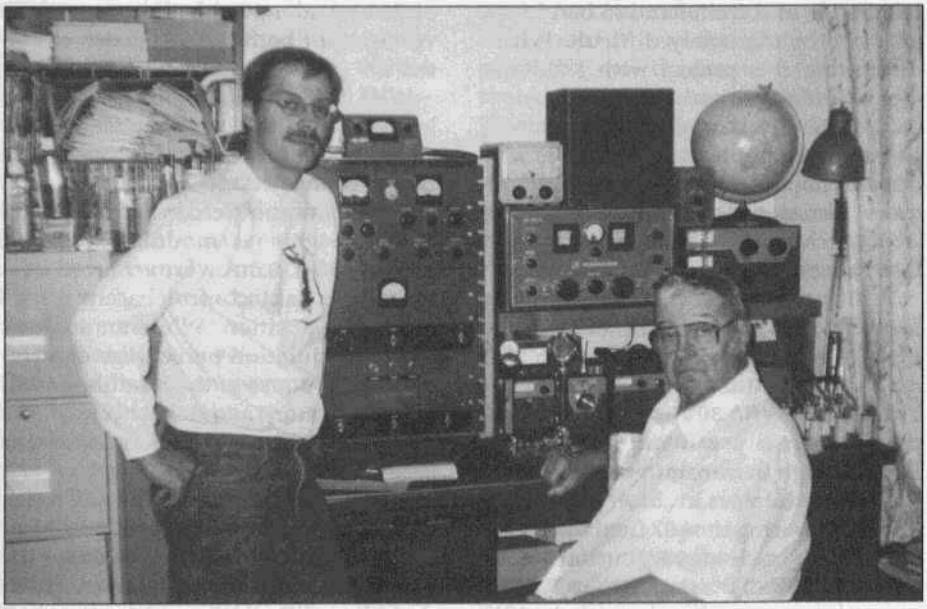
While waiting for the assembly manual to arrive, I tackled another problem—the bias supply. Although the manual states the supply should provide from 20V to 30V in the tune position, it actually put out about 63V. Equally high in transmit, this bias held the 807 modulators in cutoff. Additionally, discovering the 807 final bias to be nearly 100V made me very curious. How could the 25V of bias created by 2.5 mA of grid current passing through the 10K grid resistor of the 807 final sum with the 63V from the bias supply to equal almost 100V? Thinking something was fishy, I monitored the bias voltage and discovered it varied significantly with changes in grid drive to the 807. In light of this variation and the excessively high voltage, I elected to install a 36 Volt zener diode (1N4753A) to stabilize the bias voltage, regardless of variations in oscillator tube condition, supply voltage or grid drive. This addition seemed simpler than the procedure recommended in the manual of moving the oscillator coil tap points to adjust the bias voltage. Before installing the zener I observed the behavior of the bias voltage with a varying resistive load and determined the source resistance of the bias supply to be about 3K ohms. This value, along with the 4.9K ohm load of an existing voltage divider network, was sufficient to limit the zener current to under 10 mA when it was connected directly between the output of the supply and ground. I am happy to report this modification yielded the recommended modulator idle current of 24 mA along with the proper bias voltages for both the 6AQ5 driver and the 807 final.

With the modulator tubes content I loaded up the rig on 75 meters using a 40 Watt bulb for a load, this time with a D-104 connected. It was immediately apparent the audio chain had more than adequate gain as modulator current peaks of 90-110 mA were achieved with the audio gain control barely off its minimum position. While an analysis of the modulation percentage and frequency response of the modulator will be done later, a quick check of the Mobile's audio on a shack receiver was acceptable.

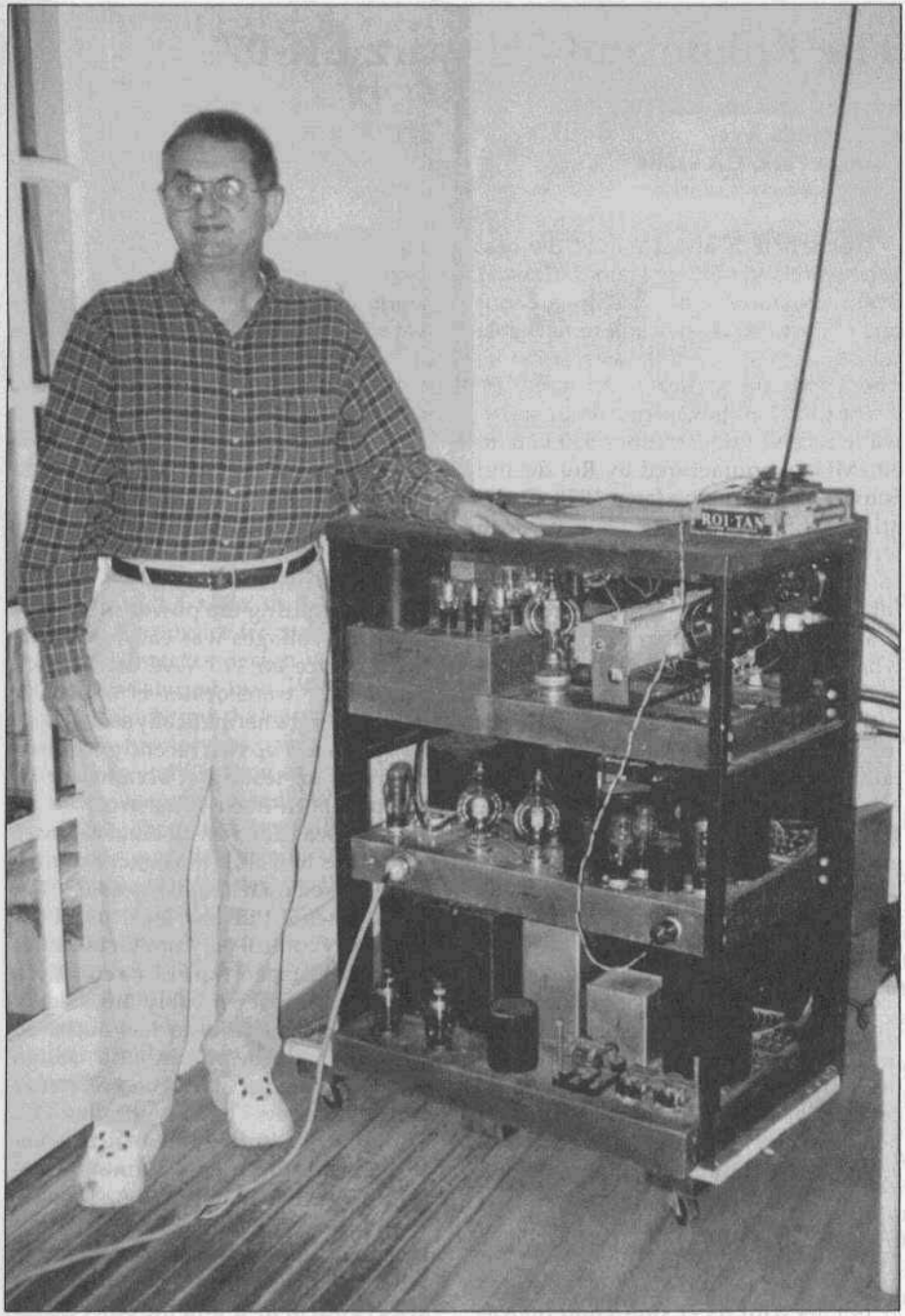
In Part Two of this article I will touch on the alignment procedure, detail and critique the Mobile VFO, describe the use of the Mobile with Johnson Thunderbolt and Courier amplifiers and offer my candid opinion of this lesser known transmitter. ER



Bruce Howes, KG2IC, in his hamshack. L to R: B&W T-368 xmtr; B&W ME-163 dummy load/SWR bridge, Nye-Viking tuner, Collins R-390A (in rack), audio processing gear (all ART). The mic is an Electrovoice RE-20.



Ron Ostman, WØNYQ with his father Bob, WØBQV in his vintage station. They had the Globe King on the air for the 15-meter jamboree back in October.



Gary Willey, W4ZXS with a BC-610 he is in the process of restoring. The modulator chassis is in the center (note the 100THs with filaments lit) and the final with the 250TH is on the top.

The Rohde and Schwarz EK-07

by Alex Samson, KE6VKJ
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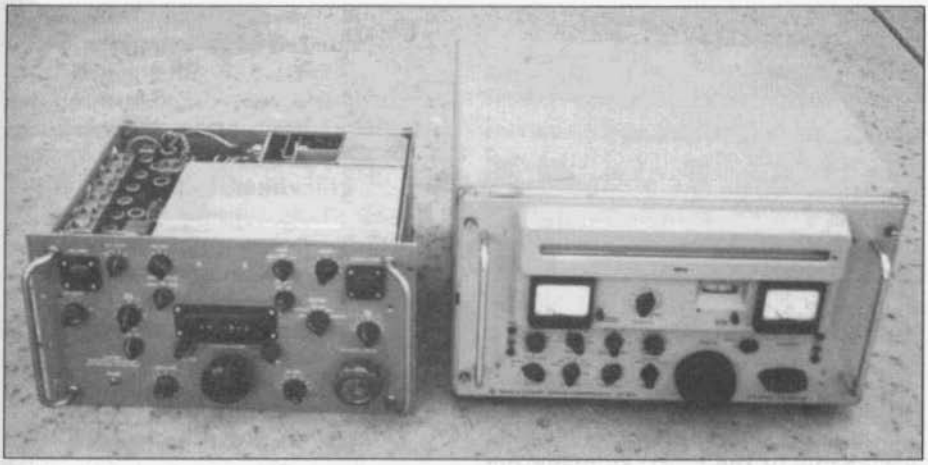
This article is about one of the best kept secrets in vintage Ham Radio and SWL enjoyment today. This is about one of the most elusive and remarkable tube-type shortwave radio ever made. The Rohde and Schwarz EK-07.

The EK-07 is a general coverage shortwave receiver which tunes 500 kHz to 30.1MHz manufactured by Rohde and Schwarz of Germany from 1958. Operating an EK-07 today will leave you with the impression that older may sometimes be better! The specification for this receiver was most probably drafted by the German Armed forces who was using NATO Collins equipment (among others) during the mid-fifties. The unique conditions prevailing in Europe because of the iron curtain created a need for a receiver that was different from anything else that was available at that time. Among several requirements was a need to listen deep beyond the iron curtain for weak signals whose frequencies were deliberately set beside powerful western European broadcasts. Careful manual scanning of extensive spans of frequencies needed to be performed continuously. Only a very limited quantity were needed. Cost, size and weight was of no concern, operator convenience, ultimate performance, and engineering excellence was the fundamental requirement.

When looking at an EK-07 for the first time, its weight and size will catch your immediate attention. This receiver is heavier than a Collins 32V weighing in at 146 lbs with its 27 tubes and no less than 50 solid state diodes. In size, this receiver is about double the volume of an R-390. When placed beside an R-390, the picture looks like a Tiger Tank parked beside a Sherman Tank. There were only two colors produced that I have seen, Olive Drab and Grey. The color did not indicate Army and Navy, the receivers were used in the different services regardless of its color. The receiver was also offered by Rohde & Schwarz to the commercial market and those receivers were exclusively colored Grey although I suspect that very few were sold to the commercial market due to its price tag.

Reconfiguring the power supply for local AC voltages was easy, one even has a choice for 115 VAC or 125 VAC The power transformer is unusually large and not a hermetically sealed unit. As I powered up two recently acquired receivers for testing, it became apparent that both need some work. One receiver was dead on all bands above 6 MHz due to a PLL malfunction (they were picked up in Germany as-is). The EK-07 uses a PLL for local oscillator frequency control very similar to a modern PLL. I suspect the PLL circuit in the EK-07 was most probably initiated by Dr. Ulrich Rhode who has authored several manuscripts on PLL design many of which are still good reference material today. A very similar PLL design was described in an article entitled "An Engineers hamband receiver" published in 1960's ARRL publications except that the ARRL article was about a fully solid state implementation. The PLL on one EK-07 was always out of lock and the other EK-07 was out of lock on some bands only. Imagine how this was implemented with tubes!



The EK-07 and an R-390.

Frequency stability of the PLL is based on a mix between the fundamental from a variable LC master oscillator which tunes from 3.4 MHz to 6.4 MHz and selected harmonics from a TCXO. It is rumored that the design work on the EK-07 was started from WW II in 1945 during which time the Germans already had some prototypes using the PLL for frequency stabilization as part of their wonder weapons arsenal. When examining the schematics, one will notice the immense quantity of adjustable components used in the design. There are 36 trimmers and 12 slugs in the local oscillator section and there are an additional 36 slugs and about 100 trimmers in the RF front end! And there are many more trimmers and slugs in the PLL unit itself and still more in the IF sections and elsewhere.

The EK-07's PLL has an ability to lock only within a 250 kc offset in the local oscillator (VCO) and this is rather dismal by modern standards. In order to work around this limitation, the local oscillator is also tuned by a section of the tuning capacitor together with the front end circuits and the master oscillator as one tunes across a 3 MHz span of each band with a multi-gang tuning capacitor. Over an entire tuning span, the local oscillator may deviate from correct tracking in frequency and the PLL will adjust its frequency back to target via an AFC circuit. The oscillator should never have an offset of more than 250 kHz from its target frequency otherwise the PLL will loose lock. Once an unlock condition exists, the PLL will continuously sweep its AFC line at 60 Hz causing reception to become impossible until lock is acquired (if ever). With a healthy PLL, all this business is completely transparent to the user.

If the PLL module ever needs to be repaired or aligned, chances are it is going to be very difficult to service. Many of its adjustments and test points are not accessible. The module has to be removed from the receiver to access the service points underneath. I used a home made extender cable using spade lugs to allow me to test the module outside the receiver. It seems to me this module was originally aligned and tested in a special test jig and when connected to a host EK-07, no more adjustments are to be made. Any problems with this module simply dictated replacement. My Rohde & Schwarz "Maintenance and Service" manuals of both German and English versions do not supply any alignment procedure

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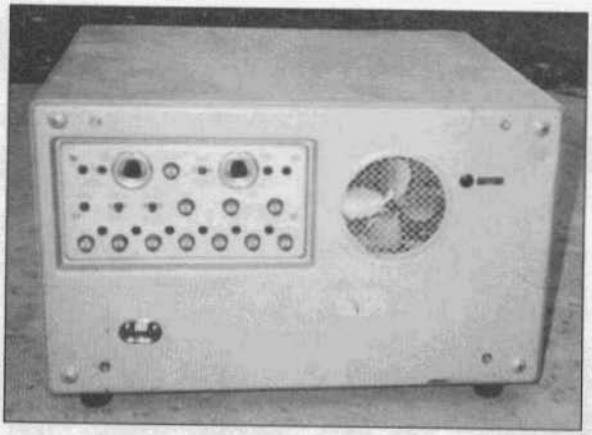

Back panel of the EK-07 showing the exhaust fan and various access jacks. The AC jack is at the lower left. The large round connectors are for audio.

for the PLL other than a basic "how it works" description and some frequency facts. Documentation is a very far cry from what is commonly supplied by Collins for example. There are no illustrations that show you how a particular module or component looks like or where they are located and assumes you already have a good deal of knowledge about the EK-07. Apparently, this service manual is not intended for a general audience and given the complication, I think the implied method of repair was to send the receiver or module back to the factory. If one has enough expertise and resources (or desperation!), the given information is sufficient to perform repairs and with modern test equipment, it can actually be quite fun.

The front end uses two independent LC circuits in tandem before the single RF amp followed by one more LC circuit going into the first mixer. Above 6.1 MHz, reception is a double conversion with a fixed first IF of 3.3 MHz. The 1st conversion oscillator is a VFO stabilized by a PLL while the 2nd conversion oscillator is an xtal oscillator. From 3.1 MHz. to 6.1 MHz, single conversion is implemented to 250 kHz using the PLL's master oscillator as the conversion oscillator itself. Below 3 MHz, the conversion oscillator is a straight VFO with no PLL control. IF image rejection is specified by Rohde and Schwarz as better than 70 dB below 6 MHz and better than 80 dB above 6 MHz Given this company's reputation, I suspect the actual figures are much higher than they claim. Stock IF selectivity is implemented at 300 kHz using two sections of four loosely coupled LC circuits in tandem and one tube stage to compensate for insertion loss. I had to physically inspect the selectivity circuits on one EK-07 because there was some malfunction. When I opened the selection-filter covers, I was so surprised by what I saw that I felt the urge to quickly put the covers back on immediately to prevent any of the parts from escaping. This circuit alone has sixty (60) air-dielectric trimmer capacitors all crammed together inside two small shielded boxes plus 4 more trimmers below deck. The trimmers looked like people staring at me from the grandstand of a Dodgers game as I walked to the batters plate. The 300 kHz inductors are fixed inductance types wound inside self-shielding pot cores making them very small and compact. The bandwidth selector switch is a geared rotary having 20 poles and is about 10 inches long. Construction and design appear top quality. In the two narrowest bandwidth settings, identical crystal filters are switched in at both sections. There is surprisingly negligible "ringing" when receiving CW with the narrowest bandwidth of 300 Hz. Skirt selectivity is very good at all bandwidth selections. The narrowest bandwidth setting is marked as +/- 150 Hz, which means a 300 Hz bandwidth.

Widest setting is marked +/- 6 kHz which means a 12 kHz bandwidth. When aligning this circuit, the response curve of each bandwidth setting can be adjusted without affecting the response curve of the other selectivity positions. This is because each bandwidth setting has its own complete bank of trimmer capacitors which are not shared by other bandwidth settings. I found this circuit a lot of fun to align using a network analyzer and I noticed good steep skirts in the response curves. Following the selective circuits are three 300 kHz IF stages then a diode detector. There is also a 2-stage AGC IF amplifier which drives an AGC diode that produces negative AGC voltage for the receiver. Attack times are automatically altered when switching the BFO on or off. A front panel switch allows selection of 0.1, 1, and 10 second decay times.

An optional selectivity module was available in place of the original selection filter module. This optional module uses two internal mixers that could offset the passbands of two fixed IF sections against each other in order to adjust the bandwidth continuously. A tuning capacitor is used instead of a rotary switch for continuously variable bandwidth selection. The manual describes this module in detail although I have not seen an EK-07 with this option.

Reception of SSB signals with a stock EK-07 is poor compared to a 75A-4 for example. Like the R-390, an optional external SSB detector is required for decent performance. The detector employed in the EK-07 when the BFO is ON is a single diode detector because this receiver was not intended for SSB reception (encrypted military traffic is never sent out on voice!!). I noticed that one EK-07 has a 6BH6 product detector installed into it by a previous owner. To adapt another EK-07 to its new occupation as a Ham receiver, I installed an MC1496 product detector to it. I find AM reception to be very good with the stock detector. A 1950's noise limiter is standard and I am intrigued to see that the EK-07 and 75A-4 share virtually identical noise limiter circuits. Operating characteristics are like a cross between an R-390. and an SP-600.

Bands are 3 MHz chunks above 3 MHz Tuning is via two concentric knobs like an SX-42. Above 3 MHz, the inner tuning knob tunes 230 kHz per knob turn while the outer knob tunes 23 kHz per turn. Below 3 MHz, the tuning rate is at least 3 times slower requiring more use of the spinner crank which is attached to the inner knob. The two knobs are geared together at 10:1, when you turn the inner knob, the outer knob spins by itself ten times faster. I find this system extremely effective, as you have two knobs with two different tuning rates readily accessible without having to move your hand from the same knob or pressing a menu button to select an alternate tuning rate. As you turn either knob, a vernier scale above the tuning knob turns slowly. This vernier scale is shaped like a drum and its entire circumference is calibrated at 500 Hz increments spanning a full 100 kHz over 360 degrees and this can be viewed from a small window in the front panel. This 100 kHz vernier scale is geared to the linear logging scale above it which spans a 3 MHz range or a 30:1 ratio. I find the vernier scale hard to read because it is small and consequently its numerals are small.

Audio fidelity is very good with its single EL84 audio output tube providing 2 watts to a fifteen (15) ohm speaker impedance. Audio hum simply does not exist even with all filter capacitors still original on both EK-07's.

It would be very interesting to compare the EK-07 on a one to one basis with the R-390. Hams tend to compare the two receivers because they were the ultimate tube type HF general coverage receivers designed and produced dur-

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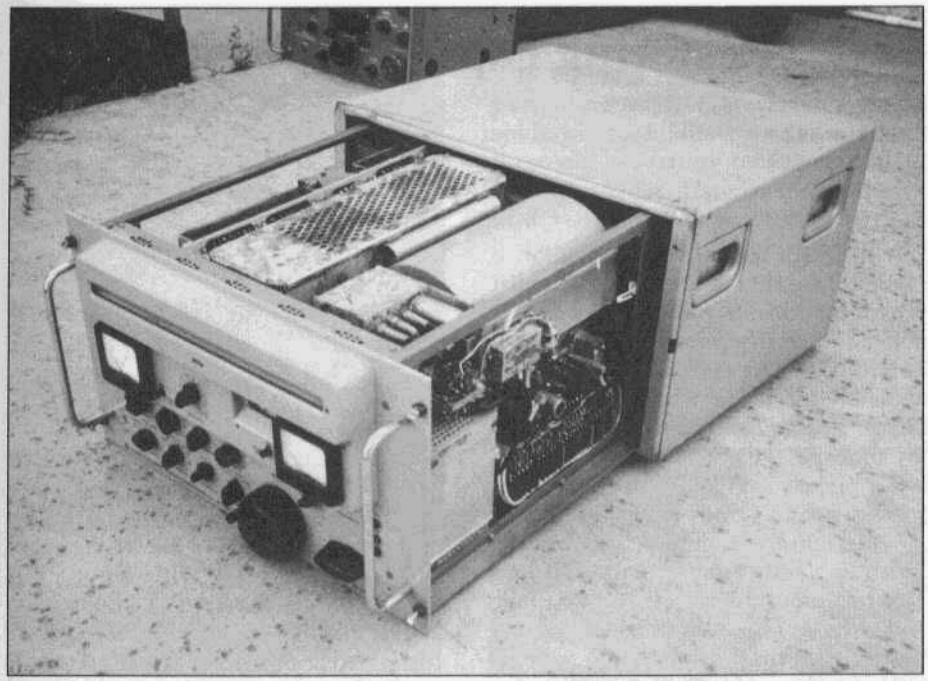
ing the 50's from two countries. However, one has to understand that these receivers were designed to meet very different requirements and therefore provide very different operating characteristics on purpose, having nothing to do with whether one is a better design than the other. In fact, the EK-07 was never intended to function as a communications receiver and it was never deployed as such! There were other receivers (such as the Siemens E311 which has a mechanical-digital readout) deployed for that purpose. For this reason, the closest receiver of comparison to the EK-07 is actually the Racal RA17 and its variants, not the R-390. It is interesting to note that these three receivers from three different countries all used three very different methods of securing frequency stability. The EK-07 with its Phase Lock Loop, the RA17 with its Barlow-Wadley Loop , and the R-390. with its bank of xtals to produce the desired frequency mix.

For my personal operating habits, I much prefer the EK-07's performance but I prefer the R-390's size and weight, and the RA17's construction. I find the R-390. more suitable for fixed frequency operation due to its tuning knob resilience and rate making it very easy to "dial-in" to a given frequency with its odometer. I find the EK-07 more conducive to eavesdropping around a span of frequencies with its fine-tuning knob which feels so free and smooth, no backlash, and virtually identical to the tuning feel of a good modern Japanese radio like a JRC or Yaesu. To the unfamiliar, the EK-07's tuning knob appears to be broken, the knob does not feel connected to anything because there is virtually no perceptible resistance to turning. I find this remarkable because the two EK-07's I examined show no evidence that their tuning mechanisms have ever been serviced or cleaned and yet maintain that level of mechanical precision we have come to expect from top-quality German made machines. On the other hand, if your R-390. breaks, you can fix it. The EK-07 could become a very different story. According to personal accounts of people who used the EK-07 during its time, this receiver had a reputation for being extremely reliable. But the EK-07 has gotten very old today and is already way beyond its life expectancy. When it breaks down, it may not be fun to fix and I think this pushes the "hobby" appeal too far for most of us. Also, I think many hams will not have desktop space for an EK-07 due to its size not to mention that you are going to need help every time you need to move its 146 lb mass.

Frequency stability for SSB and CW is top quality for its vintage. I can detect a barely perceptible fraction of a HZ of PLL jitter. Users will never notice this jitter even on CW and I noticed it because I was looking for it. Jitter is a common ailment of a PLL and when combined with other PLL maladies, the total sum becomes what is commonly referred to today as "PLL noise". The PLL master reference oscillator is inside a hermetically sealed enclosure probably designed by the same people who produced the battleship Bismark. At the back of the receiver cabinet is a small inaudible fan which spins just fast enough to exhaust some warm air. There is a lot of steel and cast aluminum in the construction of this receiver. A lot of steel is used where rigidity is important. Unlike the aluminum monocoque-style chassis of the R-390, the EK-07 uses a steel frame made up of angle bars probably welded together and burnished smooth (or maybe cast?). There are silver plated machined metal (brass?) cavities for several LC circuits. All the modules are built on fully silver plated metals. Unfortunately, since silver tends to tarnish with age, there is a lot of discoloration in the finish at most places in sharp contrast to how the yellow chromate finish on an R-390's alu-



EK-07 partially removed from cabinet.

minum components maintain their clean appearance with time. The LC circuits for the RF front end plus local oscillator is assembled into a rotating turret which is mounted inside a massive 2-piece casting and the entire assembly is floating on rubber mounts. There are roller chains with automotive-looking tensioners and gears all over the unit. Tiny ball bearings are used in the tuning shafts. Knobs that control rotary switches are fastened to their shafts with long bolts that pass through threaded holes in the shafts making a loose knob virtually impossible. The band switch feels "good" and very solid when you flip the elliptic knob from band to band (like a Getrag transmission!). When you select the highest frequency band (30 MHz), one more clockwise click and you are back to the lowest 500khz band.

An unusual feature of this receiver is a multi-position rotary switch with multimeter on the front panel for internal diagnostics. At the flip of this switch, one may check 22 specific parameters such as B+, Regulated B+, Oscillator output, PLL performance, AGC performance, individual IF stages, RF stage, and many more. The dedicated multimeter has an area marked in the scale where readings should fall into much like a tube tester multimeter. At some test positions, specific tube emissions are actually measured. In other test positions, overall stage or system performance is measured. This was very helpful in diagnosing problems with the receivers. I think an experienced EK-07 technician can probably tell which specific components are bad or out of tune just by looking at the behavior of the readings. Given this experience, I suspect the EK-07 is actually very easy to diagnose and repair under the hands of such a technician. In fact, our counterparts in Germany might state that an R-390. is much harder to repair! Not all tubes are directly tested

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Restoring Paper Capacitors

by Ray Osterwald, NØDMS
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A little while back an acquaintance asked if I would restore his 1940 Zenith broadcast console radio. I guess he'd noticed my office photo of a backlit '36 Zenith dial! I have done this work on occasion for those who are not in a hurry, and he assured me I could take my time. So, we reached an agreement and I picked up the old receiver for a trip home and some restoration work.

When I do one of these I try to leave as much as possible in original condition. I try to either find original brand tubes and parts, or repair the originals as necessary. One time I rewound a burned out broadcast band oscillator coil and it was kind of like do-it-yourself brain surgery, but I got through it. Unless stronger restoration is absolutely necessary to prevent further deterioration, I only clean off surface dirt from the cabinet and chassis. I try to preserve the ambiance of the old set by not washing away the factory ink inspection stampings or part numbers. I leave old repairs alone if possible; that's part of the set's history. Corrosion is removed, but only as much as is necessary to prevent continued degradation. From my point of view, nothing looks worse than a vintage chassis where someone has rudely replaced an old wax paper capacitor with a piece of plastic. This article shows how I get around this problem by repairing bad paper capacitors. There are other methods to visually reproduce postage stamp micas and molded paper capacitors, but this will be the subject of a future article.

A few things are needed to get the work started. The main ingredient is beeswax. Don't try paraffin wax as used in canning because it's the wrong color and is hard to work with. I got a big chunk of beeswax from a honey producer, but I've seen it for sale in craft stores and hobby shops. You don't need much. I've got about 5 pounds worth and that's probably a two-lifetime supply. Also required are a new single-edge razor blade, steel straightedge, and an old styrene foam meat tray from the store. Get a couple of small aluminum cat-food cans, an egg carton, and an old dinner spoon and you're in the capacitor business.

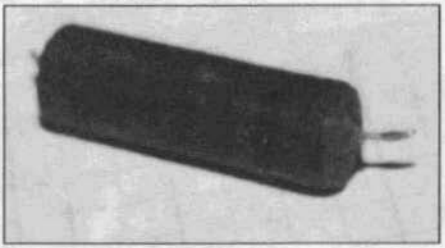

Figure 1.

Figure 1 is a picture of the first capacitor to be restored. This was taken right after it was cut out of the chassis. It is a screen bypass on one of the IF amplifiers. I always leave long pieces of the original leads in place so that I'm sure where it came from if I get interrupted and can't finish everything right away. It is also important to follow the original component routing. While one is able to crank rebuilt capacitors out like a production line, it is better to do them one at a time so that the original component layout and wiring layout is preserved. This is important in these old broadcast receivers. They are not communications quality, and were built to meet a certain production cost. The

Figure 2.

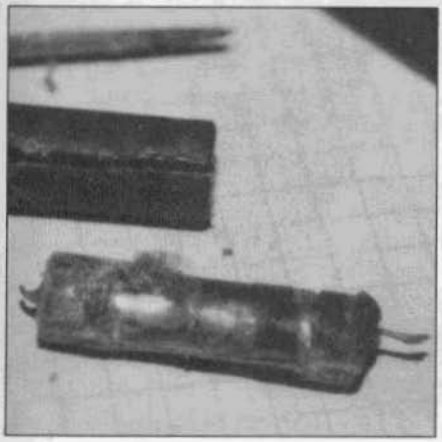

Figure 3.

designers arranged all of the components and wiring so the thing would work!

To get started, fill one of the aluminum cans with hot water and get it boiling. While you're waiting for the boil, take the razor blade and slit the paper core on the side of the capacitor that you don't want to show. I usually cut right above the part number or possibly on a section with no writing. Grip the end of the cap with pliers, as show in **Figure 2**, and quickly dip it into the boiling water. This loosens all of the wax on the inside that holds the core in.

In Figure 3, the old guts have been pushed out with the rounded end of a soldering tool. Sometimes the ends of these old capacitors have been sealed up with shellac. Usually it's not much of a seal, but if the old core is tight inside the cardboard tube, dip each end back into the boiling water until the core pushes out. Don't leave it in the boiling water too long or the cardboard will disintegrate. Save all the old bits of wax. They can be added to your wax pot so the color comes out looking old.

Figure 4.

Now we are ready to add the new parts. First, run a thin bead of white glue along the cut and hold the repair together with a tie from a bread sack. (Figure 4) While this is drying, press the ends of the cardboard capacitor tube into the styrofoam container to form a circle. Then cut out the two circles of foam, which are used for new end supports. This is shown in Figure 5. Push the new capacitor and the new ends back into the old tube and wait for the glue to set.

continued next page

Figure 5.

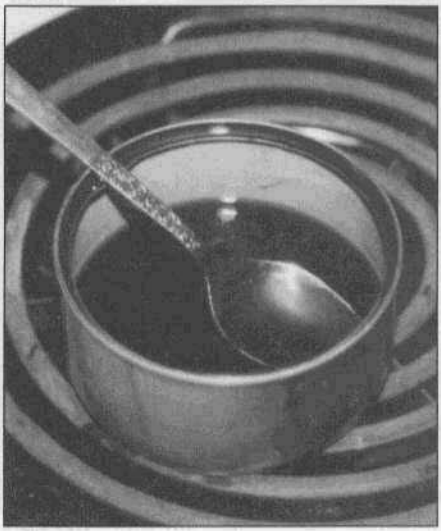

Figure 6.

While you are waiting for the glue to set, melt down the beeswax. BE CAREFUL! MOLTEN WAX IS FLAMMABLE AND THE STOVE IS A HEAT SOURCE! Use only enough heat to just melt the wax because you want it to set up quickly after it is poured into the core. Figure 6 shows the melted wax container. I leave the spoon in the wax pot when I am done, ready to go for the next time.

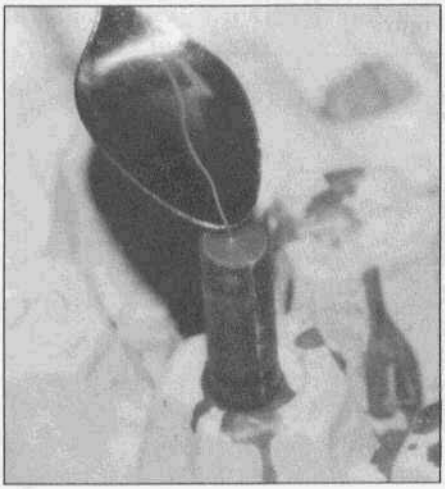

Figure 7.

Figure 7 shows the capacitor standing up on the egg carton. Carefully pour in enough wax to fill in the ends, leaving a rounded blob of wax around the component lead wire. The wax should be only hot enough to just melt, and it may run down past the foam seal. If this happens just let it cool. The wax will seal the cracks and the next pour finishes the job. Wait until the wax is completely hard, and then do the other end.

The last picture has shown the rebuilt capacitor replaced in the chassis. I set

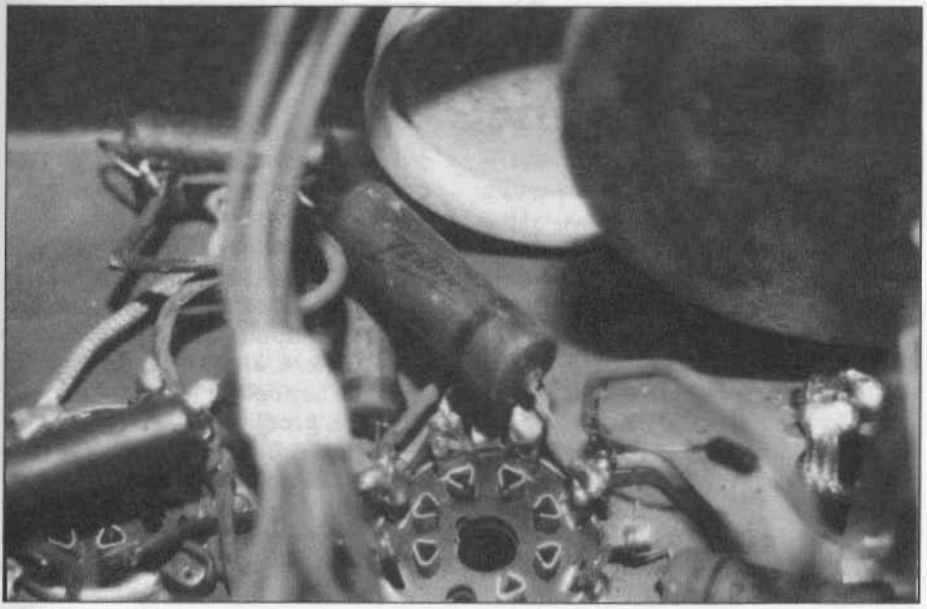

Figure 8.

the part in there for the photo. Later on, the original "spaghetti" insulation was added and the leads were properly soldered. After it gets a little dirty it can't be told from original by a casual glance.

This is just a generic production line Zenith capacitor, If you've got a set with some really nice capacitors with advertising art on the cores, like the old Sprague 600 Line, or Grey Tigers, now you can continue to enjoy them while the modern parts inside do their thing. In fifty or sixty years, a whole new generation will be able to see what vintage electronics was about. As mentioned above, a future article will go into ways of reproducing postage stamp capacitors and molded paper capacitors. Keep those filaments lit! ER

AMI January 2000 Update from page 3

of those in the old slide show are now SKs. On the bright side, there are many new calls associated with AM now. Action Required: Send a picture(s) of you and your Year 2000 shack to AMI Headquarters. The best pictures will have you standing next to, or operating your equipment. Static pictures of AM gear, with the possible exception of homebrew are pretty sterile. Make sure you are in one of the pictures with your gear. Use a camera with a wide angle lens if possible. (Some of you have such big transmitters in such small rooms that you can't take a complete picture of it with a regular lens!) If you have something notable in your shack or about your station or your station location, try to get it in the picture, or at least in a little write-up that you include with your pictures. Slides are best, but slides can be made from your prints. Send larger prints if possible. If you have a digital camera, send high quality images to dale.gagnon@compaq.com or send in a diskette with the image. And plan to come to Hamvention 2000 (May 19-21) this year, if you can. ER

REVIEW: *A PICTORIAL HISTORY OF COLLINS AMATEUR RADIO EQUIPMENT* by Jay H Miller, KK5IM

by H. Michael Crestohl, W1RC/VE2XZ

Arthur Collins WØCXX (SK) was a true radio pioneer in every sense of the word. He started his business as a young man in the early 1930s manufacturing transmitters for his fellow amateur radio operators in his parents' home in Cedar Rapids Iowa. He built his company and its reputation for excellence by producing the finest radio equipment that money could buy. When the Second World War came Collins Radio developed and manufactured equipment for the military that is still around today, such as the TCS sets for the Navy and the ART-13 transmitter. It should be noted that after WW II the Amateur Line produced less than 1% of the Collins Radio Company's gross revenue for any given year. Despite the fact that most of it is at least 40 years old, Collins amateur equipment is highly prized today by collectors and vintage radio enthusiasts because it unquestionably represents the acme of American vacuum tube electronic innovation and design.

This is Jay Miller's second book on Collins gear, the first being the *POCKET GUIDE TO COLLINS AMATEUR RADIO EQUIPMENT 1946 to 1980* which was published in 1995. I see that it is still listed in the ELECTRIC RADIO STORE ad but judging from the popularity with which it was received I doubt if there are many copies still available. Jay's latest work does not duplicate the POCKET GUIDE in any way - the first volume concentrated exclusively on the equipment itself whereas the new title focuses on the people who made it happen. Miller was the Collins Collectors Association newsletter editor from 1996 to 1998. He has also written and published several railroad history books and describes himself as a "self-styled industrial archeologist".

Although Miller's book focuses on the Collins amateur products as opposed to the military, broadcast and avionics equipment, it also takes a close but brief look at the man himself and the other key people involved with creating and producing the radios.

As one would expect from the title the book is profusely illustrated with hundreds of photographs and drawings; many obtained directly from the Collins family and probably never before published. Others were made available by several high-profile Collins collectors and archivists such as Jim Stitzinger WA3CEX who has assembled the definitive collection of Collins promotional literature (and who wrote the eloquent introduction). Others who generously contributed their photographs to this effort include Bill Wheeler KØDEW, Founder and President Emeritus of the Collins Collectors Association, Rod Blocksome KØDAS (one of the few "Old" Collins men still working at Rockwell-Collins' Cedar Rapids facility), Chuck Carney WØGDJ (Collins Amateur Radio Product Line Manager 1957 - 1966) and many more too numerous to mention. It is quite the photo album! Reproduction of these photographs is excellent and Miller's graphic design work and the printers are to be highly complemented on this area alone.

I particularly enjoyed the side-bars written in the words of Art's son Michael Collins; Warren Bruene, W5OLY; Ernie Pappenfus, K6EZ, The man "in charge of SSB" (who became a SK just before the book was published); Leo Meyerson, WØGFQ and others. These personal memoirs and recollections are invalu-

able and it is good that they have been documented for posterity.

The relationship between Arthur Collins and Generals Curtis Lemay, W6EZV (SK) and Francis "Butch" Griswold, KØDWC is interesting in itself and is nicely recounted with photographs showing the story of the Air Force tests of SSB in the mid 1950s. Art was using the Amateur Equipment line to successfully demonstrate the worldwide effectiveness of HF SSB to meet Strategic Air Command requirements of communicating with any of their aircraft anywhere in the world at any time. There are some very nice photographs of a B-29 outfitted with KWS-1/75A-4 stations for in-flight testing. Another interesting tale from Miller's book is that of "Operation Poor Richard"; Vice-President Richard Nixon's Venezulan trip in May 1958 when angry mobs of demonstrators attacked Nixon's car with stones and clubs. Nixon's pilot, Colonel Tom Collins, K4USM, (no relation) used his KWM-1 station in a suitcase and some antenna wire thrown off a balcony to establish contact with Washington with news of the incident. Great stuff!!!!

This wonderful book will be of great value to anyone who is seriously interested in Collins Radio equipment. It takes me back to the time when I was first licenced and almost all the top DX and contest station photos in the ham radio magazines were Collins. Jay's book is filled with lore and information of the man, his company and the talented people who designed and built the radios. The appendices are filled with wonderful Collins trivia such as sales figures, top-selling dealers, dealer cost/markup and more. The book is 176 pages paperbound and sells for $39.95 plus $3.00 shipping and handling from the ELECTRIC RADIO STORE whose ad appears at the back of this issue. It is, in a word, OUTSTANDING!!! ER

Polyphase AM from page 13

sure that 100% modulation is not exceeded. Overmodulation of the carrier will not cause splatter on the air, but it will cause distortion in the AM detector of the receiver.

The other idea is to use a horizontally polarized dipole configuration. A W8JK antenna would be used for the sideband antenna. The carrier antenna would be a dipole antenna located in the middle of the W8JK antenna. It probably should be shortened to 3/8 wavelength to be the same length as the W8JK antenna. It should be mounted approximately 1/2 wavelength above ground to cancel upward radiation leaving the vertical radiation patterns approximately the same. This should be practical in the 20 meter band.

Perhaps these two ideas will trigger an even better idea of your own.

Polyphase Broadcasting didn't make it to the market place, but maybe with newer technology and antenna analysis programs the concept of generating AM in the antenna field might find a useful nitch in Amateur Radio. ER

REFERENCES

1. John F. Byrne, "Polyphase Broadcasting", Electrical Engineering, Transactions, July 1939, Vol. 58.
2. Paul Loyet, "Experimental Polyphase Broadcasting", Proceedings of the I.R.E. " May 1942.
3. FCC Rules and Regulations Part 97.
4. U.S. patent number 2,313,048 was granted to John F. Byrne on March 9, 1943. The patent was titled "Broadcasting System".

Ed. This article was previously published in "Communications Quarterly".

Amateur Restructuring is Here from page 5

Under the new licensing scheme, there will be four examination elements. Element 1 will be the 5 WPM Morse code exam. Element 2 will be a 35-question written test to obtain a Technician license; Element 3 will be a 35-question written test to obtain a General license, and Element 4 will be a 50-question written test for the Amateur Extra license. The FCC has left it in the hands of the National Conference of VECs Question Pool Committee to determine the specific mix and makeup of written examination questions. Current Amateur Radio study materials remain valid at least until the new rules become effective in April.

The FCC's new licensing plan means someone will be able to become a ham by passing a single 35-question written examination. The plan also simplifies and shortens the upgrade path from the ground floor through Amateur Extra--especially since amateurs will only have to pass one Morse code test.

Elimination of the 13 and 20 WPM Morse requirements also means an end to physician certification waivers for applicants claiming an inability to pass the Morse code examination due to physical handicap.

The effective date provides a window of upgrade opportunity for current Advanced licensees. Between now and April 15, current Advanced holders may take the existingElement 4B, a 40-question test, giving them credit for having passed the current Extra written examination. Likewise, holders of a Certificate of Successful Completion of Examination (CSCE) for Elements 3B or 4B dated on or after April 17, 1999, will be able to qualify for General or Amateur Extra respectively when the new rules go into effect on April 15, 2000.

The FCC disagreed with the League's suggestion that it undertake a restructuring of operating privileges along with licensing restructuring. "We believe that in light of ongoing discussions concerning implementation of new and more modern communications technologies within the amateur service community, we should accord the amateur service community an opportunity to complete such discussions and possibly reach a consensus regarding implementation of new technologies before we undertake a comprehensive restructuring of the amateur service operating privileges and frequencies," the FCC said in its Report and Order.

In its amendments to Part 97, the FCC's Report and Order refers to a "Club Station Call Sign Administrator," something that does not exist under the current rules and which was not explained in the R&O itself. An FCC spokesperson said the Commission plans to issue a Public Notice soon to explain the program and to solicit qualified entities to serve as call sign administrators for club station applications.

A copy of the entire Report and Order (FCC 99-412) is available on the ARRL Web site in Adobe PDF format or from the FCC Web site in plain text.
Page last modified: 4:04 PM, 30 Dec 1999 ET
Page author: n1rl@arrl.org

The BC-610 Revisited from page 4

singularly on constructing a kilowatt transmitter (Grinder, ER, 1998, #109).

Consequently, I have become only recently a BC-610 owner. A thorough restorative effort led to my indoctrination. It left me with enormous admiration for the BC-610 as a premier transmitter. I increased my understanding of its role as a major communications resource for WW II military services. I acquired, too, appreciation of reasons for the widespread and enduring respect that it has earned among amateur radio operators. I make these statements

to indicate that I take for granted the distinguished reputation of the BC-610 and that I look forward to contributing further to its substantiation. ER

References:

Hutchens, W. (1992, February). "About The BC-610 Transmitter." Electric Radio, #34, 4-10, 28.

Grinder, R. E. (1998, May). Tribute to a Classic: Lew McCoy's modern design of a high-power final. Electric Radio, #109, 20-29, 40.

Thekan, P. (1999, August). At the Military Vehicle Preservation Association's convention. Electric Radio, #124, 4-5, 42.

The EK-07 from page 33

by this function but if one tube were weak, there is a chance the diagnostics might indirectly produce a weak or unusual reading on some step. The calibration oscillator is a 300 kHz type instead of the familiar 100 kHz There are several reasons for this choice of frequency. The EK-07 has a "spotting" switch. When you depress this switch, the 300 kHz calibration oscillator is activated and its output is connected to the 300 kHz IF detector like a BFO. Hence one can zero beat on any signal and be sure that zero beat is accurately dead center inside the IF passband. Another reason is when this oscillator is used as a marker signal, its output is simultaneously connected to the IF like a BFO again while harmonics are loosely coupled to the front end. Therefore, when calibrating to a multiple of 300 kHz, each zero beat would certainly be dead center without needing to pay attention to any BFO frequency adjustments. The S-meter is calibrated in antenna microvolts instead of S units and engineer types who enjoy path loss calculations will certainly like this. European tubes are used such as ECC801 but there are standard US equivalents to all the tubes used. Most but not all of the modules have plug-in connectors for easy replacement. The front panel has flanges to allow rack mounting but is NOT a standard 19-inch rack size. The back panel allows access to a lot of signals. For example, there is a buffered local oscillator output jack which makes it easy to connect a frequency counter. At the flick of a switch this jack can function as an oscillator input thereby making it very easy for one EK-07 to tune another or several EK-07's for diversity.

Judging from its construction, a lot of attention has been put to shielding the signal generating components of this receiver from spurious radiation and inter-stage coupling. The specification sheet actually has a figure of less than 5uv claim (probably at the antenna terminals) for this parameter. Also, the AC power lines entering the receiver has an elaborate multi-section RF filter inside its own fully shielded silver-plated container as an independent module.

My sources estimate that there were less than one-thousand (1,000) EK-07's ever manufactured by Rohde & Schwarz through the entire production life span of this receiver from 1958 until about 1973. R-390(A) production numbers dwarf these figures way over but you must remember that Germany is a small country with an army of very limited size supplemented by forces of NATO whose members bring in their own equipment. The history of the EK-07's deployment with the German Army has been so remarkable that details about it are still classified to this day. It is a very rare privilege for us hams to be able to acquire these great radios and adapt them to ham radio service. Like the R-390, it is unknown if some are actually still in service today even though they have officially been replaced by a newer breed of receivers many years ago. ER

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FOR SALE: General Radio 200C Variac, unmounted, beat up dial, terminal strip removed - $7. Jim Clifford, KE4DSP, 108 Bayfield Dr., Brandon, FL 33511, (813) 654-7531 j.c.clifford@juno.com

FOR SALE: Repro Nameplates, R-390A generic - $9; 51J-3 and 51J-4 exact replicas - $12. Tom Marcotte, N5OFF, 242 Chestnut Oak Dr., Mandeville, LA 70448. marcotte@iamerica.net

INFORMATION: Available on classic communications gear. Just look at: http://www.geocities.com/SiliconValley/6992/index.htm. Thanks for your visit!. Jose, EB5AGV, eb5agv@amsat.org

FOR SALE: Various parts for homebrewing. List at: http://home.earthlink.net/~af4k/trade.htm FREE: Buy/Sell crystals at: http://pluto.beseen.com/boardroom/b/21532/ Brian Carling, AF4K, af4k@earthlink.net

FOR SALE: Send SASE for large list of excess parts. publications, ham & test gear. K4AFW, 104 Glenwood Dr., Williamsburg, VA 23185.

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NOTICE: At long last Chuck Dachis has opened his web site. Come visit him at http://www.hallicraftercollector.com

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FOR SALE: Lafayette BCR101 rcvr, works, looks good - $140. Alex, NY, (718) 648-7370.

FOR SALE: Repair! Radio repair, tube or solid state. Reasonable charges. J. Dan Rupe, W7DDF, 998 Whipple, POB 697, Grayland, WA 98547. (360) 267-4011, w7ddf@yahoo.com

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FOR SALE: Collins drum overlays. 75A-2, 3, 51J#. For 75A-4 & KWS-1, specify new/old - $8.50 ea. 2/$15 ppd. Correct colors. Charlie Talbott, K3ICH, 13192 Pinnacle Ln., Leesburg, VA 20176-6146. (540) 822-5643.

FOR TRADE: Two good RCA 833A's for one Taylor 833A; also looking for Taylor 204A, 813, 875A. John H. Walker Jr., 11015 W. 126th Terr., Overland Park, KS 66213. (913) 782-6455, johnh.walker@alliedsignal.com

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FOR SALE: Raytheon RK-28-A tube, believed never used, can't test, fils OK, ceramic base, carbon anode. L. Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150.

FOR SALE: OEM Heath belts - $2.50 each shpd; or 10+ for $2 each shpd. Send check or money order. Roberta Hummel, 202 Midvale Dr., Marshall, WI 53559.

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FOR SALE: Hallicrafter Super Defiant SX25 & PM23 spkr, all orig, no modifications - $150 + shpg. Martin Piepenburg, 5536E 500N, Monterey, IN 46960. (219) 542-2591

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FOR SALE: Heath SB301, SB401, SB600 spkr, SB620, HD16 patch, SB300-4 2 mtr converter plugs into back of SB 301; Heath Mobil pwr sply HP13; rcvrs: ARC2 3-6MC & 6-9.1 MC w/110 VAC sply; BC 348; RME 45A; HRO 5TA1 w/coils A thu G in wood case; xmtrs: ARC2 3-4MC & 4-5.3MC; 2 mtr AM SCR522 rack mounted; 300 watt amp uses 4X150, 811's modulator & pwr splys; tuning unit TU7B 4500 to 6200kc; T13A VHF AM 140 to 150MC; pwr sply RA61A, PRI 120/240 VAC, FIL & HV 300-400 VDC; freq counters: BC221; Davis CTR-2-500 MC; xtals: 100 CR-68U 5650 to 8650KC; 16 FT241A; 10 CRV60042; tubes: TX & RX over 500, send for list; tube tester 1-177D; QST's 1939 thru 1994. Lowell F. Dunham, W8YKS, 215 E. Lemon Creek Rd., Berrien Springs, MI 49103. Office/Fax (616) 471-2406

FOR SALE: Heath HW101 station, consists of a very exc HW101 w/the HP23B pwr spy mounted inside an SB600 station spkr cabinet, includes a like-new D104 mic & a 400 cycle CW filter - $195; Collins R388/URR, front panel exc, some light corrosion on chassis, otherwise exc interior. Has an AVC problem, but functions very well otherwise, no-bottom cover - $250 + UPS. **WANTED:** AC supply for TCS rcvr & xmtr. Dick Dixon, W7QZO, 16032 Lost Coyote Ln., Mitchell, OR 97750. (541) 462-3078, richdix@bendnet.com

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FOR SALE: NC-46 & spkr - $225; Atlas pwr sply console w/RIT - $125; Scott RBO - $200; 4-125 new - $70; new list, free. Richard Prester, 131 Ridge Rd., W. Milford, NJ 07480. (973) 728-2454

FOR SALE: Over 600 electronics magazines (mostly 1960's - 1990's) - 99¢ ea + shpg; also available: electronics books, parts, etc. List for stamp. Bob Eckert, 133 E. 7th St., Clifton, NJ 07011.

FOR SALE: Heath SA2040 antenna (roller inductor) tuner - $75; Bird wattmeter #43, 50W 100-250 MHz - $150. R. Cohen, 11802 Willow Pt Way, Tampa, FL 33624. (813) 962-2460

WANTED: Collins - Amateur catalogs, sales literature, manuals, promotional items & Signals. Richard Coyne, POB 2000-200, Mission Viejo, CA 92690.

WANTED: Howard radios of any type. Andy Howard, WA4KCY, 105 Sweet Bay Ln, Carrollton, GA 30116. wa4kcy@usa.net

WANTED: E. F. Johnson Co. HAMALOGs, unusual photos and information 1923-70. Bruce Hering, 41120 State Highway 13, Waseca, MN 56093. (507) 835-5619. bhering@efjohnson.com

WANTED: Top dollar paid for Wincheiter Radios and Winchester related items. Donald Daggett,122 Hall Rd., Grahamsville, NY 12740. (914) 985-7249, wc2e@webtv.com

WANTED: For purchase. Equipment & technical information related to AN/ARN-6 Radio Compass. Jim Cavan, 6 Timberline, Norfolk, MA 02056. (508) 528-0908 jcavan56@aol.com

WANTED: Gearshift for Teletype Model 28, or complete machine with one. Ivan, WA6SWA, POB 248, Reno, NV 89504. (775) 329-7738, idh@cs.unr.edu

WANTED: SW3 #33A and #35 coils. I will trade my extra coils SW3 coils. Hank Bredehorst, 2440 Adrian St., Newbury Park, CA 91320. (805) 498-8907

WANTED: Parts for a TMC GPT-750 xmtr. I need the AM modulator deck and other parts to restore this unit. John, KF2JQ (716) 873-0524 jprusso@acsu.buffalo.edu

WANTED: Long wire ants AT101, AT102, GRC-9; DY88/105; PP327GRC9; counterpoise CP12 & 13 GRC9; BC348 pwr conn PLQ102/103. KA1ZQR, 348 N. Main St., Stonington, CT 06378.

WANTED: Information on BC-1206-A beacon receiver by DETROLA CORP. Dennis,KEØQM, wbfim @ kcinter.net

WANTED: Globe King 500 B/C; Viking Valiant I/II; Viking 500; Heathkit Mohawk. Frank, , (916) 635-4994, frankdellechaie@sprintmail.com

WANTED: Globe King 500 B or C for California PU. Bob, CA, (562) 928-8820. rrjlife@earthlink.net

WANTED: Broadcast gear; tube or solid-state, compressors, limiters, equalizers, microphones, consoles, micpreamps, recorders. Mike States, Box 81485, Fairbanks, AK 99708. (907) 456-3419 ph/fax or mstates@polarnet.com

WANTED: Gonset G-63, G-43, and calibrators, spkrs for same. Also re-painting info. Brian VE7BCU, (604) 240-6513, besell@earthlink.net

WANTED: Military radios: British A-13, A-14, & Soviet R(P)-129. Leroy Sparks, W6SYC, 924 W. Mc Fadden Ave., Santa Ana, CA 92707. (714) 540-8123. leroysparks@earthlink.net

WANTED: WW II German, Japanese, Italian, French equipment, tubes, manuals and parts. Bob Graham, 2105 NW 30th, Oklahoma City, OK 73112. (405) 525-3376, bglcc@aol.com

WANTED: Heath Gear, unassembled kits, catalogs and manuals. Bill Robbins, 5339 Chickadee Dr., Kalamazoo, MI 49009. (616) 375-7978, billrobb@net-link.net

WANTED: I wish to correspond with owners of National FB7/FBXA/AGS coil sets. Jim, KE4DSP, 108 Bayfield Dr., Brandon, FL 33511. j.c.clifford@juno.com

WANTED: Anyone having info on the Deltronic Corporation of Los Angeles, CA, please drop an email, letter or call. The company was in operation in the early 1950's. Thanks, George Maier, K1GXT, 64 Shadow Oak Dr., Sudbury, MA 01776. (978) 443-9659, gmaier@ultranet.com

WANTED: SW-3 coils any band; any early ham, spark or wireless equipment; early ARRL Handbooks. Mike Bald, WD5GLW, (918) 492-7361, radiomb@aol.com

WANTED: British, Commonwealth W.S. 62, W.S. 22, W.S. 18, W.S. 48, W.S. 46. George Rancourt, K1ANX, MA, (413) 527-4304

WANTED: Knight-kits; Ocean Hopper, Star Roamer II, T-150A, and others. Also Allied/Knight catalogs, especially 1959-1962, 1965, 1969-1972. Steve Donahue, 1773 Sterling Pointe, Cleveland, TN 37312.

WANTED: Iowa QSL cards pre1940 during the '9' call district era. Also want any 1950s QSL of KNØCER or KØCER at Ames, IA. W5USM, CBA or w5usm@aol.com

WANTED: Hammarlund PRO-310 dead or alive. Spencer Cromwell, K6VRS, 7607 Stvenson Way, San Diego, CA 92120. (619) 582-8280. 3232009764@pagenetmessage.net

WANTED: Hammarlund noise immunizer (silencer) for HQ170/180 rcvr. Ed, N5BFW, (817) 222-5355 days, ecuevas@juno.com

WANTED: 1930s Navy aircraft sets - Western Electric GP-1, Sylvania GO, Westinghouse GO-3, others. William Donzelli, 15 General MacArthur Dr., Carmel, NY 10512. aw288@osfn.org

WANTED: WW-2 Japanese military radio of any kind; Hammarlund PRO-310. Takashi Doi 1-21-4, Minamidai, Seyaku, Yokohama, 246 Japan. Fax 011-8145-301-8069, takadoi@carrot.ocn.ne.jp

WANTED: Lowfer radio scrapbooks by W2IMB; 85 kcs BFO coils. Dennis, KEØQM, (913) 782-9092 wbfim@kcinter.net

WANTED: Original wood box for 5 National HRO coils; National S-101 Impedence Coupler. Don Barsema, 1458 Byron SE, Grand Rapids, MI 49506. DBARSEMA@prodigy.net

FOR SALE: Hallicrafter's manuals, copies starting at $5, some Johnson, WRL, others. SASE for list. DSM Diversified, 909 Walnut St., Erie, PA 16502.

FOR SALE: Vintage radios on display, bought, sold, traded and repaired. Webpage - http://www.tiac.net/users/hobfact. Rick Galardi, W1DEJ, Boston, MA, (781) 485-1414, Fax 289-1717, hobfact@tiac.net

FREE: Encyclopedia of Amateur Radio Equipment. Hundreds of photos & descriptions spanning over 80 yrs. http://www.aade.com/hampedia/hampedia.htm

FOR SALE: LSASE for list of old parts, many V caps, Hphones, mics, accessories, rigs. Carl, WA7LUY, 644 Pineview Pl, Casper, WY 82609.

FOR SALE: Collins S-line cabinet top lid support supports - $12 a pair shpd. Butch Scahrtau, KØBS, 5361 St Mary Dr., Rochester, MN 55901. (507) 282-2141

FOR SALE: Rare Swan MK-1 linear amp, mint - $600; RME-50 w/spkr - $275; two meter Gonset Comm IV xcvr - $100; Walter Ashe catalogs 1959 & '57 - $20 ea; beautiful FADA 1930s 60"x40" (fold ups) cardboard window display - $125; Howard 450A rcvr - $450. **WANTED:** Spkr for NC-100X; directional bridge coupler for JW Miller auto-track-2500; for SX-73, band select knob, bottom covers, name plate & pull handles. Keith Perry, K7PSZ, 384 S. 48th St., Springfield, OR 97478. (541) 726-1512 res/ 995-1172 wrk

FOR SALE: Full year QST 1936 - $30 + shpg. Tom Berry, K9ZVE, 1617 W. Highland, Chicago, IL 60660. (773) 262-5360/ 262-0016

FOR SALE /RADE: SB-104 (dismantled & packed in a box, main tuning knob is missing) w/spkr, pwr sply & manuals; SB-104 w/A mods, spkr, pwr sply & A manual, has RF in audio; SB-634 w/manual, mint condx. Will sell all for - $450 or trade for SB-200 + shpg. Mike Suits, KM4KO, VA, (757) 714-0991.

FOR SALE: COR-DUB cap PL74-728D .004 mfd 50 kv - $35; CRC/7 survival xcvr, no batt, no bottom cap - $10; old Phiclo rcvr BC-1066B I & G bands - $15; Heath HX30 6MT SSB exc condx - $85; Heath SB-10 SSB adaptor - $25; EICO 377 audio gen - $10; Yaesu ant tuner 300W all bands FC107 - $70; B&W GDO mod 600 5 coils - $35; (3) 4CX250K Eimac tubes new on card - $30 ea; TCS-13s (1) TX GD condx, untested - $75; (2) RX GD condx (1) tested - $50 ea; (1) TX for parts - $25. Randy, K4RHH, 1019 Wood Haven Dr., Lynchburg, VA 24502. (804) 239-6127/ 845-4721 wrk

FOR SALE: Stancore mod xfmr; A-3893, 60 watts NIB - $80; Millen 90651 grid dip meter, w/325 to 600 kc low freq coil - $85; 7360 RCA tubes, tested NIB - $20 ea; two 304TL sockets - $22 ea. Boyd, KØLGG. NE, (402) 551-3085.

FOR SALE: WACO-5NWX telephone filters. Just plug in. 1/$13.95, 2/$25, 3/$34. Money back. Cecil Palmer, 4500 Timbercrest Ln., Waco, TX 76705. (254) 799-5931, w5nwx@juno.com

FOR SALE: Collins 30L1 owners new Cetron 811A's - $19; 32V owners Raytheon 4D32 - $19; major credit cards accepted. Don, W4GIT, FL, (352) 475-3306.

FOR SALE: Heath Nostalgia, 124 pg book contains history, pictures, many stories by longtime Heath employees. (See BOOKS inside back cover.) Terry Perdue, 18617 65th Ct., NE, Kenmore, WA 98028.

FOR SALE/TRADE: Manuals for Johnson, Elmac, Gonset, RME, Harvey-Wells, Morrow, Drake, Clegg, Swan. NI4Q, POB 690098, Orlando, FL 32869-0098. (407) 351-5536, ni4q@juno.com

FOR SALE: Galena xtal radios or parts; small radio parts are FREE S & H not. L. Gardner, 1158 Two Mile Creek Rd., Tonawanda, NY 14150. (716) 873-0447

FOR SALE: "Complete Guide To WWII Military Communications Equipment", 117 pg info on almost all WWII equip. - $15 + $2 domestic mail. Sam Hevener, W8KBF, 3583 Everett Rd., Richfield, OH 44286-9723. (330) 659-3244

FOR SALE: Convert any wattmeter to read PEP! Perfect for AM/SSB - $19.99 ppd for complete kit! HI-RES, 8232 Woodview, Clarkston, MI 48348. (248) 391-6660, hires@rust.net

FOR SALE: Hickok 600A - $99; Hallicrafters S85 - $95; Hallicrafters S120 - $65; Hallicrafters S38E - $45; Hallicrafters S38B - $45; Swan 240 - $100; Federal Television AM 864U - $40; Dentron radio long wire ant tuner - $45; LSASE 16 pg list, HF, test, misc. Clayton Vedder, 1037 Rte 23A, Catskill, NY 12414. (518) 678-0475

FOR SALE: Complete hardware set to connect Collins PM2 to KWM2 - $19.95 ppd. Warren Hall, KØZQD, POB 282, Ash Grove, MO 65604.

FOR SALE: 70 loctal tubes; 25 NOS, others used but should test good - $50 ppd. RJ Eastwick, W2RJE, 400 N. Haddon Ave Unit 109, Haddonfield, NJ 08033. (856) 429-2477.

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FOR SALE: Tube type kits for CW/AM. Vintage Radio Kit Co, 427 North Main St., Sharon, MA 02067. email us at CPCW-3 @aol.com or visit our web site at: http://www.mnsinc.com/bry/vintage.htm

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WANTED: BC-610 Parts: coils, tuning units, tubes, cable for speech amp, meters, (anything). George, N1TNQ. (401) 331-1279

WANTED: HRO-500 rcvr and/or matching spkr. Grant, KT6L, 4324 Hermosa Way, SD, CA 92103. (619) 296-4142, mwyborny@sdcoe.k12.ca.us

WANTED: SX-100 manual; junker SX100 for parts and knobs; BW5100 manual, copy OK. Al Norton, K7IEY, 1008 Liberty St. Lynden WA 98264. (360) 354-4622

WANTED: APS-13 'Tail-End Charlie'. Complete set, or for spares, also manuals. Anthony Norden, School Cottage, 10 School Lane, Watton-at-Stone, Hertfordshire SG14 3SF, England; +44 1920 830838; agwnorden@compuserve.com

WANTED: G-186B display. **FOR SALE:** T-17B mic, NIB - $25; SA-46/ART-13A knife switch, NIB - $10. Joe Orgnero, VE7LBI, 1349 Leask Rd., Nanaimo BC V9X 1P8 (250) 722-2707 joseph@pacificcoast.net

WANTED: CRR-47211 9050 to 15,800 kc tuning unit for navy ATD xmtr; mod xfmr for B&W 5100B. Steve, KD2NX, 11 Vineyard Ave., Middletown, NJ 07748. (732) 495-3241

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FOR SALE: Used technical books - radio, electronics, math, military, magazines, etc. List: $1 (stamps OK). Softwave, 2 Dept. ER, 1515 Sashabaw, Ortonville, MI 48462

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FOR SALE: Collins 51J series drum overlay - $10 ea, specify which. Ron Hankins, KK4PK, 555 Seminole Woods Blvd., Geneva, FL 32732. (407) 349-9150

FOR SALE: Copies: Hard to find schematics for radios, also kit radios 1922-1950; manuals: test equip. ham gear. Contact me for prices, availability. Duane Ballew, KB7QZK, 6813 152nd St. Ct., NW, Gig Harbor, WA 98332. (206) 851-4505

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FOR SALE: Hallicrafters SX-76, really nice - $125. **WANTED:** Heath Mohawk. Robert Braza, W1RMB, MA, (508) 222-5553

WANTED: Modulator unit for B&W 5100B xmtr. WØHUR, Rt 1 Box 140, W. Branch, IA 52358. (319) 643-2617 eves

WANTED: Wireless Set No: 19 components: key, antenna ,cables, connectors, control box. Interested in complete No 19 Mk III set. Sam Kelly, W6JTT, (714) 893-2092 or skellycp@aol.com

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WANTED: Clegg Zeus, Interceptor (B). Will pick up reasonable distance Reading, PA. Dan, K3XR@JUNO.COM,6106702980

HELP: Friend holding an item hostage! Demands Globe 755 or EICO VFO as ransom. Jay Miller, KK5IM, (214) 828-1908, jmiller@teleteam.net

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WANTED: Seeking unbuilt Heathkits, Knightkits. Gene Peroni, POB 7164, St. Davids, PA 19087. (610) 293-2421

WANTED: BC-610E mod xfmr; BC-191 or BC-375. Pete Hamersma, WB2JWU, POB 467, Holderness, NH 03245.

WANTED: Mics: Astatic JT 30/40; UT-48; Shure CR80/81/41; 707A; Turner VT-73; CD/BD; parts for same. Tom Ellis, Box 140093, Dallas, TX 75214. (214) 328-3225. tomsmics@flexcomp.com.

WANTED: CQ 1945 to 1947; Radio Craft 1938 to 1948; Radio Electronics 1948 to 1965; Radio News 1938 to 1948; Radio-TV News 1948 to 1958. Richard, KØCAB, IA, (319) 377-9126.

WANTED: Hallicrafters Village/Hamlet radios TR-5/TR-20 & Gonset Civil Defense 6m radios/accessories, manuals also. Daniel Cahn, 3444 Greenwood Ave., Los Angeles, CA 90066. Fx/msg (310) 398-7159 or danielc411@aol.com

WANTED: Cash for Collins: SM-1, 2, 3; 312A-1, 2; 55G-1; 399C-1; 62S-1; KWM-1; 302C-3; 51S-1; 75S-3C; 32S-3A. I buy any Collins equip. Leo, KJ6HI, CA, Ph/Fx (310) 670-6969. radioleo@earthlink.net

WANTED: Collins 310B3 w/ant tuner, 70EBA oscillator assembly, & Chicago 500W CMS-2, high level modulation xfmr. Jerry, W8EGD, CO, (303) 979-2323.

WANTED: Information-WW2 TCS Radio System: Design, Manufacturing & Operation for article. Any help appreciated. Thanks. Greg Greenwood, WB6FZH, POB 1325, Weaverville, CA 96093. (707) 523-9122 (message) greg6fzh@aol.com

WANTED: Transconductance tube tester, TV7 (or?); FL10 filter; misc female connectors for BC474A. Carl, KN6AL, POB 3531, Laramie, WY 82071. (307) 742-0711, kn6al@uwyo.edu

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WANTED: Panel meter in working condx for Johnson Viking Valiant I. **FOR SALE:** Hallicrafters Keyer (mint) HA-1 + manual - $65; Heath SWR/PWR meter (good condx) AM-2 - $15; Heath Keyer (good condx) HD-10 - $20. All + shpg. Tom Marcellino, W3BYM, 13806 Parkland Dr., Rockville, MD 20853. (301) 871-7463, W3BYM@arrl.net

WANTED: Info on Globe Hi-bander model VHF62. **FOR SALE:** Tecraft model CC5-220 converter. Louis L. D'Antuono, 8802 Ridge Blvd., Brooklyn, NY 11209. (718) 748-9612 after 6 PM.

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WANTED: Military survival communications equip: radios, beacons, manuals, books, historical info/photos. Daniel Cahn, 3444 Greenwood Ave., Los Angeles, CA 90066. (310) 398-7159. danielc411@aol.com

WANTED: Visitors and tubes by museum. Old and odd amateur or commercial tubes, foreign and domestic purchased, traded or donations welcome. All correspondence answered. K6DIA, Ye Olde Transmitting Tube Museum, POB 97, Crescent City, CA 95531. (707) 464-6470

WANTED: WW II Japanese, German, Italian radios & communication equip for display in intelligence museum. LTC William L. Howard, 219 Harborview Ln., Largo, FL 33770. (813) 585-7756, wlhoward@gte.net

WANTED: RCA 140, 141, AVR5A. GE K80, K80X, K85. Any condx. James Treherne, 11909 Chapel Rd., Clifton, VA 20124. treherne@erols.com

WANTED: Parts for TCS rcvr & xmtr that I am restoring. K6GPB, 5319 Sierra Vista Rd., Murphys, CA 95247. earlw@goldrush.com

WANTED: Scott Special Communication rcvr; Hallicrafters SX73. EA4JL, contact in the States, Kurt Keller, CT, (203) 431-6850.

WANTED: Military radios: British C-13, PRC-316; Czech RM-31; Soviet R129. Leroy Sparks, W6SYC, 924 W McFadden Ave., Santa Ana, CA 92707-1114. (714) 540-8123, leroysparks@earthlink.net

WANTED: Tube-type Hi-Fi & guitar amplifiers by ACRO, EICO, Fender, Marantz, McIntosh, Pilot, Triad, UTC. Rob, CA, (510) 845-2625.

WANTED: Junction box JB70-A for xmtr BC-610E. Robert L. Richmond, 3360 W. Water St., Port Huron, MI 48060. (810) 984-2439, w8mng@tit.com

WANTED: HRO-5/HRO-W G coil (180-430 kcs) marked J-196, must be common type w/one-piece name plate w/NC logo centered. Will consider coil sets, etc. Tony Stalls, K4KYO, VA, (703) 522-1568, k4kyo@arrl.net

WANTED: National HRO-5AI coils E (900-2050 kc) & F (480-960 kc). Will pay cash or trade. Don, MI, (616) 451-9874. DBARSEMA@prodigy.net

WANTED: Correspondence, info schematic for (prototype) rcvr, very simillar to Radio rcvr; R-1511/GR but no video level meter. J. Erickson, N8PMF, 8880 N. Turnerville Rd., Lake City, MI 49651. (231) 229-4812

WANTED: TMC GPT-750, TAC Tuner, GPR-90/92 & GSB-1. Alan Gray, W3BV, PA, (215) 795-0943.

WANTED: Hallicrafters S-39 rcvr Skyranger. Bob, K1YJK, CO, (303) 768-9200, k1yjk@arrl.net

WANTED: National HRO black wrinkle spkrs, oak coil boxes, coils; Western Electric horns, spkrs, amps, mics. Barry Nadel, POB 29303, San Francisco, CA 94129. bnadel@ccnet.com

WANTED: Collins 70K-2 PTOs working or not; IN82A diodes; Bretting 14/14AX manual. Clark, WØBT, KS, (785) 286-2132

WANTED: Navy xmtrs: MQ, TCA, TCE, TCN, TCX, TDE; rcvrs: RAW, RAX, RBD, RBJ. Steve Finelli, 37 Stonecroft Dr., Easton, PA 18045. (610) 252-8211. navrad@enter.net

WANTED: Tektronix memorabilia & promotional literature or catalogs from 1946-1980. James True, N5ARW, POB 820, Hot Springs, AR 71902. (501) 318-1844, Fx 623-8783, james.true@ibm.net

WANTED: Test equipment & tube audio amplifiers. Mike Nowlen, WB4UKB, 2212 Burgoe Ct., Reston, VA 20191. mike@3dnet.com

WANTED: Cash for Collins: SM-1, 2, 3; 55G-1; 62S-1; 399C-1, 51S-1; 75S-3A, C 32S-3A; any Collins equip. Leo, KJ6HI, CA, ph/fx (310) 670-6969, radioleo@earthlink.net

WANTED: Tube type shortwave converters, preferably pre-war. David L. Muse, 510 Minturn Ave., Hamlet, NC 28345.

WANTED: Mohican; SB-200; SB-220; SB-100; SB-101; SB-102; Knightkit Band Spanner II; Heath GW-12A; GW22A; GW42. Debbie, AR, (870) 857-3366.

WANTED: Copy of operating manual for Hickok model 800 tube tester. Reward. R.F. Haworth, 112 Tilford Rd., Somerdale, NJ 08083. (856) 783-4175

WANTED: Service manuals for RCA Radiomarine Direction Finder model AR8712 & military BC-314 rcvr. Al Kaiser, W3LEQ, 713 Marlowe Rd., Cherry Hill, NJ 08003-1551. (609) 424-5387

WANTED: Plate MA meter for B&W5100B xmtr. Bob, KL7HDY, 9501 Brien St., Anchorage, AK 99516. (907) 346-1044

WANTED: Autronic paddle key. Bob, KJ6CA, CA, (916) 967-7552.

WANTED: Swan 750 CX w/SS-16B. Cliff, WA9SUE, WI, (608) 625-4527 after 6 pm.

WANTED: Stripped-out ARC-5 xmtr & rcvr chassis; all cards or calls answered. Kelley, W8GFG, 9010 Marquette, St. John, IN 46373. (219) 365-4730

WANTED: Schematic or info on Coast Guard radio TRP141 by Radio Marine Corp. Robert Martin, 111 Bancroft, Rochester, NY 14616. (716) 663-4182

WANTED: Globe King 500/500A, PU anywhere. John, AA5T, TX, (281) 530-6130 or 72376.3574@compuserve.com

WANTED: AC/DC ohms probe & ground wire for EICO 232 VTVM. Alan Mark, POB 372, Pembroke, MA 02359.

WANTED: Drake 1A rcvr; 399C1 Collins VFO; JRC 505 twins. K5YY, AR, (501) 756-5010. k5yy@arrl.net

WANTED: Rhode & Schwarz rcvr type EK07. Harry Weber, 4845 W. 107th St., Oak Lawn, IL 60453-5252.

TUBE COLLECTORS GROUP FORMED: The new tube collectors association is now in operation. This is a non-profit, non-commercial organization of collectors & history enthusiasts focusing on all phases & vintages of tube design. The founding president of the group is Al Jones, W1ITX, who is known for his award winning tube collection. For more details & complimentary copy of the association's bulletin contact Al Jones, CA, (707) 464-6470, Ludwell Sibley, OR, (541) 855-5207, or mail request to POB 1181, Medford, OR 97501.

FOR SALE: Lots of old radio & related books. Eugene Rippen, WB6SZS, www.muchstuff.com

FOR SALE: RIT for KWM-2 and S-Line. No modifications for KWM-2. $59.95 tested / 42.95 for kit. SASE for details and order info. John Webb, W1ETC, Box 747, Amherst, NH 03031.

FOR SALE: Military radio TM's, origs & reprints. New list. Send $1 & address label to Robert Downs, WA5CAB, 2027 Mapleton Dr., Houston, TX 77043-2410. (713) 467-5614

FOR SALE: Johnson panel, cabs, refinishing. Done in same finish as new cars. Valiant-1 set - $285. Ranger-1 set - $250. all + shipping. Visa/MC/Am-Xp Dee, W4PNT, Virginia, (540)249-3161 or cel pho:(540)471-7023, http://home.rica.net/soundnmind/ for pics.

FOR SALE: SASE for list of reconditioned gear. Ed Clink, WA9PFB, 1285 New Salem Church Rd., New Berlin, IL 62670

FOR SALE: National HRO shortwave rcvr w/ coils, ps, orig manual, S-meter, black wrinkle finish from 1935, works perfect - $750. Chris Cross, POB 94, McConnell, IL 61050.

The Collins Video Library

The Collins KWM-2 Video 4 hours - $89.95. Highly detailed video on operation, rebuilding, alignment, troubleshooting and neutralizing of this classic! A must for anyone who owns and operates a KWM-2/2A. Printed documentation included.

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The Collins KWS-1 Video 2 hours - $39.95. This video is the perfect companion to the 75A-4 video for owners of the "Gold Dust Twins"! Butch Schartau, KØBS, shows you how to operate, maintain and repair your KWS-1. Watch as Butch goes through the entire alignment and neutralization process, as well as showing you how to properly operate this famous transmitter.

The Collins 75A-4 Video 4 hours - $89.95. This video is four hours of information on how to repair, maintain and restore this classic receiver. Butch Schartau, KØBS, guides you through all aspects of keeping your own 75A-4 running like a top.

R-390A Video 7 hours - $109.95. Here it is! Long awaited by serious "boatanchor" enthusiasts! The ultimate receiver now has the ultimate video to go along with it. R-390A expert Chuck Rippel, WA4HHG, covers an absolutely incredible array of information in this "heavy duty" video. This video looks at operation, its modules, circuit description, front and rear panel details, complete mechanical and electrical alignment, PTOs, performance evaluation, modifications, troubleshooting and restoration. There is nothing like this video available today, at any price!

R-390A Addendum Video - $49.95. Another 3 hours and 40 minutes of R-390A information from Chuck Rippel, WA4HHG

SP-600-JX Video 4 hours - $89.95. Chuck Rippel, WA4HHG, takes us through all aspects of the SP-600-JX—repairs, restoration and modifications. This video is a must for any newcomer attempting to work on the SP-600.

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Produced by Floyd Soo, W8RO (ex-KF8AT)

ER Bookstore, 14643 County Road G, Cortez, CO 81321

WANTED

Collins promotional literature, catalogs and manuals for the period 1933-1993. Jim Stitzinger, WA3CEX, 23800 Via Irana, Valencia, CA 91355. (805) 259-2011. FAX (805) 259-3830

WANTED: New or used unmodified BC459A, BC696, T18/ARC/5, T19/ARC/5, CBY52232. Louis Lytch, K2DET, 117-33 230th St., Cambria Heights, Jamaica, NY 11411-1806. (718) 528-5065

WANTED: Squires-Sanders SS-1R, SS-1T, SS-1V, SS-1S, see my web page tulsa.oklahoma.net/~wd5jfr. Hank, WD5JFR, OK, (800) 364-4265

WANTED: Manuals, manuals, manuals for radio-related equipment to buy or swap. Catalog available. Pete Markavage, WA2CWA, 27 Walling St., Sayreville, NJ 08872. (732) 238-8964

WANTED: Collecting military electronics including radio, radar, RDF and test, manuals & literature. William Van Lennep, POB 211, Pepperell, MA 01463. (978) 433-6031

WANTED: Early 2 & 3 digit tubes. E-mail fathauer@home.com for bid list. George H. Fathauer, 688 W. First St. Ste. 4, Tempe, AZ 85281. (480) 921-9961, Fax 921-9957.

WANTED: Watkins-Johnson or Communications Electronics Inc. info, catalogs, manuals or equipment. Terry O'Laughlin, WB9GVB, P.O. Box 3461, Madison, WI, 53704-0461, 608-244-3135

WANTED: Hallicrafters HT-1, HT-9, HT-31, 5-T, SX-11, SX-17, SX-25; Howard rcvrs; Harvey xmtrs. Ken Seymour, KA7OSM, 9115 SW 176th Ave., Beaverton, OR 97007. (503) 306-7439 24 hrs. ken.seymour@attws.com

WANTED: 80 & 40 meter xtals in FT243 holders. Howard Weinstein, K3HW, 4041 Ridge Ave. Apt 4-405, Philadelphia, PA 19129. (215) 843-1180. k3hw@arrl.net

WANTED: Merchant ship radio memorabilia, radios, keys, parts, clocks, documentation. Tom Mackie, W2ILA, 14 Washington St., Jamestown, RI 02835. (401) 846-1200

WANTED: BC-614/HT-5 speech amp for BC-610; tubes 250TH & 3B28. Gary Willey, W4ZXS, 8125 Lunenburg Rd., Keysville, VA 23947. (804) 736-9029

WANTED: WW II Japanese xmtrs & rcvrs (parts, plug-in coils) for restoration & ER articles. Ken Lakin, KD6B, 63140 Britta St., Ste. C106, Bend, OR 97701. (541) 923-1013. klakin@aol.com

WANTED: HQ100A or HQ110, HQ145, HQ160; dead HF tube rcvrs, xmtrs. Prefer complete. John KF7OM, NV, (702) 727-8171.

WANTED: National SW-3, model I version 3 (uses 32-32-30 tubes). Dean Showalter, W5PJR, 72 Buckboard Rd., Tijeras, NM 87059. (505) 286-1370

WANTED: Keyer paddles of all kinds. Cap, WØXC, CO, (970) 247-0088. capallen@frontier.net

WANTED: Electric Radio; Antique Radio Classifieds; Old Timers Bulletin. Alan Mark, POB 372, Pembroke, MA 02359.

NEW RELEASE: Flyer 200. For details send 2-stamp LSASE. Olde Tyme Radio Co., 2445 Lyttonsville Rd. Ste 317, Silver Spring, MD 20910. Ph/FX (301) 587-5280, oldetymeradio@juno.com

WANTED: Hammarlund HQ110 or HQ110A in exc condx or parts rig. Bill Smitherman, KD4AF, 9401 Hwy 67, East Bend, NC 27018. (336) 699-8699

WANTED: National SW-3, coils, doghouse ps, National FB-7. Scott Freeberg, WA9WFA, (651)653-2054, scott.freeberg@guidant.co

WANTED: Johnson Viking Valiant II w/TR switch & orig manual. C6ANI, POB N4106, Nassau NP, Bahamas.

WANTED: Drake 1A rcvr; 399C1 Collins VFO; JRC 505 twins. K5YY, AR, (501) 756-5010. k5yy@arrl.net

WANTED: BC454 Command Set rcvr covering the tuning range of 3 to 6 MHz, a part of the SCR-274 or ARC-5 equipments, should be in repairable condx, preferably w/tubes. Tom Duvall, W6QJZ, CA, (909) 695-7066.

WANTED: An Eimac SK-516 chimney for a 3-1000Z for an old BTI amp. Fran, K1YI, POB 109, Princeton, MA 01541. (978) 464-5500

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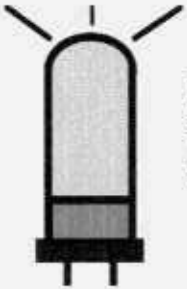

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