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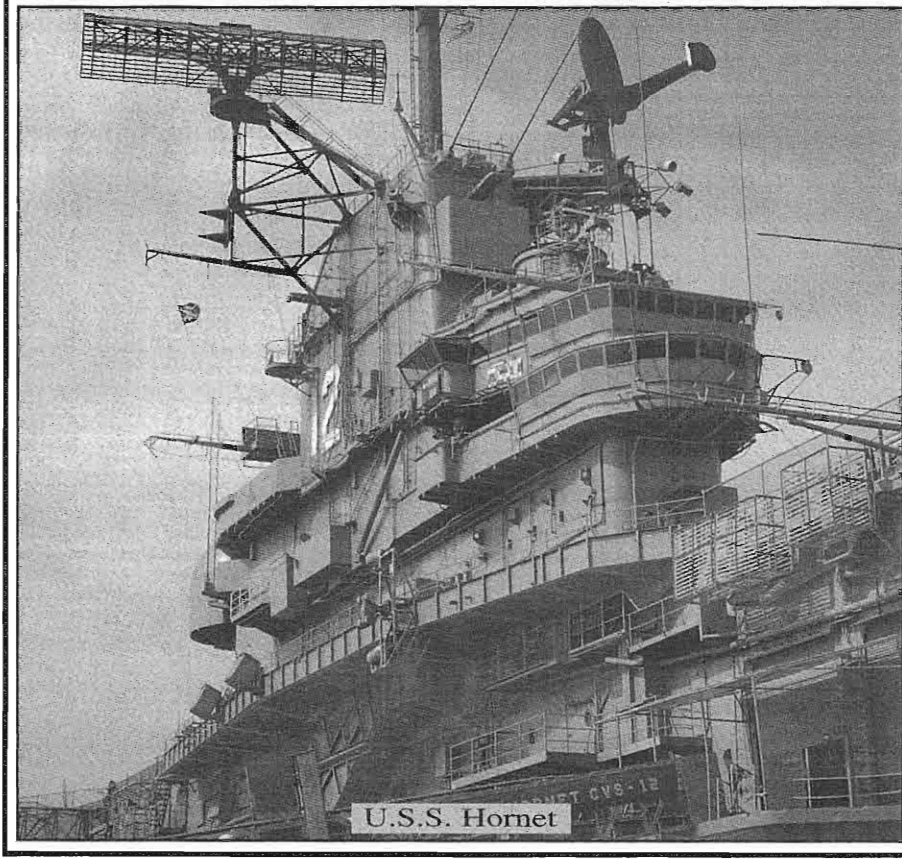
ELECTRIC RADIO

celebrating a bygone era

Number 166 March 2003



U.S.S. Hornet

ELECTRIC RADIO

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Electric Radio was founded May 1989 by Barry Wiseman, N6CSW. The magazine continues publication 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 and operating with a primary 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:
Bob Dennison (W2HBE); Dale Gagnon (KWll); Chuck Teeters (W4MEW); Bruce Vaughan (NR5Q); Bob Grinder (K7AK); Jim Hanlon (W8KGI); Brian Harris (WA5UEK); Tom Marcellino (W3BYM); John Hruza (KBØOKU)

Editor's Comments

Last month I mentioned that I would be doing an article about Hoisy Hoisington (W4CJL) in this issue. I have received a great deal of information, and in order to do a proper tribute, I have rescheduled the article for the April issue. I would like to thank everyone who has sent in information and photographs of Hoisy for this article, and the contributions received to date will be put to good use!

I have been operating a lot on 10 meters this year, and have noticed that the band is not in as good a shape as it was this time last year. If the band is open at all, it will be open for shorter periods, and tends to close abruptly. It also seems like the good openings where the band is open for hours with strong signals are becoming infrequent. Everyone I've talked to seems to be noticing the same thing, and they suggest trying 15 meters as an alternative to 10. The traditional AM gathering spot has been 21.425 mc, and I would like to suggest making it the 15-meter AM calling frequency. There is a long established maritime net at 21.400 that we need to avoid, but 15 meters is a big band and it shouldn't be too hard to find clear spots.

Recently we were sent a copy of the Canadian regulations for their Amateur Radio Service. In reading them over, I was surprised to learn what a difference an international border makes in regulating emissions. For example, here is a portion of the AM-friendly Canadian rule sections:

Standards for the Operation of Radio Stations in the Amateur Radio Service
10. Restrictions on Capacity and Power Output

The transmitting power of an amplifier installed at an amateur station shall not be capable of exceeding by more than 3 dB the limits on transmitting power described in this section.

10.1 Amateur Radio Operator Certificate with Basic Qualification

The holder of an Amateur Radio Operator Certificate with Basic Qualification is limited to a maximum transmitting power of:

(a) where expressed as direct-current input power, 250 W to the anode or collector circuit of the transmitter stage that supplies radio frequency energy to the

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Cover: The U.S.S. Hornet, as it appeared in January 2003 at the former Alameda Naval Air Station near San Francisco, California. The ship has been opened as a public museum and is widely recognized as a national historic treasure.

related to temperature variations my thought was that if I could get the RF deck temperature stable, I could also achieve frequency stability. If I did not have to replace any components in the RF deck in the process it would be an added bonus. Well, I am here to tell you that the hypothesis proved true. You can have frequency stability with original stock RF deck components and the construction of a temperature controlled environment. The best part of all is the Mohawk chassis is just made to do this. I do not know if the Heath engineers might have been thinking about this or not, but the mechanical construction of the RF deck sure makes you wonder. It would be an easy construction project.

When we think of temperature control we naturally think in terms of a thermostat such as in the kitchen oven. These work great for cooking but the temperature variations around the set point of a thermostat can be significant, often between 25 and 50 degrees. The reason for this is that full heating energy is applied until the set point is reached. This results in oven temperature overshoot when heating energy is removed. The same happens when the thermostat calls for re-application of heating energy but it is termed undershoot. We get a lot of temperature variation with the thermostat and it is just not suited for the precise control of delicate electronic circuitry.

What is suited for precise temperature control is a device that is termed a Proportional Temperature Controller. These little electronic wonders are precise and very smart. They use sensors to measure temperature and have enough sense to start reducing heating voltage as the set point is approached. Consequently, you get little temperature variation around the set point. Properly adjusted, they will hold temperature to within 0.5

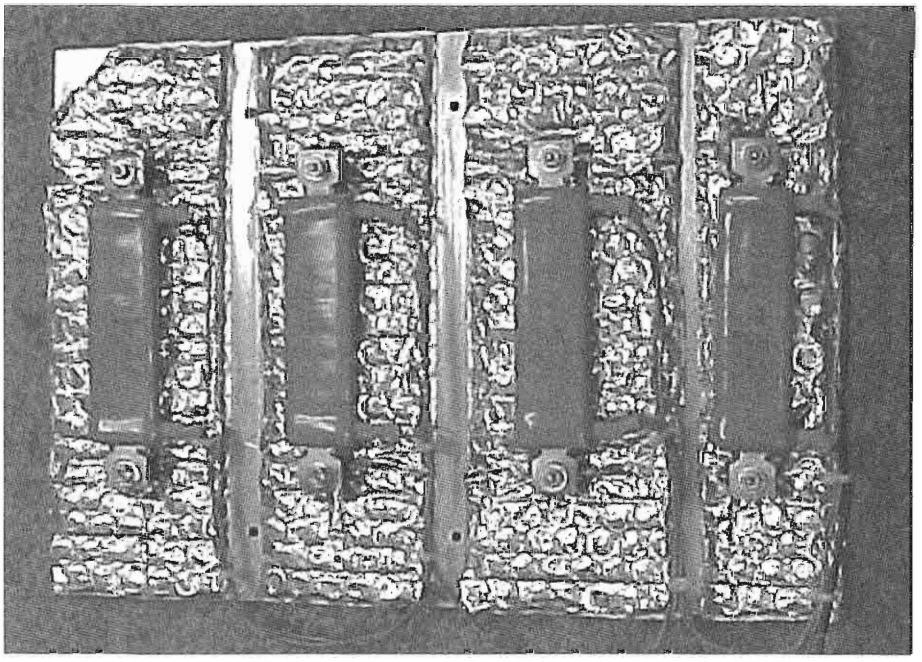

Figure 1: Oven bottom plate with heating elements mounted and wired. The foil insulation was glued to the plate prior to mounting the heating elements and then trimmed to clear the compartment partitions.

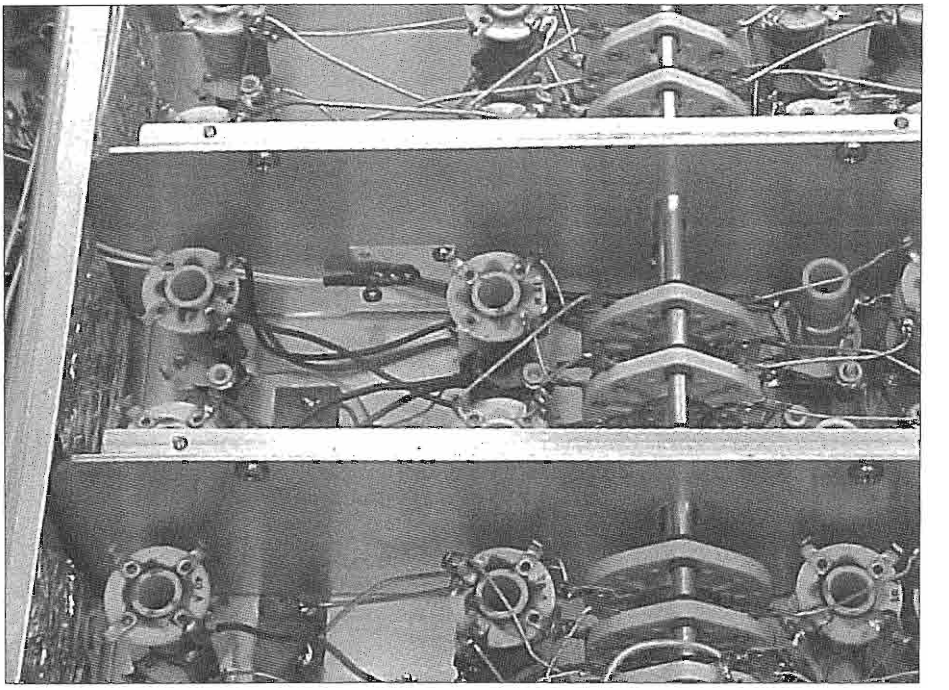

Figure 2: The temperature sensor was mounted near the top of the chassis on the mixer front partition wall. If you look closely you can see the ¼ inch aluminum stock attached to the bottom of the partition walls and used to secure the bottom plate of the oven.

degrees.

For the Mohawk project I was looking for a temperature controller that would have an accuracy of plus/minus 0.5 degrees F, would control a resistive heating load with an applied voltage of 120VAC, was economical, and was small in size. I found a controller that met all the criteria in the Oven Industries model 5C1-142 with the TP40-2 sensor. There are other manufacturers of proportional temperature controllers. Just remember that whatever controller you choose to use, it must be sized for the load, and it must be the proper sensor for the selected temperature range.

The mechanics of the sheet metal oven for the Mohawk are very simple. All you need is a metal plate to cover the underside of the RF deck chassis. My cover plate extended all the way to the front of the chassis, covering the 1st IF compartment as well. I used 0.090-inch thick aluminum plate and it was cut in a metal shop to exact dimensions to fit inside the edge rail of the chassis bottom and center partition. This needs to be cut as exact as you can get it, you don't want wind drafts entering any cracks around the bottom plate and chassis edges. The plate sits inside the chassis rails and creates a nice flush bottom over half of the chassis. The compartment shields in the RF deck are already recessed 0.090 inches below the chassis rail, which makes me think that the Heath engineers might have thought about a cover plate at some stage in their design. I counter-sunk all screw heads on the bottom side of the plate so it is nice and smooth and cre-

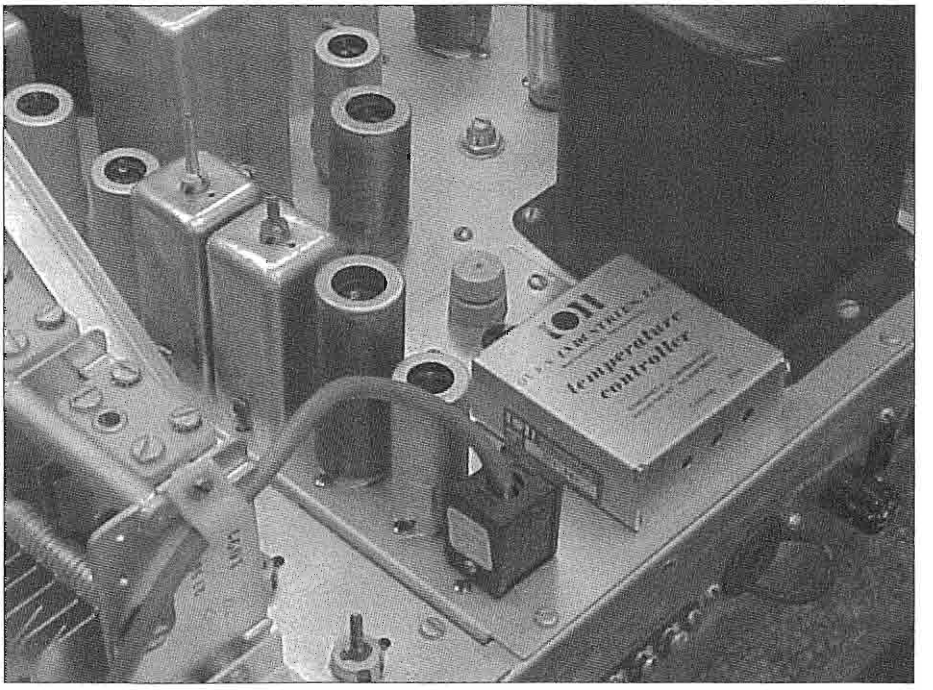

Figure 3: The mounting location chosen for the temperature controller. The associated fuse was mounted on an aluminum plate just above the controller and was fabricated to cover the hole left from the old power supply electrolytic capacitor. The fuse plate also contains a grommet to allow passage of controller wiring to the bottom of the chassis.

ates no problems sliding into the Mohawk cabinet. To secure the bottom plate to the chassis I added ¼ inch square aluminum bar across the length of two compartment shields. These were secured to the shields with metal screws and the other side of the bar was match drilled and tapped to secure the bottom plate.

For the heating elements I used four 35W, 500-ohm resistors connected in parallel. This calculates out to about 125 watts of heating power with 120 VAC applied. The flat type resistors were chosen as opposed to the round body type because they give a more even distribution of heat and their low profile gives more clearance under the chassis. The resistors were mounted on 1/4-inch spacers and metal foil insulation was glued to the inside of the bottom plate under the resistors. The insulation was carefully cut with a razor knife in places where the plate touches the compartment shields. I also cut pieces of the foil insulation and glued them to all inside edges of the oven.

Figure 1 shows basic construction of the bottom plate with resistors mounted.

Figure 2 shows detail of the sensor mounting inside the mixer compartment on the front of the mixer partition. This location was chosen because it is nearest the center of the RF deck. If you look closely you will see the aluminum square bar on top of the compartment shields. All wires were run forward and exited the compartment through the existing grommet in the 1st IF section.

Figure 3 shows the mounting detail

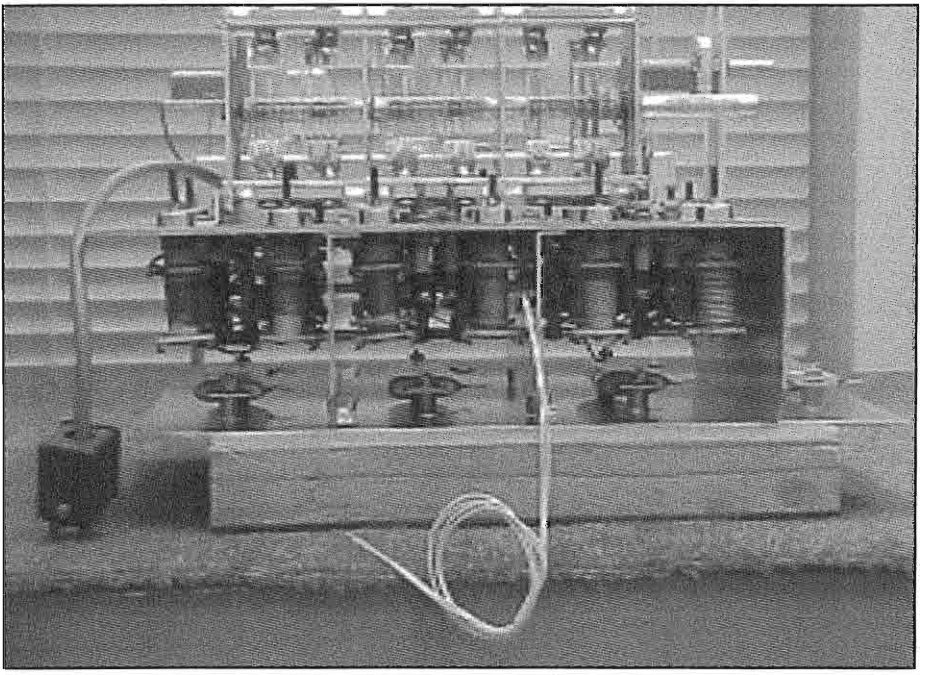

Figure 4: If we could remove the right side of the Mohawk chassis, this is what the RF deck and bottom plate would look like in cross section. The two wires in the front of the picture are attached to the sensor. The first IF section is to the right of the picture and outside of the RF deck partitions. Note the clearance room for the resistor heaters.

of the temperature controller. I put the controller in the location of the original 5V4 rectifier tube. I went with solid-state rectifiers in my Mohawk restoration and this space was available. There are plenty of other places you can mount the controller if you desire. It is small, about the size of a cigarette package, and there is lots of room in the Mohawk chassis. I wired my controller to be "always on" and installed a separate fuse in the power circuit for protection. The fuse is visible directly in front of the controller. "Always on" means that as long as the Mohawk is plugged into the wall outlet, the RF deck will be temperature stable.

Figure 4 shows the RF deck removed from the chassis and the bottom plate with heating elements installed. It should give you a clear idea of the cross section appearance. Once everything was buttoned up I did some additional sealing for air leaks. The biggest air leakage is directly under the main tuning capacitor. Those three big rectangular holes will never do! A quick trip to the attic and I returned with some pink stuff and stuffed those holes neatly. Another big air loss is in the 1st IF section along the front wall of the chassis. More pink stuff put an end to that leak. On some of the other leaks I used clear silicone seal. I did not seal every possible hole in the top deck with silicone, just the major drafts. For instance I did not seal around any of the RF coil mounting tabs.

For adjustments and measurements you will need a VOM and some type of

temperature measuring device. The VOM should be connected to the load side of the controller and set to measure voltage. It will allow you to see how the controller is responding to temperature changes by displaying voltage delivered to the load. For temperature measurements I used a digital infrared thermometer. There are other ways to measure temperature, including some good probes for your VOM. Your temperature-measuring device should have the capability of displaying at least ½ degree increments. Radio Shack makes an economical infrared hand held device that works well, model 22-325 If you go the infrared route to temperature measurement be warned that the reflective aluminum surfaces will give you false readings. I put a small piece of masking tape on the chassis in several spots and took the readings from the surface of the tape to eliminate the problem. The temperature controller has three adjustments - coarse, fine and differential. The coarse setting will get you close to the set point as measured by the sensor, the fine setting a little closer, and the differential will minimize variation around the set point. In working with the controller set the initial settings as follows: differential all the way on (full clockwise for the 5C1-142) and the coarse and fine controls about mid scale. Make small adjustments at a time and allow the chassis time to react to the new settings. Start with the coarse adjustment and as you get within two degrees of the set point, switch to the fine adjustment. Once you are within a degree, adjust the differential to minimize swings around the set point. I would make a setting and then wait about 5 minutes to see its effect.

Just what is the magic number for temperature? We certainly want a temperature that will give us frequency stability. At the same time we do not want to melt anything inside the oven. We also need to consider that when the rest of the Mohawk is powered up (the other half of the chassis that is not always on), its thermal stability point should be lower than that in the oven. Additionally, every point on the chassis will measure a different temperature. What to do, what to do! For all of you who had thermodynamics in college it would be easy to write all the equations and come up with a magic number. In my case, I had two weeks of thermo in engineering and decided that I really did not want to be an engineer. So, lacking any scientific equations here is what I did.

First, pick your temperature measurement points on the chassis and always use the same measurement points. For the Mohawk, I chose three points: top center of the RF deck, top center of the IF/AF deck (the half of the chassis that is not part of the oven), and the top center of the RF sub-chassis sitting on top of the RF deck. Remember, heat rises and this is important in choosing a temperature for the RF section. On the Mohawk you will see about a 6-degree difference from the top of the RF deck to the top of the RF sub chassis (the RF sub chassis is where the 3 front end tubes are located).

Second, calculate the melting point of components. Most are rated at 85 degrees centigrade before they become unreliable. The math calculates out to about an equivalent 185 degrees F. So, 185 degrees F would be a good point not to exceed.

Third, measurements were made on the Mohawk with the oven off to see what a normal operating temperature might be. That came out to about 114 degrees F after one hour of operation. Yours may be higher. Remember, mine is less the 5V4.

Fourth, all that is left is to find is the correct temperature between 114 and 185. I started off thinking it would be somewhere around 140 degrees, but when the temperature leveled off it was a little too toasty to the touch. I then backed down

the temperature to something more reasonable, and for my set I settled on 121 degrees F for the measurement point on the RF deck, which translated to 127 degrees on the RF sub chassis measurement point. I found no measurable frequency stability difference between 140 and 121 and it just made more sense to use the lower temperature.

Stability measurements were measured with the frequency counter connected to pin 8 of the 12AT7 high frequency oscillator tube. I used a 10x probe to avoid loading the oscillator output. Measurements were made every 15 minutes for a six-hour period and recorded. I chose to take measurements on 40 meters and a second set of measurements on 20 meters after results were recorded on the 40-meter tests. (Do not try to do both multiple sets of measurements at the same time—you will never get the Mohawk back to the same place if you switch bands. Don't touch that tuning dial!). As I started recording the first drift measurements I was convinced that my frequency counter was stuck! Some recorded measurements showed no drift over the recording period. A solid whack on the 12AT7 assured me that the counter was working properly! I was amazed. Days before I had a Mohawk that was drifting kc, and now this same set was averaging less than 100 cycles drift per hour on 40 and 20 meters. What a difference in stability, and all achieved without changing a single original component in the RF deck.

As the oven is always on, it will be consuming energy if the Mohawk is plugged into the wall. The controller and oven draw about 1/3 A once thermal stability has been reached. Annual power consumption is a consideration with an always-on circuit. However, the cost is nominal for what can be achieved in frequency stability. Control voltage to the heaters averages about 40 volts at stability. Now I only get drift in the Mohawk in the first five minutes of operation and that is attributed to the front-end tube filaments getting warmed up. Ultimate stability could be achieved by always running the filaments of the front end - maybe on regulated DC voltage. I chose to live with a few minutes of drift and not sacrifice the tube life.

This method can be applied to any boat anchor with which you may be having drift problems. If you can isolate the drifting section of the rig and create a controlled temperature environment, your drift will be minimal. I am already considering a similar circuit for the Apache VFO.

Note: Oven Industries Inc., Industrial Controls Division, 207 Hempt Road, Mechanicsburg, PA 17055 (717)-766-0721 http://www.ovenind.com

New Hope for your Heathkit Mowhawk, Tom Bonomo (K6AD), ER #103 (November 1997), ER# 102 (December 1997), ER# 104, (January 1998).

ER

The Grey Ghost-U.S.S. Hornet, CVS-12

by Al Tipsword, W6GER
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The *U.S.S. Hornet Museum Ship* (CVS-12) is currently docked at Alameda Point, the old Alameda Naval Air Station, on San Francisco Bay. What a fine lady and what an outstanding history she has.

In the summer of 2000 I toured the *Hornet* with a local radio club. This was my first time aboard a naval vessel of this size and one with this much history. During my four-year tour in the Navy as a communications technician, I had never served aboard a ship. It was overwhelming to see the complexity of the operations that the sailors aboard the *Hornet* dealt with on a daily basis. After seeing the Enlisted Men's quarters I felt a little guilty, as my shore station quarters were better than the officer's quarters aboard *Hornet*. I felt that I owed my shipboard colleagues a debt of gratitude.

In the fall of 2002 Carl (WB6PIR) called asking if I would be interested in joining a newly formed radio club, *The U.S.S. Hornet Amateur Radio Club*. I jumped at the chance. Shortly thereafter I traveled to Alameda and attended the 'volunteer' training program aboard *Hornet*. At last, I was a member of a shipboard crew.

The first thing I learned was the history of the ship. CV-12 was the eighth ship of the U.S. Navy to bear the name *Hornet*. She has a very proud heritage tracing back to a sailing ship launched in 1775 during the Revolutionary War. CV-12 was commissioned in 1943 and was named after her predecessor CV-8, which was sunk in October 1942 during the pacific battle of Santa Cruz Island.

CV-12 has a very impressive combat record. During WW2 the *Hornet* was at sea for eighteen months without ever tying up at a dock. During the Pacific Campaign the *Hornet* shot down 668 enemy aircraft, destroyed 742 on the ground, sank one carrier, a cruiser and ten destroyers. She also devastated enemy shipping by sinking 27 ships, with the possible sinking of 37, and damaging of 413 others. The *Hornet* itself was under attack 59 times and never hit by a bomb, torpedo or Kamikaze plane.

Oh what a glorious history the *Hornet* has, serving in WW2, the Viet Nam war and the Cold War. To end her fabulous career the *Hornet* served as recovery ship for the Apollo 11 & 12 moon landing astronauts. The *Hornet* was decommissioned in June of 1970. In the following decades the *Hornet* was moved several times, ending up in Alameda, CA. In August of 1998 the ship was open to the public as a museum ship.

During my indoctrination and tour of the ship it was noted that much of the ship had been renovated and restored for public viewing. A docent told me that there were 13 radio rooms on the ship, but none of the radio rooms were open to the public. These ranged from Radio Central to small compartments containing only one or two pieces of equipment. During my tour of the ship I met two volunteers, George Campbell and Andy Ceseski, who are in the process of restoring Radio Central to a condition that will permit it to be open for public viewing. Many of the other radio rooms will most likely never be open for public viewing due to their inaccessibility.

The radio rooms aboard *Hornet* were demilitarized some time after the ship was decommissioned. In 1998, when the

Here is a view of the Hornet's flight deck, taken from a location near Primary Flight Control, a part of the ship's Island structure. The San Francisco Bay Bridge is just visible in the top right of this photograph.

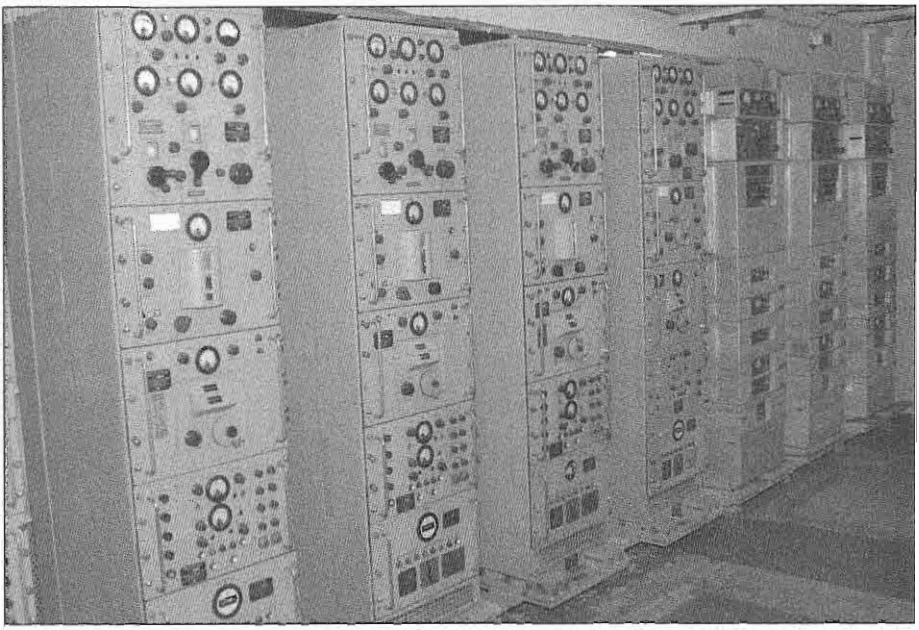
ship became a museum, it was required that environmentally unsafe materials be removed. Asbestos and PCB's and other unsafe materials were removed. Most all of the radio equipment was affected. All of the transformers and capacitors containing PCB's were removed rendering much of the equipment inoperable. Between the original demilitarization and the final environmental cleanup a majority of the radio equipment ended up in an unusable condition and will probably never be operational again.

HORNET AMATEUR RADIO CLUB

Tom (KB6SSN) formed the current USS Hornet Amateur Radio Club in July of 2002.

The club's goal is to become the *'The Voice of the Hornet'*. The ships original Navy call sign was NBGC. In honor of the original call the *Hornet* Amateur Radio Club operates with a call sign of NB6GC. The club's purpose is to promote interest in amateur radio and the *USS Hornet Museum Ship* for the community, its past crew members and club members. The club members also serve the museum ship's staff and assist in preservation of the *Hornet*.

The club operates special events from the 'New Radio Room' located in the island above the flight deck. Although this compartment was originally a navigation office, it is now used by the club



Here is the Hornet's Radio III Transmitter Room with eight racks of classic communications equipment. One rack of AN/WRT-2 is out of view, just to the left. Pictured here from left to right are 3 racks of the AN/WRT-2, one rack of AN/WRT-1, and 3 racks of the AN/URC-32 equipment. Until the ship was opened as a museum, these rooms were off limits to the public.

as the "New Radio Room". Thanks to the efforts of Carl (WB6PIR), the radio room is now equipped with three Harris RF-350 transceivers. During special events one transceiver will support SSB operations and one transceiver will support CW operations. The third unit will serve as a backup.

In February the radio club will begin providing a Boy Scout Radio Merit Badge Program. While not taking the scouts to the level necessary to obtain their license, the program will provide enough information to those who are truly interested to follow up and obtain licenses. Each of the scouts will need to make and log a live QSO. So look for them on the air every other weekend beginning February 22nd.

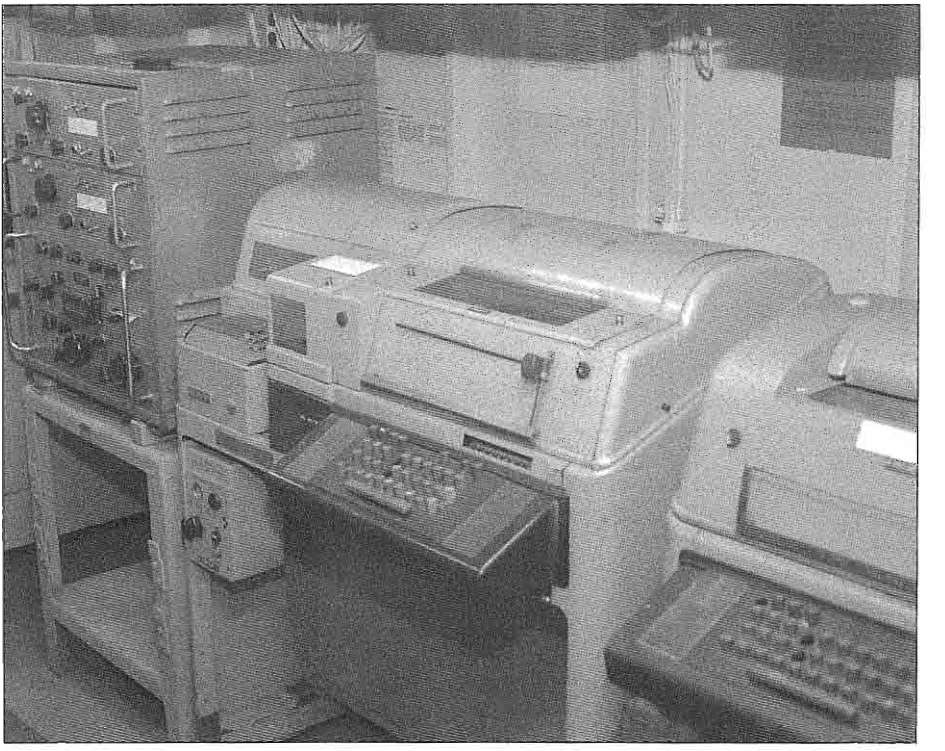
Also in February the radio club will begin the license class program for the Golden Gate Young Marines. This program will work with each Young Marine to obtaining their license. One unique aspect of this program is that it will not only be held aboard *Hornet*, but in the field as well. Radio club instructors will bivouac with the marines and hold classes. The commander of the group has stated that Marines need to be able to learn under any conditions.

One of the clubs future goals is acquiring vintage radio equipment, restoring it and putting it on the air during special events.

MEMBERSHIP

The club is currently soliciting new members and would like to ask for your support. Individuals can provide support in many ways:

Be a distant supporter and check-in to the radio net to offer your support or



In the large Radio Central Radio Receiving Room a large amount of authentic equipment has been preserved. In this photograph, from left to right, are two CV-591A SSB converters, an R390A receiver, and Model 28 ASR teletype equipment. One can only imagine the messages received here during the years CVS-12 was in service.

correspond with the members via the clubs e-mail server.

Participate in special event station operations from aboard *Hornet.*

Work with the Boy Scouts of America to assist scouts in obtaining merit badges.

Participate in restorations of vintage radio equipment for use aboard *Hornet.*

If you are interested in becoming a member of the club you can apply via e-mail or via the clubs weekly radio net. Via e-mail submit your name, address and call sign to:
hornetinfo@halemail.com

RADIO NET

Currently the club net only operates on 75-meter phone There are plans to operate a second net on one of the upper HF bands to allow distant stations an opportunity to check-in and participate.

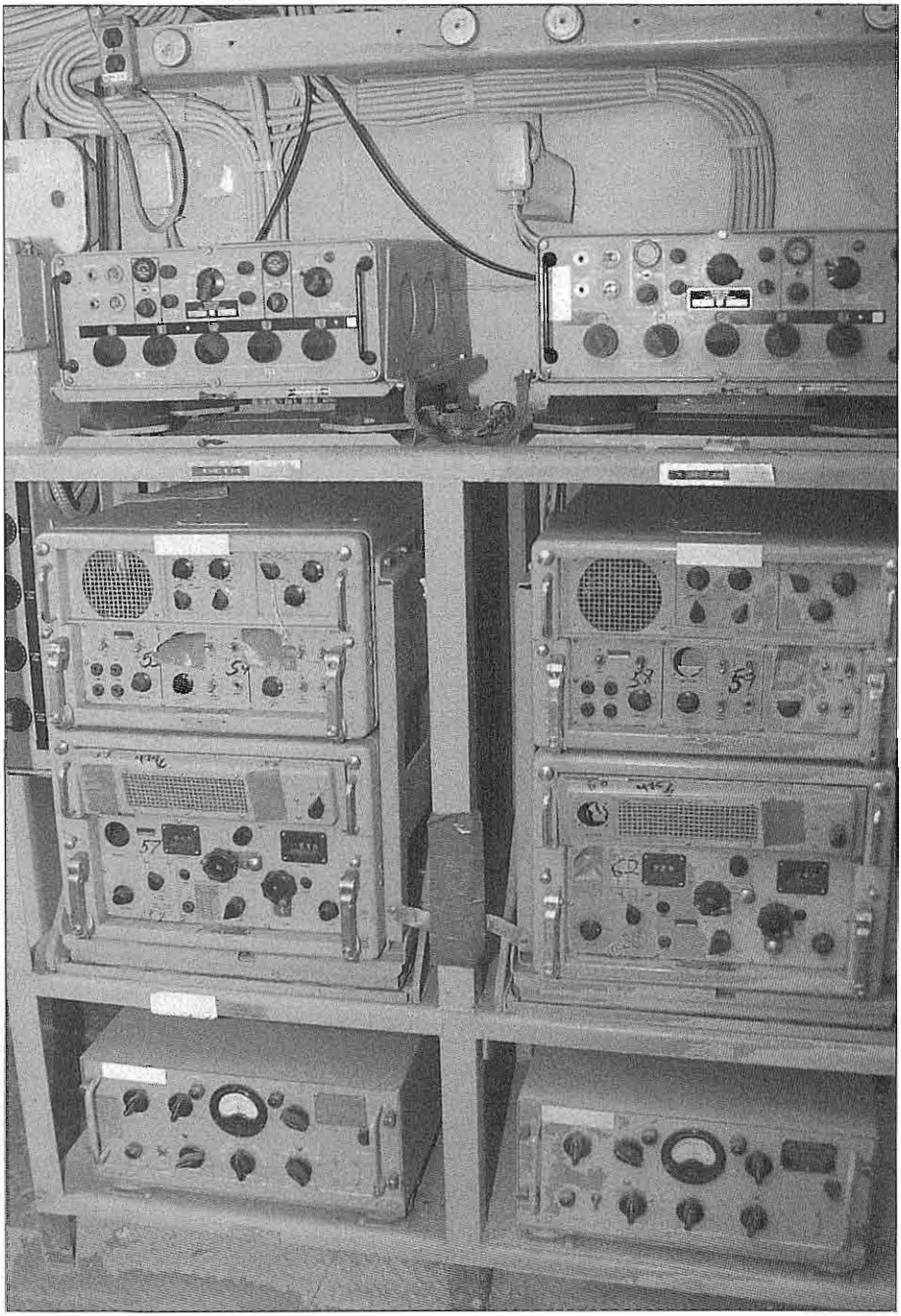
The current radio net meets each Wednesday at 21:30 hours Pacific Time on 3.857 MHz. LSB.

The club also has a working net each night of the week to coordinate the clubs efforts. This net also meets at 21:30 Pacific time on 3.857 MHz.

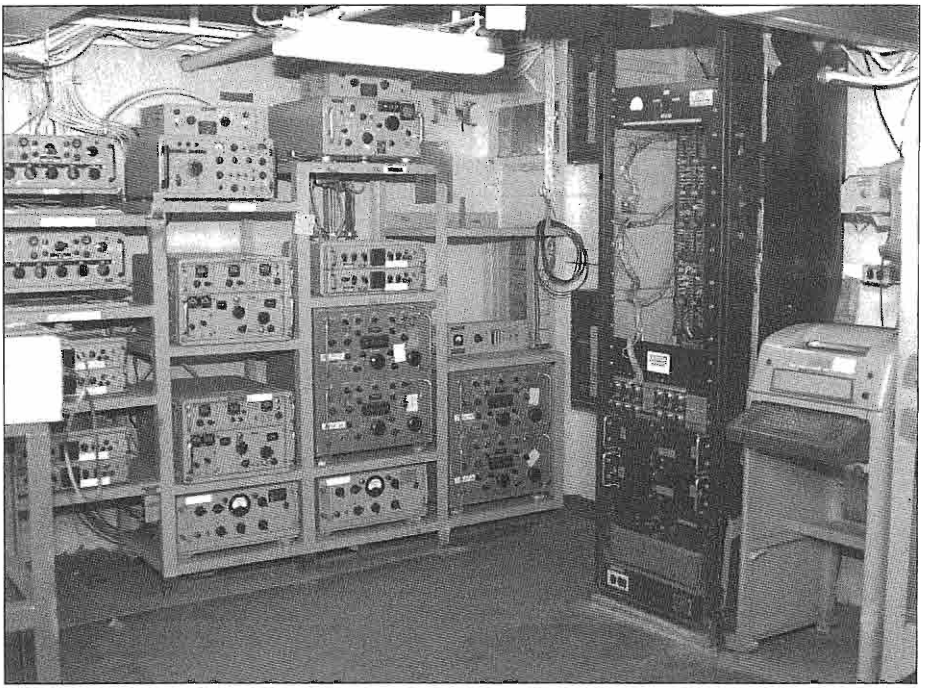
SPECIAL EVENT FREQUENCIES

SSB: 7.240, 14.320, 21.320 and 28.320 MHz.

CW: 3.530, 7.030, 14.030, 21.030 & 28.030 MHz.



Another corner of Radio Central has these three shelves of original equipment. On the top are two R1051/URR HF receivers. The center shelf holds AN/WRR-2 HF receivers, and on the bottom are AN/SGC-1 AFSK TTY converters.



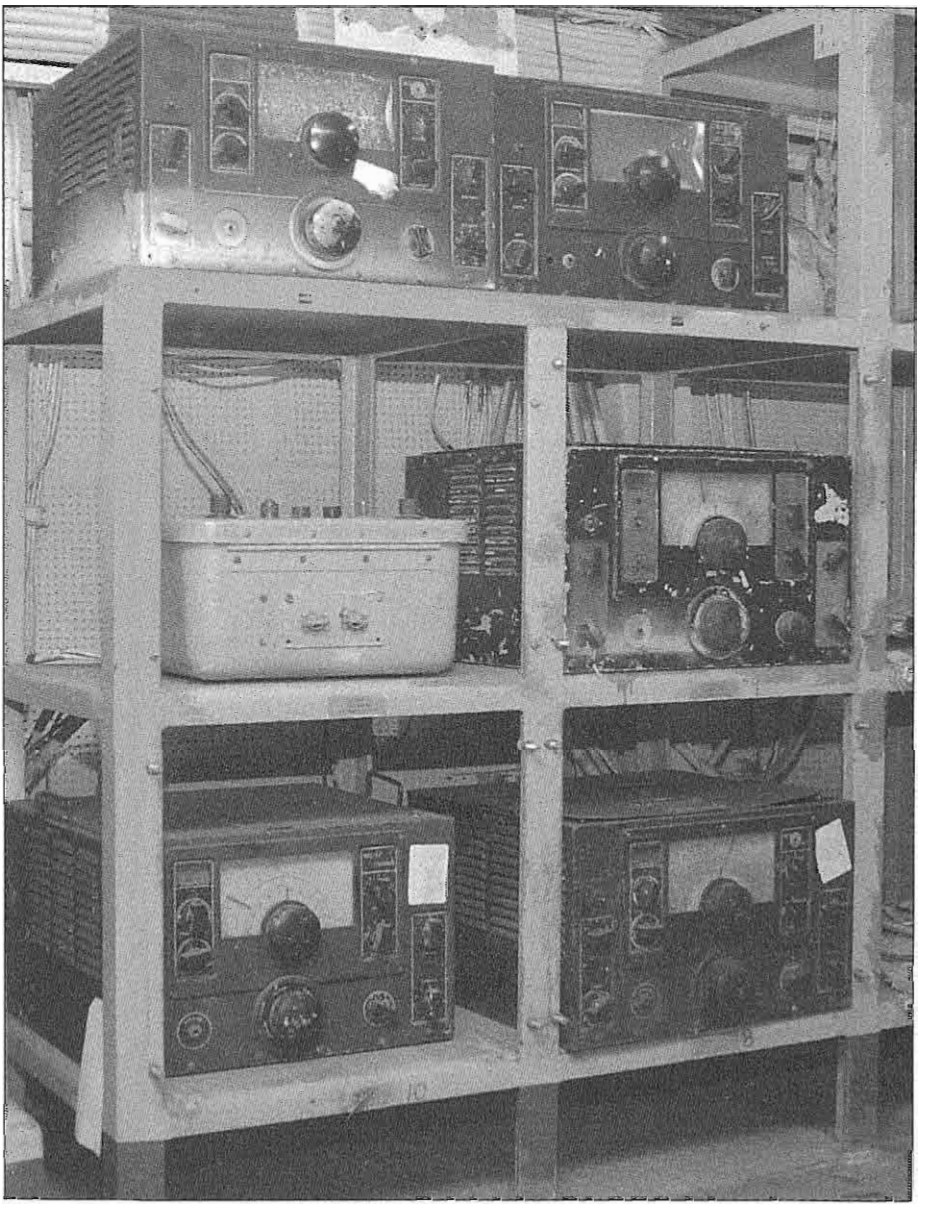
Looking another direction in Radio Central we find the multi-channel TTY receiving center. Frozen in time, the equipment is typical of the era when the ship was last in service, with numerous R1051/URR, AN/WRR-2A, AN/WRR-3 and R390A examples showing. To the right is a partially complete rack that contained TTY patch panels and power supplies for the 60 ma loop equipment for teletype communications. Don't we wish our ham "Radio Central" could look this great?

REFERENCES:

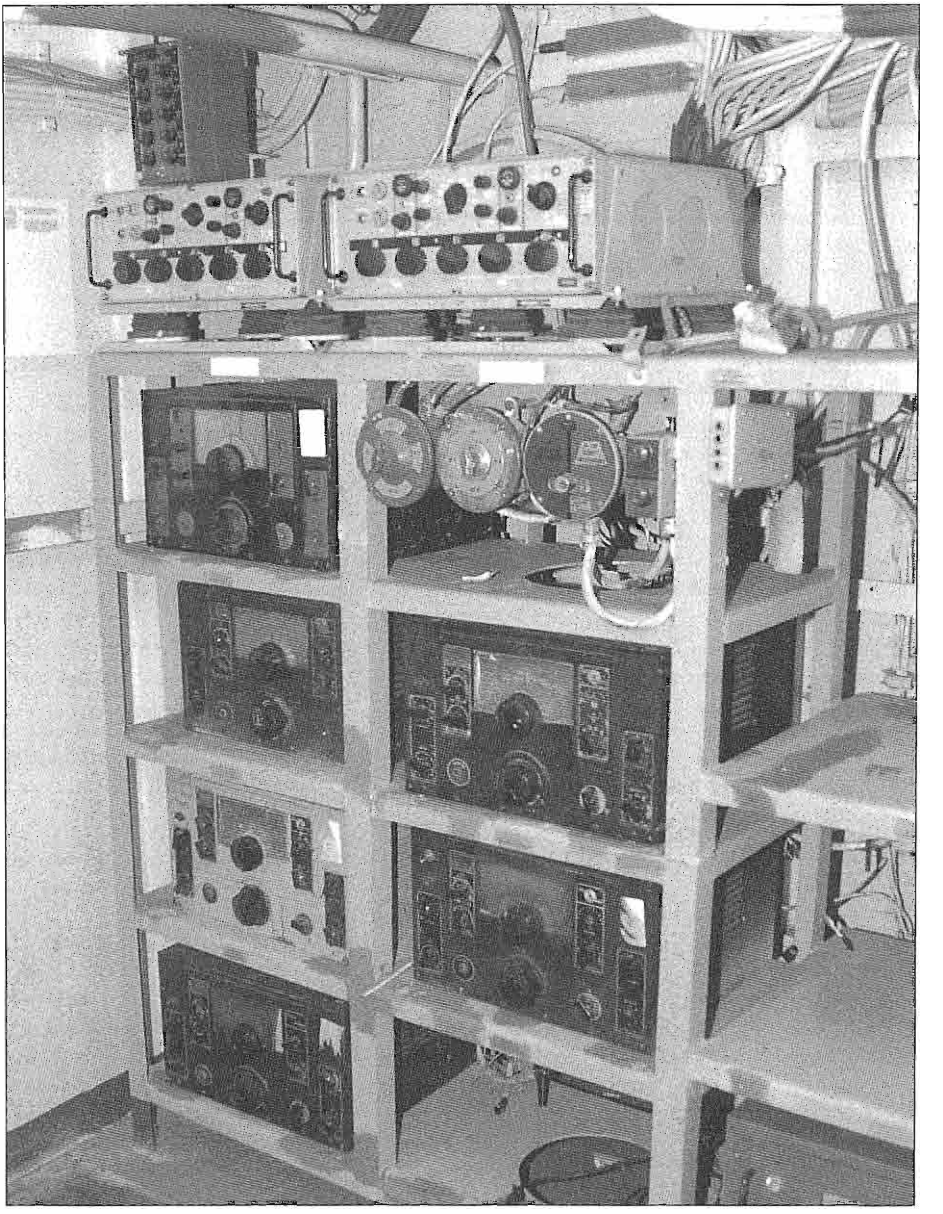
If you are interested in viewing more photos of the *USS Hornet* and the radio rooms check out the following web site. This site contains 80 photographs, mostly of the radio rooms and equipment. http://www.qsl.net/w6ger/hornet/index.html

Additional information about the *U.S.S. Hornet Museum* can be found at: http://www.uss-hornet.org.

U.S. Navy Radioman Insignia



While the USS Hornet was docked in Bremerton Washington, these World War II era National receivers were donated to the ship to become part of the museum's displays. These are all of the National RAO series, and look to be RAO-5s by inspection of the photograph. The RAO-5 was produced during WW2, and was designated the CWQ-46229 by the Navy Department. They were 11-tube, 5-band superhet HF receivers with a crystal filter. There were several versions produced, the RAO-1 thru RAO-8. In this view there are over 500 pounds of National Receivers pictured!



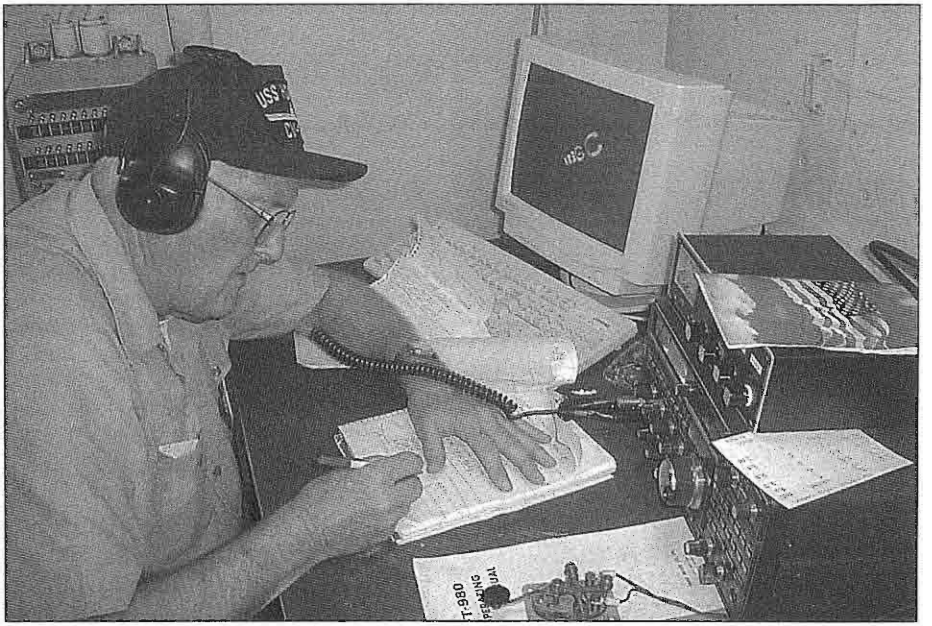
In the Radio Central Radio Receiving Room another five shelves of vintage equipment is found. The top shelf has two R1051/URR HF receivers complete with their shockmount bases. The next three shelves hold five more donated World War 2-era National RAO-series receivers. Just below the R1051's is a key-controlled switch that is was used to route secret communications to other locations on the ship.

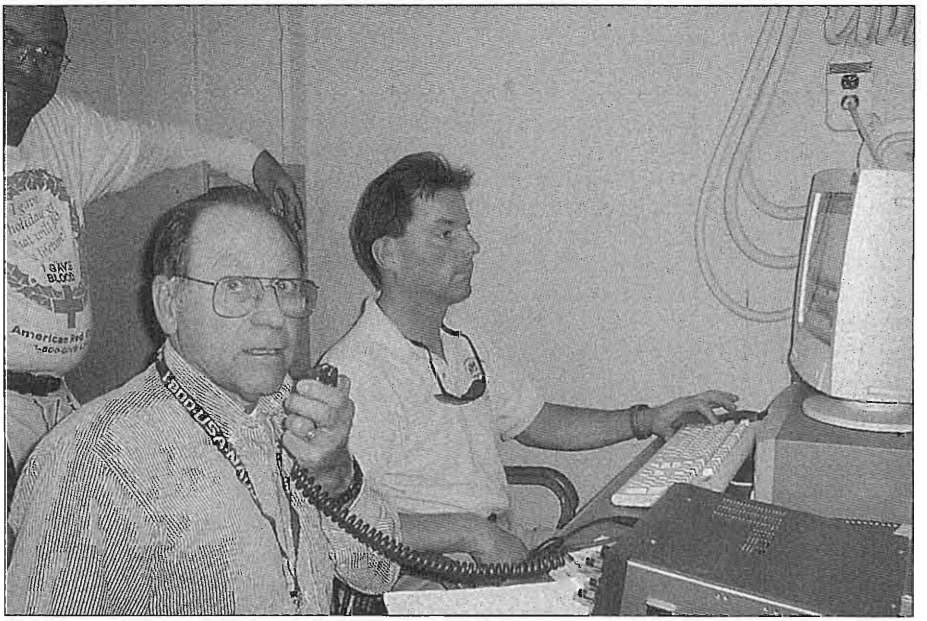
The Combat Information Center has been preserved. On the left is the AN/SPA-8 PPI, or Plan Position Indicator that shows target horizontal angle and distance. Next to it on the right is the AN/SPS-30 Radar Range Height that will show vertical slant range and height.

[Editors Note: From the Historic Naval Ships Association, ER has obtained the following additional information about the U.S.S. Hornet's distinguished history:

Class: Essex Aircraft Carrier
Launched: August 30, 1943 from Newport News Shipbuilding Co., Newport News, Virginia
Commissioned: November 29, 1943
Modernized and re-Commissioned: September 11, 1953 at Brooklyn Navy Yard, Flushing, New York.

The eighth *Hornet* (CV-12) had an extraordinary combat record in WW II, engaging the enemy in the Pacific in March 1944, just 21 months after the laying of her keel and the shortest shakedown cruise in Navy history (2 weeks). For eighteen months, she never touched land. She was constantly in the most forward areas of the Pacific war - sometimes within 40 miles of the Japanese home islands. Her pilots destroyed 1,410 enemy aircraft and over one million tons of enemy shipping. Her planes stopped the Japanese super-battleship *Yamato* and played the major part in sinking her. She launched the first strikes in the liberation of the Philippines, and in Feb. 1945, the first strikes on Japan since the Doolittle raid in 1942. The "Grey Ghost" participated in virtually all of the assault landings in the Pacific from March 1944 until the end of WW II, earning 9 battle stars and the Presidential Unit citation. In 1969, *Hornet* recovered the Apollo 11 space capsule containing astronauts Neil Armstrong and Buzz Aldrin - the first men who walked on the moon - and Michael Collins. A short time later, she recovered Apollo 12 with the all-Navy crew of "moon walkers". The F/A 18 fighter plane is named after this distinguished ship.





Because most of the demilitarized equipment is not yet operable, the Hornet ARC operates special event stations with modern equipment. On Pearl Harbor day 2002 such operations commenced. The top photo shows Rich Rasmussen (W6TQQ) copying CW, and at the bottom is the SSB station. Ken Fowler (KO6NO) is facing the camera, and Dave Clemes (KG6GTR) is logging the QSOs. The man standing is not identified. ER

Marconi Centennial Operation

by Bob Callahan, W1QWT
56 Acorn St.
Scituate MA, 02066

On the evening of January 18th 1903, Gugliemo Marconi sent the first transatlantic message by radio to the King of England from Wellfleet, Massachusetts, located on Cape Cod. 100 years later, on the evening of January 18th 2003, members of the Marconi Radio Club commemorated this event by re-broadcasting that original message along with one from George W. Bush.

For one week leading up to this centennial event, the old Coast Guard station in Eastham, a few miles south of the original Marconi station, was used to set up many types of equipment. The station represented a complete time line history of radio communications. There was a spark station which was for demonstration purposes, an amateur radio station consisting of five HF stations, a 1950's vintage ham station, an IRLP 2 meter station, a UHF Echolink station, a finally a satellite station.

As a lover of history and vintage radio equipment I was asked by the President of the Marconi Radio Club, K1VV, if I would come and operate a vintage AM station. Always willing to promote amplitude modulation and vintage ham equipment, I jumped at the chance.

At the beginning of the event Don (K1DC) brought his Johnson Ranger and Hallicrafters SX 24 Skyrider to Eastham. This combination stayed there all week. The club provided a 75-meter dipole up about 40 feet for the event, and Don used this station to make some contacts during the week. Then, on Wednesday night, AA1AU drove out to Eastham to do some operating.

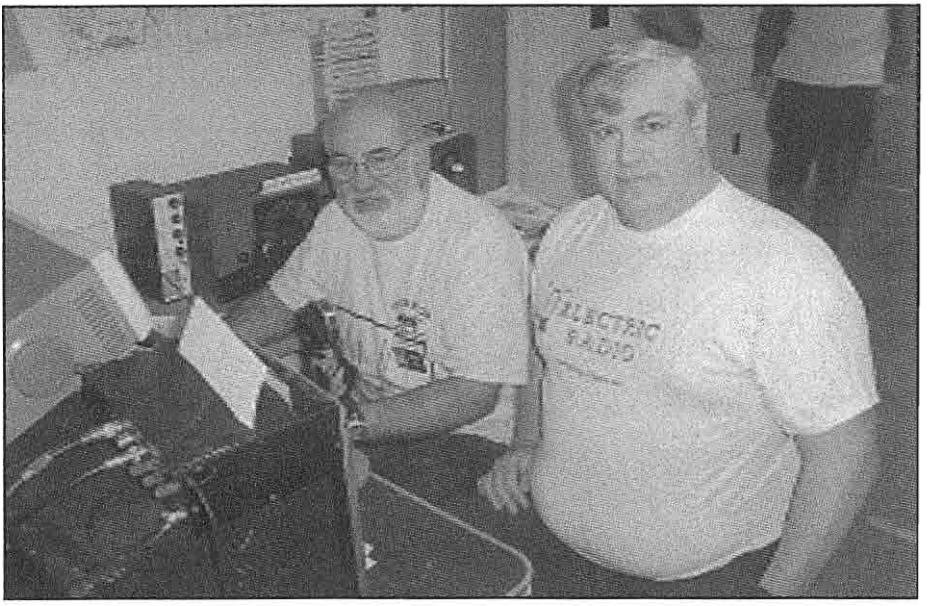
On Friday afternoon, in the middle of a Cape snowstorm, I drove my Mustang out to Eastham with my Johnson Viking Valiant and National NC-300 that I promptly set up and tested. The SWR meter showed a good match on 75 meters and the scope I brought for monitoring the modulation also showed decent modulation.

During the event Don (K1DC) and I completed about 63 AM QSO's. There were many busloads of people who visited the station. On Saturday the 18th Marconi's daughter, Princess Ellettra, visited with us and spoke about how proud her father would have been of our efforts. NASA technicians set up an uplink to the International Space Station (ISS) for the Princess to wish the ISS commander good will.

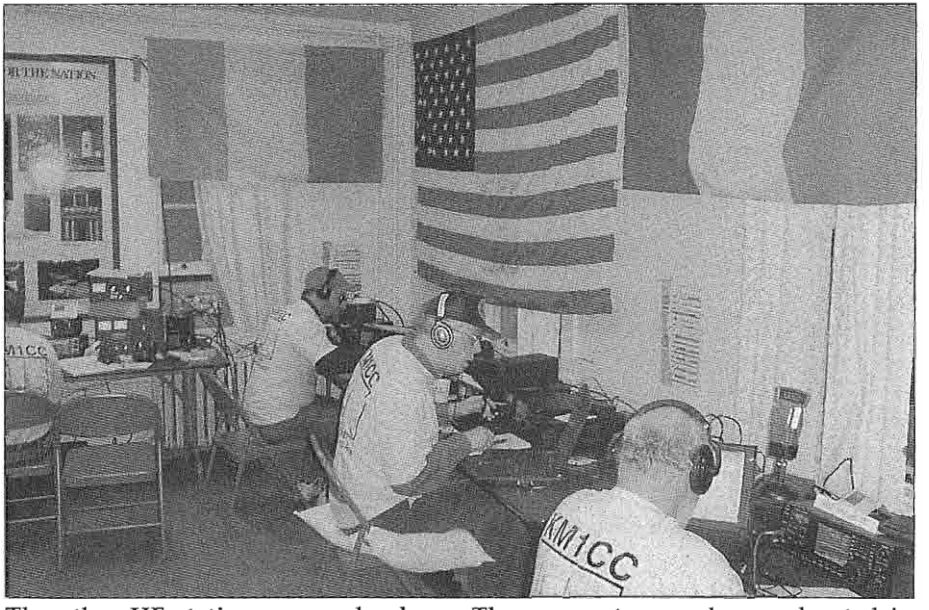
The vintage station attracted a lot of attention. Many new hams that had never seen separate receivers and transmitters stopped by to ask questions. Many an old timer would stop by to reminisce. One older gentleman stopped by with his grandson to show him how it was done in his day. The young man never saw a tube before and when he peered into the top of the Valiant he exclaimed, "Mister, Mister your radio has a fire in it!" When I explained about the "warm glow of the filaments" I think I saw a tear in the old man's eye. He was certainly thinking of the "good ole days".

That evening, the long-awaited rebroadcast of the original transatlantic message began, followed by the presidential message of 2003. Here is the text of both messages, starting at 7:00 PM on CW and at 7:30 PM on phone:

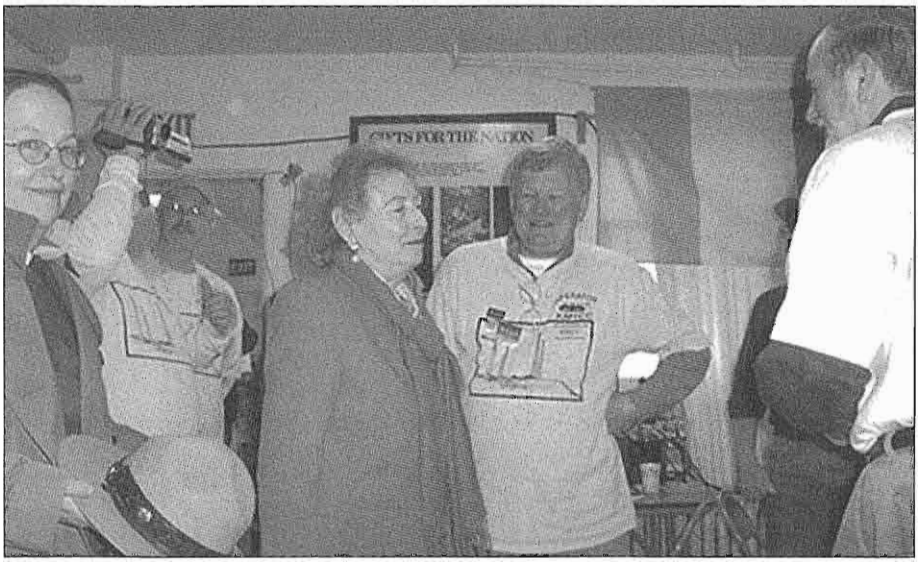
QST QST QST



During the AM operations at Eastham, Don (K1DC) on the left and Q (W1QWT) on the right pause for a photograph to be taken 100 years to the day after the historic Marconi transmission across the Atlantic Ocean occured.



The other HF stations were also busy. These operators, and some located in other rooms, contributed to the QSO total count. Icom sent a couple of IC756 Pro-2s, and the Marconi Cape Cod Memorial Radio Club had two Kenwood TS2000s. The entire operation appealed to many amateur radio interests.



Princess Elletra Marconi, Marconi's daughter, is speaking with K1VV and K1NOK. On the left is a Park Service employee.

During typical winter weather on Cape Cod, this is how the old Coast Guard station at Eastham looked during our operations. It is located a few miles south of Marconi's original station at Wellfleet, Massachusetts.

"This is the Marconi 100th Anniversary Special Event Station, KM1CC on Cape Cod. Celebrating Marconi's first transatlantic wireless telegraph transmission between the United States and Europe.

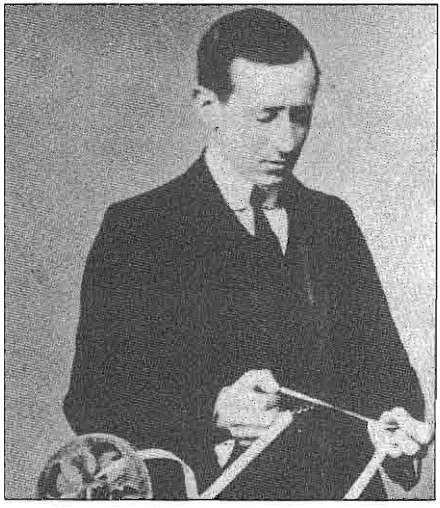
QST QST QST this is Kilo Mike One Charlie Charlie. The 1903 and 2003 presidential messages will follow.

To his Majesty Edward the Seventh
London England:
In taking advantage of the wonderful triumph of scientific research and ingenuity which has been achieved in perfecting a system of wireless telegraphy, I extend on behalf of the American people most cordial greetings and good wishes to you and to all the people of the British Empire.
Signed,
Theodore Roosevelt

A commemorative message from the President of the United States, George W. Bush to follow:

The White House
Washington
I send greetings to those celebrating the 100th anniversary of the first wireless telegraph transmission between the United States and Europe. In January 1903, President Theodore Roosevelt, in a message to King Edward the Seventh, recognized Guglielmo Marconi's invention as a wonderful triumph of scientific research and ingenuity. By inventing the first practical system of wireless telegraphy Marconi pioneered international communications and opened the door for technological advances that have improved the lives of countless Americans and people around the world. I commend the Marconi Radio Club for honoring the proud accomplishments of Guglielmo Marconi and I applaud your efforts to inspire future innovators to work hard to realize their dreams. Laura joins me in sending our best wished for a memorable celebration.
Signed
George W. Bush
President of the United States

This is the Marconi 100th Anniversary Special Event Station KM1CC on Cape Cod."



Taken about 1903, Mr. Marconi is shown reading a message tape from an early Morse inking machine. This equipment is similar to what would have been used at the Marconi station MCC at South Wellfleet, Cape Cod Massachusetts. (Photo from "Wireless Communication in the United States, by Thorn L. Mayes, 1989)

ER

Correspondence Training in Radio and Electronics

by John Hruza, KBØOKU
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Photo by Cora E Cobb, KBØLPZ

The correspondence school movement began in the latter part of the 19th century. The family farm no longer produced the income people needed to live an increasingly modern lifestyle. People from the farms of the Midwest developed new wants as they saw more of the country during the Civil War. Like today, there were new immigrants seeking better jobs.

At that time, correspondence schools offered these less well educated people technical training, especially in industrial crafts and arts, that could prepare them for relatively high paying jobs in the booming heavy industrial economy of the time. Many took advantage of this opportunity, and the schools found themselves in a booming market.

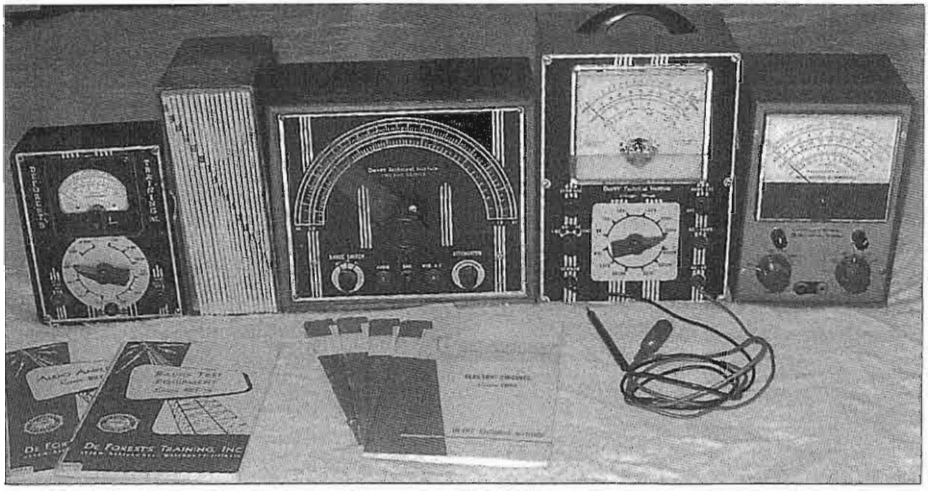
By the end of the First World War in 1918 heavy industry was generating its own workers through apprenticeship programs and on-the-job training. But the electrical trade, and especially its radio specialty, was now the leading edge of technology. This field attracted many who wanted to improve their life (read: income). When the depression arrived in the early 1930s, many laid-off workers saw the need of upgrading their education just to get (or keep) whatever job would support them and their families.

After the Second World War ended in 1945 many veterans spent their GI Bill benefits on correspondence school training, especially in the new field of electronics, with which many of them had already become at least somewhat familiar through their military assignments. The same thing happened again after the Korean "police action".

Many of these electrical and radio technical schools were located in the Chicago area, including International Correspondence Schools (ICS) (later Harcourt Learning, now Thompson Education Direct), National Radio Institute (NRI) (Conar equipment), Coyne Electrical Radio and Television School and the Commercial Technical Institute. Heathkit was a major player in this market from the 1950s until very recently, and worked for a time with Bell & Howell Schools.

In 1931, Dr. Herman DeVry established De Forest's Training, Inc. in Chicago to prepare students for technical work in electronics, motion pictures, radio and later, television. The name was changed to DeVry Technical Institute in 1953, and the Chicago school became the flagship of the current system of local campuses. In 1957, DeVry began granting associate's degrees in Electronics Engineering Technology. In 1968, the name was again changed, to DeVry Institute of Technology. The next year the school began granting bachelor's degrees in EET and, in 1979, in Computer Science for Business, later renamed Computer Information Systems. Today DeVry serves some 47,000 students on 23 campuses in thirteen states and two Canadian provinces.

As with most such schools, De Forest / DeVry offered a course that consisted of a number of printed lessons, each usually including an exam for the student to take and return for grading. The graded test was sent back to the student with a detailed explanation of the correct an-



Some of a student's hard-earned tuition money went towards this collection of test equipment and course materials. These instruments, as described, span quite a few years in the existance of the DeVry school.

swers to any missed questions.

These courses spent little time on theory. They were practical preparation for the student's work in the field. Therefore, hands-on experience was a major part of most lessons. Students would build equipment, test what they had built and report the results as answers to exam questions. The course booklets and equipment that have survived to this day form a very interesting subject for study and are still able to teach new members of the hollow-state community the skills needed to fully enjoy our hobby. Some of this material is pictured in the photo.

On the left is a De Forest 100C volt-ohmmeter (VOM). This instrument came as a kit and was to be assembled by the student as part of the training course. It has 7 voltmeter ranges (10, 100, 500 & 1000 volts dc and 10, 100 & 1000 volts ac), 3 ammeter ranges (1, 10 & 100 milliamps), and 2 ohmmeter ranges (hi & lo). My unit is powered by a series string of 3 "C" cells that perfectly fit the space available, although I'm not sure if this is original (they were alkalines from Radio Shack!) The precision resistors are 1%. A very small selenium stack accomplishes rectification on the ac ranges. The rectifier and resistors are wired between terminal points riveted to a cardboard mounting plate. This plate is supported on the meter studs and is stamped "DTI" for "De Forest's Training Inc."

Next is a boxed set of 19 lesson booklets of the Radio Repair Technician course, also from De Forest. Typical of their times, these contain inspiring quotes and little moral stories. The very first lesson advises us to "Walk forward in the sunshine and the shadows will follow behind." There are also 32 pages of text with several photos and line drawings, as well as an index and a glossary of new technical terms used in the lesson. Spread over the set of lessons is a Chronological History of Radio and Television Developments (through 1941). Although neither the VOM nor these lessons is dated, their artwork is typical of that used just after the war, so they're probably from sometime between 1946 and 1953.

The next instrument, a DeVry Technical Institute 1E02 signal generator, looks

even older although it must have been produced between 1953 and 1968. The front panel has the Art Deco look common to DTI test equipment from 1931 to 1968. As with all the units in the photo, it came as a kit. It seems to have come without a case and the student (or someone) did a very careful job of building a case for it out of 3-ply 3/8" plywood. It has two ranges: 160-520 and 560-1620 kc and both modulated RF and audio outputs. It uses a single 1R5 and is powered by a "D" cell and a 45-volt "B" battery. An Eveready 455 came in the unit which I left in place for historical reasons but which I electrically replaced with a series string of five transistor batteries.

Next to the 1E02 is a matching DeVry Technical Institute 1S14 vacuum tube voltmeter (VTVM) of about the same age. This unit also came as a kit, but reached me in the correct metal cabinet. It has 5 voltmeter ranges (5, 15, 150, 500 & 1500 volts +/-dc, ac or rf) and 6 ohmmeter ranges (Rx1, 10, 100, 1K, 10K & 100K ohms). It's ac powered using one side of a 6AL5 as the power rectifier. The other side is the ac-range rectifier. The unit uses a 12AU7 as the bridge and meter amplifier. Power for resistance measurements comes from two "AA" cells in series, also Radio Shack alkalines. In my unit these were badly corroded. I suspect that the original owner failed the course because the common terminal on the front panel is completely innocent of any hint of wire or solder. The unit could never have worked as built. The test leads came with the VTVM and are typical of those supplied with De Forest/DeVry equipment.

Below the two DeVry Technical Institute instruments are four course booklets from their basic electricity/electronics course, which consisted of at least 15 such booklets. These are the 1965 revision of that course, produced only three years before the name change to DeVry Institute of Technology. They are very similar to those from the De Forest days, but also include practice exercises, the answers to which are in the back of the booklet, just before the exam questions.

Finally, at the right end of the photo, is a post-1968 DeVry Institute of Technology (with Bell & Howell Schools) Transistorized Meter, using 4 UPI 3391 transistors. There are 8 voltmeter ranges (1, 10, 100 & 1000 volts +/-dc and 5, 50, 500 & 1000 volts ac) and 4 ohmmeter ranges (Rx1, 10, 100 & 1000 ohms). There is also a direct connection to the 50 microamp dc meter movement as well as a –25-0-+25 microamp dc galvanometer connection. The function and range switches are very high quality ceramic rotaries and the other components are comparable. Power is provided by four "D" cells which, in my unit, were removed from their holders before they could corrode and damage something.

Taken together, these instruments and lesson booklets are a fair representation of what a student of the period from the 1930s through the 1970s would receive from his correspondence school. While written materials improved only a little, instruments constantly improved in quality and kept up with current technology. If no "Elmer" was available to provide personal training, the correspondence school was a good way to learn radio/TV/electronics in the vacuum tube era.

Thanks to the DeVry Institute of Technology Denver Campus for the history of their school.

ER

Radio's Golden Age, Episode 22

Bruce Vaughan, NR5Q
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The Code Talkers

So much has been said recently about the 'Navajo Code Talkers' that it would be redundant to explain who they were, or the value of their service to this country during WW-2. I was fortunate enough to meet, and visit with one of the original Code Talkers. It was such an interesting experience that I decided to share it with ER readers.

For many years my wife and I enjoyed two vacation trips each year in our RV. The west was our favorite vacation destination—especially the states of Utah, Arizona, and New Mexico. While we found many interesting people and places within the borders of those states, we seemed to enjoy our time on the Navajo reservation most of all—especially in the Monument Valley area.

As is common with most RV buyers, we had to first own one before we were knowledgeable enough to make a proper choice of the type of vehicle needed. Sometimes ownership of several RV's is needed before one ultimately finds an RV that exactly fills their needs. In out case we, more or less, tried 'em all. Our primary purpose in travel, other than the sheer enjoyment of travel itself, was to make pictures. Both of us are avid photographers and needed space for several cameras, plus all of our photographic gear.

I have been an Amateur Radio Operator for many years now—since 1938. Any RV that we considered must also have space enough to accommodate a HF station, and necessary antennas. We found that some RV's adapted readily to electronics, while others seemed less cooperative.

Our favorite rig was a 32-foot, Holiday Rambler 'fifth-wheel' trailer, towed by a ¾ ton F-250 Ford. When we finally retired from travel due to advancing age and health problems, we owned a 33-foot, tandem-axel, motor home. For our lifestyle, and most visited destinations, the motor home—and we tried three different sizes—was never our favorite RV. We always compared it to our old 'fifth-wheel' trailer. It was by far the best RV we ever owned. The 'fifth-wheel' was big and comfortable. Its well-insulated coach was easy to heat and cool, and had two of the finest beds ever put in an RV. Once parked, the F-250 Ford was an ideal vehicle in which to explore the countryside.

I was fortunate enough to buy a complete 'Hustler,' KW rated, mobile antenna, with resonators for five bands, for $25.00 at a local swap meet. I mounted it on the rear of the coach near the ladder. All that was required to change bands was climb up the ladder and screw on the desired radiating element. It worked very well, though I was never able to get the SWR down to anything lower than 2 to 1 on any band, and higher on most.

I decided to improvise and build my own antenna. I found enough aluminum tubing at a local home supply store to fashion a lightweight antenna 16 feet long. When traveling, I stored the antenna in a piece of PVC pipe attached to the top of the RV. I made a simple base for the 16-foot antenna. I only had to drop the bottom of the vertical into a 10" section of tubing and tighten one lock screw. Co-ax from the antenna was connected to a SO-239 mounted on the

wall of the RV, above the small dinette table. By the side of the SO-239, I installed a heavy-duty 12-volt outlet next to the SO-239. Number 10 wire was used from the coach's parallel 12-volt batteries to the outlet. The big problem in this installation was fishing the co-ax, and 12-volt lead, through cabinets, under floors, and between walls.

I stored my Vibroplex and Kenwood 430 in a padded compartment under the seat in the dinette. It was only a two-minute job to remove the transceiver from under the seat, connect the necessary wires and get on the air. If I wanted to use my full ¼ wave, 20 meter vertical, another five minutes was required.

I worked friends back home nightly with good reports. Normally I worked them on 20 meters, but sometimes band conditions favored forty meters. Early one cold morning I was parked in a campground about 4500 feet above sea lever—rather low for that part of the country. I decided to give forty meters a try. I worked a JA with a 579 report. Not such a big accomplishment normally, but looking at the little Hustler 40 meter element about 30 inches long, it seemed like a miracle. Often, in the late afternoon, I would do a little 'mountain topping.' I even worked a new country from such a location. Busting pileups was not as easy as it was at home with a beam and a KW—still I could usually work a DX station if I hung in there and kept trying.

I did have one problem. This was before the days of cheap satellite dishes. Most campgrounds we stayed in were relatively remote—fringe areas with very low signal strength. Antennas on most RV's were cheaply made, inefficient affairs, and the co-ax used was not of high quality. A combination of weak TV signals, inefficient TV receiving antennas, and a Ham with high SWR is a potential problem. In remote areas, far from a TV station, my rig caused quite a lot of TVI in campgrounds. I found the easy answer was to drive away from the campground to a remote mountaintop, fire up the Onan generator, and work DX without concern. My campground operating was normally done between midnight and 6:00 AM. Due to the mobility of my station I never found TVI a problem large enough to address. I am sure that a small transmatch would have probably cured my problem.

In all my years of operating I only had one fellow camper knock on my door and chew me out for causing TVI in his set. Guess what? He was a fellow ham. I had interrupted his 5:00 PM newscast. I thought I was going to have trouble getting him to quiet down. I have never found anyone so unreasonable, irate, and hostile.

As I mentioned earlier, our favorite place on this planet, is Monument Valley. This beautiful Tribal Park is located in southeastern Utah, extending downward into northeastern Arizona. Absolutely no one who watches TV, or goes to movies, is unfamiliar with Monument Valley. Weekly on TV I see movies and commercials that have been made in the Valley. So many John Wayne movies have been filmed here that I cannot remember all of them. One of the best known John Wayne movies made here is "The Searchers.' Dozens of other movies have been filmed there, as have hundreds of TV commercials, but it was John Ford movies, and John Wayne the actor, who made the 'Mittens' of Monument Valley a familiar western landmark. The Navajo's have honored the film makers by naming landmarks after them, and their movies—John Ford Point, and John Wayne Rock, 'Stagecoach,' etc.

To see why we are so fond of this place take a look at the following website. www.eastarizona.worldweb.com/kayenta

The story of how this part of the country became Hollywood's favorite site for western movies is one of the most interesting stories you will ever experience. I urge you to read "Land of Room Enough

and Time Enough" by Richard E. Klinck.

When we visited the Valley some 35 years ago there was not a lot there. If I remember correctly, about 15 Navajo families live within the Valley. There was the Gouldings Trading Post, a small hospital, a small campground, and a public watering place where families could fill their water tanks. Attending Sunday Church services required a little effort. Today, I am sorry to say, civilization has moved in on this beautiful place. Still, it is well worth a weeklong visit.

Ours is a mixed marriage, Mary is Catholic—I am not. Despite dire predictions, our marriage has survived well over half a century. Mary is very devout, and would get up from her deathbed to attend Mass.

When visiting in the Monument Valley area, the most convenient Catholic Church is located in Kayenta, Arizona, some 27 miles south of our campground. Although we have attended Mass there before, we always check the sign in front of the church as we pass through Kayenta, to see if they still say Mass at 5:00 PM on Saturday.

The church at Kayenta is a small building located on the north side of town. There is an ample, unpaved parking lot surrounding the Church. As with most western public buildings, there is a complete absence of landscaping—just dry, hard, well packed, reddish ground surrounding the building.

On this particular trip I was driving a 27-foot Motor home. To run the air conditioner in the motor home it was necessary to power it with my 4KW generator. The generator was rather noisy to run in a church parking lot during services. It's sound was similar to that made by a medium sized riding lawnmower. We were on a late spring vacation, and the weather has hot and dry.

We arrived at the church parking lot about 4:45 PM and found only four or five other vehicles parked there. I chose a parking lot some distance from the church—perhaps 200 feet or so. Mary went inside to church, and I opened the windows wide to get some cross ventilation going. I had a nice breeze, and could see that I would be moderately comfortable waiting for Mary—so I decided to brew up a pot of coffee, get out the Kenwood 430, and see what was happening on 20-meters.

I chose to raise my 16-foot vertical. I found the home-brew vertical superior to the Hustler because of it's full size, quarter-wave, wavelength.

With the 430 perking along on 20 CW, a nice cool cross breeze blowing through the motor home, and a full cup of hot coffee, I knew the hour would pass all to quickly. I rattled out a CQ on my well-worn Vibroplex, and received two replies. Both were stateside—I chose the stronger S-9 plus signal. Soon I was involved in a good rag-chew with an old timer with a good fist.

Some twenty minutes later I noticed a Navajo gentleman standing some distance from my motor home. He appeared to be somewhere near my age, and of rather small stature. He was neatly dressed in a white shirt and dark trousers. He wore the usual Turquoise and silver jewelry—I thought his necklace of bird-egg sized turquoise nuggets was especially interesting.

The gentleman obviously was interested in something about my RV. He carefully avoided looking directly at me, but I sensed that he was trying to catch a glimpse of what was going on inside the vehicle. Then it occurred to me that the CW would carry some distance in the still air, and might arouse curiosity in some people. I even entertained the thought that he might be 'up to no good,' or perhaps he was a church member who did not approve of my mobile operation from the church parking lot.

I decided the best thing to do was sign with the station I was working, and go out and talk to him.

Navajo's do not smile a lot—especially

to strangers. I approached him fully expecting some sort of negative reaction. After speaking, and commenting on the nice breeze we had, I introduced myself, and offered my hand, which grasped firmly.

"I notice that you seem unusually interested in my Motor-home," I said. "Perhaps you are curious about radio code coming from the motor-home. You see, I am an Amateur Radio Operator. I take my radio along with me when I am on a trip. Just now, I was visiting with a ham in Ohio. I prefer using code to talking on a microphone. I find it easier to understand. Would you like to come in, and have a look at my radio? I just made a fresh pot of coffee, and I have some cold root beer and Cokes in the refrigerator."

The Navajo hesitated a moment—then said, "Yes, I'd like to see your radio set. I have heard of Amateur Radio Operators, but I never actually saw a station. I would like to see one." His deeply lined, dark brown face almost seemed to break into a smile—but one could not be sure. Let's just say that he looked less grim.

We stepped inside the coach, and found it pleasantly cool even though the outside temperature was in the low 90's. I could see a look on disappointment on the weathered face of my visitor. I sensed that he was expecting something much more imposing than a Kenwood 430. I have to admit—they do look a trifle 'anemic.'

"Not very big, is it," I said. "They keep making radios smaller and smaller. This one puts out about 60 watts, and the receiver is pretty good. Why don't you have a seat here in front of it and I'll show you how to tune in a station. I don't suppose that code makes much sense to you—I'll switch it to single sideband so that you can hear the hams voice."

I offered my guest a drink—coffee, or cold Coca-Cola. He chose the Coke. I showed him how to tune in SSB and offered him a seat in front of the 430. He turned the tuning knob carefully as though it might break. After listening for a few minutes I could tell he was somewhat disappointed in what he was hearing.

He looked at me and said, "I was one of the original 'code-talkers.' Have you ever heard of the Navajo Code Talkers that the Government used in the War?"

"Yes, indeed, I have heard of the Code Talkers. As I understand it, the Japanese never did figure out how to break the code."

"That's right," he said, "We had them fooled the entire war. We served in many important battles, including Iwo Jima. That one was really rough."

"Why don't you tell me a little bit about your job as a code-talker," I asked.

My visitor explained that when the Government first asked for help from the Navajo's that they gladly went into the Army, but in reality most of those volunteering had little knowledge of what the Government expected from them. At the peak of action, full Companies of Navajos were in the service as code-talkers. They were sent to special schools that taught them the complicated method of communicating.

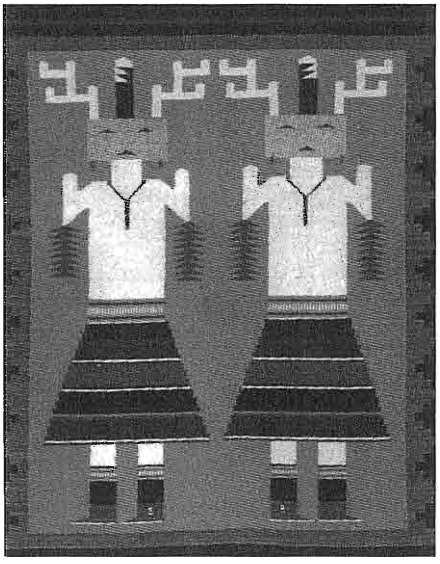
He told me of the tremendous amount of memory work involved in 'code talking.' They had to memorize many commonplace sentences that would normally be used in communications from a battlefield position. Such communications might require several words. For the code talkers this might be reduced to two completely un-related words spoken in the Navajo language. I cannot remember any actual examples, but radio messages such as, "We are under heavy fire. Request air support," might be reduced to two words such as "corn field" spoken in Navajo.

The memory and mental effort required to learn all the many phrases used in battle, and then convert those phrases into a limited number of Navajo words makes learning radio code seem small

and insignificant.

Yes, the Navajo Code Talkers played a most important role in winning the war in the Pacific. Promotions for those involved were few indeed, and recognition of their accomplishments was late in coming. Yet my visitor that sunny afternoon in Kayenta, Arizona never uttered one word of complaint. He was proud that he had been able to be of service when his country needed him, and proud that the enemy never broke the Navajo code.

Recently, our Government finally got around to issuing some medals to the code-talkers at an honors ceremony in Washington D.C. Only four of the code-talkers were still alive and well enough to attend.



ER

[...Editor's comments, from page 1]

antenna; or

(b) where expressed as radio-frequency output power measured across an impedance-matched load,

(i) 560 W peak envelope power for transmitters that produce any type of single sideband emission, or

(ii) 190 W carrier power for transmitters that produce any other type of emission.

10.2 Amateur Radio Operator Certificate with Basic and Advanced Qualifications:

The holder of an Amateur Radio Operator Certificate with Basic and Advanced Qualifications is limited to a maximum transmitting power of:

(a) where expressed as direct-current input power, 1,000 W to the anode or collector circuit of the transmitter stage that supplies radio frequency energy to the antenna; or

(b) where expressed as radio-frequency output power measured across an impedance-matched load,

(i) 2,250 W peak envelope power for transmitters that produce any type of single sideband emission, or

(ii) 750 W carrier power for transmitters that produce any other type of emission.

Tom Marcellino's relay article in February 2003, ER #165, has been very popular, judging from the mail I've received. Unfortunately, the captions for two of the illustrations were wrong. Here are the corrections:

Figure 1: This is an X-Ray micrograph of the Dow-Key receive barrel that clearly shows the continuous length of the movable contact piece on the left. In the center is the isolation connector that is closed when the relay is in the receive position. The fixed portion of the female SO-239 shows on the right side.

Figure 2: Enlarged view of the receive barrel.

Keep those filaments lit!

73, NØDMS

VINTAGE NETS

Nets that are underlined are either new, or have changed times or frequencies since the last issue.

Arizona AM Nets: Sat & Sun: 160M 1885 Kc at sunrise. 75M 3855 Kc at 6 AM MST. 40M 7293 Kc 10AM MST. 6M 50.4 Mc Sat. at 8 PM MST. Tuesday: 2M 144.45 7:30 PM MST.

Boatanchors CW Group: 3546.5, 7050, 7147, 10120, 14050 Kc. Check 80 on winter nights, 40 on summer nights, 20 and 30 meters daytime. Nightly informal net usually meets around 0200-0400 UTC. Listen for stations calling "CQ BA" or "CQ GB".

California Early Bird Net: Saturday mornings at 8 AM PST on 3870.

California Vintage SSB Net: Sunday mornings at 8AM PST on 3860 +/-

Colorado Morning Net: An informal group of AM'ers get together on 3875 Kc Monday, Wednesday, Friday, Saturday, and Sunday at 7 AM MT.

Canadian Boatanchor Net: Meets Saturday afternoon on 3745 Kc at 3:00 PM EST.

Collins Collectors Association Nets: Technical/swap sessions meet every Sunday on 14.263 Mc at 2000Z. A long-established net run by call areas. Informal ragchew nets meet Tuesday evening on 3805 Kc at 2100 Eastern time, and Thursday on 3875 Kc. West Coast 75 M net is on 3895 at 2000 Pacific time.

Collins Collector Association Monthly AM Night: Meets the first Wednesday of each month on 3880 Kc starting at 2000 CST, or 0200 UTC. All AM stations are welcome.

Collins Radio Association nets: Mon. & Wed. 0100Z on 3805 kc., also Sat 1700Z on 14.250 Mc.

Drake Technical Net: Meets Sundays on 7238 Kc, 2000Z. Hosted by John (KB9AT),Jeff (WA8SAJ) and Mark (WBØIQK).

Drake Users Net: This group gets together on 3865 Kc, Tuesday nights at 8 PM Eastern Time. Net controls are Gary (KG4D), Don (W8NS), and Dan (WA4SDE)

DX-60 Net: This net meets on 3880 Kc at 0800 AM, Eastern Time on Sundays. Net control is Jim (N8LUV), with alternates. The net is all about entry-level AM rigs like the Heath DX-60.

Eastern AM Swap Net: Thursday evenings on 3885 Kc at 7:30 PM Eastern Time. Net is for exchange of AM related equipment only.

Eastcoast Military Net: Check Saturday mornings on 3885 Kc +/- QRM. Net control station is W3PWW, Ted. It isn't necessary to check in with military gear, but that is what this net is all about.

Fort Wayne Area 6-Meter AM net: Meets nightly at 7 PM Eastern Time on 50.58 Mc. This is another long-time net, meeting since the late '50s. Most members use vintage or homebrew gear.

Gray Hair Net: The oldest (or at least one of the oldest at 44+ years) 160 meter AM nets. Net time is Tuesday evening on 1945 Kc at 8:00 PM EST and 8:30 EDT. Also check www.hamelectronics.com/ghn

Hallicrafters Collectors Association Net: Sunday on 14.293 Mc, 1730-1845 UTC. Control op varies. Midwest net Sat. 7280 Kc 1700Z. Control op Jim (WB8DML). Pacific Northwest net Sunday 7220 Kc at 2200Z. Control op Dennis (VE7DH).

K1JCL 6-meter AM repeater: Operates 50.4 Mc in, 50.4 Mc out. Repeater QTH is Connecticut.

K6HQI Memorial Twenty Meter Net: This flagship 20 meter net on 14.286 Mc has been in continuous operation for at least 20 years. It starts at 5:00 PM Pacific Time and goes for about 2 hours.

Midwest Classic Radio Net: Meeting Saturday morning on 3885 Kc at 7:30 AM, Central Time. Only AM checkins are allowed. Swap and sale, hamfest info, and technical help are frequent topics. Control op is Rob (WA9ZTY).

MOKAM AM'ers 1500Z Mon. thru Fri. on 3885 kc. A ragchew net open to all interested in old equipment.

Northwest AM Net: AM activity is daily 3 PM to 5 PM on 3875 Kc. The same group meets on 6 meters at 50.4 Mc. Times are Sundays and Wednesdays at 8:00 PM. 2 Meters Tues. and Thurs. at 8:00 PM on 144.4 Mc. The formal AM net and swap session is on 3875 Kc, Sundays at 3 PM.

Nostalgia/Hi-Fi Net: Started in 1978, this net meets Friday at 7 PM Pacific Time on 1930 Kc.

Old Buzzards Net: Daily at 10 AM local time on 3945 Kc in the New England area. Listen for net hosts George (W1GAC) and Paul (W1ECO).

Southeast Swap Net: Tuesday at 7:30 PM Eastern Time on 3885 Kc. Net controls are Andy (WA4KCY) and Sam (KF4TXQ). Group also meets Sunday on 3885 Kc at 2 PM Eastern Time.

Southern Calif. Sunday Morning 6 Meter AM Net: 10 AM on 50.4 Mc. Net control op is Will (AA6DD).

Swan Nets: User's Group meets Sunday at 4 PM Central Time on 14.250 Mc. Net control op is usually Dean (WA9AZK). Technical Net is Sat, 7235 kc, 1900Z. Net control is Stu (K4BOV)

West Coast AMI net 3870 kc, Wed. 8PM Pacific Time (winter). Net control rotates between Skip (K6YKZ), DJ (K6RCL), Don (W6BCN), Bill (N6PY) & Vic (KF6RIP)

Westcoast Military Radio Collectors Net: Meets Saturday at 2130 Pacific Time on 3980 Kc +/- QRM. Net control op is Dennis (W7QHO).

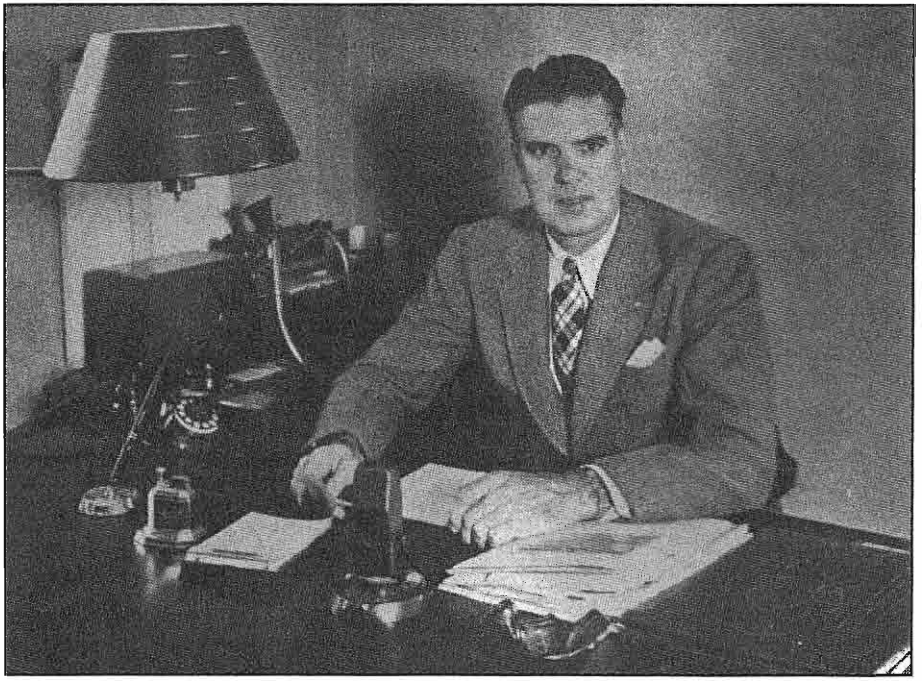
Wireless Set No. 19 Net: Meets the second Sunday of every month on 7270 Kc (+/- 25 Kc) at 1800Z. Alternate frequency is 3760 Kc, +/- 25 Kc. Net control op is Dave (VA3ORP).

The Hollister Crystal Company

by Chip Owens, NWØO
1363 Tipperary St., RR #3
Boulder, CO. 80303-1621

There were numerous small companies that manufactured crystals for the war effort in the early 1940s. Most of these companies came and went in a few short years. Hollister Crystal was one such company and was one of the first to produce crystals commercially in the United States.

J. Herbert Hollister (W9DRD) was making his own crystals in the late 1920s. If you were a ham back then, about the only way to get on the air was with a piezo electric oscillator controlling your transmitter's frequency. Then, as now, there were very few companies making crystals for the amateur radio market. The self-excited oscillator ruled the airwaves until the mid to late twenties when crystal control started catching on. To get some perspective on the state of the art consider this: the first commercial broadcast station to use crystal control of its transmitter frequency was AT&T station WEAF in New York in 1924. Not many amateurs were using crystal control then and quartz "plates" were expensive. Herb started making crystals for other hams and commercial broadcast stations. He formed Hollister Crystal Company to manufacture quartz



Herb Hollister (W9DRD) was featured in the photo section "It Takes All Kinds" of Radio Magazine for May of 1938. According to the caption, the photograph was taken while he was the general manager of KANS Broadcasting Company, and was serving on the Executive Committee of the National Association of Broadcasters Board of Directors.

Here is the laboratory at the Hollister Crystal Company, 1617 Pearl Street, Boulder, Colorado as it appeared between 1940 and 1949. According to Bob Wilkinson, who was employed there in 1942, none of these men are Herb Hollister. The older fellow with the pipe is Ted Heithecker. The younger man in the center of the photo is Ted Hollister's son. The technician seated has his hand on the audio gain control of a Hallicrafters SX-25, probably being used as a resonance detector in the crystal finishing process. Just above the receiver is some General Radio metering equipment, probably a precision wavemeter. At the top of the rack is a General Radio precision test oscillator. Other equipment on the bench is used in the grinding and measurement of crystal blanks. (Photo courtesy the Carnegie Branch Library, Local History Department of the Boulder Historical Society. Research by Chip Owens.)

crystals and holders in 1927.

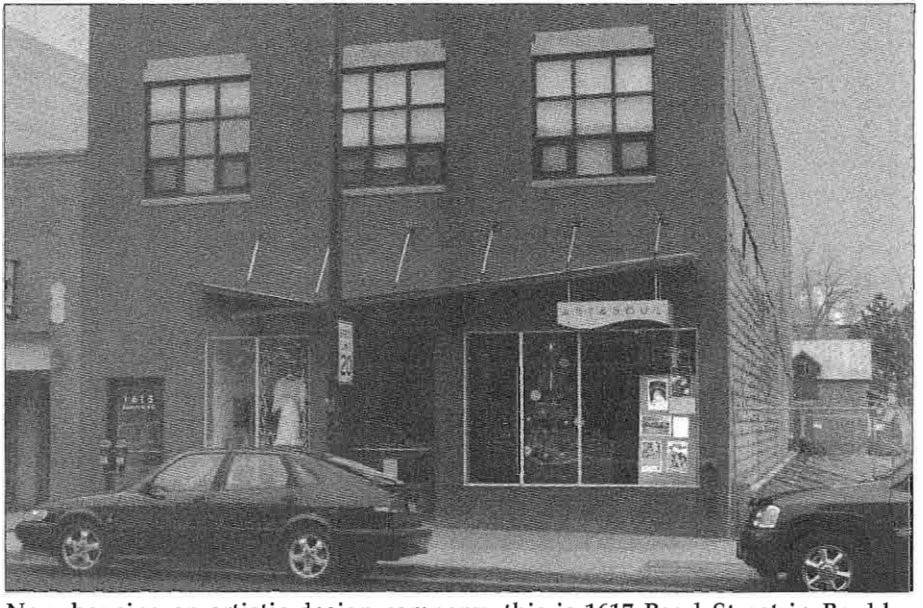
But who was Herb Hollister? He was a ham who saw an opportunity to turn one aspect of his hobby into a business. Herb never went to college, having joined the Marine Corps after completing high school. He served in the Marine Corps until the end of WW1. After the war Herb sold Hudson automobiles and got involved as a stock salesman for Farm & Home Savings Loan Association of Nevada, Missouri. Herb moved into commercial broadcasting as licensee and operator of WAAZ in Emporia, Kansas. From that beginning he expanded his interests with the purchase of additional AM broadcast stations. In his spare time Herb pursued his hobby of amateur radio as W9DRD (licensed in 1925) and relaxed by climbing mountains. All the while Herb kept the crystal business going and had a handful of people working for him. If you check QST magazine[1] for December 1928 and January of 1930 you can read articles Herb wrote to educate hams in the basics of crystal grinding and crystal control of transmitters.

In 1939[2] the military made the decision to convert all its radio equipment to crystal control. This provided a new market for the individuals who had been producing crystals for amateur and commercial use. Soon after, the

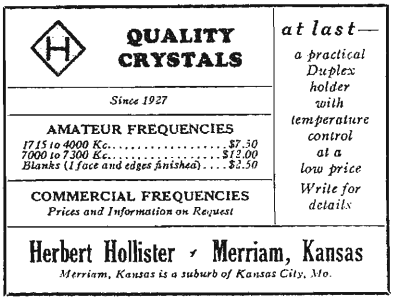
U.S. began providing radio equipment to the Allied Forces and the demand for crystals mushroomed. There simply weren't enough crystal manufacturers to meet the demand. Galvin Company (Motorola) began subsidizing a few individuals who had experience making crystals. Hollister Crystal Company was one of the companies receiving such assistance. With the U.S. entry into WW2 the demand for crystals became even more acute. Hollister Crystal Company expanded its capacity to meet the demand and increased the number of employees to eight people.

Herb moved his crystal business from Wichita, Kansas to Boulder, Colorado in August of 1942 citing the climate as being conducive to greater efficiency of production. Herb and his wife had been vacationing in the mountains of Colorado for several years and relocating his crystal company there was a good excuse to be closer to the mountains he loved. Herb set up operations at 1617 Pearl Street in Boulder. Herb's production manager, Ted Heithecker, moved to Boulder along with Ted's father and some of the employees from the Wichita shop.

One of the major problems faced by Hollister Crystal in Boulder was a lack of skilled craftsmen. Some on-the-job-training was given in the shop but there wasn't enough time to train new employees and keep production going. A government sponsored Engineering, Science, and Management War Training class was instituted at the University of Colorado to help the situation. Here men and women were given twelve weeks training in grinding and finishing crystals. Remember, crystal manufacturing was still a fledgling industry and the work was all done by hand. Materials and processes employed today were unheard of in 1942. Electrical engineering professor Harlan Palmer taught the students about the structure of quartz and Herb Hollister and Ted Heithecker taught practical shop techniques. People with diverse



Now housing an artistic design company, this is 1617 Pearl Street in Boulder Colorado, the old Hollister Crystal Company, as it appeared in December of 2002. Unfortunately, the SX-25 is long gone! (Photo by Chip Owens, NWØO)



The last ad for Hollister Crystals appeared in QST for January 1932, and is reproduced above.

backgrounds such as miners, linotype operators, lumbermen, pharmacists, surveyors, and schoolteachers all enrolled in the free training class. Upon completion a few became full time employees in the shop, but most continued their civilian jobs and worked three or four hours each evening, five nights per week, for the war effort. Production continued on Sundays with an all-volunteer crew.

Bob Wilkinson, KØXW, worked at Hollister Crystal in 1942 and provided some of the background for this article. Bob "finished" crystals to the final operating frequency, tested them for temperature coefficient, and also had the task of trying to salvage crystals that did not meet the temperature coefficient specification. He recalls that the crystals made when he worked there were destined for tank transmitters under a Galvin contract. The crystals were in the frequency range around 1 MHz and were intended for multiplication to the final operating frequency in the low VHF region.

A night shift was added at the shop in 1943 and the company continued to grow. In 1944 Hollister Crystal did half a million dollars in business with the federal government. After the war Hollister Crystal continued operation at a much-reduced rate and by 1949 closed its doors for good.

Herb remained active in the radio business for many years. He owned and operated KBOL in Boulder as well as several other AM stations in the western states. With his partner, Don Searle of Los Angeles, Herb attempted to buy KOA in Denver. The successful bidder however was Meredith Publishing Company of Des Moines, Iowa with someone named Bob Hope owning 49% of the stock.

If you look at those old crystals in your junk box or on the table at the next hamfest take a minute and check the name of the crystal manufacturer. It just might be Hollister Crystal. This happened to me recently when I found some crystals for the BC-669 transmitter/receiver in a box at the Longmont, Colorado hamfest. That's what really started me digging into the history of Hollister Crystal Company.

My thanks to the Boulder Public Library, Carnegie Historical Branch and the Boulder Daily Camera newspaper that made available a wealth of newspaper clippings and photographs. Without their assistance this article would not have been possible.

[1] J. Herbert Hollister, "Debunking Crystal Control", QST, December 1928, p.35,36 J. Herbert Hollister, "Quartz Crystal Facts", QST, January 1930, p.29,30.

2 Virgil E. Bottom, "A History of the Quartz Crystal Industry in the USA", Corning Frequency Control Incorporated, document available at: http://www.corningfrequency.com/history/vbottom.html. Note that this article incorrectly dates the use of crystal control at WEAF as 1926 when it actually was put into use in June of 1924. See: "Commercial Broadcasting Pioneer, The WEAF Experiment 1922-1926" by William Peck Browning, 1946, Harvard University Press.

ER

The Telrad 18A Frequency Standard, Also Known As the Hallicrafters HT-7

by Chuck Teeters W4MEW
841 Wimbledon Drive
Augusta GA 30909
CTEET70@AOL.COM.

I've only seen pictures of the 1939 Hallicrafters HT-7, but the Telrad 18A carbon copy frequency standard showed up in large numbers right after WWII. I bought one in 1946 from Surplus Radio Inc. in New York City for $19.95 brand new in overseas packing. I used the 18A to keep my receiver dials accurate starting with an SX-24, RME-84, BC-348, and lastly a Super Pro. In 1954 I relegated the 18A to the spare parts department when I got a Collins 75A-3. Right next to me at the Lawrenceville hamfest last year Tom, W4ULL, had a Telrad 18A for sale. He didn't get any takers and as we were leaving I worked out a trade for old times sake. In the days of two dial single conversion superhets a crystal calibrator was almost a necessity. If you had a crystal controlled transmitter you could set the receiver bandspread dial to your xtal frequency and twiddle the main tuning to find your own signal. But if you were using an ECO, which were what VFOs were called back then, you were out of luck. The receiver instruction books said set the main tuning to the red line and the bandspread dial was correct. This might put you close but was just as likely to be way off.

Here is Telrad's version of the Hallicrafters HT-7, built 1941 through 1945. This example still has the orange inspector's stamp on the front panel.

Some of the better ham receivers had calibrated bandspread dials but they were, at the best, calibrated every 50 or 100 KHz. Most however had 0 to 100 bandspread dials and presetting your receiver to a spot frequency was very much guess work.

The pride of the Hallicrafters line in 1938 was the SX-16, 17, and

18. They had 0 to 100 bandspread dials spread over 720 degrees of rotation, which provided super easy tuning, but you didn't know what frequency you were tuning to. Bliley Electric Company of Erie Pennsylvania provided a cheap answer with a frequency standard crystal that would oscillate on two frequencies. It was X cut to the correct length for 100 KHz and the Y cut thickness was right for 1000 KHz. Hallicrafters used this crystal to build the HT-7, a four tube calibrator. The HT-7 provided 10, 100, and 1000 KHz outputs with harmonics to 44 MHz. With the HT-7 connected to your receiver you could set your dial accurately within 10 KHz of any frequency. For example, with the calibrator set to 1 MHz I spot the 4 MHz harmonic signal on my SX-18 dial, switch the calibrator to 100 KHz, tune down to the first 100 KHz calibrator signal, which is 3900 KHz, switch the calibrator to 10 KHz and tune up to the second calibrator signal, which is 3920 KHz, and I am ready for the truth net, which is what we call our Augusta 75 SSB evening net on 3920.

The HT-7 uses the Bliley SCM-100 crystal circuit, a 6F6 electron-coupled oscillator with the crystal in the grid and either a 100 or 1000 KHz tank switched into the screen circuit to generate either a 1 MHz or 100 KHz signal. A 6N7 dual triode is connected as an R-C multivibrator. The multivibrator is a very unstable 10 KHz oscillator but is locked to the 100 KHz output of the 6F6 producing a crystal stabilized 10 KHz. output.

Either the 1 MHz or 100 KHz and the 10 KHz signal are mixed together in a 6L7 pentagrid mixer/converter. The plate circuit of the 6L7 is tuned by a front panel band-switching tank anywhere from 1 MHz to 44 MHz and capacity coupled to the output terminals. The 6L7 is overdriven to provide both mixing action and harmonic generation. As a result combinations of the 1000, 100, and 10 KHz signals are available every 10 KHz from 1 MHz to 44 MHz. The power supply is a transformer operated full wave rectifier with an 80. The whole works is in an 8" by 8" by 5 ½" cabinet.

Hallicrafters sold it for $29.50 in 1939 and 40. From the number around today it appears that it was not a hot selling item.

In 1941 the Signal Corps, as part of a mobile radio shop requirement, selected the HT-7 as the frequency calibrator to be included with bunch of off the shelf radio test equipment. 50 mobile radio repair shops were to be assembled at Fort Monmouth, N.J. Bill Halligan had his Indiana Avenue plant in Chicago working at full capacity with domestic and foreign government radio contracts as well as building amateur radio transmitters and receivers. He also had moved into the school PA/radio systems market as well as the marine radiotelephone market. The small government contract for 50 HT-7s was given to his friend, Fred Garner, who operated Telrad, a small company also in Chicago. Garner was building remote control units for the Seeburg Music Company, located almost next door to his plant on South Racine Avenue. His units provided wireless selection of records using carrier current transmission over 115 volt power lines. Seeburg jukeboxes could be installed much easier with Telrad units, which eliminated wiring between the customer booth coin boxes and the main jukebox. With the potential switch to war production, jukeboxes and Garners business was about to end. The offer from Bill Halligan was accepted gratefully and there is the possibility that some stock or cash exchanged hands.

In typical government fashion the contract switch to Telrad was fouled up. The HT-7 contract was listed as Crystal unit, Hallicrafters type HT-7. In the days of crystal controlled Army radios, crystal units were procured in much larger quantities than the radio sets they were used in. A ratio up to 80 to 1 for each radio ordered was normal. For example, each

Hallicrafters BC-610 transmitter was ordered with a case of 75 crystals. (Each a different frequency of course) Whoever wrote the HT-7 contract, not knowing just what a "Repair Shop, Mobile, Radio" was, to play it safe ordered the crystal units using the 75 to 1 ratio used on other Hallicrafters contracts. So Telrad and Fred Garner got a contract to supply 3750 substitute standard crystal units, Telrad type 18A to the U.S. Army Signal Corps with a contract option for 3750 more.

Telrad produced the first 50 or so 18A crystal standards identical to the HT-7. The follow on 18As, with Signal Corps approval, had a 6X5 rectifier in place of the 80 rectifiers to eliminate the 5-volt winding on the power transformer. At about serial number 0080 the power transformer was changed to a universal 50-60 hertz type with a tapped primary and a switch for 110 through 240-volt operation. Moisture and fungus proofing, MFP, was added starting in early 1943. Late units had a 6V6 in place of the 6F6 crystal oscillator. The only indication on the Telrad 18A of the government contract was the Army specified dark green exterior and the orange Signal Corps inspector's stamps. The contract was terminated in 1945. To get rid of the excess 18As at the end of the war the War Assets Administration appointed Belmont Radio Inc. in Chicago as the distributor.

Many surplus outlets on the East Coast and Midwest sold 18As, with asking prices running from $20 to $35. The stock of brand new 18As had disappeared from the surplus market by the mid fifties, but like my Lawrenceville 18A, were being sold second hand at hamfests for many years after. However the change to crystal front ends in receivers, built in crystal calibrators, and synthesized oscillators had eliminated the need for units like the Telrad 18A and they have all but disappeared from the hamfest market. Most now are probably in the junk box as a collection of old parts.

When I got the 18A home from Lawrenceville a check of the inside showed Tom had replaced the two power supply filter caps and one coupling cap in the multivibrator. Everything else was original, and it took off and worked fine.

So after 60 plus years I now calibrate my S-14 Sky Chief and SX-18 Sky Challenger in a style I couldn't afford back in 1941. ER

What's New . . . .

IN RADIO

HALLICRAFTERS HT-7 FREQUENCY STANDARD

A crystal-controlled oscillator which will accurately serve many of the purposes of frequency meters and service oscillators and which, because of its flexibility of application and low price, will be of interest to hams, servicemen and laboratory workers, is found in the new Hallicrafters HT-7 Frequency Standard.

Fundamental outputs at 1000, 100 and 10 kc. are provided, each with harmonics made useful even in the highest frequency ranges by a built-in, tunable harmonic amplifier stage. A dual-type 1000-100 kc. crystal controls the outputs at these frequencies. The 100-kc. crystal position also locks in a multivibrator which provides the 10-kc. output. Precise accuracy of the 100-kc. output (and therefore the multivibrator 10-kc. output) is assured by provision for slightly varying its frequency to resonate exactly, at its fundamental or a harmonic, with other standards such as WWV's transmissions. Exactness to a fraction of one cycle is thus obtainable. The 10-kc. harmonics are strong enough to provide useful check points to well over 15 megacycles and the 100 and 1000 kc. harmonics well beyond 30 Mc.

The entire unit is inclosed in a steel cabinet 8" x 7½" x 5½", finished in gray stipple. Four tubes serve as crystal oscillator, multivibrator, harmonic amplifier and power-supply rectifier. Its panel controls are: fundamental-frequency selector switch, 100 kc. crystal tuning, harmonic amplifier bandswitch, harmonic amplifier tuning, and on-off switch.

CLASSIFIEDS

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Non-subscribers: $3.00 minimum for each ad up to 20 words. Each additional word is 25 cents.

Please call or write for display rates.

VINTAGE EQUIPMENT ONLY

ER
PO Box 582
Pine Colorado 80470-0582

Telephone: 720-924-0171
FAX: 303-838-3665
ER@OfficeOnWeb.Net

Deadline for the April 2003 Issue: April 28

FOR SALE: Repair and restoration on all vintage equipment; 45 years experience. Barney Wooters, W5KSO, 8303 E. Mansfield Ave., Denver, CO 80237. (303) 770-5314

FOR SALE: NOS Tungsol 26Z5W as used in the R390A, $16.00 each. Electron Tube Enterprises, Box 652, Springvale ME 04083. 207-490-5870

FOR SALE: Countermeasures receiving set AN/WLR-1D, 50-10750 MHz, 9 bands, simultaneous display of frequency, spectrum, and modulation info on dual displays, manual, 1200 lbs, $4,500.00. Carl Bloom, 714-639-1679 3778111@mcimail.com

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FOR SALE: Naval Receivers, RAK, RAL, RAO, RBA, RBB, RBC, RBL, RBM. Some checked, pwr splys available. $75.00-$450.00 depending on condx. Many other types. Carl Bloom, 714-639-1679 3778111@mcimail.com

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FOR SALE: Dynamotor overhaul kits (NOS) for DM-34 & DM-35 $15.00 ppd. Bruce Beckeney, 5472 Timberway Dr., Presque Isle, MI 49777, 989-595-6483

FOR SALE: Plans reprinted from 1936/1943 Gernsback "Radio-Craft" for simple vacuum tube "Magic Eye" projects. Free list. Bob Ryan, 1000 S. Gilbert St., Apt 132, Hemet CA 92543-7065

FOR SALE: Authorized repairs and sales of all types of amateur radio and communications equipment, and also test equipment. Please call us at LAND AIR COMMUNICATIONS, 718-847-3090 and visit our web site: www.landaircom.com. We have over 3,000 items in inventory and carry all types of communications parts.

FOR SALE: Swan 350, $150: Heathkit SSB filter #404-328, 2.1 kHz AT 3.395 kHz, NOS $50. D. Michael W3TS, 129 Church Lane, Halifax, PA 17032; 1-717-896-3973

FOR SALE: 525 VDC @ 500ma PS 10.5 fil by G.E. 60 lbs. BO WØBEI 800-500-8055 MN meter on fr 19" mtg daveschmidtke@lakes.com

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FOR SALE: COLLINS PP-4765/GRC-159(V) 28V DC Pwr Sply; HEATHKIT QF-1 Q-Multiplier w/ manual $20; KNIGHT P2/SWR Pwr Meter w/ manual $20; PETER DAHL Collins 516-F Solid State Conversion Kit (new) $20. K.A.Norvell, 6015 Norway Road, Dallas, TX 75230, 214-373-3973, w5kn@aol.com.

FOR SALE: Vibroplex 1919 "Blue Racer", $300; Autronic Paddle, $125; Speed-X straight key $30. Richard Prester, 131 Ridge Road, West Milford, NJ 07480. 973-728-2454. rprester@warwick.net

FOR SALE: RBZ Receiver, 5 -13 MHz, battery case, phones and body pack. $55 R. Wurtzinger, 1140 S Taylor, Oak Park, IL 60304 708-383-4579 richwurtz@juno.com

FOR SALE: Harvey Wells Bandmaster Deluxe w/ working Pwr Sply & cord. Very Restorable. Larry, 818-917-4841 Lbolster@earthlink.net

FOR SALE: Johnson Ranger I, extra clean, works perfect, no mods, original mic and manual copy. Jim, K7BTB, AZ 928-635-2117

FOR SALE: 132- QST magazines from 1938 to 1957 $60.00 plus shipping. 9- Electric Radio Magazines $12.00 plus shipping. 12- CQ Magazines, complete 2002 $12.00 plus shipping. Alan Lurie, W9KCB, 605 East Armstrong Ave., Peoria, IL, 61603. 309-682-1674

FOR SALE: Galena crystal radios. Used radio tubes, free lists. Len Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150 radiolen@aol.com

FOR SALE: one HTX-100 $45.00, one HTX-252 $45.00, one GCR-109 $45.00 **WANTED:** one SB-300 Heathkit. James P. Barton, POB 417, Burke SD, 57523

FOR SALE: Gonset G-66B & G-77 $40.00 each. WANTED: 803, 813 tubes & sockets. W7ISJ, POB 18436, Tucson AZ, 85731, 520-886-3087

FOR SALE: Hallicrafter S 85, S 76 with speaker and Heath Gr 81 regenerative rcvr. Manuals for all. Or trade for Heath SB line. Bob WBØDMC 507-331-5103

FOR SALE: General Radio 1208-B, 1211-13 Oscillators, 1201-C Pwr Sply. $35.00 for all plus shipping. Ken, 2309 N. 51st St. Waco TX 76710

FOR SALE: 3 Military units BC-603 FM rcvr, Freq 20-27 mc. Price incl. ship. $55.00 each. Call 305-745-1801 3PM-9PM EST

FOR SALE: Drake TR-4 & RV-4 w/ manual-Exc condx. Robert Braza, W1RMB, (MA), 508-261-8231

FOR SALE/TRADE: Drake/2-B $150, SPR-4 $375. Col/310B-$325. Heath/HW-202 $50, EK-2 rcvr $50. WTD: RCA/Radiomarine/T-408/URT-12 xmtr&info. Sam KF4TXQ Box 161 Dadeville, AL 36853-0161 (256)825-7305 stimber@lakemartin.net

FOR SALE: Collins 4:1 knobs, guaranteed satisfaction. $55.00 + shipping. Dutch WB7DYW 832-549-1540 wb7dyw@ev1.net http://users2.ev1.net/~wb7dyw/4to1knob.jpg

FOR SALE: Collins 75A2-3 cabinet, Sonar Rcvr UNS1, Heathkit reflected pwr SW bridge, Lamkin freq. meter, Trio Labs RMS meter, Craftsman AM FM tuner, Stromberg Carlson SAU70 amp, Military manuals. Bill Coolahan, 1450 Miami Dr. NE, Cedar Rapids Iowa, 52402-2933. 1-319-393-8075

FOR SALE: Porcelain-based Tx tubes, send SASE for list. W7SC, 3932 S. Mesa View Ln, Boise ID, 83706-6052

FOR SALE: 6.3V @23A, 1500v. ins., sealed, transformers $12.00 + 19 lbs shipping. Jim Feasel, 13549 Morse Rd SW, Pataskala OH, 43062. 740-927-2592

FOR SALE: TMC GPR-90, $400; Hallicrafter FPM300, $250; Johnson 250 watt Matchbox w/ swr, $100; National NC303 w/spkr, $300; Drake MN4 Ant Tuner, $100. TMC GPR-90, $400; Hallicrafter FPM300, $250; Johnson 250 watt Matchbox w/swr, $100; National NC303 w/spkr, $300; Drake MN4 Ant Tuner, $100. Pickup preferred, Harry, WA6IUR, 626-355-0290 flynham@aol.com.

FOR SALE: RF-403 VHF Radio $75.00. Meisner Signal Shifter w/coil set $150.00. Al Jenkins, WA1RWB, 5 Daley Ct., Nantucket MA 02554, 508-325-7122

FOR SALE/TRADE: Original manuals; Hammarlund HQ-100, HQ-110A, HQ-145, HXL-1, SP-600-J/JX. A.J. Bernard, NI4Q, PO Box 690098, Orlando, FL 32869-0098, 407-351-5536

FOR SALE: 1942 RCAF AR-6, Exc condx, $350.00. See Dec 2001 ER. WA9IYF, 703-876-8419

FOR SALE: First user friendly circuit for early BC-348's! Send $4.00 + .37 US stamp + business envelope. Ray Larson, 12241 ½ Gorham Ave., W. Los Angeles CA 90049-5214

FOR SALE: Koss T-5 Stereo Control, Small unit, $15.00. Lafayette Mod-HE30 @9, $95.00. Bernie Samek, 113 Old Palmer Rd, Brimfield MA 01010, 413-245-7174 FAX 0441. NOTICE: If I don't return your call, please call again because message was garbled on my machine or I copied wrong.

FOR SALE: Radio books, magazines, catalogs, manuals (copies), radios, hi-fi, parts. Send 2 stamp, LSASE. David Crowell, KA1EDP, 40 Briarwood Rd., North Scituate, RI 02857. ka1edp@juno.com

FOR SALE: 1942 Royal Canadian Air Force AR6, EC, $350.00. See December 2001 ER. WA9IYF, 3429 Gaddy Ct., FLLS CH, VA 22042 703-876-8419

FOR SALE: Collins Radio stock certificates, 33 avail, 10-share (green) or 100-share (blue), issued to various companies. $20.00 each, limit one per customer. Check or MO. No choice on color. William O. Dean, KC7ICH, PO Box 3105, Tonopah, NV, 89049

FOR SALE: New Ranger 1, Valiant 1, & Navigator plastic dials, freq numbers in green, with all the holes just like orig. - $17.50 ppd. Bruce Kryder, W4LWW, 277 Mallory Station Dr., Ste. 109, Franklin, TN 37067. bak@provisiontools.com

FOR SALE: Military Radio manuals, origs & reprints. List for address label & $1. For specific requests, feel free to write or (best) email. Robert Downs, 2027 Mapleton Dr., Houston, TX 77043, wa5cab@cs.com

FOR SALE: Communications Receivers, Military Communications and some test equipment. SASE, Don Jeffery, 131 North Ivy Ave., Monrovia CA, 91016, boallan@aol.com

FOR SALE: New Collins winged lapel pin, still have meatball version, either type - $5.95 + .75 s/h. W6ZZ, 1362 Via Rancho Prky, Escondido, CA 92029. (760) 747-8710

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

FOR SALE: Vintage Radio Service. We repair radios, record changers, radios home, auto, tube & transistors. 1930-1980. Ken Hubbard, KA9WRN, POB 792, Beloit, WI 53512. (608) 362-1896

FOR SALE: Repro Nameplates, R-390A generic $9, S1J-3 and S1J-4 exact replicas, $12. Tom Marcotte, N5OFF, 210 CIem Dr., Lafayette, LA.70503. courir@yahoo.com

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

FOR SALE: R.L. Drake repair and reconditioning, most models including TR-7's, 35 years experience. Jeff Covelli, WA8SAJ, (440)-951-6406 **AFTER 4 PM**, wa8saj@ncweb.com

NOTICE: Visit Radioing.com, dedicated to traditional ham radio & vintage radio resources. Let's Radio! Charlie, W5AM. http: / / www.radioing.com.

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: S53A, DX100, 75A4, DX4O, 75A1, Ranger, TR5, 30L1, HA350, NC183D. A.J. Bernard, POB 690098, Orlando, FL 32869. 407-351-5536

FOR SALE: Pwr sply BC-610-I, BC-375E, PU only, Prescott, AZ. W7RBF, AZ 928-778-1993

FOR SALE: DX-35, DX-40 \reproduction crystal doors. $11.50 shipped. Texans add 8.25% sales tax. Glen Zook, 410 Lawndale Dr., Richardson, TX 75080

FOR SALE: TX'ers, rcvrs, parts, manuals, etc. Send a large SASE. EFJ Thunderbolt excellent $900.00 YaesuFT-22m FM $50.00 Regency HR2A $35.00 Regency 12V PS $15.00 More at http://come.to/AF4K/ Brian Carling, 117 Sterling Pine Street, Sanford, FL 32773 Brian Carling, AF4K, 117 Sterling Pine St., Sanford, FL 32773.

FOR SALE/TRADE: Transmitting/Receiving tubes, new & used. $0.55 & LSASE for list. I collect old & unique tubes of any type. **WANTED:** Taylor and Heintz-Kaufman types and large tubes from the old Eimac line; 152T through 2000T for display. John H. Walker Jr., 13406 W. 128th Terr. Overland Park, KS 66213. PH: 913- 782-6455, Email: jhwalker@prodigy.net

FOR SALE: Treasurers from the closet! Go to www.cjpworld.com/micromart to find some unique items many hams would lust for! Gus, WA, 360- 699-0038 gus@wa-net.com

FOR SALE: Books, send SASE. **WANTED:** Anything by Fairchild or Langevin. send SASE for my want list. Richard Robinson POB 1425 Wallingford CT 06492, 203-949-0871 or richmix@erols.com

FOR SALE: Manuals for old ham gear of the '30s to the '70s.Check WEB Catalog www.himanuals.com

FOR SALE/TRADE: Misc. parts, tubes, for tube gear. Sandy Blaize W5TVW, 40460 Edgar Traylor Rd., Hammond LA 70403. ebjr@i-55.com

FOR SALE: Vintage equipment at the K8CX Ham Gallery Classified Ads section. Visit the largest Antique QSL Card Gallery http: / /hamgallery.com

NOTICE: T-368 Registry. For info w2zr@aol.com Subscribe to the T-368 & BC-610 reflector at http:/ /groups.yahoo.com/group/T-368_BC-610

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

FOR SALE: Strong steatite antenna insulators. Lengths from two to fifteen inches. SASE for list. John Etter, W2ER, 16 Fairline Dr., East Quogue, NY 11942. 516-653-535

FOR SALE: Please visit RadioWorld-Online. Come to see our ham gear, parts, and more. Carl Blomstran PO Box 890473 Houston Tx. 281-660-4571.

FOR SALE: Aluminum knob inlays, Collins, Drake, National, Hallicrafters, Heath; Collins Dial Drum Overlays. Charlie Talbott, 13192 Pinnacle Ln, Leesburg VA 20176 540-822-5643, k3ich@arrl.net

FOR SALE: Some unused obsolete Triplett tester transformers. Free List. Bigelow Electronics, POB 125, Bluffton, OH 45817-0125

FOR SALE: VM parts, new-boxed electron tubes, new Heathkit parts, and new panel meters. Norm, 1440 Milton St., Benton Harbor, MI 49022

FOR SALE: Build your own "Midget" bug replication by KØYQX, ca 1918, featured by K4TWJ in CQ Magazine, May '98. 10 detailed blueprints. FAX: 507- 345-8626 or e-mail bugs@mnic.net

FOR SALE: Parts, tubes, books, ECT. Send two stamp SASE or email for list. Wayne LeTourneau, POB 62, Wannaska, MN 56761 wb0cte@arrl.net

FOR SALE: New and used early radio and collector tubes. See www.fathauer.com for lists or email tubes@qwest.net. George H. Fathauer & Assoc., 688 W. First St. Ste 4, Tempe, AZ 85281, 480-968-7686. Toll Free 877-307-1414

FOR SALE: Collins restoration. Everything inside & out to make it as Art Collins built it. 50 yrs experience. W9OJI / N4FZ, IL, 815-734-4255 or N4PZ@aol.com

FOR SALE: Collins S-line and A-line repair. FCC licensed, many years of experience. lal@metrocast.net 207-457-9257

FOR SALE: Convert any wattmeter to read PEP! Perfect for AM/SSB-$24.95 ppd for complete kit! HI-RES, 8232 Woodview, Clarkston MI 48348, 248-391-6666, info@hi-rescom.com

FOR SALE: Complete hardware set to connect Collins PM2 to KWM2 -$19.95 ppd. Warren Hall, KØZQD, FOB 282, and Ash Grove, MO 65604-0282.

FOR SALE: Repair, upgrade, performance modification of tube communications & test equip. Accepting most military, all Collins & Drake designs, & the better efforts from others. Laboratory performance documentation on request. Work guaranteed. Chuck Felton, KDØZS, Felton Electronic Design, Box 187, Wheatland, WY 82201. 307-322-5858 feltoned@coffey.com www.feltondesign.com

FOR SALE: Ur old QSL card? Search by call free, buy find at $3.50 ppd. Chuck, NZ5M, CRBCSl@prodigy.net

FOR SALE: New Release. For details send 2-stamp LSASE to: Olde Tyme Radio Co, 2445 Lyttonsville Rd. Ste 317, Silver Spring, MD 20910

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@hotmail.com

FOR SALE: 51J-4 filter replacements, direct plug in—6.0 kc Collins mech. filter, 3.3 xtal lattice, 2.3 kc xtal lattice, 500 cycle xtal lattice -$245 each; R390A 16kHz flat phase filter, for Hi-If AM-$245. Inquire about free AM xmtr parts, PU only, or S&H charge otherwise. Chuck Felton, KDØZS, WY, 307-322-5858, feltoned@coffey.com, www.feltondesign.com

FOR SALE: Military and commercial communications items. Murphy's Surplus, 401 N. Johnson Ave., El Cajon, CA 92020. 619-444-7717 http://www.maxpages.com/murphyjunk

FOR SALE: Tube list, new & used, wide variety audio, and ham. Recently expanded. SASE 52c. Bill McCombs, WBØWNQ, 10532 Bartlett Ct., Wichita, KS 67212-1212

FOR SALE: PANEL AND CABINET REFINISHING; Johnson, Hammarlund 180(a), R390(A), & others total restoration & sales; My updated web site: http://w4pnt.8k.com Patty & Dee's Marina; Dee Almquist, 534W. Main St., Waynesboro, VA 22980. 540-249-3161 Cell: 540-480-7179, FAX 540-249-5064

FOR SALE: RIT for Collins KWM-2/2A; No modifications needed. $79.95 SASE for details. John Webb, W1ETC, Box 747, Amherst NH 03031 bigspndr@bit-net.com

FOR SALE: 2 ¼" dia XP53 plug-in coils; 3 ea. 5 pin, 1 ea. 4 pin, All 4 $6.00 + shipping. Henry Mohr, W3NCX, 1005 Wyoming, Allentown, PA 18103-3131

FOR SALE: Aluminum heat dissipating plate and grid connectors for all 3, 4 and T series Eimac tubes including 3-500Z, 4-1000, 304T's and others. Alan Price fixr7526@cs.com

FOR SALE: Many parts for radio builders please call to discuss needs. Joe Battyany, W6CAS, 1501 Sherwood Ave., Sacremento CA 916-731-8261

FOR SALE: Sam's Photofact numbers 1-1300. $5.00/radio ppd in USA. Don Kuhn, W8KPD, POB 686, Marion OH, 43301-0686. 740-383-5744

FOR SALE: Ships radio room clock repros, boatanchor mugs and t-shirts, more. http://www.cafeshops.com/amradio,amradio2

FOR TRADE: Two good RCA 833A's for one Taylor 833A. Also looking for Taylor 204A, 813, TR40M. John H. Walker Jr., 13406W. 128th Terr., Overland Park, KS 66213. PH: 913-782-6455, Email: jhwalker@prodigy.net

WANTED: Collins R-389 LF receivers, parts, documentation, anecdotes, antidotes. W5OR Don Reaves, PO Box 241455, Little Rock AR, 72223 (501) 868-1287, w5or@militaryradio.com, www.r-389.com

WANTED: Kokusai 455 kcs filter for the KW 2000 series. Sold in USA by Henry Radio. Junker 2000 OK. Dave, K4JRB 770-448-0588

thompson@mindspring.com

WANTED: Drake 5-NB noise blanker and Drake AL-4 loop antenna. Bill, 507-835-8127

WANTED: Hallicrafters rcvrs SX-24, S-85, SX-99, S-110, SX-110 and HT-17 tx'er. Jerry, N5KYE, 405-373-4727

WANTED: Philmore NT-200 tx'er, Cakepanion 2-tube regen rcvr. Douglas Reeves, WB6RKY, POB 278135, Sacremento CA 95827, 916-362-3502, WB6RKY@hotmail.com

WANTED: BC-375 rotary inductor w/counter. Bill, KØRZ, POB 3214, Boulder CO, 80307-3214, 303-499-1936

WANTED: I very much need your help in finding these parts for my Collins 30K: Output Coil and Switch assembly, even partial parts, Modulation transformer, Pair 75th tubes, will consider 100th, Plate blocking Cap 150mf. If you have or know the whereabouts of these parts Please help. Thanks. BOB (916) 967-7552) Ca. rbrtkj6ca@aol.com

WANTED: AF67 Help - bias battery, dial light. Let's talk. Thanks. Dennis Olmstead, WB9EMD, 431 Ridgewood, Glen Ellyn, IL 60137 (630) 469 0531 or Wb9emd@aol.com

WANTED: Power transformer for a Viking 2. aprox 900-0-900 VAC @ 350MA Colin K1IXU electric6@juno.com

WANTED: Vintage transmitting tube, T-21 tetrode or RK-49. Dick/ W6SGJ, DGEORDAN@AOL.COM

WANTED: Anything by DAVID GRIMES: radios, advertising, ephemera, stories, literature, references; please contact: Mike Grimes, K5MLG; 3805 Appomattox Cir; Plano, Texas, 75023, (972) 867-6373. Email: grimesm@flash.net

WANTED: Type 852 or 860 tube. Must be electrically good. Have tubes or cash for trade. Tom Berry, W5LTR, 773-262-5360 or 773-262-0016

WANTED: Schematics only for Heathkit SS-9000. Have all other info. Marvin, 770-429-0314, mmoss@mindspring.com

WANTED: Burstein Applebee FU-40 tx'er/exciter. Any condx with or w/o tuning units. Ted Bracco W Ø N Z W , 2 1 7 - 8 5 7 - 6 4 0 4 X 3 0 6 . braccot@hotmail.com

WANTED: MacKay 3010 rcvr. Cliff WA9SWE 608-625-4527 after 6 PM Central.

WANTED: BC-348 rcvr and TCS tx'er. Jerry, N5KYE, 405-373-4727

WANTED: In excellent operating condx, Gonset G-28 10 Meter Communicator. Roland V. Matson, W1CSO, POB 956, Lake Panasoffkee, FL 33538, 1-352-568-1629

WANTED: Johnson 150D70 or National TMA150 Capacitor. Alan Dale, W9ZPP (812)424-5208 9zpp@evansville.net

WANTED: Collins 70K-2 PTO preferably in working condx. W3QII, 5899 Barnes Ave, Bethel Park PA. 15102, 412-835-7015

WANTED: Military MT-297/GR mobile mount, C-435/GRC control w/meter, C-375/VRC control box w/cable. John 440-243-8119 K8GVH1@juno.com

WANTED: James Millen plug-in coils p/n 42080, 42040, 42015, 43015. Commercial prewar transmitter. Gary Carter, WA4IAM, 1405 Sherwood Drive, Reidsville, NC 27320. Phone: 336-349-1991. Email: gcarter01@triad.rr.com.

WANTED: FADA 33, Hallicrafters spkr for SX-23, Mil TCS rcvr in gd condx. Bob Forte, PO Box 160, Lake Luzerne, NY 12846, 518-696-2400, email: forte@capital.net

WANTED: BC-375 or BC-191. 229-273-7264 W4ZXW, W. J. Hill, 510 E. 25th Ave, Cordele GA, 31015

WANTED: Hallicrafter S40/A/B in at least repairable condx. Appearance not too important. Carl, W2IQK, 51 Mt. Orange Rd, Slate Hill NY 10973, 845-355-1596

WANTED: APS-90 Pwr Sply for Harvey Wells T90 Txer. Ed, WA7DAX, 1649 E. Stratford Ave, Salt Lake City UT 84106, 801-484-5853

WANTED: Front panel milliammeter for the Harvey-Wells T-90 Tx'er. Richard N. Pann, W1SUJ, 2447 Yates Drive, Augusta GA, 30906, 706-798-7279. rpann2@comcast.net

WANTED: Relays from Johnson Matchbox KW and 275 watt. Raymond Fisher, WA8JLT, 937-692-8550 call collect.

WANTED: 5AP4, 5BP4 or 1805-P4 CRT for my 1939 Andrea TV set. Arch Doty, W7ACD, 503-554-9142 archd@aol.com

WANTED: Manuals for Signal Corps I-166 voltohmeter, LM-7 frequency meter, EICO 221 VTVM. Louis L. D'Antuono, 8802 Ridge Blvd, Brooklyn NY 11209. 718-748-9612, 6PM.

WANTED: Lafayette HB-400 or HB-333 or Olson Tube Type CB set for conversion to 10M AM. Will pay your price working or not. Bill Smitherman, KD4AF, 9401 Hwy 67, East Bend NC, 27018. 336-699-8699

WANTED: Power supply and connecting cable for a Harvey Wells T-90 Bandmaster Tx. Ed, WA7DAX, 1649 East Stratford Ave., Salt Lake City UT, 801-484-5853

WANTED: CINCH-JONES plug P310-CCT. This is a 10-contact plug with 5/32 inch wide contact blades, and with cable clamp in cap. Vernon Yeich, 1700 White Hall Rd., White Hall MD, 21161, phone 410-357-5112

WANTED: Looking for 2 anode connectors for 4CX250 tubes, and a main tuning knob for the KWS-1. John Munro, G3GBB, tel. 01379-783657. jmunro2@ukonline.co.uk

WANTED: The two red jewel lights on the front of Johnson Ranger. RbrtKJ6CA@aol.com

WANTED: BC-610 transmitter within driving distance of the Twin Cities MN, Email me with information at wØir@attbi.com

WANTED: Manual or schematic for National VP4050A counter and Realistic Signal Generator A11IM. Will pay for copies. Roger K1TG rwkuchera@snet.net

WANTED: HELP! I need information on a E.M. Sargent Co. Model 205A 5-band radio circa late 30's (?). David Miller, 307 754-4351 or K7ALR@arrl.net.

WANTED: Pwr Xfmr for Browning Golden Eagle MK IV. 110V pri/sec 32.4, 280, 9, 6.3 VAC. Bob K8MGC, 330-879-5250 BobJudy@sssnet.com

WANTED: T-368, GC, will PU locally, also 75A-4 filter clamp. KC9VF@arrl.net

WANTED: SBT-1K TMC PS-4 pwr sply need manual or schematic. Bernard Drew, Bernard@quidnunc.net

WANTED: (Badly) Harvey Radio Labs Model FT-30, 1935 Xmtr. See E. Rippon guide p.57 or FOS p.257. This was my rig back in 1941 when my call was W1NLL. In needed, I will send you a picture copy. I will pay $1000.00 plus shipping for one in almost any condition. Robert Enemark, W1EC, PO Box 1607, Duxbury MA, 02331. 781-585-6233

WANTED: Wanted: Manuals for Collins Antenna Tuners 180-Y and 180-V Mike Kincaid - W7FKF, 248 Justin Road, Murphy, TX 75094, 972-578-1120

WANTED: TCS Army-Navy rcvr 1.5 to 20 Mc, and good manual to rework Globe King 275. WØBEI, 800-500-8055. Dave.

WANTED: Collins 51J-4 complete, reasonable price paid for a nice clean one. Art Plummer, 650-359-1858, w6lr@arrl.net

WANTED: GRC-9 microphone, Headset, speaker. Lee, N2UDF 315-656-9578,or Lcarroll@post.com.

WANTED: Coil sets for HRO-50. Casey, W8FDE MI 231-755-1579 FAX 231-737-3101

WANTED: Panel meter M-100 for Johnson Desk KW. 50-500 MA DC grid-modulator current. Face marked two scales. Bottom 0-50, Top 100, 200, 300, 400. Also bottom of face #796, FS=5MA, 20 ohms 100 mv. Or does anyone know how to modify the circuits for maybe two separate meters? Bob, WA6ICL, 14463 Astoria St., Sylmar CA, 818-362-7404

WANTED: SB-104 main tuning knob. Ed Cuevas, Ft. Worth, 817-222-5355, ecuevas@juno.com

WANTED: Cakepanion 2 tube regen rcvr. Prefer w/all coils. Doug Reeves, WB6RKY, PO Box 278135, Sacramento CA 95827. wb6rky@hotmail.com

WANTED: Coil "C" for HRO-60. Gerald Park W8QS, 517-351-5106, park@msu.edu

WANTED: Galaxy (WRL or HyGain) LA-550 Linear, RF-550 Wattmeter, CAL-250 calibrator. All answered! Kelley, W8GFG, 9010 Marquette St., St. John IN, 46373; 219-365-4730

WANTED: Tech help to modify xtal controlled transistor CB rig for ham bands. Rex, PO Box 4518, Jeffersonville IN, 47131, 812-282-4824

WANTED: Any TMC Equipment or Manuals, what have you? Will buy or trade. Brent Bailey, 109 Belcourt Dr.,Greenwood, S.C. 29649 864-227-6292 brent@emeraldis.com

WANTED: AN/WRR3-R1134 VLF receiver. Jack Holzer 913-791 5141, days

WANTED: KNOBS and front panel meters for the GRC-19 set, T-195 and R-392. Please contact Gary W5UUO, 450 Cunningham Road, Celina, TN 38551 931-243-5323 w5uuo@info-ed.com

WANTED: Westinghouse MW-2 and MW-3 transmitters and parts. Also HP Model 1727A Oscilloscope manual. Gary, WA4ODY, Seabrook TX 77586, 281-244-7695, myctpab@earthlink.net

WANTED: Manual for General Radio Co. Unit Oscillator Type 1211-C (.5-50 Mc.) Jim Eberwine, W4APV, 8118-37th Ave. North, St. Petersburg FL. 727-347-0942

WANTED: Empire PA210 Panadaptor, URM-25 Sig Gen, URM-26 Sig Gen, URM-7 Rec SBT. Dean, 6725 Portland Ave South, Richfield, MN 55423

WANTED: Schematic diagram for Freq Meter CRR 74028 (part of LM-13). Frank Hill WA6SYI 1313 Milton Ave., Walnut Creek CA, 94596 fdhill@attglobal.net

WANTED: Hallicrafters HA-20 VFO Line Sampler, or schematic and parts to homebrew. H.I. Stark, K9UBL, 3215 S. Meridian Street, Indianapolis IN 45217-3231

WANTED: TBX radio and/or accessories required by military radio collector. Ray, VK2ILV, ROBINSON@SHLRC.MQ.EDU.AU

WANTED: Older rigs & accessories. Brian Carling, AF4K, 117 Sterling Pine St., Sanford, FL 32773. http:/ /come.to/AF4K/

WANTED: Fully functional w/manuals: Johnson AN/FRT505 xmtr, Swan F51 and FC76. Contact Ric at C6ANI@ARRL.NET

CDs From the ER Bookstore

By Radio Era Archives

R390-R390A/URR Technical CD-ROM - $57.
RCA HB-3 Tube Handbook - $75.
RCA Radiotron Handbook, 4th Edition - $62
80 years of QST - $39.95 per set (generally 5 or 10 year set).
Collins Radios Technical CD-ROM series. Vol. 1 - Collins Receivers; Vol. 2 - Collins Transmitters & Amplifiers; Vol. 3 - Collins Transceivers; Vol. 4 - Accessories, Power Supplies, VFO's, etc. Each CD - $79, Complete Set - $279

By Hamanuals

Drake equipment operator and service manuals on a two cd set by Bill Turini, KA4GAV - $71.95

By Terry Perdue

A new CD that chronicles the history of the Heath Company with over 1000 photographs, letters, newspaper articles, catalog covers and other material never before put together in one publication - $24.95

NEW! By Mathstar

The Crystal Set Design Calculator, a new CD for experimenters that calculates component values for crystal sets. Over 200 designs are featured, including one with a loudspeaker!-- $29.95-10% = $26.95

By August Johnson, KG7BZ

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