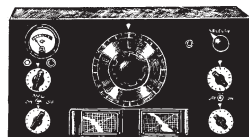


THE COMMUNICATIONS RECEIVER



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The Navy HROs

By Chuck McGregor

First, here's a correction to my description of the mechanical action of the NC-400 tuning system in the last issue. Though the pointer indicators on the NC-400 are driven by strings from the band selector, the actual tuning capacitors are gear driven. National produced an aluminum frame that is connected to the two multi-section capacitors. This design reduces the backlash in the system, however the tuning rate is still quite fast for the very narrow band crystal filter on CW.

This article concerns the special versions of the HRO produced for the U.S. Navy and Coast Guard during World War II. Author McGregor has kindly allowed us to publish it in the Journal. The RAS is the special navy version most often seen in the U.S. The RAW and RBJ are seen much less often. Most often the receivers are missing the military tags and it is possible that there are RAW and RBJ receivers that are misidentified.

The Navy had several special requirements due to the environmental conditions at most of their installations. One was for a locking mechanism to insure that the coils stayed in position under heavy vibration. Another was elimination of the high voltage from the headphone circuit.

Most receivers of that period connected the high impedance headphones between the B+ supply and the plate of the audio driver tube. Salt water spray could easily put over 200 volts DC on the operator's ears, a situation to be avoided. Navy receivers normally used a transformer to isolate the headphone circuit from DC.

As mentioned in Chuck's article, the RAS/RAW coil containers held the spare coils in a position to allow the operator to

positively identify the coil sets. The RBJ coil holder relied on the ink ID stamped on the ends of the coil for identification. The navy also required changes in the AVC as will be described.—BW

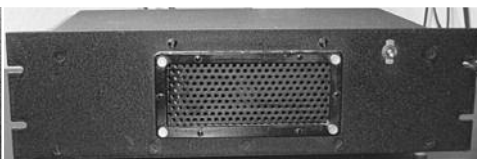
Much confusion has surrounded the identification of the HRO versions built for the Navy during WWII. This confusion has been compounded by the Navy nomenclature system and the fact that many of the radios were released for surplus without their nameplates. There were three radio equipment designators: RAS, RAW and RBJ; but there were only two radio types: CNA-46080 used in the RAS equipment and CNA-46081 used in the RAW and RBJ equipment. Each equipment set consisted of the radio, coil cabinet, power supply, and speaker or filler panel, mounted in a desktop rack. The RAW and RBJ radio equipments differed only in the coil sets included, the coil cabinet design, and the lack of a loudspeaker in the RBJ.

Recognition of the Radios

Both Navy HRO radio designs are variants of the HRO Junior, lacking crystal filter or S-meter. The feature distinguishing the Navy HROs from other HRO Junior



RAS-3 front panel—note coil locks.



Speaker and early power supply panels.

production is the addition of delayed, amplified AGC and the related circuit changes. In both radios, the detector tube designated V107 is a 6F8G dual triode, rather than the 6B7 dual-diode-pentode used in other HRO receivers. Some CNA-46080 (RAS) receivers may have a plug-in subchassis in the V107 socket, more about this later. So, a 6F8G or a plug-in subchassis in the V107 socket is a sure indication of a Navy HRO.

The distinction between the CNA-46080 and CNA-46081 radios is their IF frequency. The Navy had a requirement for a receiver which could tune frequencies around 450 kHz. This capability was provided in the CNA-46080 receiver for the RAS equipment by using an IF frequency of 175 kHz. The most easily noticed indicator of the 175 kHz IF frequency is the number of plates on the rotor of the CW oscillator capacitor. For 175 kHz IF, the capacitor has 10 plates on the rotor; for 455 kHz IF, the capacitor has 3 plates (like all other HRO receivers). So, 10 plates on the CWO capacitor identifies a CNA-46080 receiver (RAS) and 3 plates identifies a CNA-46081 receiver (RAW or RBJ).

The RAW and RBJ equipment sets differ in the number of coil sets provided with the CNA-46081 radio. RAW includes 7 coil sets covering 175 kHz to 30 MHz. RBJ added two more coil sets to extend coverage down to 50 kHz. RAW used the same coil cabinet as RAS, providing space for 6 coils with their long axis vertical and the coil nameplates visible when the cabinet door was open. RBJ provided a larger coil cabinet capable of holding 10 coils with their long axis horizontal in two rows of five. Rubber stamping coil frequency bands on the end of the coil set allowed identifying the coils in this cabinet without having to pull them out to see the front label.

All of the Navy HROs use the same CNA-100036 rack which provides 35" of vertical mounting space. Because of the larger RBJ coil cabinet, there was not enough room left in the CNA-10036 rack for a speaker panel, so the RBJ equipment fills the remaining space in the rack with a blank panel. Without the nameplates or the presence of a coil cabinet or the low frequency coils covering 50-100 kHz and 100-200 kHz, it is not possible to determine whether a CNA-46081 radio was part of a RAW or RBJ equipment set.

The AGC Circuit

Both Navy HRO receivers, CNA-46080 and CNA-46081, used an automatic gain control (AGC) circuit also found in the National NC-100 and Navy RAO radios. This circuit requires a bias voltage approximately 6 to 7.5 volts negative with respect to chassis ground. In this circuit, the negative output of the power supply is not directly grounded, but rather connected to the chassis ground through series resistors - providing a voltage drop that sets the chassis ground 6 to 7.5 volts above B-.

The variation between 6 and 7.5 volts depends on the current being drawn by the gain-controlled stages. With this bias voltage



RAS-3 coil cabinet.



RBJ cabinet holds 10 coils.



Rear of RAS—note plug-in noise limiter chassis.

applied to the cathode of the triode AGC amplifier (one-half of the 6F8G), the AGC amplifier does not begin to conduct until the IF peak signal level exceeds 4 volts. Only after the signal level at the IF output exceeds this level, known as the AGC delay level, does the AGC begin to reduce the gain of the RF and IF amplifier stages to maintain an essentially constant signal level at the IF output.

Half of a 6F8 dual triode is used as an AGC amplifier; the second half provides a biased detector to detect the IF signals and provide audio output.

The Power Supplies

Because of the requirement for power supply B- to be separate from chassis ground, Navy HRO power supplies are not interchangeable with commercial HRO power supplies. The power cable of a Navy HRO receiver has four leads for B+, B-, and heater supply plus an overall shield which is connected to the receiver chassis ground. A 4-inch lead from the shield at the plug end of this cable must be connected to a grounding screw on the power supply chassis to tie the two chassis together. Use of a commercial HRO power supply with a Navy HRO would cause AGC malfunction. Navy HRO power supplies were available in 120-volt (CNA-20090), and 240-volt (CNA20125) 60 cycle and 120 volt 25 cycle (CNA-20089) versions. CNA-20125 was supplied with RBJ, RBJ-3 and RBJ-4 equipment, CNA-20090 with RBJ-1 and RBJ-2. Pairings between RAS-() and RAW-() dash numbers and power units are not known.

RAS Noise Limiter

A plug-in noise limiter accessory for the RAS equipment, designated type CKB-50142, was manufactured for the RAS by Mission Bell Radio Co. of Los Angeles. This device was built on a small chassis which plugs into the 6F8G socket on the CNA-46080 chassis. On this chassis, a 6SQ7 dual-diode-triode tube provides signal detection and audio amplification. A 6SN7 dual triode provides one section to replace the AGC amplifier section of the 6F8G. The remaining triode section is connected as a diode in a conventional noise limiter circuit. This device is not applicable to the RAW and RBJ equipment because of its input transformer tuned to 175 kHz.