Vintage Amateur Radio

Restoration of Viking Valiant, Hammarlund SP-600 and Heathkit HX-10 Marauder

Phase 1 - Johnson Viking Valiant Transmitter

Background:

Don "KG9OM" and Bill "KJ4W" partnered the restoration of this 1956 "kit form" vintage Johnson Viking Valiant covering the 160 - 80 - 40 - 20 - 15 - 10 Meter Bands. This transmitter has a built in VFO and uses three 6146's in the final amplifier delivering 275 Watts CW - 200 Watts AM (D.C. Power Input). The transmitter weighs about 85 lbs.

Note: A "boat anchor" is what we hams fondly call "vintage tube communication equipment". This includes both military and commercial equipment. Boat Anchor equipment is typically very heavy as is the case with the Johnson Viking Valiant.

The Valiant's tube lineup (including a total of five 6146's) includes:

6AU6 VFO

6CL6 Crystal Oscillator Buffer

5763 Multiplier

6146(3) RF Power Output

6AQ5 Clamper

12AU7 Keyer

12AX7 Audio Amplifier

6AL5 Audio Clipper

6C4 Third Audio Amplifier

12AU7 Audio Driver

6146(2) Audio Modulators

866(2) Mercury Vapor H.V. Rectifiers

5V4 L.V. Rectifier

6BY5GA Bias Rectifier

OA2 Voltage Regulator

OC3(2) Voltage Regulators.

Power requirements are 185 watts standby and 560 watts key down CW (fully loaded) at 117VAC.

Project Objectives:

- **Restore transmitter to full operability.**
- **Retain as much of the transmitters original external appearance.**
- **Make selected circuit improvements for greater transmitters reliability and improved audio**

Step 1 - Inspection and cleaning:

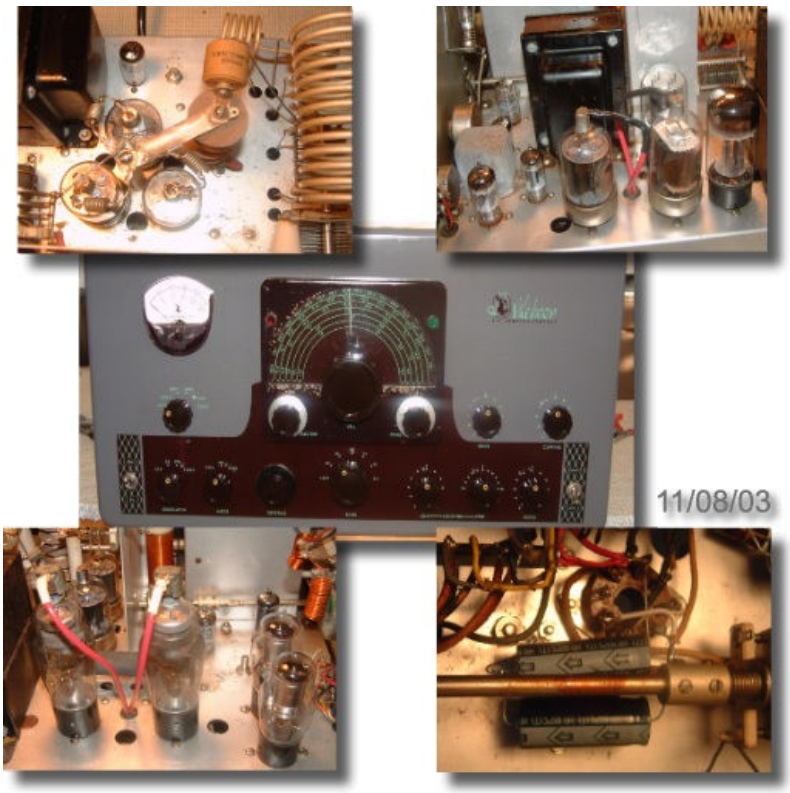
Chassis corrosion most likely resulting form moisture accumulation over the years. Note the evidence of arching of the one of the 866 Mercury Vapor H.V. Rectifier tube sockets in the center of this photo montage.

Step 2 - Electrolytic capacitor replacement:

Several old electrolytic capacitors removed from the Valiant

22.768	C82,85,78, 100	4	.1 mfd 400 WV paper condenser
22.1298	C91,92	2	80 mfd 450 V electrolytic condenser
22.1299	C93A,B	1	15-15 mfd 350 V electrolytic condenser
22.764	C98A,B	1	15-15 mfd 450 V electrolytic condenser
22.763	C99	1	10 mfd 25 V electrolytic condenser
22.828	C40	1	.001 mfd 1.5 KV ceramic condenser
22.856	C75	1	10 mmf 500 V 5% silver mica condenser
22.857	C101	1	100 mmf 500 V 5% silver mica condenser
22.1006	C89	1	.5 mfd 400 WV paper condenser

List of electrolytic capacitors (orange arrows) that were replaced. The .5 mfd paper capacitor looked suspect and was also replaced. The four .1 paper capacitors looked good and were left intact (for now).



Step 3 - Reassembly:

A montage of photographs taken after the Valiant was reassembled following completion of phases 1 and 2.

Step 4 - Preliminary testing (day one):

*Bill "KJ4W" giving the Valiant the initial "smoke test". Fortunately we didn't get any smoke but not much power either... only about 20 watts but perhaps to be expected since the old girl hadn't been on line since the 80s! Note in this photo montage that a **variac was used to slowly bring up voltages** to the rig following completion of tube testing. Also note (in the top right photo) the replacement of two original 866 mercury vapor tube rectifiers with **two 3B28 tubes** provided by Bill "KJ4W".*

Step 4 - Preliminary testing (day two):

Norm "K4PTN" (who drove up from nearby Paris Landing) and Bill "KJ4W" running the Valiant through more tests. This time we were pleased to be able to achieve 150 watts output as noted on the watt meter.

At this point in the testing phase, two critical items were identified for follow-up corrective action before moving on to phase 5:

- Panel meter inoperative. Bill "KJ4W' found a good internal **meter movement which was retrofitted** to the meter housing.
- One faulty 6146 modulator tube. Both tubes were replaced with a **matched pair of 6146B** tubes provided by Norm "K4PTN".

Step 5 - Transmitter modifications to improve reliability, frequency accuracy and audio quality:

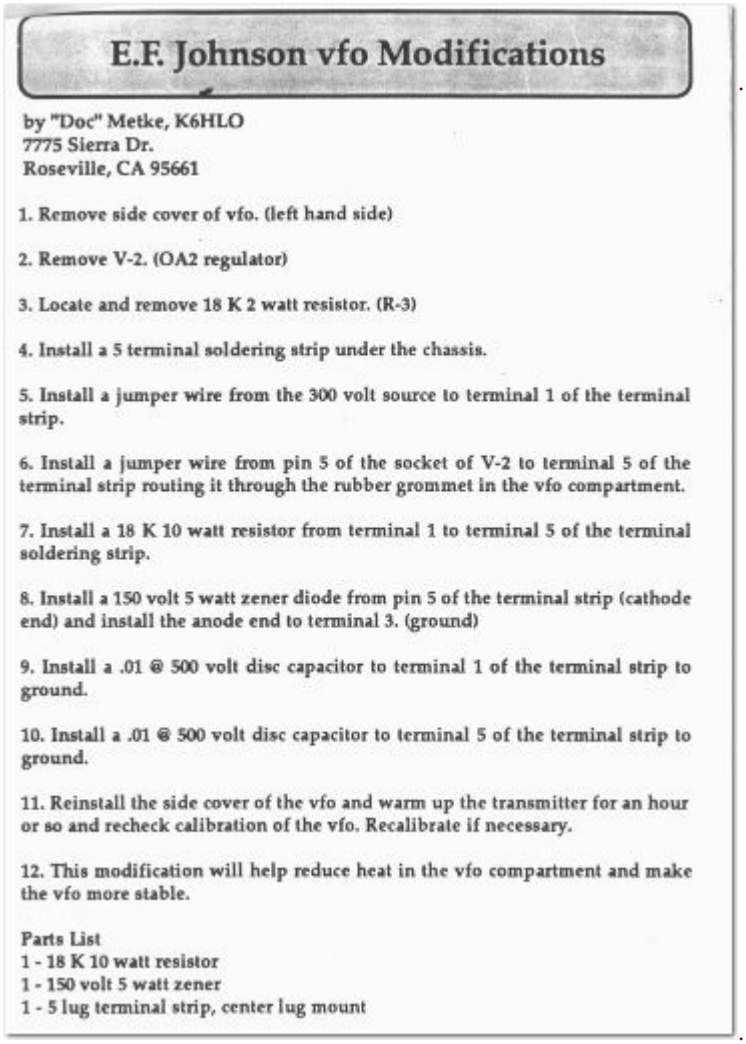
Here is a list of *modifications made to the Valiant:*

1. Replace All of the filter caps. Use higher values, Bigger is better.

2. Remove C54, C55 and C56 on the accessory plug. (Better Highs)

3. Change the Plate Choke Bypass Caps to 0.001 2KV RF types. (Better Highs)

4. Change the Screen Resistor (R16) from 12K to 20K. (Lower Voltage saves the tubes)



E.F. Johnson vfo Modifications

by "Doc" Metke, K6HLO
7775 Sierra Dr.
Roseville, CA 95661

1. Remove side cover of vfo. (left hand side)

2. Remove V-2. (OA2 regulator)

3. Locate and remove 18 K 2 watt resistor. (R-3)

4. Install a 5 terminal soldering strip under the chassis.

5. Install a jumper wire from the 300 volt source to terminal 1 of the terminal strip.

6. Install a jumper wire from pin 5 of the socket of V-2 to terminal 5 of the terminal strip routing it through the rubber grommet in the vfo compartment.

7. Install a 18 K 10 watt resistor from terminal 1 to terminal 5 of the terminal soldering strip.

8. Install a 150 volt 5 watt zener diode from pin 5 of the terminal strip (cathode end) and install the anode end to terminal 3. (ground)

9. Install a .01 @ 500 volt disc capacitor to terminal 1 of the terminal strip to ground.

10. Install a .01 @ 500 volt disc capacitor to terminal 5 of the terminal strip to ground.

11. Reinstall the side cover of the vfo and warm up the transmitter for an hour or so and recheck calibration of the vfo. Recalibrate if necessary.

12. This modification will help reduce heat in the vfo compartment and make the vfo more stable.

Parts List
1 - 18 K 10 watt resistor
1 - 150 volt 5 watt zener
1 - 5 lug terminal strip, center lug mount

all 12 steps were accomplished.

'Secret' Valiant Changes

for improved Audio quality and VFO stability

by Marcus Frisch, WA9IXP
Box 28803
Greenfield, WI 53220-0803

Replace 18K 2W resistor in VFO with 18K 5W

Drill vent holes in VFO cover

Replace C99 in audio section with 47uf 35V

Change R53 from 220K to 100K

Change R26 from 47K to 470K

Change R30 from 47K to 100K

Change C95 & C94 from .001 to.00062

Replace drive control with 20K pot + 9K resistor

Replace clipping control with 50K pot + 68K resistor

Change C77 from 300pf to 100pf

Change C80 from 200pf to 100pf

Put cooling fan on top of rig for better cooling and VFO stability

Frequency response should be flat to 3500 Hz
-3db @ 4200 Hz
-6db @ 5000 Hz
-12db @ 6000 Hz

Will Your Amateur Radio Equipment Get Proper Disposition

by Bill Mills, KC5PF
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Over an individuals life span as an Amateur Radio Operator, we can devote many years collecting equipment appropriate to our hobby. Then when we become a Silent Key, our spouse or other loved ones are faced with the task of disposing of the gear. Pre-supposing that we enter the "ham" fraternity at an early age, we could devote three to four or more decades active in accumulating a large inventory of radio equipment, test equipment, documentation, and other related items. Over these years we often fail to record (or want to forget) the initial purchase cost and a realistic current resale value. In addition, our basements, garages and attics become storage havens for old tubes, parts, magazines and books related to the hobby. Some are old and outdated and should be relegated to the trash bin, but others may have retained their value or possibly be of use to a collector or restorer of old wireless gear. To avoid confusion and uncertainty in disposing of our "ham" radio estate, we should take the time now to plan the disposition of our many years of accumulation.

1) Create and maintain an inventory of equipment and realistic, current resale values.
2) Designate a knowledgeable "ham" (or club) who can assist the family with the disposition of the equipment.
3) Provide written instructions if specific items of equipment are to be given to family members, friends, radio clubs, schools, etc.

By devoting a little time to organization, we can be of immeasurable help to our heirs and can be confident our radio collection will be handled as we would wish.

Several clubs in the Washington area, as well as the Foundation for Amateur Radio, offer a volunteer service in assisting families in the disposition of Amateur Radio estates. Give it some thought now.

...all 12 steps were accomplished except the drive control and clipping controls were left intact. Drilling holes in the VFO cover and addition of a cooling fan was not deemed to be necessary.

Audio Modifications For The Johnson Valiant

by "Doc" Metke, K6HLO
7775 Sierra Dr.
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1. Remove C-79 and replace with a .1 ufd @ 400 volts.

2. Remove V-13 and C-83 and C-84, also remove one end of L-45 and C-94 from pin 6 of V-14.

3. Install a .1 ufd @ 400 volts from pin 6 of V-12 to pin 6 of V-14.

4. Remove C-90 and install a .082 @ 400 volts.

5. Install a 10 ufd @ 35 volts from pin 8 of V-12 to ground.

6. Open secondary side of T-3 at pin 3 of J-8 and install (3) 1 amp. @ 1000 volt diodes in series, with the cathode end tied to pin 3 of J-8 and anode end to T-3. (Negative peak clipping)

7. Open primary connection of T-3 at pin 2 of J-8 and install (3) 1 amp @ 1000 volt diodes in series, with the cathode end tied to pin T-3 and the anode end tied to pin 2 of J-8. (Isolation)

8. Open the screen leads of V-5, V-6 and V-7 (finals) pin 3 and install a 50 ma. 10 hy choke in series of said lead.

9. In some cases it may be necessary to use a .05 coupling capacitor at C-83 (pin 6 of V-12 to pin 6 of V-14) due to low frequency oscillations in the audio circuit, this may be found by turning the audio level control up and down with the rig on the air and no microphone installed, while you have the meter switch in the modulation position and watching for undulating resting current.

Editor's Note: I think it is generally accepted among vintage radio enthusiasts that the Valiant is a good transmitter but that the audio from a stock rig leaves a lot to be desired. This modification really does make a Valiant sound good. Everyone agrees that Doc's Valiant sounds great. Others who have made this mod with good results include Woody, W6LHH and Roy,WB7NXX.

...all items except item 9 were accomplished.

Note: The Viking Valiant was sold to WC9M "Tom" not long after the restoration was completed. In December, 2005 Tom sold it to current owner K9FWT "Ken" who recently sent me a very nice letter and the below photo of the Viking in his shack...

Ken says in his letter "The Valiant works great. All the guys I talk to on the air say it has a great signal with great audio. Thanks"

Phase 2 - Hammarlund SP-600 JX6 Receiver

Background:

Don "KG9OM" and Bill "KJ4W" also partnered the restoration of this vintage receiver.

The SP600-JX receiver was introduced by Hammarlund around 1950 and was produced in a variety of models until 1972. This is a large nearly 100 lb receiver with a very solid and expensive feel to its operation. The mechanical 50:1 reduction tuning drive is one of the smoothest ever built. The receiver covers 540 Khz to 54 Mhz in six bands with a complement of 20 vacuum tubes. Some consider the ultimate design for the genre of receivers utilizing a tunable first conversion oscillator.

Produced in 1951, the JX6 variant was also known as Navy Model R-274B/FRR.

Project Objectives:

Replace faulty components as required and restore receiver performance to meet original specifications.

Step 1 - Initial inspection and cleaning

The receiver was completely dismantled, cleaned and reassembled. Five "Black Beauty" tubular capacitors were found to be physically cracked and were replaced. The cabinet was repainted with a light grey primer.

Step 2 - Reassembly and testing

All tubes were tested with nine requiring replacement. A **variac was used to slowly bring up voltages** to the receiver following completion of tube testing.

Above are photographs of the restored SP-600 receiver. Note the presence of 3 previously made modifications:

A - External crystal socket for plug-in of an additional crystal for fixed-frequency reception at high stability.

B - Switch to select crystal-controlled BFO for improved SSB detection.

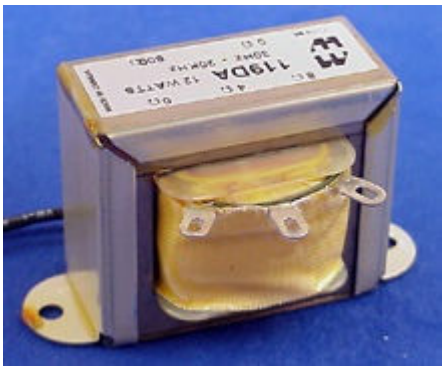
C - Trimmer capacitors for fine-tuning fixed-frequency reception crystals.

Step 3 - Follow-up repairs and adjustments

The following items were accomplished:

- Unable to properly tune ssb signals. Made adjustments to the BFO circuitry.
- Diminished receiver sensitivity at higher frequencies. Aligned the IF and RF stages.

Note: Dow Key Relay model DK60G2C 52 ohm 1000 Watts 115v to switch transmit and receive between the Valiant transmitter and Hammarland SP-600 receiver. This particular model has a separate set of contacts to mute the receiver. Click here for specifications.



Note: A Hammond Audio matching Transformer (Radio Daze part number HX119DA) was added to match the SP-600s 600 ohm audio output to an 8 ohm speaker. Here are the transformer's specifications:

Isolation unit (ie... separate primary and secondary).

Primary: 600 Ohm (with 6" wire leads).

Secondary: 8 Ohm with 4 Ohm center tap (with solder lugs).

Power: Rated at 12 watts.

Frequency response: 30 Hz.-20 Khz.(+/-1 db @ Full Power - 1Khz. Reference)

Weight: 1 Pound, 4 oz.

Mounting: 2 hole bracket mount - on 2-13/16" mounting hole centers.

Built by Hammond in response to requests from the "Collins Collectors Association" for a matching audio transformer for older equipment with 600 Ohm audio output.

Restoration completed! The first contact on the Valiant/Hammarland SP-600 combo was made 12/15/03 on 3880 AM with WB9ECK "Bob" near Madison, Wisconsin. Bob gave KG9OM "Don" a S9 +20db report and indicated that the audio sounded fine. Received audio was excellent.

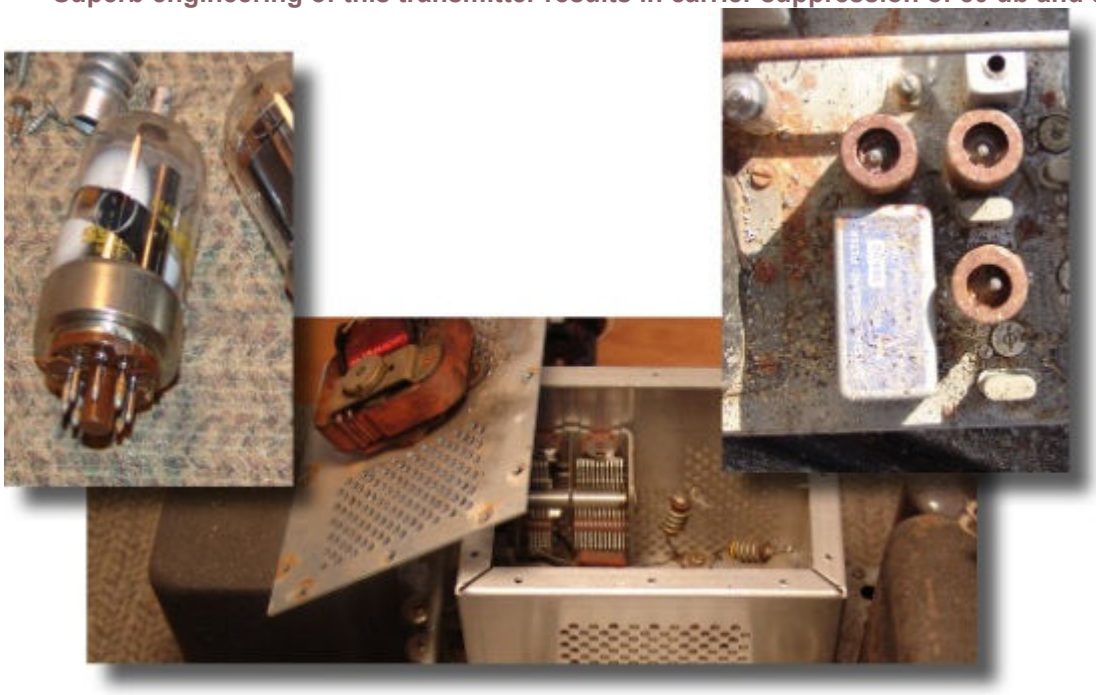
Phase 3 - Heathkit HX-10 Marauder transmitter restoration

Background:

Don "KG9OM" and Bill "KJ4W" are partnered the restoration of this vintage Heathkit "filter-type" transmitter covering the 80 - 40 - 20 - 15 - 10 Meter Ham Bands. This transmitter has a built in VFO and uses two 6146's in the final amplifier delivering 180 watts PEP on SSB and CW.

Note: A "boat anchor" is what we hams fondly call "vintage tube communication equipment". This includes both military and commercial equipment. Boat Anchor equipment is typically very heavy as is the case with the Heathkit Marauder.

The Heathkit "Marauder" SSB transmitter operates SSB (upper or lower sideband), CW, AM and FSK. It features a full 180 watts P.E.P. on SSB and CW and operates on 80 through 10 meters. A smart panel meter allows monitoring of grid and plate current, high voltage, ALC, and relative power. Its many operating conveniences include VOX controlled break-in CW and automatic level control (ALC) for higher talk power. The multi-section, hermetically sealed crystal band-pass filter ensures a clean signal with low distortion. Superb engineering of this transmitter results in carrier suppression of 50 db and unwanted sideband suppression of 55 db.



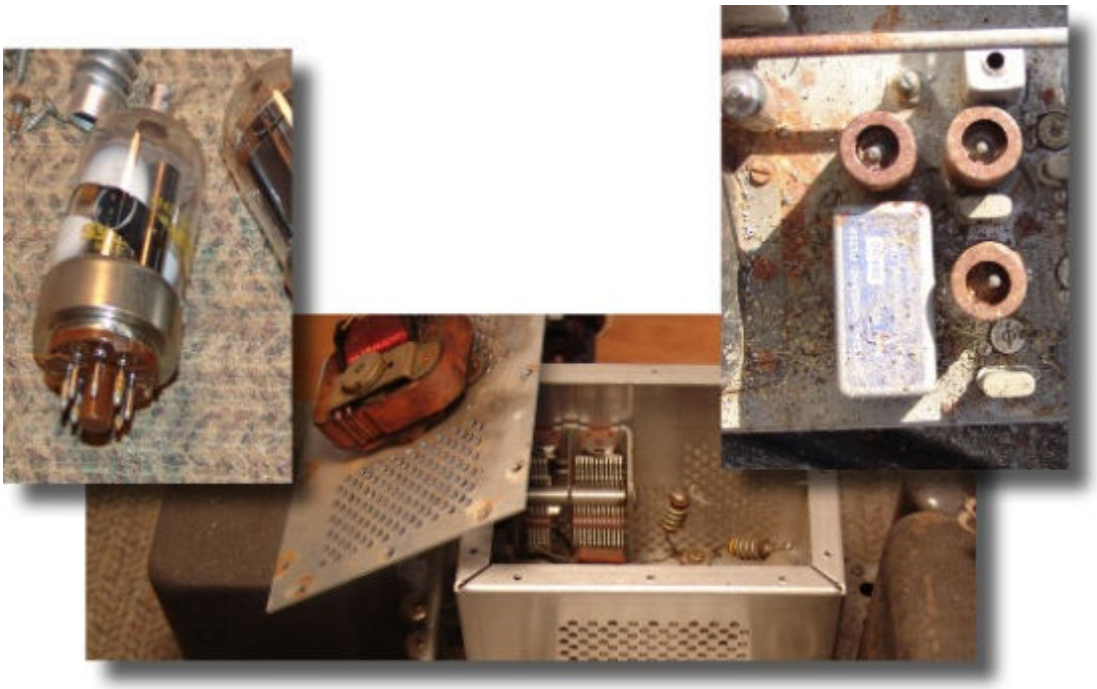
Other operating conveniences include accessory sockets, output for a monitor scope such as the HO-10, and FSK input. The preheated, temperature compensated VFO provides 100 cps stability after warmup. The final amplifier is shielded and air-cooled, and the 165 to 1 vernier gear drive tuning assembly ensures precise, smooth tuning. It features beautiful exterior styling and heavy chrome plated knobs.

SPECIFICATIONS--emission: SSB (upper or lower sideband), CW, AM and FSK. Power input: 180 watts PEP--SSB and CW, 75 watts AM. Output impedance: 50 to 75 ohms with not more than approximately 2:1 SWR. Frequency range (MC): 3.5 to 4.1; 6.9 to 7.5; 13.9 to 14.5; 20.9 to 21.5; 27.9 to 28.5; 28.5 to 29.1; 29.1 to 29.7. Frequency stability: within 100 cps, after warmup. Carrier suppression: 50 db below peak output. Unwanted sideband suppression: 55 db below peak output. Keying characteristics: Break-in CW provided by operating VOX from a keyed tone using grid-block keying. Audio input: High impedance microphone. Audio frequency response: 400 to 3000 cps at ± 3 db. Power requirements: OFF--4 watts; STANDBY--200 watts; KEY DOWN--400 watts at 117 volts, 50/60 cycles AC. Cabinet size: 19" W. x 11 5/8" H. x 16" D.

Project Objectives:

- **Restore transmitter to full operability.**
- **Retain the transmitter's original appearance and circuits.**

Step 1 - Initial Inspection and tube testing:

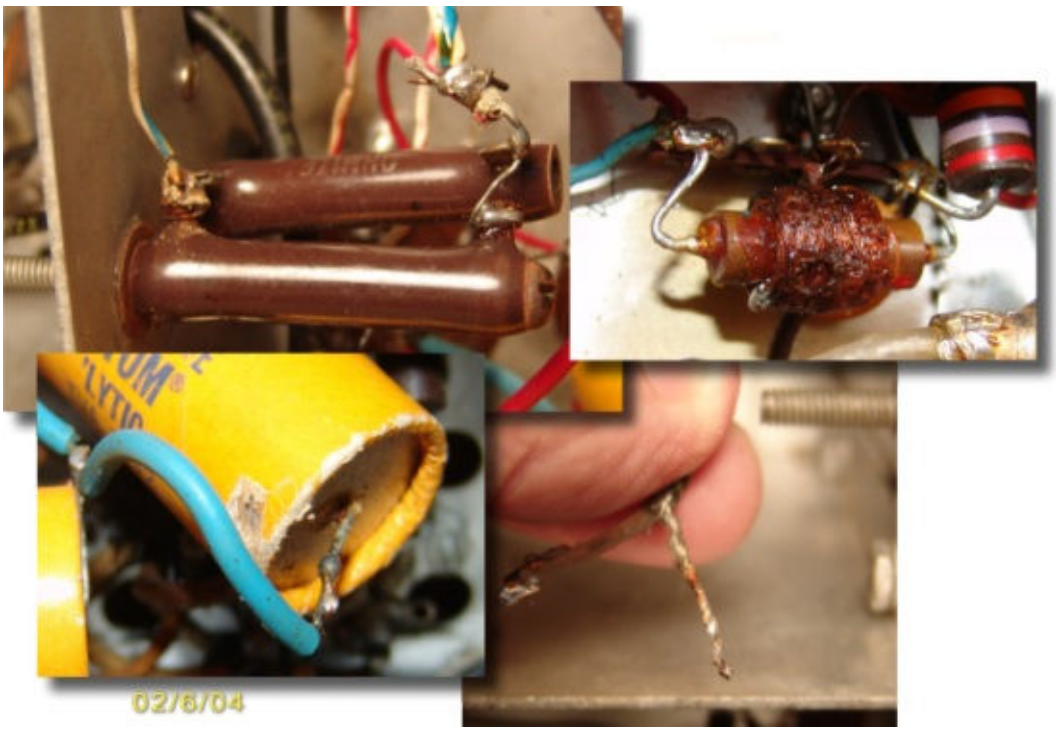


Chassis corrosion and debris accumulation over the years. Note the cracked 6146B power amplifier tube in the left of this photo montage.

K4ENE "Don" and KJ4W "Bill" inspect the components beneath transmitter's chassis. All tubes (lower center photo in the montage) were tested with seven (including both 6146 power amp tubes) requiring replacement.

Step 2 - Disassembly, cleaning and repair of physical defects:

Tubes and knobs have been cleaned and ready for reassembly. Front panel paint is in good shape and will only be cleaned.



Numerous physical defects were found and repaired/replaced during this step including (clockwise from top left) poor solder connections on two parallel wire round resistors, overheated choke, questionable electrolytic capacitor and several broken solder wire connections. A broken microphone connector (not shown here) was also replaced. The VFO tuning linkage was completely disassembled, cleaned and lubricated. All switches and contact points were cleaned with "De-oxit".

Step 3 - Reassembly:

Step 4 - Operational testing:

The Marauder was slowly powered up with a variac 02/27/02. Low and high voltage checks were within limits. However, the vfo required complete re-alignment which was expected since the linkage had been disassembled and cleaned during step 2.

The transmitter was subsequently connected to a dummy load and watt meter. Tuning was normal except for an unresponsive load control with 118 watts output on CW.

The rig was modulated on 75 meters SSB with an Electrovoice 638 microphone (see below) with output monitored an external receiver. Audio quality was excellent.

Here are several photographs of the restored Marauder: *(note original manual)*


Restored HX-10 Marauder
02/28/04


Restored HX-10 Marauder
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Restored HX-10 Marauder
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