

Vintage Amateur Radio Restoration



FIXING THE PAST

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Boxboro 2017

(Some images stolen from the Internet)

Boxboro!

WHY?

- Today's ham gear is exciting!.....
 - Software Defined Radio
 - Computer-assisted operating
 - LDMOS FET power amps
 - Digital modes (WSPR, PSK-31, etc)
- BUT sometimes modern gear gets boring.
- This talk is for the beginning restorer.

GO VINTAGE

- Living the “good ol’ days”
 - A “simpler time”
 - Old rigs are simpler, often cheaper.
 - Maybe an Elmer had a cool vintage setup?
 - Maybe YOU did?
 - Concerned about the “big EMP”?
 - Reading old magazines can still sell old junk

WHY RESTORE?

- For the enjoyment of the process
- To get a radio ready for operation once again.
- To increase safety and reliability
- To get ready for resale.
 - Note you most probably NOT make any money reselling radios.

FUN STYLING



BUT OLDER IS NOT BETTER

- Many older rigs have design flaws:
 - Chirp
 - Drift
 - Distortion
 - Poor audio
 - Heat dissipation (inefficiency)
 - Dangerous hot chassis
 - Poor performance
 - Weight and size
 - Old rigs can KILL YOU with their high voltage

NEW IS ALWAYS BETTER

- Today's rigs outperform older rigs.
 - Higher dynamic range
 - Better S/N
 - Tighter filtering
 - Wonderful stability
 - Higher efficiency
 - Spectral purity
 - BUT may not be as FUN!

COMMON OL' BRANDS

- Collins
- Drake
- Johnson
- National
- Hammarlund
- Heathkit
- Eico

TUBE OR SOLID STATE

- Vintage can now be either Tube or solid state.
 - Style
 - Ergonomics
 - Enjoyment of discovering the past (electronics archeology)



OBTAINING A BOATANCHOR

- eBay
- Craigslist
- eHam
- Trader nets
- Ham fleas
- Word of mouth!



CW, SSB, AM?

- CW transmitters are simplest
 - Heath DX60
 - Johnson Adventurer
- AM is next simplest
 - Johnson Viking Ranger, Viking 2
 - Heath DX100
- SSB can be difficult
 - Phasing method?
 - Filter method?
 - Drift and modulator balance
 - Heath Apache with SB10
 - Central Electronics transmitters

KNOW WHAT YOU WANT

- Know as much as possible about a rig model
 - Know the pitfalls
 - Know the advantages
 - Know how to get parts
 - Know how to test and repair
 - Know the appropriate price range

START WITH TEST GEAR

- VTVM, FET-VOM or DVM (Fluke 87V-RMS)
- Oscilloscope (Tek 2445 or new digital)
- RF signal generator (Heath IG102, IG5280)
- Frequency counter (HP 5381A)
- AF signal generator (Tenma 72-455A)
- Yer Noze
- Manual and schematics
- Old ARRL Handbooks
- Web boards

CLEAN AND INSPECT

- Before powering up...
 - Clean and inspect (open up)
 - Check fuses-proper ones?
 - Check for mods or loose parts
 - Lubricate certain controls
 - Work all controls to unbind
 - Re-seat tubes
 - Clean certain contacts
 - Let unit dry if cleaned
- Wait a day. Re-inspect before testing.

CLEANING

- Clean carefully!
- Paint brush and forced air for dust
- Remove dirt and nicotine
- Case and chassis should be treated separately
- Easy to remove lettering or other desired items
- Start with Water and Q-Tips
- Dishwashing soap, Windex, 409, Fantastic, Simple Green, Super Clean, WD-40, Goo Gone, dish-washer?
- Rust-clean with white vinegar, NevR-Dull, chemical rust remover, toothpaste and brush
- Knobs-clean in sink with toothbrush
- Polish case with Pledge

DRY

- Help gear to dry quickly with paper towels or compressed air
- Leave out in sun
- MAKE SURE radio is dry before powering up
 - I usually let the radio dry for a day
- Coat steel chassis with oil to prevent rust or corrosion?

CLEAN WAFER SWITCHES

- Other switch contacts too....
- Q-Tip with isopropyl alcohol
- Pencil eraser
- Coat with De-Ox-It
- Relays: wet a piece of paper with alcohol, drag between contacts while manually pushing them closed. Then drag a dry piece of paper through.

SAFETY always FIRST

- Again, HV can **KILL!!**
- Ground all gear.
- Keep yourself isolated-floor mat
- Use ONE hand
- Know what is powered up
- Transformerless radios NEED isolation transformer
- When not powered, unplug and short HV caps
- Note capacitors can “recharge” after being discharged.
Keep clip-leads shorted on caps
- Be ALERT, SLOW and SAFE!!!

INITIAL POWER UP

- Use a Variac
 - Or current limiting light bulbs
- Isolation transformer if needed
- Make sure rig is grounded
- Remove rectifiers
- Remove RF final tubes and modulators
- Check fuses for proper values
- Bring up slowly, look for excessive current draw or heating

STEP UP

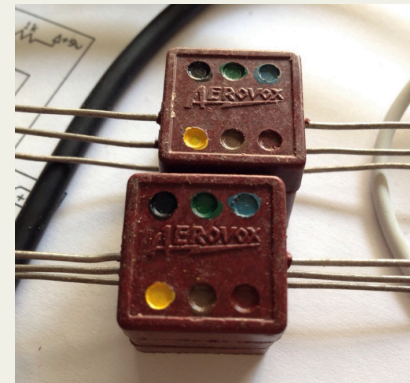
- If OK, power down and add rectifiers.
- If OK, add RF final tubes (if a transmitter)
- If OK, add modulator tubes (if a transmitter)
- Of OK, check RF output power and modulation
- Power up for short periods
- Carefully check for component (filter cap, pwr tx) heating while un-plugged and drained
- Then...

CAPS AND RESISTORS

- The main failure point in old radios are capacitors.
 - Electrolytics dry up or become resistive (leaky)
 - Wax paper caps are always resistive (leaky)
 - Ceramic caps most often are fine
 - Also carbon resistors often increase in value
 - I have seen one resistor read correctly, but become open when power was applied

MICA CAPS

- Mica caps do not fail often
 - Used in RF tuned circuits or RF bypassing
 - If Silver Mica, the silver can corrode over the years, making the cap intermittent
 - Color dot code reveals value (find key online)



SERIES PS FILTER CAPS

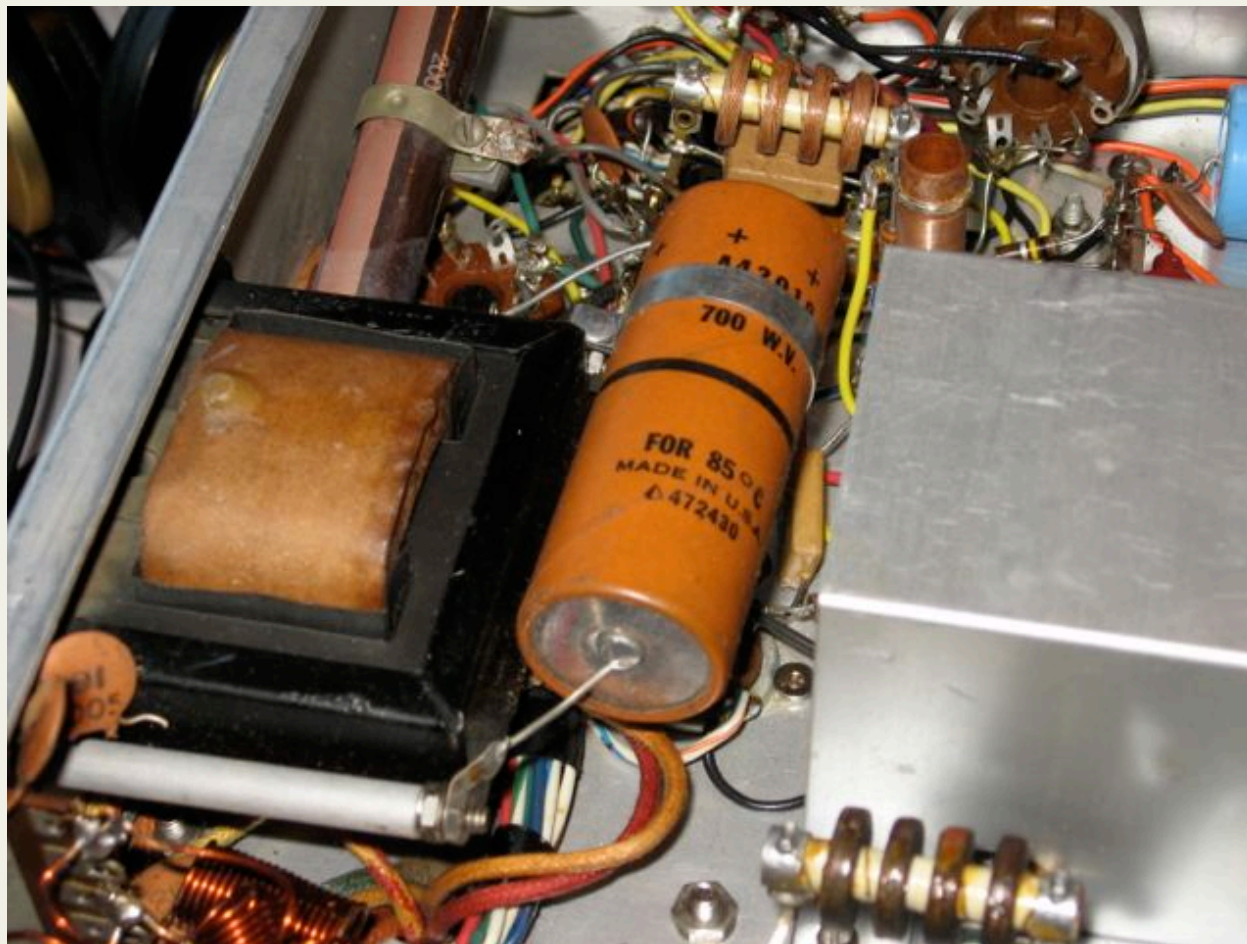
- There are not many 700v electrolytic caps out there
- The solution is to put lower voltage caps in series
- Buy caps with double the needed capacity and add 100K 2 watt equalizing resistors across them
- If a single cap is used, determine if a bleeder is needed

CHANGE PARTS

- One at a time
- Photograph before you start
- Check operation after each change
- Install new filter electrolytics
- Install new coupling Mylar caps to replace wax paper
 - No need to replace ceramic or mica caps unless they fail
- Replace out-of-tolerance resistors
- Perform radio alignment when done
- Have spare tubes or transistors
- If you are stumped on a problem, wait a day
- ALWAYS work when you are alert!!
- Unplug. Short. HV can KILL!



EXAMPLE OLD ELECTROLYTIC



LOOKS COOL, BUT NO....



EXAMPLE OLD WAX COUPLING



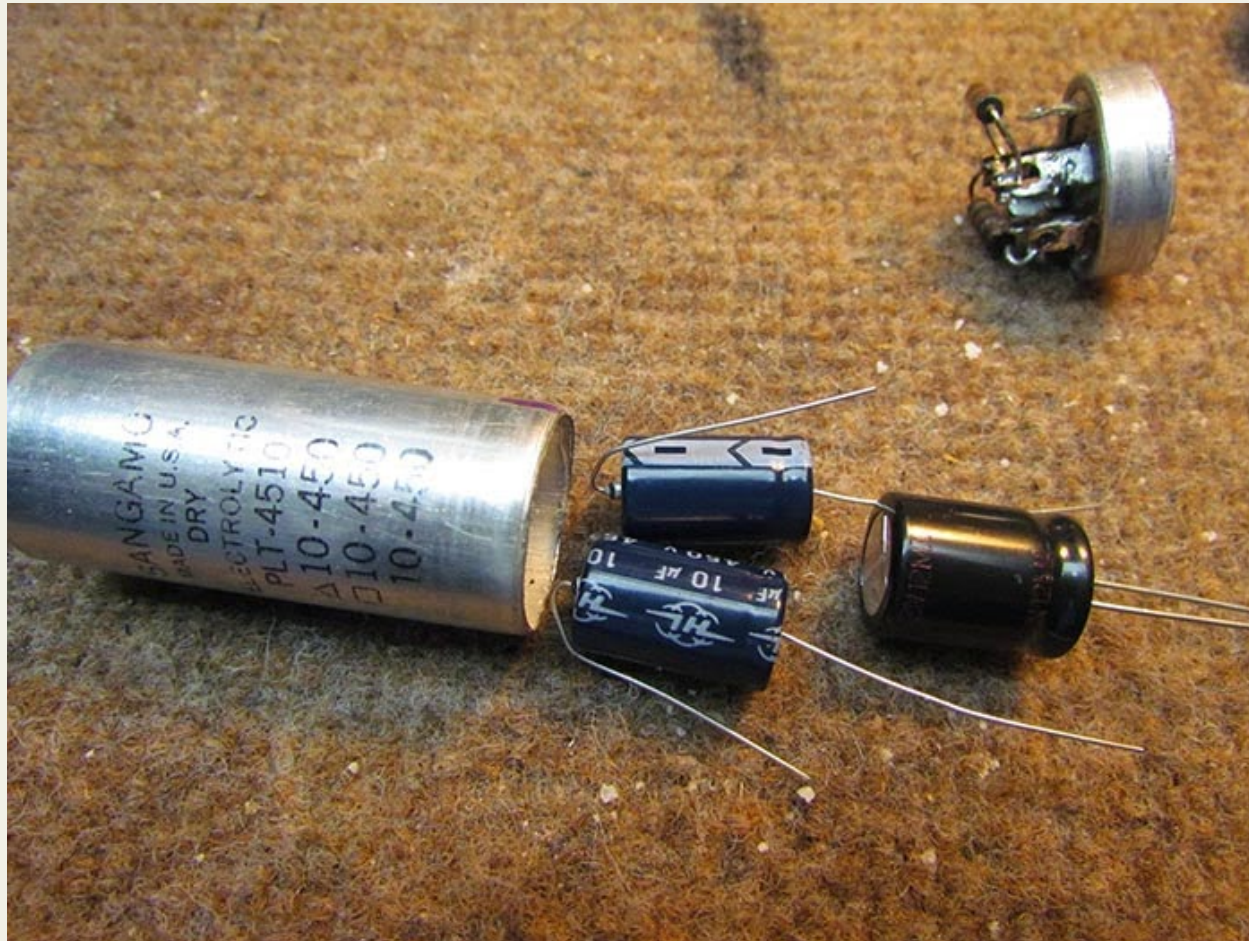
EXAMPLE RE-CAPPED



CAP STUFFING

- Some folks prefer an “original” look under the chassis
 - They re-stuff electrolytic and wax paper caps with modern replacements
 - I do not prefer as one may later end up replacing a stuffed cap!
 - YOUR choice!

GET STUFFED!



MO STUFFIN'





COMMON CAPS USED



- Wax paper coupling: use radial metalized polyester film or Mylar cap. 0.01 or 0.1uF 400 or 630v (Panasonic ECQE series).
- Electrolytic PS filter: use new 20uF 450v (example snap-in CDE 381LX820M450H022-82uF, 450V) electrolytic
- Radial snap-in caps are much cheaper if you can mount them
- Audio cathode bypass: Use 20-220uF 35v radial (axial is harder to get) electrolytic (example Panasonic EEU-ED2D101)
- Values are often not critical

CAP PRICES

- Old-style aluminum can HV can caps are expensive today
- Don't use New Old Stock (NOS)
- Axial electrolytic caps are becoming expensive
- Due to price, I use snap-in radial caps and figure out how to mount them

SIMPLE UPDATES

- Solid-state rectifiers (watch for overvoltage)
- Soft-start NTC inrush current limiter (GE CL-90) or step-start
- Surge suppression MOV
- Add fusing to primary and DC
- Portable muffin fan

VINTAGE SOLID STATE

- Drake, Hammarlund, McKay Dymek, Realistic, etc
- Earlier solid state often has a simpler topology
- Get to learn what successful semiconductors were
- Keys to home-brewing
- Change Electrolytic caps
- Clean controls
- Can easily upgrade some semiconductors for better performance (RF front-end, audio amp)

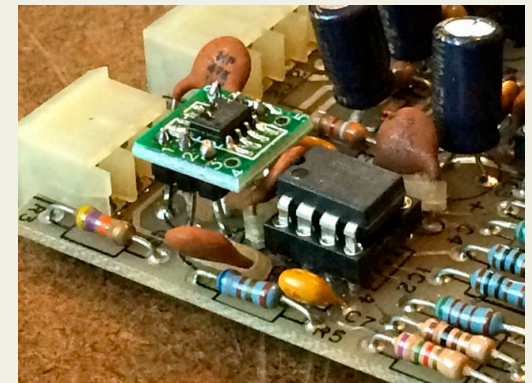
REALISTIC DX-160

- Good performing 1970s SWL receiver
- Low power consumption
- Cheap and common today
- Can run on DC (i.e. car or battery)
- Electrolytics dry up
 - Replace with modern caps.
 - Can increase value of some caps
- Bulbs die
 - Replace with LEDs
- Controls intermittent and stiff
 - Work the controls
 - Clean with De-Ox-It
 - Oil variable cap bearings
- Audio narrow
 - Replace caps with larger ones
 - Remove bypass cap
 - Add volume control tap off for external amp



ADAPT NEW

- New models of active parts are often much better
- On left, TO99 octal IC to SMT replacement
 - SOIC SMT to DIP adapter plugged in
 - SMT IC soldered to DIP to SOIC adapter
- On right, put DIP IC socket in when replacing IC



MODIFY?

- A big allure is the idea is improving an old rig
 - Widen audio frequency response
 - Lower audio distortion
 - Reduce heat dissipation
 - Better receiver front end
 - Avoid permanent modifications
 - Can get in trouble
- Modify only after unit is working

DOCUMENT

- Document your intended plans
- Review the plans, update, then execute
- When all is working well, document voltages, currents, resistances, and schematic of mods
- Date your work
- Print and place in manual
- This will help if there are future issues, or for future buyer

ENJOY!

- Fun to get something going again
- Fun to improve
- Fun to work the controls
- Fun to watch the tubes glow
- Tubes keep you warm in winter
- Older receivers sound “warmer” or “better”
- Transmitters sound more “Hi-Fi”
- Fun to tune SWL-listen for survival broadcasts and be assured your EMP-resistant rig is ready!

OPERATE!



PARTS

- Supply houses (Mouser, Digi-Key, etc)
- eBay-take your chances (Asian counterfeits?)
- Friends
- Ham fleas
- Get parts rigs

WEB LINKS

- <https://www.tubesandmore.com>
- <http://www.olderadioparts.net>
- <https://www.surplussales.com>
- <http://amfone.net/Amforum/index.php>
- <http://amfone.net/Amforum/index.php>
- eHam.net <http://www.eham.net>
- Collins, Heathkit, Drake, National collector sites
- BAMA manual archive
<http://bama.edebris.com/manuals/>

MAGIC ELIXER!



COOL VUE



LET'S CHAT!

- Questions?

- Thank you!

73,

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