'Technical Shorts'

by Gerry O'Hara, G8GUH/VE7GUH

'Technical Shorts' is a series of (fairly) short articles prepared for the Eddystone User Group (EUG) website, each focussing on a technical issue of relevance in repairing, restoring or using Eddystone valve radios. However, much of the content is also applicable to non-Eddystone valve receivers. The articles are the author's personal opinion, based on his experience and are meant to be of interest or help to the novice or hobbyist – they are not meant to be a definitive or exhaustive treatise on the topic under discussion…. References are provided for those wishing to explore the subjects discussed in more depth. The author encourages feedback and discussion on any topic covered through the EUG forum.

Radio 'Dentistry'

The majority of components contained within radio chassis we work on are reasonably easily accessed using standard tools designed for work on electronics, ie. needle-nose pliers, side cutters, small screwdrivers, nut drivers and the like, as well as a standard soldering iron. However, occasionally, a chassis presents itself where a component (or a number of components) are not so easily accessible using these tools. In these circumstances, some innovative thinking, careful planning, some 'specialist' tools (or adapted standard tools) and different techniques are needed in order to succeed. In this article, I present some real-life examples of such situations, how the issues can be overcome, and describe some of the tools I have acquired over the years to make these jobs easier (or even possible).

I term overcoming such access issues as 'radio dentistry' – in part because it reminds me of a dentist and dental technician working on a tooth in the rear of a patients partially closed mouth, and in part because some of the tools used are also similar. Maybe its more akin to 'keyhole surgery', but I currently have no direct experience of that… and hopefully won't get any…

Some of the issues that (may) need to be overcome in these circumstances:

- Actually seeing the component(s). Yes, I have had several instances where I have known a component is there but it is almost (or entirely) obscured by other components, chassis parts, wires, etc.
- Removal of the old component(s): there are two potentially problematic actions here:
    - cutting the component leads as they are very difficult to access using standard side cutters; and
    - removal of the component once the leads have been cut.
- Installation of the new component(s). There are four actions that need to be undertaken:
    - Placement of the new component;
    - Lead dressing and attachment;
    - Soldering; and (possibly)
    - Trimming and dressing leads.

- Visual inspection that the new component(s) are installed satisfactorily and that nothing is untoward, eg. leads shorting to chassis or other component/wires, insulation on nearby wires or the body of nearby components have not been damaged (eg. by the presence of the soldering iron), and that the soldered joints are good.

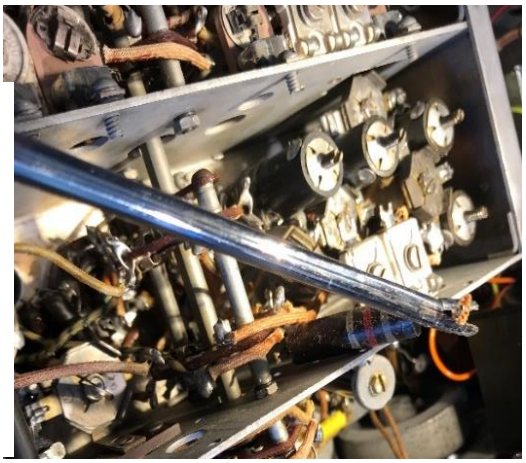
Physiological and Ambience Needs

Now, you may think I am having you on a bit here, but I have found the following to be essential:

- a calm and patient demeanor – do not try to do this type of work if you are at all stressed about anything else/have 'stuff' on your mind that will distract you and limit your focus;
- dexterity, supple fingers and a clear head – I find I work best in the mornings. Cold hands are a no-no, as is a hang-over…;
- a brain adept at 3-D spatial manipulation – some are born with a better ability in this department than others. You will have to work with what you have from a genetics point of view, but some 'training' may help – I suggest you practice on a scrap chassis;
- copious supplies of tea – works for me, better than coffee (makes me shake!);
- VERY good lighting: my bench is equipped with an overhead flood, two 'Anglepoise' spots (all LED), and I have a small 'Maglite' torch and a tiny LED light with a flexible 'swan neck' for peering into small spaces.

Tools

A selection of suitable tools (see photo, above), including: long-necked wire-cutters; very long, thin needle-nosed pliers (two types); thin, locking tweezers (selection); locking hemostats (straight and curved); remote-actuated grip tools (the offset-handle gadgets 2nd and 3rd from the right at the bottom of the photo – I think these are a type of forceps, but not sure what type. The photo, right, shows them gripping a component lead to allow extraction from a tight space) – long and short



reach versions; soldering tools (dental straight and hooked picks, and miniature wire brush), dental inspection mirror (the sort than can be extended), small telescoping magnet, and lastly, but by no means least, an Antex 15W pencil soldering iron – or similar (photo, below) - a must![1].

Planning

As in most aspects of life, time spent planning is time very well spent:

- Spend time observing the area you will be working in, how the parts are laid out. Look from various angles and in good light;
- Note carefully how things are connected and to what – be careful if connections are obscured/partially obscured as things can be misleading and may result in a mistake;
- Note what parts could be damaged by a soldering iron and may need protection;
- Consider what parts and/or wires if moved, or removed temporarily, would make access easier to the difficult-to-get-at parts. For example, can a band-change switch shaft be extracted, a transformer moved, or some parts or wires be disconnected;
- Take photos and make sketches/notes at this stage as these can save time and headaches later on when re-connecting things.

Once these observations have been made, work methodically towards your goal using the appropriate tools and the techniques described below. Above all, take your time.

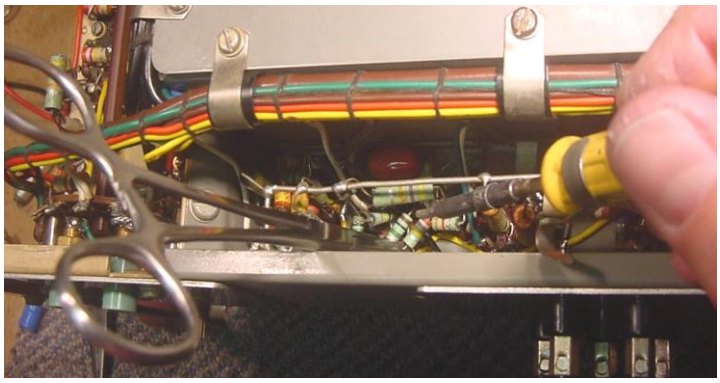
[1] Most soldering irons these days seem to be modelled on fire poker handles. I have a very expensive temperature-controlled Weller iron that is great for 95% of the work I do – it has a range of readily-interchangeable tips that can cope with anything from surface-mounted components through to changing-out large wire-wound resistors in 1930's radios. However, the shaft of this tool immediately above the tip is 3/8" in diameter and makes the iron useless for applications where access within a tight space is needed. Antex make a range of low-wattage irons that have a long, thin tip that slides over a thin heating element – ideal for use in restricted spaces. I have had a 15W Antex iron since I was 16 years old (well, at least the handle is the same! – the element and tips having been replaced several times over the years). Amazingly, Antex still make (almost) the same iron and replacement parts fit the old handle (see here for a 120v version) There are probably other suitable irons on the market, but the Antex units are readily available, low-cost, reliable and work great. In addition, the 15W size packs much more 'punch' than you would expect from such a low-wattage iron.

Techniques

The use of the correct/appropriate techniques is paramount. Some of the ones noted below are considered complete 'no-no's during standard servicing work, but 'needs must' and all that…

- if de-soldering looks like it could damage/loosen other components, eg. when on a chassis tag, and you cannot get the long-reach wire cutters in to snip off the component's leads, use your long needle-nosed pliers to twist one wire on the component until it snaps, then wiggle the component (or other lead(s) until metal fatigue sets in and it snaps/disconnects. Another tight-space 'lead-disconnecting technique' is to simply unwind the component lead using needle-nosed pliers or a forked-end pick – this works well when the solder on the old joint is weak (think of those in a tired, old RACAL RA17);

- if there is not enough room to insert the needle-nosed pliers, use the remote grip tools (forceps), or if tighter still, try a thin hacksaw blade, sharp scalpel or fretsaw blade;



- if all else fails, don't be afraid of destroying the components to be replaced if that aids removal, eg. crush or cut them up in-situ;

- modern replacement components are usually smaller than the parts being replaced, so installation of the new part in the vacated space is usually not that difficult. However, taking the time to pre-dress (cut and bend to shape) and 'tin' the leads (clean and dip in liquid flux before applying solder) can aid installation;

- it can also help to undertake some pre-assembly, eg. if a resistor and a capacitor are to be replaced and are to be connected together, do that, plus preliminary lead dressing, before installing (photo, below, left);

- for the most part forget all you have ever learned about soldering techniques (wrapping wires around tags and pins on valve sockets, heating the joint and then applying the solder along with the iron tip, etc). For a successful soldering job in confined spaces try this method instead:

o trim, pre-dress, clean and pre-tin the component leads as noted above and <u>leave a small glob of solder on the ends</u>;

o clean the tag/existing joint to be soldered onto (they usually have a dirty or dull/tarnished look) – use a miniature wire brush for this. Add a spot of liquid rosin flux to the tag/existing joint using a dental pick or similar;

o hold one of the leads of the new part in the locking tweezers, hemostat, forceps or needle-nosed pliers as appropriate, and carefully manipulate the new component into place such that one of the leads is pushed against the (pre-cleaned and fluxed) tag/existing joint to be soldered onto;

o take a slurp of tea, deep breath and, in one slick action, clean the soldering iron tip (wet sponge), melt some fresh rosin-cored solder[2] onto the tip and quickly apply to the tag/existing joint and component lead while the flux is still smoking on the iron's tip, holding it there just long enough to re-melt the existing joint and the glob of solder on the component lead – job done (sacrilege I hear you shout! – effective though with a little practice). Take care not to touch other components and insulated wires with the soldering iron during this operation – if necessary a tinfoil or similar 'guard' can be inserted to mitigate this possibility. Breath out and take another slurp of tea;

o do the same for the other component lead(s) and then, if necessary, and if access is possible (now that the tweezers/hemostat/pliers etc. have been removed from the working space), apply more heat and solder directly to the joint(s). This step is not always necessary or possible, however, each joint should be inspected closely and checked for mechanical soundness by tugging slightly on the component leads and inspecting carefully using the dentists mirror and small flashlight if needed;

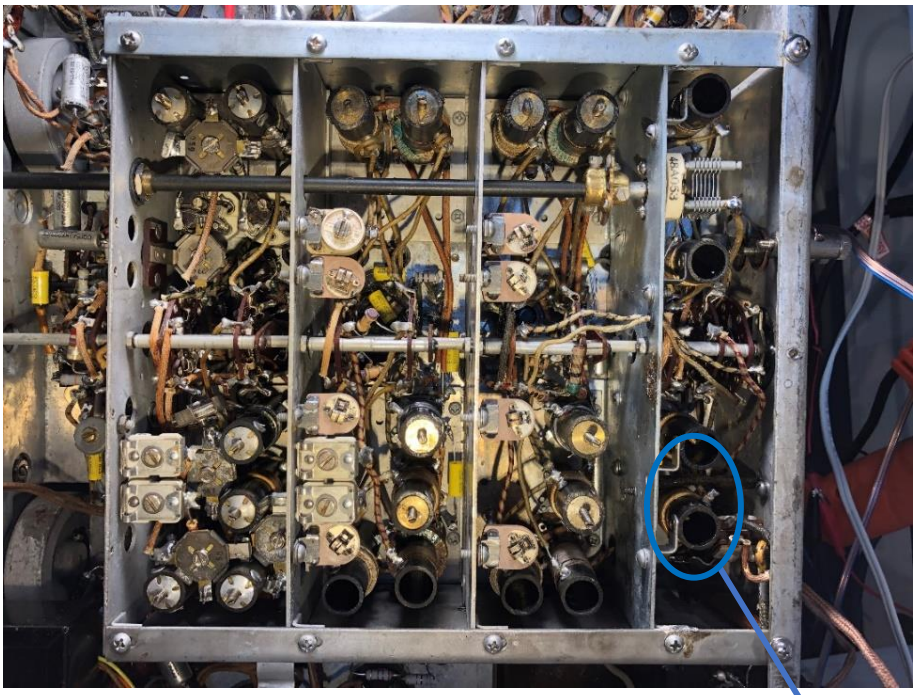
o gently adjust the component's body location and dress the leads to look neat using the dental picks/forceps/pliers.

Sometimes, the new component(s) cannot be installed where the old one(s) was located, eg. as there is not enough room, or no access to solder one end of the component – this usually occurs for those pesky chassis ground tags buried beneath many other components/wires. In this case, plan an alternate location for the replacement component – the centre spigot of the valve socket is usually grounded and can be used as an accessible and convenient ground point in such cases. Alternately, look for (or fit) a more convenient ground tag to the chassis. Bear in mind that at higher frequencies, long component leads can be an issue because of their self-inductance and stray capacitances, and thus the original component lead lengths/positions (dress) should be replicated if possible.

I was not sure whether to mention this under 'Tools' or 'Techniques', but 'Test Socket Adapters' are handy little gadgets for measuring voltages on valve sockets in cramped and/or deep chassis compartments – these are shown in the photos left and above. No need to poke around amongst the cramped components under the chassis to take voltage measurements with these bad boys in place (though be mindful of possible undesired effects of their installation at higher frequencies).

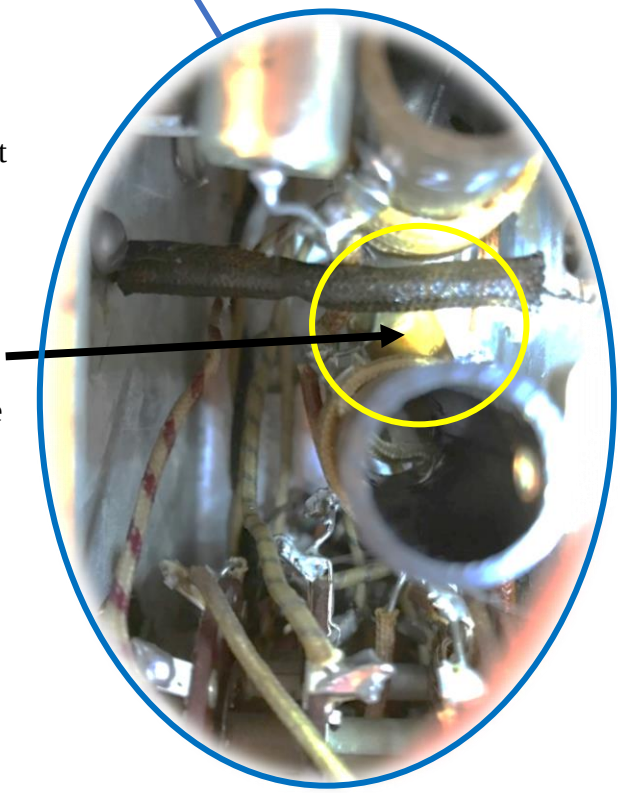
[2] Gary Albach recommends using eutectic solder (63/37 Sn-Pb) which melts/freezes at 183C, slightly lower than 60/40 at 188C. The advantage of course is that it freezes instantly when it cools, no plastic state for a crystalline joint if the joint jiggles a bit in those hard-to-reach places.

Example 1: Hallicrafters SX-28



The RF deck of the Hallicrafters SX-28 and 28A are notorious for poor access to several capacitors and resistors buried deep (photo, left) - some are almost invisible looking directly down on where the component(s) is located, being obscured by the bandchange switch shaft and wafers, numerous wires and other components, and, in the case of the SX28A, SRPB boards.

Quite often it is recommended to remove the various compartments from the RF deck completely. Having worked on several of these receivers, I have never found that to be necessary if the tools and techniques described above are used, along with careful planning and working method. The worst to work on are three waxed-paper capsacitors buried deep in the antenna section of the RF assembly. These are very difficult to access (and even see!), and the reason they may have not been replaced by anyone previously. These needed to be replaced with new plastic film capacitors (part of one such 'waxy' is just visible as circled on photo, right – follow the black arrow…).

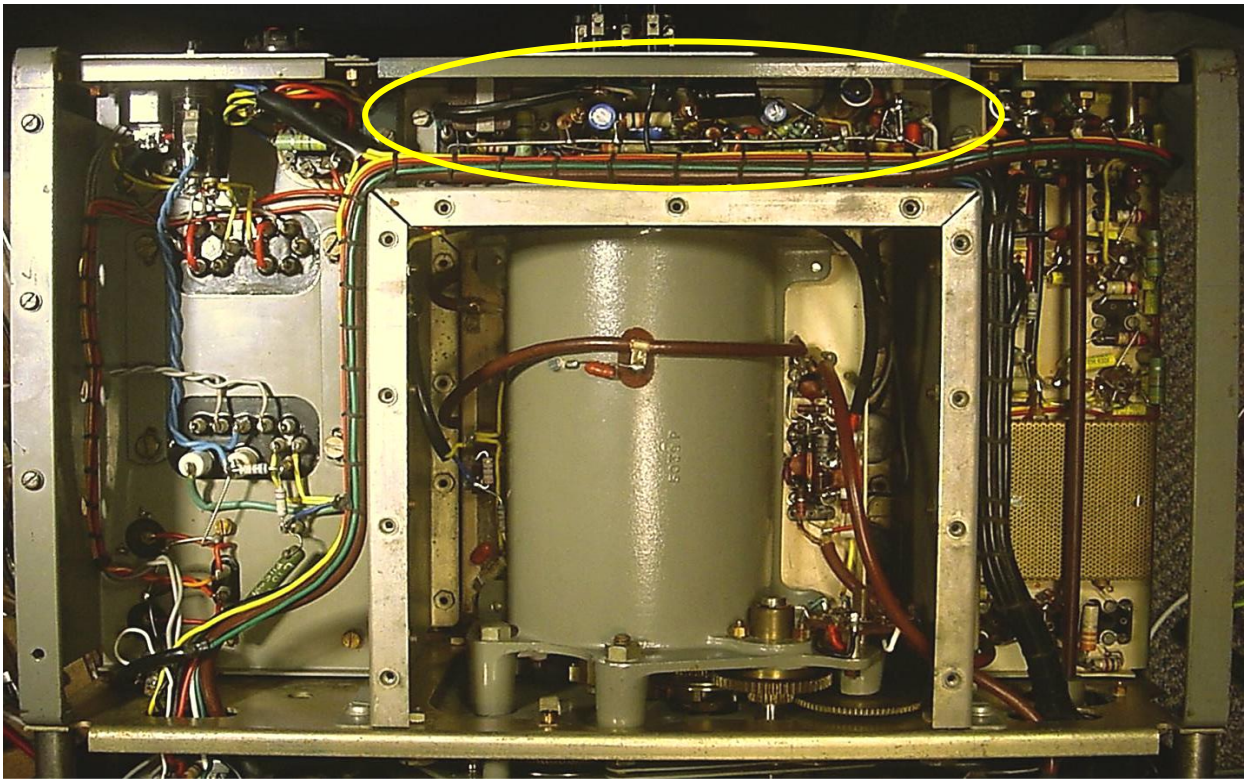


The full article on the SX-28 refurbishment is in the CVRS Newsletters (April and June 2019 issues).

Example 2: Eddystone S.770U

The AF section of the Eddystone S.770U (and several other models) is deep, narrow and cramped – being wedged between the turret tuner compartment and the rear apron of the chassis – almost like an afterthought given the amount of chassis real estate elsewhere.

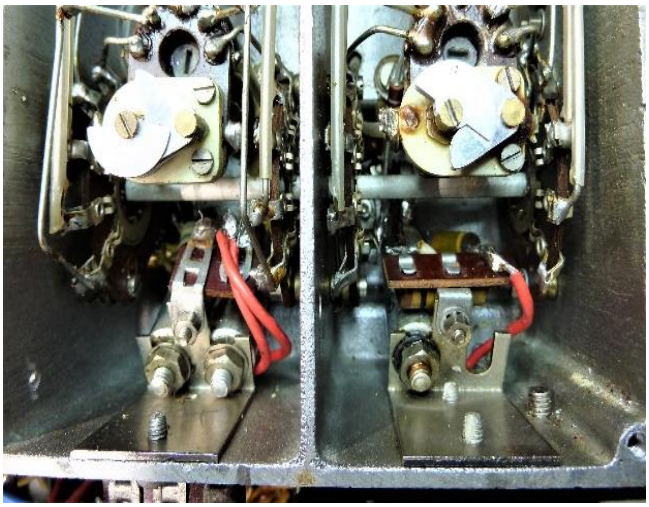
The underside of this receiver model is shown in the photo, below - the AF section is contained within the yellow ellipse. The photos on pages 3 and 4 show this section of the receiver being worked on – but to be honest, it pales in comparison to the RF section of the SX28… still, a great receiver for practicing the technique on! The full article on restoring this receiver can be found here.



Example 3: Eddystone S.750

Something a little different here: the RF sections of many communications receivers, as per the SX-28/28A, the Eddystone S.750 included, can be a real pain to work on.

In this example, a friend, Gary Albach, used a little 'lateral thinking' when planning his access to the valve sockets in his S.750. The RF section of these receivers (photo, right)



was built-up in layers, with the components wired close to the RF and mixer stages valve sockets being almost impossible to access from the base of the receiver.

So, Gary accessed the valve socket pins from above by loosening the socket mounting screws and prying the valve sockets away from the chassis (photo, right) – a very cool technique. Kinda looks like a dentist's patients mouth too!

The full article on Gary's restoration of this S.750 can be found here.

Closure

Often the most inaccessible components can be checked or replaced with a combination of observation, careful planning, the right tools and applying appropriate techniques to the situation. Have fun practicing your 'radio dentistry'…

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Below: an operation underway in the RF deck of another Eddystone (Model S.830/2)