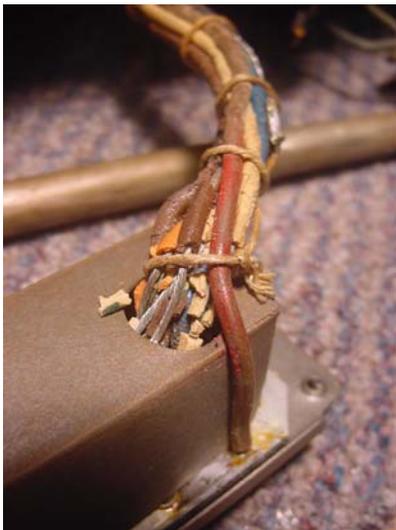


Restoration of a Zenith Transoceanic 'Bomber' Radio – Gerry O'Hara, April, 2011

The Zenith Transoceanic (TO) sets are a series of 'all band' portable radios introduced in the early - 1940's by the Zenith corporation in the USA. The first TO, Model 7G605, was introduced in 1941 and became known as the 'Clipper' as it had a sailing boat depicted on the speaker cloth. This was later changed to an outline of a bomber following the entry of the USA into WWII after the Pearl Harbour raid in December of that year. The set thereafter - not surprisingly - became known as the 'Bomber'. The Bomber was the only portable radio available at the time that covered all shortwave broadcast bands as well as the Broadcast band. This made the



set very popular and it is reported that there was a backlog of over 100,000 sets when production was halted due to Zenith switching to wartime radio and equipment production in 1942. The design used a mix of Octal and Loktal tubes in a circuit comprising an RF amplifier (1LN5), mixer (1LA6), local oscillator (1LE3), single (455kHz) IF stage (1LN5), 1st audio/detector/AGC (1LD5), audio output (3Q5G) and rectifier (117Z6G). Following the end of WWII, production of the Bomber version of the TO was not resumed, instead it was replaced by the Model 8G005 in 1946, this having a re-designed front panel and some significant modifications to the circuit, including a push-pull output stage.



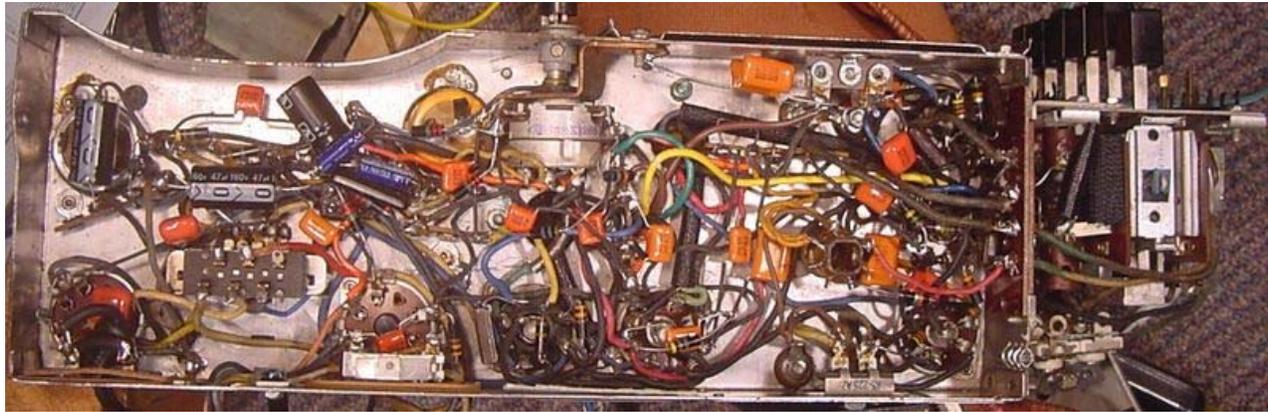
Now some 70 years old, the SPARC customers Bomber was looking a little raggy around the edges and was not working - I was not at the museum when it was brought in, but apparently the set had been working (recently) but was now reportedly 'dead'. On opening-up the back of the set, the first problem spotted was that the wiring to the tone control switch bank ('Radiorgan'), originally rubber insulated, was now just a mess of bare wires and crumbling, hardened rubber fragments (photo, left). Also, I noticed a thin layer of asbestos was present beneath the chassis, this being glued to the wooden shelf the chassis is mounted on. I have a strong aversion to being around asbestos, and this piece was flaking away around the edges. It was therefore carefully removed (while wearing a respirator in

the spray booth at the SPARC museum), double-bagged and disposed of appropriately, being replaced by an aluminum and cardboard sandwich of the correct thickness (to allow the front panel switches to align correctly with the apertures in the front panel). The need for an asbestos layer in this location in this particular set is not clear as there are no heat-generating components located beneath the chassis.

Given the obvious wiring problem I decided not to try powering-up the set, and subsequent inspection under the chassis revealed some more wiring horrors beneath - some hardened rubber insulation as above the chassis, plus some (yellow) insulation that had turned to a soft chewing gum-like consistency. Other rubber-insulated wiring and cloth-covered wiring was intact. The degraded-insulation wiring was replaced with new stock PCV insulated wire - that in the tone switch wiring loom being a bit of a challenge, as several wires passed through a metal screening braid. The trick here was to use the existing wires to pull the new ones through, having first removed two of the originals to make some room in the sleeve (lots of hardened rubber bits falling out in the process) - photo, right. The wiring insulation problems sorted out, the next job was to check the power supply circuits - safety first! Inspection showed that someone had been there before me and had replaced all the electrolytics: given the selection of types present I figured that probably at least a couple of episodes of electrolytic replacement had occurred over the years. The original two above-chassis (can) multiple electrolytic capacitors had both been replaced, and three small (newer) units had been fitted beneath the chassis (photo, below). Closer examination revealed that a 200uF unit was being used as the primary power supply filter capacitor (instead of the original 40uF unit) and that an error had been made in wiring two of the smaller electrolytic capacitors beneath the chassis - one of the low-voltage units being wired to the HT line... why this had not failed in use is a mystery. This error was corrected and all the electrolytics tested - there was some leakage present and the ESR readings were on the high side but they were left in place for the time being. The radio had been fitted with a new line cord at some point in its history, complete with a polarized two pin plug - the polarization was checked and found to be correct.



Continuity checks were then made on the tube heater circuits - all seemed in order and, with the speaker connected, power was applied via a Variac. At about



100v AC, some noise was heard on the Broadcast band, but tuning around revealed only one station that was coming in very distorted and with a strong modulation hum. With 115v AC applied, things were no better, so I started to undertake some critical voltage checks, finding some wayward ones in the process - I suspected that that some of the (original Zenith) paper capacitors were leaky. After testing a couple and proving this was indeed the case, it was decided to replace all (19) of these with new stock plastic-film capacitors for the sake of performance and reliability (photo, above). While I was undertaking this replacement work I also checked the resistors - all but one tested were within 20% tolerance: the faulty one was a 1.8kohm carbon composition unit in the HT feed. This was replaced with a 1W metal film type and the power then re-applied. The set was much better now, with more sensible voltages present throughout and several stations coming in strongly on the Broadcast band, but a strong modulation hum was still evident - a bit puzzling with all paper capacitors replaced and the electrolytics testing reasonably ok. I bridged over the electrolytics with known good units and the modulation hum persisted. Sometimes a mixer tube with a heater-cathode short can produce this effect, so the SPARC tube vault was raided for some Loktal tubes. I could not find a 1LA6 but a couple of 1LC6s were located (this tube is a good match) and these were tried - still the modulation hum persisted. After a couple of frustrating hours of further checks, the cause was finally revealed as the 'Candohm' resistor in the power supply, which was acting as a capacitor when heated-up, placing an AC voltage onto the tube heater circuit. Instead of replacing this with separate high-wattage resistors, the Candohm unit was retained, but isolated from the chassis with a teflon washer and nylon screw



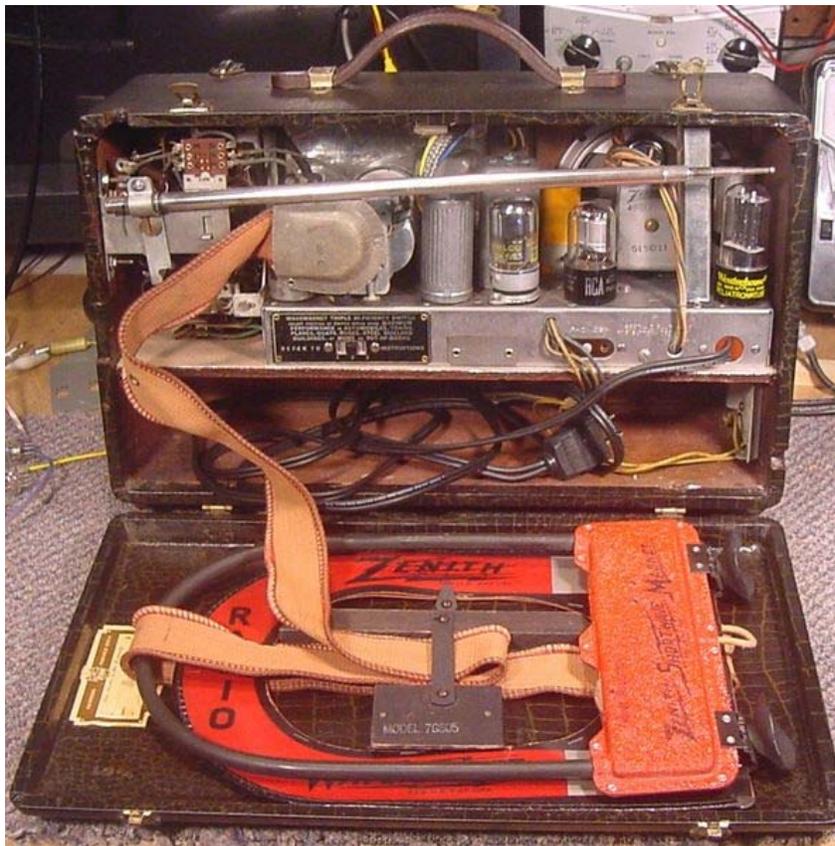
(photo, above). A minor amount of residual hum was then cured by replacing the can electrolytics with new ones installed beneath the chassis. The wave-change switches and the tone control switch bank were then cleaned with De-Oxit. A listening test indicated that the 1st AF tube was microphonic, so this was changed out.

The sets alignment was then checked - not too far out, but enough to warrant a full re-alignment. The IF alignment was undertaken with the chassis out of the cabinet and the RF alignment with the chassis re-installed. Adjustment of the local oscillator and mixer trimmers can be done easily on this model by removing the escutcheon around the band change



switches. The set was found not to be working on the upper short wave bands (above around 12MHz). A weak local oscillator tube was suspected and so this was replaced with a tested 1LE3 tube from SPARC stocks. This done (and the fault cured), the upper bands were re-aligned and the set was then soak-tested for around 8 hours and found to be working well on all bands. The dial cord was found to be slipping intermittently and a little powdered rosin was rubbed onto it to effect a cure.

As the customer had indicated that it was electronic restoration that was of primary importance, only a minimum of cosmetic work was undertaken. The black dial had a number of minor scratches and these were touched-up using a black permanent marker pen. The plastic dial and outer case were cleaned with anti-static cleaner and minor scuffs and scratches blended-out with a brown wood-tone scratch touch-up pen. Once this work was completed, the set looked very presentable.



The TO has two inbuilt antennas: a loop ('Wavemagnet') and a telescopic rod ('Waverod') – photo, left. When the Waverod aerial is rotated into the upright position, the 'Wavemagnet' is automatically switched out of circuit. In this example, the mounting plate for the Waverod had become loose and the locknut securing the antenna was missing. This assembly was cleaned, re-secured with a new locknut and tested ok. That done, the set was given another soak test, receiving Radio Havana Cuba, Radio Australia and China Radio on the Waverod – not bad in my basement workshop! Broadcast band

reception was also good, pulling in many US and Canadian stations with good sound quality (the tone control switches really do work well).

All in all a nice (if a little frustrating at times) restoration job. The set was duly returned to the SPARC museum for collection by the owner. The full set of Zenith paper capacitors were placed in a plastic bag inside the battery compartment in case any future owner wishes to 're-stuff' these to regain original under-chassis looks and increased authenticity if the above-chassis capacitors are also re-stuffed (or re-placed with new or NOS multiple capacitor electrolytics) - significantly more effort, but maybe worthwhile for such a collectible and historically interesting set.