Vintage Homebrew on Five Megs!

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Towards the end of 2003 I saw a posting on the VMARS Yahoo group by Martin Swift, G4NCE, who was offering for disposal a home-brewed valve transmitter that had been used by an Air Training Corps squadron in the Midlands. The plan was to sell the surplus transmitter and use the funds to buy a modern VHF transceiver for the squadron. After contacting Martin and receiving some more details and a set of photos, I agreed to buy the radio. Using the opportunity of taking my daughter back to University in the Midlands, I arranged to collect the transmitter from G4NCE and take it back to Norfolk.

TX as modified and in place in the shack below the HRO-50T

The main attraction of the transmitter to me was that it had been built for the 4 and 5 MHz ATC channels (using crystal control) as well as our conventional 80, 40 & 20 metre bands (with VFO coverage). The idea of using a vintage rig on our 5 MHz channels was appealing but, although the transmitter has AM and CW modes, CW was really the only option for 60 metres if I wanted to stay within the 3 kHz-wide allocated channels. As crystal operation was supported and I had a number of 10XAJ rocks for 5405kHz (Channel "Mike") the worry of being off frequency was greatly reduced.

The transmitter is constructed on three 7" high by 19" rack chassis with chrome handles and is strongly made. The chassis appear to have been originally made by Belling-Lee and were some form of RF distribution unit, judging by the holes punched in them and labels on two of the units. The three racks comprise firstly, a high-voltage PSU using a meaty Woden transformer and early model silicon rectifiers. Secondly, a modulator using a pair of KT66 valves in the output stage, a Woden UM1 modulation transformer and a power supply for the audio pre-amp and driver stages. Finally, there is the RF chassis, which has its own power supply for the oscillator and driver stages and a pair of 807s in the PA stage followed by a PI-tank output circuit. On close examination, everything seemed to be complete and there were no obvious signs of distress or leaky electrolytics, etc. Most of the few controls were labelled but there was a curious "high-voltage" ganged switch on the power supply that consisted of two toggle switches with their levers linked by a piece of wooden dowel.

Investigation of the PSU chassis soon showed that the two switches were in fact a simple arrangement with one switch controlling the mains supply to the HV transformer primary and the other switch acting as an aerial changeover between TV-type Belling-Lee coaxial sockets which were mounted on a diecast box. On applying mains power the HT came up to around 800 volts without any nasty incidents. A separate 30-volt power rail was found to be supplying a large GPO relay above the chassis, which is used for controlling the power to the other decks. I decided at this point to remove the aerial changeover switch and fit a red indicator to the vacant hole to show that power was on. Also, it was decided to utilise a spare set of contacts on the GPO relay to operate the station controller box, which mutes both main receivers and controls the main station aerial changeover relay. After replacing the twin-core screened cable that had been used to supply mains power to the unit (!) work was complete.

Next I checked out the RF deck. This has a large diecast box in the centre with a second box on top of it, forming the VFO enclosure. The tuning capacitor inside the lower box is driven by a fine RAF slow-motion drive of the type fitted to the W1191 Wavemeter and other WWII test gear. The reduction drive can be disengaged and the capacitor moved in one 180-degree movement to avoid having to laboriously crank it around the dial with the slow-motion control. The transmitter exciter stages are fairly conventional. The 6BW6 buffer stage provides plenty of output when used as the crystal oscillator, feeding a 6CH6 driver stage. The VFO is an EF80, which runs at 3.5 MHz with multiplying carried out in the driver stage. On powering-up the deck and pressing the net button a strong carrier could be heard but the lower limit was fairly high up on 80m, about 3750 kc. A slight adjustment of the trimmer capacitor on the VFO enclosure brought the VFO coverage down to cover the CW portion of 80m and up to about 3730 kHz, enough to cover most AM operation on the band. I found that both the VFO and crystal oscillators worked fine and the CW note was a good T9. The VFO stability is excellent and shows the effort in fitting the diecast box screening was worthwhile.

The next step was to see if the PA would fire up. Looking at the original wiring, the EHT was taken from the PSU deck conventionally *via* the modulator output transformer secondary winding to the PA anodes, the secondary being shorted out when CW is selected. I bypassed this for testing and took the EHT straight to the RF deck. On applying power no nasty smells or noises occurred and on 80m I could see a few watts of RF, a quick tune of the PA capacitors and I had nearly 65 watts into a 50Ω load. At this point I discovered either a design flaw or an inexpert repair. To check the PA grid current I switched the meter switch to "grid" – followed by a loud "crack" and the meter pinning itself against the end stop! A hurried power-down and investigation showed that the grid/anode current rotary switch had make-before-break

contacts - which put 150mA of anode current across the 10ma meter without benefit of the anode current shunt. Of course, if I had un-keyed the transmitter before throwing the switch to "grid" this problem wouldn't have been noticed - I suspect the original operators might have known of it!

A few minutes with the hole-cutter enlarged the meter switch hole to take a toggle switch and the rotary switch went in the bin! Unfortunately, the meter didn't want to return to zero after this experience and has had to be replaced temporarily by a later model, until the right meter turns up. On further tests I was able to get a good power output on both 60 and 40 metres but no joy on 20m. Looking at the driver stage tuning I saw that the coil taps had been played around with and the 20m one was off altogether, this was left for future investigation as I have plenty of 20m-capable vintage transmitters already. Two switches, a rotary and a toggle, had been fitted to select crystal or VFO operation and so I reduced this to one rotary type to simplify matters.

The modulator deck was checked out next. Power to the preamp and driver stages came up with no problem and I then wired the EHT back to the UM1 secondary and powered up the whole shebang. A test call into the Astatic D-104 mic produced audio on the receiver but at the most 50% modulation on a loud whistle. After drawing out the wiring of the preamp it was obvious that a low-Z dynamic mic had originally been used; most of my mics are crystal or hi-Z dynamic and so a modification was done to change the preamp input circuit to suit the D-104. After this was done about 85-90% mod could be achieved on the station monitor scope using a 1000Hz test signal. Speech sounded good, with plenty of bass component.

Now the problem of how to mount the three chassis was considered. I have limited bench space after the two receivers and the LG-300 RF deck are catered for and all the available shelving was in use. It looked as though the space under the bench was the only place to park the new TX. I remembered that the local office of my employer was throwing out quite a bit of redundant equipment and a quick phone call to a colleague there revealed that there were a number of old racks in the skip and that I was welcome to take one away. A very sturdy rack of just the right height was found in good mechanical order and complete with cage nuts and screws - this was duly carted back to G3VKM. The three 7" high units fit perfectly, with a small clearance top and bottom for ventilation. I'm now on the lookout for three sets of slide bars to relieve the weight a little from the front panels.

On the air, my first QSO (other than a quick air-test with a local, Dave - G3UUR) with the homebrew transmitter was on 3625kc AM with Gerald, G3LEO, who was very complimentary (unprompted) about the audio and assumed I was on my LG-300. Martin, G4NCE, had told me that the transmitter had been known for its "BBC-quality" modulation when in ATC service and so I was pleased to get Gerald's report as it confirmed that things were as they should be. A few days later, using a BC-221, I set the HRO-50T up on 5405kc and listened to an SSB contact there. As G3SHX was signing I fired up the transmitter and called him on CW. He immediately came back and gave me a good report on my transmission. Work then intervened for some weeks but I have been using the transmitter on 80m AM with very satisfactory results since mid-May.

The origins of the transmitter are a bit cloudy; Martin recalled it as follows. "The transmitter was at 1290 (Wednesfield) Sqn ATC in Staffordshire Wing, and was used mainly on the channel which was then called 'BRAVO 1' - 4925kHz for R/T communications with other ATC squadrons. It is believed to have been built by their radio officer, Les Rayment, who was a fairly early G3... I have had a search of all my old ATC radio documentation but I can't find a reference to his amateur callsign. An old RAFARS book or something similar might turn some info up and it is conceivable that the squadron might have held an amateur callsign at some time as well. The callsign the transmitter was used with on the ATC HF net was VQ5X43, VQ5X being the prefix for the HF net covering Wales and the central areas of England". If Martin's info rings a bell with any member I'd be interested to hear from them.

The construction of the transmitter follows the classic rack and panel designs popular up to the early 1960's in homebrew equipment. The use of separate on-chassis power supplies for the early stages of the modulator and RF decks is a little unusual, I would have expected everything to be powered from one chassis but I would guess the designer/builder used whatever came to hand. The UM1 modulation transformer is perhaps a little small for the PA stage - but it does the job.

One attraction of restoring homebrew gear is that it is possible to make the small modifications such as I carried out with a clear conscience, unlike military and commercial equipment where a mod, especially to a front panel, can reduce the collectability and value of the piece dramatically. I took all the components I needed from the shack and the cost of the rig was about what the KT66s would fetch if auctioned, so I am very happy with the outcome. There is another attraction too - the fun of following the original builder's trail and seeing how he used what he had and how he did it. There was no technical information whatsoever with the transmitter and so it was a question of tracing out the bits of the circuit I needed to work on, good practice after usually having at least a circuit to work from! Following the donation of an ex-KW Vanguard meter by G3UUR I will now be able to replace the temporary meter with something more appropriate, which will have the advantage of being scaled for percentage of modulation as well Ia/Ig readings.

In conclusion, the ATC TX needed no major work to get going but the need to trace through all the wiring was useful experience. Homebrew equipment is an area I will be watching out for from now on and I'm looking forward to a fresh challenge from a little Top Band transmitter bought at the South Normanton rally earlier this year.

RF deck and power unit as taken out of storage
(photo G4NCE)