

## Restoring a HBR-13C - Gerry O'Hara

Much of the SPARC Museum's collection has been acquired by donation - often someone will just drive up to the door on a Sunday afternoon and unload 'junk' (sometimes aka 'treasure') from their car or truck for the museum to do what they can with. Of course some such donations really are junk - water-soaked and broken 1970's stereo sets, 1960's TV sets with rats' nests inside, unidentifiable pieces of test gear, medical or industrial electronics. A 'triage' system is therefore in place whereby learned volunteers assess the donated items on arrival, with the lucky (eg. more unusual, exceptional or interesting) items being catalogued and entered into the museum's inventory, the rest being dismantled to remove useful parts (eg. valves, knobs, speakers), any obviously hazardous materials (eg. asbestos) segregated and disposed of appropriately, and the remainder of the carcass then also being segregated and disposed of or recycled appropriately (eg. wood, metals, plastics, glass).

Occasionally, items of particular interest arrive at the door. For example, back in 2007 three Racal RA117s showed up, and sometime after a HBR-13C homebrew amateur bands receiver was brought in by Jim Corbett, VE7BKX, donated by George Abbott, VE7AAN. On closer inspection, the set, complete with all its hand-wound coils was observed to be extremely well constructed and in



excellent condition - it had obviously been cherished and well looked-after for its entire life. It also came with a package of original paperwork that had been accumulated by its previous constructor/owner prior to, during and after its construction in 1965/1966. This included the chassis templates and details on some 'quirks' the receiver exhibits, for example when operating on the higher frequency bands.

## Homebrewing and the HBR Series of Receivers

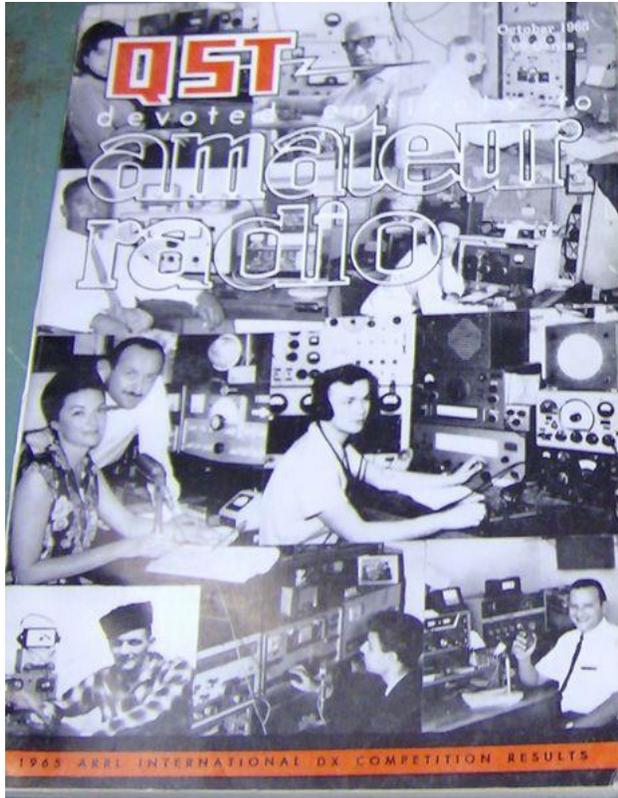
Homebrew receivers for the amateur bands have always been popular - the satisfaction of pulling in weak signals worldwide from a piece of kit that you have made yourself is difficult to describe - this was certainly the norm in the early days of radio, and the interest in receiver homebrew continues in the radio amateur community to the present day, though



the level of complexity, technologies used (eg. digital frequency readout, software defined radio and the use of PICs) and construction techniques (LSI chips and surface mount components) employed in many current leading-edge receiver designs would have been almost unimaginable at the genesis of the HBR receiver in the 1950's, though the well-known Hugo Gernsback, editor of 'Radio-Electronics' magazine in the US, often had some amazing insights into where things would go in the radio world - though not always correct...

Homebrew receivers can vary greatly in level of sophistication - from a crystal set or simple one valve (or transistor)/single band circuit through to sets rivaling professional sets of the same era, with valve-counts in the teens (or more), covering several bands, having double or triple-conversion and having sophisticated filters, noise blankers, Q-multipliers etc. Construction of the more ambitious valve receiver designs, such as the G3RKK design using a commercially-available front end from 'Electroniques' to mitigate possible errors in constructing the front end of the set (so critical to achieving first-rate performance), the famous and superlative G2DAF receiver and the G3PDM (valve-transistor hybrid) design in the UK, all published in the RSGB 'Bulletin' and/or 'Radio Communications Handbook' were definitely not for the novice: a sound understanding of radio principals, construction techniques and alignment procedures was a pre-requisite for a successful outcome. After all, the parts for such receivers were not inexpensive and the investment in time for the constructor was huge.

In the USA, the ARRL published the first 'HBR' receiver design by Tec Crosby, W6TC, in the mid-late 1950's issues of 'QST'. This receiver was a double-conversion design that simplified construction greatly by having plug-in coils rather than having a bandswitch, the latter 'convenience' item greatly adding to the complexity of the receiver wiring and therefore the potential for mistakes or poor layout affecting stability and performance of the receiver front-end (it takes 30 seconds or so to change the coil set in the HBR-13C. Not a lot of time and effort unless you are 'band-hopping' very frequently, which most of us do not do).



The excellent [web site by K5BCQ](#) devoted to the HBR series of receiver's best summarizes the context of this receiver design and its variants thus:

Many radio amateurs, over the years, have enjoyed building/using their own transmitters/amplifiers built from construction articles in QST, CQ, the ARRL Handbook, RSGB Handbook, The Radio Handbook, etc. The one homebrew item usually missing was a really good double-conversion CW/SSB/AM receiver with excellent sensitivity and selectivity that could be built/used with reasonable skills, at low cost, and with readily available tools. The answer in the late 50's and early 60's was the "HBR Receiver" and according to letters received by the original designer, Ted Crosby (W6TC-SK), the design proved very popular and several hundred were built worldwide. You probably think "...maybe great in 60's but why consider building/using one now?" ...well, because it's a really good receiver (plenty of 50's and 60's tube gear is still in use on the air today), it's

personally satisfying to build your own, and some of us just "wanted to build one" in the 60's...but never did. We now have the Internet to help locate unique parts and share ideas...and, as indicated below, there are plenty of substitute parts available today to enable YOU to build one of these excellent HBR Receivers.

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There were several versions of these very popular homebrew receivers and several hundred were built worldwide. Most were built and worked very well, some had problems, some were never completed, all were probably interesting/fun experiences. The first was the HBR-14 published in the July 1957 QST, followed by the very popular HBR-16 in October 1959 QST, the HBR-8/11 in March/April 1963 QST, the HBR-12 in April 1964 QST, and the HBR-13C in October 1965 QST. There was also the "Deluxe HBR Receiver" (and matching SSB transmitter) in the 1967/68 (17th Edition) Radio Handbook by Bill Orr. In addition, several articles covering HBR Receiver improvements and add-ons (by Alex Stewart (WA4ZNI) and Bill McKay (W7QBR) to name just two) were published in QST.

## The HBR-13C Receiver

The HBR-13C is an amateur bands only, double-conversion superhet, with IF's of 1610kHz and 100kHz. Separate gain controls are provided for the RF stage, the second mixer and the two IF amplifiers (seems like over-kill, but it is noted that "...it is one of the features of the receiver. Normally the RF stage is run wide open, the mixer gain at about halfway, and the IF gain is advanced only enough to provide suitable signals at the detector. The RF stage gain is backed off only when a very strong signal attempts to take over the receiver."). Selectivity is provided by four 100kHz IF transformers, the two between the 2nd mixer and the first 100kHz IF amp being loosely capacitance-coupled (10pF). The IF bandwidth is noted as being 3kHz with steep 'skirts' (ideal for SSB reception and OK'ish for AM), though surprisingly no crystal filter is fitted for CW reception. Instead, for CW, reliance is put on the



response curve characteristics being able to provide 'true single signal selectivity'. The design is commented on as being exceptionally stable and with a high signal-to-noise ratio. The circuit is noted to use 'standard parts' throughout, with the exception of the plug-in coils, and to cost an estimated \$170 to build (in 1965), complete with valves, crystals and cabinet. The 13C incarnation of the HBR design included a product detector for SSB/CW reception and a stage of amplification at the first IF of 1610KHz. A 3.5MHz crystal calibrator is fitted to provide a reliable indication of the lower edge of the amateur bands covered by the set.

The HBR-13C receiver donated to SPARC is a very good example. It does not follow the templates or layout shown in the prototype photographs exactly, as indeed it need not, but incorporates ideas and minor changes that the constructor thought appropriate or to suit components or materials 'in hand'. This is part of the 'poetic licence' and satisfaction of homebrewing, providing the constructor has the experience and knowledge to limit such changes to non-critical areas of the design and/or layout. Interestingly, none of the control



functions are marked on the front panel - here is a receiver whose operator obviously knew it inside and out! Four amateur bands are marked-up on the '898' dial covering 7.00 - 7.33MHz, 14.00 - 14.35MHz, 21.00 - 21.45MHz and 28.00 - 29.70MHz (80 metres is missing).

The set was briefly air-tested at SPARC and it pulled in several amateur stations on a short random-length wire on all bands.