

Tricks of the Trade

Dave Porter G4OYX with Raymond Rowe and Ron Bradbrook

Readers of this column will no doubt have noted many references to Marconi Wireless Telegraph (MWT) transmitters and senders and their use by the BBC. This is not surprising as, over the years, MWT and the BBC have had a long and mainly advantageous partnership. In general, the BBC Transmitter Planning and Installation Department specified, bought and oversaw the installation of new transmitter plant and then passed it on to the Operations Department to run and maintain it on a day-to-day basis. This article in effect steps backwards one pace to the manufacturer and illustrates the trials and tribulations in achieving the specifications demanded by the BBC and other broadcasters into development and production. As amateurs, we have no doubt been involved in just the same tribulations; indeed in the RSGB Handbooks and in the mid '60's publication "The Guide to Amateur Radio" much is made of the use of parasitic stoppers, RF filters and the general prevention of spurious. We are all used to the odd few turns here and there with an in-built 47 ohm resistor or judicious use of a screen between two sections, but how was this technique 'first-thought-of' or discovered? With the help of a presentation by the Past President of the Marconi Veterans Association, Raymond Rowe to his successor Ron Bradbrook all is revealed.

These people are the real Tricks-of-the-Trade merchants.

Marconi Veterans Reunion 23 April 2010

The President of the Marconi Veterans Association for the year 2010 is Veteran Ron Bradbrook, ex Broadcast Transmitter Development, Marconi Comms. At the reunion, Ron was introduced by Past President and Veteran, Raymond Rowe. A transcript of Raymond's speech and Ron's response is included below



Ron Bradbrook

Raymond Rowe

There's a lot of old people here isn't there?

Mr Chairman, Mr President, fellow Veterans. Now some of you know Ron Bradbrook more will have heard of him or about him there are even more who do not know about him at all or why he deserves to be our President. So, for those of you unaware of his background, or not having had the pleasure of knowing him, I will give a brief resumé of his early years and his contribution to the Marconi Company.

Ron was born in Barking and moved early on to Writtle. After the benefits of the local school he passed the exams to attend Chelmsford Technical College. During his apprenticeship he did his National Certificate studies at the Tech.; he had spells at Pottery Lane, Hut 3 at Baddow, Writtle and the dreaded Building 46 in New Street. In Building 46, as an apprentice, he came under the influence of engineers such as Tommy Thompson and Frank Page. These set him off in a sound direction. National Service saw him on a beach near the Nile during the time when we thought we still had an Empire.

After National Service he rejoined Marconi as a development engineer and found himself in Building 46 working for a very fine senior engineer, Dougie Bowers. This is where high powered transmitters started to take over his working life. He had a number of trips overseas solving problems in places such as Rwanda where he got some very large MF transmitters to work in rather difficult circumstances. His abilities and sound engineering were ideal in an area where you are dealing with high power equipment that can be lethal. This is engineering with a capital 'E'. I could list some transmitter type numbers but few of you would know them, however, some are known and remembered across the world, they range in power levels from 1 kW to 750 kW in all the broadcast wavebands. I must point out that this is real power, not some of your current digital pulse power; this is power where, in a couple of minutes, all of you could cook all of your Christmas dinners in one go. Now, as I have said, these transmitters include lethal voltages and very high RF power levels. A lot of this equipment was designed and operated before Health and Safety was born. Quality engineering and attention to detail has established equipment that has stood the test of time in performance, reliability and safety. These transmitters were and are being used around the world. BBC World Service relies on 300 kW and 500 kW HF transmitters; the Voice of America is reaching parts of the world that satellites cannot cover with the more recent 500 kW HF

transmitter. 500 kW Droitwich Long Wave is still covering most of Europe for the BBC.

Going back, was it 30 years ago, there was a major change in MF frequency allocations in the medium wave band and the BBC had to renew their MF stations. They chose a combination of our 50 kW Doherty (B6034) transmitters to produce power levels of 100, 150 and 200 kW. These replaced Marconi transmitters that were installed some 50 years earlier. As Tom Mayer remarked at the time to a senior BBC man "It is difficult to build a business when you only get an order every 50 years".

This was a major project for Marconi's and all had to be done in time to be installed across the country with a very public deadline. Then to keep the team on its toes came the replacement of the BBC FM service. The BBC wanted to replace their FM services for Radios 1, 2, 3 and 4. This required the development of a range of equipment in 10 and 20 kW using new valves and again it all had to be done to get them all installed in time for a deadline. So we have all listened to BBC programmes transmitted from equipment designed by Ron and his team; I should point out that they were only responsible for the equipment, not the programme content, that's down to the BBC!

Now I don't want you to think that Ron did it all on his own. All large projects call for many people and many skills; design office, manufacture, contracts, handbook writers, installations, installation engineers and many others. However, this range of activities needs an authoritative voice that can cut through the problems and make a decision. Your President was that man in Building 46. Now how did he provide this direction of management and encouragement? Many times I have seen people walking up the New Street yard to Building 46, people, as I have said, from the IDO, Contracts, Manufacture; they all had a worried look about them. Were they perhaps going to a progress meeting, or to check on a drawing or even to admit to a problem, or maybe just asking for clarification on something? They knew there would be a warm welcome in Ron's office. "What do you want?" "What have you got wrong now?" You're not going to waste my time are you?" There's a colleague of ours, Len Howard, who at Ron's retirement presentation said "Marconi's gain when Ron joined was a great loss to the diplomatic service".

Fellow Veterans let me introduce your President Ronald Bradbrook.

Ron Bradbrook

Well, after an introduction like that it doesn't leave much for me to say. The chap he was talking about sounded very interesting and I wish I knew him. I joined Marconi in September 1947 and the final year of that apprenticeship I was ordered to go to Building 46. I really didn't know what Building 46 was all about? I knew of it, I knew it had something to do with transmitters but I had not been called upon to work at the New Street site until the final year of my apprenticeship. But when I arrived there I soon discovered that it contained up to a 100 very, very qualified, very clever engineers and a drawing office to match and I wasn't to realise how much it would influence my next 45 years with the Company at that time. I remember two people quite vividly; one was Vic Tyler whose claim to fame was that he was a Mosquito

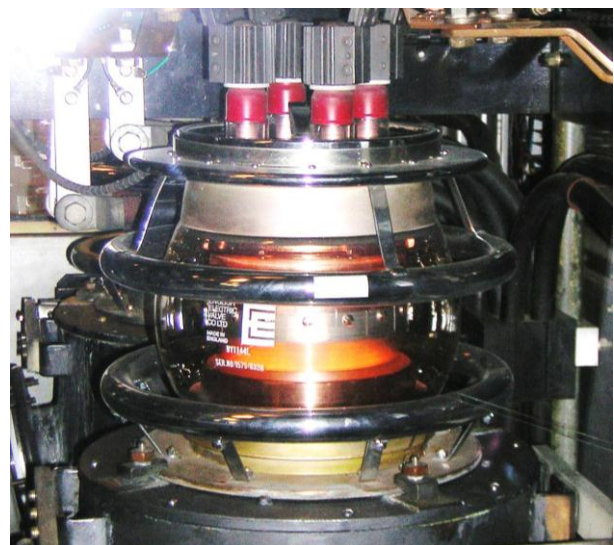
pathfinder navigator during the War and that he was responsible for producing something called the Tyler high efficiency circuit that increased the conversion efficiency of RF amplifiers by about 30% and that stood the Company in great stead against the competition for the next 40 years. And the other person I remember was Frank Page who suffered from gout and he could be seen shuffling around Building 46 in carpet slippers and he was responsible for designing what came to be known as the Page cabinet, which was used for decades afterwards.

16 Tubed Beryl and the FCO

As Raymond said, I did my National Service, and on returning I went to work for the late Douggie Bowers on high power transmitters. We didn't have long to wait because the Diplomatic Wireless Service, then part of the Foreign and Commonwealth Office, came to us and asked us to produce a 1500 kW MF transmitter. It was code-named Beryl and it was achieved by designing two 750 kW transmitters that were connected in parallel to give the required 1500 kW. Sadly just after the War, the component technology hadn't improved as much as warfare and weapons and we had to use 16 of the largest valves that English Electric then produced to create the modulator and RF output stages. Because of that, the transmitter was enormous. Those of you who don't know Building 46 the one transmitter 750 kW unit took up an area of 50 m by 12 m and that's some transmitter, a lot bigger than a communication one.

250 kW HF for the Voice and Auntie

In 1960 the Voice of America and the BBC approached the Company with a view to producing a higher power HF transmitter. HF transmitters, I should explain, are those used for world-wide broadcasting and they were after a 250 kW transmitter that was two and a half times more powerful than anything previously produced. In the interim, the English Electric Valve Company had produced this steam cooled triode valve known as the BY1144L, which had the ability of producing 125 kW of carrier and two of these were used in the output of both the modulator and the RF stages.



The BY1144L shown mounted in its boiler in a left hand modulator position

Tom Mayer said that it was one of the most successful transmitters produced up to that point and they were made in large quantities and they were installed firstly at the BBC/VOA station at Woofferton, then BBC stations at Daventry, Rampisham, Skelton and at a purpose-built station on Ascension Island. They, the BD272, were produced in some large numbers and they were stored at Rivenhall, and I distinctly remember one morning getting a phone call from a very agitated chap saying there had been an accident; would I please go to Rivenhall, and on arriving there I found that a portable Coles crane lifting one of these cabinets had toppled over, dropped the cabinet and fallen on top of it, and the transport manager at that time hastily assured me that he was not responsible – he was only responsible for it once it was on the ground and he wasn't very happy when I pointed out to him that until it hit the ground it was perfectly undamaged.



General view of a BD272 installation showing, left to right, modulator, RF and H1100 driver cubicles



Sender 96 at Woofferton being tuned by the author for its very last transmission prior to scrapping in 2006

Venturing abroad

These, as I say, were installed at a number of places and the Voice of Germany, Deutsche Welle, bought one and had it installed in the middle of darkest Africa in Rwanda, just outside the capital of Kigali, and I was sent there in 1965 to assist with the commissioning. Kigali is a 6000 ft altitude site and there had been problems with the altitude and some of peripheral equipment. It was a difficult site to get to, the nearest airport was Entebbe in Uganda and that then involved a 400 mile drive across dirt African roads for the most part, and that was quite an experience. We managed to solve the problems, get the transmitter commissioned and we came home. Now I came home from Africa with more than I went with. Now I can hear what you are thinking, I contracted infectious Hepatitis and spent the next six weeks on my back in Wood Street hospital.

Two valves 500 kW, three 750 kW – simple!

Now, during all that time the component and valve technology had improved markedly and Siemens and Thomson had produced some really tremendous valves. And at that time we decided to redesign the 500/750 kW MF. It was a transmitter that could be made to produce either 500 or 750 kW; two valves produced 500kW; three valves produced 750 kW – simple. They were installed in Kuwait in some numbers by Ewen Fenn, who is here with us and also Abu Dhabi, and one went to Singapore and it was installed on Singapore island on the West in the middle of the dense Jurong jungle; they cleared a small space and built a transmitter building, put up a 400 ft mast with a fence around it. I was always puzzled as to why the grass within the enclosure was mown so perfectly, it was immaculate, it was like a bowling green. When I asked why, they said "It is so you can see the cobras", which did nothing for my welfare.

Alfie and the station cat

That Singapore transmitter was installed by Jonny Watson and a chap called Alfie Amos, who I don't think is here today. They were there to assist with the commissioning and Alfie Amos carried on for another 12 months as a guarantee engineer, and it was after that year that I went out to update some aspects of the transmitter and I discovered what a naughty boy he had been. He had committed a foolhardy act; now the word foolhardy is one of my friend Raymond's favourite words, and he generally applies it to my chosen snooker shots. However, Alfie who, as I say, was guarantee engineer, was patrolling around the transmitter one day when he peered through the modulator window only to see that the mangy station cat had crept in the door when the transmitter was off and fallen asleep underneath the modulator valve. The transmitter was now working and the cat looked in some distress, it was probably unconscious but Alfie with great presence of mind used his frig key, a highly illegal device, to undo the door of the working transmitter and drag this blessed cat out, whereupon once it was in the air conditioned atmosphere it soon revived and I am sure was quite pleased. That wasn't the case of the Chinese staff who had been deprived of a culinary delicacy.

Three miles from Russia

I came back from Singapore and, within a week, I found myself in Romania, my God what a difference. Romania was still under Russian control and we had installed two 500 kW transmitters at a place just north of Viache, three miles from the Russian borders. The transmitters were used during the day and we were there to parallel them during the night, working from midnight until 8 a.m. At this point that I should explain that the food in Romania was awful, so bad in fact that Marconi sent what I will describe as food parcels but, in fact, were packing cases, something like 4ft square by 6 ft long filled with tinned meat, tinned vegetables, fruit and at eight o'clock every morning after the shift we boiled up a cauldron of this stuff and had at least one good meal. One of the great problems there was that we stayed at the Unery Hotel which was right on the main square and our visit happened to coincide with the Russians rehearsing for a parade to commemorate some military milestone. Now my friend Ewen, wherever he is, tells me that was to commemorate the 23rd September which is when the German forces were finally driven out of Romania by the Russians. As I said, the food was lousy. There was a supermarket but it had virtually nothing in it, one thing they did sell, wait for it, was tinned freshwater carp. Have you ever tried tinned freshwater carp? They had a quaint way of spelling it; instead of C, now look I haven't got there yet, instead of "C" "A" "R" "P" they reversed the "A" and the "R" – and they were very, very knowledgeable people.

The black widows

When we used to drive to site, in the dark of course, at about 11:30 p.m., we were puzzled because out on the country roads there were hoards of people dressed totally in black, and if it wasn't for the good headlights that we had, we would have mown them down. We later discovered that these were Romanian war widows and their life expectancy could not have been great doing that job.

The Voice gets louder

In 1985 the Voice of America (VOA) approached the Company, not only our company but six other worldwide manufacturers, to produce a 500 kW HF transmitter, and the specification was written by the Massachusetts Institute of Technology. If you know what they do, they write the most severe of specs, they leave nothing out not even the kitchen sink, and this went out to international tender. It was only due to the great efforts of all parts of the Company that we were honoured with the contract, but we were never sure if that was a good thing or not. It all turned out well in the end. We installed two transmitters in Building 46 and they were operated for six months 24 hours a day, carrying out at least 10 frequency changes daily and this transmitter had to be fully automatic; by that I mean the action of pressing one button and selecting a new frequency. It powered itself down, selected the new components, re-powered itself, retuned itself and came back on power, and the specification was within 15 seconds. Now that's not long; in 1950 it used to take an hour. When the Americans arrived, by their bus-load, to carry out acceptance tests, one of the first tests they wanted to see done was the frequency change.

They spent all day changing up and down all the HF broadcast bands and never once did we exceed 12 seconds so that was quite a relief!

Twelve of the 500 kW were installed at a purpose built station in Morocco, just south of Tangiers, and I was invited to attend the opening ceremony. That was a fitting climax to forty odd years designing and commissioning transmitters; it was an exciting job done in a brilliant atmosphere. There is no place like Building 46 in which to work, and I was privileged to work with such clever and great engineers, not only in Broadcast Division but in Communications, Television and latterly Space and Microwave; as far as I was concerned they were all world-beaters.

Thanks for listening and I would like you to raise your glass and drink to the people of Building 46, and on whom Building 46 depended for their success, and I mention IDO Building 29 and Building 720. They were a great bunch of people.

Ron and Co's Tricks in Action

The above presentation gave a detailed description of life at MWT and latterly MCSL in the Broadcast Division. In the next issue of Signal some of the techniques employed by Ron and Co to achieve a reliable, working sender or transmitter will be revealed including a very personal contribution from Ron Bradbrook!

The BD272

Ron spoke about the BD272 being produced in very large numbers; indeed the BBC had installed a total of 22 at the four UK stations with another four on Ascension Island, four at Antigua and four in Singapore from 1963 to 1978.

An additional BD272 RF section with H1100 driver stage (but without modulator) was purchased in the 1980s by the BBC from the UK Atomic Energy Authority (UKAEA) for spare parts. The UKAEA did not say why they had one.....

It was not until the decommissioning of Antigua, followed by the scrapping of Sender 96 at Woofferton in 2006, that the actual complement of these senders in use decreased. Rampisham was upgraded to 500 kW working in 1986/7 with their BD272 being dismantled by a MCSL team for re-use on the UK at Skelton. Daventry was closed in 1992 and their BD272 were again re-employed at Ascension, Singapore and Skelton.

Other countries that bought BD272 and the renumbered version B6122 were Nigeria with one, Qatar with one, Sines in Portugal with three and, as Ron said, Rwanda with one in 1965 and a second in 1969.

Over the years, various modifications have had to be made on this plant to allow continued running. Often the cessation of manufacture of a certain sort of transmitting valve can spell the end; indeed on the BD272, the cathode follower tube, 3Z/222EW triode in the modulator driver, was discontinued by STC/ITT when they closed their Paignton plant. English Electric Valves in Chelmsford came to the rescue with a cloned version, type BY1654F. It was probably in their interests to do this as, of course, they were the sole supplier of the BY1144L

final and BY1161 penultimate RF (driver) tubes at that time and would not want to compromise lucrative, profitable sales of those high power tubes just because a low power one was not available.

BY1144L were cloned by STC and sold as 3Z/240G. Siemens in Germany also sold a clone of both the BY1144L and the BY1161. Other examples were the cessation of the ACS5 in the H1100 by EEV to be replaced by a 4CX5000A by Eimac.

Besides tubes, certain vacuum variable capacitors have had to be re-sourced as Jennings in the USA ceased making a 20 - 2000pF type and we were lucky enough to persuade Comet in Switzerland in 1999 to make a clone.

Component supply can be problematical with high power, passivated glass resistors being obsoleted by UK manufacturers, only for us to find alternative supplies in the USA and France.

With MWT / MCSL broadcast going out of business in the mid-1990's the users of these senders really had to knuckle down and make both electrical and mechanical spare parts though, to be fair, most of the run-of-the-mill components were already made by the BBC HF transmitter workshops in the UK. These were then sent both home and abroad to keep the BDs running.

Acknowledgement

I am indebted to Raymond and Ron for allowing publication of their presentations. In addition, thanks must be given to the webmaster, Chris Gardinier, of the Marconi Veterans Association website who facilitated the permissions.

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