It was an early start on an overcast late June morning, that saw Practical Wireless Editor Rob Mannion G3XFD, fighting through the local traffic jams to collect me from home in readiness for our trek northwards to the Shropshire based h.f. broadcast station now owned and run by VT Merlin Communications. Although the postal address is Shropshire, Woofferton actually nestles on the border of Hereford and Shropshire with some of the antennas residing in the former county.

A Day’s Adventure

The whole adventure started many months ago when Senior Transmitter Engineer Dave Porter G4OYX invited Rob to visit the station to mark the year’s significant event. Rob mentioned the trip and I pointed out that SWM readers were likely to be most interested in the site, so I got myself invited too.

As usual when Rob and I share a car journey, the hours of travel flew by. The three hour plus journey from Dorset was over in what seemed like an instant, so engrossing was the conversation. At least we didn’t overshoot our destination this time Rob! This was I’m sure, due to the impressive view of the 23 masts which can clearly be seen on the horizon for a fair few miles before arriving at the Woofferton 300 acre site. I never cease to be fascinated by large antenna arrays such as those erected at our destination. Masts that tower 300 feet above your head supporting h.f. beams that offer 18dB of gain are awe inspiring - I could study the beauty of those arrays all day.

On our arrival at reception we were welcomed by the station manager, Barrie Elding and Dave Porter, who quickly reminded us how long the journey had actually taken by offering us lunch. Woofferton, which is a base for a total of 26 staff, though some of that number are roving or assigned to Orfordness in Suffolk, has its own canteen. It was here that he presented the run-down of what the station did and some history of its activities. I was most impressed with the canteen - excellent service indeed and very tasty sandwiches.

Part way through our preliminary chat I was spotted by another engineer who’d popped in for lunch, when I say ‘I’ was spotted, it’s more of a case that my Land Rover shirt was spotted. Tony Galvagni, who’d just returned from the VT Merlin MF and DRM site at Orfordness, is like myself, a keen Land Rover owner. So we did the inevitable and drifted off into Land Rover chat for a while, sad I know, but it’s much like radio, an addiction.

Following our re-energising lunch, Rob and I were treated to the tour of the main ‘sender’ hall. Sender is the historical BBC term for h.f. transmitters, a term which has been retained to this day. Other frequency bands utilise transmitters for dispersing radio energy but h.f. broadcasts utilise senders! The use of this term dates back to the 1930s and was employed as its use makes it easy to differentiate between the transmission of programme material and the equipment used to send it.

The Main Hall

Just incredible, that’s what went through my mind as we entered the main hall, rows of modulators and senders lined the walls of this impressive space that must be 30 -
50m in length. Being a utility enthusiast and a radio amateur, the main mode I listen to is s.s.b., but here at this broadcast site, I was reminded quickly that a.m. is the mode of the day. The need for high power modulators was brought home with a jolt. Since the nominal power output of each sender is 250kW of r.f., then, as those of you familiar with a.m. techniques will know, you need about 180kW of audio to achieve 100% modulation. As a result, there are some mighty powerful audio amplifiers in the main hall at Woofferton. Powerful they may be, but they are very simple but effective designs.

The thing that strikes you about the whole Woofferton site is the scale of the components used. I remember quite clearly some 30 odd years ago, peering into a Heathkit DX-40 amateur band a.m. transmitter owned by the late G3UNR and thinking how complex it was, but once the major functional blocks had been identified then the apparent complexity evaporated. The Marconi senders are essentially the same as the Heathkit

* The back of the satellite dish collection on the main building beyond.
* (far left) This is 328 feet high. I fancied climbing that!
* (left) The substantial anchor point for a main tower guy wire. Most of use would be happy with that much concrete as a main mast base!
* (right) More suspended wire.

* The twin feeders run well above head height as our model Rob demonstrates.
* The detail of a curtain array for all to see.

* Just who is photographing who?
transmitter. The difference in size is mind-blowing though. Dave took Rob and I into the interlock protected modulation enclosure to the rear of the sender and modulator pair that make up ‘Sender 94’. After disabling the CO2 protection and then checking with an ‘Earthing Wand’ in UK, ['Shorting Stick' in USA] that there were no stored dc voltages lurking to harm the three of us, we manoeuvred our way around the room which contained the power supply for the 300kW units. The smell of hot transformer oil pervaded the enclosed space, the whole room was rather reminiscent of an electricity sub-station.

Two rather significant mains transformers live in here as does the approximately two metre cube modulation transformer. Additionally, there is an even larger audio choke - now there’s an understatement, as I consider an modulation choke to be something that measures a few centimetres in length, this one needs a crane to move it! This particular choke is utilised to apply the modulation to the PA in the sender. The canny engineers at Marconi wanted to avoid having to run up to 30A of anode current through the modulation transformer secondary winding so came up with a cunning use of both the choke to supply the d.c. h.t. and a bypass capacitor of 21 \( \mu F \) 11000V for the audio and use a much smaller (cheaper and more reliable) mod transformer. This design expertise has clearly paid off as the senders 91 to 96 are all BD272 types which were installed in 1964 and still performing a sterling job 39 years later. Some of the senders are fitted with modulator valves that were installed in the mid 1980’s, these have completed over 65,000 hours!

Whilst mentioning valves, I was amazed that the audio driver stage of this Marconi BD272 uses four 813’s, a valve well known in amateur circles, truly incredible! I kept being struck by the scale of this whole operation, everything seemed strangely familiar, just bigger. For instance, when switching bands and Dave tells me that it’s possible to shift from 6 to 21MHz in less than 15 minutes with two engineers working on the task, the driver, PA and antenna coupling ‘coils’ need to be changed and the sender has to be retuned. I say coils, but the plug-in inductors are actually formed tube-work of about 25 to 30mm bore. These inductor sets are no mean feat in themselves and were constructed by brass musical instrument maker Boosey and Hawkes. So, next time you see an orchestra play, you can admire the very same craftsmanship that is utilised in the Woofferton senders.

Antennas
Next we moved outside to the field installed with grazing sheep to maintain trim grass. There are a total of twenty three guyed lattice masts at the Woofferton site comprising many tonnes of steel, some punch as high as 100m (328ft) into the air, an extremely impressive sight indeed. The masts are cleverly positioned to allow the antenna arrays rigged between them to achieved the headings needed to fire the station’s output at the chosen target areas. The arrays themselves are, dependent on type, steerable. By steerable, I should say, to be correct, they can be slewed.

Since the antennas at Woofferton, in common with those at many h.f. broadcast sites around the world, are ‘curtain arrays’ they can be steered electrically by tens of degrees. As the arrays can be used to beam either forwards or backwards this slewing arrangement is very effective indeed and allows pin point accuracy for pointing the senders transmission into the target area.
Intimidating. In essence though, the whole concept is pretty straightforward. Each of the arrays comprises of full-wave dipoles, typically these are stacked in two columns, four high by two deep. Thus an array has a total of sixteen active elements spaced in an appropriate manner. All the elements are driven and phased in such a way as to allow the radiated power to constructively combine to form a high gain antenna that fires backward or forwards and with differing take-off angle. It is just possible to see the construction of the array in the photos I took during our visit. The wires would have appeared clearer if there had been less cloud, however you can make out how it all connects if you study carefully.

The feeders, which are 320Ω balanced open type, run all the way from the push-pull output stages of the senders, via harmonic filters then along elevated poles via switching stations in the antenna field to the arrays, are twisted as the ascend up the stack of dipoles this is clear to see and allows you to see where the driven elements are in the mass of antenna and support wires.

What you can’t see in the antenna pictures, is the means by which the beam is slewed. This electronic turning is achieved by adding critical lengths of feeder into either the left or right side stack of dipoles. This has the effect of delaying the wave fronts and produced the equivalent action to physically turning the whole array. I’ve included a picture of the pneumatic switching unit which is responsible for adding the delay lines which produce the slewing effect. Compressed air is used all around the antenna field to route the sender output to the chosen array. Its use is no doubt related to the high electrical field strength which exists around the antennas. As we were walking around the site in the secured area Dave carried a field strength meter at all times - this indicated at just a few points up to 60V/m! So the station was on air at the time. A reading of 60V/m is the maximum level to which station staff are allowed to be exposed. Any higher and they cannot enter the area. Though this is a recently [late 1980’s] revised figure, the former limit being 200V/m. With high levels such as this I doubt that any electrically based feeder switching system would prove to be totally reliable. This high field strength is the reason why those fitted with a heart pacemaker or metal bone implants are advised to stay away - you should note that there is no such warning regarding avoiding mobile ‘phone output.

There are several different types of array aloft in the Woofferton antenna field, single band, dual band and four band types. The four band antennas can be slewed by up to ±30° whereas the single and dual band arrays are slewable up to ±12°. This steering ability allows the programme being transmitted to have its main signal beam targeted accurately enough to arrive in one country rather than its neighbour.

Unusually for an HF station in UK there is an MF station on site as well. BBC Hereford and Worcester have a 250W, [NOT 250kW!] emrp relay on 1584kHz. The MF vertical wire antenna is slung from ‘W’ mast on the NE extremity of the site. This transmitter is looked after by Crown Castle, the BBC’s domestic services provider!. Rigging

With the many kilometres of wire in the sky at Woofferton, I suspect that the team of riggers located on site have a pretty busy time. Dave commented that there is a very real need for urgency should any antenna wires suffer any damage due to ageing or the effects of the wind or ice build-up. This is quite understandable when you’ve got millions of listeners world-wide awaiting their favourite short wave programme to air. As I understand
it, the highly professional VT Merlin rigging team recently impressed the MoD with their efficiency, when, at a recently won VT Merlin military contract h.f. site, they completed the work required in a fraction of the former response time. Good news indeed and proof that commercial organisations can provide benefits to the Taxpayer.

**Electricity Bill**

Whilst we were on our way back into the main station building and passing Woofferton’s very own mains electricity substation, it occurred to me that the station is a big user of said supply. The answer to my enquiry of just how much produced the answer that the electricity bill amounts to about £40,000 per month - phew! With a requirement for six Megawatts of electricity the provision of standby generating plant is uneconomic so arrangements are made to supply the substation at 66kV from two separate routes by the local supply authority.

**In Control**

Having toured the main hall and the antenna field the other main area remaining was the Control room, here the programme feeds which can arrive via land lines (ISDN/ATM) or more usually satellite, as the dishes on the edge of the antenna field show, are processed and routed to the appropriate sender. The output of the sender is then fed to the appropriate antenna which is selected based on frequency and target area. The antenna slew is also set in the control room. Woofferton, as mentioned earlier, a part of VT Merlin’s world-wide h.f. network and as such relays a wide variety of programmes for many of the world’s international broadcasters. The majority of the station’s output is for the BBC, but there is plenty of capacity to serve their other customers such as NHK (Radio Japan), Radio Free Europe/Radio Liberty, Radio Canada International and the Voice of America. I was very interested to learn that it is a quite common occurrence for the station to swap output with other non-company relay stations, e.g. Radio Netherlands, to cater for maintenance and breakdowns. All this is of course, undetectable to the casual listener, though it would obviously show up if they were to d.f. the signal being received.

Checking just where your favourite programme is coming from could prove to be a hobby within a hobby! One thing that did take me by surprise was the discovery that although the programme sources for broadcasting are studio feeds, the continuity announcements can be pre-recorded material played to air from Woofferton control room. We discovered this as our mini-tour of the feed and antenna racks in a room off of the main control room coincided with a programme change. The result was a mildly worried member of the Woofferton team as he contemplated our impeding his insertion of the correct MiniDisc for the announcement. I’m sorry we got in the way!

Whilst amongst the equipment racks, which as you can see in the photos, house panels for feeds, senders antenna arrays and so on. We noticed a tall rack containing ten Orban “Optimod HF” processors. This is the broadcast industry standard audio compression system. I was under the impression that the processing was done at the studio end of things and therefore puzzled to see it at a transmitting station. After a quick demonstration of the audio characteristics of some of the feeds, both before and after the application of the “C2F” process I now understand the use of the unit prior to the modulator input stage.

**Grateful Thanks**

I very much appreciate the opportunity to visit the Woofferton transmitting site and would like to extend my thanks to all the staff and management who made possible such a wonderful visit. Rob and I appreciate the time taken from a busy working day for most people we met. Dave Porter looked after use on his day off. Special thanks to you Dave. I will be bringing further reports on similar sites in the future.
What and where is Woofferton?

The Woofferton short wave broadcast site is one of the three former BBC owned UK sites for transmitting the World Service around the globe. The others are Skelton located in the Cumbria just north of the A5356 and Rampisham in Dorset just south of the A356 near Dorchester. You really can’t miss them if you drive past the area as the large number of lattice towers are very prominent features. For that matter, they stand out on the map too.

A Word From Woofferton’s Owners

VT Merlin Communications, part of VT Group plc, is a leading critical communications company providing world-wide communications services and innovative technical solutions to customers in the broadcast, defence, space communications, IT, emergency services and security sectors. They provide services in over 100 countries from 23 key strategic locations around the world. Currently VT Merlin Communications operate within two core business areas:

Critical Communications - The range of critical communications services include the design, build, operation and maintenance of critical communications facilities and infrastructure world-wide. They also offer a proven track record in delivering communications vehicle engineering and conversion services for all types of military and commercial vehicles, providing customers with a complete engineering solution from design to manufacture, installation, assembly and testing. There IT and network services include the design and installation of IT systems, networks and hardware, specialist electrical and satcomms installations. We provide these services to customers including BBC World Service, the UK Ministry of Defence, European Space Agency (ESA), QinetiQ, GCHQ and other public sector organisations.

Broadcast Services - Operating the world’s leading commercial short wave network, VT Merlin delivers over 1000 hours of both short and medium wave every day for international and religious broadcasters world-wide. They currently deliver broadcast services to our customers from 15 strategically located transmission facilities and broker services from a further 45 sites through established relationships with other major broadcasters around the world. Transmission customers include BBC World Service, NHK (Radio Japan), Australian Broadcasting Corporation, Radio Canada International and Voice of America. VT Merlin also has extensive experience in the design, build, operation and maintenance of radio broadcast facilities and networks world-wide. VT Merlin is a founder member of Digital Radio Mondiale (DRM) a consortium committed to delivering a world-wide initiative to bring digital a.m. to the marketplace. The digital technical standard developed by DRM will see VT Merlin deliver near f.m. quality broadcast and data services to its short and medium wave customers. VT Merlin (formerly Merlin Communications International) was created in 1997 through a management and employee buyout (MEBO) from BBC World Service, following the UK Government’s decision to privatise the BBC’s transmission work. In December 2001 the company was acquired by Vosper Thornycroft PLC (now VT Group plc). The company was then re-branded VT Merlin Communications in August 2002 as part of the groups re-branding strategy.

New Enthusiasts Digital Sat Receiver

Roger Bunney has news of a brand new digital satellite receiver that brings full search facilities to the news feed to hobbyist - the Coship CDVB3188C.

Last month I trailed news of a soon-to-arrive ‘enthusiast’s’ satellite receiver, made in China with specifications suited for sat-hunting.

Well, it’s arrived and we certainly have a receiver worthy of any enthusiast’s ‘shack’, particularly if he has a tracking Clarke Belt dish. The Coship CDVB3188C visually resembles any other standard satellite receiver, a bland silver case, a single i.e. escutcheon, a row of small buttons and nothing else! The rear is equally bland, no SCART sockets, no modulator, only phono sockets. But, this receiver features something that no other receiver offers, Blind Search! This menu accessed facility allows the user to set a low Ku-band frequency - say 10.950GHz, then a high Ku-band frequency e.g. 11.350GHz. Select a polarity either vertical or horizontal and a tuning i.e. bandwidth e.g. wide, (mine counts up in 3MHz steps) or narrow (unknown bandwidth) and press ‘OK’, the receiver then tunes, or rather scans on its own. Each time a signal is discovered the tuning panel displays the signal strength and the signal parameters such as frequency, symbol rate, etc. are shown on the menu listing. The receiver then commits each signal eventually to memory. The ‘Blind Search’ feature enables the satellite spectrum to be ‘scanned’, signals found are listed on the Blind Search menu and all parameters are recorded (other than FEC), the receiver in effect tunes and finds out all digital parameters, you just tell the machine what to tune and the receiver does the rest!

The all important Coship ‘Blind Search’ scanning screen.

Low signal threshold is better than my RSDs, The Coship CDVB3188C is very cool running but the main advantage is that most tuning operations on the infra red remote are now unnecessary. ‘Using the set of DXing’ has improved the activity considerably and has changed the whole concept of signal hunting! The Nokias with DVB2000, much favoured and commanding high prices, are consigned to the museum, Sat-DXing has moved into the 21st century!

The upside - for once I can recommend unreservedly this realistically priced receiver for satellite ‘TV-DXers’, based on my four weeks testing.

The downside - my Coship is the MkI version, it has no r.f. modulator, no SCART sockets and basically is an NTSC defaulting machine (525 lines, 60Hz) though the format does change to PAL (625 lines, 50Hz) as soon as an appropriate signal is received. My Coship receiver was imported via the USA and even with air freight, the total cost was a reasonable £125, which makes it a cheapish receiver - however, I understand that the main processor chip stocks are now exhausted and the MkI receiver is discontinued pending the arrival of new processor chips.

The new improved Coship (MkII which has the working model number ST-3600) hopefully will be available later this year, I understand that this new version will also be without SCART connectors, but it will have more memory and an onboard v.h.f./u.h.f. modulator. The price for the new unit hasn’t been announced until a UK importer/European distributor is organised by the Asian manufacturer to ship directly into the UK to avoid Asia-USA, USA-UK dual shipping charges. I’ll advise readers full details of the UK price and outlet once known. The new set is due to be available in the Autumn.