

Tricks of the Trade

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In Issue 23 of Signal (page 22) we dealt with the history of the BBC's External Services Operational Schedule and reached a point just after the end of the Cold War. We also looked at the production, by draughtsman Bill Stickells and his team, of the actual schedules and their distribution. This ToTT will complete this part of the story and bring it up to date.

Background to the requirements

The Operational Schedule of the BBC External Services has evolved year by year during its near 80-year history to meet changes dictated by political, financial and hardware constraints. The UK Foreign and Commonwealth Office determined the budget and, therefore, the number and duration of languages which were to be carried, but editorial matters were always in the hands of Bush House.

The skeleton schedule was built up from the transmissions required to provide the necessary frequencies for each prescribed language service, usually at local dawn and evenings, but also sometimes during local midday.

World Service WS English coverage was designed to provide all highly populated regions of the world with at least two propagationally reliable frequencies, where possible, for each main listening period.

It will be appreciated that more than two frequencies could then be publicised for a single geographical area by 'picking up' transmissions intended for other areas with a similar beam heading from the transmitting station. For example, an 80° transmission from the UK, intended for Russia, could be equally suitable for reception in Central Europe or the Subcontinent during daytime, and the higher frequencies selected for Central Europe would likewise be practicable for much of Russia. Other similar area groups for receiving UK frequencies would have been 114° for South-East Europe as well as the Middle East and 160°/180° for South/South-West Europe and North Africa.

More distant areas would generally have been covered by transmissions from overseas relay sites such as Ascension Island, Cyprus, Seychelles or Singapore. Two- or more-hop coverage was avoided where possible as propagationally reliability was less easily attainable with multiple ionospheric reflection points. Severe *selective-* or *snatch-fading* would be introduced on a signal path when multi-mode propagation occurred when, say, both single-hop and two-hop signal components were received simultaneously. Also, signals reflected in or around the geomagnetic equator were subjected to very destructive flutter-fading during the early evening period rendering, for example, 'Sunday Half-Hour' an un-Holy mess! In any case, the received signal strengths could be around 10 dB less for each additional reflection. However, during high sunspot cycles and prior to the introduction of high quality satellite programme feeds, signals of near studio

quality with very little observable fading were regularly received at Ascension Island from the UK-originated 25650 kHz transmission from Daventry.

Because of the distance from the UK as well as the fact that the great circle signal paths skirted the Arctic Circle, UK-originated coverage of the Americas was not wholly reliable and relays were used; BBC-operated on Ascension and Antigua and on an exchange basis by Voice of America VoA and Radio Canada International RCI. However, some of these relay sites have since closed and greater reliance is now placed on other delivery platforms, such as local VHF/FM relays, World Service Television and the Internet.

The best-laid schemes o'mice and men

It is inevitable that, for any number of reasons, the schedules emanating from Bill Stickells' drawing office should be subjected to changes sometimes even from day one!

Changes to the transmission schedule were broadly divided into three categories:

- To accommodate programme changes
- To enable pre-planned engineering work
- Short-notice changes

Short-notice changes included any other actions required outside normal office hours, and would have been co-ordinated by the Technical Operations Manager (a.k.a. The T.O.M. or TOM BUSH!). This was a 24/7 focal contact point in Bush House able to deal with Studios and House Service facilities in addition to transmitters and the external links providing programme feeds. The first two categories, generally co-ordinated by the sender scheduling office, will be explained here.

Programme alterations

World Service English and two longer running language networks, Arabic and Russian, included junction points at certain defined times on a daily basis. These junctions enabled transmitter and/or antenna changes to be undertaken without interrupting the flow of ongoing programmes, so that area coverage or selected transmissions could be opened or closed.

Special arrangements, therefore, had to be detailed to allow coverage of longer duration programmes without interruption or curtailment just before, for example, the last deciding goal! Regular commitments have included coverage of UK sporting events such as the Cricket Tests, FA Cup Finals and Wimbledon Finals as well as

other national events of wide interest, the traditional Nine Lessons and Carols on Christmas Eve and The Queen's Speech on Christmas Day, extension of Arabic programmes during the month of Ramadan and the church services from Ennismore Gardens and the Russian Orthodox festivals. VoA likewise initiated changes for their relay stations, including Woofferton, to carry amongst other items Presidential addresses, such as the annual State-of-the-Union speech.

All of these changes to the ongoing schedule would be precisely detailed as working instructions as they affected operational staff between the Bush House studios and the transmitting antennas at the end of the chain.

Operational engineering changes

The provision of daily clear maintenance breaks was essential for each transmitting site in turn to enable routine maintenance and other repair work to be carried out on dead, isolated transmitters and antenna equipment without risk of dangerous voltages from unpredictable near-field radiation.

Other planned outages are occasionally necessary to allow extended engineering work to take place, for instance, the installation and commissioning of new equipment at a site or the occasional renewal of cooling oil in high-voltage transformers.

Tower and mast repainting and stay re-greasing is carried out normally on a seven year cycle to protect the antenna supports.

The antennas have to be at a specified height for different frequencies to be effective and all of the BBC short-wave transmitter sites are, therefore, equipped with masts and towers up to a height of 100 m, 328 ft. Not only are these steel structures exposed to extremes of weather but some at coastal and island locations have to cope with highly corrosive salt-laden air. Protection against rust is, therefore, essential if the antennas are to stay in the air for many years. This protection usually takes the form of grey, weather-erodable paint by Craig and Rose (of the Forth Bridge fame) on to all mast/tower sections with heavy greasing applied to the stay wires.

Unfortunately both these tasks are very labour intensive. Not only that, but to work whilst dangling from high in a bosun's chair amongst the many wires can be hazardous for several reasons. The painters are obviously blessed with a healthy respect for heights and are able to work happily above us more earthly mortals. But the greater danger results from the high power levels at which the antennas operate to impart the radio energy to space. Any wires near an antenna in use will pick up energy from the outgoing signals and can cause serious burns and electric shock if touched. Also, in high concentrations, this radiated energy can warm the human body internally just as a microwave cooker can heat food from the inside outwards.

Thus, it is essential that painters are prevented from working in close proximity to working antennas, or *vice versa*. Alternative antennas may be used elsewhere on the same site, or a replacement transmitter and antenna at an alternative site.

Up to four adjacent antennas may have to be cleared of power to allow painters to work in safety on any one

mast; two gangs may be employed to hasten the work, thus up to eight antennas may be out of service at any one time. However, not all of any eight will require cover because, for instance, those antennas beamed towards the Americas would be used only during our UK evening and night whilst the painters would only work during daylight!

Temporary schedules and service messages

Operational schedules in use at transmitting stations were often amended temporarily using home-made 'stickers' attached by map pins with a cork-backed mounting board. Latterly *Blu-Tack* has been used. These methods usually coped well enough with changes effective for up to several days. However, changes with a longer effective period were liable to run across other changes with different effective periods. For this reason, particularly after the introduction of computerised control at some sites, two instructions were issued, first to introduce a temporary change and, secondly, to revert to the ongoing schedule requirements.

Serially numbered telex messages detailing all changes were compiled for sending through the BBC's own teleprinter network to all external service transmitting stations to maintain continuity of communication and keep all parties informed.

However, in earlier days, these changes were dictated word-by-word over the private wire telephone system, necessitating the delegation of someone sufficiently knowledgeable, and of suitably high-standing, at the station to receive the pearls of information. This was not always easy because, in the pioneering era, senior engineering staff were, of necessity, recruited from non-broadcasting sources of manpower. Female engineering staff were not employed until during WWII.

Coloured pencils in the office

One-off marked-up schedule copies were provided to the Bush House TOM as an overview of all required changes during the Christmas holiday period. G3LXQ lays claim to a minor foible which was the colouring applied to an otherwise black and white schedule copy. The problem originated from the use of red ink biros in the office to show schedule amendments which did not always show distinctly under fluorescent lighting. Crayon-pencilled highlighting of various colours was applied to differentiate between days. Thus, yellow was used to highlight changes for 24th December, green for the 25th and pale blue for the 26th. How many others realised the basis of this colour-coding? It is said that some wags could not resist adding colour-coded holly leaves with berries around the schedule graticule - joy to all men at Christmas!

Coloured pencils on the sites

Copies were sent to sites for use, but only a few were sent pre-coloured, so one of the tasks undertaken by the site engineers was that of hand-colouring the many copies in use. G4OYX well recalls coming home from work one day and asking my five year old daughter what she had been doing at the infants' school. Her reply was "colouring in" to which I replied, "so have I!"

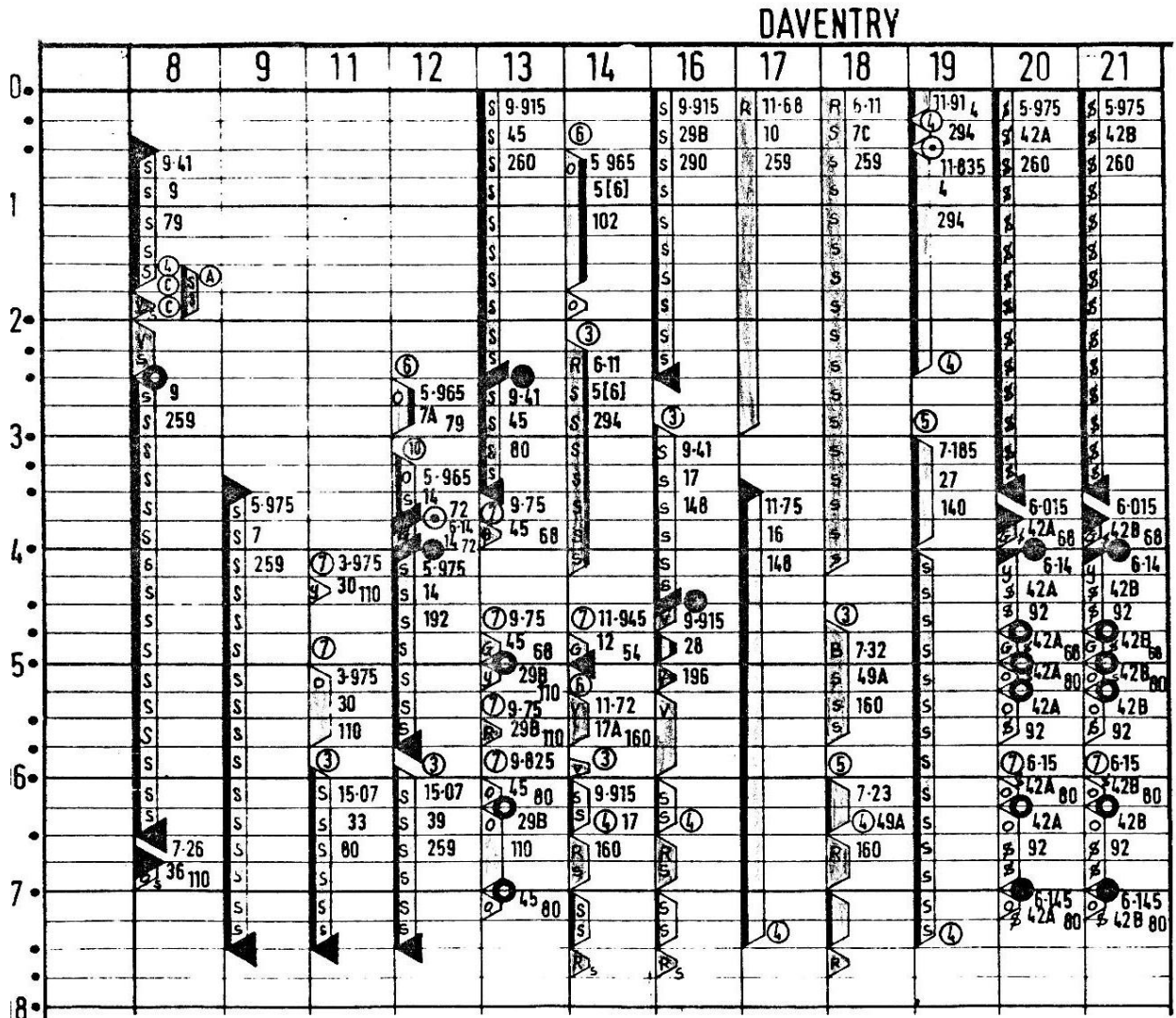


Figure 1. Schedule for Daventry

The Daventry schedule

Figure 1 is an eight hour section of schedule dating from the early 1980s and was provided by Daventry staffer Pete Edwards G8EFM. It is from there and shows the use of the plant between midnight and 0800. The monochrome scan is of a (hand!) coloured document hence the residual grey shading!

The twelve senders are along the top and 0000 to 0800 is down the LHS. It can be seen that where there are vertical lines there are transmissions and that the senders, in the main, are heavily loaded. S8, 9 and 11 were MWT SWB18 100 kW sets, S12, 13, 14 and 16 were MWT BD253 100 kW sets, S17 was a 100 kW STC WWII sender and S18, 19, 20, 21 were MWT BD272 250 kW units.

This document represents the pinnacle of Bill Stickells' team's prowess as it contains a lot of clearly defined information. There are some quarter-hour segments, for example, at 0345 on Sender 12, that show frequency, array bearing and programme information and for S20 and S21 all the above and synchronised (\$) 500 kW working.

A brief mention has been made of the coding so now is

the time to republish the WOF and SKC schedule dating from the mid 1990's and fully explain the codes, etc. This is shown as figure 2.

The coding system

To enable the reader to fully grasp this, some examples will be given by reference to figure 2.

By the mid-1990's the schedules were produced on a computer driven plotter rather than by hand stencils. The typeface used sometimes gave problems differentiating between 6 and 8 as figures, particularly after several local photocopies. This did lead to VoA being transmitted on 11885 kHz rather than 11865 kHz on at least one occasion!

BBC programmes were colour coded. BBC World Service English was always green and, on the schedule, was shown with a thick black line down the LHS. An example is 0000-0200 on S74 at SKC; the frequency is 7.325 MHz, the antenna array is 757 and the bearing is 70°. At 0200 the schedule is marked with a black triangle. This means that, at 01:59:30, the sender must be switched off promptly as one at your or another BBC site, or that of another broadcaster, will pick up that frequency. This is known as a "Crash Finish".

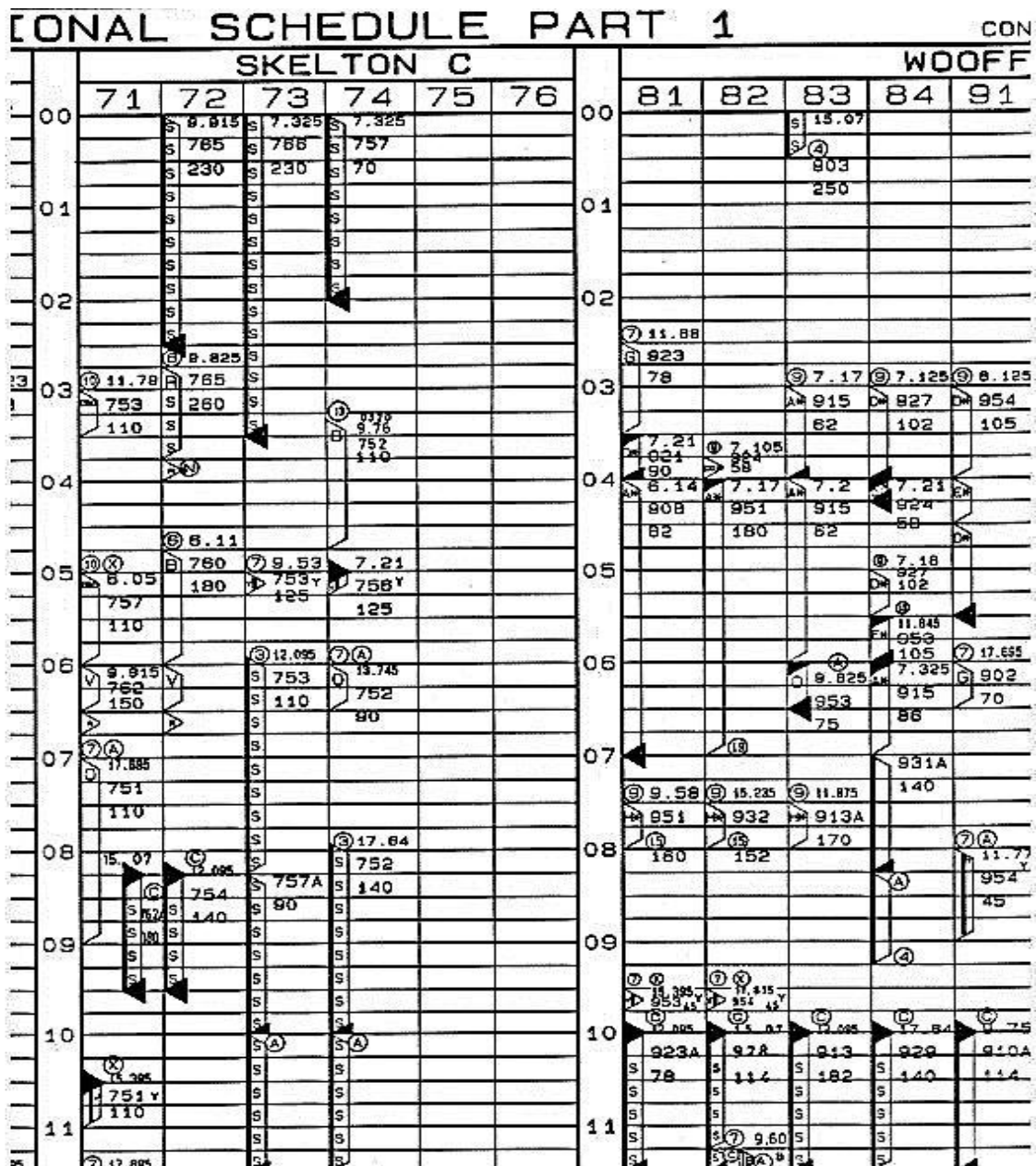


Figure 2. A WOF and SKC schedule dating from the mid 1990's

Also from SKC 0000-0330 on S73 is 7.325 MHz on array 766 on 230°; this is intended for listeners in South America. As the frequency is shared with S74 the drive to both senders is synchronised so the schedule is marked with an "S" every quarter hour period.

Staying with BBC WS in English check out S74 at 0800 with a note 3 start; these circles within which were either numbers or letters were "Operational Notes". Note 3 means the sender comes on with BBC WS programme as a crash start at zero - 2 mins 30 secs, in other words on this sender at 07:57:30.

Circles containing numbers refer to times or interval signals and circles containing letters relate to days of the week.

Figure 3 is a BBC table showing all the date codes.

Continuing with S74 check out 1000, BBC WS English 17.640 MHz, array 752 140° here daily it is to crash finish

at 09:59:30 except on A days. So, referring to Figure 2, A days are "Sundays only". Thus on Sundays the Skelton sender continues the transmission and so check out WOF S84 1000-1130 where a corresponding C day circle will be seen. C days were all in the week *except* for Sunday. The reason for this was so all sites could have a maintenance break when there would be no station output. WOF inherited the 0800-0930 break from Daventry when that site closed in 1992. Skelton typically had 1000-1100 but sometimes, due to the need for services, a half hour or so of transmission would be slipped in. It was obviously considered that blips in transmission as the stations came off and on during transfers were to be avoided on Sundays!

WOF would be used as a BBC WS English cover site 1000-1130 on many of the classic WS English frequencies; check out 12.095, 15.070, 17.640 MHz all on C days.

	DAY TO DAY LETTER CODES																																			
SUNDAY	A				E											K	L	M			O				R	S	T					W				
MONDAY		B	C		E		G									K	L	M			O	P				S	T						X			
TUESDAY			C	D	E		G			J						L			N	O					S	T						X		Z		
WEDNESDAY			C	D	E		G									K	L			N	O	P			S	T	U				X					
THURSDAY			C	D	E		G	H								K	L			N	O				S						X					
FRIDAY			C	D	E	F		H		J										N	O				R					V		X				
SATURDAY			C													K	L			N	O				R					V	W		Y			

Figure 3. Day to day letter codes

J days, Tuesdays and Fridays, were interesting as they were the two days of the week when transmissions to the Falkland Islands were scheduled. Most of the others were to facilitate either longer or shorter transmissions at weekends or maybe to be on the air over six days a week rather than seven.

Figure 4 is a BBC table showing some of the number codes.

1	Merlin interval signal. Network mint
2	WSE resumption announcement
3	Crash start with prog. at zero minus 2'30"
4	WSE closing announcement
5	W.S. English interval signal
6	W.S. Overseas interval signal
7	W.S. European interval signal
8	Joins programme as soon as possible
9	VoA ident from zero minus 20"
10	RCl interval signal
11	RFE/RL opening announcement
12	General announcement
13	Prog. at stated time preceded by op. 6
14	No radiation prior stated time
15	VoA vernacular-closing annct. From zero minus 30"
16	RTE announcement
17	Test
18	Lindos test-1 st Monday of month
19	VoA English-closing annct. from zero minus 3"
20	Operation at stated time
21	RNW interval signal, XX:27:00 – XX:29:55
91	Crash start
92	Crash finish
94	Crash finish with closing note 4
99	Speculative programme requirement. To reserve plant

Figure 4. BBC number codes

First-hand experience

With many of the VMARS Membership being SWLs, ex-Navy (both Merchant and Royal) and maybe even ex-pats you will have been listeners to the BBC WS overseas and experienced first-hand the BBC interval signals prior to start of programme and the closing announcements. Many of the transmissions on the Daventry schedule were BBC WS English and VMARS Members will no doubt recognize many of the channels. The use of these interval signals is detailed in the definitions in Figure 4. The opening note (ON) with the Bow Bells "Oranges and Lemons" was ON5, with an ON7 being the "V" in Morse on a Timpani drum (later an electronic version) for the European service.

Other opening and closing notes (CN) of interest as shown on the SK and WOF schedule are:

- ON6 at 0445 on S72 for BBC overseas service, this was B-B-C in Tonic Scale
- ON10 at 0300 on S71 preceding a Radio Canada

International relay on 6.05 MHz, these ON were always in French and English

- ON9 at 0300 on S83 preceding a Voice of America transmission on 7.17 MHz. The ON9 was voiced as " This is the Voice of America signing on" followed by a few bars of Yankee Doodle Dandy
- CN15 was a simple VoA closing note "This is the Voice of America signing off" followed by Yankee Doodle Dandy
- CN19 was also VoA but with a mention that programme schedules, *etc.*, were available from the US Cultural Centre in your country and from PO Box 20547 in Washington DC, USA

To engineers on the sites, the 30 second period prior to start of programme was always considered 'our time' and it would be where frequency and antenna (or both!) changes were effected either manually with older senders or automatically with the newer ones. Check out S83 0600 where prior to 05:59:30 the service was VoA English Net A on 7.2 MHz on array 915 62°. At 05:59:30 it would stop and wavechange on A days (Sundays only) to 9.825 MHz 953 75° for a BBC Orange Network transmission for 0600 start. On all other days at 05:59:30 it would wavechange to 11.875 MHz array 913A 170° in readiness for a VoA H* Arabic transmission for sign on at 07:29:30 with an ON9 start.

The VoA from WOF used a letter and star to indicate their language streams, for example A* English, H* Arabic, D*, D1* and E* being certain East European languages and C* always Russian. Later they were called Net A, Net C, *etc.*, the star being dropped. Being then the same as the VoA identifications, TOM Bush, Crowsley Park and any other parties involved with VoA relays were able to speak to Washington in the same language!

There were also BBC continuity suite announcements by a Studio Manager in that pre-programme 30 seconds, often in the style of "This is the European service of the BBC, the following programme is in (for example) Slovene". Again it was within 'engineering time' so it was subject to (our) interruptions.

One other note is of interest as it changed significantly in definition over the years, this was Note 8. In the 1970's it read, "Joins programme when ready" and was used where a manual wavechange was required in a 15-minute time slot. When it was completed, the sender would be powered on programme at some point (determined by the transmitter engineers) within the quarter hour to join an already radiating service on that frequency.

In later years it's meaning was changed to the more serious and commanding "Joins programme **as soon as**

possible", which could be interpreted "Engineers get your finger out!" Nowadays, with auto-wavechange senders, the frequency change is completed normally within the 30 seconds anyway and the sender is back on the air.

The fall of The Wall

Not surprisingly, it was the demise of the Berlin Wall that was to have some profound effects on HF broadcasting as, of course, the Western nations had, in effect, achieved the result for which they had been striving since 1948 with the end of the Cold War.

Suddenly the mega-use of up-to-500kW senders to overcome jamming was not required. Neither was the use of so many parallel frequencies to (attempt to) achieve good, reliable coverage. Ignoring the politik (about which much has since been written) but instead just concentrating on the engineering, the BBC and many other broadcasters found themselves with a lot of HF plant and a reduction in required service hours. Granted that, as the Russian situation did not immediately stabilise, this capacity aftershock didn't really happen until 1995 or so.

Daventry was the first major BBC HF site to close and the four new 300 kW senders installed there as late as 1988 were removed in 1992 and sent both overseas and to SKC as S75 and S76. Note on Figure 2 that S75 and S76 are shown as present but not yet in service.

WOF became more of a BBC WS site taking Daventry's WS English content and less a VoA one as they too pulled back from intensive East European broadcasting. The VoA went on to close in Germany Munich MF and Ismaning HF, Gloria HF in Portugal and Playa de Pals HF in Spain followed by an almost brand-new HF site in Morocco equipped with 10 MCSL (Marconi Communication Systems Ltd.) 500 kW senders.

The new HF carve-up

With the thaw in International Relations it was inevitable that *The Westies* and *The Easties* scenario could be abolished and, as such, a new organisation, the High Frequency Co-ordination Committee, HFCC was formed.

Their website www.hfcc.org gives their raison-de-êre and it is shown below:

About the HFCC

HFCC co-ordinates frequency channels used in short wave broadcasting. Its history started in 1990 when broadcasters, and also some representatives of administrations from both sides of the former Iron Curtain, met for the first time in Pamporovo, Bulgaria with the aim of establishing co-operation in that sphere.

HFCC is a non-governmental, non-profit association, and a sector member of the International Telecommunication Union in Geneva in the category of international and regional organisations. It manages, and co-ordinates global databases of international shortwave broadcasting in keeping with International Radio Regulations of the ITU. The HFCC provides representation, tools and services to its members for the resolution or minimisation of instances of mutual interference among shortwave transmissions. Organises regular conferences prior to the start-dates of seasonal broadcasting schedules that

coincide with the dates of clock-time changes for the summer and winter periods. There are two seasonal schedules and their validity is global. The schedule designated "A" corresponds to the summer, and "B" to the winter period on the Northern hemisphere.

Here the delegates from all countries who wished to use HF for broadcasting could be assembled under one roof. By 1992 this was in full swing and twice-yearly conferences would be held in member countries where, again, time slots and channel occupancy could be co-ordinated.

Some countries sent delegates from their Government body (PTT) as well as the broadcaster, others just broadcast representatives. Prior to 1997 the BBC sent staff from Bush House Transmission Planning Unit (TPU). After the privatisation of the WS Transmitter Department in 1997, TPU was part of the sale to Merlin Communications who also bought the UK HF sender sites, the Bush House Control Room and the right to operate the BBC overseas transmitter sites. Later, when Merlin was sold to Vosper Thornycroft, they too sent delegates and now, following the sale of VT, it is Babcock Communications who go.

This name-changing has allegedly caused some confusion, as the seating plan at the HFCC is in alphabetical order so the same UK representatives that have been going for years find themselves sitting in different parts of the room. The A's and B's are traditionally at the front with the Z's at the back. Consequently under **BBC**, **Merlin**, **VT** and **Babcock** it has been musical chairs! With Babcock they are now back where they were in 1990 as BBC!

However, by contrast, the frequency coordination meetings of 30-40 years ago were usually convened in the HQ of the hosting broadcasters in rotation and were quite informal in their table arrangements. After all, only around a dozen to fifteen frequency managers attended from 6 or 7 organisations, their seating positions probably on a first-come basis and influenced by more practical details such as access to the hospitality table bearing a coffee dispenser and the Danish pastry cakes.

The HFCC listings

Figure 5 shows a few lines from a recent (B11) schedule. The opportunity had been taken to make the schedule into a machine-readable style. The move was made to enter the frequency in kilohertz rather than megahertz to omit decimal point usage.

The BBC had dispensed with the letter day codes changing to a number system where Sunday is 1, Monday 2, etc., with every day of the week being 8.

The author is grateful to Martin Goulding 2E1EKX, a colleague at WOF, who has provided a recent WOF operational schedule dated March 5, 2012. This in HFCC-speak is B11, in other words, the winter schedule from October 2011 through to end of March 2012. The next schedule is classed as A12.

As well as dropping day codes in letters, the BBC have for A12 onwards ceased using interval signals so those number codes also have gone.

Figure 5 shows a segment of this schedule and is arranged so that the HFCC details below marry up with it.

	B6124	B6124	B6124 (with Black Heat)	B6124	RIZ	RIZ	BD272	RIZ	BD272	RIZ (No Black Heat)
	81	82	83	84	91	92	93	94	95	96
14:30:00	114A	x			8 x 903/70	8 x 916/62		8 x 929		7 905
BBC 7	17780 8	14:55:00				PRW 1 15245		Persian 92		DARA 114A
15	Hausa 930/165 SMD5 3	Ⓟ				8 953/75		AOR 47		SMD54
	6195 13	BBC 11830 4			RFE 8 11870	PRW 1 9580			RFE 9515	BBC 6195
	905	8 954			Turkmen 923	8 922/78A			123456 953	7 905
	114A	ENBUR 105			RL-1 66	PRW 1 9580			Belorussia 75	FARSA 114A
16		SMD51			AOR48	8 922/66			AOR16	SMD54
	6195 13			EDC 15500 26	VOA x 11840	PRW 1 11905		BBC 9810		BBC 6195
	905			8 932	8 906	8 923/78		8 929		7 905
	114A			140	Georgian 82	PRW 1 6050		FARSA 92		FARSA 114A
17					AOR47	234567 908		SMD55		SMD54
		RCI 8 x 11935 30	IBRA 12045 24	BBC 6110 17	YFR 8 11975	PRW 2 82	RCI 8 9555	DW08 13780		
		Russia 923/78	8 909	8 920	8 925	1	Russian 954/45	8 929		
18		RO 3	Arabic 114	ARABA 172A	Somali 128	PRW1 8 9545	RCI 3	French 152		
			18:00:00	SMD52		250kW 954/105				18:00:00

Figure 5. Segment of Woofferton B11 locally produced Excel schedule

Actual HFCC document extracts:

9515 1500 1700 28E,29W WOF 300 75 -3 611 1234567 301011 240312 D 9663 Belorussia G IBB IBB 16424
 9515 1515 1600 41 TAC 100 186 0 206 1234567 301011 250312 D Urd UZB NHK NHK 7107
 9515 1600 1800 39,40 KIM 250 285 0 216 1234567 301011 250312 D KOR KBS KBS 15462
 9515 1600 1900 30N,31 KIM 100 319 15 216 1234567 301011 250312 D KOR KBS KBS 15461

To illustrate this, check out 1500-1700 on S95, the paper schedule shows 9515 kHz Radio Free Europe on days 123456 (Sunday through Friday) in Belorussian using array 953 on 75°.

So to explain; the HFCC electronic public listing shows the following:

9515 1500 1700 Frequency and transmission duration (UTC/GMT)
 28E, 29W Target area CIRAF zone (see CIRAF chart in ToTT Signal 23)
 WOF 300 75 Transmitter site, transmit power (kW) and bearing ETN
 1234567 Days of week (note all days booked)
 301011 240312 Duration of schedule, DD/MM/YY
 Belorussia Language
 G Sender site licence administration country
 IBB Client broadcaster (in this case the International Broadcast Bureau, umbrella organisation for VoA, RFE and RL)
 IBB Frequency Management Organisation

Edited below are three other HFCC entries for this frequency with overlapping time slots

9515 1515 1600 41 TAC 100 186 1234567 Urd UZB NHK NHK
 9515 1600 1800 39, 40 KIM 250 285 1234567 KOR KBS KBS
 9515 1600 1900 30N, 31 KIM 100 319 1234567 KOR KBS KBS

The first is Japanese broadcaster NHK in Urdu at 100 kW on 186° from Tashkent to CIRAF area 41 (India) and is on up to 1600 GMT daily. Uzbekistan, UZB manages/licences the sender site.

The second is Korean Broadcasting, KBS at 250 kW on 285° from Kimjae, S Korea to CIRAF areas 39 and 40 and on from 1600-1900 GMT daily. KBS do not specify the language stream.

The third is the same broadcaster, transmitter site, time with lower power but different bearing (319°) on a synchronised transmission to different CIRAF areas, of 30N (the northern part) and 31. KBS do not specify the language stream.

As can be seen the frequency, durations and target areas have been co-ordinated to help prevent interference.

Antennas, Excel, Aspidistra and cover

Also in the HFCC listings are codes attributable to actual physical antenna types and we will investigate these next time in ToTT following on into their characteristics.

Excel is used now on the sites to provide a graphical illustration of the schedule and is drawn up locally from the computer readable files sent directly from London to the transmitter sites. The control systems on some sites can accept the machine-readable text from the TPU and drive the senders, antenna selection and programme switching directly.

The reason for Bush House having full copies of the schedules will be explained, suffice it to say the engineers on the transmitter sites have always been

grateful to TOM Bush and his successors SNE's, Senior Network Engineers, for help in finding 'cover'. Aspidistra was one of the favourite places for cover... All will be made clear next time.

And finally: the end of the old order

Sadly, the final programme originating from Bush House in London's Strand was broadcast on 12th July 2012. All programme operations for the World Service now originate from the new annexe development beside Broadcasting House at the north end of Regent Street, London W1. In BBC-speak, it is known as "West One".

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