ENG INF

The quarterly for BBC engineering, technical and operational staff

WINTER 1992/3 No 51

Resources, Engineering and Services

Bill Dennay gives us a personal view of the new Resources, Engineering and Services Directorate.

Writing this introductory article on the new Directorate is not the easiest of tasks. This is primarily because the facts, and the reasons for the changes which accompanied its setting up, have already been well publicised and I would not wish to go over the ground again. However, there are many issues raised by the changes which are worth covering in *Eng Inf* since they will have a potential impact on the way we carry out our activities in the future. It is also inevitable that I write this with a tinge of sadness that the Director of Engineering post and the Engineering Directorate will no longer exist after 1st April.

Since the Director-General's statement on 11th January, we have been working through the setting-up phase of the new Directorate, identifying the range of activities it will handle, the financial implications and the staffing implications. Most of this preparatory work is complete, the senior management team is in place and, like all others involved in Producer Choice and this activity, we all now wait for the 1st of April.

The change brings into the new Directorate not only all the expertise of Engineering Directorate but also all the technical, operational and service elements of all other areas of the Corporation. This must represent a positive and welcome step forward. For several years we have talked about potential changes in the broadcasting environment; those changes are now with us. Satellite services exist; the ITV franchises have been reconstructed; there is one national

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Mike Meyer E.I.D.

Bill Dennay (left) and David Hatch (then MDNR) at the January EsIC Conference

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As *Eng Inf* is an internal BBC magazine, it would be appreciated if no reference was made to it in articles, magazines, etc, published outside the BBC.

Stories for the Summer edition should be forwarded to the editor by Friday 14th May, 1993.

BBC and BT demonstrate Digital Coding for HDTV

BBC and BT engineers have successfully demonstrated a "two-layer" digital coding method for standard and high-definition television.

A video coding scheme — combining both standard and high-definition digital television — was successfully demonstrated at the recent London meeting of ISO/MPEG (the Moving Pictures Expert Group of the International Standards Organisation).

The demonstration — using pictures derived from software simulations provided by the latest MPEG test model — showed standard-definition television (SDTV) compressed to 6 Mbit/s and HDTV compressed to only 14 Mbit/s. The picture quality achieved was remarkably good, especially considering the relatively low bit-rates involved.

The SDTV and HDTV pictures were shown in two modes — *simulcast* and *compatible*. In the simulcast mode, the SDTV and HDTV images are coded independently. In the compatible mode, the SDTV signal is used as one prediction option for the HDTV encoder, and is therefore part of the overall data making up the high-definition picture.

This approach offers the potential for improved coding quality and efficiency. Importantly, it also allows for the HDTV picture to degrade gracefully to standard definition in non-ideal reception conditions, rather than suffering the total loss more generally associated with digital systems. One possibility offered by this approach would be to use the same signal to provide HDTV to an appropriate receiver using a fixed external aerial, whilst enabling standard-definition pictures to be received on portable receivers using simple set-top aerials.

The simulation work was carried out jointly by staff at Research Department and BT Laboratories, as part of the European collaborative project *VADIS* (Eureka 625).

The displayed HDTV sequences were replayed from an HDTV recorder at Kingswood Warren and were transmitted via satellite (Eutelsat-II F3) to the MPEG meeting at the BSI's conference centre in London. For transmission over the satellite, the HD signal was coded using 140 Mbit/s video coding equipment (developed within the *RACE HIVITS* project) which provided a transparent path for the HDTV signals.

TRANSMITTER NEWS

The following services have opened, changed or closed since our last issue:

New TV relays

Acharacle	Highland
Darley Dale	Derbyshire
Keilder	Northumberland
Perry Beeches	Birmingham

Addition of Nicam Stereo

Rowridge	Isle of Wight
Waltham	Leicestershire

TV coverage improvements

Canongate	Edinburgh

Radio 1 on FM

Ridge Hill	Herefordshire
Sheffield	S Yorkshire

Radios 1 and 4 on FM

Aberdare	Mid Glamorgan
Blaenavon	Gwent
Carmel	Dyfed
Combe Martin	Devon
Innerleithen	Borders
Kilvey Hill	West Glamorgan
Peebles	Borders
Pontypool	Gwent
Ton Pentre	Mid Glamorgan

New LR fillers on FM

Newhaven	Radio Sussex

Further information from EID on White City (07) 25040.

New technology for *Eng Inf*

From this issue onwards, *Eng Inf* is being typeset using Ventura 4.0 Publisher for Windows. So we will shortly be saying farewell to the old AM Varityper which has served us well over the last eight years or so.

Introducing this new technology has unfortunately caused the Winter edition to be rather late, but production of the magazine should speed up as we become more familiar with desktop publishing.

Contributors can now send in their stories on a 3½-inch diskette. Our Compaq PC, running WordPerfect for Windows, can load most other word-processed text files from disc, including AmiPro, DisplayWrite, MS Word, Multimate, OfficeWriter, Word Star and XyWrite. It may also help if an ASCII text file is included.

Many thanks for your continuing support. Please keep sending in those stories!

...continued from page 1

commercial radio channel already in play and a second one follows shortly. These events do cause significant impact on how the Corporation should now conduct its business and over and above that the Charter Renewal exercise is the most significant challenge we have addressed in recent times.

It might seem strange that I describe this "bringing together" as beneficial when a few years ago Priorities for the Future, or "Black Spot" as it became known, was seen as beneficial in splitting the project areas in particular into the individual Directorates. I suspect the two are compatible; in fact what John Birt described on 11th January is probably the final outcome of the process set in train by "Black Spot".

There is, however, no question of merely returning to the past. There can for example be no recreating of SCPD as we knew it, or even returning to the earlier days when a central view always seemed to be the most important. There are several critical differences between then and now, the most crucial one being the source of funding. The new Directorate, a major trader in finance terms, has no funds of its own. Be it in engineering, facility management, provision of library services or studio resources, all the income must be earned. The discipline that this brings with it cannot be over stated. It will be a challenge to our professionalism but one we will accept and overcome.

I am frequently asked what is the need for the new arrangement? If all services and resources in the Corporation are provided to the same highest degree of efficiency; if the best of market practices are used by all players; if all our practices when market tested are proved to be the most efficient; if all engineering services are absolutely needed and most efficiently provided; and if career prospects in all Resource Engineering and Service areas are optimised, then there may not be much need for the proposed change. However, the reality is of course a mixture.

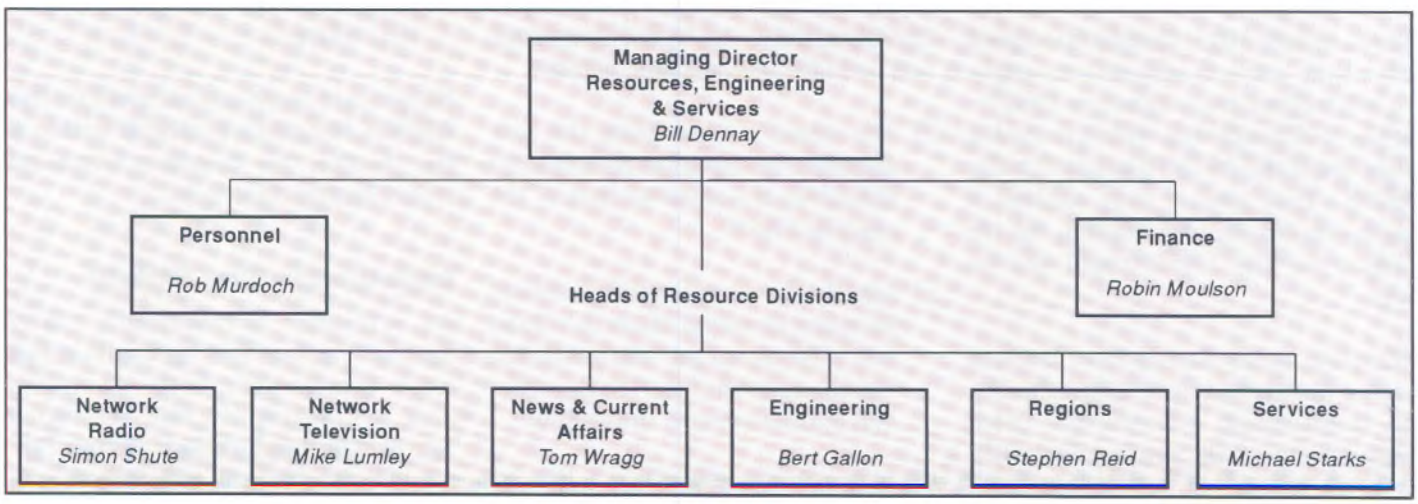
We have an outstanding record of achievement and of improved efficiency. We are well prepared for the trading arrangements that follow Producer Choice but there is room for further corporate improvement. There are variations in practices, no one area has a monopoly of best practice. In terms of strengthening the programme-making base and freeing output Directorates from the challenge of handling Resources and Services — as well as programme commissioning, scheduling and making — it makes sense to create a single Directorate dedicated to the task of managing Resources.

However the new Directorate functions in the future, it is vital that the dialogue with our customers is maintained and further developed. Many people have spent much time working on these relationships and developing sound working practices. There can be no question of going back on these matters. This dialogue is crucial to the understanding we must have in the new Directorate so that we can build further on these foundations. Only by being aware of the requirements of the end users can we develop our own plans effectively; we will after all be in competition with other suppliers.

Engineering will continue to play a key role in the Corporation's future not only in the enlarged Directorate but also through Phil Laven's role in the Policy and Planning Directorate. We must continue to be a major player and contribute to the development of broadcast technology. Whether it is in the area of enhanced television or digital audio broadcasting the BBC's views must remain those sought by the industry at large. Now, at this time of technology enhancement, is not the time for the Corporation to retreat from its leadership role. This does not imply being always a pioneering spirit but it does involve the commitment to the engineering excellence so long a major hallmark of our programmes.

These are inevitably exciting and challenging times and sometimes excitement and challenge can be unnerving. There is no reason to lose our nerve; there is much that is to be achieved and will be achieved. The Resource Engineering and Services Directorate has its own role to play in meeting this challenge. It will be judged by its achievements and I have no doubt that these will contribute to the general well-being of the Corporation in the coming years. Engineering has achieved much and in the new environment will achieve much more. I have every confidence that the strength of technical knowhow will continue to grow in the future and that BBC Engineering will continue to carry the hallmark of outstanding quality for which it is rightly renowned.

Bill Dennay
Managing Director
Resources, Engineering and Services



Resources, Engineering and Services Directorate: 01/03/93

LOUDSPEAKERS

New amplifier for the LS5/8

Graham Whitehead reassures us that the LS5/8 has not been pensioned off; it is back with a brand new drive amplifier.

For many years the LS5/8 has been the mainstay of BBC Grade 1 monitoring. There are some eighteen hundred in service, representing a capital investment in excess of a million and a half pounds.

Recently, two factors had combined to give users and project engineers the impression that they were no longer available: (i) they had been withdrawn as a stock item from the Central Stores catalogue, and (ii) Quad had ceased to manufacture the domestic amplifier which provides the power. However, contrary to that impression, the LS5/8 is very much available, is even better than before, and is in a form which could bring a new lease of life to older or problematic monitoring areas.

Two years ago, demand for the LS5/8 had fallen to such a low level that it was uneconomical to keep them in stores as an off-the-shelf item; they were demoted to being available to order only. By this means, price and delivery could be made to reflect demand accurately, a situation which carried on right up to the recent closure of Central Stores and Supplylink. But at no stage were they "not available" or "no longer manufactured".

Then, in late 1991, Quad announced that they were ceasing new supply — with effect from January 1992 — of the 405 amplifier which provides the core of the AM8/16 used with the LS5/8. This meant that, unless a replacement could be found, future orders for the LS5/8 could not be met.

(Existing users should have little to worry about, owing to Quad's policy of maintaining discontinued products for up to 25 years after withdrawal. Indeed, if you find yourself with a faulty AM8/16 output card, call Quad Service on 0480-52561 and they will be pleased to help.)

So came the difficult task of finding a worthy successor to the AM8/16 for future orders. Over the years, many new loudspeakers and amplifiers have been brought to the attention of the Loudspeaker Liaison Committee, and auditioned for possible use. Likewise, the Committee has been advised over the years of any shortcomings in our existing range of units. If available at the time, a commercial product has been substituted; otherwise, we have adapted our equipment to meet the customer's requirements.

One comment passed on to the Committee several times concerned the bass performance of the LS5/8 under some circumstances. These were most common from Radio Group 2 users who found the bass characteristics inadequate when dealing with bass drum and the like. Indeed Maida Vale engineers experimented in 1987 with modified Quad amplifiers, and later with Yamaha PC2002s, in an effort to address this. The results were promising but did not at the time provide the answer; partly because nobody had clearly defined the question!

Thus, a design brief for a revamped LS5/8 was drawn up by the Committee and included the following points:

- ☐ The sound balance from the new amplifier/loudspeaker combination should be the same as that of the existing LS5/8.
- ☐ Ideally the new amplifier should be more powerful than the Quad 405 (100 watts per channel), but not so much that the loudspeaker drive units became unreliable.
- ☐ It was desirable that only the amplifier be changed. Furthermore, it should be possible to retrofit the new amplifier to an existing LS5/8 system.
- ☐ It should have sufficient space within the box for the LS5/8 Active Crossover card to be fitted.
- ☐ The AM8/16 has a slight rolloff at the top end, due to the input transformer used. The replacement should not do this.
- ☐ The AM8/16 was considerably more expensive than the Quad 405, because of the extensive modifications required to the standard part. The replacement therefore should preferably be from a small British company which was willing to produce a modified version of a standard product, at little extra cost.
- ☐ No cooling fan should be fitted, as the amplifier is likely to be sited close to the loudspeakers.
- ☐ Build quality and safety should be to a suitably high standard.
- ☐ Any product should be available with the minimum of BBC development effort, as there was no specific budget line to support large investments of this type.

Needless to say, a replacement for the AM8/16 had to be available within a few weeks, as customer requests were already coming in.

Introducing The AM8/20

As already mentioned, many amplifiers have been auditioned over the years, both domestic and professional. The tendency for professional units is slanted towards the "sound reinforcement" industry, and hence fan cooling is

common. Large areas of the domestic market are dominated by products which are either not gutsy enough for long-term studio use, or very esoteric and hence too expensive for our purpose.

The LS5/8 uses an RD-designed active crossover card, built into the amplifier. Initially, amplifier candidates were auditioned using a pair of more conventional loudspeakers. These have 500W power handling, 4 ohm impedance, and a very inductive crossover; so any amplifier able to handle them should be able to take the LS5/8 in its stride!

While some amplifiers showed distress when trying to drive these beasts, most met the bill satisfactorily. But one met it better — displaying superb dynamics and generating Sound Pressure Level (SPL) peaks usually only encountered from very large and heavy sound reinforcement amplifiers. All from a unit little larger than the Quad 405, it was the **Chord SPM 800** amplifier which impressed us so much.

Chord Electronics is a small concern in Maidstone that makes a range of "high end" domestic amplifiers. The SPM 800 is the smallest of these, offering 160 watts per channel into an 8 ohm resistive load, but with a total dynamic reserve of almost 1kW for driving reactive and/or low impedance loads. This is due to an innovative switch-mode power supply design, and the amplifier configuration.

Two SPM 800s were each fitted with an LS5/8 active crossover for audition purposes. Outputs to the loudspeakers were via Neutrik Speakon, and similar connectors were added to the LS5/8. We expected a benefit in bass definition and overall transient response but gained a lot more, observing subtleties of definition, imaging, effortlessness, and greater control, while the balance remained the same.

The new amplifier was subsequently coded **AM8/20** and licensed to Chord Electronics.

Field trials of these prototypes in TC7 and MV1 evoked a similar response to that observed at Avenue House. The revamped LS5/8 displayed a marked improvement in bass control and definition over its predecessor: kick drum was sharpened up, even in the presence of synth or double bass; dynamics were dramatically improved, and the extreme top was smoother, as was the middle. According to Mike Lucock from MV1; *" There has always been an edginess; a wiry quality to the upper strings and a lack of warmth to the sound. On loud, complex sounds, the speakers can sound very hard. Whilst some of the subjective effects can be attributed to the acoustics of the cubicle, these new amps have definitely made a difference. The upper strings sound smoother and there is more openness in the sound. The amps seem to handle the transient responses more cleanly. This benefits the lower strings as well. Please can they stay?"* It rather looks as if the LS5/8 has suddenly come up to date!

This is not the forum to enter the "great amplifier sound debate". We could make comparative measurements of dynamic power, slew rate, TIM, output impedance, etc and find several perfectly good reasons *why* the new amp sounds better, but that investigation would not be cheap. That it *does* sound better is what is important.

Production versions of the AM8/20 have the hf channel current limited to around 2 Amps, to protect the tweeter, and power-up delay is ten seconds to

One of the LS5/8s recently installed in Manchester

Development Group

allow the desk outputs to settle. The inputs are the same as on the AM8/16; balanced PO316 or XLR3. A 1.5 metre double-ended Speakon lead is supplied with each amplifier, and we would recommend that a Speakon connector is also fitted to the loudspeaker. That is the only modification to the loudspeaker proper, although we further recommend referring the LS5/8 to us at Avenue House for a Quality Control check while the connector mod is being done; are the drive units tired, are all screws tight, are the handles airtight, etc? Naturally, all new units undergo these Quality Control checks as a matter of routine. The AM8/20 — at just over £1000 each — is a bit more expensive than was the AM8/16 (£700) but represents much better value.

While the prototypes are still undergoing field trial, two pairs of new LS5/8 systems are already in full service. The photograph on page 5 shows one of the systems finished in black for a post-production suite in Manchester.

The AM8/20 and LS5/8 are now available to order from Development Group at Avenue House. For more information, or any other query about Grade 1 monitoring, ring the Hotline on Avenue House (036) 2500, or contact:

Graham Whitehead
Development Group
Tel: Avenue House (036) 4273

ELECTRONIC GRAPHICS

Part 5 : animation stores

Concluding our series on Electronic Graphics, Mike Winston describes the devices used to store animated pictures.

Animation devices generate pictures but an *animation store* is required to record the individual frames and replay them in real time.

For simple film rostrum work, the film itself acts as an animation store. Similarly, any vt machine capable of single-frame recording can be used with electronic picture sources, in particular computer animation.

However, Film and vt cannot really be called animation stores because, once the material is recorded, the frame order is fixed and real time random access to any frame is not possible. This is an essential feature.

Animation stores are either disc-based or solid-state. Storage times from about 10 seconds up to several minutes are available. Disc systems use an array of Winchesters to achieve the required access speed but longterm reliability may be a problem, because of the disc drive mechanics. Solid-state stores have now become viable and should be more reliable because they have no moving parts, but they have the disadvantage that the storage is volatile.

So far, disc systems continue to have the advantage both in cost and capacity. The price of video RAMs has not fallen as rapidly as predicted and this has held back the developent of solid-state stores.

Most commercial machines can simultaneously record to, and replay from, different parts of the store, while some provide simple mixing and keying. These features also provide the basic requirements for the editing of moving pictures. Thus, animation stores have become popular as an alternative to vt machines for editing very short programmes such as commercials, trailers and pop videos. These types of programmes also rely heavily on digital video effects (DVE) and so some manufacturers now make animation stores and DVE machines which link digitally to form a combined unit under common control. The pioneer of this idea is the Quantel Harry/Paintbox/Encore combination which has become the industry standard for this type of work.

Commercial devices

Here is a summary of commercial devices which are currently available:

Abekas A65/A66 Disc recorder. Capacity 30/60 seconds. (Replacement for the A60/A64).

Accom Disc recorder. Maximum capacity = 30 minutes.

EVS Solid-state recorder. Maximum capacity = 32 seconds.

Getris Image Eclipse and Venice A range of machines designed for painting and multilayer 2-D animation work. Hardware incorporates solid-state store. Maximum capacity = 80 seconds.

Grass Valley DDR-4400 Modular multi-format disc recorder system. Maximum capacity = 28 minutes.

Quantel Harry Disc-based editing system with comprehensive picture-processing facilities. Operationally, it simulates film editing. Capacity = 150 seconds. Now superceded by Henry.

Quantel Henry A development of *Harry* which is able to handle multiple layers simultaneously. Capacity = 5 minutes.

Quantel Harriet Combined Paintbox and solid-state store. Capacity = 12 seconds.

Quantel Hal Similar in concept to *Harriet* but uses a disc store. Designed specifically for compositing work. Capacity = 75 seconds.

Questech Solid State Video Recorder (SSVR) An integrated video store and vision mixer/keyer. The animator version has been designed for animation work and can control external vt machines. Also available as an action replay machine for sport. Maximum capacity = 5 minutes.

VTE A combined disc and solid-state multi-standard recording system, custom-built for research and broadcasting.

Storage costs depend on the method of storage used. For the above systems, the average costs are:-

Solid-state:	£1500/sec
Disc:	£500/sec

A *laser video disc* system made by Sony is also used for various applications. It is not an animation store in the true sense because the discs are WORM discs, and access time is not quite immediate. However, the low cost and large capacity makes them very attractive for applications such as the replay of the new Network Identity Symbols. 48 minutes of video and audio can be recorded on one disc at a cost of £250. The player costs about £7.5k. Recently Pioneer has introduced a similar machine but using re-writable optical discs.

Animation in the BBC

Several BBC departments are major users of animation equipment and the main installations are as follows:

Graphic Design Department This department produces a wide range of animation work — for most programme areas — using a Video Rostrum/Harry system. When first installed in the Scenery Block at TVC, it used a computer-controlled rostrum camera with digital vision-processing equipment, and a disc-based animation store built by Research Department in 1983. The rostrum camera has been retained but a *Quantel Harry* replaced the Research Department equipment recently.

Mike Meyer E.I.D.

Graphic Design's "Flash Harry" suite at Television Centre

Computer Graphics Workshop This TVC-based department uses a network of DEC Vax 32-bit computers controlling modified Quantel Paintboxes to produce 2-D animated graphics from computer data (eg Elections, Sports Results, Weather Forecasts, Budget/Money programmes, etc). 3-D computer animations are produced using the Alias/Iris equipment. Animation stores are Abekas A64 and A60, and Sony laser disc players. The A64 was first used to compile and replay animations for the 1987 General Election programme.

Video Effects Workshop Also based at TVC, this area uses a Questech SSVR, with DVE and vt machines, for general post-production effects work, including animation.

News and Current Affairs Much animation work is done for News programmes using the directorate's Vertigo/Iris equipment. These can store material on an A64 disc or Questech SSVR.

The 1980s saw a great expansion in electronic graphics facilities for *stills* production throughout the BBC. Almost every area now has some equipment. However there is an increasing production demand for moving graphics to be combined with stills or short picture sequences. Almost all this work was done by outside companies until the purchase of the Harry system in 1989 started a shift towards providing these resources internally. This has continued with the purchase of a second Harry, and with the upgrading of several Paintboxes to Harriets.

Similarly, in-house 3-D computer work has increased, particularly in News & Current Affairs and in the Computer Graphics Workshop.

Mike Winston
Distribution Systems
TE & PS

ALEXANDRA PALACE
Battle of the beams (1940/1)

Jack Gray looks back to an important role played by Alexandra Palace during the Second World War.

It is well known that Alexandra Palace (AP) was "closed down" at the commencement of the last war. What is not so well known was its role in countering the effectiveness of the Luftwaffe night raids, during early 1941. This is the story of the BBC's involvement.

Will Pafford

In the years which preceded the war, Dr Robert (now Sir Robert) Cockburn had established his reputation as an expert in the design and development of radio equipment in the then state-of-the-art field of upper-vhf-band communications. He was reassigned from Farnborough to the Air Ministry's new Telecommunications Research Establishment, near Swanage, to set up the new Radio Counter Measures (RCM) section there.

He was soon to be joined by Dr (now Professor) Ewart Farvis who had been a lecturer in structural engineering and had been "called up" like many other scientists under the operation of the government "hit-list" of the day. He was to do outstanding fieldwork in monitoring the enemy beam transmissions and later to lead the counter-measures work at Alexandra Palace. This left Cockburn free to assess and devise counter-measures, working from a small research site which he had established at Beacon Hill (near Salisbury) where the beam field strength was lower and more easily matchable than on the South Coast.

At the Air Ministry's HQ, Dr (later Professor) R V Jones was the recently-appointed head of the Scientific Intelligence Department and was thus privy to all top secret intelligence information. One of his sources had revealed that the enemy was developing highly-accurate radio beams. These were later found to be named **Knickebein** (Crooked Leg, after the aerial shape), **X-Gerät** (X-Apparatus) and **Y-Gerät** and had approximate carrier frequencies/accuracies as follows:

Knickebein	30 MHz/1 mile
X-Gerät	70 MHz/500 yards
Y-Gerät	45 MHz/300 yards

These were phenomenal accuracy figures for that period. In comparison, the RAF raids often missed the intended towns so that the bombs fell in open farmlands with pithy comments from the local civilians such as *" and now they are trying to starve us out"*.

The first two systems depended on target location by use of two transmitters each. Their narrow-angle beams were aligned to intersect over the chosen target. They were pulse modulated using dots on one side, dashes on the other, of correct track. The Farvis/Cockburn team had devised initially stop-gap, then purpose-built, jammers so that by Christmas 1940 both systems had been effectively jammed.

Y-Gerät

The enemy was thus forced to use his third system, Y-Gerät, which was in short supply as it was barely off the production line. It operated as follows (frequencies approximate):

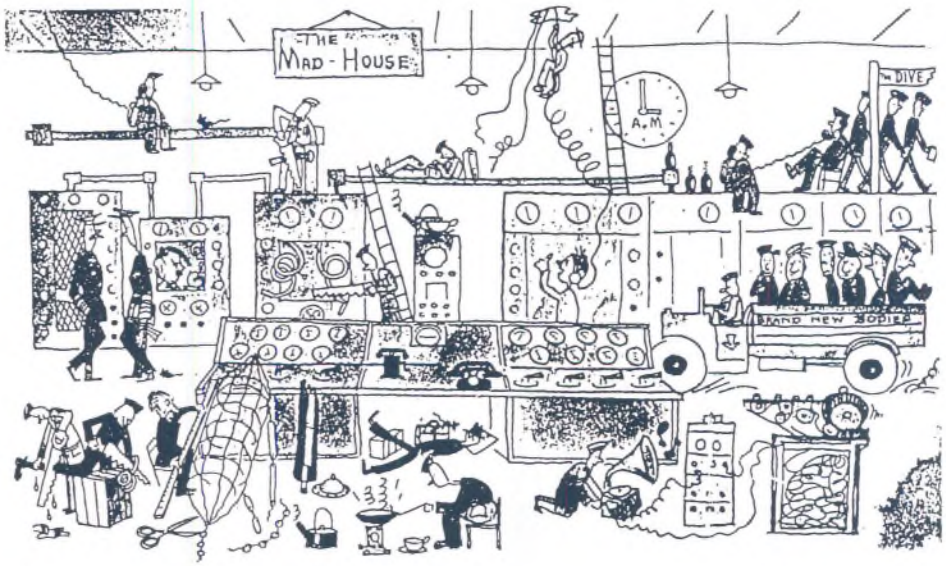
A 42 MHz carrier – modulated with a choice of 300Hz (coarse range) or 3000Hz (fine range) – was transmitted from Cassel near Calais. This signal was received by an aircraft up to about 250 miles away and then retransmitted back to Cassel on 45MHz. The operator at Cassel assessed the range using calibrated phase-delay lines so that range accuracy of under 500 yards was achieved. Bomb drop instruction were given by Cassel over RT. A co-sited transmitter, radiating on 43.5MHz, generated a "Director Beam" which was modulated with "Sync and Tracking pulses". The sync pulses provided a time reference which keyed a meter scaled "Left/Right" in the cockpit so the pilot could hold track accurately. Cockburn did not understand the function of the Director Beam

completely at that time but decided to brief R V Jones on current knowledge, and pass on an idea suggested by one of his (now forgotten) associates: the suggestion was that, because the carriers of Y-Gerät and AP roughly coincided, the AP transmitter could be used as a ready-made, high powered, jammer. Could it be opened up?

In fact, AP was already being manned on a "care and maintenance" basis by Tony Bridgewater (later C.E.Tel) and Bill Jackson (later H.E.Scotland). Tony handed over to his pre-war associate Wilf Pafford about October 1940, just as the Y-Gerät story was about to unfold. Wilf – better known for his "Paff" cartoons – was to remain at AP as "EiC Operations" for the rest of the war.

A joint BBC/RCM project was launched. The sound transmitter had originally been designed to operate anywhere in the 40-50MHz band – perhaps in case TV should become so popular that a second transmitter to the same design be required! Knowing this, Eric Varley (Drive Unit, later C.E. Transmitters) obtained an EMI "Parkin Drive". This was a variable-frequency oscillator so the Parkin could be used to replace the sound transmitter's crystal. He also modified the temperature stabilising network on the Parkin Unit so that, using a dc motor-driven capacitor, remote control of frequency became possible.

A N Thomas (later H.P.I.D.) – one of the BBC's foremost Transmitter experts – trained Bill Jackson to realign the AP r.f. circuits to operate at whichever frequency was in use. Jackson to this day remembers he could realign the system in 7 minutes flat! Other modifications allowed the transmitter to be brought from non radiating "standby" to fully operational from a remote point. There is also evidence that the transmitter output power was made variable to match the input (from Cassel) to the bomber overhead.

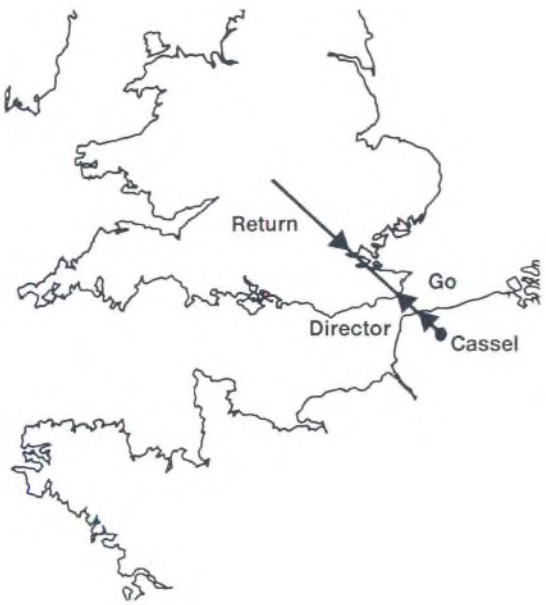


Wilf Pafford

Farvis was detached from TRE and decided to establish his "control" centre at nearby Swains Lane – partly for reasons of security, partly to avoid the interference known to exist at AP. Arthur Rowden (ex Field Strength Unit) and an RAF corporal were assigned to assist him. Arthur's first job was to modify an old EMI TV receiver – one of the "mirror in the lid" types chosen for its TRF circuitry which could be modified to wideband operation (40-50MHz). Thus the bomber's transmission could easily be detected, without retuning, whatever frequency it used. The demodulated output (300 or 3000Hz) was passed by landline to modulate the Sound transmitter.

The object was to intercept the return carrier signal (45MHz) from the aircraft and re-radiate its modulation from AP on 42MHz. This signal would contain the extra bomber/Swains Lane/AP delay so that on re-transmission from the bomber a "delayed howl-round" would develop. Using the remote Parkin Drive, Farvis could guide the AP carrier frequency to match the 42MHz transmissions from Cassel. It is thought that this condition was monitored using an oscilloscope at Swains Lane.

After several weeks of 7-day shifts, the additions and modifications were completed by 4 February 1941. By sheer coincidence this turned out to be the very night the enemy first used Y-Gerät in earnest! As a result of his previous monitoring experience in the field, Farvis could now predict the bomb dropping instant almost to the second. Jackson had completed his 7-minute line-up at AP. At just the right moment, Farvis brought AP to "transmit", adjusted the carrier frequency and observed the onset of "howl round". The RT conversations above went "blue" as the enemy crew



Y-Gerät Beams

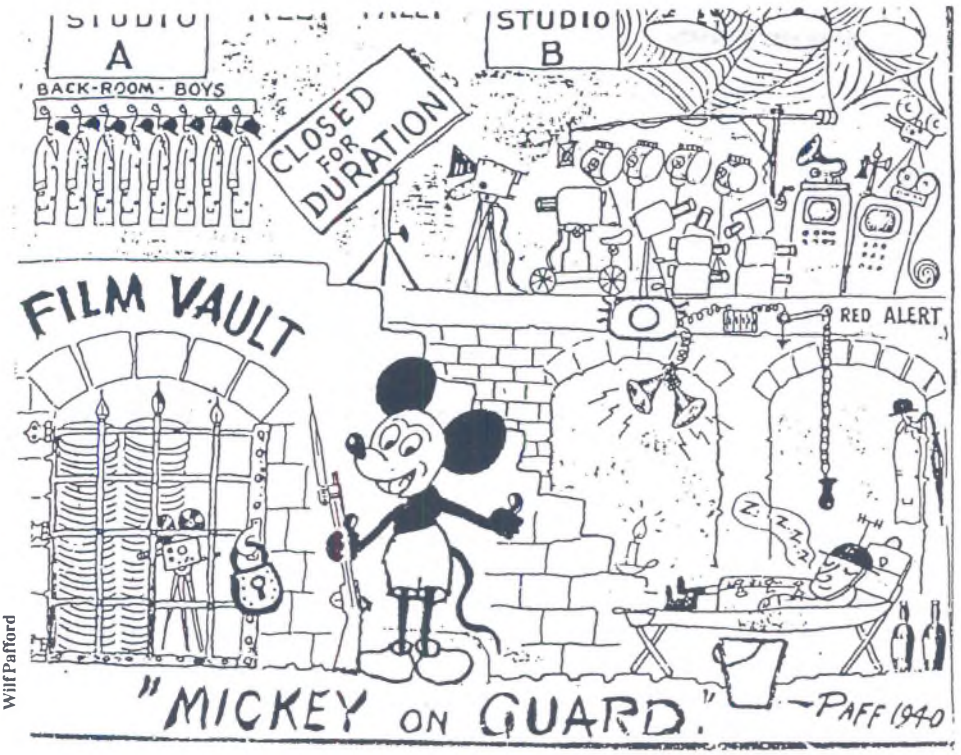
Beam frequencies (approx.):
Go Beam = 42 MHz
Return Beam = 45 MHz
Director Beam = 43.5 MHz

Modulation:
(1941) = 300 Hz / 3000 Hz
(1943) = 3000 Hz / 3300 Hz

Keying rate of Director Beam:
180 pulses / sec

Accuracy:
100 yards at 250 miles (approx.)

Bombs dropped on verbal instructions from base.



Wilf Pafford

blamed the situation on faulty equipment and Cassel blamed the crew for faulty operation at the critical moment.

When he judged "all clear", Farvis returned the transmitter to standby and the enemy crew flew the bombs back to base. Hitler, in those days of the "gentleman's war", had forbidden bomb-drop in the absence of accurate target location. In fact only about 25% of Y-Gerät-controlled enemy sorties resulted in bomb drops. This was a triumphant success for all those involved.

The Germans were unaware of this near-perfect jammer and took no action until the end of May 1941 when they adopted the standard anti-jamming technique of changing the frequency of the originating transmitter. However the far-sighted application of the Parkin Drive could easily cope with this. When – during my researches – Cockburn (the master jammer-designer of the war) first heard the full tale above, he wrote to Farvis in 1992 to congratulate him on this almost undetectable jammer design. (Earlier, all had been too busy to compare notes!)

After a crashed aircraft had revealed the secrets of the "Director Beam" to Cockburn, about May 1941, he designed and operated a prototype, low power, tone-modulated transmitter at Beacon Hill. This worked on the appropriate frequencies to blot out the relatively-weak synchronising signals. Cockburn says that he was worried in case the enemy realised what was going on and fitted dc restorers (shades of monochrome circuit design!) to their "Y" equipment. Fortunately this was never done by the Germans. By the end of 1941, enemy raids on Britain fell to almost zero as the Russian campaign developed and absorbed his equipment. Radio counter measures were thus no longer needed.

Cockburn and his team (numbering 3000 by the war's end) went on to design jammers against the German Freya and Wurtzberg radars. By the end of 1943 his work was so successful that the Germans were forced to resurrect Y-Gerät – probably in its operator-friendly design, the "Rechlin System" – to guide their night fighters onto the RAF's bomber streams.

Cockburn, Farvis and others also designed the very successful Radar "spoof" in which a slow-moving invasion convoy in the Dover Straits was simulated by dropping "Windows" – tinfoil strips – at precisely defined intervals from Lancasters, led by Leonard Cheshire VC and guided by "GEE" for which Tony Bridgewater in the RAF had responsibilities for the ground stations.

Cockburn retired as Head of Scientific Development at Farnborough, and Farvis developed a passionate interest in Radio so that, after the war, he took a second degree in that subject and later obtained his professorship. Both are now very active – near or actual – octogenarians.

Eric Varley lives in South London and has searched deep into his memory to provide the Parkin Drive details. Tony Bridgewater can certainly claim the promotion record in the BBC – from Caretaker to Chief Engineer! Pafford and A N Thomas both live on the South Coast giving the lie to the Pension Scheme's longevity statistics. And Jackson moved to St Andrews for the golf, but it is not certain whether he watches more than he plays these days!

An AP group photograph of the 1942/3 period shows that the RAF remained in occupation. There is scrappy evidence that a peculiar cartwheel-shaped aerial was fixed at the top of the vision mast but no evidence exists in respect of its function. Perhaps, herein, lies another "secret" story?

Books which cover the "Beam" are:

Most Secret War, by R V Jones
Secret War, by Brian Johnson
Instruments of Darkness, by Alfred Price

None of them gives any detailed information in respect of the Y-Gerät design or story, as described above – probably because our counter-measures were so immediately successful. Due to the secrecy clamp-down, even the Caversham archives have no records of the above events.

Jack Gray (retired)
ex PID Tel

TELECOMMUNICATIONS

"It was only 4 digits to Rio ..."

Tim West describes a multiplexing technique which was used last summer to send music, cue, telephony and computer data back to London from the Earth Summit in Rio.

When a temporary BBC office opened in Rio last year — to cover the first-ever Earth Summit — it was able to provide journalists and studio managers with facilities not normally found on location. At their disposal, night and day, during the 2 weeks of the conference were:

- ☐ Three telephones connected directly to the BH exchange
- ☐ An EDiT terminal linked to the computer system in Bush House
- ☐ Two Basys terminals connected to the NCA newsroom computer in BH
- ☐ A 7.5 kHz full duplex circuit for music and cue

And yet the only link back to the UK (via BT International) was a single 64k data line — occupying no more bandwidth than an internal phone-call between BBC regions. The Rio project set out to prove that it was possible to support all these services whilst surviving on so little bandwidth — and to reap the obvious cost-saving advantages. A combination of the following techniques was used to do the squeeze:

- ☐ Conventional Statistical Multiplexing
- ☐ Dynamic Bandwidth Allocation of synchronous data
- ☐ Voice compression; CELP (codebook excited linear predictive) encoding for telephone links, and a proprietary French method for the broadcast circuit.

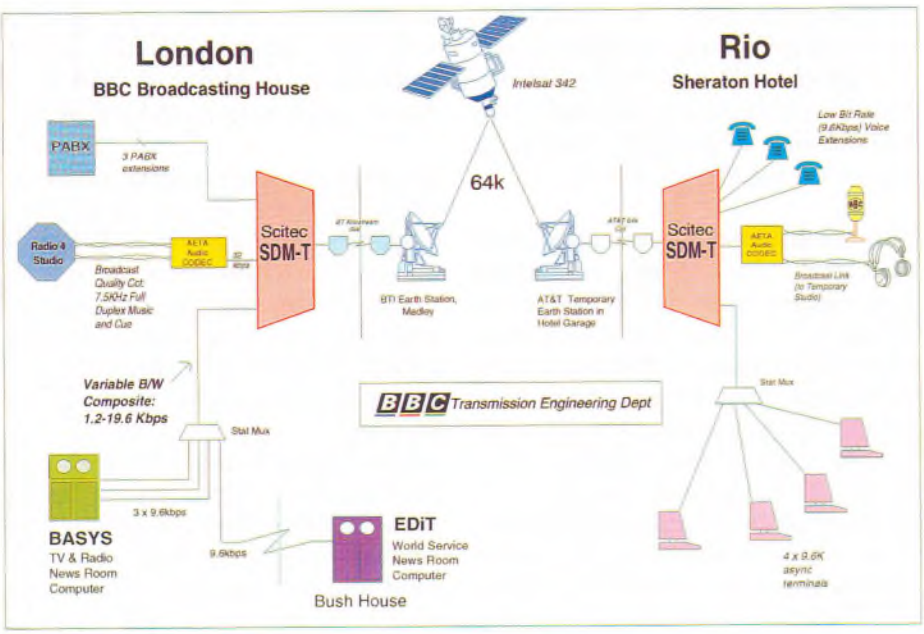
The two key pieces of equipment were the Scitec SDM-T Multiplexer, and the Aeta Scoop II audio codec. The Aeta is one of the first codecs to offer 7 kHz audio bandwidth in just 32 kbit/s — releasing half the total bandwidth for other uses. Although not conforming to the ISO standard, studio managers agreed that the audio quality was good enough for Brian Redhead, and it was used live for R4's *Today* programme.

Meanwhile, other journalists shared the remaining 32 kbit/s. Each telephone, when in use, took up 9.6 kbit/s of the aggregate. Although voice quality was undoubtedly lower than on a normal line, the Rio phones were in constant use. Anyway, this didn' t seem to matter when reminded that the hotel charged six dollars a minute for the same call, if dialled through their system.

A phone not in use, however, represented unused bandwidth. The Scitec was able to calculate how much was spare at any one time, and divert it to the Basys users — who benefited with faster response times at their VDUs. In fact, the bandwidth given over to the stat mux varied, according to phone usage, from 1.2 to 19.6 kbit/s. The mux (an SMX200) did not seem to mind having a wobbly composite and in practice the users weren't aware that they had last call on the link!

The same multiplexing techniques have since been used on a more permanent basis, in the recent re-engineering of the links to BBC overseas offices in Paris and Brussels. Brought into service at the beginning of November were single Kilostream circuits to each bureau. Using Craycom 9200 series multiplexers, similar telephone, Basys and codec circuits are now provided full-time. Should the main 64k line fail, a backup 64k will be dialled up on ISDN.

Without a doubt, the Rio project proved that broadcasting has a lot to gain from the telecomms technology and compression techniques currently available. Transmission's Central London Maintenance Services



Schematic diagram of the 64k multiplex link

integrated the Scitec equipment into the BBC's network, while NCA staff in News Sound Ops (who sparked off the idea) worked through the night in Rio, with TED Projects staff in London, to synchronise the system in time for the *Today* programme the next morning.

If you would like more information on any of the technologies mentioned, please call Nick Davies on (07) 16809.

Tim West
Engineer
TBS

CEEFAX
New technology

Aidan Stowe describes how new technology has revolutionised the way in which Ceefax pages are edited and, overleaf, Peter Weitzel describes a new technique — Dynamic Line Allocation — for speeding up the transmission rate of Ceefax pages.

"*It's like going from roller skates to Concorde*" is how one Ceefax sub-editor described the new technology which has been installed in TC 7013. The BBC was in the forefront of the development of teletext and now has pioneered the biggest advance in teletext editing technology since it all started back in 1974.

Until last autumn, Ceefax staff had to master a hotch-potch of up to three different teletext editors running on single function computers. Now, all staff have multi-function pc workstations running on an NCA network. So how did such a radical change come about?

It all started when a new Ceefax "godfather" (Richard Ayre, Head of Westminster) sent Roy Vitty, Manager News & Current Affairs (Resources), to see if it was feasible to put Ceefax on to an NCA pc network similar to that at Millbank. NCA's pc networks use Microsoft Windows and the main obstacle was not having a teletext editor that would work as a Windows application.

The answer was found at Andrew Lambourne's *Synapse Systems Ltd.* Andew had written a previous teletext editor, the Sprite system, which was in use at Ceefax until the new technology arrived. He had an embryonic Windows application under development — *WinSprite* — which became the basis of the Ceefax project, supervised by Dave Waring of NCA IT projects. Ceefax input, at an early stage of development, ensured that teletext editing functions are now, as far as possible, the same as those of other word processors working in Windows.

The network workstations — which were installed in time for the high-profile Ceefax relaunch on November 16th — are Elonex 486 IBM pc compatibles with large 17" screens, eight megabytes of RAM and 100MB hard disks. The network is serviced by a Tulip 660MB fileserver which will eventually provide Basys wire services, although each workstation is plugged directly to Basys via terminal servers.

This means that Ceefax operations are now all-electronic. Incoming news agency material is "tasted" on KEAterm — a Basys terminal emulator which runs in Windows. It is then duplicated to one of ten copy baskets in Basys, where writers can "rough cut" it into Ceefax style. Next, it is pasted across to a teletext page in another window, from where it is sent to the Signet system running on PDP 11s, either via Signet commands or by using pull-down menus in *WinSprite*.

The early advantages of the new system have been many. Editing in a Windows environment is much more sophisticated — the advent of *word-wrap* was just about the only advance in teletext editing over the previous 18 years. Access to pages stored on the fileserver is faster by almost unquantifiable proportions compared with the Signet library, and pages being prepared for future transmission can now be grouped in DOS-style directories. Tearing up news agency "tape" into itsy-bitsy story-length pieces and retyping on to a teletext page is now a distant memory. The advent of the network will also mean that the Ceefax equipment at Millbank will be in direct touch with staff back at TC.

Perhaps the most important advantage, however, is yet to come. A page-handling system is being designed for the fileserver, which will automate the sending of pages to air and take over routine tasks such as bringing in the new day's TV Listings pages overnight. This will revolutionise management of the teletext page database, which until now has been a laborious and largely manual affair. With the new system, Ceefax will once again be leading the field and the pay-off, as far as the viewer is concerned, will be faster news and fewer annoying mistakes,

such as the page not corresponding to the index entry.

The speed advantage is being enhanced further by additional transmission capacity. Ceefax, with the co-operation of the Enterprises *Datacast* service and Network Engineers, is now using nine lines of the Vertical Blanking Interval (VBI) on both BBC1 and BBC2. In addition, a Dynamic Line Allocation (DLA) system is being developed to maximise the use of precious transmission lines (as described below).

When the DLA system is in place this spring, Datacast will be able to use as many of its four VBI lines as the volume of data justifies. Lines not being used by Datacast will automatically default to Ceefax use, maximising the use of lines and giving viewers faster access to Ceefax pages.

Aidan Stowe
Duty Editor (News)
Ceefax

Dynamic Line Allocation

Ceefax is the largest single user of the VBI. It provides two different news and information services and constantly has to juggle the access time of a set of pages, by allocating magazines to streams and streams to line-pairs. Any extra transmission capacity would be very welcome but, unfortunately, the VBI cannot be expanded any further.

Thus, to enable Ceefax to transmit its new service faster, CE Tel has agreed to a temporary reallocation of the line-pairs. Furthermore, BBC Datacast has loaned some of its allocation and Network Television has temporarily removed VBI talkback from BBC2. The current arrangement is shown in Fig 1.

Even these measures though have not been enough. Further techniques will soon be implemented to speed up the transmission rate of Ceefax, at the same time making more efficient use of the VBI.

Datacast

Datacast is a commercial data-broadcasting service. Customers include: The Stock Exchange; Corals Bookmakers; Cardcast, which broadcasts stolen credit card details; and Twin Networks, who run games in Whitbread pubs! It is also used by Network Television for *Presfax* which can be received anywhere — including OBs — and to send *Telfax* to the regions.

By its very nature, the loading on Datacast varies from moment to moment — customers only send data when they want to — and so it rarely uses the whole of its potential capacity. Thus, to make more efficient use of Datacast, a new type of datastream has been developed which will have default packets (rows) which the transmission system puts in when there is no customer data. These will contain no useful information so they can be stripped out of the stream — the resulting "hole" being filled with a packet of Ceefax data.

If Datacast usage were to fall to 50%, Ceefax would be able to transmit another four pages a second per network using this new system (which has been branded *Dynamic Line Allocation*). This might not seem much but it is about a 30% increase in the speed of Ceefax. Even with Datacast running at about 99% usage, Ceefax would be able to transmit one extra page every 6 seconds — just think of 600 additional pages per hour!

The VBI manager

The term Dynamic Line Allocation is a misnomer as what is actually being done is to dynamically allocate *packets* (rows) in the VBI.

A small study group — including staff from News & Current Affairs, Datacast, Television Engineering & Project Services, Development Group and Television Network — developed the concept of allocating packets dynamically.

TE&PS wrote a specification and invited tenders for six units to replace the existing teletext data combiners (EP1/599) in the Network Chain bays.

Line pairs	BBC1	BBC2
06/319	Noise measurement	
07/320	Noise measurement	
08/321	Datacast	
09/322	Datacast	
10/323	Ceefax	Datacast
11/324	Ceefax	
12/325	Ceefax	
13/326	Ceefax	
14/327	Ceefax	
15/328	Ceefax	
16/329	Ceefax	
17/330	Ceefax	
18/331	Ceefax	
19/332	VBI talkback	Ceefax
20/333	Subtitles	
21/334	Insertion Test Signal	
22/335	Usually clear and unblanked	

Fig 1: the current VBI arrangement until DLA is implemented

The desired units should be able to combine six teletext streams, and to "flow control" the output of the Ceefax computer to respond to the instantaneous changes in Datacast usage. They should also have the ability to transmit the codes of any future *programme delivery control* service.

While processing the Ceefax stream, certain features — such as Packet 8/30, which transmits time and network identification, and Ceefax nFF headers which keep the header clock running — must be passed by the new units with minimal delay.

Other constraints include ensuring that there is a field delay between the header and the individual rows of a page, even though the stream is instantaneously going out faster than it is being instantaneously sent by Ceefax (and vice versa). Also, as Datacast must not be delayed longer than one field interval (the same as it is at the moment), the detection and packet replacement has to be carried out "on the fly".

MRG Systems were successful in tendering for this equipment and it is planned that the six units will be installed in early April. From then a new allocation of VBI line-pairs will be established with all the Datacast "lines" being available for Ceefax transmission during slack periods.

The other allocated VBI lines are not really suitable for carrying Ceefax by dynamic line allocation. For example, subtitles (on lines 20/333)

are routed with the programme video and hence the network subtitles disappear during an opt-out. However, as there is considerable spare capacity on the subtitles line-pair, it could be used for example to carry a future Audio Descriptive Service, or other *programme-related* service.

No other broadcaster is using the VBI for so many services. Tests will be required to see if the new dynamic arrangement affects good decoding and reception of either Ceefax or Datacast. In some ways we are already doing this with the line allocation of WSTV Europe! More about that in the next issue.

Peter Weitzel
Senior Engineer, Developments
TE&PS

Mike Meyer F.I.D.

A sub-editor updates Ceefax pages

NETWORK RADIO

The historic Blattnerphone

The Blattnerphone is a rather rare sound recorder which uses reels of steel tape. Here, Dave Price describes his search for the BBC' s only surviving unit, which recently went on public display at the *Radio Show* in Broadcasting House, London.

It all started when we were discussing the panels. Let me explain. It was November 1991, one month into the planning of the *Radio Show*. One thing we'd agreed on was the Heritage Corridor — our chance to put on display the priceless artefacts that a great organisation like the BBC was bound to have in its vaults. Vaults — what vaults? We'd kept our software, so to speak, in the Sound and Written Archives, but what had we done with the hardware – our engineering heritage with which the BBC had led the broadcasting industry for so long?

Sadly, we hadn' t done all that much, not officially, anyway. Here in Radio Directorate, enthusiasts like David Stripp, Peter Thomas and Chas Commander had managed, over the years, to secrete a few mics and recorders away in basement lockers, including the famous "Royal" mics on which the Abdication and other speeches had been made, but they hadn't the space to keep the larger items. Still, we had enough for a small display of microphones, at least. I felt we ought to have a panel showing the development of recording. If we couldn't find room for the recorders, at least we could show the recording media. Few of our younger listeners had ever seen a wax cylinder, let alone a reel of steel tape used on the Blattnerphone. Cylinders we had a-plenty, but a Blattnerphone tape?

We'd originally had four of these mechanical brutes in the 30s, two on loan and two we eventually bought. By 1939 we only had the one left. On the basis that where there's a Blattnerphone, there must be a reel of steel tape, I followed the trail of this last machine from BH in the 30s, to Research Department in the 40s and 50s, then possibly to Evesham or even Bristol. But memories were vague, and nobody had ever seen the machine or knew of any surviving tapes. Even the Science Museum didn' t have one.

I'd almost given up when Robert Hawes, who runs the British Vintage Wireless Society, told me of Jim Butterworth – a transmission engineer based at Rampisham who'd looked after "some old bits and pieces" before he retired. I phoned him at home in Minehead, and asked if he knew where I could lay my hands on a reel of Blattnerphone tape. *"They should be with the Blattnerphone," he said. I nearly fell off my* chair: *"Should be with the Blattnerphone? Where?". "At Wash-*

ford, of course" he said, as if it was a popular archival supermarket.

By 9 that evening I was 180 miles away, meeting Doug Grieg, who'd come over from Rampisham to open what is now an unmanned transmitting station. We went into the main building, now full of disused scenery from Bristol, old cars, and the sort of general rubbish that unmanned sites are bound to accumulate. Right at the back was an aluminium shed (only the BBC could build an aluminium shed and keep it indoors!).

Doug fumbled with the keys until he found one that looked like a padlock key and remarked that *"we haven't opened this old shed since Jim left!"* The door creaked open and there in front of me, 4 feet high, bright red, and almost blinking in the light, was the only surviving Blattnerphone. I couldn't believe my eyes. Apparently my jaw visibly dropped. I know you can't really compare it with Howard Carter opening Tutenkhamen's tomb, but I think I know how he felt at that moment!

Inside the Washford treasure-hut were more "Royal" and other mics, all carefully preserved by Jim, most in perfect working order, some the only working examples left. There was even the original "Meat-safe", complete with a perfect example of the Round-Sykes mic that it housed. A wonderful find.

Well, we got it all back to BH, and the exhibition layout was even altered to give the Blattnerphone and the Meatsafe pride of place in the "Pioneers" area. A valuable exhibit for a great show.

That should have been the end of the book, but it turned out to be just the end of a chapter. A few weeks later, I attended a conference of archivists in Australia, and opened the *Canberra Times* on my first day there to find the supplement front page headlined "Blattnerphone lives again!" Australian Telecom had restored what has turned out to be the only other machine in existence, a table-top model built somewhat later than ours. They had commissioned Ernie Dick, CBC's chief archivist, to supervise its operation.

Ernie was asked because he had eleven Blattnerphone tapes that he couldn't play in Canada as their machine was an incomplete box of bits. Ten of the tapes were vox pops of French children on school visits in the 30s — interesting but hardly box-office hit material. The eleventh wouldn't fit on the machine, as its metal flange was distorted, and it took two young Telecom engineers a whole evening to ease the centre out, so that it would fit on the hub of the Blattnerphone brute.

This rogue reel turned out to contain a unique recording of King George V's Jubilee speech in 1935, broadcast over the BBC's new Empire Service, and recorded on CBC's Blattnerphone in Toronto. We already had the main speech in our Sound Achives, but to have the "received" recording as well, complete with the "London Calling" signs, makes it very special.

Network Radio

Dave Price with the Blattnerphone

My next job will be to get our Blattnerphone working again – as much to find out what is on our three reels as for the sheer pleasure of seeing this oversized Meccano set in action again. Jim had modified an old Vortexion amplifier for demonstration use, and I'd be surprised if the whole set-up didn't work perfectly, knowing how well he'd preserved everything else.

The 3mm-wide steel tape runs through at 60 inches per second, and the heavy cast alloy reels spin at a terrifying speed. One of the operators always wore a pair of heavy asbestos gloves so that, whenever the tape broke, the reels could be stopped quickly to limit the damage caused by the lashing tape! The Health and Safety inspectors would have had a field-day!

This particular machine was installed in Broadcasting House at the end of 1932, and was used to record Chamberlain's declaration of war in 1939. It was kept for some years in Bristol Museum until returned for the BBC's 50th anniversary events. Kingswood Warren re-furbished it as per the original, using the heads of the later Marconi-Stille machine. It then went back into the museum until 1980 when Jim Butterworth took it out for the *Broadcasting in the 20s and 30s* museum display in Bridgwater, Somerset. As recently as 1984 it was demonstrated at a Vintage Wireless Society meeting in Harpenden.

The *Radio Show* has given us a great opportunity to collect some priceless artefacts from our early years, only preserved because of the enthusiasm of our dedicated engineers. The display of 2LO, the Blattnerphone and all the other examples of our technical past brought out the passion for our heritage in visitors and staff alike. History is one thing our competitors don't have; we must make every effort to preserve ours!

David Price
Head of Recording Service
Network Radio

VIDEO FORMATS
Part 2: digital formats

To conclude this two-part series, Dave Bowd describes current and near-future digital recording formats.

Digital *component* format

While the development of analogue component recorders was proceeding, Sony was completing the design of a component *digital* recorder to meet the specification produced by a joint EBU/SMPTE initiative with industry (to provide a recorder for CCIR 601 sampled 8-bit digital component signals). The format became known as "D1".

D1 Format

The specification for D1 was produced following much discussion and included the preparation of a questionnaire which was sent to broadcasters seeking the facilities required for such a recorder. In addition to a transparent performance, answers to the questionnaire had shown a strong user requirement for a cassette-based format. The machine was also required to be switchable between the 525/60 and 625/50 television standards.

Plans were initially based on the use of one-inch tape but this was later changed to three-quarter-inch tape. To cope with all requirements, three cassette sizes were defined with maximum playing times ranging from 11 minutes to 76 minutes using 16 micron tape, and from 13 to 94 minutes using 13 micron tape.

Deliveries of the Sony machine started in 1987 and BTS produced a machine which became available in 1989.

The format has become the current standard for high-end post-production activities, but has not sold in large numbers. During 1992, both Sony and BTS produced second generation machines with improved facilities, and which eliminated some compatibility problems between the earlier models.

1956	Quadruplex
1961	Electronic timebase correction
1964	Electronic editing
1964	Wideband fm recording
1968	Hs100 slow motion disc recorder
1969	Quadruplex multi -cassette playout machines
1970	U-Matic and Philips VCRs
1971	Wide-range timebase correctors
1972	EBU/SMPTE Timecode
1973	IVC 9000
1976	"B" format
1978	"AST" developed
1979	"C" format
1982	Component camcorder developed
1986	D1 recorder
1987	MII and Betacam SP
1988	D2 recorder
1990	D3 recorder
1992	"DCT" recorder
1993	Digital Betacam
1993	Panasonic recorder

Significant milestones in VTR

Digital *composite* formats

Ampex chose not to produce a D1 machine but instead concentrated on making a digital composite machine, initially as an automated multi-cassette machine to replace its ageing ACR 25 quadruplex-based machine. It was soon realised that the format could be a replacement for existing "B" and "C" format machines and therefore studio machines were produced. This format became known as D2.

D2 Format

The D2 format was able to use some of the newer techniques rejected during the development of D1. These included the use of metal particle tape and azimuth recording which enabled the format to use less tape.

D2 is also somewhat simpler and hence less expensive to make than D1. This simplicity enables better slow-motion and pictures-in-shuttle than that of the first generation D1 machines. D2 machines use the same cassette shells as the D1 format and provide maximum playing times ranging from 31 minutes for the small cassette to 207 minutes for the large cassette. As part of the development, Ampex developed a *parallel composite digital interface*. Sony also strongly supported the format and now manufactures both studio and portable D2 recorders.

D3 Format

More recently Panasonic, responding to a specification produced by NHK, has developed a composite digital recorder using half-inch tape. It provides almost identical facilities to D2, is known as the "D3" format and uses the same tape as MII. By the use of comparatively narrow data tracks, it provides maximum playing times ranging from 46 minutes to 185 minutes using 14 micron tape, and from 64 to 245 minutes with 11 micron tape.

The use of a smaller cassette makes a camcorder feasible in this format and this is now available. A field portable is now available and a smaller non-editing machine is also under development.

Both the D2 and D3 formats are in significant use; second generation models have already been introduced for the D2 format.

Second-generation digital *component* formats

While the above developments in formats have taken place, the playing

field has also been changing. Although the CCIR *parallel digital component interface* worked well, it was rather cumbersome and not suitable for long-distance interconnection. A CCIR *serial* distribution standard was in place but its implementation was delayed and this allowed an alternative system with additional features to be developed and implemented. The improvements included a 10-bit video data capability, the ability to carry either component or composite digital video signals, and also to carry optionally up to four channels of digital audio. It was also easier to implement and so has been adopted in preference to the earlier proposal. Last year saw the availability of almost every conceivable type of component digital equipment able to connect with it.

There is therefore a very strong incentive for anyone planning new facilities to consider the use of serial digital component signals for distribution and routeing. This in turn creates a demand for a practical and affordable digital recording format for component signals, since the analogue Betacam SP format will be a serious performance bottle neck, and the D1 format is both expensive and inefficient in its use of tape by today's standards.

As one would expect, the manufacturers have not been slow in reacting to this need and there are three new formats at various stages of development.

Ampex "DCT$_d$" format

The first of these formats to become available (last autumn) was the one developed by Ampex. It is included in the range of equipment known as "DCT" Digital Component Technology. Like D1 it is switchable between the 625/50 and 525/60 television standards.

The format uses a similar family of cassettes to the D1 and D2 formats but with an improved formulation of metal particle tape (it will not record on D1 or D2 tape formulations). It records 8-bit video data using *bit-rate reduction* techniques but, at the time of writing, full details have not been released. It is based on aspects of both the D2 format and a format developed for data recording. Since component recording requires roughly twice the data capacity of composite recording, one would expect this format to have half the playing time of D2 for the same size of cassette. However its bit-rate reduction techniques allow it to retain similar playing times.

The format offers four digital audio channels, and provides both the relative simplicity of D2 and D3 and similar operational features. Ampex has retained individually replaceable head pairs, like on its D2 and C format machines.

Quadruplex	15,000
U-Matic and U-Matic H	>1,000,000
"B" format	3,250
"C" format	36,000
Betacam and SP	160,000
MII	25,000
D1	1,200
D2	7,000
D3	3,000

Approximate worldwide sales of VTRs analysed by format

Panasonic digital format (Dx[10])

Panasonic has taken a different approach in producing a digital component recorder, based on its D3 composite recorder. This format was initially known as D5 but this title has not yet been agreed by the SMPTE. Panasonic does not feel that bit-rate reduction techniques are sufficiently mature for recording purposes. Instead, it has doubled the longitudinal tape speed and added two more pairs of record heads and data channels, thus doubling the data rate recorded to enable full transparency 10-bit video data recording. The same cassette and tape will be used, and 11 micron tape will allow maximum playing times of up to two hours on the large cassette.

Since many of the format parameters are the same as D3, a version of the recorder that can play back an existing D3 tape is possible. This feature could be useful for users of D3 who wish to change to a digital component format in the future, but who have a large library of D3 tapes.

Both 625/50 and 525/60 versions are planned and deliveries will start towards the end of 1993. Initially the format will have four digital audio channels but there are future plans to increase the number of channels using APT bit-rate reduction techniques. A camcorder will be available in 1994.

Digital Betacam

The third development is a digital version of Betacam from Sony in collaboration with BTS. Although Betacam SP can be purchased with digital outputs and a version is available with only digital inputs and outputs, the actual recording on the tape is still analogue.

The new digital format triples the head drum rotational speed of Betacam, uses narrower data heads and reduces the linear tape speed slightly to provide up to 124 minutes playing time for the large Betacam cassette. The format uses a new formulation of tape and will not record on existing Betacam tape. In order to keep similar playing times to Betacam, it uses bit-rate reduction but the algorithms are different to those used by the Ampex DCT$_d$.

The format records 10-bit video data and Sony has also provided the future potential to expand the initial four digital audio channels to eight. It is expected that delivery of the new format will start in Autumn 1993. A camcorder will become available in 1994, but there appears to be no immediate plan to produce a version for 525/60 television systems.

Making a choice

The potential purchaser of digital recorders now has a wide choice. If a digital *composite* recorder is required, both the D2 and D3 formats offer a cost-effective solution with a wide range of operational

TE&PS

General-purpose cubicle in Stage 5 showing Betacam SP and D3

facilities. If a large number of tapes are to be stored, the smaller cassettes of the D3 format may be a worthwhile advantage. The availability of a camcorder may also be an important factor. Certainly the intense competition between their respective suppliers will ensure a good financial deal.

If one is looking for a digital *component* recorder, the choice is rather more complex. The existing D1 recorder is a mature product, but it uses a lot of tape, and is expensive to buy and run. However it is available now, works reliably and there are two manufacturers.

The Ampex DCT_d machine is more cost-effective than D1 and, provided one is satisfied that modest amounts of bit-rate reduction are acceptable, DCT_d seems well worth investigating, particularly if the requirement is immediate. The format has a relatively wide track width and so should be robust. No portable machine is presently planned and so DCT_d is most suitable for a fixed installation in a studio or vehicle environment.

The Digital Betacam machine looks very attractive assuming that bit-rate reduction is acceptable, but is not available until Autumn 1993.

Sony also proposes a version of the machine which will be able to play back existing Betacam and Betacam SP tapes. This latter feature will allow a progressive changeover from analogue recording to digital, and enable analogue camcorders to be used until they reach the end of their life.

Both BTS and Thomson are supporting the Digital Betacam format, which is being used for the Winter Olympic games in Norway. The Norwegian national broadcaster NRK has also announced that it will adopt the format.

The Panasonic format will be attractive, particularly to existing users of D3 who wish to change to component distribution. It is the only format to record 10-bit (CCIR 601) video data with full transparency.

Because of this it has twice the number of data channels and a higher tape speed than Digital Betacam, and could give the impression that it will be dearer to buy and run. However there is also a cost overhead for the inclusion of bit-rate reduction and competition between suppliers may make the capital costs of the equipment very similar. Tape costs generally depend more on volume sales than the amount of tape in an individual cassette, and it is too early to predict what the long-term difference in tape revenue will be.

This machine has the potential to replace the D1 format. Its transparent 10-bit capability will satisfy those top-end users who find multi-generation 8-bit processing of graphics-originated material unsatisfactory.

Channel Four has announced that it intends to standardise on this new format for its new playout Centre due to be in service in 1994.

The next year is therefore going to be very interesting as the three manufacturers vie for business. Potential users of formats using bit-rate reduction will need to devise methods for evaluating the performance of such techniques in recording equipment to be used for complex post-production operations. They will also need to check that a concatenation of equipment using different bit-rate reduction techniques will not show up unexpected faults.

It can take a year or even longer to fully appraise a new format. Users will have to be satisfied that the basic control software is bug free, that error rates are acceptable, that compatibility between machines will allow multiple audio edits over the same section of tape, and that head wear and reliability are satisfactory. It can take even longer for tape to be optimised for a new format and so users may have to accept slightly higher error rates in the early days.

The availability of "standard" analogue and digital interfaces will allow signals to be transferred between the different formats. In the case of conversion between component and composite devices, it can be done inexpensively (with some degradation) via analogue coders and decoders, and transpar-

ently but at higher cost with digital coders and decoders which are now becoming available.

Recording on disc

As mentioned in Part 1, a slow-motion recorder using analogue recording on to a magnetic disc was used before the development of "C" format. More recently, digital recording has become possible on disc and practical magnetic disc-based recorders, with recording times up to fifteen minutes, are now available. These systems are very expensive and generally used with top-end graphics and post-production facilities.

Optical disc video recorders — of both the WORM (Write Once Read Many times) and Magneto Optical (erasable) type — are also available. However, as yet, they use either analogue techniques or highly-compressed digital recording to provide realistic playing times and are only suitable for limited applications. The WORM type is currently used for the BBC's network identity sequences.

Although disc recorders have a limited total data recording capacity compared to tape, their advantage lies in the very rapid access times to retrieve data from the disc . For this reason they form the basis of the current "Non-Linear" off-line edit systems. Such systems use magnetic and/or optical disc drives with very high rates of bit-rate reduction. These systems are becoming increasingly popular and can be likened to a "Word Processor" for pictures and sound. They can provide very high productivity but of course time has to be taken to transfer the original material onto the disc in real time before editing can start, and the quality of the pictures is as yet not suitable for broadcast purposes.

As bit-rate reduction techniques improve, it may be possible in the future for such systems to provide broadcast-quality performance. This would enable last-minute editing to take place — almost on air — and could be very attractive for News applications.

Future developments

Wide-screen recording

There is currently a great deal of interest in wide-screen television and this will require suitable recorders. At the present time in Europe there is a strong opinion that existing CCIR 601 sampling will be sufficient for this purpose. If this approach prevails then all the digital component formats will be suitable.

Another school of thought suggests that wide-screen television will require 18 MHz sampling for the luminance channel. If this prevails, then a 10-bit recorder sampled at 13.5 MHz can be adapted to record 8-bit data sampled at 18 MHz.

The use of *extended PAL* for wide screen television would allow the use of any digital composite recorder.

Wide-screen recording does not therefore provide a great challenge.

HDTV recording formats

The need for HDTV recording has already created a range of formats, with at least three formats in use for the Japanese 1125/60 HDTV standard.

For European standards, BTS supplies an analogue machine based on its earlier "B" format machine and has recently announced a cassette-based digital recorder.

The BBC and others have made recordings on four D1 recorders multiplexed together. Other manufacturers have shown systems using two D1 recorders.

The Panasonic Component digital recorder could in the future be used to record HDTV by incorporating bit-rate reduction techniques.

By the time the requirement is defined, the recording technology will be available to provide a practical and hopefully affordable HDTV recorder.

Dave Bowd
Head of Post Production Systems
TE&PS

625-line/50 Hz Digital Video Formats

Format	Signal System	No of video data bits	Scanning Method	No of data channels	Approx Head/ Tape Speed (m/s)	Tape Type #	Approx Coercivity (Oersteds)	Width (mm)	Thickness (µm)	Max Rec. Time (mins)	Manufacturers
D1	Component	8	Helical	4	35.3	CMO	850	19	16/13	76/94	Sony, BTS
D2	Composite	8	Helical	2	30.4	MP	1500	19	13	208	Ampex, Sony
D3	Composite	8	Helical	2	23.8	MP	1500	12.65	14/11	186/245	Panasonic
DCT_d	Component	8 *	Helical	2	30.5	MP	1500	19	13	187	Ampex
Panasonic	Component	10	Helical	4	23.8	MP	1500	12.65	14/11	93/123	Panasonic
Digital Betacam	Component	10 *	Helical	2	not yet available	MP	1500	12.65	14	124	Sony, BTS

* *Bit-rate Reduced.* # *CMO = Cobalt Modified Oxide, MP = Metal Particle*

TELECOMMUNICATIONS

Part 4 : the Managed Telecommunications Network

Nigel Adams describes the objectives of the planned Managed Telecommunications Network (MTN) and how they will be achieved.

The existing BBC voice and data network evolved rather than was created. The topology of the network, the equipping of the node systems, and the scaling of the leased circuit capacity between the nodes, resulted from a series of ad hoc requirements for additions; each of these was justified at the time as being an absolute operational requirement, or offering a proven business advantage to the BBC.

In each case, the incremental development met the user's requirement in the most cost-effective way for that user. But this led to a plethora of individual circuits and different types of node equipment being used.

While it provides many advantages to the BBC, the existing network suffers from three main problems:

1. Provision Times

The time taken to provide any new connections can be several weeks, and is a source of frustration to users. This delay stems from (i) the necessity of identifying which of the existing systems is the most appropriate to expand for the new connection; (ii) the time taken to provide the required capacity on that system, and (iii) the time taken for new *leased* circuits to be provided. These restrictions of course make it difficult and very costly to provide any short-term or temporary connections.

2. Resilience

This is basically the ability of the network to provide reserve connections at short notice. As the circuits leased from the Public Telecommunications Operators (PTOs) are not available 100% of the time, alternative routes must be available at all times to provide the required cover. A significant amount of additional circuit capacity is thus available in *each* system to provide this resilience — but may not be fully deployed at any given moment.

3. Cost of Connections

The cost of making connections to the system is based on the recovery of the capital cost of providing each individual connection. This often results in inconsistencies because, on any site, the number of connections supported by existing devices is limited, and expanding the system beyond this limit will result in a higher cost to the user. Also, as recovery of the leased circuit costs is currently only resolved to Directorate level, individual users are not aware of the true costs of providing high-speed links; they have no incentive to make better use of circuit capacity by using more efficient applications or lower link speeds.

The MTN Project

The MTN will address these problems by using the latest technology for multiplexing together the variety of voice and data services carried on the network, in a strategically-planned total solution.

By using a single network for all types of connection, the circuit capacity which is tied up in each existing system — for its own network management and to provide resilience — will be released into a pool which can then be used to benefit all users. The capacity released will allow new connections to be made without delay and, as the network will be able to re-route connections in less than one second, the capacity for individual reserve links will therefore be more effectively used by sharing it across all the network links which require resilience.

One of the key attributes of the new network is single-point management of all the network elements. This has two main functions:

1. Operational or Short Term Management

A managed network would allow fault monitoring and reporting, both for the equipment used within the network and the digital links connecting the network points (nodes) together. With appropriate resources, connections between any two points within the network could be made at very short notice, the action of providing the connection taking only minutes.

2. Strategic or Long Term Management

Over a period of time, the requirements for circuit capacity and its usage can be monitored, and circuits can be ordered or ceased as the business requirements of the Corporation change. Line and equipment faults, and times taken to repair, can also be monitored to ensure that user requirements are being met, and that maintainers and providers of plant and circuits are operating within agreed limits of repair and provision.

These management functions would ideally be provided by a network of equipment from a single manufacturer. However, investment in the existing BBC network is considerable and it would be unreasonable to change all of this plant overnight. The MTN therefore must also provide for the operational management of external devices, drawn from the existing network. To make such a system workable, the number of these external device types must be limited.

The plan is to provide main nodal equipment and any future requirements by using the MTN family of multiplexing equipment. The existing base of external equipment will be rationalised to four types which can readily be integrated into the MTN to provide single-point management.

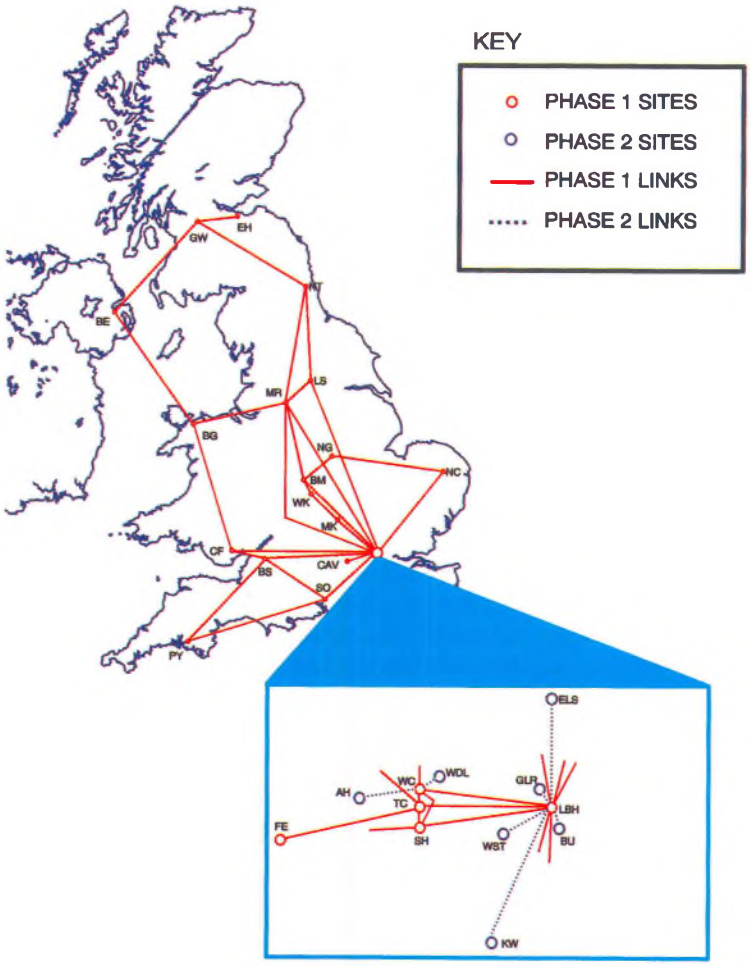
The MTN will also exploit recent technological advances to enable full integration of control line traffic including the control lines between LBH and TVC. The MTN will enable the single-point billing of users, linked directly to the costs incurred and the level of service agreed, along with a single "help desk" function for fault reporting and circuit provision.

The MTN project will be implemented in two main phases as shown in Figure 1:

Phase 1 will provide multiplexing equipment for a core network to cover the main BBC sites which are currently served by the Regional DTN, and to cover the main London centres of Broadcasting House, Television Centre, White City and Sulgrave House. This would allow full management and billing of regional centres and the main sites within London. The network would carry all the control line traffic. The purchase of the network management hardware, software and billing package will also take place in this first phase of the project.

Phase 2 will provide integration of the remaining London sites and rationalisation of the data links and equipment serving them, to enable management of the whole telecommunications network. This process will involve the selective replacement of plant and the integration of non-MTN plant as described above.

MANAGED TELECOMMUNICATIONS NETWORK



Network Management

The network management system (NMS) will consist of two identical workstations with powerful graphics to allow all the information about the state of the network to be presented to the operators. The main workstation will be used for maintenance and operational management of the network. The second workstation will carry the same network information as the main workstation, but will be used primarily for billing and will also act as a reserve in case of failure of the main workstation.

The NMS will be used for all aspects of network management of the MTN equipment, and will "window" in to other network equipment for configuration purposes and fault monitoring.

Billing

The billing system will be integrated with the network management system. Thus, the database of user connections which controls the day-to-day running of the network will also provide the information for sending bills to user departments or business units. It will eliminate any inconsistencies between services provided and billed for, and ensure that the most up-to-date information is available for user enquiries.

The Future

As well as supporting all the existing voice and data Wide Area Network requirements of the BBC, the MTN will provide an ideal and economic platform for the rapidly-growing demand for LAN-to-LAN interconnections, and shared access to new public telecommunications services and value-added networks.

Nigel Adams
Senior Project Engineer, TBS
Tel: Warwick 16804

RECRUITMENT
Joint BBC/CBI Workshop

John Reymond describes the outcome of a joint BBC/CBI Workshop that was held last October.

On Thursday 8th October, 1992, Bill Dennay (D.E.) hosted a half-day Workshop entitled *Recruiting for Quality and Equality* for CBI members in the White City Conference Centre.

The Workshop explored the work undertaken by Engineering & Technical Operations Recruitment (now Selection and Staff Development, Engineering) to introduce an approach to objective, job-specific assessments for use primarily in selection, but which also has implications for the training and development function within Human Resources.

Representatives from Personnel, Management and the Unit were major contributors. They included:-

Mark Waters (Ch. Pers. O. Eng.)
Dave Sandbrook (G.M.Tx.Ops.)
Roy Seymour (H.Eng.Tor)
John Reymond (A.H.Eng.T.O.R.)
Richard Cureton (Consultant)

In setting the scene, it was explained that in discussion with professionals involved in selection, personnel and equal opportunities, there was only one point of agreement — that selection criteria should be based exclusively on the ability to do the job. It was therefore clear that any new recruitment strategy must be based upon a proper assessment of an individual's ability to undertake the work to which they are assigned and that selection criteria must be totally job related if they are to enjoy any real credibility.

The BBC had previously gained considerable experience in the use of "off-the-shelf" psychometric tests when recruiting Trainee Engineer Graduates but was very disappointed in the results since they did not give a clear and unambiguous indication of candidate suitability for specific posts. It seemed that the results arose from the generalistic nature of the tests which inevitably did not focus accurately enough on the actual requirements of the job.

In establishing selection criteria there are two parts. Firstly there has to be a thorough analysis of the work content for each job. This job analysis is then used as a basis for the design of a series of assessment tools. Both the job analysis and the development of assessment tools are central to this new approach.

BBC Transmission was used as a case study to illustrate the work undertaken to put in place objective assessment tests for the selection of recruits. Prior to 1990, assessment centres were used only in the final selection stage during which candidates spent two days at E.T.D. The method proved highly successful in selecting staff with outstanding technical competence, but the question remained: were others with potential, but from less traditional sources, being overlooked at the initial stages?

Detailing the work undertaken on job analysis, it was noted that it focussed on the post-training grade or first-level job. A relatively small proportion (8%) of basic grade engineers and their managers were interviewed using structured interviews. These identified the typical tasks/activities undertaken by this grade and also obtained information on the skills, abilities, qualities, characteristics, etc which were perceived to be important in undertaking such tasks.

From these interviews a questionnaire was developed which was distributed to all engineers and their managers. It consisted of a list of tasks and respondents were asked to give information on how frequently basic grade engineers carried out each task and its importance. They were also asked how serious would be the consequence of an error in undertaking each task. Having identified those tasks which they considered to be the most critical, they were then asked to identify "abilities" required, stating the "level of ability" required for each of these tasks. The most important of the commonly-agreed attributes were then used in the design of the assessment tools for the job.

The assessment procedures aim to separately identify:-

(i) Essential attributes: without these there is insufficient potential to do the job and they cannot realistically be developed by entry training.

(ii) Skills, knowledge and experience: appropriate satisfactory levels are all desirable at the time of recruitment but these areas can, if necessary, be developed by training.

The need was for a first stage assessment — that could be given to all applicants at the initial stage — which would provide a group of candidates to be progressed to a more detailed and rigorous assesment at the second stage. A series of paper and pencil tests was considered to be an objective, cost-effective, and practical solution.

Having developed possible test items, these were then trialled on volunteer groups of students in schools, universities and colleges. On the basis of these trials, certain items were built into the final versions of the tests.

There was a need to ensure that the abilities to be assessed were closely linked with the actual tasks carried out in the job, therefore it was important to establish that the tests did not seek to assess a level of ability greater than the requirements of the job. Evidence of the validity of the tests was obtained

by asking those already in posts to take the tests, then relating their scores to a rating of performance in specific areas of the job.

After the first stage assessment tests had been developed, attention turned to further development of the second stage. There was scope for spending more time assessing smaller groups of candidates, using more specific tests and exercises.

The role of BBC Transmission was then described. It was detailed, from a manager's perspective, why it was vital to ensure that the reservoir from which candidates could be attracted was increased and that those who were successful possessed the mix of abilities necessary for the future. To conclude, it was illustrated how the recruitment strategy described formed an integral part of the BBC's Human Resources Strategy.

For this approach to operate effectively, all those involved — managers, personnel, recruitment specialists, existing staff and where appropriate, their union representatives must be clear about what the organisation is trying to achieve and understand and be committed to the process. Good communications between the parties and feedback on progress at each of the stages described is most important.

It must be stressed that all the work of analysing jobs can be used for a variety of purposes, not just for preparing assessment methods for recruitment. Trainers can focus on the essential requirements for the job and managers can match their existing staff to the required competencies. The balance of skills and abilities required can be clearly defined using a suitably related appraisal scheme derived from this process. It gives considerable structure to and clarification of an individual's development in post.

In many ways the BBC is only at the beginning of this process but, hopefully, it has been helpful to share what has been learned so far.

John F. Reymond
ex A.H.Eng.T.O.R.

NETWORK TELEVISION
Post off-line dubbing

Ian Hare describes the new Post Off-line Dubbing installation at Television Centre.

An important element in all tv drama and documentary programmes is *sound dubbing* or "audio sweetening". It requires an efficient amalgam of the skills and expertise found in the cinema, and the speed of mixing found in tv operations.

Traditionally this role has been achieved mainly by the film dubbing process, where the speed of turn-around of modern sepmags has been the principal *raison-d'etre* for major drama and documentary audio-dubbing. Synchronised audio multi-track tape recorders have offered an alternative but generally slower pace of working, necessarily augmented by hard disc audio recorders to provide a greater flexibility in operation.

Both these styles of audio production have been superceded by the new Post Off-line Dubbing installation in Stage V at TVC, abbreviated to "POD". It is a complete system based around the use of three elements.

1. Edit Decision List
This uses a software program called *Cuedos* to provide a list of edit in and out points for both picture and sound. The mechanical aspects of programme editing are much simplified using the list, thus allowing more time to achieve the style and pace needed to reflect the director's brief.

2. Magneto Optical Disks
These re-usable disks store the audio associated with the programme, offering a common format through the various stages of the sweetening process. Up until the last minute, changes can readily be made to the programme at any point in its flow through the operation. This is an extremely desirable attribute in the case of programmes such as topical documentaries.

3. Fully-automated Mixing Desk
This, combined with skilled operational staff, enables a great increase in productivity to be achieved.

In practical terms there are three principal areas to the new Post Off-line Dubbing facility: **PECA** (PSC Editing & Conforming Area — see *Eng Inf* No 35) where the conformed audio is first recorded on to magneto-optical disks; the **SPA** (Sound Preparation Area) where non-sync audio is added and further track conforming and problem solving is done; and lastly, the main area — **TC "R"** — where a relaxed working environment has been created for directors to see their programme zip through at speed — the mixing decisions being taken quickly and efficiently with minimum distraction.

The Equipment
The principal feature in TC "R" is an AMS fully-automated multilayer Logic 2 mixing desk, with Spectra colour screen. A touch-screen vdu on the desk provides a number of functions:

- ☐ routeing digital audio on the occasions when outboard audio is needed
- ☐ switching video
- ☐ accessing a CD jukebox

...continued from previous page

- ☐ invoking a powerful user-friendly CD library search programme called Fast FX.

Constant further development of the AMS software will in due course bring important new features into the Logic 2 desk.

Another prominent feature in TC "R" is an overhead Sony video projector with 1.5m wallscreen, while a Nagra T, a Sony 7030, a CD and a vinyl disc player have been provided for occasional play-in use. Otherwise, the decor is very relaxed, featuring a pair of two-seater sofas and a coffee table.

In SPA, a smaller version of the AMS Logic desk enables all the same elements to be accessed as in TC "R", but in a more utilitarian setting.

An adjacent Apparatus Area contains the AMS 19" equipment racks, and the magneto-optical drives, for both TC "R" and SPA. The area also has a rack of picture sources — including D3, BVW and BVU — controlled by Sony 9-pin and Timeline Microlynx.

A novel feature here is the use of a Quartz 1U 16x16 video matrix to switch digital audio. To do this, special Graham Patten XLR/BNC adaptor-transformers are used to convert the AES signal down to 1 Volt/75Ω source impedance. So digital audio appears on a separate MUSA jackfield. (NB: tests have shown that, in this form, digital audio can be sent around the country using existing equalised video tie-lines, without degradation.)

The whole installation is designed to be operationally flexible, simple to use and elegant in appearance. Our two Project Engineers — Chris Sims and Alan Riley — have brought different skills together to create an outstanding customer-orientated production centre.

Ian Hare, Project Manager
Post Production Systems
TE&PS

Mark Law

Automated mixing in TC "R"

Printed by WOOD NORTON