ENG INF

INTEGRATION OF D & E D NOW COMPLETE

In early June, Design Group and its support services moved from Western House in Central London to Avenue House in West London – thereby completing the integration of the former Designs and Equipment Departments.

This edition of 'Eng Inf' carries a six page special feature on Design and Equipment Department, starting on page 8.

RESEARCH AGREEMENT ON DIGITAL AUDIO EDITING

Dr Bruce Moffat, HRD, recently signed a co-operative agreement with Real World Research (RWR), of Bath, which covers the development of hardware and software for the newly launched RWR 'Tablet' random

The front entrance to Avenue House

access, digital, audio editor.

The agreement will consolidate on RD's expertise in random access audio editing techniques for broadcast applications, first publicly demonstrated at IBC 84. Said Dr. Moffat: "...it will pull our research ideas through into a product range which I believe will be attractive to broadcasters and recording studios, as they develop digital systems."

Six RWR 'Tablet' editors have already been ordered by BBC Radio for delivery, from Syco, to BH and Maida Vale studios during July and August. The new editors - one more step towards the all-digital radio studio - will be used across the whole range of radio programmes and, says Simon Shute, General Manager, Operations and Engineering, Radio, "...come closer to our vision of what ought to be achieved than anything else we have seen".

An enhanced version of the editor, hopefully showing some of the results of the agreement, will be demonstrated by the BBC at IBC 88.

Dr Moffat signs the agreement with Carl Schofield of RWR, watched by Simon Shute (G.M.Ops&Eng.R), David Meares (RD) and Stephen Paine, MD of RWR's distribution company, Syco Systems Ltd.

LICENCE AGREEMENTS

Three licences have been granted to different companies since our last issue:

Digi-Tel Systems (UK) Ltd, of London, has been granted the second licence to manufacture the Festival modification kit for Rank Cintel Mk III telecines. The first licence for the kit, which includes a superior burn and shading corrector, and a new head amplifier, was awarded to Digi-Grade Systems Ltd, of Farningham, and was reported in 'Eng Inf' No 30, last autumn.

A set of four units which together make up a TFM Modem, operating on 2048 kbit/sec digital signals, has been licensed to Continental Microwave Ltd, of Luton. They plan to package the equipment in a slim-line bay-mounting rack, which will incorporate the BBC-designed TFM Coder (CD2/40), Modulator (MD4/8), Demodulator (DM4/10) and Decoder (CD3/56) in a single unit.

Finally, a patent licence has been granted to Oxley Developments Co. Ltd, of Ulverston, Cumbria, for BBC British Patent No. 2 156 178. This document embodies the work carried out by Research Department on the design parameters and implementation of an Optical Switching Matrix. Oxley, who are well known for their wide range of electronic components, plans to use the BBC's research as a basis to develop a commercial optical switch module.

For further details of these and other licence agreements, please contact the D&ED Liaison Engineer, Peter Jefferson, on Avenue House 375.

'What a stupid way to fit a bird bath'.
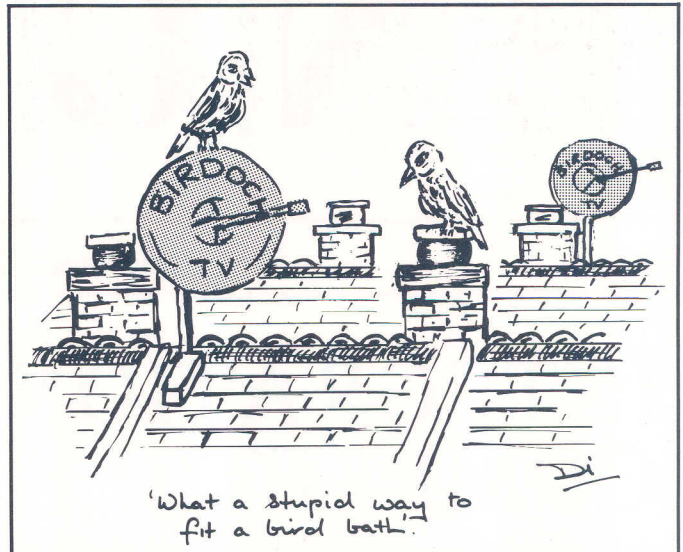
TRANSMITTER NEWS

The following stations have opened since 1 April:

Television

Birchover	Matlock, Derbyshire
Bradford West	Bradford, W. Yorkshire
Brockwell	Chesterfield, Derbyshire
Coed Derw	Betws-y-Coed, Snowdonia
Minnigaff	Newton Stewart, Galloway
Overstrand	Cromer, Norfolk
Whitaside	Richmond, N.Yorkshire

FM Radio

Ridge Hill, in Herefordshire, originally entered service in late March but had to close down shortly after due to a technical problem. The station re-opened on 30 June and the Hereford relay (which it replaces) closed down on 15 July.

THE IEE/BBC FARADAY LECTURES
.... *Where to see the BBC's Presentation:*

	1988			1989	
12 Oct	Liverpool	Philharmonic Hall	19 Jan	Belfast	Sir Wm. Whitla Hall
19 Oct	Newcastle	City Hall	26 Jan	Dublin	Nat. Concert Hall
3 Nov	Harrogate	Conference Centre	31 Jan	London	Barbican Hall
10 Nov	Birmingham	Town Hall	1 Feb	London	Barbican Hall
15 Nov	Cardiff	St. David's Hall	2 Feb	London	Barbican Hall
23 Nov	Manchester	Free Trade Hall	8 Feb	Exeter	Univ. Great Hall
29 Nov	Glasgow	Scot. Exhib. Centre	22 Feb	Bristol	Colston Hall
1 Dec	Edinburgh	Usher Hall	1 Mar	Sheffield	City Hall
13 Dec	Norwich	Univ. of E Anglia	8 Mar	Derby	Assembly Room
			15 Mar	Southampton	Guildhall

SOME CURRENT VT RECORDING FORMATS

Several VT Recording formats are currently in use and the following brief notes, describing their main features, may be of interest to readers of 'Eng Inf':

1" C

Uses 1" wide, 26 micrometre (um) thick, 650 Oersted (Oe), cobalt-doped gamma ferric oxide tape, loaded on open reels having nominal durations of 30', 60', 90', 120' and 180'.

(Note most BBC 1" C VTRs can only cope with up to 90' duration.)

An FM signal, modulated by the composite video, is recorded at a slight angle along the tape with one head on a rotating drum. The helical transport of tape round the drum results in an average of $312\frac{1}{2}$ lines being recorded by the head, during one drum rotation. Approximately 10 lines of the vertical interval are lost as the head crosses from one edge of the tape to the other. The missing blanking is re-generated in the timebase corrector (tbc).

Modulation and format standards are 625 and 525 lines and the video bandwidth is up to 5 MHz.

Colour processing standards are PAL, SECAM, NTSC and PAL M.

It has four longitudinal audio tracks, one of which is normally used for timecode (track 3). Some machines are not equipped with track 4, which is used mainly during editing and occasionally to carry a mono mix when tracks 1 & 2 are stereo. A servo control track is also recorded.

D1

Uses 19mm ($\frac{3}{4}$") wide, 16/13um thick, 850 Oe, cobalt-doped gamma ferric oxide tape, loaded into three sizes of cassettes having nominal durations of 11', 34' and 76' (94' using 13um tape).

(Note that the SONY DVR 1000 cannot handle the small-sized cassette).

Records the video and audio in digital form, using multiple head segmented helical techniques. The video signal is digitised and processed in component form, ie luminance component Y and the two colour difference components U & V. The resulting data is recorded in four parallel bit streams and is subjected to shuffling and error correction strategies to eliminate catastrophic failure in the presence of dropouts or loss of one of the data channels.

A D1 cassette recorder

Sampling rates (CCIR Rec 601) with 8 bit resolution are 13.5 MHz for the Y signal, resulting in a bandwidth of up to 5.5 MHz. U and V are each sampled at 6.75 MHz giving bandwidths of up to 2.75 MHz.

Use of D1 as a recorder for signals originating in composite form involves decoding and because the U & V components are band-limited by the PAL system, the capacity of the U & V channels is under-utilised.

Switchable format standards are 525 and 625 lines.

It has four digital audio tracks recorded **Continued on next page**

in four blocks at the centre of the video track segments. Audio is sampled at 48 kHz, 15 or 20 bit resolution, and each audio signal can be edited separately. It also has longitudinal analogue tracks for a low quality audio guide, timecode, and servo control.

D2
(available in PAL: 1989)

Uses 19mm wide, 13um thick, 1500 Oe, metal particle tape, loaded into three sizes of cassettes of identical mechanical construction to D1 but having nominal durations of 32', 94' and 208'.

(Note that the SONY DVR 10 cannot handle the large-sized cassette).

Records the video and audio in digital form using multiple head segmented helical techniques. The video signal is digitised and processed in composite form and, at normal play speeds, is not transcoded or degraded.

The resulting data is recorded in two parallel bit streams and is subjected to shuffling and error correction strategies to eliminate catastrophic failure in the presence of dropouts or loss of one of the data channels.

The additional recording time compared to D1 is possible due to there being less data to record, by achieving a greater packing density using metal particle tape and by azimuth recording which eliminates the guard band between tracks.

The 4 x fsc sampling rate, with 8 bit resolution, results in a video bandwidth of up to 7.5 MHz.

Different machines are required for 525 and 625 line operation.

It has four digital audio tracks recorded in two pairs of blocks at each end of the video track segments. Audio is sampled at 48 kHz, 16 or 20 bit resolution, and each audio signal can be separately edited. It also has longitudinal analogue tracks for a low quality audio guide, timecode and servo control.

BETACAM

Uses ½" wide, 19um thick, 650 Oe, cobalt-doped gamma ferric oxide tape, loaded into a cassette of similar size to Betamax. It has durations of 20' and 30', the latter using thinner tape.

Records the video on two pairs of rotating heads, 180 degrees apart, in analogue component form using two FM signals. One is modulated by the luminance signal and the other modulated by the colour difference signals - these being time compressed on the tape and returned to normal in the tbc. The helical transport of tape round the drum results in an average of $312\frac{1}{2}$ lines being recorded by each pair of heads, during half one drum rotation.

The bandwidths of Y, U and V are limited and do not match the expectations of the PAL system when so coded.

Use of Betacam as a recorder for signals originating in composite form involves decoding to Y, U and V.

It has two longitudinal analogue audio tracks, employing Dolby C, plus timecode and control tracks.

BETACAM SP

Uses ½" wide, 13um thick, 1500 Oe, metal particle tape, loaded into two sizes of cassettes - the smallest being of similar size to Betamax. The small cassette has a duration of 30' and the large size (similar to U-Matic, only thinner) has durations of up to 90'.

(Note the portable machines only handle the small cassette).

Records the video on two pairs of rotating heads, 180 degrees apart, in analogue component form using two FM signals.
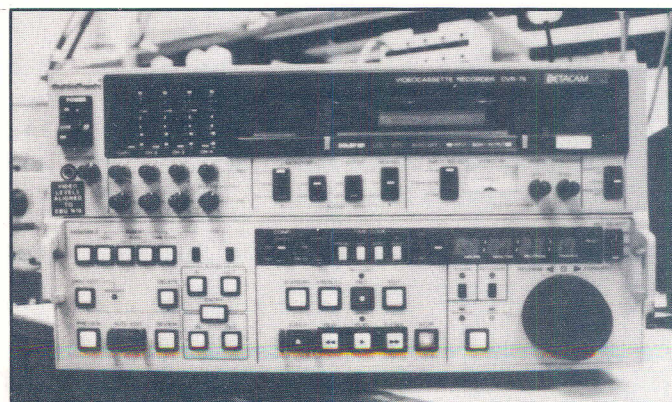
A Betacam SP cassette recorder

One is modulated by the luminance signal and the other modulated by the colour difference signals, these being time compressed on the tape and returned to normal in the tbc.

The helical transport of tape round the drum results in an average of 312½ lines being recorded by each pair of heads, during half one drum rotation.

The Y bandwidth is adequate for the PAL system when so coded. However, the analogue time compression circuitry for U and V is currently bandwidth-limited and will remain so until replaced by digital circuitry later this year.

Use of Betacam SP as a recorder for signals originating in composite form involves decoding to Y, U and V.

It has two longitudinal analogue audio tracks, employing optional Dolby C, plus timecode and control tracks. It also has two additional audio tracks which frequency modulate additional carriers, multiplexed with the U/V video FM signal.

A future option will allow two digital audio tracks to be recorded at the end of the video tracks, instead of one of the longitudinal audio tracks.

Betacam SP machines automatically switch to the Betacam standard, when a ferric oxide cassette is inserted.

M II

Uses ½" wide, 13um thick, 1500 Oe, metal particle tape, loaded into two sizes of cassettes - the largest being of similar size to VHS. The small cassette has a duration of 20' and the large size has durations of up to 90'.

(Note the portable machines only handle the small cassette).

Records the video on two pairs of rotating heads, 180 degrees apart, in analogue component form using two FM signals. One is modulated by the luminance signal and the other modulated by the colour difference signals, these being time compressed on the tape and returned to normal in the tbc. The helical transport of tape round the drum results in an average of 312½ lines being recorded by each pair of heads, during half one drum rotation.

The Y, U and V bandwidths are adequate for the PAL system when so coded.

Use of M II as a recorder for signals originating in composite form involves decoding to Y, U and V. The decoder used in M II machines uses an adaptive digital comb filter.
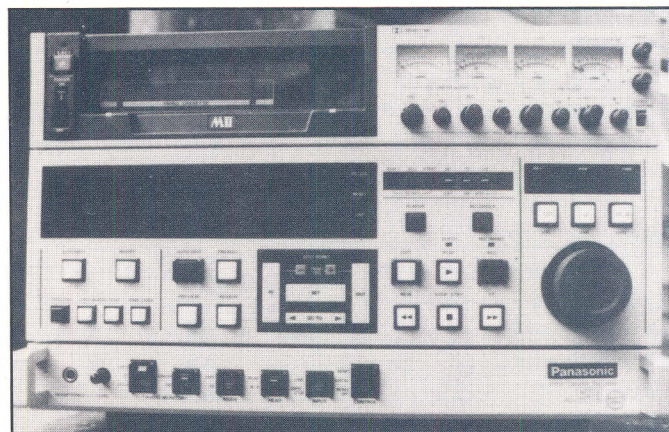
An M II cassette machine

It has two longitudinal analogue audio tracks, employing optional Dolby C, plus timecode and control tracks. It also has two additional audio tracks which frequency modulate additional carriers, multiplexed with the U/V video FM signal.

A future option will allow two digital audio tracks to be recorded at the end of the video tracks instead of one of the longitudinal audio tracks.

Don Kershaw
H.Rec. Eng. Tel., Television Centre

A BBC presentation, to the Press, has been arranged for 20 Sept at the QEII Conference Centre, in Westminster, to launch the Radio Data System (RDS).

The chairman, Duke Hussey, already a keen user of RDS, will speak at the event along with Johnny Beerling, the RDS Steering Group Chairman, and various personalities from BBC Radio. On display will be the RDS Exhibition Model, two of which are currently being constructed.

RDS will then go on show to the public at the BBC Radio Show, produced by BBC Enterprises, at Earls Court from 1-9 October.

CAD DEVELOPMENTS IN THE BBC

With the ever-increasing demands for effective resource management, technology is often asked to provide radical solutions to a complex set of problems. Computer Aided Design (CAD) presents us with a potentially powerful tool to work with. The applications have mainly been in engineering disciplines but a plethora of other uses, as diverse as carpet and landscape gardening design, can now be done with the aid of CAD. In fact the number of uses is only limited by one's imagination and grows daily.

What is CAD?

As the name suggests, the heart of a CAD system is a computer. Coupled with this is a graphics screen and a mouse (a sort of electronic pencil). This is the essential core of the system while peripheral equipment includes plotters, printers, digitising tablets, etc. There is no real need to be a computer expert but an appreciation of what is happening does help. Most systems understand English-type commands and are quite helpful in suggesting what to do, if the user gets into difficulties.

The advantages of CAD over conventional drawing methods are immediately apparent by the ease in which parts of a drawing can be moved, stretched, viewed from different angles, magnified, etc. Most types of design drawing are made up from standard parts, be it girders for an office block or transistors for a radio. These standard parts can be placed on a drawing in seconds, thus saving a lot of time, money and effort.
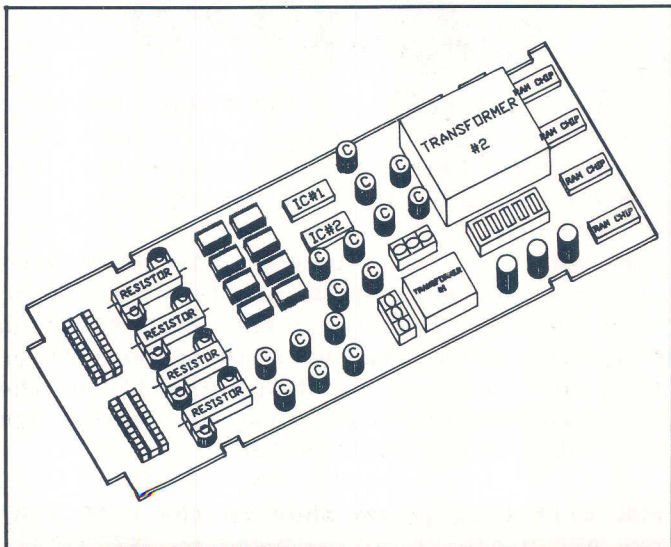
Planning a pcb layout

Why use CAD?

Although CAD is not the universal panacea, it can offer significant advantages over conventional work practices. In some cases, this may allow operational savings to be made while, in other cases, increases in productivity and accuracy. The usefulness of CAD may be judged by its ability to serve many disciplines while sharing common resources. Naturally, the benefit of such a system must be considered with respect to financial and staffing implications. The cost of introducing CAD is difficult to justify, solely on the basis of drawing office savings; a recent survey by UMIST showed that ten companies had attempted to do this and all ten had failed.

However, the case for using CAD was justified through hitherto unforeseen savings. Clearly it is important to have a defined goal at the outset to ensure that the correct problem is solved. This will then show all the potential benefits and areas where savings may be made.

Could we use CAD?

Terms such as CAE, CAD, CAM, CIM, & AMT (Computer Aided/Integrated, Engineering/ Design/Manufacture & Advanced Manufact- uring Technology) all attempt to express the relationship between new technology and the manufacturing industry. CAD offers a system which allows a designer to express ideas more easily by automating some of the conventional stages of the design process. As an example, it is now possible for a designer to draw a circuit diagram of say an amplifier, simulate its performance characteristics, make all the necessary pcb artwork, create a bill of materials, etc without the specialist help of a draughtsman, tracer or technician.

This may be applied to virtually any process that requires the exchange of information between different people. Whether or not this is cost effective, or required, must be kept in clear view at all times. How well this is achieved is dependent on the ability of those involved to define their requirements accurately.

Where is CAD used?

Two particular examples which illustrate only a small part of the CAD application spectrum are given on the next page. Both systems resulted from the effects of

'Priorities for the Future'. The first example catered for a significant increase in capital project workload with no increases to establishment staffing levels. The second example offered a partial solution to the loss of virtually all drawing office capacity in the department, coupled with the development of new working methods.

The first example is in Building Engineering Services, Radio, where the use of CAD will allow project engineers to design and plan work by making extensive use of symbol libraries and digitised floor plans. It is possible for an engineer to sketch out his design requirements and then pass these to a design draughtsman to calculate electrical and mechanical details.

There are two major benefits; the first is that a common drawing archive is readily accessible so that fewer and less detailed surveys are required. The second benefit is that modifications to existing plant drawings and design changes may be made with relative ease. Taking just these two points, greater accuracy and improved design turn-round time can be achieved. Secondary applications are to be provided to enhance estimating, routine design calculations and a method of archiving drawings for future use.

The introduction of CAD will contribute to the ability of BES Radio to absorb a higher project workload.

Designing Manchester's Studio A

The second example is that of Planning and Installation Department, Television, where project work is now carried out extensively by contract. This means that P&ID Tel no longer has a great demand to produce drawings internally. As a general rule, pre-contract drawings are generated by BBC staff and the extensive range of technical drawings are provided as part of the main contract or by third party drawing bureaux. CAD enables engineers to produce new contract drawings effectively and to a high standard. At a later stage, it also allows them to modify and exchange drawings readily with the contractors where necessary.

Where do we go from here?
As commonly occurs, the selection of a suitable product to fit a variety of complex requirements can be a problem. Fortunately, the improvements in computer technology now allow typical mainframe applications to work well on desktop PCs. This factor, coupled with a widely used American product called Autocad, has provided a near-ideal solution for at least nine different departments in the BBC and is under consideration by several others.

A particular feature of Autocad is its ability to be adapted in order to meet specific needs. At present, much work is concentrated on defining standards to ensure quality and to allow drawings to be exchanged between parties without confusion. It is even possible to send drawings electronically over wide distances allowing installation teams in the field to discuss finer points of detail with the designer back at base. This also opens the door to further possible improvements in the way that resources can be spread further.

Conclusions
The introduction of CAD has far-reaching effects which, if properly managed, can be an extremely valuable asset. It is intended to enhance the human elements of design and innovation by removing some of the hurdles that exist between the customer and the end product.

By its use, we are able to ensure that the wheel is only invented once and that the customers can see for themselves that it will not only be round-shaped but of the desired colour too. CAD has been proved to save time, money, and frustration which is surely worth consideration.

For further information on CAD, contact Miles Hudson, CAE Manager, P&ID Tel, Rm A2050 Woodlands.

SPECIAL FEATURE ON D & E D

Design and Equipment Department (D&ED) offers the BBC a very wide range of essential goods and services. Its organisation into four groups - Design, Support, Purchasing & Supply and Transport - brings together different areas of expertise which combine to offer maximum benefits to the department's customers; one of which is the opportunity to speed up the process of turning a design into a finished product.

In this special feature, we take a brief look at the various services offered by the now fully-amalgamated department.

DESIGN

The department produces designs for electronic equipment which is not obtainable commercially. Projects are chosen by discussion with the department's principal customers - Television, Radio, News and Current Affairs, Regions, External Services and Transmission. To this end, regular liaison meetings are held at a senior level and a wide variety of informal contacts at all levels helps to influence the choices. Ideas for new products come from the customer departments, D&ED itself, Research Department or more likely, a combination of all three sources.

The Design Group comprises four sections - Video, Audio, Radio Frequency and Control.

One of Video Section's most important activities has been the development of digital video equipment based on the Rec 601 4:2:2 standard.

Resulting from this work is the two-channel mixer now installed in News, TC5 and the Electronic Caption Preparation Area at Television Centre. The advantages of using digital techniques in these areas are the lack of degradation due to multiple passes through the mixer and easy interconnection with other digital equipment such as Slide File.

High-quality graphics are further instances of the use of digital techniques, notable examples being the rotating world for BBC1 and the animated logo for BBC2. Digital processing has

The digital video mixer

also been applied to the design of a PAL decoder, which sets a standard for performance and stability against which all other decoders may be judged.

The section has also been responsible for developing, in collaboration with Varian TVT, the two-channel version of sound-in-syncs which will be required to support the broadcasting of stereo sound with television. Work is also being done on a new interval test signal which only occupies one line per field and hence offers more lines for use by Ceefax/Datacast.
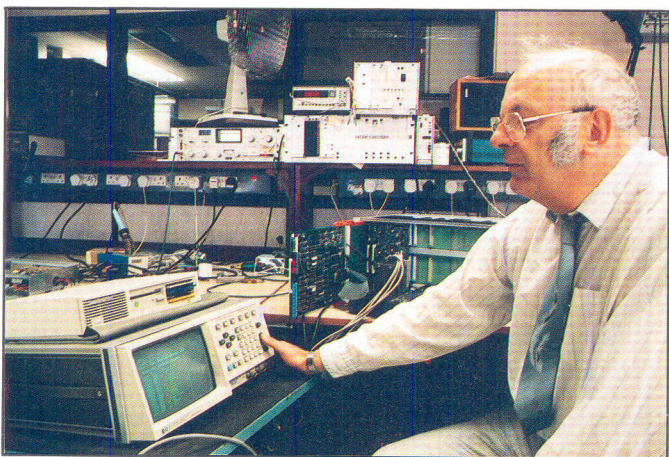
The Mk II Nicam decoder

Audio Section is similarly active in the design of equipment using digital techniques. For transmission, a new lower cost version of the Nicam system is being developed, with the replacement of the 15 year old 13-channel pcm in mind. And for studio applications, a number of units have been designed to allow evaluation of digital audio techniques, based on the AES/EBU serial bit-stream standard for a stereo pair of signals.

A trial system recently installed in Broadcasting House allows a bit-stream from the Digital Control Vehicle at an OB to be routed via a continuity suite to the digital distribution network, without conversion to analogue audio. The system involves conversion from Nicam to AES/EBU, mixing with the announcements in the continuity, limiting of the digital signal and re-conversion to Nicam. The problem of the cost of digital processing is also being tackled by the design of Large Scale Integrated (LSI) circuits, specifically for these applications.

Another major project undertaken by Audio Section is the design of equipment for the

Radio Data System. The two principal areas of design work are the software for the computer which generates the data in Broadcasting House and the equipment installed at each transmitter which assembles the data from incoming and local sources and modulates it on to the 57 kHz subcarrier.

Radio Frequency Section's principal products are receivers and low-power transmitters for both broadcast services and point-to-point links. The section designed the 2W uhf television transposer and the low-power (up to 2kW) vhf-fm transmitters which are currently being installed in large numbers. Other recent products include a high-quality television receiver for use at rebroadcast transmitting stations and a high-quality demodulator for transmitter measurements.

Another important area of work is the design of new radio links which accord with the frequency allocations recommended by the Merriman Report. A link designed to carry one high-quality music channel, operating at 141, 213 or 224 MHz, has just been completed. Digital techniques have also had their impact on RF Section and modulators have been designed to carry digital audio bit-streams in the minimum possible bandwidth.
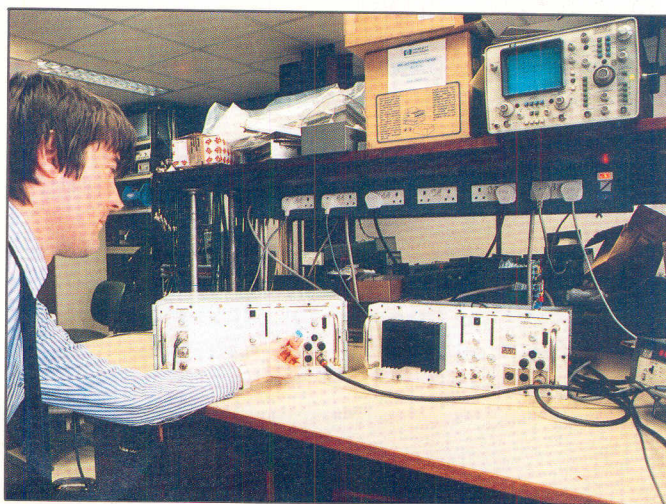
The high quality music link

Control Section specialises in control systems for a wide variety of applications in broadcast engineering. In the past, the section has been responsible for the design of equipment for the transmitter Monitoring & Information Centres and for the system used for subtitling television programmes for the deaf. It was also responsible for the equipment used to control the presentation of wide screen **Continued on next page**

General view of Control Section lab.

format films and this is being enhanced to allow zoom effects as well as the existing panning of the scanned area.

Current work includes the control of External Broadcasting's HF transmitting stations. This is a very substantial project, characterised by having a large software content in the design.

More use is being made of computers in the design process both for the development of software and for circuit analysis and simulation. Design Group's central computing facility of three VAX mini-computers is networked around the design offices and laboratories so that engineers have access through local terminals.

Printed circuit boards are designed by a separate unit which is equipped with three Racal Cadets, one Racal Redboard and two Cadnetix work stations. All these machines are capable of producing accurate, high-density designs and the Cadnetix can route the interconnections automatically.
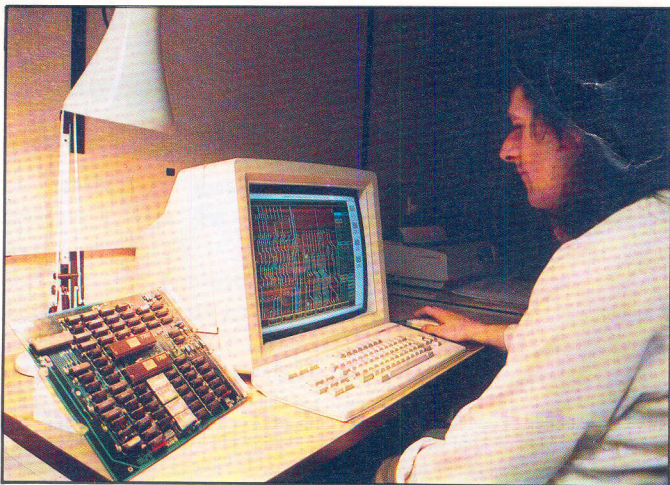
A Cadnetix work station

The Cadnetix also has the ability to accept the information in the form of circuit diagrams rather than lists of components and interconnections. The output of these machines is transferred by magnetic tape to the department's photo-plotter, thus ensuring an extremely high standard of accuracy.

PROTOTYPE WORK

It is normal as part of a design to make one or two prototype models. This work is carried out by Prototype Services whose range of facilities include: mechanical prototyping, wiring prototyping, coilwinding, silk screen printing, engraving, paint spraying, photographic work, etc.


The CNC mill

Computer-controlled machinery is now being used advantageously to produce prototypes and small-quantity work. For example, while it is often not practical to punch aluminium extrusion, the CNC mill can produce intricate shapes without the need for special tooling. Programs are stored on disc and this is particularly useful when modifications are required. Only the change requires re-programming - the machine will reproduce the rest of the job without extra technician effort and is thus more economical.

PRODUCTION

The drawing office is involved with the design process throughout but primarily, it provides draughting services to Design and Support Groups, with increasing use being made of Computer Aided Draughting. The Autocad and Cadkey systems are available and provision also exists to link into the Design Group Cadnetix system. Once drawings are available, the
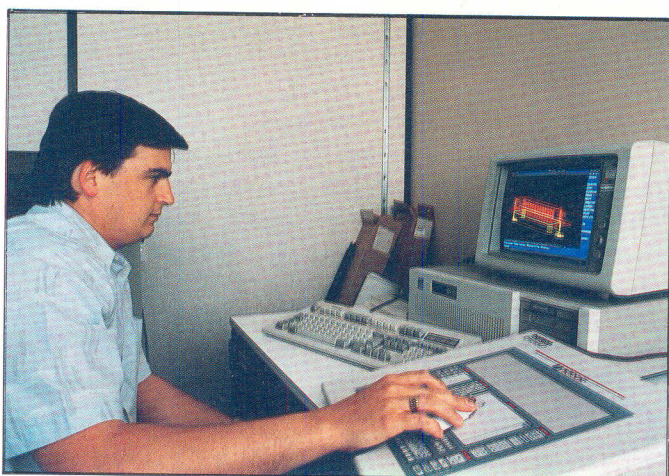
The Autocad workstation

Contracts Manager arranges for his section to have the equipment made against a firm order on the department. A contract is placed with an approved contractor following a competitive tender.

The Support Laboratory provides technical support to contractors who are supplying BBC-designed equipment on a 'make and test' basis. In some cases, testing is done within the laboratory (for example, newly-made prototype equipment).
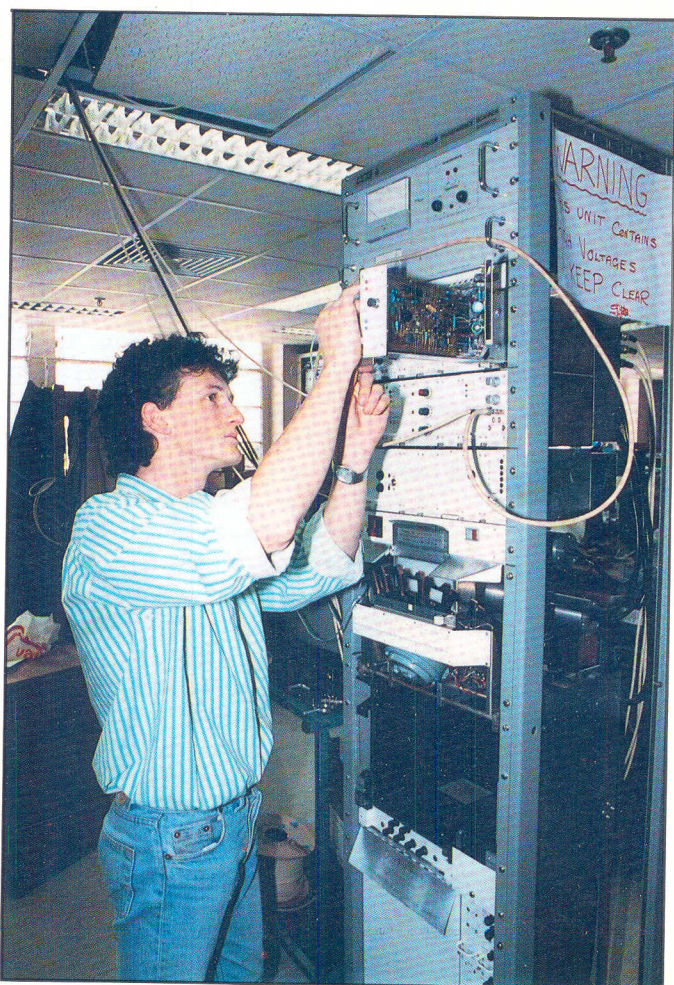
Slide scanner refurbishment

The laboratory also operates an urgent repair service for equipment, including most types of microphones, and carries out investigations on equipment, components and materials. All of these facilities are available to departments throughout the BBC.

Testing RDS equipment

CONSULTANCY

The department sees consultancy as an important part of the service it offers to its customers. As a result of the expertise gathered by Design Group during its normal work, it is in a good position to advise on the technical aspects of projects with which it may not be directly involved. Recent examples of consultancy include: investigations relating to the planning of the fifth uhf television channel; problems of multiple generations of PAL coding; improvements to commercial RT systems; authorship of the Vetters Guide to the safety of equipment and, evaluation of commercial equipment of all kinds.

As a separate activity, Design Group advises BBC Enterprises on projects which have an engineering content. Thus it was closely involved with the BBC Microcomputer and its successors, with the Domesday Project and more recently, the launch of the Datacast Service. It is also involved with the medical downloading experiment which was announced recently.

Standards Section provides information supporting the purchase and use of a rationalised range of engineering components and materials throughout the BBC - now including active devices. (More information on the section's semiconductor

service is given on page 18). The section also represents the BBC in technical negotiations with suppliers and customers and participates in British and European standards activities.

Where possible, Support Group licenses equipment designs. The Liaison Engineer is responsible for negotiating licence agreements with manufacturers to enable them to sell BBC-designed equipment on the open market. Licences are normally agreed on the basis of an up-front payment plus royalties and results in a useful income for the BBC.

Design Information sheets are published, giving details of designs available for licence, and Open Days are held annually in the autumn, normally coinciding with the EsIC conference.

INSTALLATION

A team of skilled Wiremen/Mechanics is available to undertake installation work throughout the country and abroad - strictly in accordance with BBC standards and practice. The team comprises a mix of BBC and contract staff, a common method of working being to have BBC supervisors and staff in charge of the contractors.

PURCHASING AND SUPPLY

It is almost certain that every person who reads this article will have at least one item that has been procured and supplied by one of the two stores under the department's control and direction - Avenue House and Ware. These two stores are an integral part of the Corporation and between them they provide a comprehensive supply service throughout

The Purchasing & Supply Group office

the United Kingdom - via the now famous 'Wells Fargo' trunker vehicles operated by Transport Group.

Behind the two stores there is a tremendous amount of professional purchasing and stock control expertise, which is required to meet the needs of customer departments. Purchasing and Supply group ensures that whether a contract is for a year's supply of toilet rolls or for high tech cable used to carry programmes, the BBC gets the highest possible quality for the very best discounted price.

The Engineering Store (Avenue House) is primarily 'strategic' in that it supplies most of the 'bits and pieces' that are essential to broadcasting. The store at Ware, on the other hand, services the broader needs of the BBC. Examples of its stock include coffee, Malvern water, diaries, scribbling pads, chairs and tables - all essential to the infra-structure of the BBC.

Both stores publish a priced catalogue every six months and extensively use computers to control stock. Both are cost-recovered operations; in other words they stand or fall by the price and quality of the goods they offer and the level of service they provide.

Professional purchasing advice is available to any department in the BBC.

TRANSPORT

While watching tv or listening to the radio, few people think about how big a part transport plays in the production of many programmes. Transport Group, based at Park Western, looks after a fleet of 576 cars, 161 technical vehicles, 6 motor cycles, 67 trailers, 294 commercial vehicles, 368 leased cars and even a couple of milk floats and a bus!

Vehicles are usually bought from UK manufacturers but occasionally, a foreign manufacturer is used where their vehicle is more specific to our needs.

All vehicles have to be taxed and (if not exempt) MOT'd yearly. This rather large job is organised each month from computer sheets and sometimes, it is no surprise to find the group writing out a cheque for £80,000 for tax discs. As Transport Group at Park Western is responsible for taxing all the vehicles at Bristol,
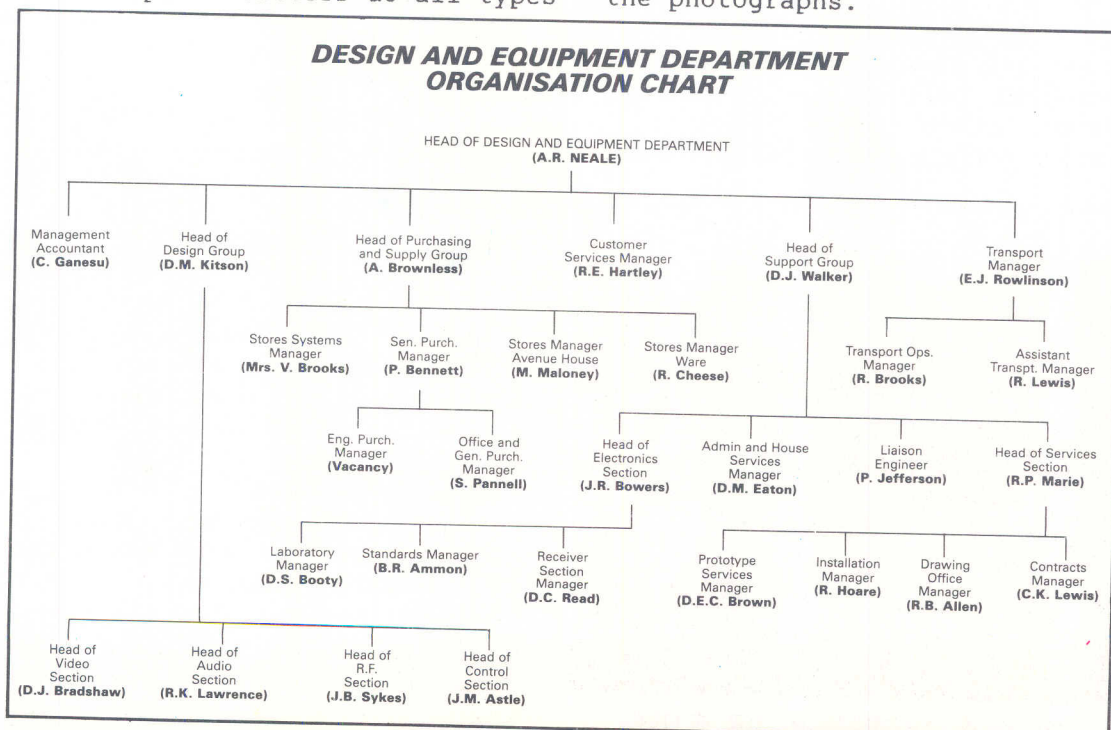
A different type of transmission!

of maintenance on the vehicles. Only in detached locations are the vehicles taken into local garages. Any breakdowns, shattered windscreens, tyre or battery problems are looked after by AA-BRS Rescue.

The vehicles in the fleet have a relatively short life span; the cars are usually replaced between 35-40,000 miles or after 3 years, vans after 5 years or 50,000 miles, trucks after 8 years or 80,000 miles while trailers normally do a 10 year service. Most of the redundant vehicles are disposed of through car auctions.

Birmingham, Cardiff, Manchester, East Kilbride and Northern Ireland, as well as at transmitters (where MOTs are done locally), efficiency and co-operation of local managers is essential to ensure that the regions receive their tax discs on time.

Very careful planning of loads, and routine schedules, ensures that no driver is double booked. The drivers themselves find they do a variety of jobs. They could be working on technical vehicles, at special events like the Royal Wedding or Wimbledon, or simply carrying props and costumes from one location to another. The drivers have a maximum amount of hours they are allowed to work per week which makes good staff planning essential.

At Park Western there is a good-sized garage where capable fitters do all types

Transport is a fully cost-recovered operation. The group has a Wang VS 80 computer where all vehicle data is regularly fed in; any information required on a vehicle in any region can thus be quickly found.

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More detailed information about D&ED can be found in the department's annual report for 1987, which is currently available. Finally, if you have any further queries, please contact the relevant manager shown on the organisation chart below or the Customer Services Manager (Bob Hartley) on Avenue House 240.

Many thanks to the staff of D&ED for their assistance in compiling this feature and to John Flewitt of EID for taking most of the photographs.

DESIGN AND EQUIPMENT DEPARTMENT ORGANISATION CHART

HEAD OF DESIGN AND EQUIPMENT DEPARTMENT
(A.R. NEALE)

Management Accountant **(C. Ganesu)**

Head of Design Group **(D.M. Kitson)**

Head of Purchasing and Supply Group **(A. Brownless)**

Customer Services Manager **(R.E. Hartley)**

Head of Support Group **(D.J. Walker)**

Transport Manager **(E.J. Rowlinson)**

Stores Systems Manager **(Mrs. V. Brooks)**

Sen. Purch. Manager **(P. Bennett)**

Stores Manager Avenue House **(M. Maloney)**

Stores Manager Ware **(R. Cheese)**

Transport Ops. Manager **(R. Brooks)**

Assistant Transpt. Manager **(R. Lewis)**

Eng. Purch. Manager **(Vacancy)**

Office and Gen. Purch. Manager **(S. Pannell)**

Head of Electronics Section **(J.R. Bowers)**

Admin and House Services Manager **(D.M. Eaton)**

Liaison Engineer **(P. Jefferson)**

Head of Services Section **(R.P. Marie)**

Laboratory Manager **(D.S. Booty)**

Standards Manager **(B.R. Ammon)**

Receiver Section Manager **(D.C. Read)**

Prototype Services Manager **(D.E.C. Brown)**

Installation Manager **(R. Hoare)**

Drawing Office Manager **(R.B. Allen)**

Contracts Manager **(C.K. Lewis)**

Head of Video Section **(D.J. Bradshaw)**

Head of Audio Section **(R.K. Lawrence)**

Head of R.F. Section **(J.B. Sykes)**

Head of Control Section **(J.M. Astle)**

NEW FACILITIES FOR SATELLITE MONITORING AT CROWSLEY PARK

Regular monitoring of satellite television broadcasts could begin soon, following the acceptance of a facility provided at Crowsley Park under a contract placed by Transmission Engineering Department.

The system comprises: two 11-metre dishes for C-Band reception; various receivers to cope with different modulation systems; signal-routeing matrices and the necessary computer control. Normal operations will be determined by a 7-day cycle of equipment-setting commands - the 'Event Schedule' - which may have as many as 3600 lines; short notice changes will be handled by manual intervention using a touchscreen fitted to a vdu.

The received signals are routed to the Monitoring Service, at Caversham, on four coaxial cables and eight music circuits. The video cables have been equalised to 10MHz to enable additional sub-carriers, above vision frequencies, to be demodulated at their destination. At Caversham, the signals are distributed via a uhf ring main to the monitoring positions, each with its own receiver/monitor and vcr.

The Dishes

The two dishes provided in this first phase are of proprietary design and fitted with high-speed steering drives - 120 degrees per minute - to enable fast changes of the target satellite with changes of programme commitment. They are fitted to receive an extended C-Band range of frequencies, 3.625 to 4.20 GHz, and meet Intelsat standard 'B' for reception performance in this band.

Future dishes, in Phase Two, will be of similar design but will cover the extended Ku-Band - 10.75 to 12.75 GHz.

The two 11m satellite monitoring dishes

The dishes have been constructed on piled, reinforced concrete bases, set into the southerly slope of a near east-west valley which is bordered to the north by a wood. In this location, the dishes have little impact on the skyline, despite their size.

The intercepted signals are conveyed at C-Band frequencies, on foam-filled Heliax cables, to the receivers in the Main Building, 400 metres away.

The Matrices

Signal routeing, under computer control, is achieved using matrices manufactured by Di-tech Inc. These have the advantage of allowing any channel card to be unplugged from the frame without affecting any other channel and without the need to remove power.

The Control System

The facilities provided are:

1) Continuous monitoring of equipment status
2) Manual control of equipment status
3) Automatic control according to a preset sequence of commands (the 'Event Schedule')
4) Facilities to load an 'Event Schedule' from, or save to, a floppy disk
5) Automatic logging of system actions and responses
6) Facilities to archive the 'Log' to a floppy disk
7) Facilities to produce on-screen or printed reports from the archived 'Log' or, of system alarms
8) On-screen facilities to edit the 'Event Schedule'

This has been achieved by a distributed-processing approach, using an Intel 310 computer to look after the 'real-time'
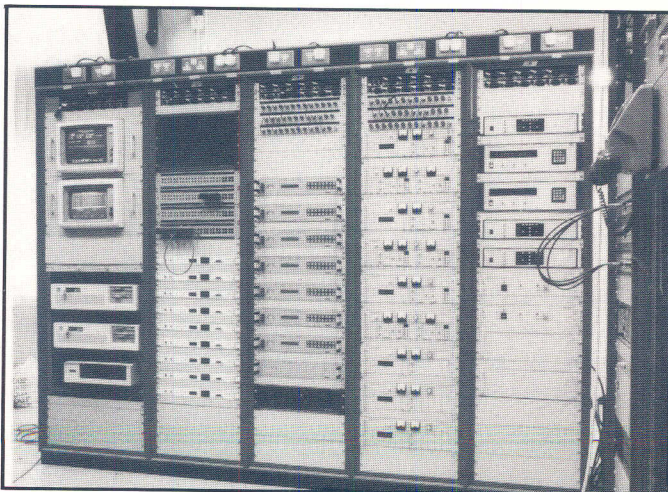
The satellite monitoring receivers
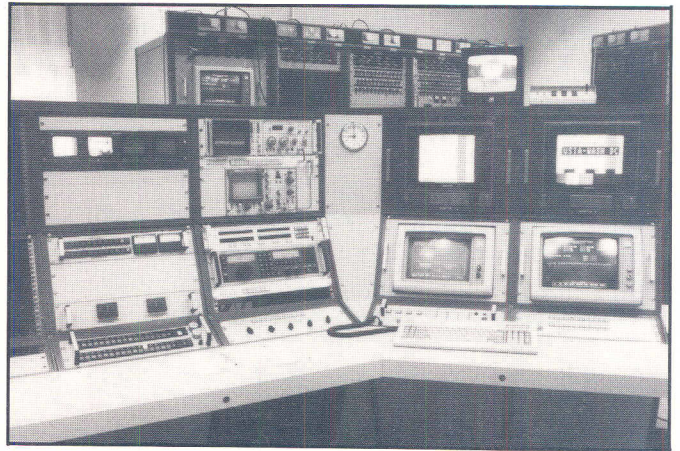
The satellite monitoring control desk

functions and IBM PC-AT based workstations to handle the human interface. Communication between computers is via RS232C data links of programmable speed.

Each workstation is provided with a monochrome vdu, for all text-related actions, and a colour vdu for equipment status indications. This last vdu is fitted with a touchscreen as the input device for manually controlling the equipment settings.

The software for this project was written mainly in 'C' and compiled to run under Intel's iRMX-86 operating system, for the 310 computer, and under PC-DOS with a task-scheduling overlay, for the IBM PC-AT.

Vernon Smith
Sen Eng, Tech Devs, Caversham

NOW YOU CAN MAKE YOUR OWN WIDEBAND FM AERIAL

Nowadays, it is important that an FM receiving aerial should have adequate gain and directivity across the whole of the 87.5 - 108 MHz band.

EID has recently published a leaflet, based on Research Department report RD 1987/13, which describes how to construct a four element yagi with a gain of at least 4.7dB across the band and a front-to-back ratio of 13dB. The half-power beam width is ± 36 degrees.

Copies of the leaflet, called "Make an FM Radio Aerial", are available from EID, Room 711, HWH. Tel: LBH 5040 (or 01-927 5040, if dialling from outside).

ICCA REFURBISHED

The International Control and Commentary Area (ICCA) at Television Centre has been refurbished to provide three new production control rooms (IPCs 1,2 & 3) and to greatly increase the capacity for sound and vision routeing in the International Control Room (ICR).

IPCs 1 & 2

These have each been provided with ten channel Calrec sound mixers while, additionally, IPC1 has a six channel married sound-and-vision mixer and IPC2, a simple vision switcher. All areas have comprehensive communications including eight channel conference systems, talkback, Network intercom and ten channel content monitoring systems.

Vision is monitored from the fifty-six source main routeing matrix - which feeds Croma multi-standard colour monitors in each area plus Tektronix waveform monitors and vectorscopes (PAL & NTSC) in ICR.

Sound is monitored by use of a special Pro-bel 128 source matrix, which can mix up to ten sources to each of the eight destinations.

IPC 3

With IPC 3, the opportunity has been taken to provide a control room which can be used for a variety of different operations:

1) As a switching point for two or more OBs to be fed to Network (eg Cricket/Golf or Racing/Cricket)

2) For gallery-only operations which require access to vt, OBs and computer graphics

3) As a control point for live international transmissions to Network, which may have standby material available and possibly a standby narrator or commentator. The production department will usually have a presence to coordinate the transmission (eg. Eurovision Song Contest, Reefwatch, Urbi et Orbi, etc)

4) As a coordination and monitoring point for large international events (The Olympic Games, World Cup, etc). Even when a studio, normally TC5, has been booked for the duration of the event, there will be certain times when the studio is either unmanned, or rehearsing, and the production staff require access to all communications and monitoring connected with the event.

5) As part of the International Control area, it must also be suitable for sound-mixing of incoming international events and have access to all ICR facilities.

To cover these requirements, IPC3 has been equipped with all the communications and monitoring facilities in IPCs 1&2 plus a twelve channel stereo Amek sound desk. Six lines from CAR, plus direct graphics key-and-fill signals from the TC5 graphics area, feed two BBC effects switchers and a Grass Valley 100 vision mixer.

The control desk in IPC 3

All these facilities, giving effectively a small television studio gallery and an international production control room, are squeezed into a desk which is only three metres wide.

The entire refurbishment was undertaken by P&ID Tel. The normal operation of the International Control Room had to be maintained throughout and this was made possible by close co-operation with the ICR operational staff.

Tim Hardiman, P&ID Tel
Brian Elliot, Duty Man, ICR

NC1 GOES STEREO

Presentation Area E at Television Centre (previously NC2) re-entered service as the Network Control for BBC1 on Monday 9th May. This follows work by P&ID Tel (Central Systems Section) to complete facilities for the handling of stereo programmes. The area now works in the stereo mode with a derived mono signal feeding the transmitter chain.

The new Network Control for BBC 1

At present, only <u>recorded</u> material from VT Transmission Suite 1 can be routed in stereo through Network Control: other sources will become available in late 1988, when the conversion of the CAR routeing system to stereo is completed. (To enable <u>live</u> stereo programmes to be transmitted experimentally from Crystal Palace, a separate stereo sound mixer is currently installed in the Spur.)

While the area was out-of-service, other work included the installation of a VHS recorder to automatically record presentation junctions.

Presentation Area F - the former NC1 - will be out-of-service until the New Year while a similar conversion to stereo takes place. When completed, the area will serve as Network Control for BBC2.

P.Barlow
Duty Manager, Pres Eng I

TRIBUTE TO FRANK WHEELER

Frank Wheeler, OBE, died on March 11. Affectionately known as 'Little Wheeler', Frank retired in 1960 after serving 36 years in the BBC, the last 17 as Superintendent Engineer (Transmitters).

As the first Engineer-in-Charge at the Moorside Edge transmitting station, he caused a stir in Head Office by purchasing 'soft soap' locally rather than ordering it through official channels - typical of his individual approach to matters.

He was very active in the war years, making arrangements for the rapid restoration of transmitter services damaged by enemy action and fighting for job equality when the very first female technical recruits joined the BBC. He wrote in 1943: "Women must be given the same opportunities as male Technical Assistants in learning and doing jobs".

After his retirement, Frank continued to take a keen interest in Corporation affairs. His frequent letters to various Head Office departments were often critical of what he saw as the falling standards of service to the public.

A founder member of the Retired Engineers Luncheon Club (RELICS), Frank delighted in reminiscing with former colleagues. His exceptional memory for detail and his experiences, told with twinkling eyes and obvious enjoyment, will be remembered with great affection.

Ron Johnson, EiC Washford 1963-1977

Frank enjoying his retirement

D & E D's SEMICONDUCTOR SERVICE

Standards Section, in D&ED at Avenue House, has extended its professional guidance for BBC staff to cover active devices as well as passive components.

The expertise required to deal with semiconductor problems has been provided by the appointment of two specialists within the section and the upgrading of facilities and equipment, including access to very powerful database services via packet-switching networks on the public telephone system.

Chris Rivers has recently joined the section as Senior Engineer, Semiconductors. He is available to advise on: developments in semiconductor technology; applications for LSI devices; the availability and effectiveness of various forms of custom devices and the performance of integrated digital devices, including comparisons between so-called 'equivalents'.

Chris is supported by Raj Davda who has particular responsibilities for: analogue devices; discrete programming semiconductors and for surface mount components and techniques. Chris and Raj have available to them databases which include Videolog and Codus.

The American-based Videolog system contains full technical details of all current semiconductor devices and those which have become obsolete within the past 5 years. In addition to the retrieval of technical information and data sheets, the services available include identification of equivalent or alternative devices, supplier and manufacturer details and distributor catalogue information. Provision also exists for automatic ordering of components or data from American sources via an electronic mail system.

The Codus database covers all components approved to CECC and BS 9000 specifications.

'Codus Reliability' is an associated facility which permits calculation of component and system reliability to the models of MIL HDBK 217 E and British Telecom HRD 4. File access is provided to allow users to store and manipulate their models and data.

The section is the approved source of programmed logic devices (PLDs) - such as PROMs and PALs - and uses equipment as authorized by device manufacturers. In addition to providing these devices for BBC purposes, it is also responsible for the registration of all data held on PLDs used in BBC equipment. This provides a legal safeguard to ensure that the ownership of the programme data is retained by the BBC. Approximately 4000 devices are already held in the register archive and the current registration rate is approaching 500 per year.

The registration of programmable devices is carried out under the supervision of Alan Brooks, who also arranges programming of such items.

A major concern within the section remains the rapid solution of customer problems and together, the evaluation of new technology.

A Standards Section engineer has recently completed an investigation into Surface Mount Techniques (SMT). He considers that this emergent technology can be useful to the BBC but warns that adherence to guidelines is essential because the yield of usable assemblies depends upon the whole process being engineered with SMT in mind - ordinary pc design, fabricating and assembly techniques are not appropriate.

Chris Rivers can be contacted by telephone on AH 255, Raj Davda on AH 338 and Alan Brooks on AH 326. All three can be reached via a dedicated enquiry number - AH 206.

Brian Ammon
Standards Manager, D&ED

TWO NEW STUDIOS FOR ETD

Two new studios have recently entered service at the Engineering Training Centre. They are described here by two Training Managers from Woodnorton.

STUDIO C
A STUDIO ON A SHOESTRING

When I was a lad my grandmother would come out with all those home-spun 'truths' such as "you can't make a silk purse out of a sow's ear". With the passing of time I have noted many other such sayings; two in particular often come to mind:

"An engineer can do for a few pence what any ...... fool can do for a pound" and "You can't please everyone all the time". So what has all the wisdom of the ages got to do with an article for 'Eng Inf' - well that brings to mind a well-known phrase about fools rushing in ...

Wood Norton (well-known for those entertaining little breaks away) has for many years struggled by with one badminton hall and one operational television studio, which has had to cope with the many courses that need access to a studio area for operational training.

The pressure on this studio has grown over the years and all manner of green huts and satanic basements have been pressed into service for use as practical areas. This generated a rabbit warren of separate activity, making creative supervision very difficult - but doing wonders for the fitness of training staff rushing around between practicals.

Now, discussing rushing reminds me of where we started and when I got involved in the project: oh yes, a project to duplicate our existing television studio. There wasn't really much left to do - the site had been chosen just north of the existing studio, the building plan had been agreed and the budget line was fixed. In fact, all we had to do was sit back and watch the building be delivered - yes delivered!

One of our requirements was to have as large a building as possible but, as cash was very limited, a very large timber shed was the result.

Those of you who know us well will realize that this will have pleased the local planners, by merging very nicely with our existing studio. For all its obvious acoustic limitations, the area is a very flexible training area. A rolling pantograph system for dual sources provides the lighting rig and the resin studio floor provides an excellent surface for camera operation training. So, given these basic features, we needed to turn the building into a working area.
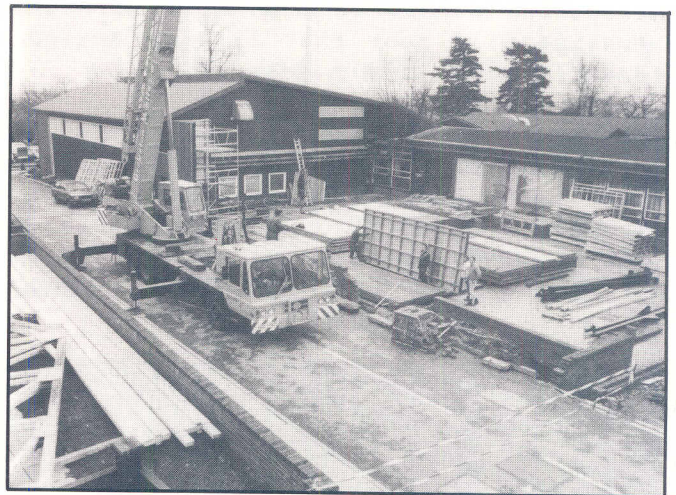
The arrival of Studio C at ETD!

Amazing good will throughout the BBC brought redundant plant, by the lorry load, to augment the various bits of kit decanted from our rabbit warren of areas. Four EMI 2001 cameras came from Aberdeen; these are now in their twentieth year and still providing pictures - most of the time! The sound desk came from a dubbing theatre in Bristol.

Around these items we installed desks, wall boxes and monitor stacks. The object of the exercise was to spend our little pot of money on generating a good basic infrastructure for operational training so that, at introductory level, the relationship between areas and the function of each area is obvious.

The studio was completed in about one year - from site clearance to first programme - and has enabled us to cope with an exceptionally heavy autumn course loading. Now that we have the basic shell, and a good floor, we can improve trimmings as we go along.
Continued on back page

ETD's NEW STUDIOS
Continued from previous page

Obviously, given the various constraints, our studio is not quite a silk purse but neither is it a sow's ear!...

Steve Westlake
Training Manager, Picture Ops Unit, ETD

STUDIO 6

For a long time, one of the most cramped training areas at ETD was the one containing a GP Mk IV sound desk. It was designated Studio 12 and those with long memories will know that it once housed a transistorised Type A desk.

The area of the cubicle was about 15 square metres, which meant that with the desk and a basic complement of two tape machines and two disc players, there was very little room for people. With one lecturer and no more than three students the place was crowded.

Also the studio itself was poor, with a very 'boxy' acoustic and inferior sound insulation so that any external noises penetrated easily. As if that was not enough, the place was often damp!

Recent rearrangement of areas has been possible and the GP desk has been moved into a reconstructed part of the training block known as Avon Wing. Here it sits in a cubicle having a floor area of around 40 square metres. This much greater space not only allows more students to be accommodated at any one time, but it also means that it can function as a conventional training area or lecture room, with projection facilities.

In case anyone is puzzled by the loudspeakers, they are LS5/9s on their sides. When the photograph was taken the LS 5/8s intended for the stands had not yet arrived!

M. Talbot-Smith
Training Manager, Audio Ops Unit, ETD

Studio 6 at ETD