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ENG INF

The Quarterly For BBC Engineering Staff

RADIO - DATA will aid tuning

Mike Buckley, Research Department, checks the operation of the display panel on a prototype radio-data receiver.

Managing Director Radio, Aubrey Singer, recently announced a firm policy of making all services properly audible on vhf by the late 1980s. As well as providing country-wide coverage, it is necessary to help listeners tune to the vhf station and programme that they want; and Research Department has recently unveiled the latest stage in its development of a new experimental system called radio-data. Radio-data could combine with microchip technology in future radio receivers to give a new dimension to radio listening.

In one version of tomorrow's receiver, a small built-in ancillary electronic display would indicate the station to which the receiver was tuned. Another form might use a voice-synthesiser to give the same information. Even portable and car radios could have this facility for little extra cost.

Alternatively, radio-data, combined with electronic intelligence in the form of a microprocessor in the receiver, might completely automate the tuning process. The listener would simply select the desired station or programme and the receiver would automatically search and find it, without the need for the listener to know anything about frequencies or wavelengths. Car radios would retune automatically as they moved from one area to another.

Although primarily intended as a tuning aid, radio-data also has limited capacity to carry other information, such as programme or music titles or sports scores for display on the receiver. The system could even give information about future programmes and the listener could pre-select those he wanted. Whenever a chosen programme was broadcast, the receiver would switch itself on and select the right station.

The key to all this is a data signal which is added to the sound-programme signal at the vhf transmitters. These data signals cannot be heard at all by listeners but suitably equipped future radio-receivers could decode the data and use it to drive the display or control the receiver.

The use of vhf for radio-data is preferred because of the much greater information capacity available there, as well as being in line with the BBC's aim

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In this edition of ENG INF:

All-digital sound mixing desk

A prototype all-digital sound mixing desk has been installed in Broadcasting House for operational assessment. This follows the recent announcement that the BBC intends to place an order for a production version of the desk, which is to be manufactured by Neve Electronics International, of Royston, Herts. When the production version of the desk is delivered in Autumn 1982 it is believed that it will become the world's first comprehensive all-digital sound mixing desk to enter operational service in broadcasting. The desk follows close collaboration between various departments and Neve over the last three years and is another example of co-operation between the BBC and British Industry that has resulted in high technology products that lead the world.

The new 48-channel digital mixing desk can perform all the normal processes such as fading, mixing, filtering or compression. In addition, it can provide real-time delay in every channel and provides comprehensive signal routing.

The channel processor design is based on the work done by engineers at Research Department, who developed COPAS (COmputer for Processing Audio Signals). The powerful architecture of the processor has enabled the production of versatile software which implements all the necessary digital audio functions.

Conventional microprocessors and mini-computers are too slow for audio signal processing applications and a 'bit-slice' technique has been employed in COPAS to overcome this problem. COPAS also uses other techniques to maximise its operating speed. Multiplication is done outside the microprocessor in a single-chip multiplier that operates some 16 times faster than the multiplying function of the microprocessor itself. Another important technique is known as "pipe-lining". This makes it possible to put the next micro instruction into the "pipe-line" while the first is being executed, and this almost halves the cycle time. Together these techniques produce a machine in which 16 separate 'activities' can be programmed into each 56-bit micro instruction, which can be executed in 140 nanoseconds.

Co-operation between the BBC and Neve has extended beyond Research Department's COPAS system, with SCPD and operational user departments contributing to the evolution of the control system. The introduction of the new digital desk will be an important step in the total digital chain from microphone to transmitter.

The production version of the desk will be installed in a digitally equipped Radio Outside Broadcast vehicle to be used on a variety of programme applications. The vehicle will also contain two ¼ inch fixed head digital tape machines, and will have provision for a multitrack machine.

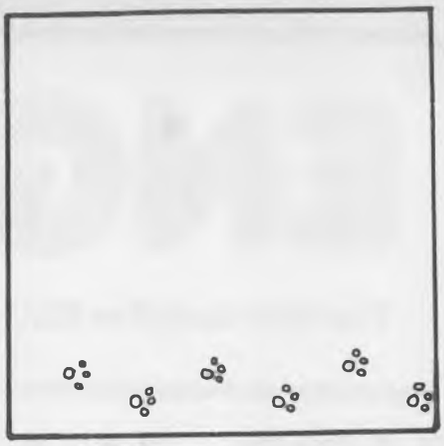
Transmitters Opened

The following uhf tv relay stations have opened since September:
Cilfrew, West Glamorgan
Fishguard, Dyfed
Trefin, Dyfed
Gulval, Cornwall
Millbrook, Hampshire
Plymouth (North Road), Devon
Workington, Cumbria
West Lavington, Wiltshire
Burnham, Norfolk
Wells-next-the-sea, Norfolk
Bushmills, Co. Antrim
Belcoo, Co. Fermanagh
Newtownards, Co. Down
Glynn, Co. Antrim
Fintry, Central Scotland
Strathallan, Tayside
Methven, Tayside
Fetlar, Shetland Isles
Dychliemore, Strathclyde
Braemar, Grampian
Dalmally, Strathclyde
Cane Hill, Surrey
Bishop's Stortford, Hertfordshire
Llanrhaedr-ym-Mochnant
Dollar, Central Scotland
Avening, Gloucestershire

Vhf Radio
Llandyfriog, Dyfed
Lethanhill, Strathclyde
Wenvoe - frequency changed

Local Radio
Radio Clwyd
Radio Lincolnshire - new mf transmitter
Radio London - vhf transmitter at Crystal Palace
Radio Sheffield - now in stereo
Radio Newcastle - new vhf transmitter at Chatton on trade tests
Radio Manchester - goes stereo
Radio West Midlands (Previously Radio Birmingham) - new mf transmitters at Langley and Sedgley Mill

List of Radio and Television Stations 1982
The 1982 edition of the EID Pocket Booklet will be published in February. Staff requiring copies should ring LBH 2921.



Editorial

The increased television licence fee has been announced, and, at £46 for colour, is still good value at less than £1 a week. Although the BBC is disappointed that it was not the full £50, they nevertheless recognise the need for economic stringency at a time of deep recession. The new fee is to last for three years. Provided inflation does not increase beyond the levels anticipated by the Government, existing capital projects should be able to go ahead as planned.

ABOUT 'ENG INF'

Congratulations to our eagle-eyed readers who spotted, amongst other things, the incorrect photo-caption on page 3 of the last edition. To be topical and up-to-date it is necessary to produce the magazine quickly and this means that the time allocated for final checking is often too short. I must apologise, therefore, for the errors that sometimes creep in.

We are always on the lookout for interesting stories, and anyone who would like to help fill the magazine can get in touch with me on LBH 5432. We cannot always guarantee to publish your stories, but we will do our best. The final copy dates for 1982 editions are: 12th March, 11th June, 10th September, 10th December, although the earlier you submit the story, the better.

May I offer my thanks to my secretary Kim, who has brightened the pages of past editions of 'Eng Inf' with her cartoons. Sadly she has moved on to better things, and this has left a space that will be difficult to fill. If there are any budding cartoonists who would like to see their work published, please let me know.

As the time of festivities draws close may I wish all our readers a Merry Christmas and a Happy New Year. Thank you also to our contributors, without whom there would be no 'Eng Inf'.

Alan Lafferty

New Continuity for Radio Scotland

Two new production continuity suites were brought into service in Glasgow for Radio Scotland on 3rd October 1981.

Aubrey Holland, from SCPD, who was the SCPD project leader, says 'The Continuity Studios in Glasgow provide Radio Scotland with both flexible and comprehensive facilities. Their dual role as continuities and production studios saves on capital and revenue costs in a region that is short of studio space. There has been the fullest co-operation with the technical staff at Glasgow, who have been involved at every stage of the planning and installation.'

The studio has an 'Alice' 10-channel desk, feeding into the cubicle desk on which the presenter can fade up discs, tapes, the desk microphones, play either of two tape cartridges or 'opt' in and out of the other networks. In addition there are three record desks.

Each control cubicle has a 12-channel, 2 output Neve sound desk, with a BBC designed 6-channel Mono Mixer, Telephone and Cue Select Panels, Network Switching, 6-channel Response Selection Amplifiers and five compressor limiters. With continuity-type operation there is an extensive requirement for line and telephone facilities, so that outside sources can be routed into the programmes. For this reason, the cubicle has a complex arrangement of lines for routing through the main Glasgow control room. The Network Switching facility allows Radio Scotland to broadcast programmes from one of the main Radio networks, Radio 1/2, 3 or 4, when not transmitting its own programmes. The cubicle is equipped with 4 Studer A80 tape machines and three of the new RP 2/10 record players.

In each announcer's booth, a smaller 8-channel, 'Alice' desk can be used as part of a continuity or separately when the announcer goes live directly into the network.

For communications within the suite and with the outside sources, SCPD has developed a talkback and prehear system using the very latest technology. They have recently installed similar equipment in a single studio continuity area for Radio Ulster in Belfast.

'continued from Page 1'

"RADIO-DATA"

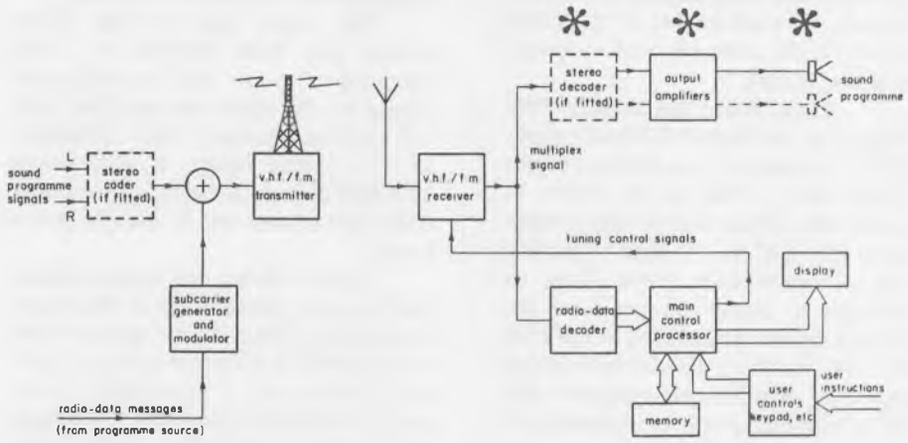
to have all it services on vhf from the late 1980's. Reception on medium and low frequencies has not been forgotten, however, and provision has been made for VHF radio-data to carry information that will enable a suitably-equipped receiver to tune automatically to long and medium wave stations as well.

Research Department began experimental radio-data signal transmission in April this year from three of its VHF FM radio stations in the London area. Transmissions of this kind have actually been going on for almost three years now, but these new experimental signals represent the latest stage in the BBC programme of work on this exciting new development.

In the paper delivered recently to the IERE Conference on Radio Receivers and Associated Systems, the technical details of radio-data were described by Dr. Bob Ely, the Research Engineer who has been concerned with this work since its inception. In a recent Research Department Report (RD 1981/4) Bob gives a description of the experimental signals now on the air. This Report gives a detailed outline specification for a posssible sysem and represents an invitation to British Industry to join in the experiment by building experimental receivers and thereby help to ensure that the BBC signals are a form best suited for the listener and the receiver. The need for receivers to be modest in cost has been considered throughout the work.

Broadcasters in other countries are also carrying out similar experimental transmissions. In particular, Televerket in Sweden and TDF in France have systems that are very similar to the BBC's and under the auspices of the EBU, discussions are taking place to agree a common European system.

"If you know what you'd like to hear and can be there to listen to it, radio-data will do the rest", says Bob.



VHF Radio-data transmission and reception

Jimmy Jewell (right), of SCPD, discusses the Neve 12-channel, 2-output sound desk with Peter Rowe, an engineer in Communications Engineering Services at Glasgow, in the new production continuity control cubicle. The studio can be seen through the window on the right.

WOW its 'SHOW GIRLS'

Some months ago a series of programmes called 'Show Girls' was made. This involved following the progress of two dancers from Britain in various talent competitions, culminating in a finale at the Desert Inn in Las Vegas. This was an 'unrepeatable' performance: the show closed the next day! Unfortunately, a fault had occurred on the Nagra audio tape recorder giving rise to severe wow (approximately 10 per cent speed variations about 3 times a second), rendering the material unusable. The fault did not come to light until after the performance.

Various conventional techniques for speed correction failed, and TFS (Television Film Studios) contacted Research Department. They wondered if anything could be accomplished using digital techniques, possibly by making use of the 50Hz control track normally used to synchronise with film.

Tony Moore and Guy McNally decided to use Research Department's PDP11 computer in an attempt to put things right. This has the ability to accept and replay data at digital audio rates (16 bits at 32 kHz). Fourteen bits of audio were input (from an analogue to digital converter) and the control signal was included as the 15th bit. The facility exists for transferring sequences of audio onto computer disc for subsequent access by conventional (e.g. Fortran) programs.

Initially the speed information had to be extracted from the control signal; this was done by a frequency demodulation process. Knowing the 'instantaneous' speed, the signal was interpolated and re-sampled at points corresponding to equal 'correct-time' intervals. The signal was then fed from the computer to a digital to analog converter using a regular 32 kHz clock and re-recorded on a Nagra recorder.

The processing was quite intricate, involving digital frequency demodulation and correction techniques. A certain amount of guesswork had to be employed initially, mainly in the extent to which the speed information was low-pass filtered: this is because the frequency of the control signal (50Hz) was barely high enough to accommodate the 'bandwidth' of the speed fluctuations. It was also found necessary to make allowances for the distances between the record, replay and control heads on the recorder.

However, the overall exercise was a success, and the material was declared to be eminently broadcastable and the show is due to be transmitted in the near future. The processing was done in 'chunks' of around 3 minutes (as this is the maximum amount a disc file can hold); the total material processed lasted about 15 minutes. As it took about 4 hours of computer time per 'session', the programs were run overnight.

The exercise was very useful, both in vividly demonstrating the power of computer audio processing and in validating certain recent processing algorithms.

TC 2 re-enters service

TC2 Production Control Room

TC2 is a small (320m^2) general purpose television studio which has been out of service since 1969. It has just been completely refurbished and equipped with up-to-date facilities.

The major part of the vision system has been supplied by Link Electronics to a BBC specification. Inputs to the mixer include five Link 125 colour cameras with Schneider 15 : 1 zoom lenses, a Rank-Cintel MKVIIIC caption scanner, a Cox 3-level colour synthesiser and 12 outside source lines.

Vision mixing and special effects facilities are provided by a 24-channel Grass Valley vision mixer equipped with a single E-MEM effects memory, a quad-split facility and a downstream keyer with a borderline generator. A "quad overlay" effects system using BBC Colour Seperation Overlay (CSO) processors and soft-edge switches allows complex shots to be set up beforehand and to be offered to the mixer when required. In addition, a shot-box is provided to control the Quantel digital effects equipment located in TC5.

The control suite is equipped with over 50 picture monitors, 30 of them in the production control room. Most of the switching functions in the studio are carried out by a Pro Bel custom-built switching system incorporating a 40 x 32 interfield-cutting preview matrix. Alpha-numeric indicators are provided under all preview monitors.

The Sound system was supplied by Neve, to a BBC specification. The sound desk is a 40-channel mono mixer, with up to eight channels which can be used with free grouping, i.e. where the 'eight' can be used either as channels or as separate groups. Novel features include pushbutton monitoring for both loudspeakers and a 144-pushbutton matrix for bay monitoring. The overall system is sufficiently comprehensive to cope with complex current affairs and sports programmes.

The studio communication system is designed around well-tried and established control circuitry and an audio matrix. The system handles production talkback and studio, camera and station intercomm. An engineering manual exchange and a presenter's telephone exchange are also provided.

The complete production lighting system was provided by Rank. The lighting control system comprises a Rank-Strand "Galaxy" 240-way lighting control desk controlling 5kW and 10kW thyristor dimmers. A completely new lighting grid had been installed; this supports 42 lighting winches, 26 overhead cyclorama winches and 33 scenery winches. "Saturation rig" lighting is provided by 88 dual-source lanterns; 17 spotlights and 26 overhead cyclorama lanterns are also available.

The SCPD project leader was Gerry Goodhew (also responsible for vision), backed by Dave Procter (sound), Wynne Griffiths (comms), John Hegerty and Pat Kennedy (lighting and mechanical) and Ray Lack (power).

TRANSMITTER NEWS

The new Bushmills relay station, sited in the grounds of a famous whiskey distillery was featured on 'Scene Around Six' from BBC Northern Ireland when the Managing Director, Bill McCourt of the Bushmills Irish Whiskey Distillery, opened the station. Following the opening several members of staff were invited to visit the distillery. The photograph above shows the Transmitter Manager, Jim Drewery (right) and Bert Gallon, acting HPSE N.I. (left), struggling to unlock the cabin before the official opening party arrived. The photograph (above right) shows the MD connecting the receiving aerial to the transposer putting the relay "on-air", having first freed the lock with some of his famous distillation.

The first of the new generation "silver-streak" tv transposers (see Eng Inf No. 3) recently entered service at the Braemar relay. The new equipment is of modular construction, making for low-cost production and ease of maintenance. The photograph shows Alan Davies, the Transmitter Manager from Meldrum, demonstrating how easy it is to change units. The TCPD installation team was led by Colin Palk.

The photograph shows the BBC's first naturally-powered transmitter station at Dychliemore, Argyllshire which has just opened. The station is a link in the chain that feeds the relay station at Dalmally with signals from the main Torosay transmitter on the Isle of Mull. The amplifiers can be powered from either solar panels or a wind generator, and these can each feed power into separate storage batteries. An automatic changeover system changes the power supply from one source to another should a battery fail. The batteries have a capacity of about three weeks without re-charging.

The adverse weather conditions at the end of November created problems for the transmitter maintenance teams in the remote parts of Scotland. Several main transmitter and relay stations were put off the air by high winds, snow and lightning strikes.

The Tullich tv transmitter was off the air for two days whilst engineers from Meldrum dried out the transmitter cabinet. Snow had entered the cubicle via a fan vent, and caused the transmitter to fail. As one viewer described it, "The picture got snowier and snowier until we lost it all together." Little did he know!

On the Isle of Lewis, the Eitshal main station was struck by lightning, and much of the BBC 1 and BBC 2 transmitter equipment was destroyed. In the workshops even the refrigerator was reduced to a pile of burnt metal. The British Telecom phone lines evaporated, and the shf link equipment was put out of action. Because of the snow and high winds, it was 2 o'clock in the morning before Pete Lawrence, from the transmitter maintenance team at Gairloch, could inspect the damage. The damage to the transmitters is so bad that a portable temporary transmitter has been installed to provide a service. The IBA transmitters, at the other end of the transmitter hall, were unaffected.

Arthur Morris, the team manager at Gairloch, had other problems, though, as the high winds had blown the fibre glass cylinder off the top of the mast at Skriag. This meant that several smaller relay stations were not working either, because they rely on Skriag for their programme feed. Fortunately, a splendid effort by the riggers, Willie Skinner from Rosemarkie, and Pat Brown from Kirk O'Shotts, allowed some temporary aerials to be rigged, and a service to be provided.

New BBC/OU Production Centre

The Administration block, main entrance and reception. On the right, is the technical block.

We, in our unique partnership with the Open University, started production work at our specially designed Open University Production Centre on the University's campus at Walton Hall, Milton Keynes in Buckinghamshire on 29th September 1981. The centre is capable of making up to 400 radio and television programmes each year, which allows for future development in the number of programmes required by the University as an integral part of its teaching system. Its opening marked the latest step in the partnership between the BBC and the Open University, which was established in 1969 when a self-contained production centre was set up in Alexandra Palace in North London.

Tony Berry, the Project Manager, says "The Production Centre compares very favourably with other production centres of similar size in the United Kingdom. It will be the biggest purpose-built educational production centre in Europe and will enable the BBC to meet its commitments to the Open University for programme productions during the coming years."

The Centre consists of an Office Block and a Technical Block joined together at the Main Reception area. The Office Block contains accommodation for management, production and administration staff, catering areas, design offices and listening and viewing rooms.

In the Technical Block there are two television studios, two sound studios, a Central Technical Area, film dubbing/review/editing areas, Outside Broadcast vehicle areas and the usual support areas. These include such facilities as wardrobe, make-up, scenery, visual effects, mechanical, electrical and electronic maintenance workshops and stores. The Centre Technical Area includes a Television Apparatus Room, Quality Check Room, video tape cubicles, telecine area and a Video Rostrum Camera.

Planning and installation of the technical equipment was carried out by Studio Capital Projects Department.

TELEVISION STUDIOS

The Technical Block at the OU Production Centre at Walton Hall, Milton Keynes, contains two television studios. Studio 1 with a floor space of 336 square metres and Studio 2 with 102 square metres.

Studio 1 is a fully equipped small production studio with four Link 110 colour cameras. The Production Control Suite is at ground floor level to allow easy access to the studio for production staff. This arrangement was considered preferable to the usual high level gallery with observation windows.

The production control suite has separate production control, vision and lighting control and sound control rooms. There are four control positions in the production control room, the Technical Manager, the Vision Mixer, the Director and the Production Assistant. The desks and monitor stacks are positioned so as to allow direct line-of-sight between the Director and the staff seated at the desk in the Production Control Room and those in the other two rooms.

The Vision Control Room has a Grass Valley 16-channel, 4-bank ABCD Vision mixer with multiple re-entry, chroma-key and comprehensive wipe pattern generators. The chroma-key incorporates the BBC fringe suppression system. The lighting is controlled by means of a 'Thornlite 500' microprocessor based system with 200 dimmer channels and 200 memory files. In the studio, the lighting grid is at a height of 8 metres above the studio floor. It is equipped with 45 motorised lighting winches supporting forty-one 2.5 metre barrels and four 1.2 metre barrels. Each of the two 2.5 metre barrels is normally fitted with two Ianiro Kahoutek 2½ kW/1¼ kW dual source luminaires. These are suspended from the barrels by pantographs to allow them to be adjusted to different heights. Cyclorama lighting is also

Tom Peckham and Mike Coy (centre) of SCPD seated at the control desk in TV Studio 1, while John Bloomfield, OUPC, adjusts the monitors. John was attached to SCPD for the installation.

available by using 4 colour overhead units suspended from the appropriate barrels or "Groundrow" units. Between the rows of lighting winches are eight scenery winch tracks. Four winches are mounted in pairs at the end of each of the tracks.

The Sound Control Room has a 20-channel/4-group control desk built to a standard BBC Specification for production studios, two Studer A80 ¼" tape recorders and two BBC-designed disk reproducers. There is also provision for the addition of a multi-track tape recorder and other equipment for post-production editing.

Studio 2 has been equipped initially for operation on a "drive-in" basis with the CMCR. The installation has thus been confined to production lighting and cabling to a connection point in the nearby OB base where the vehicle will be parked when used in this mode.

Production lighting in Studio 2 consists of luminaires supported from simple tracks and pantographs. The luminaires are controlled by a Thorn QT 120 lighting control panel which has been transferred from the studio at Alexandra Palace. Dedicated control room facilities can easily be added in the future if outside broadcast commitments prevent the Colour Mobile Control Room (CMCR) from being available for studio work.

Sound supervisor, Martin Ward (left), and Sound Manager John Eden-Eadon, seated at the Calrec MK3 general purpose desk in the Sound Control Room.

SOUND SUITE

There are two studios in the Sound Suite, one of 104 square metres and the other a small talks studio with a floor space of 20 square metres.

The larger studio is equipped for drama and music with a 19-channel general purpose stereo control desk, four Studer A80 tape machines and four disk reproducers of BBC design. The adjacent talks studio, which also serves as a quality check room, contains two tape machines and one disk reproducer. Control is from a Glensound desk equipped for 7 stereo and 4 mono channels.

The suite also contains three editing/transfer rooms, each with three tape machines and a linking console, a 'Try-over Disk Room' for listening to the content rather than the quality of a programme, a tape store, office and maintenance room.

CENTRAL TECHNICAL AREA

The area is divided into a number of rooms for video tape recorders, a video rostrum camera or episcope room, telecine, a television quality checking room, maintenance room and television apparatus room.

The Television Apparatus Room contains the equipment bays associated with the television studios and central equipment serving the Production Centre as a whole, such as signal routing, pulse and test signal distribution, off-air check receivers, and office listening/viewing distribution equipment. A modern solid-state station routing system has been installed to route vision, sound, communications and VTR time-code between 25 sources and 30 destinations. Video timing for the various sources to the studios is by use of Grass Valley 'Isophasors' instead of the digital phase shifters installed in most BBC studio centres at present.

Four of the six videotape cubicles will be equipped initially with broadcast quality machines, and one cubicle with a rack of cassette recorders for producing copies of programmes for distribution to OU study centres and libraries. The broadcast VTRs are arranged in two groups of three with provision for individual operation or two-or three-machine editing. Helical scan one-inch C format machines have been provided since it has been decided to adopt this format for all new OU recordings. However, as existing recordings are on 2-inch tape and will need to be replayed for future programme compilation, two quadruplex machines will be transferred from Alexandra Palace.

The Video Rostrum has been in use at Alexandra Palace for five years and consists of a standard Link 110

At the desk (right to left) are Andy Newell (OUPC), Alan Ferne (SCPD) and John Moss (OUPC); John Harris (SCPD) adjusts the VPR2B.

'continued on page 8'

BBC/OUPC at Milton Keynes

'continued from page 7'

TV Studio 1 Vision and Lighting Control Room with Vision Control Panel (left) and Thomlite 500 with its mimic display.

colour camera mounted vertically above a graphics table.

Pre-programmed servo-control enables the camera to be traversed laterally in two directions and the lens zoomed simultaneously. A series of movements can be stored in a memory and the time for each movement selected as required. The unit has a colour synthesiser, and a 4-channel mixer unit can be used in conjunction with the studio or VTR for animation work.

The Telecine room has one Rank flying-spot machine, with a sound Sepmag follower. A Rank Cintel twin-port transparency scanner will be installed in the same area. Space also exists for a second telecine if the need arises in the future.

FILM AREAS

All the film areas are on the first floor of the Technical Block. There are seven cutting rooms, a 'sync-up' room, three viewing rooms, listening room, sound transfer room, film rostrum camera, dubbing suite and two review theatres.

The dubbing suite and review theatres share a common projection room which accommodates a continuous motion 16mm projector for dubbing and two conventional 16mm projectors for the rushes review theatre. The main review theatre is equipped with one 16mm and one 35mm projector.

Sepmag equipment is provided in the projection room for use with the review projectors and in a separate recordist's room for dubbing. A 12-channel mixer desk, two ¼ inch tape recorders and two disk reproducers will be installed in the dubbing mixer room, which will also be available for use as an additional review theatre if required.

The sound transfer room will be equipped with ¼ inch tape machines and 16mm Sepmag equipment to enable location material recorded on ¼ inch tape to be transferred to Sepmag for editing and to provide for transcription copying on both formats. "Comopt" and "commag" transfer will be carried out using the projectors.

A comprehensive 16mm film rostrum camera has been provided, with electronic dissolve and fade, capping shutter and 6-speed motor. The table-top is motorised for E-W/N-S movement and rotation. Since it is expected that there will also be frequent use of the rostrum carrier with 35mm stock, 35mm components have been supplied. Future developments are likely to include computer control and aerial image working.

As Open University programmes demand extensive use of graphics and still photography, a large area of the first floor has been equipped to provide photographic studio and processing facilities for colour and monochrome negatives, prints and transparencies. Copying cameras for 35mm and 5 x 4 formats are included.

OUTSIDE BROADCAST VEHICLES

Existing vehicles based at Alexandra Palace include a 3-camera CMCR equipped with two Link 120 lightweight cameras and one Type 110 studio camera, 5-channel vision mixer, 10-channel sound control desk and RCA TR61 VTR. There is also a tender vehicle associated with the CMCR and a radio car which is used to transport portable radio OB equipment.

These vehicles are housed in the OB garage at the rear of the Technical Block in the new Centre, where "drive-in" connection facilities for the CMCR have been installed.

Future OB vehicles are likely to be smaller, perhaps with one or two lightweight cameras and a VTR. Enhanced post-production facilities will then be needed in the Centre, since less programme assembly will be done on location.

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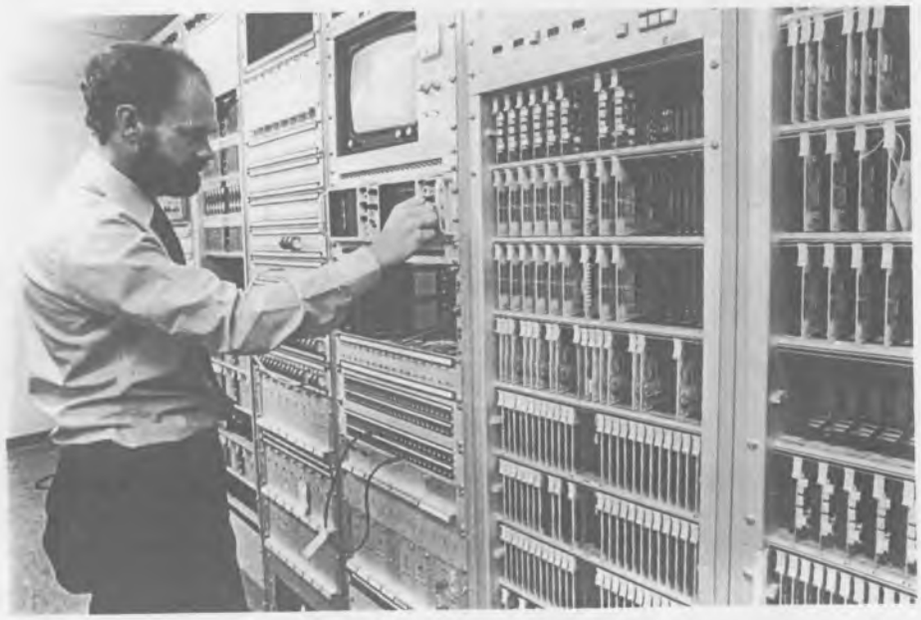

Alan Bird, S.Tel.E. OUPC, checks a vectorscope in the Central Technical Area.

'C' Format Editing Suite Opens

Don Kershaw (seated), Jerry Garratt (behind) and Ray Taylor (right) operate the new editing suite.

We have recently opened our first multiple machine C-format 1-inch helical-scan videotape editing suite at the Television Centre in London. We are gradually changing to C-format video recording, and have developed our own edit control system.

Up to now commercial editing systems have been designed for one-man operation with a single dedicated control panel geared to 'computer-keyboard-type entry'. Our system, however, offers a control panel per machine with dedicated switches for each function. Such a system is easy to use, allows for dual manning, thereby shortening editing time and also provides 'hands on' training for assistants.

Ray Taylor of Designs Department, who led the design team says 'We set out to produce equipment that would meet the needs and specification of Television Engineering and Operations Department and they have been involved with us in the project from the start. Now we believe that we have ended up with an editing system which has most, if not all, the special features required by the BBC'.

The suite consists of a new Edit Control System and can have up to four Ampex VPR2B one-inch helical-scan videotape machines. Each machine has two microprocessors associated with it as part of the editing system. A Motorola MC 6800 handles the time code data and a Motorola 6802 checks and updates the incoming time code when the tape is running below the normal time-code reading speed.

With separate control panels for each machine, an editor and his assistant can work on a programme at the same time. For example the editor can complete one edit while his assistant is preparing the next. Having dedicated control buttons and switches for each function, editors can learn to operate the system more quickly.

The system includes a Data Control Unit, an Events Selector Panel and Playback Control Panels. The Data Control Unit allows edit-point times to be entered into electronic stores either from small numeric keyboards or directly from tape timecode. These newly-entered timecodes are then used to control the video and/or audio in and out points for the different edits. The stored times can be modified, removed from the store or transferred to another store during the editing session.

The Events Selector Panels can be programmed to operate a mixer, a caption generator or a special effects unit within a sequence of up to 48 events. Event points, stored in the playback equipment, can be programmed to put the Playback machines into a Slow, Play or Stop mode at certain points in the programme. Time code can also be used to start two quarter-inch audio tape recorders. A time for an out-point, which is being rehearsed on a playback machine, can be automatically noted on the edit machine in this machine's own timecode. Updating timecode can be carried out when the tape is running at speeds which are too slow for the time-code to be read, by using control track signals from the machine. In order to find a precise point the tape can be moved one frame at a time, in either direction, by special "jog" buttons.

The Playback Control Panels are used to rehearse the material independently of the edit control panel. For example with a three-machine suite there is an edit machine and two playback machines. The control panel on each machine has buttons for controlling the Data Control unit as well as for functions such as play, stop and spool and for the various controls for editing. During editing however the edit control panels becomes the master control.

Designed with FLAIR

ENG INF No. 2 (Autumn 1980) contained a description of Research Department's television graphics microcomputer (known at that time as ERIC) which allows the graphic artist to draw images electronically on a television screen. The BBC had reached an agreement with Logica Ltd. for its manufacture under licence, and the first production models are now available. Under the new name of FLAIR a unit has been given to the BBC as part of the agreement.

The physical layout now takes the form of a pair of pedestals with a central adjustable electronic drawing board - about the shape and size of an office desk. The left-hand pedestal contains the Intel 8085A CPU with 48KB RAM and 16KB ROM, a frame store and A-D/D-A converters: the right-hand pedestal holds two 1.2MB floppy discs for system operation and storage of artwork.

FLAIR has been tailored to achieve a traditional workplace for a graphic designer. The VDU auxiliary buttons are no longer necessary and all operations can be achieved by appropriate use of the electronic stylus and drawing board.

The tablet electronics sample the successive positions of the stylus above the tablet surface, the central area of which represents a mapping of the displayed image. Since the frame store maintains a unique storage location for each pixel making up this image, and each location can be addressed in terms of its co-ordinate within the image, the computer can read the present contents or write a new value to it. The frame store is continually accessed in pixel and line sequence. The video sampling frequency is chosen to give equal vertical and horizontal positional resolution. For our 625-line system a sampling frequency of 14.78MHz is required.

Certain areas of the tablet surrounding the displayed image are reserved as software "buttons" for the designer to invoke system or artistic commands or to make changes in parameters such as drawn colour, brush widths, etc. He can also replace the "painted" picture on the video monitor with a menu page of printed commands which can be selected and effected by stylus and tablet.

The equipment as delivered contains a simple single-font text

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Real-Time Graphics for the Eighties

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"FLAIR"

Members of the Designs Department team view the ANT news logo. On the left, Brian Mason is seated in front of the Zeus software, while Dave Nichols and Richard Lawrence operate the generating equipment.

Designs Department have recently completed work on four digital graphics equipments which are now installed at Television Centre for operational use. One provides new facilities, and three are intended as replacements for analogue systems where digital techniques offer the advantages of day-to-day consistency, high resolution, and the means of reducing a dependence on mechanical models. Extensive use is made of the Designs Department Z80-based range of ZEUS microprocessor units, bringing about a degree of software standardisation and a reduction in the requirements for spares. The work commenced with two systems for use in the Network areas.

EAGLE

The Electronic Announcements, Graphics and Logo Equipment (EAGLE) is principally a replacement for the remotely controlled monochrome cameras used in the Network areas, known to all as "Noddy", which are being removed as part of the current refurbishment programme. EAGLE stores, in digital form, data which can generate a wide range of static symbols ranging from text to complicated maps or logos - in fact any static picture which can be composed on the Television Service's Graphics computer, may be subsequently transferred to EAGLE for regular use.

Initially the equipment will be used to generate the standard range of apology or announcement captions currently available to Noddy, and the "Schools' Clock". Future applications may include the generation of weather map outlines or any other frequently-used coloured graphics.

Data for the symbols are prepared on the Television Service Graphics computer and, after processing are transferred to standard, eight-inch floppy disks. Each disk holds up to sixteen symbols, which from the two drives in EAGLE, permit fast access to thirty-two different pictures. By changing disks of course, a much larger number is available.

The information is stored in a condensed form, known as run-length code, whereby each active line period is notionally divided into 1024 picture elements, (pixels). The code describes, in 8-bit instructions, which colour is to be used and for how many pixels it should run. The use of run-length coding leads to economical storage without loss of resolution. An example of this is the Schools' Clock which occupies 13k bytes in run-length form, but stored conventionally it would need more than 500k bytes.

EAGLE contains a microprocessor which is responsible for the overall control of the system, and for reading the symbol data from either of the disks. These data are placed in one of two 16k byte areas of RAM, so that two symbols are available for immediate display. Using this feature it is possible to "cut" between the two, so avoiding the half-second disk access time.

The processor carries out housekeeping tasks, such as serial communication with the control panels, and creates a VDU-style display which lists the titles of the symbols on each disk and those in the two 16k display stores. It also indicates which of the stores is being displayed and issues warning and error messages.

EAGLE can also implement a limited form of animation by changing the definitions of chosen colours according to an animation table associated with a particular symbol. Colours may be changed at pre-set rates from one to another, or perhaps from background to foreground, causing new areas to appear. By this means, the white dots of the Schools' Clock disappear in turn. Although all are initially white, they are encoded as colours one to twenty, which are subsequently faded to black according to a picture-rate count.

MOUSE

The difficulty of manipulating run-length code in real-time with only limited processing power and time, means that EAGLE cannot easily change the shape of coloured areas. A separate unit, MOUSE, (Microprocessor Open University Symbol Equipment) was designed to generate the moving OU symbol.

In MOUSE, a Z80A CPU is used,

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"FLAIR"

the facility. However, Flair's designer at Research Department, Nick Tanton, has now developed a number of additional facilities and fully anti-aliased high quality text is now possible. Other additions can include precise geometric positioning, repositioning of selected portions of a picture (cut and paste), and multiplication and overlapping of images.

Television engineers are now examining Logica's FLAIR in detail so that the requirements for its eventual integration into operational areas are fully understood. As a next step, however, the equipment will be installed in a Scenery Block area at Television Centre for appraisal and familiarisation by Graphic Design staff. The provision of appropriate cabling will enable FLAIR to be routed to other areas in due course.

* * *

Lesotho gets help from the BBC

An interesting story which shows how the BBC helps Third World Administrations is told in the Development of Broadcasting in Lesotho - a small country in Southern Africa.

Broadcasting began in its simplest form in 1956, when the Catholic Missions in Lesotho started transmitting news and religious and educational information from mission to mission. Then the Department of Information began broadcasting two half-hour programmes a day in 1964 when Radio Lesotho was set up.

Around this time, the BBC sent out an expert Tom Chalmers to advise Radio Lesotho on it proposals for improving its service. Then Les Lester of T.C.P.D. was appointed Radio Lesotho's first Chief Engineer and Michael Pickstock, the first Programme Adviser in September 1966 - the year Lesotho was granted its independence. Both were on secondment from the BBC.

With independence, the U.S.A. gave Lesotho an RCA 10 kW medium-wave transmitter and an RCA 1 kW vhf/fm transmitter. The British Government gave them three Marconi 660 kW medium-wave transmitters which they used in parallel and a 10 kW short-wave transmitter. However, Radio Lesotho had few trained staff and no adequate plant. In fact there was not enough money available to erect the vhf/fm transmitter, so the BBC paid to have it installed. Then the BBC rented it back. Ralph Williams, who had been seconded as adviser to Radio Lesotho supervised its installation and its going into service as a World Service relay in 1972.

In 1975, Chris Griggs, at present Assistant, Planning in External Services, was appointed as the I.T.U. expert to advise Lesotho on its submissions for the LF/MF Plan. Lesotho was concerned about ways of improving its service and coverage. The latter is an important consideration in country with such mountainous terrain. With Lesotho's limited financial resources, the BBC agreed to pay the running costs of two short-wave transmitters on the condition that Radio Lesotho would broadcast the World Service programmes from one of the transmitters on our behalf.

Chris Griggs was involved in advising Radio Lesotho on the two 100 kW short-wave transmitters and the aerial system that would be required. As a result the BBC prepared the estimates for the Crown Agents and contacted the suppliers, after defining the specifications for the equipment.

The transmitters were manufactured by Continental Electronics in Dallas, Texas and the Crown Agents asked the BBC to do the factory acceptance tests. After their acceptance, the transmitters were shipped to Lesotho and arrived there in October 1979. Chris Griggs went out to the transmitter site near Maseru, the capital of Lesotho, to check out the equipment in the early part of 1980.

In July 1980, the Crown Agents appointed Mike Lloyd (ex-BBC, Daventry) to take charge of the installation. The first transmitter began broadcasting Radio Lesotho's programmes in September 1980.

The other transmitter, which relays 16½ hours of World Service programmes each day, went into service in September this year. It receives the World Service 'off-air' from the short-wave transmitting stations in Ascension and the United Kingdom and provides a service to Zambia, Malawi, Zimbabwe, Tanzania and Kenya.

Mike Lloyd checks the new short-wave transmitter in Lesotho.

Valve Section gets new computer

One doesn't need to be told that the BBC uses a lot of valves and semi-conductors. Transmitter Department has a special Valve Section based at The White House, at Motspur Park in London to cope with the demand. They process the requirements for valves and semi-conductors with the aid of a Data General minicomputer operated entirely by Valve Section staff. Before the introduction of this minicomputer in mid-May, Olivetti terminals were used, in conjunction with local manual clerical procedures, to input the information to the ICL 1909 Cemast system.

The new system provides far more information and dispenses with many of the previous manual procedures. It is almost 'friendly' towards its users, giving prompts if the correct information is not entered, and checks at each stage if entry is correct. This feature not only puts the operator at ease but makes training easier.

IMPLEMENTATION

The NOVA 4X computer was supplied in late November last year and the software was installed shortly afterwards. Staff training began in December and sufficient data were loaded to carry out a parallel run during January. The run commenced in February with input of data for the remaining 5000 items, supplier and BBC customer details being fed in continuously from that date. This amounted to some 4 megabytes of information which had to be entered manually because of differences in data structure compared to the CEMAST system. This mammoth task was speedily accomplished only by the full involvement and active co-operation of the Section staff.

The change-over started in mid-May after a number of system 'bugs' had been eliminated. By early June the system went live. During the change-over period manual systems were in operation to maintain the service and minimize inconvenience to customers.

The system has been in continuous operation since going live and has worked much as predicted with very few problems.

For the future the acquisition of the NOVA 4X minicomputer will offer Valve Section greater flexibility, it is capable of considerable expansion and gives an improved service to Valve Section's customers.

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"GRAPHIC DESIGN"

together with ROM and RAM, but the display store is one originally designed by Richard Russell for the electronic Network clocks. A variant of run-length coding is employed, whereby numbers are placed in fast RAMs by the processor, and these define the pixel counts at which foreground/background transitions occur on each televison line. Fortunately the symbol comprises only three moving elements - a disc plus two shield segments.

The text below the moving symbol is generated by a run-length decoder using an EPROM store for the code. Data for the 120-line high disc is calculated in real-time and updated at picture rate over the animate or de-animate sequences which each last for 252 pictures. The dimensions of a fully displayed disc quadrant are stored, and when multiplied by appropriate sin x values from a look-up table, give sixteen-bit results which are then rounded to eight. The shield halves are generated from look-up tables as rectangles, and subsequently gated with a U-shaped mask obtained from the caption run-length decoder - a process analogous with the construction of the existing model.

The processor has access to the data and address buses at all times except when the shield is being displayed. This gives a total of 24 ms available for calculations and data loading between pictures. In order to complete these tasks within this time, a 4 MHz processor is used with fast-access RAM which is loaded with the program from EPROM at start-up, and particular care was taken with the structure of the software. As a result, each new picture is prepared with just 2 ms to spare.

ANT

As work on the Network projects was drawing to a close, the opportunity arose to assist Television News with their new opening and closing title sequences. Working closely with News and Graphics staff, and in the space of a few weeks, new software was written for MOUSE which with small hardware changes, became ANT - 'Animated News Titles', first used on-air in September. Two moving areas combine to form the nine or circular symbols whilst the third is available as a keying signal to operate an external video switch so that background pictures may be revealed. Unlike MOUSE, all positional data are obtained from look-up tables which are read in accordance with a picture-rate count, an important feature, since accurate timing of the sequences is essential in order to maintain synchronisation with the accompanying music. The generation of these title sequences by a dedicated unit has saved a considerable amount of frame-by-frame VT editing but perhaps more importantly, frees an expensive VT machine for general use during news transmissions.

DOG

In parallel with the work already mentioned, a low-cost, general purpose unit has been designed called DOG, (Digitally Originated Graphics).

The equipment uses UV erasable PROMs to provide internal storage for up to 16 bytes of run-length code. This is sufficient for a single reasonably complex picture or up to eight smaller symbols. In common with EAGLE, a primary source of data is the Television Service computer, but several graphics have been created using a Z80 development system.

Initial applications have included the generation of "action replay symbols", especially for use with C format video tape machines, safe text area overlays with an optional alignment grille, and logos for inclusion in background scenes. A remote position control allows small symbols to be moved over the screen and this has been used with a stored set of arrows to highlight points of interest.

I would like to acknowledge the assistance given by the equipment Designers, Brian Mason, Richard Lawrence and Peter Randall, with the preparation of this article.

J.M. Astle, Designs Department

Engineers meeting

Senior engineers and Managers met recently at the IEE in London for the Annual Engineers-in-Charge meeting. The first morning session started with an introduction to direct broadcasting from satellites by Dr. Geoff Phillips from Research Department. He outlined the technical considerations governing the use of satellites, and recommended the meeting to study his article in "BBC Engineering" (No. 115) for further information on the subject. Malcolm Harman, also from Research Department, then introduced the meeting to the new mobile satellite up-link that had just been completed (see Eng Inf No. 6). It was parked just outside the IEE and was being used to beam a signal up to the Orbital Test Satellite (OTS) down to Goonhilly, and via British Telecom circuits back to the IEE. A light-weight camera recorded the scene inside the conference room and demonstrated the long delay found on satellite circuits.

The second session, after coffee, started with a review of some achievements of Engineering Division from the Director of Engineering, Bryce McCrirrick. Most of the details had been included in a booklet given to the delegates before the session started, so he concentrated on a few topics of special interest. He started by congratulating all who had been associated with the superb Royal Wedding broadcast. He passed on congratulations and comments that had been made to him personally during a recent visit to Japan and the USA.

He continued his speech by up-dating members on the latest proposals for the BBC's participation in direct broadcasting from satellites and went on to deal with developments in HF transmitters for External Broadcasting, and with the BBC's plans for extension of VHF radio coverage. In the discussions following his speech he touched on a variety of subjects from the closure of 405-line transmitters to recent developments in Band II.

After lunch, delegates were given an interesting address by Douglas Muggeridge, Managing Director, External Broadcasting (MDXB). He concentrated on the recent Government proposals for cuts in External Services, and began by remarking that it would be ironic if the world's most successful international radio broadcaster celebrated its fifieth anniversary next year by making the biggest reduction of services in its history.

The final session of the day was an address by Sir Ian Trethowan, who talked about the new Royal Charter, and the future of the licence fee system. He expanded on the need for a £50 licence fee, and highlighted three points:

i)Inflation: This calculation had been made on the basis of true inflation, and not the Government's estimated 4% for pay and 9% for prices. Despite what some people believed, the BBC's expenditure has nothing to do with the Public Sector Borrowing Requirement, and limits on PSBR were irrelevant.

ii) Programme Restoration and Improvement: DG agreed that there were too many repeats and imported programmes. There was a need to increase Local Radio and Welsh programmes, and to extend the hours of television.

iii)Capital: The BBC could be in danger of falling behind and had to maintain its programme of replacement of capital plant if it was not to become out-dated.

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