

ENG INF

The Quarterly For BBC Engineering Staff



BOAT RACE MAKES HISTORY for new OB vehicles



The new CMCCR2 on site at Putney for the Boat Race.

The 127th University Boat Race marked yet another milestone in the history of Television Outside Broadcasts. In service for the first time were the new Colour Mobile Central Control Room (CMCCR) and Mobile Communications Area (MCA).

The CMCCR uses an unconventional approach to the problem of outside broadcast vehicles, whose size is normally limited by the demands of road traffic regulations. For major outside broadcasts such as the Boat Race, Open Golf Championship or Wimbledon Tennis, the normal production control room is too small for the extra number of cameras and monitors required for full coverage of the event.

The CMCCR has therefore been designed with electrically operated expanding sides, which enlarges the production control room from the normal 2.5m to 4.5m. One of the expanded sides contains a bank of thirty black and white, and four colour monitors; the other side accommodates the production staff and allows free

movement around the production control desk.

At the rear of the vehicle is the sound control area, housing a 44 channel Neve stereo sound mixer, and a communications system based on a 50 x 100 pin-board matrix that enables the communications to be tailored to suit the needs of each outside broadcast.

The front of the vehicle houses an engineering and vision control area where the vision signals are processed and monitored. The vision mixing and routing equipment is mounted here, together with a smoke detection system, alarms and the power distribution equipment. Other equipment includes digital video synchronisers, and sophisticated measuring equipment. Space has been left for two camera control positions or a video tape recorder to be accommodated on a temporary basis.

The Boat Race was rowed over some 4¼ miles of the Thames, and this created problems for Tel OB's because of the difficulty of connecting the 10 landbased camera sites to the central

control room. In addition cameras were mounted on board a helicopter and on the "Pembroke Puffin" boat, and these signals also needed to be connected to the central control room. To overcome these problems, uhf and shf radio links were provided carrying camera signals back to the CMCCR. Reverse circuits over vhf radio links were established so that the camera control data for the Philips LDK5 type cameras could be remotely controlled from the central control room. In addition an extensive vhf talkback network was established enabling the production staff to talk to the cameramen at the remote sites. The co-ordination and control of all the communication facilities was provided by the new Mobile Communication Area (MCA) vehicle, which was designed with major Outside Broadcasts such as the Boat Race in mind.

The MCA houses all of the radio link equipment and also has the capability of checking the quality of the signals coming in from a maximum of twelve dual-head links, and these can be displayed permanently on 12 monochrome monitors. The vehicle can use six independent vhf radio telephone systems allowing full talkback facilities with the camera and radio link sites. Television signals pass through a 32 x 16 routing and monitor matrix, where test signals can also be inserted to check the various link and cable parameters.

For the Boat Race broadcast twelve cameras were used, three being connected by landline, the remainder by radio link. This is a record number of remotely controlled cameras for a BBC Television Outside Broadcast.



Reception Quality Checks

Do you live in the service area of the Wrotham vhf transmitter?

Would you like to take part in listening tests at home on your own domestic radio?

Send for an explanatory letter to Alan Lafferty, Room 701, HWH.

Digital Stills Store at R.D.

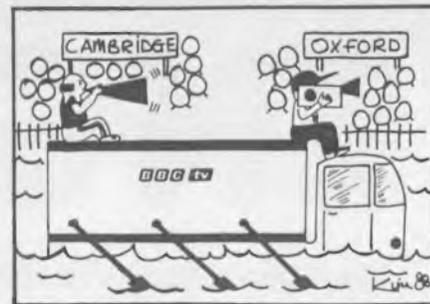
Two types of digital electronic stills-store are currently being developed at Research Department.

A television animation store is being constructed which, in conjunction with a television rostrum camera, can generate animated sequences for television. Up to 800 pictures will be stored for replaying at normal television rates. Specially developed digital television processing circuits installed within the store system will enable still pictures to be combined by normal mixing or keying operations. The operation of the system will be entirely programmable. Construction of the animation store is due to be completed by the end of 1981, although a programmable television rostrum camera will not be available until next year.

A second type of stills-store is

being developed to meet the more general need for a studio stills picture store. This store will have a smaller capacity and slower access than the animation store described above. It will simply present two still pictures to the normal studio mixer via two independent output channels. A first prototype is to be completed by September 1981 so that the Television Service can evaluate the use of such systems.

Both types of stills-store are based on the storage of television signals, on computer-type hard disc drives, in digital component form as separated luminance and colour difference signals. Special digital PAL decoders and encoders are being developed and will be installed in the inputs and outputs of the system to enable them to interface with the existing PAL studio standard.



Editorial

The economy, we are told, is in recession and the effects of inflation surround us. Yet the ingenuity and resourcefulness of engineers in the BBC enable the high standards, set many years ago, to continue. The cutbacks of the past year may still be felt in many areas, yet we still remain the finest broadcasting organisation in the world.

The need to produce a magazine such as "Eng Inf" on a small budget will be obvious to all. It is not always possible to check all of our stories for objective accuracy before publication, and inaccuracies sometimes creep in. My thanks, therefore, to several engineers in Cardiff for reminding me that the Thornlite 500 lighting system was installed and in use there, long before the equipment in TC7 and 8 came into use (Eng Inf No. 3).

It would be nice to be able to afford to print one copy of "Eng Inf" for every engineer in the BBC. However, this is not possible, and I would ask all of our readers to pass copies on where possible. Please do not file them away in ring binders to gather dust until the day you retire.

There are occasionally extra copies available, although further information on any of the individual subjects can always be gained from the Department concerned.

Alan Lafferty



This mixer has a new feature in that the controls on the control room desk are converted from analogue voltages to multiplexed digital signals, processed via PROMS to modify fading laws, and then converted, digital to analogue, in the actual respective fading amplifiers, thereby controlling the levels of the audio or video signals. Also there is no separate "cut" bank; cutting being performed as a "fast" fade. Similar mixers are due to be installed in the TV Continuities at TV Centre later in 1981.

The SCPD team responsible for the installation were Mike Lyons, Tim Hardiman, Peter Arnold and Les Cussans.

CARDIFF: new continuity



Cardiff television Continuity 'B' suite

The second TV Continuity Suite at Broadcasting House Cardiff has now been handed over by Broadcast Systems Unit 'B' of Studio Capital Projects Department on time. It has now taken over the BBC Wales continuity control from the adjacent TV Continuity Suite 'A' so that some urgent remedial modifications can be made to this TV Continuity which for a while will only be used for the occasional BBC-2 opt-outs by Wales.

The facilities in the new TV Continuity (known as TV Continuity 'B') are the same as in TV continuity 'A', less the Ryley CAPGEN character generator and one BA10/501 slide-scanner.

The control room has been

enlarged by removing the wall between it and its Engineer position room, which was not required, thereby allowing a better and more spacious layout and larger screen sizes on the picture monitors.

The mixer has been provided by Michael Cox Electronics Limited to BBC specifications, which stated that its control panel layout and functions must be identical as far as practicable to those on the Prowest/EMI mixer in TV Continuity 'A'.

The mixer is an audio/video mixer of the "knob-a-channel" type, with remote control of both audio and video. The electronics are housed in equipment racks in the Communications Centre upstairs.

RF tests on new OB vehicles



As part of the commissioning tests on new television OB equipment, engineers in SCPD supervise the rigging of the equipment in an area of high rf field strength close to high-power transmitters. Both the Crystal Palace television transmitter, which radiates powers of 1000 kW at uhf and 200 kW at vhf, and the high power mf transmitters at Brookmans Park are ideal for the tests.

The photographs show a new two-camera OB vehicle being put through its paces at the Crystal Palace Sports Stadium which is about a mile from the tv transmitter and is a regular venue for sports OBs. The vehicle is equipped with two Philips lightweight LDK14 cameras which are used with interface units to enable them to operate into LDK5 camera base stations. Philips LDK5's are the production cameras of conventional size used as standard

equipment in the latest type 5 OB vehicles.

Electronic cameras are especially vulnerable to rf interference because of the low-level signals in the head amplifiers. It is difficult to provide adequate shielding because the amplifiers are necessarily close to their respective camera tubes. Rf interference comes, literally, straight through the lens, the optical path being free of any permanent metal shielding.

For the Crystal Palace tests, the cameras were rigged with 700m runs of cable. The cameras were then moved around and pointed in various directions while their outputs were monitored for the tell-tale signs of rf patterning on the pictures.

Following the successful tests this particular OB unit entered service at Pebble Mill.

EXTRA TIME

Wednesday 1st July will be one second longer this year as the result of an international agreement. One o'clock in the morning will last for one whole second instead of flicking instantly over. There will be a new time 0059'60" (BST) which will last for one second until 0100'00". Just imagine a whole second longer in bed - unless you are unlucky enough to be on night shift!

The official statement of what is going to happen is: 'In accordance with international agreement the UTC time scale will be retarded by the insertion of a positive leap second at the end of June 1981'. UTC - (The initials for the British equivalent of Co-ordinated Universal Time) - is based on the frequency of radiation corresponding to the transition between specified energy states of the Caesium 133 atom which is, by definition, taken to be 9,192,631,770 Hz.

Under the control of the Bureau International de l'Heure, leap seconds are occasionally inserted and, if ever necessary, deleted, in order to keep UTC within ± 0.7 seconds (usually) and ± 0.9 seconds (extreme tolerance) of UTI (equivalent to GMT).

Those of you lucky enough to have watches accurate to better than a second a day must remember to adjust them. Don't take them back to the shop because you have suddenly found that they have started losing a second a day.

EQUIPMENT DEPT. OPEN DAY



Peter Hearn, Equipment Department, who is the Supervisor of the printed board shop, shows parents and potential trainees how the BBC manufactures printed circuit boards. The open day at Avenue House attracted over 150 visitors during the evening.

Transmitters Opened

The following uhf tv stations have opened since January.

Mynydd Pencarreg, Dyfed
Matlock, Derbyshire
Cwmaman, Mid. Glam.
Ludlow, Salop
St. Bees, Cumbria
Kirkmichael, Strathclyde
Looe, Cornwall
Dowderry, Cornwall
Duncraig, Highland
Culm Valley, Devon
Kerry, Powys
Lea Bridge, London
Cemaes, Gwynedd
Amlwch, Gwynedd

End of an era

BBC Piccadilly, Manchester closes after 52 years of broadcasting, when North West regional television move to their new premises at Oxford Road on May 15th.

The BBC established itself at Piccadilly in April 1929, and many new ideas were incorporated into the technical areas. An automatic switching system using uniselectors was used for the first time for the routing of lines to studios. Designed by A. S. Atkins, an ex Post Office engineer, the system eventually worked well, and remained in service for many years.

Also new to the Manchester control room were the now familiar 'A', 'B', 'C' and 'D' amplifiers mounted on standard racks. These amplifiers are supposed to be the first to be painted in the now familiar "BBC grey". Until 1929 all equipment had been painted a standard black, but the new GPO un-selector panels were a grey colour, and so the control room amplifiers were painted to match. The colour was later adopted for all BBC equipment.

Other novel features included the first use of 'Volume Indicator' meters, the forerunner of the PPM and measurements were made using a TS/4 tone source and AD/2 amplifier-detector measuring to an accuracy of 0.25 dB at a level of -55dB.

Loudspeaker developments

Because of the continuing lack of consistency amongst commercially manufactured loudspeakers, Research Department is still extremely active in the development and realisation of new designs of loudspeaker units and assemblies.

Taking the LS 5/8, as an example, this was originally designed at Kingswood by Dudley Harwood (now retired) and Derek Mathers. Once all the teething troubles, inevitable in new transducers, were solved, a British loudspeaker manufacturer, Rogers/Swisstone, was assisted to make the assembly under licence both for the BBC and for commercial exploitation. Using this approach, not only does the BBC get the loudspeakers it needs, but much of the development costs can be recouped from the licensing revenue.

Current activities at Research Department centre around a much needed smaller assembly of approximately the same size as the old LS 3/6 (or Spendor BC1). This time, however, a new method of objective assessment is available in the form of a laser interferometer recently designed by Bill Taylor. The interferometer allows a point by point measurement of even the smallest movement of the cone of a loudspeaker. Thus it can be used to locate such things as resonances

in the cone material under normal operating conditions. With the aid of the interferometer, Ted Randall and Derek Mathers hope to identify some of the limitations of earlier 200mm cone shapes, and derive a transducer free of most of the unwanted colourations which give each loudspeaker its characteristic sound.

Computer aids Project Planning

At any one time SCPD are working on many major projects. Any one of these may have a budget cost of several million pounds. At present, for example, the cost of the project for moving the Open University Production Centre, from Alexandra Palace to Milton Keynes in Buckinghamshire, is in the order of three million pounds.

With a project of this size it is important to examine critically each stage to ensure the work is properly organised and finished on time. SCPD has a special group within Planning and Information Unit which uses a computer based project planning package called P.E.R.T. Each project is broken down into small identifiable jobs. The computer is then fed with the duration for each job and other essential information such as resources (engineers, wiremen, etc). It also needs to know how the jobs depend on each other.

Roger Powell, the group leader, is also an executive committee member of the ICL PERT User Group which looks at ways of developing the software in order to extend its usefulness for each of the organisations represented.

Roger says, "We are fortunate to be able to adapt a graph plotter programme that had been developed by Leeds City Council, which gives all concerned a very clear presentation as to the timetable of the project."

Ian Stone, the Head of the Unit, says, "There is no doubt that being able to keep a close watch on any changes or delays in a large project saves SCPD a great deal of time and money. Our Project Managers realise this value and are very keen themselves to get the latest reappraisal."

OPEN WIDE



The phased replacement of type D sound mixing desks in the Television Centre studios continues with TC8, the latest in line to receive a new 50 channel, 8 group stereo mixer. The mixer was manufactured to our specification by the Royston-based firm of Rupert Neve and is the third of this basic design to be installed in the BBC, previous ones being at Pebble Mill, studio A and Cardiff, studio C.

However, the biggest installation headache with these latest desks, compared to the type D predecessors, is their physical size and, not for the first time, the new desk had to be delivered straight through the sound gallery's observation window. Not, of course, before the window had been carefully removed and considerable preparations made.

SCPD engineers Alec Whitfield, Peter Matthews and Joe Meredith, and Installation Chargehand Bryan Pope were on site early on Easter Tuesday to oversee the operation which was carried out by a team from Bullens.

TV SOUND gets it together



Terry Newbery (SCPD) discusses the NECAM control unit with Mike Jones, a sound supervisor.

Sypher-2, the new audio post-production suite, has recently entered service at Television Centre. The suite has been developed as a result of six years' experience with the Sypher-I suite. Sypher - SYNchronised Post dub with Helical-scan and Eight-track Recorder - was designed by SCPD in co-operation with Larry Goodson, A.H. Tel. Sound, to meet changes in television production techniques.

With improved video tape editing, directors may plan between 10 and 100 recording breaks, and make 200 or more edits to remove errors and to tighten the pace of a production. This makes it very difficult to produce a well-balanced continuous sound track at the time of the studio recording. With Sypher, the dialogue sound and special effects can be brought together, and music can be added to the edited video tape after the production. The recent series of 'The Hitch-Hikers Guide to the Galaxy' is an excellent example.

In the Sypher system, the edited picture is copied onto a non-broadcast standard HVTR (helical video tape recorder), and the sound on to one of the tracks of an MSR (multi-track sound recorder). EBU time code is added to both to enable sound and vision to be synchronised. Additional music and sound effects can then be recorded on the other tracks of the MSR. The sound effects are mixed with the newly edited sound which has been carefully synchronised with the edited picture, to form the final version of the sound track. This is then transferred back to the master video tape in the place of the original sound.

Terry Newbery, the Project Leader, says "Sypher-2 is an enlarged and enhanced version of the first Sypher suite. Because of the developments that have taken place over the past six years, Designs Department had to design a synchroniser system that would match the modern HVTR's and that would be capable of handling the time offsets of

slave machines. We also wanted a synchroniser with each slave recorder having its own synchroniser unit so that further slave recorders can be added at will. The modular design of this system allows the synchroniser to be used with the simplest or most complex arrangement."

The Designs Department synchronisers have been designed to operate on the wide range of speeds of modern HVTR's, so that the slaves stay together at all times. This saves time, allowing the operator to switch the synchronised recorders from spooling to play or record instantly.

Each slave synchroniser is provided with 'event' stores. An 'event' consists of an offset value and a cue point. This enables the slave tape recorder to be parked at a cue point until the master recorder reaches the corresponding time code point, when the slave recorder will then automatically run into synchronisation. This facility is particularly helpful in the use of "snoop" tapes - ¼ inch recordings of the entire studio production - which may be used to restore sounds lost in editing or to substitute sound from an alternative take.

A "NECAM" computer-assisted mixing console, made by Neve, is used to control the large number of sound channels involved and to memorise cue points for non-synchronised equipment, and to switch in effects. The cue points can be entered by either using a keyboard to put in time code, or by using, what are called 'on the fly' buttons to mark time code points on the tape. The NECAM system uses a floppy disk to store data representing the position of all the faders in the sound console against a time code reference. The data is then used to drive the motorised faders back to the same positions for each replay of a particular scene. At any time the sound balance can be changed and the new

settings stored in the memory.

The NECAM system makes it possible to go repeatedly backwards and forwards over each section of a mix, retaining that which is correct and updating only that which is not. Each "attempt" may be stored, and it is possible to select parts of different "attempts" using the stored data. The controls for NECAM include a clear and self-explanatory status display. This has a wide angle view and is easily read under normal lighting conditions.



News from PEBBLE MILL

Planning work for the technical refurbishment and Central Technical Area development for Pebble Mill has begun, and a local working party has been formed under the chairmanship of Manager, Communication and Engineering Services, Tony Pilgrim. The working party includes Manager Operations, Ken Page; Planning Manager, Eric Holmes; Video Manager, John Lannin; Audio Manager, Brian Forgham; Technical Services Manager, Frank Stevens; and Assistant to MCES, John Grantham, who will act as permanent secretary to the working party, and will co-ordinate local involvement with the project.

The refurbishment of Studios A and B, and Television Continuity at Pebble Mill will also include the formation of a new Central Technical Area, in which it is planned to combine all radio and television switching and routing operations, together with the television studio technical equipment.

H.E.Tel. Projects will shortly be issuing a statement of requirements for the refurbishment programme and the television projects engineer who has been involved with Pebble Mill from its beginning, will be Ian Stewart.

Work is expected to begin in 1982, and the programme is for Studio A to be refurbished in 1982, and Studio B in 1983.

There will, of course, be a considerable involvement of SCPD in the project, and they will be largely responsible for carrying out the work. As in 1970, when Pebble Mill was being constructed, some local engineers will be working closely with the specialist department.

Refurbishment of the radio studios is also likely to take place during this period.

Communications Department: Special feature



Keith Moore, shift engineer, measuring tv test signal parameters, in the Switching Centre

Communications Department is based in Central London and consists of a Systems section dealing with capital projects in the communications field and long-term planning of the networks, and an Operations section dealing with the day to day provision and operation of communications facilities. In this short article we are concentrating on two areas in Operations - London Switching Centre and the Audio and Telecommunications Area, both sited in Broadcasting House.

LONDON SWITCHING CENTRE

The London Switching Centre is the distribution point for the two BBC tv networks and contributions to London from within the UK and abroad. The engineers in this area are responsible for ensuring that the quality of all signals routed through the centre is within strict tolerances. The area is manned for the hours of scheduled tv programmes, but when dealing with transmission to and from countries in other time zones, it is often necessary for staff to work through the night.

Network tv Distribution

The BBC 1 and BBC 2 network signals follow similar routes from Television Centre through Broadcasting House to the transmitters throughout the UK. Two feeds of each network arrive from Television Centre on wideband coaxial cables. One carries encoded sound-in-syncs and the other has a separate analogue sound circuit. The coded feed is used to provide signals for three distribution chains to the regions and the uncoded feeds for the Crystal Palace transmitter. Reserve feeds for the chains are obtained from either the encoded or analogue circuits. In the event of the loss of the signal on one of the circuits from Television Centre the changover to the reserve feed is automatic.

At specified times, Network 1 fragments into 12 regions each producing its own local news programme. It is possible by using an arrangement of 'opt-out' switches to feed material other than network to the BBC 1 or BBC 2 transmitter chains. When this happens, the normal distribution chain can be used between London and the studio centres to carry opt-out material for use in these locally originated programmes. The Network 2 circuit can be utilised in a similar manner during periods of trade test transmission or close-down.



David Bonor, shift engineer, operating the Switching Centre central desk

TV Contribution Circuits

Contributions from a region to London or another region are carried on a network of permanent circuits, augmented by extra 'occasional' circuits as required. The temporary circuits are usually rented from British Telecom but may be borrowed from other users such as the IBA. Outside Broadcasts in the regions are routed, using mobile shf links, into the local studio centre for connection to the network. Central Allocations Unit (CAU) provides facilities to cover the daily requirements.

Satellite transmissions, which only a few years ago were rare, now occur frequently. Because of the high charges involved, there is usually no time allowed for line-up and often a circuit from another continent has to be made acceptable in a very short time. Eurovision circuits are also handled in this area.

Once a contribution circuit has been checked to see that it meets an acceptable standard, by a specified time, it is offered to the user. In the case of Television Centre and its Spur (TV News), the circuit is selected by TVC using a remote control of a number of the destinations in the 25 x 36 vision and sound matrix at Broadcasting House Switching Centre.

The remote control system, which operates using a pulsed-tone coding, also gives the Central Apparatus Room full information on the state of Network distribution in the Switching Centre e.g. which chain is on main or reserve feed, or whether a chain is opted out.

There are a total of 22 circuits between Broadcasting House and Television Centre. By using a BBC designed carrier system and base-band, they are carried on 11 coaxial tubes. All circuits have access to the full 25 sources, some of which are tied to particular uses and the remainder used according to commitments.

AUDIO AND TELECOMMUNICATIONS AREA

The Audio and Telecommunications Area (ATA) in BH is the central BBC test room for audio and telecommunications services provided on British Telecom's plant in the London area.

In the ATA, audio circuits are tested and equalised, faults diagnosed, and replacement circuits organised to restore the service. Circuits are not normally routed through the area, but whenever it is necessary for testing, equalisation and fault investigation purposes they are extended via London Control Room (LCR).

The internal telecommunications networks are centred in this area; here staff can monitor and control the operation of the system and generally work to maintain and improve the standard of service provided. In the ATA the following facilities are handled:

Outside Broadcast Circuits

Music and control lines from OB sites are usually tested two or three days before transmission, to determine the equalisation necessary for the required music bandwidth, and to ensure that noise and harmonic levels are satisfactory. Details of the equalisation settings are passed to LCR who then set up the programme chain to give the same performance as that obtained on test immediately before transmission.

One of the ATA specialities is the matching of pairs of mono circuits to permit satisfactory transmission of stereo signals. Disparate circuits with path length differences frequently of the order of 160 km require locally devised techniques and equipment to correct inter-channel phase differences. These techniques can, by fine adjustment of the special equalisers, reduce the initial phase error of several thousand degrees to better than ten



Joe Tozer, engineer, testing lines for a stereo OB, in the ATA

degrees. They also provide cheap stereo paths from sites where the only alternative transmission systems would be too expensive.

Permanent Circuits

Another responsibility of the ATA is the equalisation and maintenance of all permanent circuits in the London regions, whether part of the long distance network area or the London lines network. Some 3,000 British Telecom circuits are rented between BBC offices, studio premises, offices of foreign broadcasting organisations, and embassies, in the inner London area. Staff may work at base or visit any of the other terminals to test the lines. This often includes acceptance of new circuits which, for music lines, necessitates the design and construction of tailor-made equalisers. The work involves close co-operation with the users of the facilities, and particularly at time of faults, close liaison with British Telecom engineers in order to maintain the service and to minimise interruptions.

International Circuits

In addition to domestic audio circuits, the ATA is responsible for testing and equalising international music circuits. This includes stereo routes used by the Radio Service, such as those from venues used on the BBC Symphony Orchestra tours.

Telecommunications Networks

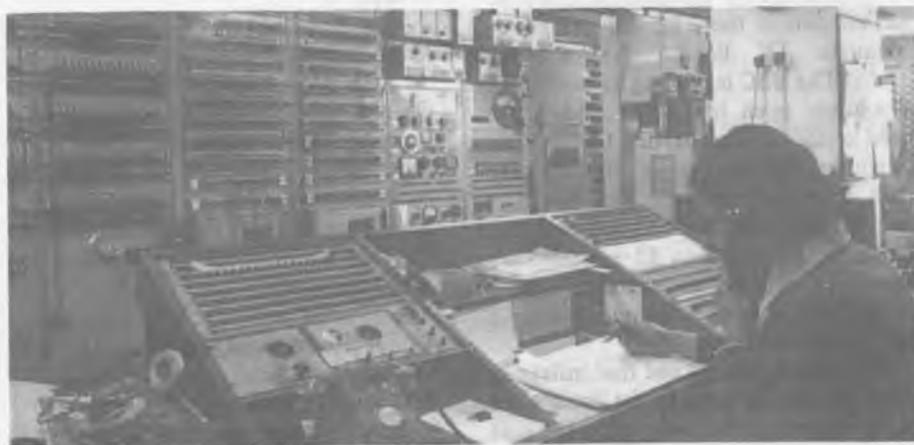
The ATA is the technical heart of the BBC's telecommunication networks for inter-regional PBX and control lines. It handles both local and long-distance telegraph circuits carrying mainly ADX and news agency messages. Interception and test facilities have been provided to permit surveillance and maintenance of the system.

Many of the telephone and teleprinter services provided throughout the UK are carried on BBC-owned multiplex terminals which allow 12 speech channels to be carried on 48kHz 'groups' rented from British Telecom.

The ATA is responsible for the satisfactory operation and maintenance of the terminal telephony equipment throughout the country. Provision of circuits using multi-channel telephony techniques gives a considerable saving when compared with renting the individual circuits from British Telecom.

Further savings are achieved by sharing the channels. For example, PBX lines which are in demand for office traffic during normal office hours, can be used in the evenings and weekends as cue or control lines for programme purposes. Facilities for switching these circuits, and for inserting the appropriate form of signalling interface, are provided in the ATA.

Long-distance telegraph channels are provided by narrow bandwidth voice-frequency signals, multiplexed onto small portions of the normal telephone or control circuits. These are routed through the testing jackfield to the ADX, with the physical circuits from the many local London out-stations. Telegraph signals from commercial news agencies and those within the BBC, are routed through the ATA. They are then distributed to a multitude of programme production areas throughout the country including Local Radio stations, and the Newsrooms at Bush House, Television Centre and Regional centres. They are also made available to topical programmes such as TODAY, WORLD AT ONE and GRANDSTAND.



Julian Strickland, engineer, checking details of a reported fault, at the telecommunications fault position in the ATA

Experimental SAW filters

A facility for producing one-off experimental surface-acoustic-wave (SAW) devices is being developed at Research Department. This work began a few years ago with the intention of producing simple SAW devices as and when required for inclusion or evaluation in experimental equipment. Briefly, the devices are constructed by photofabricating fine patterns of metal electrodes on the polished surface of a piezo-electric crystal.

The principal application to broadcasting is as band-pass i.f. filters with a range of centre frequencies from about 10–200 MHz. SAW filters are smaller in size than their conventional LC filter equivalents and there are certain performance features, such as negligible group-delay distortion, which often make them more attractive. A current project in Research Department, for example, is an attempt to use a SAW transversal filter with a large number of 'taps' to equalise the output pulses from a digital magnetic-tape recorder. Other possible applications include SAW oscillators and resonators at fundamental frequencies up to 400 MHz.



The photo-fabrication facilities and stepping camera used for experimental Surface Acoustic Wave devices at Kingswood Warren.

TV Licence — good value

The Managing Director of Radio, Aubrey Singer, gave some striking comparisons in costs when he underlined the value for money aspects of the £50 colour licence fee which the BBC will be seeking in the autumn.

In an interview on BBC Radio Cleveland, Mr. Singer pointed out that in terms of today's prices a £50 TV licence to provide all BBC services would be equivalent to:

- * Two pints of beer a week
- * Three cigarettes a day
- * Two-thirds of a gallon of petrol a week
- * A small bar of chocolate a day or half a cup of coffee a day on a train
- * Little more than the price of a daily newspaper
- * Petrol to take an average car about three miles per day
- * A glass and a half of milk a day

Taking part in a phone-in programme on BBC Radio Sheffield

Mr. Singer denied that in calling for a £50 colour licence in the autumn the BBC had pitched its demand higher than it needed.

He warned that BBC Radio services could be affected radically by further cuts if the BBC did not get an adequate TV licence fee increase.

"The BBC is putting its case on an absolutely open basis", he said. "We need a £50 colour licence to carry on providing the people of the country with a proper service. The BBC has already cut back by £130 million. For £50 a year - less than £1 a week - we would be offering an extremely good service which we feel the public deserve and would welcome."

Mr. Singer pointed out that inflation, since the last increase in the licence fee in November, 1979, had put up the cost of materials and equipment used in broadcasting.

405 LINE Transmitters to close

The following timetable for closure of 405-line television transmitters during 1982 has recently been announced:

BBC Transmitters - First Quarter

Bude (Cornwall)
Okehampton (Devon)
Bodmin (Cornwall)
Isles of Scilly
Ballachulish (Highland)
Kinlochleven (Highland)
Carmarthen
Churchdown Hill (Gloucestershire)

BBC Transmitters - Second Quarter

Belmont (Lincolnshire)
Sheffield
Scarborough
Kendal
Dundee Law
Perth
Maddybenny More (Co. Londonderry)
Ballycastle (County Antrim)
Kilkeel (County Down)

IBA Transmitters - Second Quarter

Belmont (Lincolnshire)
Sheffield
Scarborough
Ballycastle (County Antrim)

BBC Transmitters - Third Quarter

Ventnor (Isle of Wight)
Bexhill (East Sussex)
Newhaven (East Sussex)
Canterbury
Ffestiniog (Gwynedd)
Abergavenny
Cardigan
Llanelli

IBA Transmitters - Third Quarter

Newhaven (East Sussex)
Ffestiniog
Abergavenny
Brecon

BBC Transmitters - Fourth Quarter

Marlborough
Swindon
Oxford
Hungerford (Wiltshire)
Hereford
Northampton
Bedford
Cambridge
Aldeburgh
Ayr
Campbeltown (Kintyre)
Girvan
Port Ellen (Islay)

IBA Transmitters - Fourth Quarter

Membury (Berkshire)
Lethanhill (near Ayr)

CRYSTAL PALACE 25 years old

On the 28th March, Crystal Palace celebrated the 25th Anniversary of its 405-line transmitters, which were built to provide a service to fourteen and a half million people in London and the Southeast.

At the end of 1955 the transmitters at Alexandra Palace, in North London, were 20 years old and due for replacement. To obtain an even better coverage than the twelve and a half million people Alexandra Palace served, it was decided that the new station should be built south of the Thames. Several places were considered but the present site on Sydenham Hill, the site of the Crystal Palace exhibition, was found to provide the best coverage. Crystal Palace, the vast structure that had been erected in Hyde Park for the Great Exhibition of 1851, had been moved to Sydenham as a permanent exhibition but had been burnt down in a spectacular fire in 1936.

Since 1956 a tall, graceful steel tower has dominated the South London skyline from the ridge of the Sydenham Hills. The tower, 750 feet above ground level, was built to support the eight tier high-gain aerial system. A support tower of that height must have great mechanical stability to avoid vibrations in the angle of maximum radiation. The aerodynamic stability of the tower was tested by using six reaction rockets mounted in a frame, fixed 630 feet up the tower. When the rockets were fired over 2 tons of pressure was exerted against the tower's 450 ton structure. It withstood the test only moving about eight inches each side of vertical at a height of 630 feet. However, a turkey had heart failure at the noise, and the farmer insisted that the BBC staff buy it from him in compensation. It meant they had an early Christmas dinner in 1956.

One of the decisions taken for the new Crystal Palace station was to use transmitters with vestigial sideband



The control room and transmitters at Crystal Palace, 25 years ago



The Original Alexandra Palace transmitters

characteristics (vsb). Alexandra Palace had been the only station to have operated with double sidebands. Although all the postwar stations used vsb in order to conserve the frequency spectrum, and all domestic television receivers were built for vsb working, amateurs found it easier to build their receivers with double sideband characteristics.

The BBC however, adopted vsb working for the new Crystal Palace station because, not only did it save 2 MHz of spectrum space for other users, but it made it easier to design an aerial feeder system with an improved performance and greater efficiency.

Crystal Palace took over the same channel, channel 1 in Band I, as Alexandra Palace had used, and so black and white television had been broadcast on this channel over the past 45 years.

The new station used duplicate sound and vision transmitters and a feeder and aerial system constructed in two separate halves. Each half was normally connected to one vision and sound transmitter. A fault in one chain would mean a 3 dB reduction in output power to the aerial and also a 3 dB reduction in power gain - as only one half of the aerial would be active - and there would be no interruption in service. If the fault on one of the sets of transmitters was prolonged then the good transmitters could be fed to both halves of the aerial, reducing the loss in effective radiated power from 6 to 3dB.

The service opened on 28 March 1956 on a temporary 250 feet mast situated to the east of the main site with the aerial only 190 feet above ground level and with an erp of 60 kilowatts. The service moved to the main tower with the mean aerial height going up to 380 feet and the erp to 120 kilowatts. This left over 200 feet at the top of the tower for possible Band III, IV or V aerials in the future.

Crystal Palace again made history when on the 21 April 1964 the BBC 2 uhf service was transmitted from there for the first time. Then the first colour programmes were broadcast on BBC 2 on 1 July 1967. Again on 15 November 1969 the 405 line was superseded to a large extent when the duplicated BBC 1 uhf service was transmitted from Crystal Palace in colour.



George Mackenzie (CET) celebrates with two of his predecessors, Eric Varley (centre) and Maurice Crawt (right).

WORLD at ONE from Studio 3C



Sue Wilson, a Studio Manager, is shown the channel routing on the new Mark IV desk by Roy Spratley, SCPD.

From Monday 16 February 1981, 'World at One' and 'P.M.' will be broadcast daily from Studio 3C, in BH, London. The studio is the first to be refurbished in a programme to improve the facilities for News and Current Affairs. It embodies the first of the new Mark IV general purpose studio desks to go into service, one of seven being manufactured under contract by Neve Electronics International Ltd.

Roy Spratley, of SCPD, who was responsible for the installation, says 'There has been considerable consultation with the operational staff, who have contributed a great deal to the design of the desk'. Although built up from the same basic modular units, the different versions of general purpose desk are developed to fill the needs of each specialised application.

The new Mark IV desk, specially designed for News and Current Affairs, has ten of its 24 mono channels available for use with sources originating outside the studio. These are necessary facilities for news programmes when a number of outside contributors, including correspondents in the field, must be able to provide material for live or recorded insertion into the programme. As news bulletins have to be right up to the minute, material from the Central Newsroom is fed to a loudspeaker in the control cubicle. The producer can then decide whether to use an item and change the script. To make this easier the script space runs along the edge of the desk nearest to the operator, with faders directly behind this for quick operation.

The Mark IV desk still maintains its general purpose value. It provides full stereo facilities, is sufficiently well

equipped and is flexible enough to be used on other types of production when necessary.

The studio has two other interesting items - an experimental presenter's control unit and prototype headphone control facilities on the production table. The control unit allows the presenters more facilities than just reverse talkback to the producer in the cubicle next door. As well as being able to talk to the producer, the presenters can now lower the volume from the loudspeakers in the studio at a flick of the 'Loudspeaker Dim' key, or cut out their microphones for an instant by using the 'Microphone Cut' or "cough" key. Although a separate "cough" key was available before, it was not so conveniently placed and often operated with a distinct click. The new 'microphone cut' key does not have this effect because it maintains 'phantom' power to the microphone during the momentary break. The new control unit also has a quartz clock built into it.

The production table has been carefully sited in a position in the studio which gives the best acoustical effect. The table has four sets of headphones wired into it. Each separate earpiece is connected to a rotary switch, which allows the wearer to select any of six inputs to each ear. This facility allows up to four contributors to listen to different sources and to be given separate cues, a valuable facility in News and Current Affairs programmes where each item may be coming from a different part of the world and require a different specialist to comment on it in the studio.

Bristol camera goes underwater

BrisSub is an underwater television camera which has been developed to its prototype stage. The design and development was commissioned by the Bristol N.P.C. in January, 1980 and has reached its current stage as a joint project by Technical Services and Mechanical Workshops, at Bristol N.P.C. and the Special Facilities Group, T.F.S., at Ealing.

BrisSub has been designed around the Link 120 camera and Angenieux 15 x 12.5 D2 lens. Any Link 120 camera channel may be used with BrisSub providing some additional frame wiring has been installed in the back pack. The frame wiring need not be removed for normal operation because it uses spare pin connections.

To prepare a Link 120 camera channel for use underwater takes a few minutes only. The BP10 board in the back pack is exchanged for the BrisSub board, the focus servo mechanism is mounted onto the lens and the camera head is mounted and plugged into the bedplate. Finally the camera and bedplate are enclosed in the watertight housing.

The watertight housing may be considered as comprising two main sections; the cast aluminium alloy case and the camera bedplate.

The aluminium alloy case has been designed to withstand the pressures found in 50m of water. In the prototype BrisSub the camera cable enters the alloy case through a leakproof gland. Little is yet known about the effectiveness of the cable gland to provide a watertight seal and it may be necessary to replace this with a waterproof plug and socket. At present the cast aluminium alloy case is only suitable for fresh water use because the anti-corrosion treatment necessary for sea water use has not yet been provided.

The camera bedplate provides the mechanical support for the camera while it is in the housing and the two waterproof compartments for the camera power supplies, zoom and focus demand circuits and alarm circuits. By providing these facilities at the camera head conductors in the TV55 camera cables have been released for remote control circuits and the need for the camera cable to carry voltages in excess of 30V has been avoided.

DIGITAL TELEVISION STANDARDS: HRD reports from San Francisco

The SMPTE Annual Television Conference last March was lightweight compared with events such as IBC, but this year the meeting had a special significance. Concurrent with the conference held at a San Francisco hotel, the SMPTE were organising a series of 525-line digital television subjective tests and demonstrations at a nearby studio. These were similar to those based on the 625-line demonstration carried out in Europe last year which led to the European recommendations for a YUV component digital television standard. After the conference, the SMPTE Task Force charged with recommending a standard for North America was joined by representatives from the EBU for discussions aimed at achieving as much common ground as possible between 625 and 525 countries.

Since the digital television demonstrations at the studios of KPIX had to be carried out by a group of engineers who had brought their equipments from all over North America, without the benefit of the level of resident engineering support than could be mounted by the BBC last April, or the IBA last September, the event must be regarded both a success and a considerable achievement. In terms of deriving information beyond that which was obtained in Europe previously, the exercise would have to be judged as giving a poor return on investment.

Since 625 x 50 is about the same as 525 x 60, it was hardly surprising that very similar answers were obtained on the two continents; namely, that a 2:1 ratio between luminance and chrominance gives pretty good down-stream chroma key, and that you have to struggle to see the difference between pictures sampled at 12 and at 13 MHz for the luminance frequency but it is possible to do so when using critical material. Any differences between 13 and 14 tend to be masked by the quality of the equipment rather than by the sampling frequency. (In some cases different filtering techniques were used for the subjective tests carried out at the two different sampling frequencies.) Even if these tests did not add greatly to our store of knowledge, they must be considered worthwhile since one could hardly have expected the NTSC countries to produce recommendations on the basis of experiments carried out in Europe with 625-line systems.

At the conference, in a session on digital video recording, there were some rather interesting discussions on possible formats for tape recorders, but all the speakers were rather coy, quite naturally not wishing to reveal their Company's product strategies to their competitors. Perhaps the technical highlight of the conference was the demonstration by Sony of a 1-inch C-format VTR demonstrating the ability to record a digital YUV signal at bit

rates high enough to accommodate any of the standards envisaged and demonstrating such facilities as picture-in-shuttle, etc. on the experimental prototype.

Another session, on future directions for television, contained a very useful report from Japan about their two-channel sound with television, which has been radiated for about 18 months from 29 stations. Programmes such as stereo music, sport, bi-lingual news and imported films are broadcast with both the original and Japanese sound. The paper reported that there were now over one million television receivers capable of receiving two-channel sound in Japanese homes. For a sound spectacular, with 50 performers, up to 60 microphones might be used. I was rather encouraged to see a Neve 8088 computer-assisted NECAM system appearing prominently in the demonstration tape. This is used in conjunction with a 16-track recorder to produce the final Left and Right mix down.

Another significant contribution from Japan was a paper and demonstration of high-definition television. This demonstrated the feasibility of high-resolution pictures originating material such as laser telecine for 70 mm film, high-resolution cameras as well as wide-band satellite broadcast transmissions. But in the absence of a viable large screen display, the justification for the whole package was not very convincing.

One of the comments, made by the chairman of the "all-digital studio" session, when he introduced a paper on digital encoding by Chris Clarke from Kingswood Warren, put the BBC's work into perspective. He mentioned that Chris had been working on digital television in the BBC's Research Department for about ten years. The chairman then went on to say that he, himself, had not even heard of digital television until three years ago! Chris described some of the advantages of digital decoding techniques particularly with respect to the separation of the chrominance from the luminance information. He did his best to allay the fears of those concerned about the operation of studios during the period when digital equipment will have to work alongside composite analogue sources. In doing this he had also to contend with those at the conference very loath to give up the concept of a

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Some of the equipment assembled for the SMPTE digital television demonstrations at the studios of KPIX in San Francisco. The organisers pointed out that most of the equipment, most of the signals carried in the maze of cables, and most of the problems were analogue!

San Francisco

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sub-carrier related line-locked sampling structure.

In the same session Tom Robson of the IBA made a plea for people to grasp this opportunity to achieve the nearest thing to a world-wide standard that is available to us. He drew attention to the fact that we only have a limited time in which to reach agreement and that the opportunity windows will close within the next three months.

One evening during the conference, some of us had the opportunity of attending a reception at the home of Francis Coppola the producer of "The Godfather", "Apocalypse Now", "Paper Moon", etc. In true regal style Coppola appeared about twenty minutes after the last of his guests had arrived at his house (regal - appertaining to royal rather than the pre-Bingo era of cinema!). Not only did it give one a chance to see one of the magnificent houses of the Edwardian era in San Francisco, largely intact except for a movie mogul's private cinema in the basement, but it also enabled one to meet some of his associates who are experimenting with a very interesting technique in film making. Before it reaches the cutting room, all the shots are converted to tape by telecine, and edited electronically until the director is happy with the final product. He then asks the film editor to cut final copy along the lines of the most acceptable electronically mixed version. It remains to be seen whether these people are setting a new trend for the cinema or whether this is more trouble than it is worth. On the face of it, it is a rather interesting marriage of two disciplines which has also been tried by CBS in connection with situation comedies filmed for tv.

At the "consensus forming" meeting on the Sunday after the conference Ken Davies, the chairman of the relevant SMPTE Task Force, narrowly avoided disaster by deflecting a proposal for a vote which would have indicated how many people would be prepared to support a move downwards from the NTSC subcarrier locked frequency of 14.3 towards the EBU's preference for a lower frequency. This would have produced a sort of histogram of preference which would have given the SMPTE negotiators no room to manoeuvre in subsequent discussions with the EBU.

These discussions took place in Brussels about a month after the San Francisco meeting at a joint

Wrotham gets a new mast



Re-engineering work at Wrotham continues. Here the new mast is being lowered onto a 4 inch steel ball bearing.

NEW ROUTES

A new microprocessor based routing system is being installed for the Central Apparatus Room (CAR) at Television Centre on a 6 month field trial. The new router has been developed by Designs Department and SCPD in conjunction with Television E & O. Designs Department are using the standard BMM Z80 microprocessor system to control the routes selected, the times at which they are selected, and for checking that the proper route selection has been made. SCPD have constructed the interface circuits and route switching system.

Information, concerning a circuit route, and the time it is required, can be

meeting between EBU Working Party V and the SMPTE Digital Task Force. After an extensive analysis of the tests carried out in Europe and in the USA this meeting agreed that 13.5:6.75:6.75 was the best compromise for a sampling structure which would be acceptable as a world-wide standard. The EBU and SMPTE representatives at this meeting undertook to recommend these numbers to their parent organisations as the basis of their submissions to CCIR at the end of May. At the time of writing the EBU Technical Committee has accepted and confirmed this recommendation and will therefore be basing its CCIR contribution on these numbers. Acceptance of the recommendation by the SMPTE had not been confirmed at the time that this issue went to press.

stored by means of a conventional QWERTY keyboard. Displayed on a VDU are the source, destination labels, and time and duration of the routing. Also displayed are circuit identifying labels, for example, 'Grandstand', 'Eurovision' etc. Using an accurate clock tied to MSF Rugby, the microprocessor can automatically route a source to a destination at the precise time required. An alarm sounds at the end of the allocation, and the operator can either de-select the route, or inhibit the facility; this enables programme overruns to be accommodated. The microprocessor prevents double-booking, and will prevent more than one source being selected to the same destination.

The system can store information on up to 100 each of auxiliary, control line or closed-circuit vision sources, together with a similar number of destinations. The system is quite flexible, allowing immediate changes and updates via the keyboard.

At the end of the day the identifying labels can be used to re-programme the system for the following day. For example, if a particular route is required again at the same times, all of the information is automatically re-programmed; similarly the route can be deleted once the requirement has ceased, and, by keying in the label the system de-programmed.