ENG INF

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London to Birmingham at 140 Mbit/s

Howard Jones (foreground), from Research Department, John Stark (centre) from Communications Department, and David Kitson from Designs Department, study the error rate on the 140 Mbit/s circuit

Communications Department and British Telecom (BT) are using a digital transmission system to carry television, radio and other services over a high bit-rate link between London and Birmingham, during a six months pilot scheme which started in the Autumn.

After initial tests, the system will be used to carry BBC 1 and BBC 2 television signals, and associated sound, to Birmingham for distribution to the Midlands, North of England and Scotland. In the reverse direction it will carry tv contributions originating in these areas to London. The links will also be simultaneously carrying wideband music circuits for radio and television, and internal speech and telephony traffic.

The coding equipment in London and Birmingham was designed to a specification drawn up by Communications Department, and has been developed and built as a joint Research and Designs Departments project.

BT has provided a 140 Mbit/s bearer circuit over three different forms of digital transmission media. From BH in London to the London Telecom Tower, it employs optical fibre, from London Telecom Tower to Birmingham Telecom Tower it uses an 11 GHz digital radio link, and then on conventional coaxial cable to Pebble Mill.

The pilot scheme will give Communications Department and BT experience in carrying high quality vision and sound signals through a digital network, and confirm that various types of signal can be successfully combined. It will also assess the technical performance and reliability of the BBC designed and constructed coding and mulitplexing equipment in an operational environment.

It is expected that the use of digital circuits will result in improved performance, and reduced maintenance as BT's trunk network becomes fully converted to digital transmission. Combining a wide range of services into a single bitstream allows the most effective use of standard bit rates.

A vision signal and two associated sound channels are combined with radio programmes, telephone speech, control and data service, into a single 68 Mbit/s package. Two such digital packages are added to give a 140 Mbit/s bitstream that can be transmitted through bearer circuits being provided by BT as part of its modernisation programme of converting the national network to digital

continued on page 3

In this edition of ENG INF

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Editorial

It is with much sadness that we record the death of Sir Harold Bishop, CBE, FCGI, BSc (Eng), Hon. FIEE, FI Mech E, FIEEE, who retired as Director of Engineering in 1963, after a long and distinguished career with the BBC.

Sir Harold joined the British Broadcasting Company, as it was then known, in May 1923. Prior to this he had been operating the London 2LO transmitter for the Marconi Company, having first studied at the City & Guilds college, where he gained his BSc. As one of four engineers recruited directly from industry, he was appointed Southern Area Maintenance Engineer, and was responsible, together with L.W. Hayes, for finding the site at Borough Hill, Daventry, for the 'new' long wave transmitter, 5XX. At the end of 1923 he was promoted to the post of Senior Superintendent Engineer, under P.P. Eckersley. It was in this role that he undertook the technical arrangements for an Outside Broadcast that was to have the maximum impact on the listening public at that time. This was the opening by King George V of the British Empire Exhibition at Wembley on 23 April 1924. It was estimated that the speech was heard by some ten million listeners via special receivers installed in major cities, and also by the first recording (by a commercial company) for a repeat broadcast later in the day.

In 1929 he was promoted to Assistant Chief Engineer when P.P. Eckersley left, a post that he held until 1943. It was during this period that he, together with a small team of engineers, began searching the country for evacuation premises for use in the event of war breaking out. In 1938 he was instrumental in the purchase of Wood Norton Hall, near Evesham, now the home of Engineering Training Department, which became a major evacuation centre, broadcasting up to 1300 programme items a week from there. One of the more modern dormitory blocks at ETD carries his name.

It was also in 1938 that he was awarded his CBE. During the war he was responsible for the provision of a portable disc recorder for use by reporters in the WRU (War Reporting Unit), and for the provision of technical equipment and transmitters for the WRU after the D-Day landings. It was in 1943 that Sir Noel Ashbridge was appointed Deputy Director General and Director of Technical Services, and Harold Bishop succeeded him as Chief Engineer. In 1947 he went to Singapore, and negotiated successfully for a site in Tebrau for the BBC's Far Eastern Relay Station.

In August 1952 Harold Bishop became Director of Technical Services, a post in which he again succeeded Sir Noel Ashbridge, and which became known as Director of Engineering in 1956. In the Queen's Birthday Honours list in 1955 he gained his knighthood, only the second time a BBC Director of Engineering had been honoured.

The post-war period saw the growth of the television service, and many technical innovations. It was in 1958, whilst visiting America with F.C. McLean, that he saw a demonstration by Ampex of the VR1000A video tape recorder, which resulted in an order for our first machines.

Sir Harold Bishop retired in 1963 after forty years in the BBC, the first man ever to have completed this length of service. To quote from the BBC Annual Report for that year, "Sir Harold Bishop has been responsible during his long service for helping to provide great pleasure for many millions of listeners, and both the country and the BBC owe him a great debt of gratitude. He also laid firm foundations for the future developments which are to take place".

Sir Harold Bishop was President of the IEE in 1953/54, President of the Association of Supervising Electrical Engineers from 1956-1958, the first president of the IEETE when it was founded in 1956, and President of the Royal Television Society in 1960/2. A truly distinguished career, and one which achieved the aims of the BBC Engineering Department when they were laid down in the early years:

(i) to maintain a high standard of broadcasting

(ii) to spread the broadcasting service into areas of the country having either unsatisfactory reception, or none at all; and

(iii) to conduct research into all aspects of broadcasting, as only a few firms in existence at that time were equipped to do such work and interested in undertaking it.

Alan Lafferty

Transmitters Opened

The following transmitting stations have opened since July:

Uhf tv

Ardintoul, Highland
Ardnadam, Strathclyde
Attadale, Highland
Chatburn, Lancashire
Fernhill, Mid Glamorgan
Kewstoke, Avon
Llandderfel, Gwynedd
Llangadfan, Powys
Peterchurch, Hereford
Ravenstonedale, Cumbria
Rhondda Fach, Mid Glamorgan
St. Briavels, Glos.
St. Peter Port, Guernsey
Sidmouth, S. Devon
Staithes, Cleveland
Wye (Ashford), Kent
Yetholm, Borders

Vhf radio

Maddingley, Cambridge
Wharfedale, W. Yorkshire

Local Radio

Caradon Hill, Cornwall
Huntshaw Cross, Devon
Okehampton, Devon
Heathfield, Sussex

Licence Agreement

"Bradbury Limited of Newbury, Berkshire, have been granted a manufacturing licence for the Modular Audio Recording Equipment, RDIM/1, which allows them to make this equipment for general sale. This equiment, designed originally by Designs Department, is better know by its unofficial title Modular Audio Storage System, MASS."

Pilkington to make multiplexer

Reece Davies (left) signs the agreement with Russell Fletcher (HSCPD)

Russell Fletcher, HSCPD and Reece Davies, Sales Manager of Pilkington Fibre Optic Technologies Ltd., of St. Asaph, Clwyd, signed a licence agreement for a digital fibre optic control system, at the APRS Exhibition at the Kensington Exhibition Centre on 22 June. Under the agreement, Pilkington will manufacture and market a BBC-designed system to their own standard chassis module design, under the title "Mixed Function Multiplexer" with the coding "PPADS/16." The control system has been designed to provide a flexible means of switching audio, communication and dc circuits over small bearer cables.

Chris Chambers of SCPD, who designed the system, said, "Our original intention was to produce some way of increasing the number of facilities that can be taken to a new studio area, beyond that which the present arrangement of 200-pair copper cables can carry, and yet stay within the same limited space of the existing cable ducts. Fibre Optics allow us to do this. They also give us the extra advantage that they are not affected by induced electromagnetic interference. You could run them in a mains conduit if you wanted to."

The system had also to be two-way and interactive, and does, in fact, allow a large number of facilities to be carried in even more limited space. A master card at each end of the optical link allows 16 data channels to be fed into and out of a link. Each channel has a capability of 255 coded commands, so that 16 channels allow up to 4080 commands to be handled. Because they are two-way, this means that up to 2040 executive actions can be switched or remotely controlled.

A second type of master card can be made which when coded with 5-bit address codes allows up to 32 data channels to be connected into the system. Each data channel is identified by an 8-bit head code. This enables a channel output port to talk to an identified channel input port. However, the system is so flexible that a head code can be instantly changed to give a channel another address. In this way an output port can be connected to one or more input ports or can sequence through all the channels in turn.

At present three different types of channel interface cards can be plugged into the system to allow a channel to perform a specific function. A two-way digital control interface, for use with coder circuits on a 26-way ribbon cable, allows commands to individual switches, indicators and remote switching devices to be coded and sent over the system. A two-way RS232/V24 port, such as are found in computer peripherals, teleprinters and VDUs. An analogue control interface provides 8 analogue send and return lines and is for use with remote variable analogue controls. The channel port itself conforms very closely with the Centronics 8-bit parallel standard. Because of this any one system can be equipped with any combination of the available interface cards. This also means that channel ports on different systems will 'talk' to each other.

As a result of tests on the prototype equipment, the system has been found to be even more flexible than was originally expected. The full potential has not yet been exploited and already it has shown that it can be used with information retrieval systems, such as those in news broadcasting operations.

Using the system you are able to link up several out-stations to a central computer. At slower speeds of operation, the system can be used over a telephone pair or even over a standard coaxial cable.

The BBC has placed an order for 50 Pilkington Mixed Function Multiplexers for switching and reel-to-reel tape machines at its local radio stations.

Digital circuit.
continued from page 1

operation.

The vision signal is first sampled, and then quantised to a resolution of 8 bits. The resultant bit-rate is too high for economical transmission, and is reduced to 53 Mbit/s by sub-Nyquist sampling, comb filtering, and differential pulse-code modulation (DPCM).

The sound and the other channels are then added to produce the final rate of 68 Mbit/s. The DPCM is optimised to maintain transmitted picture quality. Special arrangements are made to handle teletext signals.

The tv sound is coded using the Nicam 3 process. An 8.448 Mbit/s stream which can provide up to twelve stereo circuits, and the tv sound and vision signals are combined in a specially designed mulitplexer. The multiplexer has been arranged so that individual bit streams can be subtracted, added or over-written as required.

Error-correction coding is applied over the whole signal, and the resultant bit-stream is scrambled to avoid repetitive patterns. The error-corrector provides information on the error performance of the system and also signals alarms.

Radio links Lime Grove

The topical mobile support vehicle (TSI) with mast extended

The Topical Production Centre at Lime Grove is required to cover many diverse events, and for this purpose TCPD engineers have designed and built a self-contained mobile communications unit. Essentially it is a radio link vehicle, but can replay recorded material from a high band ¾-inch video recorder and can accept live pictures from a camera. Operationally the vehicle would rendezvous with a standard T.P.C. portable single camera unit at the chosen location. Initially the unit will be used to provide short items of topical material for inclusion in programmes such as Breakfast Time, 60 Minutes and Newsnight.

Visual coverage will be provided by using a T.P.C. portable single camera unit which uses an Ikegami HL79D camera and has available BVU 50 record only, and BVU 110 record/replay video recorders.

This highly-mobile unit, based on a commercial van, can be rapidly deployed to provide immediate pictures at important events. The unit can be moved very quickly as soon as one transmission is completed, and can re-establish communications at another location. Certainly for the provision of brief, topical material, this system has a great advantage over the more conventional outside broadcast systems involving several vehicles and other ancillary units.

Two radio links are available in the van, one operating at 2.5 GHz, the other at 7 GHz. The 2.5 GHz link has a 25 watt mast-head amplifier feeding a pair of Marconi helical aerials. This system works into the three ENG receiving sites in London at Millbank, Crystal Palace and the Barbican. These are controlled from the Television News central apparatus room in the Spur at Television Centre. The 7 GHz link is normally used on a tripod from the roof of the van working into television communications OB circuits. Either link transmitter can also be operated remotely from the van via Triax cable up to a distance of six hundred feet.

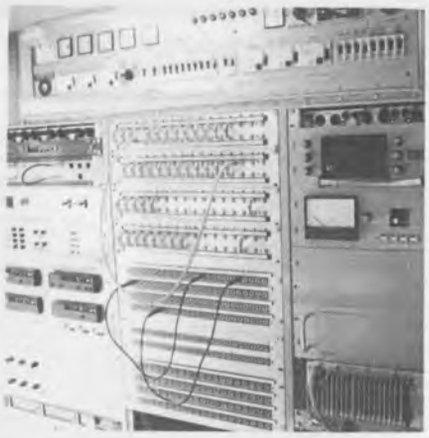
In addition to the 2.5 GHz and 7 GHz links, there is a 12 GHz, 50 milli-watt window link transmitter. This is contained in a suitcase so that pictures can be sent from a convenient point to a receiver mounted on the roof of the van thus avoiding the need for cable runs.

Radio Telephone Links

With the type of television reporting required by the T.P.C. good communications with base are essential, so a comprehensive switching system has been installed to enable the cameras and reporters to hear talk-back. The 141 MHz ENG radio telephone enables the 2.5 GHz link to be set up, and afterwards can be used for production talkback. This can be extended from the vehicle either on cable or re-radiated direct to the reporters and crew. The vehicle also has a 171 MHz radio telephone operating on the News Spur Net.

The cab of the vehicle contains access to the radio telephones and is fitted with a comprehensive panel of warning lights for monitoring all doors, jacks, mast and fuel system.

The Operational Area, situated in the middle of the van, contains six bays of equipment, three technical and three operational, mounted across the van, with a 1.2 m space in between for operational staff. Entry to the Production Area is by a separate door on the near side of the vehicle.



The technical bays inside TSI

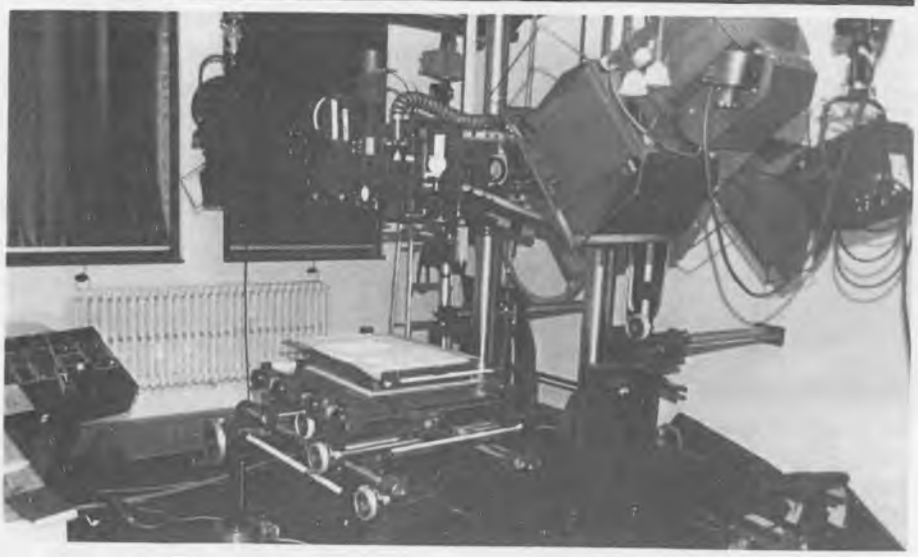
The specification called for the mast to maintain an aerial pointing accuracy to within +/-2 in winds of up to 40 mph when equipped with a 45 kg head load. The mast has a load capability of 140 kg which has been achieved by using eight mast sections with a base tube diameter of 8" reducing to a top tube diameter of 4¼".

The mast is extended by three, 12 volt air compressors working in parallel through a standard control box, as used on BBC Local Radio cars. A differential switch, which automatically re-pressurises the system in the event of pressure escaping past the seals, is included. There are also safety interlocks on the top three collars to prevent RF transmission before the aerial has been raised to its minimum safe working height.

The TCPD Project Engineer was Mike Robinson and the design and construction team was led by Gerry O'Leary of TCPD who, whilst thanking all the members of the team for their help, gave high praise to Equipment Department who supplied much of the gear at very short notice, and thanks to John Howarth and Jon Peace, specialist engineers from the Lime Grove Topical Production Centre.

The operational bays inside TSI. The space in the right-hand bay accommodates a BVU 110 VCR

New film equipment



The new Oxberry film rostrum camera at TVC

The new Oxberry film rostrum camera is the first replacement for one of three elderly machines in the recently refurbished Film Rostrum area at TVC. Being situated in its own air-conditioned room with a specially designed lighting system, the camera is capable of generating the most complex film effects.

Essentially the device is a stand which supports a precision film camera over a table on which can be art-work or other material. The table can be moved in two directions or rotated by means of leadscrews, and the camera can be raised or lowered by a motor drive. In use, the art-work is moved by small increments between successive exposures of the film, in the same way that film cartoons are created. Sometimes the same film has to be run through the camera and exposed a number of times. To ensure that the subsequent images are correctly aligned, perfect film registration is essential. A similar degree of accuracy is necessary with the table movements.

As an example of the degree of accuracy required, during the acceptance tests, some misregistration was noted on some types of film stock. Ian Sanderson of Cine Film Section, SCPD, who was responsible for preparing the specification of the machine, and has much experience of rostrum cameras, resolved the problem by having the size of the film register pins increased by 0.0002 inch.

The rostrum camera is supplied with a wide range of accessories, making it a very versatile machine. The camera can be converted from 35 mm to 16 mm operation by simply changing the film transport mechanism and shuttle. It has two sets of film take-up drives for "bi pack" operation, enabling film to be shot through another exposed and processed film. Four fixed focal-length lenses have been supplied, but zoom effects can be produced by tracking the camera up or down the vertical columns, the lens focus being controlled by a follower mechanism tracking a vertical cam profile. Automatic fades and dissolves are possible, and a microprocessor is used to control camera speeds, monitor film footage, and frame counting.

The rostrum table is fitted with four peg bars for multiple cell art-work, a backlighting unit for transparencies, and a floating peg bar to control overlays independently of the main table. All movements are controlled by handwheels fitted with counters so that the position of each can be precisely monitored.

The lighting system, installed by Jim MacDonald of Lighting and Mechanical Section, consists of two 2kW and two 1kW luminaires, the intensity of which can be controlled from a wall mounted dimmer unit. Polaroid filters are fitted to the lamps and in front of the camera lens to eliminate reflections from glossy art-work and glass platens. The lamps are mounted on a two-way ceiling track so they may be easily positioned and have some height adjustment.

As part of the scheme, the rostrum camera will be motorised and coupled to a computer control system similar to the one at present being developed for the Video Rostrum camera by Mike Wolfe of Lighting and Mechanical Section. The installation of the camera and rostrum went very smoothly, the initial setting up being carried out by the manufacturers engineers, with a great deal of help and co-operation from the staff in the Rostrum Camera Unit. The camera is now in regular use, and an order has been placed for a second machine for delivery later this year. John Tyler of Lighting and Mechanical Section was the project leader.

The artwork table associated with the film rostrum camera

Maida Vale Studio 7

The new drama studio at Maida Vale, Studio 7, which was opened on Wednesday, October 5 as the Val Gielgud studio, brings a new dimension to radio drama studio design. Starting from a basic identification of the needs, elements, and the methods of working in drama, S.C.P.D. brought it together using the latest technology in a new and exciting way, to produce the flexibility and complexity required. As a result the studio can be used for talks or for the most complex drama production.

The studio technical equipment is centred around a 30-channel, 4-stereo group, BBC-designed general purpose desk (GP Mark 4D), manufactured by Audix. This is complemented by a tape/gram sub-mixer desk which allows eleven stereo channels to be fed into two of the groups. There are also comprehensive special effects and cue switching systems.

The tapes and grams in the new studio have full remote starts, with timers showing tape times in hours, minutes and seconds. These are duplicated on the sub-mixer desk. There are four 8-track Studer A80 tape machines, three EMT 950 gram decks, and a BBC-designed RP 2/9 with two Technics turntables. The EMT 950s have a vari-speed facility with a very accurate groove indicator, which allows flexible use.

Cue-lock synchronisers use time codes to link the tape machines, and can be programmed to start them automatically. All the tape machines have Dolby A noise reduction.

The routing to the multi-track stereo tape recorders is controlled by the NTP Routing matrix computer, which operates at four distinct levels. At the first level, an 80 x 20 matrix routes the mono outputs of the main and sub-mixer desks to the multi-track recorder inputs; at the second level, a 32 x 8 stereo matrix connects the stereo outputs of the desk, sub-mixer, tapes and grams of the stereo machines and the monitoring panel. The third provides a change-over operation to switch time code to track 8 on the multi-track machines and lock it there; and the fourth is a dc matrix for control of off-tape monitoring of the tape machines. The dc matrix operates so that only a single pair of Dolby decoders are required for monitoring all the stereo outputs instead of the four that would be required without it. The software for the matrices has been custom-built. The studio has ninety microphone ports available to it, whereas a conventional GP mark 4 studio would only have twenty.

To get a wide range of differing acoustic effects, pattresses, containing microphone points, loudspeaker points, cue lights, tie-lines and mains plugs, have been installed in corridors, in the artists' rest rooms and in technical areas.

Cordless headphones are used throughout the studio, the sound being carried by a Sennheiser infa-red radiator system.

Another distinctive feature of the Val Gielgud studio is the cct video system. This has two monochrome monitors in the studio area and one in the cubicle to improve visual contact between the actors and production staff. The system also allows the status of the routing matrix to be displayed by switches on the sub-mixer desk and the special effects trolley.

Writing about the new Studio, John Tydeman, Assistant Head of BBC Radio Drama, who has produced two of the first three productions from Studio 7, 'Luther' and 'Passing Time', writes:

"Why, it might be asked, is a new studio required specifically for the use of Radio Drama production? The answer lies in the same area as the reason why the BBC is contemplating a new Radio Centre on the site of the former Langham Hotel. There was a time, a time long past, when the BBC's Radio Drama studios were the best in Europe. Time and the new technology have eroded that forefront position. There can be no denying that the four drama studios in which the Drama Department now operates have become outmoded. The old studios cannot cope with the new advances in technology and, most important of all, they are not securely soundproof. The two drama studios which exist in the basement of the extension at Broadcasting House have, since the completion of the Victoria underground line, been beset by the distant rumble of tube trains. The two studios in the old part of the building not only have problems of ventilation but are also subject to external noise. The great attribute of the new drama studio in Maida Vale is that it is entirely soundproof.

Plans for the new studio were set in motion by the former Managing Director of Radio, (now Managing Director of Television), Aubrey Singer. The building of this new studio represents a very serious commitment on the part of the BBC to continuance and furtherance of high quality Radio Drama. The studio was officially opened by Sir John Gielgud, and is named "The Val Gielgud Studio", in memory of Sir John's brother, Val, who was the first Head of the BBC Drama Department and for many years its chief. All drama producers are agreed that the new studio has an excellent atmosphere and ambience, and they hope that the high traditions of quality in the production of radio drama will not only be maintained but also be aided by the new facilities"

Designs Department open day success

Over 450 engineers from the BBC and industry visited Designs Department during three open days in October. On display were examples of the Department's work ranging from new test equipment, to fully automated systems to be found at hf transmitting stations. Visitors were greeted with a live demonstration of the injection moulding of plastics, such as that to be found in the manufacture of plastic cases, and an example of the problems encountered in the manufacture of multi-layer pcbs. In other labs on the sixth floor of Western House were demonstrations of a digital vision mixer, a digitally generated Test Card 'F', and a video effects workshop. Also on display was the transmission of digital video and sound signals on a 68 Mbit/s package (see elsewhere in this edition of Eng. Inf.); Sound pcm distribution showing how the existing 13-channel system will evolve into a 24-channel NICAM 3 system, a NICAM 3 digital test generator and an fdm audio system using digital filtering techniques. An interesting demonstration of computer aided design techniques for pcbs was also available.

On the fifth floor, recent developments at MICs, hf transmitter automation, and shf remote antenna control, occupied one lab, whilst the MAXIM system of time-code controlled synchronising of Studer audio tape-recorders was in another.

The use of computers and microprocessors in broadcasting is well established. On the fourth floor of Western House was Electralog, a software development system used for data logging in vt editing suites. Also on show was CINETRACE, an electronic film editing bench being integrated into the new wide screen film data preparation/transmission system.

The third floor divided itself between either end of the frequency spectrum. In the listening room, visitors were exposed to the new LS5/9 loudspeaker and the headphone limiter, both described in Eng. Inf. no. 10. Along the corridor the R.F. Section demonstrated uhf re-broadcast receivers, Band II solid-state transmitters, and a 1500 MHz digital radio link.

The Sound Studio Apparatus laboratory on the second floor was showing an ingenious solution to the problem of remote unattended radio studios, and a demonstration of digital audio interface and processing equipment. In the Special Studies laboratory were examples of digital television studio equipment, including cables, connectors, patch panels and routing systems. Also in this lab was a demonstration of the SLUG waveform, a novel line-up signal for colour tv monitors, incorporated into the new GE6/560 programmable colour bar generator. Finally, in the Measurements Lab on the first floor were examples of audio and video test equipment.

Clearly the number of exhibits, and range of technology involved, prevents a detailed description of all the equipment on display. Further details of individual items can be obtained from Designs Department Liaison Engineer, Peter MacMurdie on LBH 4345, or by contacting the section concerned.

Thanks must be given to all of the Designs Department staff involved, who are too numerous to mention by name, for the courteous way in which they explained their work to the visitors, and for the amount of effort that made the Open Day such a success.

CEEFAX transmits computer programs

The flexibility of the teletext system was demonstrated on the 20th September when the BBC's Telesoftware service was launched by John Butcher, MP, Parliamentary Under Secretary of State, Department of Industry, at Television Centre. The new service, available to owners of the BBC micro-computer and teletext adaptor, will broadcast computer programs on pages 700 to 706 of the BBC 1 Ceefax service. The system has been under experimental evaluation for the last nine months, and the test results have demonstrated the suitability of this medium for the transmission of Telesoftware.

Telesoftware is the name given to the transmission of computer programs via the teletext signal. The data is carried as a page of information on the existing teletext system.

A special teletext adaptor, developed by engineers at Research and Designs Departments, connects to the 1 MHz bus connector of the BBC model B micro-computer, which then enters the programs into the computer's memory in the normal way. To take advantage of the service, the user needs to connect a conventional off-air uhf television aerial to the teletext adaptor, and the teletext signal can then be decoded. The adaptor will also allow the display and processing of normal teletext pages.

The adaptor can operate on off-air television signals of about 800 uV in strength - about the same as that required for a good colour picture; however the signal must be free from multipath images (or ghosting) for the telesoftware adaptor to receive the computer programs correctly. Any distortion or ghosting will result in failure to capture the page, and the in-built cyclic redundancy checking system will reject the page, and prevent it being downloaded into the computer.

The software for the service has been specially written by Microelectronics Education Programme and Brighton Polytechnic. Other programs have been commissioned for the service, with a special bias towards educational users. It is likely that schools and colleges will find immediate application for the programs.

Owners of the BBC model B micro-computer should note that the adaptor will only work with operating system 1.2 or later, and requires a special ROM to be fitted in the sideways expansion socket of the computer.

Studio 4 at TVC re-enters service

Studio 4 production control room. Engineering staff test the new mixing desk and special effects units

Television Centre Studio TC4 returned to service on the 12th September after an extensive refurbishment costing some £2M. The studio first entered service in 1961 as an image-orthicon camera monochrome studio, concentrating on drama and light entertainment. It was later converted to multi-standard (405/625 line) operation and was completely equipped for colour operation in 1970.

The present refurbishment covers the complete replacement of the vision system, an overhaul of the audio communications and lighting control systems, and the replacement of the lighting winch, lantern and dimmer equipments. To enable SCPD to cope with their heavy work programme, it was decided to place a large proportion of the work on outside contractors, and to work with an absolute minimum out-of-service period (8 months in practice). Detailed system specifications were written and tenders sought for building, electrical, vision, audio, and lighting and mechanical work. Building work was carried out by Higgs and Hill Ltd., managed by ACED.

Electrical power and wiring work included the complete replacement of every wiring run, most of which were in rubber insulated cables, and the replacement of all lighting fittings. It also involved the installation of new switchgear and distribution boards, security, fire alarms, and the clock systems. The work was carried out by Berkeley Electrical, managed by SCPD Power Distribution Section, and TCPD, Power Services Unit.

The vision system contract was placed with Link Electronics who supplied equipment, either of their own, or under sub-contract as necessary. Some specialist items of BBC equipment were provided under embodiment loan. The vision system was modelled on that which Link has successfully completed in TC2. The sound mixing desk was refurbished by Rupert Neve Ltd., and the BBC communications system was adapted and modified by SCPD, with a change to broadcast quality microphones.

The production lighting winch system was designed and installed by Evans Ltd., of Portsmouth to BBC specification. Being a newcomer to the field several novel features were incorporated. Some one hundred new winches have been installed with a "flip-flop tray" for feeding power to the lanterns suspended on the barrels. The lantern system, which is based on the dual source concept, was a "value engineered" version based on the Colortran "Qwart" system. New producting lighting dimmers of a "wired in" type have been used for the first time.

The specification for the vision system provided for new equipment, desks and monitor stacks in the control rooms and vision apparatus room. The main items of equipment provided were: six Link 125 Broadcast Colour Cameras fitted with Schneider zoom lenses (13:1) with PVC camera cables, and a sixteen channel "Grass Valley" 1600-3FPY4 vision mixer. This enables the six cameras, the six outside sources (film, tape or outside broadcasts), and special effects captions and slides, to be added together in a variety of ways. The mixer has twin mix-effects banks and an E-mem system for memorising complex stored effects and transition sequences. A vision switching matrix for all preview and video signal switching and cues was manufactured by PROBEL Ltd of Reading. This micro-processor based system is operated from Link manufactured control panels, and a special six channel vision "sub-mixer", for special superimposition and fading work in Light Entertainment and Drama, was also installed.

Complex video effects can be produced by an effects system based on the BBC soft-edge switch SE3L/507 and controlled by a PROBEL micro-memory system. The special Link control panel enables comprehensive CSO effects to be set up. Digital special effects are available from a shared Quantel 5001-plus system operated from panels in the production desk. Caption facilities are provided by a refurbished dual-port Rank Cintel MKVIIIB flying spot scanner, with TARIFF 2 for colour correction. A full three-level colour synthesiser provides coloured captions and graphics from a black and white source. Interface facilities have been provided for hand-held cameras where necessary. Thirteen colour monitors by Barco and Sony, and forty-one black and white monitors (Luminant D) by Melford have been used. An "EAST–MEAD" programmable display system is used for labelling monitors and the name of the cameraman or the OB venue can also be typed in. A timecode display system by Selteck has been installed for production timing purposes, and finally a local VHS video recorder has been installed to enable copies to be made for production purposes.

TC4 is now in regular use for programmes such as "Top of the Pops", "The Late, Late Breakfast Show", and "Panorama".

John Tiller, SCPD

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Published by BBC Engineering Information Department