No. 8 – Spring 1982

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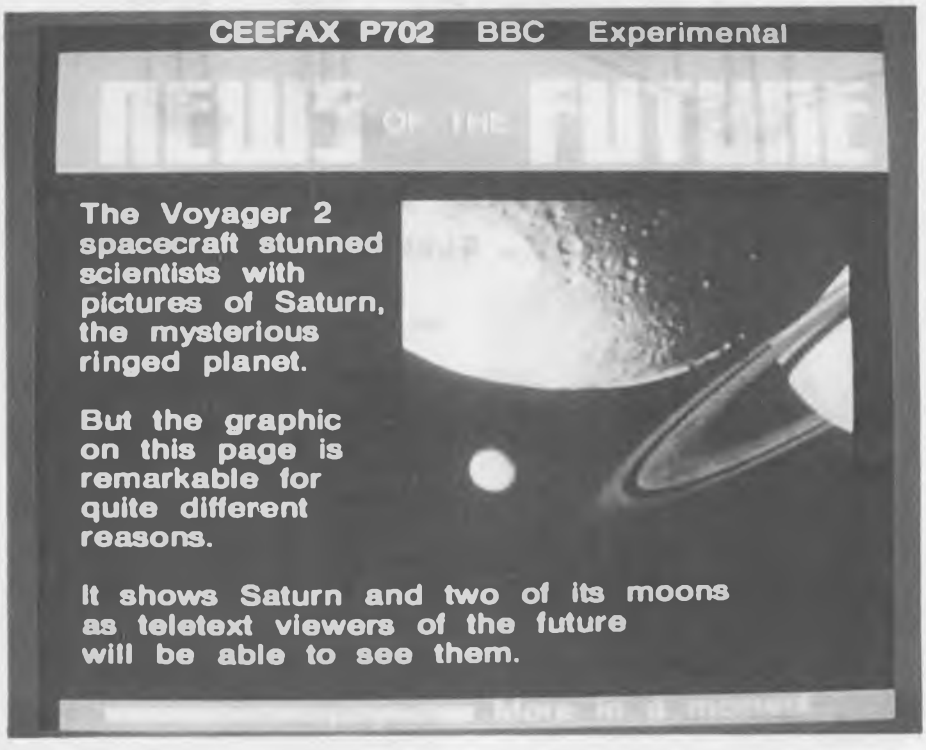
ENG INF

The Quarterly For BBC Engineering Staff



The BBC has made the first public broadcast of high quality still pictures by means of the UK Teletext system. The broadcast high-quality pictures and other enhancements were demonstrated to a technical committee of the European Broadcasting Union (EBU) on February 11th, and at a meeting of the Institution of Electrical Engineers (IEE) on March 8th. The UK teletext system has, for many years now, represented an efficient and rugged way of transmitting, receiving and decoding data for display on a television receiver. None of the efficiency or ruggedness is lost in the transmission of the enhancements.

The recent transmissions were the culmination of several years work by engineers from Special Projects Section at Research Department. The equipment used to generate the enhancements contained a teletext generator, a microcomputer system and a high-quality digital picture store, whose content was displayed on a screen. On the UK television standard (System I) the store operates at the CCIR recommended sampling rate of 13.5 MHz, with 8-bit Red, Green and Blue (RGB) samples, occupying some 1.2 M bytes of storage space. This represents an active picture size of 702 by 576 pixels, or picture elements, to fill the television screen with the high-quality picture. For the experimental transmission, a montage of the startling pictures of Saturn taken from the Voyager 2 spacecraft was used to demonstrate the capability of the system. The picture was fed from a conventional 35 mm slide scanner into the digital picture store. After sampling at 13.5 MHz it was fed to a microcomputer and data generator that sorted the information into a form suitable for transmission. The special equipment was used temporarily to replace two of the conventional four line Ceefax signals on BBC 2 for the transmission.

The Voyager 2 picture was included in a series of pages that displayed an improved character font. The new character generator in the decoding equipment enabled the characters to be more easily read, with individual characters being well spaced

'continued on Page 3'

In this edition of ENG INF

Editorial

The recent announcement that the BBC is to be allowed to operate two satellite channels has been welcomed. Thus the BBC enters another era of broadcasting. As technology has improved, so have the services which the BBC has been able to offer its audience. None of these improvements would have been possible without the dedication and skill of BBC engineers.

For many years now BBC engineers have been investigating the problems to be found in the 12 GHz band, and seeking solutions. Some of the problems have been answered, others await international agreement.

Fifty years ago the BBC entered a new era when it moved its headquarters from Savoy Place to Broadcasting House. At that time the Press were quick to blame the BBC's high-power medium-wave transmitters for the series of wet summers that had been experienced. With the advent of satellites, how long before the Press make this accusation about satellite broadcasting?

Congratulations

Mr. Peter Rainger, Deputy Director of Engineering, has been elected a Fellow of the Royal Society for contributions to electronic techniques used in television. Our warmest congratulations to him.

Welcome

We welcome Keith Hunter from VT in Cardiff to our team of contributors. Keith has kindly agreed to supply Eng Inf with cartoons, and an example of his excellent work is published elsewhere on this page. We look forward to seeing some more of his cartoons in the future.

Alan Lafferty

'THIS IS OUR NEW BAIRD 30 LINE TO PAL 625 ELECTRONIC CONVERTER'

Transmitters Opened

The following uhf tv relay stations have opened since January:
Ipstones Edge, Staffordshire
Romaldkirk, Co. Durham
Weaverthorpe, North Yorkshire
Wivenhoe Park, Essex
Newry South, Co. Down
Llanharan, Mid Glamorgan
St. Anthony-in-Roseland, Cornwall
Bretch Hill, Oxon
West Wycombe, Buckinghamshire
Coleford, Gloucestershire
Pinwherry, Strathclyde
Ballantrae, Strathclyde

Vhf Radio

Wrotham - now mixed polarisation

Local Radio

Radio Guernsey - Rohais (mf only)
Radio Jersey - Trinity (mf only)

Frank Berrisford, Assistant Head of Engineering Information Department, retired on 1st March after 25 years' service.

After serving in the Royal Navy from 1940 till 1946 and in Government Communications until 1956, Frank joined the BBC as an Engineer in Broadcasting House. He moved to External Services in 1958 and became a Senior Maintenance Engineer at the Caversham monitoring station three years later.

Frank is probably best known for his work in E.I.D. which he joined in 1964. His wide knowledge and enthusiasm ensured that the public, the retail trade, and the radio and television industry were all reliably informed about BBC engineering developments, particularly those affecting transmission or reception. There can be few representatives of the industry that have not heard his witty explanations of BBC policy from some platform or other.

Since he became A.H.E.I.D. three years ago Frank has represented the BBC in many negotiations with the Home Office on frequency planning and policy matters.

Phil Laven, the BBC's Senior Engineer in New York for the last three years, takes over as the new Assistant Head.

The following 405 line transmitters are expected to close as shown:

1983

BBC Transmitters - First Quarter
Bath (Avon)
Weymouth (Dorset)
Manningtree (Essex)
Wensleydale (N. Yorkshire)
Richmond (N. Yorkshire)
Weardale (Co. Durham)
Llangollen (Clwyd)
Newry (Co. Down)
Wenvoe Channel 13 (South Glamorgan)

IBA Transmitters - First Quarter
Bath (Avon)
Ridge Hill (Hereford)
St. Hilary Channel 10 (South Glamorgan)

BBC Transmitters - Second Quarter
Barnstaple (N. Devon)
Thrumster (Caithness)
Orkney
Bressay (Shetland)
Grantown (Badenoch & Strathspey)
Kingussie (Badenoch & Strathspey)
Ammanford (Dyfed)
Kilvey Hill (Swansea)
Llanidloes (Powys)

IBA Transmitters - Second Quarter
Huntshaw Cross (N. Devon)
Rumster Forest (Caithness)
Aviemore (Badenoch & Strathspey)

BBC Transmitters - Third Quarter
Douglas (Isle of Man)
Ballater (Kincardine & Deeside)
Toward (Argyll)
Lochgilphead (Argyll)
Rosneath (Dumbarton)
Millburn Muir (Dumbarton)

IBA Transmitters - Third Quarter
Richmond Hill (Isle of Man)
Whitehaven (Cumbria)
Rothesay (Argyll)
Rosneath (Dumbarton)

BBC Transmitters - Fourth Quarter
Larne (Co. Antrim)
Whitby (N. Yorkshire)

Electronic Stills Store Evaluated

An experimental prototype of an electronic store for still pictures was constructed for studio operation to enable pictures originated in electronic form to be stored and selected for transmission at the studio.

The need for such a stills store was identified some time ago. Traditionally, artwork and captions, etc., have been photographed and slides produced, and these have been broadcast using a studio slide scanner. More recently, however, direct electronic methods have become available for originating many of these signals. Extensive use is now made of electronic character generators and the BBC Broadcast Computer is also used in the generation of electronic pictures. With the advent of new electronic graphic drawing systems like 'Flair', it has become important that studios are provided with an all-electronic equivalent of the slide scanner.

The prototype studio store provides storage for 40 pictures. These can be selected for transmission either randomly, using a number keyboard, or in sequence using a single "CUT' button. 'MAIN' and 'PREVIEW' outputs are available so that, where sufficient monitoring facilities exist, the next picture can be previewed while a picture is 'on air'. Signals input to the store can be previewed before being recorded. Input and record operations overwrite previously stored information and are two button operations. The control keyboard contains numeric displays of the numbers of the pictures being output and can be operated remotely from the main equipment.

Signals are input and output in analogue RGB form and are processed and stored in digital YUV form using the new digital coding standard. The main signal storage is provided by one of the latest 8" Winchester magnetic disc drives which is completely sealed. Two digital semiconductor picture stores are used as buffer stores. Operation of the equipment is controlled by a Z80-based microprocessor which also provides picture processing for grabbing moving pictures.

Initial tests with the prototype studio store were most encouraging and showed that such a system could be readily incorporated into existing studios. Throughout last December and January, the prototype studio store was installed in the apparatus room of TC7. It was established that the unit could provide an extremely valuable general studio facility. Studio cameras were used to enable still pictures of general studio activities or artwork to be stored. It was also found to be beneficial to store signals from the slide scanner so that the slide scanner mechanism was not required to change slides 'on air'. In the course of these tests, a brief demonstration recording was made showing how a weather map could be crudely animated by moving the weather symbols between successive pictures and replaying the pictures at three second intervals.

Further developments of the studio store are now in hand. It is intended to construct a second experimental prototype incorporating improvements and suggestions made during tests with the first. It is also hoped to develop a method of conveying pictures between stores using a removable cartridge. Eventually a design may be made for quantity production.

Adrian Durey, Research Department, operates the control keyboard of the prototype studio store. A new picture has just been accessed and is being output via the preview output. The main output is displayed on the right-hand monitor.

"ENHANCED CEEFAX"

'continued from Page 1'

in the words.

Another innovation that was broadcast was "linked pages". In the present Ceefax system there are often pages where the content has some relevance to another page in the magazine. Viewers wishing to retrieve the additional pages need to re-select the page number and wait for the magazine to cycle round until they receive them. Using "linked pages" the Ceefax Editor would decide which pages were associated with each other, and would add extra information to link them together. In the enhanced decoder the pages would be stored and instantly displayed when the relevant linked page number was selected. For example, the news index on page 201 on BBC 2 could be linked to background information, news headlines, and complete news stories which the viewer could retrieve at the touch of a button without waiting for the magazine to cycle round.

For some time now the Ceefax Unit have been transmitting teletext software in conjunction with Brighton Polytechnic and several schools to see if it is possible to transmit computer programs by means of Ceefax, which could be directly loaded into a microcomputer memory. With the advent of the BBC Microcomputer, and using the teletext adaptor that will become available later this year, it will be possible to use the Ceefax service as a source of software for the computer system. It has been shown that using prototype equipment it is possible to download programs into the BBC Microcomputer, without the need to copy the program and then re-enter it via the computer keyboard. As well as being able to download teletext software, the teletext option associated with the BBC Microcomputer will also respond to the "linked pages" which are now being transmitted.

Most of the enhancements to the Ceefax system require additional memory in the receiver decoder, and it is not likely that the full range of enhancements will become available until later in the decade. All of the enhancements are compatible with existing decoders. For example, viewers selecting the pages carrying the picture information will currently receive the text without decoding the picture information. The characters are displayed in the existing format. When the enhancements are transmitted as part of the service it is likely that the editor will fill in the gaps where the picture would have been by a simple graphic so that the viewer is not left with a blank screen.

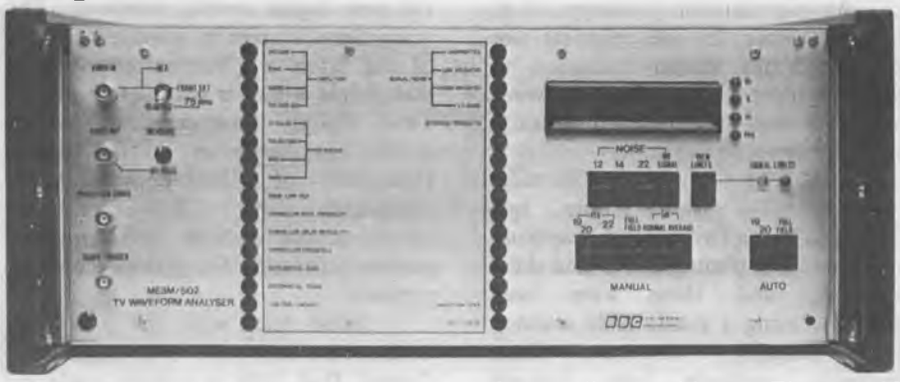
TV Waveform Analyser

Engineering Designs Department have recently completed the development of the automatic TV waveform analyser (ME3/502). The design is seen as a replacement for several separate items of existing test equipment including automatic ITS monitoring equipment which is at present in service at transmitter stations.

Both traditional analogue and modern microcomputer techniques have been blended to produce an instrument with sufficient flexibility to accommodate new measurement requirements by changing microcomputer software.

The new equipment is able to make precision measurements on either full field test signals or the insertion test signal carried during the field blanking interval, and has the capability of providing up to thirty independent requirements. The measurements include amplitude, noise, linear and non-linear waveform distortions, intermodulation interference and transmitter modulation depth.

The analyser can be used either in a manual or automatic mode. The manual mode enables an operator to make measurements of a single parameter, whereas the automatic mode



allows a selection of different measurements to be made in sequence using either ITS or full field test waveforms. If the BBC test waveform generator, type GE4M/561, is used to provide the test signals then the analyser is able to identify the particular test waveform and set itself so as to make the appropriate measurement. Intelligent operation can be further enhanced if a control line is available from the analyser back to the GE4M/561 waveform generator. Under these conditions the analyser can remotely control the generator to produce the waveform necessary for any given measurement.

The results of any measurement are continuously compared against a set of internally stored limits. There are 32 fully independent sets of limits stored within the microcomputer memory, each set consisting of upper and lower red, and upper and lower amber for each of the 30 measurement parameters. This is provided to give in a single instrument the capability of providing monitoring at any position in the whole of the BBC distribution network.

Full remote control is possible with the analyser and a BCD output of the readings is provided for logging purposes or telemetry.

The analyser is mounted in a 4U high bay width chassis and will be available in both portable and rack mounting forms.

Broadcasting House: New Studios

ACED contractors have completed the demolition work at the rear of BH London and are now halfway through the construction of a 2-floor extension above the roof of the Concert Hall gallery. It will be the first addition to BH since 'The Extension' was built. This work is part of an SCPD-led project to provide new facilities for News and Current Affairs.

Work first began in February 1981 when a firm of specialist contractors demolished the old boiler-house chimney using a 2 foot diameter, hydraulically-driven, diamond-tipped circular saw. Bearing in mind that the chimney consists of one foot thick very pebbly concrete with reinforcing rods every six inches in both directions, lateral and vertical, the process was remarkably quiet. Although Studio 3B and the Concert Hall were put out of action, the disturbance to the rest of the building was minimal.

The main building contract began in June, with the demolition of the rear wall of BH itself. This was to allow for the addition of the new steel-framed structure. The extra space within this structure will house a replacement News Intake Recording area and some offices. This will make building available for use as three new News and Current Affair studios, with 'Mixer' Studio 3B being rebuilt at the same time. This new studio, together with the new 3K, 4C and 5A Studios, will be equipped with the general purpose range of control desks.

Desks from all three suppliers of general purpose desks, Audix, Calrec and Neve, will be included in the development. Calrec have been awarded a contract for a 32-channel, 3 group 14 outside source Mark 3A desk for 3B as well as for the Technical Operator's position that goes with these desks. Studio 4C will also have a Technical Operator's position: Neve will provide a Mark 4, 24-channel desk in Studio 5A, which will be a discussion studio. Audix will supply a 12-channel Mark 4A for Studio 3K. This desk is capable of one-man operation and will act as a back-up studio/recording area to Studio 3B. A smaller back-up area for Studio 4D will be equipped with a Glen Sound GSNT-1 console. The general purpose desk Mark 3, 3A and 4A are developments from the basic general purpose design. They are the result of close co-operation between Radio O & M's Technical Consultative Committee and SCPD's Radio Studio Unit. SCPD's Broadcast Systems Unit A are to provide studio control panels which will interface with the new microprocessor-controlled solid-state source selection system. This system will feature plain language entry, and display sources by means of a keyboard and alphanumeric LED displays. Unit A will also be installing a Pye M100 intercom system to replace the existing News Production intercom. The old system is an Ericsson crossbar type, which is already overloaded.

News and Current Affairs studios tend by their nature to have a profusion of intercoms, telephones, picture monitors, printers and other peripheral equipment. With the growing importance of Ceefax and vidiprint, these and other data communications systems are under consideration for the new area. As the areas are all fairly compact care has to be taken when new equipment is brought into the studios. For this reason extra planning meetings have been set up between ACED, and the News and Current Affairs, the user department, to try and integrate as much of the extra equipment as possible into the interior design of the new

The first of the new studios will be in service early in 1983.

EXTENDED PAL CODING for SATELLITES

The quality of present-day television pictures is limited by the available transmission bandwidth and by the capabilities of currently available display tubes. There is no very immediate sign of any large bright higher definition display device to take over from the shadow mask Cathode Ray tube, but many workers are in the field and we can expect some development during the next few years.

Assuming, then, that a better display becomes available what possibilities are there for wider bandwidth transmissions to match? Both Satellite Broadcasting and optical fibre cable distribution offer wider bandwidth and Research Department has been considering how these could best be exploited. A key factor in any new transmission system must be compatibility, whereby existing receivers could continue to work with new-standard signals, although new receivers would be necessary to derive full benefit. For at least the early years of satellite or optical fibre cable services it would be required that existing receivers continue to be usable, with appropriate converters. The introduction of any non-compatible system could require many years for international agreement and new receiver development and hence seriously delay the establishment of satellite broadcasting in this country.

The present-day UK 5.5 MHz video transmission bandwidth is adequate for 625-line monochrome pictures. The limitations become apparent when the colour signals must be squeezed in with the monochrome. Ingenious though the PAL coding system may be, it is impossible to avoid some mutual interference between monochrome (luminance) and colour components. These interferences show themselves as luminance appearing in chrominance channels (cross colour) giving rise to flashes of false colour on striped suits for example; and chrominance signals appearing in the luminance channel give spurious dot patterns. To reduce these effects to acceptable levels, signals in the region of the colour sub-carrier (4.43 MHz) are attenuated, usually resulting in loss of all signal frequencies from about 4 MHz up to the 5.5 MHz band limit. So the majority of colour receivers roll-off about 4 MHz and show little fine detail whilst still suffering from some degree of cross colour aberrations.

A new proposal involves filtering-off high frequency components above 3.5 MHz. This gives a very slight reduction in picture definition, scarcely noticeable on present-day display-tubes, but virtually removes all possibility of interference between luminance and chrominance components so that cross colour effects disappear.

In a wider-bandwidth satellite or optical fibre channel there is room to transmit the filtered-off high frequency luminance components separately. The high frequencies (3.5 MHz upwards) are shifted in frequency to a higher band (8 MHz upwards) and transmitted together with the original low frequencies and chrominance signals. The upper limit of the separated high frequencies could extend above the 5.5 MHz equivalent bandwidth of the present transmission channel.

A new receiver, specially designed for this wide bandwidth transmission system, would shift the transmitted high frequencies back to their original values (3.5 MHz upwards) and hence display a much-enhanced degree of fine picture detail. The new receiver would of course also be free from cross colour effects, since the high frequencies would be re-inserted after colour decoding had taken place.

Research Department have demonstrated experimental coders and decoders working on this principle and has passed extended bandwidth signals, with associated digital sound channels, through an RF link simulating a satellite channel. Results were very satisfactory and showed also that the proposed system is entirely compatible with continuing use of present-day receivers.

"PHOTOGRAPHIC EXAMPLES"
Page 6 and 7

EQUIPMENT DEPARTMENT: Automatic Testing

The Equipment Department Test Laboratory is now using automatic methods to test a range of audio amplifiers, power supplies and oscillators, using equipment based on a general purpose interface connection system.

For some years the use of automatic testing has been closely watched, but available systems were generally specialised and intended for high-volume production. Some ten or so years ago Hewlett Packard developed a standard interface bus system which allows test instruments to communicate and exchange data with each other under the control of a stored test program. This system was adopted as American standard, IEEE-488, and later as International Standard IEC-625. However, it was not until the low cost microprocessor came on the scene that a wide range of data-controlled instruments were produced and made the system attractive.

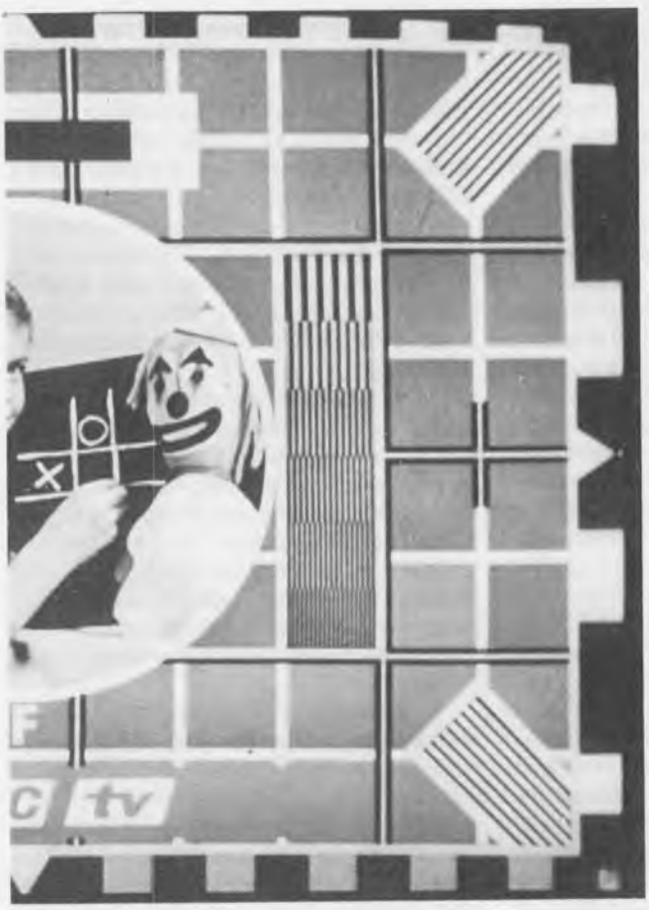
The General Purpose Interface Bus (GPIB), the generally used name for the system, has 16 lines, eight for data, and eight for interface communication management. Three of these management lines are used for "handshaking" a technique which co-ordinates the transfer of non-synchronous data. A microcomputer acts as Controller, and this commands and receives data from the other instruments on the bus. Each instrument has its own address and can either be a "talker", a "listener", or both (talkers provide information to the bus, listeners receive information).

The system was first used in Equipment Department to test synthesised oscillators for the "Silver Streak" UHF transposer, where it was required to make a large number of measurements to ensure the unit was operating correctly. A desk top microcomputer (HP85) controlled a device to originate logic signals which set the oscillator to the channels in Band 4 and 5, and a modulation analyser made four different types of measurement on each channel.

More recently the same basic system has been used for testing audio amplifiers. The desk top micro-computer controls an audio test set to originate measure signals, a digital multimeter to measure resistance and d.c. volts and current. A switching matrix configures the test set up for each test. Measurements are made of various circuit resistances, gain, frequency response, noise, distortion etc. The cost of writing the program was saved on the first batch of amplifiers tested.

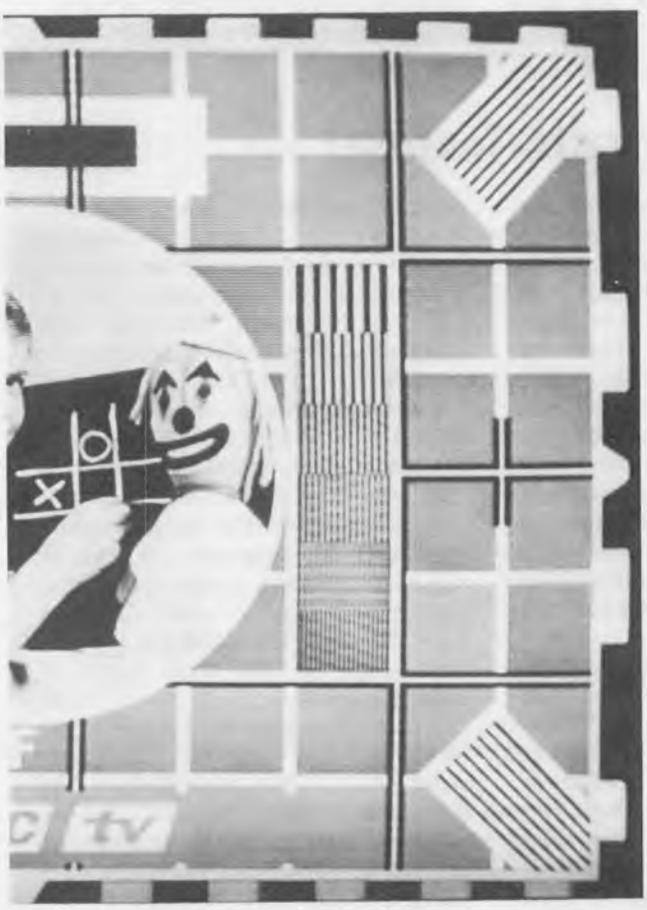
At the present time a permanent automatic test system for power suppliers is being assembled. The techniques will be adopted for an increasing range of units as the system is developed, resulting in lower costs for equipment made in Avenue House.

CONVENTIONAL PAL



The uncoded picture

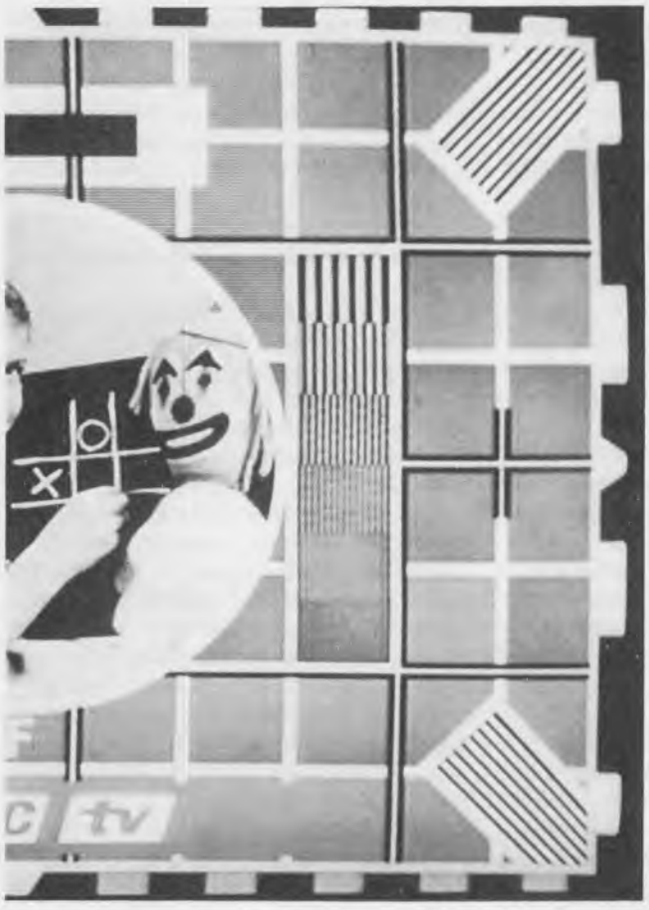
Test Card F direct from the slide scanner without any form of PAL coding.



Test Card F via Conventional PAL coder and decoder

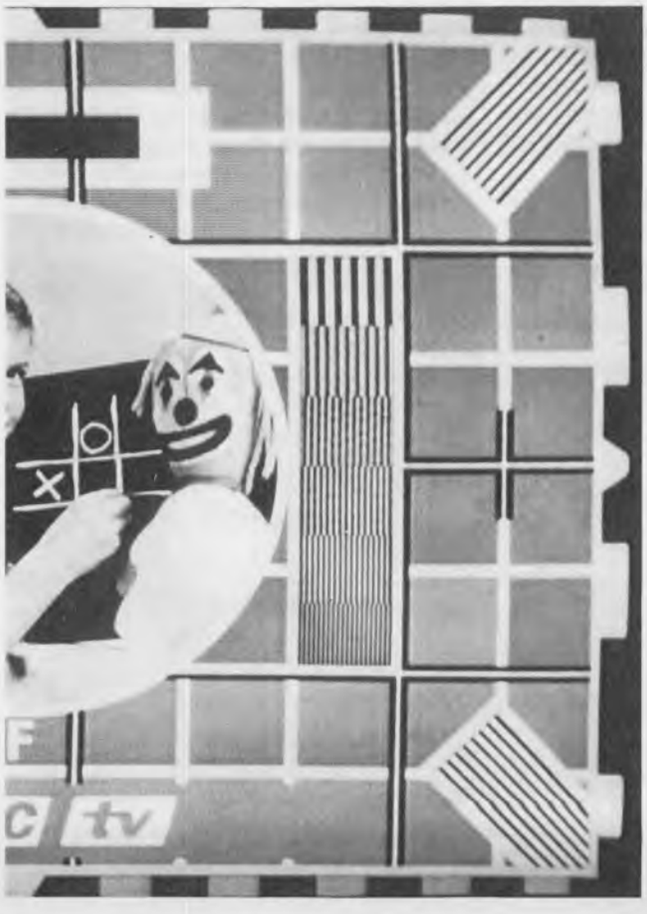
The spurious patterns on the diagonal bars at the corners of the picture and on the resolution gratings to the right of the clown are caused by crosscolour - the PAL decoder wrongly interprets fine detail in the picture as colour information because both are transmitted in the same frequency band. The next-to-bottom resolution grating is removed by the notch filter in the decoder.

EXTENDED PAL



Extended PAL - Test Card F as seen with a conventional PAL decoder

Current television receivers are not capable of displaying the full resolution of pictures transmitted by the PAL system. This is because of bandwidth restrictions in the receiver's circuitry and lack of resolution in present-day display tubes. But current receivers do reproduce the spurious coloured patterns known as crosscolour caused by the colour decoder wrongly interpreting fine detail in the picture as colour information. Thus the owners of current receivers would lose little if the fine detail which cause crosscolour is removed; in fact they would gain because crosscolour would be eliminated. This photograph of a Test Card taken from a high-quality picture monitor shows both the reduction of crosscolour and the loss of fine detail; but tests have shown that on a domestic receiver the paramount effect is the reduction of crosscolour.



Test Card F via Extended PAL coder and decoder

In the Extended PAL system the fine detail is transmitted in a separate frequency band from the colour information. Thus there can be no crosstalk between the two signals; there are therefore no spurious patterns on the diagonal bars at the corners of the picture or on the resolution bars to the right of the clown. Furthermore no notch filter is needed in the Extended PAL decoder. Thus the fidelity of the picture is maintained up to the highest resolution.

DIGITAL TRANSCODER

In February, Designs Department delivered a second digital transcoder (CO6/511) to Television Network Department. It joins an identical equipment, which has been in service since November 1981, alongside the two ACE digital standards converters in the Standards Conversion Area at Television Centre.

Much technical development has taken place in the three years since the ACE design was completed. There is now an EBU coding standard for digital television and these new transcoders are the first equipment using this standard to go into service. The standard is based on line-locked sampling frequencies of 13.5 MHz and 6.75 MHz for luminance and colour difference signals respectively.

Problems of SECAM-PAL Transcoding

The digital transcoders will replace two fifteen-year-old analogue equipments, which were also made in Designs Department. Both the new and the old machines have a SECAM decoder connected to a PAL coder, but in the new transcoders the connection is via a digital picture-store synchroniser and the output is fully synchronous with local pulses.

This removes a major difficulty which existed with analogue transcoders. The line-frequency tolerance of the SECAM standard (± 0.02%) is much wider than for PAL (± 0.001%). If a transcoder produces a PAL output with the same line frequency as the SECAM input, it is impossible to maintain the specified relationship between the PAL line and sub-carrier frequencies without exceeding the PAL sub-carrier frequency tolerance. If the sub-carrier frequency tolerance is exceeded, PAL decoders may be unable to lock to the burst - and if the line-to-sub-carrier frequency relationship is not maintained, VTRs cannot handle the signal. To cope with this difficulty the analogue transcoders had two outputs: one with the correct sub-carrier frequency, for transmission; and another with the correct sub-carrier-to-line frequency relationship, for recording.

Signal Processing

The new transcoders use a commercial SECAM decoder modified to give luminance (Y) and colour difference (U) and (V) output signals. These analogue outputs are turned into eight-bit parallel digital data by three analogue to digital converters (ADCs), each of which uses a TRW high speed 'flash' converter integrated circuit TDC 1007 J. The two colour-difference data streams, which each occur at 6.75 M words per second are multiplexed together to make an 8-bit parallel 'chrominance' data stream at 13.5 M word/s. The chrominance and the 13.5 M word/s luminance stream are each fed to a pair of identical picture stores. Each store consists of eight 4-U circuit boards and each board carries thirty-two 16 kbit random access memory (RAM) chips with associated input and output registers. These boards are essentially the same as those used in the ACE standards converter except that the older ACE boards use 4 kbit RAMs.

The 13.5 MHz and 6.75 MHz line-locked clock signals of the ADCS are generated from syncs separated from the decoded input luminance signal. The RAM addresses into which the data is written are also derived from these input syncs, so that a particular address always contains the information for the same part of the same line of the input picture.

The data output from the store is controlled by clocks and addresses which are derived from local mixed syncs. The store's reading and writing processes are therefore asynchronous so that it operates as a synchroniser.

The luminance and chrominance data from the store are blanked digitally by comparing the data with 300 ns risetime sine-squared edges stored in read-only memories. The field blanking component can be either standard width or narrowed to allow insertion signals in the blanking interval to pass through the transcoder.

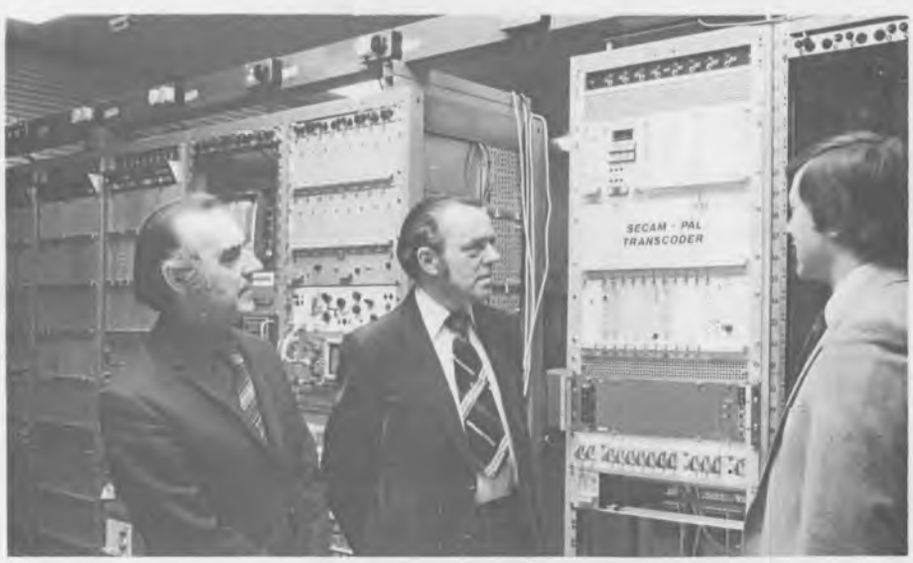
The blanked chrominance data is demultiplexed into separate (U) and (V) data streams at 6.75 M word/s and converted back to analogue signals in two digital to analogue converters (DACs). These signals are then connected to an analogue PAL coder together with the luminance signal from a third DAC. This coder, which is fed with local pulses, provides the transcoder's output.

Operation as a PAL-to-PAL Synchroniser

As well as SECAM, the equipment can accept analogue Y, U and V signals from an external PAL decoder, or digital luminance and chrominance. A PAL detecting circuit can cause either of these inputs to be selected automatically. This enables the equipment to be used as a PAL synchroniser for retiming or 'repairing' out-of-specification PAL signals. It is, of course, important that the PAL decoder removes all traces of the original chrominance from its luminance output and to this end, it is planned that a comb-filter decoder of the type used in the ACE converters will be used.

In the transcoder's design, great care was taken to make it as tolerant as possible of defective input signals. The clock pulse generator has a 'Time Base Correction' mode of operation in which it follows the sync timing jitter on signals from helical-scan recorders. Isolated, grossly mistimed link sync pulses are ignored and a previously stored line is substituted. Non-sync cuts and misplaced field syncs cause a previously stored field to be used. If the input signal fails altogether the transcoder output is maintained with a black-level signal until the input signal

'continued on Page 9'



The digital transcoder is handed over to Network Department. The photograph shows (left to right) Ralph Barrett (Network), Mike Turner (SCPD) and Roger Robinson (Designs Department).

NETWORK CONTROL for BBC 1

The new BBC 1 Network Control Room (NC1) and continuity suite have recently entered service at Television Centre. Network Control is the last point of control before the network programmes reach the transmitter. A small staff of five (Network Director, Assistant Senior Television Engineer, Presentation Operational Assistant, Network Assistant and Announcer) are responsible for the minute by minute operation of the network at any one time.

In the Central Apparatus Room (CAR) there is a 100 source by 120 destination switching matrix which is controlled by the Presentation Operational Assistant (POA) from the Control Room. Transmission facilities such as VT or TK machines, studios and Outside Broadcasts can be routed by the POA to the presentation mixer in the Control Room. Under the control of the Network Director the VT and TK machines can be remotely started, and the relevant programme sent to the transmitters at the correct time. The presentation mixer is a 24 channel video/audio Grass Valley 1600-4S, with full automatic or manual control plus video key and sound-over facilities.

NC1 incorporates the latest solid-state picture sources, such as the network clock, the Open University symbol, and the School's Clock which originate from Designs Department equipment. This has superseded "noddy", the ageing camera-originated symbols system. A camera is still used though, to generate the "rotating world" symbol seen at programme junctions. Design of a solid-state device to replace it continues.

The refurbished NC1 Control Room at Television Centre.

Two BA10/501 slide scanners and an Autocue opacity machine are used to generate caption cards, such as those seen at programme junctions to trail both network 1 and 2 programmes. A Network Assistant selects the slides, and checks that the correct ones are available to the Network Director.

At one end of the control desk the Assistant Senior Television Engineers (A S Tel E) has facilities for checking the technical quality of the incoming and outgoing signals. Besides the usual vectorscope and oscilloscope he has full communications and talkback facilities, LS 5/8 monitor speaker, and colour monitor. Off-air signals from Crystal Palace are also available so that the network output can be compared with the transmitter output.

A bank of 23 black and white, and 3 colour monitors enable the Network Director to check the quality of output, preview programmes, and check slides and captions.

Also housed in the Network Control Room is "Presfax" which makes use of "ICE" the Insertion Communications Equipment. Inserted on line 21 of the television waveform of the digitally-coded signal allows the Control Room to send messages to regional centres telling them of changes to the schedule times or linking announcements. The data is displayed on a screen in a similar format to that used for Ceefax. ICE also features in Outside Broadcast applications; for example, when the satellite ground station is used in remote locations it is often difficult for British Telecom to provide telephone control lines. On such occasions the OB team carry an ICE decoder, enabling CAR to communicate with the OB.

Adjacent to the Network Control Room is the Continuity Announcers' room. Equipped with a Cox video and audio 'knob a channel' manual mixer, the Duty Announcer controls the presentation junctions. He can also control simple programme junctions and has limited access to the automatic mixer system in the Main Control Room. The Continuity Announcer also has control of sound sources such as grams, cartridge machines and tape recorders, as well as the microphone used for linking announcements.

"DIGITAL TRANSCODER"

'continued from Page 8'

reappears and two good fields have been stored.

Remote Control

The transcoders, like the ACE equipments, are remotely operated from CAR.

The controls available include a function called 'Data-Reverse' which reverses the order of significance of the bits through most of the digital processing. This facility is provided so that should a fault occur which affects a highly significant bit, the visual effect can be made less noticeable by moving the fault to a less significant bit.

Test and Maintenance Facilities

One benefit of digital systems is the way in which equipment can be reconfigured and test signals generated. The transcoder, for instance, incorporates a digital test-signal generator, the output of which can replace the normal input to the store. A variety of colour bar signals can be generated and, if required, these can be displayed together with the normal input signal in a split-field presentation. Having a known good reference signal enables the alignment of the decoders and coder to be checked.

To help locate any faults in the store, another test facility is provided which puts vertical 'Store Test Cursor' lines on the output picture. These lines are one clock-pulse wide and, by adjusting thumb-wheel switches so that a cursor line corresponds to the position of a fault in the picture, a particular location in the store can be identified. Other switches enable the faulty bit to be identified and, by combining this information with the cursor position, the precise RAM chip at fault can be identified.

A microprocessor-based monitoring system is under development. This will monitor two transcoders and report the mode of operation of each in text on picture monitors in CAR. It will also give warnings if the equipment temperature or any supply voltages depart from normal.

AMPEX make 4000 Tape recorders

The 4000th recorder of the Ampex helical-scan VPR-2 series has been delivered to Television Centre.

The recorder, a studio console VPR-2B complete with TBC-2B digital time base corrector, is part of an order for 8 machines. With this, the 4000th VPR-2, the number of Ampex VPR-family recorders supplied to the BBC totals 67. A further seven recorders (VPR-2B and VPR-20) are to be delivered on current contracts.

Commenting on the "4000" milestone, Gerhard Wick, general manager of Ampex (Europe, Africa, Middle East) said: "Last year, 1981, marked the twenty-fifth anniversary of the invention by Ampex of the first practical recorder for broadcast television. Then, the technology was quadruplex. Increasingly now on the world-wide scene the technology is becoming the one-inch helical-scan system, in which once again Ampex has been a pioneer. To have brought 4000 VPR-2 series machines to the market in only four years on top of many hundreds of the earlier VPR-1 series is an achievement unparalleled by any other manufacturer.

"We are especially pleased", added Mr. Wick, "that this four-thousandth recorder is entering service with the BBC, which has been a valued customer, and invariably a demanding one, for many Ampex products for more than twenty years".

Speaking on behalf of the BBC, George Cook, ADE, said: "We in the BBC would like to congratulate Ampex on achieving their 4000th VPR-2. This machine and its one-inch and two-inch predecessors have been of fundamental importance in the development of television production techniques, and it comes as no surprise that the broadcasters' demand has reached so significant a level.

George Cook, ADE (right), accepts the 4000th VPR2B video tape recorder to be manufactured by Ampex, from Gerhard Wick, General Manager (Europe, Africa and Middle East).

"It is a pleasing coincidence that the 4000th VPR-2 has come the BBC's way and we are appreciative of the close attention which Ampex has always given to us. I am glad we are regarded as a 'demanding customer' and no doubt we shall continue to earn this description and so maintain a fruitful Ampex/BBC relationship".

The Ampex helical-scan VPR series was launched in 1976, and has subsequently been developed to meet the most demanding requirements of broadcasting and television production companies, particularly by the introduction of 'automatic scan tracking', the patent Ampex AST system.

The VPR-2B is an advanced version of the VPR-2 which offers a reverse slow-motion capability together with other new features and improvements. The latest option for the VPR-2B allows true-frame playback in stop-motion. The true-frame option essentially doubles the vertical resolution in stop-motion and offers dramatic picture improvements in some instances.

'C' format tape recorders, like the VPR2, are gradually replacing worn out quadraplex machines, some of which have been service since 1959. The introduction of the new machines allows significant savings in tape storage space and costs.

RADIO MAINTENANCE

Eric Palmer and Dave Austwick maintain equipment in the new maintenance test room in Broadcasting House.

Changes in the organisation of the maintenance services for Radio in London were introduced towards the end of last year with a view to improving the engineering support available to those using the programme making facilities in B.H. and the adjacent buildings. The technical areas have been divided into four groups and independent maintenance teams have been set up, one for each group. Three of the groups have been provided with new Test Rooms and the fourth occupies the old Shift Maintenance Workshop, which will be fully refurbished in the near future. Each of the groups is headed by a Senior Engineer who is charged not only with the maintenance of the broadcasting plant, but also has responsibility for ensuring that all technical areas are kept clean and tidy with the decor and furnishings maintained in good order. Two technical cleaner posts were transferred from C.S.G. to the Tech. S.R. establishment and augmented by a further four to provide a team of six Handyman Cleaners who provide all-round support for the engineering staff.

The Senior Engineers with the areas for which they are responsible are:

Sen. Eng. News & Network Maintenance - S.D. Hatherly

Sen. Eng. Basement Studios - M. O'Shaughessy

Sen. Eng. Upper Studios - P. Guest

Sen. Eng. Outside Studios - D.C. Horner

The organisation and method of operation has been based on the experimental unit set up 3 years ago at Maida Vale under Sen. Eng. Alan Stokes.

Initial indications are that lines of communication have been shortened and the programme makers are very pleased with the new more personalised service.

Transport Department TRAMS

It may come as something of a surprise to learn that the BBC operates more than 1,200 vehicles up and down the country. Some are light vans and estate cars for news teams, cameras and the like, but a large number are commercial vehicles, with as wide a range of body types as you're ever likely to find in a single fleet, - anything from simple box vans to the highly complex CMCCR2.

Looking after such a varied fleet is not made any easier by the fact that the vehicles are spread over about 100 different locations around the country, some with fully-equipped garage facilities, but others just remote outposts such as transmitting stations, where only one or two vehicles may be based.

Management of the whole fleet is co-ordinated by Equipment Department at a central office in Weir Road. The functions of Transport Department are to buy and sell the vehicles, tax and maintain them - and make sure that the user departments are paying a reasonable price for running costs.

That may sound simple. But it demands constant vigilance by the department's staff - for instance, to make sure that vehicles they never see are correctly taxed and regularly maintained. It also demands a perpetual flow of information between staff and the numerous vehicle locations, and an almost continual updating of records.

It sounds an ideal situation for some kind of computerised control; and that's what Transport Department thought too.

Following discussions with several firms, Transport Department called in A. J. Associates of Beckenham, Kent, a small consultancy and software house. Besides being ready and willing to draw up a computer programme to suit their needs, A. J. Associates had close links with Wang, a computer manufacturer whose range included a medium-sized, self-contained system that looked ideal for the job.

In hardware terms, what the Transport Department has acquired looks remarkably straightforward and compact. The Wang 2200-series computer itself is not much bigger than a desk-top copier; it contains a Winchester memory disk with a capacity of 4 megabytes, and has the facility for small 1 megabyte "floppy disks" to be inserted. In terms of software - A. J. Associates came up with something called TRAMS, short for Transport Management System.

In essence, this allows the BBC's central vehicle files to be stored on a computer. The contents of a whole row of filing cabinets have effectively been condensed to a series of electronic pulses.

It's not really quite as simple as that though, as Ralph Lewis, the Assistant Transport Manager, says: "There are still a lot of bits of paper that have to be put somewhere." These include purchase and licensing documents, for instance, for which the original files are maintained. For each vehicle, a comprehensive array of information, such as make, model, registration number, body type, gross and unladen weights, supplier and replacement cost, along with a lot of other details, can be stored in uniform fashion and displayed in consolidated form on the v.d.u. screen or printed out. The vehicles are designated by make, model, registration number and chassis number; no fleet numbers are used. The computer can also list vehicles by model designation or by chassis number, or any other parameter desired.

In practical terms, one of the first ways this facility has helped Transport Department in drawing up consolidated lists of vehicles needing taxing, and MOTs each month.

The next facility to come into use was 'User Charging Report' which provides Management Accountant with the rates to be charged on vehicles operated by user departments. This report identifies the quarterly standing charge and the mileage charge for each vehicle.

A unique feature of the system is its ability to provide 5-year and 1-year replacement plans. These reports identify vehicles to be replaced, the date at which they will achieve their planned life and the required budget provision.

What of the cost of all this? Ralph Lewis puts it at around £15,000 - which, as he says, is "not much more than the price of some new Bedfords" (of which the BBC has many). In any case, the cost is modest when you consider the savings and improved management control that have resulted.

(Condensed from an article in "Bedford Operator").

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Steerable Array at CAVERSHAM

A new type of receiving aerial system is now in operation at Caversham. The system was designed and constructed by engineers Henry Price (now with External Services), and Adrian Robinson at Research Department. The aerial array forms a narrow beam which can be steered electronically to any direction. It thus has the ability to select the wanted signal from the many interfering and/or jamming signals coming from other bearings. The array operates in the h.f. broadcast bands over the frequency range 6 MHz to 26 MHz.

If conventional aerials are used, either a large collection of fixed directional aerials is needed, in order to cover all the points of the compass, or alternatively a mechanically directional aerial must be used. Such arrangements occupy a lot of space or are unwieldy to operate.

The new array is compact and easy to use, and has an additional feature to suppress particularly difficult jamming signals more effectively. It comprises eight 2m vertical elements in a line at 5m spacing, and a bay of aerial-signal combining equipment. The key to such a simple array is the use of a high input-impedance, high-quality r.f. amplifier at the base of each element. The signals from the elements are then passed to variable delay lines housed in the bay, and combined to feed the monitoring receiver.

The array is arranged to form a beam which is steered by adjusting the lengths of the delay lines. The necessary calculations are done by a micro-processor which is at the heart of the control system. At the request of the Monitoring Service, a serial data link has been provided, so that the array can be controlled remotely, in the same way as the associated receiver.

An additional feature, not available with conventional aerials, is the ability to steer a null against particular interfering signals. Initial reports from the Monitoring Service have been encouraging. For example, using the steerable array, it is possible to receive a usable signal from Teheran Radio whilst it is not resolvable with the other aerials available at Caversham. This intercept was particularly useful in providing valuable news reports at the time of the assassination of President Sadat.

NICAM AWARD

Engineers from Designs Department received the Lord Mountbatten Premium (1980) from the IERE for a paper published on NICAM 3. The photograph shows IERE Acting President, Professor William Gorling (second from right) presenting the award to (left to right) Alan English, John O'Clarey and Robin Caine. The Lord Mountbatten Premium is awarded annually for the most outstanding paper on the engineering aspects of electronics or radio.

SILVER STREAK LICENSED

Bryce McCrirrick, DE, and David Young, Managing Director of Continental Microwave Limited of Dunstable, Bedfordshire, met recently to sign a licence agreement for Continental Microwave to manufacture and market the BBC-designed 'Silver Streak' Uhf Transposer equipment. (See Eng Inf No. 3)

The 'Silver Streak' was initially developed by Designs Department to provide full broadcast quality television equipment at minimum cost but with maximum reliability for the BBC's programme for relay stations serving areas of small population. A transposer allows a signal, received from a master station on one channel, to be 'transposed' to another channel without the signal being demodulated and then reprocessed.

DE signs the licence agreement with David Young of Continental Microwave Limited.

Because it is intended for use in small buildings, often on isolated sites, the transposer has been designed so that no adjustments at all are required on site. This is done by using, for the first time, universal modules in which all active components are similar. A separate panel, known as the 'personality' panel, which contains no active units determines the frequency, offset, slope, maximum gain and output power by providing control to the transposer's active module. If a fault does develop, as soon as the replacement module is plugged into its associated 'personality' panel it is automatically set to the required characteristics. The 'personality' panel, consisting of two uhf bandpass filters and a simple control circuit should outlast the life of the transposer.

The modular construction allows the equipment to be very flexible in the way it can be arranged for single or multi-channel operation. Normally in the United Kingdom it has four separate modules for the BBC 1, BBC 2, IBA and the fourth channel allocation. Replacement modules allow for quick and easy maintenance.

Each service has its own transposer module and in turn each module has three detachable units - a power amplifier, an IF amplifier with mixers and a dual frequency synthesiser. As already explained there are no integral controls.

The equipment has been designed for high reliability at an economic price by using fewer more generously rated components and by keeping the operating temperature low. The signal path through the distribution amplifier is duplicated so that any single transistor failure will only result in a loss of gain rather than a loss of service. Although the duplicate signal path is not continued through each module because of the cost, several stages do have a parallel configuration to improve both performance and reliability.

This winter has provided an excellent reliability test for the first transposer, which was installed at the Braemar television relay station. Temperatures of below -20 degrees Celsius were recorded and the equipment went on working satisfactorily.

As the equipment was designed to allow modification, it is expected that transposers will become available for vhf television and for international standards other than System I.

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