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ENG

The Quarterly For BBC Engineering Staff

D.E. reports on CBA conference in Sydney

Bryce McCrirrick speaking at 13th CBA Conference in Sydney

" The thirteenth General Conference of the Commonwealth Broadcasting Association was held in Sydney, Australia, from the 16-25 September. It was attended by 101 delegates from national broadcasting organisations throughout the Commonwealth.

The Conference splits up into two separate committees - onc dealing with administrative and programme matters and the other engineering. The BBC was represented at the Administrative and Programme Committee by M.D.Tel., Alasdair Milne, M.D.R., Aubrey Singer and Controller International Relations, Noble WiIson. I was present at the Engineering Committee which had, itself, 32 delegates from 24 broadcasting countries.

During the seven days that the Committee sat, we considered 62 technical papers of which 14 had come from the BBC. The papers covered all fields of radio and television broadcasting with particular emphasis on the application of a communications technology for remote areas and the appropriate technology for developing countries. The delegates from the country originating the paper had to give a presentation of ten to fifteen minutes and then was required to discuss the points which were raised. The great difficulty at this, my first CBA Conference, was the tremendous variation in the technical level of the broadcasters represented. At one end of the scale we had the BBC, Canadian CBC and Australian ABC - all with highly developed television services - and at the other end some of the African countries who only had a very elementary radio service. To be discussing such matters as a possible future television digital standard limited the participation greatly. As a result of this we have agreed to give much more thought to the composition of the agenda for the next Conference so that it can be of more value to the majority of the participants and we thought we may also have one or two teach-ins on specific subjects of interest at the time. Notwithstanding, 1 found the experience most valuable, renewing some old friendships and making many new ones.

The next General Conference of the Commonwealth Broadcasting Association will be held in Canada in 1982. 1 hope that next time it will not coincide with the me. "

Bryce McCrirrick

Olympic Games not forgotten

By now the Olympic Games may seem just a memory in the past. As they missed our first edition and were a 'special', we are including a description of our technical involvement in Moscow.

We had to cut our coverage of the Olympic Games to only 45 hours but even so BBC engineers had to put together systems and equipment that ensured that the coverage from Moscow met the high standards that we always set in sports broadcasting. The Olympics condensed so much sporting activity into a single fortnight that it needed a good deal of engineering and production ingenuity to devise systems that ensured that events of particular interest to British viewers were not missed.

To simplify production arrangements virtually all our coverage was produced and presented from a studio that we had hired in the Olympic Television and Radio Complex (OTRC) in Moscow. The programmes put out from this studio reached Britain through one channel of Intelsat IV.

The Moscow studio had access to feeds' from all major sports locations and some of them supplied more than one international vision feed. Athletics from the Lenin Stadium, for example, generated three independent international vision feeds covering field and track even ts.

The job of the studio was to link these sources together into coherent television programmes. The studio was equipped with three cameras and was used for interviews and preview programmes as well as linking coverage to the separate events.

All the television signals from Moscow were originated in SECAM, the colour television system adopted by the USSR and they were still in SECAM when they arrived at the BBC Television Centre in London. There they were transcoded to the British PAL System using ACE, the BBC's four-field digital standards converter, the most advanced and accurate device of its kind in the world.

With so many events going on at the same time, video-tape played an important part in the coverage. Engineers installed six VPR2 machines in a separate video-tape area one floor above the BBC Moscow studio in the

Continued on page I I

New film and video-tape dubbing theatre at Lime Grove

The new multirole film and video-tape dubbing theatre came into operation at Lime Grove on 13 October 1980. The new theatre will be used mainly for sport and current affairs programmes.

Ian Hare, of SCPD, the Project Leader, says, 'The theatre has been designed to be as flexible as possible and can be used for drama, documentaries and sports programmes. Few viewers realise how important dubbing is in television. In Current Affairs productions, films, and video tapes arrive at Lime Grove, perhaps only minutes before transmission, completely mute - without sound or commentary. After being edited, they need to have background sound, commentary and sometimes music added in such a way that they follow the action. This is where the new facilities will come into their own'.

The new theatre is based on an empty fonner studio, with a floor space of 300 square metres. The focal point is the mixing desk in the main Dubbing Mixer Room, around which are two commentary studios, an Effects Area, an Apparatus Room, a Monitoring Room and a Projection Room. They are laid out so as to give the operator in charge, the Dubbing Mixer, eye contact with both studios, the Effects Area and the Apparatus Room, as well as having the large projection screen in front of him.

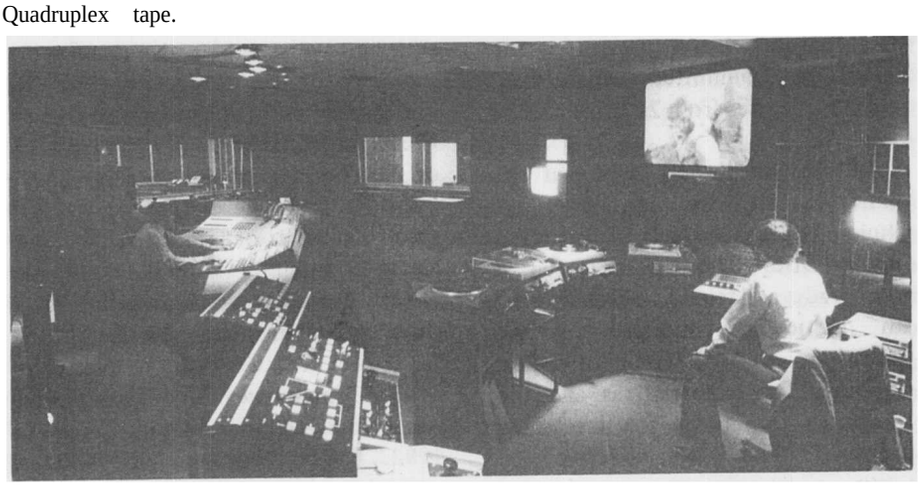
The Neve 20-channel, 6-group, Mixing Desk includes several special features. The main section has 10 channel modules and faders on each side of a Central script rack. Each channel is only 40 mm wide so that the operator can span five faders in each hand. Above each fader is a Response Selection Amplifier unit (RSA) and a switching module. Each of the fader units has access to a Klark-Technik graphic equaliser, noise gates and a telephone effects unit. The centre area contains two stereo auto faders, timet footage counter controls and 'Io-fi' monitoring.

A separate effects 'mini-mixer' console in the main mixer room, has disc reproducers, two cartridge recorders and two Studer tape recorders routed to it. Each of the Studer tape recorders has its own BBC-designed synchroniseI' which is controlled by a microprocessor. Using it, the addresses of 99 effects can be put on to each tape. They can be automatically located and then cued manually when needed by the Dubbing Mixer. Reviews of entries in either the master or slave store are possible without disturbing what is going on at the time.

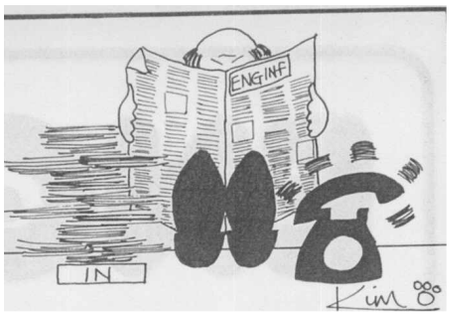
A BBC modification to the disc reproducers, which use quick-start Technics SP 10 Mk II turntables, provides variable speed operation from 20 to 80 rpm, with instant change. It does this whilst at the same time maintaining full broadcast quality.

In the Apparatus Room, there are nine 16 mm Perfectone Rapimag sepmag transporters. The machines, fitted with EBU twin-track heads, are arranged as two 1600 metre capacity simplex main recorders and six 1 000 metre capacity duplex replay transports. Two of the replay machines can also be used for recording when required. The sixth .machine is normally used for commentary recording or for Quadruplex VT transfer but can be used as a seventh replay transport.

With the increasing use of video tape on location, being able to dub on to video tape is a useful innovation in the new theatre. In the BBC system the programme material is transferred, together with a continuous time code, from a Quadruplex VT machine to a U-matic. A BBC-designed interface unit allows the same varispeed control as with film and also translates instructions to the U-matic into a language it understands. After the dub is complete the programme is transferred back to Quadruplex tape.



View of the multi-role dubbing theatre in action



Editorial

Despite the obvious errors in crediting the ACE standards converter to Research Department and not Designs Department, the first edition of 'Eng Inf was well received by most engineers.

We apologise to those areas that received insufficient copies, it was never our intention to provide one for everyone, but hope that our new mailing list is better than the old one.

Much of this edition is given over to IBC 80, and we hope that this compensates those engineers who were unable to attend in person. It is pleasing to note that of all the exhibition stands by both manufacturers and broadcasters, the BBC stand was the one which attracted most visitors. This is surely a reflection of the high standard of inventiveness and engineering still seen in the exhibits, and bodes well for the future of BBC broadcasting.

One grateful reader rang to thank us for his copy of ENG INF. It arrived on his desk the morning before a board. Apparently he found the answers to many of the questions there. We never did find out whether he was successfu: or not!

Contact us on London BH 5432/5433 with your comments or your news

INTERNATIONAL BROADCASTING CONVENTION

BRIGHTON 20-23 September 1980

The eighth International Broadcasting Convention was held at the Metropole Hotel, Brighton for four days in September. At the Convention BBC engineers read many papers covering most aspects of broadcast engineering, from electronic zone plates to how the broadcast programmes will reach the home in the future.

At the associated exhibition the BBC was a major contributor having twelve different exhibits and demonstrations, including the ACE standards converter, which had been temporarily removed from service at Television Centre, and installed on the exhibition stand.

Because of the limitations on space and the cost it was not possible to allow too many engineers to visit either the Convention or exhibition. We hope that the photographs and articles featured here will be helpful to those of you who were unable to attend in person.

Credit must be given to the Engineers at Research, Designs, Capital Projects and Information Departments for all the hard work that was put in before, during and after the Convention, that made the BBC presence so worthwhile.

BBC Chairman, George Howard (centre) looks at ERIC with Charlie Sandbank, HRD and Nick Tanton, RD, its designer

IEricl - Television graphics micro- computer

The new Television Graphics Micro-computer, 'ERIC' was actually demonstrated to the delegates visiting our stand at Brighton. Graham McCallum, a Television Graphic-artist, took ERIC through his paces, many times each day, impressing the on-lookers with its versatility.

The BBC had reached an agreement with Logica Limited for the manufacture, under licence, of the BBC's new sophisticated Television Graphics Micro-computer virtually on the eve of IBC. The Micro-computer developed by Nick Tanton of the Special Projects Section of Research Department, is built around a low-cost microprocessor and allows the graphic artist to draw images electronically on a television monitor. It is expected to become the standard method of producing graphics for the television screen.

The system is based on an 8-bit picture store in which the addresses of the 768 picture elements in each of the 575 active lines of a 625-line television picture are recorded as 8-bit numbers. As the artist moves his stylus across the tablet or 'drawing board', a cursor, seen as an arrowhead on the screen, follows the point of the stylus and reads out the data for each picture element touched.

The graphic artist can choose any of the 256 colours stored in the palette, or 'look-up' table, as different combinations of red, green and blue (RGB) outputs. He does this by calling up the palette onto the monitor screen and by touching the colour he wants with the stylus. Instead of choosing a palette with 256 colours he can bring up combinations of hue, saturation and brightness. For example he could select four hues, each with 64 different grey-scale levels. He can also select a particular brush shape and size in a similar way. Once a colour or brush type has been used on the screen, he can pick it up again without having to go back to the palette.

As an alternative the artist can use a button box, a set of logic assisted switches on the side of the tablet, to select colours and types of finish. Each time he presses a switch, lights show him the choice he is making.

When he has chosen a colour the artist can either paint lines with it or get a Micro-computer to colour-in outlines or the background to his drawing. He can make the lines any thickness from one line thick to the thickness of the whole screen. By using thick vertical lines leading into thin horizontal ones he gets an italic effect.

In practice the artist does not even have to draw a complete line but can mark the two end points and the system will join them up to the required thickness. The Micro-computer can also be instructed to draw geometric shapes like circles, parabolae and ellipses. Anyone who has tried to draw circles freehand can realize the advantage this provides.

The completed graphic can be stored on a floppy disc, ready for use. To reduce the size and speed of the memory needed, the floppy disc uses 'run-length' encoding. With 'run-length' encoding the colour is assumed to remain the same until a change is requested. The result is that instead of having to tell each picture element what colour is required, it is only necessary to say how long a colour is going to last - the length of the run.

A separate visual display unit (VDU) is used for controlling the recording or replaying of the images stored on the floppy disc and for entering the RGB values of the colours stored in the palette.

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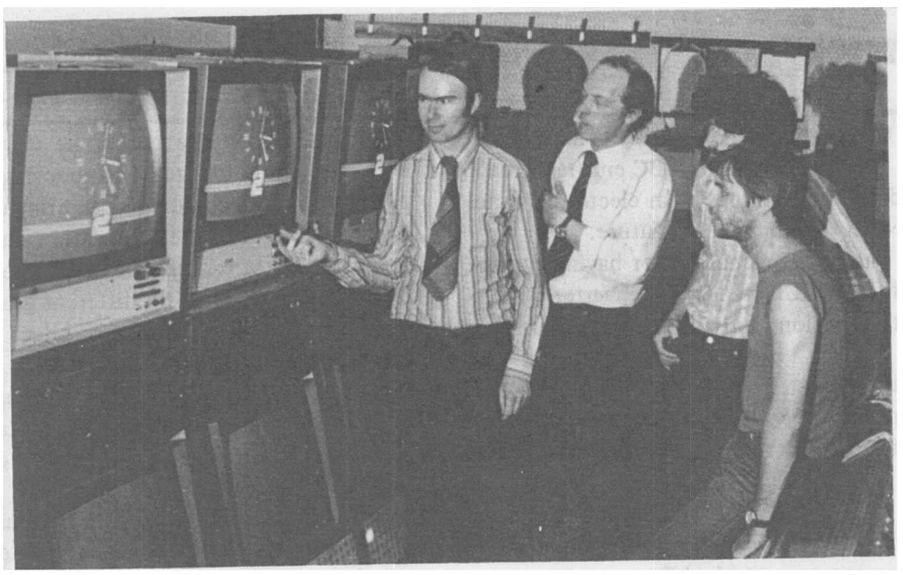
New Electronically generated clock at IBC



(From left to right) Richard Russell, the designer with John Mitchell Tel. Investigation Section, Ewen McLaine and Robin Vinson of Computer Graphics Workshop.

Another new development on our stand at Brighton was our new Electronic Clock.

From Saturday 6 September 1980, the clock seen on BBC 2 has been produced electronically. The BBC 1 clock is expected to 'go electronic' next year. The new BBC system, designed by Richard Russell of Designs Department, has done away with the need for cameras, slide scanners and mechanical clocks. Richard Russell, says 'the new clock has been designed to take up less space, to be less costly to operate and to be more reliable and offer better resolution than the system it has replaced.'

The picture the viewer sees, is made up of the clock and the BBC logo showing him which channel he is watching. The network logo for BBC 2 is generated using run-length encoding, where the data is stored in a programmable read-only memory (PROM). Run-length encoding is where, instead of telling each picture element what colour it should be, it is only necessary at each colour change to tell the system how long the colour will last Le. its 'run-length'. Although theoretically 1024 colour changes could take place on each line, this is limited by the size and speed of the data memory. The use of a buffer memory permits at least 64 changes on each line.

The run-length data for the BBC 2 logo has been produced by John Mitchell of the Television Investigation Section. Robin Vinson and Ewen MacLaine of the Computer Graphics Worshop produced the data for the Open University symbol on BBC 2, which is also generated by the new equipment.

The logo generator can operate in two modes. The first limits the system to four different colours and reduces the size of the memory needed to a minimum. The other makes 32 different colours possible but as a result needs a much larger memory. For example it needs about 4 kilobytes of memory storage to display a simple logo.

An additional feature of the BBC logo generator is that it can be used to produce simple animation. Although it is mainly intended to produce fixed patterns by reading run-length data from a PROM, movement can be achieved by using a microprocessor to make real-time alterations in the data held in a random access memory (RAM). The system reads the data from the RAM by means of direct memory access (DMA).

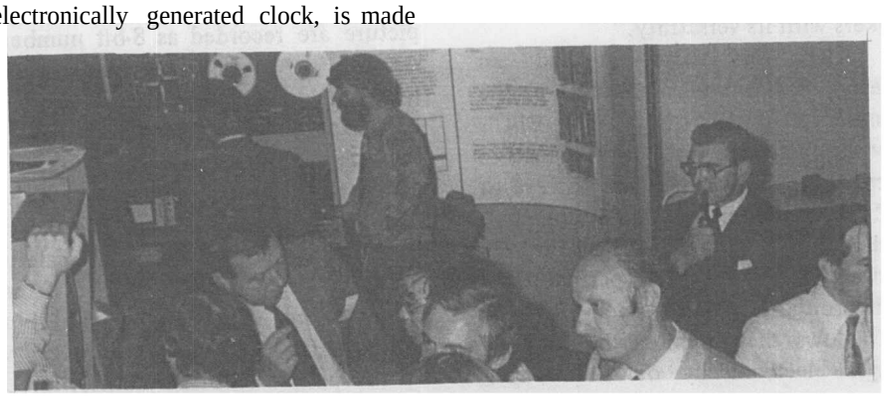
The main part of the picture, the electronically generated clock, is made up of two components - the fixed elements on the clock face and its moving hands. The fixed elements - hour markers, the circle and the centre spot - are stored in a PROM as a series of horizontal position co-ordinates which are read out in sync with the television waveform. The size of the memory required is reduced by using horizontal and vertical symmetry.

The data for the clock hands is stored in a RAM. A microprocessor controlled by an erasable programmable read-only memory (EPROM), keeps track of the time and every second calculates the correct angle of the hour, minute and seconJ hands.

The BBC designers had to get ovcr the problem that when thc hands made only a small angle to the horizontal, the tclevision line structure breaks the edge of the hands up into a staircase. The BBC's answer is to feed the hand signals through analogue proccssing circuitry which adjusts the rise and fall timcs of the waveform according to the angle of each hand. The microprocessor then selects the rise time to give the best optical effect on the viewers screen.

All the equipment needs is mixed blanking and mixed sync pulses together with a.c. mains power. However, time reference pulses and logo-selection signals for remote control can be used as optional inputs. Without an external time reference signal, the clock derives its reference from either incoming television pulses or from its own internal oscillator. The outputs are standard 0.7 volt peak-to-peak RGB and a composite monochrome output suitable for feeding to a colour synthesiser.

The clock can be set to any time. It can be corrected in one second intervals or by the hour - useful for the twice yearly changes between GMT and BST.



NICAM-3 put to the test at IBC

John Sykes, DD, explains Nicam 3 and the Band 11 transmitter equipment

The display of NICAM 3, our 2048 kilobit sound transmission system at IBC '80. allowed visitors to listen to its high quality. A signal was received 'off-air', decoded to its A and B components, recoded into NICAM 3, passed down a fibreoptic, decoded again and fed into the modulator of a Designs Department Band IJ transmitter. Visitors were able to listen on headphones to the demodulated output of the Band IJ equipment. (An article on the BBCfMarconi licence agreement for the Band IJ drives and power amplifiers is included in this edition of ENG INF).

In 1971 our engineers developed the first Sound-in-Syncs system for distributing high-quality television sound signals in digital form in the line-synchronising pulses. With a sampling rate of twice line frequency and audio companding, satisfactory quality was obtained with ten bits per sample.

For high-quality stereo signal distribution over the BBC's national radio networks, BBC engineers developed a thirteen-channel multiplexed system. Recognising the possibility that up to four codecs in tandem might be needed, they used linear coding, a sampling rate of 32 kHz, and 13 bits per sample (a fourteenth bit being avoided by using 'dither', a perturbing signal). The 6336-kbitfs bitstream is carried by video cables and links to provide high-quality feeds of four national radio programmes to transmitters serving most of the UK.

NICAM 3 (Near Instantaneollsly Companded Audio Multiplex) in the latest system which arises from the desire to use a bit rate of 2048 kbitfs (CCITT Recommendation G 732) fur sound-programme transmission. BBC engineers aimed to use a sampling rate of 32 kHz, ten bits per sample and companding to send six programme channels over a 2048 kbitfs system with the same quality as the 13-channel described above.

In NICAM 3 each audio input is pre-emphasised, 15-kHz low-pass filtered and variable-emphasis limited before being sampled at 32 kHz, each sample being coded as a 14-bit word. Depending on the maximum level of the audio signal a 'range' is chosen to determine which 10 of the 14 bits are sent. There are thus 5 ranges and it is not necessary (and not desirable for bit economy) to send a range code with every sample. In fact, each range code applies for 32 consecutive samples and this feature gives rise to the name 'near instantaneous' .

Automatic tape reclamation equipment saves money

New automatic Tape Reclamation equipment has recently been brought into service for Radio and External Services in London. The new equipment ensures that the tape reclaimed is suitable for every broadcasting use, including stereo, and saves us a large amount of money at the same time. It is expected that the equipment wiIJ be available in the Regions in the near future.

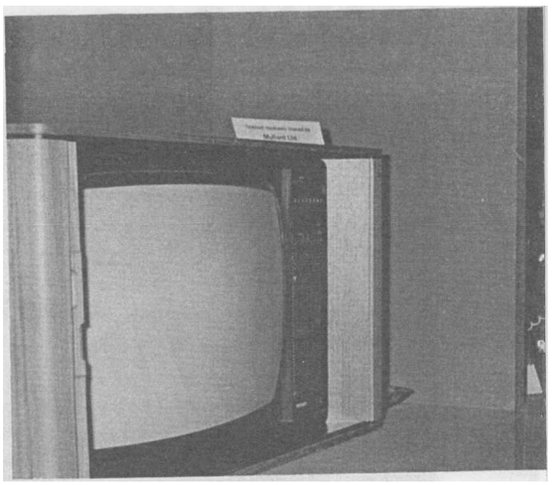
Mick Gleave, of Designs Department, who is at present responsible for the design of the Tape Reclamation equipment says 'The equipment is expected to save even mo~e money in the future. Magnetic recording tape is an oil-based product and is likely to escalate in price. As early trials show that a trained operator could be able to recover twenty-five 2400 foot reels each day, you get a good idea of the equipment's value to the BBC'.

The new equipment continually monitors the sensitivity of the tape, for the quality along its edges, for the number and distance between splices and for drop outs. It also checks that changes in sensitivity across each splice are within acceptable limits.

The processed tape is now so good that it is suitable for any broadcasting use. The previous system only carried out limited tests with the result that the tape reclaimed could only be used for mono. The new machines however do not allow the sensitivity of the tape being processed to vary beyond our specification for new tape. They do not accept jumps in sensitivity across splices of more 'than 0.8 dB and also, because of their physically weakening effect on the tape, they do not permit splices to occur too close together - usually not less than 100 feet apart.

Sue Tubb, DD, seen operating the Tape Reclamation equipment

Guy McNaUy, RD, explains to Huw Wheldon the changes COPAS is making to the signal



Jim Chew, RD, shows Huw Wheldon Polyglot Ceef

COPAS-2D Demonstration

A very popular display at IBC '80 was the second generation COmputer for Processing Audio Signals, COPAS-2D. Delegates were able to process a digital recording of a symphony orchestra themselves altering the bass, treble or selected frequencies by varying amounts (Digital dynamic range control) or trying out different equalization characterisations (Digital Equalization).

COPAS, developed by Guy McNally of Research Department can be used to fade, fIlter, compress and expand digital signals as well as perform the binary arithmetic computations on the digital input required for research.

With digital dynamic range control the COPAS-2D is programmed as a combined compressor/limiter/ expander/noise-gate. The dynamic characteristics, such as attack and decay times of the peak following circuits, can be varied, or an R.M.S. mode of operation can be selected. A delay up to 8 milliseconds can be inserted to operate on sudden large peaks in the signal. The wanted threshold and slope is selected from those available and the coefficients and data set up for the COPAS unit.

For digital equalization the PET computer is programmed to accept and send the filter coefficients to the COPAS module. The particular filter characteristics can be set up again accurately, their performance being checked by listening on headphones.

Digital audio processors have to work at high speeds. The equipment at IBC '80 used six four-bit slices connected to give a 24.bit machine. It also uses specially-developed micro-instructions to carry out operations such as arithmetic functions, input/ output functions and finding the next address. Also, multiplication is done in a separate single-chip multiplier which works 16 times faster than the micro-processor's own multiplier.

Another important technique in COPAS is 'pipelining', which halves the cycle time. This is where the next microinstruction can be called up while the first is being executed. Using this facility 16 separate 'activities' can be programmed into each 56-bit micro-instruction and only take 140 nano-seconds to carry out.

Although the audio signals can be sampled at any sampling rate, the higher the rate then the smaller the number of instructions that can be carried out within the time of each sample. The equipment on show at Brighton had a sampling rate of 32 kHz which allowed 223 instructions to be completed for each sample.

Comments on BBC stand

'Very impressed, IBA green with envy about the quality of the stand'

'Congratulations for a first rate production'

'Polyglot' CEEFAX 01

The Polyglot Ceefax receiver on the BBC stand at IB,C 80 was a very popular exhibit. Polyglot is the name now given to a teletext system which can be used with languages having accented letters or even completely different alphabets. Apparently 196 characters are needed to cover all the languages within the EBU instead of the 95 required for the British system. This does not include the characters needed to cover the non-Latin languages such as Greek, Arabic and Hebrew.

We have proposed two techniques for Dynamically Redefinable Character Sets (ORCS); a system of 'soft Alphabets' to allow a full range of letters required for all the European languages - each language would be able to use a working set of about 94 characters from the total store of 400 characters - and a system, which shapes any characters not in the decoder's store by addressing a pattern of dots to the required part of the page.

In the first issue we touched on the enhancements to the present teletext system in the article 'UK Teletext Beats World Rivals' (ENG INF No. 1 Summer, 1980). We described 'linked pages' and 'page check words'. Linked pages allow the viewer instant access to sets of related pages at the touch of a button. 'Page check words' check that a page has been correctly received before moving on to the next one. This facility allows a series of linked pages to be

1. 'Teletext - enhancing the basic system', Pr'
2. 'Alphabets for Ceefax', BBC Engineering N,
3. 'The impact of improved teletext characteJ sets (DRCS)', BBC Research Department, J
4. 'Polyglot-C System', Philips Telecommu Document IWP 11/3 CP39.

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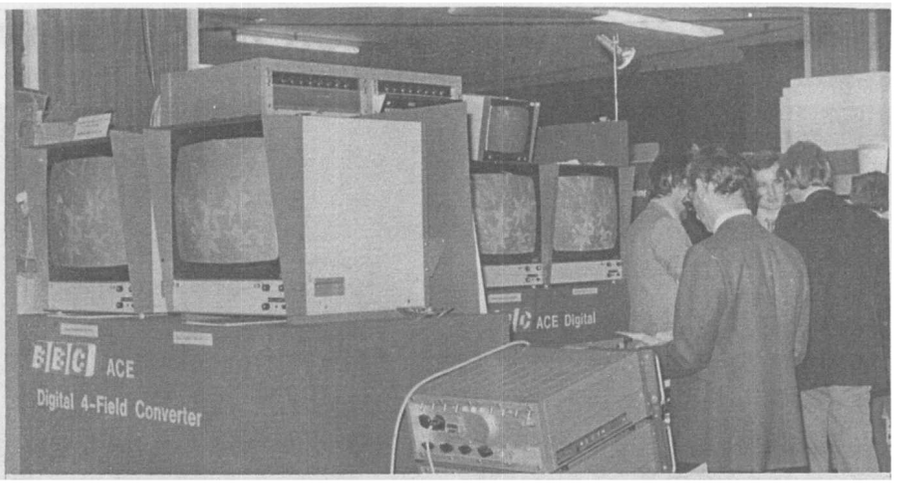

ACE, the digital 4-field Standards Converter had a prominent position on the BBC stand

1 show

automatically filed, in the knowledge that they have all been received correctly.

We have also proposed two types of additional data which could be carried in the Teletext signal without interfering with the operation of existing decoders. Blocks of data, such as computer programs of 'telesoftware', could be sent as 'pseudo pages'. Totally independent 'auxiliary data channels' could be used to carry 'packets' of data which could be used for applications not necessarily related to either television or teletext.

With the first type of additional data each 'pseudo page' could contain up to 1024 8-bit bytes of information. In this way over 12 million 'pseudo pages' could be made available; each protected by a page check word. They could be linked with each other as well as with normal pages.

An example of an 'auxiliary data channel' is a 'television service data line' which as well as the header line information (page number, date and time) would identify the television channel, network and the programme being received. The information would be repeated every second.

A specification for the enhanced television system is being drawn up by broadcasters and industry. Until this is available readers may find the following references useful:

DC. lEE Vol. 126, No. 12, December 1979.
D. 108, December 1977.
: generation on dynamically redefined character
anuary 1980.
nicatie 1ndustrie B.V. August 1980. CC1R

Latest standards converter

The latest digital field-store standards converter from BBC Research and Designs engineers was on show on the BBC stand. It can be used to convert from any internationally-recognised television standard to any other (including PAL M, 525-line PAL) and where the incoming programme contains a mixture of standards, the equipment automatically switche~ to the correct mode.

The new equipment, now in service at the BBC's Television Centre in London, was developed by a team of Engineers led by Jolm Astle of Designs Department. It provides all the signal processing required for international programme exchange and can therefore be used to change SECAM signals to PAL or vice-versa, or it may be used as a synchroniser or to 'repair' an input signal which is out of specification.

This revolutionary equipment was designed as a result of a rigorous analysis of the fundamental requirements by Chris Clarke of Research Department.

The interpolation process was scientifically defined and the required parameters mathematically deduced. The converter interpolates from four fields of the input waveform to produce an output which contains virtually no visible impairments. Advantage has been taken of the latest developments in semiconductor technology to provide cheaper, smaller field stores and comb filters were specially designed to separate the input chrominance and luminance signals, leading to a significant improvement to quality of the output signal.

The equipment also features a microprocessor-based monitoring unit which gives a plain-language VDU display of fault conditions with an indication of the grade of remedial action required. Digital test routines are also provided so that operation can be checked when the equipment is not being used for programme conversion.

Further information on this and o~her new BBC equipment is available.

(i) 'Developments in Standards Conversion' C.K.P. Clarke and G.D. Roe IBC 1978

(ii) 'The Filtering of Luminance and Chrominance Signals to Avoid Cross-colour in a PAL Colour System' J.0. Drewery BBC Engineering No. 104 Sept. 1976

(iii) C.J. Dalton, G.D. Roe Patent Application No. 2068/78

Further comments

'Very successful, and our contribution to IBC as a whole, very impressive'

'I thought this years stand was superb'

CMCCR-2 on the beach at Brighton

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Visitors queue up to look round the new CMCCR 2 during a break in the weather

The new Colour Mobile Central Control Room, CMCCR 2, parked on the Lower Promenade at Brighton was the largest and one of the most popular exhibits at this year's International Broadcasting Convention. It did have a special advantage. As it was outside the main exhibition hall the general public were able to look around when delegates were attending lectures and seminars.

It was greeted with acclaim. One visitor said that he would never again object to paying his licence fee, after seeing the dedication of the BBC staff and the complex equipment in the vehicle.

The idea for the vehicle had been discussed in SCPD for some time. The decision to go ahead with it came after a visit by Bill Rhodes, Head of OB Unit, SCPD, to America and numerous discussions he had with the user department, Tel. OB's. The idea was just the beginning. The design and development of the vehicle has been carried out over the last two years by Duncan Stewart, the Project Leader, and his team of SCPD engineers together with Dell Technical Vehicles of Southampton.

The v~hicle brings a whole new concept to OB vehicle design. Up to now even the largest OB vehicle has not been large enough to provide all the production and engineering facilities needed for programmes involving perhaps thirty picture sources. Their size has been determined by the Road Traffic Acts. These lay down a maximum size for a rigid vehicle of 11 metres long and 2.5 metres wide, which, considering some of the roads and the location of the OB sites, seems sensible. Getting the CMCCR through the railings and down on to the sea front at Brighton took l!h hours. Negotiating the narrow route, with no space to swing, created a virtual jacknife for the articulated tractor, which had to be uncoupled and recoupled several times,

The CMCCR I which this vehicle is replacing has had to operate as a production, sound and communications centre for two or more conventional OB vehicles. These vehicles had to provide separate camera control as well as many of the other facilities needed,

The new vehicle overcomes the problem of space in a unique way, On site, the walls of the central part, which forms the production control room, are driven out electrically to create a production control room 4.5 metres by 5 metres wide. One wall carries a stack of 34 monitors and two loudspeakers. As these are outside the main body of the vehicle they give a good viewing angle from each position on the desk. The extra space on the other side of the control area allows staff to move freely behind the production team sitting at the desk. The moving walls maintain the high standards of sound and heat insula tion.

A t the front of the vehicle is an engineering and vision control area with its equipment for processing and monitoring all thc vision signals entering and leaving the vehicle. The equipment includes digital video synchronisers, sophisticated mcasuring equipment as well as the main vision mixing desk, power distribution bays and smoke detection alarms. An adjacent area can accommodate one or two cameras or video-tape recorders when needed.

The sound control room at the rear of the vehicle contains a 44-channel Neve stereo sound mixer and a central communications system, based on a 50 x 100 pin-board matrix to give the maximum operational flexibility.

The **rack of 34 monitors and the control desk in the extended production control room**