ENG INF

AUTUMN 1990 No. 42

IBC 90
Farewell to Brighton

At IBC 90 we saw evidence of the continuing development of HDTV on both the Japanese 1125-line and Eureka 1250-line systems. However, also on display was a computer simulation of one of the HDTV systems being proposed for adoption in the United States. The proposal is based on an all-digital system in which the HDTV signal is data-compressed from about 1000 to 30 Mbit/s or even lower. The data can then be transmitted direct to the home via satellite or even via terrestrial channels. Conventional 525/625-line tv could also be transmitted by this system at about one quarter of the HDTV data rate. A satellite channel could therefore carry HDTV, or multiple 525/625 signals, or possibly a combination of both. This is an exciting proposal of which I am sure we will hear more in the future.

Another major topic was the enhancement of present-day television — Germany's ***PAL Plus*** and the UK's ***Enhanced PAL***. The aim of this work is to give the PAL/Secam viewer the option of watching in wide screen format with increased resolution — a sort of halfway house to full HDTV. The tricky bit is to find a way of doing this without impairing the normal 625-line picture.

In the studio, the development of all solid-state and digital equipment continues apace. The CCD has virtually displaced the tube in 525/625 cameras, with developments now being concentrated on improving the performance of the sensor itself. Of particular interest was the ½-inch digital video cassette recorder (known as Dx or D3) which has been chosen in principle by the BBC for use in Television Centre's new Post Production areas.

We must now say goodbye to Brighton — where the sky, the sea and the wind always seemed to put on an impressive display for IBC. The Convention has outgrown Brighton, during its ten year residency, resulting in an acute shortage of exhibition space and a lack of hotel accommodation. From 1992 onwards, it will be held at the RAI — a purpose-built exhibition centre with modern conference facilities, located some 3km from Amsterdam.

Henry Price
HEID

The BBC's exhibits at IBC 90 are described on pages 14-17.

MRM

Dark clouds hanging over Brighton in September! The IBC moves to a new venue in Amsterdam from 1992.

CONTENTS

ENG INF

Edited, designed and typeset by EID, Room 707A, HWH. Tel: LBH 4316

☆ ☆ ☆ ☆

The closing date for stories to be included in our next issue is Friday the 16th of November.

Mike Meyer

TRANSMITTER NEWS

The following services opened or changed between 23rd June and 28th September:

Television

Great Torrington	Devon
Haverfordwest	Dyfed
Kinross	Tayside
Lydden	Kent
Millthrop	Cumbria
North Hessary Tor	Devon
Rookhope	Durham

FM Radio

Chippenham	Wiltshire
Salisbury	Wiltshire

Radio 1 FM

Belmont	Lincolnshire

On August 3rd, the Radio 1 FM service from Black Mountain, near Belfast, changed frequency from 96.0 to 99.7 MHz.

Radio 2 FM

Radio 2 became an FM-only service on the 27th of August, with the birth of Radio 5.

Radio 4 FM

Black Mountain	Belfast

Radio 5 MW

Radio 5 was launched on August 27th, using what was previously Radio 2's medium-wave network — 693 and 909 kHz (plus 990 kHz in West Wales).

Local Radio

A new FM relay for ***BBC Hereford and Worcester*** opened at Kidderminster on August 1st.

LICENCE AGREEMENTS

Four licence agreements have been struck since the last edition of ***Eng Inf*** was published.

As Simon Wegerif reported in Issue 41, Design & Equipment Department has implemented an Interface for the AES/EBU serial digital audio transmission standard on a single integrated circuit. Called AESIC, this device is manufactured by LSI Logic (UK) at their Foots Cray facility.

The BBC has now licensed two companies the rights to sell AESIC to third parties, and to offer technical support for the device and advise on how to integrate it into equipment designs. These companies are ***Mogul Electronics*** of Sevenoaks, and ***Newbridge Microsystems*** of Ontario.

Bill Fletcher, who is one of the AESIC design team, presented a paper on the device at the International Broadcasting Convention in Brighton during September. In addition, the BBC stand at IBC90 included a display showing the main features of the development, alongside three new designs which incorporate AESIC as a key component. Running concurrently to IBC was the AES Show in Los Angeles, where Newbridge formally launched the device onto the American market.

Both of the other licences are to ***Eddystone Radio*** of Birmingham, for the FL5/8A Band II Combining Filter and PS2/272 Stabilised Power Supplier. These latest acquisitions increase yet again the range of Band II-related items available from this company.

Further details on any of the above, or on other aspects of licensing, can be sought from the Liaison Engineer on Avenue House ext 375.

Peter Jefferson
D&ED Liaison Engineer

ENTERPRISES

Cardcast combats credit card fraud

A major new service called ***Cardcast*** has been launched to reduce credit card fraud dramatically — currently estimated to cost over £100 million a year. This new service gives retailers instant access to a constantly updated list of invalid card numbers, using data that is broadcast alongside normal BBC Television transmissions.

Cardcast is a joint venture between BBC Enterprises, Electronic Data Exchange Service Ltd (EDES), and Registrator Industries Ltd.

Using ***Cardcast***, a retailer simply swipes a customer's credit or debit card through a card reader or EPOS terminal to carry out automatically an instantaneous check, thus allowing the transaction to be either approved or prohibited. ***Cardcast*** delivers this service to the point of sale using the BBC's Datacast service, which transmits data using the BBC 1 and 2 tv transmitter network — similar technology is used for the Ceefax teletext service. With Datacast, an unlimited number of retail ***Cardcast*** terminals can be updated simultaneously within a fraction of a second.

"*In recent times, the growth of credit card fraud has reached alarming proportions.*" said Gerry Clark, Sales and Marketing Manager of BBC Datacast. "*This is because criminals frequently take advantage of the poor communications that generally exist between retailers and credit card issuers, which means that lost, stolen or over-limit cards are often used fraudulently for long periods after they have been identified.* ***Cardcast*** *now gives retailers instant access to an up-to-the-second database of invalid cards, thanks to this novel use of broadcast technology.*"

John Spink, Managing Director of EDES, said: "*Our role in the* ***Cardcast*** *joint venture company is to collate and manage the database of card numbers. Already, card issuers are showing tremendous interest in the concept, which will result in reduced losses from fraud and increased business capacity.*"

The third partner in the joint venture is Registrator Industries. Their Director, Mike Hendry commented: "*As manufacturers of Datacast receivers and retail equipment, we will be providing customer systems for* ***Cardcast***. Trials are already taking place to demonstrate the service, and retailers have been quick to realise the benefits of lower costs and faster transaction times with potentially increased business. Customers will also appreciate ***Cardcast***, as queues should be shorter and card usage made easier."

ACED Guide to Acoustic Practice

The second edition of ACED's *Guide to Acoustic Practice* was published earlier this year. Prepared by Keith Rose, ACED's Acoustic Architect, it is an extensively modified and improved version of the 1980 'Guide'. The new edition is described here by Bob Walker.

MRM

Keith Rose.

The new ***Guide to Acoustic Practice*** contains 144 pages of text and graphical information relating to the acoustic design and construction of all types of areas within a broadcasting centre. Its principal objective is as a vehicle for ensuring a common approach to common problems; it aims to ensure that adequate standards are achieved, without the costs of duplicated design effort.

Much of the background to acoustic design is given but, because it originated as a set of standard details for Clerks of Works, it is heavily biased towards the practical aspects of building design and construction, and shows many standard details for building elements. The current BBC acoustic standards for noise levels, sound insulation and internal acoustics are given in full and some of their origins, justifications and inter-relationships are discussed in detail.

The first of the principal subdivisions relates to Noise. It covers planning, environmental noise, building services, OB vehicles and technical equipment. The second relates to Sound Insulation and includes details of structures such as walls, floors, ceilings, staircases as well as the sound insulation aspects of building services. Both of these sections relate as much to the Health and Safety requirements for non-broadcasting areas as they do to acoustically-sensitive studios and control rooms, although of course the absolute standards are different.

The third main section deals with the internal design of studios, control rooms, and other critical areas. It contains a large amount of detail about the acoustic aspects of the basic structures and the many different types of additional acoustic material which is generally used in such rooms.

The Guide is intended principally for use as a design reference by architects and as a working handbook by site-supervisors. Because it covers subjects as diverse as 'Guidelines on Sound Control Room Layouts' and 'The Acoustic Effect of Studio Furniture', it is as relevant to the technical installation as it is to the architectural and structural designs.

Published by ACED, the ***Guide to Acoustic Practice*** (ISBN 0 563 36079 8) is available externally at a price of £30.00. Internal purchases, including personal copies for staff, are available at a discounted price of £20.00. For further details and order forms, please contact John Winfield, Business Manager, ACED, Room 510, Henry Wood House.

Bob Walker
A/Head of Sound Section
Research Department

TELEVISION SCENERY
Modular steel system

Traditionally, television scenery has been constructed from timber and plywood panels supported by scaffolding. Multi-level constructions have involved rather more complex structures, again constructed mainly from timber. In order to reduce the costs of set construction and to provide greater flexibility, the television service is now using purpose-made steel frames, rather like a giant Meccano system. It is made by RMD Construction Equipment and was specified by Structural Engineer, John Aitken, of ACED.

The RMD system is totally modular and is based on 6-way node-connectors which join mini-slim columns to mini-slim beams: add plywood decking and lightweight flattage (wall panels, doors, windows, etc) and you have all the ingredients for a free-standing television set structure. Bracing is installed using either rapid tie rods, as rigid cross members, or webbing straps similar to those used to secure loads on HGVs. The columns and bracing can readily be relocated to suit particular camera shot angles.

The hospital programme ***Casualty*** is a familiar example of the RMD system in use (at a warehouse in Bristol). However, it has found use in a wide range of other programmes such as ***Dr Who***, ***Election Special*** and ***The Old Bailey***. Recently, a complete 4-storey house was built for television using the RMD system, including courtyards with cars, fountains and a basement. This would have been very complex and expensive to construct using traditional methods and materials.

John Aitken, ACED

Part of the Casualty set under construction.

EID The FM Promotion Campaign

As reported in our last issue, FM will become the only outlet for Radios 1 to 3 and the main outlet for Radio 4 in the next few years. Consequently, Radio has mounted an FM promotion campaign to encourage listeners to switch to FM, even if it means buying new radio equipment.

The main emphasis this year has been on Radio 2 which became an FM-only service on 27 August, with the birth of Radio 5. In the months leading up to the change, frequent FM promotional trails were broadcast by Radio 2. However, Radio 1 has also been very active on the FM promotions front, now that its stereo FM network is rapidly expanding.

As part of Radio's campaign, EID has been very involved in promoting the switch to FM: justifying the technical reasons for the move; advising listeners on how best to receive their programmes on FM; assuring doubters that they are well served by an FM transmitter (or won't have too long to wait for FM reception improvements to take place in their area); or helping, advising and sympathising with the relatively few listeners who may have a long wait before they get an FM service because of their remote geographical location.

To assist in this work, EID has installed a special telephone ***Linkline*** which charges callers only local rates, irrespective of where they telephone from in the country. A computerised mapping system called ***Wings*** has also been installed in the telephone answering area, to assist in quickly finding the preferred FM station and its transmission frequencies, at any location in the UK.

Complementing this office-based activity, EID has fitted out a ***Tuning Clinic*** caravan which can be parked in town centres around the country to promote BBC National and Local Radio, and the switch to FM in particular. The department also staffs a small but often busy stand in the ***Radio Goes To Town*** big top, from where the FM message has been promoted by Network and Local Radio at a number of high-profile venues over the summer months.

The Telephone Linkline

Prior to the FM promotion campaign, EID's twenty year old system for answering phonecalls from the public consisted of ten Key & Lamp units at individual desks in an open plan office. Each unit could handle the five public lines (on 071-927 5040) and four other lines used for general calls within the BBC. The proposed ***Linkline*** could not be added to this elderly system so, to achieve the necessary flexibility, the old Key and Lamp system was replaced with a BT Navigator system over the Easter weekend. This provides for up to sixteen incoming lines along with sixteen extensions and comprehensive intercom and conference facilities.

Initially the Navigator simply replaced the existing system but, at the end of May, the Linkline facility (0345 010 313) was installed — eight of the incoming lines forming the "Radio 2 Helpline". At the same time, a further four extension terminals were fitted, allowing a possible fourteen calls to be answered at the same time.

The Radio 2 Helpline began to be advertised on air by the network at the end of June, initially just during normal office hours but later at planned times in the evenings and at weekends. The first Sunday session, in mid July, covered the morning only and had all lines continuously busy from 8am until 2.30pm. From mid August until early September — the most critical period — the Helpline was staffed for 12 hours a day, 7 days a week.

To assist EID with this additional workload, extra help was brought in, mainly from Radio 2 — PAs, producers and presentation staff, including announcers. Because these very-willing people had no knowledge of the BBC's FM coverage, other than it reached over 98% of the population, an easy-access information system was needed. And this is where ***Wings*** comes in.

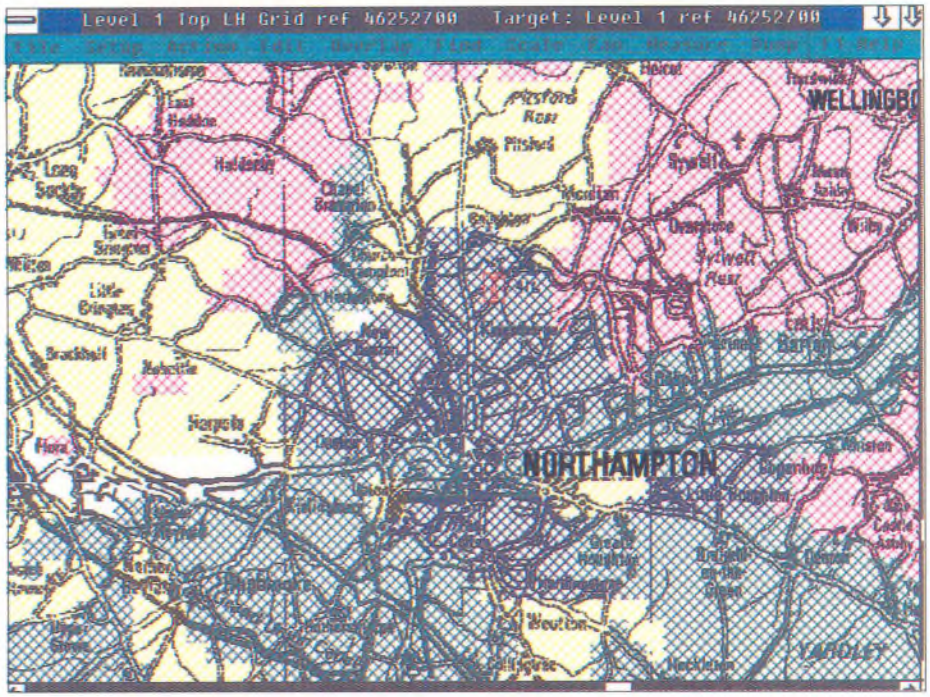


*Fig. 1: A print from **Wings** showing FM coverage in the Northampton area. Red-shaded areas are served best by Peterborough; dark blue areas by the Northampton relay; yellow areas by Sutton Coldfield and the cyan areas by Bow Brickhill. The white areas are unserved.*

Wings

For some while, Service Planning Section at Research Department had been looking into ways of storing transmitter coverage information in a graphical way. A software house — Systems Options — had developed a map-based system for recording pipeline and cable routes throughout the country, and this was modified and extended to provide FM coverage information by means of colour overlays (cross-hatching) on the displayed map (see Fig 1). The package also included a full Ordnance Survey (OS)

gazetteer of place names in Great Britain but, regretably, not those in Northern Ireland (which had to be laboriously typed in by EID staff).

The system works by entering a place name via the computer keyboard. After a few seconds, a 1:250,000 scale map is displayed which shows the FM coverage in the vicinity of the selected place. By using the mouse to point the cursor at any specific location on the displayed map, the usable FM frequencies at that location can be listed.

Problems arose in the early days because the commonly-known name of a place is not necessarily the same as its gazatteer-listed name. Did you know, for example, that it is "ROYAL Tunbridge Wells" or that it is "Stoke-on-Trent" and not "Stoke on Trent"? Once these quirks had been mastered, ***Wings*** became a very useful tool for all those involved in the Radio 2 FM campaign. The ten terminals were used extensively by the visiting helpers as well as by the regular EID staff.

For those interested in computers, or wondering if their Model B would be able to offer similar facilities, the system requires a 118 Mbyte hard disc. Two file servers (Apricot 350 Qi PCs) are connected to ten Apricot XEN-S 200 terminals via two parallel Ethernet networks. A Hewlett Packard Ink Jet printer is fitted to one of the terminals, allowing personalised coverage maps to be printed (such as the one shown in Fig 1).

The system is still very much in use, assisting staff to answer general enquiries about FM reception. In the near future, it is hoped to add coverage information on uhf television, which will be even more complex as there are about ten times as many transmitting stations in the uhf network. This enhancement to the system will require a computer map with much better detail — a scale of 1:50,000 compared with the 1:250,000 provided for FM coverage.

The Tuning Clinic

This is based on a sixteen foot Lynton Executive display caravan. The unit was built at Lynton's workshops in Manchester and fitted out in London. The interior is divided into two sections — a kitchen area and the public area.

1 The kitchen occupies about one fifth of the overall area and includes a gas hob, microwave oven, gas fridge and twin sinks. The power cabinet and associated metering are also in this area.

2 The public area contains seating, four RDS car radios, various portable radios and a typical domestic music centre 'stack'.

Signals for the four car radios are provided by separate car radio whip aerials on the roof. This ensures that each radio works properly on long-wave, medium-wave and FM. The music centre is fed from a 3-element yagi aerial rigged on a 12 foot demountable pole, assembled from four sections.

Power for the whole unit is provided by either conventional mains (240V single phase) or from a 3 kVA Honda petrol generator which runs for about twelve hours on a full tank. The maximum power drawn is around 2 kVA.

Background heating is provided by a Propane gas heater.

The doors open out to reveal display leaflet holders and promotional material. Two technical staff are usually on duty and are kept fully occupied with visitors much of the time, particularly following a ***Tuning Clinic*** trail by National or Local Radio. In fact, to draw in the crowds, known pesonalities from Radio 2 and Local Radio have attended many of the clinics this year.

During the summer months, the caravan visited around twenty towns; from Inverness in the north to Horsham (West Sussex) in the south, and from Wrexham (Clwyd) in the west, to Woodbridge (Suffolk) in the east. The duration of each stay varied from one day to a week.

Radio Goes To Town

In support of Radio Publicity, EID staffs an Engineering Advice desk at ***Radio Goes To Town***. This area is equipped with four RDS car radios, fed from the central rf distribution system around the big top, as well as a selection of 3-waveband portable radios. The stand is stocked with a variety of technical leaflets on reception, etc, as well as coverage maps of adjacent FM stations.

This summer, the Show visited Ipswich, Glasgow, Torquay, Gateshead, Blackpool, Alton Towers and Salisbury, usually for about seven to ten days at a time.

Dealer Meetings

Also in support of Radio Publicity, HEID or AHEID has attended radio dealer meetings around the country, to stress the importance of stocking and selling three waveband radio receivers. In the case of Hi-Fi equipment, the need to use a good outdoor FM aerial has also been stressed at these regional events.

Statistics For The Campaign

According to Broadcasting Research, some 60% of regular Radio 2 listeners were using FM before the campaign began (in January this year). By late August, this figure had risen to 85%.

Richard Ashwell, EID

The Tuning Clinic at Peterborough in July.

– THE FM PROMOTION CAMPAIGN –

Radio Publicity

Radio Goes to Town at Ipswich in April.

Between late May and early September, EID answered about 25,000 calls on the Helpline and is still replying to the several thousand letters which have been sent in.

The Future

Next autumn, Radio 3 is expected to become an FM-only service (its medium-wave channel will be required by the Radio Authority for re-allocating to a commercial operator). Consequently, there will be a Radio 3 FM campaign starting in the New Year. In support of this campaign, EID will operate a "Radio 3 Helpline", as well as providing out-and-about publicity, information and advice via ***Radio Goes To Town*** and the ***Tuning Clinic***. Additionally, the department will produce further literature, coverage maps, etc, which are relevent to the new campaign.

And the year after? Well that could be Radio 1's turn ...

SOUTHAMPTON
New car parking areas

What is Windsor Davies doing with a Pantomime Cow in ***Eng Inf***? The answer "Opening a Multi-Storey Car Park designed by ACED for Southampton City Council" only seems to add to the confusion. The explanation goes back to early discussions in 1986 between the BBC and the City Council over acquisition and development of the West Park Road site.

When it became apparent that the proposed Regional Broadcast Centre (RBC) only required part of the site and that a shared multistorey car park should occupy the remainder, it was agreed that to maintain a consistent design approach, ACED should be responsible for the design of both projects.

The resulting design posed a challenging problem, as the requirement was to provide the maximum number of spaces possible for the minimum cost, and to provide separate areas for BBC staff, Southampton Council employees and the general public — all on a steeply-sloping triangular site — without disruption to the adjacent RBC contract programme.

However, using experience gained on the Wood Lane car park at Television Centre, ACED was able to produce a solution to satisfy all the criteria at a final cost below the original estimate. When, in addition, it proved possible to open the building for public parking in time for the pre-Christmas shopping rush, it is understandable that Southampton City Council (who became the building owners) wished to celebrate. As the car park is extensively used in the evening by patrons of the adjacent Mayflower Theatre, it seemed logical to involve the cast of the Christmas Pantomime as well as BBC Radio Solent in the opening ceremony.

So, although at first sight it all seems very strange, like any good pantomime there is a happy ending: the BBC has the use of a separate secure area in the car park; the City Council gets a very economical building which its parking department finds easy to run; members of the public get convenient parking near the railway station, and I became the first engineer in history to have his building opened by a cow!

Eric Finlayson
Structural Section, ACED

DIGITAL TELEVISION

Spot the homologous structures!

Howard Jones takes us on a conducted tour of digital television, covering such topics as point-to-point transmission, switching and routeing within studio centres, HDTV, HD-MAC, Enhanced PAL, and Standardisation.

If you and I were to wander around a zoo, we would be particularly impressed, I suspect, by the enormous variety within the animal kingdom. Hippos, kangaroos, porcupines, bats — all so very different from one another. But if we were to be accompanied by a zoologist, we would get quite a different picture. Whilst well aware of the differences between them, he would be anxious to point out the similarities in their internal make up. And, although he would not claim to see fully into the mind of the Creator, he would be able to show how in the development of the various species, the same basic mechanisms had become adapted to fit each animal to the environment in which it lives.

I shall attempt to be your digital zoologist. And from time to time I shall try to show you how similar processing techniques can be found in a number of applications, adapting the signal to the constraints of its environment. And we shall look at the process of standardisation and speculate on what the concept of "natural selection" means within the world of broadcast engineering.

Mention has already been made in ***Eng Inf*** of CCIR Recommendation 601, which specifies the characteristics of 525- and 625-line YUV digital television within studios. Luminance signals are sampled at 13.5 MHz, and each of the colour difference signals at 6.75 MHz. So with 8 bits per sample, the gross bit-rate of the complete digital signal is 216 Mbit/s (Fig 1).

CCIR Recommendation 601

Luminance	'Y' 13.5MHz x 8bits	= 108Mbit/s
Chrominance	'U' 6.75MHz x 8bits	= 54Mbit/s
Chrominance	'V' 6.75MHz x 8bits	= 54Mbit/s
	Total	= 216Mbit/s

Fig. 1: CCIR Recommendation 601

Now this is a pretty high bit-rate for all but the shortest connections using coaxial cables. It is, however, only a very small fraction of what can be transmitted with ease along optical fibres. Nevertheless, once you emerge from the studios and want to convey such signals over point-to-point links, every bit costs money and this is likely to be the case for many years yet. Thus many hundreds of man-years of effort have been expended on ways of reducing the required bit-rate without sacrifice of quality, and this work is now beginning to bear fruit in the emergence of equipment working at 34 and 140 Mbit/s, and with the prospect of worldwide standardisation at these bit rates.

Bit-rate reduction

Now to carry a 216 Mbit/s signal at just a little over 30 Mbit/s, with no-one aware of the difference, requires a lot of very clever processing and a lot of inherent redundancy in the information conveyed by the original signal. We also require that the reconstructed signal shall be adequate for downstream Chromakey — a process which effectively holds up a magnifying glass to any imperfections in the colour difference components.

Actually, it is just possible to squeeze the signal satisfactorily into a little less than 34 Mbit/s, provided that you are very clever about it. Most tv pictures do in fact contain a fair amount of redundancy, otherwise they would be unwatchable! We can often find large plain areas containing very little or only low contrast detail, and there are normally at least some parts of the scene that stay much the same from one picture to another. Even where movement is taking place it is generally fairly structured, with a tendency for adjacent small areas of the picture to exhibit movement in the same direction and at the same speed.

What I am saying is that, even before information is transmitted about a given small area of a particular television field, what is going on in that area can usually be predicted quite accurately. It can be derived from previously-sent information relating to adjacent areas in the same field or to the same and adjacent areas in previous fields.

Thus, advanced bit-rate reduction codecs contain complicated prediction circuits at both the sending and the receiving end of the link. The idea is that if the prediction is good, which it generally is, one needs to send only a small amount of information along the link to correct for any inaccuracies. So the transmitted signal usually conveys the difference between prediction and reality.

A further opportunity to reduce the bit-rate comes from the fact that, for most of the time, these differences will be small. So it is worthwhile to organise the digital codes allocated to the differences in such a way that small differences are sent using small digital words, and larger differences using longer words. Of course, you have to arrange this so that none of the longer words begins with the bit sequences allocated to the shorter words. But you can get a useful bit-rate reduction of about 25% from this feature alone.

Now clearly some picture sequences contain more activity, or more fine detail, than others. So they will be less easy to predict, and there will be more information to send. The technique, therefore, is to have a buffer store into which the information to be transmitted is put as it is generated and from which it is taken at the uniform rate required by the transmission link. A corresponding buffer store at the receiving end takes in the information as it arrives and delivers it to the picture reconstruction circuits when they need it.

These buffer stores will, of course, impose an overall delay on the picture signal. For some of the sophisticated codecs now being designed, the delay is between one and two frames. So we are beginning to think about compensating audio delays to avoid a loss of lip sync, particularly when a number of codecs are connected in tandem.

Everything I have said so far relates to the redundancy within the picture information itself. But, in addition to that, some of the information is more easily perceived by the viewer and some less. So, for example, the precise reproduction of fine detail is not quite so important as that of coarse detail. And when an object is moving, particularly if the pattern of movement is complex, it does not need to be portrayed with the accuracy required when it is stationary. In other words, when the picture information is difficult to predict it is also difficult to discern. This is very fortunate indeed. It means that when the buffer store at the sending end is becoming dangerously full, we can avoid disaster by instructing the coder to reduce the accuracy with which the signal is being sent and thereby to reduce the demand for bit-rate.

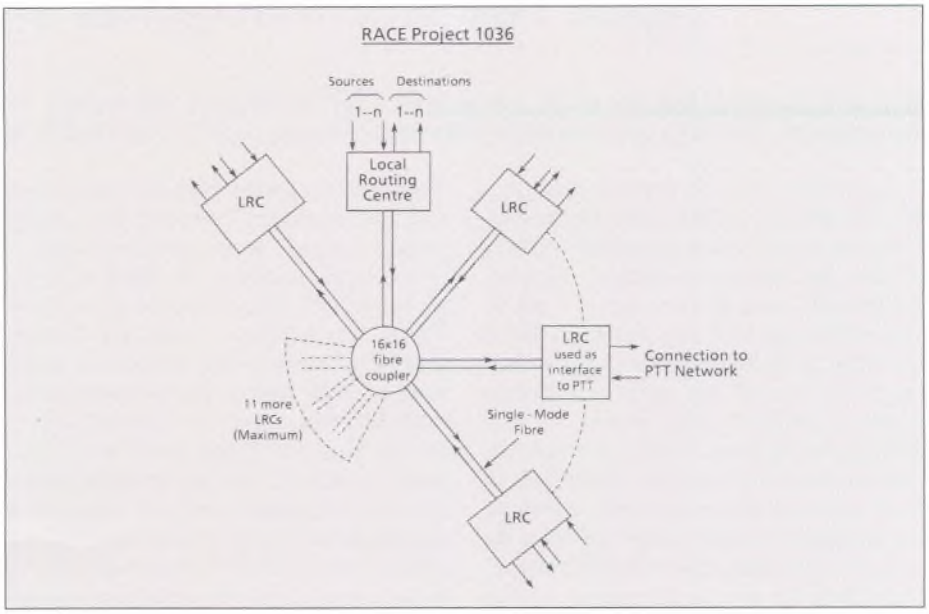


Fig.2: the proposed European studio routeing system (RACE Project 1036).

In the previous paragraph I said "if the pattern of movement is complex". If movement is well structured, on the other hand, the eye can follow the objects across the screen and thereby see any distortions we have allowed. This problem can be overcome by dividing the picture into small areas, estimating the velocity of movement in each area, and sending that information along the link. By that means, the prediction process can take account of the movement.

We see, then, that the real skill in designing a codec is to make use of not only the properties of the signal but also those of the observer.

In modern 34 Mbit/s codecs, the signal to be sent conveys a prediction error derived from a reconstruction of the previous field assisted by motion vectors. A DCT, or 'discrete cosine transformation' box converts this into a form in which different spatial frequency components can be differently quantised depending on the varying demands of the output buffer. Codecs using these techniques can reduce the bit-rate to about 1/7 of the original while maintaining broadcast quality.

Studio routeing/Optical fibres

So much for point-to-point links. Now let's get back to the studio, where we can handle the full bit-rate, even when routeing the signals over long distances, provided that we employ optical fibres. Optical fibres have an enormous capacity. It is nowadays possible in the laboratory to modulate the lasers that drive them with bit-rates of some 5 to 10 Gbit/s, and components working to 2½ Gbit/s will soon be generally available. This bit-rate will carry up to ten television signals to Rec. 601, but it is convenient in practice to use various standard multiplexing arrangements which, after the inclusion of sound and ancillary data, mean that eight signals are carried in the bitstream.

In addition, it is possible to convey several of these bitstreams through a single fibre by causing them to modulate lasers of slightly different wavelength, and then combining their outputs to form a single beam of light. How many different wavelengths depends on how much power is available from each laser, bearing in mind that each local area in which a laser is situated is also going to require a feed of the combined signal — in other words the light from each laser is going to have to be divided amongst all the areas without, for the time being, the benefit of optical amplification. Using light at wavelengths of about 1½ microns, the practical answer at present is of the order of sixteen different lasers.

This suggests a system based on sixteen local routeing centres, each accepting and delivering a mix of digitised video, audio, and ancillary data signals. (Fig. 2) At each routeing centre these signals are combined into a 2.4 Gbit/s stream which modulates a laser which is emitting light at a wavelength of about 1500nm. The laser wavelengths are separated by intervals of about 4nm, and their outputs are combined in a central optical star coupler. The multicoloured light is then sent back to all of the local routeing centres, at which the required signals can be obtained by a process of wavelength and time division demultiplexing. The wavelength division demultiplexing is done using a diffraction grating with sixteen output fibres positioned so that each one catches light at one of the original wavelengths.

The development of this system is being carried out within a European collaborative endeavour called RACE * Project 1036. The various building blocks are being assembled and the first demonstration of a 4-laser prototype system is scheduled for later this year.

You may already have gathered that this approach will completely revolutionise routeing and switching within television, not to mention radio, studios. Two of its properties are of special interest.

The first is that all signals are available everywhere as required. You don't need a centralised routeing switcher with appropriate booking arrangements to make sure that signals are sent from particular sources to particular destinations at particular times. Instead, you have what amount to selector switches

* *Research into Advanced Communications in Europe.*

operated at each local centre without reference to anywhere else.

Secondly, the concept of time division multiplexing has an inherent flexibility. The idea is to use the 155 Mbit/s data containers being produced for the telecommunications industry. But what goes into the various containers can be entirely at the discretion of the user. So the signal presented to a given laser could contain two digitised HDTV signals, or eight 625-line YUV signals, or sixteen PAL signals, or umpteen stereo sound signals or, and this is of particular importance, any appropriate mixture of these. So a single routeing system can live happily through the time when the studio centre operation is evolving from 625-line television to HDTV.

So, having found an evolutionary pathway, let's look now at HDTV.

HDTV

The principal attraction of HDTV is that by increasing spatial resolution it enables the picture to fill more of the field of view and therefore gives the viewer a greater involvement in the action. Since the layout of our living rooms is not solely determined by television watching, the likelihood is that we shall get this greater involvement by looking at bigger screens.

So we eagerly await the arrival of large pictures that will not involve heavy or bulky display mechanisms. Experiments in real living rooms have indicated that a screen diagonal of just over one metre is judged optimum and that this would be viewed from distances of about two metres or more; that is about three times picture height.

At this viewing distance, the present 625-line standard gives unsatisfactory pictures. The line structure is very apparent, there is an obvious lack of resolution, and flicker becomes disturbing because of the greater use of peripheral vision. So we need more lines, more resolution, and a greater refresh rate, at least at the display. So circuits have to work faster and a greater bandwidth is required.

In order to keep reasonably within practical limits, there is general agreement that we should aim to double the horizontal and vertical resolution. Add to this a need to increase the aspect ratio so as to approach cinema presentation and you find that, even with the existing field rate, there is a 5:1 increase in bandwidth. So whereas the serial bit-rate for 625-line YUV signals is somewhat over 200 Mbit/s, for HDTV it is well over 1 Gbit/s. It is not surprising that bit-rate reduction is now being proposed, not only for digital HDTV transmission but also for digital HDTV recording.

As you know, there is little agreement so far on HDTV Studio Standards. The Japanese were first in the field, with a system based on 1125 lines interlaced at 60 fields per second. But this does not fit in with European and American thinking, which is that both at the studio and at the broadcast end of the chain, there should be a measure of compatibility with existing standards. This is partly to facilitate standards conversion and, more importantly, it would allow a process of compatible evolution by the addition of extra information to existing broadcast signals to enhance the image and take it some way to HDTV whilst we await the provision of sufficient spectral capacity for the transmission of real HDTV signals.

So the preferred European standard is 1250 lines at 50 fields per second, and the preferred standard for the USA is 1050 lines at 59.94 fields per second. The chance of a single worldwide standard seems very small now, such that attempts have been made to search for a family of standards which would satisfy Japanese, European, and American requirements at present, while allowing a move to a single standard later. But even this approach is producing difficulties.

For bit-rate reduction, the same basic techniques which I described for 625-line television are again being proposed, this time for reducing the bit-rate to about 140 Mbit/s. In fact at least two of the present proposals are expected to be implemented, in the first instance at least, by operating several of the 34 Mbit/s codecs in parallel and dividing the signal between them (Fig. 3). Such techniques would provide an economic means for the point-to-point transmission of HDTV signals. They are expected to be demonstrated over a satellite link to a spectrum allocation conference early in 1992 in order to support the case for the provision of channels around 20 GHz for the broadcasting of digital HDTV direct to the home.

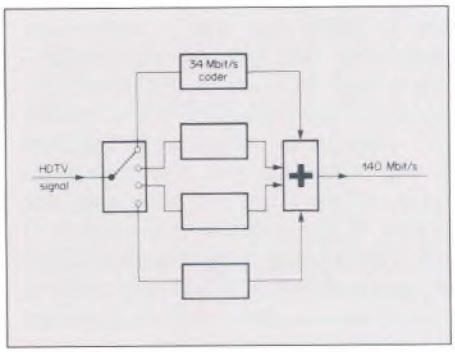


Fig. 3: a proposed technique for HDTV bit-rate reduction.

But that is for the longer term future. If we want an enhanced tv broadcasting system for the 1990s, we shall have to put up with analogue channels of limited bandwidth and the need for compatibility with the receivers using those channels.

The combined analogue bandwidth for the HDTV luminance and colour difference signals is of the order of 50 MHz. Satellite MAC channels have the merit of keeping luminance and colour difference separate, but HDTV signals will have to be reduced in bandwidth by about 4:1 if they are to use those channels. The European Eureka consortium has developed a bandwidth compression system of this type in which the signals can also be received and displayed in 625-line form by conventional MAC receivers.

HD-MAC

The MAC signal, as you know, contains three components which are time division multiplexed together on a line-to-line basis (Fig 4). The luminance signal is

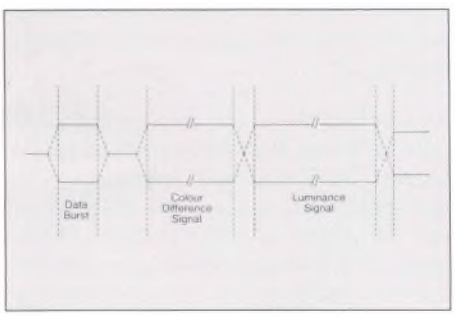


Fig. 4: the MAC line format

time-compressed to about 2/3 of the active line period, colour difference signals are also time-compressed to about 1/3 of the active line period and sent alternately: R-Y on one line and B-Y on the next. Most of the remaining

time is taken up with a data burst containing 206 bits in the D-MAC system and 105 bits in the D2-MAC system. In the so-called HD-MAC system, a 4:1 bandwidth reduction is achieved by sub sampling the high definition picture at the input, so that only one quarter of the original information is sent. The sub sampling is accompanied by input and output filtering in order to prevent alias components from appearing on the reconstructed picture.

Half of the input samples are permanently discarded on the assumption that the loss of high frequency diagonal information incurred by the associated filtering would generally be unnoticed. The remaining samples are sent over a 4-field period for stationary areas, or over a 2-field period (with further filtering to reduce the vertical resolution) in areas that are moving with a motion vector which can be measured reliably. If the movement is beyond the capability of the motion vector, or if the area is moving in an unpredictable fashion, the signal is updated every field but with even more severe spatial filtering.

Motion vector information is conveyed within the vertical blanking interval which affords a capacity of about 1 Mbit/s. This means that the areas within which motion is determined each encompass about 36 samples. The use of auxiliary data of this type, whose purpose is to instruct the receiving terminal on what to do with the analogue signal makes HD-MAC an example of what is termed "digitally assisted television" or DATV.

It is instructive to compare HD-MAC with the bit-rate reduced digital point-to-point system I described earlier. This is where the homologous features emerge (see Fig. 5).

On the face of it, the two systems are quite different. One is all digital; one is a mixture of digital and analogue. One uses transform coding; the other does not. One has a buffer store whose occupancy, which is obviously related to how busy the picture is, controls the way in which the signal is processed; in the other the processing is determined by a more direct measure of picture activity. Perhaps most importantly, in one of them the transmitted signal only needs to conform to the properties of the link; but the other has to give an acceptable picture on a standard receiver.

DIFFERENCES	
HD-MAC	**Bit rate reduction**
Analogue/digital	Digital
Processing depends on activity measure	Processing depends on buffer occupancy
Compatibility required with 625-line TV	No compatibility required
HOMOLOGOUS STRUCTURES	
Signal redundancy removed Properties of observer exploited Motion vectors employed	

Fig. 5: comparison of HD-MAC and bit-rate reduction.

If you look below the surface, however, there are important similarities, and the same basic properties of the signal and of the observer are being exploited in compressing the information transmitted. Thus, in both signals, the information that is believed (or discovered) to contribute in only a minor fashion is discarded.

In both systems we use motion vectors in order to prevent information from being lost from those areas which are moving in a manner which the eye can track. In both systems we make use of the eye's inability to perceive fine detail when there is more complicated motion.

Now no one pretends that HD-MAC will bring pictures to the home that are indistinguishable from HDTV in the studio. For that we shall need the 140 Mbit/s bit-rate reduced digital broadcasting techniques that we expect to see demonstrated to the 1992 frequency planning conference.

Meanwhile, however, HD-MAC will give a substantial increase in quality over standard 625-line PAL, so much so that attempts are being made to enhance the quality of PAL transmissions so that they will not be left behind in the move to higher quality.

Enhanced PAL

Enhanced PAL presents a much greater challenge than does HD-MAC. The latter has already escaped from the cross-colour and cross-luminance effects that plague PAL, and it uses a channel that will carry a 10¼ MHz bandwidth as compared to the 5 or 5½ MHz available to PAL. Moreover, there are about thirty million PAL receivers in the UK alone, not to mention the hundreds of transmitters carefully arranged not to interfere with one another, and Enhanced PAL must be fully compatible with them.

There is nevertheless some room for manoeuvre. It is possible to form up a compatible PAL signal in which the spectra of the luminance and colour difference signals are shaped and folded in such a way as to enhance vertical or horizontal resolution at the expense of diagonal or temporal resolution, and to send the colour and luminance signals in such a way that they do not interact with one another despite sharing the same frequency band. Moreover, we can bring in the concept of DATV again, sending motion vector information to compensate for any loss in temporal resolution and to assist motion adaptive up-conversion in advanced receivers.

It is not yet fully clear how we will cope with the 16:9 aspect ratio characteristic of HDTV pictures. One way would be to convey the picture in "letterbox" form, such that blank lines would appear at the top and bottom of 4:3 displays — this is a technique commonly used on the Continent when broadcasting cine film, and it has from time to time been used also in the UK. The top and bottom lines need not in fact be

completely blank — they could convey, at a level low enough not to cause annoyance to the viewer, DATV data or analogue signals required to enhance the reproduced picture.

DATV data could alternatively travel in the adjacent television channel. The adjacent channels can generally not be used at present because of interference considerations. Digital signals are essentially noise-like in appearance, however, so they do not pose such an interference threat and, moreover, they are very rugged and can therefore be transmitted at a much lower level.

Work on enhanced PAL is currently at a very early stage. The same homologous techniques are appearing once again, but the right mix has yet to be determined, taking into account the need to get optimum picture quality, to preserve an acceptable degree of compatibility, and to achieve a signal ruggedness that will enable it to withstand the vicissitudes imposed by vhf and uhf propagation conditions. Work is proceeding in several laboratories and the EBU is providing a useful forum at which ideas can be exchanged and moves towards standardisation considered. Which brings me briefly to the question of standardisation.

Standardisation

There are a number of arguments, from the customer's point of view, in favour of standardisation. One is that it facilitates the exchange of signals between one broadcaster and another, not to mention the provision to one receiver of signals from many broadcasters. Another is that it facilitates the use of LSI with a consequent reduction of cost. Another is that it encourages manufacturers to compete in the enhancement of their products rather than in trying to sell us a number of incompatible options.

It seems to me that there are at least four ways in which standardisation can come about. The first is the 'de facto' process in which an attractive product appears on the market with very little alternative in sight, and is immediately adopted without argument by most of the customers. A good example is the Philips Musicassette. Granted, there was a little competition from the 8-track cartridge, but it was short lived and the supremacy of the Philips cassette was soon established.

If you believe, however, that two heads are better than one, you will feel that standards-making committees offer the best route to acceptable standards. They certainly allow the requirements of the user to be formulated and candidate systems to be tested against those requirements, and they can provide a valuable forum in which different approaches can be examined and resolved.

For the committee to succeed in its work, however, three conditions must be met. Firstly, everyone must want it to succeed. Secondly, everyone must believe that if and when it does succeed the arguments will stop.

The third and perhaps the most important condition is that the timing must be right. There is a time before which it is too early to expect people to agree. They want first to build up their own experience in the subject, and so they say that standardisation now would inhibit future development.

Then follows a period during which their desire to learn more is matched by a desire to avoid the chaos that could arise if equipment working to several incompatible standards were to be allowed to proliferate. Standardisation is now seen as a most important issue, and each organisation would even be prepared to settle for something a little different from its best preference if that were to be the only way to get agreement.

If an agreement is not achieved, however, one or more of the organisations will eventually abandon its flexible position and become committed to one particular system which it hopes will eventually be adopted by some form of de facto process. The discussions still go on, but they become less and less meaningful because there is now only one system that the organisation is prepared to accept — its own. As far as the committee is concerned, therefore, the verdict must be "too late".

The interesting thing of course is that the "too early" and "too late" phases can occur at different times for different organisations, although they are not entirely independent of one another. So it is important to arrange matters so as to constrain the parties to make their joint decision at just the right time. And that can be quite tricky!

Any agreement reached by the committee, however, is likely to stick, provided that all of the relevant interests have been represented. A good example, in fact is provided by Recommendation 601. The introduction of digital YUV into studios is taking rather longer than we had at first imagined. Nevertheless there is no argument now on what sampling frequencies should be used, how many per active line, and so on.

If the committee in the end fails to achieve agreement, one hopes that the market place will decide. We have watched this happening in the consumer market, for example, in the struggle between VHS, Betamax, and VR 2000, ultimately won by VHS.

This is not actually a very satisfactory method. The eventual result may have little to do with technical merit, and a lot of money can be lost either in developments that are not going to pay off, or in unnecessary purchases. Much better, if there has to be a shoot-out, to let the committee do it.

Since a proliferation of standards can be at the very least a great inconvenience, some authorities have seen fit to impose standards. For example, the French Government has insisted that everyone who used the TDF1 satellite will employ the Eurocrypt M conditional access system. The European Commission issued a directive regarding the use of MAC on satellite transmissions. It is intended that binding decisions on point-to-point transmission systems will be taken by a relatively new body called ETSI.

All of the developments I have covered are dependent on the use of digital technology, and all are crying out for agreed standards. The homologous aspects discernible where the signal bandwidth is being squeezed are helping to promote the relevant systems within the digital zoo, and may even lead, if we are lucky, to standardised building blocks.

Howard Jones
Head of Transmission Group
Research Department

NETWORK RADIO
Radio 5's studio facilities

The studio facilities of Radio 5 comprise two suites - 1A and 1B - along with a Production Workshop, 1D, and a telephone answering area. They are described here by Alan Stokes.

In November 1988 a project began to replace Air Conditioning Plant Number 1 in Broadcasting House, London. Among other things, this plant served the redundant Continuities A to F, which lay adjacent to the London Control Room, now renamed the Engineering Operations Centre (EOC). It was decided as part of the project to carry out a minimum amount of building work to this area and provide a number of general purpose studios and production workshops.

However, in August 1989 I was asked to 'pop' up to George Legg's (HSNRR) office where I found assembled such Radio notables as Pat Ewing (CR5), Gaynor Shute (now Ed R5), George Crowe (HRDER) and Jeff Bottom (HPM London). I was asked if I thought the area containing Continuities A to F was suitable for Radio 5 — yes — and then off we all trooped to see it. They also agreed this area was suitable and asked if it could be ready by July 1990!

The original A to F project was frozen while a revised finance case was prepared by Keith Lilliwhite (the ACED Project Leader), Peter Bear (the ACED Architect) and myself. Working from an outline specification from CR5 and aided by Mike Ring — a bit of a whizz on Auto Sketch — we tried various layouts using only the space occupied by Continuities A, B, E and F. If possible, we would try to retain Continuities C and D as they were.

The requirements were for: a large mixer suite, similar to Mixer Suite B9; a network studio suite; a production workshop; plus phone-in and office areas. It soon became apparent that they were not going to fit in the space provided, so back I went to George Legg to ask if he would release the Continuity D space. Now we were getting somewhere. By re-routeing the corridors and maximising the space, we had something that was workable. The height of the area allowed for four rows of acoustic boxes, so we could have lovely big observation windows in virtually every wall — and Tony Woolf, Radio's Acoustic Engineer, could still obtain the required reverberation times.

The revised finance case was approved and we restarted the project on November 1989, led by Tim Singleton of Radio Projects. As Radio 5 had not appointed any production staff at this stage, we enlisted the aid of Bob Nettles, Tony Ernshaw and Mike Page from Prog Ops Group 5 to help define the technical facilities for the areas.

Mixer Suite 1A was relatively straightforward and would have the following facilities:

- A four-group stereo mixing console with eight microphone, six repro, two telephone and twenty-four outside source channels. The latter would be fed from destinations on the BH router and equipped with

MRM

Studio Suite 1A.

MRM

Studio Suite 1B.

comprehensive clean feed, cue and communications facilities.

- Extensive talkback facilities which, in addition to the normal inter-area talkback, allowed the producer, programme assistant, comms manager and tape operators to talk to any outside source.
- A router-based record selection system allowing recording devices in any of the three cubicles to be fed from any outside source, desk output or auxiliary source.
- A replay 'bus bar' system which would enable the outputs from various combinations of reproducers to be mixed for feeding to one or more desk channels.
- A network switcher panel to connect the area to the Radio 5 network, or any other network.

Because of the short timescale, a simple construction was essential. We wanted to avoid having a lot of built-in equipment housings along the rear of the cubicle, as these would restrict the size of the observation window between Cubicle 1A and the Workshop which would often be used together. To get over this problem, tape level controls, record selectors and tape operator talkback facilities would be installed on a trolley between each pair of reel-to-reel machines.

Studio Suite 1B would be a scaled down version of 1A. Because it was intended for one-person operation, the equipment would be grouped around the mixing console. Reel-to-reel machines would be provided on the right and disc reproducers, surmounted by an equipment penthouse, on the left. Further remotely-controlled recording machines would be provided along the rear wall.

An innovation in 1B is the provision of a Direct-To-Network facility. This allows tape and router sources to be fed to Network totally independent of the main installation.

The Production Workshop was to be equipped from existing resources. A small mixing console, recorders, reproducers, dubbing trollies and high speed cassette copying facilities would be provided. It is a compliment to Tony Wood of Radio Projects that this area turned out so well.

Having decided what was required, Tim Singleton and I visited several mixing console manufacturers armed with our list of requirements. The handover date demanded a product with a proven track and delivery record. Thus, after much discussion and deliberation, we chose two standard Solid State Logic 5000 series consoles.

Several installation contractors were invited to tender and, eventually, Philip Drake Electronics was given the contract. Their interpretation of our requirements and their level of resources was impressive and they also had their own equipment manufacturing division.

The building work was carried out by Mullen and Lumsden under the supervision of their site manager, Eric Skidmore. Chartered designer, Rod Palliser, was brought in to create a Radio 5 image in the circulating areas which link the suites, while Lintern Shopfitters were employed to implement them. The problem of accommodating a phone-in area was solved by removing the angled inner glazing along the corridor to the EOC, thus making it into a usable space for this facility.

ACED and the builders handed over the area for technical installation, on target, at the end of April 1990. Similarly, Philip Drake Electronics completed their work on time so that Steve Urbanek and Chas Commander could start commissioning the area towards the end of June. Suite 1A became available for operational appraisal at the beginning of July 1990.

All those involved - builders, electricians, architects, engineers, etc - can now be justly proud of the results and the targets achieved. We were a happy team (well most of the time!) with great enthusiasm in what we were doing. We hope everything goes according to plan for Radio 5 and wish them every success in the future.

Alan Stokes, Project Manager
Control Room and Networks
Radio Projects

A more detailed description of the equipment installed in the Radio 5 suites is published in the September issue of ***Line Up****, the journal of the Institute of Broadcast Sound, and in the October issue of* ***Broadcast Systems International****.*

MRM

The Phone-in area.

IBC90 The BBC's exhibits and papers

IBC90 was held in Brighton between 21 and 25 September. In this report, we describe the BBC's exhibits and list the accompanying papers delivered by BBC staff during the Technical Sessions.

As in previous years, the Convention took place in the Metropole Centre, The Grand Hotel and The Brighton Centre but, to meet the ever-increasing demand for exhibition space, four aluminium-framed buildings were additionally provided along the seafront. The number of exhibitors this year totalled 271 — an increase over IBC88 of around 30%.

MRM

Research Department's HDTV viewing theatre on the Brighton promenade, with the HDTV outside broadcast vehicle immediately behind. In the foreground, the Eureka 95 HDTV viewing theatre.

RESEARCH

High Definition Television

Research Department's HDTV outside broadcast vehicle was parked on the promenade to provide HDTV 1250-line pictures from its four D1 625-line recorders (see ***Eng Inf*** No 34). Adjacent to the vehicle was a transportable HDTV cabin (viewing theatre) which enabled delegates — and members of the public as well — to see a variety of HDTV demonstration material on a 36-inch 1250-line colour monitor, with surround sound. There was also a Eureka HDTV viewing theatre on the promenade.

Research Department is studying all aspects of HDTV pictures from the camera, through transmission, to the domestic receiver. It is also carrying out extensive production studies to find the best form of accompanying sound. Given a wider sharper picture display, is stereo sound sufficient? In the context of a domestic environment, do HDTV pictures benefit from surround sound? How should broadcasters cope with multiple languages? Visitors to the BBC viewing theatre were given the opportunity to assess for themselves some of the multi-channel sound formats being studied.

HDTV programmes were shown every hour in the BBC cabin and included: ***Viennese Evening at the Proms, Wimbledon 1990, Prince of the Pagodas, 1989 FA Cup Final*** and ***Edinburgh Tattoo***. Each of these ran for no more than half an hour so, between programmes, compilation tapes were shown.

In addition to the above HDTV demonstrations, Eureka European HDTV programmes were relayed from the promenade to the BBC's stand in the Metropole Centre, where they were viewed on a 28-inch 1250-line colour monitor. These Eureka programmes were also supplied to around ten other exhibitors at the Convention, including the IBA and the ITV Association.

Fibre-Optic Routeing

In 1988, an international consortium led by the BBC started RACE* project number 1036 to develop a broadband customer premises network (BCPN), suitable for signal distribution in television studio centres. The network uses optical fibres and a combination of optical wavelength-division-multiplexing (WDM) and electrical time-division-multiplexing (TDM) to distribute digital signals from all sources to all destinations — a combination known as Wavelength and Time Division Multiplexing (WTDM).

The main principles of WDM were demonstrated with a simple model at IBC88. At this year's Convention, a more advanced model was on display which uses actual lasers and other components (optical couplers and de-multiplexers) to demonstrate the transportation of digital video signals, by means of WTDM techniques.

This RACE project has already been described in Eng Inf No 32 but we will be publishing an updated article on Digital Routeing in a forthcoming issue.

TV Programme Delivery Control

For many years, viewers have been asking for a system to ensure that off-air video recordings capture only the wanted programme, even if it starts later than scheduled or lasts longer than expected. A change in UK law in 1989 has now legitimised the home recording of broadcast programmes, as long as it is for private use only.

Programme Delivery Control (PDC) is a system which uses teletext to broadcast a label accompanying each programme. These labels are carried by the Broadcast Service Data Packet (teletext packet 8/30) and are typically sent once a second while the programme is being broadcast.

A video recorder equipped for PDC will store a list of wanted programme labels, each with its network and the 'time window' during which it is expected. When the recorder finds a match between a wanted label and a broadcast label on the wanted

* *Research into Advanced Communications in Europe.*

network during the time window, the recording starts and continues until the label changes.

The details of the wanted programmes, including their labels, can be entered by keypad, barcode or other methods. One particularly convenient technique is to use a normal programme listings page on teletext as the 'menu' and to invite the viewer to select the chosen programmes with an on-screen cursor. All the necessary information (including some carried by 'ghost rows' associated with that teletext page) is then extracted by the PDC recorder. In this way the programming of video recorders can be made more reliable and user-friendly.

PDC is the subject of an EBU Specification and the details of its implementation are being defined by a 'Code of Practice' Working Group.

Radio-Cameras

On the BBC Stand was a variety of live and recorded demonstrations of Radio-Cameras. These basically comprise a lightweight portable camera with associated microwave transmitter and antenna, also portable. Radio-Cameras allow the operator to move around as a spectator would, unhindered by cables etc.

In a simple system, the transmitting antenna is omnidirectional so the link is insensitive to the orientation of the operator. However this system can be prone to multipath effects in some location and hence cannot be used.

Research Department's new Radio-Cameras — operating on 2.5 and 12 GHz — use circular polarisation and a controlled radiation pattern to minimise multipath effects. However even these models can only be used in about 80% of the ground area at a typical sports stadium, as multipath is still significant in the remaining areas.

Another way to combat multipath is to use a directional transmitting antenna with a tracking system built into the Radio-Camera. Research Department is currently developing such a system which has the potential to allow even greater coverage from inside 'cluttered areas' prone to multipath.

The use of Radio-Camera systems is increasing, at indoor as well as outdoor events, and Tel OBs will be using ten single-operator systems by the end of this year.

For a more detailed description of Radio-Cameras, please see ***Eng Inf*** No 34.

Helitrak

Certain outside broadcasts benefit greatly from the use of a helicopter to provide an elevated camera platform or to relay radio-linked camera signals from a road vehicle. The University Boat Race and the London Marathon are good examples. A microwave transmitter in the helicopter sends the signals back to a roof-top receiver where a manually-pointed dish antenna is used to receive the signals.

An automatic tracking system named ***Helitrak*** has been developed by Research Department to replace the manual operation. This system uses the existing radio-link signal — requiring no additional frequency spectrum — and does not require a separate tracking receiver.

The tracking information is obtained by momentarily offsetting the beam electronically — up, down, right, and left of its normal direction — whilst monitoring the strength of the received signal and then comparing the results for up and down, and for right and left. Error signals are then derived, representing the amounts of movement required in the elevation and azimuth planes to keep the normal beam pointing towards the helicopter. The error signals are amplified and fed to two-axis positioning motors which keep the antenna on track.

The beam-scanning occurs during the field-blanking interval, so the process is invisible to the viewer. Additionally, the system uses a microcomputer to assist in acquiring track, and to maintain track during short 'outages' such as when the helicopter is obscured by a nearby building.

The ***Helitrak*** system is now being introduced into service and has been used successfully for a number of OBs including the 1990 Boat Race. It has the potential to increase the usable range of the radio link to 80 km (50 miles) or more, and to improve operational efficiency as well as the reliability of the link.

Video recordings of the new system in action were shown on the BBC stand.

Enhanced PAL

Work is being undertaken to establish if enhanced definition pictures could be broadcast compatibly with the existing television services, hopefully using the same distribution and uhf transmission network. A range of possible Enhanced PAL systems has been devised, based on ideas formulated in the 1970s and incorporating techniques developed more recently in the Eureka 95 project for HD-MAC.

To achieve a significant level of enhancement, the system must exploit all possible areas of redundancy within the television waveform and the broadcast spectrum. It is clear that performance targets will essentially be lower than those established with the HD-MAC system. However, it might still be possible for the BBC to deliver a picture which could be displayed on a large-screen domestic receiver and which would not look out of place alongside high definition pictures delivered by other means.

The IBC demonstration showed a comparison between HD source pictures and the same pictures coded using an Enhanced PAL system, decoded, and displayed at 1250 lines, 50 fields.

For further information on Enhanced PAL, please see the article on Digital Television (starting on page 7).

DESIGN AND EQUIPMENT

Clock Display Generator

The GE6SM/574 (acronym GNAT: Generator, Network Analogue Time) is a new clock display generator which is capable of producing very high-quality results without the limitations of its predecessor.

The three clock hands are stored in EPROM and may be of arbitrary shape and colour; the second hand does not even need to be concentric with the minute and hour hands. Provision has been made for the hands to cast a shadow on the background, the darkness and position of the shadow being user-selectable.

Motion of the hand is also user-selectable as one of four options; for example, a continuous sweep, an instantaneous step from one second to the next or something in between (eg, to simulate the inertia of a heavy hand). It is also possible to mimic

MRM

John Drury (RD) explains the concepts of Enhanced PAL to a visitor.

mechanical imperfections such as under-damped motion with overshoot.

The clock time reference is normally derived from MSF data, decoded from the Rugby 60 kHz transmission (via a separate receiver). In the absence of MSF, the input video or mixed-syncs signal is used as a frequency reference, and manual time-setting capabilities are provided. In the event of power failure, an internal real-time clock maintains the time to an accuracy of better than two seconds per day.

AESIC

This project, to develop an LSI chip for the AES/EBU digital audio Interface, was described in the previous issue of ***Eng Inf***. And as reported on page 2 of this issue, D&ED has completed licence agreements with two companies which allows them the rights to sell the AESIC device to third parties on a worldwide basis.

An evaluation board, BBC code CO4/38 is now available to allow intending users of AESIC to assess its functionality before designing the chip into their systems. It is a 240 x 130 mm double-sided glass fibre pcb, which supplies AESIC's power and clocking needs together with ready access to all relevant inputs and outputs to the chip.

On the BBC stand were samples of the AESIC chip, the CO4/38 AESIC evaluation unit and several pieces of BBC-designed equipment which make use of the device.

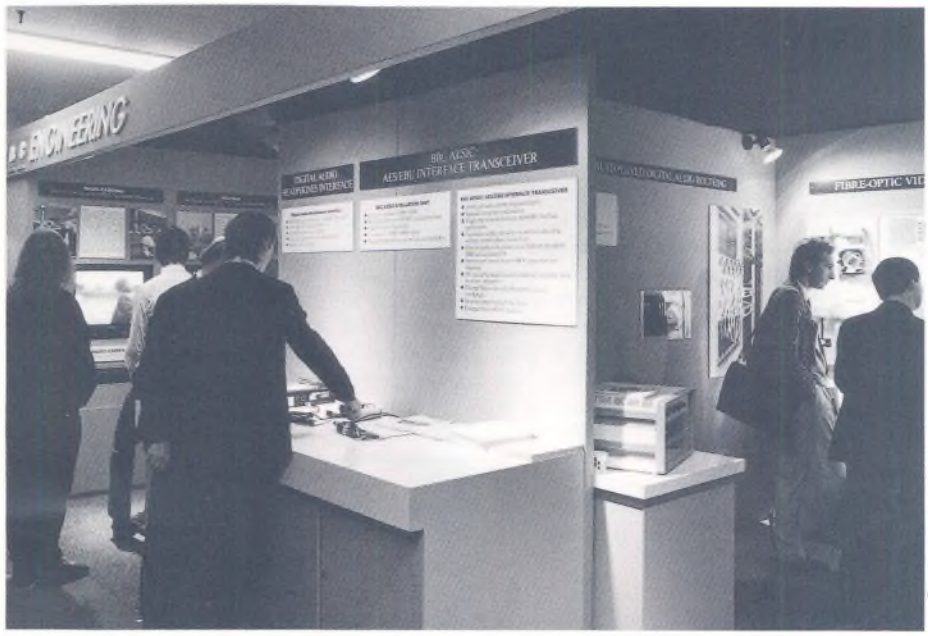
Digital Audio Headphones Interface

This compact digital-to-analogue converter unit allows headphone monitoring of digital audio signals encoded in the AES/EBU serial format. Making use of the AESIC chip, the unit is capable of automatically decoding digital audio sources having sample-rates between 30 kHz and 54 kHz. Input is via an XLR connector.

Audio data is decoded using the AESIC chip operating at 50 MHz and the analogue output is derived from a 16-bit digital-to-analogue converter. The analogue output is intended to drive stereo high-impedance headphones but is capable of driving loads down to 30 ohms and is short-circuit protected.

The unit features an LED indicator for the presence of an AES/EBU-format signal at the input, allowing the user to distinguish between an open-circuit input and a digitally-encoded silence. A warning LED indicates the presence of errors in the received digital bitstream.

To conserve the NiCad battery pack, the unit automatically switches off when disconnected from a digital audio source. The built-in battery charger allows recharging from most commercial mains-to-dc adaptors and the unit may be used normally while charging.



John Barrett, RD

Partial view of the BBC's stand, showing D&ED's AESIC designs in the foreground.

Digital Audio Routeing

An experimental routeing system has been installed in Broadcasting House, London, to investigate the practicability of carrying multiplexed digital audio signals over an optical fibre link. The equipment on show at IBC90 was a slightly simplified version of this system.

The BH system uses a single 6U rack to produce a 500 Mbit/s signal from 112 AES/EBU stereo inputs. Another 6U rack can hold enough analogue-to-digital converters (ADCs) to produce twenty-eight AES/EBU outputs, or one quarter of the total fibre capacity. Passive optical splitters are used to distribute the signals to four destinations — an operational studio, a training area, a quality-monitoring point, and an engineering test area.

We will be carrying an article on Digital Audio Routeing in a forthcoming issue.

Tardis

Tardis stands for sTAndardised Receiver Drive Integrated System. It is a specially-designed equipment for use at FM relay sites.

The basic design offers up to six FM services plus splitting and combining filters in a standard 7ft high x 2ft deep (2134mm x 610mm) bay. ***Tardis*** enables a compact universal design to be used at all relay sites requiring up to 40 watts output to the antenna (with wide spacing between the carriers). At high power sites or where power amplifier redundancy is required, the bay may be used as a driver stage by omitting the combining filter.

Considerable emphasis has been placed on producing a unit which is economic to install and maintain. A common set of broadband plug-in units is used for the receiver, drive and monitoring demodulator. Two broadband easily inter-changeable power amplifier modules offer a wide range of output powers for different applications (2W-75W per service). Functional modules can be interchanged without realignment other than, in some cases, resetting of thumb-wheels.

Careful attention to design has resulted in a system which can offer transpositions down to 500 kHz with excellent audio fidelity. In applications requiring 400 kHz transpositions, a narrow-band i.f. filter is easily fitted without undue degradation in audio performance. Output carrier spacings as low as 600 kHz are possible with exceptional spectral purity.

FM Music Link Equipment, Bands IV and V

A high-quality point-to-point OB link, for programme material and communications use, was on show at IBC90. With an output power of 5 watts, it is usable over a range of approximately 40 km (25 miles).

The equipment uses frequencies in uhf television bands IV and V and there are three versions covering 422 to 550 MHz, 542 to

694 MHz and 654 to 862 MHz. Together, they provide overlapping coverage of the whole of bands IV and V in 100 kHz steps. Any version may be converted to another by simply changing two modules — this may be done 'in the field' if required.

The transmitter and receiver are both synthesised and can be configured easily to operate on any channel or sub-channel within the operating frequency range. In the interest of spectral efficiency, much effort has been made to design the system to provide a high signal-to-noise ratio with a low peak frequency deviation. The design has a peak deviation of 30 kHz which, with a maximum audio (modulating) frequency of 15 kHz, gives a radio frequency bandwidth of 90 kHz. To achieve a high signal-to-noise ratio, audio processing with a BBC-designed hybrid compander circuit is used at both ends of the link.

Considerable precautions have been taken to ensure that the link will operate in hostile r.f. environments such as those found on complex outside broadcast sites. The transmitter and receiver are each housed in a rugged splash-proof case with all operational controls, indicators and connectors on the front panel. The units may be equipment-bay mounted if desired; on both units, automatic switch-over between mains and battery operation is provided.

RDS

In 1989 the EBU published a supplement to the RDS specification detailing the EON (Enhanced Other Networks) feature. The BBC played a large part in the drafting of this supplement and today carries the feature in all its RDS transmissions.

EON data enables suitably-designed RDS receivers to implement faster and more sophisticated auto-tuning techniques, and permits them to switch automatically between radio channels as travel announcements are made. The BBC believes that the EON feature is essential if a receiver is to offer the performance a listener really wants:

- Instant tuning regardless of distance travelled
- Instant display of station name
- Travel information regardless of listening choice

Currently-available sets, referred to as 'first generation' RDS receivers, have no EON facility: they can only switch from cassette or stand-by mode to a travel announcement. So-called 'second generation' receivers, which are capable of utilising the EON radio station switching feature, are being developed by a number of manufacturers but are not yet available.

For the duration of the Convention, Radio Sussex transmitted the RDS 'Travel Flag' at five minute intervals (for a duration of one minute). This enabled the EON facility to be demonstrated on a commercially-available 'first generation' RDS car radio, specially modified by D&ED. Every time the flag was 'raised', the RDS car radio received instructions via the EON facility to switch over to Radio Sussex, irrespective of which Network Radio channel it had been tuned to.

TRAINING

Television Training

Representatives from this Elstree-based department were on hand to answer questions about training courses in production and direction techniques. The department runs courses for overseas broadcasters as well as BBC staff.

New training packages have been developed, including ***Creative Editing*** and ***Continuity Training Course***, available on a videotape with accompanying script, notes, shot list, etc. The department has also produced a new wall chart entitled ***Television – In the Studio*** which accurately depicts a studio being set up for a major drama.

A new interactive training aid — The Action Series — was being demonstrated. It enables basic television techniques to be taught, using a computer and operational material specially recorded and then edited onto videodisc which is controlled by specially-written software. The system can be used to train vision mixers, directors and even videotape editors.

The Action Series provides (simulated) hands-on experience of real operational material at a tiny fraction of the cost of providing the real resources (cameras, studio, vision mixer, scenery, lighting crew and actors plus a videotape editing suite). Two videodiscs are currently available — ***News Gallery*** and ***EastEnders Gallery*** — but the system is being developed with additional specially-prepared operational material to cover other basic training needs such as camera positioning, editing and lighting.

THE BBC'S TECHNICAL PAPERS

Further developments in the use of DATV for bandwidth compression of HDTV by R Storey and P J Brightwell

Compatible enhancement of terrestrial PAL TV transmission by J O Drewery, C P Sandbank, M Weston and R I Black

Tardis - an integrated design for an 8-channel FM relay by S T Baily, A R Lewis, P N Moss and G J Wimpenny

Generation of high quality slow-motion replay using motion compensation by G A Thomas and H Y K Lau

The impact of CCD studio and outside broadcast cameras by P Calvert-Smith and J D Wardle

BBC World Service: schedule operations and the new Bush House control room by D J H Singleton, D J Gooding, J Eagland and P Bryan

A single chip solution for interfacing digital audio in broadcast applications by W H Fletcher and S C Wegerif

UK developments in digital audio broadcasting by C P Bell and J H Stott

RDS developments by S J Parnall and J L Riley

A domestic television programme delivery service based on Teletext by J P Chambers

The replacement of recording facilities at Television Centre by J A Frisby and A C Ferbe

Motion compensated display field rate UP conversion by T Borer

Experimental digital audio routeing in the BBC's radio operations by N A F Cutmore, G W Crowe and R P Marsden

Radio-cameras: The key to improved flexibility in live outside broadcasts by C Gandy, J M Scott and B F Devlin

The provision of circuits to outside broadcast locations using spectrum within the UHF broadcasting bands by N J Laflin, D J Darlington and R A Salmon

LOCAL RADIO
RT frequency changes

New frequency allocations have come into use for programme contribution circuits, production talkback and other non-broadcast purposes. Roger Palmer explains here some of the problems caused to Local Radio by the new frequency plan.

Over the years, the thirty-plus BBC Local Radio stations in England have developed a small range of Outside Broadcast vehicles to meet their programme commitments. Broadly there are three vehicle types: the OB van, the radio car and the reporters car.

Until recently, all three made use of uhf frequencies for programme contributions and vhf frequencies for production co-ordination (talkbalk, etc). The vhf frequencies could be used for programme purposes in emergencies, or if the uhf system was out of range, since the standard radiotelephone equipment had been modified to produce a wider audio bandwidth than is usual with this type of equipment. Using these uhf and vhf frequencies, the vehicles were linked to the studio via a number of base stations (typically two per Local Radio station) located close to the centre of the editorially-important areas.

Under the old frequency plan, BBC Local Radio had the use of seven uhf frequencies between 446 and 470 MHz and twelve vhf frequencies around 141 MHz (see Table 1). The ILR companies also had spectrum in this band. In the early 1980s, the Department of Trade and Industry (DTI) gave notice to both the BBC and the IBA that about half of the 141 MHz frequencies would be lost to military applications. To compensate the broadcasters, the DTI offered some spectrum at the top end of the old Band III 405-line tv transmission band. However, its use was limited to transmitter aerial heights of 10m above ground level (agl).

A deadline of December 1989 was imposed by the DTI for the implementation of the revised vhf plan.

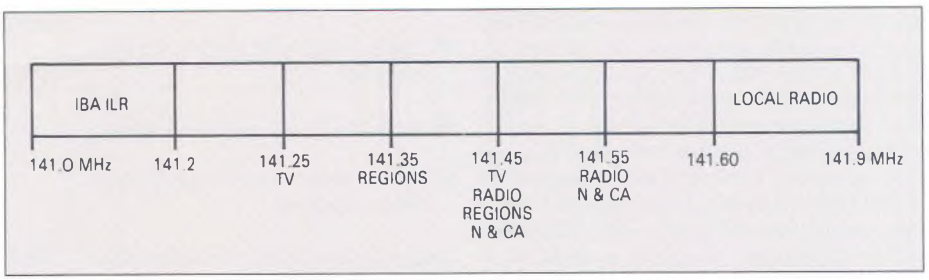


Table 1: the original 141 MHz band plan.

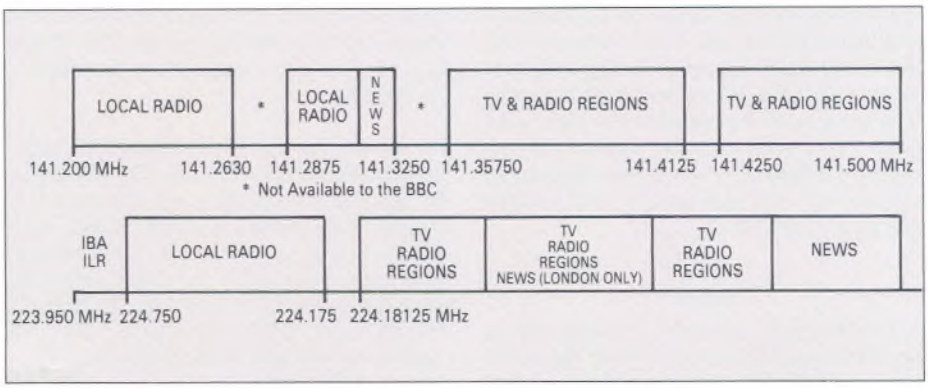


Table 2: the revised 141 and 224 MHz band plan.

The new vhf plan

The new 141 MHz plan offers only 287.5 kHz of spectrum for the BBC's use, compared with 700 kHz previously. However, by way of compensation, 425 kHz of spectrum has been made available at 224 MHz. Following the use of sophisticated computer-aided planning facilities at Research Department, and inter-directorate discussions, a new band plan has been agreed and is shown in Table 2. A number of factors are worth noting:

1 It was decided by the output directorates (Radio, Television, News and Current Affairs, and Regional Broadcasting) that the 141 MHz band — which facilitates UK-wide operations — would primarily be used for 75 kHz bandwidth music links. This left insufficient spectrum to accommodate Local Radio's 25 kHz bandwidth mobile transmissions, and led to the concept of a full ***duplex*** system with base stations providing talkback (12.5 kHz bandwidth) at transmit frequencies of 141 MHz and programme link reception at 224 MHz. At OB venues, this overcomes the problem of one user attempting to receive in the same band that a co-sited user is transmitting in.

2 The new plan offers seven 141 MHz frequencies and eight 224 MHz frequencies — used in duplex operation — compared to the original thirteen 141 MHz frequencies, used in simplex operation.

Fewer frequencies mean that they have to be re-used more often and this leads to an increase in co-channel and adjacent channel interference (cci and aci). The likelihood of aci could have been reduced at 224 MHz if standard radiotelephone equipment had been used, offering an rf bandwidth of only 12.5 kHz compared to the 25 kHz required for an enhanced audio bandwidth. When the band plan was formulated, Local Radio representatives accepted a statistical likelihood of an increase in interference as a price worth paying for an enhanced audio performance at 224 MHz. (The 141 MHz equipment is standard and therefore this problem is less significant.)

For the next few years there is a restriction on the use of 224 MHz within an 80 km radius of London and channels at 213 MHz have been made available for use in this area. This has lightened the load on the 224 MHz frequencies and hence the instances of rf interference outside the London area.

3 The coverage offered by 224 MHz equipment is somewhat smaller than that of 141 MHz transmitters of similar power.

4 The two wideband allocations at 141 MHz — shared by Television, Radio and the Regions — are the only ones (at vhf or uhf) that have no geographical or height restrictions. They are thus the only ones that the BBC can use for airborne operations.

The replacement programme

Once the new band plan had been agreed, nineteen radiotelephone manufacturers were approached to provide estimates to supply and install sixty base stations, eighty mobiles, and seventy handportables, together with new aerial systems at 213/224 MHz. Only two responded positively. The others were either unwilling to produce special 224 MHz links offering an enhanced audio performance, or were unable to do so in the timescale imposed by the DTI.

The installation programme was split into three phases. Partway through the first phase it became apparent that the 224 MHz mobile transmitter performance was not consistent from one unit to another, though even at its worst it was still usable for basic radiotelephone duties. The programme was thus halted pending a detailed investigation by the contractor. It was found that when the equipment was used in a stationary vehicle, it performed satisfactorily but not in vehicles on the move. The problem was identified as one of conditional stability requiring an alternative modulator design.

The programme restarted early in November 1989 and the new band plan was in position by the years end, the last thirty base-stations and twenty or so radio cars being completed in thirty working days. Faulty equipment installed prior to the suspension of the installation programme was replaced by the end of January this year and since then, the system has worked with few problems.

The replacement programme involved the co-operation of several sections in Transmission. The aerial work was co-ordinated by Clive Hoskens and Tony Smith of Antenna Section, while the principal engineer was Guy Stanbury of Broadcast Communications Section. The project leaders were Bal Shahi and Peter Gooderham, also of Broadcast Communications Section.

Roger Palmer
Senior Project Engineer
Broadcast Comms Section, TED

NETWORK TELEVISION

New stereo sound desk for Pres A

The first of the new Calrec Compact sound desks delivered to the BBC has been installed in Presentation Studio A at Television Centre. It enables Studio A to handle the production and presentation of programme trails for the new stereo television sound service, due to be launched in the Autumn of 1991.

The new desk is described here by Graham Brewer.

The Calrec Compact installed in Studio A has sixteen channels, four stereo groups and two stereo outputs. The channels are a mix of mono mic/line, stereo mic and stereo line. There is some customisation of the monitoring to provide the operation preferred by Television Centre. It replaces the twenty channel Neve desk installed in 1981.

Graham Brewer, P&ID Tel

The Calrec Compact stereo sound desk.

Studio A was originally mono and the interfacing of a stereo desk into the complex system was not an easy task. It is a credit to the previous P&ID Tel team that the records were of a high standard. The studio is heavily used by Presentation and only the minimum out-of-service time was permissible. It was planned to complete the project within just two weeks. To enable this, new panels were made for the communication and control systems housed in the desk, so they could be connected quickly to the existing cables. A new jumper frame was constructed to act as the stereo interface and, during an earlier redecoration period, cables, routes and spare tag blocks were investigated to help reduce the on-site work.

The delivery date of the sound desk was very close to the out-of-service period given by Presentation and, in the event, slippage of two weeks meant the desk going straight into Studio A without P&ID Tel being able to connect and test the new panels and frame. Nevertheless, some determined efforts and a few late nights resulted in only a few extra days being lost.

The P&ID Tel team was Paul Robinson and Peter Cresdee, from Studio and OB Group (SOBG), and Denis Gale from Central Systems Group.

Graham Brewer (Project Leader)
Senior Project Engineer, SOBG
P&ID Tel

NETWORK RADIO
The Radio Roadshows 1990

HRH the Princess Royal was present for the first broadcast of the new Radio One Roadshow, which was launched with a deserved splash of publicity at the National Garden Festival in Gateshead. Following rapidly behind, with appearances at Wembley, Donnington Park and Milton Keynes, was the 'little brother' to the Roadshow – the Radio One Roadster. And not to be outdone by all this promotional activity, Radio Two has also been equipped with a Roadshow vehicle to publicise its move to FM this autumn.

These new vehicles are described here by Nick Sharwood-Smith.

The Radio One Roadshow

The Radio One Roadshow has attracted increasingly large audiences in recent years and it was decided last season that a more substantial showpiece was needed for the event. The new Roadshow fulfils this need —combining two vehicles parked back-to-back (or in a variety of configurations) to form a single presentation area.

In addition to a 5m x 7m hydraulically-operated stage built into the side of the larger vehicle, the whole roof area of both trucks has been built with railings and an internal staircase, allowing it to be used as a further performance area for musicians and DJs. The overall character of the unit has been enhanced by some stunning graphics derived from the individual elements of the new Radio One logo.

The on-air mixing equipment is based around a standard Glensound DJ Desk, complemented by Glensound MX6 units for submixing and PA. To cater for audiences of up to 25,000 people, Amcron PA amplifiers with a total power output of 3.6 kW are used to drive four Electrovoice Deltemax DML-1152 loudspeakers in stereo. On-stage monitoring for the DJs is supplied by Harrison amps driving individual Bose loud-speakers, while Electrovoice S200 speakers powered by a Quad 512 amplifier can provide a separate foldback to both roof and stage.

Given the extra space available in the new vehicles, it was decided that the operators would most benefit from acoustic isolation and, as a consequence, air-conditioning. This was achieved using a full acoustic build for the walls of the technical area and double glazing to all the windows. A split pack unit was then mounted in the ceiling of the technical area, taking advantage of the generous headroom.

Communication between the two vehicles is via an extending rear walkway. This is hydraulically operated on the larger vehicle and manually operated on the smaller. To assist in rigging on the roof, a hydraulic lift is installed on the offside adjacent to the area and store.

The smaller support vehicle is largely concerned with providing a guest area, which has acoustic treatment to allow it to be used for interviews independent of the main stage activities. This vehicle is fitted with a seating area leading through to a kitchen containing fridge, sink and water heater. On the walls are cupboards for the storage of carts, CDs and discs. A fold-down Producers desk has also been provided together with an RDS Radio and Bose speaker system for guest monitoring.

To power the whole ensemble — and the satellite ground station which sends the signal back to Broadcasting House — a 25 kVA generator is mounted at the very front of the larger vehicle, enclosed in an acoustic housing for optimum noise screening.

The installation team was Delroy Stephenson, Mary Agar and Carl Powell, and the acceptance engineers were Bob Cross and Simon Tindall. Coachbuilding was by CMA Coachbuilders.

The Radio One Roadster

This is primarily a publicity vehicle, based on a Ford LWB Transit van. It has been equipped with a simple disco mixer, cart and CD players, a cassette machine and an RDS radio. It presents a unique eye-catching image, with its lively Radio One logos and heavily customised exterior and interior.

Of particular interest on this vehicle is the power system which can switch between feeds from the mains supply (13A) or an internal inverter. The latter is fed from two 80 Ahr traction batteries — themselves charged from the car engine — allowing considerable freedom of operation. External speakers mounted in the sides of the van and powered from a 200 W amplifier allow the Roadster to pull up and generate a useful volume of noise immediately. It is even possible to use the van for mobile PA work in carnivals or processions.

Guests and DJs can be accommodated on a drop-down stage, formed by the tailgate at the rear of the van. A cellnet telephone, complete with Comrex, has been provided to allow for live inserts into Radio One programmes.

The wireman was Andy Cottrington and coachbuilding was by Krystal Klear Ltd.

The Radio Two Roadshow

The loss of Radio Two's medium wave frequencies to Radio Five this autumn prompted a huge publicity campaign to move their audience to FM. With this in mind, the availability of a redundant — but still highly roadworthy — roadshow vehicle (in the form of the old Radio One Roadshow) gave Radio OBs the opportunity to create a brand new roadshow for Radio Two. The vehicle has now been completely refurbished in Radio Two colours and decorated with Radio Two logos. The repainting and refurbishing work was carried out by CMA Coachbuilders.

Research Department

The Radio One Roadshow at Margate on August 6th.

Picture Publicity

The Radio Two Roadshow with Alan Titchmarsh and Gloria Hunniford.

Technically, it will be furnished with equipment as dictated by programme requirements rather than being kitted out permanently with a specific rig. In this way, it can be fitted with a DJ desk, as before, or used for Publicity with a small local PA set-up. However, a Glensound MX6 mixer and an RDS tuner have been fitted, to cover most eventualities.

The Radio Two Roadshow, featuring Derek Jameson, began its run of programmes from Liverpool in late August.

Further Credits

The Specification, Project Management and Technical Installation were by Radio Projects: Keith Harte, Winston Phillips, Mark Edgar, Nick Sharwood-Smith and Tim Cowin.

Vehicle logos and styling were created by Information Design: Gill Hiley, Tina Norman-Ross and Diane Klein.

Nick Sharwood-Smith
Project Engineer, Radio Projects

SKELTON
The flight of the fritillary

Planned maintenance work to the concrete foundations at the Skelton transmitting station was thrown into jeopardy in May this year, when part of the aerial field was declared a Site of Special Scientific Interest by the Nature Conservancy Council (NCC). Contracts for the work had already been placed by Masts & Towers Section, ACED, when notification was received just a week prior to the planned commencement date. Nicola Boucher takes up the story ...

The restrictions imposed on the BBC and the contractors seriously affected the access and working methods proposed. However, careful planning and continued negotiation by Skelton and ACED Staff with the regional Scientific Officer of the NCC enabled the work to be carried out satisfactorily.

The reason for the NCC's interest is the presence of a colony of the marsh fritillary butterfly ***Eurodryas Aurinia***. Found throughout most of Europe and parts of Asia, it has disappeared from many areas and is listed as a protected species in certain parts of Europe. Once abundant over the British Isles, this beautiful fritillary is now virtually extinct in eastern and S W England. The few surviving colonies may be found on nature reserves.

The substantial decline of the species may be due to the traditional habitats becoming increasingly rare, with many such fen pastures being lost through agricultural development and afforestation. The clearance of the site at Skelton, for antenna installation and maintenance, has encouraged marsh grasses to flourish — thereby creating a perfect habitat for the butterfly.

The marsh fritillary thrives on the larval food plant ***Devil's-bit scabious*** which is ubiquitous on the Cumbrian site. Thus, Skelton Pastures is an exceptional site, combining several fen meadow vegetation types and playing host to the largest known colony of the marsh fritillary in Cumbria. All British fritillaries have one generation in the year and the small Skelton inhabitant is on the wing in May and June.

Bristol NHU

Eurodryas Aurinia.

Some of the planned work had to be re-scheduled to accommodate the flight of this fritillary. Legal representations have had to be made to the NCC to enable existing station activities to continue unhindered, but normal station maintenance can be carried out and sensitive areas bypassed, with minimal disturbance to both the butterfly and the BBC.

Nicola J Boucher
Masts and Towers Section
ACED

RESEARCH DEPARTMENT
60th Anniversary Open Days

Research Department held Open Days in July, the first since 1951, to celebrate its 60th Anniversary. Approaching one thousand visitors from within and outside the BBC attended. Fortunately, the occasion was blessed with fine weather which was important as many of the demonstrations were held outside. The Open Days are described here by Ted Hartwell.

Research Department began in 1930 at Savoy Hill under H L Kirke, the Senior Research Engineer, moving three times during the 1930s before finally coming to Kingswood Warren in 1948. During its 60 years it has kept the BBC at the forefront of broadcasting technology and provided the technical foundations on which programme makers have been able to reach their audience. Thus, in the age of satellite broadcasting and digital communications with High Definition Television just around the corner, it seemed opportune — after nearly forty years since the last Open Day — to let others see how the Department is maintaining this tradition into the 90s and even the next century.

Ted Hartwell, RD

Looking down on the visiting Type 6 scanner from the dizzy heights of the 70 ft camera platform.

Over fifty examples of the Department's work were on display or being demonstrated. These covered not only a wide spectrum of the kind of work currently being undertaken but also illustrated past achievements; for example, an historic display of microphones and loudspeakers.

High Definition Television was probably the biggest crowd-puller; visitors were able to see not only recorded and live displays but also, if they were lucky (and slim enough to squeeze into), the interior of the Department's HDTV vehicle to see where and hear how the recordings were made. (The vehicle had only just made it back in time from nearly three weeks of recording and demonstrating HDTV at Wimbledon.)

Unfortunately another display, the Transportable Satellite Earth Station, had not arrived back in time from Italy where it had been sending back pictures of the World Cup.

Other major demonstrations were of RDS, Nicam 728, digital optical routeing, low bit-rate television, digital audio editing and acoustic testing of structures. There were numerous demonstrations covering our radio frequency work, including: satellite broadcasting reception and planning; Euroradio; antennas of various kinds and antenna radiation pattern measurement; various aspects of planning the radio, television and ancillary services; and how computer software plays an important part in all of them.

The Model Workshop and the Drawing Office put on a splendid display of their skills, appreciated by both ourselves and our visitors.

Attractions popular with non-technical visitors were: the Television Outside Broadcast unit, where they could indulge their fantasies as cameramen; a hot-air balloon which, because of a slight breeze, was unfortunately not able to get very far off the ground but which did offer a few lucky ones an exciting but brief bounce around; and a 70 ft camera platform which gave panoramic views over the top of the Mansion.

These last two items were primarily serving a serious purpose though. The balloon carried a radio-camera feeding signals to the ***Helitrak*** receiving equipment, simulating its main purpose of being used to transmit pictures from a helicopter, such as during the annual University Boat Race. The camera platform, on the other hand, was used to relay live HDTV pictures to the indoor viewers.

Another attraction was the Free-field Room, or 'dead room', where visitors could experience the uncanny silence of this acoustically-treated labyrinth, which is an essential tool for the testing of microphones, loudspeakers and other equipment.

Everyone at 'KW' had been busy over the previous weeks preparing for the big event, in addition to carrying out their normal work for the Department. The Drawing Office and Photographic and Print Unit had a particularly demanding workload, preparing all the display material for the demonstrations and exhibits, the Anniversary souvenir pack and the numerous direction signs and notices, all of which will be very useful for future visitors and demonstrations (of which we have many). Our Catering Staff were magnificent in providing a continuous running buffet throughout the two days.

We are most grateful to our colleagues in Engineering Information Department and Television Outside Broadcasts for major supporting displays; to Network Radio who provided and staffed the RDS vehicle; and to ETD who undertook the colour printing which was part of the information pack presented to all visitors.

Among the many visitors were: two BBC Governors; senior BBC figures; the Mayor and Chief Executive of Reigate and Banstead; and representatives from Government Ministries, other research establishments, universities and industry, many of whom we are in co-operation with.

Distinguished retired members of senior BBC engineering management also attended.

We were further honoured by the presence of some special visitors: Sir Nicholas Bonsor, MP, the great grandson of Sir Cosmo Orme Bonsor, who lived at Kingswood Warren from 1885 to 1912, and Miss Patricia Kirke and her sister Mrs Barbara Hampshire, daughters of Harold Lister Kirke, the Department's first and longest-serving Head.

Family, friends, our own retired staff and our immediate neighbours all helped in this celebration by coming along on the first day.

It was a splendid occasion. Not only did we demonstrate to our visitors the diversity of work that goes on here, but some of us actually found out for the first time what our colleagues do!

Ted Hartwell
Research Author
Research Department

John Barrett, RD

The Digital Audio Broadcasting display.

WORLD SERVICE
Punggol - the end of the line!

The BBC's Far Eastern Relay Station is at Kranji (Singapore). Nowadays fed from Bush House via the Indian Ocean satellite, Eddie Cousin here laments the passing of an era – the closing of the relay's hf receiving site at Punggol.

Mention receiving stations at the Far Eastern Relay Station and the names Woodleigh, Ulu Tiram, Yew Tee and Punggol quickly come to mind. Over the last forty or so years, these four sites in turn have provided the programmes for re-transmission from Kranji (and before it, Tebrau) to most of the countries in South East Asia.

The last of these, Punggol, has been in use since December 1977 — initially providing the main programme feed. However, this function was overtaken in 1982 when the Indian Ocean satellite became available, thus providing good quality and reliable programme circuits from Bush House to Kranji. Since then, Punggol has been used as a back-up when the satellite circuit has failed and it has also provided band-scanning facilities.

To get to Punggol, one passes through an area of tropical jungle, with small kampong (village houses) dotted here and there. The road eventually peters out and the last three or four hundred yards resemble some of our more difficult access tracks in the UK.

The site is most unusual, with the building and one tower sitting on a narrow piece of reclaimed land of approximately half an acre. The remainder consists of thirty acres of tidal, mud-bound, estuary through which the River Punggol flows. Seven other towers are situated in the middle of the estuary and are only accessible at high tide by boat, thus limiting work on the towers to about four hours per day.

The closure of Punggol will no doubt bring tears to the eyes of former Resident Engineers and their assistants who have had the good fortune to work at Kranji. There is little doubt however that the biggest impact will be on Senior Maintenance Engineer (SME), Chua Boon Cheng.

"Chua", as he is known to his colleagues, joined the Corporation way back in 1958 at Tebrau, since when he has had considerable involvement with all the receiving stations. He moved to Singapore in 1978, when Kranji opened, and was SME in charge of Punggol which at that time was an attended station. Some two years later, technical progress caused the de-staffing of the station and Chua moved to Kranji, taking on additional responsibilities for antennae maintenance and also the Tanglin vhf transmitter. However, his responsibility for Punggol continued throughout the eighties — keeping the unattended equipment in good working order.

On August 17th, the remaining facilities were switched off and Punggol closed down. The Kranji staff have since been involved in dismantling and removing the equipment, for eventual restoration of the site. This will be no mean task, given the problem of dismantling the towers and bases which sit in water or mud. A start has been made and the accompanying photo shows Chua and his rigging team having successfully recovered a microwave dish.

By the time this article is published, little will be left and another era will have ended. All is not lost, however, and Kranji lives on: the staff are now looking forward to the next decade and the possibility of re-engineering.

Eddie Cousin
Resident Engineer
Far Eastern Relay Station

NETWORK TELEVISION
New vision mixer for Studio 7

A Grass Valley GVG-200 vision mixer has been installed in Studio 7 at Television Centre. Andrew Hughes describes this new facility for the '90s.

Studio 7 was last refurbished about ten years ago and was equipped with what was then 'state of the art' hardware. The vision mixer was the Queen's Award to Industry winner from BBC Designs Dept — the EP5/512. An eight channel, two bank mixer, the TC7 unit was fitted with a source/channel selector and had the added attraction of being twelve and sixteen channel capable.

Sadly, this design has been overtaken by modern concepts. By 1990, producers were beginning to find its capabilities extremely limited and a new mixer became a 'must'. It was thought necessary to provide something new in advance of the regular studio refurbishment, scheduled for 1993, if live programming were to continue in TC7.

The range of vision mixers on the market today is vast, and all suitable examples were appraised. However, the BBC's tradition of using Grass Valley equipment in production studios indicated that a closer examination of that company's Model 200 switcher was appropriate. With twenty channels, together with the sophistications of a design only just released onto the market, the Model 200 looked to be more than suitable. It had the added advantage that the Television Service already had some of these — one in a similar studio, at Elstree (Studio A). Its enhanced facilities would allow programmes using TC7, such as the children's show 'Going Live', to produce much better television.

The GVG-200 is a twenty channel, two mix/effects (m/e) bank switcher with memory, disc storage and a downstream keyer. Each m/e bank can mix or wipe and has two separate keyers; 'look-ahead' previews allow simple set-up of effects before transmission. Automation is built into the design and auto-fade, auto-transition and memory-controlled 'timeline' functions are available. While other designs on the market offer similar or better facilities, the Grass Valley operational concepts proved attractive to the BBC operators at Television Centre.

Known as a 'small' studio, TC7 is a versatile production facility which is heavily used. Consequently, Programme Planning had difficulty allocating any out-of-service time. The need to remove asbestos from the control rooms during the same period put even more pressure on the installation. The final plan involved a complete and thorough off-site prefabrication exercise, followed by an uncomfortably short four week on-site installation period during the summer of 1990.

The old mixer was hastily removed and donated to The National Museum of Photography, Film and Television at Bradford. The new switcher then had to be integrated into an eight channel system. The old source selector was removed, new distributions were built and the control desk was mercilessly mutilated to reappear gleaming and glinting with '90s technology. Monitor stacks were enlarged and indicators were rebuilt to take account of all the changes. A new cue director was designed and constructed using relay logic, to integrate the new mixer tallies with the existing on-air cue lights.

By working seven-day weeks, P&ID Tel completed the installation on time and to the satisfaction of the user departments. The team consisted of Steve Gapp, Paul Robinson and Tom Whiting of Studio & OB Group (SOBG), Gerry Sugrue from the Drawing Office and D & ED Wiremen, Zia Faith and C Verdee. Studio Engineering staff, led by Adrian Corcoran, also contributed greatly to the implementation of the project.

Andrew Hughes (Project Leader)
Project Engineer, SOBG
P&ID Tel

MRM

The Grass Valley GVG-200 vision mixer in TC7.

Printed by WOOD NORTON