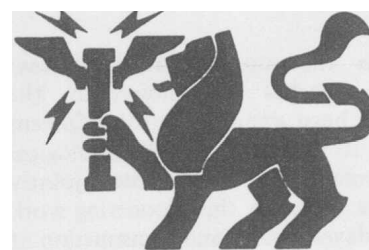


ENG INF

The Quarterly for BBC Engineering StaH



Direct Broadcasting by Satellite DE signs "Heads of Agreement"

In this edition of
ENG INF



Bryce McCrerrick signing the Heads of Agreement with Alan Jefferis, (left) Managing Director of United Satellites Limited.

On March 7th, Bryce McCrerrick, (DE), and Alan Jefferis, Managing Director of United Satellites Limited (Unisat), signed Heads of Agreement for provision by Unisat of two direct broadcasting by satellite television channels for the BBC DBS services due to start in 1986.

Unisat, jointly owned by British Telecom, British Aerospace and the General Electric Company, will be responsible for building and launching two satellites in 1986, the first to be operational and the second as a flying spare. A third spacecraft will be available on the ground as an additional safeguard. Launch will be by the European Ariane rocket or by the American Space Shuttle, the final choice to be made nearer the time. The satellites will be in geostationary orbit 36,000 km above the equator and will provide signals of sufficient power

for high-quality reception by individual households, with suitable receivers and small dish antennas less than 1 metre in diameter, within a 'footprint' covering the United Kingdom and parts of Western Europe. The agreement covers a period of operation of the satellite service of at least seven years.

The satellite will carry transponders for two BBC DBS services; DBS 1 will be a Subscription Channel carrying feature films and other attractions; and DBS 2 will have an international flavour. There will also be a number of digital sound channels affording stereo sound with television and some high-quality radio channels.

The signing of the Heads of Agreement represents a notable landmark in the development of British broadcasting. It will be followed later by completion of a full Agreement covering the finer details.

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Editorial

As the one millionth Teletext receiver reaches the showroom, the BBC has been awarded its third Queens Award to Industry for Technological Achievement, on this occasion jointly with the IBA, for the pioneering work on the development and transmission of Teletext, the basic concept of which has been adopted world-wide.

It is now ten years almost to the day that Research Department, then led by Mr. P. Rainger (now DDE), conducted tests after normal broadcasting hours to determine which lines in the field blanking period to use for a system called Ceefax. The results showed the preference for lines 17 and 18. A detailed specification was issued in April 1973, and there then followed a series of meetings at which a joint standard with the IBA emerged about a year later. This was followed by a unified standard specification in September 1974. In the meantime the BBC began an experimental service on BBC 2 using 32 identical pages (except for the page numbers) on 16th July 1973.

An editorial unit was set-up under CoUn McIntyre on New Years Day 1974. Initially all he had were a photocopier, a typewriter and a telephone answering machine! This blossomed into a nine-person unit in a purpose built suite by April 1975; Ceefax was on the way to becoming a full service.

Our congratulations, therefore, to the BBC engineers, particularly those at Research and Designs Departments, who devised the system, made it work, and finally persuaded industry that it should invest in the new technology.

Two recent announcements from the Home Office have a special significance for BBC Engineering Division.

The first was the announcement that the remainder of vhf Band 2 be cleared of ancillary services to make way for two additional national radio networks. Once the fire, police, ambulance and other services have moved to other frequencies, the space created could be used for a national Radio 1 network, and an IBA network. The announcement has been greeted with both joy and sadness. Joy, because at last our most popular radio service, Radio 1, will have its own vhf service, and the annoying splits between Radio 1 and 2 will no longer be necessary. Sadness, because the new network will not be introduced until 1990, seven years away. By this time we will have had four years of digital sound systems from a satellite.

The second announcement was

the closure of 405-line television service by the end of 1984, two years earlier than had originally been planned. It has been estimated that there will be about 90,000 people scattered around the UK who will be outside the range of uhf transmitters at the end of 1984. With the extension of Phase II of the uhf transmitter building programme, to bring a 625-line service to populations of 500 people or more, an estimated 60-70,000 people could still have been without a uhf service in 1986 when the 405-line service was scheduled to close anyway. Some of these, where there are 200 people or more, and where it is economical to build a station, will eventually receive an off-air service. For the remainder a "self-help" active deflector or wired system will be the only way of receiving uhf television.

The Home Secretary recognised that by bringing forward the closure date "there will be a hiatus before alternative provision for some 405-line viewers is available, while some others will be denied the service earlier than had been foreseen". He went on to add that "there is no alternative but to make these (*frequency*) bands available for land mobile services at the earliest possible date".

Alan Lafferty

Transmitters Opened

The following transmitting stations have opened since January:

Uhf tv
Abington, Strathclyde
Andoversford, Gloucestershire
Ascott-under-Wychwood, Oxon
Betws-yn-Rhos, Clwyd
Bury St. Edmunds, Suffolk
Frome, Somerset
Glasgow (West Central), Strathclyde
Glyndyfrdwy, Clwyd
Llanddulas, Clwyd
Ovingdean, E. Sussex
Penmaen Rhos, Cornwall
Portreath, Cornwall
Saltdean, E. Sussex
Vhf radio
Strachur, Strathclyde/Argyll
Local radio
Radio Cornwall
Radio Devon

Copies of the pocket booklet 'Television and Radio Stations 1983' are available by telephoning LBH 2921.

METAL FILM RESISTORS AND IEC RECOMMENDATION

Sixth colour band shows temperature coefficient

By Margaret Crowther, Mullard Limited.

All MR25 and MR30 metal film resistors manufactured after August 1st '82 carry a sixth colour band to show the temperature coefficient of the product. This innovation brings the colour coding system of these resistors into line with the latest recommendations in IEC publication 62, and IEC115-1 clause 4.5. It also helps to emphasise that, although MR25 and MR30 metal film resistors are categorised as general purpose components, their performance is closely specified.

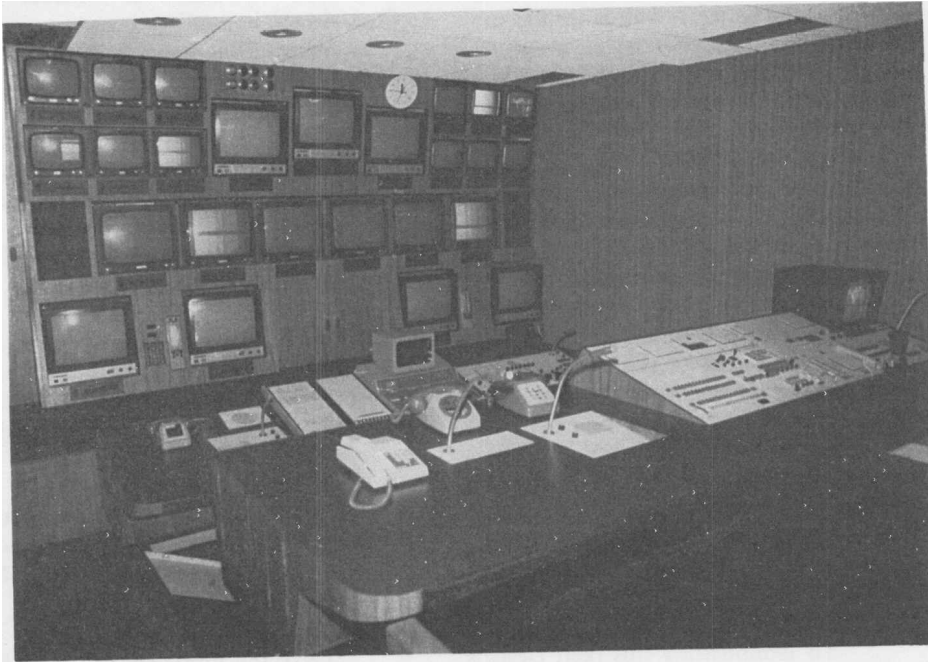
All performance details are given in a six-page data sheet available from Mullard Ltd., packed with information invaluable to the designer. This includes a very useful performance nomogram showing the relationship of the resistors' stability with power dissipation, ambient temperature and hot-spot temperature.

The temperature coefficient band is easy to spot - it is wider than the others and is located on the end-cap.

The temperature coefficients, together with other key data for MR25 and MR30 metal film resistors are given in the table below:

Resistor Type	Power Rating	Temperature Coefficient	Colour Band		
MR25 resistors	In to 4.99n	:t1%	OAW	100ppm	brown
	5.05n to 1Mn	:t1%	OAW	50ppm	red
	In to 1Mn	:t2%	OAW	not applicable	
MR30 resistors	In to 4.99n	:t1%	0.5W	100ppm	brown
	4.99n to 1Mn	:t1%	0.5W	50ppm	red
	In to 1Mn	:t2%	0.5W	not applicable	

New Pebble Mill 'C' Control Room



Pebble Mill 'C' production and vision lighting control room

Refurbishments and improvements to the technical facilities at Pebble Mill continue, with the first project, "c" control room, nearing completion. The new gallery is on the site of the reserve network continuity suite. It will handle the familiar "lobby" programmes such as "Pebble Mill at One" or "6.55 Special" or in fact, any programmes requiring production facilities away from the more conventional studio A and B environments.

The production control room is co-sited with the vision and lighting control in a split level room, furnished in natural brick and wood. At the high-level is the production control desk housing a Grass Valley 1600 ZVPY4 mixer with full facilities. Here also is the TM's position, with own colour monitor and full communication facilities. A QWERTY keyboard has been installed to enable the Eastmead indicators, located under each of the production monitors, to be pre-programmed with picture source information. The keyboard could also be used when computerised source selection equipment is installed. In the small space to the rear of the production control desk, cinema-style tip-up seats have been provided.

At a lower level, in front of the production control desk, is the lighting and vision control equipment. A Strand Duet 2 lighting control system has been installed. Using computer style memory, it can handle up to 96 channels. To provide maximum flexibility, the dimmers will be switched for

use in one or two areas.

One of these is the lobby, which is equipped with HMI lights for daytime use, and incandescent lights at night. Alternatively the lighting system can drive lights in radio studio 1, which doubles as a television studio for programmes such as "6.5 5 Special". Next to the lighting control position are the vision controllers for the cameras.

The gallery can handle a normal complement of four Link 125 cameras fitted with Schneider lenses plus one Ikegami HL79A light-weight camera, with an option to add either a fifth Link 125 or another Ikegami HL79A.

The monitor stack, specially made of aluminium by Pearl Electronics of Windsor, has been erected in the small space between the vision and lighting control desk, and an outside wall. This means that the six Melford colour production monitors and eighteen Melford black and white monitors can be repaired and maintained when necessary via the front of the stack. Special cable cupboards have been incorporated into the design to assist with rigging and de-rigging the monitors. To reduce stray magnetic fields that could upset the colour monitors (see Eng Inf No 97), in addition to the aluminium frame, the twin loudspeakers have been mounted in special mumetal screened cases.

Next to the production gallery is the sound control room, which is equipped with a standard Calrec 36-channel stereo mixing desk. Following the trend away from centralised echoplates, the sound control room will have the benefit of two AMS RMX 16 echo units. Six compressor limiters are pluggable via miniature audio jackfields. A pair of LS5/8 loudspeakers are provided for monitoring purposes. The control room also houses a pair of gram decks and two B62 tape machines.

The new "c" control room will allow the production staff more flexibility when making programmes in and around the Network Production Centre.

Mike Cox, the SCPD project leader said "The gallery layout is a radical departure from traditional studio practice due to the nature of the Pebble Mill programmes and limited space available".



Pebble Mill 'C' sound control room

Towards the Digital Television Studio

"How can pieces of digital television equipment be connected together?" Although this seems to be a mundane question, it is one of the most important that remains to be answered. This is because, even though the major parameters of the digital television coding standard have been agreed, it has yet to be made into a practical system.

The question of interconnection is so important that the Production Systems Engineering Subcommittee of the EBU (European Broadcasting Union) set up an ad-hoc working group last year to look at it. This group is chaired by Mike Stickler of SCPD with David Bradshaw of Designs Department as a co-opt member.

The study is based on the 13.5:6.75:6.75 MHz digital coding standard for the luminance and two colour-difference signals with sampling at 8 bits per sample.

The early questions facing the group concentrated on the choice between serial and parallel interconnections. In a serial interconnection the eight bits of each sample are sent consecutively over one circuit whereas with a parallel interconnection separate circuits within a cable are used for the simultaneous transmission of the eight bits. Whilst the latter method of interconnection could operate using three separate cables for the luminance and the two colour-difference signals respectively, it would be impractical to install as it would involve at least 24 separate connections.

A slightly better method would be to time-division multiplex the two colour-difference signals and transmit them both on one cable at the same data rate as the luminance signal. It would be even better to multiplex all three components and transmit them on one multi-pair cable at 27 Mbytes per second, and this is the method that has been selected.

In a similar way a serial link could be formed from either up to three separate cables for the three picture

components or, possibly, a single cable carrying time-division multiplexed signals. Although the latter method seems to be the most convenient it is by no means trivial to convert from parallel to serial and back, requiring operation at up to 280 Mbitfs. For this reason, and because of its instrumental simplicity, it was decided to pursue the parallel interface first.

The distance over which satisfactory operation can be expected is, clearly, a function of cable performance and so a number of tests were carried out in Designs Department to assess the performance and suitability of existing multiway cables. Two other European broadcasters have commissioned special cables at considerable cost. Bearing in mind that digital signals can be regenerated and that, the great majority of studio interconnections can be made with a near-standard cable.

To demonstrate this fact, Designs Department last year treated a somewhat bemused EBU group to multiplexed digital video components being transmitted at 27 Mbytesfs for a distance of over 100 metres on (PSN40f2M standard) audio multi-pair cable! This demonstration confirmed the feasibility of parallel distribution in studios.

Other questions that had to be decided included such things as whether or not sound signals should be carried within the video signal in studios and the way in which ancillary signals, such as timecode, should be incorporated in the digital datastream.

The original digital coding standard was established after considerable international collaboration and it was desirable that this should extend to the equipment interface. Close liaison has taken place between the EBU ad-hoc group and the SMPTE's digital working group which operates under the chairmanship of Ken Davies of CBC.

One topic that provoked considerable discussion was that of a synchronisation component. In digital studios, video signals are expected to be processed as 'packets' of data and an indication of the start of video data will be more appropriate than some kind of digital representation of a conventional sync. pulse. What has been agreed are digital labels that precede and follow each packet of video data, effectively providing a video start/finish indication. Again, demonstrations of this type of synchronisation were given at Designs Department during an EBU meeting in London.

The EBU ad-hoc group has now

completed its work on the parallel interface specification and it is hoped that it will be approved by the EBU Technical Committee when it meets in Copenhagen in April.

Some of the important parameters of the interface are:

Video data is sent as a time-division multiplex of 8-bit luminance and chrominance components at 27 Mbytesfs. A clock signal is sent with the data at 27 MHz.

Eight balanced pairs are used for video data, plus one pair for clock, using ECL-compatible signal levels and 110 ohms cable impedance.

The connector is the miniature 25-way, type-D socket on equipment and plug on cable. Cable screening is recommended.

Television lines 23 and 623 are not blanked at all in the digital system but 'analogue' blanking will be applied when conversion to analogue form takes place.

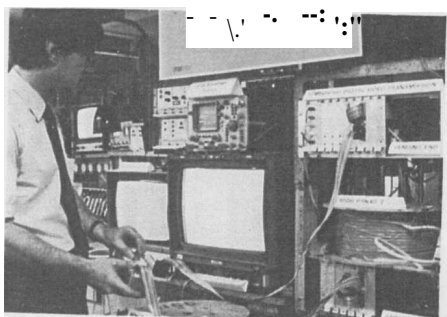
Ancillary signals are multiplexed into the data stream on lines 20, 21, 333 and 334. (Not endorsed by the SMPTE, they want freedom to put ancillary data anywhere in blanking but the numbers would be different for 525 lines anyway).

No provision in the specification for carrying a sound signal.

With the completion of work on the parallel interface, the Group is turning its attention to the serial interface (for longer, inter-area links) and the format of the ancillary signals.

Further investigations into low-cost cables for digital studios using lengths of custom-built cable are being undertaken in Designs Department. Two manufacturers are supplying lengths of prototype cable which it is hoped will prove to be acceptable on the basis of size and flexibility as well as electrical performance and cost. The limiting factor in cable performance for digital parallel transmission tends to be differential delay errors between the different pairs - the maximum error between the clock and any data signal due to the cable is specified at only 5 nanoseconds.

Consideration is now being given to some of the 'building blocks' that will be required for interconnections in digital studios, the most complex of which is probably the routing matrix.



Digital studio interface demonstration

Radio OBs New Base - On Display

Radio OB's recently moved to a new base at Concord Road, Acton, opposite their television counterpart at Kendal Avenue. The new base, three large units on an industrial estate, will house the latest OB vehicles, and provide base maintenance, storage and office accommodation. Duncan

MacEwan, (CERB) said, "The new Base will bring together probably the biggest and most comprehensive fleet of fitted Radio Outside Broadcast vehicles anywhere in the world".

BBC Radio have been transmitting outside broadcasts for over sixty years. In January 1923 there was one from the Royal Opera House, Covent Garden of Mozart's "The Magic Flute". In those days, and until quite recently, it was the practice to transport the mixers and special line amplifiers to the location as separate units, unload them and then connect them together as required. The complexity of modern equipment and the increasing demands for high-quality broadcasts has meant that the equipment now has to be mounted into purpose-built vehicles. The new OB base is intended to house these.

With the expansion of stereo radio in the 1970's, the "Stereo Control Vehicle" (or SCV) has become the main vehicle in the fleet. It has been designed in three different styles: the Type 'A' with a fully-comprehensive Calrec MKII desk or SSL computer assisted desk; the Type 'B' with a 40-channel Calrec desk; and the smaller 15 cwt Type 'C', with a Glensound MX6/3 mixing desk.

The specialist vehicles in the fleet range from the large Mobile Studios (see Eng Inf No 9) to the smaller multi-track recording vehicle, digital recording vehicle, foreign commentators vehicle, and, most importantly, the radio link communication vehicles.

For the future, an expanding-side articulated trailer has been given special acoustic treatment by Research Department. This will house the world first all-digital sound mixing desk manufactured by Neve Ltd, and incorporating the Research Department designed COPAS (Computer for Processing Audio Signals) system.

In this special feature article, we examine each vehicle in turn, the technical facilities provided, and the part it plays to make the Radio Outside Broadcast fleet the best in the world.

Type A

The introduction of stereo radio to the majority of listeners in the 1970s

The Solid State Logic (SSL) computer-assisted control desk inside a Type A stereo control vehicle

prompted the need for a dedicated control vehicle, with sophisticated technical facilities and listening standards compatible with a modern production studio. The Type A stereo control vehicle fulfilled these needs and has been accepted as one of the most versatile and operationally convenient vehicles in the fleet.

The earlier vehicles (SCV 1 and 2) are based on a Luton-type body, fitted to an 11 ton Bedford chassis. In developing the specification for the vehicle, the valuable experience gained by BBC engineers designing television vehicles was drawn on. The successful three-skin, high-sound-insulation body construction was used. For maximum sound absorption the outer cavity is filled with glass fibre and the intermediate skin is of jute-based sound barrier mat. The inner cavity is filled with fire-retardant absorbent foam, retained by perforated steel plate which forms the inner skin of the vehicle and is covered with an acoustically-absorbent plastic material.

The Calrec MkII outside broadcast mixer, which was specially designed for the BBC, is mounted across the rear of the vehicle. The normal in-line configuration is used, with fortyeight input channels, eight stereo groups and a twenty-four track monitor/mixer which is coupled to an input/output monitor.

The latest versions of the vehicle (SCV 3 and 4) have been equipped with Solid State Logic (SSL) computer assisted 40-channel mixers. Using 4000-series software, the desk operates in real

time, allowing total recall. Forty separate input amplifiers are installed and thus up to eighty different microphones can be mixed. The size of the desk is such that doors have been fitted to the side of the vehicles for ease of access.

Both types of vehicle are fitted with a pair of high-quality monitor loudspeakers to the latest BBC design, LS5/8. They are mounted either side of the control desk to allow the operator the maximum stereo effect within the limitation of the confined space. Provision has been made for a television camera and a monitor/receiver for use on complicated productions such as operas and pop concerts. A colour monitor displays the SSL computer control settings.

At the front of the vehicles provision has been made for three twin-track tape recorders such as the Studer B62 and for a multi-track tape recorder such as the Studer A800 or Lyrec. In SCV 3 and 4 the front of the vehicle houses the computer and floppy disc drive unit.

Outside the vehicles there are connections for up to 120 microphones and patch panels connecting to the mixer and tape recorders.

Other features include Dolby M/6 noise reducers, peak programme meters (PPMs), a six-line manual telephone exchange and an ample supply of recording and line up tapes.

'continued over'