No. 13. – Summer 1983 Please circulate

# ENG INF

The Quarterly For BBC Engineering Staff

## Engineering Division gains third Queens Award

*The Queen's Award Logo, as displayed on CEEFAX*

The BBC has been awarded the Queen's Award to Industry for the third time. The Award goes jointly to the British Broadcasting Corporation Engineering Directorate and the Independent Broadcasting Authority's Engineering Division for their pioneering work on the development and transmission of Teletext, the basic concept of which has been adopted worldwide.

Following a year's engineering experiments the BBC began transmitting a Teletext service, called CEEFAX, in September 1974. The IBA had also been investigating a similar system known as Oracle. Close co-operation between the BBC and IBA during the experimental period resulted in a unified standard being agreed between the two organisations which has been used for CEEFAX and ORACLE ever since. Recent development work offers the possibility of improved graphics, enhanced character sets for foreign language users, and the transmission of photographic quality pictures.

The latest innovation is the transmission of Telesoftware. Ceefax pages are used to carry computer programes, which can be downloaded directly into home computers, such as the much-acclaimed BBC micro-computer. This is done by a special teletext adaptor developed by Acorn Computers, manufacturers of the micro-computer, in co-operation with engineers from Research and Designs Departments. This adaptor can not only handle the computer software, but can also provide normal CEEFAX pages.

## In this edition of ENG INF



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# ☆☆☆Editorial ☆☆☆

Feedback is a term that most engineers love or hate. When its positive feedback in an amplifier circuit it oscillates causing all sorts of untold misery. When the negative feedback circuit fails, the gain goes haywire, yet the output still resembles a much enlarged input. These complex engineering problems can often be solved by use of a dual-beam oscilloscope, or sensible intuition.

But what of the "positive feedback" in more real terms; the magazine editor who wants to know who is reading the magazine, or the audience researcher who would like to know what you watched on TV the night before? Their task is a little more complicated, but several hundred interviewers, and the sensible use of a clip-board can provide quite accurate answers.

So what relevance has this to engineering and engineers? We have all been asked to fill in a form when the equipment failed in service, and thought "What a nuisance this form-filling is!". But spare a thought for the engineer who has to monitor the performance of the equipment, and anticipate spares requirements some years ahead. You would be the first to complain if equipment exhibited a persistent fault without some modification, or if the spares ran out after a few years in service. In the years ahead, no doubt, this chore will be transmitted to the central collecting point by electronic means, as, and when, a component fails; in the meantime we will have to continue to fill in the fault reports, and hope that someone, somewhere takes the time and trouble to read them!

Transmitters

Whilst on the subject of maintenance can I draw your attention to an interesting lecture being given by Bill Mitchell, of Transmitter Department, to the Society of Electronic and Radio Technicians at Sussex University on the 12th September. In his paper Bill describes the process that Transmitter Department have gone through from having one man per transmitter continuously monitoring the output, to one visit every six months (or when things go wrong!), and virtually no monitoring at all on the smallest uhf relays. Surely this must highlight the high degree of professionalism and engineering skill of todays transmitter engineers. As Bill says in his paper "Broadcasting maintenance engineers have adapted successfully to the many changes of the past fifty years: there is every reason to believe that the new generation can face the future with confidence."

Eng Inf

I must, once again, apologise for the late appearance of Eng Inf. Apart from a red face, I had little to show for the summer edition, until the Prime Minister decided to go to the country. This threw the inevitable short-circuit into the works, and blew a fuse on our type-setting machine in the process. All is now calm, and "Eng Inf" has survived the 92F in the editor's office. In the meantime, I am STILL short of material for the autumn edition, so unless we can arrange for a collapse in Government, I still need your help in preparing the next edition. Any contributions would be welcomed (though not necessarily published), on whatever engineering subject you choose. Contact me, or Linda, on extension LBH 5432, or from August 30th 01-927 5432 (now there's an interesting story.....).

Alan Lafferty

# Transmitters Opened

The following transmitting stations have opened since April:

**Uhf tv**
Aberfoyle, Central
Bambridge, Co. Down
Blakeney, Glos.
Burry Port, Dyfed
Ironbridge, Salop
Killin, Central
Llyswen, Powis
St. Marks (Tunbridge Wells), Kent
Welwyn, Herts
**Vhf radio**
Blaenplwyf, West Wales
Ffestiniog, West Wales
Haverfordwest, West Wales
Llandyfriog, West Wales
Machynlleth, West Wales
Mynydd Pencarreg, West Wales
(all to stereo operation)
Isles of Scilly, Cornwall
(mixed polarisation)
**Mf radio**
Tywyn, Cardigan
**Local radio**
Bexhill, Radio Brighton
Radio Gwent
Radio Solway
Radio Tweed
Radio York

# *Radio Data demonstrated to E.B.U.*

The proposed unified European v.h.f. radio-data system was successfully demonstrated to the EBU Technical Committee at it's meeting in Copenhagen in April. Radio-data signals conforming with the proposed standard were put on-air from transmitters in Copenhagen and Horby in Sweden by engineers from the Swedish Telecommunication Administration.

# Schedule Unit on the right frequency

In 1932 the BBC started the Empire Service, its first regular international broadcasting service. Fifty years later, in 1982, BBC External Services celebrated its first half century as a major international broadcaster currently serving a regular world wide audience estimated at upwards of one hundred million to its World Service in English and thirty-six vernacular language broadcasts.

The vast majority of BBC External Services broadcasts are transmitted on frequencies in the 3-30 MHz frequency, or short-wave part of the radio spectrum. This is because the ionosphere, those layers of ionised gases that exist in the earth's upper atmosphere, can refract such frequencies back to earth at a distance by a single hop or series of hops.

In the fifty years between 1932 and 1982 the use of short-wave transmissions for international broadcasts has increased dramatically. This has been espcially true since September 1960 when the present procedures for the use of frequencies for international short-wave broadcasting were implemented. In the same period there has been no increase in the number of frequencies available for international short-wave broadcasts and so there is intense competition amongst the many international broadcasters both large and small around the world.

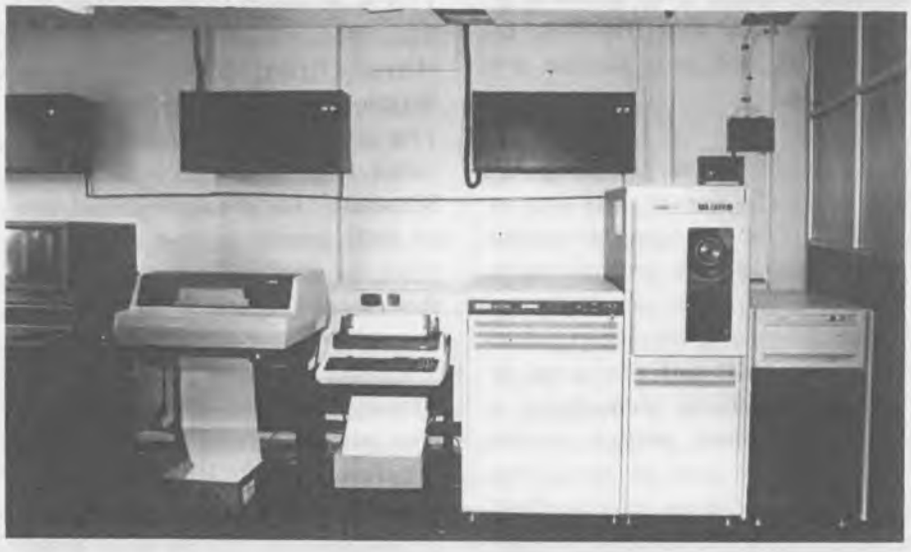
The job of all these broadcasters is first to produce the strongest and clearest possible signals in the right places at the right times so as to give their audience the best possible service. Secondly to protect these signals from interference created by competing broadcasters using the same or adjacent frequencies for their own broadcasts. Given today's very overcrowded high frequency broadcast bands the job requires a blend of delicate art and transmitter power.

The Engineers in External Services Schedule Unit are only too familiar with these problems, since theirs is the task of balancing BBC programme requirements against the availability of eighty-five transmitters and some three hundred aerials at BBC transmitting stations in the UK and at our overseas relay bases, and the best choice of frequencies within the crowded short-wave bands.

Schedule Unit, led by Dennis Thompson, is divided into three complimentary sections. Under Schedule Operations Manager (SOM), Mike Sollars, three Schedule Engineers, Jim Chilton, Dave Gallop and Bert Metcalfe together with an assistant, Myrna Ramsey, are responsible for the detailed preparation of each future schedule, as well as the day to day running of the current schedule.

Frequency Management Engineers (FMEs), Mike Still, Geoff Spells and Brian Malone together with their Assistant, Beverley Stevens, ensure that their choice of frequencies remain as clear of interference from other broadcasters as possible, and liaise with national and international administrations and other broadcasters about this frequency usage. The third side of the triangle is provided by John Hynd and three Data Preparation Clerks in Reception Analysis Unit, who provide the essential feedback of incoming reception data gleaned from listeners of all kinds around the world telling BBC External Services how its broadcasts are being heard by them.

From September 1960 until the summer of 1980 four schedules were drawn up each year - the first covering the two month period of the Spring Equinox, followed by a four month period covering the Summer, a second two month schedule for the Autumn Equinox and finally a four month period covering Winter - this being the pattern determined by international agreement at the Geneva Frequency Conference of 1959 and which is still operated today by most international broadcasters. In 1980 most European Governments adopted a measure of energy saving, and agreed to have a defined period of Summertime, which in most cases begins on the last Sunday in March and ends on the last Sunday in September. This immediately presented Schedule Unit with considerable problems since not unnaturally, programme makers in Bush House wished the timing of our



*The new computer in Schedule Unit*

# Schedule Unit *(Continued)*

fifteen European language services to continue to reach their audiences at the same time of day, in spite of the one-hour advance in local clock times during the summertime period. The solution to this problem was to run two six-month schedules - approximately April-September and October-March inclusive - to match the dates of European Summer and Wintertime. The complication being that in order to co-ordinate our frequency usage with other broadcasters it is still necessary for Schedule Unit to observe the four schedule pattern determined by the International Frequency Registration Board (IFRB) and which is still followed by the majority of international broadcasters.

In turn, each of the three Schedule Engineers begins the preparation of the next future Schedule nine months in advance of its operational start date. Using a post mortem of the schedule for the previous corresponding season as their starting point, they build in any relevant changes to take account of propagational changes due to change of season and/or sun-spot activity. A clever mathematical programme based on the work of Propagation Engineer, Raymond Fricker, of External Services Projects Unit allows engineers to check that the range of frequencies for any service are still usable.

Using an HP45 desk top computer they enter the known data such as transmitter and receiver co-ordinates, month of the year, sun-spot number and power of the transmitter. The computer then calculates and prints out the range of usable frequencies throughout a twenty-four hour period in two hour steps as well as the transmission mode angle, median field strength, and percentage reliability achieved by these usable frequencies. The Schedule Engineers also have to accommodate any changes in programme requirements and equipment availability. The re-engineering works at Rampisham, Skelton A and Cyprus are a good example of the large headache for Schedule Unit Engineers. A lead time of nine months is necessary to allow the Frequency Managers time to ensure that the frequencies chosen for this new schedule represent the best selection possible. Where this is not the case, they research the available short-wave bandscan information, and select more suitable replacement frequencies.

Having made the final selection of frequencies the FMEs then embark on the job of co-ordinating some eight hundred and fifty hours of daily BBC frequency usage with those of other broadcasters the world over. The first stage in this international co-ordination is their attendance at a regular meeting of broadcasters, who have mainly similar broadcasting targets as the BBC, in order to pre-coordinate seasonal frequency requirements and to reduce mutual interference to the least possible. The next stage is to co-ordinate that seasons frequency requirements on a world wide basis.

This is achieved by submitting the BBC requirements through the Home Office, the UK Administration, to the IFRB in Geneva. The IFRB then produces a "Tentative High Frequency Broadcast Schedule" for the appropriate two or four month period which displays the BBC frequency usage for that season along with those of the other short-wave broadcasters amongst the one hundred and fifty-eight states of the ITU. It also indicates those periods where interference problems exist between broadcasters operating simultaneously on the same or adjacent frequencies. This gives FMEs around the world an opportunity of resolving as many of these problems as possible in advance of the start of the schedule by direct negotiation between themselves or via their respective administrations. With the present scheduling timetable a new headache inherited by the BBC FMEs is the problem of maintaining, say, a viable six month Summertime Schedule between April-September inclusive, with maximum frequency continuity for each language service, whilst at the same time maintaining their frequency co-ordination with other international broadcasters most of whom operate part of a Spring schedule, the whole of a Summer schedule and part of an Autumn schedule within this same period.

At the end of these initial deliberations by the Schedule Engineers and Frequency Managers, a Provisional Summer and Wintertime Schedule evolves. At some two months in advance of its start date this provisional schedule is despatched to the various transmitter stations for assessment by the Transmitter Manager, who liaises with SOM and Schedule Engineer over any operational or equipment problems. Any modifications necessary as a result of these discussions are then built into the final schedule.

On the appointed day the final schedule enters operational service and the same Schedule Engineer looks after this schedule for the first three months of its life, coping with the day to day changes that are required to cover any necessary amendments. These may be permanent or temporary alterations to the current Schedule, and cover propagational and interference problems, repair of transmission equipment, staff training, programme retimings, as well as special broadcasts to cover General Elections, Cricket Test Series, visiting Statesmen, etc. The list of reasons for amendments is almost endless and service messages cover-



Continued on Page 10

# Election '83 — How the U K heard it

One of Radio's election aims has always been to broadcast live as many declarations as possible. For Election '83, however, this req--ment was supplemented by involving those directly concerned with the process of government in the programme by interviews and reactions from M.P.'s and experts around the constituencies. This decision presented Radio Networks with an unprecendented election planning and co-ordination exercise in bringing together effort from Local Radio, Regional Centres and London Tech. Ops.

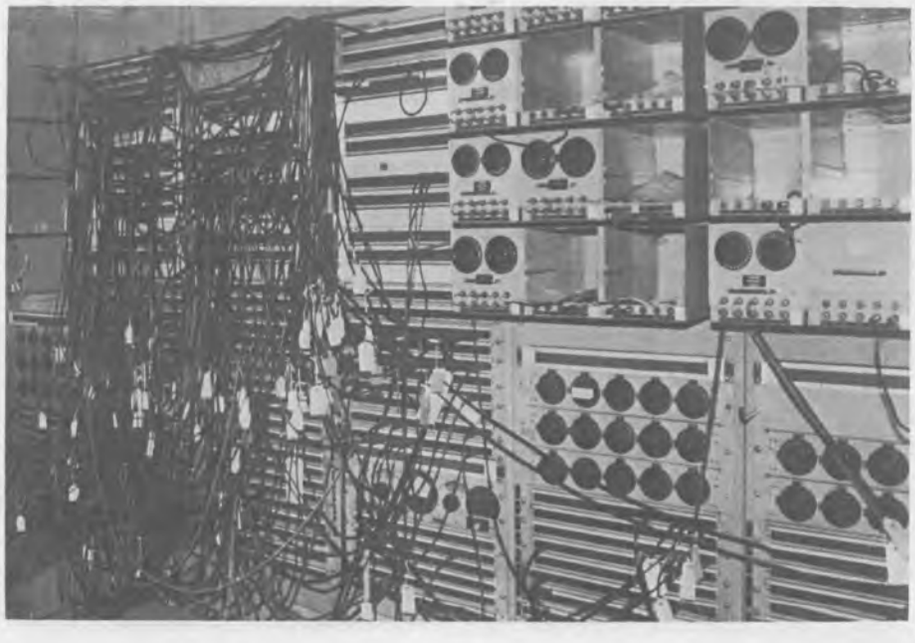
This year, for the first time, two complete regional networks of programme and communication circuits were set up. These enabled results and interviews to be handled by specific studios in London. In this way, OB sources, manned by Local Radio OB units, for fifty-seven constituencies were fed via twenty-one Local Radio sub-mixers into five Regional Centres. Each source could then be fed down either the 'interview' or 'declaration' network to the London Control Room. As well, London, on its own, handled a further nineteen OBs. These, along with the 'declaration' network, were routed into the Special Operations Centre (S.O.C.), which had been especially set up by Radio Network for the election. The routing desk in the S.O.C. had had to be supplemented by a further two locally sited sub-mixers.

On the Election night, each OB informed the S.O.C. as it neared the time for declaring the result in its constituency, so that a running order could be compiled. Then about two minutes before an announcement from the Returning Officer was expected, the circuit was routed by the S.O.C. into Studio 3B, the main election studio, for live transmission. At the same time, the S.O.C. also made the sources available to T.C., Bush House and a number of Overseas Broadcasting organisations so that as many people as possible listening to Radio or External Services or watching television could have the results as they were being declared.

Two off-tube information systems were used to supplement this service. As in previous elections, Radio News staff displayed the results on closed-circuit television as they were telephoned into Studio 3A by stringers or their colleagues in the S.O.C. However, this year a central computer was also used with its input terminals at all the points where results were available, including the two sited in the S.O.C. itself.

After giving their declaration, many of the OBs were passed to Studio 3E in order to arrange an interview. Whilst all this was in progress, broadcasting continued on the other networks, and contributions from some of the OBs were also required in Studio 4A for the Jimmy Young Show on Radio 2. Technical Operators in each of the studios and in the S.O.C. handled the circuits and liaised with each other to ensure the circuits arrived at the right studio at the right time, and so that prompt attention could be given to each contributor.

During the election programme, London Control Room may have seemed relatively calm to the casual observer. In fact work had begun early on the election morning to ensure that by the time the election programme started every circuit had been tested and plugged through to its user. But this is only part of the story because as soon as the date of the election was announced, George Legg, H.E.R. Networks, started planning the complicated system with the Regional Managers. In turn Colin Prior, a London Control Room supervisor, began to plan and organise the London end of the networks. He had to acquire the extra equipment needed and arrange for Radio Engineering Services to provide and install all the additional cabling required. So, in all the London Control Room staff were working three weeks on the project.



*The Special Operation Centre became a mass of extra cables for Election night*

# Election '83 — How the world heard it

The requirement to provide comprehensive coverage of a British General Election for a world audience has always been achieved in past years at Bush House by intensive temporary remodelling of existing facilities. This has involved the decanting of the World Service operation from Continuity 1 into alternative accommodation, thus releasing the continuity suite for conversion into an Election studio. Additional temporary recording channels were provided to handle the large amounts of actuality material which becomes available as the results come in.

This year the timely completion of the Bush House Special Events Suite meant that the entire World Service Election operation could be accommodated in this new complex of studios and recording areas, and so obviate the disruption of previous years. The Special Events Suite comprises three areas, S36, S37 and S38, plus a recording channel, E6, and a teleprinter room. S36 cubicle can intake S37 (small talks) and S38 (medium talks) as studio areas. This is achieved by a simple "hand shaking" arrangement handing over relevant signalling and programme circuits to S36 control desk. This desk is a specially built and extended DK4/19 which has the usual nine channels plus ten additional outside sources, three of which have self-selection from the source multiple. All outside source pre-hear and communications facilities are extended to a producers position together with additional talkback facilities. S36 cubicle contains eight tape machines (Levers-Rich) and one gram (RP2/ 9) plus access to six tape machines in E6. These latter machines can record from S36 output or outside sources, or be arranged as two dubbing channels of three machines.

For Election coverage S36 employed the studio area of S38 which housed presentation staff, analysts and V.I.P.s all contributing to a "free flow" programme, interspersed with constituency declarations. Eighty 'declaration' OB points were available from the intake area in Room 212 Broadcasting House. These were routed via Broadcasting House and Bush control rooms on four lines, together with a co-ordinating circuit which enabled production staff to be made aware of an imminent declaration and its appropriate line. Additionally a listening feed of the talkback between the Radio V.I.P. interview studio and the main Radio 4 Election studio was provided to enable excerpts of particular interviews on Radio 4 to be recorded.

A news/intake and distribution area, set up within the cubicle of S38 was fed with Press Association teleprinter services and a terminal of the Bush electronic distribution system. A further remote terminal of E.D.S. was located in 3A in Broadcasting House and linked to Bush by existing control lines.

This description has concentrated on the facilities provided for the World Service operation which transmitted Election coverage from 2200 GMT on June 9th to 1300 GMT on June 10th. Other language services also provided detailed coverage and some additional transmissions were mounted. The major addition being in German from 2300 on the 9th to 0300 on the 10th, and later on that day from 1100 - 1300 GMT. The Brazilian transmission was extended by 15 minutes and Bengali and Tamil transmissions were also lengthened. These changes formed part of an extensive re-scheduling of transmitter facilities in the United Kingdom and at overseas relay bases. The situation was further complicated by the start of the Prudential World Cup Cricket Series on Election day. This brought intense pressure on line availability between Bush and Broadcasting House and produced a period of busy re-plugging in both control rooms at the close of the day's play before the Election results service got under way.

*Members of BBC World Service's Election Special Team in the special events suite at Bush House*

Authors:

Phil Lacey
Manager, Engineering Services
John Knight
Manager, Engineering Operations
Ian Fleming
Senior Test Room Engineer

# Election '83 — How television saw it

The General election on June 9th proved to be a landslide for the Conservatives, but what of the television coverage of the event? How do you put together a programme in which the majority of the Public have taken a part, and what of the technicalities involved in providing a fast, comprehensive results service? To reflect the 'battle on the hustings' the planners decided that 1983 would use all of the outside broadcast facilities available to them, backed by a new, fast, computer to provide the results.

*Brian Hunt (foreground) and John Carter test communication facilities in TC6 observation room, which was converted to an OB editors booth for "Election 83"*

Planning for the event, about which the precise timing was unknown, had been going on for eighteen months before. The idea of the production team, led by editor David Dickinson and director Tom Gutteridge, was to show more of the events up and down the country, with experts interpreting the results as they came in. Technical co-ordinator Paul Mason was given the difficult task of displaying as many outside broadcasts as possible on the one hand, and the results on the other. To achieve this required a considerable amount of resources, and the involvement of many different departments.

To display the OBs it was decided that the studio set would have eight back-projectors each able to show an individual OB or a selection of OBs, results graphics, and still pictures from earlier OBs. Facilities to do this would be limited, and some compromise would be necessary to enable all the OBs to be properly directed and controlled. As with past Elections the Regions would co-ordinate their own local OBs, feeding them to London as requested.

However, this creates its own problems, since the director in London is unable to communicate effectively with the OB director in the Region without some fast cross-connecting when the OB went on the air. To overcome this as we shall see later, a system known as DART (Directors Automatic Reverse Talkback) was developed by Television Special Projects in London.

**London and Regions connected**

Studio 6 at Television Centre in London was to be the centre of operations, with the Regional centres becoming 'hubs' for events in their areas. Studio 7 would be used as a production office, whilst the technical facilities would be utilised as a London and south-east 'hub'.

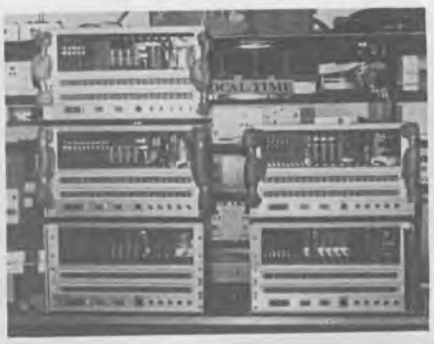
As soon as the date of the Election became known, the plans were put into action. Extra equipment was installed in TC6 apparatus room, production control room, and studio floor, and between 10-12km of extra cabling was used to connect the various facilities together. The observation room overlooking the production control room became an 'OB booth' controlling the flow of OBs to the production team. A Special Projects team led by Ken Godden and John Try began an eighteen hour day, seven day week, to get the extra facilities installed in time.

For the "Election '83" programme, the Network Production Centres at Bristol, Birmingham and Manchester acted as regional hubs for the west, midlands and north of England. Glasgow was the hub for Scotland, whilst sub-centres were set up at Cardiff, feeding into the Bristol hub, for Wales, and Belfast, feeding into the Manchester hub, for Northern Ireland. Southampton acted as a sub-centre feeding into the London hub in TC7, as were the OBs from the London area. The BBC mobile satellite ground station was positioned at Selkirk, Scotland, constituency of David Steel, where the difficult terrestrial communications prevented conventional circuit use. This fed a signal via the OTS satellite, to the London hub in TC7. Into the OB booth were fed two circuits from Manchester (North 1 and North 2), two from Bristol (West 1 and West 2), one from Glasgow (Scotland 1), and one from Birmingham, (Midlands). In addition there were two circuits from TC7, (South 1 and South 2).

**DART**

As mentioned earlier, to accommodate all the OBs was difficult, and experience at previous elections had highlighted the problem of the directors talk-back between

# Election '83



*The five DART (Directors Automatic Reverse Talkback) systems.*

London and the OB in the regions. Operationally the OB would line up the sound and vision circuits with its regional centre, and then offer the OB to London. However, when the OB went on the air the London director was unable to talk to the OB director unless some fast cross connecting was carried out. To simplify matters, it was suggested that there must be some technical solution that could switch the four wire talk-back circuit at the same time as the vision mixer selected the OB in London.

From ideas put forward by two sound supervisors, a DART prototype was developed by Television Special Projects, and demonstrated in November 1982. By March 1983 the Special Projects team, set out to manufacture, test and install five DART systems in time for the Election - the date of which was at that time unknown. Special credit should be given to John Try, Brian Hunt Kevin Warrener, Mike Endersby, John Byrne and Alan Laird for completing the task on time, not without the help given by the cable workshop team led by Dave Stone, the Drawing Office led by John Payne, and the technical stores staff led by Brian Ellison. The five units were completed by May 24th - only two and a half weeks before the Election.

The DART system essentially uses cues from the vision mixer to control a small sound relay matrix. Thus, as the name implies, the DART unit will automatically select the London directors talk-back to an OB, and the reverse talk-back from the OB to London, when the vision mixer selects the OB for transmission.

**Changes in the Studio**

To accommodate all the extra facilities needed in the studio, the presenters set was mounted eight feet above floor level on steel girders. Underneath were support teams, make-up points, and several bays of video distribution amplifiers needed to drive equipment on the set above. The raised floor also helped to avoid the extensive cable runs from getting in the way of the programme production.

Set into the walls of the presenters set were eight back-projectors and eight Carousel slide projectors. These were controlled from a special cubicle in one corner of the main set. Here the floor director selected any of the OBs currently switched to London, or displayed the results service from the graphics computers. Selected scenes from the OBs were saved for later display using the Research Department prototype Stills Store.

**Computer graphics**

A month before the Election was called, Roger Kelly from SCPD had just finished installing a new dual VAX11 computer in the computer graphics workshop. Naturally, as he was the project leader, he was asked to carry on to ensure the smooth running of the computer during the Election.

The VAX11 was used for a fast results service. A database of constituencies, candidates and other statistics were stored on the computer, and input terminals were installed in a conference room at television centre. A telephone results service then inputted the data as the result became known. The output of the computer was coupled to four graphics devices. Three Quantel 7001 devices were used to provide the headline graphics, full-form and constituency graphics, and screamer headlines should these be required; the "State of the Parties" graphics were derived from a Flair graphics device. Much of the time this graphic was used over a picture of Big Ben; in actual fact this was a working model mounted in TC7 equipment store room, since the real thing was shrouded in scaffolding on the night.

**Outside Broadcasts**

Television Outside Broadcasts handled forty-four OBs on election night, stretching both vision and communications equipment to the full. In spite of this, they still managed to provide coverage of the World Cup cricket that inconveniently was reaching its climax at the same time. An additional thirteen OBs were covered for "Breakfast Time" the following morning, making a total of fifty-seven OBs in less than twelve hours.

**Technology Breakdown**

Despite all the high-technology, and superior communications systems, provision had to be made for the unthinkable - an equipment failure.

So that the show could continue without the OBs, and without the computer graphics, a hole was made in the studio set floor, so that important results could be passed to the presenters from the back-up team below by hand.

All of the careful planning was of little help when a clash of important declarations could not be averted. Two of the Party leaders, David Steel, and the Prime Minister, Mrs Thatcher, declared simultaneously.

# Election '83 - Regional round - up

*A Manchester based communication vehicle hides itself in Carlisle Fire Station*

The success of "Election '83" was largely due to the contribution made by staff in the regions and at the OBs. A brief glimpse of the large operation shows not only the facilities used, but also some of the lighter moments that occur in any programme of this nature.

## MANCHESTER

*Dave Gledhill, from the Central Technical Area, describes some of the problems the engineering staff faced.*

The first week of election preparation was embarked upon in the secure feeling that we already had a sound basis for planning the Central Technical Area operation, namely the comprehensive file on the very successful 1979 election programme. Apart from vaguely disturbing references to some new system called "DART" we were reasonably confident and spent the first week and a half re-engineering the opt-out system (to enable Regional Television to use Studio A) and wiring in extra tie-lines between the main equipment bays. It was only after the first facilities meeting that we began to be really disturbed, and then we woke up in a real sense of panic! Twelve television OBs with all manner of facilities - cues, two-way talkbacks, etc., (what on earth is this DART thing?) - meant seventy-two local ends between us and British Telecom trunks. Even with the extras we had ordered as per 1979, we didn't have enough and there were still ten local radio stations for R4 and probably a host of extra inter-region circuits!

We ended up by increasing our local end complement to one hundred but even then there were some nail-biting moments. Radio caused a minor panic by suddenly wanting cue circuits to all local radio stations. Fortunately, we learned that two TV OBs had been dropped and we could breathe again. We then discovered that our great British institution, cricket, was batting calmly on, unperturbed by the bustle of politics and electioneering, and that we had a cricket OB - yes, you've guessed it - on Election Day itself.

By this time DART had appeared; the studio engineers had finished building their programme switches; the whole lot was strung together with control cables and so many patch-cards that you could hardly see the equipment, let alone the labels on the jack-fields; tests were conducted and rehearsals started.

Then came the thunderstorm during Tuesday night's rehearsal. The first inkling we had of this was a tremendous bang as the building next door was struck by lightening, the sky lit up; the screens went dark; the surge had been too much for the delicate 6522 IC in the switching gear and we were off the air! Someone rang from Television Centre to enquire what had happened and, when told, asked querulously, "It - it will not happen on the night will it?" Well, about the one facility we hadn't quite managed to plumb in was a hot line to the Almighty, so we couldn't really give him an answer! It was soon established that there was only one other 6522 chip in the whole building - in Projects Department's BBC micro computer, and this was duly robbed of it's input and output facilities in order that the show might go on.

Election Day itself was characterised by the calmness of systematic activity, when all the fume and fret of frantic planning was over, nervous breakdowns avoided and everything worked, we had two local ends to spare, and we had another comprehensive file which, probably, will be of just as little use when the next time comes!

*The hired unit arrives in Manchester in style*

# Ceefax goes for 6

Faster access times and more information for users of the CEEFAX service could be the result of a decision announced on 13th July by Aubrey Singer, M.D. Tel. Extra digital information could be added to the CEEFAX signal, reducing the average waiting time for a page to 5 or 6 seconds. At the same time, the number of pages of information could be increased. The improvement would be brought about by increasing the number of television lines carrying the data from four to six.

Improvements in receiver technology should now make it possible to add data to lines 13 and 14, but tests need to be made to ensure there will be no impairment to normal television pictures. If these tests are satisfactory, the BBC will be seeking Home Office authority to start an extended CEEFAX service in the Spring of 1984.

At the start of the service in 1974, the BBC used only two blank lines of the television picture, lines 17 and 18, to carry the CEEFAX data. In 1981, to overcome the drawback of lengthy waiting between pages, the number of lines transmitted was increased from two to four, using lines 15, 16, 17 and 18 and their corresponding lines on the alternate field.



*John Riley explains Telesoftware to the PM*

# Schedule Unit *(Continued)*

ing such changes can amount to some five hundred over a year and, on the day of peak operational activity, can run into double figures. At the end of this three month period, the "current" Schedule Engineer then hands over the day to day running to one of his colleagues so that he can begin work on the preparation of yet another future schedule.

Whilst the planning and day to day problems are handled by Schedule Engineers and Frequency managers, Reception Analysis Unit (RAU) is busy analysing the data sent in by its regular panel of reception reporters. Currently these number about two hundred and are made up of ordinary listeners, reception enthusiasts, British Embassy staff, other broadcasting organisations and BBC Relay Bases. Reporters are asked to provide regular reports at key times of the day, on both World Service in English and relevant vernacular language broadcasts, giving their subjective assessment of signal strength, interference level, and overall merit of the required transmissions. Various analyses of this RAU data are produced to assist the other engineers in Schedule Unit and to demonstrate the effectiveness of External Services broadcasts to programme makers in Bush House and other interested parties.

Starting in August of this year under a contract with Logica Ltd, Schedule Unit will begin to go computerised. The initial installation work has already started on a system based on a Digital Equipment Corporation VAX 11/750 Computer plus large database, several VDUs (including Graphics), hard copy-terminals and a plotter. Special purpose applications software written by Logica will also be available. Schedule Engineers will be able to plan their schedules by entering transmission details using menu-driven input facilities at their desks.

Frequency Managers activities will include the use of their colour graphics terminals to examine signal strengths across the hf spectrum on simulated three dimensional displays of signal strength against frequency and time. This will allow them more readily and more easily to identify regions of bad interference affecting BBC transmissions and to find those all too few unused sections of the frequency spectrum into which they can move such BBC transmission.

Finally, RAU will be able to input their reception reports more simply and more rapidly. This vital feedback of reception information will continuously update the system database and what is more will be instantly available for the use of Schedule Engineers and Frequency Managers as they tackle their day to day scheduling problems.

Thus the Unit produce a schedule from known data, experience, and subjective assessments. The result provides the best possible signal into the target service area that can be found and heard by the listeners. Who knows whether satellites will eventually remove some of the problems; at the end of the day the village in Kenya or kampong in Malaya will still rely on cheap hf receivers for their BBC programmes, and the need for Schedule Units expertise will ensure that we can be heard.

# *...*...The Singapore connection...*...*

On the 1st August 1983, the BBC's External Service programmes for the Far East will be transmitted by satellite to Singapore. From there they are relayed by hf transmitters to millions of listeners as far apart as Hong Kong and New Zealand.

As a result of an agreement reached in October last year, the Telecommunications Authority of Singapore has provided the BBC with four high-quality sound channels from London to Singapore via the Indian Ocean Region satellite. The programmes from Bush House are transmitted to the satellite via the British Telecom International, (BTI), Earth Station at Madley. The same signals are already used to feed two Foreign and Commonwealth Office stations on Cyprus and Masirah which relay BBC programmes, (see Eng Inf no. 5).

A significant improvement in the sound programme quality is expected when the system comes into operation as a result of using pulse code modulation (pcm) on the satellite. Previously, telephone circuits or off-air reception of high-frequency (hf) and single sideband (ssb) transmitters were the only means of relaying live broadcasts from the United Kingdom.

Four 128 kbit/s pcm signals from the Intelsat Indian Ocean satellite are received at the Singapore Telecoms earth station on the Island of Sentosa to the south of Singapore. They are picked up by one of the twin 30 m antennas and relayed by microwave radio link to the Telecoms Comcentre Tower in the centre of Singapore. From there, new link equipment has been installed to carry the signals to the BBC Far Eastern Relay Station transmitters at Kranji in the north of the Island.

Planning of the system was undertaken by Communications Department and installation of the special pcm satellite receiving equipment with its associated distribution system in Singapore was carried out, in under nine months, by engineers from Telecoms Singapore in conjunction with the resident engineers from the BBC transmitting station at Kranji. In the United Kingdom, British Telecom International have modified the transmitting equipment at their satellite Earth Station at Madley in Herefordshire to handle the special pcm signals, and have provided high quality audio lines to convey the programmes from Bush House.

*Singapore Telecoms satellite earth station, Sentosa*

The satellite system first came into service from London to Cyprus in November 1982 bringing improved reception of BBC programmes to countries in the Middle East, later the service was extended to the relay station at Masirah.

Kranji is the third transmitter to be fed from the multi-destination transmissions radiated by the satellite using modified single carrier per channel (scpc) equipment. Telephony, between overseas countries where few calls are required, is usually carried out by the use of single carriers modulated by four-phase psk signals at 64 kbit/s. Up to eight hundred scpc channels spaced at 45 kHz intervals can be accommodated within the bandwidth of one transponder on the satellite. Each country is allocated one or more channels and calls are automatically set up by the subscriber remotely changing frequency on the scpc unit when the country dialling code is used.

In the case of the circuits for External Services, special 128 kbit/s pcm equipment occupying twice the bandwidth of the standard telephony equipment was manufactured in the USA and adjacent pairs of telephony channels were allocated by Intelsat for use by the BBC. The system is non-directional as scpc channels radiated by the satellite can be received almost anywhere within the hemisphere. Once the system was in use at Cyprus, other stations could be used to receive the transmissions without further modifications to the system at Madley.

The system falls somewhat short of Direct Broadcasting by Satellite as the power radiated by the satellite is so low that, even with a 30 m diameter dish and a pre-amplifier cooled in liquid carbon dioxide, the carrier to noise ratio is just 22 dB! However, by the very nature of PCM, a programme signal to noise of over 60 dB is obtained under these circumstances and smaller antennas can be used to meet the BBC's requirements.

# Temporary cover for Pebble Mill

*The temporary canopy ready to be extended over the courtyard*

"6.55 Special", from the BBC's studios at Pebble Mill, took on a new look for the summer season. The construction and erection of a temporary large canopy over the courtyard at the Mill has enabled all-weather production of the programme in an external environment. The landscaped gardens provide an ideal setting for the lively musical groups and other items that appear on the programme.

The temporary canopy has been formed by nine steel support girders, each 31 m long, and weighing 2.5 tonnes. A welded cover of Polyester reinforced PVC, 35 m by 31 m, and weighing 1.25 tonnes, extends across the girders to complete the canopy. Tracked steelwork, 45 m long, mounted on the existing roof allows the canopy to be pulled across the courtyard in about 45 minutes by hand; a motorised system will shortly be installed that will considerably speed up the covering process.

The idea for the new canopy came from Eric Benn, Head of Resources and Engineering, at Pebble Mill. This was turned into reality by Consulting Engineers Roy Bolsover and Associates who were the consulting engineers for Pebble Mill, and Keith Jones the Building Engineering Services Manager. The time scale for this project was very short, with only six weeks between placing the order for the steelwork and its delivery on site.

One of the early problems to be faced was the mounting of the tracked support girders over the existing building, which meant using diamond tipped drills into the roof. "No-knocking" agreements prevented daytime work, and to complete the initial work on time, the contractors therefore had to work at night using floodlights.

Meanwhile the steelwork for the span girders was being fabricated at the works of Tubecon Ltd. in Chipping Sudbury near Bristol. "I visited their works with some aprehension," said Joe Jeffries, of Roy Bolsover & Associates, "the girders needed to be precisely 31 m wide or they would not track up and down on the support rails. You have only to look at the quality of the welding to realise that my fears were unfounded. An excellent job, done by a British Company using British Steel!"

The next problem was how to get the span girders onto the Pebble Mill site. 'We were asked to use a weekend to move the girders, but the only one possible in the time was the Spring Bank holiday one!" explained Joe. 'The Department of Transport insisted on these abnormally long loads moving up motorways, which meant special Police escorts from five different forces." Having reached Pebble Mill the problems were just beginning. A huge crane was already in position outside the foyer to lift them onto the roof and, after the lorries carrying the girders had been manoeuvred across Pebble Mill Road, the girders were unloaded, one by one. Two tall trees made this operation even more difficult, but careful handling left minimal damage behind.

Once the nine support girders were in position, the specially manufactured PVC cover was stretched into position. The cover is in fact, made from strips of PVC only 1.5 m wide. Strips are welded together using high-frequency welding techniques. The cover is actually two sheets separated by about 150 mm so that rain noise is reduced.

The temporary cover has already been used with much success during the "6.55 Special" programme, producing an even light, so that the cameras require only to be opened up one stop from the normal external settings and the only additional light required being 'spots' to create shadow effects.

The cover is manually pulled back to the roof of the Pebble Mill Road side of the building as often as possible so that the elements allow the plants to grow naturally in the courtyard below.



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