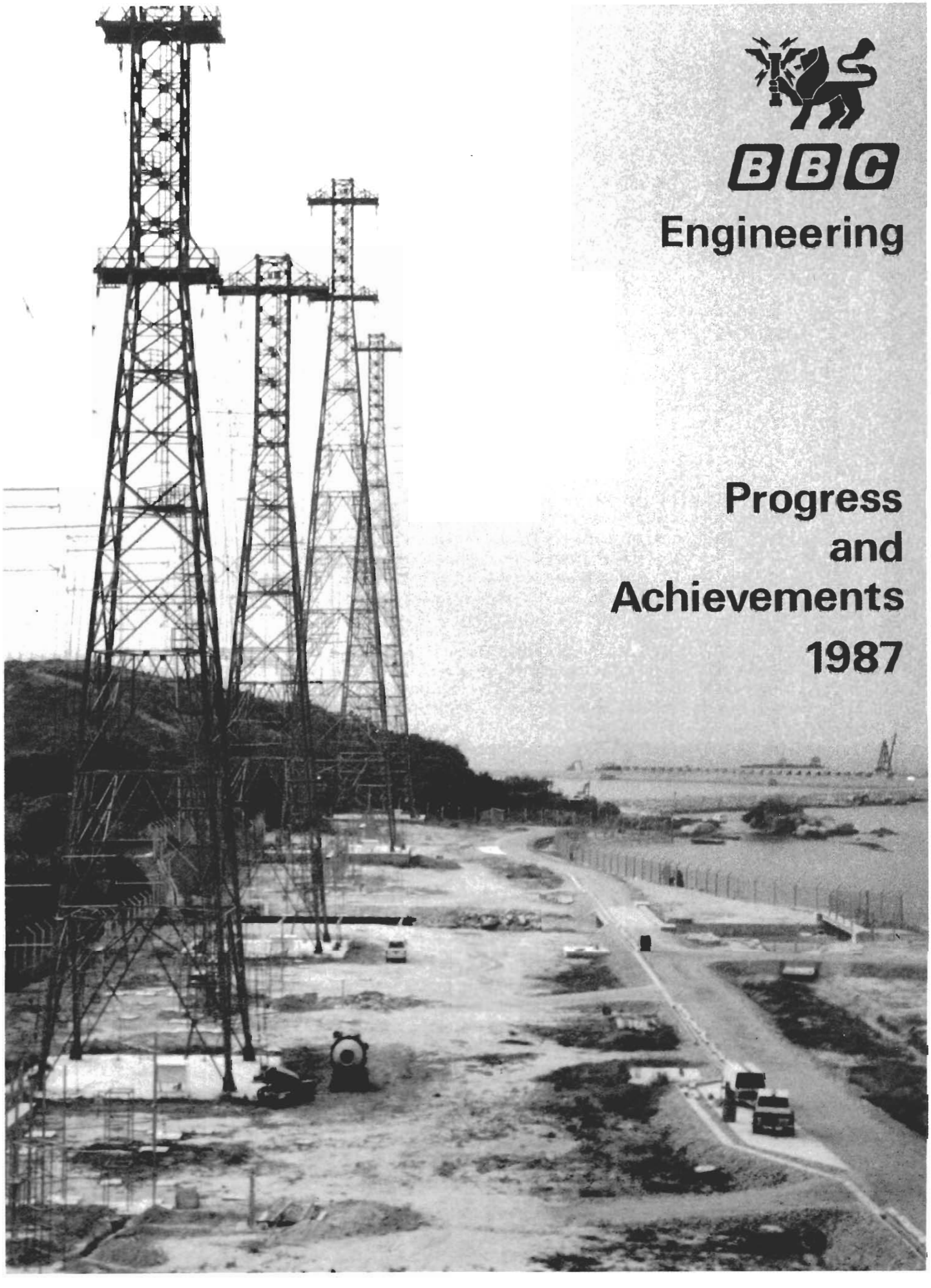


BBC

Engineering

Progress and Achievements 1987

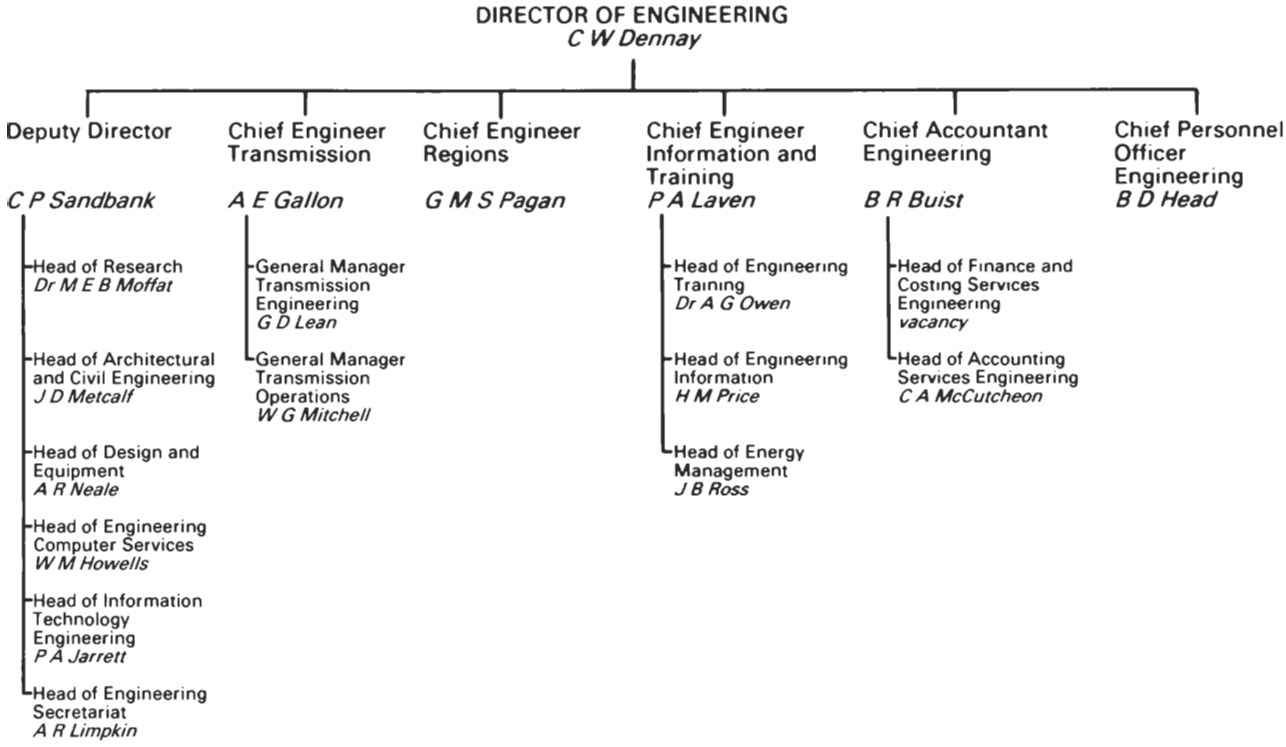
Front cover photograph, taken in February 1987, shows four of the five towers erected for the East Asia Relay Station, Hong Kong.

OVERVIEW

This has been an eventful year for Engineering. In April we received our fourth Queen's Award, on this occasion jointly with the Electricity Council, for our pioneering work in developing Radio Teleswitching. This system uses our 200 kHz transmissions to carry digital signals which control electricity switches and meters in consumers' homes, allowing demand peaks to be smoothed to the mutual benefit of both consumer and supplier.

Radio Teleswitching is an offshoot of what, to broadcasters, is a much more important system - RDS. For a long time we have known that listeners have trouble finding their way round the radio tuning dial, particularly on portables and VHF-FM car receivers. RDS offers the complete answer to this problem, but it has taken years of patient effort through international trials and committees to shape a system that would find favour throughout Europe. All that is now behind us and the launch of the system in England is constrained only by a dearth of receivers: this situation should be rectified early next year, and the launch is now planned for spring 1988.

Some important changes have taken place in the structure of Engineering Division over the last few months. Transmission has been reorganised along the lines of the Output Directorates - Capital Projects is now integrated with the operational departments, and we expect major benefits to accrue from this change. And I have brought External Relations, Information, and Training together under their own Head of Establishment (Chief Engineer, Information & Training).


DIRECTOR OF ENGINEERING
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Chief Engineer Transmission
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General Manager Transmission Engineering
G D Lean
General Manager Transmission Operations
W G Mitchell
Chief Engineer Regions
G M S Pagan
Chief Engineer Information and Training
P A Laven
Head of Engineering Training
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Head of Energy Management
J B Ross
Chief Accountant Engineering
B R Buist
Head of Finance and Costing Services Engineering
vacancy
Head of Accounting Services Engineering
C A McCutcheon
Chief Personnel Officer Engineering
B D Head

TRANSMISSION

REORGANISATION

Responsibility for transmitter capital projects was transferred from DDE to CET on 6 April 1987.

In addition to bringing the Engineering departments into line with the practices already established in the Output Directorates, the amalgamation was seen to provide the opportunity of removing certain overlaps in responsibility and of providing for a more economic and effective method of working.

A new structure was, accordingly, introduced on 3 August which has combined the Communications and Transmitter Engineering and Transmitter Capital Projects Departments into a new Transmission Engineering Department. The Communications and Transmitter Operations Department has been redesignated as Transmission Operations Department.

The new structure has resulted in an overall reduction of 33 posts and an attendant annual reduction in staff costs of just over £600,000. Further discussions are taking place with the Union on rationalising certain other functions such as the Mechanical Support Services that are presently based at Brookmans Park.

VHF-FM

During the past twelve months, a new VHF filler was put into service at Darvel replacing Ayr, and improved reception was brought to parts of County Londonderry by the introduction of VHF transmissions from Limavady replacing the earlier low power services from Maddybenny Moor. Wenvoe and four relay stations came into service with mixed polarisation, and new "fillers" were brought into service at Winter Hill, Kenley, and Caterham. Frequency changes to conform with the international VHF plan, affecting 30 Local Radio transmitters, have been completed.

In the Dartford Tunnel, motorists using the southbound carriageway can now receive six BBC services which are transmitted from a leaky feeder. This service will also be available soon in the northbound carriageway where the installation of equipment has now reached an advanced stage.

Wenvoe

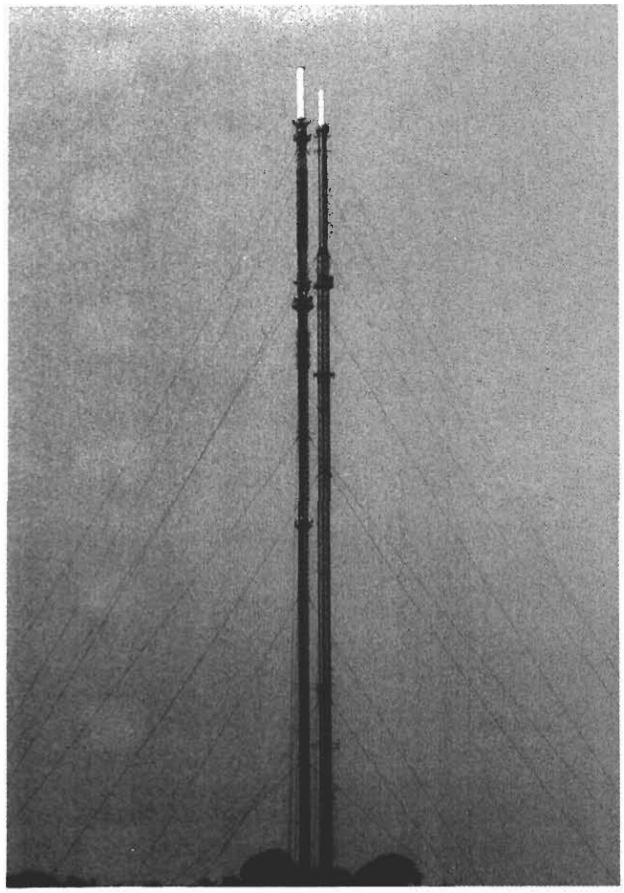
Perhaps the most important single event has been the re-engineering of Wenvoe to radiate high power mixed-polarised VHF transmissions of R1, R2, R3, R4(UK) and Radio Cymru to cover the South Wales and Bristol channel area.

To carry the more complex transmitting antennas needed for mixed-polarised transmissions, a heavier 225 m mast has been erected. This supports not only the extensive VHF array of crossed dipoles but also a new UHF aerial within a cantilever cylinder at the mast head.

The existing linear PCM bays have been relocated and interfaced with the new 6-channel NICAM equipment supplying stereo feeds to the replacement network-fed transmitters; in the case of the Cymru service, more comprehensive opt-out arrangements have been provided.

RDS

1987 has seen extensive work at 10 main stations and 38 Local Radio stations in England. Progress has been very good due to a major commitment of effort on the design, production, and installation of equipment.



The new mast (left) and the old at Wenvoe. The old mast is now being dismantled.

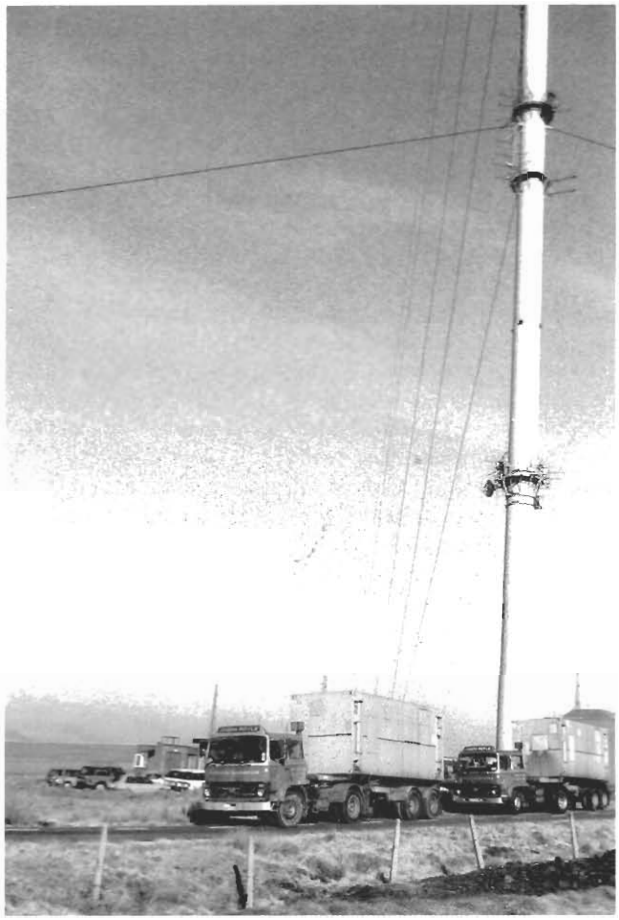
PCM Expansion

The past year has seen the extension of 8 Mbit/s PCM feeds to all but two of the major VHF-FM stations. This has provided an increase in channels from thirteen to eighteen (nine stereo pairs) as far as Kirk o'Shotts and Divis. Revenue savings due to the use of some of these channels for contributions will be made during 1987. Enough channels are now available to serve Radio 1 requirements on VHF, and to provide additional Regional needs.

Work is under way so that by the end of the year Belfast will be the new PCM Distribution centre in Ulster, and both Divis and Londonderry will be PCM fed at the new 8 Mbit/s rate.

When the Rowridge VHF antennas are re-engineered to provide mixed polarisation, the radiation pattern will be modified to reduce the radiation towards the Continent to comply with current international agreements. As a consequence the feed from Rowridge to the Channel Islands will be adversely affected. Experimental work has now been completed which confirms that it will be possible to provide digital feeds from Stockland Hill to Alderney over a UHF link.

One of the two 250 kW transmitters under test at Droitwich.



Standby UHF transmitters, one 20 kW and one 10 kW, leaving Winter Hill for Pontop Pike.

LF/MF

At Droitwich the new 200 kHz Marconi transmitters (2 x 250 kW) entered service in mid-June. A project is now in progress to replace the Radio 3 MF transmitter by the end of this year, completing Droitwich re-engineering.

The MF re-engineering of Burghead is complete and the new LF transmitters are to be installed at the end of this year for the change to 198 kHz in February 1988. New LF transmitters for Westerglen will be installed concurrently with those at Burghead.

Television

Fifty new UHF relay stations were brought into service in 1986, and it is expected that the target of twenty five stations in 1987 will be met. All these stations are very low power.

Re-engineering of the BBC's high power UHF transmitter network continues. During the past year the Winter Hill station in the North West has been completely re-equipped with new UHF transmitters, and work is now proceeding at Pontop Pike in the North East to replace the ageing transmitters there with new high efficiency units. This station, together with Black Hill where work is due to commence shortly, is expected to be completed in the coming year.

The Crystal Palace UHF television transmitters have been partially re-engineered during the past year with new drive equipment and high power combining units. The station is now routinely transmitting 2-channel digital sound carriers on both BBC1 and BBC2, and much programme material has been successfully transmitted, although not on a scheduled programme basis. The new drives at Crystal Palace also support sync-pulsing, which allows a significant reduction in the mains power consumption.

Re-engineering of the older relay stations continues. This large project involves removing the old thermionic transposers which were commissioned in the late sixties and early seventies, and replacing them with the latest solid state technology which requires less maintenance and is much more energy efficient.

External Services

Rampisham

At Rampisham four Marconi 500 kW transmitters have now joined the four AEG 500 kW units in service, using a completely re-engineered aerial system and controlled by the D & ED computerised control system.

Daventry

The first three (of six) new fully automatic 300 kW HF transmitters came into service during the first three months of 1987. Two of these transmitters were installed for the Canadian Broadcasting Corporation whilst the third enabled one of the existing 250 kW transmitters to be relocated at the Far Eastern Relay Station, Singapore. These 300 kW transmitters are computer controlled as

at Rampisham, reducing the need for operational attendance.

Installation of the remaining three 300 kW transmitters is well advanced and these are expected to be brought into service in December 1987 and in February and May 1988. This will complete the transmitter replacement programme at Daventry. Two of the three 250 kW transmitters which are being replaced will be relocated at the Atlantic Relay Station, and the third at Skelton.

Orfordness
Work on the development of the HF extension at Orfordness has been suspended whilst a joint BBC/FCO reappraisal of Orfordness, and other associated developments in the Audibility Programme, is carried out.

Far Eastern Relay Station, Singapore
The 250 kW transmitter, transferred from Daventry, has been installed at FERS. The commissioning of this transmitter during July 1987 brought the total number of service transmitters at this station to nine.

Atlantic Relay Station, Ascension Island
Work on the scheme to provide ARS with a further two 250 kW transmitters has started; contracts have been placed for the erection of the five towers and for the eight new arrays which they will support, the extension of the switch-station, and for the transfer of the transmitters from Daventry. The work at ARS also includes the installation of a new HF automatic control system and, to provide the additional generating capacity for the extra load created by the two transmitters, a seventh 1.36 MW diesel-alternator set will be installed at the power station.

East Asia Relay Station, Hong Kong
After two years of construction and installation work, the East Asia Relay Station is about to become operational. Located in the north-west of the Hong Kong New Territories, it comprises two fully automatic Marconi 250 kW transmitters which can feed any of four Marconi four/five band wide-slew arrays or a 450 kW Brown-Boveri soda test load, via a 50 ohms coaxial switching system.

This is the first BBC HF station to use an unbalanced coaxial feeder system, which consists of Kabelmetal 100/230 semi-rigid feeders and a Spinner 5 x 2 switching matrix, all of which are slightly pressurised with dry air.

Automatic control of the system is achieved using the latest generation of BBC designed control systems. The high degree of automation and monitoring means that from first coming into service the station will be run unattended during the evening and night.

The station is due to begin service on target during September. It will be manned during the day but run unattended for the rest of the 24 hour period. This is the first time this has been attempted by the BBC and the experience gained will be invaluable in the future development of HF station operational practice.

Indian Ocean Relay Station, Seychelles
Civil works for the Indian Ocean Relay Station are now complete and the transmitter building is taking shape. The construction of four towers, forming three antenna bays, each bay containing two arrays, is well under way.

Virtually all of the technical equipment has now been manufactured, and installation will begin in earnest early in November. Like Hong Kong, two 250 kW Marconi transmitters will be used, in this case feeding six Marconi arrays, via Kabelmetal 50 ohm coaxial

One of the two 250 kW transmitters under test at the East Asia Relay Station.

feeders and a 7 x 2 Spinner switching matrix. Here also, the BBC designed multiprocessor control system will be used to permit fully automatic unattended operation, and this system is at present being tested in Western House.

Due to commence service in autumn 1988, this station will radiate the BBC's vernacular and World Service programmes to East Africa.

Lesotho

To improve External Services audibility in South Africa, a new HF service is being engineered in the independent Kingdom of Lesotho. The main items of plant include a 100 kW HF transmitter, an omni-directional antenna and power generating plant. The project also provides for the replacement of the programme feed (off-air reception of ARS transmissions) by a satellite feed and a local SHF/UHF link to the transmitting station. The work is expected to be completed two months ahead of schedule, in October 1987.

Cyprus and Masirah

The transfer of management of the Cyprus and Masirah relay stations from the Foreign Office to the BBC is now complete and BBC managers have taken over the running of these stations.

Broadcast Communication

Network Planning

A re-organisation of the television distribution network in East Anglia is planned, which will give more rational programme routeing arrangements, with improved transmission quality in certain areas, and result in a decrease in revenue costs.

Planning work is currently being undertaken in Northern Ireland to provide a comprehensive system of reserve programme feeds for Radio and Television and also to provide a vision contribution circuit from Londonderry to Belfast.

As part of the move of TV operations from New Bridge Street in Newcastle to the new premises at Fenham, analogue vision circuits using optical fibres have been brought into service between Fenham and Newcastle Network Switching Centre.

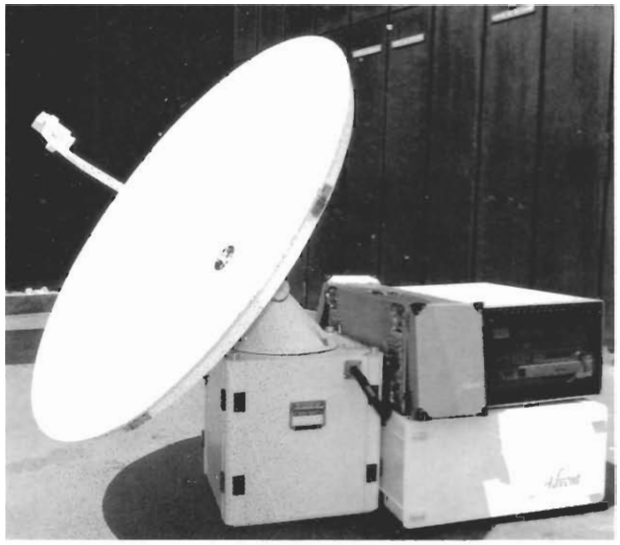
Satellites

The satellite feeds to Lesotho have been commissioned and put into service.

Agreement has been reached to provide European Broadcasters and operators within the European area with programme feeds of the World Service and a European language stream, and this became operational during August via the Eutelsat IF-1 Satellite.

Advice and assistance were provided to Enterprises and External Services for the provision of 8-hours a day of BBC1/BBC2 programming, World Service, and a European Language stream to Scandinavia. The service commenced on 4 June 1987.

A portable satellite transmitter was provided, at short notice, for Television News for use in the General Election period. This 300 watt terminal has been constructed in the form of individual case-packed units to enable the system to be carried on scheduled air flights. The 1.5 metre diameter dish is constructed from six "petals" to enable it to be taken apart for transit. Equipment was loaned by the manufacturer for the General Election period and the final equipment is expected in September.



Portable satellite transmitter ready for operation

Radio Links

The television OB radio link reception site in Bristol, on the Royal Fort site, is being completely refurbished and provided with a permanent rotatable SHF aerial system. Additional facilities have been included in the control room on site to enable an expected increase in OB activity to be dealt with. The installation will be available for service in October 1987.

The first phase of the re-engineering of the Television OB reception facility at Divis has been completed. This phase covers additional facilities and re-location of equipment to extend equipment life and ease maintenance. Phase 2, to undertake a complete refurbishment and to increase facilities, will be undertaken after 1988.

Two new London "Radio Taxis" have replaced the earlier versions. These vehicles are equipped with a radio link system operating into a number of reception points in the London area and are now in daily use.

Three Television OB radio link vehicles are being produced, based on a standard extended-wheelbase Land Rover. These vehicles are for Television Outside Broadcasts, Television News and the Topical Production Centre. On-board power generators are included and each vehicle will have SHF radio link facilities together with vision and sound switching and distribution systems: each vehicle will have a telescopic mast for mounting a rotatable SHF aerial, and a comprehensive communication system. The first vehicle is expected to enter service at the end of the year.

A VHF radio-telephone communication system has been engineered to provide coverage of South Wales. Four base stations have been equipped at Wenvoe, Carmel, Presely and Blaenplwyf. The system will operate with 20 mobile units and will allow efficient deployment of reporters and Portable Single Camera operation in the area.

A similar but larger and more complex system is being engineered in London for Television News. This system, known as "Spurnet" comprises three base stations controlled from Television Centre with approximately 115 mobile units and is used to coordinate the activity of Television News Reporters, Cameramen, lighting units, ENG and other technical facilities. It is expected to go into service in February 1988.

Ancillary Frequencies
A joint Frequency Management Group has been set up by the BBC, the IBA and the ITCA to administer the radio spectrum allocated by the Department of Trade and Industry (DTI) to the Broadcasters for ancillary services. The amount of spectrum available assumes dynamic sharing of spectrum between the Broadcasters. The first phase in the establishment of an ancillary frequency data-bank has now been completed. The Radio Investigation service of the DTI is showing an increasing interest in the Broadcaster's activities and consequently there is an even greater need to use the radio spectrum in the most effective manner.

Transmitter Operations Reorganisation
A reorganisation in the South East of England, in line with a similar exercise in the South West, is now under way. A new Team Base is being set up at Wrotham to cover the old Crystal Palace, Dover and Heathfield team areas, south of London. A mini-team will operate out of Brookmans Park to cover sites north of the river, while Hannington will take over most of the Oxford area.

Monitoring and Control
All the Monitoring and Information Centres (MICs) have now been modified to store 'All UK Data'. This means that the teams fitted with Data Dissemination equipment can now receive up-to-date fault information across MIC boundaries.

Computers
All Transmission Operations head office sections in Henry Wood House have Burroughs B25 computers linked to TRISTAR (Transmitter Information Storage and Retrieval),the database holding comprehensive information on all transmitter stations and their equipment, and it is planned that Transmission Engineering machines will be similarly linked; the MIC stations are now in the process of receiving their B25s. The ability of everyone to contribute to, extract from, and cross reference the information held on TRISTAR is proving a very useful tool for managers in increasing the efficiency of the Department.

Communications Operations
During the BT strike the flexibility and resourcefulness of sections of Communications Operations were fully stretched in finding alternative routeings for the variety of circuits which were affected.

Another testing occasion was the General Election results programme. The number of OBs and special feeds surpassed all other elections making June 11th and 12th and the preparation days prior to the election the busiest period on record. To give some idea of the size of the operation, the number of audio local ends permanently connected between BT and BBC in London for "occasional" use (OBs and temporary circuits generally) is 115. For the election period an additional 245 were provided, making 360 in all. These were used for extension to OBs - Television and Radio - and inter-regional use.

On the vision side, virtually every BT protection channel in the country was in use, and all the available vision circuits between Tower, BH and TC were allocated. There was, however, a shortfall in the number of television OB radio links provided by BT and the number available was augmented by the use of four mobile satellite earth stations working "time spaced" into two satellite transponders.

All in all it was a very successful operation which stretched BT and BBC facilities to the limit.

Support Services
Thirty-three new sites were found and progressed in the last year (22 UHF, 2 MF, 2 Link and 6 Radio Car Base). The average time from receiving the brief to gaining access for building is approximately 2½ years.

Radio Communication growth continues in the public and private sector and our annual income from site sharing and grazing rentals is in the order of £1m.

Safety continues to take up significant time both corporately and departmentally. The main issues have been asbestos and PCB (polychlorobiphenyl) hazards and the need to reassure staff exposed to ionising and non-ionising radiation. An epidemiological survey has been initiated by the Chief Medical Officer to assess the health of staff working in RF fields: this study has the full support of BETA and the National Radiological Protection Board.

TELEVISION

LONDON STUDIOS

Lime Grove

The film dubbing theatre at Lime Grove has recently undergone a major refurbishment by PID Tel, with minimal use of outside contractors. A new control desk (Calrec 28-channel) and small studio have been installed and the working arrangments transferred to forward projection from the old back projection system.

An unusual part of the refurbishment is the new dubbing studio. A prefabricated galvanised steel acoustic cabin was purchased and constructed on top of a concrete screed. This is the first medium sized studio to use this arrangement, which fully meets operational requirements, including the 0.1 second reverberation time.

Lime Grove dubbing theatre mixer room

Television Centre

TC5

Television Centre Studio 5 re-entered service in February 1987 following a complete refurbishment carried out in-house by PID Tel. The facilities in this studio, with its associated Graphics area, are tailored to the needs of Sport. A radically different approach to the vision system design, involving the integration of vision mixing with other vision selection facilities under common software control, enabled the high level of facilities required to be provided with fewer parallel timed paths.

To maintain picture quality, all routeing and processing is in component form. This allows composite graphics from a variety of sources to be created layer by layer with minimum degradation. Careful design has meant that facilities are available not only to TC5 but also to other areas via CAR.

TC5 Sports Graphics design area

TC4

TC4 was only partially re-equipped during 1983, and the current refurbishment is primarily concerned with those points not dealt with then, notably lighting and sound, while meeting the programme planning requirement of equipping the studio to match the facilities of TC3 to provide interchangeability.

The vision system is being enhanced, and a new sound desk is currently under acceptance from Calrex Audio, having 72 channels, 24 of which will be stereo-capable. More significantly, it will be the first assignable sound desk at Television Centre, in which a computerised system and customised software remotely control the processing of the analogue audio signals in bay-located voltage-controlled amplifiers.

The studio will return to service in December 1987.

TC1

Contracts were placed in June/July 1987 for new vision, sound and communications facilities for this studio, which will be taken out of service in January 1988 for complete refurbishment.

ICCA

The International Control and Commentary Area has been refurbished to produce two new production control rooms and greatly increased capacity for sound and vision routeing in the International Control Room (ICR). A new electronics graphics area has just entered service which provides enhanced pictures for all news bulletins.

Sypher 3 and 4

This project has been seriously affected by very late delivery of the new 5000 series sound desks from Solid State Logic. It is expected that both Sypher Suites will be handed over by October 1987.

SCAR

A new Spur Central Apparatus Room (SCAR) has been introduced to replace the old area which had seen service dating back to 1969 when News moved from Alexandra Palace, no major work having been done since then. The new SCAR was essential to service the requirements of the recently refurbished News studios on the sixth floor, the addition of a large VT area on the fourth floor, and many other support areas.

News

The refurbishment of the News areas in TC Spur is virtually complete. However, following the recent decision to transfer Current Affairs from Lime Grove to Television Centre (as an interim move prior to the White City development) a further major rebuild of graphics and video tape facilities, plus modifications to SCAR, will be required.

Weather Office

With the advent of Daytime Television in autumn '86 it was decided to have short weather bulletins hourly with the News. To accommodate this a camera was installed in the Weatherman's office. It was initially a simple arrangement to feed only the Network Controls, but due to increased demands it is now set up as a studio and can operate as a source to anywhere, including twice daily to Superchannel. Audio output is controlled automatically using an Innovonics 260LM Audio Processor.

Fixed lighting is used in the office and to control the balance of light between outside and inside a polarizing filter is fitted to the window and a rotating polarizer is fitted to the camera. Rotating the camera filter adjusts the light the camera sees coming from the window.

Stereo Facilities

At present experimental stereo material for the Crystal Palace transmissions is being originated from a small area at TC which has been equipped with simple sound mixers and a CD player. In addition, separate stereo feeds are obtained from a small number of programme sources and fed to Crystal Palace.

In order to rationalise this situation so that the Crystal Palace transmitters can radiate programme stereo sound, the central areas at TC are being modified so that they can handle stereo. This will also mean that no further work is required in these areas when the BBC starts a stereo service proper.

Two Network Controls and the Central Apparatus Room will have been modified for stereo working by autumn 1988. It is worth noting that in CAR the 27-year old uniselectors will continue to be used for stereo routeing!

General Election

The studio installation in TC3 had to be greatly enhanced so that it could meet the complex programme requirements, and additions were also made to TC2, although to a lesser extent.

The VAX 11/750 computer system was upgraded, and the Ethernet system was expanded into areas such as News and TC3 which, together with TC2, housed the results input, data manipulation and output control for the system on the night.

Additional graphics equipment was provided, and much temporary equipment was installed on the studio floor and integrated into the main system in order to realise the "Battleground", which showed tables of critical constituencies and pictures from OBs etc.

TELEVISION RECORDING

During 1986 some 43 new "C" format machines were ordered, but 1987 has shown a sharp decline in number: only six have been ordered so far. The total number of "C" format machines purchased by the BBC is now 262 Studio and 27 portable. It is interesting to note that at the recent Montreux Symposium Sony introduced a new "C" format full facility machine, the BVH 3000, at a price getting close to that of the new component analogue machines.

Sony D1 digital VTRs have also been ordered, with two due for delivery in September 87 and a further three to be delivered in 1988. These will be used in Television Service to gain experience of the format in areas which will make the best use of their "transparent" processing. A further machine has been ordered for Research Department for delivery in April 1988 where it will be used as a research tool.

The year has also been an eventful one for new component analogue formats, with both Sony and Matsushita showing second generation component-analogue video cassette recorders at NAB and Montreux. Both types have been ordered for delivery in the autumn but the equipment is still under development and will probably not be fully developed until late 1988. Improvements in the new equipment compared with the existing Betacam first generation equipment include wider bandwidth luminance and colour difference channels and two FM audio channels, with an option to have two PCM channels at the expense of one longitudinal track.

The main jobs completed since the last meeting include a replacement VTR vehicle for the ill-fated Kendal Avenue vehicle which was written off in Spain last year; the Record Bank at Television Centre which makes the first use in the BBC of the EBU/SMPTE Remote Control Bus; the completion, but not the putting into service, of the recording elements of Newcastle's new headquarters; and improvements in the VTR Area in Norwich.

One more unusual project was the creation of a viewing area within the Videotape library at Brentford. This enables production staff to View Quadruplex, "C" Format, and "U-Matic-H" tapes from the library and to make VHS copies.

On the telecine front, collaborative work between RD, D&DE, PID Tel and Television recording has significantly improved the performance of the Cintel MK III Digiscan telecines, and at the same time Cintel has dramatically improved the performance of the digital aperture corrector.

CAMERAS

The announcement in autumn 1986 of the withdrawal of the Link 130 camera initiated an intensive programme to assess alternatives. This led to contracts being placed in March 1987 on Ikegami and Thomson for the provision of 49 cameras for projects dependent on the Link 130. These included the Type 6 CMCRs (see below), Leeds, Glasgow 'A', Newcastle and TC5. Temporary camera arrangements were made to bring Leeds and Glasgow into service, TC5 has its permanent cameras, and Newcastle's permanent cameras are presently undergoing acceptance testing.

PSC

The purchase and commissioning of PSC equipment continues apace. More than 500 U-matic machines have been supplied, and 18 of the new CCD cameras.

Type 6 CMCR covering the Llanelli-Pontypridd rugby match at Stradey Park on 5 September.

OUTSIDE BROADCASTS

Type 6 CMCRS

Five of these 6-camera television OB vehicles are under construction for use in Scotland (two vehicles), Wales (two) , and Northern Ireland (one). The first vehicles should have entered service by spring 1987 but suffered a major setback when the Link 130 camera, around which the vehicles were designed, was withdrawn from the market after numerous delivery delays.

A rapid survey of alternatives in late 1986 resulted in a contract being placed for Thomson cameras but at the cost of delaying the Wales and Northern Ireland service dates. One of the Welsh vehicles has just gone into service, and the others should be operational by the end of the year, both with borrowed cameras; full specification cameras will be fitted in the spring of 1988. The Northern Ireland vehicle is already in service as a control room utilising the cameras on the old vehicle. It will have its new cameras fitted and be put into full service next May. The Scottish vehicles, due in service in 1988, will hopefully be unaffected.

The early Type 6 vehicles, long completed but lacking cameras, have not been wholly wasted. One was rushed into service as a central control room for last year's Royal Wedding using camera feeds from other vehicles. It was used again, in a similar way, at the London Palladium earlier this year when a hired vehicle proved to have inadequate production facilities.

Master Sound Control Vehicle

A replacement for the MSCV, long awaited by London Tel OBs, has recently entered service. This vehicle is equipped with very complex sound facilities and no vision equipment other than picture monitors and a simple camera used to give the sound supervisor as independent view of stage activity. It is used on television OBs where the sound content is paramount and is felt to be too complex to be handled with the more limited facilities available in a normal OB truck.

The new vehicle has a Calrec assignable desk, the first of its kind in the BBC. In common with all such desks it does not have specific numbers of groups and channels but has 112 inputs which can be configured to create the number of groups and channels, stereo or mono, which are required. The vehicle can be used for live programmes or for recording, for which purpose it is equipped with two 24 track-recorders.

The absence of vision equipment has made it possible to create a more spacious environment than is normally possible in the television fleet. The opportunity has been taken to increase the wall thickness, improving the sound isolation and acoustic properties. The reduction in desk size resulting from the use of assignable controls has also helped the design of a much improved operational area with good listening characteristics.

COMPUTER PROJECTS

A small PID Tel team, working in conjunction with Head of Television Computer Services, define and implement a strategy for computer based developments in Television. Some schemes use the mainframe at Sulgrave House while many distributed processing systems utilise small mainframe, mini or microcomputers integrated via local area networks and external communications. A notable recent project included the Television News electronic newsroom system, which was installed in four months so as to be ready for "Daytime" news bulletins.

DATACAST

The BBC's Datacast Service of data broadcasting was launched in October last year and is now carrying data for customers (including Joe Coral, the bookmaker!). The system is being marketed by Enterprises, and over the coming months the number of customers using the system is expected to increase further, producing useful income for the BBC.

Data is sent direct by line to Television Centre, where, after being incorporated into teletext-compatible "packets", it is inserted on an allocated line in the vertical blanking interval, thus making further use of the spare capacity in the television signal waveform.

Transmission equipment has been provided by Research Department and a receiving terminal designed by D & ED has been licensed to manufacturers for a commercial sale.

Interior of Television's new Master Sound Control Vehicle (MSC 3)

RADIO

Organisation

The beginning of the year saw the final consolidation of the Radio Engineering departments following the changes of 1986. Good progress has been achieved on all fronts with the possible exception of Local Radio, where the need to reconsider priorities following the formation of the new Regional Directorate has led to some delays.

London Studios

In London, the major schemes mentioned last year are on target. The Drama Studio 6A and the Concert Hall in BH are both being completely refurbished and are due in service in October. This completes the present round of BH studios with the exception of 8A, where the noisy building work has been done in advance to coincide with the out-of-service period of 6A and the Concert Hall. 8A will re-enter service when the Portland Place studios are discontinued.

In the Network areas, Continuities M and Q are in the handover and training phase at the time of writing. These suites represent the first use of commercial mixing equipment in network continuity applications and have paved the way for future refurbishments.

In London Control Room the last valved amplifiers have finally been removed and solid state routeing equipment will be installed to replace the uniselectors by the end of the year.

Outside the technical areas, replacement of worn out production office tape machines has continued apace with the first batch of the new Studer A807 recorders entering service. Inevitably, various teething problems have occurred with this new equipment. Several improvements suggested by the BBC will be incorporated in future production. Satellite receiving equipment has been installed to provide feeds of Superchannel and Cable News Network to areas in BH.

New Continuity Studio M in Broadcasting House, equipped with SSL 5000 desk.

New Belfast Newsroom shortly before it entered service.

Outside Broadcasts

On the Outside Broadcast front, contracts have been placed for four medium size "Type B" vehicles and six of the smaller "Type C", all for service during 1988. These will all replace worn-out vehicles in London and the Regions. A special "Roadshow" vehicle has recently been delivered to Wales and another is being supplied for Northern Ireland.

Regions

The English Regions now include Local Radio, and Radio Capital Projects has been restructured to reflect this. A single Project Manager now looks after all aspects of Radio work in a given region.

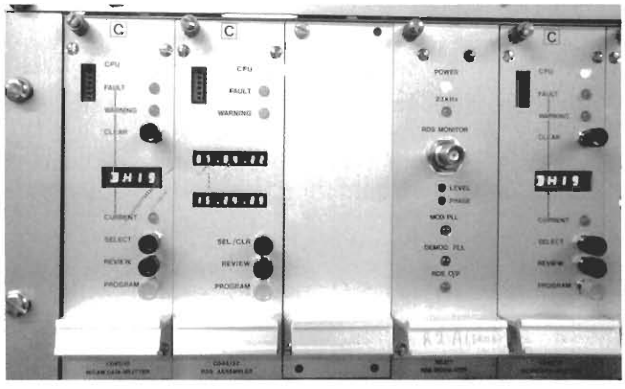
Radio Oxford and Radio Lancashire (Blackburn), are both being relocated and re-equipped in new purpose-built premises and BBC Essex (so named to avoid confusion with the commercial station Essex Radio) went on the air late last year. Premises have been acquired for the new stations, Wiltshire, Hereford & Worcester, and Warwickshire (in Coventry), and the studio headquarters building for Radio Gloucestershire is nearing completion. Additonally, facilities are being enhanced and expanded at Radios Norfolk, Northamptonshire and Cornwall.

In Manchester, Studio 4 is presently being refurbished including the provision of a new mixing desk.

In the National Regions, the main work in Northern Ireland has been the establishment of the new Newsroom and Studio 2 complex which was opened in the summer. In Scotland, the major project is, of course, Edinburgh. Decanting is under way at the time of writing prior to the major modernisation of the Queen Street premises: the remaining part of the premises which did not belong to the BBC was purchased this year. A new studio block is being built at Inverness and refurbishment work is also in progress in Aberdeen. In Wales, the major work is centred on Bangor where the new block to replace, at last, the temporary buildings is now well under way.

Developments

The major activities have concerned digital audio, as in previous years, but 1987 will be remembered for the introduction of RDS. Virtually all VHF transmitters in England will be on air with RDS this year, and planning for the National Regions has commenced. The response from the receiver industry is now encouraging and models from several manufacturers are expected, although initially these will all be car radios.



RDS encoder (Radio 2 at Sutton Coldfield).

The disk-based audio editor developed by Research Department and mentioned last year is on the point of entering service. It is too early to comment on operational aspects but a number of manufacturers remain interested in the development and several discussions have been held. The equipment is being installed in a newly designated suite in BH which will handle digital recording, editing and transmission work, tidying up for the first time the somewhat ad hoc arrangements which had existed to date. By the year end it is expected that the capability to link digital contributions or recordings directly to the distribution will be available, thanks to work being done in Design Group on a digital continuity mixer.

Also of significance during the year has been the agreement of a new frequency plan for Local Radio radio links following the loss of part of the 141 MHz band. The replacement of worn-out links can now proceed.

Operational Engineering

The year has been dominated by Election broadcasts: the Local and General Elections in Britain required, as usual, extensive special arrangements. Several studios were specially rigged and an intake area was created. As usual, production staff took full advantage of the maximum capabilities of the system and more facilities were provided than ever before. In addition, the Australian and German General Elections required the provision of facilities in Sydney and Paris, as well as London, Paris being involved as a convenient mid-point for circuits.

Computers

On the Computer front, Radio's Information Technology strategy is being pursued with the development of three new departmental mainframe systems. The first stage of the Drama System was installed in July for data take-on, and the Radio 2 system is planned for December. The third system will assist in the management of current recordings in Radio.

IBM compatible microcomputers have been adopted as the standard workstation and have been used on the five Local Area Networks so far installed. Novell Software has been used and three of the networks have gateways to the ICL mainframe.

An automatic Music Logging System using bar codes on records is being installed in Local Radio Stations. This will reduce the work of reporting music broadcast and improve the accuracy of the reports.

Other Projects

Out of the remainder of the work handled in the Group during the year the following examples will serve to indicate the variety.

A microcomputer-controlled system has been developed to produce test tapes. Over 1,000 test tapes of various kinds are produced and distributed by Radio Engineering each year and the demand is not fully satisfied. The new system will allow efficient, accurate production and replaces a variety of old equipment.

Technical evaluation work has been undertaken on a wide variety of equipment but perhaps the most significant in the long term will prove to have been the initial evaluation of an R-DAT recorder.

One of the most time-consuming routine activities has been the checking and acceptance of new tape machines. Tape machine manufacturers have responded to this problem by providing serial interfaces through which machines can be controlled, and Radio Engineering staff have put together an automatic test system using a BBC microcomputer which greatly reduces the checking and line-up time.

Some Radio programmes, e.g. "You The Jury", involve audience participation by voting. New microprocessor-controlled systems for this have been installed in the Paris theatre and Concert Hall in BH. The system displays the total number of voters, those for and against the proposal, and automatically computes the percentages.

Finally, mention should be made of the Tape Services operation located at Daventry which distributes audio tape to all BBC centres as well as operating a reclamation system. The costs of the unit are fully covered by the tape and spools reclaimed.

"Roadshow" vehicle recently delivered to Wales.

EXTERNAL SERVICES

Bush House Modernisation
The refurbishing of studio facilities in the North West Wing continues. This involves the construction of two medium talks studios and a green room. Completion is expected early in 1988.

The complete rebuilding of the air conditioning system for the South East Wing DIY studios has been completed, as has the refurbishing of the technical facilities.

Work has just started on the rebuilding of the 2nd floor Centre Block to accommodate Topical Tapes. Once the area is completed and the 7th floor Centre Block has been cleared, work will commence on Centre Block studio refurbishing.

The reconstruction of the Emergency Control Room for the Central Technical Area (CTA) has been completed and full operational tests have been carried out. The first phase of major work associated with the rebuilding of the CTA has now started. The total CTA project is scheduled for completion in 1991.

Transcription Recording Unit Studio KH1 is now in the process of being rebuilt. In order to maximise the use of both the vehicle and KH1 a similar Solid State Logic desk to that installed in TRU's new vehicle is being fitted.

Caversham Modernisation
The construction of the new extension is now nearly complete. The computer system contract has been placed with Honeywell and some hardware has now been installed in the new Computer Room, enabling training to commence of Engineering system maintenance staff.

At Crowsley Park satellite dishes 1 and 2 are now in limited operation. Delays in the supply of controlling software have resulted in full operational service being delayed.

WARC : Geneva
The WARC HF conference took place in Geneva during February and March 1987. If adopted, the radical nature of the proposed planning system would have had severe implications for External Services, denying us of at least 40% of our current frequency usage. A joint delegation comprising the FCO, DTI, and BBC conducted an effective and highly admired campaign throughout the six weeks of talks, leading to a decision to defer the action on any planning system for at least six years. Whilst this may appear a not wholly positive outcome, it represents the most that could have been anticipated given the diverse views expressed before and during the conference.

EDS
External Services' current Electronic News System, the first in the BBC, is now approaching the end of its useful life. Radical proposals for the replacement of this system have been made to the FCO and detailed discussions with possible suppliers of the new equipment are in progress.

Satellites
In the past year External Services have negotiated the use of two different satellite transponders serving Europe. Currently the programme material consists of a vernacular stream of European Languages and World Service. The primary aim is to provide a high quality service to cable system and local radio stations for live rebroadcast.

Transmission
External services transmitter projects are covered under the appropriate heading in "Transmission" at the beginning of this Report.

Transmitter building for the Indian Ocean Relay Station, Seychelles, August 1987.

AROUND THE REGIONS

WALES

Cardiff

Studio C2 will be taken out of service during 1988 for a complete refurbishment; temporary studio facilities will be provided in a radio studio. Currently, PID Tel is seeking tenders for the technical installation.

The BBC has completed the purchase of the School of Home Economics from University College. This site, immediately opposite BH at Llandaff, will replace the Gabalfa site which was purchased five years ago for the expansion associated with S4C. In due course, the Gabalfa site will be sold.

SCOTLAND

A new television continuity suite has just been commissioned in Glasgow. The suite, fitted with the latest audio/visual equipment, is in a former sound control room. It has a presentation control room, small television studio, caption room and lobby, and replaces the existing 22 year old television continuity facilities. The old suite is to be converted into a computer graphics area.

NORTH EAST

Leeds

Studio A went back into service in December 1986 after a full refurbishment. Due to withdrawal of the Link 130 it was necessary to temporarily retain the EMI cameras. Completion of Studio D, with enhanced dubbing facilities, and installation of Ikegami cameras in late 1987 will conclude this total refurbishment of the Leeds TV Studio facilities.

Newcastle

The technical installation of Studios A and B in the new Regional Broadcasting Centre was completed at the beginning of 1987 with the exception of cameras (due to the withdrawal of the Link 130). Ikegami HK-323 and HK-323P cameras will be installed during September 1987. Training and programme work-ups will take place in October and the service date is scheduled for November 1987.

The transfer of the regional Television operation from New Bridge Street is planned for mid-January 1988.

SOUTH AND EAST

Considerable adaption work has been carried out at Elstree to house staff for the new South and East Region.

Contracts were placed in July 1987 for extensive work on the technical facilities in Studio 'D' at Elstree to bring them up to the standard required for a series of 'Allo 'Allo' starting in December 1987. This kind of urgent enhancement of existing facilities would previously have been handled in-house, and the performance of the contractor in this new role will be a useful pointer for the future.

Local Radio in the South and East

The planning of three new stations for Suffolk, Surrey, and Berkshire goes ahead but implementation is, of course, dependent on BOG approval.

A new approach is being taken in Reading for Berkshire. This will be an opt-out of the Surrey station and will broadcast locally originated material for some five hours a day, and take Surrey-produced programmes and network material for the remainder of the time. The station will have two main cubicles and no separate studio but retain most other facilities, contained in 5000 sq ft premises. The cost is estimated at 60% of that for a full station.

Work has already begun at Radio Norfolk and Radio Northampton on schemes to improve and refurbish production areas and provide News Preparation Studios. The opportunity has also been taken to install modern telephone exchanges and their associated equipment.

MIDLANDS

Birmingham

The construction of the Programme Service Block at Pebble Mill started last March and building is well under way. It is due for completion next spring when the Graphics operation will be consolidated adjacent to the studios. Costume Department will - for the first time - be able to work in daylight instead of the basement of Studio A.

NORTH WEST

Carlisle

Responding quickly to the re-organisation of the Regions in the North West, a PSC editing suite has been installed in Carlisle, taking advantage of ex-Commonwealth Games machines, to provide additional news gathering capability.

Manchester

The BBC's most sophisticated audio post production suite has opened in Manchester with facilities for film, television and radio under one roof for the first time. The suite, on the site of the old dubbing theatre at New Broadcasting House, took two years to complete and combines all the facilities of a sypher suite, a video post production unit, and post production for 24-track radio.

SOUTH AND WEST

Bristol

Work has continued on the Bristol Phase 2 development which will ultimately contain post production, restaurant, and club facilities. The new club opened for service at the end of June 1987, quickly followed by the demolition of the old club to make way for the third new block of Phase 2. Final completion of the whole project is expected in the fourth quarter of 1989.

The Christchurch Radio Studio in Clifton has been refurbished to a high standard of technical performance:

Christchurch studio in Clifton with SSL 6000 desk

facilities include a Solid State Logic 6000 desk, and a wide range of acoustic areas are available throughout the building.

The Link 120 cameras on the Bristol OB Unit have been replaced with Ikegami 79Es. There will shortly be four Regional PSC editing suites in operation and also a dedicated regional graphics area.

Radio Bristol took delivery of an OB vehicle, fitted out with a 24-channel Chilton mixer.

Plymouth

The major event in Plymouth during the past year has been the closing of Film Processing at Broadcasting House and the advent of the all-electronic regional news programme. This was achieved by equipping the mute film cameramen with either single-tube Betacams or a combination of CCD camera and portable Beta recorder. The latter arrangement is quite bulky but works remarkably well and it is hoped to extend it to the Channel Islands within the next year.

The change to video tape for news has meant an expansion in editing suites. Plymouth has taken delivery of a third PSC suite and the fourth is imminent. A single Beta player has been provided and it has been engineered into the system so that it can be used in any of the suites. At the same time, the number of one inch machines has increased to three, providing much greater flexibility in the video tape area.

Graphics continues to expand: a Rank Cintel Artfile has been installed and the whole of the graphics area has been rebuilt.

Approval has just been given to lease new premises at Plymouth for Radio Devon. The move to the Old City Treasury Department, a city centre site, will help to relieve Radio Devon's shortage of office accommodation at Seymour Road.

Southampton

The new Cintel Artfile has been installed in a temporary location, and the next phase of development of the recording areas has just started.

A design brief has been issued for the proposed development of the West Park Road site opposite the Civic Centre as a new regional centre. The requirement is for a building of some 5,300 square metres gross, to house BBC Radio Solent, Regional Television, and associated shared facilities. An outline planning application has been submitted to the Southampton City Council and detailed costings are being prepared. Subject to financial approval, site work is planned to start in summer 1988, with service dates of summer 1990 for Radio Solent and late 1991 for Regional Television.

Radio Cornwall

Radio Cornwall's project to refurbish the newly acquired Trafalgar Gallery premises in Truro continues. The scheme includes provision of a news preparation area and a long-awaited OB garage.

New Local Radio Stations

The building work on the studio centre for Radio Gloucestershire (London Road, Gloucester) is nearing completion. This is the first local radio station to be built using non-BBC specialists. The technical installation will be carried out by RCPD and it is hoped that the station will open in the autumn of next year.

At Swindon, a building has been purchased for conversion to a studio centre for Radio Wiltshire. An opening date has yet to be fixed.

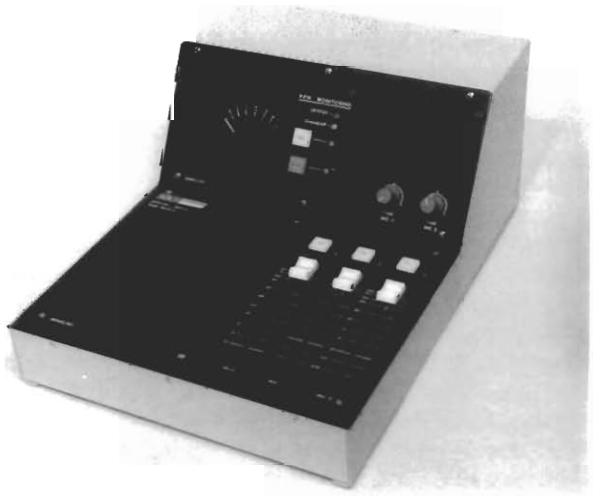
DESIGN AND EQUIPMENT DEPARTMENT

Avenue House
Work is well under way at Avenue House, Chiswick, to provide accommodation for D & ED staff presently housed in central London. A two-storey extension is being added, and two existing floors are being completely gutted and refurbished. As the building continues to be occupied throughout, the work is being carried out in phases, and requires a great deal of forbearance and understanding on the part of the staff who continue to work there.

DESIGN GROUP

Radio Data
Design Group's contribution to the launch of the Radio Data Service has fallen into two parts. The first was the development of the equipment for the transmitters: 110 sets have been manufactured by D & ED and installed by TCPD. The second part of the work has involved the programming of the computer: this is installed at Broadcasting House and generates the dynamic data which is transmitted over the data channel of NICAM to be combined with the static data generated at the transmitters.

Digital Audio Developments
Further items of digital audio equipment have been developed and are being brought into service. Among these are a simple digital mixer for the digital tape transfer suite at Broadcasting House and a system which will allow signals from digital sources, such as OBs and digital tape recorders, to bypass Continuity and reach the transmitter before they are converted to analogue. The continuity announcer's voice is converted to digital form before mixing with the digital contribution. The process involves, among other things, digital conversion between NICAM contribution and distribution bit-streams at 32 kHz sampling frequency and the AES-EBU standard at 48 kHz sampling frequency. These installations are providing invaluable experience with handling digital audio in a broadcasting environment.



Digital audio mixer control desk

Digital Video
Following the installation in 1986 of a digital video mixer in the electronic caption preparation area, further mixers have been built and installed in TC5 and in News, the latter in time for the General Election. The mixers provide two-channel mixing with four modes: cross-fade, mix, key and matte. They are used in conjunction with Slide File to provide loss-free multi-generation compilation of captions.

Datacast
The datacast receiver, which was designed to stimulate interest in the service, has been licensed to a number of manufacturers. Help has also been given to Enterprises to deal with technical enquiries and problems, and the service is now beginning to generate substantial income.

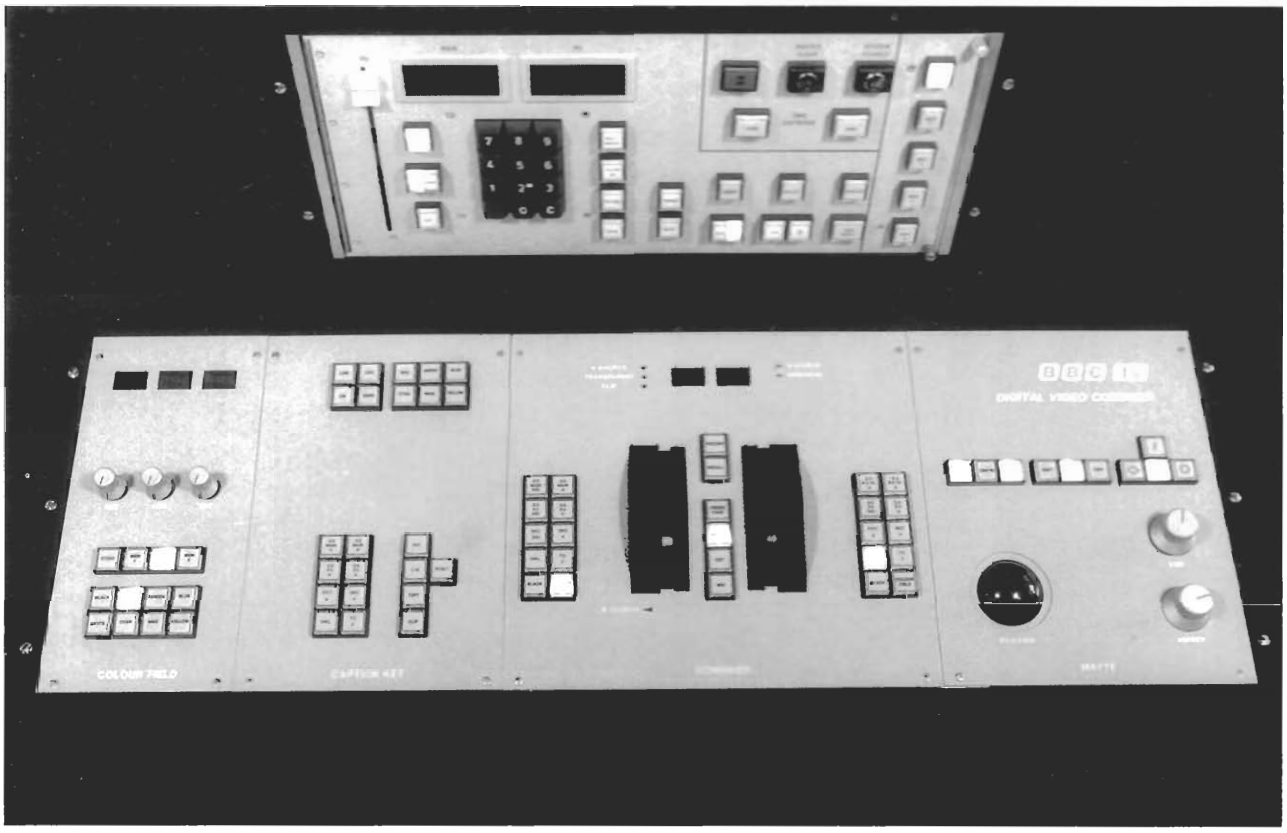
Radio Microphones
The review of the frequency spectrum by the Merriman Committee and the resulting re-allocation of frequencies has created a demand for equipment to work on the new channels. The first item to be designed is a high power radio microphone working in Band I. The transmitter and receiver use synthesised channel selection and incorporate features which allow optimum usage of the RF spectrum. Work has since started on the design of a new radio link to carry music circuits at 141 and 224 MHz. The requirement is urgent in view of the decision to change the frequency allocations in late 1989.

Control System for HF Transmitters
The control system for the HF transmitter at Hong Kong was delivered early in the year. It is being fitted with a new generation of software developed as a result of experience with the control systems installed at transmitters in the UK.

PURCHASING AND SUPPLY GROUP
The Group's Stores' activities were expanded further when in April the Central Engineering Stores assumed responsibility for the procurement and supply of semi-conductors, cathode ray tubes and small thermionic devices. Hitherto, these had been supplied by Valve Stores at Motspur Park but the closure of this store means that supplies of a very comprehensive range of electronic components can now be obtained from one source - Avenue House.

Ware Stores is undergoing major changes and is currently being completely re-equipped with a modern storage system to make better utilisation of the space available; in due course this will lead to a substantial improvement in the efficiency and performance of the store.

In June a full colour Ware Stores catalogue was published as a 'sister' publication to the Engineering Components Catalogue. Both catalogues are produced twice yearly and feature all stock lines held at each store and the fixed selling price for each item.



Digital Video Mixer control surfaces

SUPPORT GROUP

The use of contractors to supply complete and working equipment has developed during the year, although some difficulty is being experienced in finding organisations with the necessary expertise and facilities.

Standards Section have continued to provide authoritative information on the range of rationalised components and materials for use throughout the BBC. This work is supported by the comprehensive use of computer databases: one such system is being currently built-up to provide technical advice on semiconductors as a result of the transfer of Valve Section activities to the Department.

TRANSPORT

New Headquarters

At the beginning of 1987 the transport operation moved to a new purpose-built base at Park Western, next to the Kendal Avenue OB base. The new building houses the management and administrative staff and a well equipped vehicle workshop.

In addition to the usual peripheral facilities, the workshop has one 8-tonne and two 14-tonne vehicle hoists, and a well lit and ventilated long pit. To keep pace with the ever-increasing level of electronics in vehicle engines, the latest Crypton Tuning diagnostic centre has been provided.

One of the last remaining items moved from Weir Road was the computer. This schedules all the regular duties as well as providing information about the vehicles such as when bought, what servicing is required, etc.

Using a workforce of about 180 people the Transport Group provides a 24-hour, all-year-round operation servicing a fleet of some 1,000 vehicles.

RESEARCH

Two-Channel Sound with Terrestrial Television
Although the BBC has postponed consideration of public service for three years, experimental broadcasts continue from the re-equipped BBC1 and BBC2 transmitters at Crystal Palace. It is noteworthy that this system is likely to provide the world's first terrestrial digital audio broadcasting, well matched to compact disc quality.

Several "System B countries" have expressed an interest in the UK System, in particular Sweden, where stereo is required, and Finland, where two-language transmissions are envisaged. Following laboratory and over-air tests in these countries, the Nordic Countries as a whole decided to adopt the UK system. It was subsequently recommended by the EBU and now forms part of a draft CCIR Recommendation. Other countries interested in using the system include Hong Kong, New Zealand, Singapore, India and Spain.

The use of digital sound, with associated additional data capacity, makes the UK system attractive in the context of subscription television since scrambling and encryption can easily be included. This aspect was recognised in a recent independent assessment of subscription commissioned by the Home Office.

HDTV and DATV (Digitally Assisted Television)
The work necessary to assemble HDTV sources and displays has continued and a slow-speed slide-scanner, designed in 1985, has been completed. This work has included the writing and testing of computer software in order to process the resultant images for gamma and aperture correction. An HDTV projector has been purchased for large-screen display of 16:9 aspect ratio pictures, and a 760 mm (30 inch) diagonal direct view HDTV monitor is on order. Design and construction of a digital processing channel for an HDTV camera continued and attention has been given to the modifications necessary to make it suitable for telecine processing.

Rank Cintel have provided on loan a telecine to handle 35 mm colour film at a frame rate of 50 Hz. A number of 35 mm films have been produced and in this way we have an HDTV source with spatial and temporal resolution approaching that implied by most HDTV proposals.

Methods of bit-rate reduction, applicable to digital broadcasting of HDTV, have been studied and one, known as vector quantisation, has proved to be particularly promising: bit-rate reduction ratios of 5:1 have been achieved. This method is well suited to broadcast applications and may enable the digital part of a DATV signal to be bit-rate reduced. (With DATV a digital control signal is used to instruct the receiver how to construct full bandwidth HDTV pictures from a bandwidth-reduced analogue HDTV picture signal).

As well as the above studies, which are mainly applicable to the introduction of HDTV by a 'revolutionary' strategy, that is, one where the HDTV standard need bear no relationship to existing 625-line systems, investigations have also been made into methods of developing bandwidth-compressed HDTV as a series of compatible steps, i.e. by an 'evolutionary' strategy. Such a strategy has recently assumed increased importance owing to the start of a European industry project, under the Eureka umbrella, aimed at the production of an HDTV transmission system having compatibility with the MAC-packet family for satellite broadcasting. From the outset, the BBC has been recognised as having the capability of making a substantial contribution to this project.

With a 12 GHz DBS channel the maximum video baseband width available is 12 MHz (or between 60 and 100 Mbit/s in digital capacity). Such a bandwidth or bit rate presents a significant constraint for HDTV and therefore higher capacity channels are also being considered, together with a new frequency band in the region of 20 GHz.

Direct Broadcasting by Satellite
A European Community Directive mandates member states to comply with the MAC-packet family of DBS and cable standards (or compatible developments) until at least 1991. Preparations for the Second Session of the Geostationary Satellite Orbit Conference [WARC (ORB) in 1988] are continuing with new initiatives being taken to press for new frequency bands for both HDTV (at around 20 GHz) and Direct Radio Broadcasting by Satellite (DRBS, at around 1 GHz) both nationally and through the EBU and the CCIR.

For DRBS the spectrum requirements and sharing problems have been shown to be reduced by digital modulation and efforts are being made to promote an attractive solution for European countries.

Work continues on the design of low cost flat-plate antennas for domestic installations and a novel 'functional demonstrator' design has been constructed. This will use a microwave lens to achieve some beam steering capability. A new microwave antenna measurement range has been constructed in the grounds at Kingswood Warren to facilitate fuller assessments of microwave antennas for SHF communications.

Digital Television Signal Routeing and Switching
Discussions with industry have confirmed the basic feasibility of a signal routeing system employing Time Division Multiplexing (TDM) combined with Wavelength Division Multiplexing (WDM) on optical cables. Current work is concerned with investigations into the required characteristics of the optical and electrical components. The BBC is expecting to lead a RACE (Research into Advanced Communications in Europe) project in which it is hoped that these components will be developed.

Digital Television Transmission
A large number of international organisations are now involved in work to define standards for the exchange of television signals on international digital links, particularly where the video signals are in YUV component form. In addition to the CCIR (which has set up Interim Working Parties on this topic) and the EBU, the European COST (Co-operation On Science and Technology) and RACE (Research and development of

Advanced Communications in Europe) programmes are also pursuing developments at bit rates of interest to the broadcasters. The BBC is represented on all of these groups, and its experience in bit-rate reduction techniques enables it to make a useful contribution to the discussion.

International interest is confined to YUV transmission and mainly concentrated at present on 34 Mbit/s although higher rates such as 68 and 140 Mbit/s are also being considered. The leading 34 Mbit/s proposal is based on a motion adaptive form of Differential Pulse Code Modulation (DPCM) but it seems unlikely that this will be adequate for broadcast applications, especially where signal processing downstream is required, and so interest is also being directed to an alternative approach based on the Discrete Cosine Transformation of the input signal.

At 140 Mbit/s, a proposal is being considered which derives from work at Research Department and in West Germany. The BBC has submitted a 68 Mbit/s proposal.

Digital Multi-Picture Storage

About 60 Slide Files, the television studio stills store developed at Research Department and manufactured and marketed by Rank Cintel, are now installed in television studios throughout the BBC. Approximately 80 more have been sold to organisations worldwide (the BBC receives a royalty on each unit sold). Software for these stores has been further developed to prevent unpredictable operation when control buttons are misoperated and to maintain consistency within the BBC.

Eleven of the low-cost Art File graphics systems described in last year's Report are being installed by the BBC, mainly in regional areas where Slide Files are already installed and electronic graphics facilities could not otherwise have been a justified expense.

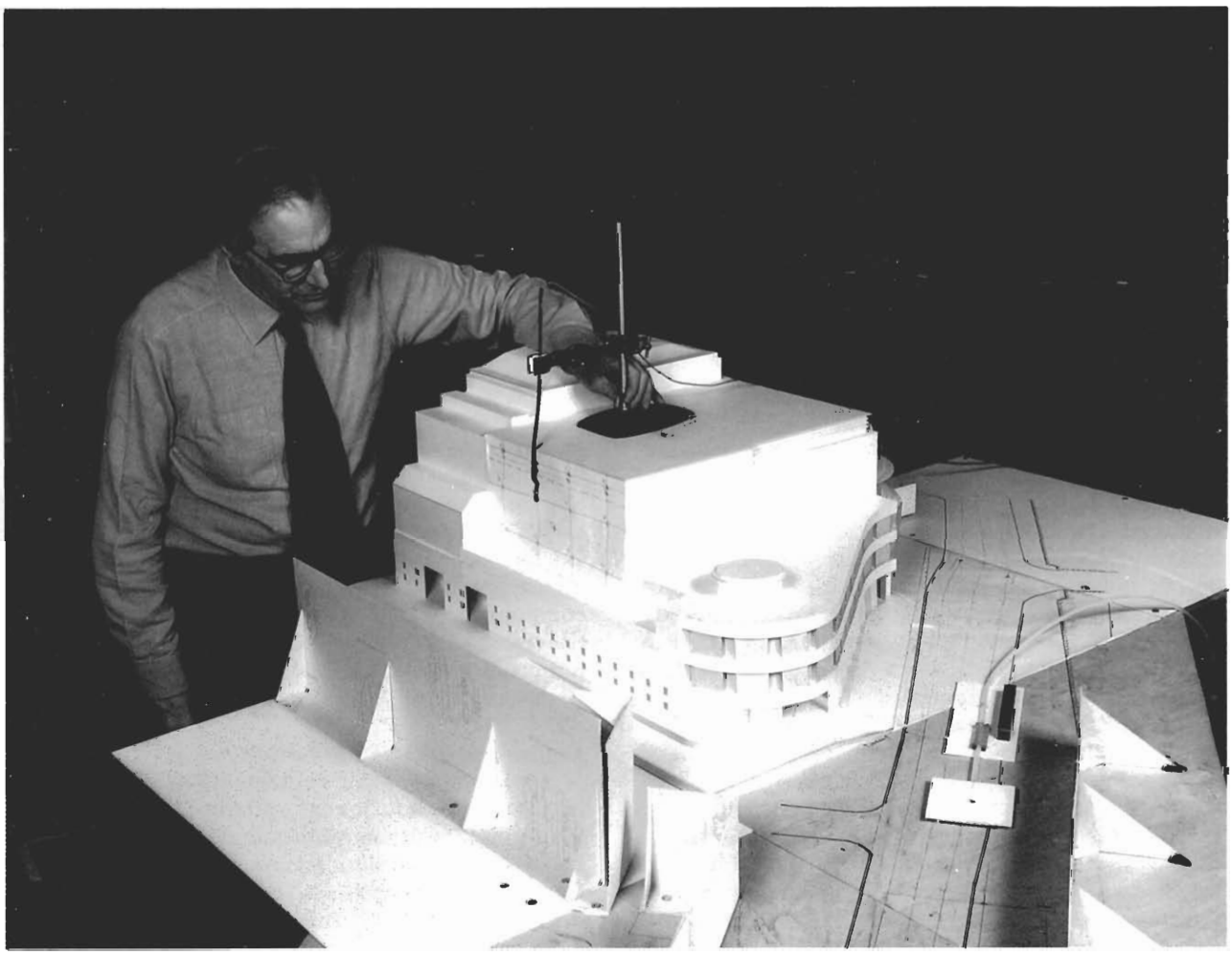
Video Tape Recording

Recorders using the CCIR endorsed format are now being delivered by Sony. Also BTS (Broadcast Television Systems - the Philips/Bosch consortium) have demonstrated prototype recorders and achieved tape interchange compatibility with Sony recorders.

Assistance has also been given in drawing up specifications, testing recorders and devising test methods and waveforms for wideband analogue component video recorders being developed by Panasonic and Sony.

Studio Acoustics

Continuing a study started last year, Research Department have carried out significant work related to the Television Centre Stage V building project. For the Music Studio the design of variable acoustics facilities



100:1 scale model used in evaluating level of sound insulation required for the new Television Theatre

was completed to the point where acoustic performances had been quantified. This involved special designs of both low frequency and wideband absorbers that could be 'turned-off' when not wanted. However, the Television Service decided that the cost was too great and the development has been discontinued.

The other area in Stage V which was causing concern was the insulation of the proposed new Television Theatre against airborne traffic noise. The Theatre will be immediately adjacent to Wood Lane, and measurements of traffic noise indicated that a triple wall was needed. Subsequently, more detailed plans of the Theatre and adjacent facilities showed that a scene-dock would offer some screening from line-of-sight noise exposure, but on the other hand neighbouring buildings would reflect low-frequency noise. A 100:1 scale modelling exercise confirmed both effects but showed that the former was more significant. As a result a much simpler and cheaper double wall design has been adopted.

Vibration Isolation

Knowledge acquired in conducting vibration studies on the Langham has been put to good use. Stage V at Television Centre suffers groundborne vibration from road traffic, and design information was prepared for the project teams for both the Music Studio and the Theatre. In the case of the Music Studio, box-within-box construction was recommended because of additional locally-generated structure-borne vibration. For the Theatre pile-cap anti-vibration mounts have been recommended.

Also a site for the new headquarters in Southampton was tested for groundborne vibration from rail and road traffic, and information has been passed to the project team.

Video Watermarking

The proposed video watermarking system has been modified to reduce its data rate and tests have shown that it can provide a highly reliable service. A decoder has been supplied to BBC Enterprises for monitoring purposes and to enable them to identify positively a television programme as having been broadcast and/or originated by the BBC.

UHF planning

In view of the 3 dB reduction of primary sound carrier power and the future need to accommodate an additional digital sound carrier, consideration is been given to revising some of the tolerance limits. In addition, the specification for lower sideband radiation (below the nominal vestigial band) has been reviewed and a new test procedure established to allow for pulsed klystron operation. This will permit greater efficiency to be obtained.

Electromagnetic compatibility of digital equipment

The problem of unwanted radiation from digital television equipment is potentially very serious, since harmonics of the 13.5 MHz clock frequency fall on the aeronautical and maritime distress frequencies of 121.5 MHz and 243 MHz.

An assessment of the problem, made in conjunction with the EBU, has included MAC-packet DBS receivers which can also contribute interference. It was provisionally concluded that provided that equipment conforms to the CISPR (International Special Committee on Radio Interference) and BSI specifications for unwanted radiation from electronic office equipment, there should not be a hazard. However, measurements made of various experimental and commercial digital studio equipments show that these specifications are often exceeded by up to 20 dB; clearly screening must be substantially improved.

Radio Data System (RDS)

Several manufacturers have expressed an interest in the system, and a number have indicated their intention to produce receivers. Advice was given to them, and the 'concept model' has been used to encourage discussion and to demonstrate some of RDS facilities. The concept model is built around a general purpose computer and includes a touch-sensitive 512 x 256 element electroluminescent display panel. Plans are being made in consultation with Radio to develop the model further.

The BBC has begun RDS trade test transmissions and expects to launch a full service early in 1988.

VHF-FM Band II planning

A review of VHF-FM population coverage concluded that the VHF-FM National Network population coverage is 96.7% overall, and VHF-FM Local Radio coverage in England is 82%.

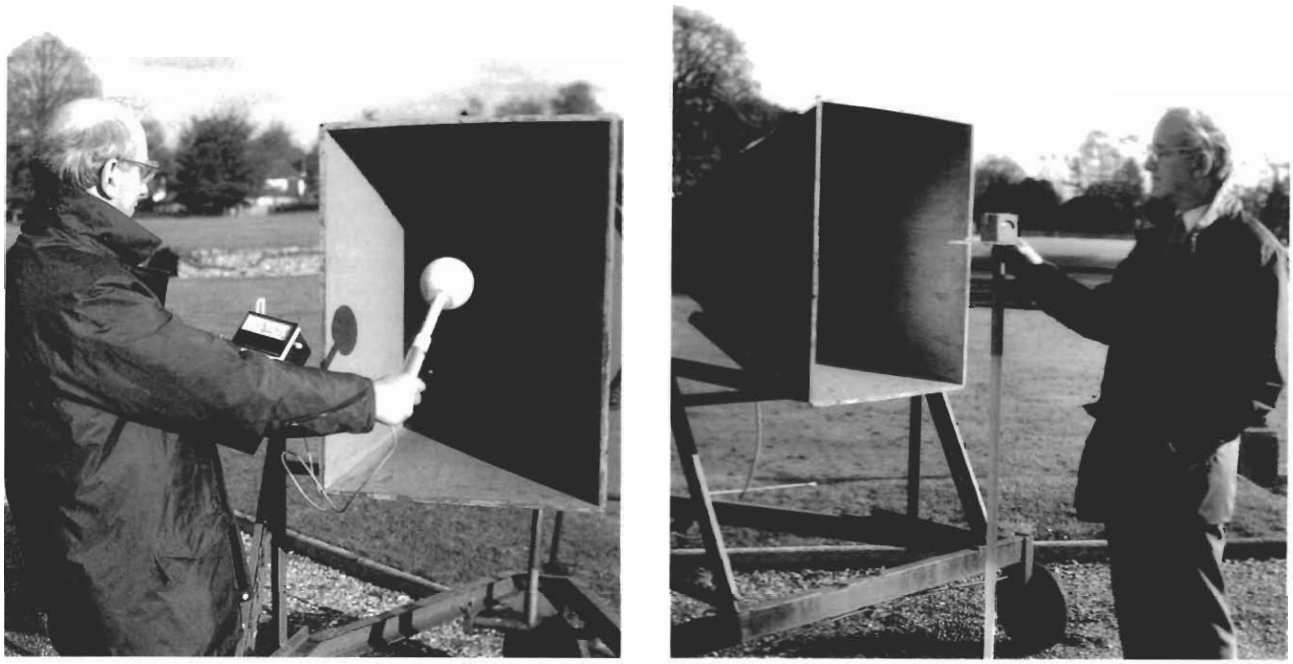
Implementation of many of the higher frequency assignments in the 1984 Plan is still subject to agreement with the aeronautical navigation authorities. Different methods of assessing incompatibilities are being advocated by various countries and the UK has taken an initiative to resolve these; Research Department remains heavily involved in trying to gain a sensible agreement.

Following DTI measurements of broadcast intermodulation products in the field a joint BBC/IBA/DTI measurement trial was established and we showed that measurement problems were local to the measurement site, due to overhead power lines, and also to insufficient selectivity in DTI equipment. We established that, for reliability, measurements must be made in the transmitter aerial feeder.

Further work to improve the digital link from Stockland Hill to Alderney is in progress. This system may provide a satisfactory primary feed of radio services to the Channel Islands in place of the rebroadcast link from Rowridge. (The signal from Rowridge must be reduced for international planning reasons).

Digital Audio Switching and Routeing

The essential feature of a proposed digital audio routeing system have been widely demonstrated. It was shown that a version of the EBU/AES digital audio interface multiplex in which programme co-ordination signals are carried as ancillary data would provide a suitable means for interconnection: one such multiplex in each direction would convey all the required information. The ability to 'drop in' co-ordination signals downstream of the programme source, and to switch the multiplexed signal simply between destinations, was also demonstrated. The possibility of high level multiplexing as an alternative to centralised switching is also being con-



Radiation hazard meters are employed at transmitter sites to measure the RF voltage field. The calibration of the rugged BBC designed ME1/4 hazard meter (right) is being checked in a standard field against a precision laboratory field strength meter (left).

sidered. The BBC is hoping to lead another RACE project in which these techniques will be developed further.

Digital Audio Editing

The development of the Winchester disc based digital audio editor has progressed well. Though its eventual delivery to Radio was somewhat delayed it has now been installed in Broadcasting House. The essential feature of the device which differentiates it from commercial hardware is that edit point location is by rock-and-roll operation with high quality audition. This further provides variable speed replay of broadcast quality. The unit also offers non-destructive rehearsal of edits, variable crossfade, edit decision management and spooling facilities.

Radiation hazards

Advice was given to the BBC's Engineering Safety Committee on the proposals made by the National Radiological Protection Board (NRPB) for biological protection against electromagnetic radiation. No account of the near-field situation (relevant to a rigger climbing masts) has yet been taken. A study of this is in progress.

Whilst Transmitter Capital Projects Group continues to try to persuade a manufacturer to design a more sophisticated hazard warning meter for radio-frequency radiation, the existing Research Department VHF/UHF design has been modified to improve its accuracy and a reference sample has been calibrated by the NPL. Research Department are now recalibrating all existing service meters as they are modified by Design and Equipment Department.

Sound Insulation Handbook

In designing studios it is necessary to specify and control the acoustic isolation between them and the adjacent areas, yet while many publications describe how to achieve 30 to 45 dB of sound insulation in the domestic environment there is scant published material regarding the 45 to 90 dB required between studios. In contrast the BBC has built numerous studio partitions for which both structural and acoustic data are available. Thus, mainly for BBC reference use, a databank has been compiled on partition data, and a reference handbook has been published in conjunction with ACED. The handbook has been widely distributed within the BBC, and is also being sold to the public.

HF transmitting antenna arrays

There is significant interest in the performance of HF wideband transmitting arrays. Studies are in progress of novel arrays and methods of predicting the radiation pattern of arrays over ground which is not flat. These latter studios will be backed up by External Services measurements in a helicopter.

Dynamic Carrier Control (DCC) for HF transmitters

DCC is used at MF as a means of saving power. The use of DCC at HF, in addition to power saving, can be used to improve audibility and to reduce stress on the transmitter and aerial system.

A Marconi 300 kW sender has been modified successfully for DCC in the factory. Work will hopefully be carried out at Daventry to verify the benefits on an operational system.

Experiments at Rampisham on DCC to enhance audibility were curtailed because of operational requirements, and because limited cooling prevented transmitter operation at higher mean power levels.

ENGINEERING COMPUTER SERVICES (ECS)

ECS exists to provide Engineering Division with a service for the development and maintenance of data processing systems, with the emphasis on providing solutions to business problems. Other aspects of computing such as technical computing, control systems, and Computer-Aided Engineering, are supported by Engineering departments themselves or with help from "Information Technology Engineering" (see below). ECS has some 25 analysts and programmers and is situated in Bentinck House.

The last 12 months has seen a strengthening of the coordination of Directorate computing through the Computer Steering Group. This recognises the importance of Information as a strategic resource and the need for a strategy to support it. All computer developments are first offered to this group before preparing the finance case. The group has researched and confirmed the Directorate hardware and software standards.

The Directorate is participating in the development of Corporate computing standards with DDE on the Corporate Policy IT Group (chaired by DG) and HECS on the IT Managers Meeting.

Developments of Mainframe Systems - EMIAS & CEMAST

EMIAS - the Directorate finance system - has been enhanced in many respects with two major new facilities expected to be operational late in 1987. These are "Local Printing of Orders" and "Commitment Control on Revenue". The latter will provide managers with a necessary control tool for their own revenue expenditure.

CEMAST - the system which supports Engineering central stores at Avenue House - has been enhanced with a major new function for Service Orders. Also it now incorporates the majority of the Valve Stores items with a new "user friendly" screen interface. ECS also supports the separate stores system at Ware.

Developments of Local Systems

There has been a major expansion in ECS's role in the area of departmental systems running on Local Area Networks (LANs) of desk top micros. These are multi-user systems hitherto implemented on minis. There are some 18 such LANs (or clusters) installed in Engineering Departments, all using standard Unisys B25 hardware with standard software. This consistent approach has given benefits to all users and ECS in implementing new systems and providing ongoing support. The interconnection of LANs (already underway) will allow further benefits to be achieved in 1987/88 through a Directorate System which will allow information to be shared and communicated and an Electronic Mail service to be provided.

Developments of Mixed Distributed Systems

Mixed Distributed Systems will harness the power of the desk top computer into an integrated network incorporating the power of the mainframe. This will achieve the best of both computing worlds. We have seen the beginning of this in the downloading of mainframe data to local B25 workstations.

It is thought that this is the best architecture to support the future needs of Engineering users and ECS are working to further develop this approach.

INFORMATION TECHNOLOGY ENGINEERING

The first full year of operation of Information Technology Engineering (ITE) has proved to be one of intense activity for all members of staff. Whilst still under-established (short-term contracts are being used to boost specialist staff effort) ITE is nevertheless extending its areas of expertise, in response to user demand, to encompass developing technologies such as Networking, Desk Top Publishing and Computer Aided Design.

Information Technology Engineering is now represented on all of the Central Directorate Steering Committees, and on the Regional Computer Liaison Committee. This participation, at the request of these Committees, has improved communications with end users, and has enabled ITE engineers to be involved in notional developments at an earlier and more appropriate stage; however, there is still much to be done to improve dialogue.

Projects currently being managed range from the very basic - for example, the extension of an existing system by the addition of a single workstation - to the provision of very complex information capture and retrieval systems, such as those for the Monitoring Service at Caversham and for 'Radio Times'.

At present, Information Technology Engineering, with a total established staff complement of sixteen, including Clerical and Secretarial effort, is handling approximately 50 simultaneous projects.

ENERGY MANAGEMENT

The second year of Energy Management's operation has proved most cost effective - the financial benefits achieved exceeded targets by a substantial margin. In the 5-year projected period to 1991-92, net cumulative savings identified to date exceed £2.9 million.

A major survey completed at Pebble Mill has resulted in identified savings amounting to 35% of the Plant Lighting and Heating budget. Energy reduction programmes are under way at Glasgow, Wood Norton, and Manchester, and further surveys are to be undertaken at BH London, BH Belfast, and Bristol.

ENGINEERING TRAINING

The continuing heavy statutory workload has again placed significant pressure both on manpower and resources.

Major achievements this year were the completion of the development of the A (Eng), B (Eng) and C (Eng) progression courses, and the redesign of the A course into the Introduction to Television Operations (ITO), Introduction to Radio Operations (IRO) and Introduction to Audio Operations (IAO) courses together with the follow up Q courses. Considerable extra input was required from the staff in order to ensure the courses were available at the correct time and the staff at ETD were delighted to receive, recently, the congratulations of the BBC's Training Consultative Committee for their work.

The Priorities for the Future document published in mid-1985 impinged on ETD in two major areas. The most significant was the possibility of a Training Trust being established, but this proposal has been deferred for the foreseeable future following consideration of a report by John Wilkinson (ex BBC Director Public Affairs). The other consequence of the "Priorities" policy was the possible privatisation of the catering service and this resulted in the appointment, on the 5th January, of Gardner Merchant Limited as the catering contractor.

The implementation of the Deloitte, Haskins and Sells Activity Review recommendations continues. The straightforward recommendations have been completed and those of a longer term nature or which involved a more complex framework for implementation are well in hand. The continuing development of our RACE computer system will further enhance local management information systems and will simultaneously complement a number of the Activity Review recommendations.

RECRUITMENT

Engineering and Technical Operations Recruitment are looking for some 112 qualified Engineers, 84 Trainee Engineers, 30 Sponsored students and 93 Technical Operators during the financial year 1987/1988.

At present the BBC is succeeding in recruiting suitable people in sufficient numbers, and experiments to increase the size of the pool from which recruitment can take place have been continuing successfully. This year an increased number of sponsored students have been taken on and a further group of Trainee Engineer (Graduates), i.e. graduates with non-technical degrees, have been recruited to train as Engineers.

In order to ensure that the Corporation has a high profile and a good reputation amongst further and higher education establishments, and the public at large, the BBC has taken part in a number of exhibitions and careers fairs during the current year.

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