Post Office telecommunications journal

Summer 1978 Vol.30 No. 2 Price 18p

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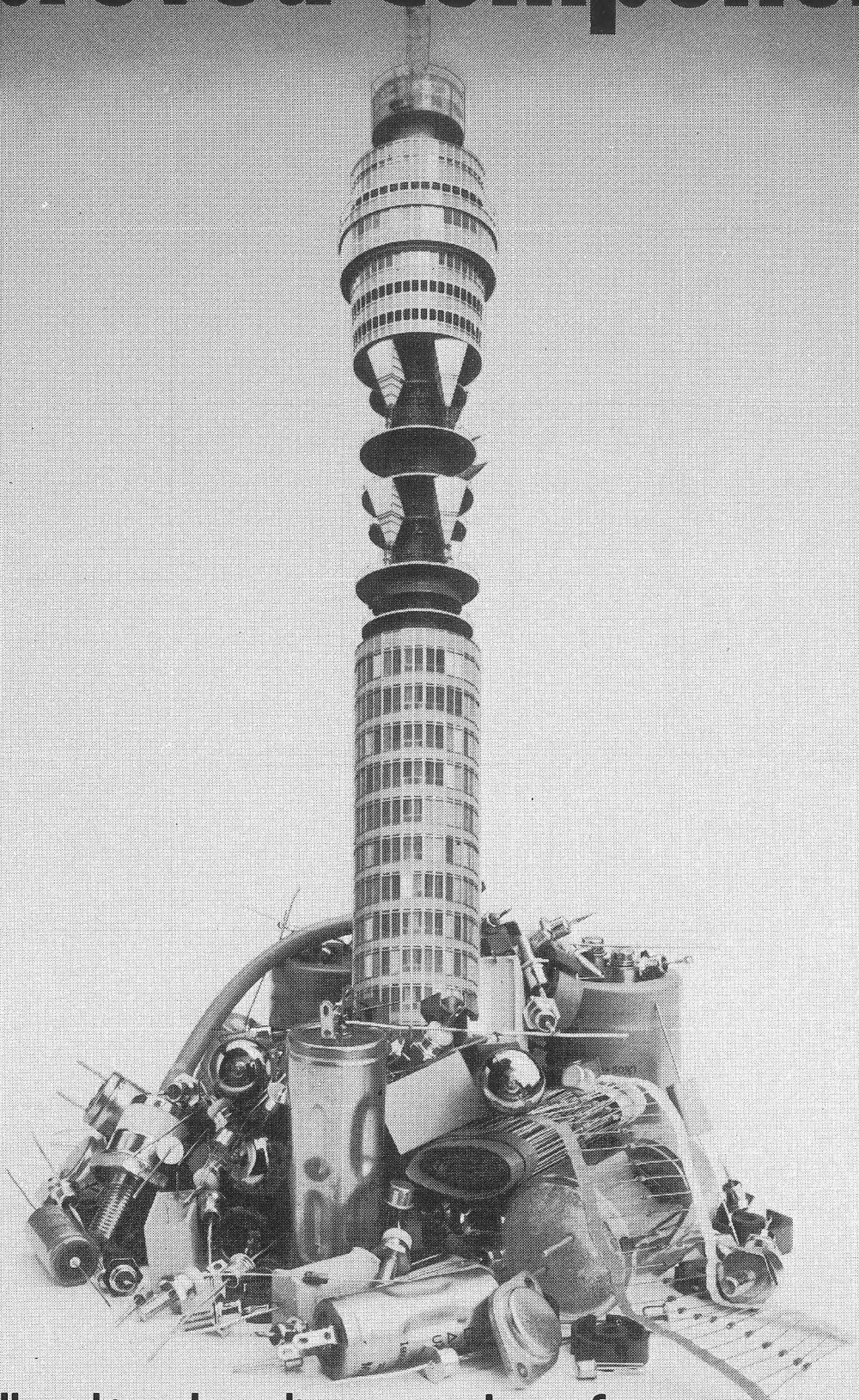

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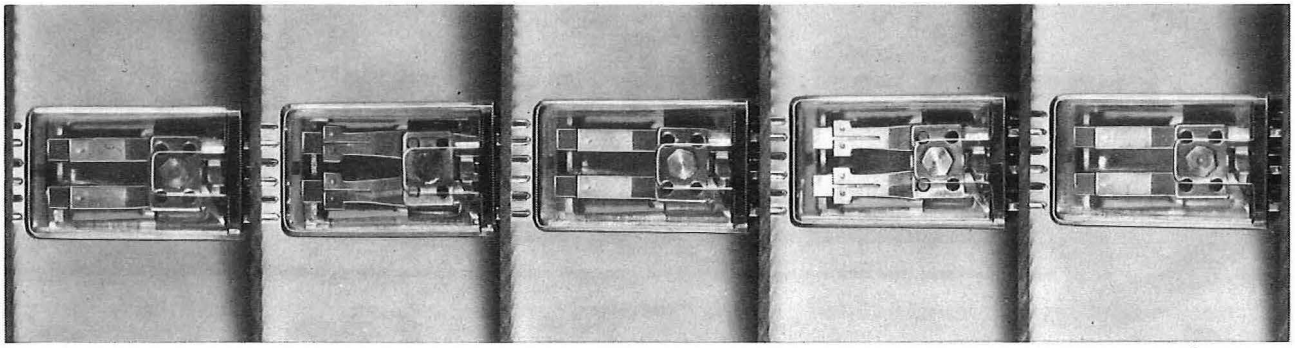

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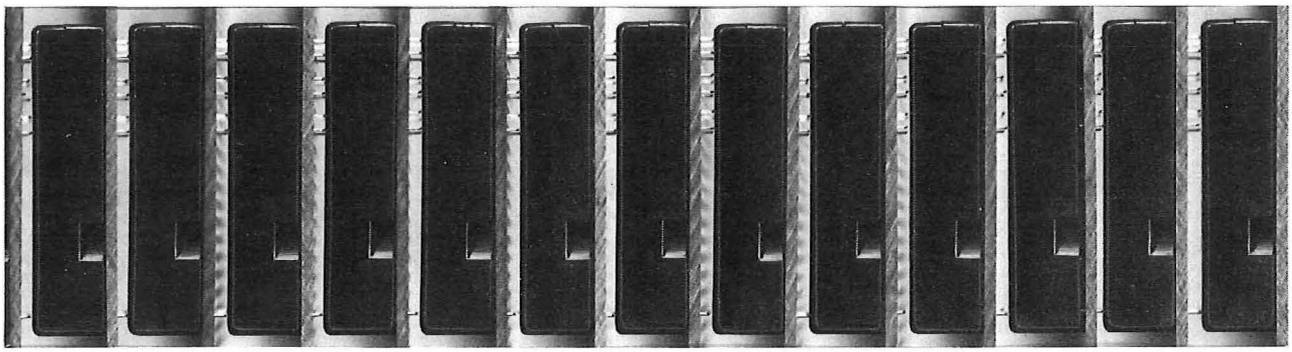

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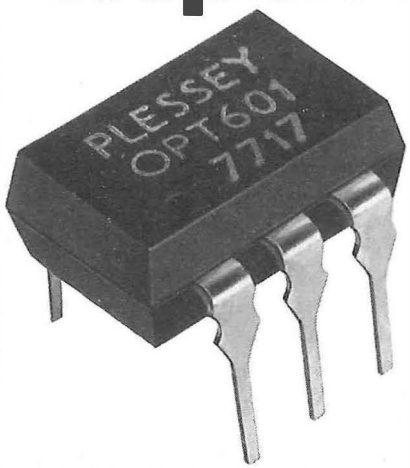

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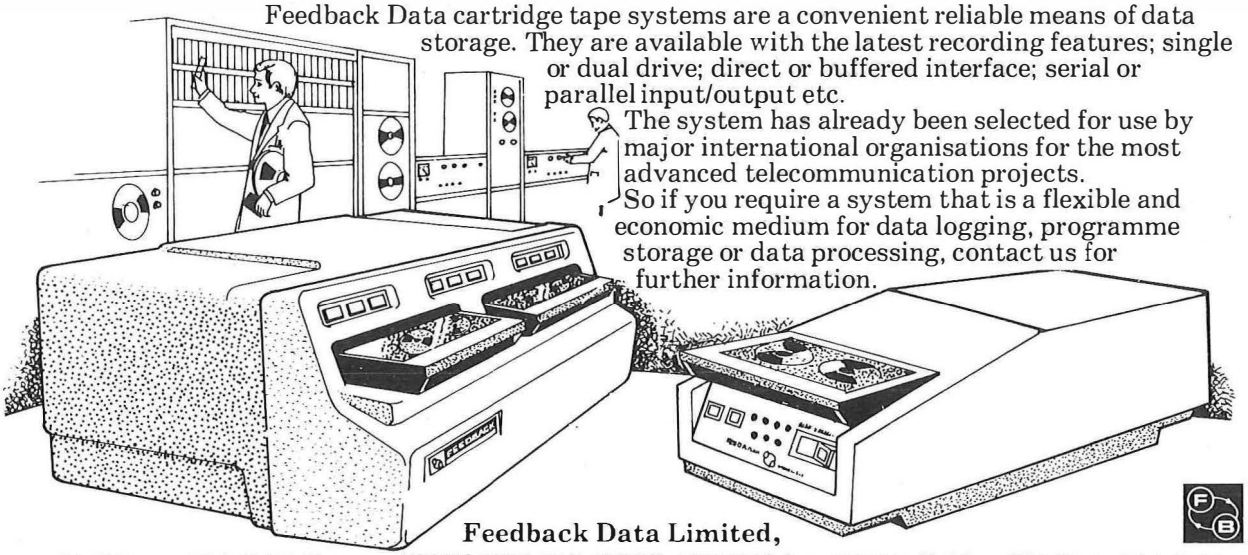

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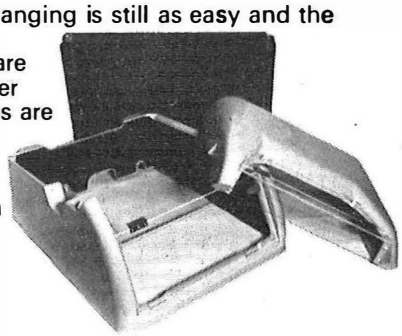

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Public show for packet switching

The recent first public demonstration in Europe of the Post Office system which uses packet switching techniques to send computer data over telecommunications links proved an ideal platform for showing visitors from government, industry, research and education the practical value of the facilities available.

Known as the Experimental Packet Switched Service (EPSS) the system is being tried out by the Post Office in co-operation with 33 organisations in Britain's computing and computer-using industries. It links up to 150 terminals and 27 computers and users can access information ranging from a list of published books to deciding the best route for a new road.

Packet switching is, in fact, the transmission and routing of data in self contained addressed blocks. Each packet consists of a "header" section containing control information which includes the network address of the destination terminal, a data section containing the information to be transferred and a "tail" section containing information which enables transmission error checks to be made at appropriate places. Packets are routed through the network by automatic switching at packet switching exchanges currently in London, Manchester and Glasgow.

There are several important features to packet switching. It provides a flexible and reliable way of linking different computers and terminals; it allows terminals working at different rates to communicate with each other and it enables a large number of separate terminals to link up to a computer over a single high-capacity "highway" into the machine, reducing access costs.

Users of EPSS have collaborated with the Post Office in developing techniques which allow these features to be exploited in the British packet switching experiment which became fully operational in April last year. Information on store includes personnel records, various technical material and data on EPSS itself. Other computers offer various computing facilities such as road routing, design of electronic circuit boards or determining the extent of flooding in East Anglia that would result from rises in sea level. The network is also linked to Arpanet, a private packet-switching network in the United States to which 50 computers – including some of the largest and most powerful in the world – are connected.

EPSS is planned to operate for a minimum experimental period of two years and already the Post Office has gained valuable experience in determining the facilities and services needed to support packet switching users. This will be vital in planning a permanent service for the future.

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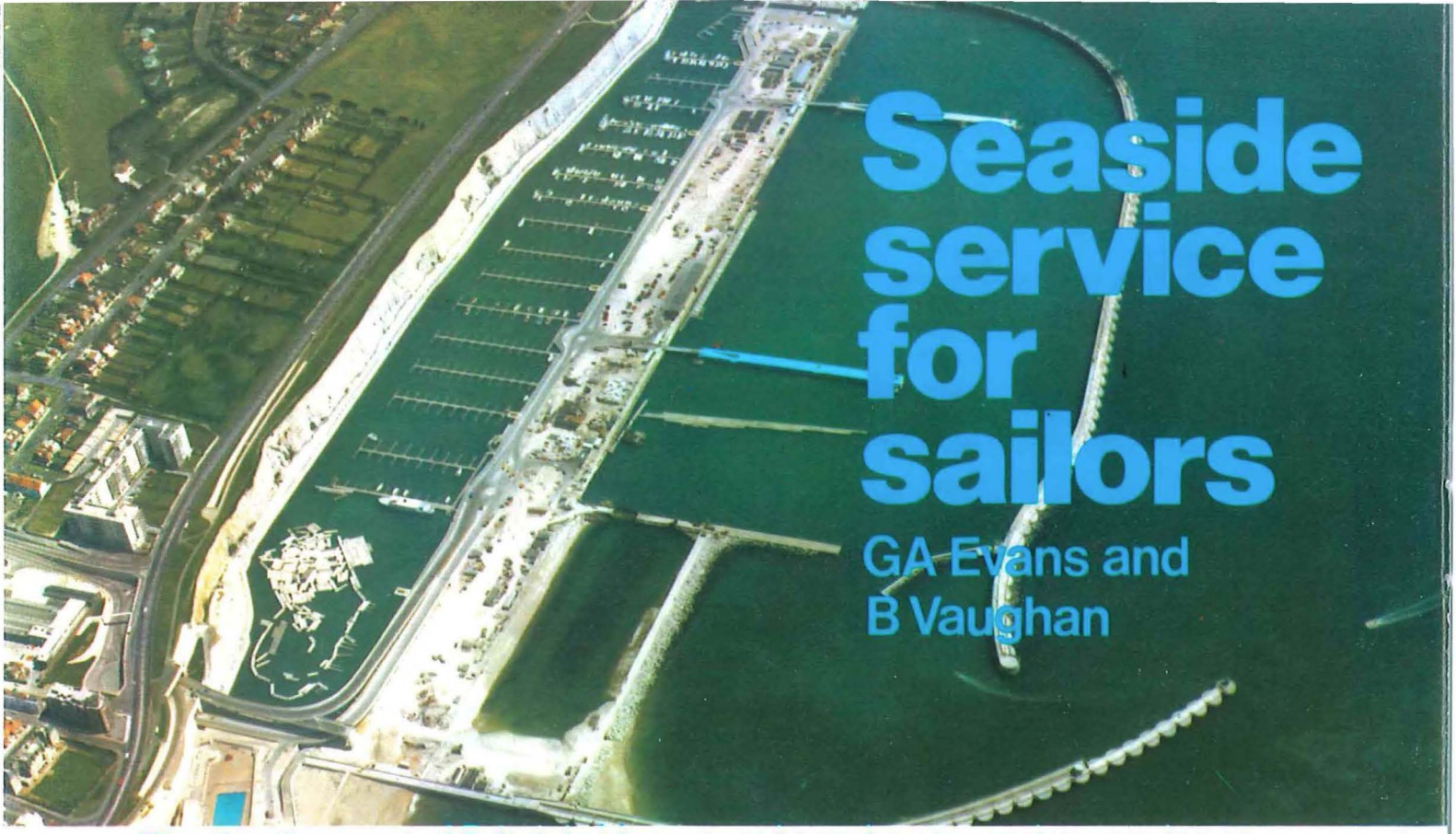
Cover: The first aerial at Madley earth station. When it becomes operational later this year it will work to a satellite high over the Indian Ocean. (See page 4.)



Seaside service for sailors

GA Evans and B Vaughan

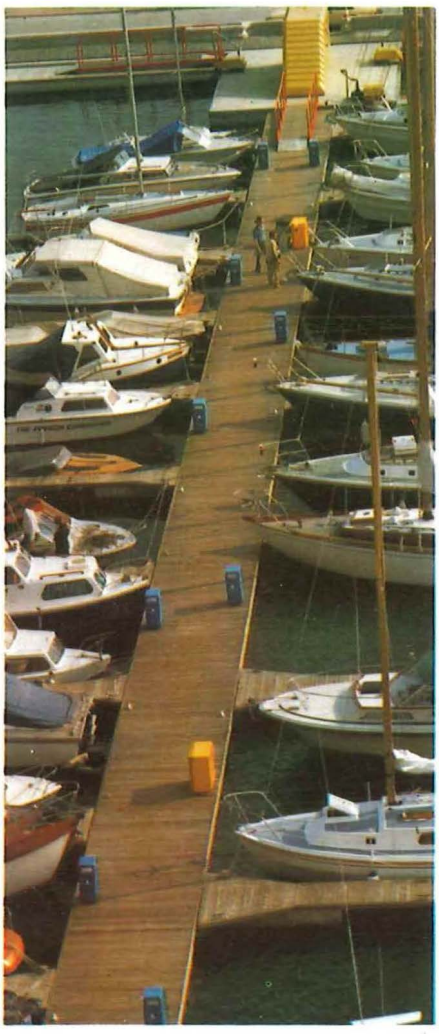
The development of Britain's biggest yacht and motor cruiser marina at Brighton has involved the local Telephone Area in a mammoth project to anticipate the potential need for "floating telephones" among the 2,300 berths it will eventually contain.

SOUTH COAST sailors using Brighton's new multi-million pound Marina will no longer need to come ashore and hunt for a kiosk to make their urgent business or domestic telephone calls. Instead they will be able to moor their boats and plug straight into the national telephone network with access to more than 300 million telephones around the world via Subscriber Trunk Dialling (STD) and International Direct Dialling (IDD).

This facility is the culmination of some four years work carried out by Brighton Telephone Area staff and the plan is to install about 4,500 exchange lines by the year 2001 throughout the 126-acre Marina site.

The need for a refuge for the increasing number of pleasure sailors had been clear for some time and the Brighton Marina Company was formed in 1964. Two huge harbour walls enclose the Marina area and a central spine parallel with the shore separates an outer tidal basin from an inner non-tidal basin. These are interconnected by means of a 125-metre long lock.

Within the inner harbour, berths for about 900 vessels are provided at floating pontoons and similarly, services for about 1,400 boats are provided at floating pontoons in the outer tidal harbour, the latter berths stemming from two 160-metre long floating concourses.



Brighton Marina as seen from the air.

The Marina outline scheme provides for blocks of flats to be built on the central spine and on five promontories which will project into the inner harbour. Also envisaged is the construction of chalets on top of the two floating concourses which lead to the outer harbour pontoons.

As soon as the Marina project got off the ground Brighton Area Sales Division began a study of the market for telephones for boats. Enquiries were made of other yachting locations and marinas, including some from overseas, and it was decided that the potential for telephones was high.

In what is almost a completely man-made structure, much of it solid concrete, provision of access for telephone cables needed careful attention. In the event the Marina Company "built in" ducts for telephone cables to the main structure of the Marina, and elsewhere support trays and channels have been provided, in such a way that

The brightly coloured bollards which give access to telephone service at each berth are clearly seen in this view.

the various services are carefully separated.

Rooms have been set aside by the Marina Company for distribution frames at five points, providing "on site" main and subsidiary flexibility points. Alongside each berth a brightly-coloured fibreglass bollard is provided. Each one has three compartments – one giving access to electricity and water services, one for general illuminations, and one for telephone access.

Brighton's Customer Works Group specified Post Office requirements for telephone connections in the bollards, and following consultation with Factories Division, a special mounting plate was designed which could house a telephone connection socket in such a way that the socket could be locked by the customer whether the plug was in or out.

Telecommunications Headquarters Development Department was consulted on the design of the plug and socket with a view to achieving a design suitable for national use. The socket has, in fact, been designed to provide a high resistance loop when the plug is withdrawn as a test "indicator" on "no reply" complaints. Distribution cables to the bollards have been laid along the central well of the pontoons in a section reserved for the water and telephone services.

At an early stage of site construction temporary cables were run underground on the site to give service to the builders, and telephone lines were connected to the travelling crane to provide instant communications during the tricky operation of laying the huge concrete caissons which form the harbour wall. A private automatic branch exchange (PABX) No 1 was installed adjacent to the site for the main administrative offices, and a PABX 7 was provided for the project control group with many other lines provided on a temporary basis as the need arose. A new PABX 7 has now been provided for the Marina Company's "on site" office.

Although much of the work on the site followed normal practice, and standard safety rules for work on a construction site were applied, there was, in this case, the unusual feature that staff were carrying out work on pontoons some distance from the shore. It was decided that staff working beside the water should wear life jackets and an automatically inflatable type was chosen.

No major project is accomplished without the co-operation of many people and the Marina Company and its representatives have gone out of their way to help the Post Office expedite provision of telephone service. Already the harbour has been in use in a small way since August last year, but as 1978 develops the tempo of yachting activity should increase and the fruits of 14 years intensive project development be gathered.

Mr G. A. Evans is an external planning engineer in Brighton Telephone Area and was closely involved in the detailed planning of the Marina cabling.
Mr B. Vaughan is Deputy General Manager in Brighton Telephone Area and was formerly responsible for overall planning.

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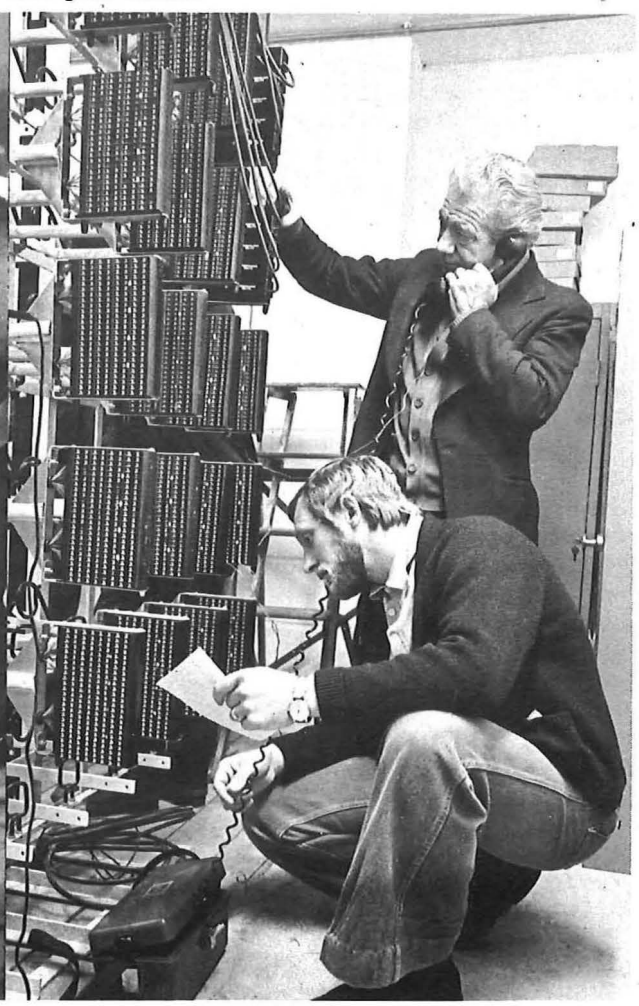
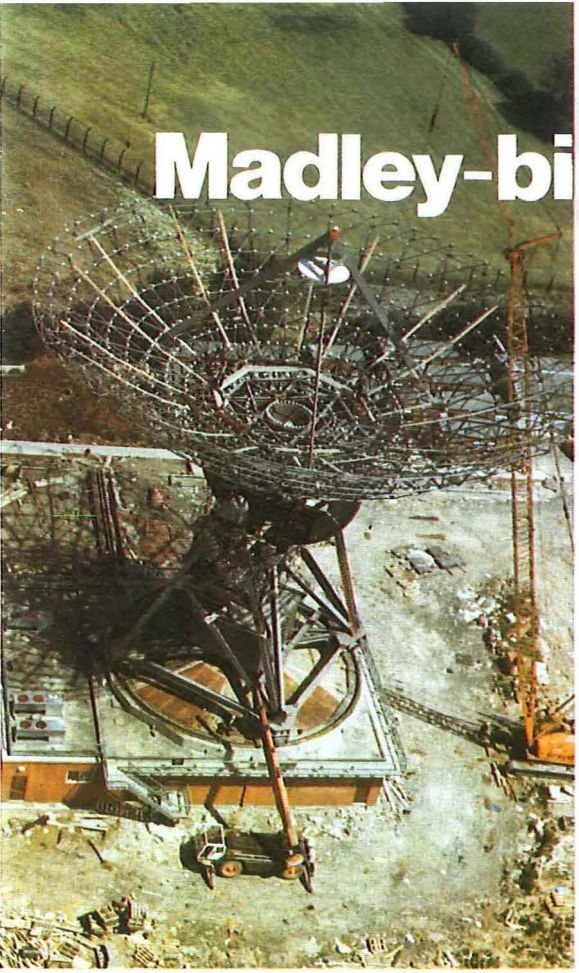
Co-author Mr George Evans and external maintenance engineer John Woodford provide a termination on the telephone cable serving one of the bollards.

Technicians Reg Bucknell and Rod Everett at work on one of the frames in the main distribution room at Brighton Marina.



Madley-birth of an earth station

M Flack



Construction work on the Madley 1 aerial dish shortly before the aluminium panels were lifted into position by crane.

THE FIRST Post Office earth station at Goonhilly, Cornwall, was acquired in the early 1960s and three satellite communication earth terminals have since been built there for operation in the INTELSAT system. A fourth terminal will be ready in September this year for tests with a prototype European satellite.

By the late 1960s, however, it had become clear that the Post Office would soon need a second earth station, firstly to provide site diversification – Goonhilly was then, as now, the third largest earth station in the world – and secondly to guard against interference in the 6 and 4 GHz bands, which had been experienced from time to time, from the French inland microwave system.

Following extensive searches over a large area of the country to find a location which measured up to the many technical and other requirements, a site was eventually chosen near Hereford and for the past three years the quiet countryside around the village of Madley has been the scene of much activity as the new earth station has steadily taken shape.

The first earth terminal at Madley – the largest so far built by the Post Office – will, in fact, become operational later this year and will work in the INTELSAT system to the Indian Ocean Region satellite. The Radio Engineering Services Division of the Post Office's External Telecommunications Executive (ETE) is responsible for running the station, and for the past two years has been re-training some 30 technical staff selected from appropriate ETE divisions to operate and maintain Madley when it comes into service.

ETE has also recruited many support staff and selected management and supervisory people and trained them where necessary. But the development of the earth station as a whole has tapped the resources of many Departments within the Post Office. The mains power supplies have been the responsibility of ETE as have, through the Property Services Agency (PSA), site roads and buildings; Network Planning Department (NPD) have provided the inland link terminal and the connections to London while Service Department (SVD) have set up a television control room.

The specification, technical negotiation and oversight of the contract for the steerable aerial and associated radio equipment have been the responsibility of Earth Station Planning and Provision Division of Telecommunications Development Department (TDD). The advice of Operational Programming Department (OPD) on civil and mechanical engineering aspects of the aerial has been invaluable and Quality Assurance staff from the Purchasing Department advised on materials and finishes used on the aerial. Last but not least, Purchasing Department undertook all the commercial negotiations.

Specifically under the control of ETE's Satellite Services Section, as is Goonhilly, the station will be part of the Radio Engineering Services area organisation. The site has been laid out with a group of buildings at the centre housing administration, inland link and satellite intermediate frequency (IF) equipment, station monitoring and control equipment, power generation equipment, stores and garages.

It is, of course, the aerial and its slender structure on which initial attention is certain to be focused. Its design is very different from the earlier Goonhilly aerials and at 32 metres diameter, it is almost 2½ metres larger than Goonhilly 3 and some six metres larger than the first Goonhilly aerial. The terminal is equipped to transmit up to seven carriers and receive up to 35 carriers with a total capability of up to 2,000 telephone circuits as well as television.

The major feature which has enabled the markedly different aerial design is the recently developed Beam Waveguide System. This is an arrangement of mirrors in the form of a periscope which convey the radio signals between the aerial reflector and the radio equipment at ground level. Although the basic concept of a periscope is simple the use of plane mirrors alone would attenuate the signals and distort their planes of polarisation.

To overcome this the design adopted for Madley 1 has three concave and one plane mirror arranged in such a way that polarisation errors occurring at one reflector are cancelled by errors of opposite sign at another reflector. The use of concave mirrors contains the radio wave within a narrow "tube" of rays keeping signal loss to a minimum.

The Beam Waveguide System used on the Madley 1 aerial enables all the radio equipment to be placed in a fixed building at ground level which can, within reason, be as large as necessary to accommodate all the equipment required. As a result the aerial structure can be lighter and less bulky and the task of equipment maintenance made easier.

The aerial has two satellite tracking systems. The monopulse system is similar to that used for Goonhilly 3 but the other is a development known as the "step-track" or "hill climbing" system. The monopulse system uses normally unwanted modes of wave propagation which are generated in the feed horn when the aerial is not directly pointing to the satellite. This controls the aerial drive servo-system in a way which reduces the unwanted modes to a minimum and ensures that the aerial beam is centred on the satellite.

In the step-track system the aerial is made to turn a small pre-determined distance in one direction. If the signal received from the satellite increases in power as a result of this movement, the

equipment deduces that the aerial has turned in the correct direction and makes a further similar move. If, however, the signal decreases, the equipment deduces it has made an incorrect move and turns the aerial in the opposite direction. By acting in the azimuth and elevation planes in sequence the aerial centres itself on the satellite.

This is a perfectly satisfactory method of tracking where the strength of the radio signal reaching the aerial remains constant or nearly so in the United Kingdom and this is the case at aerial pointing elevations of 20 degrees to 30 degrees – the requirement for tracking satellites over the Atlantic Ocean. At low elevations however, where the satellite signal travels a considerable distance through the Earth's atmosphere, the signals are sometimes subject to fading or scintillation.

As Madley 1 aerial is intended for use with the Indian Ocean satellite which has an elevation angle of only about six degrees at Madley and because of the lack of information about the effectiveness of a step-track system at such a low elevation angle, it was decided to fit one step-track and one monopulse system instead of one main and one standby system, both of the same type. This will enable the Post Office to obtain experience of the new system and if it can be shown that the step-track system is satisfactory at low elevations it is probable that the system will be used exclusively on future aerials.

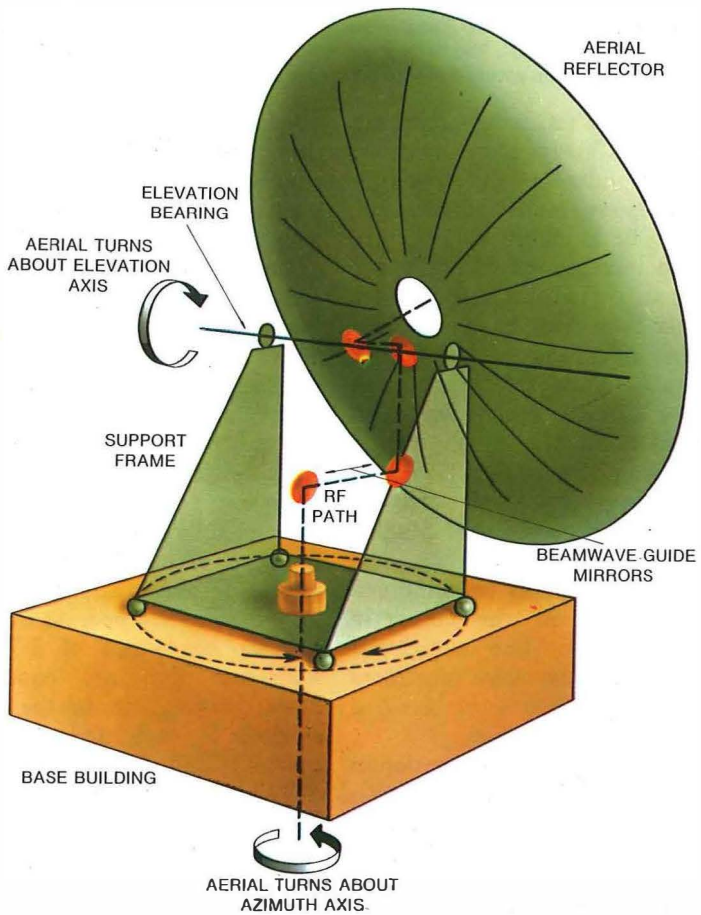
The aerial itself consists of a wedge shaped steel support framework standing at its wide end on four single-wheeled bogies running on a circular track on the roof of the aerial equipment building. At the top of the support structure are two roller bearings which support the reflector and enable it to be tilted in elevation by means of a large semi-circular rack and pinion gear. In the azimuth plane the whole structure turns on the circular rail.

The structure has been designed to require a minimum of repainting by constructing the reflector surface, the subreflector and the subreflector support tripod from aluminium and stainless steel and by coating the mild steel support structure and reflector backing ribs with metallic zinc followed by three coats of paint. Only the mild steel parts will require eventual repainting and these can be reached without taking the aerial out of service.

Inside the aerial building there is room for 18 transmitters and four low

Post Office Technical Officers Derek Hale and Steve Hack supervise preliminary testing of one of the transmitters in the aerial building.

The Beam Waveguide System showing how the mirrors reflect the RF signals around the aerial axes.



Contractor staff worked some 70 ft above the ground to fix aluminium panels to form the reflector surface of the aerial. The bolts projecting above the framework are used to adjust the surface within 1 mm of a true paraboloid.

noise parametric receiving amplifiers although only 10 transmitters and two low noise amplifiers are fitted at present. The latest series of INTELSAT satellites to be launched in 1979 are planned to increase substantially the traffic capacity available in the 4 GHz and 6 GHz frequency band allocated for satellite communications by using orthogonally polarised signals to enable two different sets of signals to be transmitted simultaneously on the same frequency. (See page 30).

A dual polarisation aerial feed has already been provided at Madley which will enable the two signals to be separated for reception or combined for transmission in the correctly polarised manner. The additional transmitters and low noise amplifiers will be fitted when INTELSAT bring in the dual polarisation system.

The transmitters are of a new design employing an air cooled 3 kw klystron output valve. They each transmit only one carrier whereas at Goonhilly each transmitter employs a 10 kw travelling wave tube and deals with several carriers simultaneously. At Madley the outputs are combined in a specially developed network for connection to the aerial. This arrangement eliminates the intermodulation problems which arise with multiple carrier transmitters.

The transmitters are arranged in groups of four of which one is a "standby". In the event of a transmitter failure the standby is automatically tuned to the appropriate frequency and switched into the place of the faulty unit by means of a waveguide switch matrix.

The low noise parametric amplifiers are cooled by gaseous helium to a temperature of minus 253°C and are similar to those already installed at Goonhilly. They operate over the full satellite bandwidth of 3.700 GHz to 4.200 GHz and are connected by flexible waveguide to the individual receivers for each carrier located in the central building.

The arrangement of equipment in the central building differs from that at Goonhilly where the inland link equipment and satellite radio equipment are in separate wings and where control of the station is exercised from a large console in a room some distance from the equipment. At Madley the equipment and control suites are located in one large room.

The controls and supervisory panels for the remote aerials and for the radio equipment are located in the operations area in the centre of the room together with a television switching and control console and an enclosure for the duty controller. This area includes a flexibility point at which the incoming or outgoing traffic can be quickly patched between operational and standby equipment in the event of an equipment failure.

On one side of the operations area is the satellite area. This contains the modulators which frequency modulate the baseband signals for each destination on to separate IF carriers at 70 MHz.

On the other side of the operations area is the multiplex area which contains the inland link terminal equipment and the baseband multiplex equipment. It is here that the signals from London are broken down into the groups required for each transmitted carrier and the baseband signals on the individual carriers received from the satellite are assembled for onward transmission over the inland link to London.

To enable the operators of any earth station in the INTELSAT system to communicate with the operators of other earth stations in the system a special network of telephone and telegraph circuits are provided via the satellite in each Region. At Madley, switching of the telephone circuits is carried out using commercial processor-controlled equipment.

For the teleprinter part of the system, however, TDD's Telegraph and Data Systems Division have designed and constructed a modified version of their Telegraph Processing System No 1 equipment and it is believed that the Post Office is the only administration in the INTELSAT system which has been able to provide such a fully automatic system from its own resources.

There can be little doubt that Madley earth station will prove a vital new milestone in the development of the UK's satellite communications. It incorporates many recent technical advances in the field of earth station development and sets a new style for large terminals.

Mr M. Flack is head of group in Earth Station Planning Provision Division of Telecommunications Development Department responsible for the placing of contracts at Madley.

PO Telecommunications Journal, Summer 1978

ABROAD WITH PRESTEL

RD Bright

Prestel, the Post Office viewdata service, has a world lead of some two to three years. Plans for a United Kingdom public service have been brought forward and there is now a major upsurge in interest from overseas.

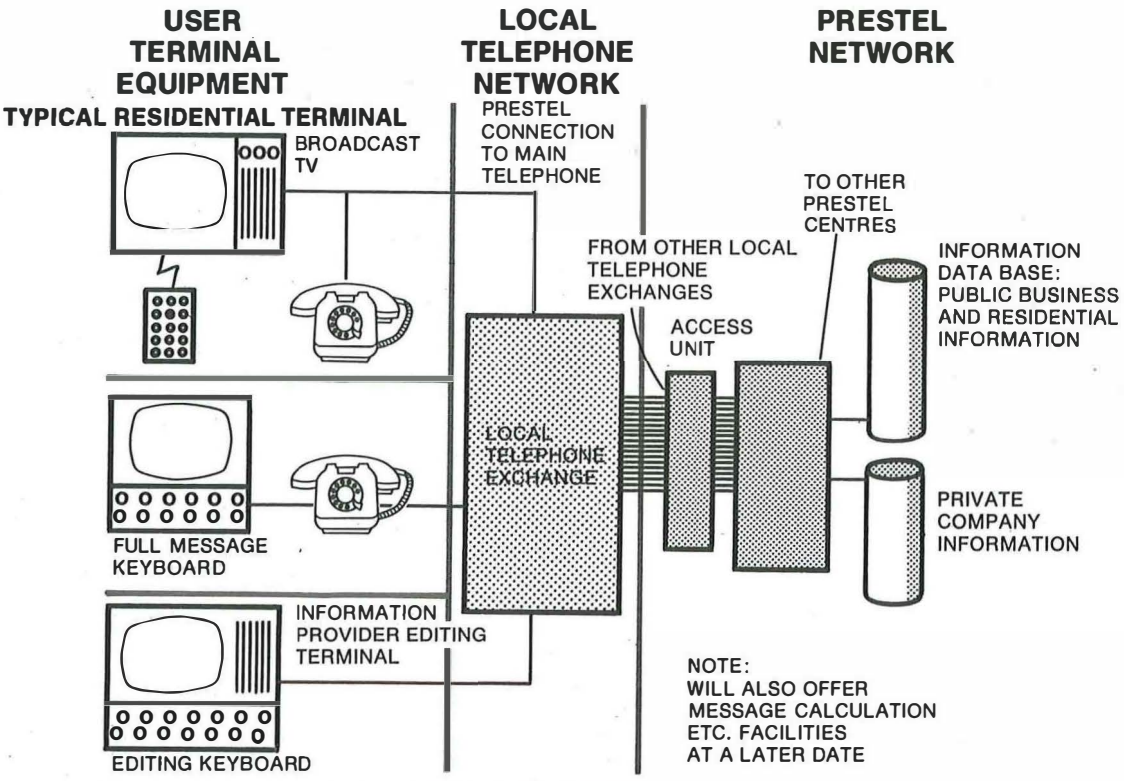
THE EARLIEST public announcement by the Post Office about viewdata dates back to September 1975 when, at a major international conference the announcement about the beginning of a pilot trial in January 1976 was made. There followed a period of intense activity as the Post Office stimulated the television manufacturing industry – who were already immersed in the developing CEEFAX and ORACLE teletext services – and the information and publishing industry to start experimental use of the pilot trial facility.

Since then there have been several further developments and the possibilities of a full nationwide viewdata service have been demonstrated at exhibitions, seminars and throughout the national press and in specialist magazines.

The biggest boost came earlier this year when Mr Peter Benton, managing director, Telecommunications, announced Post Office plans to launch the world's first public viewdata service during the first quarter of 1979. This, he explained, would entail an investment of £23 million to the end of 1979 in order to establish further centres in London, and open new centres in Birmingham, Manchester and Scotland.

The reasons for this earlier than expected date included the Post

POST OFFICE PRESTEL SYSTEM OUTLINE



Office's tremendous confidence in viewdata, overwhelming support from the television industry with eight major suppliers offering eleven different viewdata equipped models and strong backing from the information industry. So far, in fact, about 130 organisations have agreed to provide 131,000 "pages" of information. There was also evidence of demand from potential users, especially those in business and, of course, the determination to ensure Britain's world lead with viewdata is maintained with a strong eye on export potential.

And reflecting this last point it is appropriate to consider the international area. The first realisation of the export potential for viewdata emerged early last year when the Deutsche Bundespost, the West German Postal and Telecommunications administration, began negotiations for the purchase of the Post Office's viewdata software which had been developed by the Research Department – originally in Dollis Hill,

This desk top receiver for the business user has a special typewriter keyboard of particular benefit for the deaf enabling them to send messages and have them displayed in words on the screen.

Firms supplying information to Prestel users can put their "pages" into the computer store by using a special control keyboard.

London and latterly at the Martlesham Research Centre.

The significance of this opportunity could be measured in both financial terms and in the status which such an influential purchaser would lend to future viewdata international developments – including standards and harmonisation. Another important feature was the likelihood that this would encourage a faster transition to large scale integration for the decoders and other special circuits required to convert television receivers into viewdata terminals and thus stimulate lower prices. This is essential to achieve a mass consumer market demand in the coming years.

Final negotiation on this significant contract coincided with the decision to establish a full time "viewdata international" team and by July last year the embryo organisation was in existence. Since then, a constant stream of foreign delegations, both from PTTs and private industry, have been received in London and on several occasions this has resulted in visits to various countries to demonstrate viewdata to officials and senior managment on their own premises – though always relying on access to the UK database via International Direct Dialling (IDD) or, occasionally, leased lines.

A typical case occurred last Autumn when three days of presentations were made in Ottawa at the request of the Canadian Department of Communications to invited audiences comprising representatives from carriers, cable TV companies, Government agencies, universities and other bodies.

In addition stands have been taken at major international exhibitions such as "INTEL COMM 77", in Atlanta, Georgia, and this year's "EUROCOMM 78" in Copenhagen where Prestel shared a stand by courtesy of the Danish PTT and telephone operating companies. For the future, plans are in hand to exhibit in Jerusalem this summer and Bahrain in early 1979.

Similarly, Prestel is often featured in special events – the most notable recently being the commemoration of the one-millionth telephone connection to the Hong Kong Telephone Company's system. In the presence of the Deputy Governor of Hong Kong and about 300 representatives of the business community, Prestel was demonstrated via a 60,000 mile round the world link-up using IDD satellite in one direction and leased line submarine cable in the reverse direction. This use of the satellite link was a world-first for Prestel.

At home the Prestel user has a receiver with a small remote push button unit covering the numbers 0 to 9, enabling her to select the desired page of information.

The potential sales opportunities created by these activities are invaluable. Following the Hong Kong visit for instance, considerable interest has been shown and the Telephone Company has already rented, for three months, access to the UK database to conduct market research among their business community. Similarly, as a direct result of the Atlanta exhibition, response from United States sources escalated and led to the agreement to provide INSAC Data Systems Ltd (established by the National Enterprise Board to promote exports of British software) with user and editing terminal facilities in their New York office. This is to generate market interest and eventually, it is hoped, to license them to operate a Prestel service in the United States.

As far as Western Europe is concerned, a contract has recently been agreed with the Netherlands PTT for the sale of the pilot trial software, and negotiations are in hand with three other PTTs. As sales like this are concluded, there is a relevant benefit to the computer industry for the viewdata software which depends on the use of the GEC 4000 series computers. Both the Bundespost and Netherlands collaborations have led to the purchase of these computers from abroad.

It is also envisaged that in due course these activities should open the way for export opportunities in other industries, notably for television set manufacturers, software houses and information providers.

Finally, it is important to note that the present world lead enjoyed by Prestel will require strenuous efforts to be maintained, and it was appropriate that the managing director, Telecommunications, should single out the importance of the international market as one of the reasons for implementing the public service at an early date. While Prestel is seen as a new and exciting development, such is the rate of technological progress that even while today's version is still being implemented, there needs to be a continuing and significant research and development effort devoted to the next generation of Prestel software and hardware if the Post Office's present lead is to be kept.

Mr R. D. Bright is head of Prestel International Operations, responsible for all overseas exploitation of the system.

Forward step for facsimile

AH Robinson and AT Bence

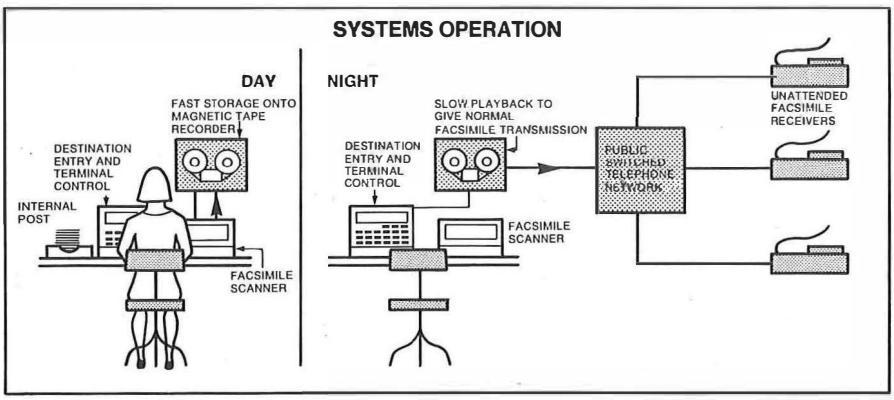
FACSIMILE, the system which enables a wide variety of documents to be transmitted over the telephone network, has for some time offered a reliable alternative to the postal and telex services. Now, following extensive work at the Post Office Research Centre, Martlesham, it has been developed to incorporate a store and forward facility, which, among other things, will eventually enable businessmen to feed items into their machines for transmission during quiet, "cheap rate" periods.

Known as Autofax or Nightfax, the Post Office system follows on from other developments which have led to faster transmission times, better copy quality and improved compatibility between different machines.

To obtain a reasonable copy of a document or photograph a relatively high resolution in scanning and reproduction equipment is needed. More than 1,100 scan lines are, for instance, required for an A4 size document compared with the 625 lines on a television screen. Expensive electromechanical scanning and printing devices, involving rotating cylinders and similar equipment have been used in the past, but solid state scanning mechanisms and electrostatic facsimile printers using, for example, change-coupled devices and comb printers, are becoming available and leading to a range of new improved terminals.

Providing an adequate resolution of 100 lines per inch means that about one million picture samples have to be transmitted for each A4 size document. Some machines use conventional analogue modulation methods which lead to a transmission time over the Public Switched Telephone Network (PSTN) of six minutes per document. Early last year, however, a

Having loaded a document into her facsimile machine, the operator keys in the addressee's telephone number. The document and number are then stored until an automatic clock switches to the "send" mode.



CCITT standard was ratified for three-minute analogue facsimile transmission, which is achieved by exploiting a novel analogue coding technique. It is expected that this three-minute equipment will quickly supersede the six-minute machines.

At the same time a third standard is now imminent which will provide for digital transmission on the PSTN at 4800 bit/s and will enable typical A4 size document transmission times of just one minute, relying on the use of data reduction techniques. These machines will allow the reproduction of documents in black and white only, so that no grey shades are possible, unlike the three and six-minute machines.

Compatibility between facsimile machines has until now been virtually non-existent, so that even if the terminal costs and call charges could be justified, inter-working was only possible with a small fraction of machines in the field. Now that a new international standard for transmission procedures has been ratified, it is expected most compatibility problems will cease.

These developments along with more competitive pricing, resulting in part from the high volume production methods of most overseas manufacturers, mean that facsimile communication methods are likely to be used on the PSTN increasingly in the future.

Basically, Autofax or Nightfax, which is now at the preprototype stage, consists of a microprocessor-controlled transmitting station with fast document loading and storage capabilities. Receiving stations will consist of standard three-minute facsimile receivers, with, in some cases, the addition of a simple interface unit for automatic answering and receiver terminal identification purposes.

It is envisaged that the transmitter station will be used for document loading during normal office hours, when the user will place his document on a flat bed scanner and key in the addressee's telephone number. He will then press a store button which will cause his document to be scanned in about 10 seconds and stored together with the telephone number on magnetic tape.

The telephone number will be held on tape in a small block of data referred to as the document header. An alphanumeric display will be provided with the keyboard for the user to check that he has correctly keyed in the required telephone number. Finally, the user will remove his original document from the scanner and the system will then be immediately ready to accept further documents.

When all documents have been loaded, and probably when the low telephone tariffs come into effect, the transmitting station will be automatically switched by a time clock from "store" mode to "send" mode. Document headers will be read from tape in sequence and used for automatic set up of the telephone calls.

If the system fails to establish a particular connection, because a number is either engaged or unobtainable, the equipment will set up the remaining calls before trying again. If a connection is established and recognised as being that of a non-facsimile subscriber it will be immediately cleared down and the number will not be tried again. The preprototype transmitter station is able to send some 15 A4 documents per hour since, in addition to its call set-up time, each document requires three minutes for transmission to take place.

By the following morning the system will have switched from the "send" mode to the "hold" mode. It can then be interrogated by a "key" operator who will check for any message transmission failures. The visual display will indicate the reason for each individual message failure. If necessary the key operator can then instruct the Autofax station to transmit these documents immediately. The key operator will then erase the tape with a keyswitch and the system automatically reverts to its store mode.

As the basic Autofax transmitting terminal is microprocessor-controlled many extra facilities could be provided simply by making appropriate changes to the software. Already with the preprototype, for instance, documents are assigned either high or low priority when loaded into the store and the maximum number of call attempts for each is dependent on priority status. Many documents can be sent to each destination within the duration of a single call, and a possible future development is the transmission of a document to a number of destinations, having been scanned and stored only once.

Identification and verification procedures on the preprototype are already more rigorous than those used in telex calls, requiring the called terminal to give its STD number for comparison with that used by the caller before transmission can proceed. Enlarged Autofax could provide a number of input scanners, each with its keyboard and display, and the storage and controller modules would be centralised and even perhaps associated with a PABX.

The Autofax controller and store could be arranged to accept coded alphanumeric input data from, say, an editing typewriter, with transmission being a mixture of facsimile and text-coded messages. And if a facsimile printer were used as a common output device at the receiving station it could operate automatically in text or facsimile mode as required. In text mode the printing speed can be very high, and already speeds in excess of 250 characters per second have been reached. In this way Autofax would make it possible to transmit an A4 size page of 4,000 characters in less than 16 seconds.

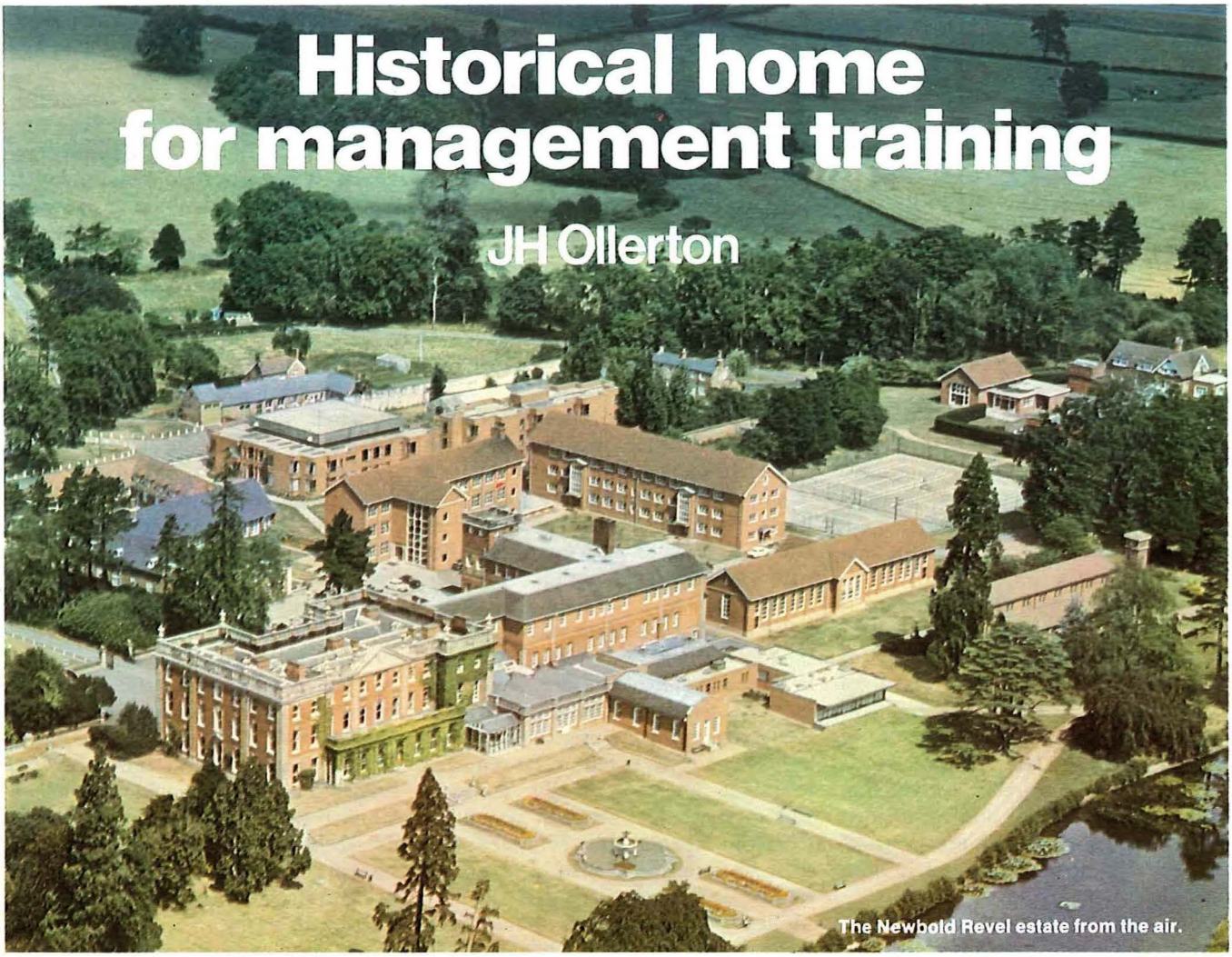
The potential of facsimile transmission is clearly considerable and it is likely to play an ever more significant role over the next few years as Research Department experiments are translated into everyday office practice.

Dr A. H. Robinson is head of facsimile systems section at Post Office Research Centre, Martlesham, responsible for research into system improvements.
Mr A. T. Bence is a head of group in the same section.

PO Telecommunications Journal, Summer 1978

Historical home for management training

JH Ollerton



The Newbold Revel estate from the air.

Back to the Saxons...

Newbold Revel owes its origin to a Warwickshire manor which existed in Saxon times and which was a prize allocated by William the Conqueror after the Norman conquest to Geoffrey de Wirce, one of his followers from the borders of Brittany and Anjou. The entry for Newbold Revel appears in the Domesday Book as Feni-Newbold. The change of name to Newbold Revel took place in the late 12th century following a marriage involving the Newbold Family.

But there are other important historical links. The estate eventually passed from the Revel family to Sir Stephen Malory and it was his son, Sir Thomas Malory who was identified as the author of Morte d'Arthur.

The most recent research suggests that this book was among the first to be printed by William Caxton who was a near neighbour.

FROM A PRIZE handed over by William the Conqueror to one of his followers after the Norman conquest to home for the Telecommunications Management College (TMC) . . . that's just part of the colourful history of a 324-acre estate in Warwickshire recently bought for about £2 million by the Post Office and which, during the next few years, should establish itself as the Business's principal centre for management training.

The estate, known as Newbold Revel, has most recently been used as a teacher training college and naturally much building and conversion work is necessary before the Queen Anne mansion with its 250 plus bedrooms is ready to receive its first intake of students – optimistically next Spring.

Meeting the target date for the opening of Newbold Revel will, of course, depend on the constructive support and activities of many parties including architects and builders. A key body will be the Telecommunications Management College Joint Working Party which held its first meeting at the end of May. As well as being concerned about the future comfort, welfare and training of management students from all parts of the Telecommunications Business, TMC management and COPOU representatives will be vitally concerned to safeguard the interests of tutorial, administrative and domestic staff.

Putting Newbold Revel, and with it Telecommunications management training, firmly on the map will represent fulfilment of the long standing Post Office objective to centralise the TMC. Management training is available for 27,000 management staff ranging from Executive Officers (EOs), Sales Superintendents (SSs) and Assistant Executive Engineers (AEEs) to Controllers, General Managers (GMs) and Heads of Division in Telecom-

The author and Sister Joan, Principal of the teacher training college, pose in front of the splendid Queen Anne mansion.

munications Headquarters (THQ). About 8,000 students a year will pass through the College.

At present training is provided in three locations – Manor Gardens, London, Bexhill, Sussex and Horwood House, Milton Keynes. Manor Gardens is non-residential and with an executive and traffic and sales wing takes in newly promoted and recruited executive and traffic staff. The Bexhill establishment is residential with 50 student bedrooms and looks after newly promoted engineering staff. At Horwood House – also residential – middle and senior management training takes place together with the initial training of newly recruited AEEs and EEs, engineering job conferences and certain laboratory based courses.

It cannot be pretended that TMC is a neat and tidy organisation. The initial training of newly promoted Inspectors and AEEs, for example, is undertaken at the three Regional Engineering Training Centres in Edinburgh, Bletchley and London on behalf of TMC while the initial training of Sales Representatives is carried out in the sales and traffic wing at Manor Gardens. Similarly one of the most vital questions of all – What constitutes management training? – is not uniformly answered by the course designs used in each of the five wings of TMC.

In the sales and traffic wings as well as imparting managerial skills, job skills are also included in the training. Engineering and executive staff on the other hand, need to attend vocational training courses principally designed for basic grade staff to become familiar with the vital details within their control. What exists is not the product of a carefully executed master plan but the evolutionary result of the separate development of each wing.

The opening of the Telecommunications Management College at Newbold Revel offers both outstanding challenges and opportunities for improved management training throughout the Telecommunications Business. Executive, traffic and sales managers will, for example, be spared the twice daily trek across London from and to a miscellany of hotels and will exchange this for a residentially based course. The engineering students who hitherto travelled to Bexhill will in many cases make a much shorter journey to a centre which will give access to the latest demonstration equipment provided for sales and traffic managers.

Mrs Jill Johnston, an STS tutor, instructs a group of mixed "students" in one of the classrooms at Manor Gardens, London.

It will also make sense for the newly recruited engineering managers currently trained at Horwood House to have their training alongside the promotee engineering managers at Newbold Revel. Ultimately it is hoped that Horwood House will become the senior staff college for the Telecommunications Business and no less important in the total plan will be the opportunity to develop at Newbold Revel a single administration, research and visual aids unit for the benefit of all wings of TMC.

While it can be argued that both students and management training will benefit from the development of Newbold Revel there is still the question of existing TMC staff. The problem for administrative staff in London and Bexhill and domestic staff at Bexhill is fairly straightforward in that alternative jobs will most likely be available close at hand. The position of tutorial staff is somewhat different. They come to TMC for a set term of between three to five years at the end of which they return to their normal specialism. For reasons frequently debated a decision has been made against setting up a career structure exclusively in training.

Clearly there will be transitional difficulties but the present conviction remains unshaken that management training carries significantly more impact when it comes from a tutor of proven management experience rather than if it were offered by a tutor whose principal and particular skill is the ability to teach. Even so the importance of teaching ability is not ignored hence the existence within the executive wing of an effective Instructor Training Group to which new tutors report before taking their first course.

To complete the philosophy it is considered that a tutor's credibility and his own career prospects suffer if he does not return to operational duties by the end of his term. And as a further contribution to improving management training the overall conditions for tutors within TMC are steadily being improved.

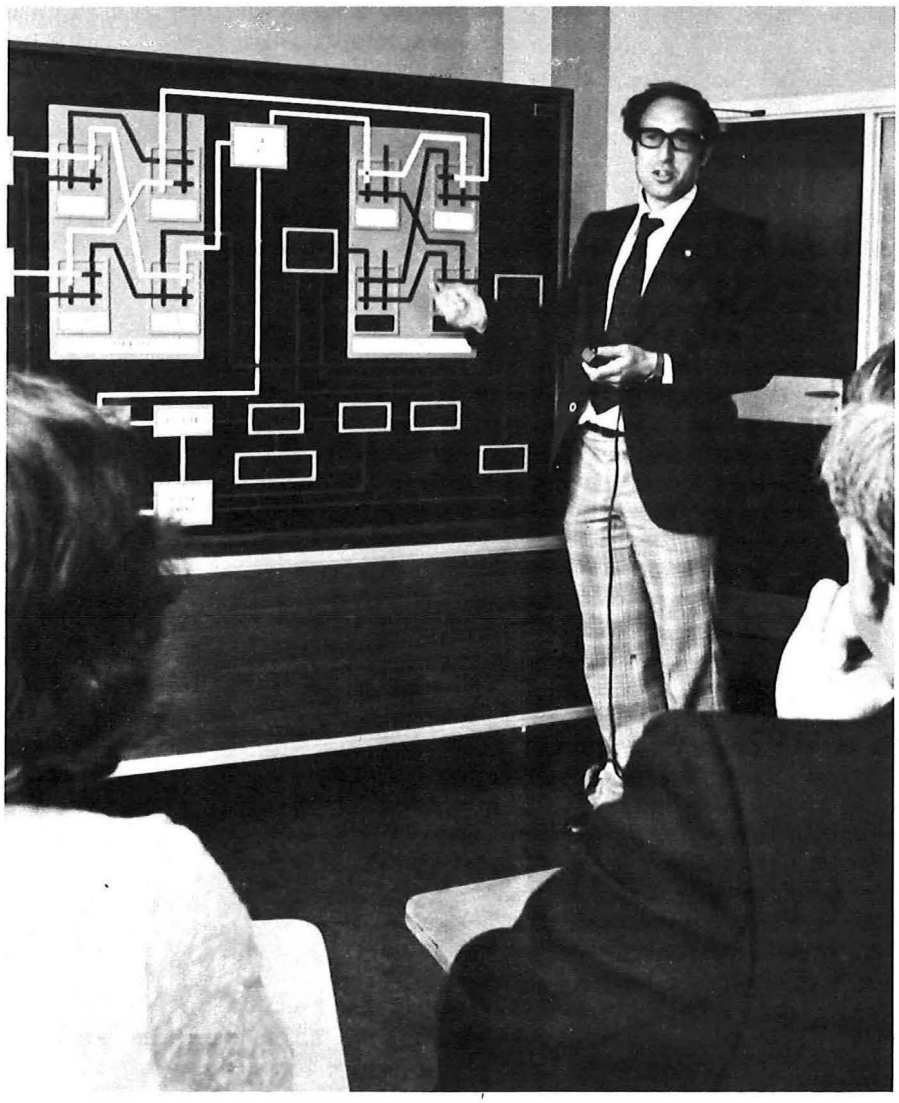
As far as course content is concerned, it could be argued that because the Telecommunications Business recruits most of its staff for the whole of their working lives and because most of its management training is given internally, an unhealthy, narrowly insular approach must result especially if the design of course material is left to the few in TMC who do not even have to bear the pressures of operational management. The facts however are rather different. TMC is essentially an agent serving the needs of the Business and newly designed courses must be approved by the operational THQ Department as well as COPOU. Equally it is important that TMC takes regular and active measures to ensure the continuing relevance of courses in a changing environment.

TMC must also react quickly to declared changes whether they be in statutory requirements through changing employment legislation, new Post Office policy as in the case of industrial democracy, changes in policy emphasis exemplified by the strengthened attention to customer service, and, of course, changes in technology which promoted the introduction of the microprocessor course and the extension of job conferences.

Considerable value is also placed on maintaining close touch with developing thinking in management training emerging particularly from the business schools. Use is already made of material or tutors from three business schools and to ensure a progressive approach these links are to be strengthened further.

The establishment of TMC at Newbold Revel promises to make available an even greater input of new thinking and better co-ordinated research, and it is expected that the most senior officers in the Business and the Corporation as a whole will be attracted to Newbold Revel to make their contribution to the development of management thinking and training. And the ultimate hope is that the name of Newbold Revel will quickly establish itself as being as synonymous with telecommunications management training in the future as Manor Gardens and Bexhill have in the past.

STS tutor Alan Cummings uses a light path model in one of the Manor Gardens training rooms to demonstrate how an exchange system works.



Mr J. H. Ollerton is head of division in Telecommunications Personnel Department and Principal of the Telecommunications Management College with overall responsibility for management training.

A future for telegrams

Mr Tony Finucane, until recently General Manager of London Telecommunications Region's Centre Area, has been appointed Director of the newly-created Telegram Services Executive (TSE) set up to bring together the Inland and International Telegram services under one administrative umbrella. Here he explains how the Post Office aims to make telegrams a viable and integral part of the Telecommunications Business.

COMPARED WITH other Telecommunications products and services, telegrams have, in recent years, been allowed to recede in the public mind through lack of positive marketing. Yet there is little doubt that demand for a telegram service will continue to exist for a long time to come.

Last year alone the Post Office handled more than three million inland telegrams and nine million international telegrams – about one third of them to or from the developing countries where there is likely to be a shortage of telephones for many years. Even in the United Kingdom four homes in ten still have no phone.

But against this there is the fact that last year inland telegrams lost £10 million and international telegrams £22 million while other areas of the Telecommunications Business continued to bring in the profits so vital for the annual £1,000 million investment needed to maintain and improve services.

Recommendations to and by the Carter Review Committee unfortunately had an adverse effect on staff morale and rumours were soon abounding about the service's future. Indeed, at one time things looked so bad that there was a feeling in certain places that within a very short time the last remaining telegraphist would be keying in the final telegram.

It was in this climate of uncertainty that the TSE was established. Top priority was to look at the shape and organisation of the telegram services and work out, in full consultation with the unions, what needed to be done to get the best from the two services for the benefit of the Post Office, its customers and the 6,000 staff in telegram work.

It was decided that TSE would assume responsibility for overseas telegraph supervising and operating staff employed on international telex switchboards and those working on telex billing for the External Telecommunications Executive (ETE). It would not be responsible for telex, data and private telegraph services.

Over the next year or so national press advertising campaigns will be run, mostly in the popular dailies, to draw attention to specific telegram services. Readers will be reminded that telegrams are a good way of exchanging greetings on birthdays, Mother's and Father's Days and at Christmas and Easter as well as that most traditional of all telegram occasions – the wedding. Other advertisements will be directed towards businessmen showing that telegrams are a useful part of the total telecommunications services available.

It must also, of course, be possible to improve on the number of telegrams sent and received in this country, particularly to and from areas like India, where in most districts the telegram is the only means of sending or receiving urgent messages. At home, too, there is plenty of scope for improvement if all avenues are properly exploited.

The establishment of the TSE is a clear indication that the Post Office is determined to revitalise the telegram service. There are many technical advances, which after discussion with the unions can be used to streamline the system and make it pay a much larger share of its costs. The telegram service is still very much alive and kicking . . .

Telegraphist Miss Susan Hartshorn at work when Post Office Chairman Sir William Barlow visited London Inland Telegraphs at Fleet Building recently. On the right is Mr Finucane.

The phone-in phenomenon

PG Archer and B Egglestone

THE ADVENT of commercial radio in the United Kingdom has firmly established a previously little known broadcasting phenomenon – the phone-in programme. And as interest in audience participation has grown, it has been quickly recognised that such shows fulfil a genuine demand for which Post Office Telecommunications needs to cater.

Although the BBC and Radio Luxembourg had on occasion previously made use of phone-in facilities, the Post Office had not encouraged its further use since it was concerned to protect other customers using the telephone network from interference which could be caused by the high level of calls involved.

The main problem with phone-in programmes, in fact, lies in the ratio of calls made to those that are answered. In the end, the number of callers who are successful in getting through must depend on how many calls the radio or television station can handle. All the Post Office can do is adapt the telephone network to cope with the extraordinary demands made by such programmes.

The more attractive the programme, or wider the coverage, the more calls will be made, but whatever the response, the studio only wishes to receive a certain number. In many cases, particularly in local radio, the number of calls can be easily handled by the station. In the case of television and some of the larger local radio stations, however, the presenters are concerned with attracting large numbers of callers, to reflect the popularity of their programme.

One of the conditions of allowing phone-in programmes is that the broadcaster must rent enough lines to give calls a reasonable chance of being answered either by the studio staff or by an answering machine in the studio. As phone-in programmes frequently generate hundreds of thousands of calls it is quite impossible for many of them to be answered even if the producer so wished. Thus congestion is created in the public network to the detriment of customers generally. So while it is operationally desirable for the broadcaster to rent sufficient lines to handle the calls, in practice it is generally unrealistic.

In an attempt to overcome this problem companies who use the phone-in technique on a large scale are allocated special exchange codes and calls to these exchanges are kept separate from normal telephone traffic in an attempt to reduce interference. This arrangement is called the TV and Radio Audience Participation Programme facility (TRAPP) and the most recent user has been Capital Radio, broadcasting from London.

This popular station, with some four million listeners, encourages audience participation by telephone in many of its programmes. Response was so great that some of the automatic switching equipment in the local exchange which serves Capital had become worn out by

Capital Radio girl Liz Goodacre notes the name and telephone number of a caller to the "Love-line" programme.

Disc-jockey Dave Cash prepares to deal with another romantic dedication on Capital Radio's "Love-line".

the constant wear of calls which could not be connected. Furthermore other customers on the same exchange had difficulty in receiving incoming calls because listeners wanting Capital Radio were blocking the lines, or misrouting to them.

It was decided therefore to provide Capital Radio with the TRAPP facility and they were given their own special exchange code 01–484. . . . All phone-in callers were asked to use only that code. By using this special number the telephone switching equipment at various stages in the routing of a call would recognise it and limit the total calls it extended to Capital Radio to the number which could be handled.

If the programme generated few calls, all would be connected but if the programme aroused great interest the number of calls would be automatically limited and engaged tone connected to those which could not get through. In this way the funnel of calls which previously caused so much damage and congestion was replaced by a steady stream of calls which would be answered.

Unfortunately this does not solve all the problems, however. As with all telephone calls some are misdialled by the caller and a few are misconnected. When several hundred thousand calls are made in a short space of time to one number, the percentage misrouted, however small, will cause unnecessary problems to other customers.

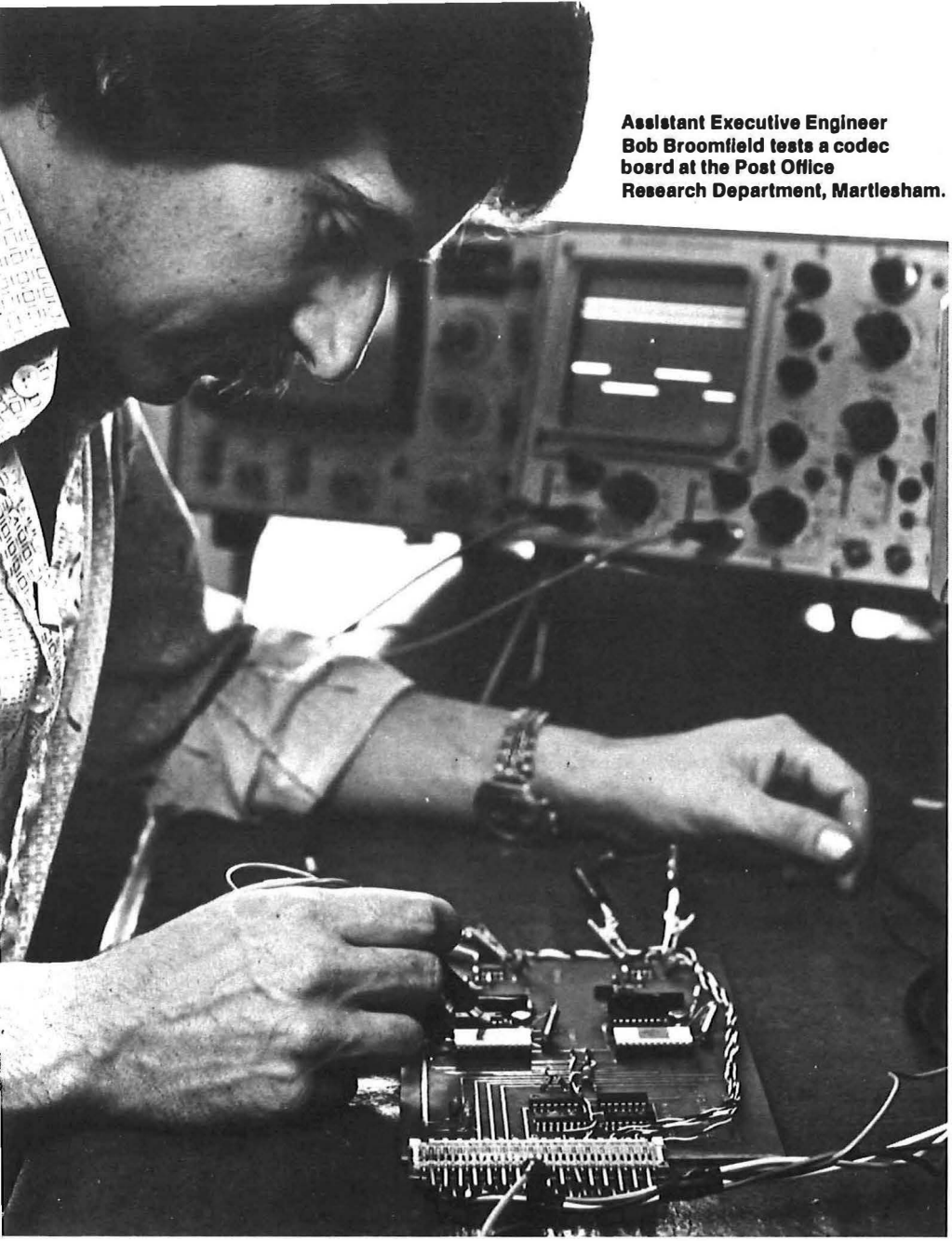
An example is the fact that at one time the BBC was using the special exchange code 01–288 . . . and any caller who omitted the digit 1 was misrouted to Bude in Cornwall (STD code 0288). Needless to say the customer in Bude was not pleased to receive hundreds of calls. By very careful selection of numbers this problem can be minimised although never entirely overcome.

By giving Capital Radio its own exchange code therefore with a well chosen number, the Post Office has adapted the network to cope with the problem, and prevented possible frustration and nuisance for many other customers.

Post Office technicians John Elliott and Tom Fagan check the key and lamp unit in a room adjoining the main control area and studios at Capital Radio.

Mr P. G. Archer is head of group and **Mr B. Egglestone** a Senior Traffic Superintendent dealing with customer services at London Telecommunications Region Headquarters.

PO Telecommunications Journal, Summer 1978



Assistant Executive Engineer Bob Broomfield tests a codec bosrd at the Post Office Research Department, Martlesham.

Low cost chips bring digital advance

PA Mitchell

The single channel codec (coder/decoder), one of Europe's most advanced microelectronic chips and central to the success of such telecommunications systems as the new rental range Private Automatic Branch Exchange (PABX) has been developed by the Post Office. With the promise of low cost in commercial production, the new device is expected to have a significant impact on the development of future electronic telephone exchanges.

THE WORLDWIDE trend towards digital techniques in telecommunications began when the transistor made digital transmission systems economically competitive. It was not, however, until the advent of low-cost digital integrated circuits, developed principally for the computer industry, that digital telephone exchanges became a realistic possibility.

To use digital techniques it is first necessary to convert analogue signals, such as the voltage variations produced by telephone microphones, to a stream of pulses by using an analogue to digital coder/decoder known as a pulse code modulation (PCM) codec.

At exchanges with highly concentrated telephone traffic, reduction in switch-block size and costs offered by digital circuitry can be significant, even when the overhead of converting the incoming speech to PCM form is taken into account, and consequently this is where the first impact of digital exchanges is being felt. The London Empress digital tandem exchange was introduced in 1968 and now digital trunk exchanges are in development or production all over the world.

At the other end of the scale there are now several digital PABXs on the market, and it has become feasible to look forward to the time when a 64 kbit/s transparent digital path will be available between customers for use for telephony, high speed facsimile and data or other developments as yet unforeseen.

Until recently, however, the local exchange has been a barrier to complete penetration of digital switching, because the cost savings available in a digital switchblock catering for low traffic are outweighed by the cost of converting between the analogue speech available from standard telephones to the digital form used in the exchange as this requires a codec on the line of each individual customer.

Of the two main classes of digital modulation, delta and pulse code, delta is simpler and delta modulators are relatively inexpensive. Mixing delta and PCM in one network however, introduces problems of compatibility and possible loss of transparency of the 64 kbit/s digital path and Post Office Research Department decided to concentrate on standard 8 k sample/second PCM for its all-digital local exchange work. Because of this arose the need for a PCM codec cheap enough to be used on a one-per-telephone line basis.

The key to low-cost is to put as much of the circuitry as possible on a single chip of silicon, as, within limits, the more components put on the chip, the cheaper the cost per component. This is known as Large Scale Integration (LSI) and the resulting chips can be very cheap if sufficient numbers are needed.

The potential market for codec chips

is high by LSI standards, and if all local exchanges in the United Kingdom were digital, the annual demand for single-channel codecs would exceed one million. If repeated on a world scale demand could approach 20 million each year.

There are two fundamental methods of producing PCM. In the first the signal to be encoded is compared with an internally generated approximation voltage, which is then stepped up or down in a predetermined way until as close a match as possible is achieved between the approximation voltage and the voltage to be encoded. When this has been done the level of the approximation is expressed as a digital code which is the required PCM codeword.

The most common method of generating the approximation voltage is to use a resistor ladder network, although resistor-capacitor charging and other methods are available. In the reverse direction the received PCM code word is used to generate the corresponding approximation voltage by activating a particular node in the resistor ladder network for example.

The main problem with this technique is that stability of the approximation voltage and accurate matching of encoder and distant decoder resistor networks are essential if acceptable performance is to be obtained. Unfortunately silicon microelectronics are not ideally suited to this type of circuit and very advanced technology is needed.

In the second method the analogue signal is first converted to a non-PCM code, for example, delta modulation, which is subsequently digitally processed to produce PCM. The advantage of this method is that a trade-off is possible between the complexities of the initial modulator and the subsequent code-conversion logic.

In this way a simple and low cost modulator can be used in conjunction with a complex digital code-conversion chip which is well suited to realisation using LSI technology available in the United Kingdom. The disadvantage of this method is that to give adequate noise performance, the initial modulator may need to operate at speeds greater than the LSI code conversion chip can handle.

Post Office Research Department decided to develop the latter method of encoding. Linear Delta-Sigma modulation, a derivative of delta modulation was chosen for the initial code, as practical circuits with the required performance were found to be cheaper than any of the alternatives examined.

In the decode direction the Post Office solution uses a novel complementary technique. The incoming PCM is digitally converted to a Delta-Sigma stream, which can be demodulated using a simple low pass filter. To demonstrate that a codec to this design could be built using LSI, the micro-electronic design and fabrication team at the Research Centre were asked to make the code-converter chip, which is probably the most complex chip they have ever attempted.

The result is a chip of about 5 mm x 4 mm which contains several thousands of MOS transistors. The Delta Sigma modulator consists of two active devices, a thin film resistor pack, and some capacitors. The performance of the complete codec is very satisfactory, meeting the CCITT recommendations with a good safety margin.

The codec is used in the Customer Digital Switching System No 1 (s1) – the digital PABX due to be introduced in 1980 (see Telecommunications Journal, Spring 1978) and the chip is now in production by both Ferranti and General Instrument Microelectronics in the United Kingdom. The two companies use very different technologies for realisation of the chip but have produced devices to the same Post Office specification, so acting as alternative sources of supply. The codecs are installed in prototype PABXs and local exchange models and have been satisfactorily carrying traffic on the public network for several months.

Price indications from the manufacturers and operating experience show that the Post Office has a single channel codec as good as anything on offer anywhere else in the world, and that a major obstacle to the introduction of digital local exchanges has at last been removed.

Mr P. A. Mitchell is head of section at Post Office Research Department, Martlesham, responsible for exploiting digital switching below trunk exchange level.

PO Telecommunications Journal, Summer 1978

A single channel codec chip – the dark area in the centre – compared in size with a postage stamp.

Blasted rock makes way for cable

RH Lewis

Spray rises from the sea as the "blaster" fires a charge in the reef.

THE SEDATE south coast resort of Eastbourne has long been associated with gentle sea breezes and senior citizens anxious to spend their retirement in relative peace and quiet.

Recently, however, the usual calm was broken by a unique Post Office project in which 2,000 lbs of explosives were used to blast a channel through 400 metres of tough, rocky reef for a new £5 million United Kingdom-France telephone cable which will double the number of direct telecommunications links between the two countries. Known as the UK-France II, the cable has a capacity of 3,900 circuits, and will provide much improved telephone, telex and other links with several Western European nations.

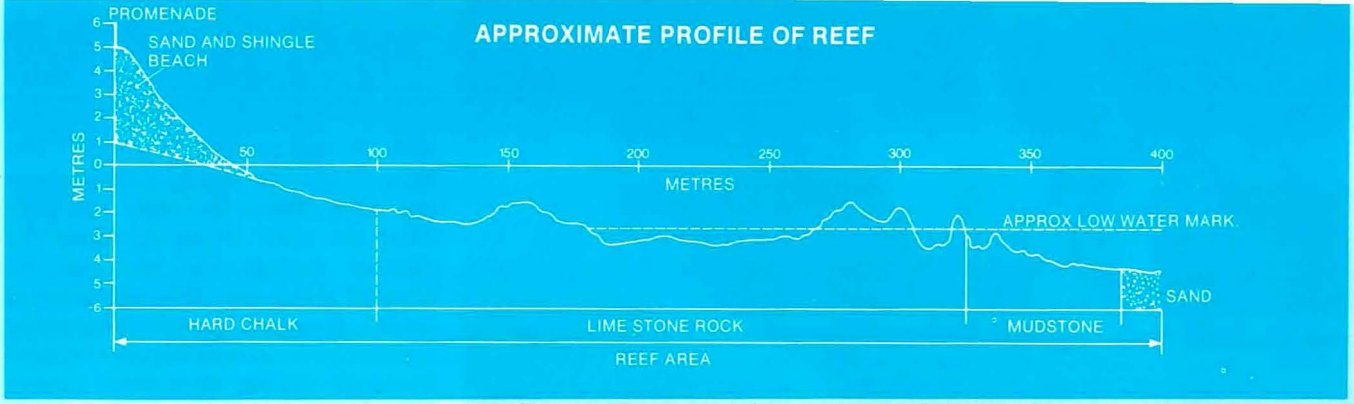
Previously landing points for major continental and transatlantic submarine cables have been on sand or shingle beaches, but at Eastbourne the approach from the sea to the beach is across an irregular reef, partly of hard chalk but mostly limestone. Not only were there serious technical problems, but in addition the work had to be done at a time and in a manner which would cause least inconvenience both to late season holidaymakers and to local residents. Marine life was also to be disturbed as little as possible.

As the work was carried out in winter, it made it more difficult from a practical point of view because of the high winds and heavy seas. Before the operation began an accurate profile of the proposed channel was obtained using an infra-red system because of the presence of a lagoon which was rarely less than one metre deep. Beyond that seaward, there is a ridge running along the coastline. It was this ridge which posed the major problem of how to drill and blast in this sector and beyond, and it illustrated how the operation was not a fully land or marine one but a combination of both.

Over the outer reef the contractor, Blasting (UK) Ltd, used a staging system which was basically elaborate scaffolding arranged either side of the proposed channel with a platform across the top for drilling the shot holes. The staging was then moved along as required by adding additional sections. The channel from the beach to the ridge was to be both one metre wide and deep while over the ridge and beyond it would increase to four metres to reduce problems in laying the shore-end of the cable. With the cable nine cms in diameter and quite rigid it was important that the bottom of the channel should be substantially flat, and this was the main reason for the accurate survey.

A pneumatically powered rotary hand drill with a tungsten carbide tip was used for drilling the shot holes where the rock was relatively soft, and this was done along the centre line of the channel at low water. A layer of clay about 10 cms below the rock surface, however, soon meant that a pneumatically powered drill rig on tracks was needed as the hand drill often became blocked with clay and difficult to withdraw from the hole. A series of six or seven holes were drilled and plugged ready for the explosive charges.

Half-pound sticks of gelignite of a type that would be rendered harmless after about eight hours in sea water were used for safety reasons in the event of a misfire. A hole was pierced through the stick of explosive to be placed at the bottom of the drill or shot hole, and a piece of detonator cord was then passed through and secured. Petroleum jelly was used to prevent water creeping along the cord,



and the gelignite was then inserted into the hole with the detonator cord brought out as a tail.

In most cases two or three sticks were enough for each shot hole, the upper part of which was then filled with general material from the beach and plugged. Detonator cord tails for two or three holes were tied to an electric detonator, and the two wires from each detonator were connected and secured to a twin cable taken up the beach. The wire joint was protected with petroleum jelly and tape to prevent water ingress. Each detonator had a 25 milli-second delay to minimise noise and vibration.

At high water flagmen would take up positions at strategic points, keeping everyone clear for the firing, while the blaster connected the twin wires up the beach to the exploder box. After the "all clear" signal, the blaster pressed the exploder button and set off the charge, usually creating a spray some three metres high but causing no measurable ground vibration at the top of the beach and very little noise, especially when an offshore wind was blowing. A vibrograph was used to monitor and record each explosion, and the readings were so low that they were barely perceptible.

Inside the ridge some surface rock was very hard, and the drilling pattern changed from a straight line to a domino formation with shot holes drilled down each side of the channel about one metre apart and down the centre. This drilling pattern was also used at the ridge where the channel was wider and the holes considerably deeper at about three metres.

While surface rock over the ridge was hard, the material near the bottom of the holes was much softer, so a special plug was inserted before charging to prevent most of the energy being dissipated downwards. Seaward of the ridge the rock was mostly mudstone and too soft for the staging anchor bolts to hold. The contractor therefore adopted a "lay-on" charge method, using packs of 10 pounds of explosive charges wrapped in perforated polythene bags and taped to hold the sticks of gelignite firmly together.

Four packs were made up, each with its own detonator cord and detonator and a 25 milli-second delay between each pack, and arranged in a square formation one metre apart straddling the channel centre line. Divers placed the charges on the sea bed and used sand bags to prevent movement by the tide. The detonator wires were brought to the surface and buoyed, and a second formation was set further along the line of the channel.

At high tide an inflatable boat went out to pick up the first buoy and the detonator wires were connected to one end of a coil of cable and the joints sealed. After allowing the boat to drift to a safe distance from the charges the exploder was connected to the other end of the coil of wire, ready for the blaster to fire the charge when given the all clear. The operation was repeated for the second buoy.

The trench landward of the ridge was cleared by tractor with a backacting bucket after every two or three charges had been fired. The channel bottom was checked for relative smoothness and then backfilled for safety; occasionally an extra charge was needed to clear obstructions.

Marker poles were secured either side of the channel tall enough to be seen above the high water mark so that the position of the channel was visible when the cable was laid by Post Office Cable Ship Monarch on a rising tide

Drilling work goes ahead in the lagoon area before blasting can begin.

A cord is tied securely to the detonator before it is carefully placed in position.

Mission complete: The UK-France cable is floated ashore at Eastbourne. In the background is Post Office cable ship Monarch.

with the reef completely covered. The channel was completely cleared about one week before the cable was laid. After the cable laying operation the channel through the reef was reinstated giving the cable one metre of cover – enough to prevent it becoming exposed as sometimes happens on sand or shingle beaches after severe erosion following winter storms.

Although all the technical and mechanical details had proved highly satisfactory one area which was severely underestimated was the degree of public interest in the operation. Early on the contractors found themselves losing time answering questions from the public, and to meet this demand South Eastern Telecommunications Region Publicity Department produced a special leaflet describing blasting and subsequent cable operations.

As far as complaints were concerned, there were, on the whole, few and these were the result of rapid air movement. Following an explosion a large "bubble" of higher pressure air would be produced, and with an offshore wind it would be taken out to sea. With an onshore wind, however, it would come inland and though no more severe than a high wind it would strike a building more suddenly and in some cases cause alarm especially if it coincided with the noise of the explosion. At no time was there any measurable ground vibration.

To reassure the mainly elderly people who feared their homes were about to crumble around them, the contractors and the Post Office used a direct approach to allay their fears. Residents were telephoned, given some reassurance and arrangements were made for a vibrograph to be set up at their premises. Results from an explosion were explained in simple terms and many people who were initially dubious became genuinely interested in the operation as a whole; in fact it became a very worthwhile public relations exercise.

In all, the rock blasting progressed smoothly except for a few hold ups caused by bad weather. The operation should reach its final stage in September this year when the Post Office Cableship Alert is scheduled to lay the main cable across the Channel.

Mr R. H. Lewis is an Executive Engineer in the Marine Division of Telecommunications Network Planning Department, responsible for shore end planning and protection of undersea telephone cables.

PO Telecommunications Journal, Summer 1978

Post Office technician George Baillie at work in the special international call booth in which the box will accept 50 pence coins only.

Take-off for six-year project

GR Lee and AB Peterson

The new Edinburgh terminal, seen here from the aircraft apron, was shaped and coloured to blend into the landscape.

WHEN THE FIRST scheduled flight climbed away from Edinburgh's new international airport heralding a new era in passenger transport from Scotland's capital city, a small team of Post Office staff were able to take particular satisfaction. For although not the largest single project ever undertaken by the Edinburgh Telephone Area, work in providing a comprehensive communications set-up for the airport spanned six years, was highly prestigious and involved every division in the Area as well as some 13 individual customers.

Edinburgh Airport lies some nine km west of the city and began as a grass airfield in 1915 for use by the Royal Flying Corps. The first paved runway was laid by the Royal Air Force in 1939, but it was not until 1947 that civil flights began. The aerodrome, then known as Turnhouse, remained under military control until 1960 when RAF Fighter Command handed it over to the Ministry of Civil Aviation.

A major redevelopment of the airport was needed to meet growing demand for air travel and raise standards to international levels. In April 1971, the British Airports Authority (BAA) took over and embarked on a £15 million programme to provide a new passenger terminal building as well as a re-aligned runway to replace the old one which was susceptible to crosswinds and so severely limited for use during poor weather.

The new runway was surrounded by a 7,000 m loop of Post Office four-way duct, with separated outlets to each navigational aid point. Jointing chambers were constructed to a special BAA/Post Office specification at 200 m intervals around the runway. A perimeter cable containing 160 pairs linked to the control tower, provided circuits to points around the runway.

As it had been decided that a new control tower would not be built with this phase of the project, the cable had to be looped back to the existing tower, adding a further 3,000 m to the 7,000 m loop. Additional keyboard panels and signalling units were required to extend the communications facilities to the radar and visual control room in the control tower.

The perimeter cable is pressurised from equipment located in the control tower to reduce faults which might affect service. Spurs from the perimeter cable are terminated on test tablets housed in purpose-built glass fibre cabinets. In the event of a fault developing, it is possible to bring into service a quick alternative routing by shifting "U" links on the test tablet. In this way, circuits can be routed in the reverse direction around the loop, so avoiding the fault.

Some 200 internal and external private circuits and 25 external extensions were required to provide communications with points around the runway. These included navigational aids, electrical substation, the new fire station and three rendezvous points which are used as gathering points in the event of an emergency. Each rendezvous point cabin has a direct private wire to the control tower together with extension telephone facilities from the main private branch exchange (PBX).

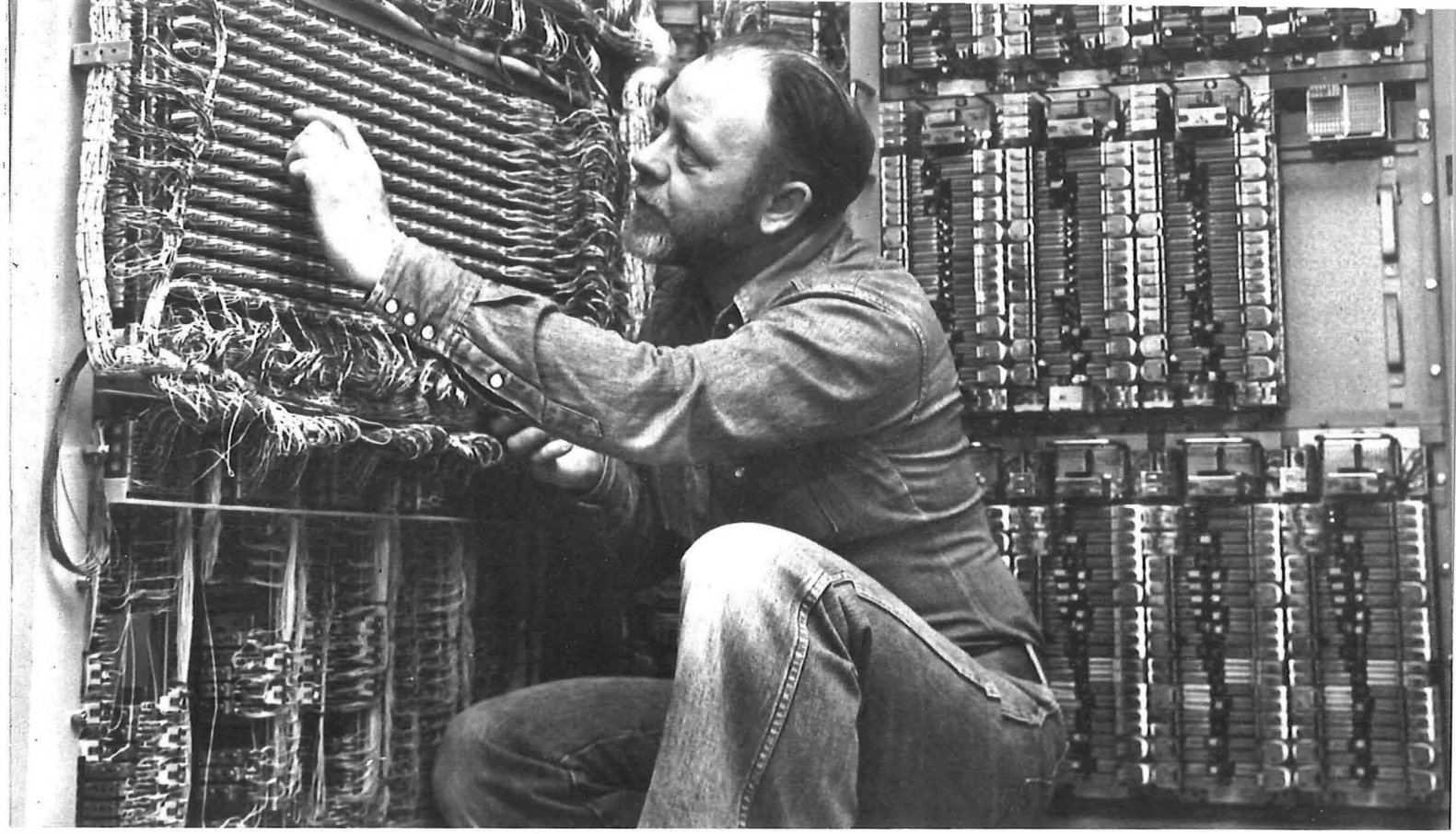
As the western edge of the the new runway is partially out of sight of the control tower, a runway control unit (RCU) has been built and provided with similar communications equipment to that in the main control tower. An "omni-crash" system has been provided for the airport fire station, the BAA PBX operator and the Lothians Police and Fire Headquarters.

This enables the air traffic controller to alert the emergency services at the push of a button. Circuits to the Police and Fire Headquarters are normally used as administrative circuits by the PBX operator. These two circuits are known as "snatch circuits" since the controller automatically overrides them in an emergency.

All the work, some of which was on existing operational equipment, had to be carried out without any interruption of service to the old runway. For changeover purposes, an intricate jumpering network was designed and provided on the existing main distribution frame within the air traffic control building.

For the second phase, telecommunications work was co-ordinated by an Area project steering committee. The old terminal building had been

Testing one of the pendant telephones which provide direct communication to the terminal is Post Office technician George Jack who was involved in the installation.



Maintenance of the switchboard at the new terminal is in the charge of Technical Officer Vic Dudgeon.

served by a five-position PMBX 1A but it soon became clear that this would be redundant. The new terminal building was to be served by a BAA-owned, large crossbar PABX, with two switchboard consoles. The RAF would have their own PABX and the needs of the National Air Traffic Services (NATS) could be met from the PABX No 1. The main BAA PABX would also meet the needs of the airlines and other concessionaires operating within the complex.

Extension metering equipment had to be included for this purpose as well as exchange line metering equipment. The main PABX was also designed with Direct Dialling In (DDI) facilities which enable customers to reach an extension number directly, without the assistance of the PABX operator. All outgoing lines and incoming lines to the switchboard were provided from the local public exchange on two new, dedicated 200 pair cables.

The high standard of interior finish within the new terminal building meant all the cabling had to be concealed. In all, 52 km of cable was hidden behind panels which, once in position, could not be removed. Special provision had to be made for cabling to "island" locations and since the polished stone floor could not be disturbed, cables were fed from the acoustically controlled, suspended ceiling, through poles, to the individual islands.

The obvious maintenance problems associated with concealed cabling have been offset by running two cables to each telephone outlet. BAA architects designed purpose-built desks to incorporate pendant telephones at the international and domestic check-in area. Similar facilities were designed for 10-line key and lamp units at the information and car hire desks. The main concourse also contains a number of telephones connected, by private wire, to the larger Edinburgh hotels. This enables airport users to make enquiries and reservations without cost.

Twenty-nine public call offices are strategically positioned throughout the new terminal building each one housed in its own flame-red acoustic hood. The Departure area also boasts an international call office. This is easily distinguished by its metallic blue colouring and is available for International Direct Dialling (IDD) calls only. The box will only accept 50 pence coins and any attempt to dial other than 010 or 100 will be met with the "number unobtainable" tone.

The acoustic hood has four information panels, two of which contain lists of selected countries that can be dialled directly, the other two containing instructions how to use the system in English, French, German and Italian.

Another, less common item of apparatus is the "ring once" telephone. Connected as an ordinary extension, the ringing ceases after an initial burst, leaving the neon lamp in the handset glowing to indicate that the telephone has yet to be answered. The Apron Controller, who supervises the movement of aircraft on the ground, has direct, push button links to the airline desk, information desks, fire station and control tower.

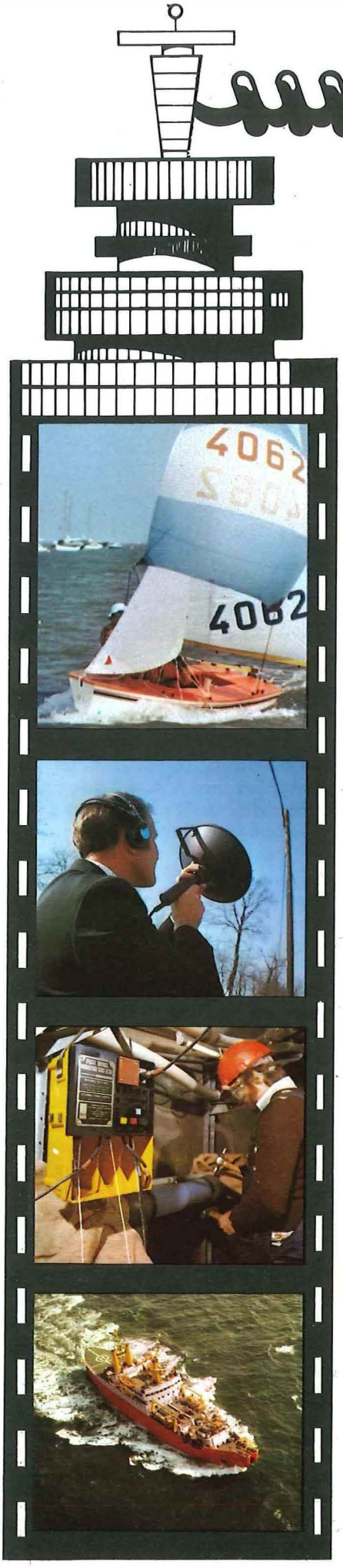
In total, the new terminal building was equipped with eight teleprinters connected to the telex network, one teleprinter connected to Societe International Transportation Aeronautical (SITA), a worldwide airline telegraph network, 180 internal and 60 external extensions including 21 red emergency telephones, 35 direct exchange lines and 60 private circuits for data, inter-PBX lines and emergency alarms.

A high proportion of the external private circuits were controlled by other Areas, which gave Edinburgh sales and customer works group staff additional problems, as changes involving telecommunications requirements were made up to the opening date.

The six year project reached its climax when the Queen opened the new airport at the end of her Silver Jubilee tour of Scotland. Two days later the first flight was safely away.

Mr G. R. Lee is an Executive Engineer on Customer Works Group in Edinburgh Telephone Area and chaired the Project Steering Committee.

Mr A. B. Peterson is an Assistant Executive Engineer in the same group and was responsible for project co-ordination.



Keeping in the picture

In the sixth in our series on some of the many different jobs essential to the efficient operation of Post Office Telecommunications, Jim McDermid, Acting Superintending Chief Photographer in the Post Office Photographic Unit, outlines some of the aspects of its work.

Jim McDermid

HOW WOULD YOU like being stranded on board a cable ship for five weeks in the middle of the gale lashed Bay of Biscay? Or does the idea of hovering in an open-doored helicopter 2,000 feet above the North Sea appeal more to your sense of excitement? You might, on the other hand, fancy yourself in a James Bond-type role avoiding arrest by military police while taking photographs near a secret defence establishment.

Well, in an outfit like the Post Office Photographic Unit it is all part of the day's work. We are one of the very few units which covers every conceivable aspect of Post Office activity – inevitably bringing variety, excitement and the odd close shave.

Our photographic set-up would be the envy of any top-rate picture news agency in Fleet Street, both for the range of equipment and facilities at its disposal and the enormous variety of assignments it undertakes. Yet, incredibly many people within the Post Office do not even know we exist let alone the sort of work we do.

The Photographic Unit is situated at Cardinal House in Farringdon Road and at Old Street, and is part of the Purchasing and Supply Department. Day-to-day running is controlled by a chief photographer backed by four principal photographers with a staff of 61 including 51 qualified photographers and two photoprinters. And it is one department where it is almost impossible to keep up with the Joneses as there are four of them – three named David.

Last year we dealt with almost 17,000 requisitions from 3,000 Post Office customers including 1,550 outside assignments. We produced 35,000 transparencies and more than 140,000 black and white prints, 3,500 overhead projection slides and 8,000 printed circuit master negatives or positives to a tolerance of ± 0.05 or less. Plans and maps reproduced last year numbered some 2,000. Processing of colour and black and white films is done internally along with transparencies and overhead slides.

But one of the most important – if unexciting – jobs each day is meter photography. The Unit provides and maintains 170 cameras and ancillary equipment for every Telephone Area in the United Kingdom and trains local staff – telephone operators, clerical officers and others – to use cameras so that the subsequent films can be forwarded to the Data Processing Service for input to the telephone billing system.

At the last tariff revision, film arrived at the Unit at the rate of 800 rolls per day, which meant we processed and printed more than 2,000 rolls of film in five days representing a daily income to the Post Office of some £14 million. With the introduction of Telecommunications On-Line Data (TOLD), processing of meter films has now become a local job as we train the unskilled to do the processing. This allows data to be read from prints or readers and input direct to the billing system from Telephone Accounts Group offices, resulting in a possible

It's our business

Outside operator Roy Argent prepares to set off on another photographic assignment armed with the large range of cameras and essential back-up equipment he may need.

saving of time and up to £500,000 each day.

Directly developed from the meter photography system have come several variations operating in both the Postal and Telecommunications businesses, for example TRAMP and TRUMP (Traffic Recording using meter photography) for Network Planning Department and other sections of the Post Office. There are more than 41 TRAMP and TRUMP units spread over the country from Penzance to the Shetlands, using photo equipment especially designed by the Post Office and costing more than £600 each.

Public Relations Department assignments for publications like Post Office Telecommunications Journal and Courier and for the Features Bureau and Press Offices are among those tackled by the seven-strong team of outside photographers. On one day our photographers can be accompanying the Chairman of the Post Office on his regional visits and the next taking shots in an underground tunnel or up a telegraph pole or radio mast. There are also exhibitions and presentation ceremonies to be fitted in between making a month-by-month photographic and cine record of the building of Madley earth station.

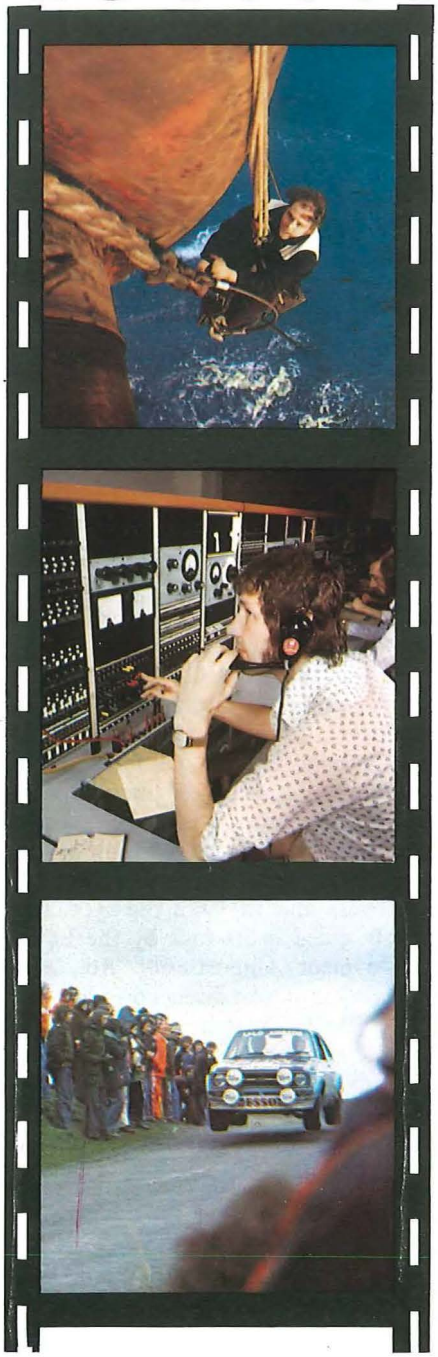
Working in close collaboration with Staff in Telecommunications Marketing Department, recruitment, training and safety films are produced by the cine section. In the past 10 years more than 100 films have been made with some accredited successes such as a silver award from the British Industrial Films Association for "Telecomms Network" and a certificate of merit for the film "Brought to Account."

In addition the Cine Film and Audio Visual Section make film records of such things as the installation of equipment for reference purposes and they make colour slide Audio Visual productions with speech and sound effects. They also offer advisory services in connection with cine and AV. Projection equipment is available on loan to Departments in London.

The main studio at Cardinal House contains a vast array of props and the studio photographer is often the envy of his colleagues, for his is the world of gorgeous food for the Dial-a-Recipe service, or glamorous telephonists scantly clad in a borrowed Norwegian sleigh for Dial-a-Santa. Studio work also includes photographing damaged or faulty equipment, providing portraits of senior management to accompany press releases and making passport and visa prints.

Photography is not new to the Post Office as prior to 1919 this work was carried out in the drawing office of the Engineering Department by two unestablished draughtsmen. But in August of that year the first official photographer joined the Post Office, though still classified a draughtsman until a second photographer was taken on in 1920.

Things, however, have come a long way since those days and now the size of the Unit is such that we are hoping to move to better accommodation. The



first phase of the move has already taken place to Old Street where there are facilities for photo-lithography, instrumentation, audio-visual and cinemaphotography. A cinema seating 26 in comfortable surroundings is available on the fifth floor to cater for all types of projection work.

Certainly the job of a Post Office photographer can be exciting but it does have its drawbacks – hours of driving to site carrying £2,000 worth of equipment, unsocial hours and working in all types of weather. At all times a sense of humour is essential.

How women make the grade

Joan Sweeney, a Higher Executive Officer in the Scottish Telecommunications Board Headquarters Finance Division, recently took advantage of a Churchill Travelling Fellowship to study the status of women and minority groups in telephone companies in the United States. The award enabled her to visit eight Bell Telephone companies as well as three independent organisations and this article outlines her findings.

THE UNITED STATES had a head start over Britain in outlawing discrimination, with active lobbying by well-organised women's groups leading to the enactment of the Equal Pay Act in 1963. The key legislation, however, was the 1964 Civil Rights Act, which made it unlawful for an employer to discriminate because of race, colour, religion, national origin or sex. An Equal Employment Opportunity Commission (EEOC) was created to ensure that the provisions of the new Act were observed by all employers and in 1972 the EEOC was greatly aided in its task by the Equal Employment Opportunity Act, empowering it to take direct court action.

The Bell Telephone Company, because of its size and the traditional American dislike of monopolistic businesses, has always been subject to a high degree of government oversight and cannot, for example, raise its inter-state tariffs without government agreement. In 1970, Bell applied to the Federal Government for permission to increase inter-state rates, and the EEOC immediately intervened alleging that the Bell companies' hiring and promotional practices discriminated.

More than two years later, after much legal wrangling between the Bell companies and various Government departments, a comprehensive agreement on behalf of all the Bell Telephone Companies was signed with the EEOC, resolving all the issues raised. The Consent Decree, as it is called, is legally binding and has been hailed by many as the most far-reaching corporate civil rights agreement ever negotiated.

As a result of the Consent Decree the Bell System agreed to give immediate wage increases to thousands of women and minority groups which amounted to nearly 40 million dollars in the first year alone. About another 15 million dollars was paid to satisfy claims of past discrimination. Most significant of all, each company's hiring and promotion practices were completely revised to enable thousands of women and minority groups to establish themselves on career paths which would eventually lead to management positions or better jobs. In addition, the agreement opened the doors for women to enter the higher paying technical and outdoor jobs which were hitherto almost exclusively male. Conversely, it provided for a sizeable percentage of "female" jobs to be filled by men.

To meet the requirements of the Consent Decree and assist in implementing equal opportunity policies, each Bell Company, like all Federal contractors, has to maintain a set of

An illustration taken from a selection of recruitment literature used by the Bell Telephone companies to attract women to non-traditional work.

procedures designed to attain a representative workforce. An Affirmative Action Programme (AAP) pledges each company to achieve, in a reasonable period, an employee workforce which, in all major job classifications and levels, approximately reflects the race and sex make-up of the market from which applicants are recruited.

Targets are set for each of a number of job classifications and geographical areas in a company, with race and sex ratios in the labour market determined and used as the basis for target-setting. Any community making up more than two per cent of the total labour force has a target set for it, so that in some companies which serve multi-racial areas there are different female and male targets for Blacks, Whites, Spanish-surnamed Americans, American Indians, Asian Americans and any others. Manpower planning is now a very complicated art in the Bell Companies. . .

The chief vehicle for enabling women to move into non-traditional jobs such as installation or maintenance are mobility application plans which enable any non-management employee after a minimum time on any particular job to apply to be considered for any other non-management job whether at the same or at a higher level.

On the management side, the Consent Decree led to the introduction of a special programme in each Bell Company, designed to assess the career qualifications of women graduates who had not had the same opportunities for management training as their male colleagues. Those who elected to participate in the programme attended a two-day session at a special Bell assessment centre. Successful candidates received an immediate increase in their monthly salary of about 100 dollars and had career programmes specially developed for them.

The most controversial aspect of the legislation has been the invention of the Affirmative Action Override, which allows an applicant with the basic minimum qualifications for a job, but with fewer qualifications or less seniority than other applicants, to be selected for a job if this selection will help meet an Affirmative Action target. Thus if a company is falling short of its target for women in a particular job classification, it may select or promote a woman, even if she has fewer qualifications and less seniority than male applicants, so long as she has the basic qualifications for the job.

Bell's three main unions have contended in court, and lost, that this conflicts with portions of their contracts concerning seniority. The courts ruled that the use of seniority for promotion was in itself discriminatory since it favoured white males who had better opportunities in the past to gain seniority than women and minorities. The unions' appeal is now before the Supreme Court which has not yet decided to hear its case.

The Consent Decree requires that on-site investigations into a company's efforts to implement equal employment policies, be conducted both by company personnel and by government agencies. Just how seriously government agencies take their responsibilities in this matter was found out by Bell in 1976. Because of government dissatisfaction at the slow progress made by some companies within the Bell System, another agreement was negotiated with Bell – The Supplemental Order – to redress alleged deficiencies in compliance with the Consent Decree.

This Order also has the force of law, and resulted in instances of almost overnight promotions of women into non-traditional and management jobs. To administer the changes in Equal Employment Policies and practices, to monitor compliance, and to keep the Government supplied with the required mass of employment statistics, Bell has had to set up a miniature EEOC of its own employing some 750 people and costing some 15 million dollars a year.

There can be no doubt that the Affirmative Action Plans have had a dramatic effect on the composition of Bell's workforce. Women and minorities are now well represented in non-traditional jobs and are generally much better off both financially and from a career prospects viewpoint.

On the negative side there are still complaints that boardrooms in each company are not representative of the male/female split of the workforce but Bell argue that it will take time before the effects of the revolution at lower levels can be repeated in senior management. At non-management levels there is a very much higher accident rate among women employees in outside craft jobs – there has already been one fatality and several serious accidents.

Overall, however, considering the extent of the changes required by the Consent Decree and the comparatively short time since it was signed, there can be no denying the effectiveness of Bell's Affirmative Action Programmes. The EEOC, in fact, frequently refers other companies to the Bell System for advice on the setting up of Affirmative Action Plans and the Bell agreement has served as a model for similar agreements by other large companies in the United States.

Independent companies also had to observe the provisions of equal employment legislation but had not been forced into the position of having to sign Consent Decrees. Generally, in these companies progress had been made in placing women and minorities in non-traditional jobs but more slowly than in Bell resulting in less resentment among non-protected groups.

A woman installation and repair instructor (centre), takes a session at a Bell System training school in Washington DC.

An artist's impression of the spot beam method of increasing satellite capacity.

SPACE FOR DOUBLING SATELLITE CAPACITY

JE Purdy

The development of a technique using the polarisation property of radio waves to keep signals separate and allow two microwave carriers to be transmitted on a common frequency can virtually double satellite capacity at only modest extra cost.

THE RAPID GROWTH of international telephone traffic in the last few years has been made possible to a very large degree by the continuing development of Satellite Communications Systems. Successive generations of satellites have so far kept pace with traffic demands, usually by increasing satellite output power and bandwidth to the maximum allowable under international radio regulations.

Additional capacity has also been achieved by employing narrow-beam aerials, analogous to spotlights, which by spatial separation enable the same frequencies to be used more than once. Each spot beam can illuminate particular zones on the Earth's surface without mutual interference and this method has proved extremely effective but is limited in that only those earth stations covered by particular spot beams can operate to each other. Because of this, one of the prime advantages of satellite communications – all stations working to the same satellite being accessible to each other – is not fully realised.

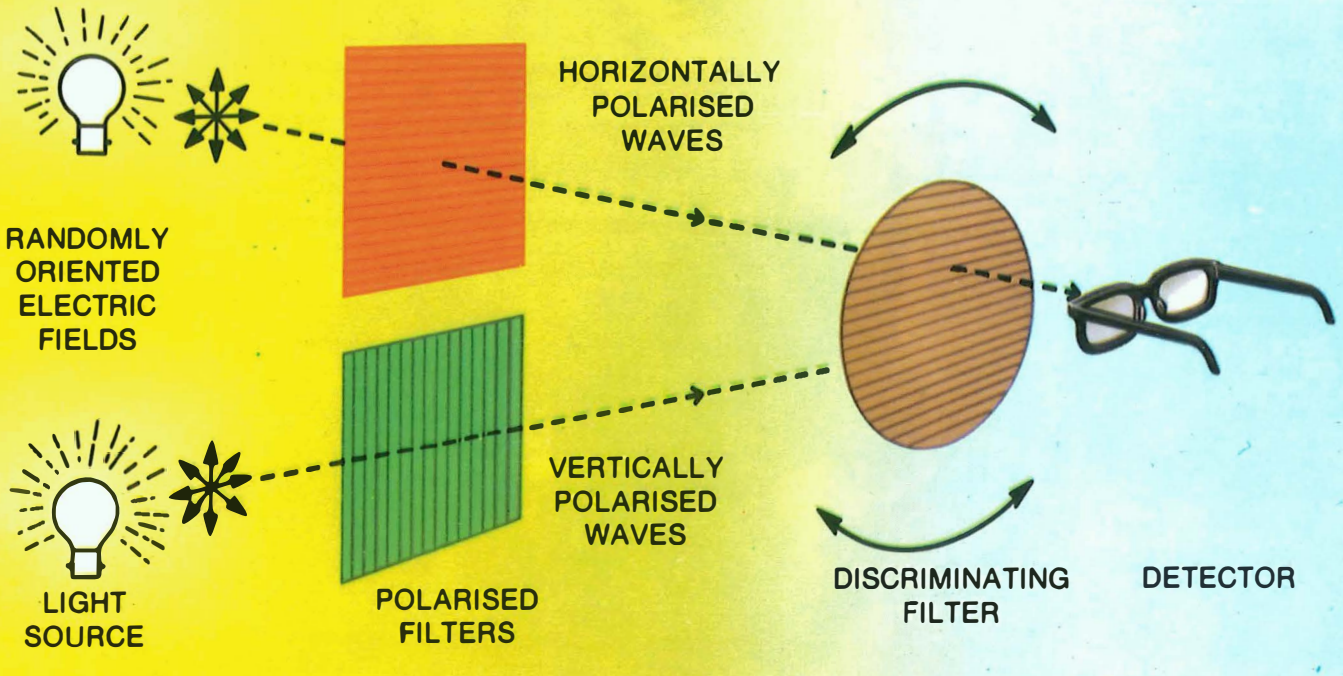
Another way of increasing traffic is simply by putting more satellites in orbit and/or using additional frequency bands, but this involves considerable capital cost in providing new earth stations and satellites.

The possibility of doubling satellite capacity by using two signals of identical frequency but kept separate by radiating them on different polarisations has been the subject of study by various research and development teams – including the Post Office – for several years. The technique is well known but there are special problems in applying it to satellite systems which use wide bandwidths and in which the transmit and receive signals pass through the same aerial feed.

It has now been established however, that at the expense of some technical and mechanical complexity, dual polarisation working in satellite systems is practical and that during clear weather conditions it is possible to limit the interference level from one polarisation to the other to less than one thousandth of the wanted signal over the whole of the satellite frequency band.

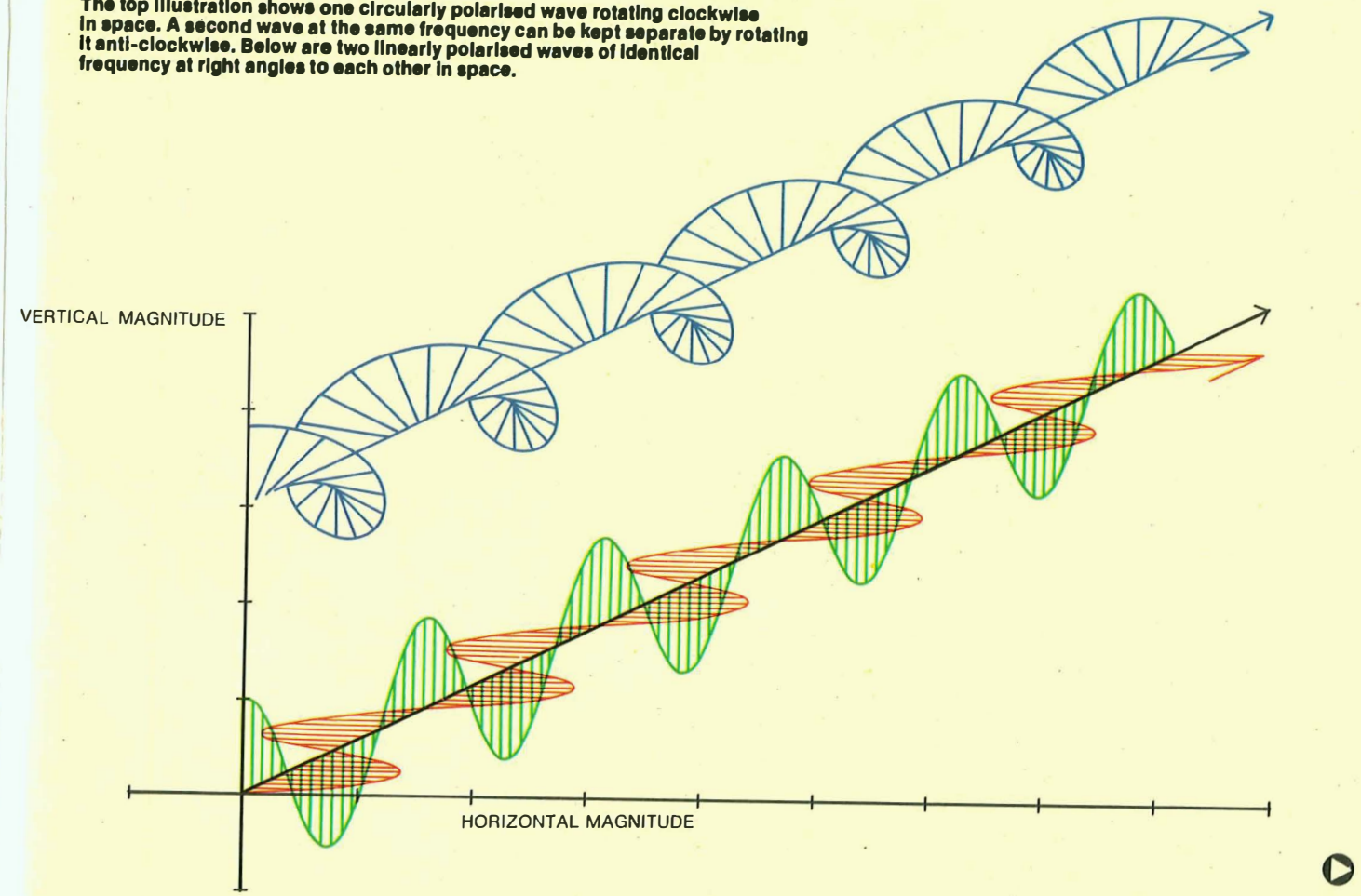
The benefits of the technique can be seen best in the fact that present INTELSAT IVA satellites have a capacity of about 11,000 telephone channels whereas the new INTELSAT V satellite, employing frequency re-use by both narrow beams and dual polarisation, will have a capacity of between 20,000 and 25,000 channels depending upon the detailed manner of its use. Some of this increase will be achieved by the use of an additional operating facility at 11/14 GHz but a substantial proportion is due to the use of dual polar techniques.

The technique uses the polarisation properties of electromagnetic waves to keep the signals separate. Most people who have used polarised sun glasses are familiar with the phenomenon which occurs with visible light. Most light sources are randomly polarised and a Polaroid filter, such as used in some sun glasses, reduces the intensity because only light which has its electric field oscillating in one particular direction in space can pass through.



An optical model of polarisation discrimination.

The top illustration shows one circularly polarised wave rotating clockwise in space. A second wave at the same frequency can be kept separate by rotating it anti-clockwise. Below are two linearly polarised waves of identical frequency at right angles to each other in space.



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The resultant light waves are then linearly polarised and can be accepted or rejected by a second Polaroid filter according to its orientation in space. This ability to accept or reject linearly polarised light waves according to their direction of polarisation can be applied to radio microwaves in satellite systems.

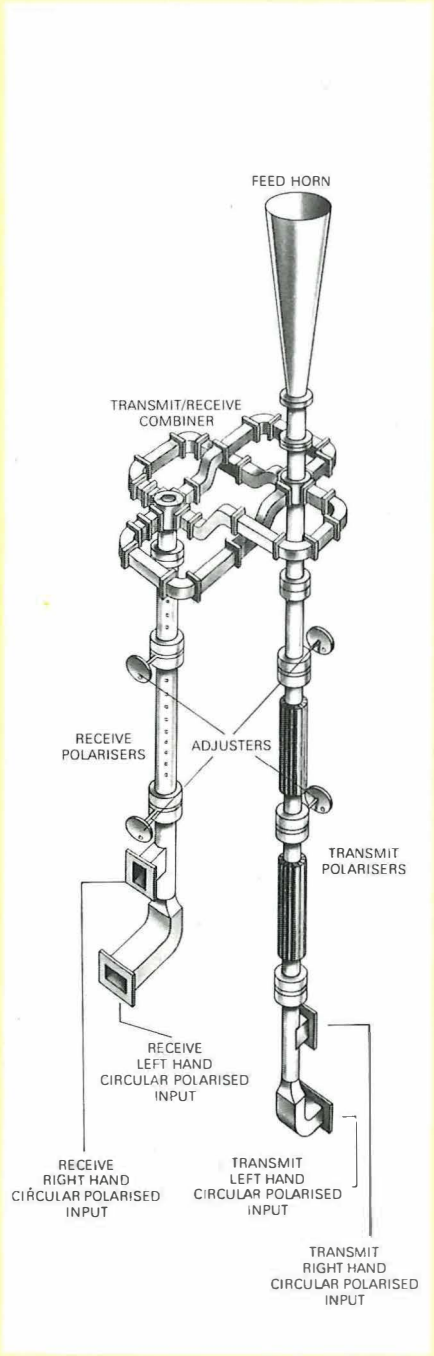
A wave is described as linearly polarised if the electric fields in the wave oscillate only in one plane in space. Ideally, the aerial is designed to transmit and receive simultaneously, radio waves which are propagated on two linear polarisations at right angles to each other and thus have no coupling between them. An alternative method which has advantages under certain propagation conditions is to use circular polarisation instead of linear.

Circularly polarised waves rotate as they travel through space in either a left-handed or right-handed sense and again an aerial can be designed to transmit and receive both hands simultaneously and without mutual coupling. Earth station aerials are therefore now designed to transmit two microwave carriers on the same frequency using either the two opposite "hands" of circular polarisation or two perpendicular linear polarisations. The choice will depend upon the frequency band to be employed.

Under certain slant-path propagation conditions circular polarisation has a distinct advantage over linear polarisation. Below a frequency of about 10 GHz ionized layers in the upper atmosphere can produce an effect known as Faraday Rotation in which linearly polarised signals are rotated in space. This may result in significant crosstalk since the transmitted signals now no longer line-up with the receive aerial and cross-polar interference can occur. The effect is not noticeable in the case of circular polarisation because the electric field is already rotating at signal frequency.

These signals are received by the satellite, separated for amplification and frequency conversion and retransmitted to earth station aerials which receive signals from the satellite in both polarisations and separate them in the respective receiver chains. This frequency re-use system relies on the polarisation purity of the transmitted waves and the associated aerials to limit the interference between cross-polarised microwave carriers on the same frequency.

Fortunately it is comparatively easy to convert from linear to circular



A drawing of the dual polar feed hardware which is installed at Madley earth station.

polarisation and back again though it does add further complexity to the aerial hardware. A short length of waveguide known as a polariser must be inserted between the input combiner which combines two inputs in such a way that the linearly polarised outputs are at right angles to each other and the launching horn. This polariser produces a phase delay in one plane of transmission and by suitably adjusting its length and orientation relative to the angle of the linear input signals, a circularly polarised output is obtained.

The same polariser also operates in the reverse direction of transmission and converts a circularly polarised input to a linear output. Right hand circular and left hand circular polarisations correspond to perpendicular linear polarisations after passing through the polariser so it is still possible to discriminate between two circularly polarised signals of opposite hand even though they are of identical frequency.

The difficulties associated with frequency re-use by dual polarisation are now sufficiently well understood for the technique to be used in the next generation of INTELSAT satellites (INTELSAT V). Studies have shown that by careful design of the aerial and waveguide components associated with the feed hardware a satisfactory performance can be achieved. The most critical component in the design and manufacture is the polariser due to the necessity to operate over very large bandwidths.

One way of easing this problem is to provide two polarisers, one for the transmit band and one for the receive band so that they each operate over a narrower bandwidth. This of course further increases complexity and results in a very formidable piece of hardware of the type which is now installed in the first aerial shortly to be commissioned at the new United Kingdom earth station site at Madley, Herefordshire. (See page 4.)

Other problems can arise due to distortion along the propagation path by atmospheric disturbances such as rain, snow and ice particles. The mechanisms of depolarisation are now well understood but long-term collection of data is required so that the statistics for particular areas are available. In those parts of the world which suffer from heavy rainstorms it may be necessary to provide automatic means of correction for the consequent depolarisation. This can be done electronically or by a combination of electronic and mechanical methods.

Fortunately measurements taken so far indicate this will not be necessary in the UK at the frequencies currently in use but the picture may be considerably different, however, when working in the higher frequency band. Investigations into these effects are continuing but it is too early at present to reach any meaningful conclusions.

Mr J. E. Purdy is head of a development group in Earth Station Planning Division of Telecommunications Development Department with special responsibility for aerial development and propagation studies.

MISCELLANY

Doubling Dutch links

Britain's undersea telecommunications links with the Netherlands will more than double in 1980 when a £6 million giant cable, capable of carrying nearly 4,000 telephone calls at once, comes into regular service.

To be used primarily for telephone calls, telex messages and other communications between the UK and the Netherlands, Belgium and Germany, it is one of several major submarine cable systems planned by the Post Office working in close co-operation with the telecommunications authorities of other European countries.

A heavily-armoured cable will be used to give maximum protection against damage by trawlers over much of the route – 110 nautical miles from Lowestoft to Egmond aan Zee near Alkmaar in Noord – which was chosen to avoid the fishing concentrations on the Brown Ridge shoals.

Cable laying will start in October 1979 so that the system, which is of British design and will be made in Britain by Standard Telephones and Cables Limited, can be ready for service at the beginning of the following year.

Contracts

Vauxhall, Chrysler and British Leyland – A total of £13 million for some 6,000 Telecommunications vehicles, mostly vans and trucks but including small numbers of estate cars and saloons, almost entirely from plants in Britain.

Plessey Telecommunications Ltd – £5 million as part of the annual ordering programme for supply of 430,000 telephones, 48,000 loud-ringing bells, 5,200 relay units and 22,400 key and lamp units.

Standard Telephones and Cables Ltd – £4 million for the supply and installation of transmission equipment for development of international services at Mondial House, London, Lands End, Cornwall and Madley satellite earth station, Hereford.

GEC Telecommunications Ltd – £3 million for digital transmission equipment, covering 120 Mbit/s trunk line and multiplex, 30-channel junction PCM and telegraph equipment as well as data modems.

Marconi Communication Systems Ltd – £2 million, for the supply of data modems to extend and develop the Post Office Datel 200 service for transmission of data at speeds up to 300 bit/s.

Eddystone Radio Ltd – A contract to make and supply more than 200 radio receivers for use by the Post Office's Radio Interference Service.

Leyland and Birmingham Rubber Company – £130,000 for supply of industrial respirators.

Cheaper data

Data transmission by telephone to Singapore has been cheaper since May through the introduction of International Datel 2400, enabling users to send data at up to 2400 bit/s – at least twice as quickly as before, when the highest rate was 1200 bit/s using International Datel 600.

Recipe for success

About 2.5 million calls were made to the Post Office's "Dial-a-Recipe" recorded information service in the year ended 31 March, 1978 – an increase of 18 per cent over the previous 12 months. Most popular service, however, is still the Speaking Clock with more than 380 million calls connected last year, followed by "Dial-a-Disc" with more than 80 million calls received.

Cutting costs

Cheaper international calls for about three million customers, meaning an annual saving of about £1½ million, or £1 on an average call, will come into effect from 1 October when UK phone users who do not have International Direct Dialling (IDD) will be charged the same rate per minute for operator-connected calls as for overseas calls dialled direct at the standard rate. This will not include transfer-charge, credit card and other special facility calls.

Bridging a gap

Another stage in Post Office plans to improve communications for ships in British waters was completed when a new remotely-controlled radio station came into operation at the Firth of Forth, providing short-range radiotelephone service to vessels within about 80 km of its site on Blackcastle Hill near Dunbar.

In service continuously and bridging a communications gap between Stonehaven Radio and Cullercoats Radio, the new Forth Radio will provide a local radiotelephone service linked through International Direct Dialling (IDD) to the world, as well as broadcasting weather and navigation warnings and checking for distress signals.

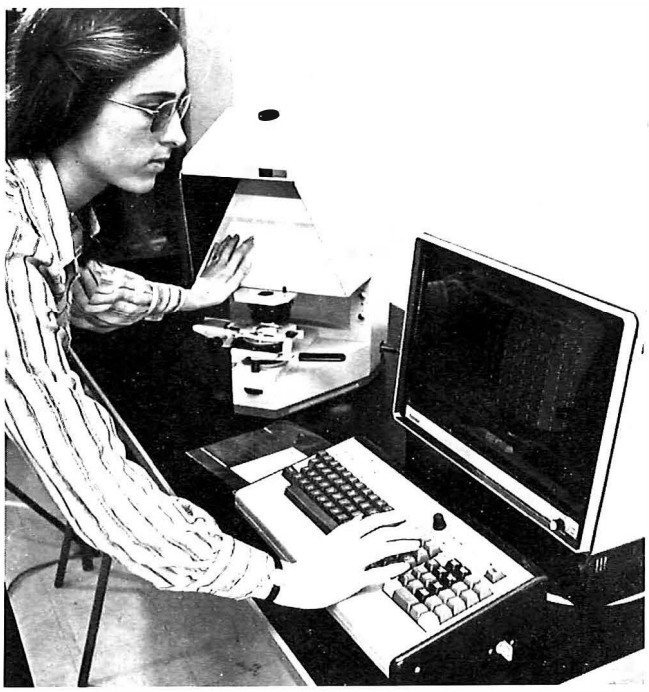
Buzby on the rails

"The Buzby Special" exhibition train – a travelling shop window of Post Office Telecommunications – toured 19 centres throughout England, Scotland and Wales during July, featuring items that are currently available and under development for business and residential use.

Introduced last year to mark the Queen's Silver Jubilee, the train was redesigned and extended this time to provide more facilities including a reception car, two exhibition coaches and a seminar or cinema coach for invited guests. The train was on hire from British Rail Inter-City Exhibitions.

Retirement advice

A new film aimed at those about to retire from work has been produced by the Post Office, which loses some 10,000 employees on age grounds each year. Called "A Time to Look Forward", the film highlights different attitudes to retirement and the benefits of adopting the right approach. It is of general use to industrial and business firms, pre-retirement bodies and educational establishments, and can be hired or



Savings of more than £22 million will be made by Post Office Telecommunications through a nationwide computer project known as TOLD – Telecommunications On-Line Data – a £12 million system that saves time and paperwork by enabling staff to put a large part of the information directly into the computers for processing. Clerks like Judy Copping, who works in the Newbury, Berks, telephone accounts office, use 1,300 desk-top visual display units. Details of staff pay, or telephone meter readings, can be entered in seconds without laborious form-filling.

bought from The Films Officer at Post Office Telecommunications, Room 405, Union House, St. Martin's-le-Grand, London, EC1A 1AR.

Datel savings

Reliability of Post Office data transmission equipment has allowed the cost of getting a Datel data transmission service to go down since 1 July. Customers who operate Datel services over leased circuits no longer need to allocate a telephone line connection for fault-testing purposes with each Datel modem installation unless they want a standby link for use should the circuit develop a fault.

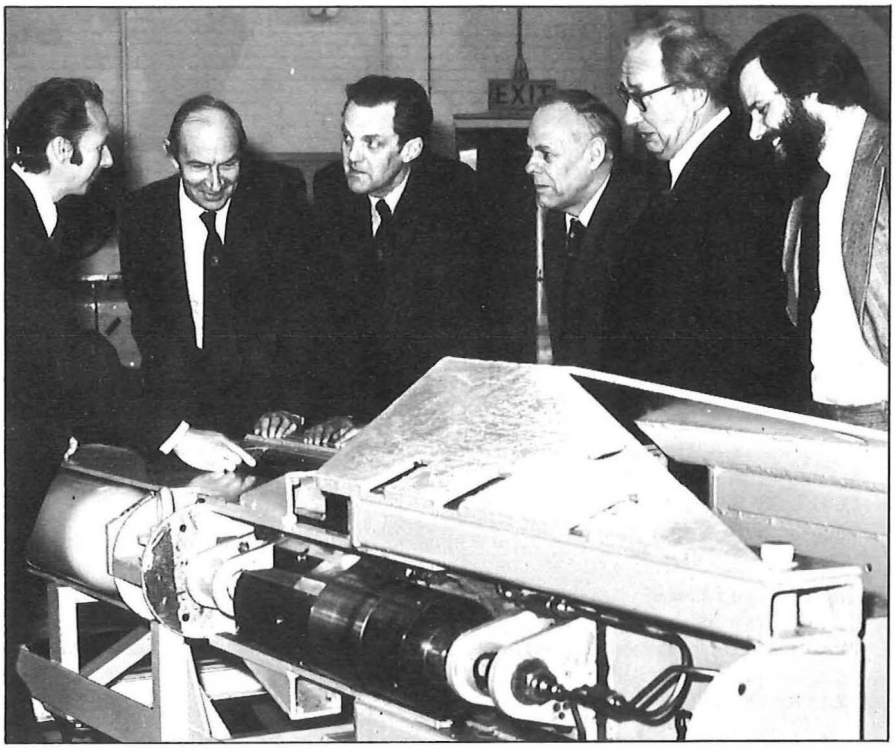
Help phoning home

Copies of four free leaflets explaining how holiday makers in 16 countries can make phone calls to the UK by International Direct Dialling (IDD) were supplied this year by the Post Office to more than 100 travel organisations, including tour operators, airlines and ferry operators, as well as the Automobile Association and Royal Automobile Club.

A total of 1,500,000 copies of the updated and extended leaflets were printed to give UK tourists in Western Europe, Scandinavia and the Mediterranean a simple guide to public telephones from which international calls can be made.

Autotelex boost

Britain's telex links with the Nigerian capital of Lagos, Gibraltar and most numbers in Chile, have become automatic providing faster and more convenient links for the UK's 72,000 telex users. Some 2,500 telex calls are made each month from the UK to Lagos, where all five-digit numbers starting with 2 are now available without the aid of an international telex operator. About 1,600 calls are made to Gibraltar and 2,000 to Chile where five-digit numbers except those beginning 25 and 80 are on autotelex.



Mr John Scarfe, an engineer working on submarine cable systems development, explains the operation of a new cable recovery grapnel developed by his group, when a new building for testing undersea cables was opened recently at the Post Office Research Centre at Martlesham Heath, Ipswich.

Listening (left to right) are Mr Stan Taylor, Head of Submarine Cable Division, Mr Charles May, Director of Research at Martlesham, Mr Charles Hughes, Deputy Director, and engineers Jim Cosier and Peter Jenkins.

Cricket service

The Post Office's cricket-by-phone service was extended to 125 centres outside London this summer – eight more than last season – providing cricket lovers with the latest state of play on England's four games in the Prudential Trophy against Pakistan and New Zealand as well as matches in the two Cornhill Insurance Test series against the same two countries. The nationwide service has included all five rounds of the Gillette Cup and the three final rounds of the Benson and Hedges competition.

More than 22,500,000 cricket-score calls were made last year on the service which shares the Dial-a-Disc telephone number.

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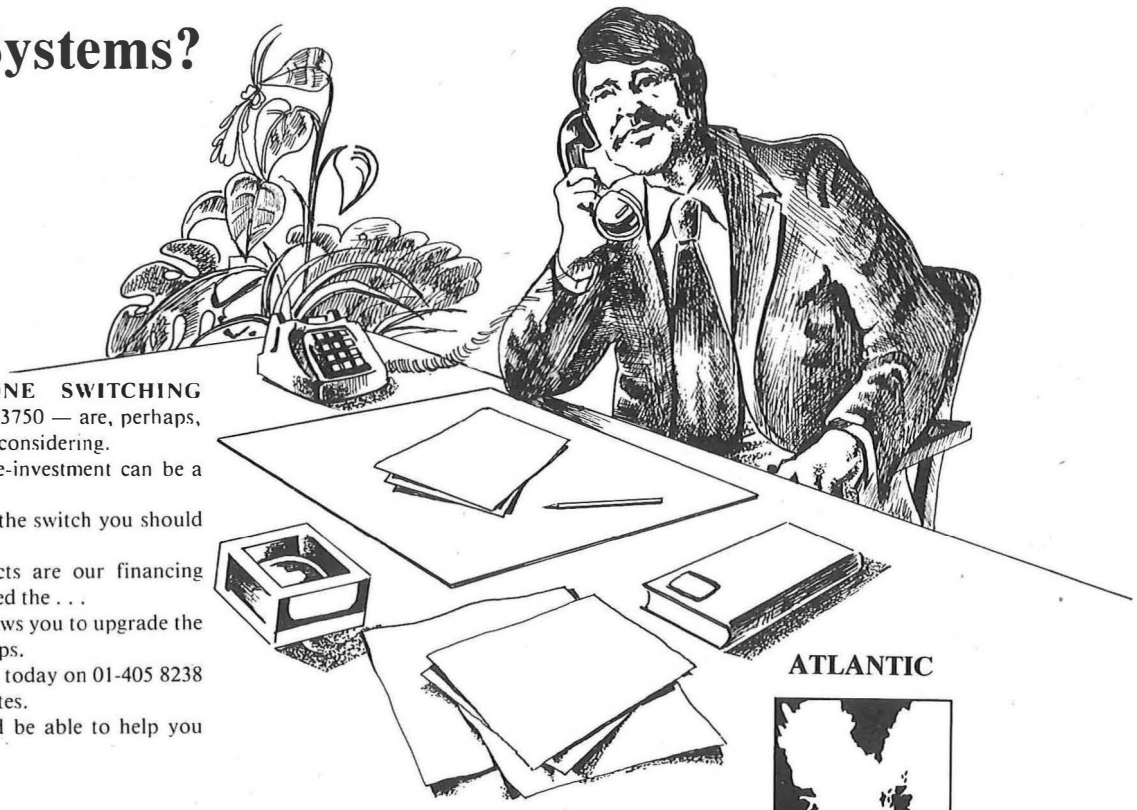

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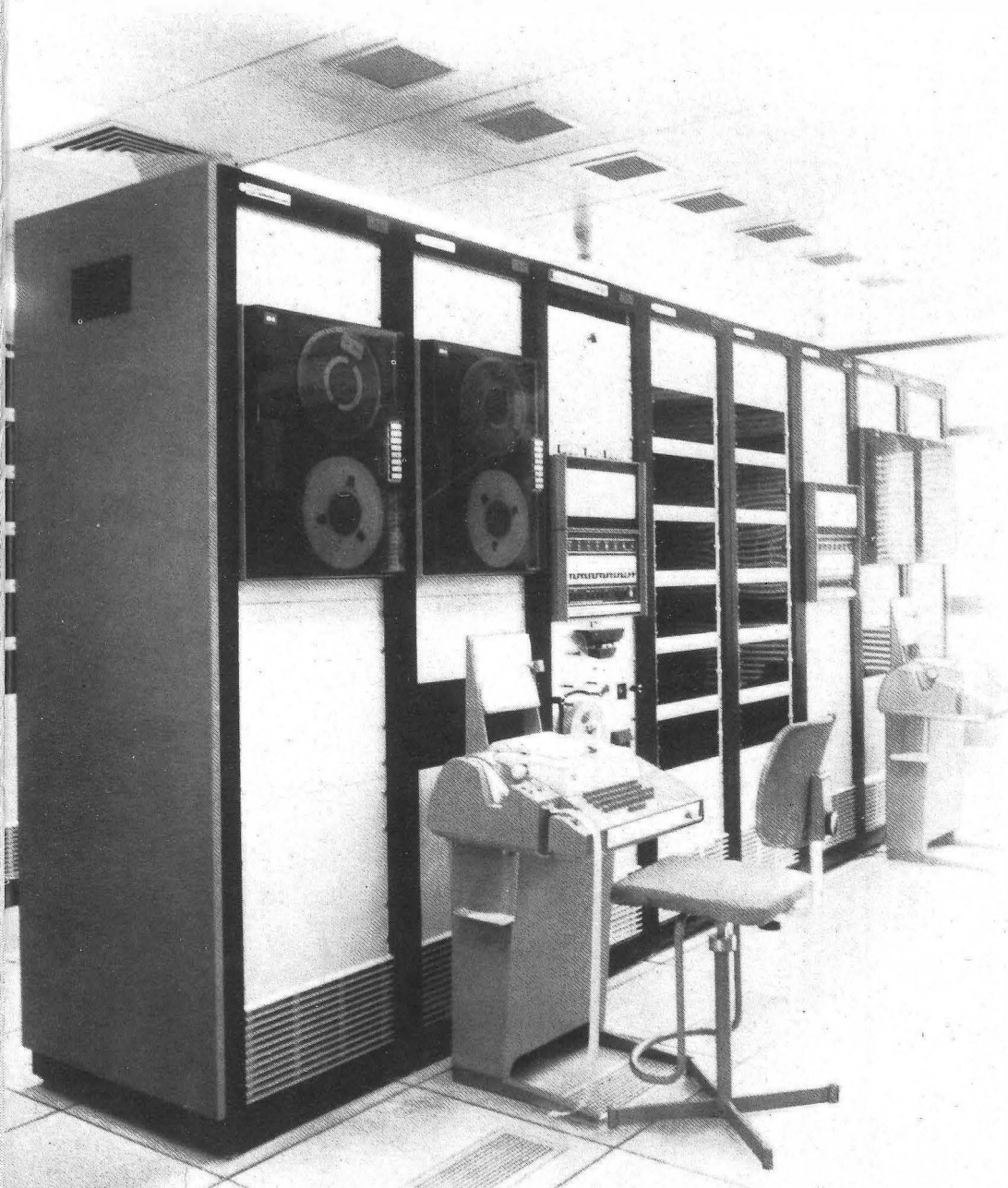

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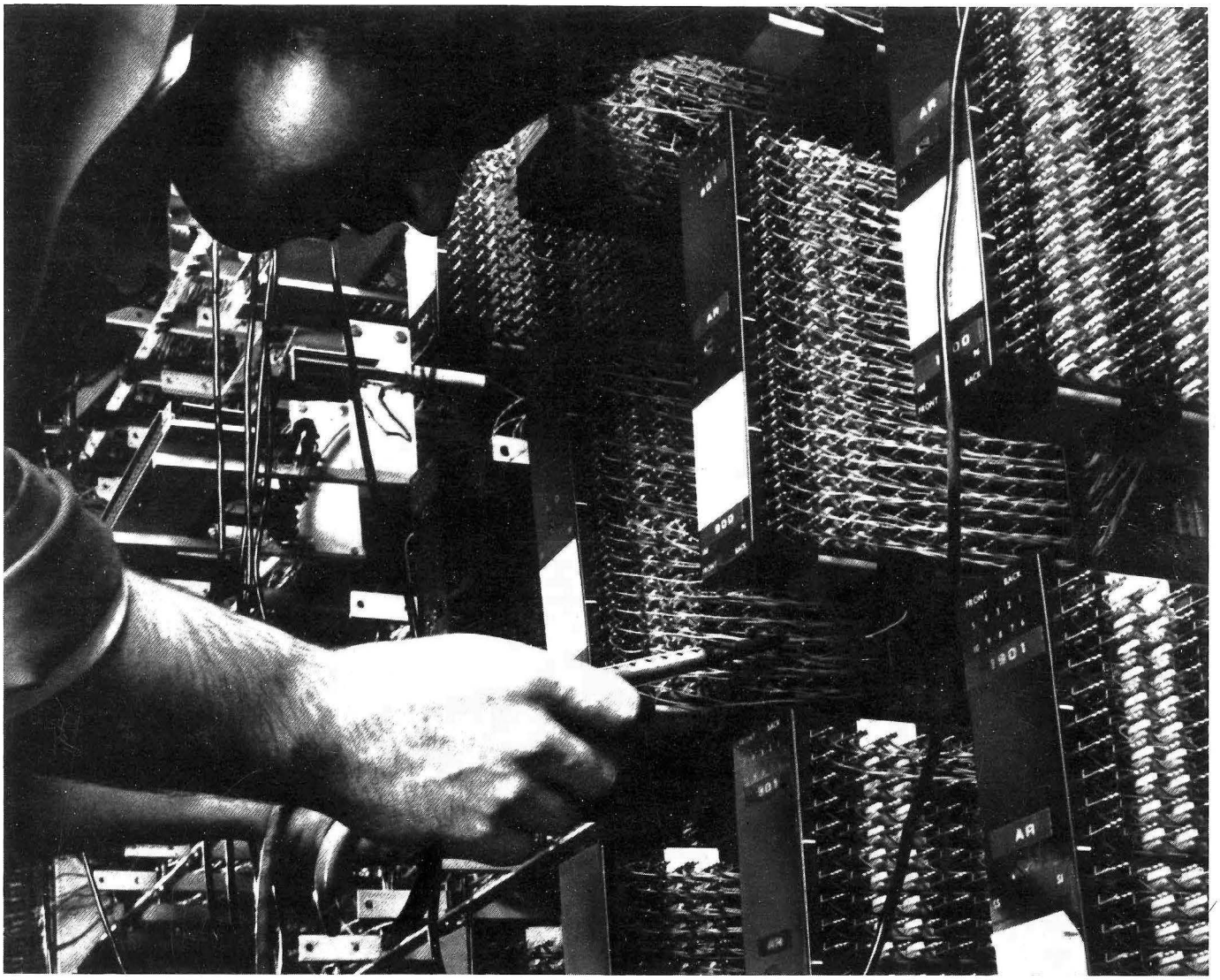

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