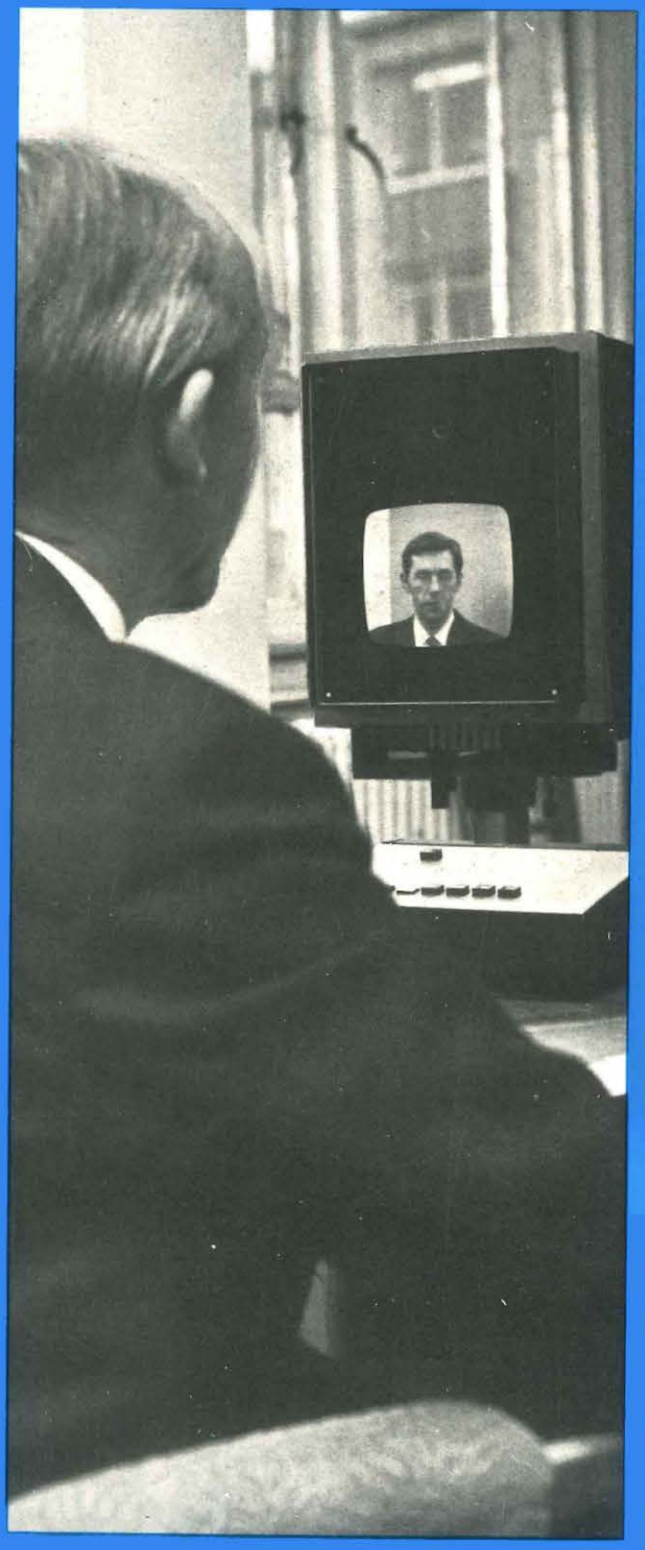
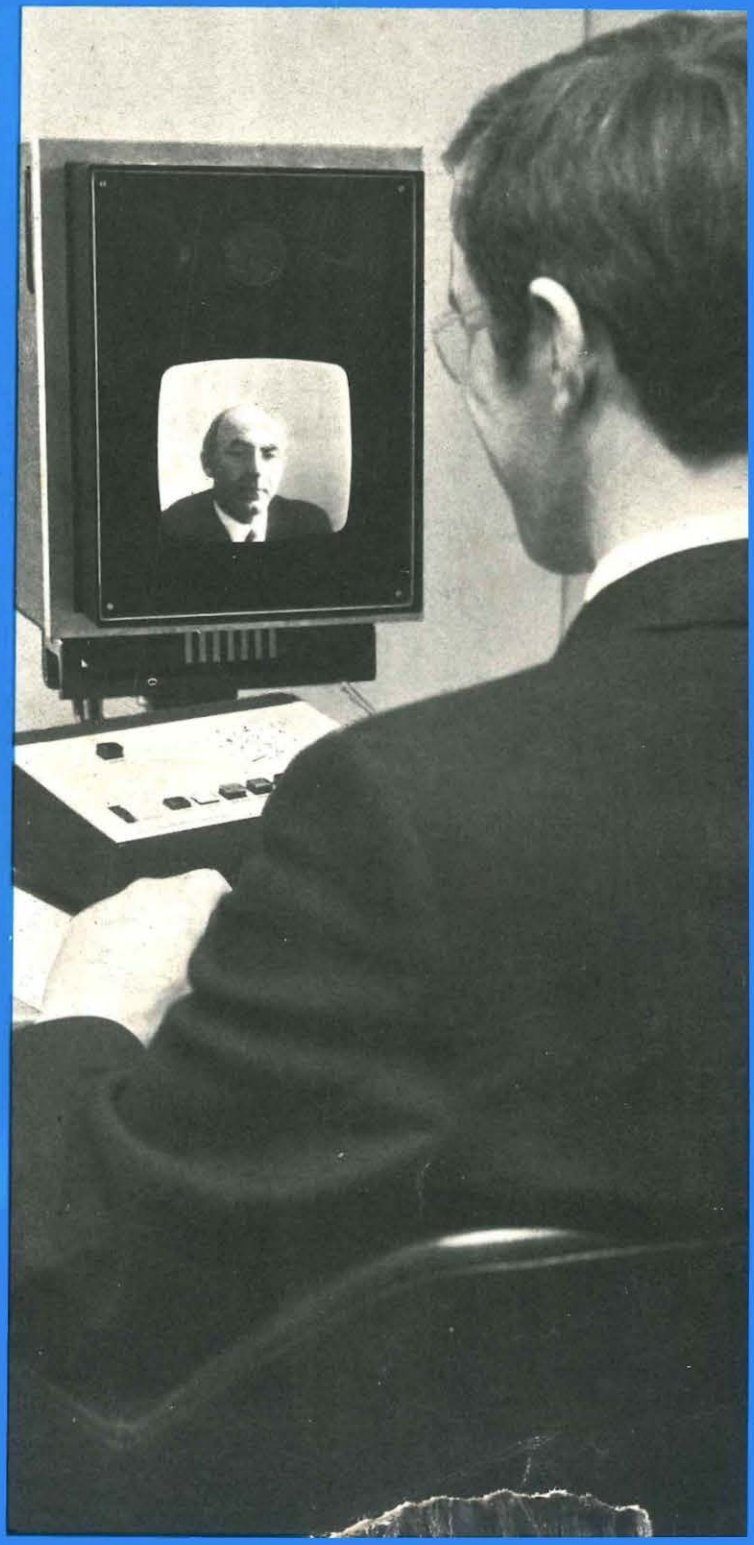
Post Office telecommunications journal

Winter 1971/72 Vol. 23 No. 4 Price 9p





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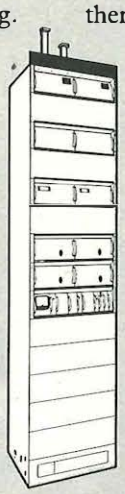

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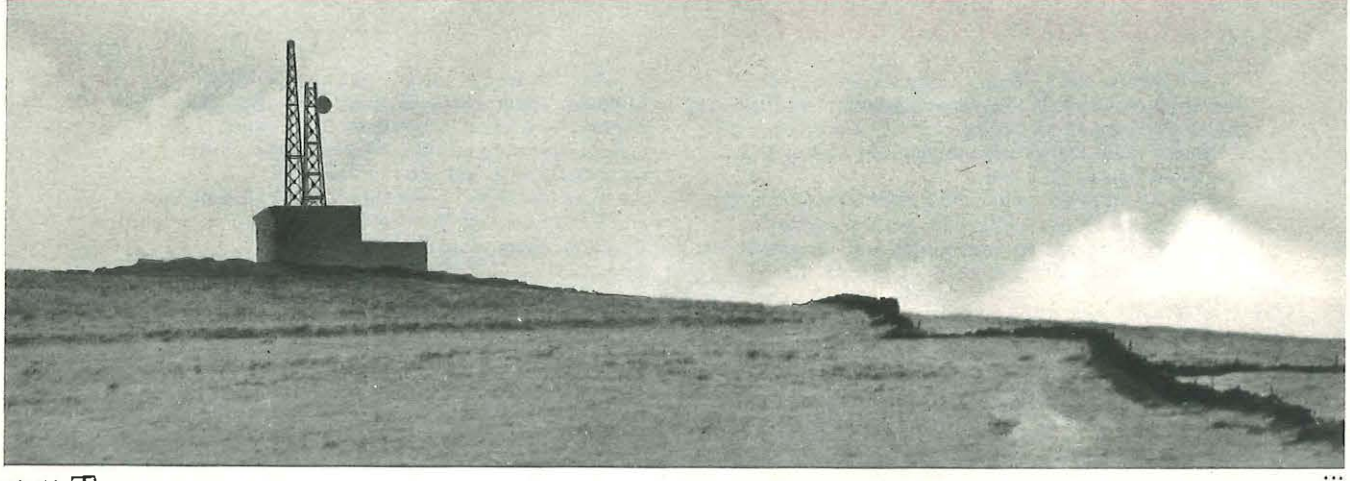

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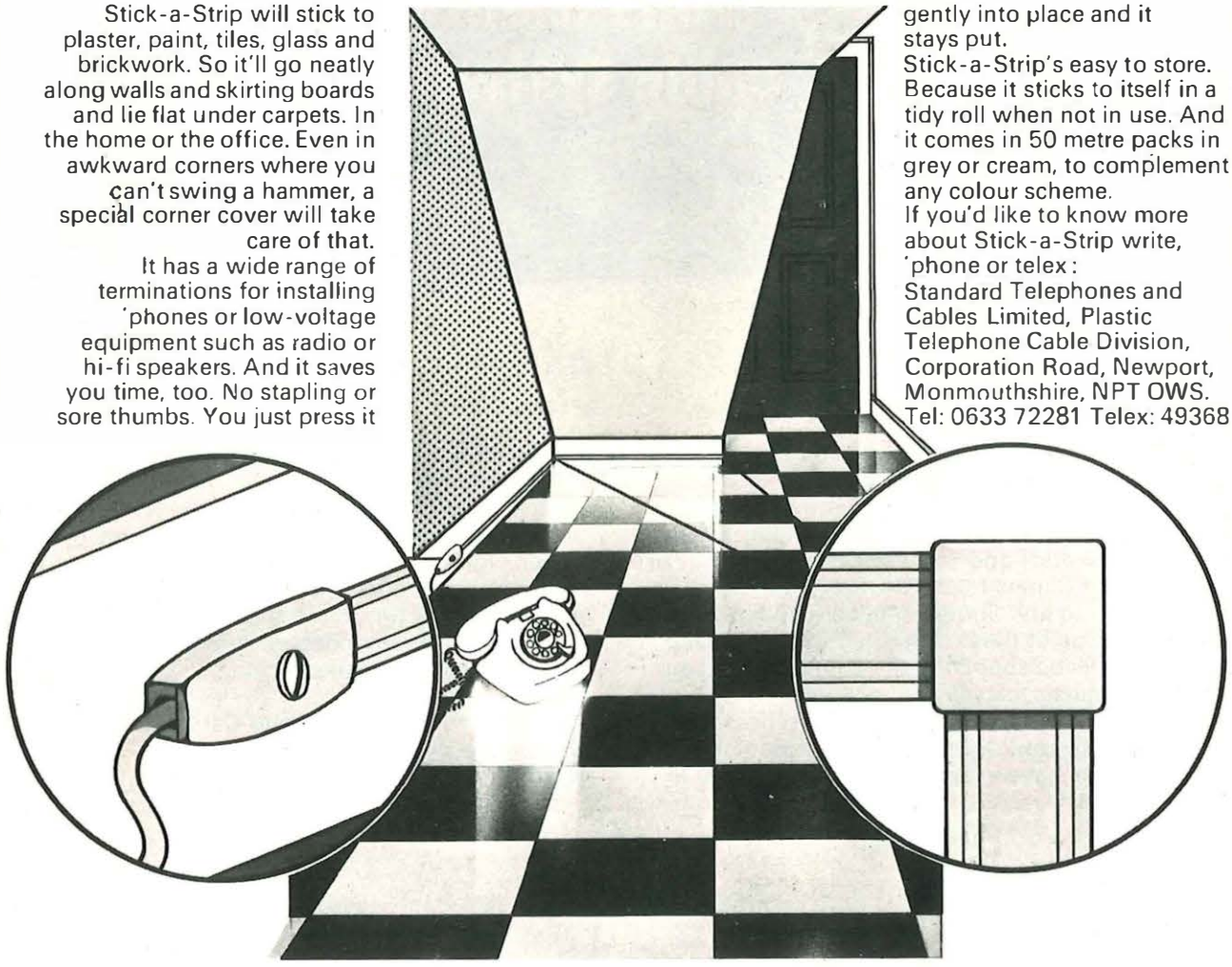

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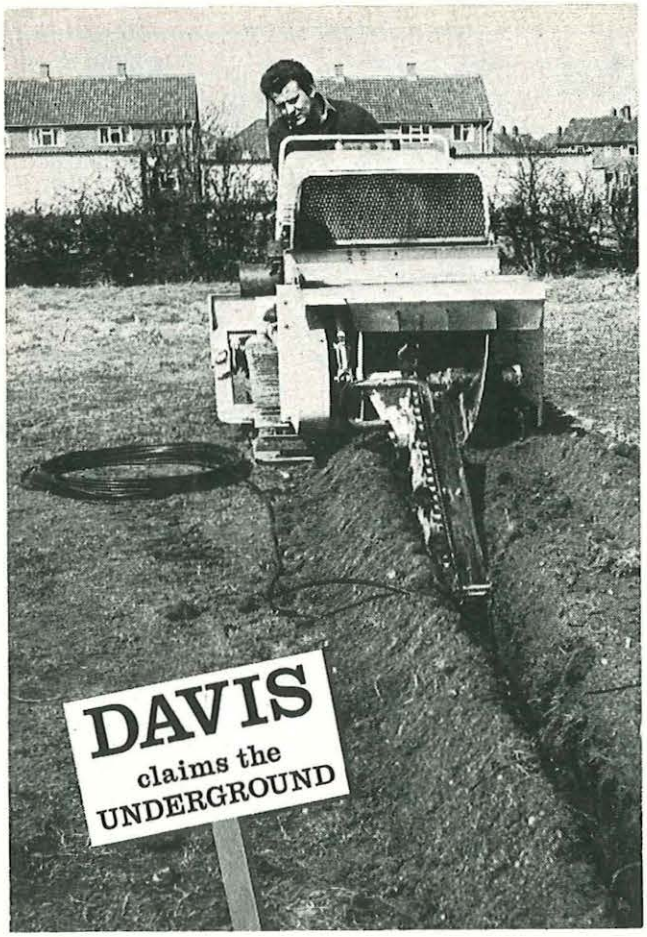

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Published by the Post Office of the United Kingdom to promote and extend knowledge of the operation and management of telecommunications

Post Office telecommunications journal

Winter 1971-72 Vol. 23 No. 4

CONTENTS

COVER: London Post Office staff are taking part in a trial of experimental visual telephone equipment – the Viewphone – and in our pictures a link between two offices is being tested. Eighteen Viewphone instruments will interconnect offices in a number of Telecommunications Headquarters buildings, including the research station at Dollis Hill. It is hoped that the trial will provide a preliminary assessment of the usefulness of a "face-to-face" communication service, and a number of operational and technical problems will be examined. A full description of the trial will appear in a subsequent issue.

In this issue we highlight the explosive growth of international telecommunications. Our series of articles, which explain some of the steps being taken to meet the continuously rising demand, is introduced by Mr D. R. B. Ellis, Works Controller for the Post Office's International and Maritime Telecommunications Region.

EXPANDING WORLD

The floodgates of international telecommunications were first prised apart in the autumn of the fifties with the advent of the trans-oceanic cable and finally burst wide open some years later with the launching of communication satellites in space. Both were great technological advances which freed world networks of the limitations for so long imposed on them by high frequency radio.

The result has been a phenomenal increase in traffic between Britain and the rest of the world. Traffic is currently rising at 20 per cent a year and is expected to continue at this rate until the end of the decade although there are even now indications from some European countries that this high rate will be exceeded in the next few years. So, if the situation is to be dealt with successfully, the traffic handling capacity of the existing system will require to be doubled every four to five years.

In hard figures it means that by 1980 international telephone calls from the UK will have jumped in 10 years from 18 million to nearer 90 million and international telex calls from 25 million to a staggering 175 million. The 3,750 telephone circuits which were available between the UK and other countries in 1970 will need

to be increased to well over 20,000 – submarine cable circuits for instance will increase from nearly 2,000 to 11,000; satellite circuits from 290 to 3,600 and microwave radio circuits to France from 1,500 to 6,400.

International data transmission, first started from Britain to USA and three European countries in 1965 and since extended in Europe and to Australia and Canada, will also rise dramatically. The need for a separate international data network offering an extended range of transmission speeds has already been studied.

Together the figures represent for the Post Office's International and Maritime Telecommunications Region a formidable task in terms of accommodation, manufacture, installation and commissioning of new International Centres.

Towards this end the Post Office will have spent during the present decade something of the order of £50 million on new equipment alone and is also spending many millions on buildings in London to house the equipment. New buildings and equipment at Wood Street and Mondial House on the banks of the Thames will give much needed relief to the Faraday International Telephone Services Centre which for so long has carried the full burden of increasing international traffic. That Faraday has in fact been able to cope as successfully as it has done has been due to the introduction of new ideas and methods which have resulted in improvements to existing equipment there. The Wood Street exchange, a prototype which uses 5005 crossbar equipment in the UK for the first time on international routes, was opened early in 1971. Additional plant will continue to be brought into service there, and by early next year it will be providing a further 3,000 circuits. But the greatest contribution will be made by Mondial House which when fully equipped will provide a further 18,000 international circuits.

By 1977/78 the total capacity in Faraday, Wood Street and Mondial House buildings will exceed 25,500 international circuits. This will meet forecast needs until the approach of the end of this decade and then new units of about 4,500 circuits will be required each year. By that time ISD facilities will not only be available to all subscribers in the UK but will give access to most parts of the world. The increasing volume of traffic to and from the provinces will no doubt have made it necessary to expand the services in units located away from London.

In 10 years from now it is expected that telephone traffic to the USA will require the provision of over 3,000 circuits to that country. It is a far cry from the pre-cable and satellite days when only enough traffic to USA could be found to occupy eight high-frequency radio circuits.

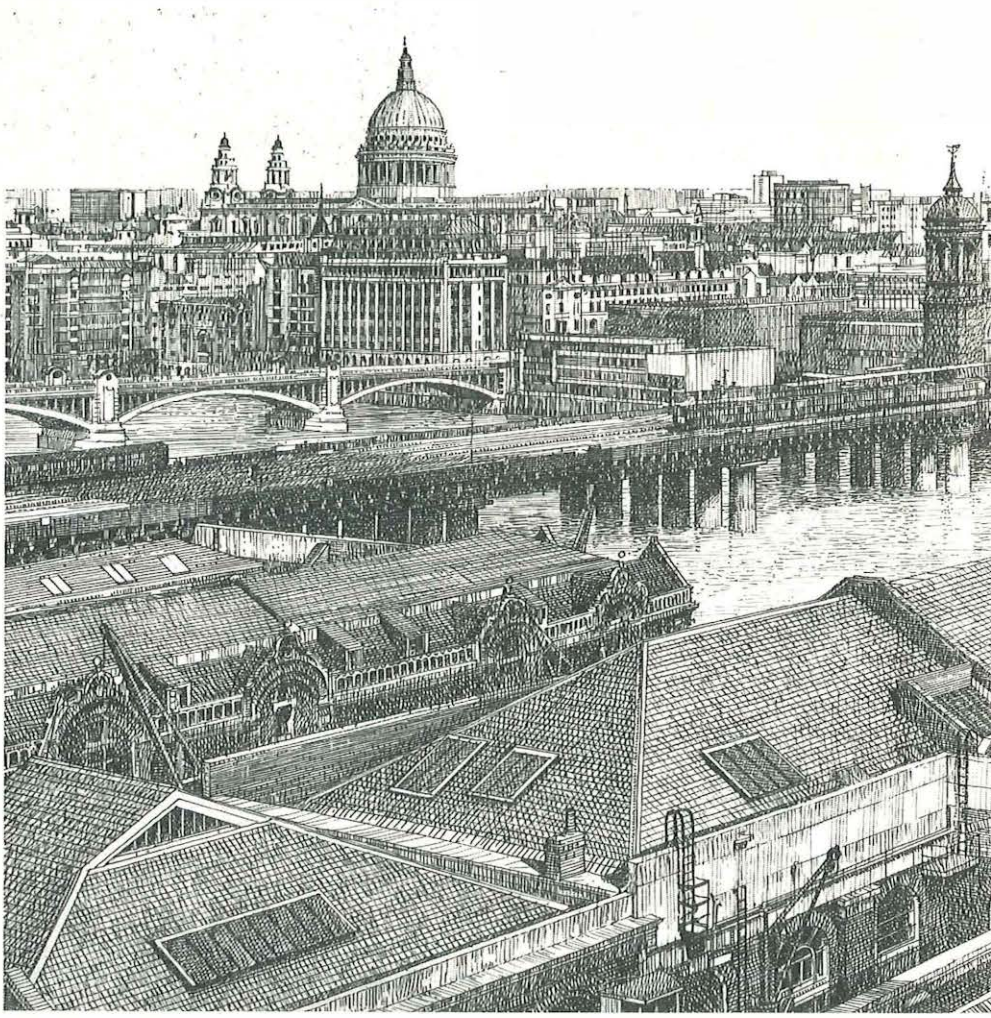
Below: An artist's impression of how Mondial House will look from the south bank of the Thames. Its unusual pyramid-like shape was devised so as not to interfere with views of St. Paul's Cathedral from London Bridge further down river. Mondial House will be an outstanding landmark on the riverside scene, and the design, which includes riverside walks which will be open to the public, has been approved by both the London City Corporation and the Royal Fine Arts Commission.
The 2½ acre site is adjacent to Cannon Street railway station.

Mondial House, as befits a telecommunications complex representing an investment of the order of £60 million, will be the largest international "gateway" exchange in Europe and possibly the world. When fully operational in the mid-1980s it will make available a further 18,000 international circuits, three times as many as will be provided by London's other two international exchanges, Faraday and Wood Street, put together.

The equipment at Mondial House will connect United Kingdom customers to numbers in all parts of the world, and the great majority of the calls will be dialled direct. It will also connect calls from abroad to telephones in this country and will route traffic in transit between countries in Europe and the rest of the world. Ultimately, the Mondial complex will be dealing with over 200 million calls a year.

Apart from the massive switching complex, the building's half-a-million square feet will house many other

200 million



advanced features. These will include an International Transmission Maintenance Centre (ITMC) which will ensure maximum availability and efficiency of the high revenue-earning international circuits, and computer-controlled International Accounting and Traffic Analysis Equipment (IATAE) which will cope with international charging for a huge volume of subscriber-dialled calls and at the same time provide much more detailed information than has previously been available on the performance of international exchange equipment and routes.

The Mondial equipment will be installed in stages. A contract exceeding £10 million for the first installation, effectively half of the switching equipment plus certain other equipments such as the IATAE, has been placed with Plessey Telecommunications. Manufacture is under way and traffic is expected to be carried in 1974–75.

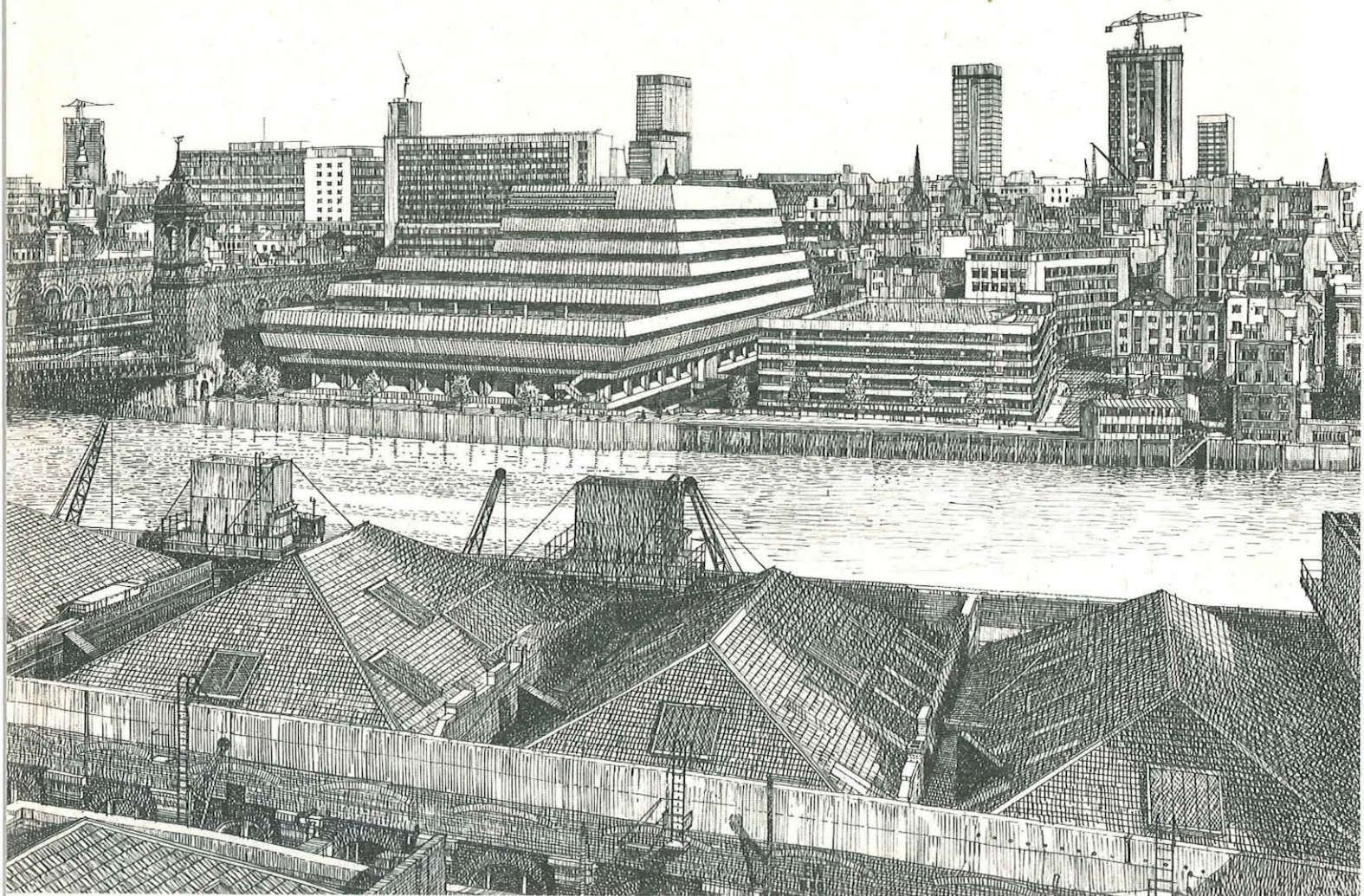
The huge switching complex will consist of some 830 enclosed racks mounting 16,000 shelves of 5005 Crossbar system equipment which, although some engineering changes have been made, will be very similar to that currently in use or being installed at Wood Street.

Although the majority of the calls passing through Mondial House will be dialled direct by customers there will be no reduction in the number of calls requiring an operator. The vast overall growth of international telephone traffic is such that the volume of operator-assisted calls will in fact increase. To cope with this traffic would normally have entailed allotting a great deal of expensive floor space for switchroom accommodation. In fact, Mondial House itself will accommodate only two of the six 100-position switchrooms which will be required. New techniques will make it possible for operators in provincial centres to control the switching in London.

This will be done through the use of Auto-Manual Switching Units (AMSUs) and the somewhat revolutionary Cordless Switchboard System No. 2. The use of coding techniques makes it economically possible to separate switchboards from the exchange equipment they are using. While operators, say in an international centre in Leicester will control the setting up of a call, the switching task will be carried out and controlled by the AMSUs at Mondial House.

The International Accounting and Traffic Analysis Equipment (IATAE) makes use of a computer which, linked to the switching equipment complex, will provide information on the use of international circuits, routes and destinations for the clearing of international charges – each country handling originating or transit calls has to render appropriate statements for mutual settlement. Although an IATAE is already operational in the new Wood Street exchange, the Mondial House installation will be of a much more advanced design which will give it the capability to deal with the huge traffic flow through the

calls a year



Mondial House complex. In addition to its job of international accounting the IATAE will monitor the performance of the exchange equipment and routes, provide statistical traffic records and draw attention to any suspect equipment. Data stored on magnetic and paper tape will be printed out automatically or on demand as required. All the computer equipment will be duplicated to provide stand-by back-up.

The International Transmission Maintenance Centre will be a vital part of the Mondial complex. The Centre will consist of a suite of consoles at which technical staff will have a whole range of testing devices at their fingertips. From the consoles the staff will have access to the exchange circuits through a special five-stage test network. They will therefore be able to keep a constant watch on live or test calls with regard to switching, transmission and signalling performance.

Concerned as the planners have been with equipment requirements the needs of the 2,500 staff who will occupy this vast international communications complex when it is fully established have not been forgotten. The whole of the seventh floor of the building and part of the sixth has been allocated to such needs as welfare, restaurant and office areas.

SQUEEZING IN EXTRA CIRCUITS

The Mondial House complex when first planned was designed to cope with a forecast growth rate in international traffic of some 15 per cent a year. It was a forecast which was made before it was known how the public would respond to the much-improved quality of transmission from cables and satellites or to the introduction of International Subscriber Dialling.

In the event this forecast has been proved to be too low. The growth rate for international traffic is now running at 20 per cent per annum and there are already indications from some countries, particularly in Europe, that even this rate will soon be exceeded.

It is this additional growth factor, coupled with the inherent problems which have been encountered in introducing a new system like that at the Wood Street switching centre, which has made it necessary to provide further capacity within the Mondial complex.

Indeed, a further 12,000 international circuits will have to be provided through two supplementary units to utilise the building to its full capacity.

The simplified design of the supplementary units, however, will not only make it possible to "squeeze" them into such space as can be made available in the Mondial building, but is also expected to result in their costing somewhat less than the main unit.

The design changes have been made possible by the fact that the supplementary units will be used for further extensions of International Subscriber Dialling to Europe. As a result it will be possible to concentrate traffic into a small number of very large European routes. ISD also makes it unnecessary to provide all the facilities of a fully flexible international unit. For example, there will be no need for complicated international accounting equipment to distinguish between outgoing calls dialled by UK subscribers and those keyed or dialled by UK or overseas operators. Nor will the complex facilities associated with operator-traffic – both outgoing and incoming – be required.

The two units will be of the crossbar type, one for dealing with outgoing traffic and the other for incoming calls. Each will have an ultimate capacity of 6,000 international circuits but initially each will provide approximately 2,200 circuits. Because most of the international traffic originates or terminates in London, the units will ultimately carry only London traffic although during their early years it will be necessary to connect traffic to and from subscribers in the provinces. Flexibility in the design of the units is therefore essential.

Some idea of the size of the units can be gained from the size of the routes to be connected. On the international side of the incoming unit there will initially be routes with 300 circuits from France, 300 from Germany, 150 from Italy, 200 from the Netherlands and 150 from Switzerland. On the national side there will be 1,200 circuits to London central or sector switching centres and over 1,200 circuits to individual director exchanges in London.

Computer system to speed tele

CBH Wake-Walker

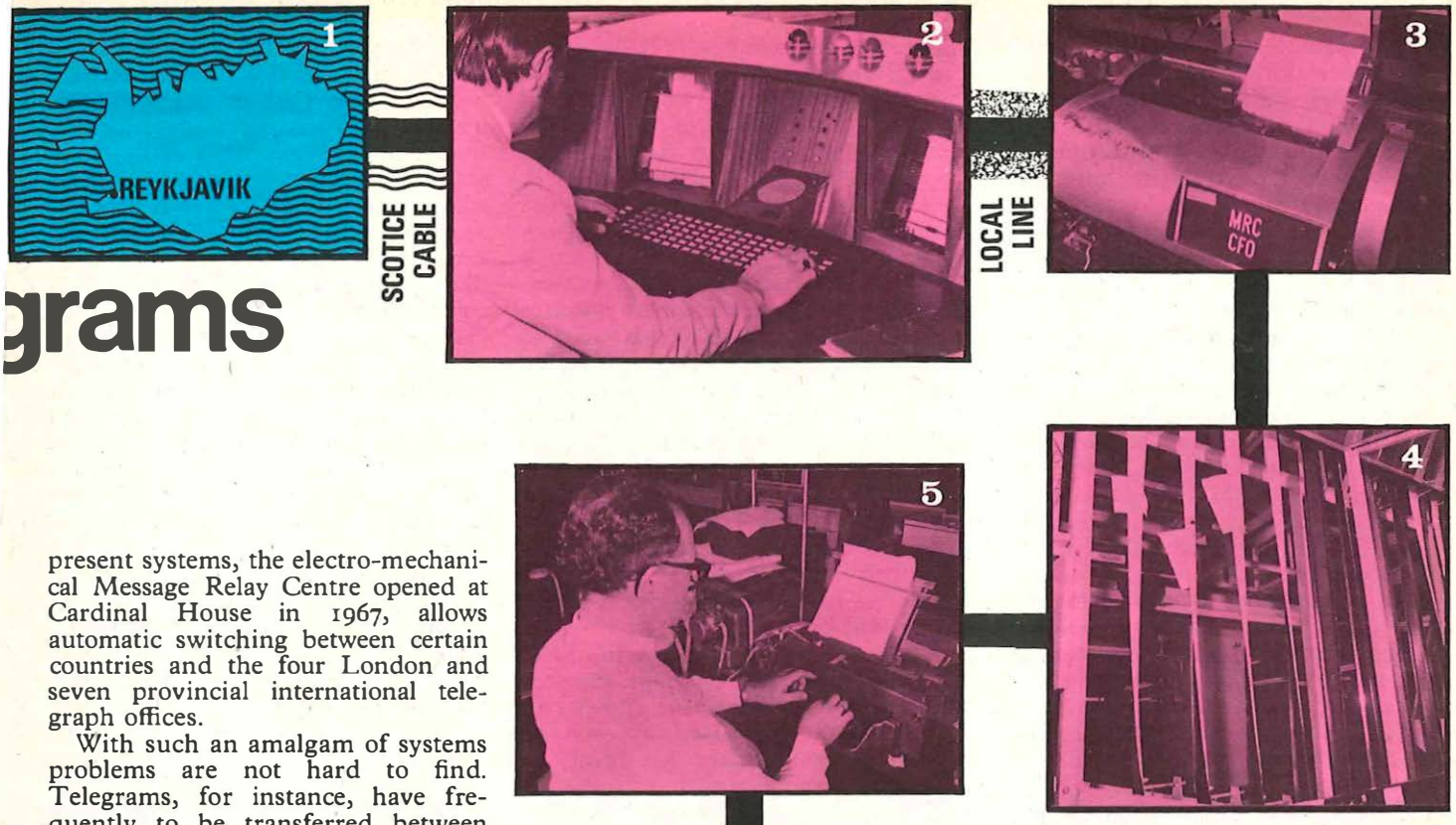
London is the busiest telegraph centre in the world. The Post Office's Electra House and Cardinal House in the heart of the city are at the hub of the world's international telegraph network. Not only do they handle all British traffic, but they also act as the "clearing house" for the many telegrams which are received in London for onward transmission to destinations around the globe.

This huge volume of traffic is dealt with as speedily as existing methods of working will allow. On the whole, however, when compared with present-day communications standards it is a slow service. It is to speed up the service and increase overall efficiency that the Post Office is to launch its computer-based stored program system in Cardinal House in 1973. It will provide completely automatic switching and transmission of international telegrams into and out of the United Kingdom. The computer will also be programmed for rapid retrieval of telegrams to help deal with enquiries, as well as the extraction of information for accounting and invoicing customers.

In later stages it will be programmed to "translate" registered telegraphic addresses into telex numbers so that telegrams can be transmitted direct to telex subscribers.

At present four different systems are in use. European Gentex allows the transmission of telegrams over European telex links. There are direct point-to-point teleprinter circuits and semi-automatic Torn Tape Relay Units over which messages are received or transmitted in punched-tape form. The most modern of the

grams



The step-by-step journey through the existing telegraph system of a telegram from Reykjavik, Iceland, in transit for Colombo, Ceylon. ❶ A telegram from Reykjavik is sent by teleprinter over the Scotice submarine cable . . . ❷ arrives in the Message Relay Centre, Cardinal House, London, where it is switched via a local link . . . ❸ received on a teleprinter at Electra House . . . ❹ where it is transported on belts to . . . ❺ a teleprinter in another section of Electra House for onward transmission to Colombo ❻

present systems, the electro-mechanical Message Relay Centre opened at Cardinal House in 1967, allows automatic switching between certain countries and the four London and seven provincial international telegraph offices.

With such an amalgam of systems problems are not hard to find. Telegrams, for instance, have frequently to be transferred between one system and another. A telegram from Reykjavik for onward transmission say to Colombo would be sent by teleprinter from Iceland and received in the Message Relay Centre at Cardinal House which would automatically route the message over a private wire to the appropriate room in Electra House. It would then have to be taken from the receiving teleprinter at Electra House, sent to the Colombo transmission position where it would be converted to punched-tape form and then transmitted over a point-to-point link to its final destination.

The computer-based system will replace three of the four existing systems and act as an interface for the fourth, the European Gentex system. Compared with the present 80,000 telegrams a day the new system, in broad terms, will be able to switch 100,000 a day. In the busy hour it will be capable of handling up to 12,500 telegrams and, based on a telegram length of 360 telegraph characters, could if required handle more than 20,000 an hour, six telegrams every second, without overload.

In the event of a telegram being queried by a customer the system will hold available for rapid retrieval one week's traffic. In other words, by a simple instruction to the computer it will print out in seconds any one of approximately 750,000 telegrams.

The system should be of particular benefit to Britain's telex users. Today, up to 40 per cent of telegrams received in this country are for telex subscribers and are retransmitted to them manually over the telex network. The computer, however, will automatically translate a telegraphic address into the relevant telex number and send the message direct to the telex subscriber.

To make this possible the computer will have a memory capable of holding up to 100,000 registered telegraphic addresses – there are some 85,000 existing in the UK at the moment – together with associated instructions. The computer will read the delivery instructions which will take account of telegram priority, the hour of the day or the calendar (bank holidays, weekends etc.).

To permit the identification of destination towns the system will store some 10,000 codes of place names. In reading place names on telegrams the computer will again take account of common spelling errors and foreign orthography, for example Londres instead of London.

Many of the routine operations will be carried out using fixed logic, in other words permanent standing instructions will be built in to the machinery. This will leave the processor, the computer's "brain", free to deal with the more complicated issues. When installed, the system will have full redundancy on all important components—they will be duplicated so that if one fails the other will immediately and automatically be brought into service. There will in fact be three processors – one will carry the full program of "on-line" work, a second will be kept in the "hot standby" condition and able to take over immediately from its working companion, and the third will be used for "off-line" work, such as program development, but will be available to take over as "hot standby" or to take on the "on-line" work during, for instance, maintenance periods.

The interface with incoming and outgoing circuits will be via multiplexers. Initially, 500 duplex low-speed (50-200 baud) lines will be connected to the system but this can be extended to 1,250 lines and in addition there is provision for 30 medium-speed lines. The processor will be more than capable of coping with the potential magnitude of such a throughput.

Obviously, the success of an automatic telegraph system will depend very largely on the accuracy of the operators putting information into it. Telegrams have to be transmitted in

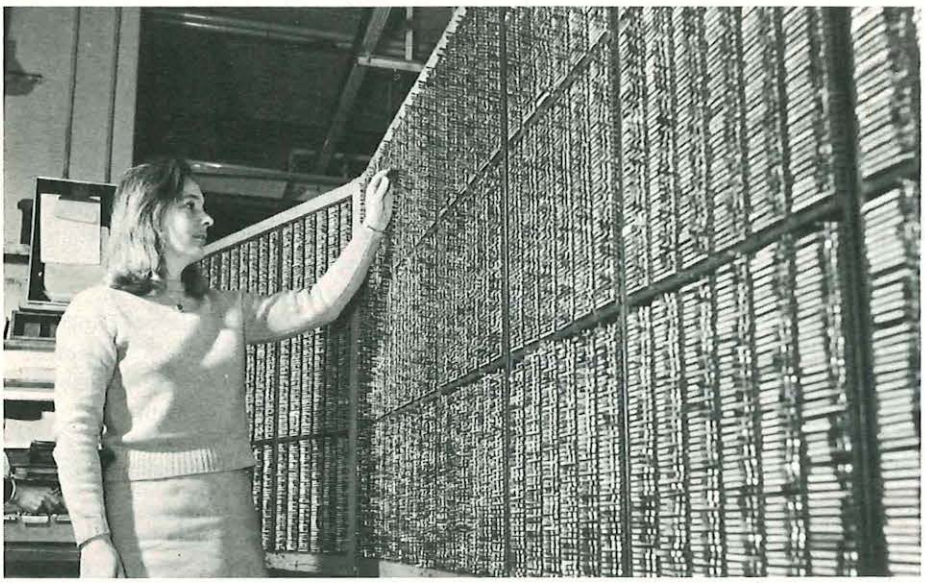
the correct format. In this respect Administrations operating in the international public telegram service are bound by international agreements. They are not, unfortunately, always fulfilled to the letter and this is particularly so in the case of the format designated for use with automatic systems. Inevitably, some traffic will therefore have to be reprocessed manually before it enters the system. It is of course possible to program a computer to convert from one format to another but this is expensive in processor time and is best avoided.

The Post Office has placed an order worth about $3\frac{1}{4}$ million with Pye/TMC for the supply and installation of the new system which has been designed and will be manufactured by Philips Telecommunicatie Industrie of Holland. It would be foolish to suppose that the entire system could be brought into operation in one fell swoop. The introduction will be achieved by stages starting with the largest and most important function, that of telegram switching. No particular order has yet been decided upon for introducing the remaining stages but it could well be two years from the date of acceptance of the Cardinal House installation in 1973 before every function has been implemented.

The immediate benefit to the customer, as soon as the first stage is operating, will be a very much quicker and more accurate service. Delays will be measured in minutes rather than hours and this will be especially noticeable on transit traffic where they should be minimal. As the later stages are brought into service delays will be further eliminated and those customers whose telegrams can be delivered by telex will gain the most. Complaints and queries will be dealt with more promptly and accounts should be rendered more quickly and verified more easily.

No system ever achieves the ideal and this will be no exception. Day-to-day working inevitably shows up what has been missed as well as unearthing completely new ideas. In fact, it is already seen how this system may develop. The extensive use of Visual Display Units, in this instance perhaps better described as silent teleprinters with a cathode ray screen, is under consideration. These will improve efficiency in a number of areas as well as help to reduce the expense of seven tons of paper which the present method of operation consumes every week.

Next there is the capability to accept telegrams direct from telex subscribers. There will be the problem of how to get the telegram into the right format but this can be solved. Finally, as more administrations adopt stored program systems and as these systems become more efficient so will the overall standard of telegram format improve. It will then be possible for a trend to develop in which the systems themselves deal with normal enquiries. Although the possibilities seem endless, only time and experience will show how far they are worth exploiting.



Above left: Telegrams are often received with only a brief telegraphic address. This bank of metal files is used by staff to identify a customer's full address so that the telegram can be delivered by messenger. Eventually the new computer system will automatically transmit a telegram to the customer by telex.

Above: Telegrams received from abroad in punched tape form on this relay unit can be retransmitted immediately from the same position to any of the International Telegraph Area Offices in the UK or to other positions in Electra House for onward transmission abroad.

Left: The Message Relay Centre at Cardinal House, the most modern of the existing telegraph systems, which allows automatic switching between certain countries and the London and provincial International Telegraph Area Offices.

BRAINWAVES BEAT THE TRAFFIC JAM

A W Powell

In any business a return of some millions of pounds on a capital investment of only £20,000 is success indeed. It is precisely the kind of success which is being achieved in the Faraday International Telephone Services Centre in London, which at present handles the switching of the vast majority of international telephone calls.

Through a series of innovations, equipment designed virtually for the 1955–65 era has been improved and up-dated so successfully that it is now coping more effectively with the patterns of present-day traffic. The innovations have helped materially to relieve the difficulties facing the international services arising from the phenomenal traffic growth and acute shortage of new equipment.

Little used equipment is being redeployed, existing circuits have been exploited to the full, and the traffic-carrying capacity has been increased tremendously so speeding up the call connection processes.

These and other factors contributed greatly in the recent extension of International Subscriber Dialling to the USA to thousands of customers in the Manchester, Birmingham, Glasgow, Edinburgh and Liverpool Director Areas. Dialling direct to the American mainland had previously been limited to telephone subscribers in London only. As a result of the improvements, Faraday is now handling up to 5,000 more effective ISD calls each weekday, a large source of additional revenue.

Improvements at Faraday also had a direct bearing on the extension of the London "107" service through which intercontinental calls can be connected on demand. Until recently the "107" service was available to destinations in North America only, all other intercontinental calls being available on a "booked" basis. Now the "107" demand service has been extended to include Australia, Hong Kong, Singapore, Kuala Lumpur, etc.

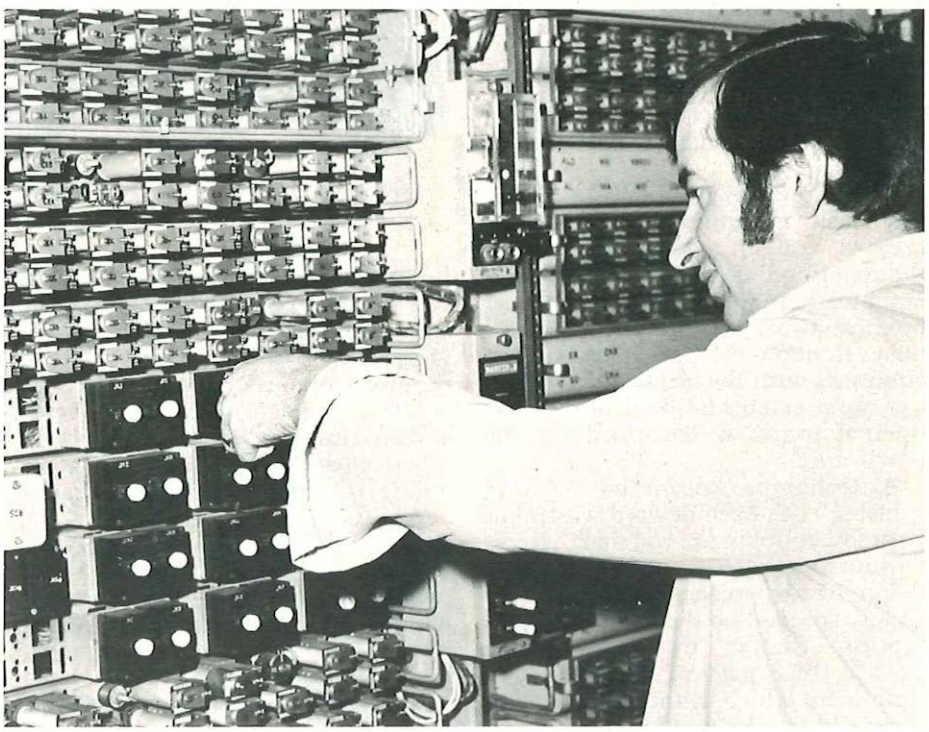
One of the most profitable exercises in the exploitation of circuits has come in that area which in the past has been so adversely affected by international time zones. While one half of the globe is asleep, the other half works, and the result was that international exchange equipment working to and from destinations in certain time zones was idle for a considerable period of the 24 hours. A similar problem arises where, because of climatic conditions, some countries prefer to conduct business during the early hours of the morning – in the very hot Middle East and Persian Gulf oil producing regions for example.

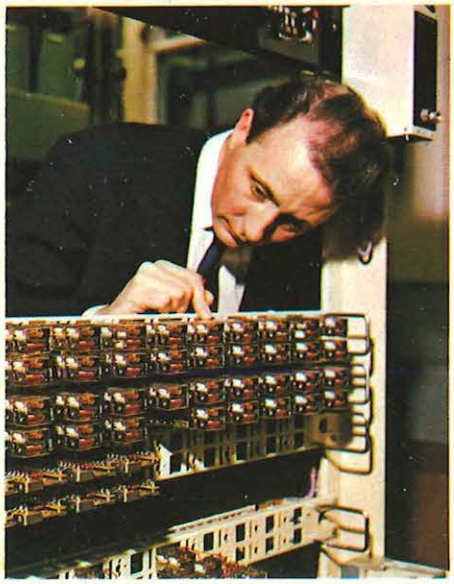
In either case very expensive international equipment is not used to full advantage, a situation completely unacceptable in times of acute equipment and circuit shortage. A special type of circuit changeover unit has been devised which allows those idle circuits to be switched on a fully automatic or semi-automatic basis to an alternative route. By this method circuits normally in service on the USA route are being used for a 12-hour period each day to augment the London–Sydney and Hong Kong routes. A possible extension to Bahrain is conceivable as is extension to any country in the western Pacific time zones.

Results to date have been very satisfactory in terms of improved service performance and circuit loading. Additional revenue is also being earned by the Post Office at the rate of about £20,000 a week.

In the Faraday unit it has also been possible to reduce greatly the number of "pocketed calls". These are calls which have queued up within the switching system, but which because of time delays in the switching or routing process are not allocated a free circuit quickly enough to avoid the equipment engaged tone being returned to either operator or sub-

Technical Officer John Marshall adjusts "marker splitting" equipment at Faraday which has virtually doubled the outgoing circuit capacity of the Centre. The "splitting" technique was John's brainwave. He said: "Working on the maintenance of switching equipment made me realise that the markers were not doing as useful a job as they might. I spent a long time studying the problem at work and at home." John's idea has earned him a £500 award.





Above: Dave Locke, an Assistant Executive Engineer, examines the miniature relays which are reducing call-queueing problems. These little electronic devices "sense" a build-up of waiting calls and switch them to a free route much more quickly than before.

Right: Because of time differences, one half of the world works while the other half sleeps. This used to mean that circuits to the sleeping countries had to lie idle for many hours each day. Now a special unit has been devised which makes it possible to switch "sleeping" circuits to other countries where demand for international circuits is heavy. The special unit is activated from switches on the control console in the picture. The array of clocks in the background, shown in more detail in the drawing below, tell the control operator the different times in the major cities to which his circuits are working.

scriber. By adding to existing equipment simple electronic devices which "sense" impending queueing problems and enable waiting calls to be switched to a free route much quicker than before there has been a reduction of between 60 and 75 per cent in "pocketed" calls.

The result has been improvements in overall performance including increased traffic-carrying capacity, a reduction of the load on common equipment and a cut back on register holding time. At present only the busy London–Paris route has been equipped with the electronic devices, but rapid extension to all major continental routes is scheduled for the near future.

A technique known as "marker splitting" has been devised which has virtually doubled the outgoing circuit terminating capacity of the Centre's switching system and at the same time greatly speeded up the call connection process. Simply by enabling the marker, that part of the switching equipment which connects the calling party to a free international circuit, to handle two calls at a time instead of one as previously, the switching unit which could at best handle 14 simultaneous calls can now deal with 28 if required to do so.

Other projects have been devised and are currently under consideration. These include the feasibility of providing improved operator dialling access through the Faraday unit, and the possible introduction of "skipped" grading in place of conventional methods in an attempt to correct the loading balance on incoming international circuits and access to the inland network.

The achievements to date have been considerable. Delays in the provision of new units has inhibited the efforts to provide a completely satisfactory international service to customers but the expedient measures introduced at Faraday have helped to offset considerably the effects of shortages in call connection facilities.

New services have been introduced on schedule and are working well; the traffic handling capacity of the Faraday unit has been increased by the improved exploitation of existing equipment; automatic service performance is steadily improving and a notable decrease in plant failure is evident. Last but not least, the success of the innovations and changes has been a tremendous stimulant to staff morale.

Link for Channel Island

Laying has begun of the largest capacity submarine cable in home waters. It is a 1,380-circuit cable running from Bournemouth, Hampshire, to Guernsey in the Channel Islands, a distance of 100 nautical miles, and is due to come into service in 1972.

This new cable is identical in construction to the four giant cables which are to span the North Sea, all with capacity of 1,260 circuits.

The first of the North Sea cables – from Winterton in Norfolk to Fedderwarden in Germany – has been completed. The second in the series from Broadstairs, Kent, to Ostend in Belgium is expected to be ready for service early this year. It will be followed by others between Aldeburgh, Suffolk, and Domburg in the Netherlands and from Scarborough, Yorkshire, to Thisted in Denmark. All the cables and repeaters are being supplied by Standard Telephones and Cables Ltd.

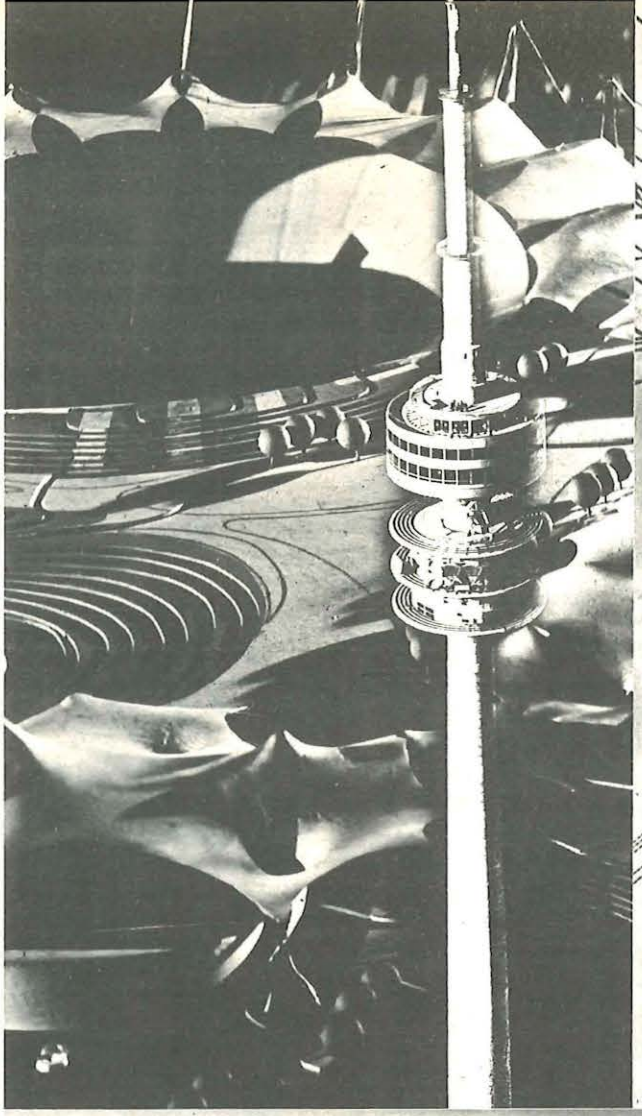
The North Sea project stems from a decision of a seven-nation London conference in May, 1967 held on the initiative of the British Post Office. At the end of that year there were just over 1,900 cable circuits in operation between Britain and the Continent; cables completed since then have brought the total to 2,880 circuits, which will rise to 7,920 when the four new cables come into use. Together with 2,160 microwave circuits now available and others planned, this is expected to meet telecommunication needs between the UK and the Continent for the next five years.

The cables are coaxial with a centre conductor consisting of a stranded steel core lapped with copper tape, surrounded by a polythene dielectric 1.47 in (37 mm) in diameter and carrying a wrapped-round aluminium-strip outer conductor. This is enclosed in an outer polythene sheath with a waterproof serving and wire armouring for mechanical protection.

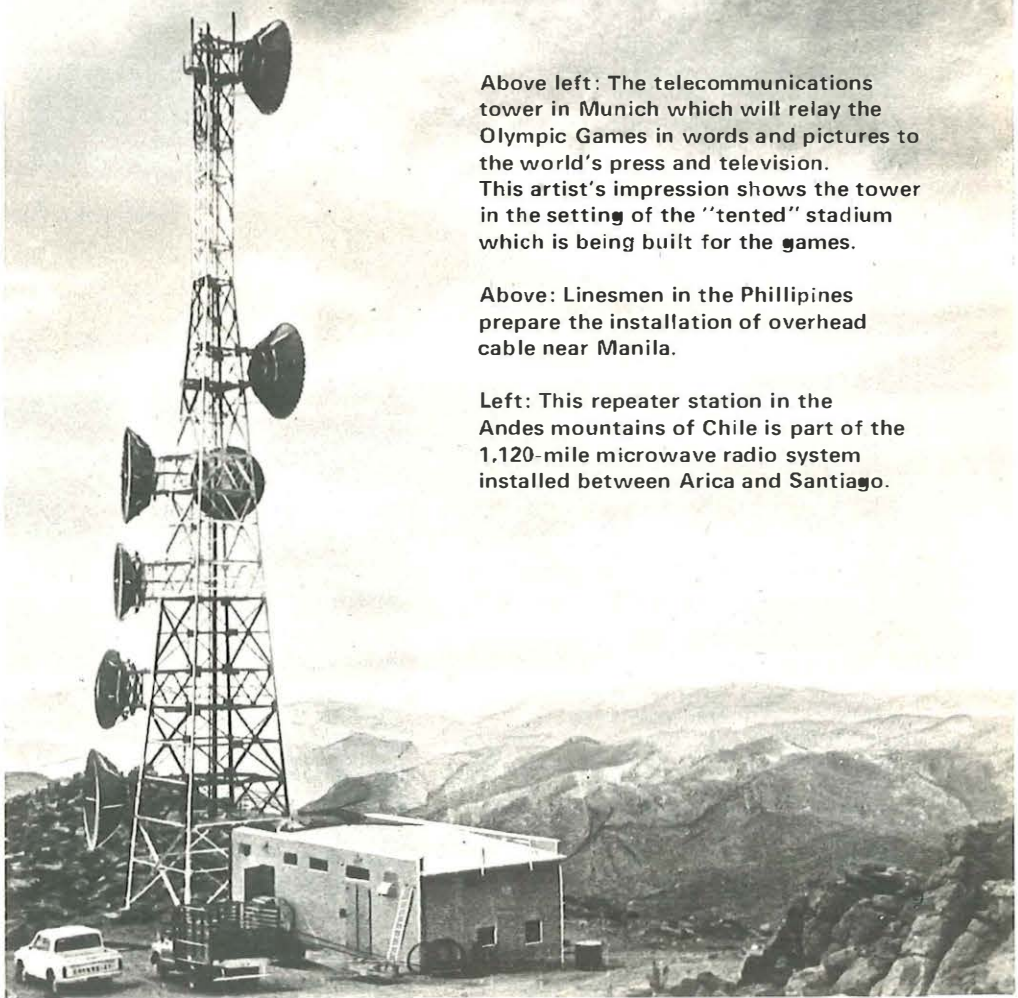
Multiple-circuits operation is achieved by frequency division multiplexing at 4 kHz intervals. Outgoing circuits from the UK occupy the base band of 312 to 6,016 kHz in each cable; return circuits (carried on a principal carrier of 14,012 kHz) occupy the upper band of 7,996 to 13,700 kHz, the carrier and upper sidebands being suppressed.

The repeaters, which have an amplification of 43.15 dB, are powered in series from a constant current source at each end, feeding a direct current of 495 mA into the cable, establishes a potential drop of 20V across each repeater.

When a cable is three miles deep . . . see centre pages.



THE OTHER END OF THE LINE



Above left: The telecommunications tower in Munich which will relay the Olympic Games in words and pictures to the world's press and television. This artist's impression shows the tower in the setting of the "tented" stadium which is being built for the games.

Above: Linesmen in the Phillipines prepare the installation of overhead cable near Manila.

Left: This repeater station in the Andes mountains of Chile is part of the 1,120-mile microwave radio system installed between Arica and Santiago.

REFIT AT ONGAR

Two radio stations were recently in the news – one at the end of its life and the other receiving a new lease of life.

Ongar radio station in Essex, has been re-fitted with transmitting equipment worth £¾ million. By installing the new equipment in phases, the Post Office has ensured that the station's services have not been disrupted during the re-equipment programme. The station transmits telephone, telegraph and facsimile services to more than 25 administrations in eastern Europe, the Middle East, Africa and South-East Asia.

The new equipment – a total of 23 self-tuning high-frequency radio transmitters – has increased the capacity of the station to 30 modern high-power units capable of world-wide operation.

Mr Keith Hannant, Director of Post Office International and Maritime Telecommunications, said at a ceremony at the station, that the equipment would make Ongar one of the most up-to-date radio stations of its kind in the world. Mr Hannant demonstrated the ease and speed with which a change of frequency and re-selection of aerial could be made. Less than 20 seconds after he had pressed a button on the control panel the transmitter had tuned itself, loaded itself to the correct output power, and begun broadcasting a greetings message to the world.

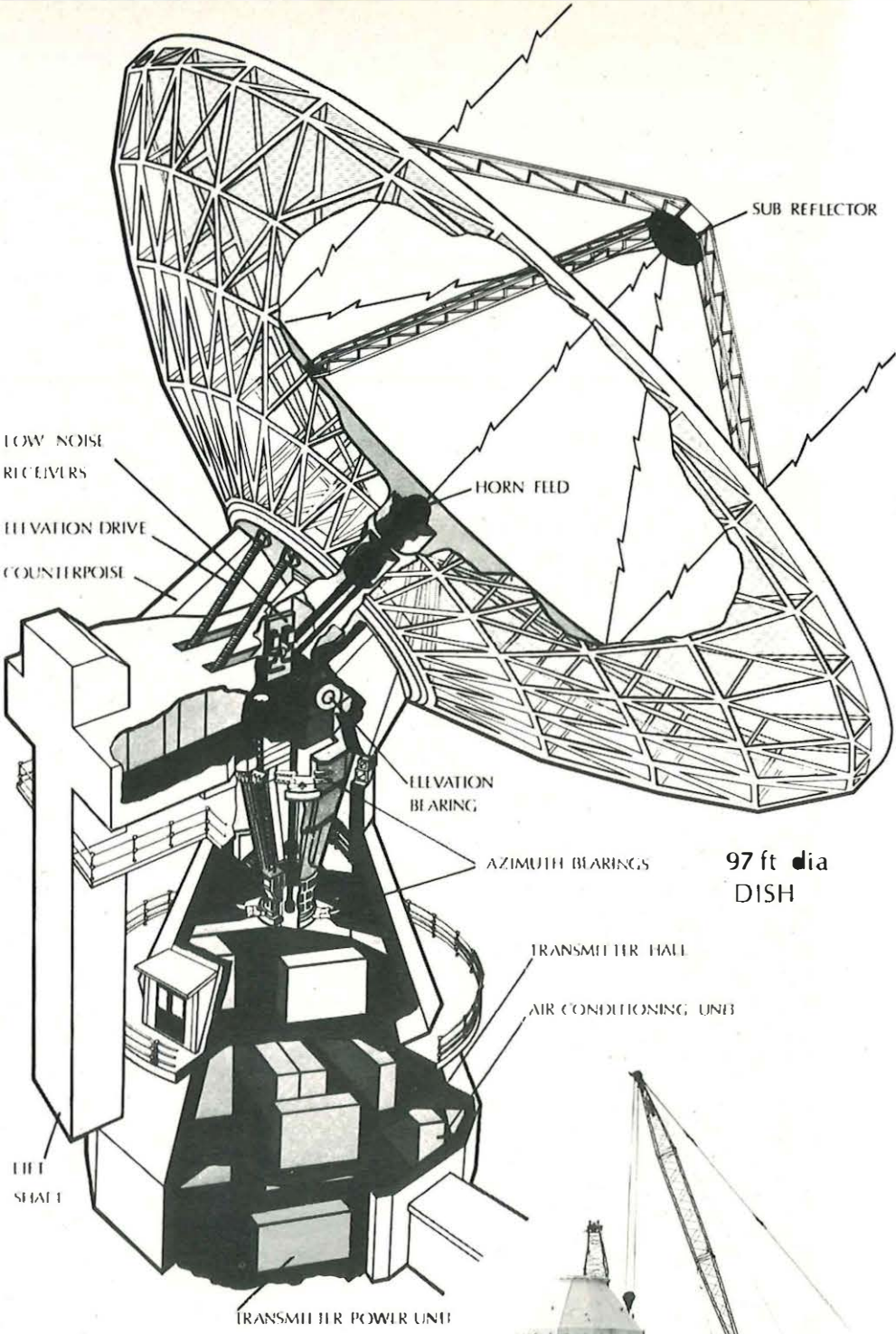
Slip End, near Baldock, Herts, which has now closed down, has been involved in a number of historic events in its 42 years' service. It opened the first public telephone service with the USA, monitored radio transmissions from the first Sputnik, and maintained communication with lone yachtsman Robin Knox-Johnston, winner of the round-the-world race.

One of the station's first jobs was to listen for any reply to a telegram transmitted to the Moon from G-BR Rugby, handed in and paid for by an eccentric.

Since 1938 Slip End has acted as a frequency-checking station, monitoring domestic radio transmissions for accurate maintenance of frequencies and co-operating with other countries in tracing interference and maintaining trouble-free operation of international radio-communication. This work has now been taken over by the Ministry of Posts and Telecommunications.

Radiotelephone traffic at Slip End reached its peak in the 'fifties, when the station was working to 40 different countries and 100 ships a day. Traffic with other countries declined with the laying of the first transatlantic telephone cable and fell off sharply as other transoceanic cables, and then communication satellites, were brought into service. Meanwhile, ship-to-shore traffic continues to increase.

Traffic with other countries formerly handled at Slip End now passes through Post Office radio stations at Bearley (Warwickshire) and Somerton (Somerset) while the traffic with ships at sea is handled at the Burnham (Somerset) station, bringing the long-range maritime services under one roof.



The satellite spectrum

J K S Jowett

The World Conference organised by the International Telecommunications Union to conclude new frequency allocations and regulations for space communications has come and gone. But the important agreements reached by some 700 delegates from over 100 countries will have repercussions on telecommunications operating organisations for many years to come.

The conference has resulted in both a radical revision and a large extension of all the international regulations dealing with the use of radiocommunications in and through the environment of space and, in the process, has also had some important effects on the regulation of conventional terrestrial radiocommunications.

So far as the Post Office is concerned, probably the most interesting conclusions were:

- The allocation of further frequency spectrum – between 10 and 15 GHz – for the fixed-satellite service; this is in effect the new term for what we have known up to now as communication satellites operating to fixed earth stations.
- The allocation, for longer-term developments, of ample spectrum at even higher frequencies – some of it on an exclusive basis – for the fixed-satellite service.
- The protection of terrestrial microwave radio-relay communications, in particular the provision of sufficient spectrum for this service, and the establishment of safe technical criteria for bands to be shared with space services.
- Agreements on bases for the international use of the geostationary satellite orbit – an increasingly valuable and indeed unique orbit at about 36,000 km altitude in which the velocity of the satellite is such that it appears from the earth to be stationary.
- The allocation of adequate frequency spectrum for the development of mobile communications by satellite, particularly for the development of satellite communications with ships.

The need to allocate additional frequency spectrum has been foreseen for some time, and because of the increasingly heavy signal attenuation caused by rain at frequencies much above 10 GHz it has generally been recognised that further allocations for the fixed-satellite service should be made in the region of 10–15 GHz. As a result of developments which have already taken place in some countries in this region of the spectrum, and also because frequencies suitable for the fixed-satellite service are equally suitable for the expanding terrestrial radio-relay services of the world, the problem presented was particularly complex and difficult. However, after many meetings in the committees and working groups, agreements were reached that must be regarded as satisfactory in all the circumstances.

The final outcome in so far as ITU Region 1 (Europe and Africa) is concerned, was that a total of 1,250 MHz of new spectrum was allocated for the fixed-satellite service of which 250 MHz – that between 12.5 and 12.75 GHz – was allocated exclusively. The importance of this exclusive band is that it will eliminate the need for restrictions which must be imposed, to avoid mutual interference, in bands shared with terrestrial services and will allow the construction of less sophisticated and therefore much less expensive small-aerial earth stations.

The other services in this region of the spectrum are all terrestrial services, except for the satellite broadcasting service which is permitted to develop on a shared basis in the 11.7 to 12.5 GHz band and a small band for a radionavigation satellite. It remains to be seen whether the use of satellites to supplement television broadcasting services will in fact develop in European countries, although there is little doubt that some international frequency planning will now take place with this possibility in view.

Those frequency bands below 10.7 GHz allocated in 1963 for the fixed-satellite service will remain available for the further development of this service and it is in these bands that all INTELSAT operations have so far taken place. Undoubtedly, much more can be done in these bands using satellites placed in new positions in the orbit, but the introduction of the new bands will also promote further developments for international, regional and, in the larger countries, national systems of communication.

The conference extended the international frequency allocation table to 275 GHz, although many of the applications in the higher frequency regions must be regarded as speculative at this stage and subject to change as more experience is gained in succeeding decades. A total frequency spectrum of 39 GHz was allocated between 17 and 275 GHz for fixed-satellite systems, 35 GHz of this being on an exclusive basis.

Because of the severe effects of precipitation attenuation expected over all this region of the spectrum, satellite powers would generally have to be much higher than at present in order to provide an effective communications service. On the other hand it will become much easier, in the millimetric bands, to provide very high aerial directivity on board a satellite and, with further long-term developments in spacecraft technology, very narrow pencil beams covering small territories may be used for particular services. This is a part of the spectrum in which much effort is likely to be mounted in the coming years not only in hardware technology for terrestrial and space services, but also in a comprehensive investigation of propagation effects about which too little is known as yet.

It is interesting to note that in certain frequency areas, for example around 60 and 115 GHz, molecular absorption effects in the normal atmosphere produce very severe attenuation of signals and in these particular areas, allocations were made for direct satellite-to-satellite transmissions. Such arrangements are ideal in the sense that the atmosphere serves as a permanent "cloud" to such transmissions and thus obscures interfering effects which would otherwise be noticeable on the earth's surface.

The procedures agreed at Geneva for registering and regulating the use to be made of the geo-stationary satellite orbit were very satisfactory. Provision is made, on a step-by-step basis, for countries or groups of countries to claim and, following appropriate technical consultations

Left: A third aerial takes shape at the Post Office earth station at Goonhilly Downs, Cornwall. When the £2¼ million aerial starts work later this year, Goonhilly will be the busiest satellite earth station in the world. At first the aerial's receiving equipment will cater for 400 channels, but the capacity can be increased to at least 1,800 telephone circuits. The drawing of the new aerial shows how much of the equipment will be housed within the concrete tower.

with other users of the orbit, to use in a specified way parts of the orbit for the fixed-satellite and other services. Technical bases for the calculation of potential interference between fixed-satellite systems using neighbouring parts of the orbit were agreed and standards were established to determine in what circumstances a consultation procedure should be initiated. In this area as well as in other areas of the work of the conference, the detailed and extensive technical conclusions of the Special Joint Meeting of the CCIR held earlier this year proved invaluable.

Lengthy and detailed discussions took place on the frequency allocations to be made for maritime satellite communications. It is steadily becoming clearer that the advent of space communications provides the only way in which the needs of ships for a continuously available and adequate communications service can ultimately be provided. On the other hand it is accepted that the cost of the average ship's terminal must not be high and the cost of using the space segment – the satellites – of any maritime satellite system must be low. These latter considerations are mutually and sharply conflicting at the present stage of satellite technology. Hence considerable debate took place at the conference on the optimum frequency band for this service, that is that part of the frequency spectrum which would minimise the overall operational costs of a service to ships.

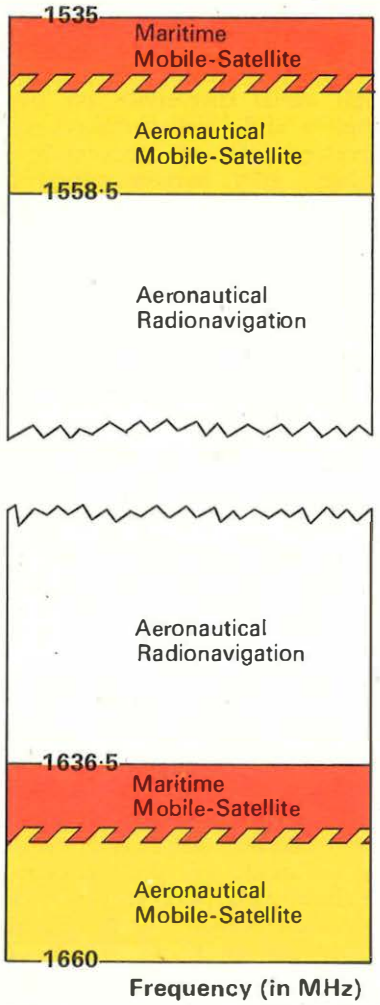
It was generally accepted that the lower part of the UHF range would be optimum, but in the end it proved impossible to find allocations here because of the extensive use already made of this part of the spectrum. The final decision taken was to use the higher part of the UHF range, around 1,600 MHz, and to allocate two 7.5 MHz bands for maritime satellite communications adjacent to and partially overlapping the allocations made for an aeronautical satellite service. The latter service in particular is expected to develop fairly rapidly to provide advanced communications and navigational aids for aircraft.

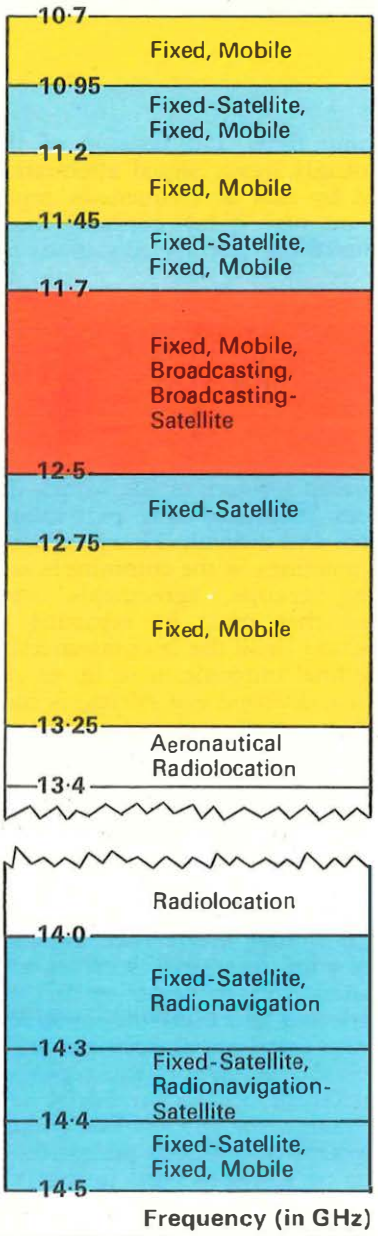
The allocation of closely adjacent frequencies for maritime and aeronautical satellite services will enable equipment development for both to proceed along somewhat similar lines and this should facilitate the progress to be made in both these areas.

This short review necessarily omits discussion of many important results of the conference, particularly as regards the space research, manned-space, earth exploration and similar services. In summary, however, it may be concluded that the conference successfully achieved its objects and has laid the foundation for further extensive developments in the many and growing applications of space radio-communications.

Below: Frequency allocations for maritime and aeronautical mobile satellites will overlap at each end of the range between 1,535 MHz and 1,660 MHz.

Right: This shows how 1,250 MHz of new spectrum has been allocated within the range 10.7 and 14.5 GHz to communication satellites, now to be known as fixed-satellites. Apart from some small provision for broadcasting satellites (TV) and radionavigation satellites (a position-fixing system for ships or aircraft) the rest of this part of the spectrum is shared with terrestrial services such as fixed (microwave radio relay network) and mobile (eg car radiophone) services.





The authors

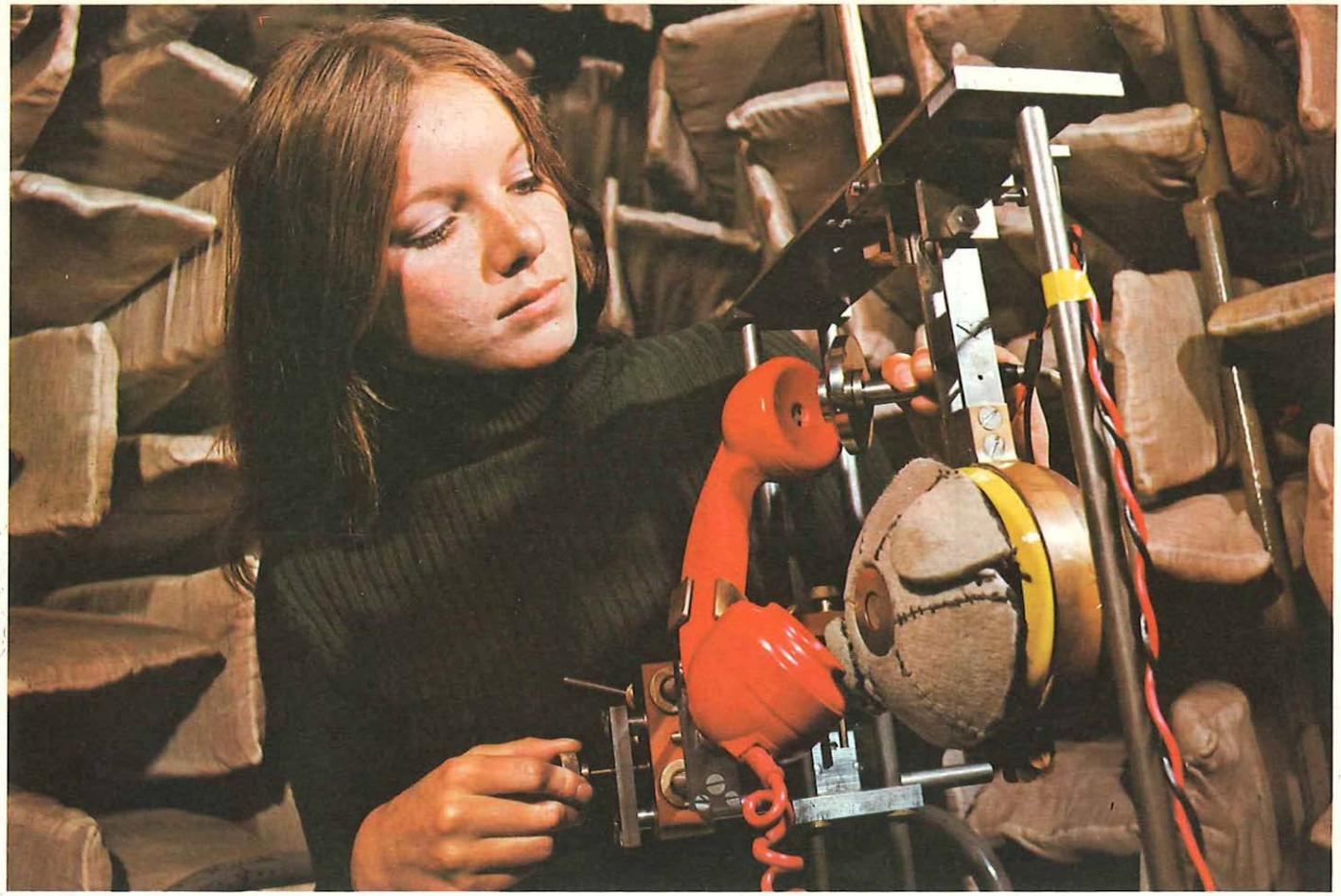
Mr D. R. B. Ellis is the Controller (Works) International and Maritime Telecommunications Region. He has served in a number of Post Office departments since 1935 and joined the international services in 1969.

Mr C. B. H. Wake-Walker has been in charge of the Telegram Retransmission Centre project since its inception. He is Service Controller, International and Maritime Telecommunications Region.

Mr A. W. Powell is Area Engineer in the International and Maritime Telephone Manager's Office. He has been involved with the international telecommunications services since 1953.

Mr J. K. S. Jowett is Deputy Director Engineering in charge of the Space Systems Division of the Telecommunications Development Department. He was a member of the UK delegation which attended the World Space Communications Conference.

● *Further articles about international services will appear in the next issue.*



In a specially designed room at the Dollis Hill research station tests are made to ensure that the microphones and receivers used in Post Office telephones are produced to the highest standard. The room is kept echo-free by the large wedges of fibre glass which protrude from the wall.

PROFIT ON TARGET

A large growth in the telecommunications system and the traffic carried . . . a steady improvement in the standard of service provided . . . high productivity . . . and a profit which reached the financial target for the year. That was the record of the telecommunications business in the first full year in which the Post Office acted as a public corporation.

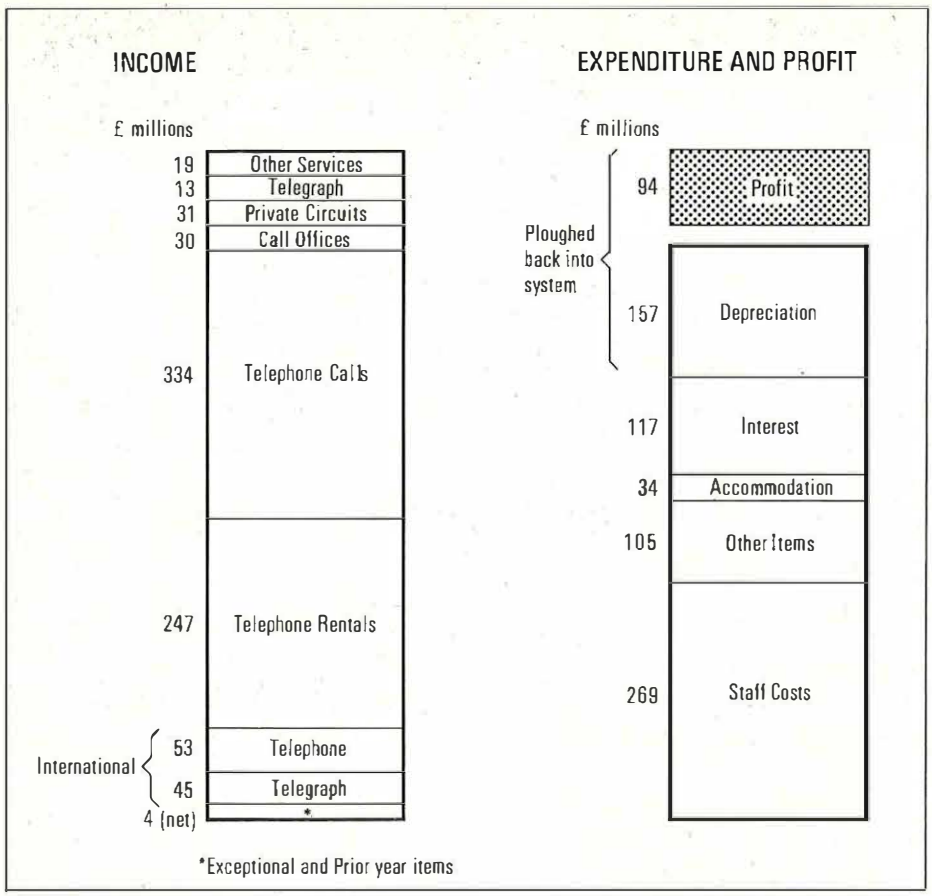
The Post Office report for the financial year 1970-71 shows that a profit of £93.5m, together with the sum set aside for depreciation, was ploughed back into the telecommunications business to meet current growth and future demands for service. During the year the number of inland calls made went up by about 12 per cent and there was a considerably larger percentage increase in international calls. Despite higher charges, demand for new connections was maintained, and with more than a million provided the system grew by nearly 8 per cent. The growth in traffic and system size was achieved with less than two per cent increase in staff.

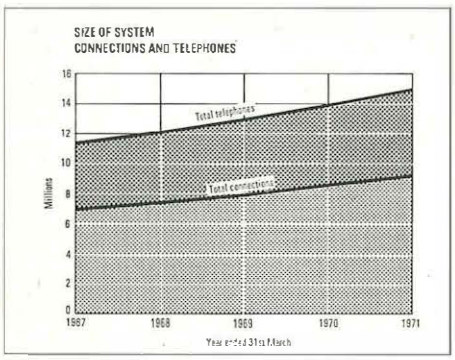
One of the biggest difficulties facing the telecommunications business, says the report, is the supply of exchange equipment from manufacturers. Many contracts were in delay during the year, but combined efforts by the Post Office and industry are producing results. Dealing with prices, the report says that there were wide variations in profitability within the telecommunications tariff structure. Telephone calls were profitable, but the average return on the rental of a telephone was less than the rate of interest on money borrowed. "This is important because about half of telecommunications investment goes in increasing the size of the system," says the report. "The relative cheapness of the telephone is creating a very heavy demand which is increasingly difficult to meet with present resources. In the absence of a price regulator waiting lists are bound to increase and service deteriorate until prices can be adjusted."

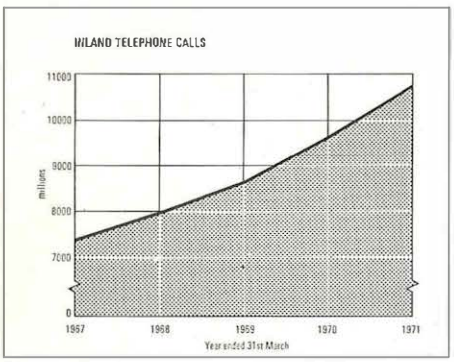
Some of the main details from the report are given here:

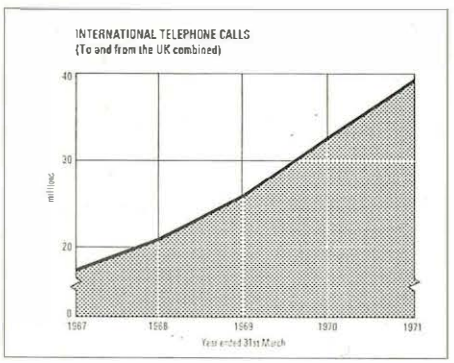
A record 1,085,000 new connections were provided, and the total number of lines in service grew by more than 660,000 to 9.2 million. The number of telephones in service reached nearly 15 million. About 85 per cent of orders were met on demand. However, there were continuing delays in completing exchange equipment contracts and constructing new buildings. As a result, the waiting list rose by 13,000 to 121,000.

The total number of calls made grew at an even faster rate than the previous year.









Local calls increased by 11.6 per cent to 9,230 million; trunk calls by 12.2 per cent to 1,517 million; continental calls by 16.7 per cent to 34 million; and intercontinental calls by 37.0 per cent to 5 million. There was a record increase of 3,800 in the number of telex connections, bringing the total in service to 33,000. Inland traffic increased by 25 per cent – a much faster rate than in recent years, largely as a result of the UPW strike – and international traffic rose by 18.5 per cent.

Data communications continued to expand rapidly. By the end of March, 1971 more than 15,000 Datel terminals were in service and more than 100 networks specifically tailored for applications ranging from banking to theatre and hotel reservations were being installed. A new Datel service, transmitting information at a speed of 48,000 bits (binary units) per second, was introduced. An experimental public switched network was also set up, transmitting data at a similar rate between London, Birmingham and Manchester. Various kinds of data control equipment were introduced to enable computers to set up and answer datel calls automatically over the public telephone and telex networks. An important feature of this equipment is that it allows customers to exploit the "midnight line" service which, for a fixed rental, allows unlimited inland dialled calls between midnight and 6 a.m.

Quality of service

The quality of the STD service improved significantly over the first nine months of the year, but the higher number of calls made during the UPW strike increased congestion in the last quarter. By the end of the year 90 per cent of customers had STD – an increase of more than 950,000 during the year. Eighty-six exchanges, serving about one per cent of customers, remained to be converted from manual to automatic working. Customers also dialled more of their own calls – 79 per cent of trunk calls compared with 75 per cent in 1969–70. The quality of service on dialled local calls improved slightly.

Although the international telephone and telex services remained under pressure, the speed of connection and the proportion of calls successfully connected were maintained. Customers dialled 64 per cent of continental calls themselves. Direct dialling to the United States was extended to customers in the main conurbations.

Fewer faults per customer were reported. About 79 per cent of service faults were cleared on the day they were reported; 92 per cent were cleared by the end of the following day. Although the number of cases of kiosk vandalism decreased slightly the severity of the damage increased. The total cost of repairs rose to about £600,000 in the year. 10,000 of a new type of heavy steel coinbox were installed in an effort to combat the vandalism and, if successful, they will be used in the other 65,000 kiosks.

Improving efficiency

Staff costs account for 39 per cent of the current expenditure of the business which employs nearly one per cent of the country's labour force. Particularly at a time of rising costs, therefore, improvements in productivity are vital to success. Despite an increase of 7.7 per cent in the number of telephone connections and a greater increase in calls, total staff numbers increased by less than 2 per cent.

On the engineering side, output per head improved by more than 5 per cent, the equivalent of a saving of more than 4,000 men. The number of exchange operating staff in the inland telephone service decreased by about 1,100 during the year. The effect of higher levels of traffic and of a reduction in the telephonist's working week, was more than offset by savings from increased automation of operator services and from improved productivity.

Clerical productivity has risen encouragingly. Output per head improved by 6 per cent, mostly as a result of computerisation of customers' accounts. This was equivalent to a saving of some 1,300 staff and enabled the total clerical staff to remain constant throughout the year.

Research and development

The problem of modernising switching equipment continues to be the major limitation in providing the highest quality of service. The existing system is very largely Strowger and imposes a very definite limit to both the quality of service and facilities that can be offered. Replacement of this by a modern system is essential if an adequate standard of service is to be provided in the future. Because of the magnitude of the existing network of Strowger exchanges and the high costs involved replacement of this equipment is, of necessity, a long-term commitment. Intensive technical and economic studies (involving a complex computer-based model of the principal elements of the UK switching system) were undertaken to help determine policy on the type of equipment to be installed in the coming decade and beyond and the rate at which the existing obsolescent Strowger equipment should be replaced.

Completion of studies indicating long-term advantages of adopting digital transmission and switching has given a strong impetus to the development of trunk digital transmission systems. Feasibility studies have been completed under contract for a system operating on the

standard design coaxial cable with a capacity of about 1,600 telephone circuits, or one television channel, on each pair of tubes. A lower capacity system for use on the main microwave radio relay routes is also being developed.

A two-year study into future data communications systems has enabled the characteristics of a possible national switched data transmission service to be defined with some precision. This would be integrated with the total UK telecommunications system. Trunk routes, becoming progressively more digital, would carry the whole range of telecommunications services from telephone calls to data. Customers would be linked to the service through the existing telephone local networks. Switching equipment would employ techniques suitable for data transmission; this equipment might also be used to switch telex traffic.

Studies of longer-term developments cover such matters as a local distribution system capable of carrying a variety of services, including viewphone and television as well as telephone calls and data; the use of higher frequencies than at present for microwave radio relay systems, including digital systems; the rationalisation of components for new systems, aimed at ensuring that a wide variety of needs will be met by a few families of devices, each based on a common technology and serving a number of purposes; and the development of new types of high-quality telephone microphone to replace the traditional carbon-granule type.

Capital investment

Delay in the supply of equipment from manufacturers remains a major problem. As a result of unrelenting pressure from the Post Office, the telecommunications industry has greatly improved its control of the execution of contracts, but recovery was hampered during the year by industrial disputes. Installation of equipment by contractors again fell below target and slightly fewer orders were completed than in the previous year. However, performance can be expected to improve given a period of reasonable industrial peace.

To cope with expansion, more than 10,000 long-distance circuits and 66,000 shorter-distance circuits were added to the network. Testing began of the first stage of a special network of new trunk lines and switching centres which, within a few years, will enable all trunk calls to be dialled by STD. A record number of more than 350 new buildings and extensions, mainly for telephone exchanges, were started – about 30 per cent more than in the previous year.

The expansion of satellite services continued and by March, 1971 there were direct services with 26 countries. The construction of a third aerial system at the Post Office earth station at Goonhilly began during the year.

Finance

Income was £120 million higher than the previous year – £52 million from price changes and £68 million from increased business. Pay awards accounted for £40 million and higher prices for £6 million of the total rise in expenditure of £92 million which reflected the high level of investment.

The return on capital of 9.8 per cent was a little higher than the financial target of 9.6 per cent.

One of the additions to the gallery provided by the Post Office is a large and colourful working display showing the way a call is routed. Six different types of call can be dialled by the visitor to the gallery, and coloured lights flash on to trace the path of the call through illustrations of the exchange equipment involved. The telephone – in transparent material with the "works" illuminated – provides a recorded commentary.

It's fun finding out...

More than 500 exhibits, ranging from the electric telegraph of the early nineteenth century to the laser beam cable of the day after tomorrow, can be seen in the new Telecommunications Gallery at the Science Museum in London.

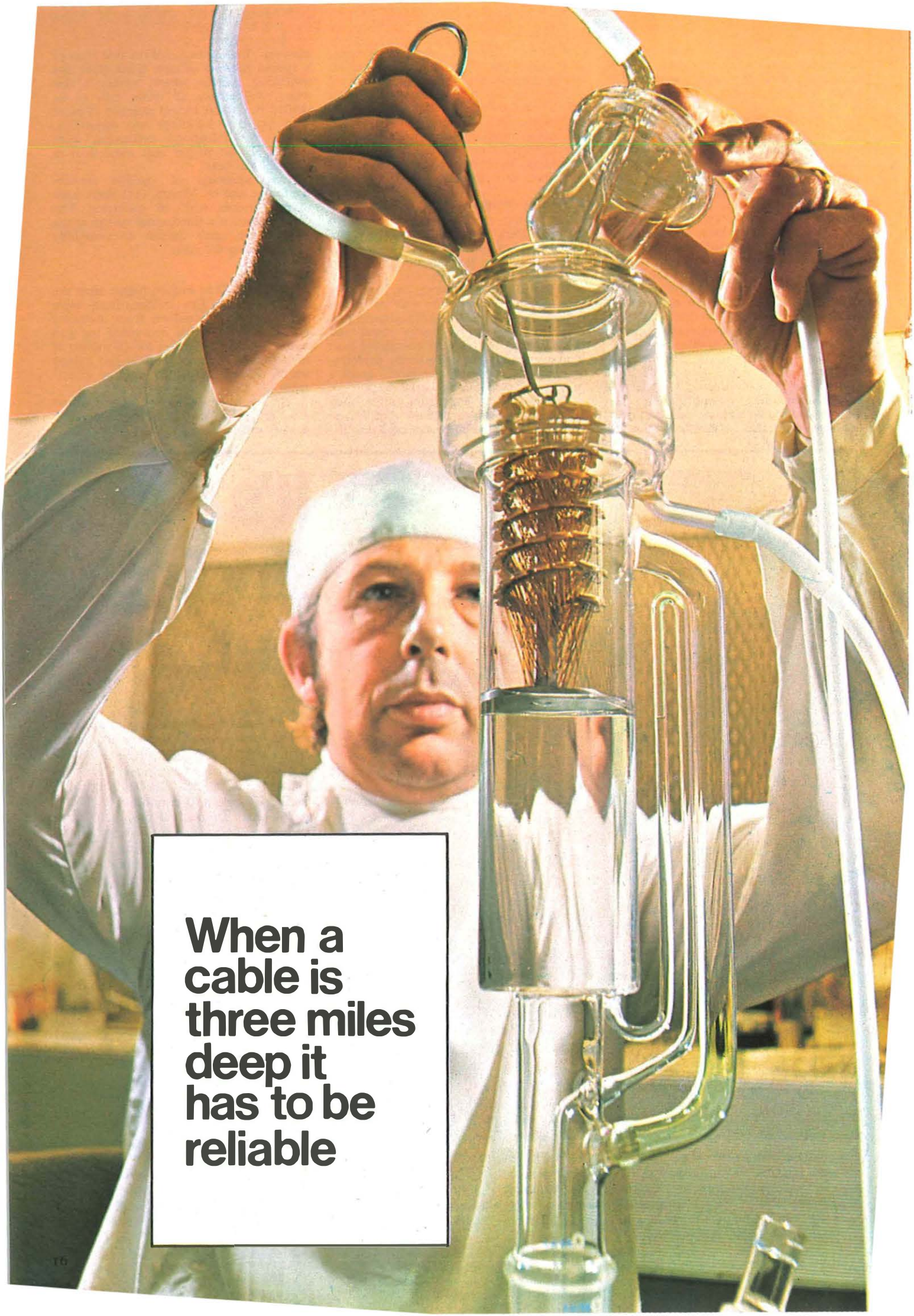
The Post Office has played a major part in tracing and providing additions to the gallery which now occupies twice the space previously available to telecommunications exhibits in the museum.

Dollis Hill research station provided the electronics for a number of working models, and also demonstration recordings which can be heard when the visitor lifts a telephone handset.

The gallery now takes the visitor through every important aspect of the rapid development of telecommunications technology, and offers clearly illustrated explanations of the most modern techniques.

Among the exhibits shown for the first time are items dealing with crossbar and electronic exchange equipment, and the development of communications by satellite. The cable display has been brought up to date and work on waveguides and optical fibres is shown.

A prized addition to the historical exhibits is a 20 kW short-wave transmitter dating from 1927 which was in use at Dorchester radio station until only a few years ago.


When a
cable is
three miles
deep it
has to be
reliable

A new transatlantic cable between the United Kingdom and Canada will be lowered to the ocean bed next year. In some places the cable will lie three miles deep, and no one in the Post Office will want to see it again for a very long time. It is a lengthy and costly business to reach the deep of the Atlantic to repair or replace a faulty cable component, and a great deal of effort is put into ensuring that every part will perform its task without failure for many years.

The new cable—called Cantat 2—will carry nearly 2,000 circuits, more than double the number of all existing cable circuits across the Atlantic. Spaced along its length will be nearly 500 repeaters, each designed to give a trouble-free life of more than 25 years. They will contain about 3,000 transistors, but in the manufacture of the cable more than 20,000 transistors will be exhaustively tested to ensure the quality of those selected for use. The high capacity of the cable is made possible by the development of these solid state devices with guaranteed reliability and performance which will operate to the higher bandwidths of sub-marine cable—13.7 MHz in the case of Cantat 2. The Post Office Research Station at Dollis Hill pioneered this work and developed a process in which the transistors use aluminium wires bonded to aluminium contacts. There has not been a single failure in 40,000 bonds tested in production and 6,000 in transistors now on the sea bed.

Both the Post Office and Standard Telephones and Cables Ltd, who have been awarded the £22 million Cantat 2 contract, produce and test the transistors in "superclean" laboratories where the air is filtered and purified. Even the smallest speck of dust will contaminate the transistor it settles on, and in the production rooms staff dress like surgeons in an operating theatre.

Cantat 2 will yield about £1,000 a minute at full capacity—a large sum to lose if it is put out of action. Although the components can be relied upon, there is always a considerable danger of accidental damage. The biggest risk comes from trawlers fishing the rich beds of the Atlantic shelves off the American and UK seaboards. The trawler problem would be reduced by burying the cable beneath the seabed near the shore ends, a move now being considered. However, this creates the problem of how to locate and bring the cable to the surface for repair if it breaks down.

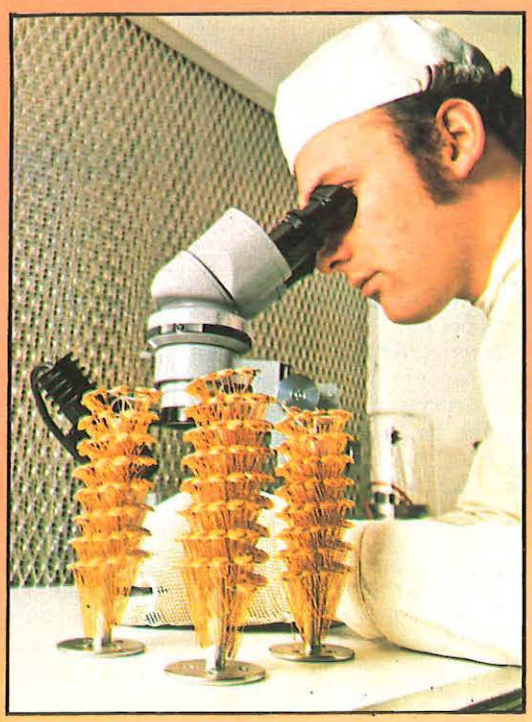
An orbiting satellite designed as a navigational aid to shipping will be used during cable laying operations so that the cable route can be recorded with great accuracy. As an additional aid to speedy repairs, Post Office research workers have developed a new way of jointing damaged cable. It is about an hour faster than existing repair methods.

The cable to be used is the proven 1.47 inch coaxial design, and it will be made by STC in England. More than 2,800 nautical miles will be laid to cover the route between the British cable station in Widemouth Bay, Cornwall, and a new cable terminal to be built near Halifax, Nova Scotia.

Bringing the cable into service will cost about £30,500,000, to be shared between the British Post Office and the Canadian Overseas Telecommunications Corporation.

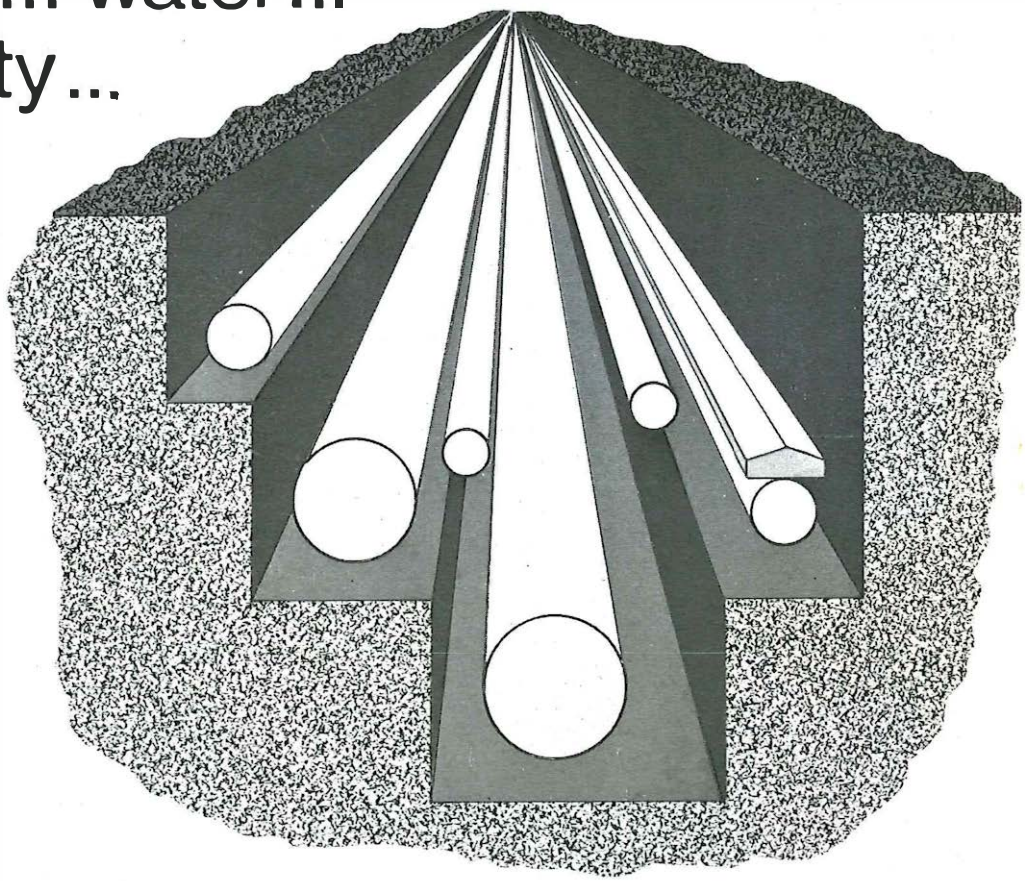
Left: Every effort is made to ensure the reliability of the 3,000 transistors - each no bigger than a pinhead - which will be used in the Cantat 2 cable. At the Dollis Hill research station a technician, gowned like a surgeon, works in the ultra-clean atmosphere of the transistor production room. He is lifting a batch of transistor "headers" - small gold-plated beds on which the transistors will eventually rest - from an alcohol bath. The "headers" are then baked in a vacuum.

Below: Transistor "headers" are examined for flaws.



Below: Repeaters are assembled at the STC plant at North Woolwich. The assembly shop, known locally as the "dairy", also provides clinically clean manufacturing conditions. The repeaters, which amplify the signals carried on the cable, will be spliced into Cantat 2 at intervals of about six nautical miles.

phone... gas... water... TV... electricity...



All together now

CRG Harris

Some 300,000 houses are built throughout Britain every year, most of them on estates and in the increasing number of new towns. All will require water, electricity or gas and a great many, we hope, will want a telephone.

When providing these services on new building sites each public utility has generally dug its own trenches and laid its own pipes or cables. For many years there has been an obvious need for some kind of co-ordinated operation which would minimise the wasted effort and expense which undeniably exists. It has rarely come about in the past largely because co-ordination is beset with problems, both technical and managerial.

A Government Advisory Committee has been looking at the problems since late 1966 and of the several plans which have been put forward two have now been acknowledged as the most likely to allow successful co-ordination. One calls for the use of common trenching to carry all services which would be provided by one contractor, the so-called multi-skilled contractor. Alternatively, a "twinning" arrangement is proposed with the cable utilities, Post Office and Electricity, providing their cable in one joint trench and the pipe utilities, Gas and Water, similarly combining in another.

Opinion seems to have settled on the conclusion that "twinning" will be the better short-term solution. To the Post Office and the Electricity Boards "twinning" will not be entirely new. To an extent, their planners have co-operated in the past in the provision of cables on building sites throughout the country. But no doubt due to the work of the Advisory Committee there is now an increasing awareness of the benefits which will accrue to both sides.

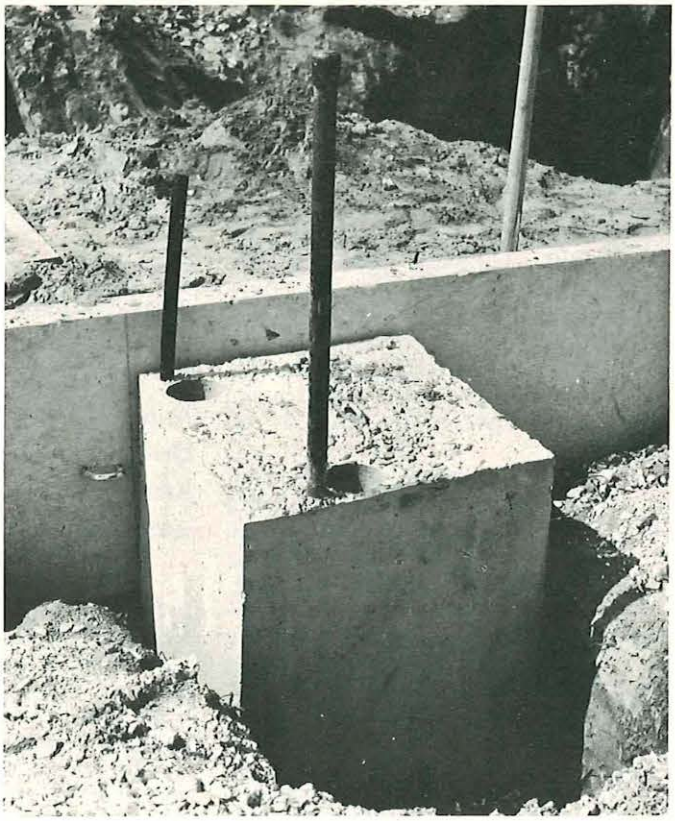
Telecommunications Headquarters has already formalised "twinning" agreements with the South Eastern and Southern Electricity Boards to replace the existing *ad hoc* arrangements, and some Regions are making similar arrangements with Electricity Boards in their own areas.

Whereas in the past telephone cables on new housing sites have been laid by the local developer or an appointed contractor, "twinning" will enable them to be laid by the Electricity Board at the same time as they lay their own electricity cables.

For the common trench the Advisory Committee has established a set of working rules and has recommended the positions for minimum separation distances between each utility's plant. This arrangement will lend itself to a stepped profile for the trench excavation, an orderly system for laying plant and for back-filling. It should also ensure that subsequent maintenance work by one utility will not interfere with the plant of the other. To get maximum benefit from a common trench will require the fullest possible co-ordination of the work involved. It has been suggested that this will best be achieved by using one contractor to carry out, as far as possible, all the work.

At first glance this should be a satisfactory solution, but in practice it has snags. There are, for example, few contractors with the necessary expertise to satisfy all the utilities. Even when such a contractor can be found, utilities are reluctant to let all facets of their work to him because of the present industrial working arrangements which include productivity agreements and bonus incentives etc.

The laying of all pipes and cables by one contractor will also demand a high degree of on-site co-ordination with the building programme to avoid abortive and unnecessary work which



Left: Telephone and electricity cables are laid side by side during a "twinning" job at Bracknell, Berks. The Housing Estates Liaison Officer for Bedford Telephone Area discusses the job with the foreman of the Electricity Board gang which laid both cables.

Above: A number of these concrete blocks were used in a common trenching trial at Finchampstead, Berks, to lead in the various services to houses on a new estate. The near pipe is gas, the other is a Post Office polythene duct. The two holes carry a water pipe and electricity and piped-TV cables. The block was placed under the foundations of a house and the pipes and cables fed through the floor to a cupboard which accommodated meters, connection boxes etc, for all the services.

in the end results in additional costs to the utilities. This control must be vested in a recognised "co-ordinator" having the necessary expertise and level of authority.

Such a co-ordinator was appointed in the first common trenching trial at Finchampstead, Berkshire, where a multi-skilled contractor was employed. Not all aspects of the work were carried out by the contractor, the Post Office for instance reserved all cable jointing for its own staff, and in the event not all the utilities made a saving. Nevertheless, it was very satisfactory from the Post Office viewpoint and much was learned in the trial, particularly in regard to documentation. Other trials of a similar nature are progressing.

Experience so far indicates that the use of the multi-skilled contractor is a somewhat longer term solution and that currently this concept must be restricted to only the very large projects, such as new towns, where the co-ordinating expertise will probably be available. Common trenching will in fact be used in the new town of Milton Keynes and will accommodate cable for "piped" television.

No matter what method of co-ordination is adopted, many problems will still have to be overcome. Adjudication on costs, liability for injury, loss and damage, penalty clauses for non-availability of staff or stores, documentation and records – these are just a few.

A necessary pre-requisite to the apparently simple on-site arrangement involved in "twinning", for example, is the establishment between the parties of an appropriate code of practice and agreement on costs. Any form of co-ordination will often only be established after many hours of discussion, on the telephone and around committee tables, firstly in fashioning the framework and then agreeing the details for adoption on a particular project. There will then follow the important task of translating the proposals into fact under site conditions in the face of the multitude of upsets that are all too familiar on building sites – effects of weather, labour disputes, out-of-phase completion of houses, roads and footpaths and providing temporary service to name but a few.

Co-ordination will not be easy, but co-ordinate we must if we are to keep down the cost of the high investment level involved. In the past the Post Office has not been found wanting in co-operating with developers who have tried variations on conventional methods of plant provision.

In the future, planners must consider all possibilities of integrating their scheme proposals, examining and even initiating methods of co-ordinating the provision of Post Office plant with that of the other utilities. In the past we have not consciously sought to beat 'em, except perhaps to get in first; now we must try harder to join 'em!

Mr C. R. G. Harris is a Senior Executive Engineer in Operational Programming Department and is responsible for planning and development in the local line network. He sits on a Study Group set up to look into the management problems involved in co-ordination.

Maths for

Scientific methods are being used increasingly as aids to solving management problems. Their introduction is not an attempt to overthrow the art of management by substituting scientific fact for innate ability. It is an attempt to make the knowledgeable guess in decision-taking much more knowledgeable than it has ever been in the past.

T Lomas

The problems of running a complex and growing business are becoming greater as each year passes. To control and make the best possible use of manpower, materials and money is a huge task which demands from management a very high degree of professionalism. If they are to use their skill and judgement effectively, managers need to be provided with the necessary data marshalled in the clearest possible way. They must not be overwhelmed with too much information, nor must they be expected to make sound decisions on the basis of too little.

It is in this area of work that businesses are now making increasing use of the management sciences to improve the effectiveness of their managements' decision-making. Management science is the application to management problems of the well-tried and proven numerate disciplines so familiar in engineering, statistics and economics. It involves the development of models, usually in the form of algebraic equations, which simulate management situations. By manipulating the equation – or getting a computer to do it for him – the manager can experiment with alternative choices of decision, and can discover the probable consequences. All this is done without affecting the real situation, and obviously increases the probability of reaching the right decision.

In the telecommunications business, for example, we may wish to examine the likely consequences of various modifications to our tariff structure; to experiment with the allocation of our resources; to predict the effects of altering pay rates or of changes in organisation. We may wish to determine the best investment strategy in the face of uncertainty of forecast demands for service or of anticipated productivity improvements. Or we may wish to examine the combined effects of all of these changes and uncertainties simultaneously. To experiment in the real situation would be impracticable, to say the least. At best it would risk serious inconvenience to customers, at worst reduce the business to chaos. But experimental changes can be carried out safely on representative models of a situation with a computer manipulating the various sets of equations.

The management sciences approach is to identify the significant factors in a management situation, to quantify these factors where possible, to establish the relationships between them and the desired outcome, and finally to postulate changes in those factors which are within management's control, so that the likely effects on the desired outcome can be examined.

Management science methods are being used, for example, to determine the most favourable vehicle pool sizes for those staff based at Telephone Engineering Centres. A computer-based model representing the operations of a depot over one year was built and the effects of removing vehicles from the pool were simulated.

The model enabled account to be taken of the random nature of staff absences and of events which cause vehicles to be out of commission, and was used to demonstrate the likely costs resulting from various proportions of vehicles to crew. The random nature of crew and vehicle absences made it impracticable to solve the problem analytically and so a stochastic simulation model was necessary. This type of model operates on data chosen at random from a known distribution – in this case past attendance records of the men and records of vehicles off the road.

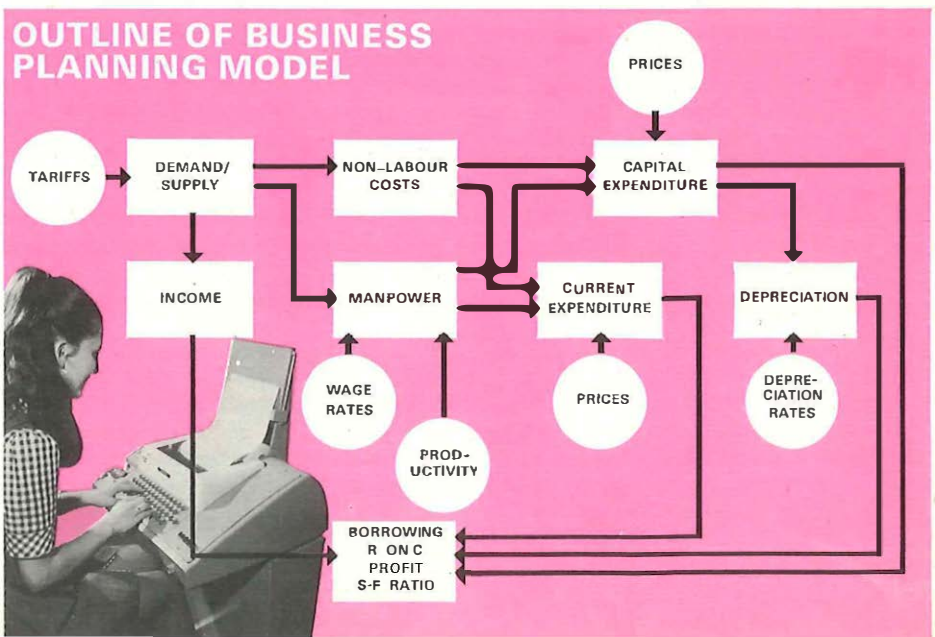
Other management problems which have been tackled in a similar way have been concerned with stock holding, maintenance replacement policy, problems of vehicle routing, location of depots, and investment appraisal.

Mathematical models are also proving to be of benefit in manpower planning. The models used here are of two broad classes – demand models and supply models. The former are concerned with forecasting levels of demand for resources and may take the form of extrapolation of past data where historic trends may be expected to continue or, more usefully, may be explanatory in the sense that the equations express a casual explanation of past behaviour, for example system size, calling rates, productivity, technological changes etc., which may be expected to be valid in the future. An explanatory manpower model for example might take the form:

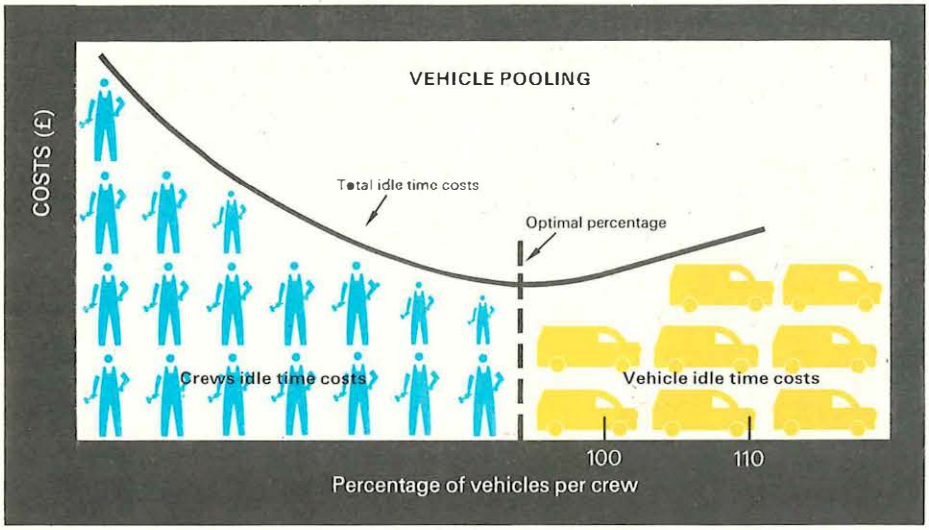
manpower = f
(work-units, manpower performance)
where work units = g
(amount of equipment, number and type of connections, calling rates, grade of service)

The model is therefore a series of algebraic equations establishing the relationships between all those variables which could be expected to

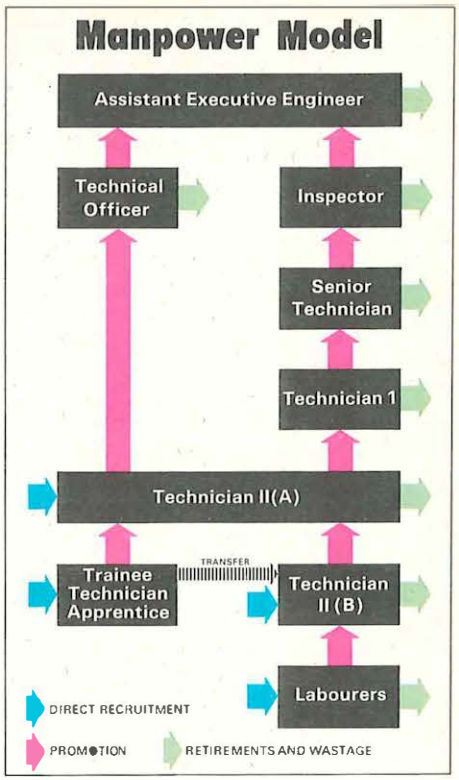
Business planning models are being developed to help senior managers choose the best plan of action from a range of possibilities. Using a computer terminal an operator can ask: "If demand were . . . if tariffs were . . . etc . . . what would be the likely effect on borrowing requirements, return on capital, profit and the self-financing ratio?"



managers



A computer-based model has been used to indicate the most favourable vehicle pool sizes at Telephone Engineering Centres. After a wide range of events—likely absences, breakdowns etc.—have been taken into account the probable costs resulting from varying proportions of vehicles to crew can be shown.



A model has been devised to examine the effects of varying recruitment, promotion and retirement rates on manpower levels.

affect the work-load and the level of the resultant work-load. Work-load is then translated into manpower by taking account of expected manpower performance (manhours per work-unit). Such a model is not a forecasting device but rather is used to interpret forecast demands for services into resultant demands for manpower. Models of this form have been developed for use at various levels in the telecommunications business.

Supply models take a variety of forms, the most successful of which is probably the Markov-chain. The theory of Markov-chains is a branch of probability theory which deals with changes of state, as in physics, but there is an analogy with the changes of grade in a manpower hierarchy caused by promotions, etc., in as much as the transition from one state to another and from one grade to another can never be predicted with certainty. The structure of a manpower hierarchy for instance is never just a simple matter of recruitment at one end and promotion upwards through the various grades. For example, the Technicians IIA grade will be affected by promotions from Technicians IIB and Trainee Technician Apprentices grades, by direct recruitment, by retirements, by men leaving to take up other jobs, by promotions from the Tech IIA grade to Technical Officers or Technicians I. All of these movements will be subject to uncertainty.

Markov-chain models have enabled management to take account of all these factors, and have proved useful for examining the likely consequences of varying recruitment rates, promotion rates, retirement rates etc. Such models have been used extensively in the Civil Service and have an obvious application in the Post Office.

The pace of application of the management science approach to management problems is accelerating as management is becoming more aware of its possibilities and the emphasis is now shifting from the tactical to the strategic. An example of the latter is in the construction of computer-based models of the headquarters planning activities of the telecommunications business.

These models are being developed and constructed as aids to business planning. They will not, in themselves, produce business plans but rather will enable senior management to make sets of assumptions about demand, tariffs, pay rates, productivity etc, and see quickly the likely effects upon profit, return on capital, borrowing requirements, self-financing ratio, etc. The main purpose of these models is to enable senior managers rapidly to consider a range of possibilities and to choose the best plan of action. The model will also permit exploration of the sensitivity of the results to the assumptions.

Sensitivity analysis is one of the more useful facilities provided by the use of mathematical models. It involves postulating errors or changes in the basic data from which decisions are to be made and examining their effects on the conclusions reached. For example, if a decision has been reached on the basis that demand for telephone service will rise at an annual rate of 10 per cent, a sensitivity analysis will allow management to examine the likely effects on their conclusions if demand dropped to say three or four per cent or say jumped to 15 or 20 per cent. This gives a measure of confidence in the conclusions, directs attention to data which need more careful measurement, and also shows which, if any, basic assumptions might have little or no measurable effect upon the outcome. The use of computer-based mathematical models lends itself particularly to the application of sensitivity analysis, as without these aids the computations can be long and tedious.

The application of scientific methods are proving to be beneficial in many areas of management. It is emphasised, however, that the management sciences are aids to better decision-making and supplement rather than replace subjective judgement. The knowledgeable guess, it could be said, has been overtaken by calculated reasoning, but the final responsibility for decision-making will still rest, of course, with the managers.

Mr T. Lomas is head of the Management Sciences Section of Management Services Department, Telecommunications Headquarters. He is currently involved in the design and construction of business planning models and with studies into the application of the management sciences throughout the telecommunications business.

A customer makes a call from a market fruit stall in Hong Kong. There is a flat-rate rental and no charge is made for local calls.

FREE CALLS IN THE MARKET

Continuing our look at other administrations around the world, here is a glimpse of how Hong Kong is coping with an explosive demand for telephones.

Hong Kong had its first telephone scarcely 12 months after Alexander Graham Bell patented his new invention. True, its range was only 50 yards, but it represented something of a triumph. It was made in 1877 by a government clerk named Jeao Maria Silva on the sole basis of newspaper reports and descriptions about the new-fangled talking machine.

It was an augury for the future, because today Hong Kong has one of the most highly-developed internal and international communications systems in Asia. The telephone network grew slowly at first, then speeded up in the mid-20s when the Hong Kong Telephone Company received the sole franchise to develop the system.

Really large-scale expansion got under way after the end of World War Two when the number of telephones in service went up from 37,000 in 1952 to 145,000 by the end of 1962. The rate of growth in the late 60s was at positive breakneck speed—from 220,000 in 1964, to 540,000 by mid-1970.

This puts Hong Kong—whose population is only 4,000,000—in the select group of 33 countries with more than half-a-million telephones. In fact, the expansion of its telephone system is the highest in the world, on a percentage basis. Growth is at a cumulative rate of 21 per cent per annum, so the system will double in size in four years. The number of telephones for every 100 people was 13.46 in mid-1970. The proportionate figure for Europe in 1968 was 11.2, and the world-wide figure 6.4.

To subscribers, a gratifying aspect of the telephone system in Hong Kong is that it is one of the cheapest in the world. There is no charge for local calls. Instead, a subscriber pays an annual flat-rate rental, which works out at £16 for a residential line. Not surprisingly, Hong Kong people are among the world's top telephone users, making an average of 15 calls a day per person.

Visitors to the Colony are delighted by the "free telephone calls" facility. Hotels, shops, restaurants, bars and barbers usually have a telephone available to customers as "part of the service".

Two features of the Colony—its geography and distribution of population—have posed problems for the Hong Kong Telephone Company. About 80 per cent of the people live and work in about one-fortieth of the total land area, some 10-12 square miles, which necessitates much larger exchanges than are found in some other big cities of the world. The Company has had to build exchanges which will eventually accommodate as many as 100,000 subscriber lines.

Hong Kong has also innovated a computer-controlled exchange, the largest of its kind in the world, to service an expanding residential and industrial area at Laichikok, in the south-western New Territories.

In contrast to the crowded urban areas, the telephone system has had to tackle the problem of serving the sparsely populated outlying islands. The seven more important islands have now been fully integrated within the system, giving residents there exactly the same sort of facilities as are available to people living in the urban areas. Links with the islands are by a combination of microwave and, to a lesser extent, radio-telephony and marine cable.

The telephone system continues to expand. The Company says there is "an insatiable demand" for new telephones, and hopes to treble the number of lines over the next 15 years.

Confravision

Five-city link

Confravision, the world's first conference-by-television system, is now available in five centres. The inter-city television service, which saves businessmen the energy and expense of travelling to conferences, was officially opened by Mr Edward Fennessy, Managing Director Telecommunications, in linked ceremonies in studios at Birmingham, Bristol, Glasgow and London. A fifth studio in Manchester has since joined the network.

The new service enables face-to-face conferences to be held between groups of people hundreds of miles apart over Post Office video circuits. Up to five people can be "in vision" at each centre, but there is also room for support staff in the studios. The conferences are held in the comfort of studios designed to reflect a boardroom atmosphere, and the television gadgetry is kept as unobtrusive as possible.

One of the special advantages of Confravision is that there is complete privacy for the businessman. No cameramen or Post Office staff are present in the studio, and all equipment is controlled by those taking part in the conference with the aid of a simple push-button panel.

The main studio camera has a remote-control, two-turret lens. With one lens five people seated at a conference table are all in view; the other view shows the central three people in greater close-up. A second camera can be used to transmit documents, charts and similar material. It has a zoom lens so that a full-screen picture can be obtained from documents of varying size.

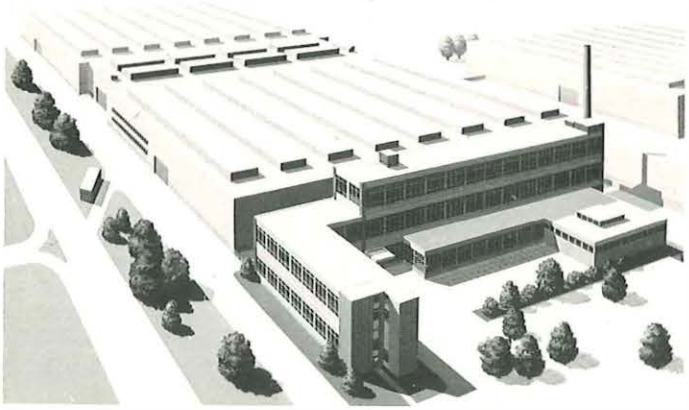
Each Confravision studio (identical in all five cities) has two 625-line television screens, one showing the "home team" and the other the distant group, or the documents they wish to transmit. The five people in camera each have a directional microphone. Seats are provided out of camera view for a secretary and the person operating the documents display camera, and three extra people may also be seated in comfort. The air conditioning is designed to allow for ten people smoking heavily, and also the heat generated by the studio lighting during a long conference.

The vision signal is carried over the microwave network on a standard Post Office television channel, identical to that used by the broadcasting organisations. The microwave channel is linked by video cable extensions to the network switching centre (NSC) nearest to each studio. From the NSC the local ends of the vision circuit are completed in co-axial cable. Sound is at present carried over music-quality circuits to ensure high-standard reproduction but future development may include use of "sound-in-sync" technique to improve overall performance of the system still further.

The camera, unobtrusively placed in a recessed panel above the television monitor screens, focuses on speakers in the Euston Confravision studio in London. The monitors show the pictures from both studios taking part in the conference.

SUPPLIES AT SWINDON

An artist's impression of the new stores complex.



Work has begun on the clearance of a 35-acre site at Swindon, in preparation for the move of part of Post Office Supplies Division to the Wiltshire town.

A huge postal and general stores complex is to be built on an industrial estate, and will take over the activities of six depots in the London area. Part of the Supplies Division Headquarters is also to move to Swindon, but on a different site.

The Swindon depot will initially include three warehouses of 120,000 sq. ft and there will be 65,000 sq. ft of office and welfare accommodation. It has been designed by the Department of the Environment and is being built by Wimpeys – with a completion date for mid-1973.

The move has been made necessary by a number of factors. For a long time the widely separated locations of the London depots have created problems. In addition there has been the pressure of increased demands from both telecommunications and posts businesses, and difficulty in recruiting staff in London. Swindon was chosen as an area well suited geographically for distribution purposes, and more favourable for staff recruitment.

It provided the opportunity for the design of modern, purpose-built accommodation.

To gain first-hand knowledge of local housing, schools, shopping and other facilities a number of Post Office staff and close relatives have already visited Swindon.

The Post Office has one of the biggest transport fleets in the world. It owns 45,000 vehicles and spends around £20 million a year to provide and operate them. Developments which will lead to a more efficient and economic operation of the fleet of vans and lorries are constantly being considered, and two such developments are described here by Mr A. C. Lord.

A fuel for the 'doomwatch' age

A fuel which has none of the atmosphere polluting ingredients of petrol or diesel oil and which gives longer engine life is currently exciting the motor transport industry.

Known as Liquified Petroleum Gas (LPG) it is being considered as an alternative to petrol or derv. Some large operators have already converted their vehicles to use it. Recently, performance tests on four Commer 15 cwt Utility vehicles were conducted by the Post Office. These were sufficiently successful to justify field trials which are now being carried out at Walton-on-Thames and Chiswick in the London Region, and at High Wycombe and Hemel Hempstead in the Eastern Region.

Liquified Petroleum Gas is derived from normal petrol refining processes. Perhaps its greatest advantage, at a time when the country is becoming more aware of the need for a clean and healthy environment, is its anti-pollution qualities. Unlike petrol or derv it produces little or no carbon monoxide or sulphur dioxide fumes and contains no lead. Considering the huge number of commercial vehicles on Britain's roads today there could therefore be tremendous benefits to public health.

Because it produces little or no corrosive products of combustion the fuel is also understood to be beneficial to engine life. In this respect LPG, although it is in liquid form when stored in special pressurised fuel tanks, is a dry gas under normal atmospheric conditions. Because of this no liquid settles in the induction manifold or in the cylinders to dilute or contaminate the oil. Engine wear should therefore be further reduced, and oil should last at least three times as long.

The results of the performance tests, which were conducted using four different makes of equipment, indicated a much higher fuel consumption rate. The fall in miles per gallon varied from 13 to 38 per cent depending on the make. The high consumption rate, however, is more than compensated for by the cheapness of LPG which at present costs 16p per gallon. Although Excise duty is soon to be charged on the fuel it is hoped that this will be below the normal 22½p per gallon.

Acceleration, speed and gradeability tests indicated little change from normal petrol performance. All the vehicles when fully laden to a gross weight of 2.45 tons were capable of starting from rest on a gradient of 1 in 6. Similarly loaded and towing a trailer tool-car with a gross weight of 10 cwt, all were capable of starting on a hill of 1 in 8. Other performance tests are summarised in the table.

The conversion of vehicles is relatively simple. The pressurised fuel tank is fitted under the floor and stores the LPG in liquid form. The pressure, about 75 lb per square inch in normal weather, is sufficient to get the fuel from the tank to a two-stage regulator and does the job of the traditional fuel pump. The first stage of the regulator reduces the pressure to about 5 lb per square inch, so changing the fuel from a liquid to gas, and the second stage meters the gas to the carburettor. Solenoids are used to switch on and turn off the fuel supply as the vehicle ignition is turned on and off. Total cost of the conversion is about £130 per vehicle.

The performance tests, while very satisfactory, were carried out in controlled conditions. It will therefore be very interesting to compare these results with those of the current field trials which will be carried on for about 12 months in actual working conditions. The trials too will give an indication of how the new equipment stands up to every day wear and tear and of the effect of the fuel on engine life.

PERFORMANCE TESTS RESULTS

Vehicle	Fuel consumption (miles per gallon)*		Acceleration (secs) 20-40 mph in top gear		Maximum speed (mph) half-mile straight	
	Petrol	Gas	Petrol	Gas	Petrol	Gas
A	15.07	9.31	23	23	60	61
B	14.74	12.77	25	24	62	61
C	12.91	8.51	23	28	61	60
D	14.68	10.96	23	26	60	58

*Calculated from 10 miles economical driving with four stops per mile and 10 miles hard driving with two stops per mile.

The three minute wash

Vehicles of all sizes go through the Automatic Vehicle Washing Machine at the Telephone Engineering Centre in Slough, Buckinghamshire.

Keeping vehicles clean is a necessary part of the daily grind of any transport operation, and for the big fleet operator it can be a costly and time-consuming operation. To wash down manually thousands of vehicles occupies many man-hours and requires a lot of space.

Some time ago the Post Office conducted tests of Automatic Vehicle Washing Machines (AVWMs) which resulted in a considerable saving in both manpower and accommodation. There are 50 of these machines now in operation and it is planned to double this number by the end of this year. By 1976, 350 are expected to be in operation. Currently, six different makes of AVWMs are being tested for suitability and reliability.

The one pictured here consists of a large frame containing three rotating brushes, two vertical and one horizontal, and a series of high-pressure water jets overhead and at the sides. The brushes automatically adjust to and follow the contours of the vehicles which can be up to 10 ft 6 in. high, 8 ft wide and 36 ft long.

A control panel is housed in a small kiosk sited so that the operator can watch the progress of the wash. For vehicles with awkward projections the control panel has a series of over-ride controls which allow for a certain degree of manual control by the operator. Nevertheless, everything is done to enable the machine to operate fully automatically. For example, wherever possible, awkward projections such as driving mirrors are spring-loaded so that they will yield to allow the brushes to follow as closely as possible the contours of the vehicle.

To wash a vehicle it is parked in the wash area in a marked position. The operator presses a start button and the frame moves over the vehicle with the jets cascading detergent solution and clean water over its top, sides, front and rear. At the same time the horizontal and vertical brushes revolve and maintain contact with the surface of the vehicle, the horizontal brush cleaning front, top and back and the vertical brushes the sides. Wherever possible the machine is sited so as to provide a drive-through facility, usually in the open and with side screens to confine the spray.

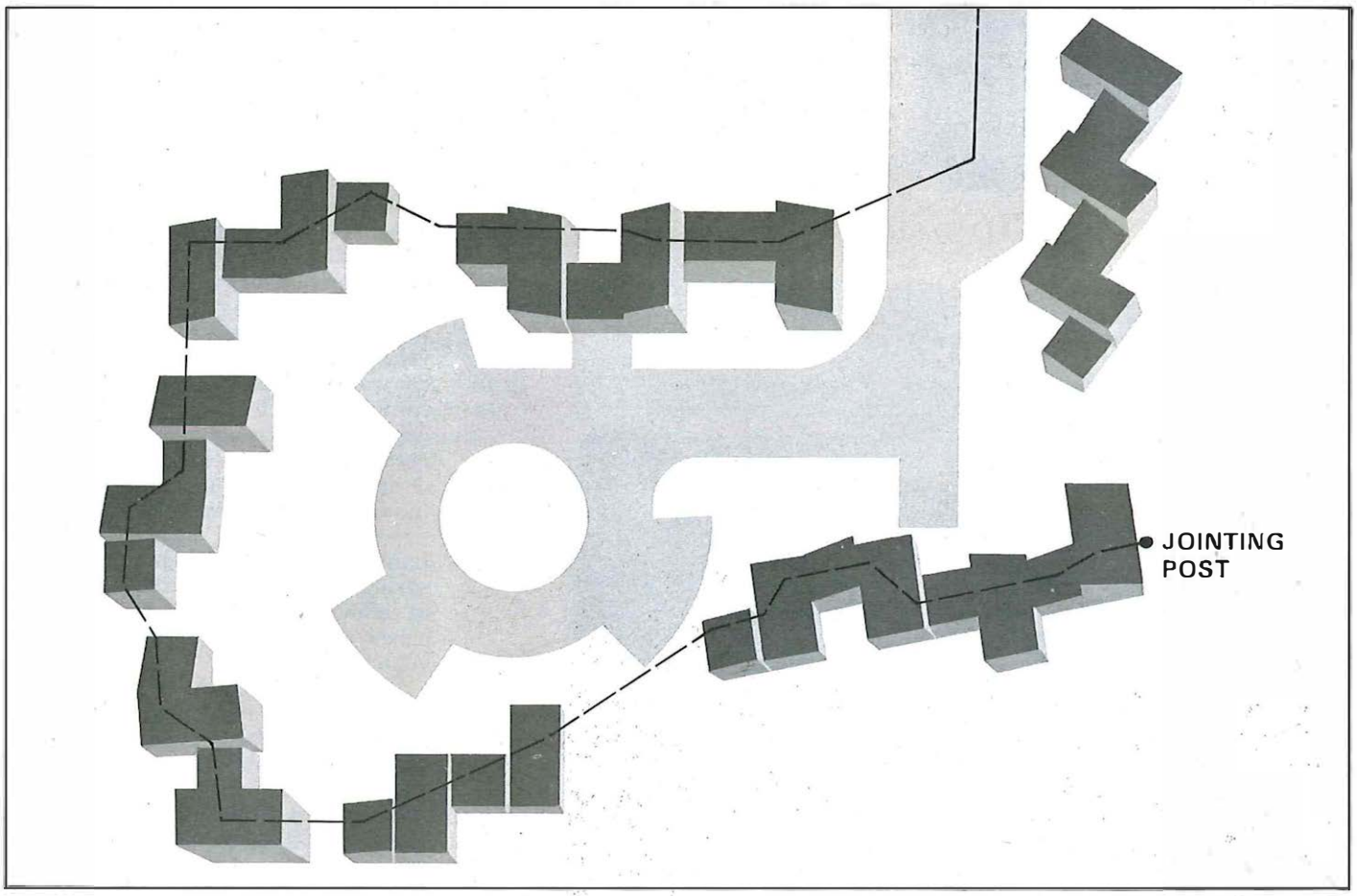
The whole operation takes only 2½ to 3½ minutes, depending on the length of the vehicle. Where there are large concentrations of vehicles, the machine is operated by Motor Transport staff so as to avoid time being wasted by drivers having to wait to clean their vehicles.

Mr A. C. Lord joined the Post Office in 1937 as a mechanic and has since served the division at various levels in Headquarters, the Regions and on training work at the Motor Transport Central Training College, Yeading. He is now MTO 1 with responsibility for policy concerning vehicle utilisation and provision of maintenance.

Bringing the phone to the customer with...

CABLE UNDER THE FLOOR

A R Fleming and D F M Peters



Part of the local authority development at Aboyne, Aberdeenshire, showing how the cable is led through the houses. The solid black line indicates cable laid at Post Office cost, and the broken line cable laid without charge by the local authority.

In Aberdeen Telephone Area Post Office engineers have been doing their bit for the environment in that beautiful part of North Scotland. By using a new and relatively inexpensive method of underground cabling to link customers' telephones to the local distribution network they have reduced the need for unsightly telegraph poles and overhead wires.

Known as "Underfloor" or "Straight Through" cabling, it involves leading a distribution cable, to which telephones in the homes can be easily connected, through the foundations of blocks of new Council or private development houses. Compared with the standard method of underground distribution, in which armoured cable is taken to individual homes from agreed points on a cable under the footpath, the new system has a number of advantages. Underfloor cable runs are shorter and cheaper; cable joints are in a safe and dry position; the armoured cable, as much as four times as expensive as the unprotected variety, is not required and the possibility of mechanical damage in the early stages of site work is much reduced.

The system also has advantages over overhead distribution. Initial costs are often cheaper since much of the cabling is laid by the site developer without charge. Telephone installation is less expensive since it is a relatively simple task to connect the telephone to a connection box in a hallway compared with leading an overhead wire from a pole often some distance away. Maintenance costs are also lower.

Estimated costs for installing underfloor cabling in a high amenity local authority housing development at Aboyne showed that it could be done for £24 per tenancy compared with £36 for standard underground cabling and £23 for overhead distribution. The margin in favour of the latter, however, is less than at first appears because allowance was not made for the higher installation and maintenance costs of overhead working. When all factors are considered underfloor cabling can, in many

instances, prove to be the cheapest method of all.

The new technique shows to greatest advantage in developments where houses are often built in terraces of four or more units. Cable is laid at Post Office cost under the pavements, taking advantage of favourable excavating rates by sharing a trench with one of the public utilities. From the footpath the site developer, without charge to the Post Office, lays a distribution cable up to and through the nearest foundation wall of the houses to be served. The cable is allowed to lie unprotected in the foundations and in each house is brought close to a trap-door access in the floor. At the end of a block, or series of blocks the cable is taken through the foundation and all pairs are labelled in a Jointing Post above ground. From the footway the cable to the nearest foundation wall and between blocks of houses is normally laid in PVC duct for protection.

In each house a jointer cuts into one pair of the cable and joints the four-wire ends to an internal-type, four-wire PVC cable the other end of which terminates in a flush-fitting connection box in the hall of the house. The joint between the two cables is taped and secured to a joist.

Underfloor cabling has two disadvantages in that it does not lend itself to sites on which houses are built at random, and access to the joints, although rarely required, has to be assured and safeguarded by a legal agreement. Such disadvantages, however, are minor in comparison to the problems which pole-siting and erection have created for Post Office engineers in Scotland over the years.

In a country of great natural beauty, which is zealously guarded by many of its people and certainly by the majority of its local authorities, the telegraph pole has been an object of dislike for many years.

Local authorities in Scotland are much less tolerant than their counterparts in England about siting poles on the public footpath. It is also becoming increasingly difficult to get wayleaves for poles in any position in new housing estates.

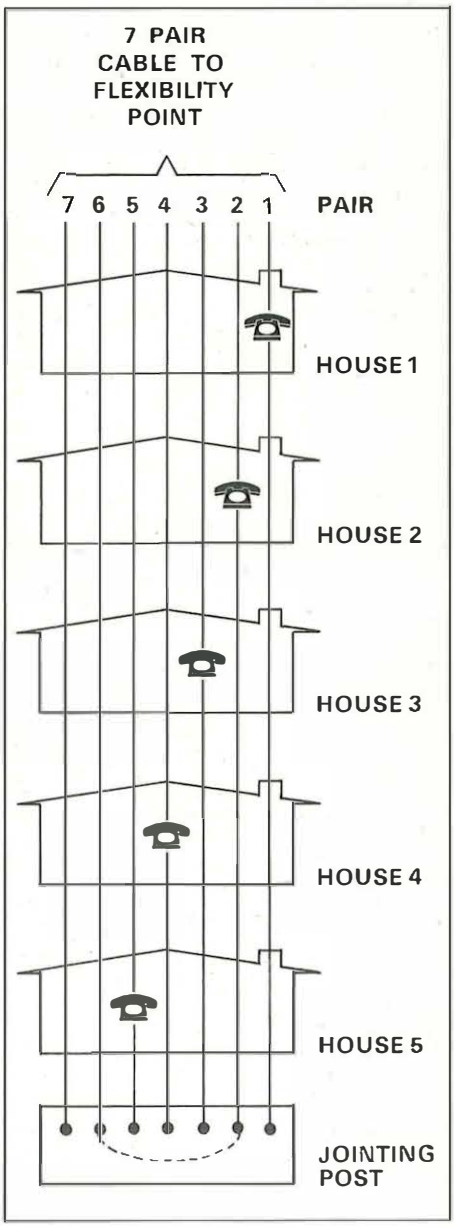
The direct underground method considerably reduces such problems in the Aberdeen Telephone Area. There are now some 7,500 houses in the Area served by cabling under the floor and the system has so far been virtually trouble-free. Not surprisingly, it is being used to an increasing extent and is arousing interest in other Telephone Areas in Scotland.

Mr A. R. Fleming is an Executive Engineer in the external planning section at Aberdeen Telephone Manager's Office and has special responsibilities for productivity improvements in the Area.

Mr D. F. M. Peters is an Executive Engineer in the same section with responsibilities for local line planning.

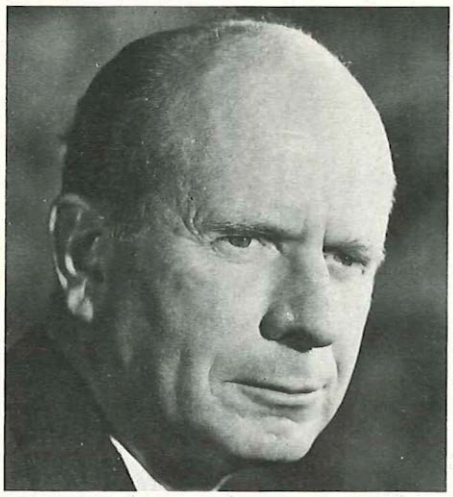
Making a joint in the cable at one of the Aboyne houses. The jointer has quick and easy access to the cable from the trapdoor.

Right: This diagram shows how pairs in the underfloor cable are distributed. House No. 2 may be given a second line to the exchange by connecting pair 6 to the "back end" of pair 2 in the Jointing Post.
Below: A jointer prepares the Jointing Post at the end of the blocks of houses.



miscellany

University honour



Mr Fennessy

Mr Edward Fennessy, Managing Director Telecommunications, received an Honorary Doctorate of the University of Surrey in December. The honour was conferred by the Chancellor of the University, Lord Robens, in Guildford Cathedral.

Mr Fennessy became Managing Director Telecommunications on his appointment to the Post Office Board in 1969, following an unbroken career of 35 years in telecommunications and electronics.

He was awarded the CBE in 1957 for his contribution to the national defence and electronics export.

In 1965 he was appointed Managing Director of The Electronics Group of The Plessey Company and was Chairman of The Electronics Engineering Association during 1967/68.

European study

Telecommunications administrations of 15 countries, including Britain, have joined together to sponsor a Europe-wide study of data communications demand over the next 15 years.

The main aims of the study will be to examine the different activities that create a demand for data communications and to forecast the type and number of data terminals that will be needed. It will provide vital information for future planning for the various administrations.

The project is probably the largest and most comprehensive telecommunications market research study ever carried out, and it is the first time that members of CEPT (the European posts and telecommunications organisation) have combined in such a way. Fourteen of the countries involved have contracted a British firm of management consultants to carry out the study, and the fifteenth – Italy – has signed a separate but related contract with an Italian company.

In a joint statement, the sponsors of the study say that computers and communications are becoming more closely associated, and the suppliers of each must co-ordinate their activities if the customer is to benefit.

"Since the operations of both manufacturers and customers are spreading across national boundaries," the statement continues "it is essential for the telecommunications administrations to think more and more in international terms. This study marks an important beginning in respect of data communications."

The results of the survey are expected in 1973. They will include estimates of future customer requirements, and data traffic flow within and between European countries, and to other main centres of the world.

Tourist calls

The Teletourist information service attracted more calls than ever last summer. In the three months to the end of September, 1971, there were 349,122 calls to the service – 31,000 up on the same period last year. The service gives information on main events of the day in and around London and in Edinburgh.

In London, where the service is available in five languages, calls increased from 291,074 to 315,794 – English 176,230 (not including some 5,700 calls made to each of the Brighton and Guildford numbers on which it is also available), French 44,212, German 40,256, Spanish 33,802 and Italian 21,294.

Installation record

A record number of telephones were installed between April and September, 1971. Nearly 885,000 orders were met compared with a previous best of just over 810,000 in the first half of 1970. The new record represents a 9.14 per cent increase over the same period last year.

New contracts

GEC-AEI Ltd. – £2.5 million for a crossbar group switching centre at Nottingham. To be known as the Bowman/Sheriff GSC it will serve 65 local exchanges within an area of 1,000 square miles. The Centre will have direct access to some 170 trunk routes and will have 38 routers each capable of handling 160 incoming circuits. There will be a total of 5,882 incoming circuits and a similar number of outgoing circuits. The Sheriff section will contain the automatic switching equipment and the Bowman portion operator-assistance services through a 60-position cordless manual switchboard.

£9 million for Strowger, crossbar and reed-electronic exchange equipment for installations at Burnley, Barrow-in-Furness, East Belfast, Ilford, Dover, Kendal, Warwick and Wimbledon.

Standard Telephones and Cables Ltd. – £3½ million for Trimphones and other subscriber apparatus.

Help for housebound

Post Office engineers in Wales and the Marches have volunteered to work without pay during evenings and weekends to install telephones for the chronically sick and disabled. The Post Office will, as a result, cut connection charges by half for housebound people in the area.

The plan was initiated by the Post Office Engineering Union's Wales & Marches Regional Council because they were disappointed by the response of local authorities to the opportunities of providing telephones under the Chronically Sick and Disabled Persons Act 1970.

The scheme has been approved by the Wales & Marches, Telecommunications Board, which will make vehicles and materials available to the volunteers.

Commenting on the scheme the Union's General Secretary, Lord Delacourt-Smith, said: "Local councils should look upon our initiative as a means of doubling the number of telephones installed for the sick and disabled under the Act rather than a means of reducing the overall expenditure."

The scheme will be reviewed after a six-month experimental period.

Tower safe

The Department of the Environment has confirmed its initial finding that the structural stability of the Post Office Tower was unaffected by the bomb explosion which took place on the 31st floor.

The revolving restaurant at the top of the Tower reopened for business three weeks after the bomb incident, but the public viewing galleries will remain closed for some time while extensive repairs are carried out.

Faced with the loss of 1,200 circuits in the early hours of the morning of the explosion, Headquarters and Centre Area staff in the London Telecommunications Region had them all back in service by noon of the same day.

Price restraint

The Post Office, which agreed to support the Confederation of British Industry's initiative for voluntary price restraint, has in turn, sought the support of its 1,200 main suppliers. The Corporation spends over £380 million a year on manufactured items and its prices depend greatly on contractors' charges. A letter to suppliers points out that the Post Office support of the CBI initiative will be difficult unless they adopt a similar attitude.

Readership survey

The Editorial Board would like to thank all those who took part in the recent survey in which readers were asked to give their views about the content and presentation of articles in Telecommunications Journal.

Some preliminary results are available, and these show an encouraging response. Of the subscribers who were asked how they rated the publication as a journal about Post Office telecommunications, 32 per cent regarded it as very good and 60 per cent as good. This total of 92 per cent occupied the top two ratings out of five possibilities.

Asked about the appearance of the Journal, 86 per cent said the lay-out and presentation was either attractive (70 per cent) or very attractive. A total of 77 per cent found the level of technical content "about right", but there was a division among others who thought it either too technical or not technical enough.

Detailed studies are now being made of the questionnaire responses to determine, among other things, whether any particular areas of interest or speciality are not being covered adequately at present. The aim is to make the Journal an even more interesting and useful publication, and the survey has provided valuable information about our readers and their interests.—*Editor*

You need to be big to take over from Atlas.

Atlas, once the most powerful computer in the world, finally has to be pensioned off. Reluctantly, Atlas Computer Laboratory started to look for a new computer of much greater power and of more modern and more flexible design, capable of handling substantial numbers of on-line users on many advanced applications.

The Atlas Laboratory now has a 1906A, supported by the advanced software facilities of the George 3 operating system.

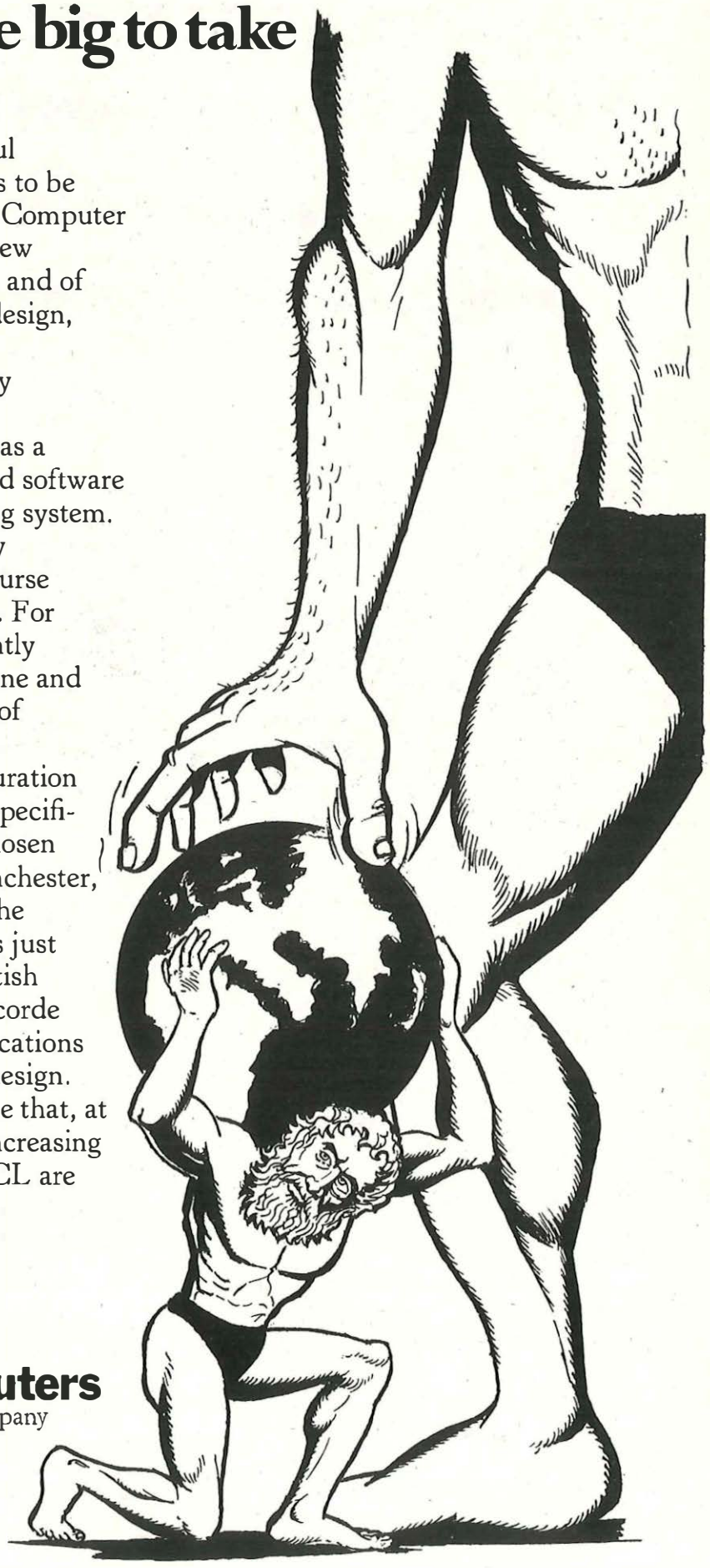
The case of Atlas Laboratory outgrowing their capacity is of course by no means an isolated instance. For example Oxford University recently needed a very much larger machine and they invited tenders on the basis of their "bench mark" test.

It was an ICL 1906A configuration that met — and surpassed — the specification. ICL 1906A's were also chosen by the Universities of Leeds, Manchester, Nottingham and Birmingham. The Queen's University of Belfast has just ordered a 1906S. In industry, British Aircraft Corporation for the Concorde project is using a 1906A for applications from payroll to computer-aided design.

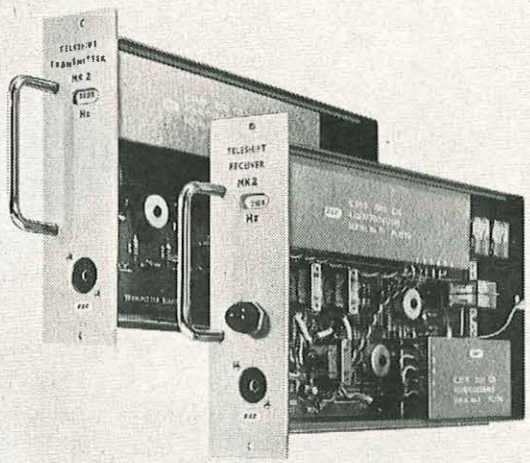
Orders like these are evidence that, at a time when the user is making increasing demands on the manufacturer, ICL are more than keeping pace.

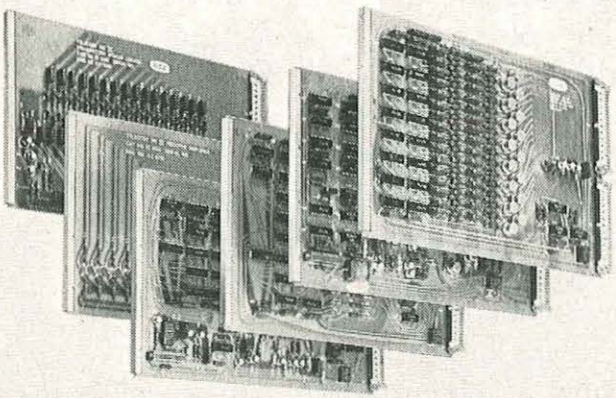
International Computers

Europe's world-wide computer company



Designing a telemetry link-up? Then measure with TELEDUCER scan with TELECODE and transmit with TELESHIFT





These three units add up to the finest range of modules available for use in configurations suitable for most telemetry systems. And who makes them? GEC-Elliott Process Automation Ltd., of course, the company which has been a pioneer in the design and manufacture of telemetry equipment for use in a wide cross-section of industry.

Here are some of the basic facts:–

Teleshift
- for the transmission of alarms, indications and controls over land line or radio link.
- can also be used as a modem – up to 50 or 200 baud – with other telemetry equipment.
- caters for up to 24 channels on any one line.

Teleducer
- an analogue measurement transmission system using Teleshift for transmission.
- allows for simultaneous transmission of up to 24 measurements over one line.

Telecode
- a scanning system for either "on/off" or analogue signals using Teleshift for transmission.
- scanning speeds of 15 or 100 bits per second.
- up to 120 bits per channel with a maximum of 24 channels on any one line.

The unit modular design of these components enables systems to be constructed as required without the assistance of special design engineers.

If you are presently designing a new system or merely thinking about one, get in touch with GEC-Elliott; there's a feast of information available that you will find useful.

GEC-Elliott Process Automation Ltd.,
Telemetry and Digital Systems Division,
New Parks, Leicester LE3 1UF, England.
Tel: Leicester (0533) 871331

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book reviews

Foundations of Wireless and Electronics, 8th Edition by M. G. Scroogie (Butterworth) £3 (hard covers) £1.80 (limp covers)

"and Electronics" has been added to the title for the 8th Edition of a book which first appeared in 1936 as "Foundation of Wireless" under the authorship of A. L. M. Sowerby. The new edition runs to 521 pages including three appendices and a comprehensive index of 13 pages.

The early chapters of the book retain the thorough qualitative approach to basic radio principles for which earlier editions were deservedly well known. They lead naturally into later chapters which describe and explain their applications to audio and h.f. amplifiers, radio transmitters and receivers. The emphasis throughout is on the development of an understanding of the phenomena involved rather than a rigorous theoretical treatment.

The first 18 chapters deal with circuit elements and lead through tuned circuit theory to electronic devices, diodes and triodes, both valve and semi-conductor, and their equivalent circuits and static working conditions. Then the reader is introduced to applications via oscillators, senders, transmission lines, radiation, l.f. amplification and receivers. Concluding chapters deal briefly with the use of cathode-ray tubes and waveform generators in television and radar, with computers and power supplies.

Unlike the conventional text book, written with a specific examination syllabus in mind, there are no problems for the student to attempt or formal proofs; the style is an artful mixture of description and worked-out examples with extensive use of graphs and diagrams. The literate and mature student or amateur, for whom the book is undoubtedly written, who works steadily and conscientiously through the "foundations" chapters should acquire a solid grasp of elementary radio technology.

One point of criticism that must be made concerns the author's use throughout the book of his own symbol for a transistor, which he seeks to justify against established practice (BS 3939) on the ground that his symbol more closely resembles the construction of a junction transistor. This argument ignores the recognised rule that a symbol should represent the function and not the construction of a circuit component. It also ignores the author's duty to his novice reader who ought not to be introduced to a symbol which he will have to unlearn when he reads circuit diagrams elsewhere which follow the usual conventions.

Another failure to consider fully the interests of the reader appears in the section (11.8) on the "Maximum Power Law". This law is deduced from an example of a valve amplifier supplied with a constant input voltage. This example is hardly an apt one for an introductory text because the "load matching" criterion (load resistance equal to the anode resistance) is rarely, if ever, relevant to the design of a power amplifier. An adequate treatment of optimum loads for output stages comes later in the book. **MBW**

Telecommunications Principles for Final Certificate by S. A. Knight (Butterworth). Volume 1, Principles B, 273 pages, Volume 2, Principles C, 266 pages, hard covers £2.50 and £3.00 respectively, in limp covers £1.50 and £2.00

These two volumes together aim to cover the two-year Telecommunications Principles syllabus of the City and Guilds of London Telecommunications Technician's Course 49 from intermediate to final level.

The 12 chapters of Volume 1 deal with basic magnetic and electric circuit theory including a.c. circuits and selectivity; introduction to valves and transistors, measurements, generators and motors.

The 11 chapters of Volume 2 continue circuit theory to cover network theorems, resonance, transformers and coupled circuits, repeated networks, filters and line transmission. A more extensive treatment of transistors under small-signal conditions is given together with valve amplifiers and oscillators.

The treatment in both volumes is clear, concise, straightforward with extensive use of figures and worked examples. Each chapter concludes with a set of questions, mainly reproduced from past C & G examination papers with numerical answers given to most.

The volumes adequately cover the C & G syllabus and can be recommended as text books for the course. **MBW**

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Spring 1971 to Winter 1971-2

ALPHABETICAL INDEX

GROUP INDEX

Easy on the eye

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Telecommunications statistics

(Figures rounded to nearest thousand)

	Quarter ended June, 1971	Quarter ended March, 1971	Quarter ended June, 1970
TELEPHONE SERVICE			
Inland			
Net demand	330,000	290,000	265,000
Connections supplied	292,000	277,000	279,000
Outstanding applications	335,000	296,000	278,000
Total working stations	15,231,000	14,979,000	14,215,000
Total working connections	9,409,000	9,214,000	8,723,000
Shared service connections (Bus. and Res.)	1,758,000	1,716,000	1,612,000
Total effective inland trunk calls	408,613,000	402,439,000	365,669,000
Effective cheap rate trunk calls	116,823,000	107,942,000†	89,566,000
External			
Continental: Outward	4,439,000	4,408,000†	3,979,000
Inter-continental: Outward	773,000	646,000	520,000
TELEX SERVICE			
Inland			
Total working lines	34,000	33,000	30,000
Metered units (incl. Service)	93,807,000	106,160,000	88,882,000
Manual calls from automatic exchanges (incl. Service and Irish Republic)	47,000	37,000	52,000
External			
Originating (UK and Irish Republic)	6,249,000	6,871,000†	5,846,000
TELEGRAPH SERVICE			
Inland telegrams (incl. Press, Service and Irish Republic)	1,694,000	789,000	2,075,000
Greetings telegrams	555,000	208,000	606,000
External telegrams:			
Originating UK messages	1,729,000	921,000*	1,887,000
Terminating UK messages	1,649,000	893,000*	1,765,000
Transit messages	1,529,000	731,000*	1,636,000

**Subject to industrial action.* †*Amended figures.*

Publication and Price. The Journal is published in January, April, July and October, price 9p per issue. The annual postal subscription is 50p—reduced to 36p for former Post Office staff.

Advertisements. Communications, advertisement copy, etc., should be addressed to Sawell & Sons Ltd., 4 Ludgate Circus, LONDON, EC4M 7LE. (Telephone: 01–353 4353). No official responsibility is accepted for any of the private or trade advertisements included in this publication.

Contributions: The Editorial Board will be glad to consider articles of general interest within the telecommunications field. No guarantee of publication can be given. The ideal length of such articles would by 750, 1,500 or 2,000 words. The views of contributors are not necessarily those of the Board or of the Post Office.

Correspondence. Communications should be addressed to the Editor, Post Office Telecommunications Journal, Public Relations Department, Post Office Central Headquarters, 23 Howland St., LONDON, W1P 6HQ. Telephone: 01–631 2191 (editorial), 2193 (sales). Remittances should be made payable to "The Post Office" and should be crossed "& Co.". The Giro account number is 535–1006.

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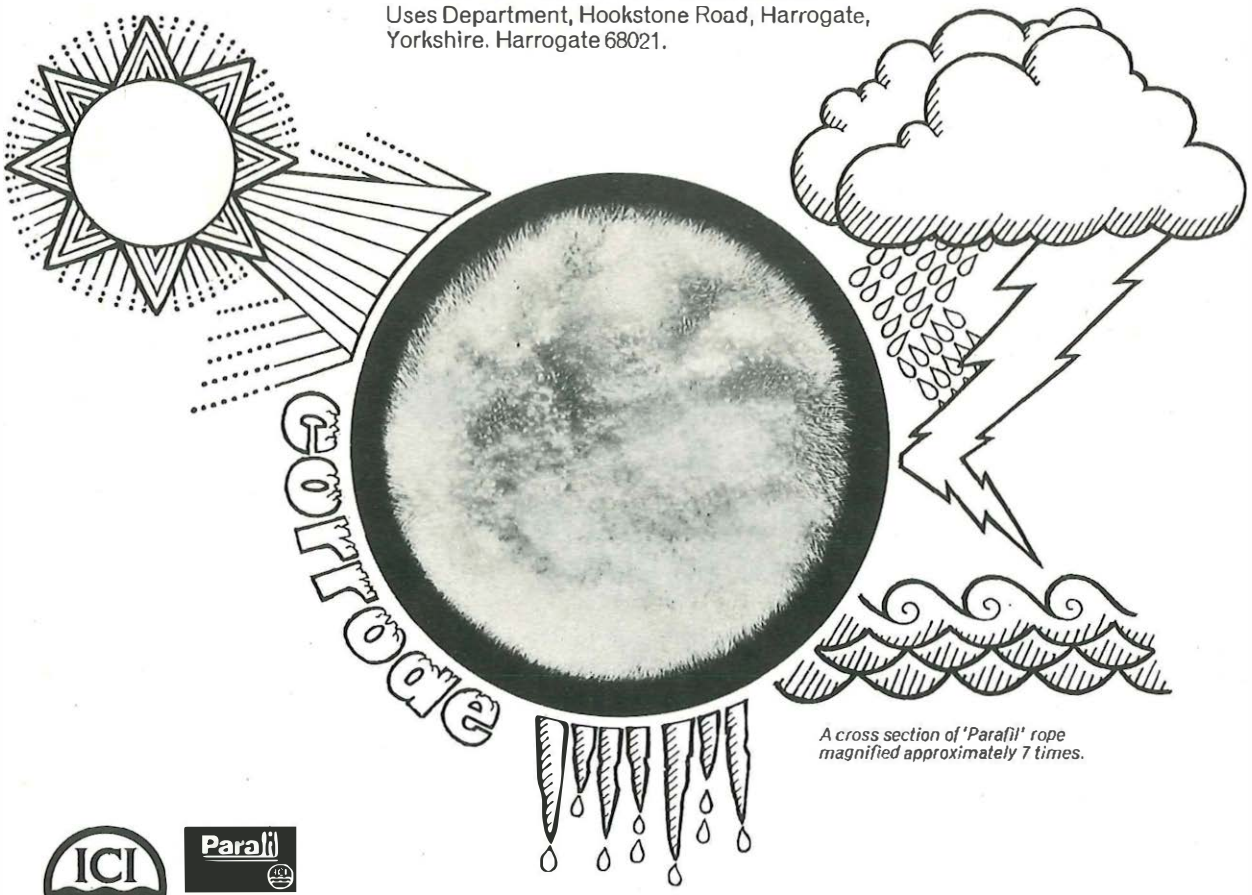

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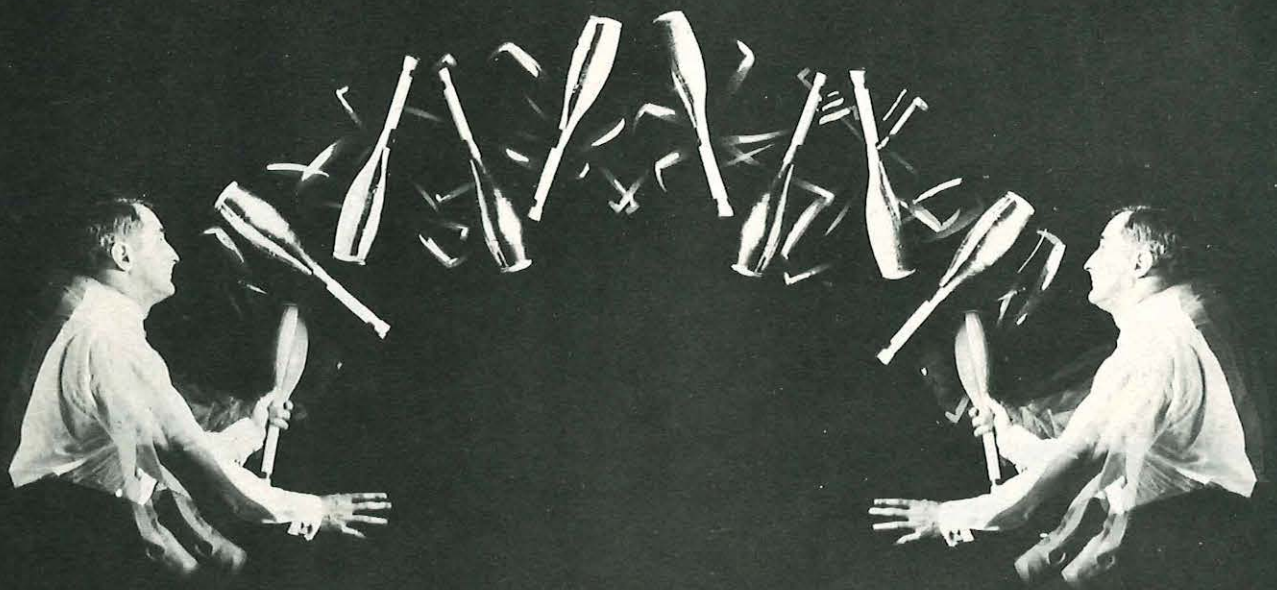
ever wanted

to handle up to eight at a time in each direction?



with the GEC upper 6 microwave system you can!

For high density routes, the GEC 6·8GHz semiconductored microwave radio equipment can accommodate up to eight radio bearers in each direction of transmission, using a single antenna. The highly economical frequency usage provides up to 16x960 high-quality speech channels in the same frequency spectrum.

GEC MICROWAVE TYPE 68R9A

G.E.C.

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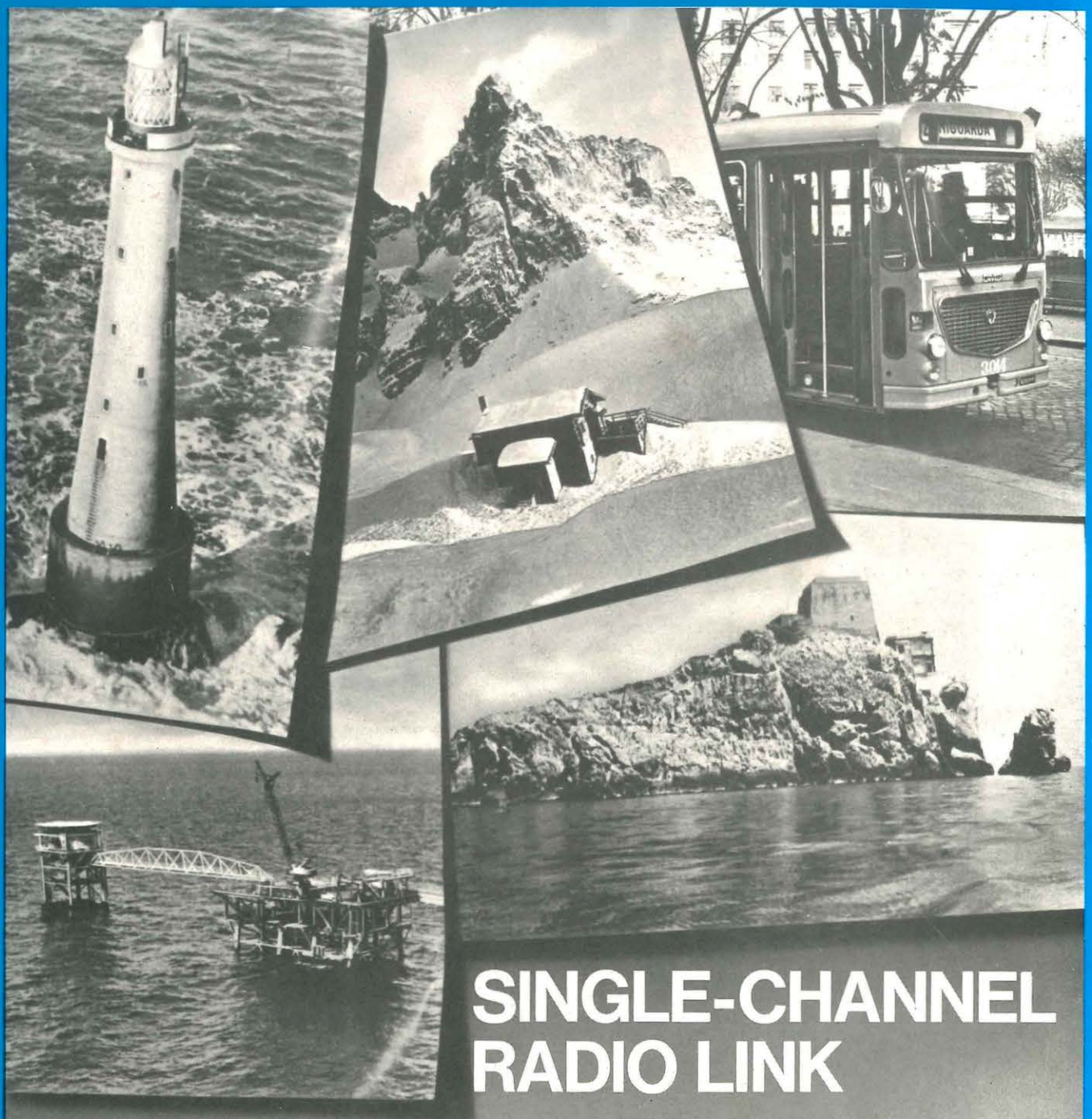
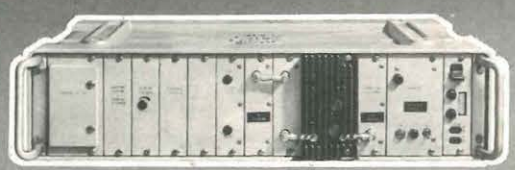
Post Office Telecommunications Journal is printed by BKT Printers Ltd., London and Tonbridge, and is published quarterly in January, April, July and October by the Post Office.



SINGLE-CHANNEL RADIO LINK



Particularly versatile because of its modular structure, the single-channel radio link PM 1/160 (156-170 MHz) allows to connect up the most isolated places with the national and international telephone network, or alternatively, it may be employed as a fixed station for radiotelephone communications in mobile means networks. Its high reliability warrants a constant and safe service even in the most difficult environment conditions.

SOCIETÀ ITALIANA TELECOMUNICAZIONI ITALTEL

ITALTEL s.p.a.

20149 Milan (Italy) - 12, piazzale Zavattari - phone 4388