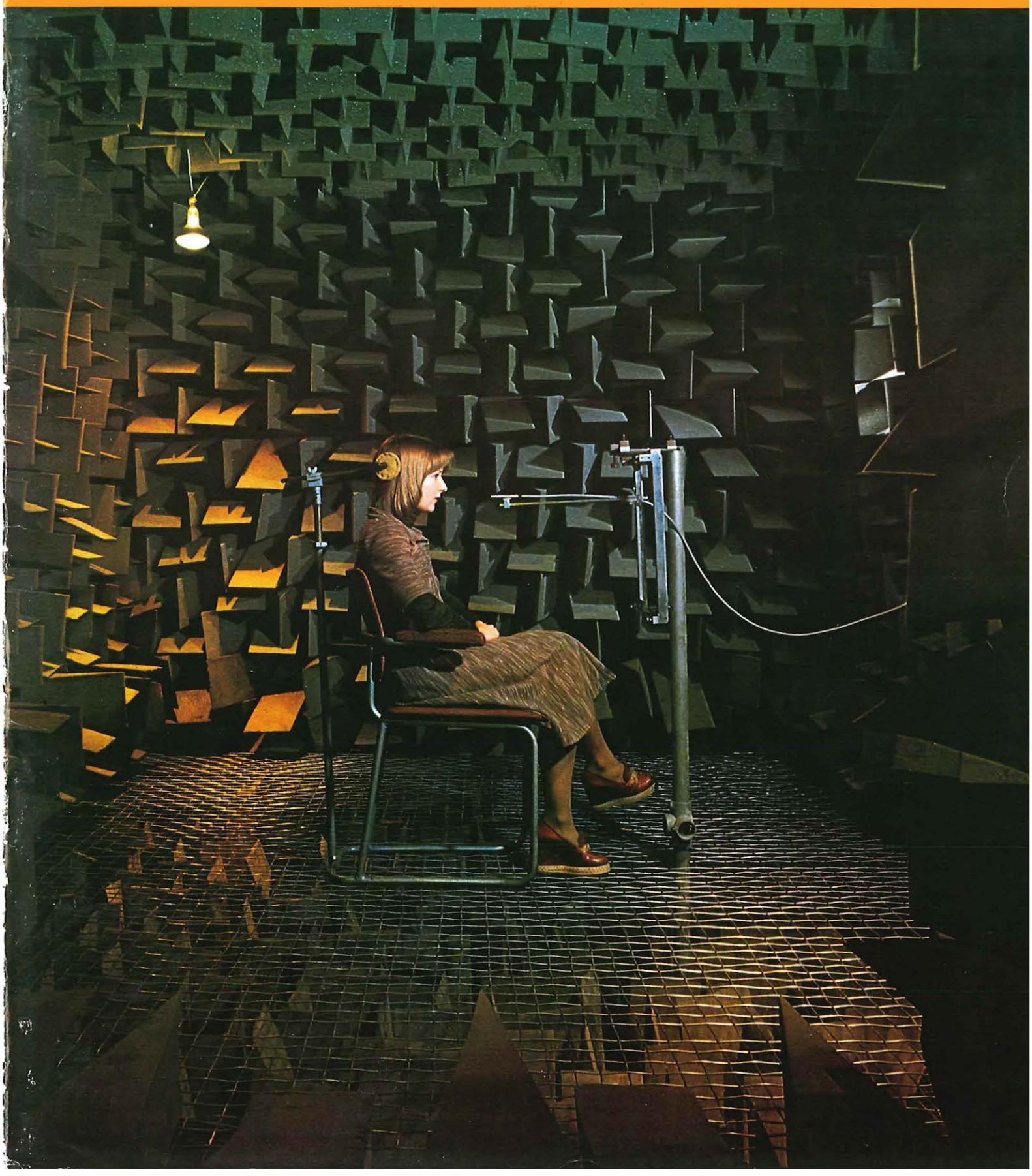
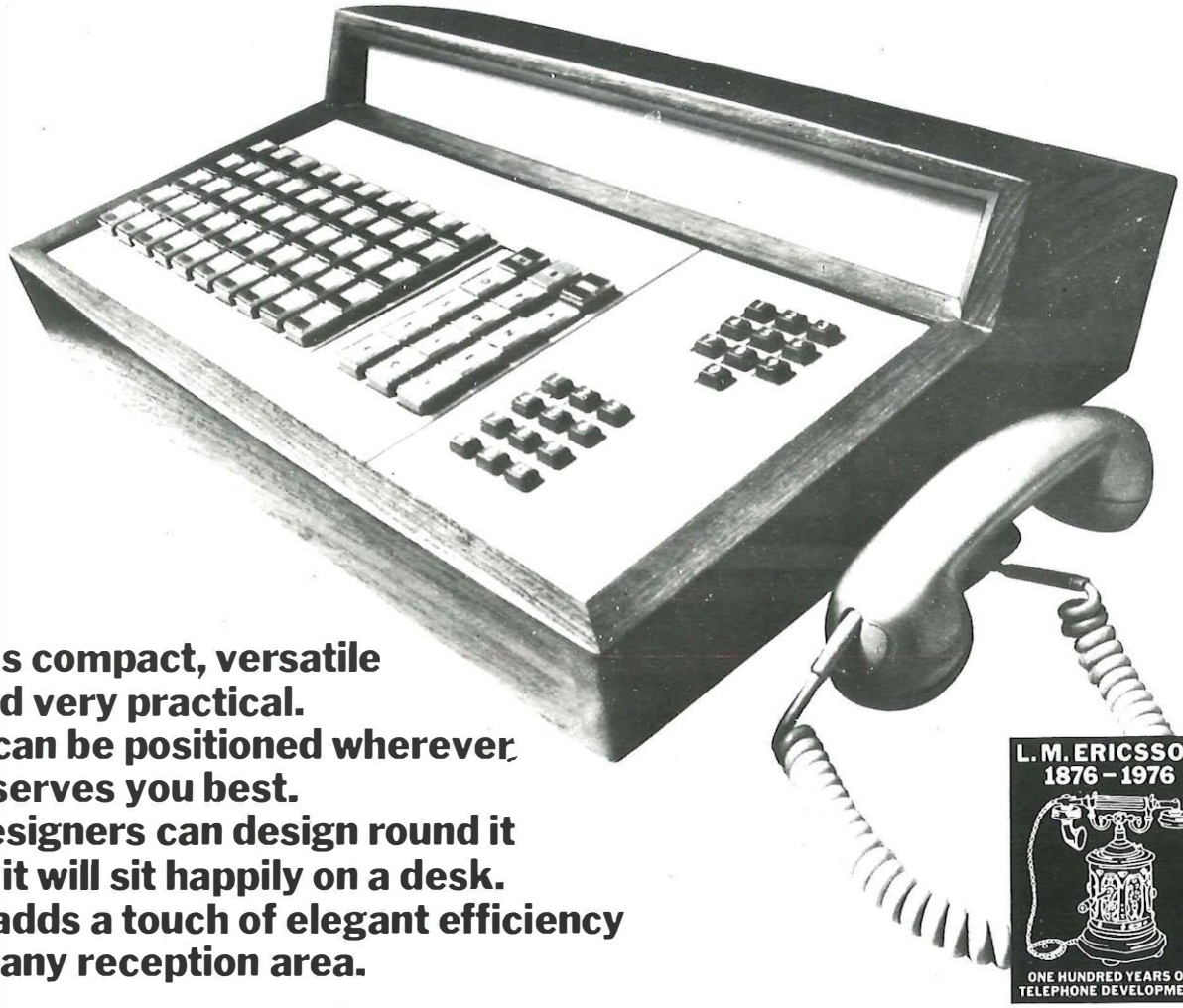
Post Office telecommunications journal

Summer 1977 Vol. 29 No. 2 Price 18p



The Thorn Ericsson operator's console is a remarkable piece of engineering



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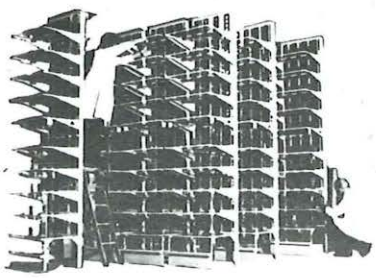

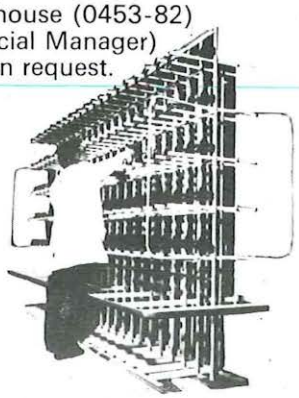

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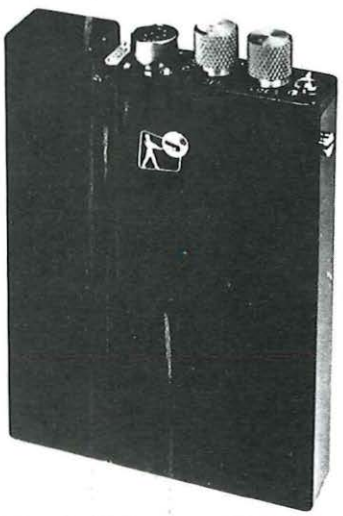

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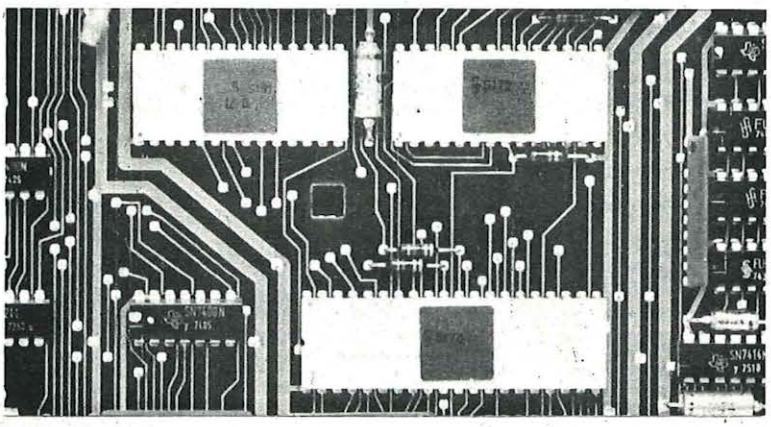

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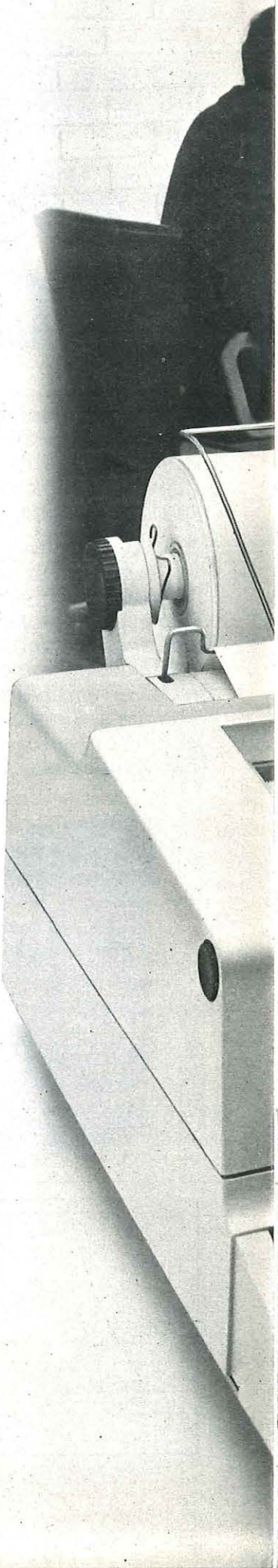

In the world of international communications Siemens has the answer.


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Business sense prevails

In a business that is investing £1,000 million a year to cater for growth and future needs, it is clearly vital to explore every possible avenue for avoiding unnecessary or untimely expenditure. Thus it was, in November last, that the Post Office was able to reveal savings on forward orders for telephone exchange equipment amounting to £220 million over four years, which were made possible by new methods of measurement and analysis of exchange equipment usage.

Any major decision of this kind, of course, is not without its implications. Concern among equipment suppliers about effects of the Post Office savings on the telecommunications industry led the Secretary of State for Industry to commission an independent enquiry into exchange equipment ordering by Mr Michael Posner of Cambridge University.

In confirming that the Post Office's decision was justified, Mr Posner's report is also a vindication of good business sense. The results of his enquiry endorse the Corporation's endeavour to save money both for taxpayers and customers by cutting back on orders which it believed to be unnecessary, accepting that it would be bad business practice to increase any orders above the levels announced to suppliers last November. Two suggestions put forward by Mr Posner, however, which he considered might help alleviate employment consequences in the supplying industry, have been carefully examined by the Post Office.

One suggestion was that future orders for electromechanical Strowger equipment should be concentrated in the early years of the ordering programme, although Mr Posner recognised the practical problems in bringing these forward. At the Government's request, the Post Office considered the possibilities that Strowger equipment orders worth £3 million and due to be placed in 1979/80 should be awarded to one company in the current year without competition. The three other firms which supply Strowger equipment, however, indicated that they felt obliged to object to a non-competitive contract of this type. There the matter must rest.

The Post Office was unable to take up Mr Posner's second suggestion, that the economic yardstick – known as the Test Discount Rate – applying to the purchase of TXE4 electronic exchange equipment should be modified to enable the Post Office to increase its orders in this area. Even if it were appropriate to modify the standard Test Discount Rate which was set up in a Government White Paper for this particular purpose, the fact is that the Post Office is to double the number of electronic exchanges in service during the next five years.

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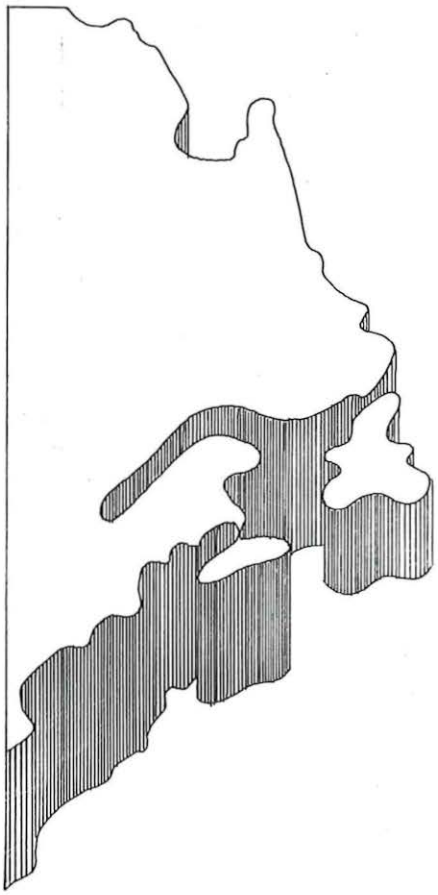
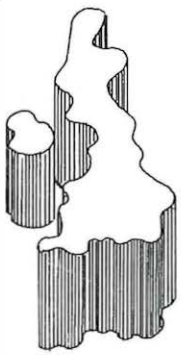
Cover: Tests aimed at producing a telephone handset microphone that will give clearer speech are carried out in the echo-free conditions of an anechoic chamber at the Post Office's Martlesham Research Centre. The volunteer's voice is relayed over a special microphone to a high-quality tape recorder for later analysis.



Database access spans the Atlantic



BG Bayross

IN RECENT years it has become increasingly obvious that a small but significant proportion of data users in the United Kingdom wants rapid access to technical and scientific information held on American databases, as well as other transatlantic computer facilities. A pharmaceutical company, for example, might want information on the biological effects of drugs, a user of time-sharing services could require access to the appropriate processors in the USA, or a multi-national concern might wish to link its computers in America with terminals in Britain.

To meet needs of this kind the Post Office has set up a transatlantic database access and remote computing service. Its introduction followed the successful negotiation of operating agreements with Western Union International, one of the authorised International Record carriers, for interconnection with the large TYMNET inter-State computer services network in the USA.

Introduced on a trial basis in February, the new service enables users of Post Office Datel 200 equipped with suitable terminals to gain access to the databases and teleprocessing systems connected to the TYMNET network. Similarly, American customers will be able to access databases in the UK.

Currently, information is available to UK customers on a variety of topics which include chemistry, engineering, medicine, patents, transport and the weather. Some database vendors in the network offer services covering a wide range of subjects, while others are within a specialised field, and the Post Office service has already attracted more than 80 customers, including universities, research organisations, medical authorities, chemical manufacturers and libraries.

Data transmission services from Britain to the USA using the public switched telephone network have, in fact, been in operation since 1965, when the International Datel 600 service was established. The structure of communications and regulatory restrictions in America, however, meant that services could be offered only by its established international record carriers, special arrangements for data being provided over operator controlled dedicated circuits.

Since those days of the early and mid 1960s, international data transmission requirements have mainly been met by the setting up of customers' private line networks leased from administrations. On a national basis, demand for data transmission facilities grew and, in the USA in particular, reflected developments in the computer industry. In addition there was significant expansion in the availability of scientific and technical information which, by the late 1960s, had reached such proportions that files of references were beginning to be made computer-readable.

This led to the advent of databases. Broadly, databases can be classified under two categories – databanks and bibliographic files. Databanks are machine readable collections of ultimate information on, for example, flight reservations and money transactions, whereas bibliographic files are machine readable collections of intermediate information, such as indexes of selected articles from a wide range of publications.

It was against this background of developments that Tymshare was founded in 1965 in the USA, becoming the first independent commercial venture into the computer time-sharing industry. Initially, Tymshare's customers had to rely on the public telephone network for access to its computer resources, but the company later developed communications processors and interconnected them via leased carrier facilities.

The resultant communications network was further enhanced by instal-

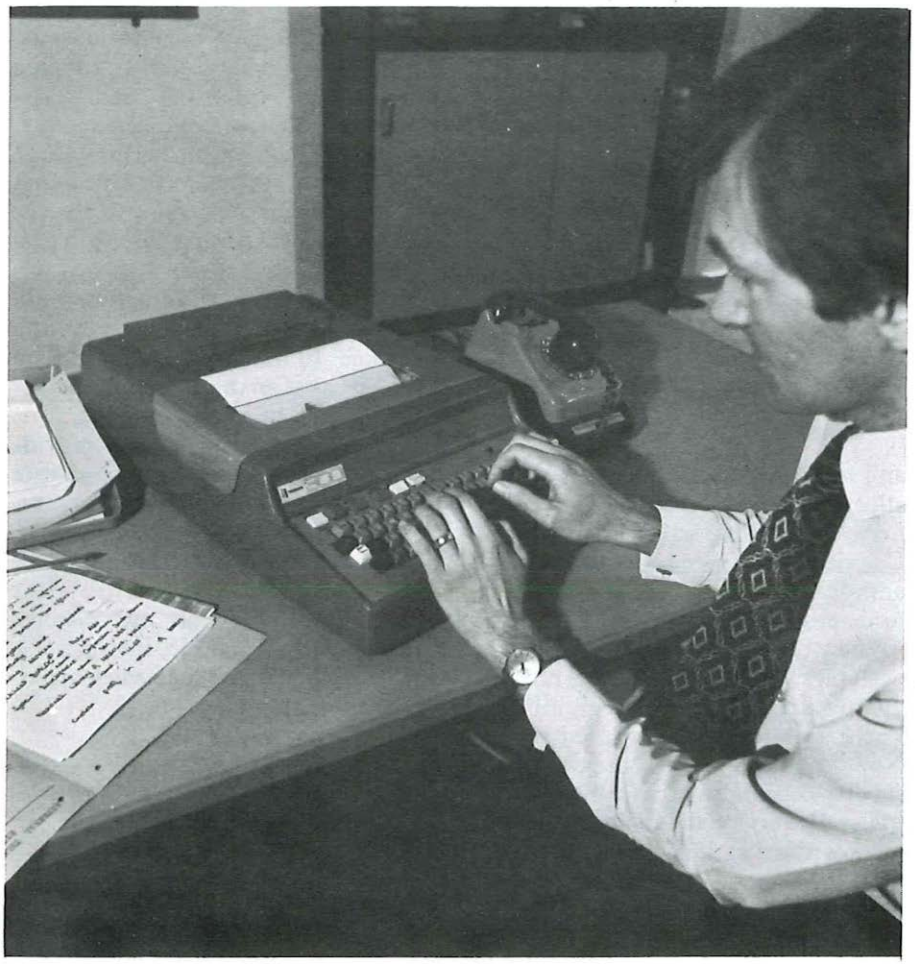
By means of the new Post Office service, an operator at a major London company uses a terminal to obtain information held on a database in the United States of America.

ling a central control, known as a "Supervisor", which enabled users to communicate with any one of several computers that were connected to the network.

Shortly afterwards the National Library of Medicine, seeking a means of providing the communications portion of its bibliographical retrieval service to nationwide users, became the first of a number of joint-users connecting more than 50 non-Tymshare computers to the network.

As Tymshare's own activities continued to grow – it operates some 50 computers in the USA – and as both the company and its joint-users wished to expand their services, a subsidiary known as TYMNET Inc was established to provide inter-State common carrier services in the USA.

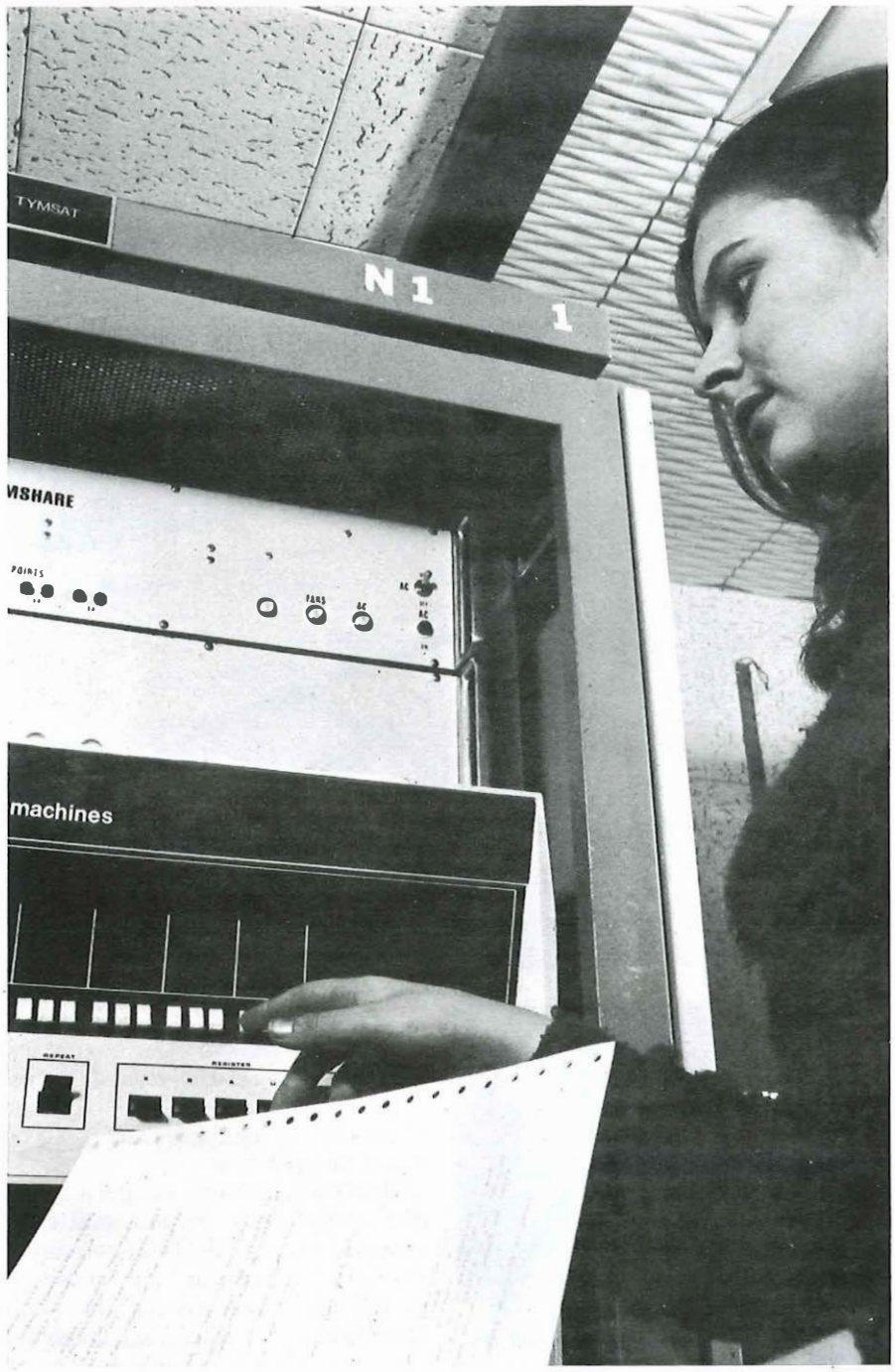
In the new Post Office service, UK customers gain access to the TYMNET network by first dialling a telephone number connected to Post Office facilities in London which request the user's terminal to give its Username – a code allocated by the Post Office to permit access to a chosen database or processor. This code is also used for routing purposes, and UK customers therefore require separate Usernames to gain access to each system in the network.



When the Username has been given, the connection is automatically extended over a cable bearer circuit to TYMNET's "Supervisor" central control in the USA which checks the Username against a Master User Directory (MUD) at Cupertino, California, to determine the required database. The "Supervisor" then requests the UK terminal to enter its Password (a code chosen by the customer), the purpose of which is to confirm the validity of the caller and to provide security checks.

Once this "logging in" procedure has been correctly completed, the connection is extended to the host computer or database, where further "logging in" may be required. At the end of the call, the customer "logs out" of the

Mr Jeff Newell, of the External Telecommunications Executive's Customer Services Group, adds details of a new customer to the database access service by keying in the Username and Password on a data terminal for transmission to the Master User Directory in California.



The data concentrator at Tymcom's office in West London is set to enable the Post Office to gain access to the TYMNET network.

network and terminates the telephone connection to the London centre. By limiting details of a Username and Password to authorised personnel of the customer, unauthorised use of the service is prevented.

In the UK, the service is run and marketed by the Post Office although, for technical expediency, the data concentrator is installed at the Brentford, London, office of Tymcom Ltd, the UK subsidiary of Tymshare. Requests for service are handled by the Customer Services Group of the External Telecommunications Executive, which is also responsible for updating the MUD with details of Usernames, Passwords and unique Host Numbers which are allocated to each host on the TYMNET network. During call set up a valid Username is matched against the appropriate Host Number in the MUD to determine the objective host.

When the service was introduced a customer paid a flat rate rental of £50 a quarter, irrespective of the number of Usernames issued to that customer. Now, however, both to encourage smaller organisations to make greater use of the service and to obtain further market information on sensitivity of tariff levels, this rental is based on the number of Usernames held, the charge for each – up to a total of 10 – being £5, with a maximum charge of £50 to customers.

Other charges covering the provision of the communications link are £6.60 for every hour the customer's terminal is connected to a database or processor, 30p per thousand characters exchanged and the normal charge for an inland telephone call to London. Users also pay the normal rental for Datel 200 facilities, modems and ancillary equipment supplied by the Post Office. It is the responsibility of a potential customer to make separate arrangements for the use of a particular database or processor, for which the appropriate charges will be levied by the vendor.

Although it is too early to assess the success of the service, customer interest has been encouraging. To date more than 330 Usernames have been issued to 83 customers. The possibility of providing an incoming service is being examined and it is hoped that the first UK database will be made available to US customers during the next few months. Similarly additional access within the USA to other data networks is likely to be provided in the not too distant future.

While the service has been introduced on a trial basis, it is hoped to provide something more permanent which will offer a greater range of services and facilities, including higher transmission speeds and the recently adopted International Telegraph and Telephone Consultative Committee (CCITT) x25 terminal/network interface which will enable UK customers to have access to other networks in the USA. In the long term, Post Office plans are to provide international packet switched services, by way of a Post Office built international packet switching exchange. In the meantime an interim solution based on the use of proprietary equipment is being examined.

In both cases, it is planned to provide services and facilities in accordance with those recommended by the CCITT. Assuming that the project is approved, the interim arrangement is likely to be introduced during 1978 and will be the next logical step for the planned development of public international data services to meet the new demands of the UK customer.

Mr B. G. Bayross is a Senior Telecommunications Superintendent in the Post Office's External Telecommunications Executive, in a section responsible for the policy and strategy of international data transmission services.

Taking measures to aid undersea planners

D A Bardouleau

THE DISTINCTIVE ebb and flow patterns of the seas surrounding the United Kingdom and the movement of water, say, from the North Sea to the English Channel have interested scientists – and Post Office submarine cable planners – for many years. Various experiments have taken place, and as a result measurements have been made of such things as the shape of the sea bed, the movement of sand ridges and even the size of sand particles.

With the extensive and ever-growing network of undersea telecommunications cables extending from many points around Britain's shores, the Post Office has a particular interest in the effect of tidal flows on these cables and makes constant use of the available information not only in maintaining and repairing existing links but also in planning new routes.

All the relevant data is held by the Institute of Oceanographic Sciences (IOS) which was created in 1973 by the merger of three other organisations and now controls all marine research around the United Kingdom. The Post Office has access to this information, which includes details of sea temperatures at various depths, the effects of wind and tide and the places where there is a "bath-tub" effect as water surges from one area to another and then back again.

The IOS experiments began in the early 1950s and were based on 19th Century scientist Michael Faraday's discovery that a volume of water moving in the earth's magnetic field has an electrical current induced in it. If the water moved through a channel spanned by an immersed cable earthed at both ends, as is the case with a submerged coaxial telephone cable with the outer conductor wires in contact with the sea water, the potential difference (voltage) created between the ends of the cable would set up a current in the cable conductor. This would have a direct relationship to the moving volume of water.

If the movement of water was due to the tides, the current would change direction with the tides. It would, in fact, be an alternating current because the height of the tide varies in a regular pattern between the points of high and low water. The induced current would

Mr Derek Bardouleau, the author, points out to Martin Devereux, a Technician at St Margaret's Bay repeater station, the difference in amplitude of magnetic disturbances on two submarine cables. Amplitude is affected by the direction in which the cable is laid.

therefore usually have a frequency of two cycles per day. Evidence from IOS studies supported this contention.

The first experimental measurements based on this above theory were taken in 1954 on the Dublin-Nefyn (Eire-North Wales) cable and the nearby Portpatrick-Donaghadee (Scotland-Northern Ireland) cable. For most of the time fluctuations, variable both in period and amplitude, were superimposed on the water-induced cable signal. These extra variations were due to earth currents associated with disturbances of the Earth's magnetic field.

The measurements were discontinued by the IOS after several months but the Portpatrick measurements were later restarted at the request of the University of Liverpool. Results obtained established a correlation between the measured wind speed and the amplitude of the cable potential (voltage) which demonstrated the direct effect of the wind on tide flow.

The Portpatrick measurements have continued and now provide an uninterrupted series of measurements spanning a 20-year period. The tidal flow in the English Channel has been recorded from the St Margaret's Bay (Dover) to La Panne (near Ostend), and Audresselles (near Boulogne) and Sangatte (near Calais) submarine cables. The Audresselles and La Panne data was applied to a two-channel chart recorder. Both chart traces showed the same tidal variation.

With increased demand for large capacity submarine cables the number of non-amplified submarine cable systems has radically decreased. It was therefore necessary to consider with the IOS whether the cable measurements were still necessary and, if so, whether they could be made on cables carrying the direct current (DC) power required to energise the submerged repeaters, which are spliced into the cables to amplify the telephone signals.

The IOS were anxious to acquire additional data on the behaviour of the North Sea, and to that end various countries had co-operated in organising a project during 1973 known as JONSDAP (Joint North Sea Data Acquisition Project). This made use of ships and personnel from nearly all the countries whose coastlines bordered the North Sea.

Part of the IOS contribution was the presentation of a paper giving details of the cable potential measurements made using Post Office submarine cables. Some of the data obtained was to be used in modifying the mathematical model of the North Sea which is used to predict the behaviour of that particular area.

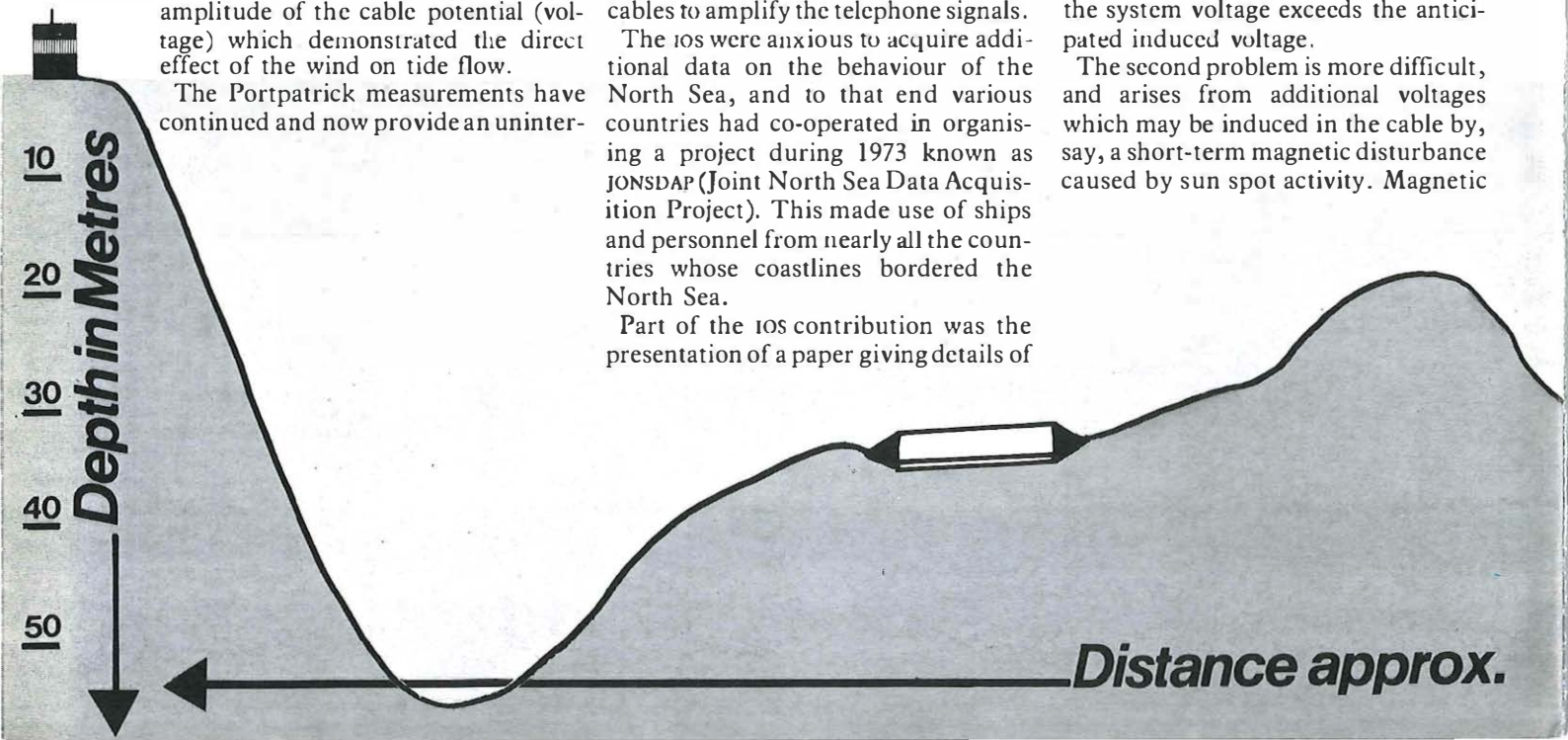
When tidal flow is from the North Sea into the English Channel, the build up of water at the narrow Straits of Dover can lead to extensive flooding along the banks of the Thames Estuary. The measurements of cable potentials on a cable close to the Estuary could therefore provide early warning of an approaching high water condition – if the information could be analysed in sufficient time.

A submarine cable system thought to be useful in this context was the 420 circuit telephone cable between St Margaret's Bay and La Panne. It uses only two transistorised repeaters powered by a 140 mA constant DC current fed into the cable from the shore terminals at 80 volts. The voltage is, in fact, provided by separate power units, operating at 40 volts at each end of the system, in order to increase the overall reliability. If one unit fails, the other one will take over and feed the full system voltage of 80 volts.

The cable potential due to the water-induced current can be measured and applied to a chart recorder or, better still, a digital data logger which has the advantage that information can be readily transmitted to a distant terminal point.

Two problems arise, however, when making these measurements. The first concerns limitations in controlling the accuracy of the power feeding equipment. This means that the present measurement technique cannot be used on cables where one per cent of the system voltage exceeds the anticipated induced voltage.

The second problem is more difficult, and arises from additional voltages which may be induced in the cable by, say, a short-term magnetic disturbance caused by sun spot activity. Magnetic



Mr Frank Dawkins, Leading Technical Officer at St Margaret's Bay repeater station, checks the value of the line current being fed on to the submarine cable system to Belgium.

disturbances are a quite different phenomenon from induction due to tidal flow, and their effect on the accuracy of cable potential measurements is currently being studied by the IOS.

Whenever the IOS wish to conduct tests on Post Office cables their first step is to approach Telecommunications Headquarters for permission. This is usually given as a formality and the appropriate Region and Area are alerted. Staff from Network Planning Department normally oversee the attachment of IOS equipment at the cable's shore terminal to make certain that service is not affected. After that the only Post Office involvement is when local staff change recording charts as necessary.

Three instruments are used for recording cable voltage. The first, a chart recorder, is used to obtain a long period record while the second, an analogue/digital battery-operated data logger, records 12 channels of data on magnetic tape at 10-minute intervals. The time to complete one scan of all 12 channels is six seconds.

The third instrument is a chart recorder which provides a direct analogue recording instrument concurrent with the data logger recorder. Timing marks are derived from the clock which controls the timing of the data logger. This signal is removed at selected times, enabling the digital and analogue records to be synchronised and to give a check on the chart record.

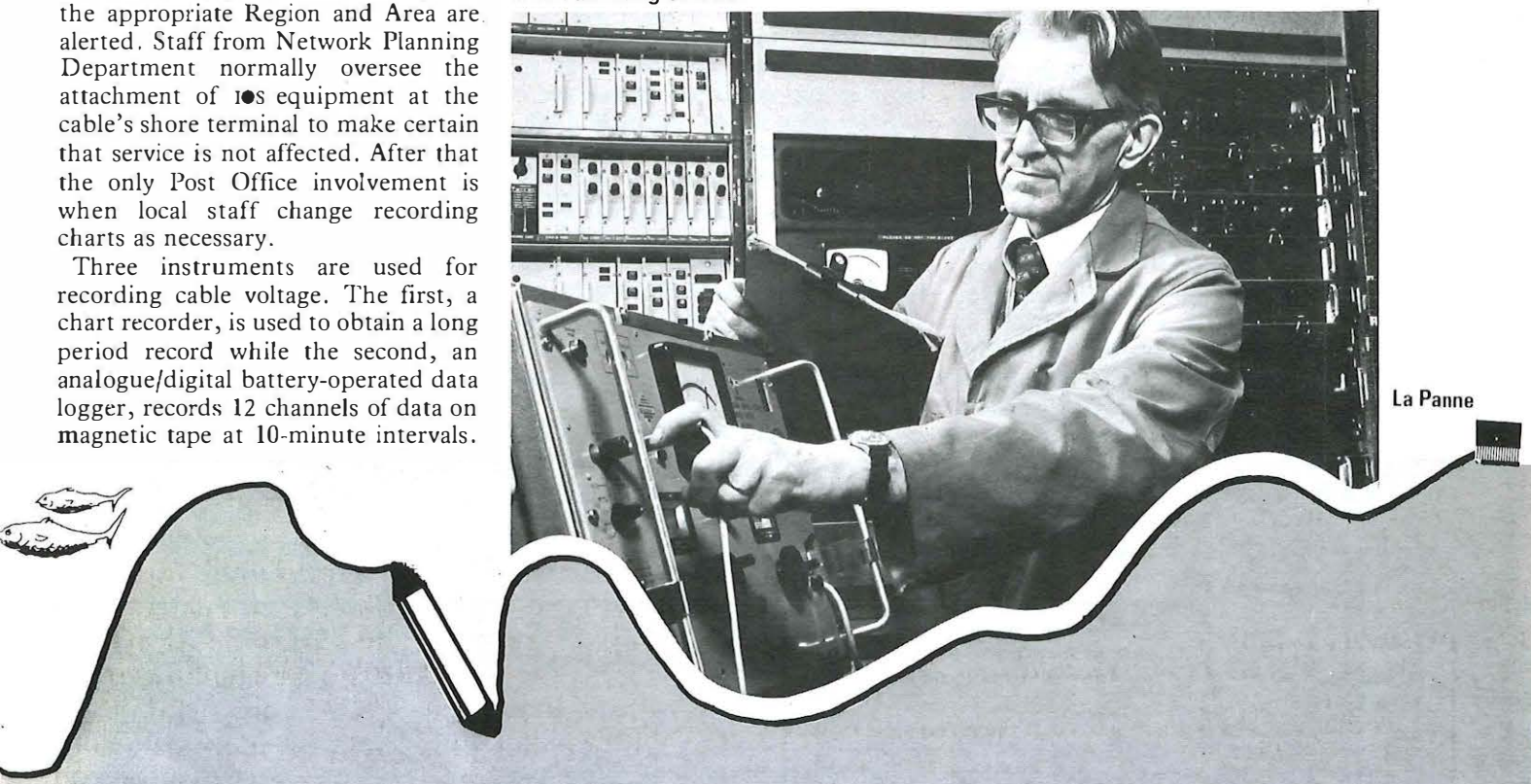
Final processing of the measurements taken on the St Margaret's Bay-La Panne repeatered cable are now awaited. When these become available further discussions will be held between the IOS and the Post Office with a view to implementing a further development in cable potential measurement techniques.

If the necessary ancillary equipment is available in time, it is intended to include the Belgian administration in the discussions to secure their agreement and co-operation when the measurements are resumed. Hopefully they will be for a sufficient time to validate the new procedure and gain tidal information vital to the two countries.

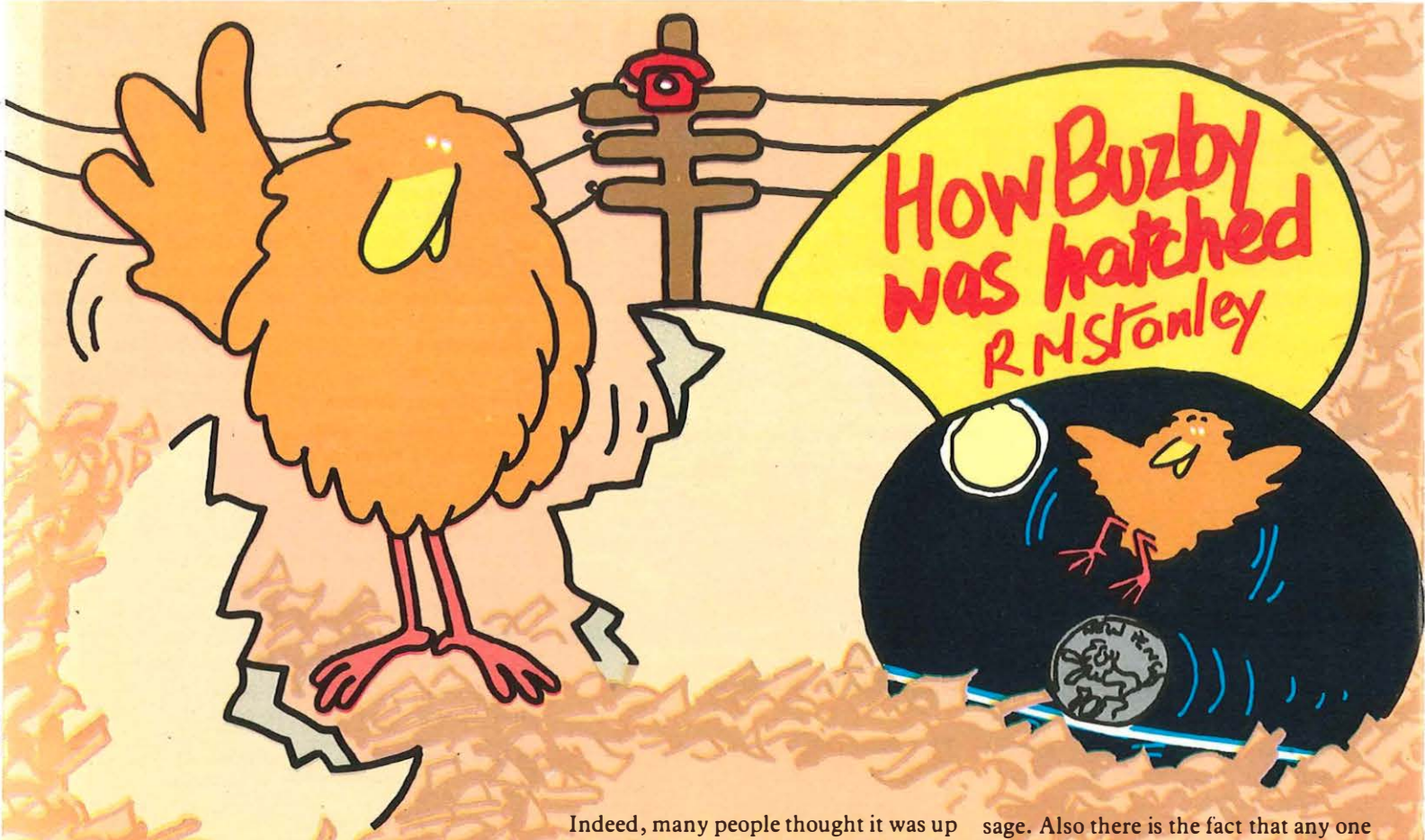
Mr D. A. Bardouleau is an Executive Engineer in the Submarine Systems Division of Network Planning Department at Telecommunications Headquarters, responsible for the day-to-day maintenance of European and oceanic submarine systems.

PO Telecommunications Journal, Summer 1977

Technical Officer Charlie Hutchins takes transmission measurements on the St Margaret's Bay to La Panne system to ensure that the tidal measuring equipment is not affecting service.



Sea bed profile of cable between St Margaret's Bay and La Panne.



EIGHTEEN months ago Buzby was not even conceived let alone hatched. Today he is to be seen all over Britain on television screens, on poster sites, on the London Underground and buses, on the Post Office's own huge fleet of vehicles, and at exhibitions. His jaunty figure is also familiar at County cricket grounds, on millions of Post Office leaflets, and he will shortly be appearing on telephone bill envelopes.

But that is not all. He is illuminated in Piccadilly Circus, and he appears in advertisements in national, provincial and local newspapers and magazines. He is already a T-shirt favourite and by Christmas there will be a range of Buzby toys and games. And last, but not least, Telephone Areas all over the country have invented their own ways of adapting him for use in their own local promotional material.

A meteoric rise indeed. But who is Buzby, why was he born and what objectives has he been designed to fulfil? It was towards the end of 1975, following two tariff increases in a short time that public concern was aroused and there was strong evidence that people thought the telephone service was much more expensive than, in fact, it was.

Research showed that public knowledge of the actual cost of a cheap rate trunk call was unacceptably low. Indeed, many people thought it was up to six times as much as it really was. There was clearly a need to stimulate more calls and particularly to publicise the low cost of trunk calls made during cheap rate periods.

A start was therefore made early in 1976 with a national television campaign which showed a 10p coin rolling across the screen and telling people how far 10p could get them even in days of rising prices. Before-and-after surveys showed a steep rise in awareness during the period of the campaign, but there was a marked fall-off soon after the campaign finished.

When planning the campaign strategy for the year from April 1976 it was, therefore, vital to get as much continuity as possible, but it was equally important to achieve as much memorability and goodwill from the proposed advertising as possible. The question was how best to vest the advertising with an image that would be warm and friendly but, above all, memorable.

Since the objective was to humanise and personalise the Post Office image there were really two choices. A live personality could be used as presenter or a cartoon could be devised to fit the bill as the co-ordinating symbol for publicity.

The drawbacks of using a person as presenter were obvious. Whoever was selected would not be everybody's choice, and such advertising – particularly on television – could draw attention to the person and his image, often at the expense of the advertising message. Also there is the fact that any one person is vulnerable to human factors such as illness or other commitments.

There is the point, too, that it would be very difficult to select any personality who would appeal to both business and residential markets. This is borne out by the fact that no business, industry or corporation which advertises nationally has, over the past 20 years, used a live personality to present its case except in very minor campaigns.

The case for cartoon-type characters is altogether stronger. This is why the gas industry used Mr Therm, why Tate and Lyle use Mr Cube and why Shell has animated its own Shell symbol. The Telecommunications Business is very fortunate in the wide availability of outlets available for publicity purposes for, in addition to all forms of paid media advertising, it has the largest transport fleet in the country and it produces continuously, vast quantities of literature for distribution to its customers. About 50 million account envelopes reach the public in any one year, for instance.

There is wide evidence that cartoon characters appeal to most people regardless of class or age group. This is why Mickey Mouse is now celebrating a jubilee, why the Wombles sell over £16 million worth of toys a year, and why Robertson's can still use the golliwog for their products. It was with this knowledge that Buzby was conceived and soon afterwards made his television debut.

Three commercials were used during 1976 showing Buzby in various situa-

tions on the wires near his telephone post. In one he was listening, entranced, to children wishing their grandma a happy birthday, in another he was speaking affectionately, supposedly to his girl friend, only to find to his embarrassment that it was his mother, and finally he did a daring high-wire act by riding a 10p coin across the line and marvelling at the cheapness of a call.

The first television campaign ran between May and July and the second was at the end of the year running into the current year.

Between these campaigns there was a national poster campaign all over the country using more than 1,000 of the very large 48-sheet sites. Two separate posters were used, one for daylight and one for the evening, with Buzby wondering whom he should ring to make happy.

In the meantime, the Post Office Telecommunications vehicles were using back-up posters on an ever increasing scale and this helped considerably to ensure that Buzby was kept permanently and prominently in the public's eye.

Towards the end of 1976 the original slogan "Make someone happy with a cheap rate phone call" was changed to accord with the policy of emphasising value once the price has been sufficiently established. It then became "Make someone happy with a phone call". Currently, as Buzby is becoming clearly identified with telephone calls, the slogan is being further shortened to simply "Make someone happy".

So what has Buzby achieved? Results have been spectacular on the internal front, where he has clearly filled the need of staff all over the country for a warm visual identification of the business for which they work. Enthusiasm in Areas to use him for every conceivable purpose has been unbounded.

As far as marketing objectives are concerned it is difficult to measure achievement precisely. Advertising is only one of many things which can influence people in the use they make of their telephones, and simply because there was a substantial increase in cheap rate trunk calls does not necessarily mean that it was due to the advertising campaigns. The only reliable method of measuring the success of advertising is by measuring the awareness of the public to the message conveyed through the advertising.

On this basis the Buzby campaigns have met all the objectives set for them. A more precise test in which Granada TV had heavier than average advertising, while Border TV carried no advertising at all, is now being assessed to see whether it can produce any additional information on what the campaign has so far achieved.

The programme for the 12 months from April this year leans more heavily on television advertising than 1976, and four new commercials have been produced to emphasise the happiness and value theme. In one, Buzby imitates showbusiness star Max Bygraves, in another he shows delirious happiness by his laughter during a phone call, in a third he speaks to his mother with Irene Handl lending her voice, and finally he is made "bird brain of Britain" by giving the correct answer to the cost of a cheap rate call after doing rather badly on simpler questions.

There will again be a national poster campaign from July until the end of November, and during the summer large posters will be on all the cricket grounds where Test Matches are being played and also on most County grounds. A supply of posters for Telecommunications vans will continue throughout the year and it is hoped that by Christmas the many toys and novelties featuring Buzby, now being developed, will be in the shops and on sale to the public.

Clearly Buzby has won an affectionate place in the hearts of Post Office staff and there is every reason to suppose that he will become a firm favourite with the public. His usefulness is constantly being extended and it seems he will be spreading his wings and his message for a long time to come.

Mr R. M. Stanley is head of Publicity Division at Telecommunications Headquarters and was responsible, in collaboration with the advertising agency, for devising the Buzby character.

PO Telecommunications Journal, Summer 1977

SUBMARINE CROSSING TO HOLIDAY ISLE

MH Pendlebury

Novel uses of established marine practices have enabled new undersea cables to be laid across the Solent, providing extra telephone capacity between Britain's mainland and the Isle of Wight.

FOUR years ago forecast demand for telephone circuits between the Isle of Wight, off the South Coast of England, and the mainland indicated that additional capacity would be required by this year. Existing service to the island was provided by a radio link and submarine cables, and it was decided to cater for the increased needs by means of new undersea links.

Used since 1914, the submarine cable route consists of a narrow corridor across the eastern end of the Solent, which is protected to some degree by the prohibition of anchoring and fishing. The route is, in fact, divided into two parts which share a common landing at Portsmouth but use separate beaches on the island.

A feature of the Portsmouth landing is a wartime anti-submarine barrier extending from the shore for two miles. Nine of the existing cables – a mixture of audio and coaxial types – were laid to the east of this barrier and landed at Nettlestone Point on the island, with three more recently installed audio cables crossing to Toll Beach, Seaview.

An early difficulty in the new project was that cables could be laid only within the narrow corridor. Royal Navy anchorages, natural obstructions and dredging areas precluded any widening of the route and there was no other available space on the seabed in the area. It was evident, therefore, that some existing cables would have to be recovered before laying could begin.

This situation presented the opportunity to provide a discrete high-frequency (HF) cable route, with the anti-submarine barrier giving natural separation from the audio route. It was therefore decided to clear the nine cables on the route to Nettlestone Point and to dedicate that crossing to HF cables. By using two 1.47-in coaxial cables it was possible to provide a 2,700 circuit 12 MHz system without the need for repeaters on the proposed 4.5 nautical mile undersea route. It was also planned to lay a third, experimental cable as a maintenance standby.

Changeover links and transformers for matching the impedances of the submarine and 0.375-in land cables were installed in jointboxes adjacent to the beach manholes. To make best use of the existing duct entries it was necessary to reduce the size of the submarine cables to 0.935 in at each shore end, these sections of both the "outward" and "return" cables being screened against radio interference.

The cables used for the working systems were of the same type as that employed on the continental shelf sections of the CANTAT 2 transatlantic link, for which there were already well-established jointing procedures. The standby cable, on the other hand, although of similar overall size to the working cables, differed in the construction of its centre conductor and external armouring, which was of hard plastic instead of galvanised steel wires, and its shore ends were not screened against radio interference.

A major advantage of the experimental cable's design was that it was more economical to produce. Samples were used to adapt normal jointing techniques prior to the laying operation, and periodic tests were planned after laying to examine the performance of its unscreened shore ends and the rate of "ageing" of the cable.

The fact that the shore ends of the cables were a different size from the main sections presented a problem in laying. For a normal end-to-end laying operation the shore ends would have needed to have been spliced to the main sections prior to loading on the cableship and, in providing adequate margins for error, there was a possibility that the lengths might have been longer than required. This could have resulted in either having to lay excess cable on the seabed, which was undesirable because of the restricted route corridor, or possibly having to cut off too much of the shore-end sections when landing, thus reducing their screening effects. On the other hand, the use of longer screened shore ends could have eroded the advantage of having large main sections.

To overcome these problems it was decided to lay separate shore ends at Portsmouth first, for a distance of 0.25 nautical miles offshore, and to mark their seaward ends with buoys. The main sections, already jointed to the Isle of Wight shore ends, would then be laid from Nettlestone Point to the buoy positions, where final splices could be made.

Cable laying and final splicing would have been common practice for the specially equipped Post Office cableships, but for two miles off Portsmouth landing and one mile off Nettlestone Point the sea would have been too shallow for these ships to operate during low tides. As a joint could take up to eight hours to complete, other vessels capable of working in depths of about 6 ft were therefore needed.

Eventually, the MV Elation of Crescent Shipping was chartered to lay the cables, agreement being reached to adapt the Master's cabin as a darkroom for developing x-ray films of the cable joints, and to share the use of the galley. Elation was not suitable, however, for recovering the existing cables so a salvage vessel was contracted to do this work under the guidance of Post Office Marine Division.

Both landing points of the cables were in popular holiday resorts, Nettlestone Point in particular being an area of intensive sailing activity during the summer months. The recovery and laying operations were therefore scheduled to avoid working on the beaches during this period.

Recovery of the old cables began in April last year as soon as all working circuits had been diverted on to the existing audio route and radio link. The beaches were cleared first, and then followed the intricate task of lifting the cables, parts of which had become buried or interwoven over the years. By working where weather con-

ditions permitted the route was gradually cleared, a total of 550 tons of cable being recovered.

Laying of the new cables started in October last with the landing of the three shore ends at Portsmouth. Elation anchored about 100 yards from the beach at low water, passed each cable ashore in turn and laid them on diverging courses out to sea. After buoying and slipping each seaward end the vessel returned to its original anchorage, which had also been buoyed, to ensure that all three cables were closely grouped in a trench on the beach.

It was important to maintain sufficient separation between the main sections of cable clear of the foreshore so that, if a fault occurred, the required section could be grappled and lifted for repair without endangering the other two cables. A series of geographical and navigational features, which when visually coincident gave a reliable position line, were plotted on a chart and used during the laying operation. Elation's radar was also used to measure the passing distances from fixed objects, such as the Solent Forts, and a small tug assisted manoeuvring.

Each main cable was laid in the same manner. Elation anchored as close as possible to the beach at Nettlestone Point and the first cable end – already spliced to its main section – was passed ashore and secured. Being a rocky landing, the shore end was protected by fitting articulated, cast-iron ducts during low tides. When the cable had been secured, the vessel sailed on a pre-determined course across the Solent, paying out cable and maintaining frequent contact with Southampton Port Radio, which controls shipping in the area.

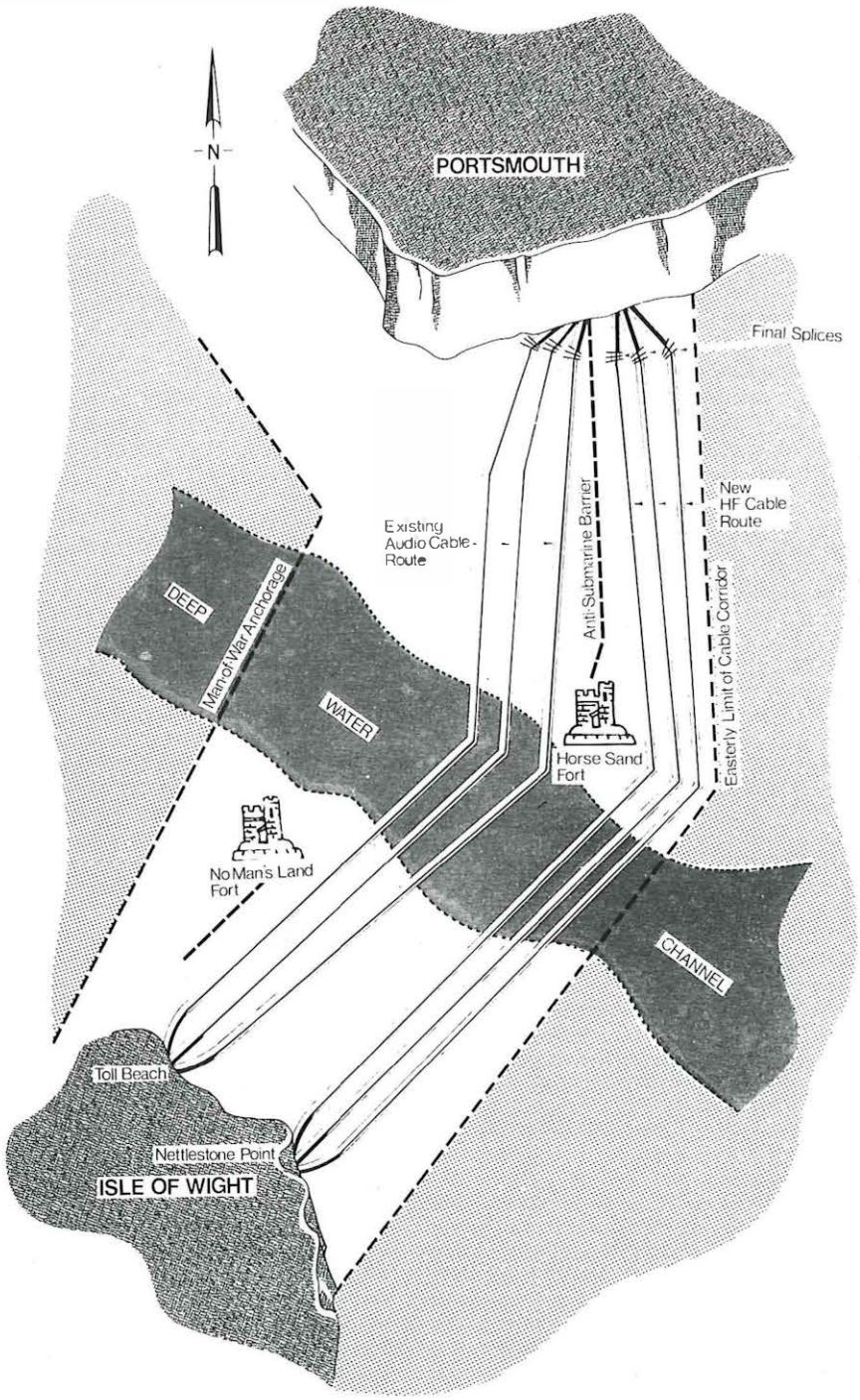
On approaching the marker buoys off the Portsmouth landing, Elation picked up the appropriate shore end and winched it over the bow until there was sufficient cable inboard for jointing. The main cable was cut, the end cleared from the hold and tests were carried out towards both landings. The vessel's hatch covers were installed to provide a firm platform for jointing tents and equipment, and the cable ends were prepared for final splicing.

Between each laying operation, Elation returned to the Post Office Central Marine Depot at Southampton to discharge the residue from the previous lay and to load cable for the next operation. After some delays caused by adverse weather and exceptionally low tides, the final laying operation was completed in late October.

The two new working cables became available for service at the beginning of April. Capable of carrying 2,700 conversations at the same time, the system will eventually provide two-thirds of the telephone circuits between the Isle of Wight and the mainland. As well as providing improved telephone service for this summer's calls to and from the holiday island, it will also cater for forecast increased demand until the end of this century.

Mr M. H. Pendlebury is an Assistant Executive Engineer at the Post Office Central Marine Depot, Southampton, in a group responsible for undersea cable provision, planning and works.

PO Telecommunications Journal, Summer 1977



The Vital Human Factor

RF Yates

FEW industries have seen as many technological advances in recent years as telecommunications, yet despite a whole range of exciting developments their ultimate success depends largely on the vital human factor. For, inevitably, problems arise at the interface between machines and people – both the customers of services and the staff responsible for their operation and maintenance.

These areas where customers and staff meet the Post Office system are the concern of Research Department's Human Factors Section, now based at Martlesham Heath in Suffolk. The Section's job, in the short term, is to alleviate existing difficulties while, in the longer term, its aim is to anticipate potential problems and advise on suitable avoiding action.

All these difficulties are the result of a complicated interaction between the physiological, psychological and ergonomic limitations of human beings on the one hand, and the electrical and mechanical characteristics of systems, equipment and machines on the other. Naturally, the scope and need for human factors research are expanding as telecommunications evolves. Increasing complexity means more digits to dial, more tones to be understood and a wider range of facilities for customers to comprehend and use effectively.

Currently, the major support for the Section's work comes from three main sources, although its services are available to all in the Post Office. One source is the Post Office Human Factors Research Committee, chaired by a Deputy Director of Research and drawing its membership from all the Businesses. Its primary concern is with longer term projects which promote a greater understanding of human factors principles as they relate to the operation of the Post Office. This work is of vital importance if the section is to develop its full potential in providing advice on a wide range of problems.

More immediate work is put to the Section by the Service and Marketing Departments at Telecommunications Headquarters, who are the other chief sponsors. This direct and detailed involvement in the running of the Telecommunications Business keeps the Section's feet firmly on the ground, which is an essential prerequisite for any practising human factors engineer. But more of this later.

One of the outcomes of the move of Research Department from Dollis Hill, London, to Martlesham was the loss of a subject panel recruited from local residents. While a certain amount of subjective testing can be conducted using Post Office staff, there is a great need for access to non-Post Office and primarily non-engineering people.

Early steps have been taken at Martlesham to recruit a new subject panel although the scattered population near the Research Centre has meant that the focus of activity has been switched to Ipswich, some seven miles away. With a population of more than 120,000 this town is well able to support a subject panel of about 1,000 volunteers, which was the original aim.

A preliminary approach by letter to a

Mr Peter James, of Human Factors Section, observes a volunteer using a wall mounted keyphone. The keypad can be set at various angles to determine the best position for use.

The author presents to a subject a set of pictorial instructions designed to guide her through the correct sequence of operation of abstract test equipment. Pictorial instructions of this kind could one day be used to help callers in telephone kiosks.

At the special outstation now being set up in Ipswich, Executive Engineer Martin Cooper records on videotape user response to light emitting diodes which are being introduced on various items of customers' equipment in place of filament bulbs.

small proportion of the Ipswich electorate established the likely response rate, and on this basis a major recruiting exercise was undertaken. Again, the approach was by letter, but because a number of these were passed on to friends and relatives the resulting panel has stabilised at about 1,500 people.

It is unlikely that any individual will attend more than once or twice a year, which leads to the conclusion that the excellent response has been engendered by a genuine desire to help, rather than for the small fee paid for each attendance. To keep in touch with the subject panel, plans are in hand for an occasional newsletter which will carry articles on current work and will introduce staff of the Human Factors Section.

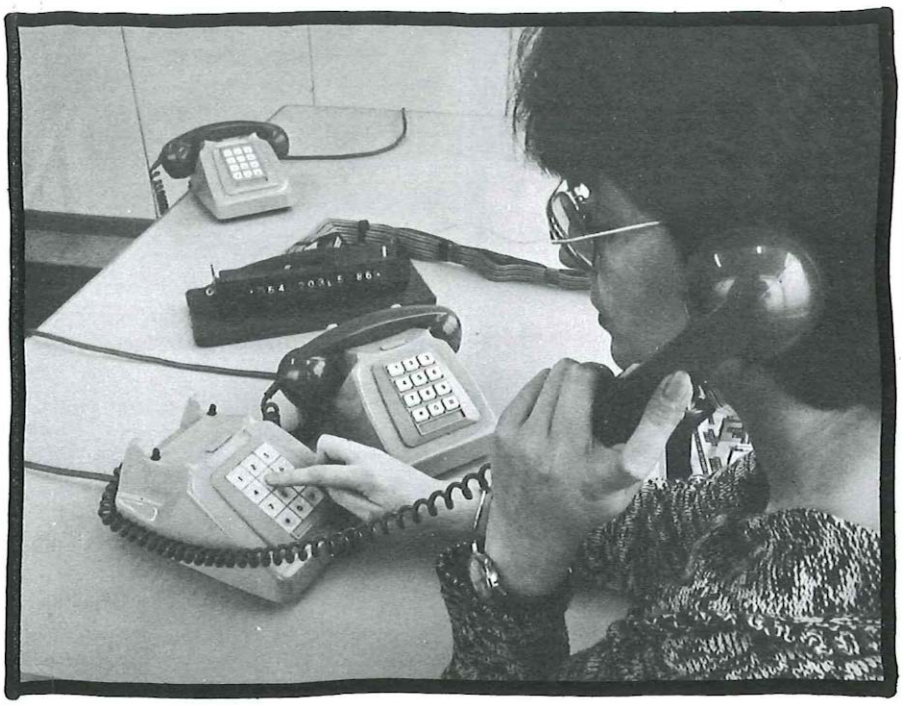
Following the need to establish the subject panel in a centre of population has been the need for certain experimental facilities to be located as an outstation away from the Research Centre. This outstation is currently being set up in the centre of Ipswich, within easy reach of public transport, shops and industrial and commercial premises. It will provide accommodation for running several human factors experiments simultaneously, together with supporting office and laboratory space and the all-important computers.

The outstation's facilities will enable the experiments to be controlled precisely and repeatedly and for a wealth of experimental data to be assembled for further processing. With the exception of a receptionist, the outstation is staffed as necessary by members of the Human Factors Section whose permanent base, together with further computing and experimental facilities, is in the main laboratory block at Martlesham Research Centre.

Probably the most significant change facing the average customer in the use of Post Office facilities is that from a dial telephone to a keyphone. In anticipation of the consequences of this change, and in direct support of the operational Departments of the Post Office, much effort has been expended in determining the optimum parameters for keypad telephones.

While in appearance and use, the keypad may appear to be a very simple device, various aspects of its design serve to show its hidden complexities. The size, spacing and shape of the buttons must be suitable for the different hand and finger sizes using them, and the visual target which they present to the user can considerably affect their suitability and acceptance.

Another feature which calls for com-



A volunteer tests "button action" on various types of keyphone to compare the feel and touch with standard equipment.

promise is the angle at which the keypad is mounted. The angle which is best for viewing is much nearer the vertical than that which is more suited to easy finger action. An intermediate angle therefore has to be selected. This optimum angle has been determined, through user experiments, for a number of table and wall-mounted telephone arrangements.

The "feel" of a particular button – that is, its response to the finger pressure applied to it – has also been investigated together with the very important concept which is known as feedback.

This is the general term for information the user receives from the button to show that it has operated. Feedback can be tactile, from the movement and resistance of the button, audible (inherent clicks or operation of a buzzer) or visual, provided by means of a lamp or number display.

There is a familiar saying, "If all else fails, read the instructions". Although rather cynical, there is an element of truth in it because it summarises human experience of poorly given instructions.

It is against this background that Post Office instructions in telephone directories and dialling code books and labels on equipment must be presented in a way that produces the best results not only for the customer but also for the Post Office.

This fact was forcibly demonstrated in recent experiments aimed at determining the effectiveness of pictorial instructions in public call offices, when the main finding was that few subjects referred to the instructions even though they did not know how to operate the equipment.

Much effort has been expended recently in assessing the value of pictorial instructions, particularly in situations where written instructions would need to be in more than one language. A sensible basis for pictorial representation of an idea or instruction is to include as many elements as possible that are already generally familiar. These elements are known as "population stereotypes" and their identification is an important part of human factors work.

Technical Officer Larry Hughes, foreground, and Brian Roe, Assistant Executive Engineer, prepare to record instructions for use by volunteers taking part in human factors experiments.

A study of the symbolic conventions people adopt to represent the use of certain controls is in progress, as is comparative work between sequences of pictures and written instructions. One interesting result so far is that fewer people than expected follow the sequence of pictorial instructions intended by the designer.

"Population stereotypes" have also featured in related work exploring the need for symbolic representation of telephone signal tones, again for a multi-lingual situation. Subjects listened to a number of experimental tones and then devised graphical representations of them.

From the mass of data thus produced, certain common features relating to timing, pitch, loudness and timbre (roughness) were identified and incorporated into a set of graphical representations. These were then tested against written instructions and a combination of written and graphical presentation.

The general conclusion has been that for simple tones, such as those encountered on telephone systems, a graphical representation is better than a written description. In the description of complex tones, however, a written explanation is better.

The continuing need for human factors research stems from two aspects of technological development – namely, the application of new techniques to existing situations and the creation of entirely new circumstances. The keyphone is a good example of the former, as are the introduction of light emitting diodes (LEDs) to replace filament lamps and the development of aids for people suffering from various types of handicap.

The range of customer-controlled supplementary services available from a modern, computer-controlled telephone exchange, however, poses many new problems. Human Factors staff are closely involved in all these areas to try to ensure that the human touch is still evident in what is becoming an increasingly automated world.

Mr R. F. Yates is head of Human Factors Section at the Post Office Research Centre, Martlesham, responsible for a wide range of projects involving customer and staff use of telecommunications equipment and services.

Something to celebrate

In this, the Queen's Silver Jubilee Year it is, perhaps, appropriate to look back at some of the major developments of the past 25 years which have kept the Post Office in the forefront of world telecommunications technology.

As the new Elizabethan era dawned in 1952, Britain had a modest six million telephones and a network which needed the operator to connect all but local calls. Today, after 25 years of breathtaking technological progress, there are 21 million phones in use and nearly four out of five customers can dial their own calls to 320 million people in more than 50 countries via satellites and undersea cables.

But this, in fact, is only part of a success story which has not only seen many spectacular developments but also – despite inflation – a cut in some of the charges. In 1952, for instance, the charge for a call over 125 miles was 20p for three minutes while the same connection dialled direct now costs only 18p.

Currently Britain has the world's third largest telephone system behind the United States of America and Japan and handles 512 calls every second. There are also 60,000 telex connections and 41,000 data transmission terminals – more than any other country except the USA.

Telecommunications has, of course, become huge business worldwide. More than 6,000 calls are routed abroad from Britain each hour of the day and the Post Office earth station at Goonhilly Downs, Cornwall, plays a vital role in ensuring they get through.

On December 5, 1958, the Queen inaugurated the Subscriber Trunk Dialling service by making a call to the Lord Mayor of London from Bristol Central telephone exchange.

To keep pace with this ever increasing demand for telecommunications facilities the Post Office spends £40 million a year looking into the future and developing new ideas. Much of this important work is done at the Research Centre at Martlesham Heath, Suffolk, opened by the Queen.

Overall investment in new plant and equipment is at the rate of £3 million a day to meet the challenges of growth and change, and all profits are ploughed back into the Business.

The two most significant breakthroughs in the last 25 years, however, remain the provision of undersea cables across the Atlantic and Early Bird – the first earth orbiting satellite to handle a regular telephone service. Post Office research has now reached the point where long lasting transistors are used in the repeaters spliced into undersea cables. The latest cable to be laid – TAT 6 – came into service last year and can handle 4,000 calls at once.

During the early 1960s Goonhilly became the first European earth station to receive and transmit telephone calls by satellite, the first to transmit colour television across thousands of miles and the first to transmit through a satellite a live television programme from Europe to America.

In 1965 the first commercial satellite, Early Bird, was launched. A total of 18 telephone calls could be handled, sent up from Goonhilly, bounced off Early Bird and received on the other side of the Atlantic. Further satellites were launched and the number of circuits working between Britain and the USA grew from 18 in 1966 to 177 at the start of 1970. Today there are more than 700 satellite circuits between the two countries. The latest satellite, Intelsat IVA can handle 6,000 telephone calls and two television programmes simultaneously. And demand is such that the Post Office is building a second earth station near Madley in Herefordshire.

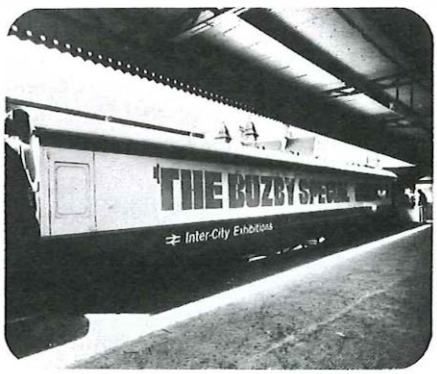
But completely new techniques have also been developed by the Post Office. Among the latest are optical fibre and waveguide transmission systems. Both these are in an advanced state of development at Martlesham, as is Viewdata, which within the next two or three years will enable customers to have a special link built into their telephones to "call up" news and information on their own television set.

Today's worldwide telephone network is unquestionably the biggest, most complex and expensive machine yet devised by man. It represents a total investment of £130,000 million – and it is growing at six per cent every year.

During the next 25 years giant telecommunications satellites powered by solar or nuclear energy will be assembled in space and have at least five times the capacity of today's satellites. Should Britain be able to celebrate the Queen's Golden Jubilee, people will be able to look back and see that communications developments during the second 25 years were every bit as exciting and dramatic as in the first 25 years.

PO Telecommunications Journal, Summer 1977

Part of Post Office Telecommunications' contribution to the Jubilee, this Buzby Special exhibition train toured the country for two weeks to publicise the latest services and facilities.



Special phone rings in JUBILEE

TWENTY-FIVE thousand special telephones – 1,000 for each year of the Queen's reign – are finding their way on to shelves, sideboards and walls in homes and offices throughout Britain as part of the Post Office's contribution to the Silver Jubilee celebrations.

Their main feature is the dial centre which carries a blue relief reproduction of the Jubilee emblem with the details picked out in silver. There are two versions of the emblem: one for Scotland featuring the Scottish Crown, the other depicting the English Crown.

The telephones selected for this special treatment are of the recently developed slimline Compact design. The case, handset and wall-shelf have been produced in Balmoral Blue, a colour chosen specially for the occasion, while the cords and separate bell unit cover are in grey.

The digits on the dial are printed in the same blue as the telephone. A holder, based on the keyphone design has been provided between the switch hooks for the number label which is of the standard keyphone type.

All the components for the Jubilee telephone were bought by Post Office Factories Division and assembled at its Cwmcarn factory in South Wales. From here the complete telephones and their ancillary parts were delivered direct to Telephone Areas over a 12-week period as supplies became progressively available.

Because of the limited number and the likelihood of a future rarity value, the Post Office has made special arrangements for customers with Jubilee telephones who move house. Normally they would leave their telephone at the old address but they are being allowed to take their special phones with them following disconnection by a Post Office engineer.

The Compact telephone revives an old-fashioned design in that the bell is housed in a unit which is entirely separate from the telephone, the two parts being connected by means of an extensible line cord. This means it is small enough to be placed on narrow ledges and window sills while the bell unit may be easily fitted to horizontal or vertical surfaces.

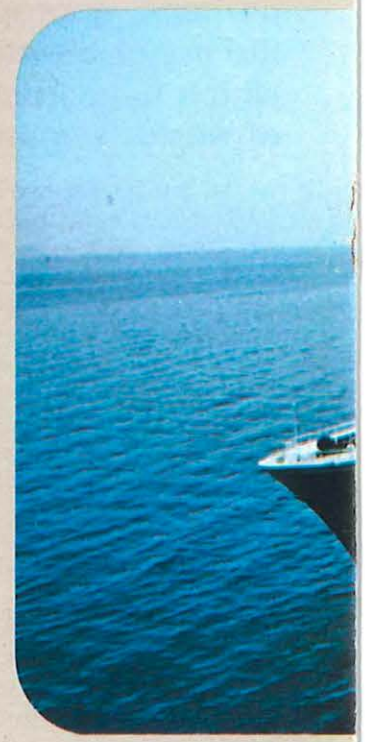
An ingeniously designed wall-shelf is also available. This combines the advantages of the wall-mounted telephone with the mobility of a free standing unit.

The Compact telephone was developed by the Post Office in conjunction with David Carter Associates and went on trial during 1973 in Cardiff, Canterbury and Sheffield Telephone Areas (see Telecommunications Journal, Autumn 1972). Originally it was intended to become standard provision in residential premises, but now it has been decided it will be available optionally on a single payment with no extra rental.

The Compact will be marketed – probably during the middle of next year – in competition with the other telephones in the range.

Comm

D Bishop



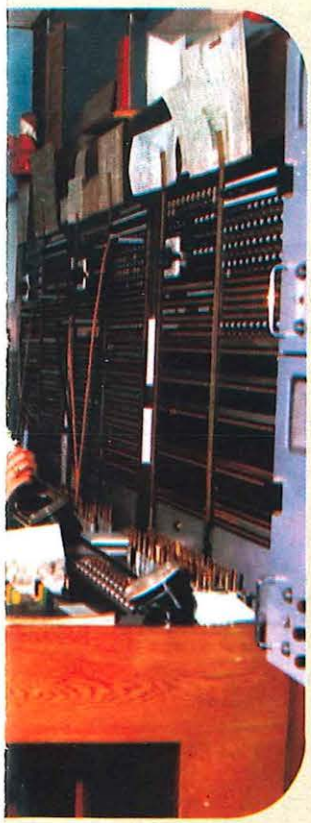
Keeping in touch is no problem f

The switchboard on QE2, which
for 1,500 extensions and serves
and the ship's crew.

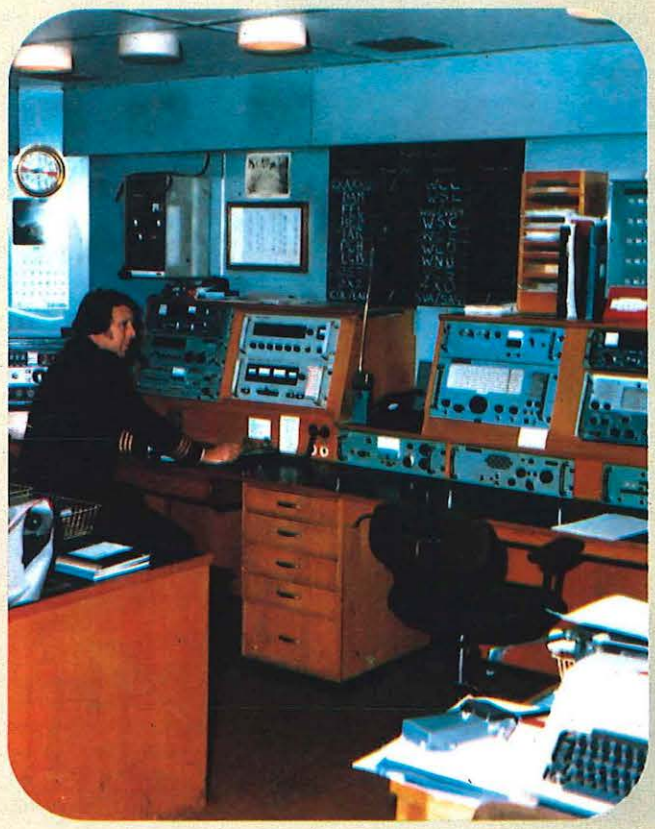
nunications fit for a Queen

or the RMS Queen Elizabeth 2 as she steams the world's oceans.

is equipped
both passengers



Part of the radio receiving room, where QE2's communications services are centred.



TO MANY people a world cruise means "getting away from it all". For others the need remains to "keep in touch". The RMS Queen Elizabeth 2 – or QE2 as she is universally known – offers the best of both worlds. Equipped to provide every conceivable cossetted comfort for her passengers, she also has a comprehensive range of modern communications services for use both at sea and in port.

The sole survivor of a long line of giant Cunard passenger ships, QE2 was originally designed for the United Kingdom – North America route. Changing needs of the travelling public, however, have since extended her use to cruising the oceans of the world.

So how does, say, the hard-pressed business executive maintain contact with his office from the middle of the Atlantic? Or how do an elderly couple make a reassuring call to their family while relaxing on board in the Pacific?

The answers lie in the liner's radio receiving room – the centre of its communications services. From this room, which is manned 24 hours a day, flows a steady two-way traffic of morse, radio-telephone, telex, data and facsimile transmissions.

For commercial telephone calls, radio circuits are extended to a telephone exchange located five decks below the radio room. The switchboard, a three-position PABX equipped for 1,500 extensions, serves both passengers and crew, although a discreet barring system protects passengers and senior officers from unwanted calls.

Suites of coinboxes, permanently wired to the ship's switchboard, are provided for passengers who prefer not to use their stateroom telephones. Recording facilities are also installed in the switchroom to provide information services, including time announcements in four languages.

A radio-teleprinter service linked to the telex network is provided by a transmitter, two receivers and two active selectors. These work in conjunction with Marconi SPECTOR (Single Path Error Correcting Teleprinter Over Radio) equipment connected to teleprinters.

Cunard rents three teleprinters with signalling units, and two perforators on a "no maintenance" basis from the Post Office. Servicing of the teleprinters is carried out at sea by the ship's radio officers, while major repairs and

renewals are undertaken by the Post Office on a cost of works basis when QE2 returns to Southampton.

Facsimile forms yet another part of the liner's communications complex, enabling her to transmit photographs over a radio circuit to suitably equipped shore stations. The equipment is designed for "grey scale" working and is therefore able to accept both black-and-white and colour photographs. Equipment is also installed in the chartroom for the reception of weather charts, which are broadcast from various stations around the world.

The QE2 entered the era of space age communications when she was fitted with satellite transmission equipment in time for a world cruise from New York earlier this year. Installed on an experimental and evaluation basis, it provides facilities for telephone, telex, data and facsimile links with networks around the world. The main equipment comprises a Comsat General satellite communications terminal and a 4-ft dish aerial.

The terminal operates through one of two geostationary satellites, one of which serves the whole Atlantic area and includes the navigable areas of the Mediterranean, Red Sea, Black Sea, Gulf of Bahrain, North Sea, Baltic, most of the Caribbean Sea and the Pacific seaboard of South America. The second satellite serves the Pacific Ocean and covers an area that includes Singapore and the Indonesian Islands to the west, the Bering Sea to the north, California to the east and Australia and New Zealand to the south.

Housed in the radio room, the terminal is a compact free-standing unit with a telephone handset and teleprinter attached. All controls and indicators for service selection and aerial control are clearly visible from the operating position at the teleprinter keyboard. The aerial, together with its associated azimuth and elevation drive, output amplifier and receiver pre-amplifier, is mounted in a radome on a 14-ft mast on top of the ship's penthouse suites.

Once the aerial is aligned with the appropriate satellite it is automatically maintained in the correct direction. The ship's movements – that is, roll, pitch and heading – are transmitted to the aerial's control circuits to keep it aligned, and an automatic "step track" ensures against errors by continuously searching the area of the satellite's location in one-degree steps for optimum signal.

The Atlantic satellite works into an earth station at Southbury, Connecticut, while the Pacific satellite works into an earth station at Santa Paula, California. Telephone circuits are currently handled by an operator at the appropriate earth station, but automatic ship-dialled calls will be available in the near future.

Ship-dialled telex circuits are routed through an exchange computer in Washington, which recognises the ship's answerback and makes the connection to the requested number entered on the ship's keyboard. When the call has been completed, the exchange gives the time and duration of the call and automatically bills Cunard. Operators can assist in telex connections if difficulty is experienced on the automatic system.

The data mode of transmission is capable of 2.4 kbit/s (2,400 bits per second). It may be used for any form of information transfer – such as data, facsimile, or biomedical – which can be contained within a voice bandwidth circuit.

Tests are currently being made on satellite facsimile transmissions using standard duplex equipment which is connected to the Comsat terminal and to an exchange line in Cunard's office at Southampton. A link is established by a radio call from QE2, via satellite to the earth station at Southbury, from where it is extended over the international network to Southampton.

In addition to the wide range of communications services available on QE2 at sea, extensive facilities are also provided when she is in port. Anywhere in the world, for example, up to 40 connections can be made to the local telephone exchange by wiring a shore cable to a port or starboard jackfield, which are in the liner's main entrance lobbies.

At her normal berth at the Ocean Terminal in Southampton, QE2 is connected to the UK telephone network by a purpose-made umbilical cord. This comprises two 50-ft long, flexible 30-pair cables which have special multiple plugs fitted at both ends. The corresponding sockets inboard are permanently wired to the port and starboard jackfields.

Within minutes of docking, the cables are run aboard by docks-based Post Office engineers and, after a quick test of the circuits, the ship is linked to the shore. A group of 25 exchange lines, terminated on the ship's PABX, four external extensions to the local Cunard offices and five coinbox lines for the crew's use are connected in this one operation. When the ship is at sea, the first line of the 25-line exchange group is diverted to the Cunard offices and the remainder are busied out.

When QE2 is in port on either side of the Atlantic, five dual-purpose call offices on board are connected to the local exchange for the crew's use. Each cabinet is equipped with a standard Post Office rented coinbox, for use in the UK ports, and its American equivalent for the other side of the Atlantic.

The Comsat General terminal in the liner's radio room, which provides facilities for telephone, telex, data and facsimile communications via satellite with international networks.

Mr D. Bishop is Public Relations Officer in Southampton Telephone Area.
Acknowledgements to: the Cunard Company and Chief Radio Officers Don Butterworth and Allan Holmes.

PUTTING INDEPENDENT LOCAL RADIO ON THE AIR

WT Atkinson

Special facilities provided by the Post Office have played an important part in the setting up of Independent Local Radio stations throughout the country.

THE LAST dozen or so years have been particularly eventful in the history of sound broadcasting in the United Kingdom. The pop music boom of the early 1960s was a major factor in the creation of "pirate" radio stations and the BBC itself undertook a major reorganisation of its programmes with the introduction of Radios 1, 2, 3 and 4.

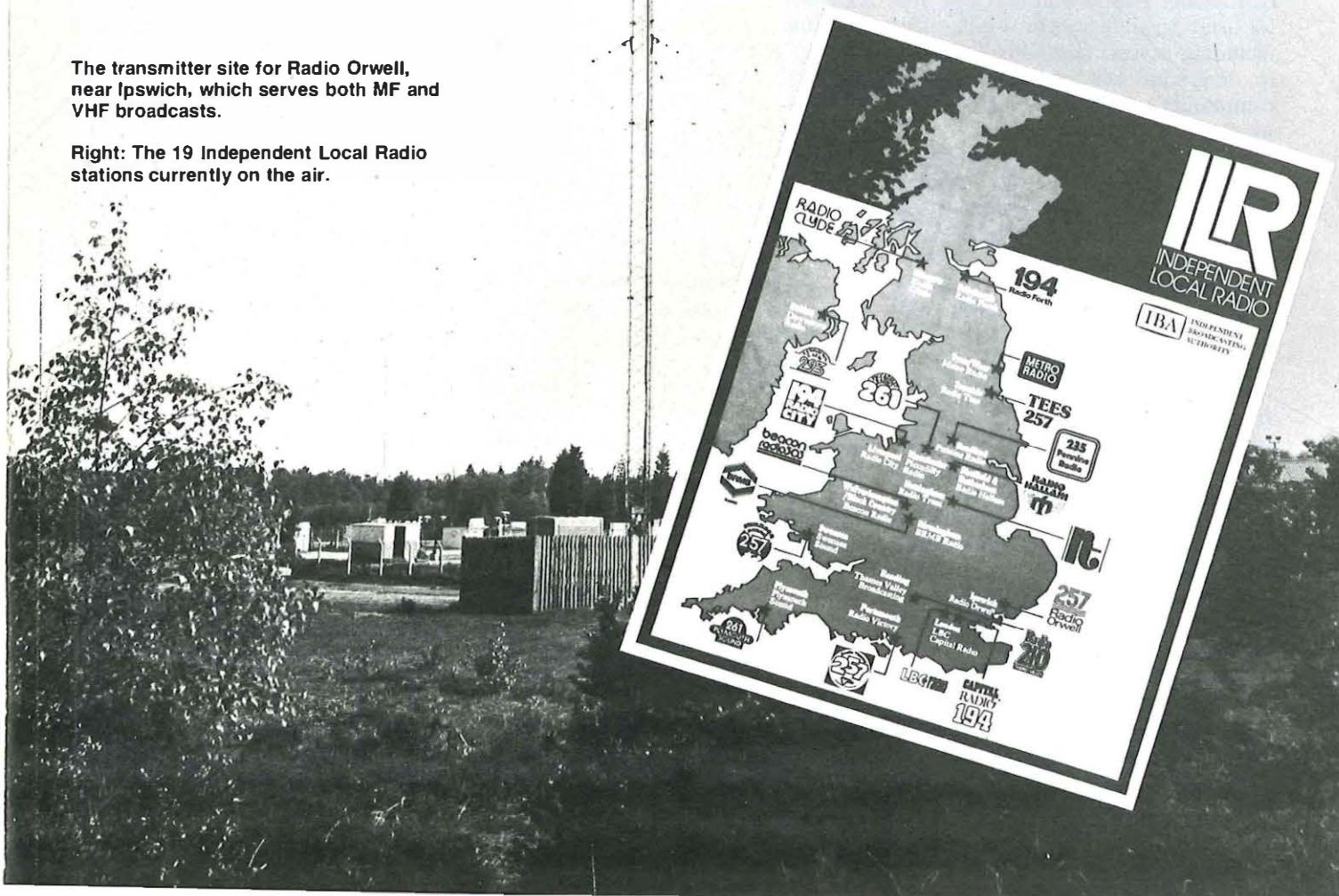
At about this time, too, the Sound Broadcast Act 1964 first suggested the setting up of Independent Local Radio (ILR) and the Sound Broadcast Act of 1972 enabled the Independent Television Authority to become the Independent Broadcasting Authority (IBA) with powers to establish the ILR service. Obviously the Post Office was closely involved because it was responsible for providing the necessary transmission circuits between studios and transmitters, as well as the local and inter-studio connections.

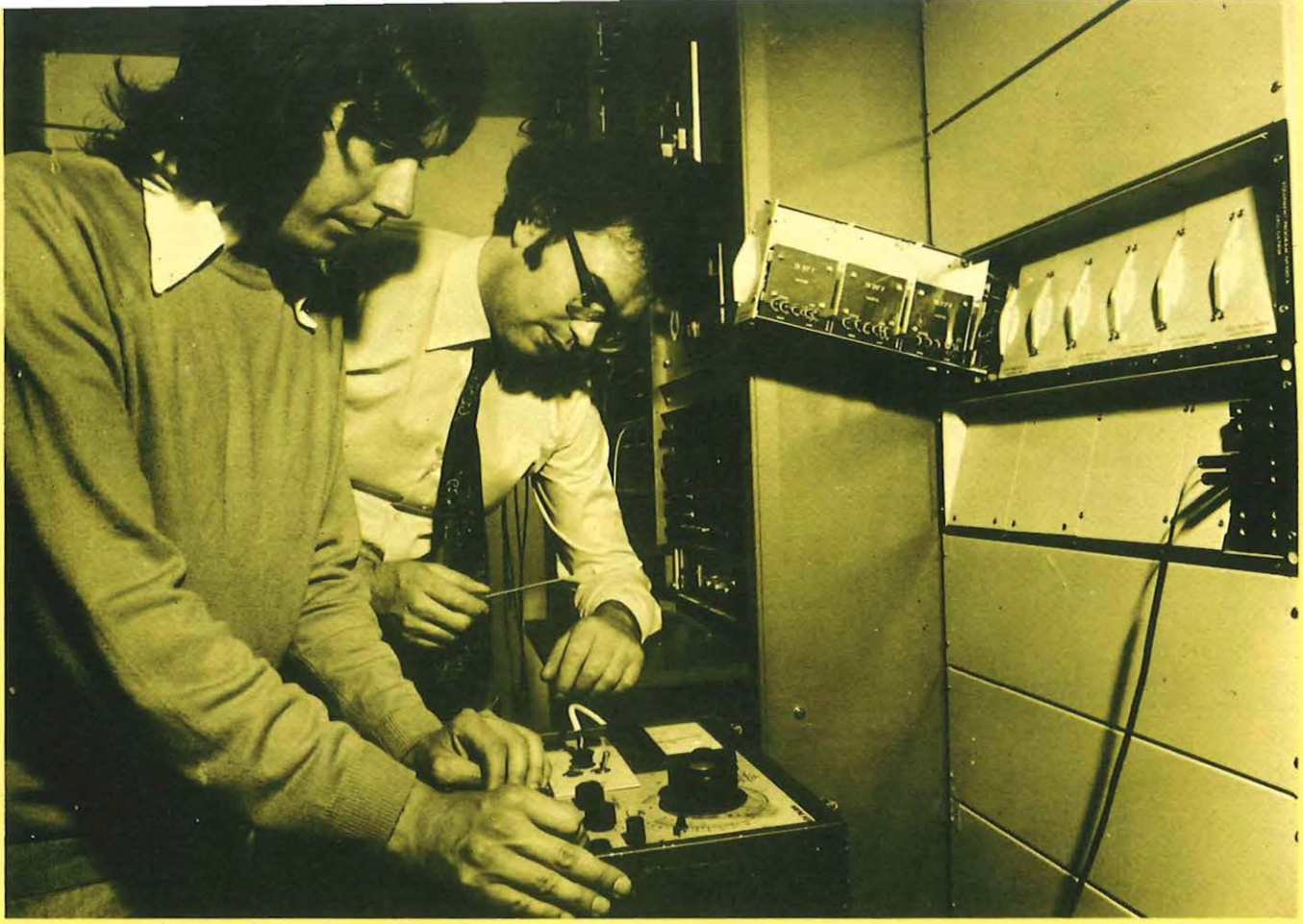
Originally some 60 ILR stations were envisaged but the Government authorised only 19 while awaiting the recommendations of the Annan Committee on the future of UK broadcasting in general. The Annan Report, published earlier this year, in fact favours more stations and if Government approval is forthcoming a rapid expansion of local radio could occur during the next few years.

The first independent local radio sta-

The transmitter site for Radio Orwell, near Ipswich, which serves both MF and VHF broadcasts.

Right: The 19 Independent Local Radio stations currently on the air.





Post Office Technical Officer Chris Brooks, left, watched by Radio Orwell's chief engineer Richard Allison, tests the overall performance of the private circuit which links the Ipswich studios with Independent Radio News.

tions were set up to provide variety both in their locations, and size of areas and populations covered. They ranged, for example, from 8.5 million in London and 2.4 million in Manchester, to 210,000 in Ipswich and 270,000 in Reading. The IBA were asked to cater for listening audiences of varying sizes including several fairly small stations to determine the minimum size of community capable of sustaining a worthwhile local radio station.

Before an ILR station becomes operational the basic Post Office facilities required include a monophonic programme circuit from the studio to the transmitter site for medium frequency (MF) transmissions and a stereophonic circuit to a very high frequency (VHF) transmitter site. In most cases the MF and VHF sites are separately sited.

A programme circuit is also needed from the London Broadcasting Company (LBC), which produces and distributes national and international news for all companies, as well as a telex network from LBC to all companies as support for the programme circuit news feed. And to meet current demand for listener participation programmes, a "phone-in switchboard" is an essential requirement.

Finally, there is a need for various telephone and telex lines and private wires with places of frequent local interest and activity such as town halls.

Discussions had taken place between the Post Office and IBA on all these facilities well before the first ILR station, the LBC, went on the air in October 1973. Many of the foreseeable problems, such as equipment accommodation, circuit terminations and interfaces, had been resolved at these meetings.

The relationship between the IBA and the local companies is similar to that with Independent Television, where the IBA provides the transmitters and the necessary expertise for the quality control of studios and equipment, and the companies are concerned with day-to-day programme production.

All ILR programme companies are, in fact, a consortium representing a wide range of interests and subject to the controls of the IBA on quality and content of programmes. The companies have been set up as a result of the franchise being advertised, the publishing of a specification, interviews of applicant groups and the appointment of the successful applicant.

Very little Post Office line planning could take place until the studio premises were known, and the time between the contractor being appointed and going "on the air" was only about six months. The Post Office, therefore, needed to make a sustained and coordinated effort to meet the "on air" dates.

Perhaps the most interesting aspect of the Post Office's role in setting up the radio stations was the provision of stereophonic feeds to the VHF transmitter. These were a new departure for the Post Office and the first permanent circuits of this type to be provided in the United Kingdom. Previously all permanent programme circuits had been provided as single circuits with a bandwidth of 50 Hz to 8.5 kHz.

The problem arose of not only providing an assured performance of 50 Hz to 15 kHz on each channel of a stereo pair but also matching the two channels in amplitude and phase. The answer came in the development of special new equipment and test gear for these permanent programme circuits, the use of dedicated plant and by restricting their circuit length to 40 km. In this way the required parameters were achieved.

As the ILR service was planned to operate continuously, no time for routine maintenance would be available during normal working hours on these circuits without the use of special make-good facilities. To determine the stability of the stereophonic circuits, tests at monthly intervals between 2 am and 4 am were carried out for a year by Telephone Area staff in London, Birmingham and Glasgow; the IBA carried out a series of tests at these and other stations for the same purpose.

Analysis of results showed that, except for the predicted variations due to temperature, changes in circuit parameters were extremely small. As a

result, it was decided that periodic routine maintenance by the Post Office on the circuits would not be needed.

The VHF and MF transmitters are generally unstaffed, maintenance being by an IBA mobile team. To assist in fault detection and reduce programme losses a sophisticated supervisory and control system has been built in. This is basically a series of programme detectors monitoring the programme path from Post Office circuit input to transmitter output and relaying this information as a coded signal to alarm indicators at the studio.

The control functions are to switch in a reserve transmitter on failure of the main and, if one channel of the Post Office stereophonic circuit fails, to switch transmission to the monophonic mode. On complete failure of the Post Office feed, either transmitter will have a re-broadcast facility from the other and this, again, is switched automatically.

The monitoring has proved satisfactory in practice, and the Post Office has accepted the alarm indicators as the basis of fault reports. In modern popular music, however, there are instances where long quiet passages and periods on one stereophonic channel only have resulted in false indications of programme loss, and this is a situation which may need to be further discussed with the broadcasters.

The ILR stations gather their news in two ways. They have their own newsrooms which collect and broadcast local news and they receive national and international news from Independent Radio News (IRN), which is part of the LBC. IRN provides a full "agency" style round-the-clock news service every day, the news being distributed to each company either by a Post Office telex network or by a dedicated programme circuit distribution network from which it can be transmitted live.

The programme circuit distribution network originates in London and feeds all the ILR companies by way of branching units at appropriate repeater stations. It is, in fact, probably the largest permanent distribution network of its type in the UK and although always used as a network it is rented on an individual circuit point-to-point basis.

One pre-requisite for the successful running of a local radio station is the provision of "phone-in" facilities. Seven years ago talks took place between the Post Office and the IBA but there were no firm orders at that time. In April 1973, however, only six months before the first ILR station began broadcasting, Roger Hedgecoe of Telecommunications Development Department was asked to produce a suitable system (See Telecommunications Journal, Winter 1973-74). Each station's installation was a "one-off" development and had to be built on site to each company's requirements.

Later the BBC also became interested in "phone-in" facilities, as a result of which special equipment, called Telespot, was developed by the Post Office. Telespot is extremely flexible and capable of meeting various demands with the minimum of equipment change. The original "Hedgecoe" system is, however, still giving admirable service.

The first stage in the development of ILR was completed with the launch of Beacon Radio, Wolverhampton, last year. The 19 stations now on the air offer the ILR service to at least half the population of the UK and represent the start of a major new development in British broadcasting. Their success is due in no small part to the efforts and ingenuity of Post Office staff in providing the required facilities in a relatively short time. Equally important is the fact that valuable expertise has been gained and future demands can therefore be met with confidence.

Above: A programme presenter "on the air" in a studio at Radio Orwell.

Below: Miss Judith Rudge, a technical operator at Radio Orwell, handles a call during a "phone-in" programme.

Mr W. T. Atkinson is an Executive Engineer in Service Department at Telecommunications Headquarters, responsible for the maintenance of broadcasters' programme circuits.

The STD 'Trouble-shooters'

N C Rolfe

Using the facilities of a test desk at Cambridge Trunk Maintenance Control Centre, Technical Officer Maurice Flinders localises a fault on a circuit.

SUBSCRIBER Trunk Dialling is now available to all but a few customers in the United Kingdom, and it is essential that the system operates as reliably as possible. Many factors combine to achieve this, but a key role is played by Trunk Maintenance Control Centres (TMCCs). These are installed at every Main Network Switching Centre (MNSC) in the country and their prime function is to co-ordinate maintenance activities on the circuits which interconnect MNSCs and thereby make up the STD network.

Staff at a TMCC are responsible for detecting faulty circuits and localising the faults in co-operation with staff at telephone exchanges and repeater stations, as well as with other TMCCs. They also ensure that faults are quickly cleared and circuits returned to service. As a result, the chances of calls being lost owing to faulty or busied circuits are kept to a minimum and this results in better service to the customer. The possibility of network congestion is also reduced which, in turn, could affect the amount of equipment needed.

TMCCs also co-ordinate maintenance activities on private circuits and networks which they control. In these cases staff are often in direct contact with customers, and their contribution to maintenance activities is vital in minimising inconvenience.

In the past, TMCCs were often located with Repair Service Controls (RSCs) which, in general, deal with customers' complaints about service and which themselves evolved from the original concept of a test desk for checking lines in early manual exchanges. The policy now is that, to reduce noise, TMCCs should be housed on their own away from exchange equipment, but it is recognised that this is difficult to achieve at smaller TMCCs.

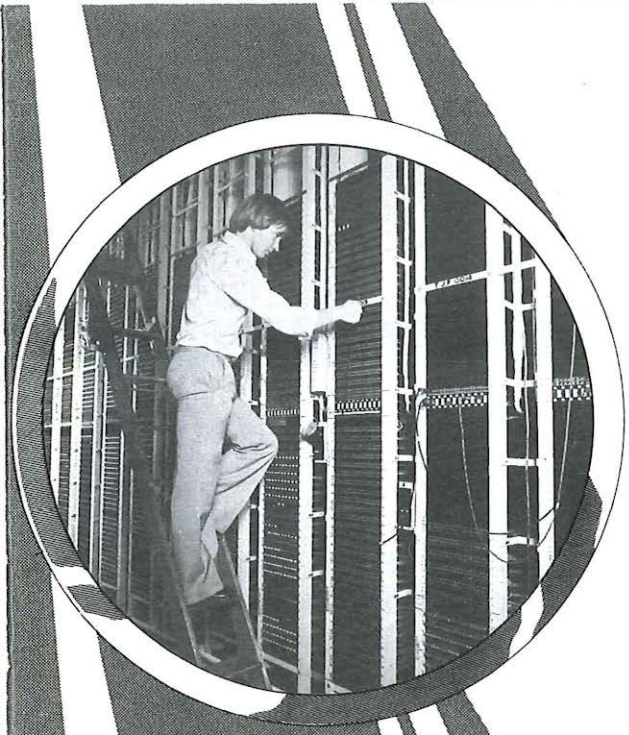
With the introduction of office-type environments for some RSCs, the possibility has been discussed of a similar approach being applied to TMCCs. Test desks and other essential TMCC equipment would, however, be out of place in an office type environment and it is difficult to see how some items could be suitably modified. The general environment is of great importance, and steps have been taken to ensure that when planning new TMCCs the best possible environment will be provided, particular account being taken of noise and lighting considerations.

A TMCC generally comprises four basic blocks – test desks, test jack frames (TJFs), busy frames and trunk and junction routiners. Each test desk has facilities for automatically gaining access to outgoing trunk circuits and for conducting functional and electrical tests upon them. Transmission testing and measuring facilities are provided and, by using connections with TJFs, line signalling tones can be monitored. Where staff suspect a particular outgoing signalling relay set is faulty it is possible, at the test desk, to patch a substitution relay set into the circuit, thus proving by elimination whether the suspect one is operating correctly.

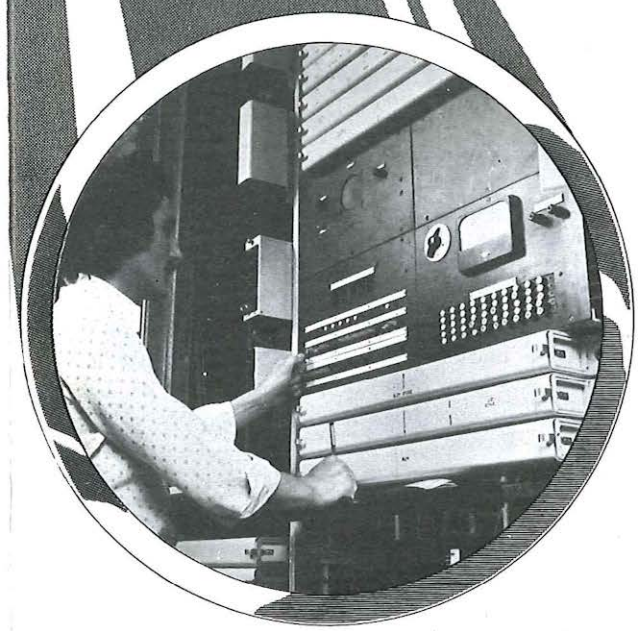
Test jack frames provide direct access to circuits and allow TMCC staff to connect circuits to test desks and to cross-patch circuits by patching in "good"circuits. Busy frames enable staff to "busy" faulty circuits, thus preventing customers experiencing a failed call. Circuits required for maintenance can also be "taken over" in this way but only when existing calls clear down so that they are not interrupted. Under failure conditions some circuits activate alarm lamps on busy frames, and regular checks of these can detect faulty circuits.

Trunk and junction routiners (TJRs) are the basic tool TMCC staff use for detecting faulty circuits. At present they are mainly used only on trunk circuits, but the name refers to a time when all circuits under 40 km were called junctions and those over 40 km trunks. Now any circuit interconnecting two MNSCs is termed a trunk circuit, but the historical name of the routiners remains.

The TJRs gain access in sequence to circuits connected to them and make a test call to distant exchanges, thus testing the signalling and switching functions associated with the circuits. Tones of 800 Hz or 1,600 Hz at known levels are exchanged by the routiners and distant answering equipment to check the transmission performance of



Technician Jed Isbell connects a circuit on the test jack frame at Cambridge TMCC.



Faulty circuits, indicated on dockets produced by overnight routining, are rechecked the following morning on the TMCC trunk and junction routiner by Technical Officer Barry Parr.

each circuit. The calls are then released and the circuits monitored to ensure that they clear down correctly.

TJRs are run automatically overnight, the identity of faulty circuits being printed on dockets together with the numbers of the tests which the circuits failed. During the day TJRs are run manually using a "step over engaged" facility which means that the routiner will stop on faulty circuits and busy circuits not carrying conversations, but will pass over those circuits being used for conversation. In this way all trunk circuits are routine-tested at least once every 24 hours.

Circuits for which dockets have been printed overnight are routined each morning and for those which fail, Trunk Service Reports are issued. A high proportion of faulty circuits, especially those which are reported as busy during the night routine, pass the morning routine. This second routine is, however, necessary to find those circuits which are busy due to fault conditions, and to meet the need for circuit tests at least every 24 hours.

Circuits for which Trunk Service Reports have been issued are then tested from the test desk to localise the faults. These faults are mostly located at either the near or distant switching centre but may be found in transmission equipment between the centres.

Fault locations are usually determined initially by making a test call and monitoring line signalling tones, and then by either substituting the near end signalling relay set or co-operating with repeater station or distant exchange staff as required. When a fault is located, details are passed to the relevant fault control which issues slip numbers entered, with the time the faults are handed over, on the Trunk Service Reports.

On clearance the fault controls advise the TMCC of the faults found and the action taken to clear them. The circuits are then restored to service.

The Trunk Service Report is a two-part form, the completed left-hand side being retained by TMCCs for three months for reference in the event of a circuit failing again within that period. The right-hand side of the form is used as a computer input document for the Trunk Circuit Fault Recording Procedure which gives a monthly printout for each TMCC with Area, Region and national summaries. Each printout gives trunk circuit serviceability, details of out-of-service time per fault and fault rates for each fault category. Thus the system provides a performance monitor and gives an indication of where problems are being met.

TMCCs are mainly concerned with outgoing circuits as it is for these that they are the nominated control and have responsibility for performance. Their staff, however, are often called upon to deal with incoming circuits when co-operating with other TMCCs. Circuit provision staff also make use of TMCC equipment as, on initial provision, circuits must be cabled to TJF and TJR access circuits and subsequently be adjusted to give the correct transmission performance. This latter operation is carried out from the test desk in co-operation with repeater station staff. At the larger TMCCs there are dedicated positions provided for circuit provision use.

When dealing with private circuits, TMCC staff are not concerned with routining, but deal with fault reports as they arise. The types of circuit and equipment used vary widely which means that a high degree of background knowledge is required in localising faults, especially those occurring on complex private networks and those involving data circuits. A computer input docket is completed for each private circuit fault, the returns from which give a measure of performance in maintenance.

As far as maintenance of the STD network is concerned knowledge of switching or transmission equipment alone is not enough. TMCC staff must know how the network is assembled and must be expert in the operation of all the signalling systems used.

Mr N. C. Rolfe is a head of group in Service Department at Telecommunications Headquarters where he was formerly an Executive Engineer concerned with maintenance and operational aspects of TMCCs.

A view from the bridge

Continuing our series on some of the many different jobs essential to efficient operation of Post Office Telecommunications, CAPT R. M. TUCKWELL highlights his responsibilities as a cableship Commander.

IT'S COLD, wet and blowing a gale so hard that the angry sea is whipped into boiling, 25 ft-high swells: the sort of weather, in fact, that can send a shiver down the spine of even the hardiest seaman, and which prompts all but the largest ships to scurry for the sanctuary of the nearest harbour or the relative calm of coastal waters.

But it's at times like these that the Master of a Post Office cableship may well have to take the decision to leave his haven. For one of the fleet's main tasks is to make urgent repairs to a seabed network of more than 19,000 miles of telecommunications cables which provide vital links for international services.

Take, for example, the breakdown of communications between Britain and the Channel Isles earlier this year, when all cables were severed within a few hours. The immediate need was to get the main cable, from Bournemouth to Guernsey, working again in the shortest possible time. When I received this priority instruction, however, my ship – the CS IRIS – was sheltering from storm force westerly winds off Margate.

Getting under way was quickly achieved but, as often happens, the unexpected arose. Soon after leaving Margate our port engine developed governor trouble. Fortunately, the makers had an engineer in Dover and he was duly embarked, mentioning that he would have to be back in Dover that evening. In view of the urgency of the task, and with the evening some hours away, I decided he would rather see a cable repair operation – my action, perhaps, once being known as Shanghaiing!

An approximate location of the fault had been determined by tests from St. Peter Port repeater station in the

The Post Office cableship IRIS which, like its twin – the MONARCH – is on continuous standby for repair around the British Isles and near continent.

Channel Isles, and was given to the ship over radio-telephone by way of the Guernsey Harbourmaster. On arriving in the area, therefore, my first task was to identify the fault's position as accurately as possible.

This is normally done by a method known as electroding, which consists of towing two electrodes astern of the ship and measuring the potential difference produced by the field of a low-frequency alternating current of either 17 or 25 Hz. The deflections cease when the fault has been passed, and by allowing for the distance from the bridge to the electrodes, a fairly accurate fault position can be calculated.

Using one of a selection of hook-like devices, the ship next grapples for the cable and brings it to the surface. A skilled team secures the cable on board, cuts it and carries out tests back to the land station which enable me to identify the actual position of the fault. The damaged section is then "cut out", a new section is jointed in and the cable is returned to the seabed. Finally, the system is tested before being restored to service.

Despite the fact that all these repair operations on the Bournemouth-Guernsey cable break had to be carried out in weather conditions far worse than normally experienced, the system was restored in reasonably quick time. With a southwesterly force 8 or 9 (40 knots) and a steep swell, it was an extremely difficult task, made practicable largely by the excellent manoeuvrability and station keeping of the IRIS.

These characteristics – common features of the twin cableship, the MONARCH, which was also involved in the Channel Isles repair operations – result largely from the vessel's special design which incorporates a bow thrust propeller and a rudder thrust unit.

The Post Office cableship fleet consists of three vessels, all based at Southampton. The IRIS and MONARCH, both of 3,900 tons, are on continuous standby for repairs to cables around the British Isles and near continent while the third, the 6,100-ton CS ALERT, is on 24 hours' notice at all times for repairs to the transatlantic telephone network. Each ship is equipped for any eventuality in the maintenance role, from a very simple joint in a cable crossing a river estuary to the more sophisticated joint that is necessary for modern cables.

Typical activity aboard a Post Office cableship.

Life on board these vessels is probably unique in modern seafaring in that it is impossible to forecast when, and for how long, a ship is going to be ordered to sea. And while my business as Master is broadly to lay and repair cables, I have ultimate responsibility for all ship-board life.

Although, for example, a ship's crew works long hours at sea, the problems of leisure time activities and maintaining morale must concern the Commander. When such duties are aligned with the difficulty of predicting accurately the duration of a repair programme, it can be seen that the Commander and his officers have special responsibilities which very often exceed those expected of shore-based management.

Another major problem, which concerns both the Commanders and the Post Office Marine Division, is how soon a ship can get on station to carry out a repair. One of the many constraints is adequate manning at the time a fault occurs to enable a ship to put to sea without undue delay. The complement of officers and crew, while adequate for most occasions, does not always have the flexibility to cope with sudden demands. Often staff will be on leave, and I am occasionally obliged to recall essential personnel before an operation can begin.

With cableship charter rates alone reaching £7,500 a day, it is understandable why ships are urged to complete all operations as speedily as possible. In addition there are such factors as the unquantifiable cost of lost revenue while a cable system is out of operation. Fortunately, standby facilities are normally available to reroute circuits on to other cables and then by way of the inland networks of the terminal countries, and lost revenue in these instances is reduced to a re-routing charge for the facilities and rental of the cable capacity which is in temporary use.

With the increasing capacity of new submarine cable systems, however, the principle of re-routing is becoming more difficult and expensive. The trend must therefore be towards even more rapid repair of systems, thus reducing their out-of-service times to a minimum.

It is in this respect that the problems associated with carrying out efficient repairs have been immeasurably eased by the introduction of the modern cableships, IRIS and MONARCH, whose handling techniques give greater flexibility in operations (see "The Birth of a Boat," Telecommunications Journal, Autumn 1972).

These new ships also provide considerable improvements in officer and crew accommodation, which enable the Post Office to compete more effectively in the labour market. Indeed, it has been my experience that once a recruit stays with a ship for more than a few repair operations, he tends to identify himself with it and remains with the Business.

Overall, the Post Office's cableship fleet and its Marine Division are now better equipped than at any time in their history to meet the demands placed upon them. With the continued technological advances in undersea cable development, it is encouraging to know that the Post Office is fully geared to play a prominent role in both the provision and maintenance of international communications as they continue to grow.

Avoiding explosive situations

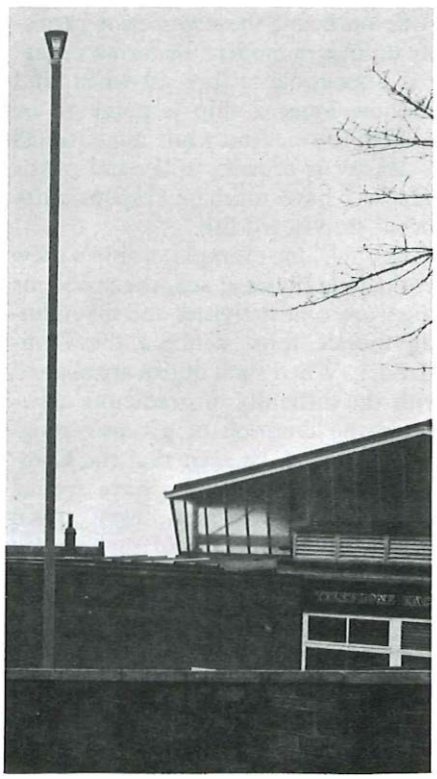
JO Colyer and M Hannan

Aided by close co-operation between the Post Office and British Gas, new and improved methods have been developed for the prevention, detection and location of gas leaking into underground telecommunications plant.

IN MEETING the service requirements of industrial, business and residential areas, it is often necessary to provide gas mains and underground telephone plant close to each other. If gas leaks occur, therefore, Post Office cable ducts, jointboxes and manholes generally provide a potentially easy path for the escaping gas.

These problems have increased in recent years with the growth in both telecommunications and British Gas networks, particularly the introduction of high-pressure mains carrying North Sea gas. As a result, it has become clear that risks to Post Office staff and equipment can only be minimised by providing more comprehensive safeguards and by close co-operation between the two organisations in gas leak prevention, detection and repair.

Prevention is, of course, the Post Office's first line of defence. The consequences, for example, of gas leaking into telecommunications buildings by way of their cable chambers could be very serious although, fortunately, such instances are rare. Here, prevention is achieved primarily by duct seals which are augmented wherever possible by ventilation.

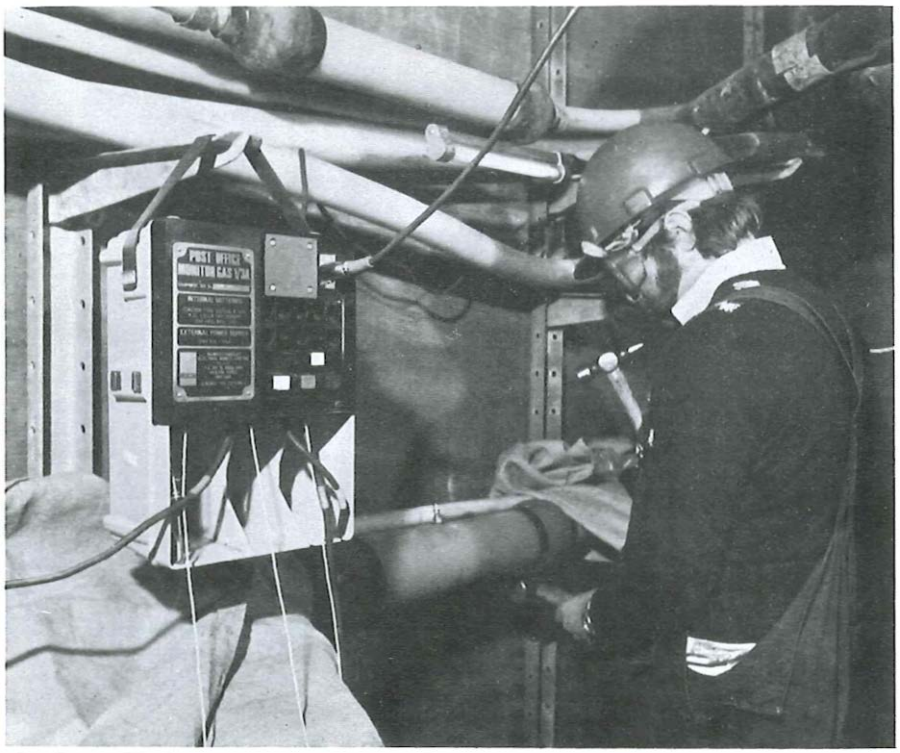


A lamp standard type of ventilating shaft for telephone exchange manholes, which has a special top to keep out birds and prevent down-draughts.

Double duct seals – one in the cable chamber and one in the manhole at the far end of the lead-in – are now standard. Improved methods of sealing give great reliability and, where two good seals can be made, no further protection for a building is normally necessary.

Recent work has also shown that a properly designed ventilating shaft can clear gas from an exchange manhole so effectively that it prevents even a quite large leak from building up an explosive concentration. The shaft normally consists of a tall lamp standard, with a special top to keep out birds and prevent down-draughts, erected close to the manhole and connected to it by two short ducts.

It is not practicable to seal Post Office manholes and jointboxes against gas ingress, so safety in these situations depends on careful testing. Current regulations and procedures for testing are clearly set out in Telecommunications Instructions, and all indications of the presence of gas are reported to British Gas. External staff working at



The Post Office's new portable gas monitor stands guard in a manhole while jointer Brian Williams prepares to open a junction cable. The equipment monitors three different points and gives audible warning of gas ingress, even at low concentration.

manholes and jointboxes, for example, should always carry out tests before starting work and at other regular intervals, and since the mid-1960s the gas indicator has become a familiar item of equipment for this purpose.

For long periods of work, however, it would be more convenient for repeat tests to be made by a monitor which operates every two minutes or so. Portable equipment, which enables these tests to be made at three different points in a manhole, has been developed and is expected to go into service this year.

Equipment similar to the portable monitor has also been developed for use in cable chambers. Some 1,500 monitors have been purchased and installation is already in progress for buildings considered to be particularly at risk.

The cable chamber monitor uses power from the exchange battery and can be connected into the exchange alarm system. It gives a warning for a gas concentration of 20 per cent of the lower explosive limit (LEL) and a second alarm for 50 per cent LEL. The LEL is the minimum proportion of gas in air that will explode or burn, which for North Sea gas (methane) is about 5 per cent gas and 95 per cent air.

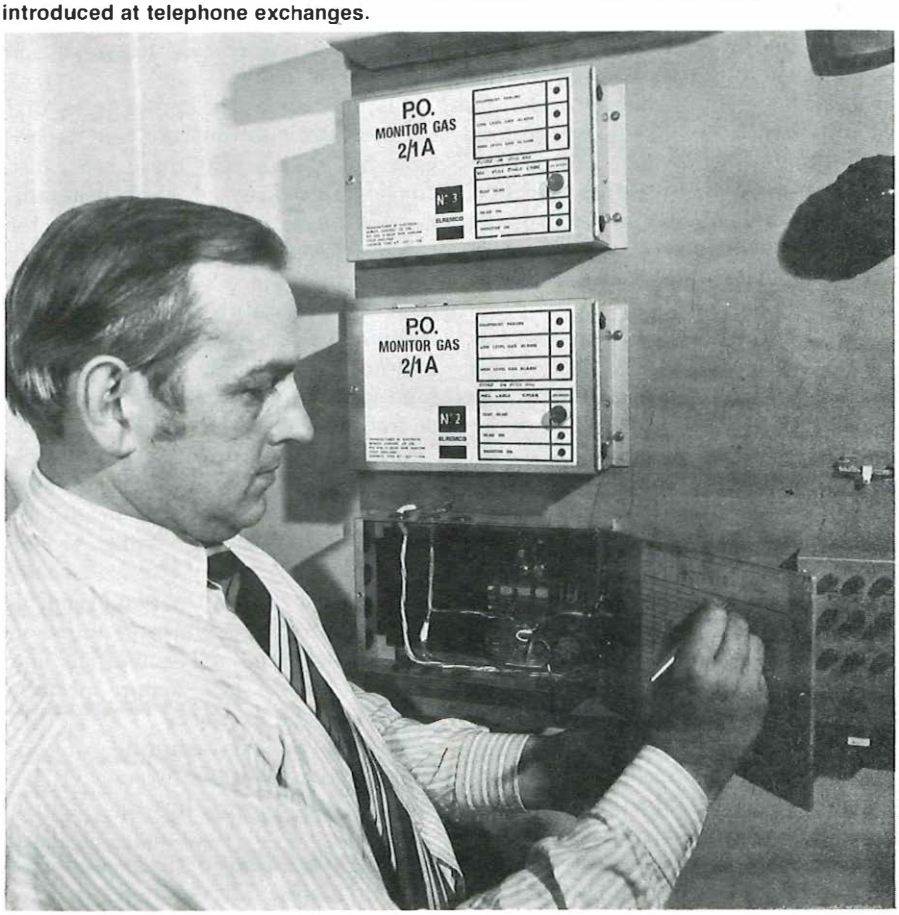
When a gas leak is detected remedial action must be taken, and it is here that a number of new co-operative arrangements have been made between the Post Office and British Gas. Probably the most important are those for ensuring quick reporting of and attention to leaks. This has been achieved by the setting up of special local communications facilities between liaison officers of the two organisations.

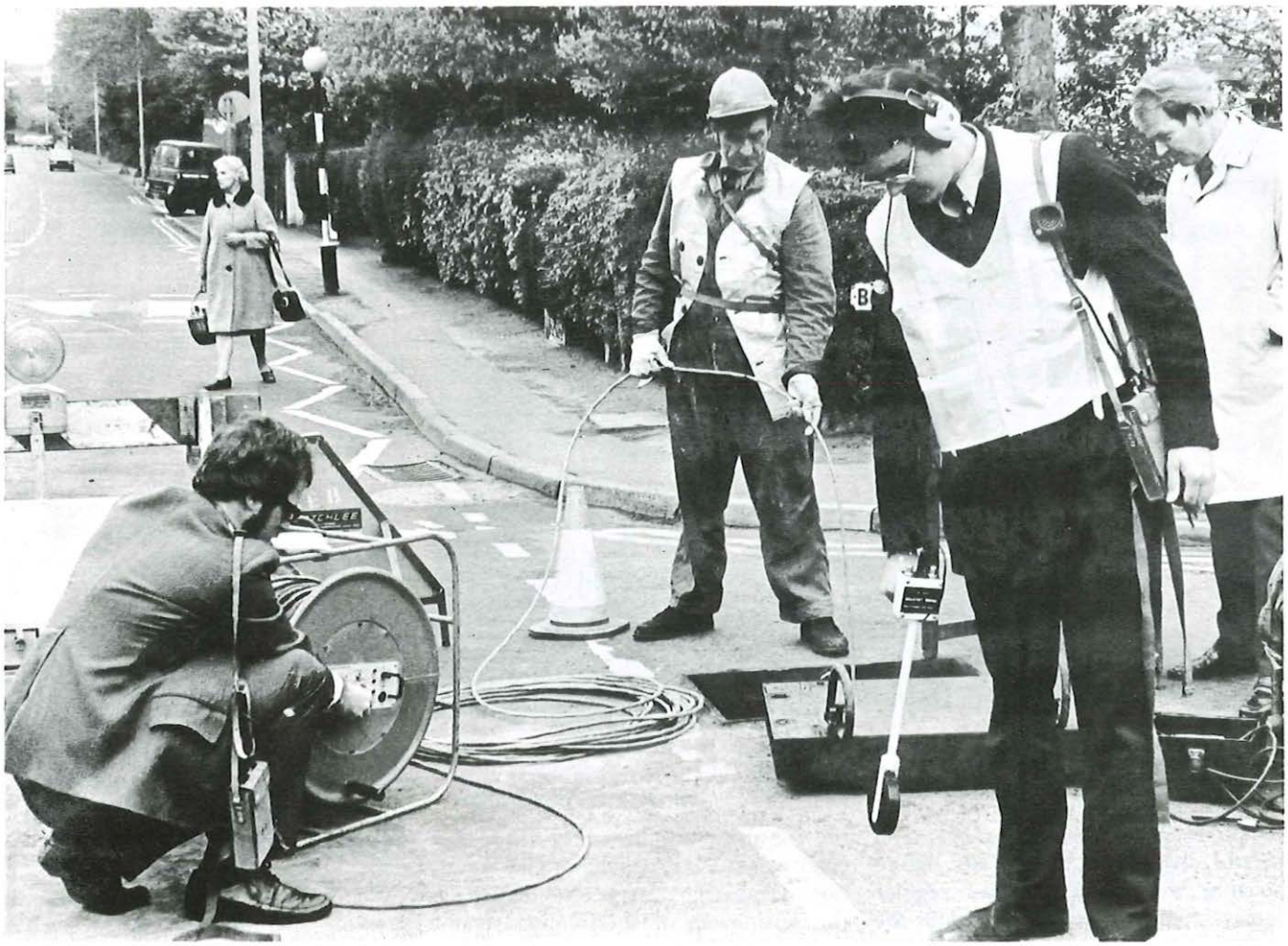
A good example of this close co-operation is a new, improved technique for the detection and location of gas leaking into Post Office cable ducts, which relies for its operation on the staff of both organisations. While British Gas normally use special overground equipment to help trace leaks, it sometimes becomes necessary to drive holes into the ground along the line of the gas main. Apart from being time-consuming and expensive, this may also be hazardous to other undertakers' plant. There is always the possibility, too, that long sections of gas main may have to be excavated.

The new technique eliminates the need for both making holes and large-scale excavation. It uses a sensor, housed in a probe which is pulled by draw rope through the duct where Post Office tests have indicated the presence of gas. The sensor is connected electrically to an operating panel at one end of the duct section, and when a gas ingress point is encountered, audible and visual warning signals are given on the panel, the frequency of these signals indicating gas concentration.

When the signals are received, the drawing operation is stopped and the

Assistant Executive Engineer George Leonard records details of a routine test on the alarm of one of the cable chamber monitors now being introduced at telephone exchanges.





Author Matthew Hannan, far right, watches a trial of the new technique for detecting and locating gas in Post Office cable ducts. Technician Sam Sanderson handles the probe's drawrope while British Gas officers adjust the operating panel and test the overground receiver.

position of the trouble is located by activating a small transmitter in the probe. This is coupled inductively to a receiver which is carried overground along the line of the duct. The ground surface is marked at the probe position and, following re-runs to confirm the location, excavations are made to carry out the necessary repair or replacement of faulty main.

This new method of location has already been used effectively on a trial basis in a number of Telephone Areas and could prove invaluable to both the Post Office and British Gas. Following the successful field trial, arrangements are now being made to permit British Gas to introduce the probe for regular use in Post Office ducts throughout the country.

Use of the probe can reduce costly surface reinstatements and minimise disturbance to Post Office plant, as well as enabling quicker restoration of telephone service after cable breakdowns where gas has been found. Programmed dates for installation and maintenance of the telephone network should also be more realistic as existing work is less likely to be held up for long periods by unforeseen delays caused through gas leaks.

It is, of course, the minor leaks that are most difficult to locate, and experience has shown that these can cause considerable delays in work programmes. While Tunbridge Wells Area, for example, were experiencing difficulty with two cases of gas leakage into duct lines the possibility of using the new technique arose. The problems centred around areas where a complex of high-grade cables existed and density of traffic was high.

Following discussions at local level, the British Gas area office quickly obtained agreement from its headquarters for Tunbridge Wells to be included in feasibility studies already in progress between the two organisations. The Area was also included in the later field trial, a liaison officer and party of field staff being specially trained for the exercise.

Another typical example of co-operation between the two concerns is the Aperture Survey, in which British Gas staff use an extremely sensitive detector at openings in the ground near to their mains. The keyholes in telecommunications jointboxes are ideal for this purpose and, with Post Office help in making duct records available and clearing blocked keyholes, large lengths of gas distribution pipes can be monitored for leaks. The detector is much more sensitive than the Post Office's gas indicator and can detect traces far below the LEL.

Organisation of the Aperture Survey parties has still to be finalised, but British Gas expect to increase their use for Post Office plant in the future. At present some parties use hand-held equipment, while others use vehicles equipped with pen recorders connected to detectors and the vehicle's mileage meter so that the whole process can be mechanised.

Mr J. O. Colyer is a head of group in Operational Programming Department at Telecommunications Headquarters where he was until recently responsible for gas detection and precautions in Post Office buildings and plant.
Mr M. Hannan is an Assistant Executive Engineer in Tunbridge Wells Telephone Area, responsible for external plant maintenance.

Operator services - the changing pattern

AE Garrett

Increasing automation of the telephone network over the years has had a major effect on the role of the Post Office operator. This article, which is based on an in-depth study in Eastern Telecommunications Region, describes changes that have taken place and outlines planning considerations for operator services of the future.

THE PROCESS of converting the United Kingdom telephone network from manual operation to a fully automatic system began in 1912 with the opening of the first Strowger equipped exchange at Epsom, Surrey.

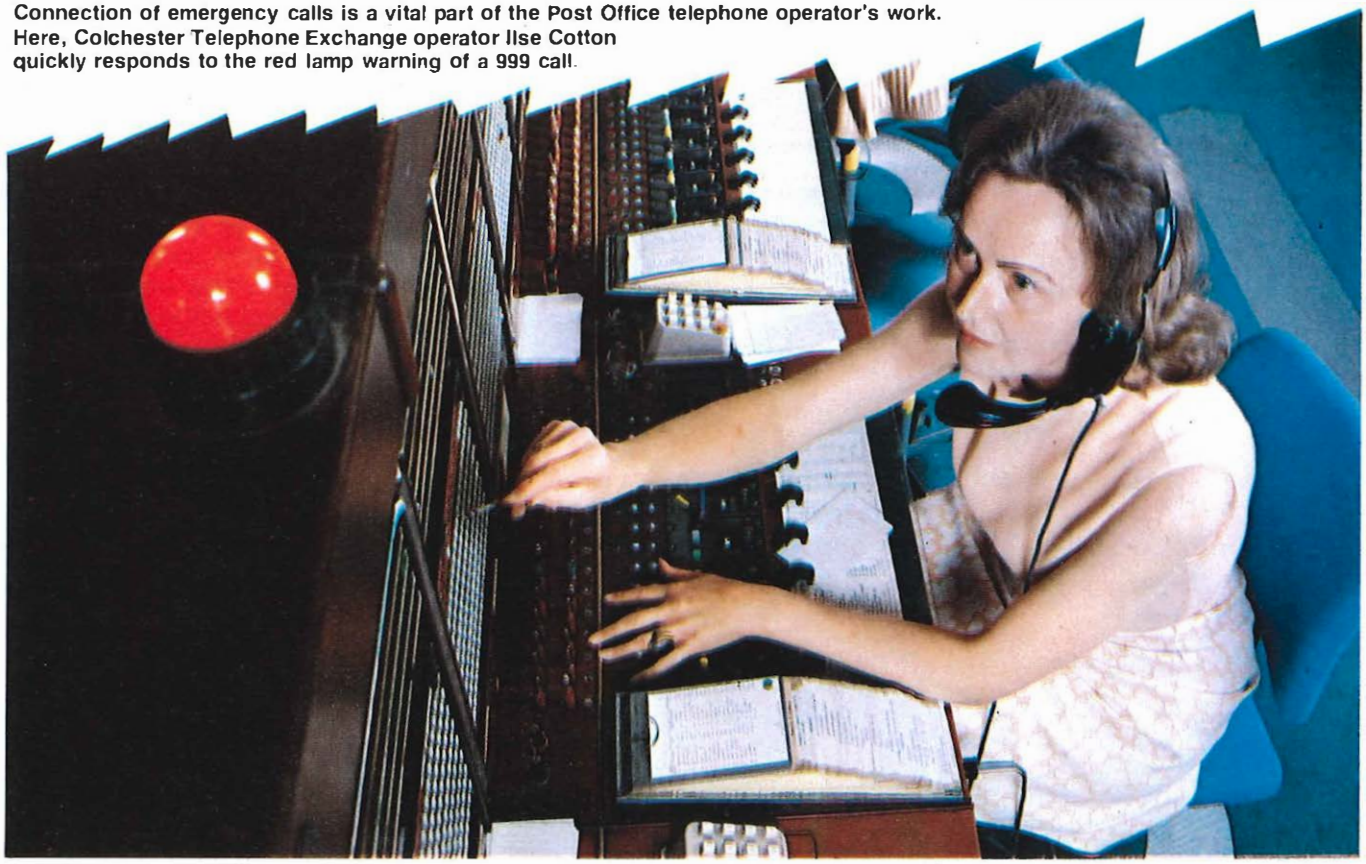
Since those pioneer days there have been countless technological advances and over the last few years, in particular, the development of improved signalling systems, communications satellites and high-capacity submarine cables have enabled almost all UK customers to dial their own calls throughout Britain and across the world. Last year, in fact, saw the last few manual exchanges converted to automatic.

Not surprisingly, one of the major effects of these spectacular achievements has been on the role of the Post Office telephone operator. From the earliest days of the system operators have always been an integral part of the service and while, originally, their main job was the connection of calls, it is now more concerned with giving assistance and connecting the more complex type of call. Because of these changes it is necessary to consider the operator service of the future.

It is vital, for example, that under full automation the operator service is properly tailored, not only to meet all customer requirements until the forthcoming era of digital switching, but also to be a viable, economic undertaking for Telecommunications.

Before the introduction of Subscriber Trunk Dialling (STD) in 1958 all calls outside the local area of each automatic exchange – over 15 miles chargeable distance – needed to be connected by the operator. As STD became available to more customers and they became familiar with the new system, however, the need for operator involvement began to decrease. Until 1970, this decrease was offset by the increasing number of new customers, as well as by technical constraints and delays in the provision of equipment which

Connection of emergency calls is a vital part of the Post Office telephone operator's work. Here, Colchester Telephone Exchange operator Ilse Cotton quickly responds to the red lamp warning of a 999 call.



restricted the number of distant exchanges that could be dialled direct.

In addition, although the earlier introduction of trunk mechanisation had reduced the amount of operating work required to route calls over the network there were, nevertheless, many calls which still required the assistance of an intermediate operator, including those calls routed to manual exchanges.

Thus the expected reduction in the number of telephone operators during the 10 years from 1958 announced in the White Paper "Full Automation of the Telephone System", was deferred. The 1962 expectation that the 306 Operator Service Centres (OSCs) then existing nationally would fall to 200 with full automation, has not yet been achieved. In fact, there has been a small increase in their number.

During the early 1970s progress towards full automation of the system was being made, but there were still technical limitations restricting the number of exchanges that could be dialled direct over the STD network and where access to the transit network was needed. This required the provision of a separate network using a combination of fast signalling techniques and high-grade circuits over which calls could be routed through a number of switching stages without degrading the transmission quality; thus making possible the ultimate aim of complete inter-dailling facilities to all customers.

"Transit" introduction began in 1971 and the majority of Group Switching Centres (GSCs) now have access to the network. Some 75 per cent of the total planned transit routings are now available to customers and it is hoped to complete the programme by the end of next year. This, together with STD access over the non-transit network, means that customers are already dialling all but a few of their trunk calls.

In addition to increased dialling access within the inland system, considerable progress is now being made in providing customers with International Direct Dialling (IDD). This facility is already available to about 75 per cent of customers and the programme will be virtually completed by 1981.

The provision of International Demand Service (IDS) facilities to give customers code dialling access to International Control Centres (ICCs) for those overseas calls which cannot be dialled direct, is also well under way. The need for assistance by inland operators in the connection of overseas calls is rapidly declining as a result of these facilities.

Although the longer term effects of full automation on operator traffic were broadly anticipated, it could not have been foreseen that a critical stage of the programme would also coincide with the present economic recession. As a result of the general decline in business activity and increased tariffs, the number of calls being made is fewer than forecast, particularly those which are not dialled direct. This has accelerated the rate at which the traffic handled by operators has fallen.

A significant aspect of the operator's function, of course, is concerned with special facility, enquiry and directory enquiry (DQ) calls. Special facility calls are those where the customer wants an additional service such as transfer charge, personal, credit card, freephone, or advice of duration and charge (ADC). With the advantages of STD, demand for some of these facilities has receded and there is now little call for personal or ADC services. There is, indeed, evidence to suggest that fewer transfer charge calls are made where customers have direct dialling access.

The only real growth element of operator traffic at present is DQ calls. The number of these calls has increased by about 12 per cent per year during the last five years. The rate of growth has now slowed down partially owing, no doubt, to the recession and is currently about six per cent a year.

The main problem associated with DQ is the increasing pressure on storage space in exchanges to house the growing size of directories and yet enable operators to retain easy access to them. To overcome this, trials have been carried out into the feasibility of a microfiche system (see Telecommunications Journal, Summer 1976), and it is planned to introduce the system nationally within the next two years.

As well as these specific operator functions there are, of course, many others, not least of which is the need to have someone to whom customers can readily go for help when the automatic system develops faults or becomes congested, and for the connection of emergency calls.

In planning operator services of the future the first essential is to determine the likely size of the system. The various means of meeting this need then have to be explored from both practical and cost points of view, taking into account the need to provide exchange staff with a continued variety of work and reasonable career prospects.

The present situaton is that there are in the UK more than 300 OSCs varying in size from 10 to more than 100 installed positions. Experience has shown that, generally, a unit of fewer than 15 busy-hour positions is too small to constitute a desirable management unit and there are indications that effective management becomes more difficult above about 60 positions.

Each OSC needs to be examined in relation to its expected size and with regard to the overall requirement for each General Manager's Area. If there are costs which could be avoided if traffic were transferred elsewhere, then the various costs have to be quantified and alternative options for meeting the

"Directory Enquiries – which town please?" DQ calls are a continuously growing element of operator traffic.

Typical older-type switchroom of a medium-sized Operator Service Centre, showing how relatively few fitted positions are now staffed. Enquiry positions are located down the centre of the room.

overall Area forecast identified and costed.

There are several factors to be considered, including the type and age of the switchboard equipment installed at each OSC to handle call connect traffic. As far as EQ and DQ positions are concerned, however, modified call-connect positions which would not otherwise be needed can be used for EQ, and the few remaining DQ cord-type switchboards can be replaced by modern DQ desks if necessary.

If replacement of an OSC is necessary new accommodation may be required, involving high building and equipment costs. The total capital cost for replacing an OSC of, say, 40 positions in new accommodation is likely to be in the region of £500,000. It is necessary, therefore, to establish whether more economic options are available before a commitment of this kind is made.

The environment conditions at each OSC have to be considered. Although redecorating and refurbishing of accommodation is carried out whenever possible, the physical layout of some of the older buildings is less than ideal. Considerable expenditure may be necessary to raise conditions to the level of modern standards.

Important, too, is the adequacy of operator recruitment potential to meet expected need. In the past OSCs have often been located with little regard to the ability of the Post Office to attract sufficient staff of the right calibre for operating work and, while in the present economic climate recruitment presents little difficulty, it is an important aspect in deciding on the future location of OSCs.

In many cases OSCs occupy accommodation in the same building as the customers' local equipment and/or the switching equipment associated with the GSC. Because of the growth of the automatic system and the need to modernise existing equipment there is increasing pressure for more equipment accommodation space. The cost of extending an existing building or, where this is impracticable, the purchase of a site and erection of a new building is considerable.

In many cases substantial additional costs would be incurred for diverting underground cables to a new location which may not in itself be the most economic point for the area served. The possibility of deferring or avoiding future building costs by utilising OSC accommodation for equipment use must therefore be considered where this option is available.

Finally there is the practicability and cost of transferring operator traffic from one OSC to another to consider. The technical requirements, including specified transmission standards, additional equipment and circuits which would be needed to re-parent traffic, have to be evaluated and the costs balanced against savings from other sources.

The final decision whether to adopt a particular planning option has to take into account not only quantifiable costs but also the views of all those who are concerned.

Since exchange staff must either be re-deployed or made redundant as a result of OSC closures it is imperative that all practicable measures are taken to reduce the impact on staff to a minimum.

An evaluation of all the factors suggests that the Post Office needs to progress towards a far more compact system than at present with possibly little more than half the existing OSCs being retained. The practicability of divorcing call-connect from EQ/DQ work has been studied; apart from the larger conurbations, however, separation would not at present appear to be economic or advantageous to management or staff.

Once a strategy has been determined, the details of implementation will need to be thrashed out, and this will inevitably take time in view of all the different interests involved. Nevertheless, there seems little doubt that by the mid 1980s a more efficient and streamlined operator service could be available to the benefit of customers, exchange staff and the Telecommunications Business as a whole.

Mr A. E. Garrett is a Regional Operator Service Adviser in Eastern Telecommunications Region and was formerly involved in operator service planning in the long-term Planning Group.

MISCELLANY

Directors on order

An order worth about £7 million for advanced electronic equipment to cut maintenance costs in telephone exchanges has been placed by the Post Office. It follows extensive tests at Surbiton telephone exchange, Surrey, where the prototype equipment was demonstrated publicly for the first time in June. The new equipment, known as electronic directors, will be supplied and installed by Pye TMC Ltd. at 243 exchanges in London, Birmingham, Edinburgh, Glasgow, Liverpool and also in Manchester.

Each call dialled within these areas is controlled by a director which governs the setting up of every call within the area. Once the call is connected the director switches itself out of circuit and becomes free to deal with the next call. The equipment automatically stores the dialled numbers and directs the call to its destination.

A total of 280 electronic directors are to be provided under a modernisation programme in which all existing electromechanical directors are to be replaced by the end of 1981.

Full EPSS working

The Post Office's Experimental Packet Switched Service (EPSS) has been brought into full operation following the progressive extension of facilities to users since late 1975. Completion of the last phase was made possible by delivery of the remaining hardware and final development of the necessary switching software.

Based on packet-switching exchanges in London, Manchester and Glasgow, EPSS enables data to be sent between participants in the form of fully addressed blocks or packets. The three exchanges are fully interconnected by 48 kHz circuits operating at 48 kbit/s.

So far, the three exchanges operate for eight hours every weekday, presently serving more than 30 computers. Ultimately the network is expected to support 43 packet-terminal connections, carrying data at rates of 2,400, 4,800, or 48,000 bit/s, and up to 100 asynchronous character terminals transmitting at 110 or 300 bit/s and linked to their local packet-switching exchanges over the public telephone network.

EPSS is planned to operate for a minimum experimental period of two years to provide users and the Post Office with experience of operating in a public network environment. During this period, the hours in which the service is available will be progressively increased.

Waveguide go-ahead

A commercial millimetric waveguide telephone system linking Bristol and Reading has been given the go-ahead by the Post Office, and is due to become operational by 1983. Detailed planning of the 125 km route is already under way.

Construction and laying of the 110 mm steel pipe housing the waveguide is due to start in 1979, with completion in 1980. Installation of the waveguide will follow immediately after, to be finished by 1981. Five booster stations will be needed at about 20 km intervals along the route, and installation of their electronic equipment is scheduled for 1982.

At Reading, the proposed waveguide system will be provided with links to a "supercable" system over a spur of the cable from Reading to High Wycombe (see 'Supercable' progress). At Bristol, connections will be made from the waveguide to cable and microwave radio links to South West England and South Wales. These connections will include links to the new satellite communications earth station at Madley, Hereford, and to Goonhilly.

Expanding electronically

During the next five years the Post Office will install 750 new electronic telephone exchanges, doubling the number in service. This was announced by Sir Edward Fennessy, Deputy Chairman of the Post Office and Managing Director Telecommunications, when opening a new TXE2 exchange at Milton Abbas, Dorset – the 800th of its kind installed in Britain.

The TXE2 is primarily designed to serve small rural and suburban communities. The first exchange was opened in 1966 and over the next five years the Post Office plans to bring about 100 new TXE2s into service each year.

"But we also have a rapidly expanding programme of large electronic exchanges for densely populated areas", Sir Edward said. "We expect to bring more than 20 of these (TXE4) exchanges into service in the next 12 months; in five years' time we expect to have 250 in operation."

The new Milton Abbas exchange is being used for the first trial in Britain of plug-and-socket connections – already used in TXE4 exchanges – between TXE2 equipment racks, in response to the exchange supplier's request. Using these connections offers great potential savings in installation time and should also enable the work to be done by less skilled staff, an important factor for export versions of the TXE2 exchange system.

In the prototype, multi-wire cables terminating in cable-end sockets are connected to each exchange equipment rack at the factory during manufacture. This enables some of the cable continuity tests to be carried out at the works, where better facilities are available to speed the task. On site, installation staff interconnect the equipment racks, and also link them to the main distribution frame, by plugging the cable-end sockets into fixed, double-sided plug modules.

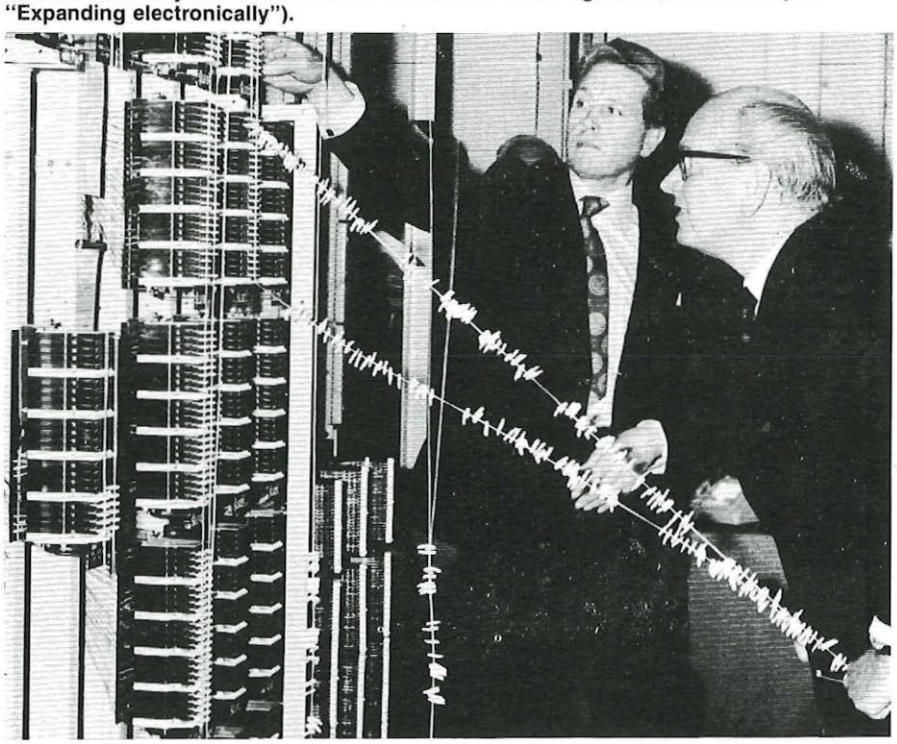
Viewdata's public trial

About 1,000 people will participate in a market trial of Viewdata, the Post Office's computer-based information system, starting next summer. The system enables users – at the touch of a button – to call up information on a variety of subjects over the telephone for display in words or simple diagrams on a television screen (see Telecommunications Journal, Winter 1975/76.)

The trial will involve people at home and at work in London, Birmingham and Norwich, and they will have access to 60,000 "pages" of information. If successful, the trial could develop into an initial public Viewdata service by 1980 and be extended throughout the United Kingdom during the 1980s.

As well as testing public reaction to Viewdata and its charges, the trial will also compare reaction to Viewdata and to tele-

Mr B. H. Berresford, General Manager of Bournemouth Telephone Area (left), helps Sir Edward Fennessy switch in Britain's 800th TXE2 exchange at Milton Abbas (see "Expanding electronically").



text – the broadcast information services provided by the BBC and IBA. It will also help information providers and the television industry to evaluate the market.

The Post Office will be contacting more than 5,000 people to select the 1,000 or so who will be taking part. Of these participants, about 700 will be householders and 300 business people in shops, offices or factories. A few non-commercial organisations serving the general public will also be chosen – such as libraries, community centres, citizens' advice bureaux, railway stations and post offices.

To assist in the market research, participants will be asked to log their use of Viewdata and teletext. They will be expected to bear the cost of a modified receiver and to pay for Viewdata telephone calls at local call rates, as well as being charged a small fee for some pages of information. Certain information, such as advertisements, will be free of charge.

● The German Post Office has taken delivery of a GEC 4080 computer system for use in its proposed public teletext information service, Bildschirmtext – equivalent to the Viewdata service. The decision of the Deutsches Bundespost to proceed with the service followed negotiations with the British Post Office over software collaboration and assistance with generation of databases.

London on call

The Post Office's new Radiopaging service in London is now fully operational, covering a 900 square-mile area from Potters Bar southwards to Caterham, and from Heathrow eastwards to Dartford and Dagenham. The system is designed to cater for 20,000 customers initially, rising to a maximum of 100,000 in the future.

'Supercable' progress

Work is now under way on laying the southern section of the "supercable" which will carry 60 MHz transmission systems between London, Reading, Birmingham and Manchester. Capable of carrying nearly 100,000 calls at once, the cable will form a new high-capacity backbone for Britain's telecommunications network, and a high-degree of engineering skill was called for in preparing its route. (See Telecommunications Journal, Autumn 1976.)

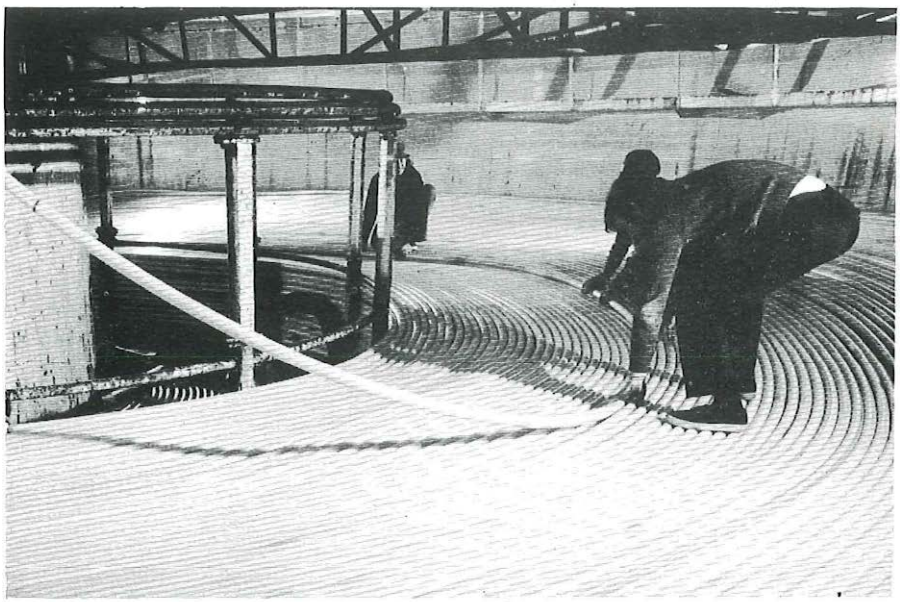
The cable now being laid in West London is the start of a 200 km link between London and Birmingham. This is being routed through High Wycombe, from where a 30 km spur will run to Reading. Cable laying over the northern leg of the route – 153 km from Birmingham to Manchester – was completed late last year.

New Datel service

A new Datel service has been introduced by the Post Office, based on a modem which enables users to exchange data more widely with overseas organisations. Known as Datel 2412, the service can be used to send binary data at 2,400 bit/s or 1,200 bit/s over private circuits and the public telephone network. Among the advantages over Datel 2400 services is that it incorporates customer-operated test functions for the first time, enabling a full check to be made of circuit and modems.

The new service is available for simultaneous bothway (full duplex) data transmission over four-wire private circuits, for alternate bothway (half duplex) transmission over the public telephone network, or for full duplex private circuit operation with half duplex public telephone network transmission as a standby. In each case, a control channel working at 150 bit/s in the reverse direction can be provided as an optional extra, and is available for full duplex operation over private circuits or half duplex over the public network.

Basis of the service is the new Post Office Modem 12, which conforms to CCITT regulations and is compatible with a wide range of 2,400 bit/s modems in use overseas, enabling data to be transmitted or received at this rate over international dialled connections.



Lightweight undersea telephone cable is loaded into the cableship Mercury for Columbus, a telecommunications system across the South Atlantic linking South America and Europe. The £40 million system, designed and manufactured by Standard Telephones & Cables, will have 3,250 nautical miles of cable and will be able to carry 1,840 simultaneous conversations between Venezuela and the Canary Islands.

IDD tops fifty

Britain became the first nation in the world to have direct telephone dialling to 50 countries with the introduction of International Direct Dialling (IDD) to Jamaica. Dr Arthur Wint, High Commissioner for Jamaica, inaugurated the 50th direct-dialling service with a call from the offices of the Jamaica Tourist Board.

Further extensions of IDD – to Bermuda, the Cayman Islands, Hungary and Swaziland – have brought to 54 the total number of countries that British telephone users can dial direct. In addition, direct dialling to the United States of America has been extended to include Hawaii, meaning that the facility is available to every American State apart from Alaska.

Currently IDD is available to about 75 per cent of the 21 million telephones in Britain, and almost all should have the facility during the next four years. The introduction of IDD on 2 May for subscribers on the Rugby, Crick, Swinford and West Haddon exchanges was marked by a call from Rugby Radio Station to Rugby, Tennessee. The call was made by Mr Alan Lee, Second Master at Rugby School, to Mrs Carolyn Hughes d'Agostino, grand-daughter of Thomas Hughes, author of "Tom Brown's Schooldays" and founder of the town of Rugby, Tennessee, in 1877.

Following the inaugural call, a plaque at Rugby Radio Station was unveiled by a high-frequency radio signal sent from Rocky Point Radio Station, Long Island, New York. The unveiling marked the 50th anniversary of the first transatlantic telephone call, which was made between the two radio stations.

Automatic interception

Two prototype automatic changed number intercept equipments have been installed for service trials at telephone exchanges in Chelmsford and Birmingham. The system enables the service to be provided independently of telephone operators and to be local to the exchange – no special circuits being needed to route calls to the manual switchboard.

In the prototype equipment, supplied by Pye TMC, the call is terminated in the telephone exchange and an automatic spoken message is passed to the caller. The message is stored in digital form in large-scale integrated circuits, each message being built up from a limited vocabulary of words and phrases. Each word or phrase is decoded from its digital storage form and continuously applied to an audio highway, there being as many audio highways as items in the vocabulary.

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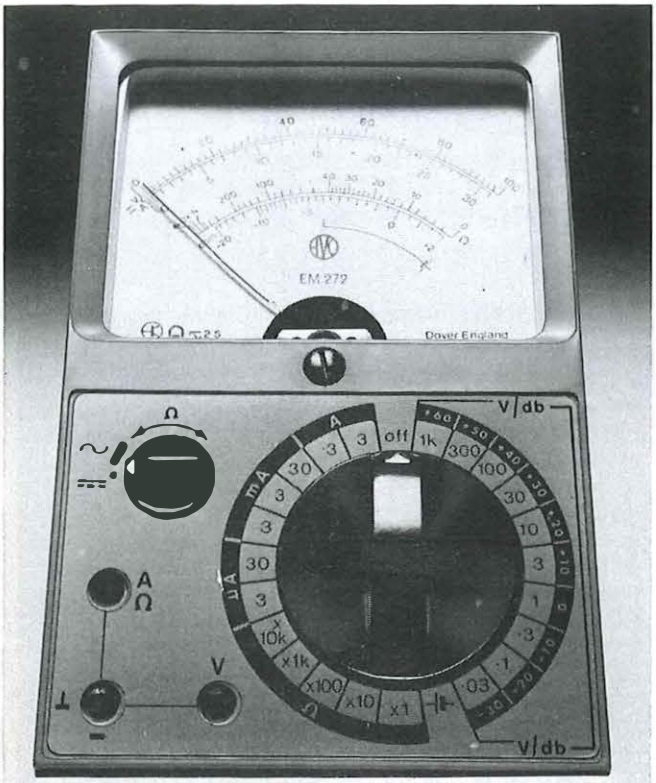

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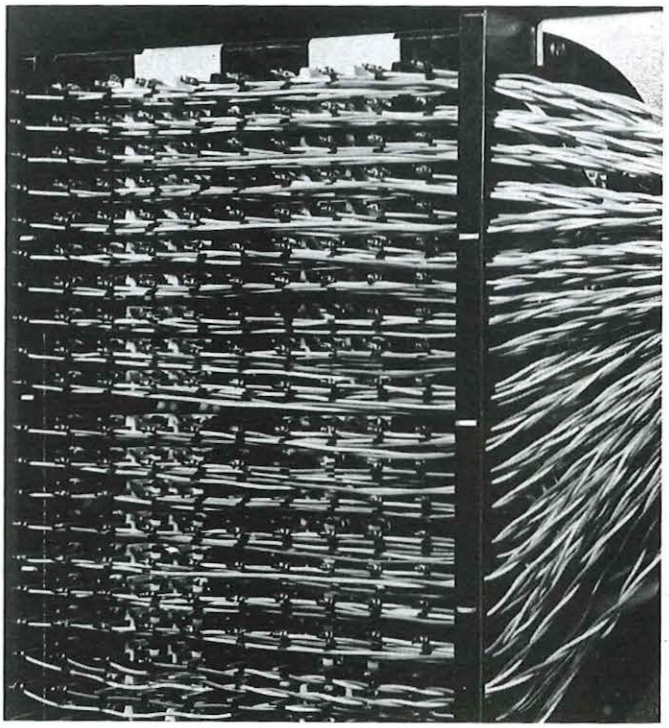

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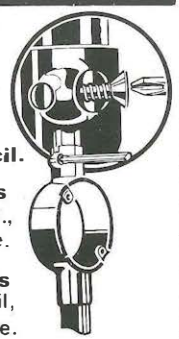

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