Post Office telecommunications journal

Autumn 1977 Vol. 29 No. 3 Price 18p

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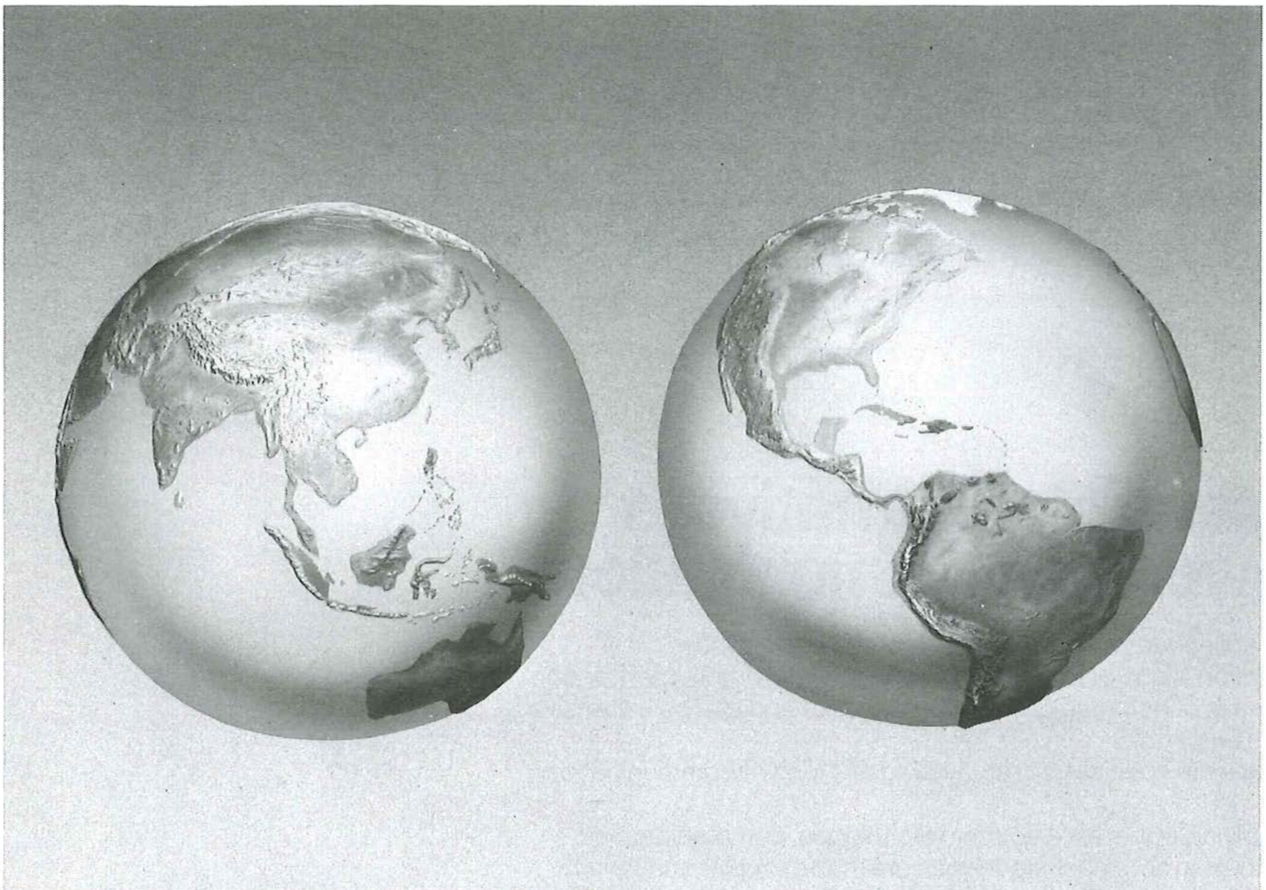

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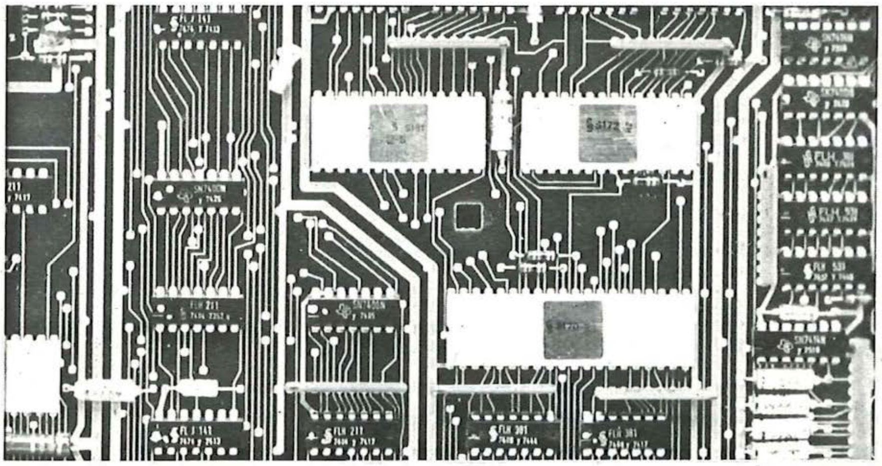

An example of a large-scale integrated circuit employed in Siemens communication systems. One of these microcircuits replaces several thousand conventional electronic components.

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In the world of communications Siemens has the answer

Laying the foundations of System X

System X, the new generation of technically advanced exchange equipment that will carry United Kingdom telecommunications into the next century, is undoubtedly the biggest development of its kind undertaken in this country. Based on digital, micro-electronic and software technologies, it is being designed to meet a wide range of applications which include local exchanges of various capacities and a family of main network exchanges used on longer distance and international calls.

Development of System X has been considerable in the past year and continues to gain momentum. The 1976-77 Annual Report and Accounts of the Post Office disclosed that initial studies for the first trunk and local applications had been completed and that large-scale development had begun. Now contracts worth £20 million have been placed with British manufacturers, covering the design of trunk, tandem and small-to-medium capacity local exchange equipment.

Export as well as Post Office requirements are being taken into account in the development programme, in which some 500 engineers are already involved. Justification for expected development costs of some £100 million before the full range of applications is in service lies in the very large supply programme envisaged in the 1980s and 1990s and the boost System X is expected to give to exports.

To meet an expanding range of service and network requirements, both at home and overseas, System X will use a family of modular "building bricks" (sub-systems). To simplify production, planning and operational problems, these sub-systems are being designed to common equipment, documentation and other standards, including a standard equipment practice.

The development of System X builds on experience gained with earlier systems, such as the reed electronic TXE2s and TXE4s and digital transmission systems, as well as on the private development undertaken by the manufacturers in recent years. During the project, development capabilities – such as computer support facilities – are also being established which will reduce the time required to respond to changing customer requirements and later advances in technology.

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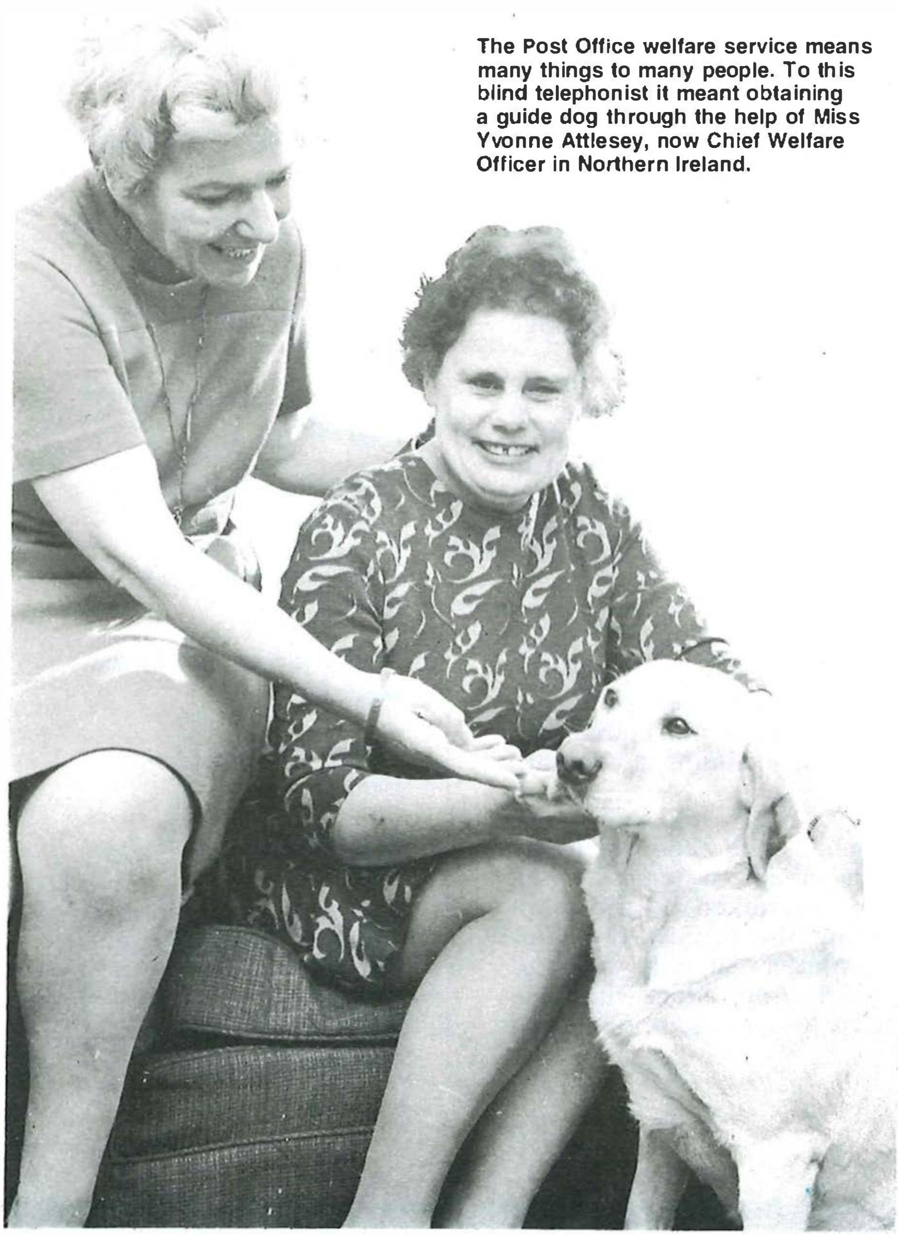
Cover: Under the watchful eye of a closed-circuit television camera, a trainee Post Office welfare officer carries out an interviewing exercise. In this way, the trainee's technique is recorded on videotape for later analysis. **(See page 2)**

Welfare at work

J McChesney



The Post Office welfare service means many things to many people. To this blind telephonist it meant obtaining a guide dog through the help of Miss Yvonne Attlesey, now Chief Welfare Officer in Northern Ireland.

DESPAIR for the young Post Office telephonist was almost complete. Starry eyed, she had come to London from the North to work but now found herself alone, frightened – and pregnant. She was afraid to return home because of the problems she would bring to her family.

But just as the future looked most bleak came the turning point. The local Post Office welfare officer heard of the youngster's plight and within days all the necessary arrangements for her well-being had been made.

The case was just one of 46,000 dealt with last year by the Post Office welfare service which, since it was set up soon after the Second World War, has become one of the biggest, and best, in the field of industry and commerce. Indeed, the comprehensive training programme it has developed is the envy of many other organisations and between 70 and 80 firms have sent their welfare staff to the Post Office for training on a fee-paying basis. A number of foreign Post Office Administrations, too, continue to send representatives on fact finding missions with a view to setting up a welfare service in their own organisations.

But how and why did the Post Office first become involved in welfare work? Enlightened employers had long realised that the general well-being of their workers had a direct bearing on morale and efficiency. In those days most effort was concentrated on improving working conditions and providing better opportunities for recreation and further education.

Today welfare in the Post Office has become much more personal. The objective of its 150 or so welfare staff throughout the country is to exercise a counselling service to individual members of staff and an advisory function to management covering a variety of human problems.

Success of the service depends, as always, on the co-operation and understanding between welfare staff, controlling and supervising officers and the unions. Each has his part to play in taking an active interest in the personal well-being of Post Office staff.

At first some managers viewed the new welfare service with suspicion, thinking that welfare officers were in business merely to look after "lame ducks". During the past 25 years, however, the Post Office has demonstrated that there is much more to being a welfare officer than having a kind face and a big heart.

The reasons for the existence of a welfare service in a major industrial organisation are many and various. As well as being in keeping with a "good employer" image, it can bring about important savings in management time. Many managers cannot avoid getting involved in some of the personal problems of staff, and the efforts of a trained and skilled welfare officer will cost less than those of line managers who usually have many other pressing pre-occupations.

It is a fact, too, that personal problems which can damage productivity are often bottled up rather than discussed with supervising staff, but employees in these circumstances may be willing to consult a recognised welfare officer. The welfare service has, without doubt, a productivity value worthy of recognition.

In the course of normal duty the welfare officer encounters the widest possible range of problems. There are domestic difficulties, financial hardship, prolonged illness, disablement, unmarried motherhood and bereavement, to name but a few.

A typical welfare officer's case book might tell of:

. . . The Technical Officer who was reluctant to work because his wife was ill and in his absence would be without food or company all day. The welfare officer approached the local authority, secured the services of a home help for two hours a day and the man was able to work as usual.

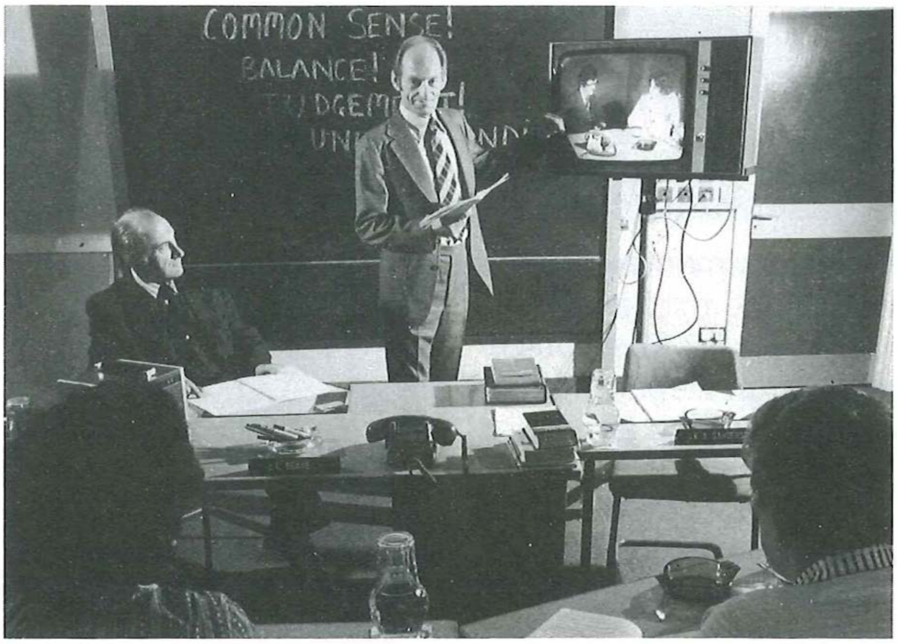
. . . The Traffic Officer on long sick leave and now on greatly reduced pay who was running into financial difficulties. The welfare officer was able to obtain certain reliefs from statutory sources and assistance from a Benevolent Fund.

. . . The Clerical Officer, with an elderly mother, who had not had a holiday for 10 years. The welfare officer arranged for the mother to go into a nursing home for a fortnight while the Clerical Officer enjoyed a well earned rest.

. . . The Executive Engineer who died intestate, leaving an estate but no will and very little cash. The welfare officer was able to arrange a temporary loan through a Benevolent Fund and helped the widow to obtain letters of administration, saving a substantial sum of money in the process.

Many cases of this kind reach the welfare officer through a direct approach by the individual concerned, but a surprising number are referred by management and supervisors. Others come from medical social workers, and some from union sources.

All welfare staff are recruited from within the Post Office, and despite stringent requirements a recent advertisement in the Post Office Gazette resulted in more than 300 applications from men and women all over the country.



Trainee welfare officers analyse their interviewing techniques, recorded earlier on videotape by closed-circuit television. Laurie Deane, Chief Welfare Officer for Headquarters Departments, seated, and Senior Welfare Officer (Tutor) Ken Sanderson lead the discussion.

Welfare officers must have many qualities, the main ones being that they must be a good listener, tactful, impartial, mature and objective. But, above all, they must have the ability to establish rapport with those who seek their advice. It is pointless having someone who knows all the answers if people are not going to ask the questions.

Over the past few years the trend has been towards a more professional service. This inevitably involves extended training and field work under supervision. New welfare officers undergo thorough training before taking up their first appointment and then, after six months in practice under a watchful eye, they attend a further three-week course which covers a wide range of subjects that include training in human relationships, social understanding and interviewing techniques.

Welfare Officer Steve Stevens pays a routine call on Trainee Technician Apprentices undertaking work in the field.

Wide use is made of closed-circuit television to strengthen technique in interviewing and counselling. Professional people with expert knowledge of particular subjects are engaged for specific sessions, and full use is made of specialists in the Post Office and social service agencies.

Apart from a knowledge of social sciences and techniques, the welfare officer needs to know not only Post Office regulations, but also about things like rent rebates, family income supplements, the Race Relations Act and the ever-changing legislation covering social security in all its forms. When they begin work in the field their greatest assets are a wide range of contacts with all social workers and the stamina to work long and often unsociable hours.

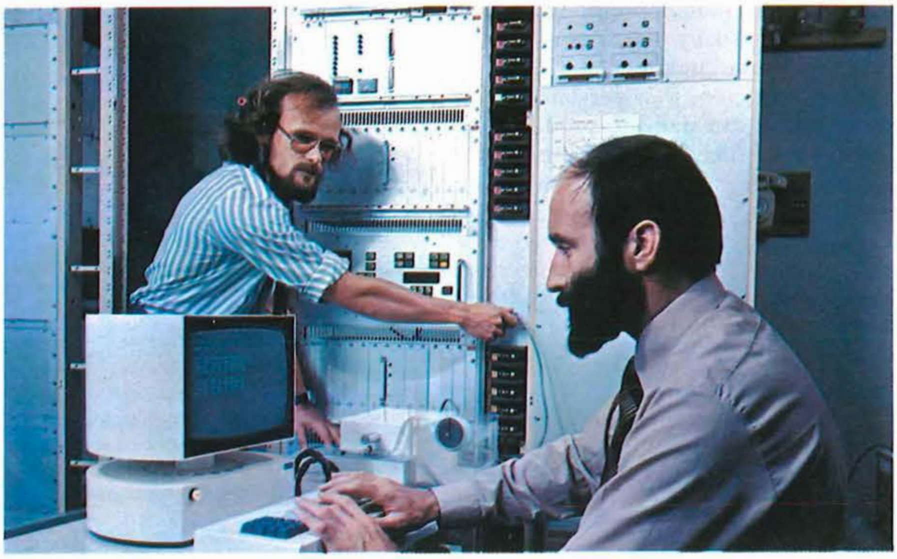
The welfare officer's reward is the gratitude of Post Office colleagues who have been helped through some sort of crisis. It often happens, however, that individuals are unaware of the role that welfare officers have played in helping them, and in these cases the reward can only be satisfaction of a job well done.

Mr J. McChesney is Chief Welfare Adviser to the Post Office, responsible for operational, establishment and organisation aspects of the welfare service.

Pathfinder leads the way

CSA Smith

An experimental 100-line telephone exchange, designed by Post Office Research Department, is being used as an operational test bed for new developments in electronic switching. Called Pathfinder, its aim is to extend advantages of computer control to small, local exchanges.



Assistant Executive Engineers Russ Wangham and Chris Kearey collaborate while making a change to the program in the PUMPS using portable equipment. Eventually these changes will be made over data links from the remote central processor.

WHEN Almon B. Strowger devised the step-by-step principle of switching telephone calls automatically in the late 1880s, he could not have foreseen that the technique would still be in wide use 100 years later. Switching systems did take a major step forward with the opening of the first crossbar exchange in Sweden in 1926, but not until the highly reliable sealed reed contact was developed and reliable computers became available in the 1960s did switching engineers have the constituents for dramatically improving the design of telephone exchanges.

The reed contacts, when placed at the intersection of an array of vertical and horizontal wires, form an efficient switching matrix while the computer forms a highly flexible control system in that it can be programmed to provide complex functions which can easily be changed.

Although the first computers using solid-state components were much more reliable than their valve predecessors, the computer for exchange control requires a different design approach than for processing data.

A primary concern of the computer designer for scientific computations, payroll calculations or similar tasks is that the machine should never produce an undetected error. A complete breakdown, while financially embarrassing, is not catastrophic. The processor which controls a telephone exchange, however, must have outstanding resistance to complete failure, as even the smallest exchange in the United Kingdom has a design target of no more than one catastrophic failure every 50 years.

In the early days there was much excitement over the enormous increase in control flexibility offered by computers, but it was soon realised that this could be achieved only by a large investment in manpower, both for initial preparation and for subsequent elimination of errors, the latter process continuing over many years. The provision of new facilities for customers was also an attraction, but the difficulty of defining simple procedures by which telephone users could invoke these facilities has proved to be a major obstacle to their early introduction.

While new facilities are still of interest, currently the major attraction of stored program control (SPC) is to improve, and reduce the cost of the basic service. In this respect, the ability to change the control program and the data stored in the exchange electrically – and, therefore, remotely – minimises exchange visits, and the remote interaction capability with the further support of remote computers can be used to enhance maintenance and network management facilities.

Additionally, by using components in the exchange which are compatible with those used in the computer industry, benefits of larger production are gained. In particular, the use where possible of programmable components – for example, microprocessors – enables the same components to be used for several different functions.

As an adequately reliable processor was a relatively expensive part of the exchange, early applications were to large exchanges where the cost could be spread over many thousands of customers. In the UK, however, 60 per cent of the exchanges serve no more than 1,000 customers, so in 1970 the Post Office Research Department began to study the small exchange problem and, in particular, the design of a cheap but powerful control processor.

The result was the partially uncommitted mini-processor (PUMP) – so called because it could, if necessary, be tailored to other tasks. The processor consists of about 1,000 components and is capable of performing sequentially all the logic necessary to set up calls at the peak traffic time in an exchange with 2,000 customers. When associated with a switch design using the reed relay for connecting speech circuits but electronic integrated circuits for all control functions, it was found possible to design an economically competitive exchange.

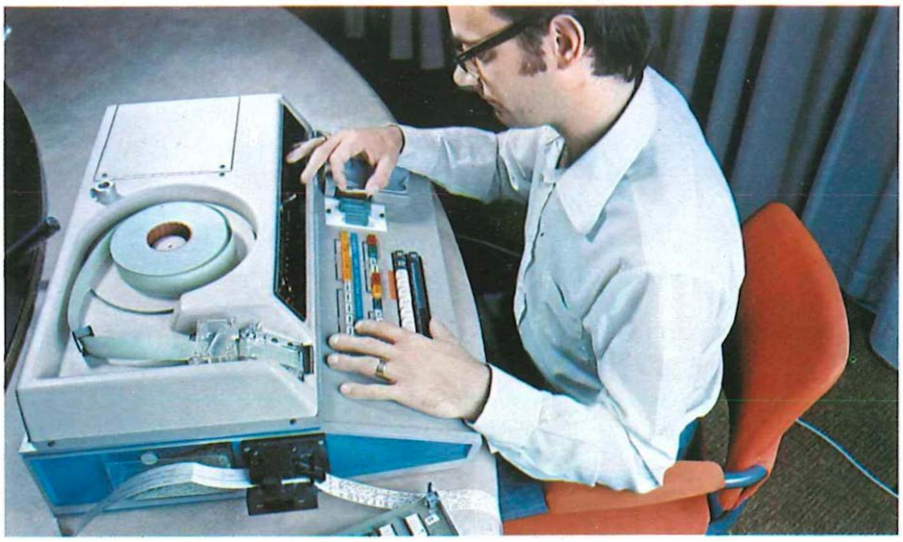
Continuity of service being an essential feature of a telephone exchange, it was decided to subject the experimental design to the rigours of operational service. By doing so, valuable experience would be gained on the maintenance procedures required for an SPC exchange.

With assistance from staff in Eastern Telecommunications Region, the experimental exchange was installed adjoining the production TXE2 exchange which serves the Post Office Research Centre at Martlesham. It was provided with connections to telephones for 100 staff on the site, with junctions to and from the Group Switching Centre in Ipswich and with sideways junctions to the TXE2 for access to the rest of the site.

The exchange thus forms part of the national network, with its own dialling code, and has provided normal telephone service since April 1976. To convey the exploratory nature of the design, and to provide a link with the aviation history of Martlesham Heath, the exchange is called Pathfinder.

The processors controlling Pathfinder are arranged in a three-level hierarchy. At the lowest level are a number of microprocessors which perform very simple tasks. Microprocessors can now, in fact, be constructed as a single component and associated with one or more storage components which, when programmed, define the function performed by the unit. An example is the Pathfinder register.

When a telephone user lifts his handset, the looped-line signal is detected and one out of a pool of six registers is connected to his line by way of the reed relay switchblock. The register returns dial tone and awaits the first digit of the required number. The digits can be signalled to the exchange in three different ways: the most common type of telephone connected to Pathfinder has a 12-button keypad which sends voice frequency signals to the exchange, but other telephones could have a standard dial or a keypad which generates high speed binary-coded loop-disconnect pulses.



A microwave memory chip is reprogrammed by Technical Officer Mike Bloomfield from the paper tape master record.

During the first few milliseconds of the line signal, the microprocessor associated with each register recognises the signalling system being used and thereafter obeys the relevant part of the signal interpretation software. This allows a mixture of telephones to be connected to Pathfinder and changed without any modification in the exchange. As the register interprets each digit, it passes the information up the processor hierarchy.

The second level in the hierarchy comprises a pair of PUMPs, which handle all the processes needed to set up a basic call. Although the complexity – and, thus, the number – of components in a PUMP is relatively low, the probable interval between failures is only about one year. This is far from adequate for even a small exchange, and the two PUMPs therefore operate in a worker/standby mode to achieve the necessary reliability.

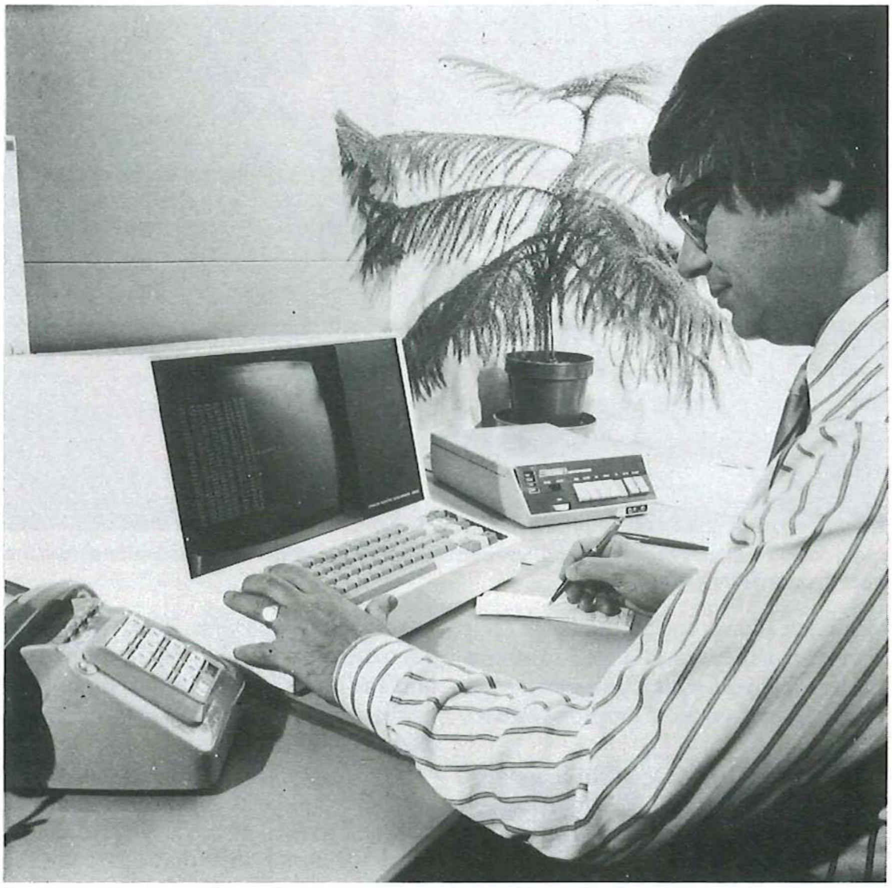
Processing of a simple telephone call can be divided into a number of phases. The end of each phase is defined by the need for more information from the customer – for example, a further digit during the signalling phases or a clearance signal from either customer during the speech phase. During each phase several events have to occur in the exchange and each requires processing activity from the PUMP.

Each event requires messages to flow between PUMP and exchange equipment. After the calling loop has been detected on a Pathfinder line, for example, at least 10 of these messages are necessary before dial tone is returned and the next customer action of keying a digit is awaited. The PUMP must carry out some processing as a result of each message, and this is achieved by one pass through its program. Each pass is sufficiently fast to interleave all the processing required for the peak calling rate on a 2,000-line exchange so this can be done serially.

Each pass through the program is further divided into five stages of processing. Before each stage is started the processor sends a coded signal to a simple "watchdog" circuit telling it which stage is being entered and how long it expects to be occupied in it. If the signal is not received, is received incorrectly or if the predicted time elapses without a further signal, the "watchdog" initiates a processor changeover.

To ensure that the changeover equipment on Pathfinder is working correctly it is tested every night. This is

Much of the data obtained from Pathfinder, such as billing information, can be stored on magnetic tape. Executive Engineer John Fox, who has prepared some of the programs, removes a reel of tape from the central processor.



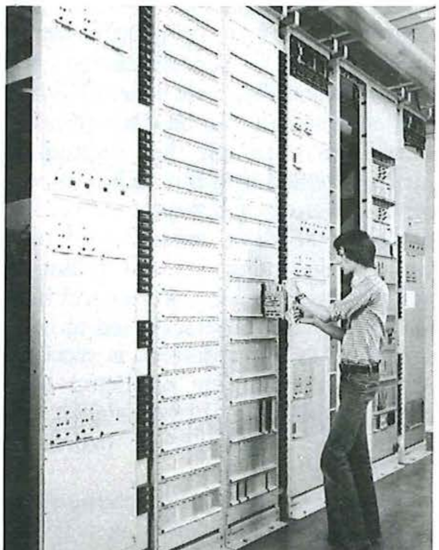
Executive Engineer Gerry Garwood demonstrates that with the aid of a visual display unit, diagnostic information held by the central processor can be obtained.

carried out with the aid of a large, remotely situated, processor which forms the third, and highest level in the hierarchy.

In addition to supervising changeovers between the two local processors, there are a number of tasks more appropriate to a central processor whose services can be shared between many small exchanges. Two classes of task are those requiring infrequently used programs, such as controlling supplementary services – for example, automatic alarm calls – and those requiring large amounts of storage, such as the translator for the Man Machine Language which simplifies communication with the system and protects it from inadvertent mis-operation by the human.

A task of particular interest is the automatic diagnosis of faults and centralised control of maintenance procedures. Pathfinder uses a low-cost computer-aided diagnostic system based on error collation which counts the occasions on which any error, or potential error, in exchange operation incriminates a particular piece of equipment.

A faulty card in the Pathfinder exchange is removed and changed by Technical Officer Don Clark.



Assistant Executive Engineer Jackie Hunter uses a 12-button keyphone connected to the Pathfinder exchange.

Error indications may result from detection equipment, such as that making a continuity check on any path set up through the exchange, or from unusual events caused either by customer action or by a fault. A single indication may not identify a faulty unit, and might not even be caused by a fault, but a succession of errors soon provides a more conclusive indication of a faulty component.

A significant advantage of this method is that it is tailored to the service received by the customer; the more often a fault could affect service, the more quickly it is detected. Where possible, of course, the multiple attempt and replicated equipment features of normal exchange design protect the customer from a knowledge of such faults.

Initial results from Pathfinder, while confirming that error collation is a viable diagnostic tool for many faults, have shown that further interaction with the system is often necessary to determine the unit to be replaced. Such interaction is carried out remotely, using a visual display unit connected to the central processor, and the protection and assistance of the Man Machine Language is vital to this interaction.

A further tool available is a simple call generator in the exchange, which can be remotely controlled to exercise any suspect unit. Eventually this call generator could be made available to the diagnostic software to assist in the automatic location of faults.

Pathfinder has now provided daily service for 18 months with an average of four faults per month attributable to components and wiring, while two faults per month have been caused by software errors. This level of performance has been achieved in the face of substantial ongoing development. The worker/standby security scheme using two PUMPS has proved extremely reliable and makes it a likely candidate for SPC exchanges in the United Kingdom network.

Mr C. S. A. Smith is head of the section at Post Office Research Department responsible for processor and signalling techniques for small electronic exchanges.

PO Telecommunications Journal, Autumn 1977

safe passage across Bristol harbour

J Fielding

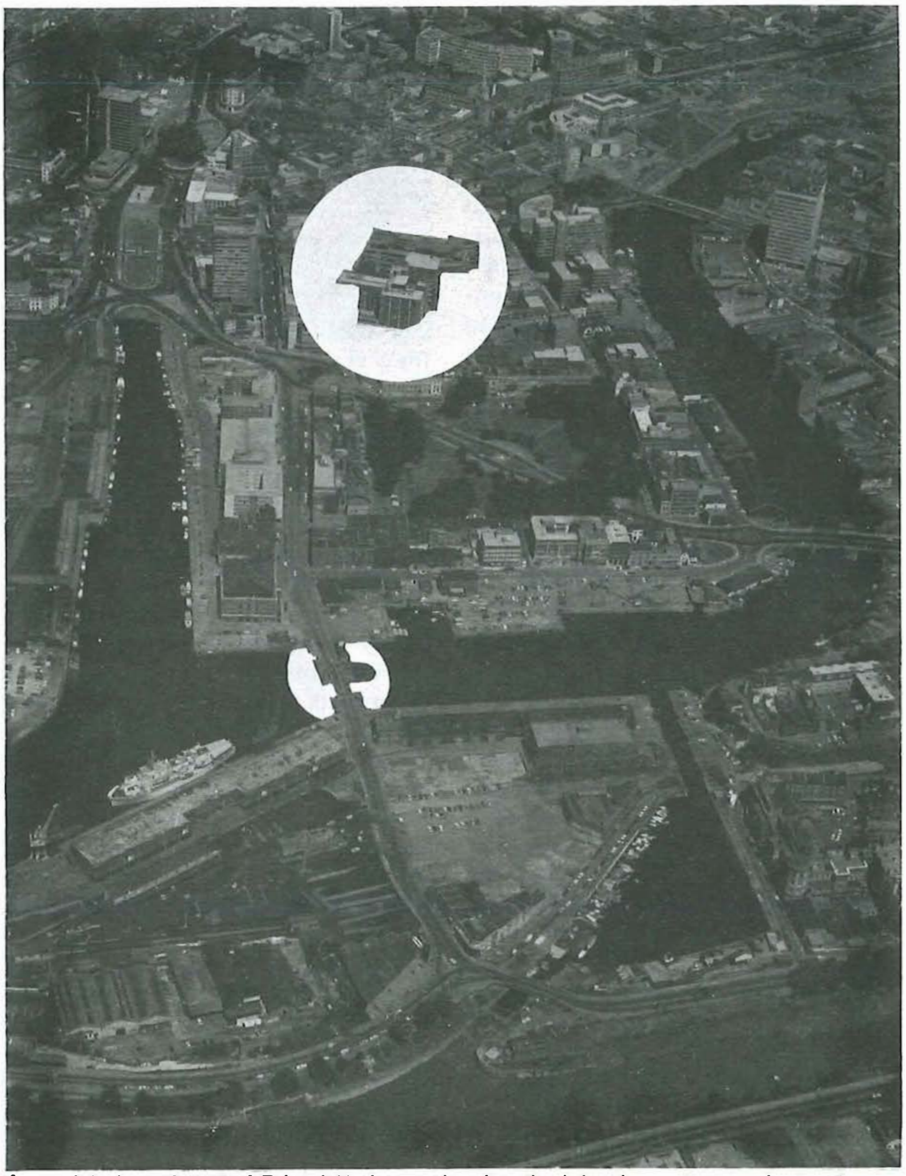
CENTURIES ago Bristol was one of Britain's major ports, with ships setting sail for the Colonies and merchant vessels arriving daily. Today, with most important dockside work transferred to the coastal port of Avonmouth, Bristol and its man-made Floating Harbour have become less active for sea-going craft.

Recently, however, a flurry of activity generated by the Post Office helped recapture a little of the adventure of former times. It involved teams of divers plunging into the murky, silt-filled water alongside a causeway and swing bridge to determine whether steel ducts carrying new telephone cables could be safely laid across the harbour bed.

The cables were necessary to meet future demands for service which will be made when the now run-down island area between the Floating Harbour and a channel known as the New Cut, is redeveloped for both business and residential accommodation. They have replaced two existing submarine cables of 75 and 150 pairs which have served the area well but which, as well as being of insufficient capacity to cope with further developments, have been damaged several times by ships.

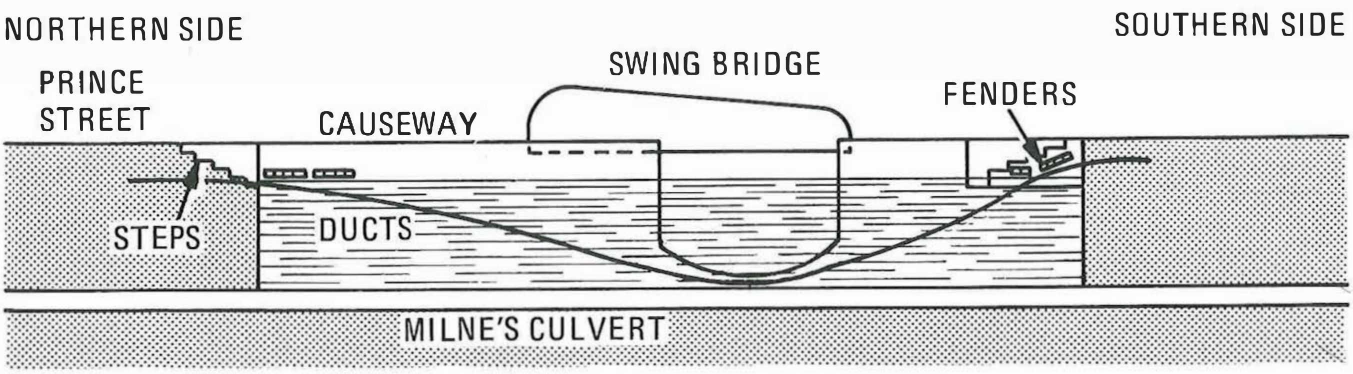
The Floating Harbour was created between 1804 and 1809 when the Cut was engineered. This left the old course of the River Avon as a 5 km long area where the water level was maintained by lock gates.

It was around this area that the City Docks grew, but eventually the land-locked position of the harbour inhibited further development and a new port was built in 1877 at Avonmouth, which gradually took over the



An aerial view of part of Bristol Harbour, showing the island area (centre, bottom) to which the new telephone cables had to be laid from the telephone exchange (top). A section was laid under water, alongside the swing bridge (centre).

Below: Cross-section of the swing bridge area showing the duct route.



functions formerly carried out by the City Docks.

Because of its position in the heart of the city, the island area still has great potential. It is connected to the mainland by no fewer than seven swing bridges and one suspension bridge. There is only one fixed bridge and this is at the end of the island furthest from the telephone exchange. The only practical telephone cable route therefore is underwater.

The sales forecasters had calculated that about 1,600 additional connections would be required by 1979, rising to more than 3,000 over the next 20 years. The most economical way to provide for this anticipated growth was obviously by the installation in stages of cable in steel ducts, welded into continuous lengths, to link the island to the mainland. The problems were how it could best be done and where.

The first duct length being towed across the harbour from its assembly point.

The swing bridge at Prince Street is only 500 m from the telephone exchange and it was logical to carry out an underwater survey to determine the practicability of placing ducts across the mouth of the bridge. The channel under the bridge is 13 m wide and 7 m deep. The bridge itself is set into a stone-built, two-lane causeway linking the harbour walls which are 62 m apart at this point.

At the bottom of the harbour close beside the causeway is Milne's Culvert, a large cast-iron pipe, 1.5 m in diameter. This was laid in 1835 to carry flood water and sewage to the tidal waters of the Avon where it flows through the New Cut. The culvert is still in use, although its function as a sewer will shortly cease.

The diving team's inspection operations were hampered by a complete lack of visibility and layers of silt, but long steel probes were used and these established that it was possible to lay ducts along the top of the culvert in front of and below the mouth of the swing bridge channel.

Special mild steel duct of 100 mm internal diameter, protected inside against corrosion by a coating of epoxy-resin paint and outside with an external cladding of polyethylene, was chosen. The sections of duct could be securely welded together to form a water-proof joint, and continuity of the cladding was ensured by a carefully applied wrapping of plastic tape.

Although the 20-year forecast indicated that two ducts would be sufficient, it was considered that two more would not appreciably add to the cost once the equipment, boats and men had been assembled. The alternative of providing extra ducts in the future would have been much more costly.

The plan was to construct a manhole at the top of steps leading down to the water on the northern side of the harbour and to run the four welded duct lengths from the manhole and under the steps to slant down into the water tightly against the causeway wall, one above the other.

The ducts were to curve gently below the entrance sill of the swing bridge channel and rise more steeply against the southern section of the causeway, entering the southern section of the harbour wall above the water level at an angle of 25 deg through drilled holes. Inside the wall they would link with land section ducts.

The underwater duct was welded into 75 m lengths and each length was sealed by rubber expansion plugs fitted with air valves and filled with compressed air to check there were no leaks.

Floats were attached at 5 m spacings to the first duct length and then, without removing the expansion plugs, this was carefully lowered into the water and floated across towards the swing-bridge. When the Harbour Master was able to confirm that shipping through the bridge had ceased, the duct length was towed into position across the harbour entrance.

One end was taken through a hole made under the steps on the northern side and hauled up a gently sloping trench to the manhole position. The other end was secured opposite the hole prepared for it in the southern wall of the harbour. The expansion plugs were removed and the ducts flooded.

Because steel ducts are flexible the divers, using weights, were able to push the central sections to the bottom of the harbour. At the same time the southern end was held close to its prepared hole in the wall. When the inclination caused by the lowering of the central section reached 25 deg it was possible to pull the end through, ready for connection with the land section of the duct.

The other duct lengths were similarly dealt with and allowed to settle for two days. All were then sealed into the trench in front of the harbour entrance by layers of bags of concrete placed over them up to the level of the sill. Special U-shaped brackets of mild steel, with self-locating clips to prevent them opening out, had been designed to hold the four steel ducts against the causeway wall. These were placed by the divers around the ducts and bolted to the wall. Most of the water was then pumped out, and the ducts were dried out satisfactorily by drawing a mandrel and brush through each duct.

Today the harbour is used mainly by small craft, and to shield the ducts for a suitable distance out from their entry points into the water, elm wood fenders were bolted on to the causeway wall above the ducts.

So far a 1,600-pair cable, 66 mm in diameter, has been drawn into one of the ducts and installation was entirely satisfactory. Currently the island is still being cleared, but Bristol Telephone Area is now well prepared to meet the demands for telephone service which will arise in future years.

Mr J. Fielding is an Assistant Executive Engineer in the External Planning Group of Bristol Telephone Area.

PO Telecommunications Journal, Autumn 1977

ON CALL FOR EMERGENCY

A E Luck

WITH flight paths from both Heathrow and Gatwick airports extending deep into its territory, and the world's largest aeronautical show at Farnborough an annual event, it is little wonder that Guildford Telephone Area is highly conscious of the need to provide speedy emergency telephone facilities at any point, however remote.

For many years a 15-cwt van, modified to enable six acoustic hoods with ready-fitted telephones to be fixed on the outside of the vehicle, has filled the bill. By being available to speed to the scene of, say, an air disaster or a major railway accident and running out cable links to the nearest connecting point in the telephone network, it was ready to provide on-the-spot communications facilities for use both by the emergency services and survivors.

Now it has been replaced by a new purpose-built trailer unit offering six "kiosks" and a more sophisticated service. Built by a Hampshire firm, the unit's interior has been fitted out by various groups in the Guildford Area.

The decision to consider a trailer unit was made when the original van became due for replacement. Apart from its somewhat untidy appearance, it proved a costly investment as tax and insurance, as well as normal depreciation charges, had to be taken into account. It also meant an operational vehicle was off the road for a large part of its life and when, in fact, it was used for non-emergency purposes a radio unit had to be provided to ensure that it could be speedily recalled if necessary.

One of the main advantages of a trailer

The new trailer unit takes to the road.

unit as an emergency vehicle was that it would not only cut tax, insurance and maintenance bills, but could also be designed for other, revenue earning, purposes. Support from the Regional Motor Transport Officer of South Eastern Telecommunications Region led to the Operational Programming Department at Telecommunications Headquarters sponsoring a competitive contract, based on Guildford Area's design, and the trailer unit was delivered to the Area's workshops in May for final fitting.

The basic structure comprises a steel chassis supporting a solid wooden floor on which is mounted a troughed aluminium shell lined with plywood. Window and door arrangements were selected from standard stock, and interior divisions were fitted to provide the six telephone kiosks and a lockable workshop/storeroom. A removable door enables the kiosk units to be reduced to two or four, depending on the requirement.

The upper portions of the kiosk units are lined with acoustic tiles and light fittings are provided, their controls being sited in the storeroom. Each kiosk has a permanently fixed standard call office parcel shelf unit. Two sets of closely fitting custom-built backboards are available, one fitted with a coinbox and one with a non-coin box wall-type telephone. One set is retained in situ in the kiosks and the alternative boards are housed in the storeroom.

All telephones are terminated on plugs with the corresponding jacks fixed to the wall lining board but located centrally behind the backboards for security. Permanent wiring from the jacks is concealed in the corrugations of the trailer body and from there by way of skirting trunking to a connection block mounted in the storeroom.

All interior surfaces not covered by acoustic tiling are covered with melamine sheeting with a woodgrain finish. The fluorescent lighting is fed from a battery in the storeroom, but alternative switching enables an external 12-volt source, such as the towing vehicle battery, to be used. The 230-volt lighting circuit is supplied by way of a mains consumer unit which also provides an outlet for a standard car-type charging unit to maintain the fixed battery.

Left: In the new trailer unit, Technician Norman Hawkins prepares to remove a coinbox telephone from a 'kiosk' and replace it with a wall type non-coinbox telephone.

Below: Mr Neil Smith from Guildford workshops fits the terminal block in the unit's storeroom. The alternative wallboards and teleprinter can be seen.

Cable access for the telephone services, the mains power feed and the external 12-volt supply is through bushed holes in the trailer floor to the connection block, the consumer unit or a changeover switch which is located in the battery circuit.

The storeroom is sufficiently large for several lightweight cable drums, and two are normally kept on the vehicle, one being mounted on a drop-wire dispenser. An additional 13-ampere socket has also been fitted in this room and some floor strengthening has been provided so that a teleprinter can be installed.

In the event of an emergency the trailer can be moved to the spot by any Post Office vehicle with towing capacity. For this use backboards with non-coinbox wall-type telephones would be fitted in the kiosks so that telephone facilities for the emergency services and survivors would be available as soon as access to the network could be provided. Any available calling equipments in the telephone exchange could be utilised as payments for such calls would not be required.

If, after the initial emergency, service was required by the Press, the coinbox units could be substituted for some or all of the wall-type telephones and by changing to coin and fee checking terminations in the exchange, payphone facilities could be offered. If the emergency authorities required extended service, either call box or non-payment service could be made available on a standard temporary service basis in units of two, four or six telephones.

The trailer has already been used at several local functions to provide public call office facilities, and current indications are that it will provide a reasonable measure of income to offset the capital and maintenance costs that have been incurred in both the unit's development and its availability for emergency purposes.

Mr A. E. Luck is Deputy General Manager in Guildford Telephone Area and was responsible for the development of the emergency vehicle.

Capital way of keeping in touch

PR Clark

Following successful trials in the Thames Valley, the Post Office has now introduced a radiopaging service centred on London and covering 900 square miles of the surrounding area.

THE PROBLEM of contacting people on the move has taxed the ingenuity of mankind for centuries. When the pyramids were being built, for instance, no doubt key people had to be found and the solution was probably to have hundreds of runners despatched in all directions. In more recent times town criers, factory hooters, bells, lights, loudspeaker systems, rockets and minor explosions have all been used to indicate to someone, somewhere, that they are wanted.

Effective though some of these methods may have been, the noise and the general chaos created, as well as their limited range, have restricted their applications. Obviously a more sophisticated means was needed for widespread use which would do the job just as well.

Clearly the answer lay in the ever quickening pace of technological development and during the late 1960s the Post Office became interested in the wide area selective "paging" systems being installed in North America. These utilised radio propagation from a number of strategically sited transmitters to activate small receivers (pagers) carried by the required persons, and a particular attraction was that access to the system was possible by means of the public switched telephone network (PSTN). A simple number quickly dialled would alert the required person by causing his pager to emit an audible tone or "bleep." He would then make a telephone call to a pre-arranged number.

Meanwhile the British public was getting its first glimpse of the potential of paging systems as a result of television, the "Emergency Ward 10" programme being a classic example. Writers realising the dramatic "Will they be able to reach him in time" possibilities of hospital life, exploited the role radiopaging could play and in doing so educated a large number of people into the value of this method of communication. From there it was only a short step for industry to accept that the principle would hold good for them. As a result on-site systems proliferated. But there were major drawbacks compared with the system the Post Office was developing. They were only useful within a relatively small area – usually the site occupied by the organisation – so the problem remained for the person wishing to leave the building or area in which he worked and yet remain in close touch.

By 1968 the Post Office had assembled sufficient information for a market survey to be carried out. Results were encouraging and showed there was a need for wide area paging in the United Kingdom. The next step was the provision of a trial system in an area which contained as many of the classes

At the Zone Transmitter Control (ZTC) in Central London, Technical Officer Ian Harrington checks the tone on a signal from a transmitter in the northern suburbs.

of customer as possible within the known pager market.

In February 1973 the Thames Valley radiopaging system was introduced, covering an area of some 900 square miles (See Telecommunications Journal, Winter 1972/73). It soon became apparent that the service was highly popular and the Post Office introduced the London Radiopaging Service last December.

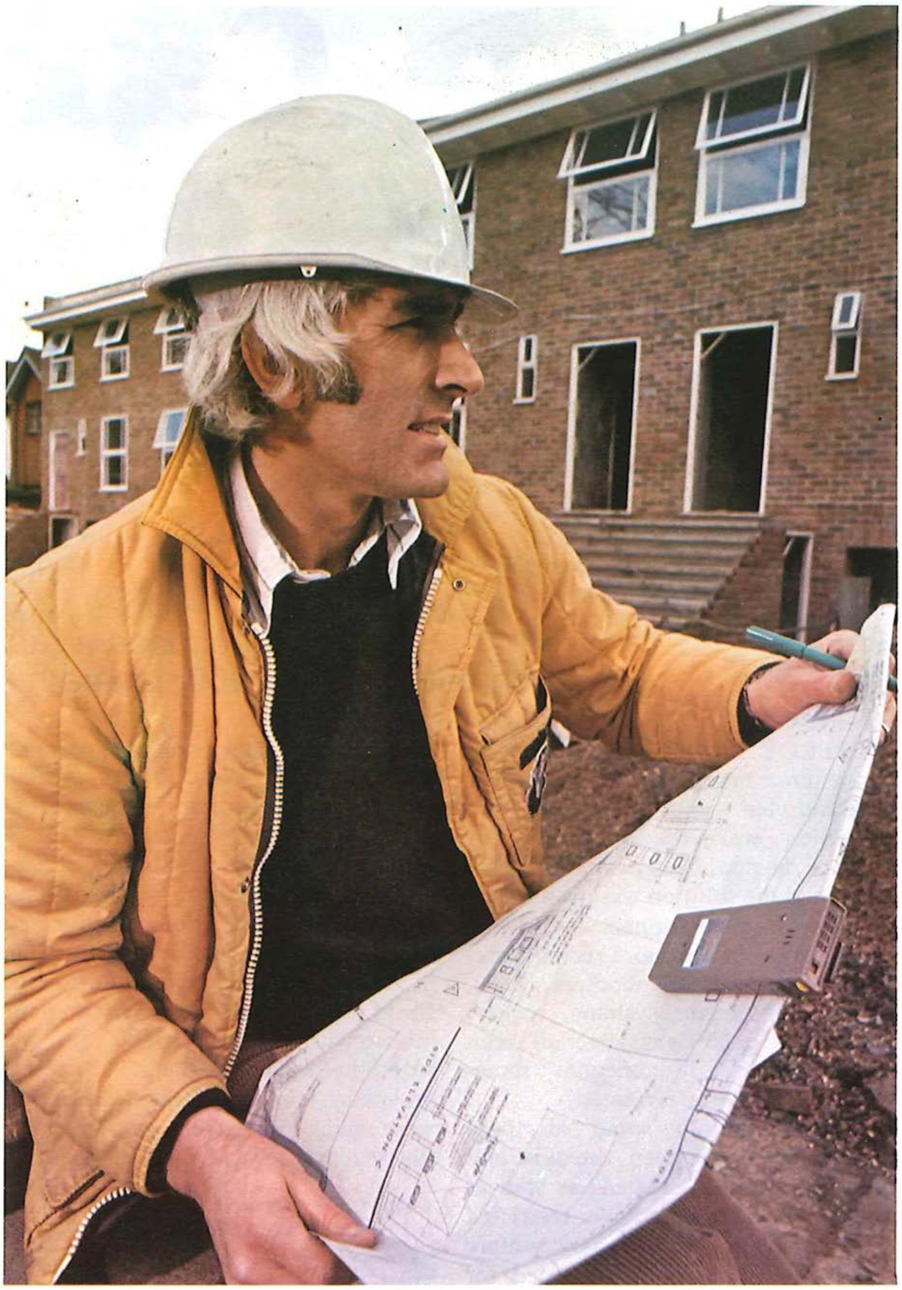
Although the Thames Valley and London coverage areas are of similar size geographically, the respective populations of 600,000 and 8,000,000 mean that the London system must have a considerably larger capacity, which is achieved by means of a fast signalling system capable of handling the calls generated. Consequently, even though the basic principles are alike, the London system incorporates many engineering features which are significantly different.

The London system was designed to have a capacity of up to 100,000 paging numbers and allowed for a number of different types of proprietary pagers to be used to safeguard supplies and provide competition between manufacturers. It was also stipulated that pagers should be able to operate at a transmission rate of at least four to five calls per second and, to permit easy pager replacement, it should be possible to give a pager any number within the numbering range of the service.

It was important, too, that paging calls should be able to be dialled from any subscriber trunk dialling (STD) exchange in the UK and that the holding time for any paging call should be very short. Finally, the defined reception area should result in a reliability of more than 95 per cent of "within building" calls being received correctly, even at the boundaries (most other parts of the area are better than this).

Manufacturers offering pager designs to the Post Office have to meet demanding requirements. The pager must be robust enough to withstand being dropped on a concrete floor but should be light and small enough to be carried easily. It should also, despite all the man-made electrical noise generated in a city, be able to receive well over 95 per cent of all calls made to it and without an external aerial. Energy consumption should be low enough to ensure that the small primary cells providing its power will last for between two and three months under normal conditions of use.

The London radiopaging system consists of a number of different equipments accessible over the PSTN using a unique STD code: Namely, there is the paging control equipment (PCE) which contains a processor and disc memory store; an administrative centre (the Radiopaging Centre) equipped with visual display terminals (VDUs) incorporating keyboards for updating the customer information stores in the PCE; a zone transmitter control (ZTC) for interfacing the PCE with the radio transmitters and for providing full supervisory and test facilities for lines and transmitters; a dedicated network to link the ZTC to the transmitters, and, finally, a number of transmitters mostly sited in built-up areas where maximum signal strength is required to penetrate buildings.



For men on the move . . . A building site planning engineer ensures he keeps in touch by having his radiopager at his fingertips . . .

To ensure reliability, the terminal equipment is duplicated so that the system is constructed in similar halves. Normally, traffic alternates at two-minute intervals between the halves, but in the unlikely event of a failure the serviceable half can take the full load.

A customer anywhere in the country can contact his local telephone sales office to order one or more pagers. Provided he already has telephone service – necessary for the accounting procedure – an advice note will be issued and forwarded to the Radiopaging Centre. Before a pager is delivered to the user its codeword is entered into the terminal, via the Radiopaging Centre's VDU, together with the paging number it is associated with.

The paging number is in 10-digit STD form. The first four digits route the call to the terminal and the last six digits

. . . Within a minute or two of his radiopager "bleeping" a travel bound City businessman stops his taxi at the nearest telephone kiosk and responds to an urgent call.

identify a particular pager. The terminal, on receiving a dialled number, checks it against a list of registered numbers. Assuming the number is valid, the associated pager codeword is placed in a call queue and a short recorded announcement is played back to the caller to tell him that the paging call has been accepted. The telephone handset can then be replaced.

At intervals of no more than two minutes, the contents of each call queue are passed to the ZTC by way of a 1,200 bit/s Datel link. The ZTC is capable of recognising the type of pagers to be signalled – pagers of the same type being placed in the same batch – and generates the appropriate codes and then forwards them onwards to the radio transmitters.

The introduction of paging throughout London is setting new standards of efficiency and the business world is becoming alive to the fact. Without paging most people leaving their place of business have no real method by which they can be found. Even if they tell people where they are likely to be at a given time, the elapsed time to find them can be substantial and may be measured in hours rather than minutes. With radiopaging the need to make checking in calls disappears. Users of the London system can have two numbers connected to their pager which will emit two alternative bleep patterns to indicate different meanings to the user.

To market the service effectively it is necessary to know why people want radiopaging. Be it a surgeon who is needed to operate or a plumber called in to fix a sticking ball-cock, the whole idea is to save time. And it is a particularly vital sort of time in the customer's terms. For some users, saving vital time will save money, for others it will make money – it can even help to save lives.

In City financial circles, bankers, stockbrokers, insurance underwriters, and commodity market dealers can be found by their principals in time to make an effective contribution to a particular deal – saving time in this case means making money. Companies with service staff on the move around London can find them quickly and divert them to other locations: saving time in these circumstances saves money.

There are also many other advantages. Outside sales staff can be found quickly and effectively to deal with urgent situations; medical personnel attached to major hospitals, general practitioners and veterinary surgeons no longer need spend a large proportion of their lives close to a telephone, and security personnel, electricity, gas and water staff can be alerted when emergency situations arise and demand prompt attention.

There is, also, a wide range of social benefits to be gained from the use of radiopaging. Couples with young children are able to leave their paging number with the babysitter and wives can bleep their husbands at the pub or club to say "Dinner is ready".

Obviously, the demand for a paging service is not confined to London and the Thames Valley but exists wherever people depend on communications in their business and social activities.

The future could see the establishment, over a number of years, of new service zones based on centres of population) with in-fill ZTCs being provided at less populated areas. Sixteen PCEs would supply sufficient capacity for more than a million pagers and customers should be able to choose whether, for example, they want to be paged in one zone or, for a slightly higher rental, in two or more zones.

On the whole, there certainly seems little doubt that in future the verb "to page" may take on as much meaning as "to ring" does at present.

Mr P. R. Clark is a Senior Sales Superintendent in Telecommunications Marketing Department responsible for the marketing aspects of radiopaging.

Calls go faster with Shell

A UNIQUE private telephone service is speeding calls across the Channel between staff in a major group of oil companies. The facility enables desk-to-desk dialling, without operator assistance, for some 6,500 extension users at Shell offices in London and their colleagues working in Holland.

It is the first time that the Post Office has provided direct extension-to-extension dialling between two private networks over privately rented international circuits. Its introduction resulted from a request by Shell International for facilities to interconnect the Royal Dutch/Shell group's offices in London and The Hague and, at a later stage, their national networks. The group now estimates that their call connection times between the two countries are as much as 25 per cent faster.

To meet the requirements, a total of 24 circuits were provided between the Shell Centre in London and the group's offices in The Hague, with initial access being limited between these two points. The service has, however, been progressively extended via The Hague to provide direct links to other offices in Amsterdam, Rijswijk, Rotterdam and Pernis. A further three circuits in each direction have also been ordered to cater for increased traffic.

With the new service an extension user, say, in London who wishes to call a colleague in The Hague first dials two digits to gain automatic access to the distant private exchange and, on receiving a dialling tone, then dials the required extension number. Previously, the caller dialled two digits simply to contact the PABX operator in Holland, who then connected the call.

In addition to speech, two other facilities have been incorporated on some circuits. One caters for Confratel, Shell's own telephone conference facility for up to 10 people at the Shell Centre and a similar number in The Hague, while the other provides four telegraph channels in each direction. The speech circuits are also available as fall back for dedicated data circuits.

As an international service of this kind had never before been provided by the Post Office, a number of problems had to be resolved. Early discussions between the Post Office and the Netherlands Administration, for example, showed that transmission constraints and the limitation of the existing private automatic branch exchanges (PABXS) to two-wire switching would make it impossible to provide full desk-to-desk dialling.

Agreement was reached to limit the service initially to extension users on the Shell Centre PABX and those at the Dutch offices mentioned earlier. Mr P. E. Carter, of the Post Office's External Telecommunications Executive (ETE), liaised with the Netherlands Administration during these negotiations and Mr G. E. Brett, General Manager of

Some of the circuits provided for Shell's desk-to-desk dialling service cater for the Confratel facility in which up to 10 people at the Shell Centre in London can hold telephone conferences with colleagues in The Hague.

London's South Central Telephone Area, liaised with Shell.

The main point to be agreed was the form of signalling used, as no internationally agreed standard policy existed for dialling over privately leased international circuits from the United Kingdom to other European countries. Various forms of signalling were considered, and it was decided to use SS AC9, a system normally used only within the Public Switched Telephone Network.

Following a successful trial, carried out over two circuits between the Shell Centre and The Hague to prove the compatibility of the two systems, Shell ordered 24 circuits and it was agreed to go ahead with provision and circuit design work. Planning and circuit design for the equipment at the Shell Centre was carried out by South Central Area, while similar work at The Hague was done by the Netherlands Administration.

Two SS AC9 relay sets used in The Hague for the trial were supplied by the Post Office, but the Dutch used a modified form of its own equipment for the actual service, one modification being the addition of a 2,280 Hz signal receiver. The PABX at The Hague is, in fact, a Philips UB 49A – a form of common-controlled PABX with registers controlling the operation of high-speed uniselectors.

The PABX at the Shell Centre in London is a Plessey ATE pre-standard No 4, and there was no space available for additional apparatus racks. Two racks carrying unused apparatus were therefore stripped and altered to take the SS AC9 relay sets and associated PABX relay sets. To provide for satisfactory maintenance facilities, test jack access was provided on the racks on the four-wire and two-wire sides of the relay sets. Part of the design work included alarms, oscillator fail-detection and an automatic oscillator change-over facility, as well as modifications for the relay sets to ensure complete compatibility.

A short time-scale between the start of planning and the target date for operation meant that design work and actual installation had to go hand-in-hand. During the latter stages there was close co-operation between the staffs of South Central Area, ETE and The Hague in testing equipment and circuits, and use was made of Shell's Confratel facility at various stages for discussions between the two Administrations.

The international portion of the circuits – that is, between International

The message switching centre at the Shell Centre, which is connected to similar equipment in The Hague by way of telegraph channels superimposed upon the dedicated speech circuits for the desk-to-desk dialling facility.

Maintenance Centres (IMCs) – are to International Telegraph and Telephone Consultative Committee (CCITT) standards, while from the IMCs to the Shell Centre the circuit is to Engineering Performance Specifications. There is no equivalent specification for private circuits in Holland, but the circuit to Shell's offices in The Hague from their IMC is to similar standards as the British specifications.

Maintenance of the Confratel and telegraph equipment is Shell's responsibility, and South Central Area maintain the PABX and SS AC9 relay sets. Control stations for the international leased circuits are in accordance with CCITT recommendations, which means that the Holland-to-UK circuits are controlled by The Hague, while those in the other direction are controlled by London. The compilation of maintenance procedures, also broke new ground with Mr G. Blaxall, of ETE, preparing fault reporting and locating procedures as well as obtaining agreement from all maintenance groups.

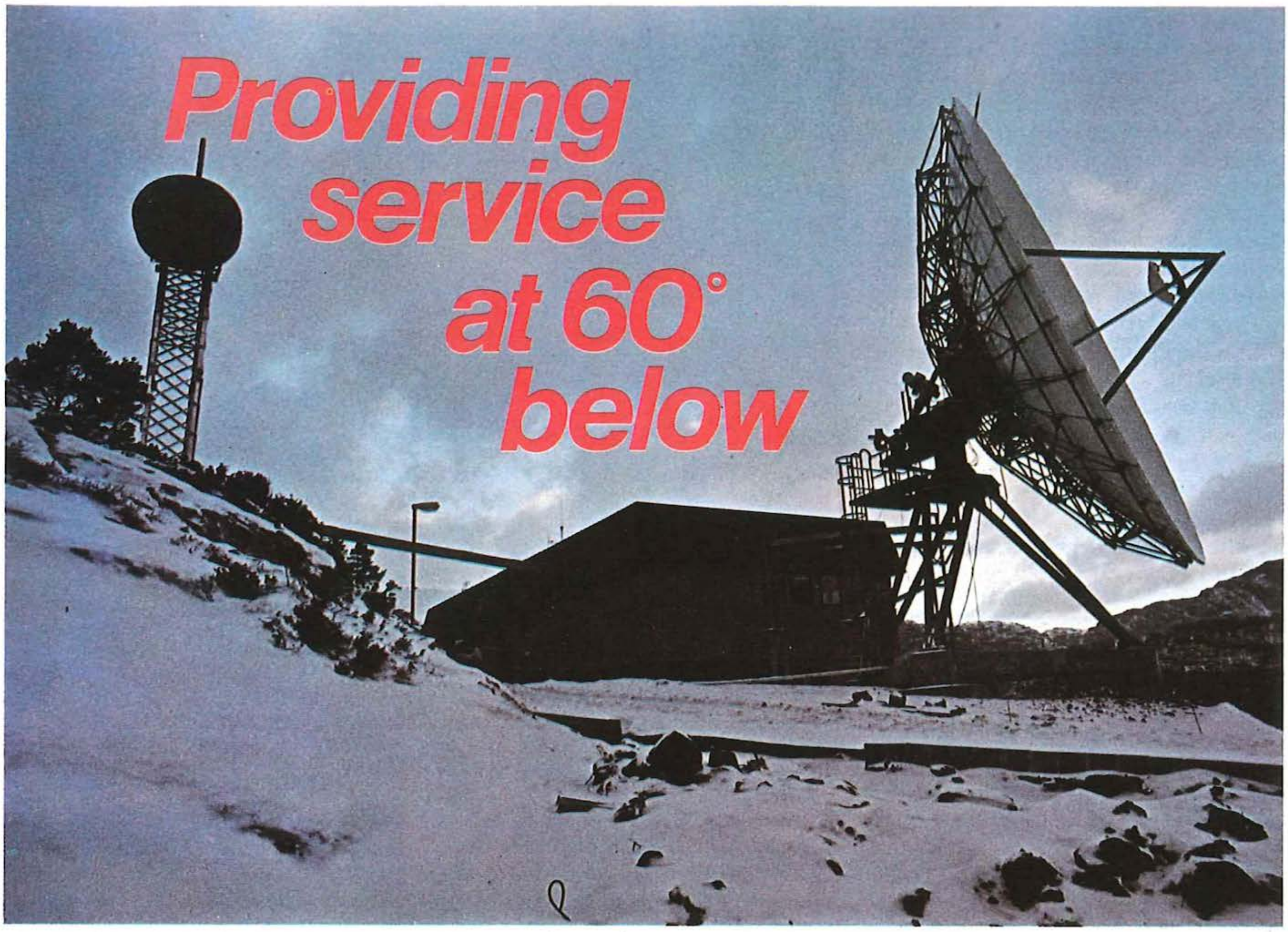
Barry Metcalfe, a Technical Officer in London's South Central telephone Area, checks an incoming circuit from The Hague on the apparatus racks at the Shell Centre.

Having expressed their delight with the new desk-to-desk dialling facility, Shell are now looking forward to the next stage when it can be extended both into the UK network and beyond Holland to other European countries. This can only be satisfactorily achieved by establishing four-wire switching at the Shell Offices in London and The Hague, but preliminary discussions have taken place and the group hopes to be able to finalise its plans soon.

Other international organisations are also interested in the desk-to-desk facility. This first development could therefore be the forerunner of a standard for international dialling over similar privately leased networks.

Mr S. C. N. Balls is Head of Customer Works Division in London's South Central Telephone Area, and has overall responsibility for provision aspects of all complex customers' installations in the Area.

Providing service at 60° below



The satellite earth station at Eik in west Norway.

Mr Gordon McCallum, until recently a Technical Officer in Scotland West Telephone Area, spent a year in Norway on a staff interchange scheme between the Post Office and the Norwegian Administration. In this article, Mr McCallum, now an Assistant Executive Engineer in Edinburgh, describes how telecommunications services in that country have developed in recent years.

WITH temperatures often plummeting to –60 deg C and blizzards leaving isolated areas snowbound for weeks at a time, the telephone is of particular significance to many of the people who live in the frozen grip of a Norwegian winter. Almost three-quarters of the country is covered by mountains, and with most of the remainder being dense forest, small pockets of population have tended to develop around the coastal areas.

Norway's extreme climate, therefore, together with its rugged geography and scattered four million population, have been major factors in shaping the country's telecommunications network. Radio links are used on a wide scale, especially over highland routes where winter maintenance on snow and ice-covered line plant would be expensive, if not, in many instances, impossible.

About 66 per cent of all trunk calls are connected by radio links. Small crossbar exchanges have been developed for use in remote communities to meet the need for service as modern as that provided in large centres. There are 2,900 telephone exchanges, which is relatively high in comparison with the total of nearly one million connections. A fifth are manual exchanges and serve 10 per cent of the country's subscribers.

The country's telecommunications Administration, Televerket, operates profitably but as little as two years ago, its telephone penetration was only 35 per cent per head of population. Subscriber trunk dialling is available to 83 per cent of customers, and complete STD is envisaged by the early 1980s. International telephone facilities are well developed, with access available to a total of 188 countries and territories. Of these countries, 63 can be directly dialled by the operator in Oslo while 68 per cent of customers have IDD facilities to another 21 countries.

Modernisation of the system began in the late 1950s with the introduction of Standard Telefon and Kabel's common control crossbar exchange which replaced older electromechanical systems. Later came Ericsson's common control crossbar exchange in various forms, there being a transit group switching centre, a large exchange, and a small exchange which has been widely used to replace small, remote exchanges serving between 30 and 90 customers.

There is a telephone waiting list of more than 36,000. The area with the highest waiting list is Oslo where large exchanges using rotary switches are to be replaced by stored program controlled (SPC) exchanges with reed relay switching. The first SPC exchange with 8,000 customers was opened in 1975 and two more will be in service this year. Its opening also marked the introduction of a field trial for push-button telephones.

Another type of SPC exchange is also under construction in Oslo. This is a multi-computer controlled transit exchange using code-switches for switching and can be used for national, international and inter-continental connection. It will be used in conjunction with the existing international switching centre.

As well as maintaining its many radio links, Televerket is also responsible for maintenance of the Norwegian Broadcasting Company's 44 transmitters, 622 booster stations for television, and 42 transmitters and 265 booster stations for FM radio. The television, FM radio and microwave equipment is often situated at the same stations, and these constitute the most difficult maintenance duty in Televerket, especially during winter when access is often possible only on skis or snow shoes, or even by helicopter.

In the near future, work will begin on the computer control of switching and distribution of radio and television programmes. The switching will take place at Tryvanns Tower in Oslo, which is a mini-equivalent of the Post Office Tower in London.

Pulse code modulation over radio links was introduced in 1969 with 24-channel PCM being fed over 13 GHz radio systems. The advantage of a greatly enhanced capacity over radio links has now led to 120-channel PCM being transmitted at 8.44 Mbit/s. Much higher capacities are envisaged, and 480-channel PCM over radio should be in operation this year. Transmission systems of up to 12 MHz are also in use and, in 1975, 24 per cent of trunk calls went over coaxial cable links.

While annual telegram traffic has halved since 1965, to about 1.5 million items, telex traffic has almost trebled to about 36 million chargeable minutes. All inland telex traffic and 94 per cent of international traffic to 40 other countries is now automatically switched. Developments in the field of telex exchanges are equally as advanced as in telephone exchanges, and the first SPC telex exchange opened in 1975.

After a trial period of six years, a telex service using radio transmission was introduced in 1971. Three years later radio telex was used in communication to and from 10 oil drilling platforms in the North Sea as well as shipping. Manning and maintenance of 15 maritime radio stations, and the maintenance of 10 which are remotely controlled is the responsibility of Televerket. Work is being done to convert manned stations to remote control.

After eight years of Datel operation, there are now 2,200 customers' modems – equipment which provides the interface between a telephone line and data terminal equipment – in the network, which operate over systems from 100 bit/s to 48 kbit/s. Plans are under way for a data communications network between the major towns in Norway, with eventual extension to other Scandinavian countries.

Norway became the first country in

Women have been employed as technicians in Norway for some years. Here two are at work on a distribution pole.

A snowmobile is used to take transmission maintenance staff up to Sogndal television radio and microwave station situated 1,168 m above sea level.

Western Europe, and the fifth in the world, to use satellite communications on a national basis with the introduction of Norsat, a system providing communications from the mainland to oil platforms in the North Sea. The earth station is at Eik in west Norway. The Norwegian Administration now plans to extend its satellite communications to Svalbard in the northern part of the country.

A car radiophone service was introduced in 1966 and the whole of Norway is now covered by 104 VHF base stations which last year carried 1.5 million calls from 9,000 customers. At present, the system is operator connected, but plans have been prepared for a completely automatic system which should be in operation by about 1980.

Televerket is small in comparison with, for example, the British Post Office, but it has continued to develop its systems and thus keep abreast of other leading nations. The cost, however, is reflected in the high level of customers' charges. The installation and connection charge for a telephone, for example, is £360, £240 of which is a loan that Televerket uses as capital. This accumulates at 6.5 per cent interest per year for the customer and is repaid when the line is ceased.

Rental varies according to the number of customers in the local area. As a customer in a small community has access to fewer telephones for the cost of a local call than in a large exchange area the rental is cheaper, being calculated on a sliding scale.

Until 1974, local calls in all periods cost 7½p for unlimited time. To try to ease the busy-hour load and spread traffic to off-peak periods, a 7½p charge for three minutes was introduced for local calls between 8 am and 5 pm from Monday to Saturday. Trunk calls have a flat rate of 7½p for 45 seconds on distances up to 50 km, and 7½p for 22½ seconds over that distance. Local and trunk calls from coinboxes are charged at similar rates.

Most Norwegians consider the telephone to be expensive, and a comparison is often drawn with the neighbouring Swedish telephone system, which is one of the cheapest in the world. Despite this, however, Televerket's total of about 900,000 customers is growing at a rate of about 30,000 per year as the telephone becomes more and more of a necessity to many people living and working in remote areas. To others it has become a convenient luxury.

Buzby spreads his message abroad

Buzby, who during the past year or so has become a household name as the symbol of Post Office Telecommunications, has been on migration. Throughout August and September he temporarily flew these shores to be on the road to Sydney, Australia, carrying the message that phoning Britain 'would make someone happy'.

Buzby was, in fact, taking part in the mammoth 30,000 km London to Sydney rally. He was prominently featured on a 1275GT Mini sponsored by Post Office Telecommunications and driven by Mike Dicken, producer and motoring editor with BBC Radio Oxford.

This year's rally, sponsored by Singapore Airlines, was the longest in the history of the sport and featured about 80 cars racing through 17 countries.

For the real enthusiast reports on the rally were available by telephone from recordings made by rally headquarters staff in London. Information, available 24 hours a day, seven days a week was updated regularly, providing details of the leading positions, retirements and general information.

At a telephone exchange, Technical Officer Cyril Faulkner takes readings on the gauges connected to pressurised junction cables.

Following injection of a tracer gas into an air-pressurised cable, Technical Officer Erick Brock uses a detector gun to check for leaks.

When there's trouble in the air

M Doherty

New methods of locating air leaks in Post Office telephone cables which are pressurised with dry air to keep out water are helping to reduce the lengths of faulty cable needing replacement.

WATER has always been a common enemy of all types of Post Office telephone cable. Its ingress at cable sheath defects has caused countless breakdowns in service owing to reductions in insulation resistance which can result, for example, in loss of power and overhearing other conversations.

Some years ago, however, an important countermeasure was taken when it was decided to pressurise all the high-grade cables which comprise Britain's 200,000 km trunk and junction network, as well as large cables in the even more extensive local telephone network. By pressurising the cables with dry air it is possible not only to prevent water entering but also to detect a break in the cable sheath.

When a trunk or junction cable is laid,

dry air is pumped into it at a pressure of 620 millibars (9 lb per sq in). This operation is carried out at the telephone exchange or repeater station by means of a special tube attachment. The air is then sealed in the cable. Because of the complexity of the local network, however, it is not possible economically to achieve a 100 per cent airtight system, so dry air is fed continuously into the local cables from the exchange.

The high cost of these operations is justified by the fact that leaks can be detected at an early stage before they have a major effect on telephone service. This is achieved by monitoring the level of air pressure in all cables at telephone exchanges and repeater stations using both flowmeters and pressure gauges. In remotely situated parts of the network pressure-sensitive contactors and alarmed pressure gauges, remotely linked to exchanges, are used for this purpose.

If a leak occurs in the cable sheath – indicated by excessive flows of air to the cable or by an alarm being activated at a terminal station from a remote pressure indicator – steps are immediately taken to locate it. The position of the alarm gives a broad indication of the area of search, which can vary from a few metres to more than 3 km on a particular cable.

A series of pressure readings at manholes spaced along the cable route is taken by a jointer using a mercury manometer and these are plotted on graph paper. This further reduces the area to be covered. As leaks often occur at jointing points a detailed search can be made in many cases by using a special solution which forms bubbles at the leak when it is painted over the joint sleeve and cable sheath.

When a leak in the cable is proved to be between jointing access points more sophisticated location techniques need to be used. A new type of detector, which recently became available, uses a tiny microphone to pick up the noise produced by the escaping air. The microphone, within a metal probe, is attached to thin rods which are pushed into the duct alongside the cable. The microphone is connected to a detector by a trailing lead which is attached to the rods.

If the escaping air is producing audible noise it will first be heard on the detector operator's headphones and then, as the probe nears the leak, will be indicated on the meter. Maximum meter deflection indicates the position of the leak. If the duct contains water the escaping air makes a considerable noise bubbling through it, and as the microphone is waterproof leaks can quite easily be found in conditions of this type.

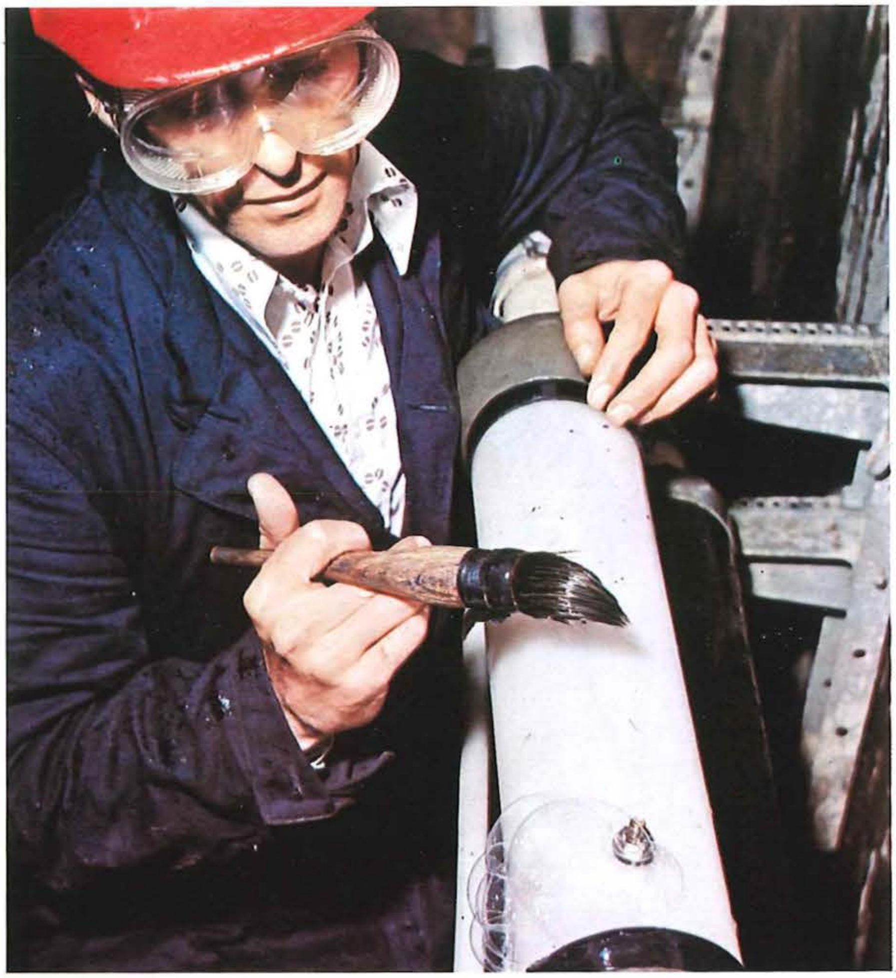
When the duct is reasonably dry and the leak inaudible, a tracer gas and air mixture is injected at the nearest manhole through a valve from a pressurised cylinder into the cable itself. The air in the duct line is sampled by means of a trailing tube rodded over the cables in a similar manner to that used with the audio probe. The point at which the tracer gas and air mixture is escaping from the cable is indicated by the maximum reading on a meter attached to the tracer gas detector.

The meter indicates the concentration of the tracer gas which is, at a maximum, very close to the leak. The tracer gas detector is highly sensitive and it can be used to locate a leak in cable buried directly in the ground. After injecting the gas and air mixture into the buried cable, small holes are bored in the ground just a few inches deep and close to the cable track. A few hours later, minute quantities of tracer gas will collect in the holes and can be detected and measured by the detector. The hole with the most tracer gas in it is the one nearest to the leak.

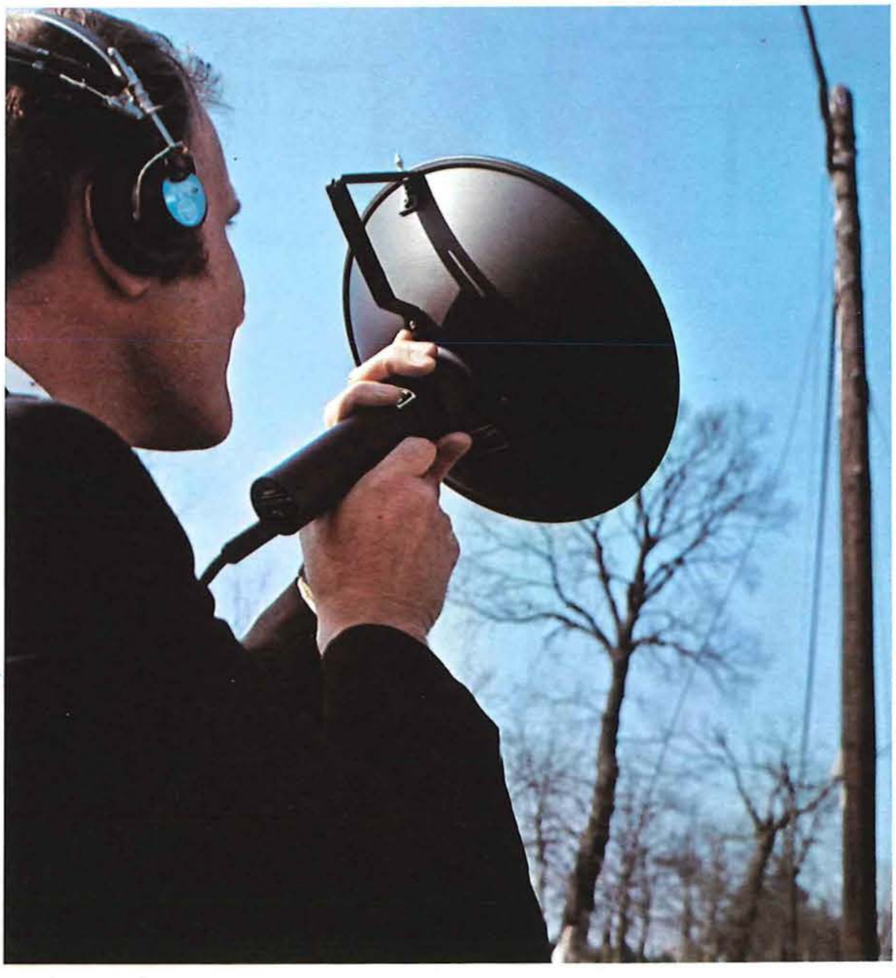
Neither of these two methods of locating leaks in cables in duct can be used if the duct is too congested for rodding. In this case a sensitive aneroid man-

Technician Albert Wood inserts an audio probe into a duct to locate an air leak in a pressurised cable between two jointing access points.

Right: Escaping air around the valve of a cable joint sleeve is detected by Technician Bob Day applying a special solution which forms bubbles at the leak.



Bottom right: A new type of ultrasonic tester for locating air leaks in pressurised aerial cables undergoes field trials.



ometer, which works on the same principle as a barometer, is used to obtain a more accurate pressure graph along the cable. The manometer readings must be corrected for altitude and for the time it takes to obtain them over the defective section. The method can give a location that is accurate enough for excavation.

Finding leaks in aerial cables often requires the use of an elevating platform to examine the cable sheath between its supporting poles. These leaks, often caused by shot-gun pellets during the shooting season, can be troublesome and to enable them and other defects to be located from ground level, a test is being undertaken which transforms any ultrasonic noise produced by the escaping air into audible sounds. A parabolic reflector directed towards the cable collects some of the ultrasonic noise and focuses it on to the transducer of the tester. The transformed sound is then heard through a pair of earphones.

The effectiveness of the methods for detecting and locating air leaks described above depends very much on the conditions on site. An obstruction in the duct, for instance, may prevent rodding as far as the leak or the leak may not produce sufficient noise to be detected.

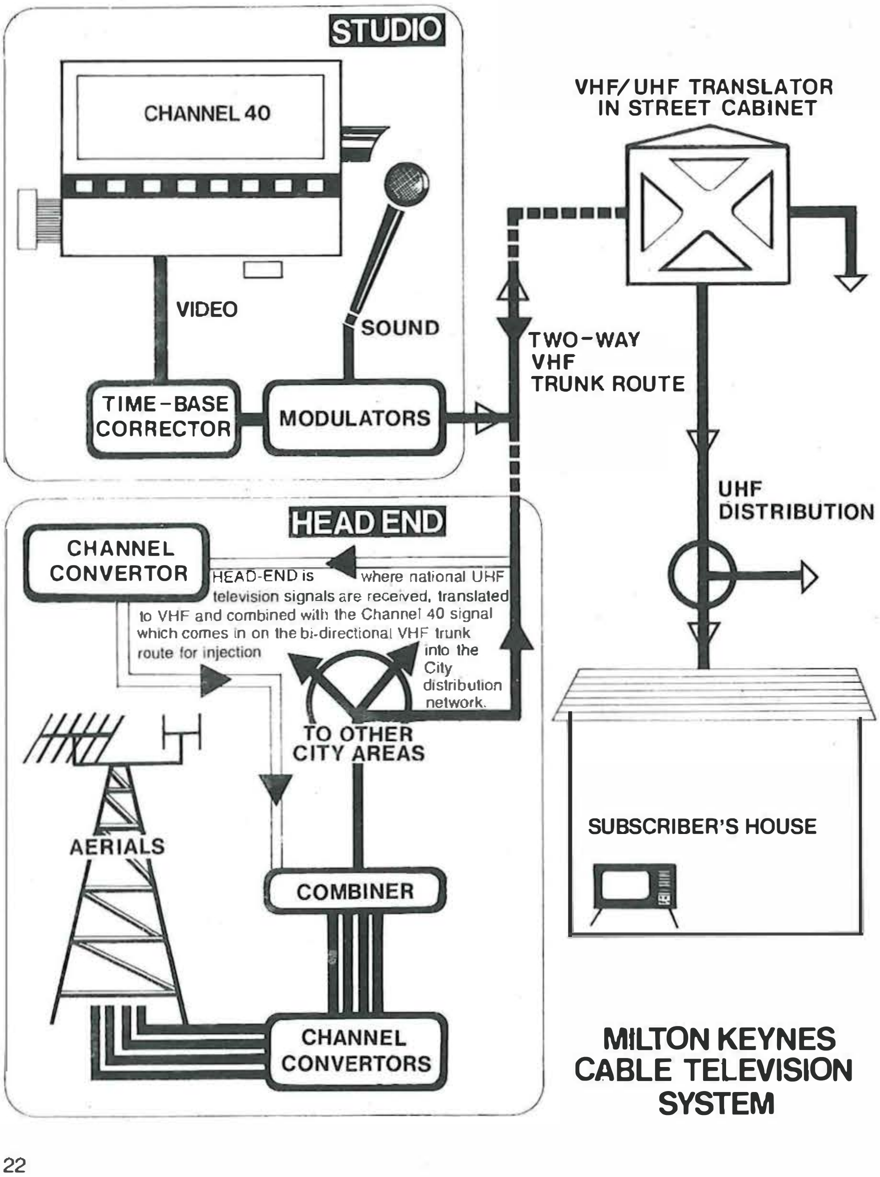
A novel method of overcoming many of the problems, however, has been developed by the Post Office Research Department and involves the use of a pneumatic bridge, analogous to the electrical Wheatstone Bridge, to locate a pressure defect within a length of cable. This is currently being tested in the field.

All these aids are helping to reduce the number of faulty cable lengths which have to be renewed. Repairing the sheath defect in situ and before the water has had a chance to penetrate to the conductors and affect service, is both cheaper and causes less disturbance to customers.

Mr M. Doherty is an Executive Engineer in Service Department at Telecommunications Headquarters, responsible for main underground and junction cable maintenance.

Helping establish the community view

CG Taylor and E Williams



MILTON KEYNES CABLE TELEVISION SYSTEM

PEOPLE living in 10,000 homes in Buckinghamshire's new city of Milton Keynes can, thanks to the Post Office and the local Development Corporation, relax in front of their television sets and tune in not only to established favourites like 'Coronation Street' and 'Nationwide,' but also to Channel 40 – a locally produced programme which deals with news, views and activities in the community.

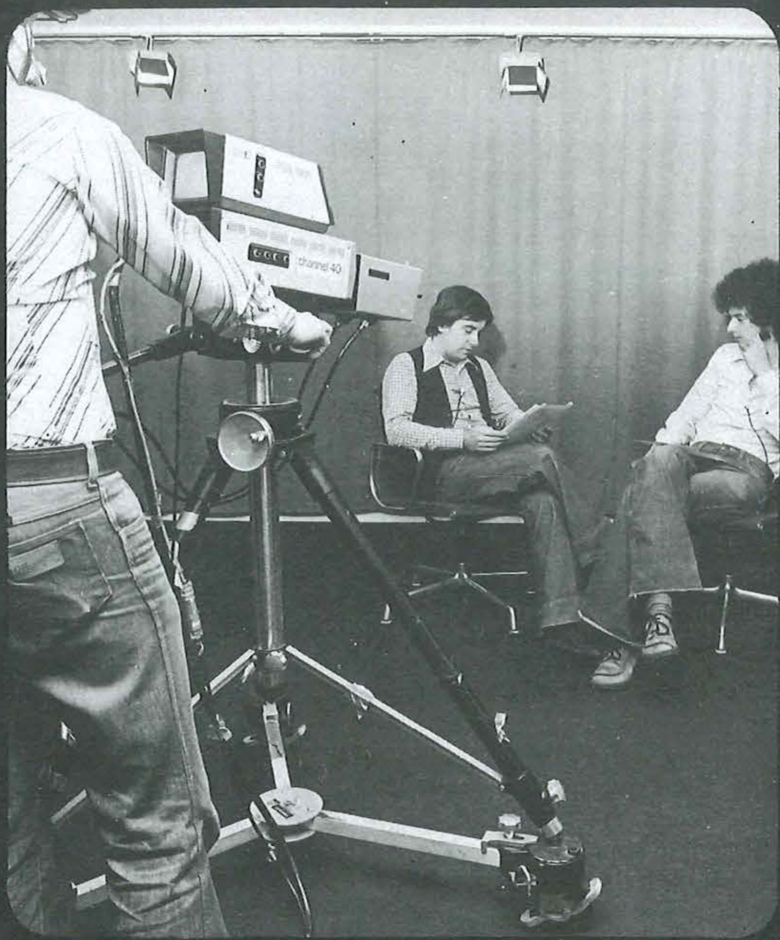
Channel 40 is available to all residents of the city who subscribe to the special Post Office cable system which enables BBC, commercial and other television and radio broadcasts to be piped into their homes. Telephone service is supplied by a separate cable.

The first Channel 40 programmes were screened in December last and transmissions now run for up to one-and-a-half hours every evening. Set up on an experimental basis, the 'station' is an attempt to fulfil the communication needs of a new community, to provide increased social awareness and greater participation. For a three-year period it will be funded partly by the Milton Keynes Development Corporation and partly by the Post Office.

The station is run by a small staff whose role is to help anyone who wants to make a programme. Help is given by editing material, and by offering advice and technical assistance, but no attempt is made to influence the content or objectives.

The television studio is located in two

On camera in the Channel 40 television studio at Milton Keynes, an interview is recorded on videotape for later broadcasting to residents in the city who subscribe to the Post Office cable system.



converted flats close to the city centre. It consists of meeting rooms to discuss programmes, a general office and reception area where people can watch the broadcasts, and a studio. Equipped with black-and-white television cameras, the studio is used for recording interviews, announcements and link routines on videotape. Separated from it by a large, plate-glass window is the control room from where the light, sound and vision for the studio is controlled. It is here that the videotapes are edited into their final format before being transmitted.

The philosophy of the Channel 40 staff is that they should act primarily to help the residents of Milton Keynes make their own programmes. Of the first 445 tapes recorded, 86 per cent were on topics suggested and defined by Milton Keynes residents themselves, and covered a wide range of activities from a folk music programme to a discussion between the Over-50s Club and local councillors. Although most programmes are initiated by residents, the station staff at present do most (77 per cent) of the filming. They are, however, working towards training residents to do most of this work for themselves.

It is hoped that, in a year or so, most programmes will be filmed by amateur cameramen from Milton Keynes, although editing still has to be done by station staff. Editing decisions are made by the initiators of the programme wherever possible. If more equipment can be provided, residents will later be given the opportunity to do their own editing, and live broadcasts may also be possible.

Because the portable video recorders used by the station are small and relatively unsophisticated, the television pictures produced are subject to timing errors which result in 'jitter' of the picture when viewed on a normal, domestic television set. Editing and recording of the tapes only compounds these errors.

To make the pictures more acceptable the Post Office has used a digital time-base corrector, which acts an an interface between the studio and the Post Office cable system to produce an out-

In the studio's control room, Post Office Technical Officer Brian Davies, left, checks the time-base corrector. Channel 40 Project Director Michael Barratt, far right, supervises videotape editing work.

Left: Trainee Technician Apprentice John Simmons measures television signal levels on the VHF/UHF translator equipment at a roadside cabinet.

Below, left: Incoming television signals are monitored at the Channel 40 head-end where UHF signals are processed and transmitted to line at VHF.

put which is as stable as those produced by the national television companies.

This then is the local television station, and how the Post Office gets the programmes to its audience. But is it a worthwhile service? The Annan Committee (Report of the Committee on the Future of Broadcasting, Cmnd 6753, HMSO 1977) came out strongly in favour of such stations. Detailed research findings on the reactions of the community will become available through a research programme funded by Telecommunications Systems Strategy Department. A first series of interviews with Milton Keynes residents was completed just before the first programmes were transmitted, and the 520 interviewees will be questioned again in November 1977 and 1978.

Preliminary results from this study suggest that people are enthusiastic about the idea of community television. Some 98 percent thought it was a good idea; 49 per cent said they would like to participate in making a programme; and 48 per cent said they would be prepared to subscribe 10p or more a week to support such a station. The survey is also designed to see if Channel 40 is helpful in informing residents about local events, in involving them in community activities, and in generating some community spirit.

The Milton Keynes Development Corporation is particularly anxious that all new residents should be helped to settle in quickly, and that Milton Keynes should become a real community, rather than just a miscellaneous collection of people and houses dotted over the countryside. It will be interesting to see, through the results of the survey, whether Channel 40 is helping to realise this aim.

Mr C. G. Taylor is an Executive Engineer in Telecommunications Development Department, and was until recently responsible for cable television systems development.

Dr E. Williams is a social psychologist working for the Engineering Department of Cambridge University and under contract to Telecommunications Systems Strategy Department.

Above par links for golf writers

I K Mothersole

A FEW hours after the American golfer Tom Watson had sunk his championship winning putt in the dramatic climax to this year's British Open at Turnberry, a small group of Post Office staff were able to sit back and relax – albeit only temporarily – for the first time in days.

The unsung "heroes" were Ian Campbell, Archie Faull and Helen Phillips from Glasgow International Telegraph Exchange, and their job had been to ensure that every one of nearly 200,000 words filed by journalists from all over the world during the six-day period of the championship were successfully transmitted to newspaper offices in Australia, France, Germany, Italy, Hong Kong, South Africa, Spain, Switzerland and the USA.

The trio, working from the Post Office telex centre in a corner of the Press tent, were faced with messages in English, French, Italian, Spanish and Afrikaans which occupied Post Office telex line plant for 42 hours during the course of the championship.

Before the tournament began a great deal of time was spent determining routings and checking the telex numbers to which copy was being sent. Once the golfers had teed off the operation ran very smoothly, although a few minor problems were encountered with typing in foreign languages and in dealing with the names of some of the course holes like Mak Siccar, Blaw Wearie and Tappie Toorie!

One Australian journalist alone sent messages to an agency in his home country for onward transmission to a dozen newspapers in three different countries. The New York Times, Sydney Telegraph, Melbourne Sun, Washington Post, Los Angeles Times and La Gazetta Dello Sport were some of the well known papers which used the Post Office service, and famous names like Tom Ramsey of News Ltd Australia, John Radosta of the New York Times and Dan Jenkins of Time Magazine all disposed of their copy from the Post Office telex centre. Some of their stories had a transmission time of more than 40 minutes.

British journalists also took advantage of the facilities, and coverage of the golf by Peter Ryde of The Times, Mark Wilson of the Daily Express and many others ensured that the teleprinters were seldom silent. Not one newspaper missed a deadline throughout the week and several letters of appreciation have been received from journalists for the service extended to them by the Post Office, and in particular the hard working operators from Glasgow.

One of the most interesting operations was determining a strict format for sending messages to a particular teleprinter connected to a computer terminal. The computer automatically set up the news type and even one misplaced character could have "thrown a spanner in the works".

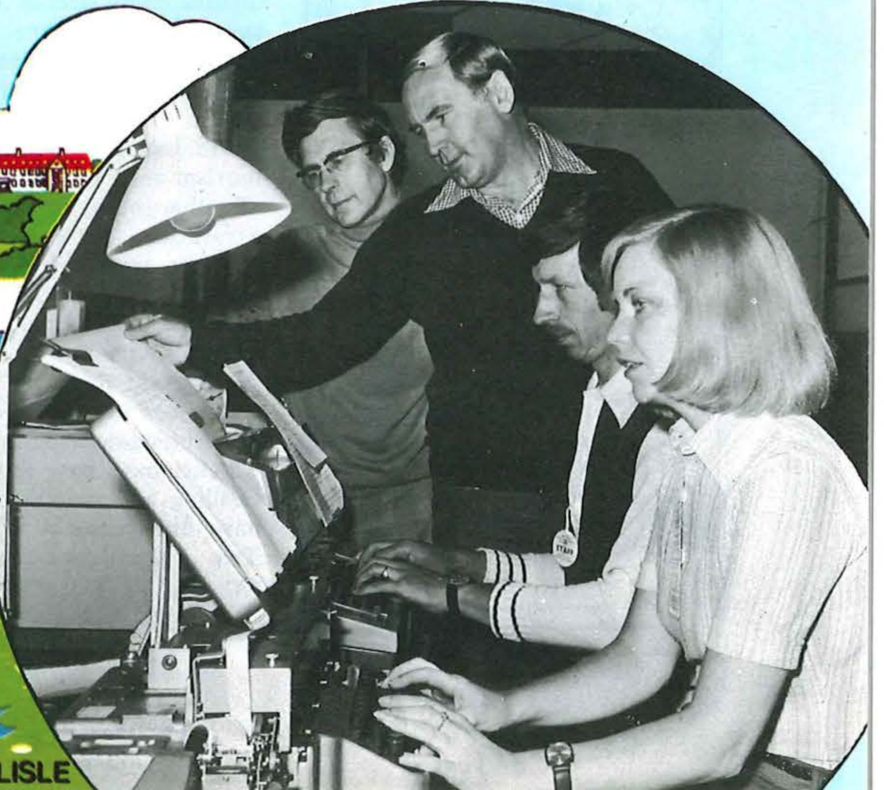
But transmitting messages for the Press was not the only function performed by the telex centre. In conjunction with a Mobile Post Office from Girvan, situated in the course's tented village, numerous incoming congratulatory and greetings telegrams for competitors and officials were handled. A large number of overseas cables and telegrams were also accepted at the Mobile Post Office.

After the event the mass of paper work involved in pricing calls and determining costs showed that although the Post Office did more than £2,000 worth of business, by the time 50 per cent of the call charges were paid to overseas Administrations and VAT deducted, the Post Office did little more than break even on telex.

Perhaps more important, however, was the goodwill engendered, and this extract from a letter from John Radosta of the New York Times seemed to sum the general feeling: "If all my communications were handled as well as they have been during the 106th Open my job . . . would be immensely easier. I have been absolutely delighted with your management of my copy and I am happy to congratulate every one of your hard working staff."

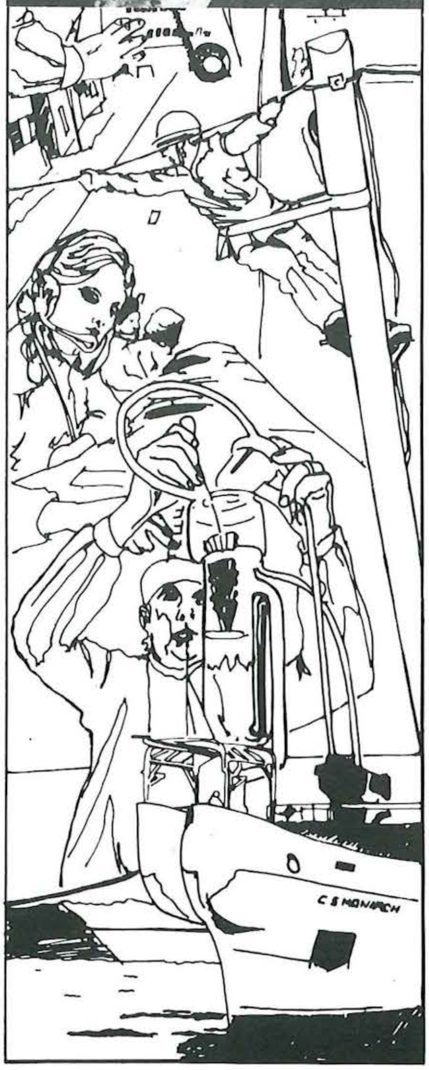
Mr I. K. Mothersole is a Telecommunications Traffic Superintendent at the Scottish Telecommunications Board Headquarters responsible for telex and telegraphs.

PO Telecommunications Journal, Autumn 1977



Journalist Tom Ramsey of the Sydney Telegraph, Australia, watches his copy being transmitted from the Post Office telex centre. Left to right in the picture are Ian Campbell, Archie Faull and Helen Phillips from Glasgow International Exchange.

Maintaining good service



In this, the third in our series of articles on some of the many different jobs essential to the efficient operation of Post Office Telecommunications, Mr W. K. Taylor outlines his responsibilities as Head of Maintenance (West) in Scotland West Telephone Area.

LIFE as Head of a Maintenance Division in any Telephone Area could never be called routine, and in territory as diverse and wide ranging as Scotland West this must be doubly so. Just look at the sheer size and variety of the land. It embraces some 7,600 square miles from Duror on Loch Linnhe in the north to the Solway Firth in the south and from the Islands of Tiree and Islay in the west to Langholm in the east.

The central belt has heavy industry dominated by steel at Motherwell and shipbuilding at Port Glasgow, and these in turn attract other heavy and light engineering industries. Light industry and agriculture is found in South Lanarkshire and Ayrshire and tourism on the Clyde coast.

Further south, around Dumfries and Stranraer, tourism is stronger, together with fishing, farming and forestry, while in the north and west tourism, foresty and fishing are the main activities.

At present there are about 400,000 telephones in the Area connected to 305 automatic telephone exchanges. All customers have Subscriber Trunk Dialling and more than 75 per cent have International Direct Dialling. Two transatlantic cable systems – TAT 1 and CANTAT–terminate at Oban.

The main function of a Maintenance Division is to ensure that a customer making a call reaches the required number and can communicate clearly. A single call may use a complex combination of external plant, exchange, transmission and radio equipment, and the Maintenance Division is responsible for the correct functioning of all this plant. The necessary effort is directed by the Divisional Head through his chain of command and, as with any project, the objectives must be clear.

My responsibility is broadly to ensure that the quality of service given to customers and the cost of doing this is as agreed with the General Manager. Quality of service is affected by the performance of switching, transmission, line plant and customers' apparatus.

To enable managers to assess the service offered and to identify areas where improvement can be made there are statistics to indicate fault incidence, speed of repair and the performance of the local and STD automatic service. The organisation and complementing of the Division is kept under review to ensure adequate supervision and that staff numbers are sufficient.

An important part of my work is visiting and talking to field staff in their own environment. These visits reveal a wide variety of difficulties, provide a good background for staff appraisal and counselling and help in keeping a free flow of information up and down the chain of command. Other responsibilities common to all Heads of Divisions include recruitment, training, discipline, sick absences, and accident investigation.

Consultation with unions takes place over a wide field, ranging from the introduction of new work practices to the employment of disabled staff. With seven branches of the Post Office Engineering Union in the Area this can take considerable time.

Operating a Maintenance Division in Scotland West presents particular problems, such as staffing in remote locations, training and supervision. To overcome these difficulties at, for example, island stations accom-

Mr Taylor discusses a point with one of his staff during a "field visit" to part of his area.

modation is arranged by the Post Office and tours of duty are specified after which a return to the mainland is arranged.

Here, perhaps, it is worth considering the situation on, say, the island of Tiree. The Technical Officer – the only Post Office engineer on the island – has a duty involving the maintenance of a small automatic exchange, a microwave radio-relay station, a telephone repeater station, teleprinters and a variety of customers' apparatus and line plant. A visit from the supervising officer means making use of air and sea transport.

In the industrial belt the problems are more akin to those encountered in most Areas. Strowger switching systems are being replaced by common control exchanges of electronic or crossbar design. Training in new skills is necessary but not all of the older and experienced Strowger trained men can readily be re-trained and rearrangements of duties are required to make best use of their skills. All such redeployment is of course discussed with the appropriate staff association.

In the external field, the replacement of lead sheathed cables by polyethylene types has demanded new skills in fault location and repair. New techniques are required to locate pneumatic faults in the pressurised cable systems provided between the telephone exchange and the primary cross connection points (PCPs) – usually referred to as cabinets.

To provide a better customer service we have, for the last three years, concentrated efforts on improving local underground plant. This plant could no longer withstand the effects of the Area's higher than average rainfall and problems had arisen in making good joint closures in polyethylene sheathed cables. There were also difficulties caused by the disturbance of existing plant by the external development work necessary to cater for a high growth rate and because too little money had been spent in the past on plant maintenance.

The situation had been reached, in fact, where not only was the fault incidence too high but the repair time was too long. The problem was how to break this vicious circle.

At that time responsibility for underground plant maintenance lay outside the Maintenance Division but a reorganisation was undertaken making the Head of Maintenance Division responsible for all maintenance apart from a small amount in rural areas which was devolved. Additional staff were recruited and work began to remedy the situation. Meetings were organised with underground maintenance staff at Repair Service Controls to let them know what was being attempted and why, to make them aware of their vital role and to encourage them to make suggestions for improvements.

The local line insulation routiners (LLIRs) which can detect faults before customer service is affected, but which had been neglected, were checked and brought back into use. Initially dozens of faults were detected and we began by tackling only the bad cases. Now routine LLIR tests are made at all large exchanges and as a result numerous faulty terminating assemblies in PCPs have been replaced by modern types, and many faulty cable lengths and damp joints have been eliminated from the system.

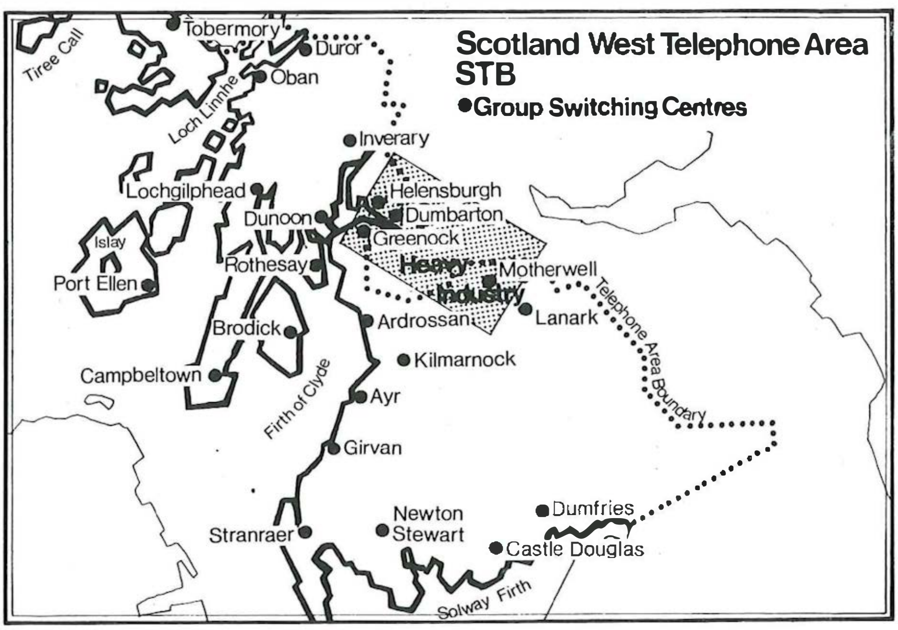
Work was also started to eliminate leaks in the pressurised cable systems between the telephone exchange and the PCPs. Alarm circuits which had in many cases been disabled were reconnected and staff were allocated to inspections and maintenance of cabinets.

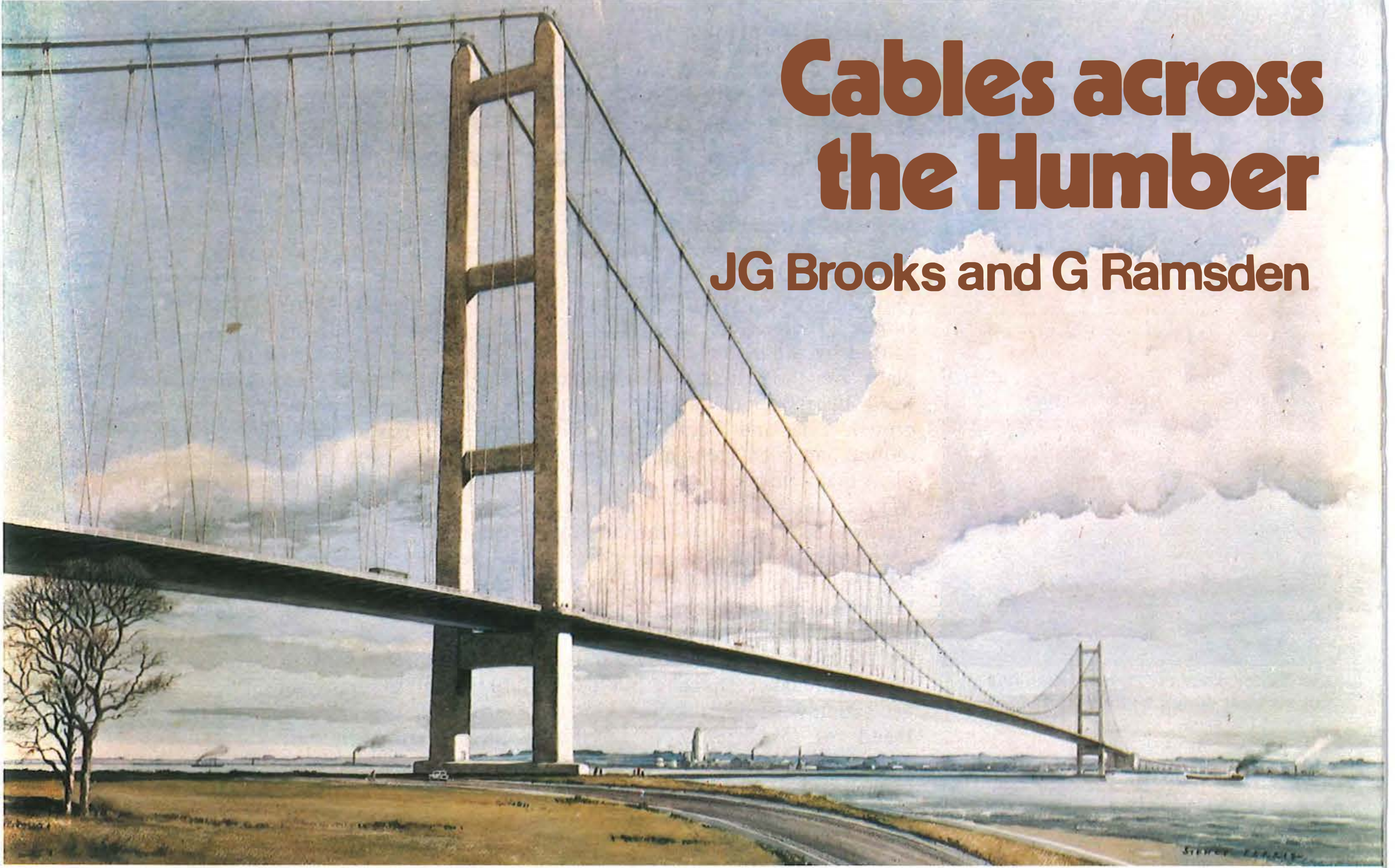
The working environment in underground structures has been improved, and wide use has been made of films covering safety aspects. Supervision has also been improved by a reduction of the staff to supervisor ratio, enabling supervising officers to spend time on the job with their staff.

Results so far have been encouraging, with overall speed of repair now running at better than the target of clearing 87 per cent of reports by the end of the next working day. Currently the underground fault rate is falling – dramatically in black spots – and staff morale is at a high level.

As I said at the beginning, life as Head of a Maintenance Division is never routine. My work is frequently affected by actions totally unconnected with the Post Office, like those of trawlers and construction equipment damaging plant. There is also lightning and floods to contend with, but although in no way is it a peaceful existence, it is always challenging and personally satisfying.

PO Telecommunications Journal, Autumn 1977





Cables across the Humber

JG Brooks and G Ramsden

As well as a main span of 1,410 m, larger than any other of its kind in the world, the Humber suspension bridge will have several other notable features. The distance between the anchorage points of its main suspension cables, for example, is 2,200 m, the tops of its towers are more than 160 m above river level and the roadway structure will be not less than 30 m above high water.

The anchorage on the northern side is 250 m closer to its adjacent tower than the corresponding anchorage to the south, and for this reason the suspension cables, each consisting of nearly 15,000 wires 5 mm in diameter, are augmented by 800 more between the anchorage at the top of the north bank tower.

The bridge's suspended structure will comprise 124 prefabricated hollow box sections, made from stiffened steel plates. This structure will form dual two-lane carriageways, and panels cantilevered from each side provide footways and cycle tracks.

From the anchorage points on each side viaducts, bridges and elevated roadways will link with existing main roads. It is, perhaps, of interest that the nearest alternative route by road between the two points on the north and south banks where the bridge crosses is more than 80 km.

Consulting engineers to the Humber Board, which is responsible by Act of Parliament for the creation and subsequent operation of the bridge, are Freeman, Fox and Partners of London.

FOR MORE than 100 years there has been a desire to span the River Humber in North-East England with a bridge. Now that wish will soon become a reality as work progresses on a new structure which will cross from Hessle on the north bank to the south side near Barton-upon-Humber.

Creation of the Humber Bridge – 5 km long, including approaches – will provide carriageways, footways and cycle tracks between the two banks. It will also include a valuable new route for Post Office telecommunications cables which will come into use during the 1980s.

Since the early 1900s the Humber has been crossed many times by telegraph and telephone cables laid on or in the river bed between Kingston-upon-Hull and the south bank. The first four-wire telegraph cables were laid before 1905, followed quickly by others of successively larger size over the next few years and culminating in a 28-wire cable in 1922.

Several telephone cables followed in the years up to 1929, but all of these earlier cables are now disused. Cables laid in subsequent years progressed from the conventional audio trunk cables in 1937 and 1945, through carrier cables in 1953 to a four-tube coaxial cable in 1968. These are still in use.

The Humber Bridge Act of 1959 first gave authority for the bridge to be constructed, and this contained provisions for Post Office cables to be accommodated. The fact that the bridge was to be built, however, did not automaticallly mean that it had to be used by the Post Office, and comparative cost studies of alternative methods for providing for long-term main and junction network requirements were made before the requirement was proved.

Very early thoughts on the amount of Post Office cabling space needed in the bridge resulted in an estimate of 16 ducts. Since that time, however, revised estimates in the light of current technological trends have reduced the requirement to eight, which will be equally divided between the main and junction networks.

Ducts for the Post Office and for bridge services – such as roadway, aircraft warning and navigation lighting, traffic control and emergency and administration telephones – will be housed on either side of the centre line of the bridge and will pass through shared access chambers. The ducts through the main structure, which are being provided by the bridge builders, are made of plastic coated steel to save painting but will be untreated internally. They are being welded into position during construction of the box sections and will be sleeve jointed between the sections when these are erected.

At the anchorages the Post Office ducts change position to the eastern side of the bridge. Because they need to be self-supporting, or for mechanical strength through being laid at shallow depth, Post Office steel ducts are being used here, as well as in the viaducts which carry the approach roads to the main bridge structure.

Whereas Post Office ducts will occupy space under the eastern footway on the northern viaduct, in the southern viaduct – which is of twin concrete box construction – they will be suspended in special frames from the underside of the southbound carriageway inside the box sections. PVC duct is being installed from the ends of the viaducts to link up with existing Post Office cable routes.

Ten chambers, spaced at regular intervals across the bridge, will give facilities for installing and jointing cables, as well as providing accommodation for loading coils and repeater equipment cases. These chambers, 4.5 m long and 3.3 m wide, are being formed within the box sections as they are made. Aluminium ladders, specially designed by staff at Telecommunications Headquarters to be carried by cable installation and maintenance parties when working on the bridge, will give access to the chambers through entrances on each side of the central traffic barrier.

Conventional Post Office manholes will be built in the approach roads to the bridge but, owing to design difficulties, the need for access to the cable route in the viaducts has been avoided. Additional access to the ducts and the cabling route is given at the expansion joints in the suspended structure and at the anchorages.

Probably one of the most interesting aspects of the project is the means of allowing for expansion and contraction of the bridge. This is being achieved by introducing expansion joints at the towers and anchorages.

At the anchorages, the ducts from the bridge side spans will be suspended so that they project across the expansion gap into an expansion chamber where 2-m diameter horizontal loops formed in the Post Office cables will be suspended by wire ropes from the underside of the roof slab before going across an anchor block, again in ducts. At the opposite end of the anchorages there will also be expansion chambers for accommodating small thermal movement of the adjacent viaduct.

At each of the towers, a long beam with cable supports along each side will be fixed through a fully articulating joint to the end-plate of the side span. The beam will project into the main span and be able to slide, as the bridge expands and contracts, between and on plastic bearing plates carried in a special framework.

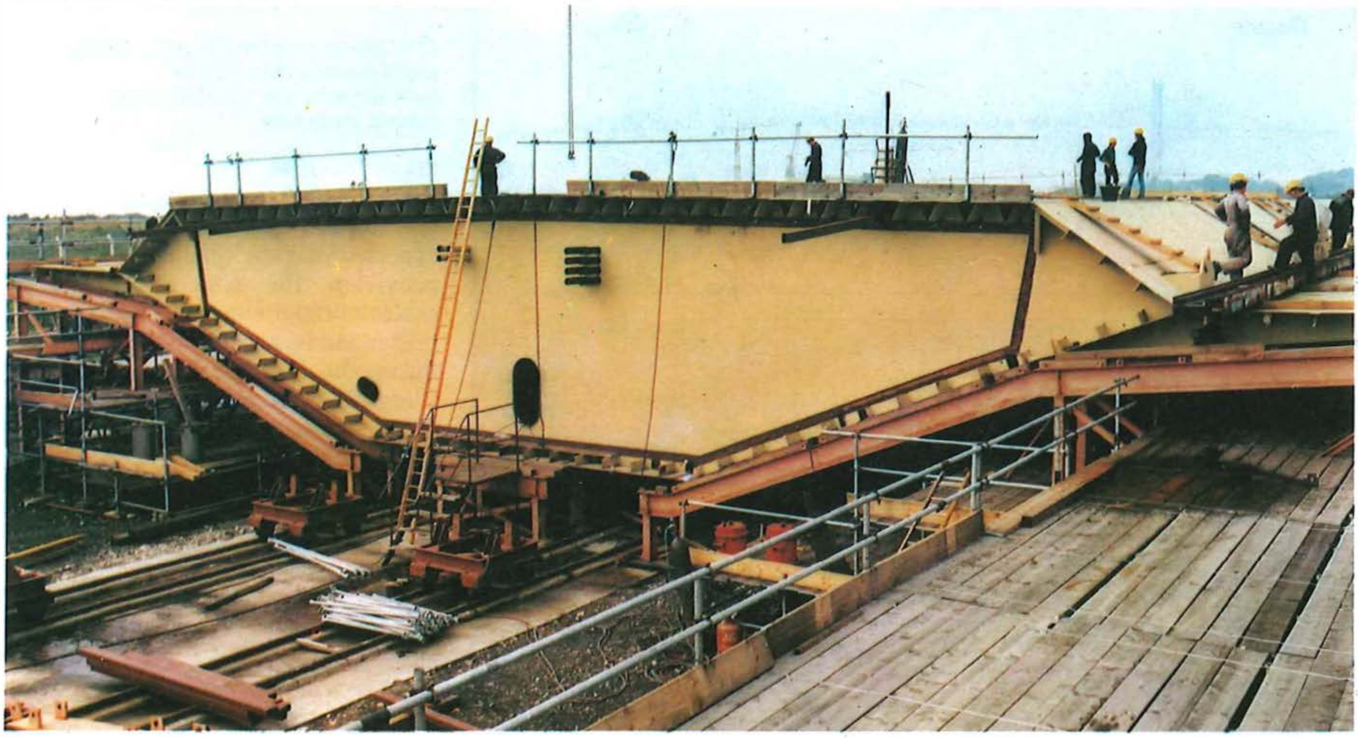
From the end of the main beam two smaller subsidiary beams which carry cable hangers will be successively pivoted towards the side of the box sections of the bridge. This arrangement will support the cables so that they form an elongated loop as they pass along the subsidiary beams and turn to rejoin the line-of-route on fixed bearers, finally passing up through the floor of the adjacent access chamber.

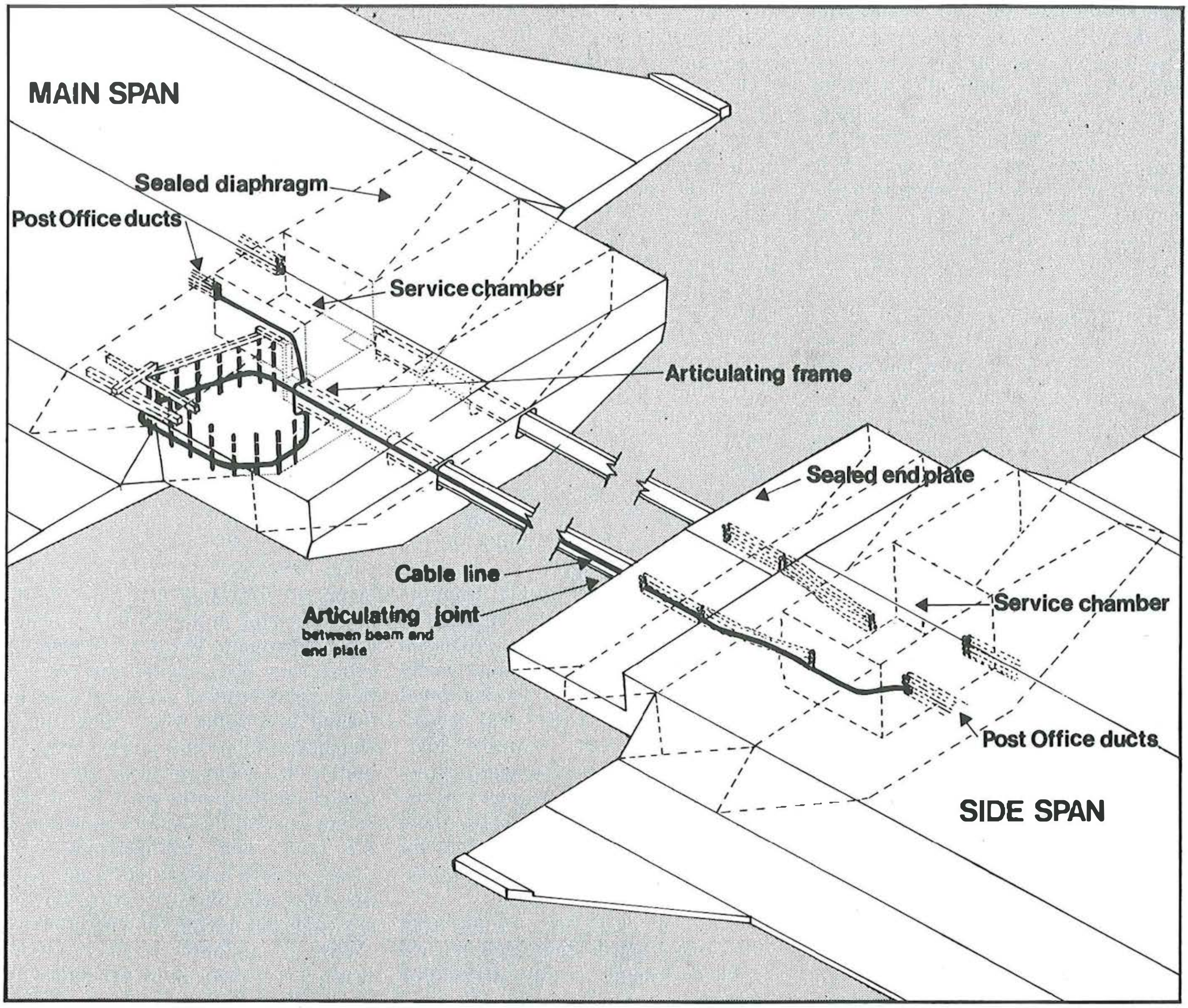
Expansion and contraction of the bridge up to 2.6 m caused by temperature changes are thus accommodated by a moderate amount of opening or closing of a large loop in each of the cables.

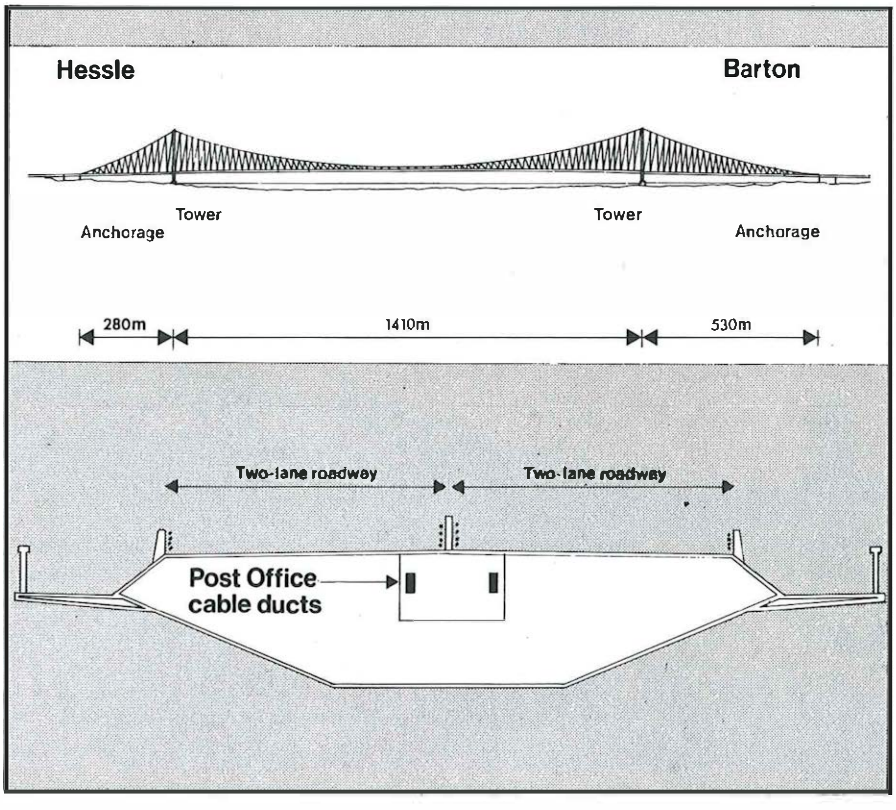
The box sections of the bridge are being prefabricated at a site on the northern bank of the Humber, about 2 km downstream. When the suspension cables have been erected the box sections will be loaded on to pontoons and floated to a point where they can be winched into position. The specially built jetty where sections are to be loaded on the pontoons is in an area where existing Post Office cables cross the river, and arrangements have therefore been made to locate and mark the cables with buoys to ensure they are not damaged during the operations.

With the inflation levels of recent years, it is as difficult to assess the cost to the Post Office of the provisions

A box section of the bridge under construction, showing the black Post Office ducts.







Above: Arrangement for Post Office cables at the towers, which allows for expansion and contraction of the bridge.

Left: Elevation of the Humber Bridge, and a section through the deck showing the location of the access chambers.

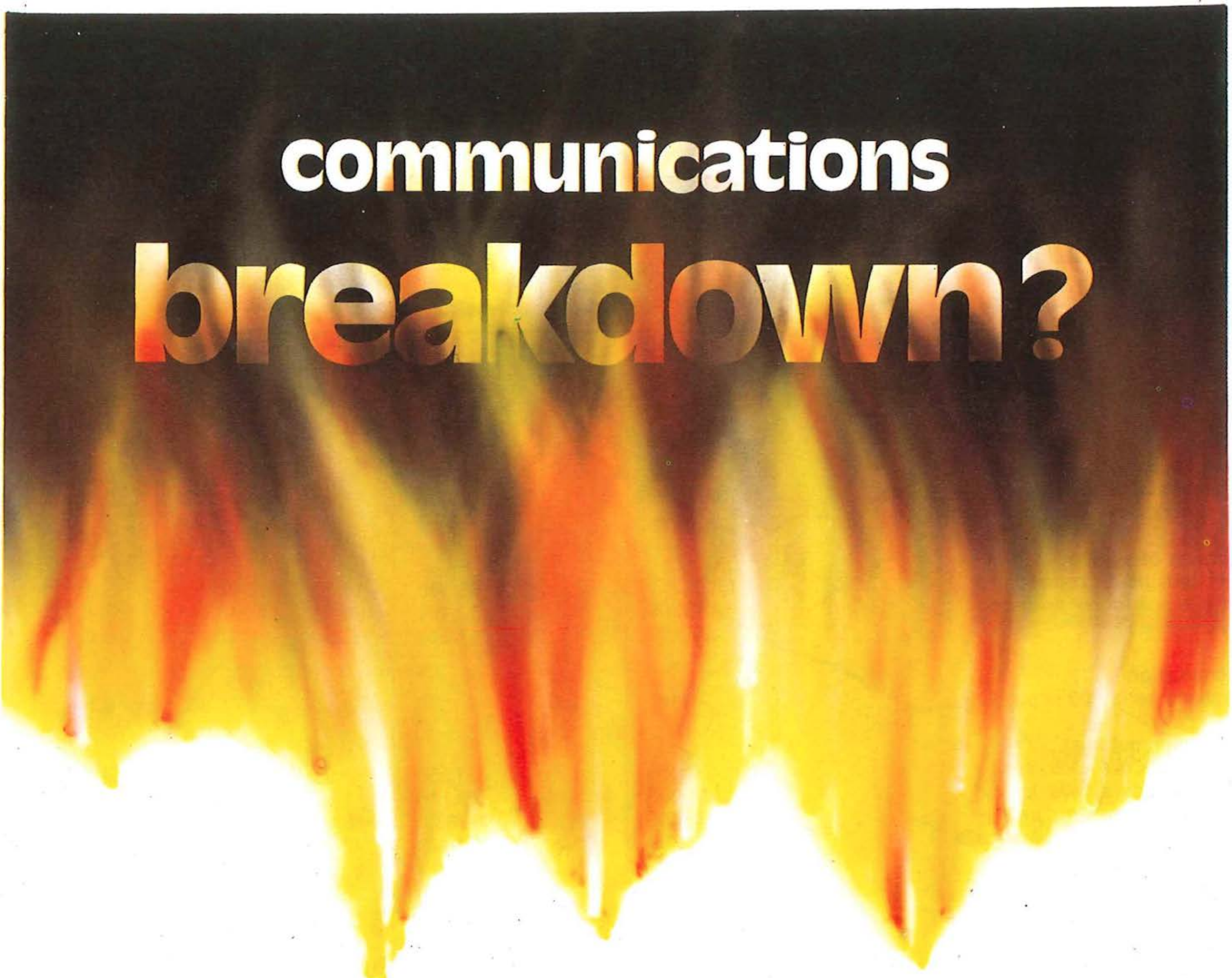
being made as it is for the Humber Bridge Board to forecast the ultimate cost of the bridge. It is, however, expected that the final cost of making provision for telecommunications cables throughout the length of the bridge and its approach roads will be in the region of £600,000. This represents a large investment in helping to ensure that continued growth in demand for telecommunications services will be effectively met in the future.

Mr J. G. Brooks is an Executive Engineer in the Planning Division of North Eastern Telecommunications Region with responsibility for external planning and works.
Mr G. Ramsden is an Assistant Executive Engineer in the same Division.

The year in figures

A review of Post Office Telecommunications progress in the year 1976-77

	1976-77 Result	1976-77 % growth over 75-76	1975-76 Result	1975-76 % growth over 74-75	1974-75 Result	1974-75 % growth over 73-74
TELEPHONE SERVICE						
Size of system						
Total working connections	13,961,573	5.5	13,230,344	4.2	12,698,642	6.7
Total working stations	22,075,832	4.7	21,092,198	3.5	20,389,129	6.5
Call office connections	77,302	0.1	77,221	0.5	76,787	0.2
Shared service connections	1,664,509	−13.2	1,918,402	−8.8	2,104,592	0.8
% of connections on auto exchanges	100	0.1	99.9		99.9	
Growth of system						
Net demand for connections	1,425,257	22.2	1,166,089	−10.5	1,302,714	−3.9
New supply of connections	1,423,208	11.9	1,272,180	−5.7	1,348,744	−7.4
Waiting list	38,402	−18.8	47,307	−53.8	102,415	−6.6
Penetration						
Stations per 1,000 population	397	5.6	376	3.6	363	6.1
Traffic (in millions)						
Inland effective calls: trunk	2,456	4.2	2,356	1.9	2,313	8.2
Inland effective calls: local	14,200	3.4	13,736	1.6	13,523	6.4
Continental: outward calls	42.3	21.1	35.0	18.2	29.6	23.7
Inter-continental: outward calls	11.9	28.2	9.3	40.5	6.6	26.7
Telephone usage						
Calls per connection	1,228	−1.4	1,245	−3.5	1,290	−0.9
Calls per head of population	299	3.7	288	1.6	283	6.8
Local exchanges						
Manual	Nil	−100	3	−76.9	13	−56.7
Total automatic	6,260	—	6,260	0.3	6,242	0.4
Strowger	not yet available		5,206	−2.5	5,339	−2.9
Crossbar			359	15.8	310	32.5
Mixed strowger/crossbar			17	325	4	—
Electronic			669	14.2	586	19.1
Mixed strowger/electronic			9	200	3	—
TELEX SERVICE						
Total working lines	64,804	9.6	59,142	9.0	54,256	10.7
Inland calls (thousands)	67,655	5.2	64,325	25.6	51,226	6.4
External originating traffic (thousands)	53,736	13.7	47,250	10.8	42,637	12.1
TELEGRAPH SERVICE						
Inland telegrams (thousands)	3,367	−20.4	4,230	−31.8	6,200	−14.5
External telegrams:						
UK originating (thousands)	5,236	−11.2	5,894	−16.5	7,056	−5.4
UK terminating (thousands)	5,382	−8.0	5,847	−11.7	6,622	−5.4
UK transit (thousands)	4,664	−3.4	4,833	−8.9	5,304	−2.5
TELECOMMUNICATIONS STAFF						
(Part timers count as half)						
Telecommunications Headquarters (including Research, Development, Purchasing and Supply)	20,102	−1.4	20,384	−2.2	20,829	5.6
Regional Headquarters	13,034	−1.4	13,217	−2.2	13,881	−3.5
Telephone Areas	194,920	−4.5	204,092	−4.0	212,495	−2.2
Total	228,056	−4.1	237,693	−3.8	247,205	2.1



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PABX for 1980s

An advanced design of PABX, using digital switching under stored program control, has been selected by the Post Office as its new standard for the 1980s. The system is intended for smaller users needing up to about 100 extensions, and like existing Post Office PABX systems, it will be offered on a rental basis.

Called the Customers' Digital Switching System 1 (CDSS1), the new PABX is the result of work by Post Office research and development teams since early last year. It was selected after discussions with the United Kingdom telecommunications industry and following full consideration of modern proprietary PABX designs.

Development of CDSS1 has now reached the stage of involving the manufacturing expertise of the industry. Plessey and GEC are working jointly with the Post Office on the final engineering and assembly of production prototypes.

Big deal in Libya

The Post Office has won its biggest ever telecommunications consultancy contract in a £6.75 million deal signed in Libya. Under the contract, Post Office Telecommunications will help the Libyan Posts and Telecommunications Corporation in planning, specifying and constructing an extensive new telephone cable network.

The network – involving 3,600 km of land coaxial cable – will significantly strengthen Libya's existing communication links. Work on the project has already begun and it will take an estimated five to six years to complete.

Telex goes into orbit

A new, more reliable telex service for ships using communications satellites has been introduced by the Post Office. It is at present available to more than 50 ships – including the QE2 – fitted with special equipment. The service offers instant automatic connection at any time between those ships and Britain's 60,000 customers.

Until now ships' telex used normal radio circuits which can be subject to fading and distortion. This can cause delays in making contact with a ship and may, on occasion, render parts of the message unreadable.

Telex by satellite, however, is unaffected by atmospheric conditions. It uses microwave radio beamed between the ground station (or ship) and the satellite. The new service uses the United States maritime satellite system known as Marisat which has two satellites orbiting 22,300 miles above the Atlantic and Pacific Oceans.

Inaugural call

Post Office Chairman Sir William Ryland received the inaugural telephone call made over an optical fibre link between Hitchin and Stevenage exchanges in Hertfordshire. The call was made by Mr Bob Cryer, Parliamentary Under Secretary of State at the Department of Industry, at a special ceremony at the Savoy Hotel arranged by Standard Telephones and Cables Ltd.

The 140 Mbit/s optical transmission system, designed and installed by STC, runs six miles through Post Office cable ducts between the two exchanges. At about two-mile intervals along the route optical detectors "read" the signal, boost it and retransmit it onwards. In this way two fibres – one for each direction – can carry 1,920 simultaneous telephone conversations in the Hitchin-Stevenage link.

Greater database access

The transatlantic database service started by the Post Office earlier this year (see Telecommunications Journal, Summer 1977) is being extended. The original service allows United Kingdom organisations to contact computers on the network operated by TYMNET in the United States of America. With the extension, users in Britain now also have access to computers linked to the American Telenet network.

In both cases the transatlantic service is being operated jointly by the Post Office and Western Union International. To obtain database access, customers in the UK use the Post Office's Datel 200 service. To date, 103 UK customers are using the service to call up computerised technical and scientific information in the USA.

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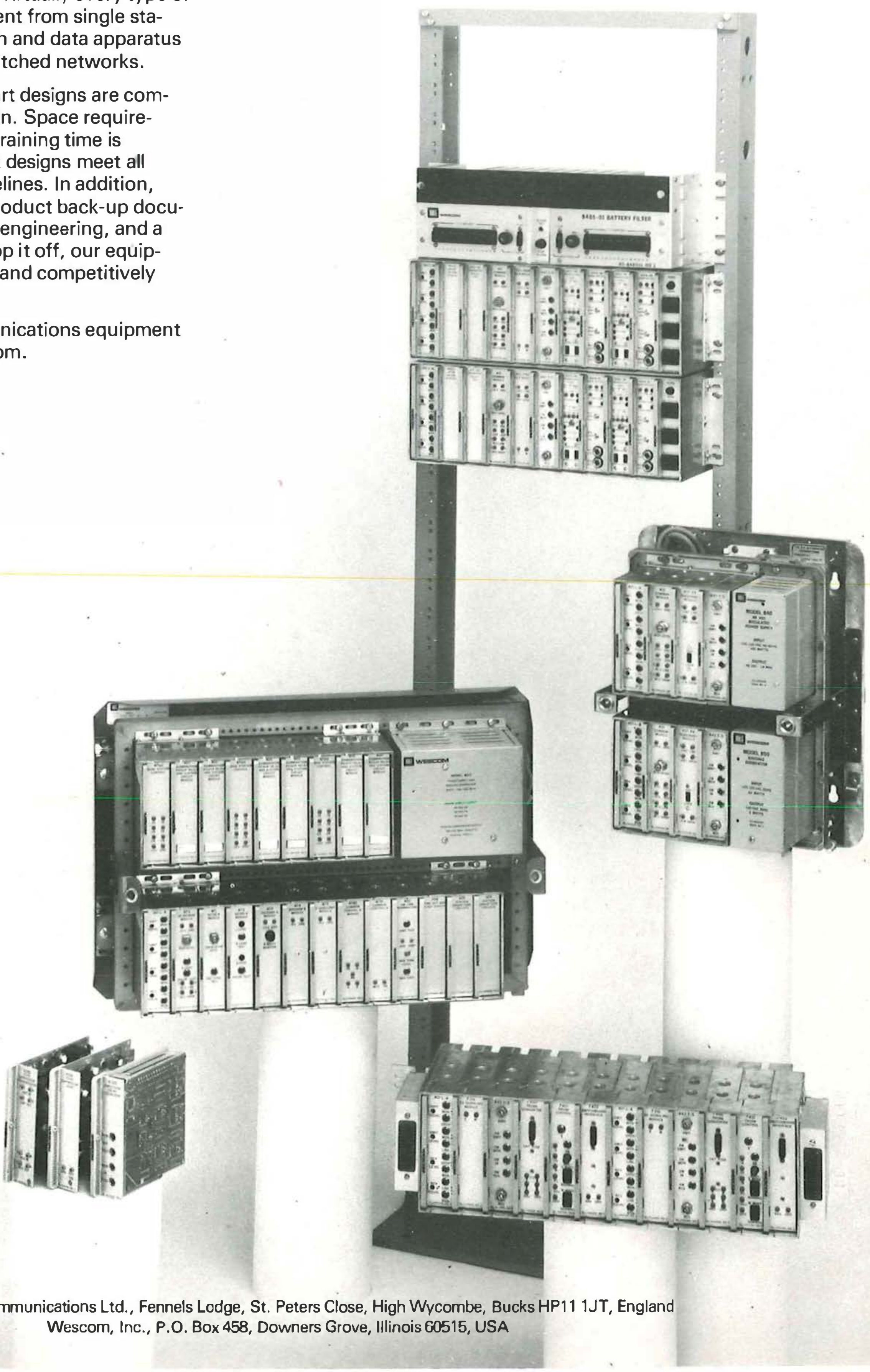

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