Post Office telecommunications journal

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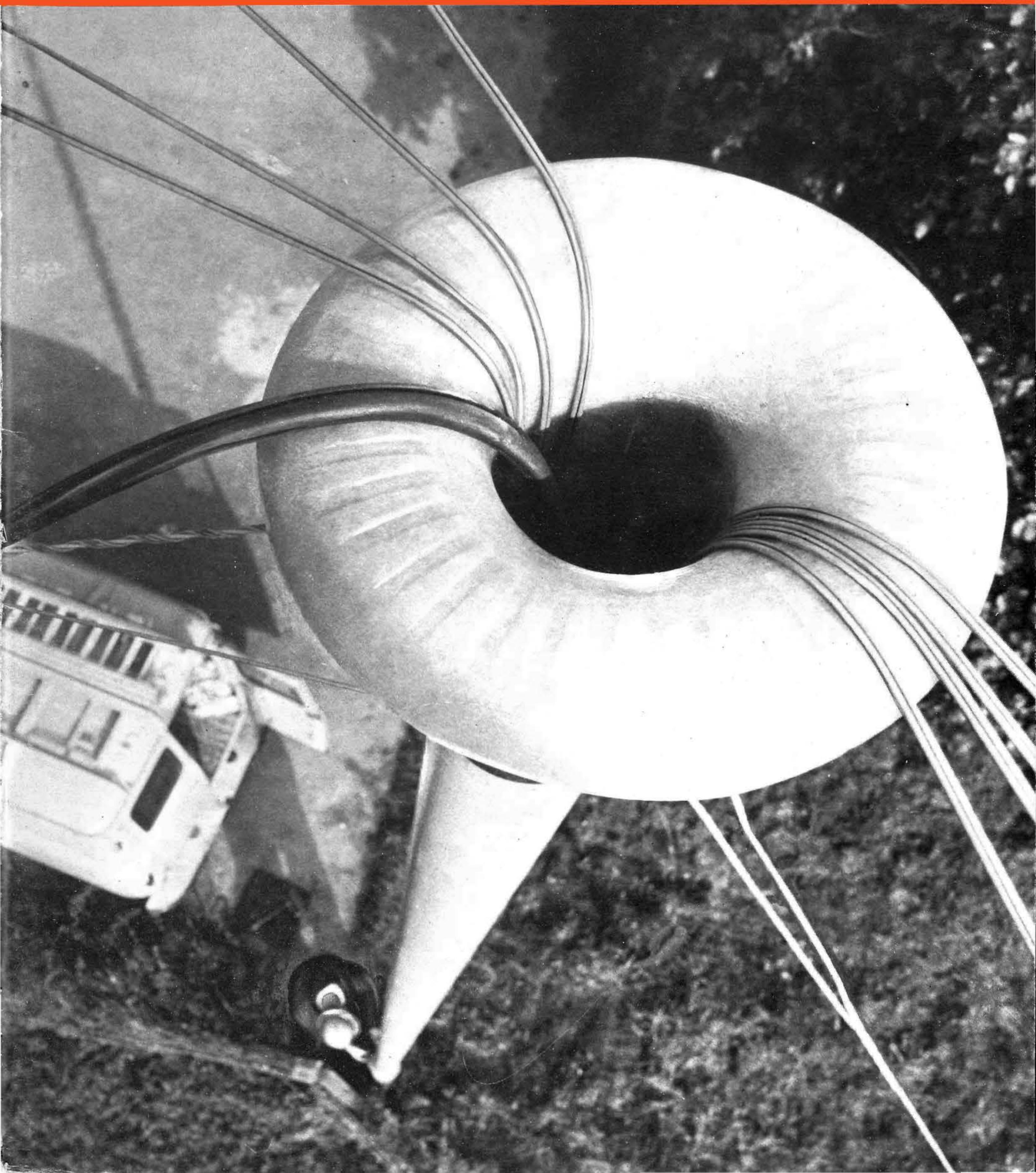
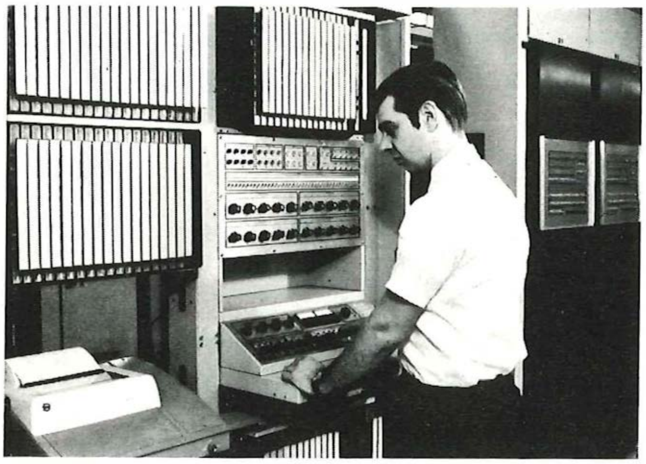


C-1 EAX Computer for the small



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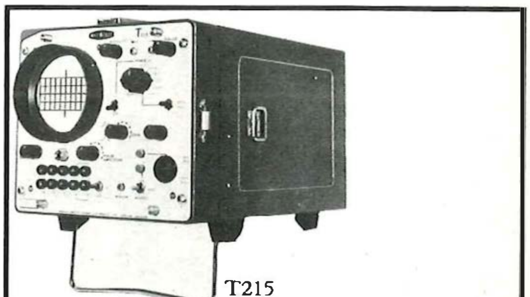

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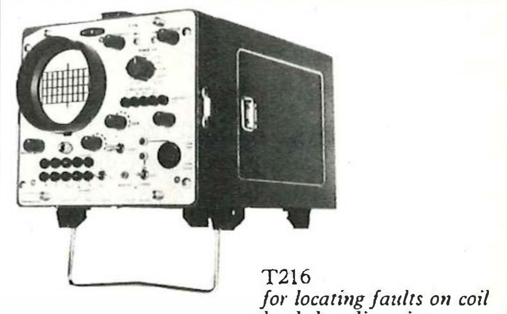

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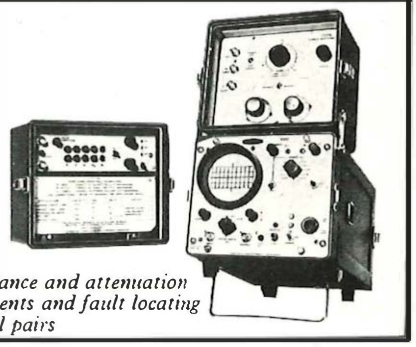

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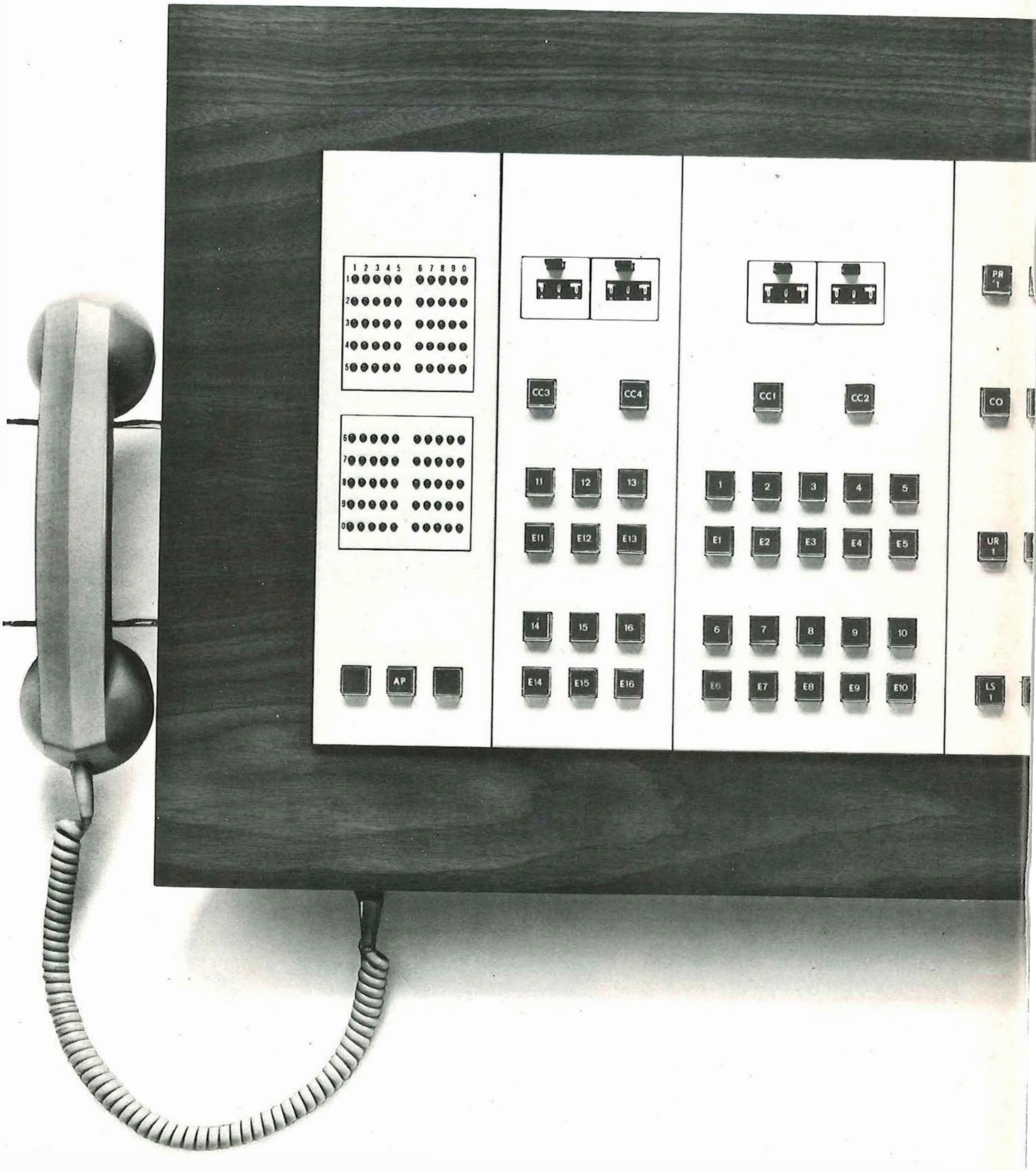
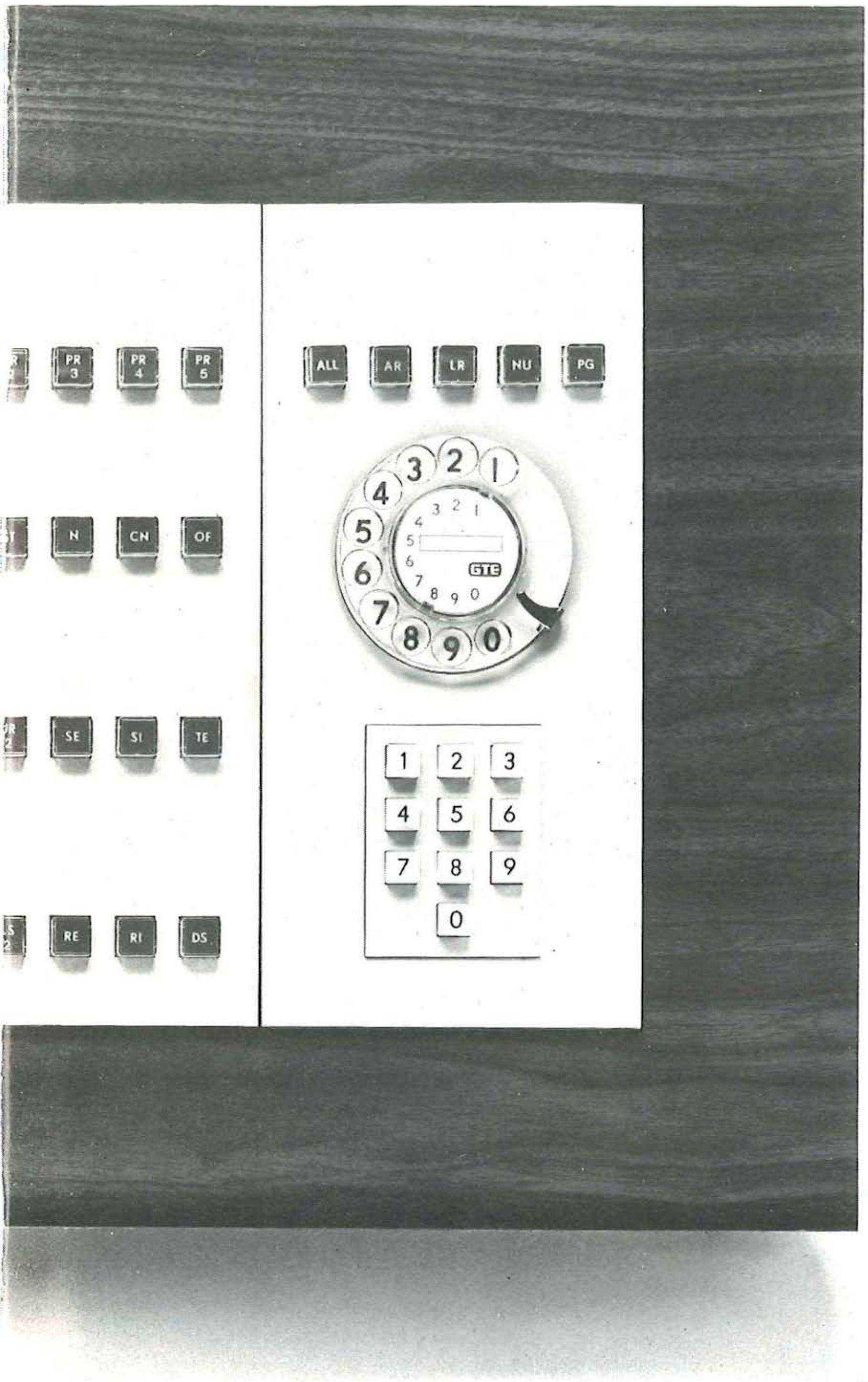


only a big business could do before.



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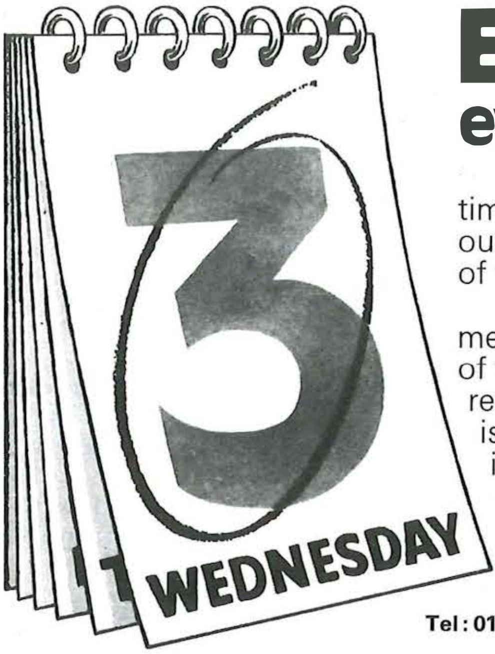
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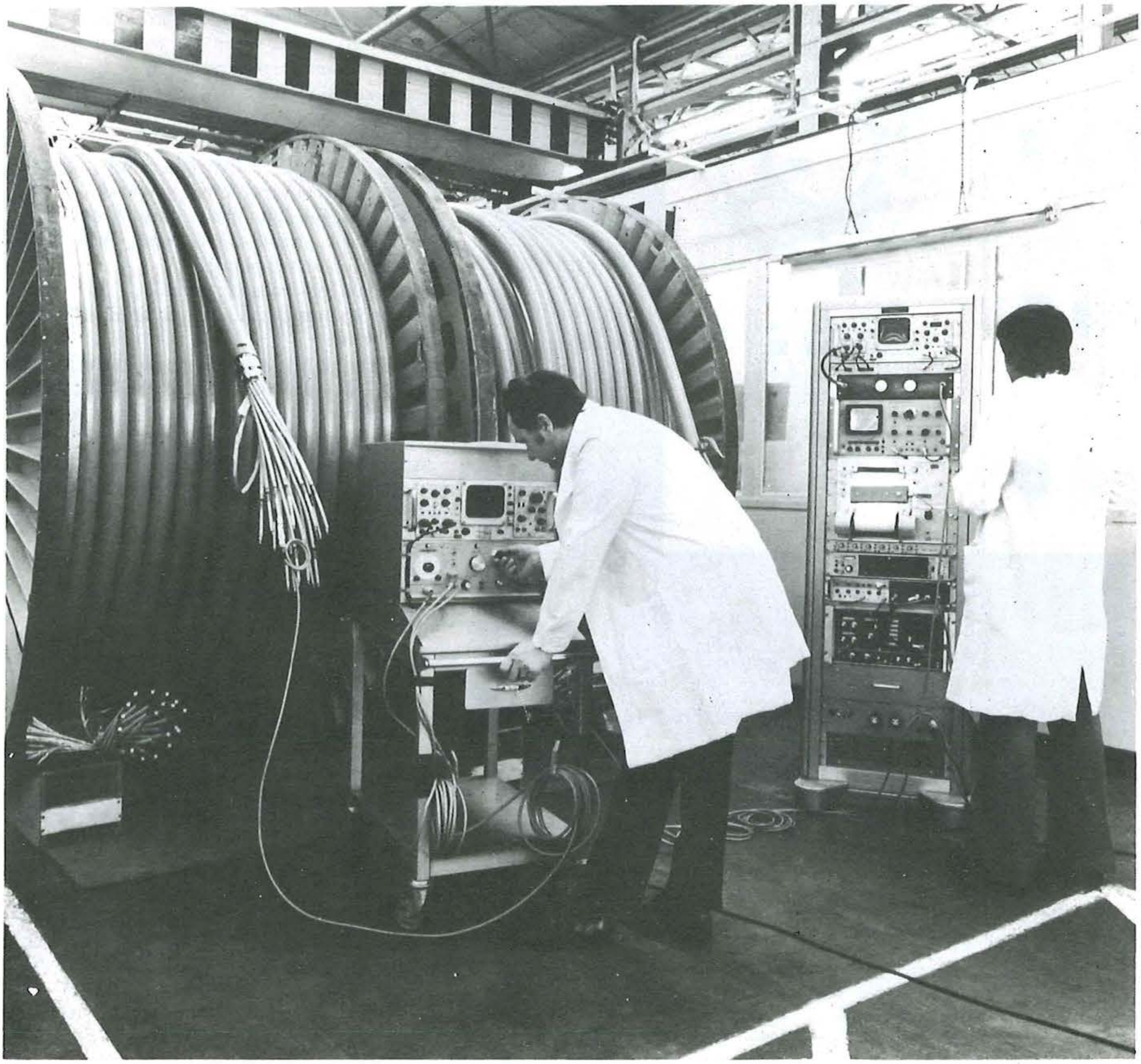
WEDNESDAY



Martlesham-a key to the future

For more than 40 years an inscription above the main entrance to the Post Office Research Station at Dollis Hill, London, has informed staff and visitors that "Research is the door to tomorrow". In telecommunications today there are more doors than ever waiting to be opened, and a vital key has been provided on a 100-acre site in the Suffolk countryside – the new Post Office Research Centre at Martlesham Heath.

The official opening of this vast new centre on 21 November by Her Majesty the Queen marks another step forward in the Post Office's long history of communications research, which dates back nearly a century to experimental work on the electric telegraph. An officially recognised research section was formed in 1909, and so that the capabilities of the telegraph and telephone service could be more fully explored these scattered groups were later concentrated at Dollis Hill where, in 1933, new laboratory buildings were opened.

Over the years the growing pace of innovation has required an increasing number of research staff – from a couple of hundred to about 1,800. As a result, Dollis Hill has been outgrown and is now outdated. At Martlesham modern laboratories, workshops and offices provide facilities comparable with the best in the world and the centre has been planned to meet research requirements of the Post Office for the next 50 years.

The extent of communications development over the past 40 years is perhaps most vividly illustrated by the fact that one-third of the exhibits at Dollis Hill's official opening were concerned with "materials and devices". Although today's research objectives are still heavily committed in this area, an increasing amount of effort is being devoted to switching techniques. And the theme typifying the present range of Research Department activities is "towards an integrated telecommunications system".

But the research programme is, in fact, as wide as the telecommunications business itself and takes in development, design, manufacture, operation and service demands. Every project is carefully evaluated and the efforts of the scientists, engineers and technicians who work at Martlesham are geared to one main objective: to obtain at all times the best reward both for the Post Office and its customers.

(A review of the new Martlesham research centre will be featured in the Winter 1975/76 issue of the Journal.)

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Cover: The moulded glass fibre top of a galvanised steel telephone pole which enables all operations to be carried out at ground level. It is one of several new types of pole being evaluated at the Post Office's Smallford Test Centre. (See page 24)

Gateway for international telegrams

RA Jackson

MOST of the 18 million telegrams which pass into and out of the United Kingdom each year are now automatically routed to their destinations by a computer based system set up by the Post Office. Designed to provide a faster and more efficient international public telegraph service, the new system forms one of the largest and most technically advanced telegram retransmission centres (TRCs) of its kind.

Located in London, the TRC routes telegrams to any place in the world, either directly or by using distant terminals. It is directly connected to 13 International Telegraph Area Offices in the UK – six in London and the others in Belfast, Birmingham, Bradford, Bristol, Glasgow, Liverpool and Manchester. On the international side, the centre has direct links with 77 terminals in 71 countries. It is also connected to seven countries via the European Gentex network. This network uses a system similar to telex to interconnect the telegraph offices of the seven countries. The TRC will be the terminal for the UK.

The TRC is the culmination of an extensive International Telegraph Service modernisation programme. Since starting operations earlier this year the centre has replaced systems provided by a manual relay centre, a torn-tape unit and a message switching relay centre. Each telegram received by the manual relay centre was carried by conveyor belt to a despatch operator who then typed it out on a teleprinter linked by direct circuit to the destination office. At the torn-tape unit each telegram was produced as perforated tape and, when completed, it was relayed by tearing the tape off the incoming machine and feeding it into the tape reader of an outgoing machine. Telegrams handled by the message relay centre were switched automatically by semi-electronic equipment but this system had only limited facilities and capacity.

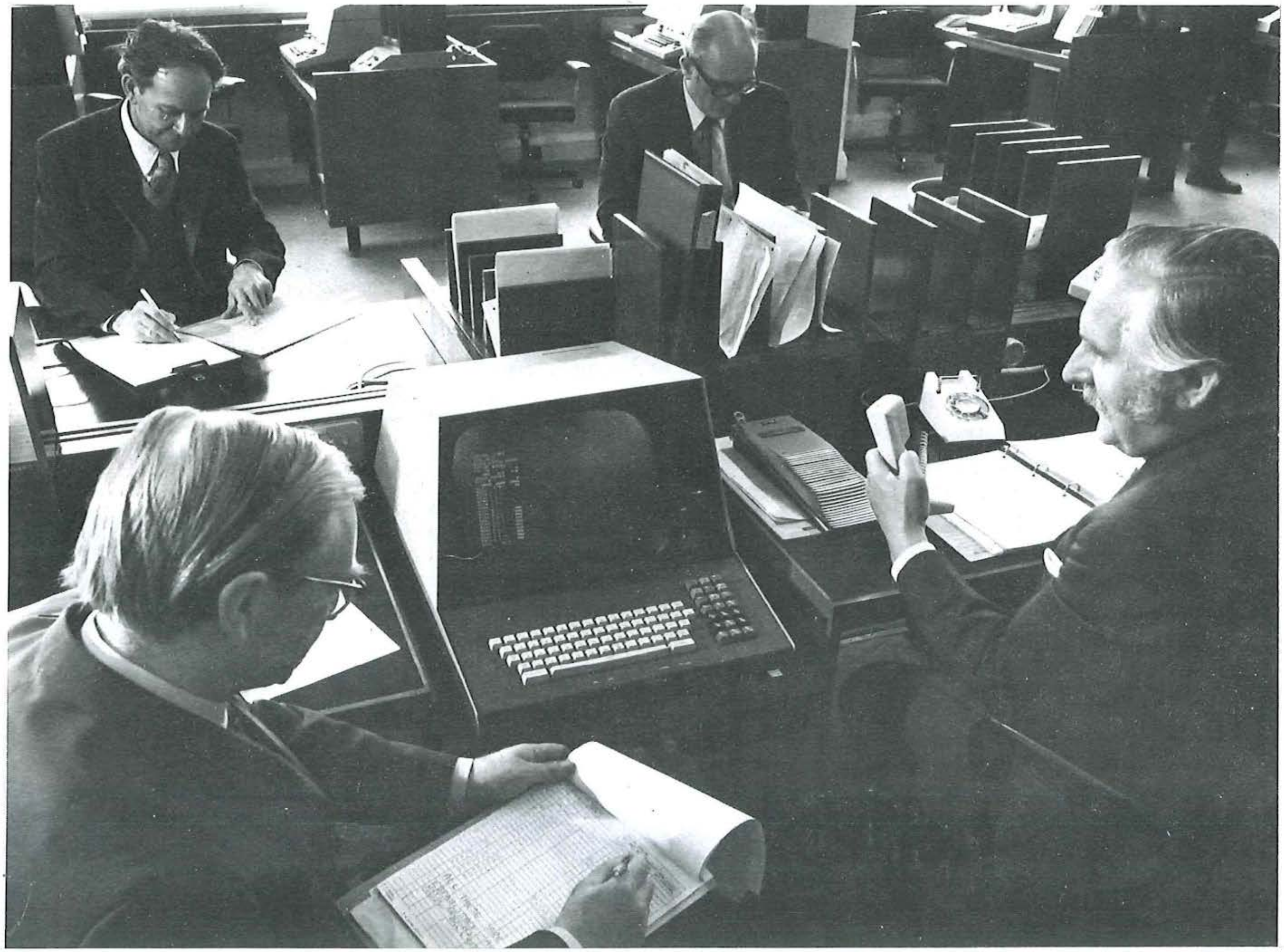
The new computer based, stored program system has been designed to handle automatically as many as possible of the telegrams offered to it, but with provision for manual intervention if necessary. Adequate safety margins in traffic carrying capacity have been allowed. The maximum working capacity required is 100,000 telegrams a day with a peak in the busiest hour of 12,000 – that is 3.3 a second – although the system's maximum capability is 5.2 telegrams a second.

The average length of a telegram is 350 characters, comprising about 33 actual words with additional characters for routing, line alignment, etc. As most of the circuits on the system run at 50 bauds – that is, 400 characters a minute – it takes just under a minute to transmit the average telegram.

In addition there is a comprehensive system monitoring facility for various parameters, such as the number of telegrams being carried and the amount of time they remain in the system. When the system detects some function which is out of character or beyond the prescribed limits, a report is printed out on teleprinters in the centre.

Statistical and number checking facilities ensure that telegrams are not lost in the system and also provide managerial control information. The system provides for immediate retrieval of the last 750,000 telegrams transmitted, and includes a seven-month store of telegrams, copies of which can be retrieved when required. It also extracts customer billing information

Every stage of routing international telegrams through the new retransmission centre can be monitored and controlled from this operational control position.



for the whole of the UK as well as for international accounting purposes.

Great care has been taken in the overall design of the TRC to ensure operational reliability. It is equipped, for example, with three identical computer processors which can be used in any combination to provide on-line working, "hot" standby and "cold" standby functions. This duplication of equipment and the flexibility of its operation is designed to reduce the anticipated total equipment failure rate to not more than two-and-a-half hours in 11 years.

The on-line processor handles the switching of telegrams but the "hot" standby can take over these functions at any instant; in the meanwhile it can be used for other work such as off-line retrieval of information and certain statistical programs. The "cold" stand-by processor is normally used for program development and the running of test and statistical programs, but can also be quickly brought to operational readiness.

Another important safeguard against possible loss of service is provided by a "no-break" standby power supply system, consisting of two 200 kVA diesel generators which use a unique stabilising filter. Under normal operating conditions this equipment automatically eliminates interference and fluctuations in the public power supply but in the event of power supply failure the standby system would take over completely without any break in supply to the TRC.

The technical control position at the TRC, from which operation of the computer system is supervised and controlled.

The processor area and standby power supply form two of the centre's three self-contained areas, the third part being a control and manual operations suite. The TRC's large size has, in fact, made it necessary to split system control into technical and operational functions.

Technical control, situated in the processor area, deals with system malfunctions, ensuring that equipment is operating to the best advantage. Operational control, situated in the operational area, has been provided with a supervisory control panel with an associated teleprinter so that the controlling officer can give commands to the system to open and close circuits, re-route traffic, and so forth. The controlling officer also has a Visual Display Unit (VDU) on which system conditions can be displayed by command, and a printout of the display can be obtained as a permanent record.

The operational area is fully air-conditioned and special efforts have been made to keep the noise level to a minimum. Telegrams that require attention are presented on VDUs at edit positions. This equipment was chosen because of its silent operation and lack of paper – and therefore dust. Each VDU has a television-type screen and a keyboard that has been specially adapted to resemble those of teleprinters used elsewhere in the system. The screen can display 27 lines of 80 characters each, although facilities have been provided so that a telegram with lines in excess of the nominal screen capacity can be displayed for analysis without processor intervention.

A "command" method of amending telegrams is used by which the VDU operator instructs the processor to amend, delete or add information. The "command" mode enables the system to check the format of an entry before acting on it, and allows the operator to order a routing, thus over-ruling that shown on the telegram.

In addition to routing telegrams from the UK to other countries and those from abroad for delivery in this country, the TRC also handles telegrams in transit from one country to another which are routed through London. To make automatic routing possible and to provide facilities for international accounting and customer billing, the system is designed to handle telegrams prepared in an internationally agreed format which uses a letter/figure code preceding the recipient's address and the text, to give information on the routing, priority, tariff and so forth.

Post Office International Telegraph Area Offices receive telegrams from UK customers by telex, telephone and hand, and each one is prepared on punched paper tape in the correct format. In the "header" the telegraph operator includes a prefix to indicate the sending channel and a figure which represents the serial number of the telegram over that transmission path.

With the new system it is not necessary for the Area Office to check and insert the destination indicator – a four-letter code which identifies the country and ▶

office to which the telegram is to be sent. Instead the operator simply uses the letters "wowo". The telegram is then transmitted over the designated channel to the TRC.

The first action of the computer system is to check the prefix and serial number for accuracy. If these are missing, unrecognisable or invalid, the telegram is displayed on a VDU at an edit position. If necessary, the operator instructs the system to assign its own prefix and serial number.

Having checked the prefix and serial number, the system's next task is to validate the telegram format. Some errors, such as lines that are too long and thus overprint on a teleprinter, can be corrected automatically. Others cause the telegram, together with the reasons, to be returned to the originating office or displayed at an edit position or printed out at special operating positions in the TRC.

When the telegram format is acceptable, the system searches the last line of the recipient's address and compares the town shown with a list of 10,000 foreign town names held in its memory. When the town name has been matched the appropriate destination indicator is inserted in the telegram in place of the letters "wowo".

The telegram can now be routed through the system to wait in a queue according to its priority until the outgoing circuit is free. When transmission has been completed, a copy is stored in the rapid access memory and, at the same time, on a long-term tape and an accounting and billing tape. Details are also stored on a history tape which provides a record of all transactions through the system.

Telegrams received by the TRC from abroad for delivery in the UK carry a destination indicator. The system identifies the recipient's town by comparing the indicator with a list of 10,000 UK town names in its memory, and when a correct match has been obtained the routing information is added to the telegram. If the telegram does not bear a registered telegraphic address, it is routed direct to the appropriate Area Office for delivery by telephone, telex, messenger or post.

If an incoming telegram bears a registered telegraphic address, the system checks this against an index of 60,000 addresses held in its memory. Delivery instructions are then added to the telegram before it is transmitted to the appropriate Area Office or delivered automatically by telex to the customer.

Telegrams received in transit by the TRC from international circuits or from cable companies already carry destination indicators. After checking the incoming prefix, number and format of a telegram, the system uses its store of 5,000 international destination indicators to ascertain the route and then switches it to the appropriate outgoing circuit. Telegrams from international origins or from cable companies which cannot be routed automatically are dealt with at special positions or edit positions in the TRC.

When a telegram is received from the Gentex network the system has to check that it has a valid answerback at the beginning and end. In addition, Gentex requires the detection of error signals and subsequent correction of the copy where the telegram is to be automatically delivered by telex.

Altogether about 25 per cent of the 60,000 telegrams handled in a typical day by the TRC are in transit from one country to another through London. About 25,000 of the daily total are from the UK to overseas destinations and the remainder are incoming for delivery in this country. Operating around the clock throughout the year, the new TRC is therefore truly the Post Office's telegraph gateway of the UK.

Mr R. A. Jackson is head of Telegram Mechanisation Section (Operations) in the Post Office's External Telecommunications Executive. He was responsible for the operational design of the TRC.

PO Telecommunications Journal, Autumn 1975

A "fish-eye" view of the processor area in the new centre.

Modern machines sweep away old brooms

LH Child

A new approach to the problem of keeping telephone exchanges and their equipment clean, which uses modern mechanical aids, is currently being evaluated in London.

PARTICLES of dirt and dust often many times smaller than a pin head have been one of the most constant and serious threats to the efficiency of Britain's telephone service since the first exchanges were opened nearly 100 years ago.

The Post Office has, of course, always been fully aware of the problem and a continuous battle has been waged to keep exchanges as clean as possible. The front line "troops" have normally been squads of cleaners armed with a variety of traditional weapons such as brushes and brooms.

In recent years, however, the need for a more considered approach to the problems of exchange cleaning has been evident and the whole problem has been closely examined by a joint working party representing both management and the Post Office Engineering Union in London. It could mean the end of the "Mrs Mop" attitude to cleaning.

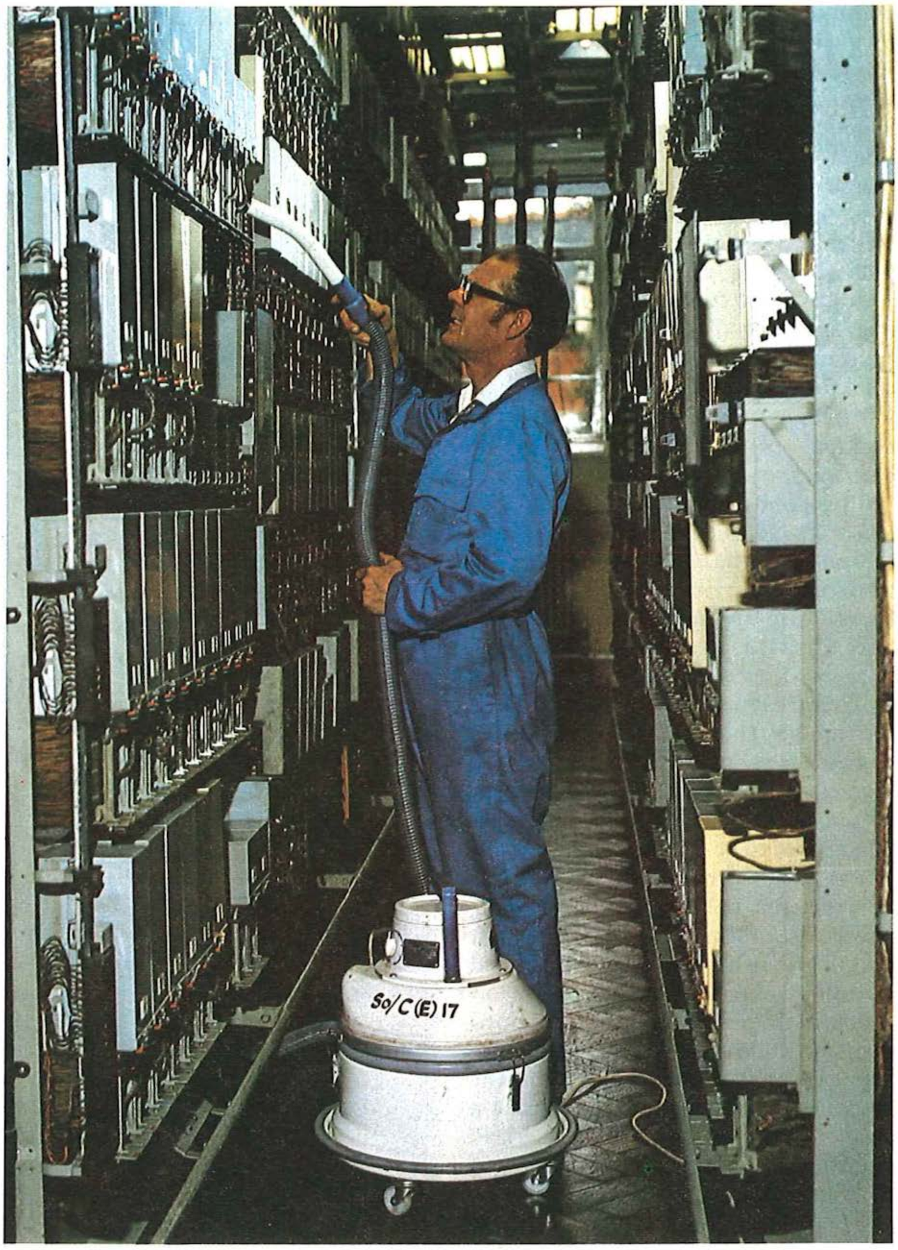
A major step forward has been the development of a new range of cleaning aids and programmes which will lead to cleaner working conditions for staff and an eventual reduction in the fault rate of automatic exchange equipment. Much of the switching equipment is particularly vulnerable to dirt and dust as contacts very soon get soiled and lubricants are prevented from flowing.

The new cleaning aids – basically a mechanical sweeping and vacuum machine, a "wet" pick-up machine and an impregnated floor sweeper mop – are designed for efficiency of dirt removal, ease of operation and the removal of unnecessary physical stress and strain. They are suitable for use by men and women and can be carried between floors in multi-storey buildings not provided with passenger or goods lifts. And new cleaning programmes to take account of the machines are designed for normal working hours, thus removing the need for anti-social hours and working conditions.

The new ideas and new equipment, however, were not developed overnight. Before any attempt could be made to improve existing methods it was necessary to identify the various sources of dirt generation and make comparisons with other industries. Early investigations clearly showed that operational telecommunications buildings generated heat rather than dirt while in offices dirt was introduced by staff, outside dust and paper movement. All this of course is in addition to the existing levels of atmospheric dirt surrounding these buildings.

Heat generated in telephone exchange ▶

A Technician removes dust and dirt from exchange equipment racks with a new-style vacuum machine.



apparatus rooms is removed by exhausting or cooling the hot air, but no matter how efficient the ventilation filters are, dirt still collects. And as well as causing operational problems accumulated carbon and fibrous dust particles also create a potential fire hazard.

Dust particles themselves are measured in two ways – by concentration in particles per cubic foot and by size in microns, a micron being one millionth of a metre. Average levels of pollution outdoors vary between 200,000 and two million particles per cubic foot when measured down to 0.5 microns, although obviously various industrial processes produce localised concentration in excess of these figures.

Geographical formation will also produce unsuspected variations in dirt levels. London, for instance, is built in a natural basin and although the centre of the City generates a high level of pollution, the heat produced lifts it away and deposits it on the outer fringes. This results in the rural outer areas of London recording pollution levels up to four times as high as inner London.

Houses, flats and centres of social activity such as the local public house are dirtier inside than out due in part to poor cleaning techniques but also because of the concentration of cigarette smoke and the like. As far as health is concerned most hazards are caused by solid pollutants of less than 5.0 microns in size. Cigarette smoke for example consists of pollutants of between two and three microns.

In telephone exchanges airborne dirt levels should not be greater than outside and with the use of modern ventilation plant particles larger than 10 microns will be eliminated and a restriction imposed on those down to 0.5 microns. Electrostatic filtration is the most efficient method now in use.

Although the telecommunications business is capable of producing these high clean air standards, it is the basic methods of removing dust and dirt which need to be effective. Many traditional aids – particularly brooms and non-suction polishing machines – recirculate, rather than remove, dust and dirt that has settled on floors and other horizontal surfaces.

Most of this dirt would have remained undisturbed but for the normal day-to-day cleaning practices and thus the situation is created that the harder a cleaner works the more dirt he is likely to disturb to settle on to apparatus and other equipment. And this is where the new aids and programmes come in. A series of formal training courses has been produced on the maintenance, correct and safe operation of the new machines and three specially prepared handbooks have been published.

In the buildings where the new system has been working the results have been encouraging with cleaning staff finding a high level of job satisfaction from their efforts. Technical staff have also been happy with the effect of these new standards which will mean less attention in the future for a whole range of exchange apparatus.

So how do the new aids work? First it is necessary to study dust particle circulation inside a building. With the low air velocities in buildings only the smallest particles will fully recirculate and the amount of pollution is twice as great at about three or four feet high as at six or seven feet. This shows that although the heavier carbon pollution has a limited recirculation of up to about four feet, lighter fibrous pollutants have a full floor to ceiling circulation pattern.

Most rooms exhaust stale air through upper windows and because of this the heavier dirt and dust which can be blown into a building will not necessarily be exhausted. In this way the building can quickly become a "dustbin".

The continuous removal of this type of dust is carried out in polished floor areas by using the vacuum machine and the sweeper mop. These two aids are inter-related, the vacuum machine removing the fine dust and the sweeper mop removing dirt and waste materials.

The sweeper mop is used daily over the total floor surface to recover as much fine dirt and waste as possible. It does

Following removal of old wax from the floor by the scrubbing equipment (left), the area is immediately dried by using a "wet" pick-up machine.

increase the level of dust recirculation but only by about 10 per cent whereas a broom not only leaves all small dirt particles behind but increases the level of dust recirculation by more than 400 per cent. And the sweeper mop, as designed for operational buildings, is five times as fast in use as a broom and uses one tenth the physical energy.

With non-polished floor areas, such as concrete screed, it is still necessary to wash or scrub. The wet pick-up machine has been introduced to prevent water damage to floor finishes and to remove slipping hazards from wetted floor areas. It recovers 99 per cent of water applied to a floor surface and thus eliminates the need for rinsing operations. It also recovers all the dirt suspended in the liquid, giving chemically clean floors which can then be treated with an emulsive polish as required. As well as this it enables apparatus floors to be wet scrubbed with a minimum amount of detergent or stripper and eliminates the risk of damaging telephone equipment.

This machine is also used for dry vacuuming of large floor areas or as a lightweight general purpose vacuum cleaner. The single filtration unit built into the machine limits its exhaust pollution to 300,000 particles per cubic foot for general office use and the secondary exhaust filter attachment will limit it to 30,000 particles per cubic foot for apparatus and computer area operation.

Carpeted areas are included in the cleaning programme and to maintain the high standard of dirt filtration a carpet sweeper base attachment has been developed for use with the vacuum machine. This base is intended for use on large carpeted areas such as manual board switchrooms and will recover dust in limited circulation as well as carpet dirt.

Natural wool dusters and wool dusting mops are used to absorb dirt during dusting operations. The use of impregnated dusters is not encouraged because the impregnating fluids eventually leave a sticky film which discolours paintwork and retains finer dirt particles. Dusters hired from various laundries may use an oil based impregnating fluid which could cause dermatitis if protective gloves are not worn at all times.

Spirit based floor dressings will be phased out as floors are converted to emulsive dressings. With the change in modern floor finishes many accidents are caused by slipping as a result of spirit dressing. The release of hydrocarbon vapours also causes fine dust to stick to apparatus thereby lowering its performance and paintwork soon becomes spoiled. Certain areas of cement screed will also be sealed and converted to a polished finish to simplify day-to-day maintenance and produce better standard of dust control as well as improved appearance.

The future benefits of these new cleaning techniques will be a reduction in apparatus cleaning by technicians, fewer equipment faults due to dirt and improved working conditions for staff.

Manufacturers of cleaning equipment and chemicals now recognise the need for labour saving in dust control techniques and the need to reduce the noise level of mechanical aids. Their designers are working on the development of new machines to meet these requirements and they are developing safer and more stable chemicals for all aspects of the cleaning industry.

The gradual spread of the new system together with its cleaning aids throughout the various Telecommunications Regions, will have considerable effect. These methods have taken seven years to develop and the next seven years are certain to see further progress in the cleaning industry – a vital factor in ensuring that an efficient service is provided at all times.

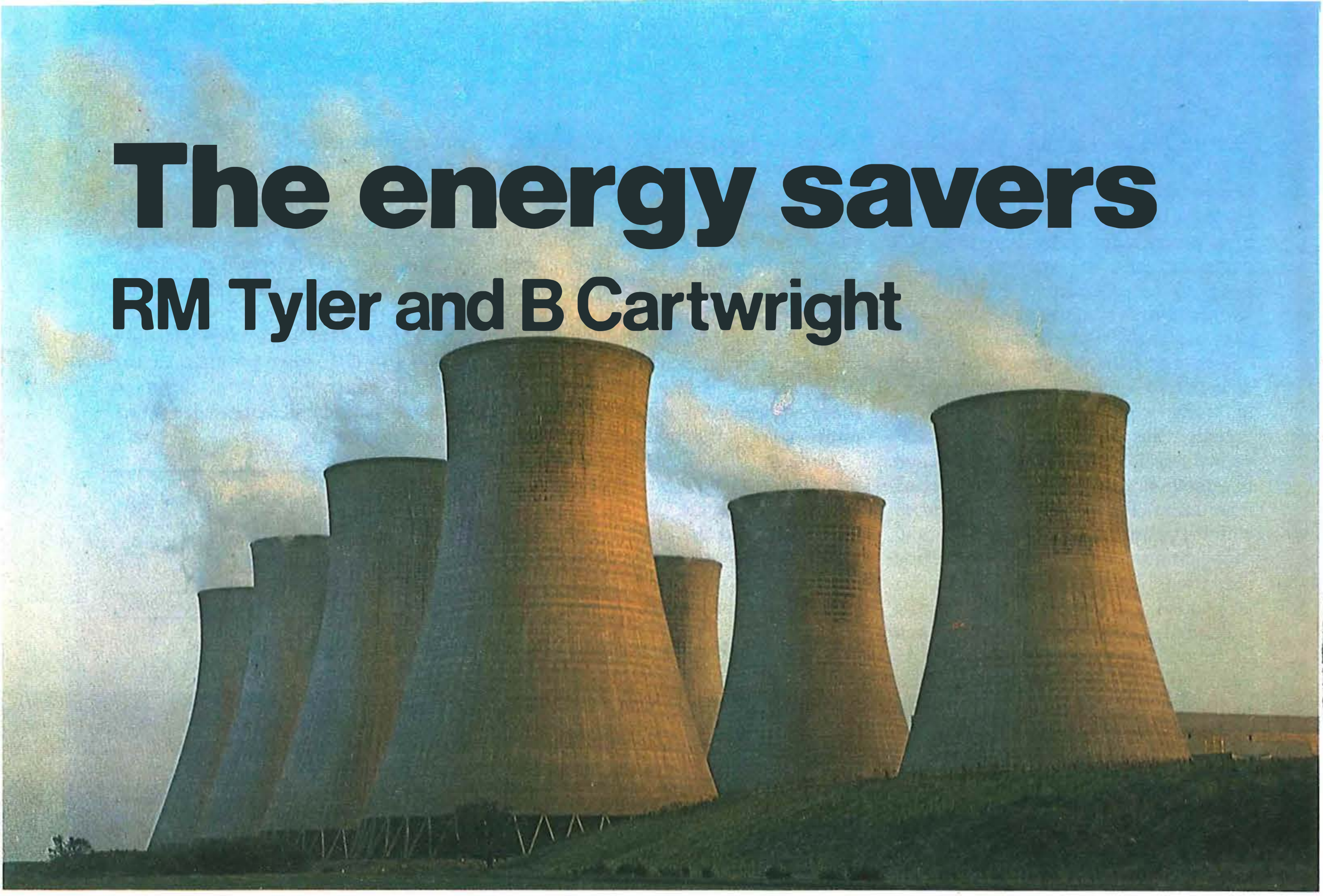
Mr L. H. Child is the technical cleaning liaison officer attached to the Service Group at London Telecommunications Region Headquarters.

PO Telecommunications Journal, Autumn 1975

This lightweight suction polisher simplifies cleaning in the narrow gangways between exchange equipment racks.

The energy savers

RM Tyler and B Cartwright



Post Office studies have shown that advanced telecommunications systems like conference-by-television can serve as an effective substitute for travel and, looking to the future, will offer valuable savings in energy.

THE ENERGY crisis of 1973 and 1974, which brought not only scarcer and dearer fuels, but also drastic shortages of petroleum-based products such as plastics, led to much hard thinking about how to use energy more frugally and effectively. Now that the immediate crisis has receded it is widely recognized, both at national level and in major organisations, that the vital need is to develop an effective strategy for the future.

In the Post Office a team in the Long Range Studies Divisions at Telecommunications Headquarters has been examining these issues. Based on the conclusion that there will continue to be a severe, but not insuperable, energy problem for the forseeable future (even allowing for North Sea oil), high on the team's list of energy-saving strategies is the replacement of travel by telecommunications wherever possible. This would be beneficial nationally and would also open up new marketing and system development opportunities for the Post Office.

The transport sector of the British economy offers substantial potential for energy saving. At present transport uses more than 15 per cent of the total energy consumed in this country and more than 30 per cent of its petroleum supply. There is little doubt that advanced telecommunications systems present an energy-efficient alternative to many forms of passenger travel. In the longer term the availability of advanced telecommunication systems may also alter the present pattern of travelling, often some distance, to the office (see "Working from Home", Summer 1975 issue).

All this could bring significant energy savings. But, even given the answers to questions as to the size of these savings and their importance in the overall energy situation, how should the Post Office respond?

These were the kinds of issues that Long Range Studies set about investigating in August 1973. As it turned out the long-term problem very soon became a short-term reality. The energy studies were undertaken in a two-stage programme, considerably revised in the light of the crisis which reached its peak while the analytical work was being done.

The first stage involved drawing together the available evidence on the likely future energy situation and its economic implications. The view of analysts varies so widely that an in-depth review of their work was essential to arrive at a balanced view.

This review revealed many important findings. Although the more pessimistic assessments of "limits to growth" and the likely exhaustion of energy sources appear exaggerated, the growth of energy-supply will be hard put to meet the anticipated growth of demand. This is especially true when the effects of rising expectations about environmental and safety standards for nuclear power, for example, are considered.

As a result, the real price of energy (that is, the price adjusted to allow for changes in the value of money) is unlikely to be as low again as it was in the 1960s, the era of cheap oil. The growth of demand will need to be curbed by energy-saving measures. The problem will be especially acute for "portable" fuels which depend on the availability of petroleum.

And on the subject of petroleum, prices which now prevail following the 1973-74 crisis, though they could increase further in the medium-term, are likely to fall eventually as new energy-supply technology makes itself felt on the market.

The new energy sources, including North Sea oil, will require large investments. The diversion of these funds from other uses, together with the dislocating effects of major price changes and the balance of payments problem caused by dear oil imports will exert a drag on growth of industrial economies – but not, according to our calculations, with a very large effect.

In the second stage of its work the study team looked at the implications of these findings for telecommunications. The direct effect of a slightly slower long-term economic growth rate on the likely growth of telecommunications traffic for existing services proved to be slight. But background research had shown that new or relatively new telecommunications services – ranging from loudspeaking telephones to video systems such as Confravision – could serve as an effective and acceptable substitute for much business travel.

Accordingly, the researchers conducted a detailed investigation of the energy saving potential of such substitutions. They estimated the energy used by each of the three main components of the telecommunications system: transmission, switching, and the operation of terminal equipment such as television cameras or loudspeakers.

Figure 1 (page 10) shows the team's estimate of energy savings in a typical case of long distance business travel by train. Two hundred kilowatt-hours or more (up to 2,000 kwh) can be saved on a typical trip by using a video-conference system instead of travelling; this is equivalent to saving up to 40 gallons of petrol. If a sound-only telecommunication system is used this energy saving can be doubled.

To be conservative in their estimates of these energy savings, the group made no allowance for technological progress in telecommunications other than the use of low-power television cameras and lighting. However, rapid progress in the development of transmission media such as waveguides and optical fibres, as well as other technological innovations, means that further substantial reductions in the energy consumption of video telecommunications can be expected.

A further step in the analysis involved assessing the hidden or "indirect" energy inputs. If, for example, the Post Office must buy more copper cables to expand telecommunications capacity, the calculations should include the energy used to mine and refine the copper. These indirect effects can be important: studies of motor transport in the United States of America have shown that these effects can add between 50 and 90 per cent to the amount of energy used directly.

A recent French study made use of a mathematical model to estimate the effect of increasing the price of petroleum by 100 per cent, and showed that the subsequent rise in the total direct and indirect costs of road, river and railroad transport would be 10.5 per cent; meanwhile telecommunication costs would rise only slightly more than one per cent. A 100 per cent price rise for all energy sources would increase transport costs by 12.7 per cent as against only 1.9 per cent for telecommunications. These results, based on an input-output analysis, demonstrate that telecommunications is very much less intensive that transport in both direct and indirect energy.

None of these considerations are of much interest, however, unless it can be shown that telecommunications are genuinely likely to replace travel on a significant scale. Therefore a major theme of the studies has been to develop well-founded judgments on this issue. Theoretical studies, laboratory experiments and field trials of new systems all showed that the degree of possible substitution depends on the purpose of the journey; the characteristics of the journey – such as cost and travel times – and the traveller's attitudes. How much for example, is he prepared to pay to save time? And much depends on the characteristics of the various methods of travel.

Of all trip purposes, business travel was judged most suitable for substitution. At present, businessmen must choose between holding a face-to-face meeting or using the telephone, but alternative telecommunications media are now emerging. Multi-person telephone conferences and advanced audio conferencing systems provide high quality sound, and some of the latter also overcome the problems of organisation and chairmanship by automatically identifying who is speaking. Computer-based keyboard message systems can also be used for some kinds of discussions.

For those meetings which rely on non-verbal information communicated by gestures or facial expressions, visual conference systems like the Post Office's Confravision can provide the necessary communication medium. In addition, ancillary facsimile and graphics devices exist which enable documents, notes and sketches to be displayed, modified or exchanged.

What determines the individual's choice between these systems and an actual face-to-face meeting? Both psychological and economic forces influence the decision and the psychological aspect is much the toughest analytical problem facing researchers in this field. Social psychologists at ▶

A three-way conference in session using Confravision. This Post Office service enables businessmen to hold meetings with distant colleagues without needing to travel long distances.

University College, London, have in fact carried out, over a period of four years, an intensive programme of psychological experiments on telecommunications. Civil servants and other kinds of managers conducted realistic communications tasks with a variety of media: face-to-face, over an audio-only system, and over a television link. These experiments enabled the psychologists to assess whether the telecommunications media were an acceptable and effective substitute for the face-to-face meeting.

Results showed that both audio and video teleconferencing systems are effective for meetings involving information exchange, brainstorming, co-operative problem solving, or routine decision-making. But where bargaining or "getting to know people" is important, audio systems are less effective and less acceptable than face-to-face systems. And though television systems are more satisfactory, they still fall short of a face-to-face meeting.

These results are based on the assumption that, if a teleconference does not give exactly the same outcome as a corresponding face-to-face meeting, the telecommunicating medium is not "effective". The results indicate only conservatively the extent of substitution which could ideally take place, not the substitution which will take place.

The probable amount of substitution that will take place depends largely on costs, although it must be stressed that a wide range of factors make up the "generalised cost" of travelling or telecommunicating.

Analysis of these generalised cost comparisons shows that although it is almost always cheaper to use audio telecommunications than to travel, the competitiveness of video telecommunications is sensitive to factors such as the value of time savings, the duration of a meeting, and the length of a journey.

Take the fairly typical case of London to Manchester business trips. If two people travel to a particular meeting, then with present technology, Confravision is cheaper than travel (taking the value of travelling time at £5 per hour) provided the meeting does not last much more than one hour. But in future the video-telecommunications alternative will be viable for longer and smaller meetings.

This greater viability is not only because of the rapid progress of cost-cutting telecommunications technology, but because the labour and energy-intensiveness of transport and the trend towards higher productivity incomes and "value of time", tend to raise the real cost of travel as time goes on. Nevertheless, the use of teleconferencing is likely to be specialised at first, before diffusing more widely when technical and economic developments permit.

The studies have demonstrated that substantial energy savings will be made in the future by telecommunications substitution for travel. But as in any exercise in technology assessment judgment must be qualified by a careful consideration of the adverse indirect effects this innovation might have.

Concentrating on the energy question – and thus setting aside for the present issues such as the sociological consequences of limiting some kinds of contacts – the team were able to construct a qualitative analysis of indirect effects. They found that two processes might tend to offset the energy savings achieved by travel substitution.

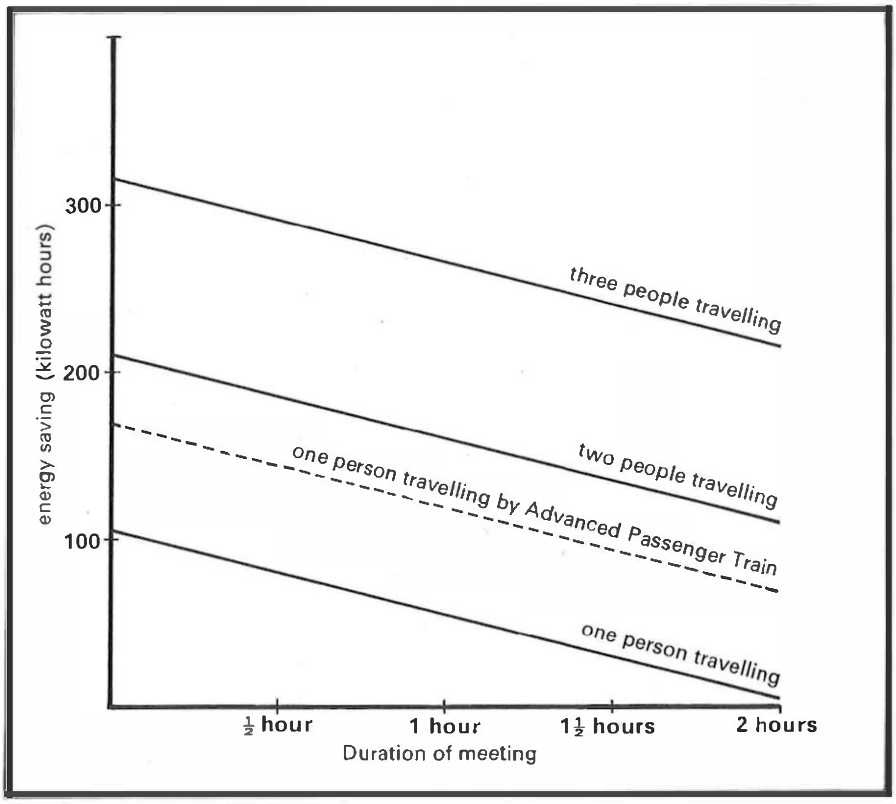
One of these offsetting processes is accelerated dispersal of employment, which could occur if telecommunications are substituted for certain key trips, and the amount of commuting travel is reduced. While this implies a reduction in the total number of trips, the average trip length may be increased, due to the greater distance between establishments which dispersal entails.

A more disturbing possibility is that easier communication would cause a "generation" effect, encouraging mobility and increasing traffic on both transport and telecommunications systems. There is a need for additional research to develop a proper forecast of these impacts, and to develop appropriate policies relating transport planning, urban and regional planning and telecommunications.

Looking at the situation overall, however, it seems unlikely that the possible negative aspects of effects would outweigh the positive potential that has definitely been identified.

The Post Office has an outstanding opportunity to pursue both its business objectives and the national interest at large, in promoting new telecommunication services and in emphasising the positive importance of its role in saving resources and protecting the environment.

Figure 1: Estimates of the energy savings achieved by using a video-conference system for business meetings rather than travelling by rail from London to Manchester.



Mr R. M. Tyler is head of a section in Telecommunications Systems Strategy Department responsible for economic and environmental studies.

Mr B. Cartwright is a head of group in the same Department and has been involved in demand studies for advanced teleconferencing systems.

PO Telecommunications Journal, Autumn 1975

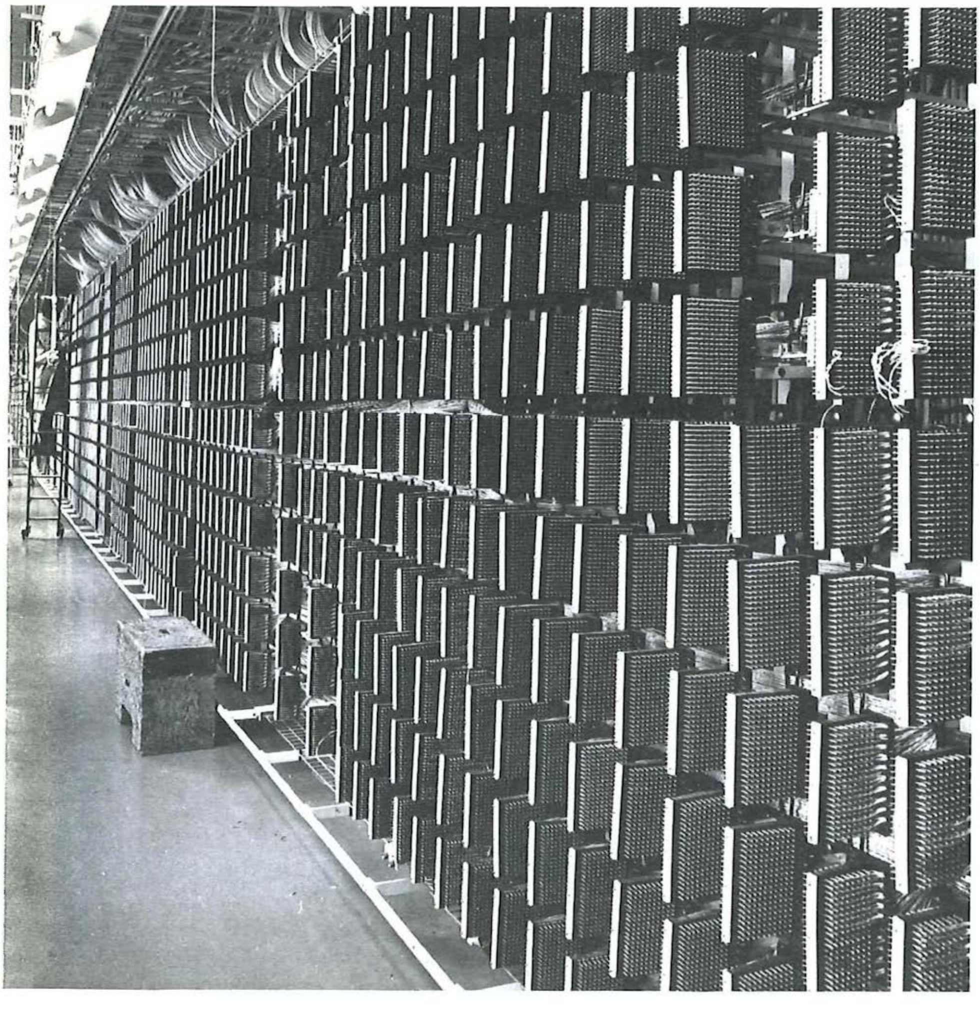
Helping to plan main network growth

K Waterhouse

The main circuits and routes over which Britain's trunk calls flow, and by which overseas telephone traffic is carried to and from the country's international exchanges, form an integral part of the national telephone network. The following two articles describe different, but equally vital aspects of Post Office main network planning aimed at ensuring that plant is provided in the most efficient and economical way to keep pace with forecast demand and to provide a foundation for future growth.

THE COST of providing line plant and exchange equipment for the main network in Britain's national telephone system represents a significant part of Post Office investment in telecommunications fixed assets. The network provides the main "highways" over which trunk calls are routed and by which overseas telephone traffic is carried to and from the international "gateway" exchanges providing links with other countries. It consists of more than 400 trunk switching units together with the routes carrying circuits inter-connecting these units.

Planning provision and expenditure for line plant is based on an Annual Schedule of Circuit Estimates (ASCE). This is produced each year by Telephone Areas and shows the estimated route and circuit requirements for every trunk unit for a period of five years ahead. ASCEs are also an input to exchange equipment planning and design, thus ensuring that equipment provision aligns with that of line plant.



An important link in the main network – part of an intermediate distribution frame at Reading group and transit switching centre.

Each yearly estimate in a particular ASCE is used for a different purpose. The first year constitutes the authority to provide additional circuits required in that year, while the second and third years are used for ordering terminal equipment and other stores. The fourth year determines the requirements of certain specific repeater station equipment, and the fifth is used to prepare duct, cable and radio link and transmission programmes.

As ASCEs form the cornerstone of main network planning they must reflect not only the estimated requirements of Telecommunications Regions and Telephone Areas, but also national estimates of overall requirements and national policy. National control over growth of the main network is therefore essential. This task is the responsibility of Network Planning Department at Telecommunications Headquarters (THQ/NPD) and is achieved by allocating to Regions upper and lower target limits within which fifth-year requirements of the next ASCEs prepared by their Areas must fall.

These target limits are based on the trunk planning growth rate, which is forecast annually by NPD. The basic parameters used in preparing this▶

growth rate are THQ Marketing Department's (TMkD) forecast growth of trunk calls for the various charge rates and Regional assessments of traffic levels. The growth rate derived from the basic parameters is then adjusted in the light of current practical operational factors, such as forecasting uncertainty and likely delays in equipment delivery.

The proposed trunk planning growth rate is submitted for approval to the Managing Director's Committee, Telecommunications, together with estimated levels of resultant expenditure. When it has been approved, Regions are advised of their planning limits and are responsible for ensuring that their Area ASCEs, when summated, come within these limits. By this means the increase in fifth-year needs over those of the previous ASCE are sensibly controlled. As a result, investment needs can be forecast and manufacturers can be given information upon which to plan their production.

It can be seen, therefore, that the trunk planning growth rate is a key factor governing future expansion of the main network. The TMkD forecast growth of trunk calls used in its preparation takes account of assumed tariff increases, forecast growth in telephone connections and Government assessments of future levels of the Retail Price Index and the Gross Domestic Product. The forecast is made on a national and Regional basis and shows separate forecasts for peak, standard and cheap rate trunk calls.

Until quite recently it was correct to assume for planning purposes that busy hour erlangs would grow at the same rate as total effective (daily) trunk calls. However, changes in the political and economic scene over the past eighteen months, as well as in public attitudes, have possibly disturbed some of the accepted historic relationships.

One result of these changing circumstances is the manner in which traffic peaks have moved from what hitherto was regarded as a static situation. Growth of traffic measured at exchanges during the busiest hour of the day – that is, recorded route busy hour erlangs – has been less than that of effective trunk calls made during the peak plus standard charging periods, indicating some movement of telephone traffic away from the busy hour. This situation is currently being reviewed to see whether the differences are sufficiently significant to be taken into account when deriving the trunk planning growth rate.

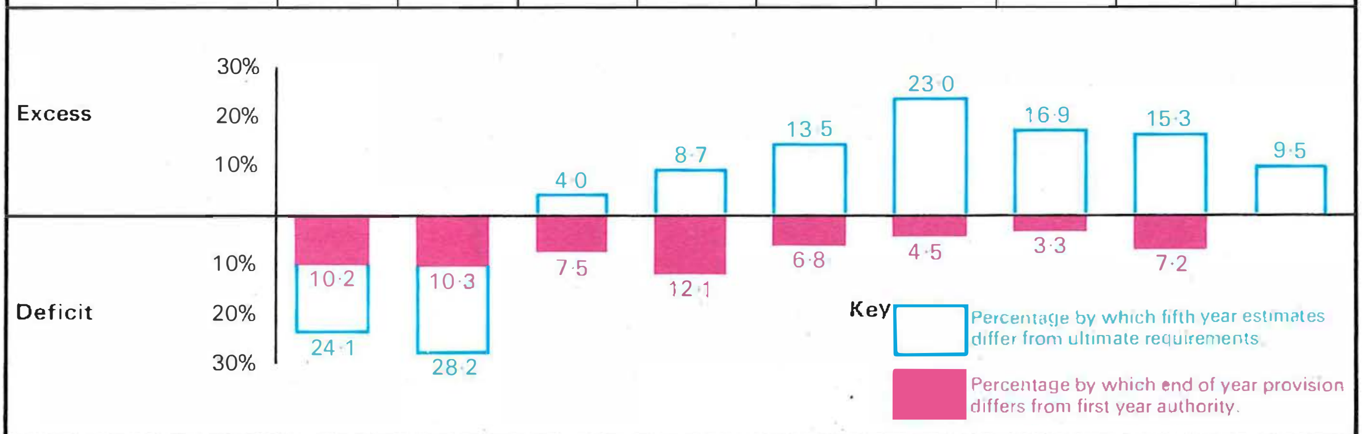
Regional assessments provided in October each year for NPD in calculating the trunk planning growth rate cover the level of traffic as at the previous March together with estimates as at March two and seven years ahead. Regions also assess their changing pattern of traffic flow resulting from local considerations such as new routes, transfers of traffic etc.

It is not NPD's job to find valid excuses why plant arrives early or late, but to ensure plant arrives on time. Plant arriving early wastes money, while plant arriving late impairs service. In formulating the planning growth rate NPD therefore makes adjustments and adds margins to the basic TMkD and Regional assessments to allow for deviations that will probably happen in practice.

These margins attempt to minimise the elements of uncertainty inherent in

Over 40 km Main Network Circuits – Fifth Year: First year Comparison of ASCE estimates

Fifth year of forecast circuits	1963-68 ASCE 55,723	1964-69 ASCE 61,083	1965-70 ASCE 98,398	1966-71 ASCE 120,961	1967-72 ASCE 135,489	1968-73 ASCE 164,468	1969-74 ASCE 174,776	1970-75 ASCE 199,668	1971-76 ASCE 206,600
First year of forecast circuits	1967-72 ASCE 73,392	1968-73 ASCE 85,075	1969-74 ASCE 94,624	1970-75 ASCE 111,276	1971-76 ASCE 119,413	1972-77 ASCE 133,774	1973-78 ASCE 149,544	1974-79 ASCE 173,207	1975-80 ASCE 188,736
Actual ASCE year	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
Basic growth rate (% p.a.)						15·0	14·0	12·1	10·7
Planning growth rate including margins			15·7%	17·0%	17·0% pa	17·0% pa	15·5% pa	15·5% pa	14·5% pa
Trunk call growth over ASCE period (% p.a.)	14·67	13·82	12·12	11·55	12·13	11·80	11·50	11·30	
Circuits provided at end of ASCE year	3/68 65,904	3/69 76,303	3/70 87,517	3/71 97,781	3/72 111,270	3/73 127,733	3/74 144,570	3/75 160,810	



all forecasting and to allow for delays in the installation of circuits and contract equipment. They also compensate for some of the shortcomings in traffic recording techniques and for differences in call and route erlang growth.

Adjustments must also be made for the differing rates of growth on non-speech traffic – for example, data. Allowance must be made, too, for new services as, during the period covered by the ASCE, facilities such as radio paging and facsimile may lead to the routing of extra traffic over the main network.

As mentioned earlier, ASCEs are also used in the planning of equipment programmes and designs. It is essential that equipment data aligns with the requirements shown in the ASCE as, for example, it is pointless for the ASCE to show a new direct route if the equipment data does not also show this need. Complexities arise owing to the differences in route and switching equipment busy hours, but this problem will be helped with the introduction of a "Group Switching Centre Planning Line" which aims to achieve compatibility in this forecasting field.

Data for planning site and accommodation needs is based upon the fifth-year circuit requirements of the current ASCE grown to the optimum design date by means of the long-term trunk planning growth rate. Until recently this growth rate stood at 8 per cent per annum, but recent indications from TMkD show that during the early 1980s growth is expected to be somewhat higher owing to the effects of North Sea oil on the economy.

Overall, the Post Office has an obligation to ensure that main network forecasts are realistic and that ordering policy reflects as near as possible the true requirements of the network. This article merely provides a broad outline of the philosophy behind the derivation of the trunk planning growth rate, and does not deal in detail with the many basic aspects of main network forecasting. However, it has endeavoured to emphasise the importance of the work of estimating staff and the role this work plays.

Mr K. Waterhouse is a Senior Telecommunications Superintendent in Operational Programming Department at Telecommunications Headquarters. He was formerly in Network Planning Department, responsible for deriving the trunk planning growth rate.

Computers aid the network planners

IF Galpin

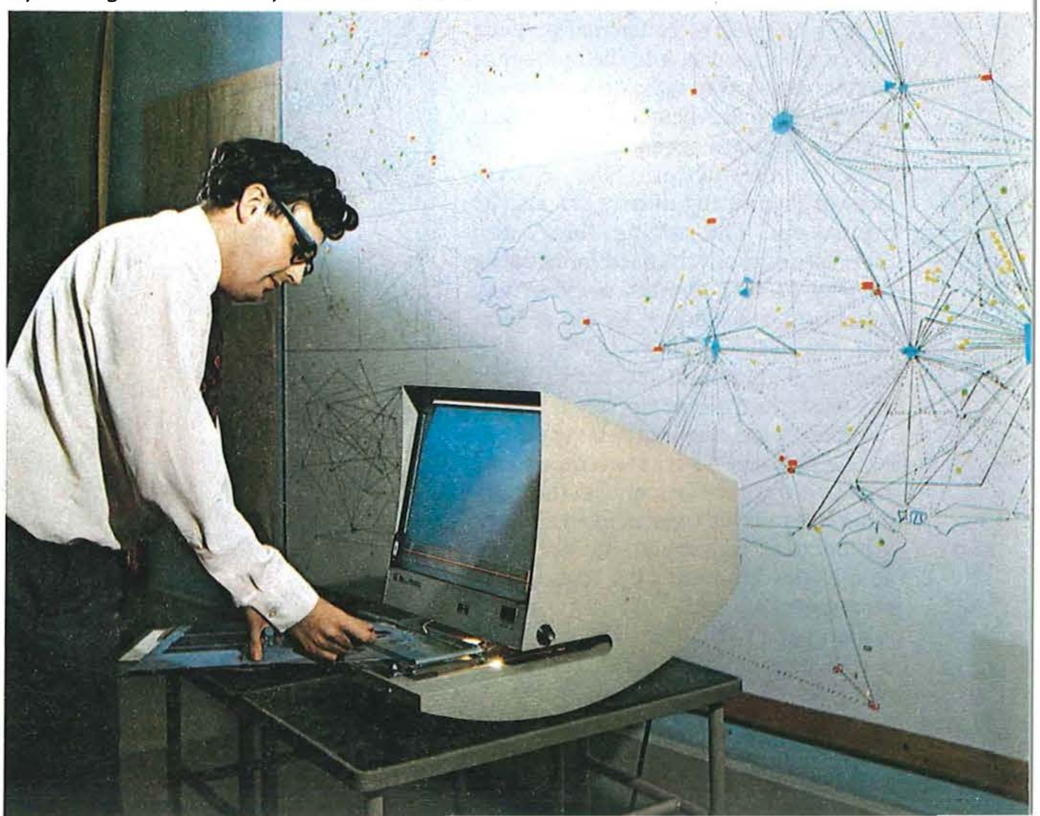
SINCE the Post Office introduced subscriber trunk dialling in 1958 the ever-increasing demand for trunk telephone circuits has encouraged the development of transmission systems with greater capacity. At the same time the main, high frequency (HF) transmission network – the coaxial cables and microwave radio links which interconnect the major centres of the United Kingdom – has become more and more complex. Not surprisingly this increase in complexity has made the task of the transmission planning engineer that much more difficult.

It is the job of staff in Network Planning Department (NPD) at Telecommunications Headquarters to ensure that sufficient plant is added to the main network each year to keep pace with forecast demand, and to form a foundation for growth in future years. Account must be taken of technological advances and of various technological and economic constraints, and the plan must be produced quickly in order that implementation will not be delayed.

Every year the forecast demand for circuits from some 13,000 to 14,000 main network routes is extracted from an Annual Schedule of Circuit Estimates (ASCE). These forecasts are prepared by staff in Telephone Areas and show year by year, for five years ahead, the estimated number of circuits needed to carry the forecast traffic between exchanges. In preparing these ASCEs Areas take account of the national growth target limits set by NPD. (Main network growth is discussed in more detail in the preceding article.)

Only when the circuit demand of the main network traffic routes has been spread over the transmission network, which comprises 1,500 links between 600 exchanges and repeater stations, is it possible to determine where planned capacity is insufficient. It may, for instance, be that demand for additional circuits between the north of Scotland and southern England could cause ▶

Using a microfiche reader, the author checks an output from the HFP2 computer system against a wallmap of the main network.



very heavy use of links between, say, Edinburgh and Birmingham. If this is the case planners can then take the necessary steps to avoid the problem by increasing capacity between Edinburgh and Birmingham or re-routing some of the circuits.

By 1964 the manual task of distributing demand over the network was becoming more and more onerous and time consuming and it was desirable to provide some form of mechanised assistance for the planners, both to speed the processes and increase accuracy.

Experimental computer programs were written to use an Elliott 803, a small machine which had originally been acquired by the Post Office for scientific calculations. When these programs had demonstrated the feasibility of the project, the programs were transferred to a larger Elliott 503 computer. On this machine, it was possible to increase substantially both the scope and facilities offered by the programs; it is only recently that these programs, introduced in 1966, and gradually improved, have been superseded.

Although the present computer system contains several useful and sophisticated features not available in the early programs, the basic principles of all the systems remain the same and are surprisingly simple. The computer holds records of plant available in the network. Circuit forecasts input to the system are distributed over this theoretical network according to information held in a computer file, called the routing library. This is maintained by the system and can be updated to reflect the currently planned network situation.

The main output shows the forecast circuits planned to be carried on each link in the network, and the number of circuits using transmission equipment in each terminal repeater station. These outputs indicate where planned capacity is insufficient. The current state of the routing library can also be printed out. The routing library also takes into account the need for network security in that circuits between any two towns are planned to use at least two physically separate paths. This ensures that should one path fail for any reason, not all the circuits are lost.

Planners use the outputs from the system to decide where plant needs to be added to the network, and as the computer has relieved them of much tedious arithmetical manipulation, they are able to devote more time to planning better relief schemes.

Because of the time taken to plan, manufacture and install transmission plant, plans are prepared using forecasts for five years ahead. This means that if the computer output shows that capacity in part of the network is likely to run out in five years' time, action must be taken. Obviously the correct answer simply may be to increase capacity, but frequently a better (cheaper) answer is obtained if the information on the routing library is changed and use is made of less congested parts of the network. Often a combination of these techniques has to be used.

The quality of the plans produced depends on accurate information being available to the planner as soon as it is required. As the transmission plant added to the network represents a commitment of capital resources in the order of £20-30 million each year it is obvious that even a small improvement in planning accuracy is worthwhile.

As part of a long lines computer project aiming to provide assistance for network planning, it was decided to mechanise production of the ASCE. This forms the major input to the HF planning system, and it was clear that direct links between the systems were therefore desirable.

Additional programs were written to make the linkage and were introduced in 1972 with considerable success. The ASCE system is run on more modern ICL System 4 computers and the linkage programs would have to produce an output capable of being used on the Elliott 503.

At the same time as the ASCE linkage programs were being considered it was becoming clear that the Elliott 503 computer was nearing the end of its useful life and re-programming of the HF planning computer system would be necessary. It was decided to run the new programs on the same System 4 machines as the ASCE. Advantage was taken of the need to re-program and consideration was given to the changes to planning methods brought about by the proposed introduction of time division multiplex (TDM) transmission techniques into the main HF network.

The main difference, from a computer processing point of view, between frequency division multiplex (FDM) and TDM is that while FDM is built up in blocks of 12 circuits (one group), TDM is built up in blocks of 30 circuits. This deceptively simple difference gives rise to a variety of unexpected problems, particularly where both types of plant co-exist in the same part of the network.

The new system, called HFP2, was introduced at the end of last year and incorporated many new facilities. In programming this system it proved possible to learn from data processing experience gained during implementation of the Junction Network Planning computer system which is based on similar principles. The Post Office Data Processing Service who were responsible for writing the programs for HFP2 were also involved in the development of the latest version of the Junction Network Planning system.

In addition to the planning facilities, HFP2 can produce management

A computer terminal of the type that will provide planners with on-line access to the HFP3 system, which is to be introduced next year.

statistics, both on a regular and one-off basis, and facilities have been provided to enable a "backward look" to be taken. This is called the comparison process and is used to evaluate previous plans in the light of current forecasts.

Outputs from HFP2 are produced on microfiche, compressing 69 pages of printout on to one 150 mm by 105 mm sheet of film. This means that the more detailed, bigger outputs from the new system are easier to handle and do not occupy as much storage space as paper output from the earlier system.

But development has not stopped with HFP2. Despite the complexities which have had to be built into the system it does a very simple job. HFP2 indicates where capacity would be insufficient if a certain plan were to be carried out. It is left to the planner to turn this shortfall information into viable plans for relief. This task can be assisted if the planner can rapidly assess the effects of his decisions. The next stage of computer processing (HFP3) will give the planner "on-line" access to a theoretical model of the network using a local computer terminal. This will enable him to try different network configurations, working towards the best solution.

Other features of the HFP3 proposal include an attempt to increase planning realism by taking into account, in greater detail than HFP2, the group (12 circuits), supergroup (60 circuits) and hypergroup (900/960 circuits) configuration of the network. The equivalent hierarchy which will exist in the TDM network will, of course, be provided for.

Routing library information will be updated automatically, network security (two paths between towns) being automatically provided for by the new programs. With the present system it is necessary for the planner to inspect his records and prepare routing library information for input to the machine.

The HFP3 system opens up new horizons in network planning. It is not expected that it will be easy to integrate a system of this complexity with present planning, but if the challenge can be met NPD will have sufficient flexibility to plan an even better network despite rapidly changing economic and technological conditions.

Mr I. F. Galpin is an Executive Engineer in Network Planning Department at Telecommunications Headquarters responsible for computer aided aspects of main network planning.

Niton's day! New coast station is opened

Earl Mounbatten talks to a radio officer in the new coast station at Niton. Looking on is Officer-in-Charge Mr S. Abram.

ADMIRAL of the Fleet Earl Mountbatten of Burma leant forward, picked up a red telephone and within seconds the voice of the captain of the Cherbourg-bound Queen Elizabeth II came through loud and clear. The call – plus two more made to other vessels – marked the official opening of the new Post Office radio station at Niton, Isle of Wight, and the completion of the main part of a modernisation programme for the Post Office's 11 medium-range coast radio stations.

Post Office coast radio stations extend from Wick to Land's End and handle a continuous flow of messages between Britain and ships of every nation. They also serve rigs exploring for gas and oil. The stations make radiotelephone contact with ships up to 200 miles away, connecting them directly to callers in Britain or overseas over the public telephone network. They also make wireless telegraphy connection with ships up to 500 miles away, sending messages by Morse code and more recently by radioteleprinter.

In the last few years the short-range radiotelephone service they provide over VHF – reaching out to ships up to 40 miles from the stations – has been extended to include yachting.

Niton – third busiest of the medium-range coast radio stations – has a staff of 17, all of whom have served at sea. Last year its 15 radio officers handled 48,000 messages and broadcasts and 53,000 telephone calls. There has been a coast station at Niton – call sign Niton Radio – for more than 60 years. The new station, housed in a former RAF building on the clifftop at St Lawrence, replaces the previous station at Niton Undercliffe two miles to the west.

The work of modernising the medium-range coast radio stations was first announced in 1972. Most of the eleven stations are fully equipped with modern single-sideband (SSB) radio-telephony equipment operating in the maritime band (1.6 to 3.8 MHz).

SSB operation, now being adopted internationally, increases transmitter efficiency and makes more effective use of the crowded radio frequency spectrum. It also makes selective calling possible, to end the tradition of having to call ships at set times each day.

Ten years in the Tower

DT Horn

TEN YEARS ago this autumn Mr Harold Wilson, then in his first term as Prime Minister, declared the Post Office Tower open for service and described it as "a nervecentre... which will help to ensure that both national and international telecommunications will be adequate during the next decade and beyond".

Mr Wilson went on to refer to the Tower as a magnificent example of British engineering skill and Post Office enterprise. Glowing praise indeed but how, 10 years on, does that tribute stand? And how has the Post Office Tower measured up to the forecasts made for it in 1965?

The main engineering functions that operate within the Tower column and the adjoining buildings, which together make up the Tower complex, are trunk switching of calls out of and into London via the Tower and Mercury group switching centres respectively, radio transmission incorporating telephony, and television channels and television network switching.

All these functions have common points in the aerial systems which terminate at the aerial galleries perched 111–144 metres above the London streets. Such a height was necessary to enable the radio systems to transmit and receive signals from the site of the old London Museum radio station without the signals being obstructed by the high rise buildings that were being constructed – and others that were also planned–in and around the London area.

Radio signals from the Tower radiate in four main directions towards Dover, Bristol, Birmingham and Norwich. It is essential, therefore, that no very tall buildings are constructed in, or even close to, these paths of transmission. The Post Office has no statutory right to prevent buildings being constructed in the paths of radio transmission so it is necessary therefore to maintain close liaison with the building planners of the Greater London Council. So far no building has been constructed that interferes in any way with radio system transmission.

Back in 1965 the ultimate capacity of the Tower radio systems was seen as 50 television links and 150,000 telephony channels. Today the radio station deals with 28 television links and 40,000 telephony channels, so there is capacity to extend should it become necessary in the future.

In the 10 years that the Tower and Mercury trunk switching units have been in service, they have been extended to virtually their full capacity, and new incoming and outgoing trunk units have been provided elsewhere in London.

The extensions both to Tower and Mercury and also the introduction of new London units have been carried out in well planned stages as part of the long term trunk switching plan, and to the credit of the trunk system planners, each stage of expansion was completed on time to meet increased traffic demand.

All calls outgoing from the Tower trunk switching unit are routed under the control of register/translator equipment of the magnetic drum type and it is remarkable that some of the magnetic drums have been rotating at over 2,000 revolutions per minute non-stop for 10 years. With the clearance between the rotating drum and the "read" and "write" heads, which record or obtain call routing information from the rotating drum, set at only 0.001 inches, it becomes evident what a fine engineering achievement this is.

One of the most important functions performed within the Tower complex takes place in the Television Network Centre. This centre acts as the principal point of control for the extensive line and radio transmission network which serves the needs of the BBC and the Independent Broadcasting Authority (IBA) throughout the country. It also serves the BBC and IBA when overseas television transmissions are fed into this country via the Eurovision or satellite communication systems.

This is a Post Office service which is monitored by all television viewers and for the wedding of HRH Princess Anne and Captain Mark Phillips, the service from Westminster Abbey was relayed via the Post Office Tower across the world to an audience which was estimated at many hundreds of millions of people.

The staff at the Tower are naturally proud of their involvement with such events, and they take pride in the standard of service provided. Considerable improvements have in fact been made over the past 10 years. Most television transmission equipment is now transistorised, television network distribution equipment is completely automatic, and synchronised to the Speaking Clock Service for programme changes.

These modifications and many more, have enabled the Post Office to improve on the standard of service which 10 years ago was accepted as very reliable, to a point where the very rare breaks in service are measured in seconds. Serviceability in 1975 stands at 99.998 per cent.

The vast array of engineering systems operating within the Tower complex are fascinating, but it would not be claimed that they are peculiar to the complex, or even London. The Tower column, however, is unique, certainly in the United Kingdom, because of its height, 176 metres and its attractive shape. It has become as familiar a London landmark as Buckingham Palace, St Paul's Cathedral or the Tower of London.

The design specification set out by the Post Office to the Department of the Environment (then the Ministry of Public Buildings and Works) Architects and Structural Engineers for the Tower included the vital limiting factor, that the column should not deviate from its vertical position more than one third of a degree in any wind condition. This limit was necessary because of the high directivity characteristics of microwave aerials and if the Tower even now moved one half of a degree from its vertical position, the strength of the information signal being received at the objective aerial would be reduced to half the normal power.

At the drawing board stage the Department's structural engineers, following ▶

A Technical Officer at work in the Tower television control room where programmes from both home and overseas are switched.

mathematical calculations and wind tunnel tests at the National Physical Laboratory, predicted that subjected to winds of 110 miles per hour the Tower would move a distance of 15 inches (380 mm) measured at the roof, from its vertical position. To date the actual maximum movement recorded is nine inches (229 mm), in winds of 90 miles per hour.

It was realised early in the planning stage that the building would be a great attraction for visitors, and consequently provision was made to accommodate the general public. At ground level an imposing vestibule was equipped with diagrams, photographs, automatic question and answer machines dealing with the Tower and Post Office services generally, stamp machines and souvenir shop.

Public galleries were provided on floors 31–33, the restaurant with its revolving floor on floor 34 and associated with the restaurant a cocktail lounge on floor 35. The Tower quickly became a favourite place to see and was on the schedule of most visitors to London.

In the first five and a half years no fewer than 4.6 million visitors were taken to the observation galleries: the record number in one day was 5,600 on May 30, 1966, two weeks after the opening of the public side of the Tower. All were taken up in one or other of the two high-speed lifts, each of which is limited to 14 passengers, and which as well as carrying visitors to the galleries and the Top of the Tower restaurant, also had to take Post Office engineers working in the Tower. In those early days income from the public was considerable, and Post Office enterprise in providing the facilities seemed to be well justified. Children's charities also benefited from coins that were tossed into the water fountain in the public vestibule. On average about £400 was collected and donated each year the Tower was open.

But all the hectic activities of the public side of the Tower came to a sudden and dramatic end early on October 31 1971. Floors which only a few hours earlier had been crowded with visitors enjoying the sight of the London skyline by night, were shattered by an explosion. The blast removed one section of the outer wall of floor 31, and severed domestic water supplies to the upper floors. Within minutes of the explosion police and fire services were on the scene, and together with Post Office staff, they set about accounting for all staff on duty, making a preliminary assessment of the extent of the damage, and dealing with services that had been disrupted.

Examination of the communication systems revealed that disruption to service was limited to a failure of one radio link to Dover. A piece of falling debris had knocked a hole in the reflector of the horn sorial providing the radio link and matters were complicated by water entering the hole and thereby into the waveguide aerial feeder. Because of this one international telephony link of 1,800 channels and one television link were effectively put out of service for about six hours.

Following the explosion, DOE architects and structural engineers made a detailed examination of the building and found, fortunately, that the main structure had been unaffected by the blast. The building restoration work was finally completed in early 1973, and although the Top of the Tower restaurant reopened less than a month after the blast the observation galleries have remained closed to the public ever since.

Security at the Tower involves the stringent checking of people in and out of the building, including patrons of the restaurant, and dealing with bomb hoaxes. Since the end of 1971 staff have had to deal with more than 2,000 hoaxes; at one time three or four a day were being received. The number slackened, however, when one offender was given a six-month prison sentence. The bomb incident, as might be expected, had a very real effect on the administration of the whole complex and every member of the Post Office staff on site was involved.

But significant though the events of October 31 1971 were, most staff who have been at the Tower for between five and 10 years prefer to recall some of the happier and more interesting events.

Visitors have included HM The Queen, HRH Prince Philip, foreign royalty, Prime Ministers of the United Kingdom and of the Commonwealth, well-known sportsmen and stars of the entertainment world. Other memorable occasions which readily spring to mind were the transatlantic air race of 1969, when 360 competitors started on their journey to the Empire State Building, New York, and the many races up and down the column staircase.

On the engineering side, events recalled would be the introduction of colour television transmission, connection of subscriber trunk dialling transit facilities, Post Office involvement with world-wide transmission of television pictures for royal functions, Parliamentary elections, Apollo moon shots and major sporting events.

Undoubtedly 1965/1975 has been an eventful decade. The plans that were first drawn up as long ago as the early 1950s have been realised, and nothing has happened that in any way detracts from the statement made by Mr Wilson at the opening of the Tower.

Mr D. T. Horn has been head of the Tower Operations Division, London Telecommunications Region, Centre Area, for the past three years.

PO Telecommunications Journal, Autumn 1975

Bird's eye view from the top. This dramatic picture was taken as building work on the Tower neared completion.

Providing new lines of information

DH Cremer and RG Carter

A VISIT to the local library or a search through dusty old newspaper archives has usually been the quickest way to delve back into history, but now the events of 50 years ago could soon be just a telephone call away.

At the turn of the year a trial is due to begin at Bournemouth and Swindon in which subscribers can dial a special number and hear well known BBC announcer John Snagge reading the headlines from 50 years ago that week.

The trial is the latest example of the Post Office's rapidly expanding recorded information services and if successful is likely to be extended to other parts of the country as well.

And in the London area a new record release service is being tried – in which record companies pay to have their "breakers" played. These are the up and coming discs just outside the top 50 which they hope will become big hits in the near future.

But though the last few years have seen a whole new range of recorded information services – and new equipment to carry them – the original Speaking Clock is still easily the most popular. Introduced in 1936 it received 13 million calls in its first 12 months and last year this number had risen to an incredible 430 million. With an average length of call of only 20 seconds this is almost the perfect information service and easily the most profitable.

After the Speaking Clock it was 20 years before the next service – the weather – was introduced in 1956; but others soon followed. And the order in which they came reflects the Englishman's interests – cricket, motoring, holidays, food. All began in a small way but have grown steadily and spread throughout the country as described in the panel on page 21.

Naturally, such far reaching extensions to the recorded information services have had significant effect on the equipment needed to run them. Until 1970 all the services apart from the Speaking Clock, were being provided by the equipment announcer No 5A, basically a modified commercial dictating machine which had replaced the use of tape loops played on commercial tape recorders.

The original Speaking Clock used a photographic technique whereby the constituent parts of the announcement were recorded on glass discs. A complete announcement was assembled in the correct sequence, every 10 seconds by scanning the discs with associated photo-electric cells. These clocks were replaced in 1963 by the present design developed by Research Department staff at Dollis Hill.

This uses as its recording medium a tyre of magnetically loaded neoprene stretched over a rotating brass drum ▶

A Technical Officer makes a routine check on the Speaking Clock equipment at Kelvin House, London.

and continuously lubricated with silicone oil. During the past three years an overhaul programme for the Speaking Clocks has been completed and until the overhaul the recording medium had given more than 150 million repeats with negligible wear of the neoprene tyre. This well-tried technique has now been incorporated into the present design of announcer for recorded information services.

The equipment announcer No 5A, however, was becoming increasingly difficult to maintain because the supply of new equipment was dependent on the manufacturer receiving sufficient demand from other organisations as well as the Post Office. Lack of this demand made the item difficult to obtain as it was no longer a viable proposition from a manufacturing point of view. Spare parts were also subject to similar problems and the quality of the announcements, and therefore the service given to customers, was deteriorating.

In 1966 the equipment announcer No 9A was introduced for the new Dial-a-Disc service and also as a replacement for the 5A on the Changed Number Announcements. This announcer is a replay only machine using a tape loop previously recorded under engineering supervision on a tape recorder. The tape cassette is capable of holding sufficient tape to provide an announcement of up to four minutes playing at a tape speed of $3\frac{3}{4}$ inches per second.

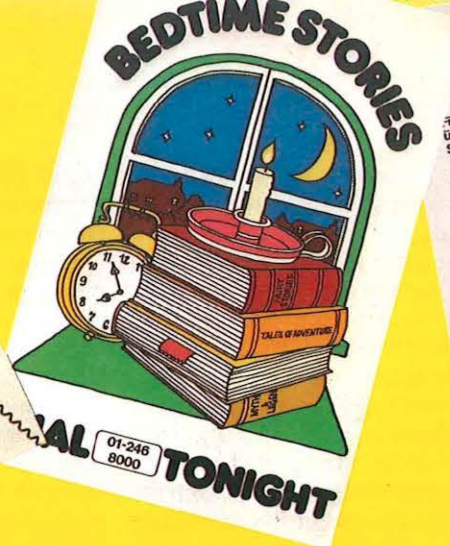
With the 5A maintenance difficulties increasing it was necessary to introduce the 9A on the other recorded information services. Ideally suited, it is reliable, capable of good quality reproduction and can provide sufficient length of announcement to meet all needs. But the number of services now requiring the preparation of tapes for the 9A greatly increased the engineering costs and the introduction of the 9A for those services requiring change more than once daily was to be a stop gap measure pending the development of a new announcer giving direct recording facilities and thereby reducing engineering attention.

In early 1972 the first production sample of the latest announcer, the equipment announcer No 11A, became available from the manufacturer. This announcer was developed from the well-tried technique using a magnetically loaded neoprene tyre stretched over a rotating brass drum – the method used on the latest Speaking Clock design since its introduction twelve years ago in 1963.

Turn to page 22

Above: An adjustment is made to one of the latest 11A equipment announcers. These are used mainly on services like cricket or tennis where frequent updating is necessary because of the rapidly changing scores.

Below: Currently attracting more than 70 million calls a year is the dial-a-disc service. Here a recording is being transferred from an original disc on to tape, ready for use in the service.



'At the third stroke' and after...

THE SPEAKING Clock is now available for a local call fee to more than 90 per cent of subscribers. The time given is accurate to one twentieth of a second. The announcements on the present clocks were recorded by Miss Pat Simmons then an Assistant Supervisor at a London exchange who won a "Golden Voice" competition. The weather service was originally set up as a means of relieving pressure on the Meteorological Office Switchboard in London but has now been extended to 54 centres throughout Britain providing local forecasts updated at least three times a day.

Sports fans are also well catered for by the Recorded Information Services and this year the Cricket service covered almost 50 matches starting with the Prudential World Cup, continuing throughout the drama packed Test Series against Australia, all the Gillette Cup matches and the last three rounds of the Benson and Hedges Trophy. Six new centres received the Cricket service during this summer which brought the total to 90. It was certainly a "bumper" year and interest in the service continues to be very high. One Test Match alone can attract more than 4m calls. Message length is kept to a maximum of 45 seconds, with a cut-off between 90-180 seconds, to enable as many people as possible to get the news.

London now has its own cricket network; but elsewhere it is taken over every evening for Dial-a-Disc. Although one of the younger services, Dial-a-Disc is now available in 83 towns and attracts more than 70 million calls a year. The top eight pop records are played each week, with two on Sundays; on a trial basis, all top 20 records are now being played in London on its own separate network (two each weekday evening and five each on Saturday and Sunday all day) with a view to ultimate extension on a national basis of these facilities.

Similar to the Weather Service but concentrating on road conditions is the Motoring Service, with information produced by the Automobile Association. This began as a winter-only service but now runs throughout the year and is available from many centres. The hard winter now being forecast after the good summer should mean more calls to this service.

The Teletourist Service gives daily details of a selection of events and places of interest in and around London, from regular favourites like the Changing of the Guard to information about exhibitions, shows and sporting events. Currently there is a demand for more information about shopping, as our Common Market cousins come over in search of bargains. The information is provided by the London Tourist Board and recorded in English, French, German, Spanish and Italian. A similar service is available in Edinburgh from May to September, but in English only, and there are local "What's on" services in some provincial centres.

The Recipe Service, better known as "Dial-a-Dish" gives recipes provided by the British Farm Produce Council. Since last year this has concentrated on an economical main meal for four, the current price ceiling being £1. Last year also saw the start in London of the Food Price News Service, sponsored by the Department of Prices and Consumer Protection, giving each week the latest trend in food prices.

Two services which have been on trial in London, Birmingham, Bristol and Cardiff are Gardening Information and Bedtime Stories. The former gives weekly hints on gardening topics by Eric Hobbis and the latter stories for children told by Johnny Morris. New hints and stories are currently being recorded, with the help of the BBC and plans are in hand to combine these with the Recipe service and extend the combined "Household" service throughout the country during the next year. Recipes would be put out each weekday, Gardening Hints at the weekend and Bedtime Stories would be heard each evening.

The recent unpredictability of the Stock Market has seen a marked upsurge in the number of calls to the *Financial Times* and Business News Summary. This service is updated hourly from the *Financial Times* Office during business hours and is available on London and Birmingham numbers, though it is rung regularly from all parts of the country. Economic difficulties and disputes boost the calling rate, just as bad weather helps the Motoring Service. At least an ill-wind blows good to Post Office finances.

As well as the "all-the-year-round" services recorded information services also cater for periodic events like the RAC International Rally. This has been covered for the past five years from London, Leeds and Chester and further centres are being added this year.

But not all services emanate from Telecommunications Headquarters. A number of local services are provided by the Regions, including Skiing Information from Edinburgh, Father Christmas messages from London and a number of other centres, and Children's London with Ed Stewart. The Wimbledon Tennis championships have been covered for the past three years in London and this year Dundee Area covered the Open Golf Championship at Carnoustie. Some centres in Wales have made available special Dial-a-Disc and Bedtime Stories Services in Welsh. Services have also been provided for British Rail and certain Electricity Boards to give information on rail services and power cuts during disputes.

The 11A unit is designed for direct recording by an operator with subsequent continuous or stop/start repetitive playback. The length of the announcement can be up to a maximum of six and a half minutes. The drum is driven by a synchronous motor via a reduction gearbox which results in a drum surface speed, and thus a recording speed of 3.14 inches per second. Positioned diametrically opposite either side of the drum are the erase and record/replay heads. These are on travelling carriage assemblies which mesh with a central threaded drive shaft at various times during the record, replay and erase cycles. Complete erasure of the drum precedes the start of each new recording.

The initial use of the 11A in late 1972 was to replace the 5As being used at the London Recorded Information Service Centre (RISC) where a system of supplying a maximum of 20 services from a pool of 24 machines was in use. Full accessibility was had from three control units in the recording studios. These machines were to supply the services like Weather Forecasts, *Financial Times*, Wimbledon Tennis and Cricket Scores where frequent announcement changes occur. Less frequently changed announcements such as Teletourist, Recipe and Dial-a-Disc continue to be supplied by the now well established 9A.

To introduce these announcers into the remaining 14 RISCs throughout the country a "Provincial" rack has been developed capable of holding all the equipment, other than the studio control unit required to provide a system of six services from a pool of eight announcers.

The lower half is used to house the eight announcers on four shelves. At head height are the supervisory controls providing facilities such as monitoring of announcements, busying of out of service machines, communication between the rack (normally sited in an apparatus room) and the control unit in the studio. The remainder of the rack contains the control equipment used in the making of a recording.

Installation of this rack at the provincial RISCs is now well advanced and so far the centres now using the equipment are Plymouth, Bristol, Nottingham, Manchester, Leeds and Lincoln. To make a recording using the Provincial Rack is a simple matter requiring no engineering assistance. The first stage is to allocate the operator a free machine which is done automatically via a reed relay matrix. Before recording can begin the erase cycle of the announcer starts when the erase carriage engages with the threaded drive shaft.

After 12 seconds a signal is sent to the operator indicating that she can operate the "record" key on the control unit which allows the record/replay carriage to engage with the drive shaft. Recording now begins and a "proceed" signal indicates this. During the recording cycle the record/replay carriage pushes along a microswitch in front of it. At the end of the recording when the operator restores the "Record" key the record/replay carriage restores to its normal position ready for playback but the microswitch is left in place at the "end-of-message" position.

This is now used to indicate the end of the announcement during the repetitive playbacks. The erase cycle which began at least 12 seconds before recording continues until the complete surface of the recording medium has been covered and then the erase carriage is held mechanically at the far end of the drum until re-recording is necessary. Before the announcement is connected to the public network it is monitored to check quality and completeness.

At the London RISC, a facility exists which it is hoped to extend to the provincial racks, whereby remote sited customers such as the *Financial Times* and Weather Centre can regularly update their information by recording directly on to the Post Office announcers. The only assistance required from Post Office staff is the final monitoring of the announcement and the subsequent connection into service.

The voice of Time.
Miss Pat Simmons who made the current recording in 1963.

During the early part of 1974 a provincial rack was installed at the London RISC to use for recording the Cricket Service. It has since been used to supply all the cricket information including this summer's series. The high rate of change of announcements, where information is updated at every change of score or fall of wicket, subjected the equipment to a most thorough test and has brought praise from both the operating and engineering staff who have worked with it.

The 11A has a working life of about 20 years and although techniques rapidly change and developments such as synthesised speech progress, this announcer and its associated equipment will provide the bulk of the information services well into the future.

It is now felt that the Post Office has the equipment capable of meeting the demands which the range of Recorded Information Services are likely to make of it. It provides good quality reproduction, works with the minimum of engineering assistance and can be easily operated and maintained.

The existing information services are run to make a profit, which helps to improve the telephone service generally. The Post Office is always studying ideas for new services and is open to suggestions for any that fulfil a need and are likely to make a profit.

Among many ideas put up in the past is Dial-a-Laugh, not a joke just an infectious laugh; there could be some interesting reactions if anyone were to get this service accidentally, through crossed lines. The ideal information service is one with a very short message which everyone has an urge to ring in the middle of the night, since this avoids congestion during business hours and makes use of idle equipment. There are a number of proposals for new services currently being planned or under discussion. These will reflect in general a more commercial approach and the coming years should see even more developments than the past.

Mr D. H. Cremer is a head of section in Service Policy Division at Telecommunications Headquarters with responsibility for recorded information services.
Mr R. G. Carter is an Assistant Executive Engineer in THQ Service Department responsible for equipment maintenance on the recorded information services.

Telephonist Mrs Joyce Fitzclark makes the daily recording for the North Central newsflash service. She reads the message into each recording machine in turn.

North Central have it taped

DT Sloman

MORE THAN 5,000 Post Office staff in London need no longer be caught unawares by breakdowns in transport services, long delays and other commuter travel miseries. A telephone newsflash service set up in the North Central Telephone Area provides staff with easy access to up-to-date information on travel problems, as well as details of current local events and items of general interest.

The service is based on a dial-in recorded information system, designed and installed at North Central Headquarters by Area staff, and can handle up to four calls simultaneously. Basically the system comprises four wall-type telephones, each connected to a separate answering set and clock type meter for monitoring the number of calls received.

The telephones are used to record information daily on the tape of each answering set. By dialling a special number on the Headquarters private automatic branch exchange, staff in any of the Area's 22 buildings are automatically connected to the first free answering set.

The idea for the service was triggered when Mr Norman Chapman, General Manager, North Central Telephone Area saw a magazine article describing a news service supplied via the PABX of the London offices of a large organisation. Discussions with staff followed and consideration was given to the possibility of adopting a similar system throughout the PABX system for North Central. First steps were to establish exactly what types of message could be transmitted, their length, the total length of each broadcast and the type of equipment to be used.

Once these questions had been decided it was basically a matter of setting up the system, and a target date was made for the third week in June when the British Rail strike was due to take effect. Staff might have had difficulty in getting to and from work but at least they would have details of any services that were running and conditions on London Transport.

A newsflash was produced to all first line managers telling them of the new service and the number to ring and then – anti-climax: the strike was called off. At least, this did give a little more breathing space and the introduction of the service was postponed for a week.

As the countdown began many trial broadcasts were made, including using the monthly bulletins on daily events in the City of London. Norcentals, the sports committee for North Central Telephone Area also made broadcasts and there were other items of interest to staff. The inaugural broadcast was made by a young clerical officer in the Area public relations office, and contained news of the retirement of an Assistant Executive Engineer with 47 years' service in Holborn followed by news about Norcentals. It ended with the weather forecast.

By the end of the first week the number of calls made to the service was encouraging and with the recording equipment situated alongside the public relations staff desks it was simple for urgent items to be added as and when they occurred.

An early example of this was the severe flooding which occurred in North London during a freak storm in August. As soon as details of transport cuts were known they were recorded on the tape and scores of staff were quickly able to assess their travelling options. And for the future to make sure the service can always provide the latest information, North Central have arranged special telephone links with British Rail and London Transport which enables them to by-pass the normal enquiry procedure.

Following one or two early teething troubles a regular pattern of daily broadcasting has now been established. Late each afternoon a member of the public relations team drafts out the next day's broadcast which normally contains information about current activities in the area, sports and social events, and ends with the weather forecast.

Early the following morning a telephonist from the Fleet auto-manual centre arrives to record the message. She broadcasts it separately into each of the wall telephones and by 10 am the four answering sets are ready to receive calls. So far the average number of calls per day is around the 50 mark but on occasions like the flooding or a power failure that crippled the Underground, there have been four times that many.

Experience has already shown that 90-second tapes are the best to use in normal circumstances but when there are transport problems a shorter tape is probably better.

Mr D. T. Sloman is public relations officer for North Central Telephone Area, London, and played a leading role in setting up the newsflash service.

Grounds for testing at Smallford

IJ Jenkins

A QUIET lane in the Hertfordshire countryside near St Albans is hardly the sort of place to associate with the development of modern telecommunications technology. Yet off this lane is the Smallford Test Centre – 37 acres of open fields, laboratories and workshops owned by the Post Office and used extensively for experimental work by staff from Telecommunications Headquarters.

Smallford, just 20 miles from the centre of London, is unique. It began life in 1925 as a small radio receiving station working in conjunction with another station at nearby Sandridge. It comprised four self-supporting aerials each linked to 12 receivers and cabled to Brent Buildings in North West London.

Soon after the war, Smallford closed as a receiving station and passed to the control of Research Department, Dollis Hill, who used it for aerial design and testing. In the years that followed much valuable experimental work was carried out particularly on the development of satellite tracking systems and this continued until the late 1960s.

Telecommunications Development Department took over the site and buildings in 1968 and since then the station has been host to countless tests and trials of a whole variety of external plant ranging from cable brackets to the latest moleploughing equipment for burying plastic ducts and cable.

The original building was able to provide a well equipped machine shop, a project workroom, overhead plant laboratory, canteen and an office, but as work intensified it was obvious new indoor facilities were needed. These came last year in the shape of a huge barn type prefabricated building which was designed to meet council planning consent for a building to fit in with the rural nature of its surroundings.

Once erected the new structure was modified internally to provide – for the first time – garage accommodation for all site vehicles equipped with hydraulic plant, and workshop and pit facilities for modification to vehicular and other mechanical aids.

A workshop and testing laboratory for experimental work using different types of concrete, joining chamber construction methods, frames and covers was also set up together with an instrument laboratory for the safe keeping and maintenance of instruments used in conjunction with any current testing programme. Room was also made for a small store area, a first aid room and toilets and the building has warm air heating.

One of the first jobs the new building was used for was to test the 60 MHz cable which will provide high capacity trunk telephone links between London, Birmingham and Manchester. The cable was tested to exact manufacturers' specifications and then sent to the factory as a standard comparison for new cable coming off the production line. Much of the early development work for the 60 MHz cable was, in fact, undertaken at Smallford including installation methods for the welded steel type repeater housing, including its pressure and atmospheric testing.

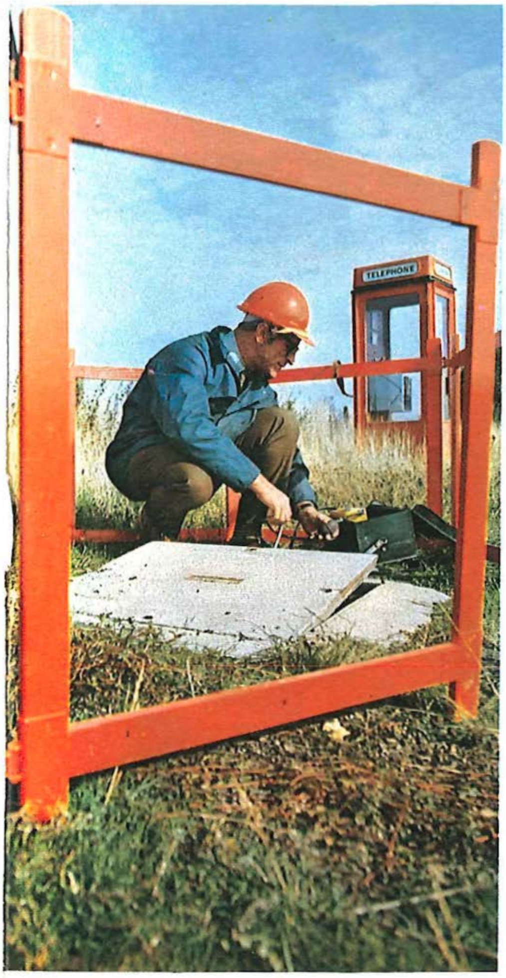
But despite the presence of highly sophisticated equipment, vehicles and working methods, Smallford has no trouble in retaining its farmyard environment. Indeed grazing rights on the 37 acres remain with a nearby Agricultural Institute and the local farmer coming to tend the cattle which wander around the site is a daily routine. It is a fact, too, that until 1960 Smallford's water supply was electrically pumped up from a 100 ft-deep artesian well!

But what is the site currently being used for? One of the biggest problems facing the Post Office is the prevention

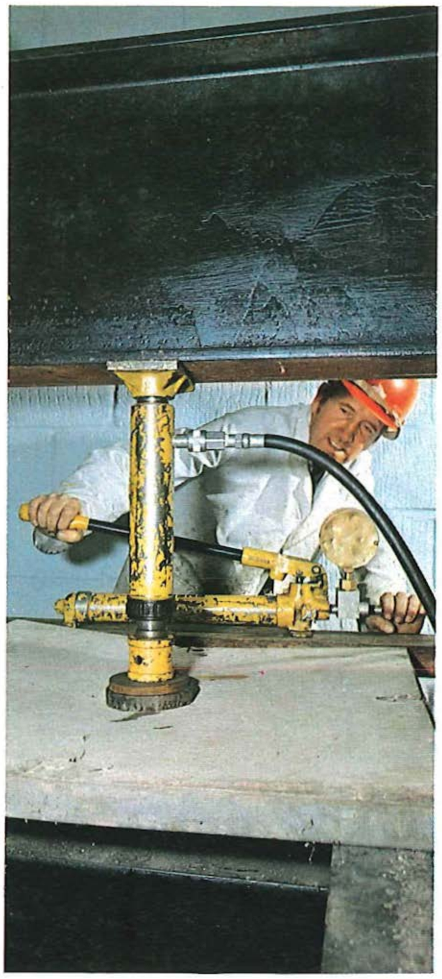
Among the forest of telephone poles at the Post Office's Smallford Test Centre, a technician prepares to check the wire on a galvanised steel pole undergoing trials.

Known as the "Ditchwitch", this multi-purpose trench digger, moleplough and earth scooper undergoes evaluation trials at Smallford. Staff at the centre are proud that they can simulate most types of working situation.

Gas testing is an important feature of current work at Smallford. Here a technician makes a preliminary test at a manhole in one of the fields.



In the new workshop and laboratory building at Smallford, a concrete manhole cover is put under pressure to test its breaking point.



of natural gas leaking into underground cable ducts and tunnels. The situation is made worse by the increasing use of natural gas which is not only pumped into the mains at higher pressure than town gas but which is also much drier. It thus attracts moisture from its surroundings and permeates into the soil, sometimes finding its way into Post Office plant or buildings.

It is for gas testing purposes that two telephone kiosks stand somewhat incongruously in the middle of one of the Smallford fields. Recently two girls were hurt when standing in a kiosk one of them dropped a lighted cigarette. Their long skirts had acted as an umbrella which trapped gas leaking into the kiosk and the result was a small explosion.

Since this accident work has been continuing on methods for sealing leaks including the use of polyurethane resin packs which have been tested at Smallford. These packs contain a special resin and a foaming agent which are squirted together into the mouth of a duct. The mixture then hardens out and forms a gas proof seal.

As well as being concerned about safety and efficiency underground the Post Office is equally concerned about staff and the equipment they use on overhead work. One of the most striking features about Smallford, in fact, is the forest of telephone poles spread round the site. Together with their wiring and aerial cables, most of these poles are constantly being used in a variety of trials.

Although many of the poles are of the traditional wooden variety, more and more tests have been done in recent years with hollow poles made from galvanised steel. The view is that they could well become a realistic alternative to the increasingly expensive wooden type of pole.

As well as being tested to see how they fare in the vagaries of the English climate the steel poles are also being used to study possible new methods of holding wires and fittings. Ideally, of course, the safest type of pole is one that doesn't need to be climbed and efforts are currently being made to design a pole which is capable of having its wiring lowered for installation and repair at ground level.

All the wires and aerial cables linking the poles terminate on a main frame inside the overhead plant laboratory where accelerated life testing is another of the main tests carried out. Also in this laboratory is a special vibrating machine which tests the strength and ▶

durability of overhead cables and brackets.

The fields of Smallford have also been the testing ground for pole and cable erection units and the group responsible for this work has used the site extensively to devise safe working methods for installing, renewing and recovering poles and wires.

Other frequent users of the many Smallford facilities are the groups responsible for the design and development of ducts, buried cable and moleploughing techniques. Many different types of cable and ducting are offered by manufacturers and Smallford is an ideal site for testing their suitability for Post Office working. Various types of moleplough and other associated equipment have also been evaluated in the field.

Recently tests have been undertaken with new steel pipes which will eventually contain waveguides – a technology now being developed at the Post Office Research Centre, Martlesham. The problem is to install them in the ground without materially reducing the accuracy of curvature as when manufactured.

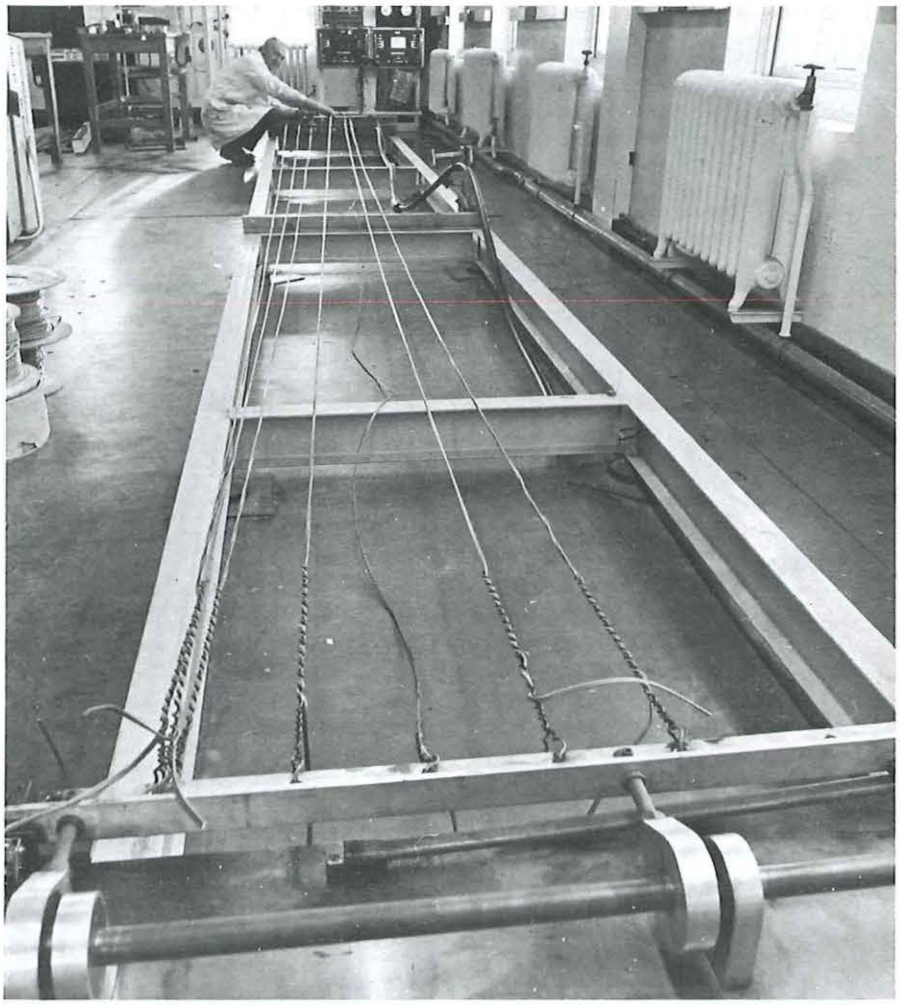
Although Smallford is owned by the Post Office its use is not restricted entirely to Telecommunications Headquarters. Outside firms, including Standard Telephone and Cables and the Building Research Council, have been willing to pay to take advantage of the site's facilities for cable testing and acoustic experiments.

In addition to these activities, over in a corner near the entrance to the site is an area that has been taken over by the Ministry of Posts and Telecommunications for testing all new automotive products to ensure that they do not cause undue radio interference. Among recent equipment to arrive for this purpose was a batch of exotic looking foreign cars.

Smallford is permanently staffed by one Technical Officer and two other staff and the claim is that with a little warning almost any localised condition can be simulated on the site. One thing is certain: without Smallford the work of Telecommunications Headquarter's Operational Programming Department, which is now responsible for the site, would be considerably restricted.

Pumps under test draw water up to the top of this specially erected tower. Performance is measured on a meter panel linked to the pumps.

A vibrating, accelerated life testing machine is used for tests on overhead telephone lines to see how they withstand vigorous wear and tear.



Mr I. J. Jenkins is an Executive Engineer in the Operational Programming Department at Telecommunications Headquarters with responsibility for site control at the Smallford Test Centre.

PO Telecommunications Journal, Autumn 1975

Technician appraisement takes a new form

PM Newey

After pay, promotion is probably the most popular topic among Post Office staff. And a vital factor in promotion is the appraisement procedure in which a supervising officer assesses the performance and potential of his staff. A new procedure using an improved appraisement form will be introduced next year for the Post Office's 100,000 engineering technicians.

EVERY working day a vast army of Post Office engineering technicians report for duties which range from installing cables and telephones to maintaining vital equipment in exchanges, repeater stations and sorting offices. The grades involved are Technician IIA and B, Technician 1, Senior Technician 1 and Technical Officer and collectively they are a most valuable resource of the Post Office both by virtue of their skill and experience and the training they have undergone at Post Office training schools or technical colleges.

It is vital, therefore, that the right man is put in the right job and given opportunities for career development. It is the technician's own supervising officer who, in the main, must be responsible for the effectiveness and efficiency of his staff.

The present appraisement procedure results from the recommendations of a joint committee that was appointed by the Post Office Engineering Factories and Supplies Departmental Whitley Committee which reported in 1955. It is generally acknowledged that the Post Office is to the fore in the field of appraisal and promotion and outside the Post Office and Civil Service it is rare to find appraisement systems for staff below management level.

But 20 years is a long time in personnel management, and systems must keep pace with attitudes and aspirations. That is why, following a major review of the current appraisement procedure by a joint committee with membership from management, the Council of Post Office Unions, the Post Office Engineering Union and the Society of Post Office Executives, a new system will be introduced on 1 January 1976.

At present the appraisement form is based on the personal characteristics of a Technician or Technical Officer but obviously attention to these sort of personality traits to the exclusion of others is not the best approach to getting the job done efficiently. Further, over the last 20 years it has become generally accepted as desirable – even essential – that staff are kept aware of their progress. To achieve this there is a need for regular counselling interviews for Technicians and Technical Officers, and while the personality factors may need discussing if they are to be improved they are not the ideal basis from which to start the discussion.

There are also other aspects of the existing appraisement form which are not satisfactory if counselling interviews are to be effective. Although many managers can discuss strengths and weaknesses openly and frankly with their staff, some find it difficult, and the existing form with its need to mark staff on a five-point scale from "poor" to "outstanding" holds an obvious invitation to overcome the problem by marking in the middle category. This means in effect that supervising officers can abdicate from a decision on, for example, whether a Technician has the potential for promotion, leaving it entirely to the promotion board.

There is also the need to consider the number of staff a supervising officer might have under his control. For instance, under the present system, an Executive Engineer might be involved in the appraisement of 300 Technical Officers and Technicians although, because appraisement of engineering grades is only every two years, he does not appraise them all every 12 months.

It is to overcome these disadvantages that the new system has been developed. It has been clearly recognised that there is the need to keep staff fully in the picture about their own progress, and that the process of appraising and counselling should be undertaken by the immediate supervising officer who has first hand knowledge of the individual concerned and his work. Several significant changes have also been made to the appraisement form, including adoption of a four-point marking scheme.

The new form – which replaces three separate forms – covers every one of the Technical Officer and Technician grades and will be completed every two years as now. It takes in both assessment of performance of present duties and potential for promotion. The questions relate more directly to the work performed and require assessment of the knowledge of the job, the quality and quantity of the work produced, ability to organise work and management of staff.

The four-point marking scale indicating whether performance is outstanding, satisfactory, not quite satisfactory or unsatisfactory has been used throughout: the overall assessment of suitability for promotion is either shown as highly recommended, recommended, shows potential but needs further development or shows no potential at present. The latter questions are answered only for staff whose present performance is at least satisfactory.

Most of the form will be completed by the reporting officer, the immediate first line supervisor, who will either be an Inspector or an Assistant Executive Engineer. Additional comments will be made by a countersigning officer one grade above.

The countersigning officer has the facility to amend markings if he does not agree with them. The Executive Engineer will countersign the appraisements of Technical Officers and the Technician grades who do not work to an Inspector. As the majority of the latter do, in fact, work to an Inspector, his load is considerably lightened. The result is that nobody above the rank of Executive Engineer will now be directly involved in the appraisement ▶

process apart from in a general capacity of advising the appraising officers on standards.

One of the most important features of the new procedure is the introduction of regular counselling. In past years, appraising officers have been encouraged to talk to their staff about their performance but in future every Technician and Technical Officer will be given a counselling interview unless exceptionally there is a good reason for him not to be given one.

This interview will take place before the reporting officer has finalised his parts of the report so that it can be amended in the light of discussion if necessary. The reporting officer will tell the Technician or Technical Officer the gist of his appraisement, outlining his performance and also telling him if necessary where improvements could be made. He will tell him also whether or not he will be appraised as recommended for promotion and discuss with him his future development. But this will not be a one way exercise: it is the opportunity for the man himself to express his own views on how he feels he has performed his job and to put forward any factors he feels should be taken into account on his report together with his own ideas for his future development within the Post Office.

At the end of the counselling interview the reporting officer will make a brief summary of the views exchanged on the appraisement form and the employee will sign it.

The Technician or Technical Officer can influence the appraisement procedure in the matter of promotion. He has an early opportunity to give some thought to his future career because a note will be published at the time appraisements are due. Any staff who do not wish to be considered for promotion may register this fact with their supervising officer. They will then be assessed on performance of present duties only and given a counselling interview.

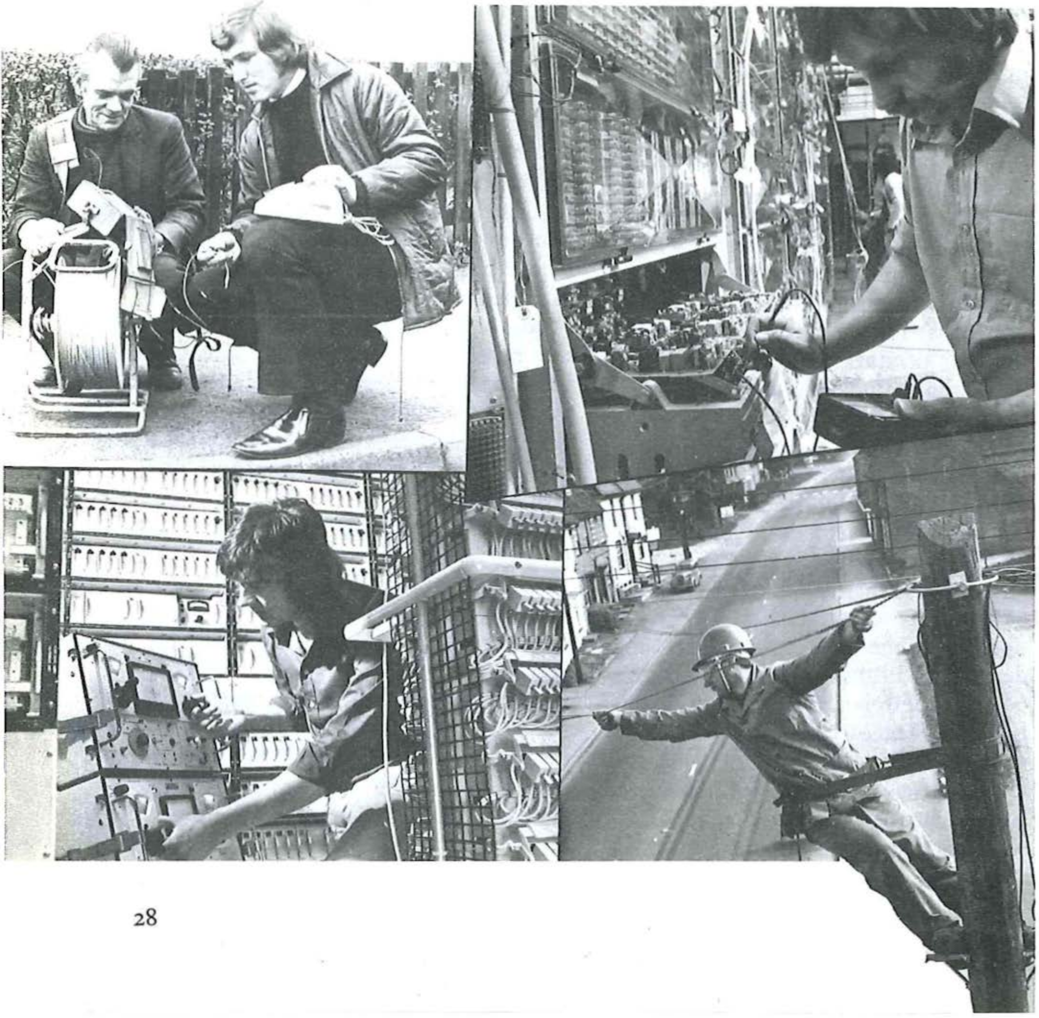
The last stage before implementing the new procedure is training of the officers. There are about 15,000 appraising officers throughout the country who needed to be introduced to the new system and this was undertaken by the Management Training Division of the Telecommunications Personnel Department. It would have been impossible to bring so many to a central point for training within the timescale available – the new procedure was only ratified by the unions in June this year – so a "ripple effect" training programme was devised by a team at the Telecommunications Management College, Bexhill, headed by Mr D. G. Rossiter.

One or two representatives at Executive Engineer level, from each Area and Region in the country, and others from THQ and PHQ, attended a two-day course at the college, where they were given an outline of the new procedure and advice on training. They then returned to their parent units where they were responsible for training other staff by holding one-day training sessions within the unit. This meant that all engineering supervising officers had at least one day's training in the new procedure before having to put it into practice.

The new procedure will lower the level of reporting and countersigning officers and thus the numbers of appraisements a supervisor has to deal with at any one time, so that adequate attention can be given to individual appraisements. It will make appraisements more objective and will involve the staff more fully. The outcome should be better performance by the staff, higher morale and more reliable information for promotions boards. But appraisement and counselling are far from easy and everything will depend on the way supervisors tackle what to some will be unfamiliar tasks. It is on their attitude and skill that the success of the new system will depend.

An extension to this principle of involving the appraisee is open reporting which is the subject of an experiment beginning this year for Technician II grades in Sheffield Telephone Area. During this trial Technicians II will be counselled but will also be able to see the entire appraisement. The Technician will also be free to add in the form of a note his own comments on the content of the appraisement or what he was told at the counselling interview and this will be kept with the appraisement.

This experiment will be confidentially evaluated by staff from Psychological Services Division at Central Headquarters. It will finish after two appraisements have been completed and the trial will then be reviewed. As Technician II appraisements are biennial, however, it will be 1978/79 before information from the evaluation process will be available. Only then can decisions on the future of open reporting be considered.



Post Office engineering technicians at work on some of the many tasks they carry out in helping to provide and maintain telecommunications services.

Mr P. M. Newey is head of a section in Telecommunications Personnel Department responsible for the recruitment and promotion policy of engineering and allied grades.

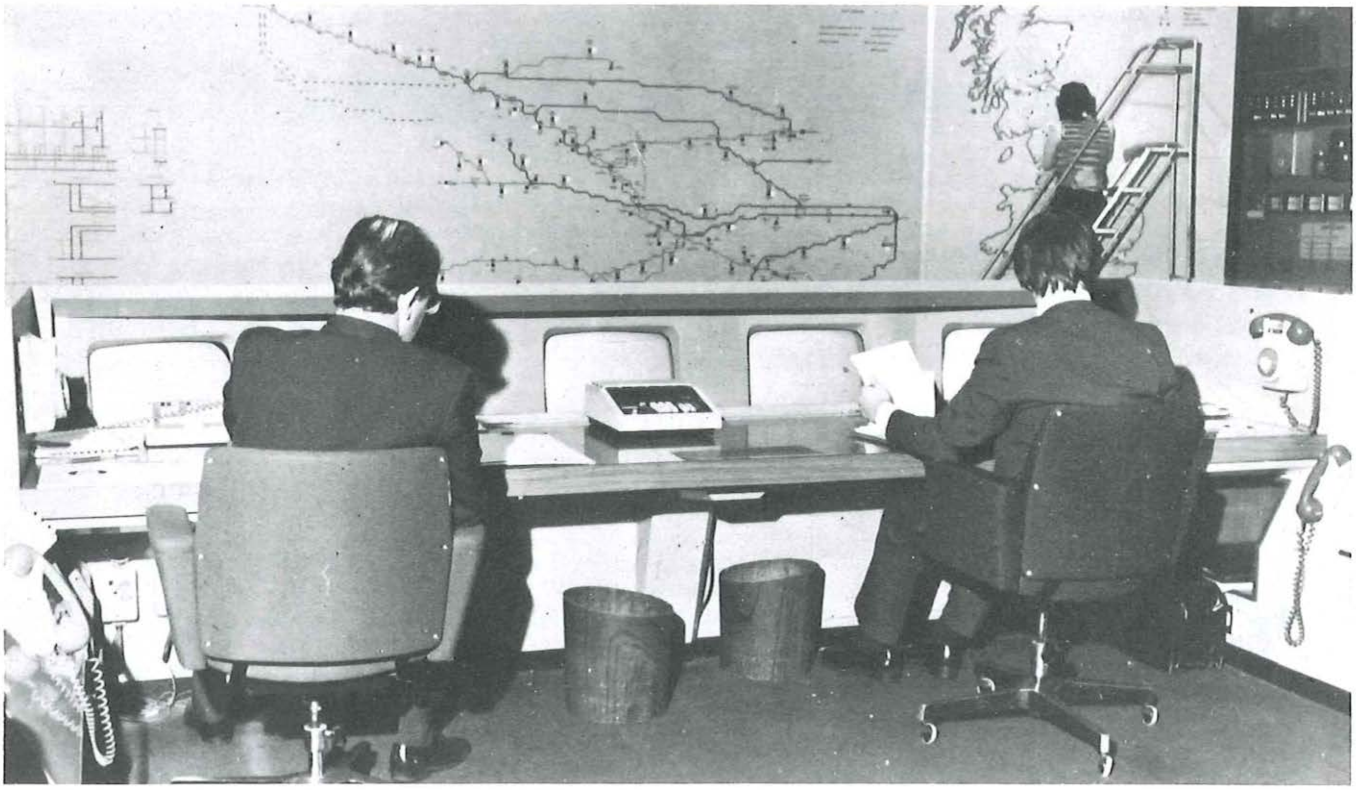
PO Telecommunications Journal, Autumn 1975

The year in figures

A review of Post Office Telecommunications progress in the year 1974–75

	1974–75 Result	1974–75 % growth over 73–74	1973–74 Result	1973–74 % growth over 72–73	1972–73 Result	1972–73 % growth over 71–72
TELEPHONE SERVICE						
Size of system						
Total working connections	12,698,476	6·7	11,903,627	8·7	10,947,102	9·2
Total working stations	20,389,129	6·5	19,136,847	8·7	17,601,650	8·9
Call office connections	76,787	0·2	76,600	0·4	76,281	0·5
Shared service connections	2,104,586	0·8	2,087,950	2·9	2,028,904	7·7
% of connections on auto exchanges	99·9	0·3	99·6	0·4	99·2	0·2
Growth of system						
Net demand for connections	1,302,714	−3·9	1,355,540	−5·3	1,431,029	−0·8
New supply of connections	1,348,744	−7·4	1,456,524	2·5	1,420,911	9·5
Waiting list	102,415	−6·6	109,610	−45·2	200,066	−8·2
Penetration						
Stations per 1,000 population	363	6·1	342	8·9	314	8·6
Traffic (in millions)						
Inland effective trunk calls	2,313	8·2	2,138	10·0	1,944	14·4
Inland effective local calls	13,523	6·4	12,707	9·6	11,595	12·2
Continental: outward calls	27·23	13·9	*23·90	*13·4	21·08	14·1
Inter-continental: outward calls	7·58	45·5	5·21	22·2	4·28	24·0
Telephone usage						
Calls per connection	1,290	−0·9	1,302	0·7	1,293	3·2
Calls per head of population	283	6·8	265	9·1	243	11·5
Exchanges						
Local manual	13	−56·7	30	−37·5	48	−30·4
Local automatic	6,228	0·2	6,215	1·2	6,140	0·7
Local electronic	591	27·9	462	23·9	373	91·2
Local crossbar	249	18·0	211	42·6	148	92·2
Automanual and trunk	373	−0·5	375	2·7	365	−1·3
TELEX SERVICE						
Total working lines	54,493	10·7	49,220	13·7	43,292	14·6
Metered units	386,153,000	6·2	363,481,000	−1·4	368,703,000	4·3
External originating traffic	42,637,000	12·1	38,028,000	15·6	32,893,000	14·1
TELEGRAPH SERVICE						
Inland telegrams	6,200,000	−14·5	7,252,000	−0·7	7,303,000	6·6
External telegrams: UK originating	7,062,000	−5·3	7,461,000	5·8	7,049,000	0·1
UK terminating	6,622,000	−5·4	6,997,000	3·3	6,777,000	−2·0
UK transit	5,323,000	−2·1	5,438,000	1·2	5,501,000	−4·4
TELECOMMUNICATIONS STAFF						
(Part timers count as half)						
Total	247,205	2·1	242,086	0·8	240,105	2·6
Minor engineers	109,308	1·3	107,892	2·2	105,531	4·9
Telephone operating force	49,982	1·7	49,155	−2·88	50,608	0·1
Clerical staff	30,678	5·4	29,120	1·8	28,595	0·5
Other staff	57,237	2·4	55,919	1·0	55,371	1·8

* Revised figure



Staff in the control room of the British Gas National Control Centre in Leicestershire – nerve centre of the whole grid operation.

Two-tier operation for BRITISH GAS

JB Marsden

LIKE the Post Office, the British Gas Corporation has a responsibility for supplying a service to customers in every corner of the country. In the last 15 years new technologies and the discovery of large fields of methane gas under the North Sea have totally transformed the industry and resulted in the setting up of a pipeline network to cope with increasing demand. A new national control centre has been specially built in Leicestershire and is at the heart of the huge operation required to get gas safely to its millions of consumers throughout the country.

Obviously on such a large project good communications are essential and the Post Office has been closely involved in helping to create facilities which provide a variety of speech and data transmission services. The result is a new two-tier communications network between the national control centre and terminals and outstations throughout the pipeline.

The first-tier network links the national control centre to sea terminals at Easington, Bacton and Canvey Island and 12 regional control centres, while the second-tier network connects the regional control centres to pipeline outstations under their control. The two networks are interfaced by means of data reduction computers which gather information from each of the outstations and rearrange it in a form which is suitable for onward transmission to the national control centre.

The first-tier network, providing a variety of speech and data transmission services, is designed to provide reliability, mainly by means of a triangular configuration which as well as providing a direct route between the national control centre and a regional control centre, also allows an alternative routing between these two points via another regional control centre.

Situations at pipeline outstations such as pressure readings are monitored by a Ferranti Argus 500 computer at the national control centre. This interfaces with the first-tier network via a front-end processor – a second computer – which restructures incoming data from the regional control centres and the sea terminals into a form suitable for input to the Argus 500 computer.

As well as storing all operational programs for the day-to-day control of the pipelines, the Argus computer store also carries a "rolling" record of everything that has happened on the pipeline during the previous 24 hours including alarm conditions and all control actions taken within that period. At hourly intervals this information is transcribed on to magnetic tape as a permanent record.

Control instructions from the national control centre are only issued under the direction of grid control officers. To help them with their decisions five visual display units give access to simplified diagrams of both the pipeline network and individual outstations, graphic displays of pressure variations and of course immediate display of alarm conditions at any point. It is possible also for the grid control officers to look back over the last 24 hours (or further by reference to the permanent pipeline record) and study the variations in measured values alongside the control actions taken during that time.

A Univac 1106 scientific computer at the national control centre may also be used for simulating pipeline failures and predicting the effect of possible changes to the pipeline. This enables grid control officers and designers to assess the performance of the grid under various conditions and develop programmes of action to deal effectively with the resulting situation. The Univac 1106 can, if desired, be run on on-line data collected by the Argus 500 computer.

As a failure of the Argus 500 computer would effectively isolate the grid control officers at the national control centre from all information regarding pipeline performance – making it necessary for all regions to assume local control – this vital element and its associated front end processor are duplicated.

The first-tier communications network is a configuration of nine 48 kHz private wideband links, each of which carries 12 speech-band circuits, and 89 speech-band private circuits employing routing duplication, reserve circuits and triangulation in order to achieve the desired reliability. The Post Office circuits are rented "wires-only" with modems, special terminal equipments and associated facilities being provided and maintained by the British Gas Corporation.

Communication is maintained between the national control centre and each sea terminal via two separated routes, one direct and one via British Gas Headquarters, London, to ensure extra reliability.

Between the national control centre and the 12 regional control centres five communications facilities are catered for. There is telemetry/data for input to the Argus computer, and control telephony to allow grid control officers easy contact with their colleagues at the regional control centres. There are also teleprinter facilities, mobile radio which links the grid control officer to regional radio transmitters to establish contact with mobile staff and facilities to allow a telephone conference to be set up between Headquarters and regions.

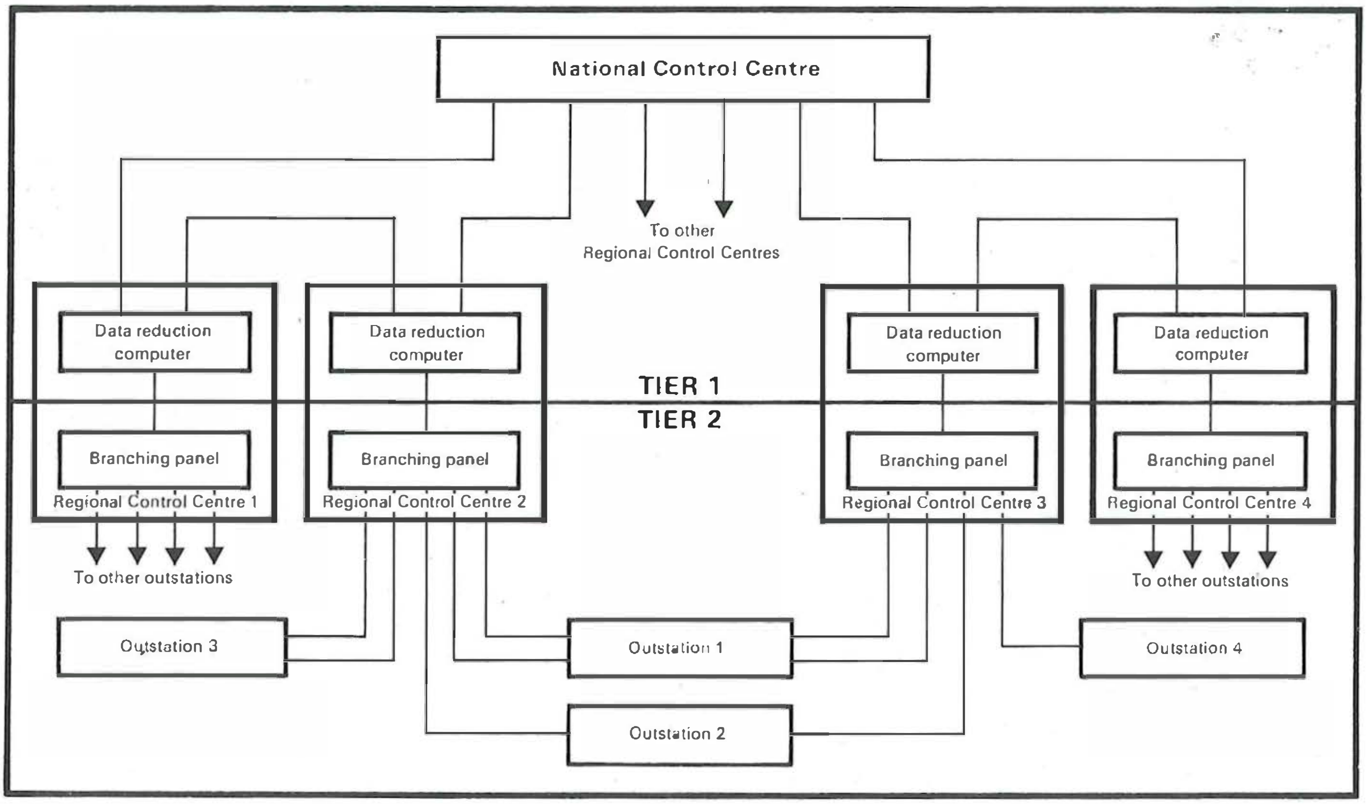
The reliability of these facilities is achieved by either duplication, alternative routing or triangulation. The shorter routes each consist of five speech-band circuits with five additional circuits provided over a physically separated route as a standby (although they may also be used for low priority traffic). The two regions nearest to the national control centre are connected directly to it in this way and the four closest to London are connected to the Headquarters there. The circuits to the latter are extended to the national control centre using speech-band channels of one of the three 48 kHz wideband links.

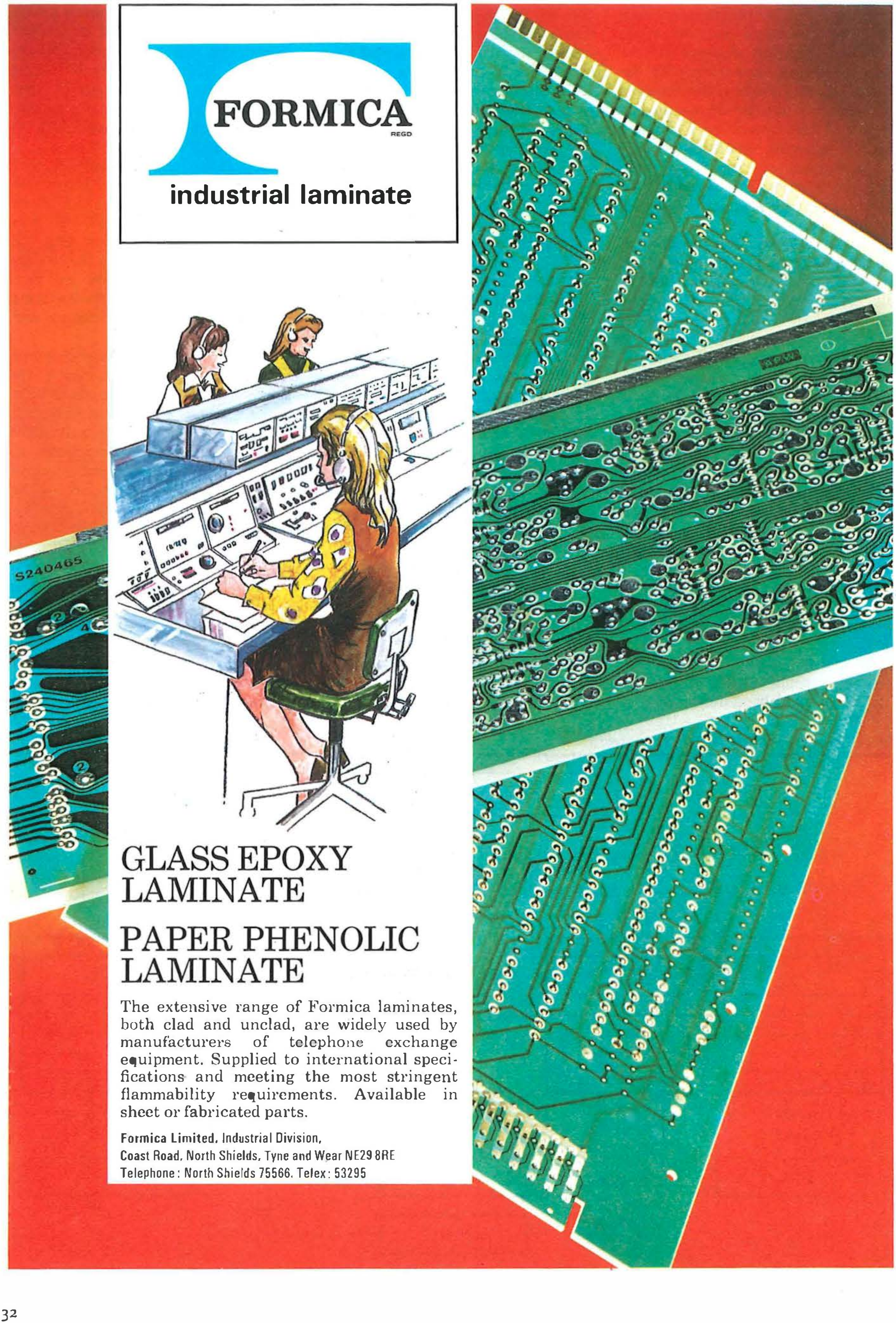
The regional control centres further from the national control centre are arranged in pairs by British Gas. From each, a 48 kHz wideband link provides direct communication with the national control centre and five speech-band circuits link each pair and provides a standby route for the two most important facilities – telemetry and control telephony.

These facilities are not only connected to the national control centre via channels of the direct wideband links but also via two of the speech-band circuits to the "paired" regional control centre, where they are connected to channels of that regional control centre's direct wideband link to the national control centre. It is possible, therefore, if either direct route fails, to retain telephony and telemetry communication with both regional control centres.

Each of the dozen regional control centres houses a data reduction computer. This is programmed to poll each outstation in turn via the second-tier communications network and to process and store the data received, which ▶

Principles of the two-tier British Gas network.

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includes pressure readings, states of values and alarm conditions, until the regional centre's data reduction computer is itself polled by the Argus 500 computer at the national control centre. Facilities are also provided to display the incoming data and station diagrams on an associated visual display unit.

The second-tier communications network is, in fact, a set of 12 partially interconnected networks of Post Office speechband private circuits, radiating from each regional control centre, where branching panels combine the circuits for input to its data reduction computer. Extensive routing separation and duplication is built into the second-tier network design.

To protect the concentration of circuits into the regional control centre the local serving cables accessing the main Post Office system are duplicated and routed in physically separated duct tracks. Changeover keys at the regional control centre and its serving exchange allow circuits to be switched between the two cables. In the normal situation the circuits are distributed more or less equally between the two cables so that the effects of a cable failure would be limited; under fault conditions either cable has adequate capacity for all circuits.

For operational reasons some outstations are connected to only one regional control centre. The links are either by one circuit used for data and telemetry purposes or by two separated circuits, one used for data and telementry the other for speech transmission. Other outstations are connected by separated outlets to two regional control centres. Data/telemetry and speech circuits, diversely routed and capable of being used for either purpose, are provided to each regional control centre.

The connections to the second regional control centre substantially improve the reliability of communications between the outstation and the national control centre since the two regional control centres are served by the first-tier network in such a way as to make the simultaneous loss of communication into the national control centre highly unlikely.

A Post Office network control at Leicester is responsible for the maintenance of the entire first-tier network and interfaces directly with the British Gas national control centre for fault reporting and other purposes such as planned interruptions to service. It has general control over the network within the Post Office and co-operates with the various Post Office maintenance staffs up and down the country.

In the second-tier network each of the separate sections related to the 12 regional control centres have their own individual Post Office network controls which interface directly with the British Gas national control centre.

From the British Gas viewpoint operational control of both network tiers is based at its national control centre. Post Office procedures regarding the networks and their maintenance are mutually agreed with the British Gas Corporation. There has been, and continues to be close co-operation and consultation between British Gas and the Post Office in the planning and operation of the telecommunications requirements for these networks.

Mr J. B. Marsden is an Executive Engineer in Service Department at Telecommunications Headquarters. His responsibilities include customer service aspects of private circuit services for certain nationalised industries.

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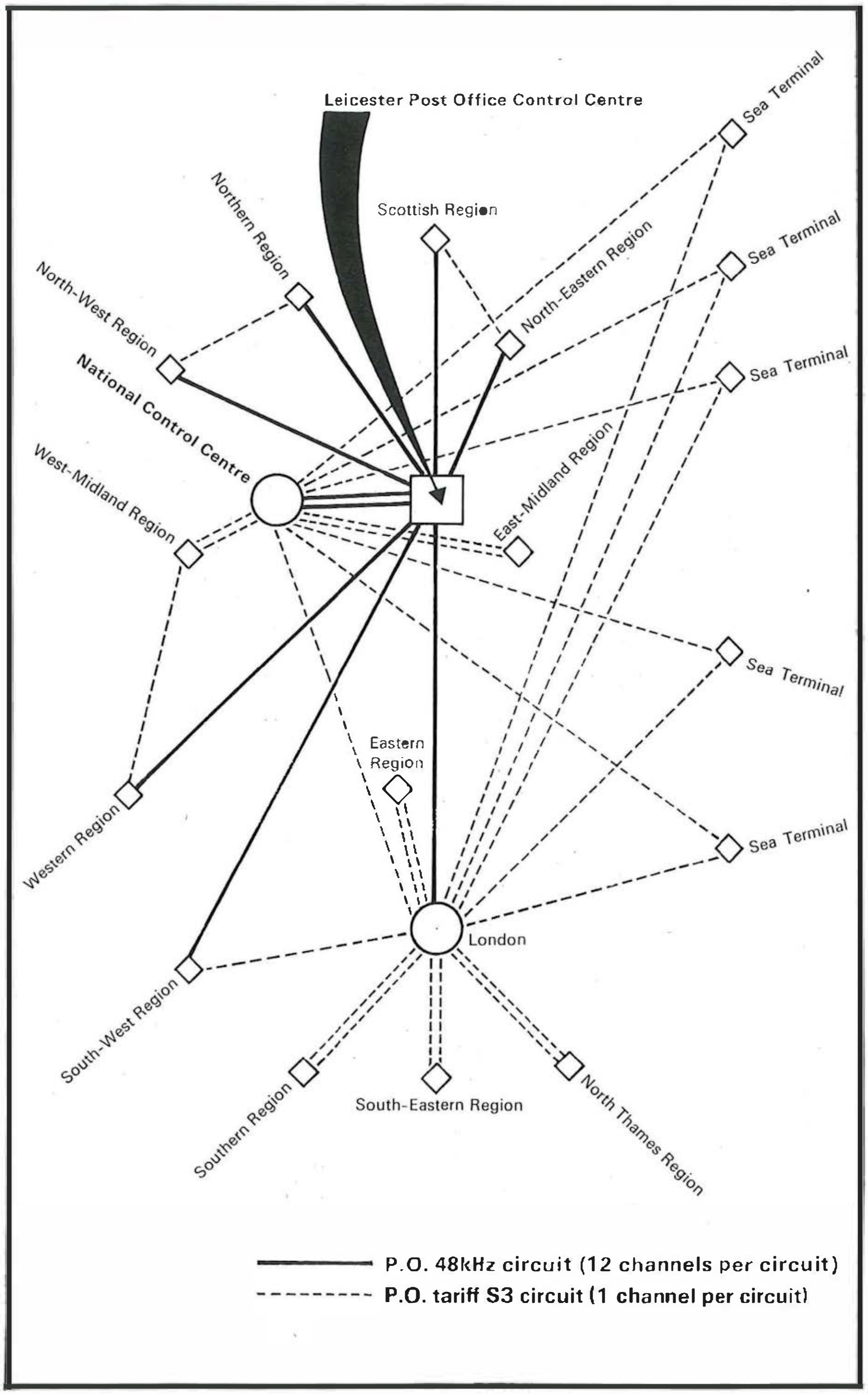
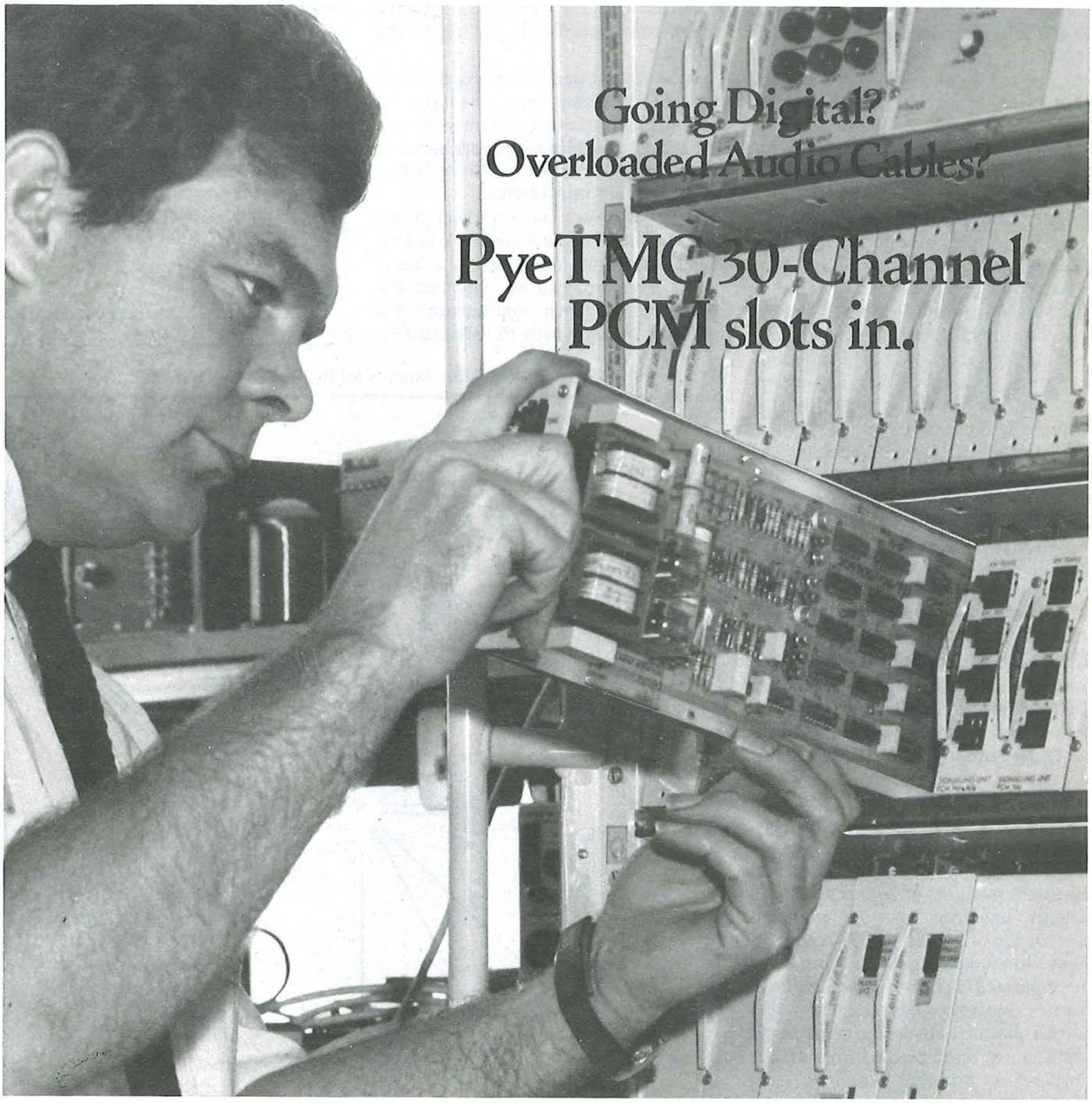
Schematic diagram of Post Office circuits for the British Gas network.






Typical line regenerator casing

Pye TMC 30-Channel PCM systems will increase the capacity of existing cables and will also interwork directly with most types of exchange.

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MISCELLANY

Sister for Monarch

The second of the two new British cableships which will work from the Post Office Central Marine Depot at Southampton was launched from Dundee in October by Lady Fennessy, wife of Sir Edward Fennessy, Deputy Chairman of the Post Office and Managing Director, Telecommunications.

Lady Fennessy named the new ship *Iris* and it is identical to its sister vessel *Monarch* which was launched in January (Telecommunications Journal, Spring 1975).

Working from Southampton the ships will be within easy sailing distance of the cable systems spanning the Atlantic and landing in south-west England and the cables crossing the English channel and North Sea to the continent.

CS *Monarch* was due to be handed over by Robb Caledon to the Post Office in October and start service a month later. CS *Iris* is scheduled to begin work next year.

Keyphones on the way

Push-button telephones (Keyphones) will become generally available to customers in London next spring, and in other parts of the country later in 1976. Instead of a dial the new two-tone grey coloured telephone has a keypad of ten numbered buttons, arranged in four rows. The International Telegraph and Telephone Consultative Committee (CCITT) chose this layout as the standard for world-wide use.

Vans go electric

New electric-powered vans are being introduced by the Post Office on a trial basis, and telephone engineers in the Stevenage area will be the first users.

Purpose of the three-year trial is to determine the performance of the vehicles in everyday conditions.

Developed by Lucas Industries, the vans have a 0-30 miles per hour acceleration of about 10 seconds and top speed in excess of 50 miles per hour. There is no gearbox or clutch – two push-buttons on the fascia control forward or reverse movement.

New satellite launched

The first in a series of six Intelsat IV-A communications satellites has been launched from Cape Canaveral in Florida. When placed in synchronous orbit 22,300 miles over the Atlantic above the Equator, the new satellite will provide telephone, data and television facilities between Europe, North and South America, Africa and the Middle East. Britain will operate to the satellite through the Post Office earth station at Goonhilly Downs, Cornwall.

The Intelsat IV-A has about two thirds more communications capacity than its predecessors, the Intelsat IV, three of which are in service over the Atlantic, two over the Pacific and two over the Indian Ocean. It will have an average assigned use of 6,000 circuits or 20 colour television channels, or various combinations of telecommunications, including telex, facsimile, telegraph and data.

Contracts

EMI – EMISOUND Division – £800,000 to supply new telephone dials. The new dials make use of the latest advances in injection moulding techniques and are interchangeable with previously used designs produced to Post Office standards. They are also of similar appearance.

International Computers – £6 million for three ICL 2970 computers with an option on two more for use on production of about 50 million telephone bills a year for the Telecommunications business. The three new computers will be used to begin the phase-out of the Post Office's 11 LEO 326 computers which have been in use for more than 10 years.

The first of the new computers was installed for trials at the Post Office Data Processing Service's Barbican Centre in late summer. The first operational 2970 is to be installed in the PODPS centre at Edinburgh in June 1976 and the second is scheduled for the Derby centre six months later.

Unilever network opens

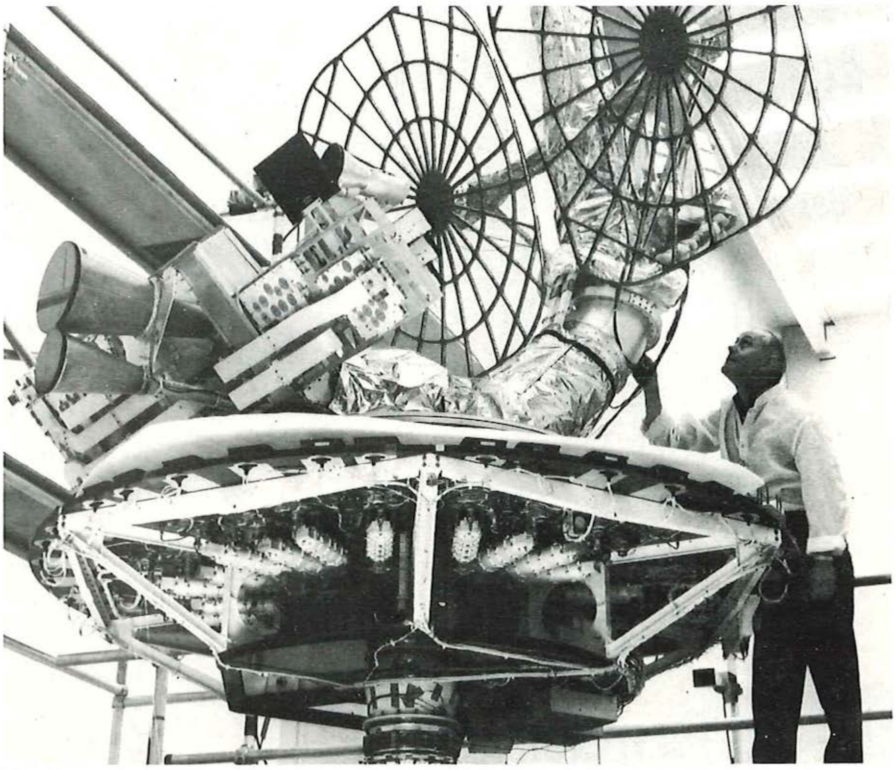
More than 800 telephone circuits have been supplied by the Post Office for a private telecommunications network opened by Unilever Ltd. The nationwide network, the largest of its kind in Britain, links three main crossbar tandem switching centres and 135 private automatic branch exchanges at Unilever sites.

The tandem centres – in London, Leeds and Port Sunlight, Wirral – are linked by wideband systems. Most of the PABXs are connected directly to their tandem centre, while others are connected through an intermediate sub-tandem switching unit.

Competition

A total of £50 in prize money is offered by the Institution of Post Office Electrical Engineers in its 1975/76 essay competition. Entrants are asked to prepare 2,000–5,000 words on engineering activities in the Post Office.

Further details of the competition can be obtained from the Secretary of the Institution, THQ, 2–12 Gresham Street, London EC2V 7AG.



The first of six Intelsat IV-A communications satellites is prepared for launch by engineers in California. (See "New satellite launched".)

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