Post Office telecommunications journal

Spring 1978 Vol. 30 No. 1 Price 18p

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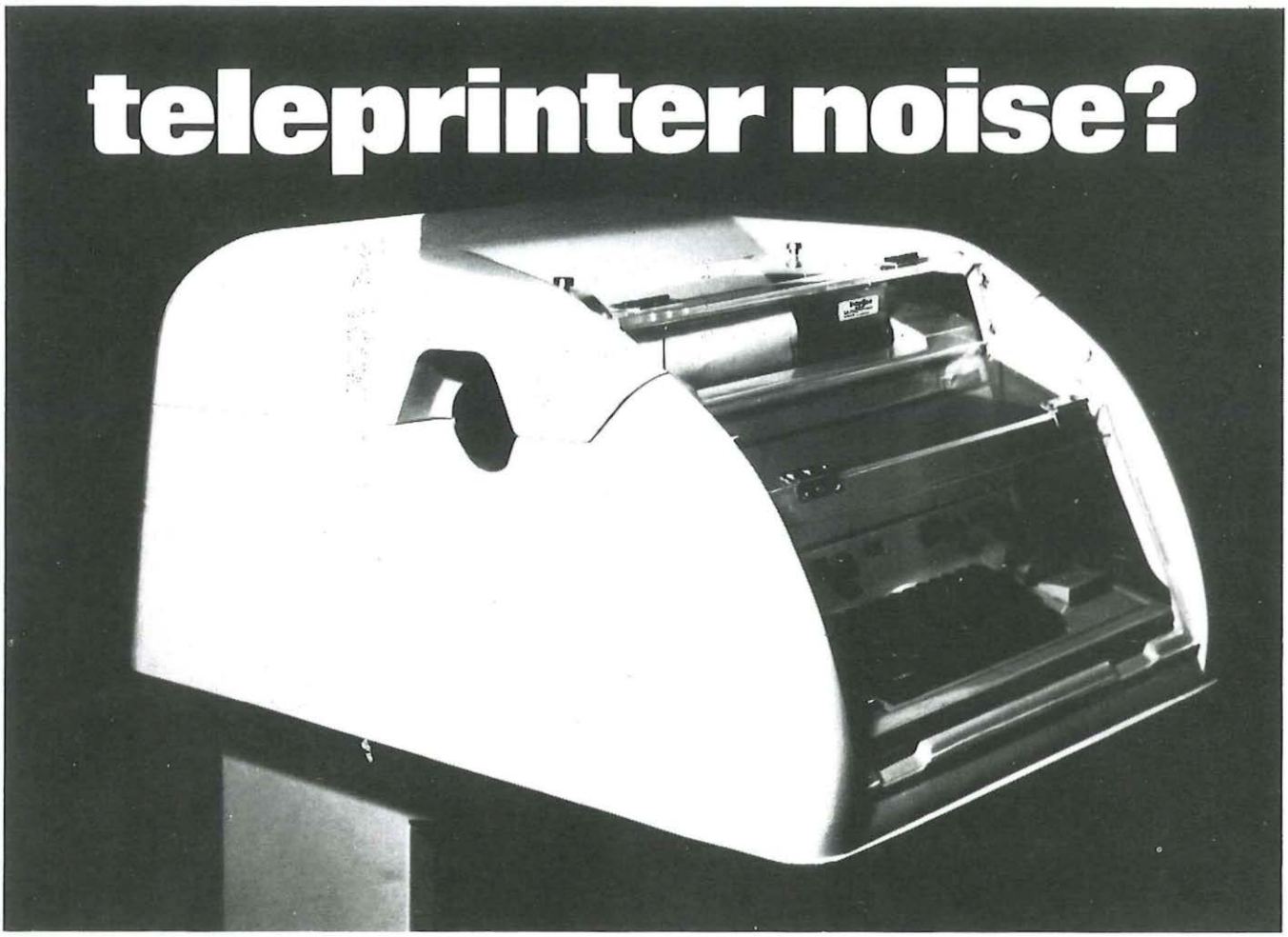

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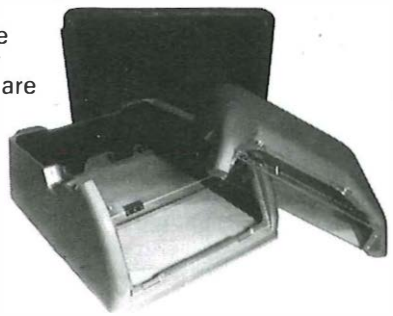

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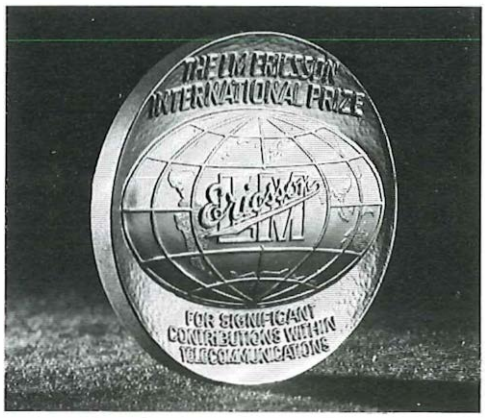

Nomination of candidates
is now invited for the

1979 AWARD

of the

LM ERICSSON INTERNATIONAL PRIZE

for notable contributions to

TELECOMMUNICATIONS RESEARCH AND DEVELOPMENT

The LM Ericsson International Prize of 100,000 Swedish kronor was presented for the first time in May, 1976, in connection with the celebration of the Company's 100th anniversary.

The Prize — which honors the memory of Lars Magnus Ericsson, founder of the Company — is designed to encourage and advance research and development within the field of telecommunications engineering.

The Prize is being awarded every third year in recognition of an outstandingly significant "scientific or technological contribution within telecommunications engineering" during the three-year period preceding the award year. Earlier contributions whose importance becomes established during the three years are also eligible for nomination.

The winner of the Prize is selected by an independent Prize Committee consisting of members appointed by the Royal Swedish Academy of Engineering Sciences, the Board of Directors of the Swedish Telecommunications Administration and representatives of leading Swedish institutes of technology.

Candidates may be nominated by members of the Prize Committee and by organizations or individuals active in the telecommunications field.

Nominations are now being accepted for the 1979 award. All nominations must be in writing and should be accompanied by all relevant supporting material. The closing date for nominations is October 1, 1978.

Only the winner's name will be disclosed. Where the Prize contribution results from the work of two or three people, the Prize may be awarded jointly.

Nomination of candidates, or requests for further information including the complete rules governing the award, should be addressed to: *The LM Ericsson Prize Committee, S-126 25 Stockholm, Sweden.*

Harold A. Rosen, (Hughes Aircraft Company, Los Angeles, USA), winner of the first Ericsson International Prize, receives his award medal from King Carl Gustaf of Sweden at the presentation ceremonies in Stockholm in May, 1976.

Winner's Prize: 100,000 Swedish kronor.

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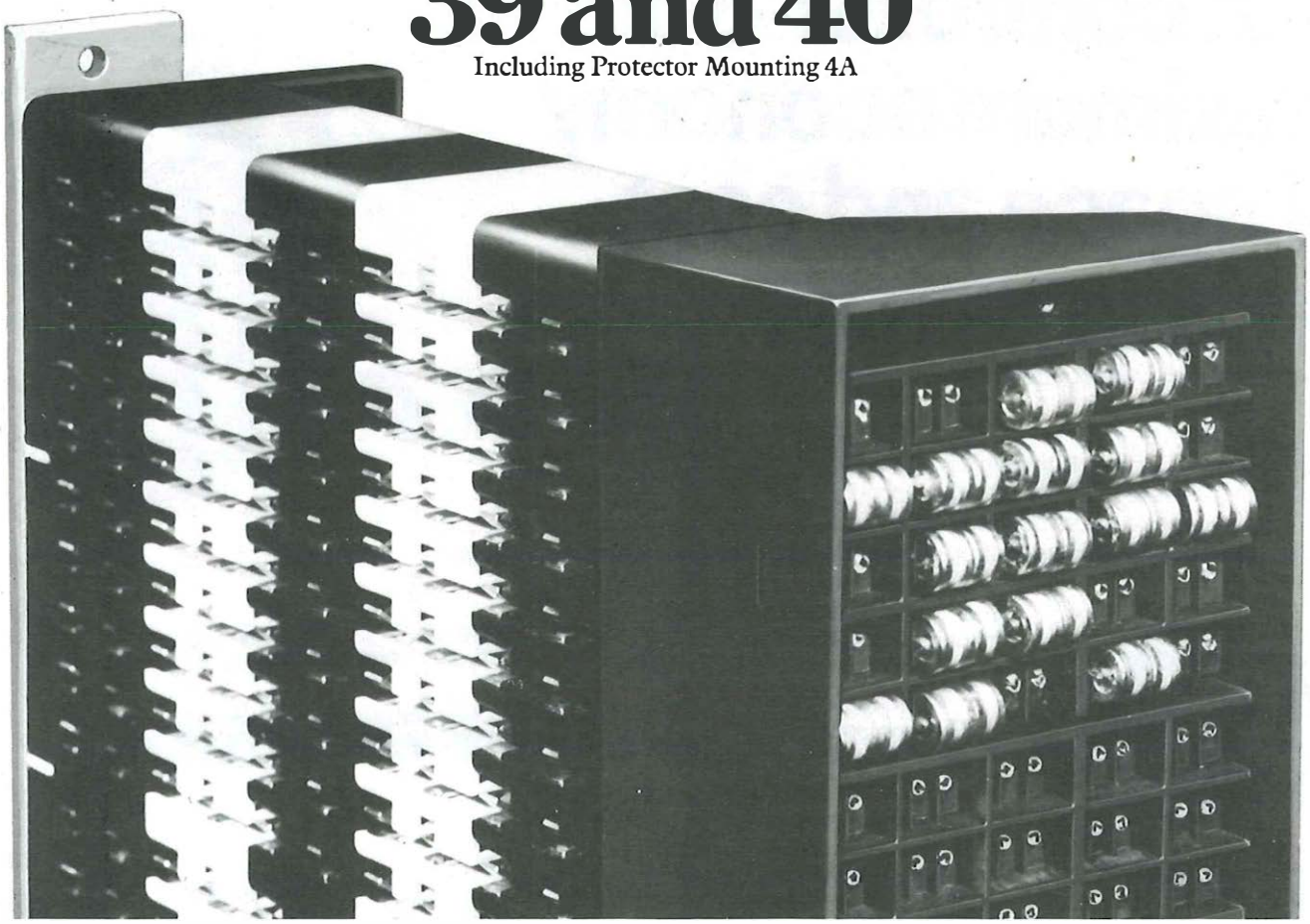

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Prestel- the world's first viewdata service

In less than 12 months' time – a year ahead of schedule – the Post Office will launch Prestel, the world's first public viewdata service. People in Britain will be just a fingertip away from up to 250,000 'pages' of information ranging from stock-market prices and sports results to household hints and travel timetables.

Invented and developed exclusively by the Post Office, viewdata is the revolutionary communications system which enables people to call up information over their telephones and have it displayed in words and diagrams on their television screens.

Commenting on the early start for Prestel, Mr Peter Benton, managing director, Telecommunications, said it reflected the Post Office's confidence in what was "a marvellous new technology". Overwhelming support had been received from the television industry and backing from the information suppliers had so far led to nearly 100 organisations agreeing to provide 'pages' of information.

Mr Benton said the Post Office was determined to ensure that Britain's world lead with viewdata was maintained and extended with a strong eye on export potential. The system had already been exported to Germany and the Post Office was currently looking at ways of marketing in the United States of America.

The countdown to the introduction of Prestel begins this summer with a test service in London, Birmingham and Norwich based on a new computer centre being set up in London. For the public Prestel service, 12 additional computers will be set up to enable the Post Office to offer the facility on a much wider basis. To start with, the system will have a capacity of 250,000 pages of information and to use Prestel at home people will need a telephone and a specially modified television set. For business users, desk top TV sets are being developed.

Prestel's potential is, in fact, limitless and it is a mark of the Post Office's faith in it that it has earmarked £23 million to establish the service and plans to invest up to £100 million by 1985 to bring it to the whole country.

Please help . . .

It is now seven years since the Journal undertook a readership survey and in that time circulation has risen rapidly to 61,000. It is now felt that another survey would be of value and at the back of this issue there is a specially prepared questionnaire. Please complete and return it, and in doing so you will be helping us to provide the sort of Journal you want to read.

Post Office telecommunications journal

Spring 1978 Vol. 30 No. 1

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

Cover: Technical officer Malcolm Hancock compares the time pulses of the Rugby standard frequency transmitters with the synchronising waveform from a TV station in Bedfordshire which is in step with the Caesium atomic standard at the National Physical Laboratory, Teddington.

Private agents go on trial

DC Bowen

UNTIL RECENTLY a Government Agency, known since 1972 as the Property Services Agency (PSA), handled all the negotiations concerned with the buying, selling and leasing of sites and buildings for the Post Office. Now, in a series of trials in which private estate agents and consultants have undertaken the work instead, the results in terms of cost, time and quality are being evaluated, and a decision will be made in due course on future policy of Estates Services in the Post Office which last year had a building programme running to some £100 million.

The trials started in Gloucester Telephone Area in 1974 and others followed a year later in Bristol and Shrewsbury Telephone Areas to provide a more representative sample. A minimum of two to three years was considered necessary for meaningful results to be obtained and, so that direct comparisons could be made with PSA services, "control areas" were set up in Tunbridge Wells, West Midlands and Nottingham Telephone Areas.

In the trials all professional estates services are undertaken by the commercial estate agents and consultant architects while Post Office staff are handling the non-professional matters previously dealt with by the PSA.

In Shrewsbury, whose control area is Nottingham, the initial work load was identified as the acquisition of some 39 sites up to 1981/82. The major difference between the experiment here and that in Gloucester is the much larger territory of Shrewsbury Area which also entails dealing with two PSA regions.

In Gloucester the trial has been conducted predominantly from South Western Region Headquarters while at Shrewsbury the experiment is being conducted in the main from the Area which is dealing with all standard type telephone exchange buildings. Wales and the Marches Board Headquarters continue to deal with sites work related to non-standard telephone exchanges and all non-operational buildings.

In practice the Area has also handled site searches for non-standard telephone exchanges as well as telecommunications engineering centre (TEC) and telephone area office (TAO) sites, liaising with Board headquarters in these cases.

The trial has, of course, meant new work for Area staff and involves close liaison between the newly created duty and the existing Area Sites Liaison Officer (ASLO). This covers site requirements, preliminary site searches, instructions to the agents, securing appropriate authority for site purchase and handling legal documentation with the Post Office Solicitors. There is also the disposal of redundant property and maintenance of individual case histories as well as monitoring and costing of the scheme.

Selection and commissioning of the commercial estate agent and the consultant architect was undertaken by Telecommunications Headquarters in consultation with the Region and Area. In selecting the agent it was essential there was existing adequate coverage of the 4400 square miles that comprise Shrewsbury Telephone Area. There had also to be no potential conflict of interest, and a willingness to provide the type of service the Post Office required at what was a reasonable cost.

Assessing a site at Hanwood – the first acquired under the experiment – are Post Office estates officer Laurence Ellis, estate agent Rod Haigh and sites liaison officer John Davies.

Consultant architect Keith Cluderay (seated) discusses with Laurence Ellis and John Davies the problems of siting a building at a particular place.

The estate agent is paid an annual retaining fee and scale fees for purchases and sales as recommended by the Royal Institute of Chartered Surveyors. Fees are claimed by the agent on completion of each individual transaction. The consultant architect is paid for site surveys, on a time basis in accordance with conditions laid down by the Royal British Institute of Architects.

When the trial began site acquisitions not progressed beyond "site search" or "site-in-view" stage were handed back by PSA to the Area and these formed the initial load of work for the experiment.

When the need for a new telecommunications building is established and authority given to proceed, the ASLO initiates the site search. He provides the Estates Officer with information for the agents about the type of building and size of site required.

Maps prepared by External Planning Division show the "practical centre" for a new building and extent of the line of search. The "practical centre" is the point where the telephone exchange should be situated for the most economical layout of local and junction line plant. The Estates Officer then instructs the agent to start looking for a suitable site.

Experience over the past two years has shown that it is best for the ASLO and/or Estates Officer to conduct an initial search and indicate on the search maps any likely site or sites seen. Additional information about possible sites or areas excluded for technical reasons are also given at this stage, and there is always close liaison between the Post Office and agent to ensure negotiations for unsuitable or costly sites are not protracted.

The next step is the agent reporting back with a list of possible sites together with owners' names and addresses, their reactions to possible sale and anticipated prices together with any other relevant information such as the probability of getting planning permission.

Sites offered are examined by the ASLO for engineering suitability and, for example, cabling costs. A decision is then reached on which site is best suited to the Post Office's needs. Having reached a decision the agent is instructed to open negotiations.

If purchase appears possible the consultant architect is instructed to undertake a site suitability survey including site characteristics, ground investigation, available services and application to the local authority for outline planning permission.

If the site seems to meet all Post Office needs the estate agent is given the go ahead for detailed negotiations with the owner. He submits his report on the property, the terms provisionally agreed, recommendations for purchase and his valuation. As soon as the agent's recommendation has been accepted and financial approval given, the Estates Officer instructs him to send a letter of acceptance.

When a case is completed it is costed and, including the agents' fees, the total cost to the Post Office can be expressed as a percentage of the value of the property purchased or disposed of. The Post Office Solicitors Office work is excluded as being common to both PSA and non-PSA transactions.

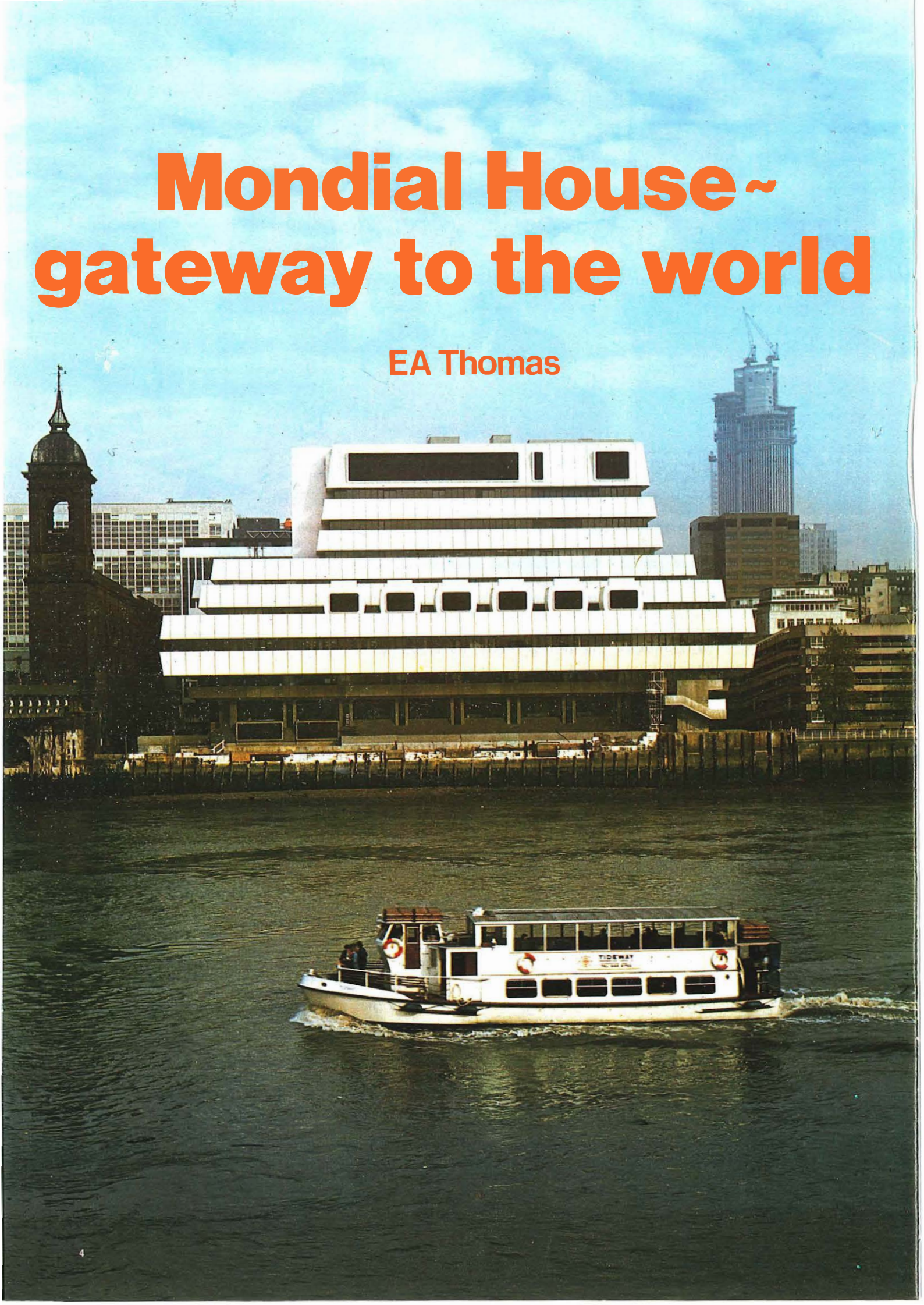
Main features of the service provided by the commercial agents include speed of access. As they have shown on a number of occasions, they can respond within minutes and it has always been possible to obtain an appointment with the partner concerned within a matter of hours. There is also, of course, their local knowledge and flexibility which invariably enables them to give full weight to the needs of the specific case under consideration.

It is, of course, still too early to reach any firm conclusions about results of the trials and it is difficult at this stage even to compare the performances of the commercial agent in Shrewsbury with that of the PSA service in the Nottingham central area. The earliest indications, however, are that the cost of using the private agent is not likely to be higher than the PSA service.

Mr D. C. Bowen is an executive officer on the Estates Duty of Shrewsbury Telephone Area with responsibility for contacts with estate agents, architects and others concerned in the experiment.

Mondial House ~ gateway to the world

EA Thomas



THE GROWTH of International Direct Dialling (IDD) since the first field trial between London and Paris in 1963 has been phenomenal, and currently nearly 80 countries and 355 million telephones are just a fingertip away from most of Britain's telephone subscribers.

To help cope with this explosive demand, the Post Office had to undertake a major revision of plans made originally in the early 1960s for an automatic international service. One of the most spectacular results is the new Thames-side "Dial the World" exchange complex known as Mondial House. When complete it will be the biggest telecommunications centre of its kind in Europe and one of the biggest in the world.

Planning Britain's first fully automatic International Telephone Service Centre (ITSC) at Wood Street, London, began in 1964. But it soon became clear that the growth of international calls – at that time around 22 per cent of all traffic – demanded another very large ITSC to be ready for service in the 1970's. Mondial House was thus given the go-ahead in 1970 and marked the start of a massive investment in the future of IDD which currently stands at £150 million.

The plan was to house three International Switching Centres (ISCs) each with up to about 30,000 lines, and transmission equipment linking with circuits into the inland network. There were to be two International Control Centres (ICCs) for manual assistance calls, along with power and ventilation plant and all administrative, training and welfare facilities.

The first ISC installation, known as Mondial, is being provided in two stages, the first of which is now nearing completion. It will be a full facility unit of about 10,000 lines allowing handling of incoming, outgoing transit and manual assistance traffic.

Installation practice has been improved with advance provision of cabling on grid ready for wiring up to racks, and massive effort on Quality Assurance control has resulted in acceptance testing proceeding comparatively painlessly.

The first stage of the second ISC (known as Thames) is a limited facility unit similar to the Mollison installation at Stag Lane (see Telecommunications Journal, Spring 1974). Installation follows conventional Thorn Ericsson practice of completing all cabling to jack points on rack frames and then plugging in shelves of equipment at a later stage of the work.

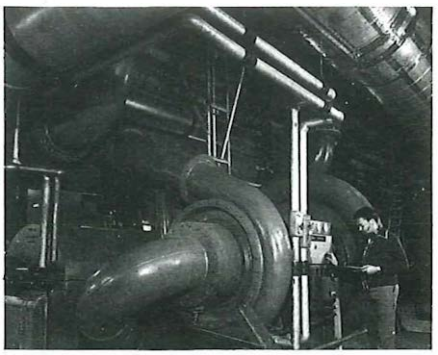
Both ISCs are equipped with special International Accounting and Traffic Analysis Equipments (IATAE). The on line computers fulfil an important role in international accounting for calls routed to other administrations and for transit traffic. The equipment continuously monitors all national and international routes and is a main source of information on grades of service at all times.

A number of different signalling systems are used on international circuits and as most of the existing ones have limitations it became necessary to widen the scope of systems which could be handled by the ISCs to include CCITT6.

Preparations are now well in hand for the connections of major continental and intercontinental routes to the first stage of the Mondial and Thames ISC switching units. This will expand the scope of IDD and give an improved service on routes which are currently overloaded and subject to delays.

Mondial ISC, as its name implies, will carry circuits to any country in the world which can offer reciprocal IDD facilities, and it will fulfil the important function of an international transit switching centre between countries which are not directly interconnected.

Thames ISC will handle the four major intercontinental routes to North America, Canada, Australia and South Africa and the very busy continental links to the Scandinavian countries, Netherlands, Belgium, Germany, France, Spain, Italy, Switzerland, Austria and Greece.



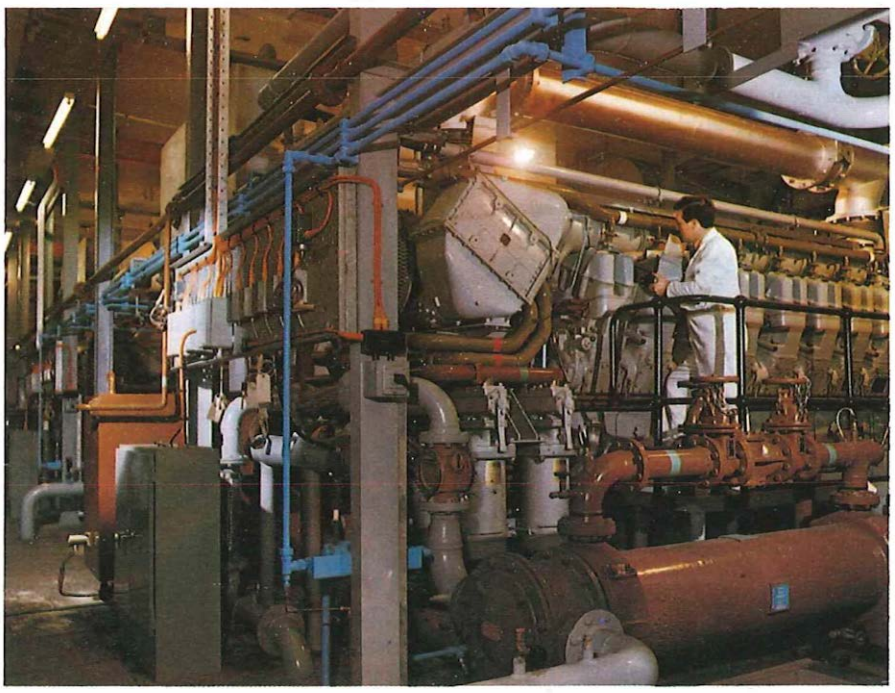
Technical Officer George Wright makes an adjustment to the demand switch on one of the four compressors which make up the refrigeration unit.

The Mondial House building was intended originally as a 15–30 storey tower block and podium. But the planning authority was persuaded to limit the height to 150 feet and ensure the dome of St Paul's would remain visible from the centre of London Bridge. It seems in fact, the planners may have done the Post Office a good turn, for the result is an impressive building, with perhaps a touch of the 21st Century.

The building incorporates a public walkway at first floor level, which will link up with the City of London high level walkway when completed. The south side of the building will be bounded by the river walkway.

In order to make the best use of expensive land, and achieve the required 57,000 square metres area – enough to swallow seven Wembley soccer pitches – a highly unusual stepped building design was adopted for the eight floors above ground level.

A contractor's engineer checks over one of the huge 45 ton standby engine sets which will come to life should normal power supplies fail.



These house the switching and transmission equipment, associated services, administration and welfare. Outside windows are set back to reduce heat from the sun and the glass reinforced plastic cladding is reputedly self-cleaning, to avoid future maintenance costs.

In the dual basement are the massive, but normally unattended, power and ventilation plants. Engine radiators are at third floor level, and the special housings are a feature of the southern aspect of the building.

Internally large solid columns at sub-floor levels give way to split column and beam construction on upper floors. This has the advantage of providing natural housings for the 700 or so Air Handling Units (AHUs) for equipment ventilation, at the same time as reducing the dimensions of the ductwork. The split beam feature was also important, in that removable precast floor sections could be provided between the beams giving complete flexibility of vertical access for bus bars and cables.

The site has an interesting international history, and as far back as the 13th Century Flemish traders in the Dowgate area settled in a styllyard (or yard for measuring by the beam) where Cannon Street Station arches now stand. Brewing and warehousing were established on the site by the early 15th Century and flourished alongside the Styllyard, which was taken over by the The City of London Brewery in 1850.

The site has been devastated twice, first by the great fire of 1666 and later by enemy action in the Second World War. The old burial ground of the All Hallows Church had to be cleared of bodies which were removed to new burial grounds, and the site deconsecrated before any construction work could start on the huge new complex.

One of the many piles of bones unearthed during excavation of the foundations.

George Wright takes a reading at the engineering control centre where alarms from the various plants throughout Mondial are monitored.

The excavation of the basement – nearly 15 metres below high tide level – involved the removal of some 20,000 large lorry loads containing more than 100,000 tons of spoil, most of which was used in the construction of the M3 Motorway. The work posed major engineering problems which had to be taken into account. Cofferdamming and anti-flotation measures had to be taken to avoid the building emulating St. Paul's, which is known to rise and fall about a quarter of a inch between high and low tide.

As a major International Telephone Service Centre, a very high degree of service reliability is essential, and of course operational requirements demand attendance 24 hours a day. This has resulted in features which may not be general even in large inland telephone exchanges.

The refrigeration plant at basement level is the largest in the Post Office, and comprises four centrifugal compressors each of 1,100 tons refrigeration capacity – enough to make nearly 5,000 tons of ice cream a day or cool the Empire State Building.

The pipework carrying chilled water is awe inspiring, and to ensure freedom from leaks in the future, all welded joints were radiographed after work had been completed. Central air handling plants supply electrostatically filtered fresh air to local AHUs on the apparatus floor, and separate systems serve lavatories, kitchen welfare etc. Ventilation of the Mondial building was a massive undertaking, but apart from the main plant rooms the installation comprises a considerable

Technician Danny Smith prepares to change a filter in one of the building's air handling units. In the background Dave Fewkes, a Technical Officer works on an independent distribution frame.

number of fairly standardised units.

The building is virtually sealed and with heat loads that would cause temperatures to escalate beyond safe working levels well within the hour, it is essential to maintain ventilation in the event of mains failure. The standby engine installation has, therefore, been designed to provide cover, not only for normal DC power supplies via rectifiers and batteries, but for essential environmental services. This resulted in a standby installation of some 12 MW ultimate capacity, large enough to supply a small town of about 15,000 people.

Four engine sets, each weighing some 45 tons will come to life when the public supply fails, and after a very short period, when only emergency battery lighting will function, all services will again operate normally. At the engineering control centre alarms from the various plants are collated with facilities for monitoring the status of essential controls or services, and for organising efficient maintenance programmes.

There can be little doubt that although Mondial House is a massive investment it will, when fully operational, more than earn an adequate return for the Post Office.

Mr E. A. Thomas is a head of section in External Telecommunications Executive responsible for building and environmental services for telephone and telex installations.

Getting to grips with undersea cables

A detrenching cable for use in digging out cable buried on the sea bed.

JEH Cosier

Two hydraulically operated grapnels for cutting faulty or damaged submarine cables on the sea bed prior to repair, have been developed at the Post Office Research Department, Martlesham. A third grapnel for detrenching buried cable is also now available.

IRON CLAWED grapnels, thrown with a rope and used effectively in countless escape and adventure films, have long been playing an equally important but less spectacular role for Post Office Telecommunications. Developed originally, it is thought, by the ancient Greeks to secure rival ships before boarding them, grapnels have been used since the middle of the last century to recover early submarine cables from the sea bed to enable repairs to be carried out.

As with most simple and efficient things the design has changed little and has usually consisted of a central shank with four or five curved hooks at the lower end. A shackling device is situated at the top for the rope to be attached. In most grappling operations the pronged grapnel is lowered over the bow of the cable ship so that, as it slowly proceeds, the grapnel trails along the sea bed at right angles to the cable.

The success of the operation is dependent on several factors including accurate navigation and plotting of the original cable route. And to a considerable extent it depends on the nature of the sea bed – whether it is hard, compacted sand, soft "oozy" sand into which the cable could become partially buried, or whether there is a rocky bottom which could easily catch and probably destroy the pronged grapnel. Because of this, several other types of grapnel have emerged based on a chain-like device with hooks attached to the links.

In shallow water there is usually enough slack cable available to enable a grapnel to be pulled to the surface with a bight of cable on it. But in deep water, where there is not enough slack to reach the surface, the story is very different. To bring modern deep sea cables equipped with submerged repeaters to the surface they first have to be cut. This has led the Post Office Research Department to design and produce a whole new range of grapnels to cope with this type of work.

Previously the technique has been to use the "Flat Fish" grapnel with a sharpened hook so that by pulling on the rope and so increasing the stress in the cable, it eventually broke. Both ends disappeared and had to be grappled for again. Three "graps" were thus required for first time success – but usually there were more. Clearly this method was uneconomical, and with submerged repeaters now much closer together they could be dragged along the sea bottom and in some cases even lifted off. When dropped down again they stood a high chance of being damaged.

Ideally a device to catch the cable, cut it, and hold on to one of the cut ends while attaching a line to the

The cut and hold grapnel (left) undergoing land trials at Martleaham.

Final adjustments are made to the cutting grapnel (below) before it is lowered into the water during its sea trials.

other was needed. The grapnel would then be lifted with one cable end attached and the line attached to the other end would be paid out as the grapnel came to the surface. This would mean that in very deep water several miles of high tensile rope would have to be accommodated in the grapnel – not of course a practical proposition.

The answer research staff have come up with is a grapnel which cuts and holds only one cable end. The second is freed and grappled for on a second run. This means two runs are required instead of three and this not only saves time but also takes account of possible delays due to bad weather.

Deep water cables are of the lightweight type and the forces required to cut them are not very great compared with those needed for armoured cables. Armoured cables are mainly used in shallower waters where they can be damaged by fishing gear, but in recent years, due to the problems of the fishing industry, fleets have moved to deeper waters and consequently armoured cables have been laid in 1,000 fathoms. Thus a similar problem can exist with armoured cables and so a grapnel has been developed which will cut through them by means of a hydraulically operated device but which does not hold on to the cut ends.

Let us first consider the deepwater grapnel – known as Cut and Hold Grapnel. This is double sided, so that no matter which way it lands on the sea bed it will operate correctly. There is a projecting broad triangular plate, or fluke, at both the top and bottom, and as the grapnel is pulled along, the bottom fluke digs into the sea bed.

On each side, just ahead of the fluke, there is a triangular sectioned wedge which deflects sand, mud or stones away from the path of the triggers which are just inside the mouth of the fluke. Two triggers, one at the top and the other at the bottom, are preloaded and pivoted on the end of the main barrel of the grapnel.

The barrel forms the cylinder of a double acting hydraulic ram but, unlike most rams, this cylinder moves along its piston rod which extends for the whole length of the grapnel. It is fixed rigidly to cross members at both ends of the chassis and there is a spiral thread cut on the outside of the barrel which engages in a nut built into the central cross member. This means that if the cylinder is made to move lengthwise it will also rotate.

The whole device is driven by hydraulic power stored at 6,000 pounds per square inch in devices known as accumulators. These consist of steel pressure housings containing a loose fitting neoprene rubber bag which can be filled with nitrogen. The ring-like space between the bag and the shell is filled with oil, and if the nitrogen is compressed to 6,000 psi, the oil in the system connected to the space will also be pressurized to 6,000 psi.

As the grapnel is pulled along the sea bed, the lower fluke catches the cable which rides up the inclined edges of the fluke and ends up stretched in a triangular formation with the two anvils at the base of the triangle and the trigger at the apex. Thus as the pull continues the tension in the cable rises and the trigger will operate and open a valve which allows oil to flow from the accumulator to the main cylinder which will then start to move lengthwise and rotate.

At the cylinder end near the triggers are two horns which will now move in a spiral path. In doing so, one horn will catch on the cable stretched between the two anvils, a loop will be formed in the cable and this will be secured around the periphery of the barrel, on top of the thread. As the barrel reaches the far end of its travel, a second valve operates and switches the remaining pressurized oil to the two guillotine cylinders situated one on each side of the chassis. The cylinders move along the fixed piston rods and each has a blade attached to it which can cut through lightweight cable against one of the anvils.

By positioning these blades in a diagonal formation a predetermined port or starboard cut can be achieved irrespective of which way up the grapnel lands on the sea bed. The remaining uncut cable is attached to the grapnel by means of the cable loop fastened around the barrel. Tests have shown that this will sustain a load in excess of 18 tons.

To monitor progress of this operation the grapnel has a sonar surveillance system working on the same frequency as the ship's Precision Depth Recorder, so that as the grapnel is towed along to meet the cable, a pulse is received every eight seconds. When the trigger operates it changes to one per second so that the ship can give out rope and go astern to reduce tension and, finally, when the cut is completed, the pulse changes to two per second to let those in control know that recovery can begin.

The grapnel for use with armoured cable is known as a Cutting Grapnel and is similar in shape to the Cut and Hold Grapnel, but smaller. It is double-sided, hydraulically driven and as it does not hold on to an end, its operation is much simpler. There are no triggers and as the cable rides into the form of the fluke it comes against the anvil of the guillotine.

As the cable tension increases, the anvil assembly moves backwards and operates a hydraulic valve. This switches high pressure oil to the large central ram to which a double-ended cutting blade is attached. This will cut through the armoured cable against the anvil, the cutting thrust available being approximately 96 tons.

Both grapnels have been successfully used in sea trials on 1.47-inch and 1.7-inch cables. The Cut and Hold Grapnel is currently available for operational use but the prototype Cutting Grapnel was lost at sea whilst helping an American cable ship during a pre-service repair of TAT6. A mark II version is about to be completed at the Post Office Research Centre at Martlesham.

Meanwhile to cope with a slightly different type of problem, a third type of grapnel has been developed and is now available for operational use.

For many years the Post Office has suffered from the problem of damage to its submarine cables caused by various types of fishing gear being trawled across them. The situation has become increasingly serious in recent years and has resulted in some cables and repeaters having to be buried by ploughing or "jetting in" methods.

In some cases these cables still become damaged and this results in lengths of cable having to be detrenched. The average depth of burial is about two feet and so a grapnel was needed which could penetrate slightly deeper, engage the cable and then pull it out without breaking it. As a result of sea trials Research Department staff undertook to look into the soil mechanics of an existing mud grapnel which had insufficient penetration. Their solution is the development of a Detrenching Grapnel which has been produced in two sizes, one for 36 inches and a second for 26 inches penetration.

The ancient Greeks would undoubtedly have been impressed . . .

Mr J. E. H. Cosier is a head of section at Post Office Research Department responsible for the laying and recovery of undersea cables and mechanical aspects of repeater design.

Overseas students can familiarise themselves with a wide variety of telephones in the practical demonstration room at the Manor Gardens TMC.

Helping staff from overseas

R N Fletcher & R Parker

AS WORLD-WIDE communications become more and more important, the developing countries of Africa, Asia and the Middle East are facing problems arising from the rapid growth of their own telecommunications organisations. And the British Post Office, with more than 80 years of practical experience in telecommunications, is playing an important role in helping them.

With such growth in telecommunications systems inevitably placing a severe strain on existing skilled staff in the developing lands, the Post Office is offering training courses aimed at equipping overseas telecommunications workers with the techniques and knowledge necessary to manage their own systems.

The overseas students are trained in operational and management skills and the courses, which make a modest profit, can be classed as hidden exports. Some students are sponsored under foundations such as the United Nations Agency and British Government Technical Co-operation schemes, while in some cases, overseas administrations themselves pay for the training.

With arrangements made by the Vocational Training Division at Telecommunications Headquarters, courses are run at the various Post Office training establishments. One such centre is a wing of the Telecommunications Management College (TMC) at Manor Gardens in London, which provides training for traffic and sales managers, an area of training in which demand from overseas students has increased in recent years.

The Overseas Administrations Traffic and Sales course is based on management and duty training given to the Post Office's own new entrant Telecommunications Traffic Superintendents (TTS) and Sales Superintendents (SS). It includes appreciation of the telephone system including both Strowger and common control telephone exchanges.

Forecasting of customers' connections and traffic levels, the results of which are used in planning inter-exchange connections and equipment, is also tackled. The course involves practical case studies, exchange operating service management where a staffing scheme is prepared, and pure management techniques. Appreciation of the statistics used by traffic and sales staff and the use of computers

are also included in the programme.

Classroom training is enlivened with training aids varying from elaborate working models to a simple demonstration of a crossbar switch. Much value is placed on involving students actively in the training course by practical exercises, discussions and seminar work.

During the first two days, for example, they are employed as syndicates, considering the organisational needs in providing and maintaining a telephone system for a hypothetical community. The exercise draws out the students' level of background and experience, helps to mould the group and bring out critical faculties. It also requires students to adopt a specific managerial role and make a presentation for their colleagues.

Closed circuit television is used when, after training, the student is put in the front line, dealing with a variety of telephone service complaints requiring decision and immediate action. In these situations the interviews are controlled by experienced tutors playing the part of customers. Films also play an important part in the sessions.

A statistics module, outlining the basic principles of statistical presentation, sampling techniques and an awareness of the degree of accuracy which can be placed on results, concludes the course.

The overseas traffic and sales training programme is not exclusively carried out at the TMC. A sandwich principle is used with Management College training interspersed with field consolidation and follow-up training. Quite early in the course the whole group also visits a regional telecommunications training centre for a short appreciation course in auto-manual operating techniques.

Working under qualified exchange training supervisors they receive part traditional class-room instruction, part programmed learning and practice on telephone switchboards handling live traffic. TMC believe that the opportunity for a manager to experience personally the training methods under the working conditions applicable to his staff is invaluable and will temper his understanding and handling of his staff later.

Living and working in a close community away from their temporary London bases helps the students with the process of group formation and especially encourages self-reliance and initiative in the younger junior managers, many of whom are away from their own countries for the first time. In fact the individuals from many different countries soon knit together with a common aim of learning not only from formal instruction but from each others' experience. Facilities at the TMC such as the students lounge and games room help create an informal, relaxed atmosphere for them to meet in.

To consolidate classroom training, field experience is given under the guidance of Area Traffic Training Officers in Telephone Areas spread throughout the country. Students are given the opportunity to see in practice what they have learnt at the TMC and they visit telephone exchanges of various types and sit in with staff performing duties in various hierarchies within the Telephone Area.

At an interview with the Training Officer at the beginning of each week of area training, the student is invited to indicate any particular aspect which needs fuller explanation and to discuss the relevance of the training to his job in his own country. Area training allows the students to use their initiative to gain a real insight into the working of a Telephone Area and to appreciate the day-to-day problems which arise.

At first most students are a little dubious about leaving London and going to the various parts of the country but after their first visit to a training area they are keen to return to it and to see their new friends as well as some of the United Kingdom countryside. Most students share in some of the social life of the staff in the training area, enjoying local events such as football matches, hill walking and tours of cathedrals and castles.

The course lasts six months, normally running from January to June. Annual leave commitment in TMC and the training areas and the difficulty in obtaining accommodation for the students against the influx of tourists to the UK bars starting courses in late spring or summer.

From time to time senior officials from the overseas administrations make a visit themselves, and their assurances, together with the increasing number of requests for courses, provide sufficient feedback to show that this work, in which THQ, RHQ and Areas are involved, is well worthwhile and beneficial to our colleagues from different parts of the world.

Mr R. N. Fletcher is Principal of the Sales and Traffic Management Training wing of the Telecommunications Management Training College.
Mr R. Parker is Temporary Head of Group in Traffic Management and Service Faculty, responsible for the administration of the overseas students' training course.

PO Telecommunications Journal, Spring 1978.

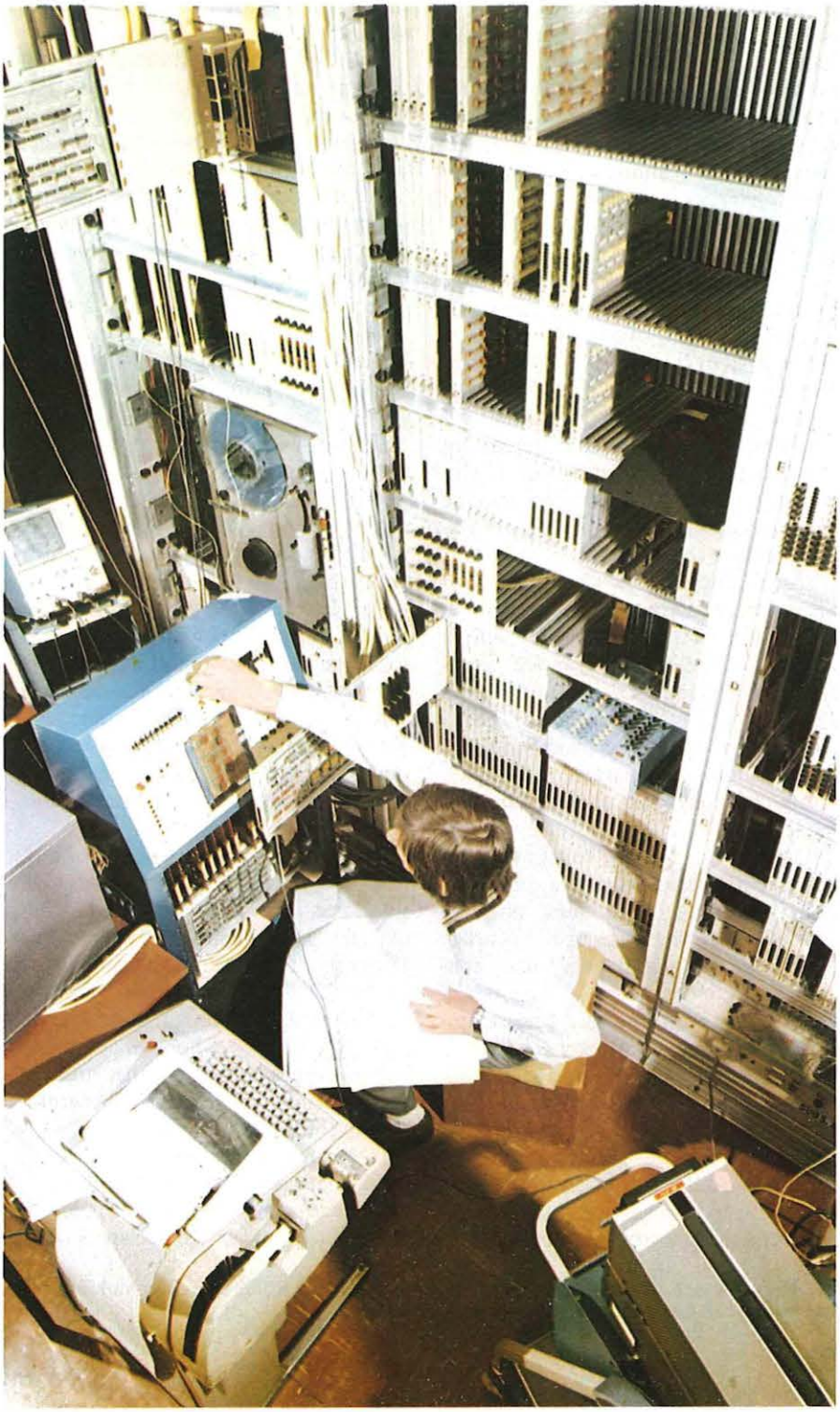
The students' lounge helps create an informal atmosphere in which course members can get to know one another and compare experiences.

TXE4A

The cost cutting space saver

DH Vogan

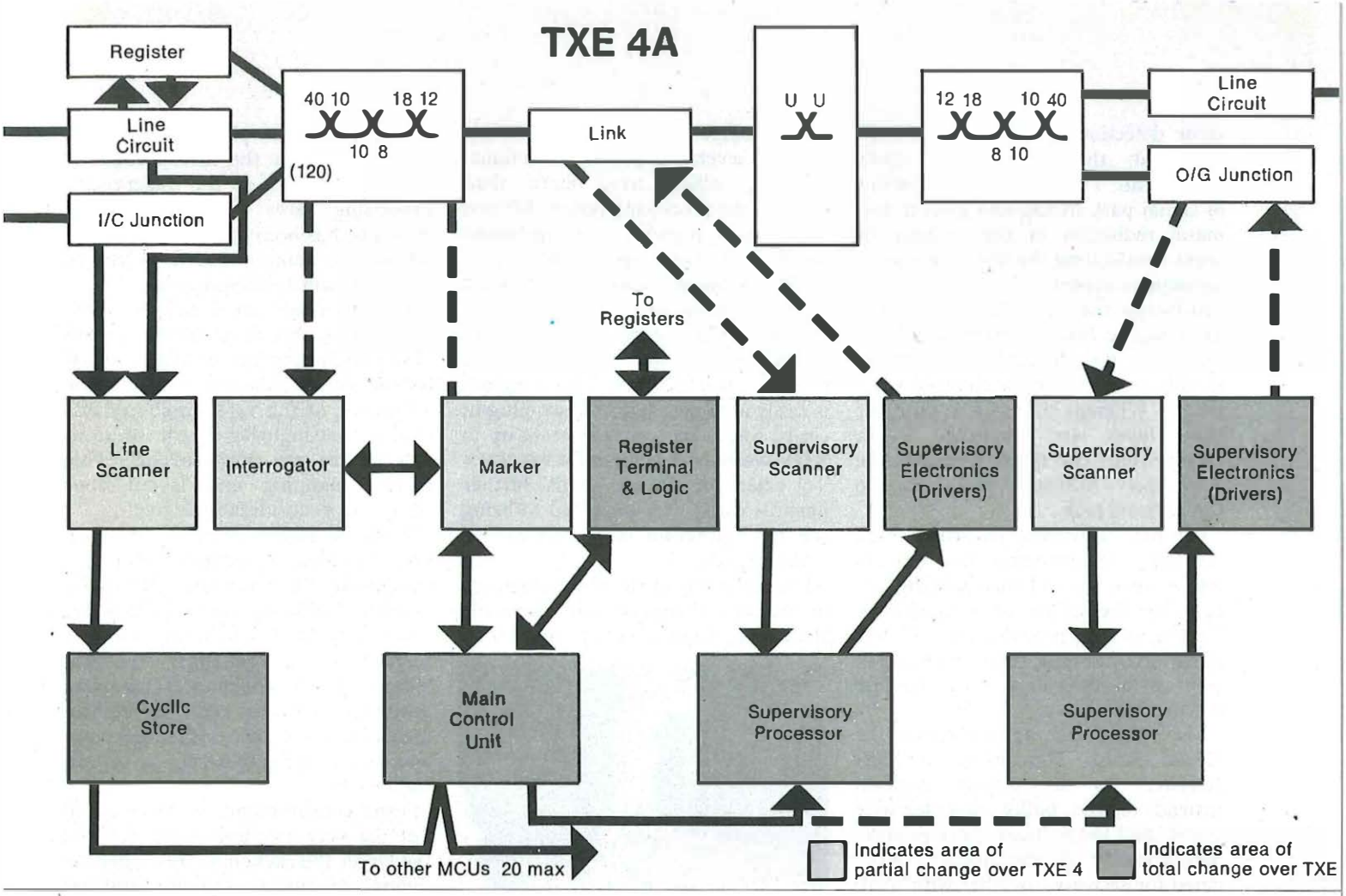
Design work on the development of TXE4A, the cost reduced technology updated version of the TXE4 electronic telephone exchange, is now almost complete. Intensive testing is underway and manufacturing information is being prepared so that the first exchange incorporating the new space saving equipment can be brought into service in 1980.



Tests are made to the cyclic store on TXE4A equipment designed and manufactured by Standard Telephones and Cables Ltd.

THE DECISION in 1972 to replace Strowger electro-mechanical local exchanges with the TXE4 electronic system was based largely on the fact that there was considerable potential for further development using integrated circuits instead of separate components as the more advanced technology became available.

Indeed at the same time as the first orders for TXE4 were being placed,



work had already been put in hand to formulate development plans for the succeeding generation of TXE4 equipment with the prime objective of cutting the cost of the system. Design specifications were prepared for the new equipment and in the spring of 1975 work started on development of the new apparatus, which was designated 'TXE4A Equipment'.

It is important to establish that TXE4A is not a new system: it is new equipment which will supersede certain of the original TXE4 sub-systems. Redesign has been confined to the Control Area of the exchange – the Cyclic Stores, Main Control Units and the Supervisory Processing Units – where the wide use of integrated circuit technology can have the greatest impact in cost savings. The switching area, comprising relay sets, line circuits, links and similar equipment remains unchanged.

At the time TXE4 was developed only single circuit elements using discrete components were sufficiently proven to be incorporated into the designs. Now, integrated-circuit packages containing several thousand interconnected transistor cells, are available which provide the circuit functions of complete logic elements.

Two of the Large Scale Integrated Circuits (LSI) devices which have been widely used in TXE4A are the Shift Register and Re-Programmable Read-Only Memories (REPROM). A Shift Register consists of a series-connected chain of bistable "flip-flop" circuit elements connected in such a way that data entered at the input in the form of an "on" or "off" state, is pulsed along the chain from one bistable circuit element to the next, eventually appearing as an "on" or "off" condition of the last bistable element. Having reached the end of the chain, the information is momentarily available for use and is lost as the following driving pulse occurs. By connecting the output back to the input however, the device becomes a re-circulating data store and it is in this form that it is used in the TXE4A equipment.

REPROMS function similarly to Read Only Memories (ROM) which are devices used only in the read-out mode, when reference to fixed information is required. In REPROMS, however, the stored data is entered electrically, after manufacture. Further, the data can subsequently be erased by exposing the device to high intensity ultra-violet light and be re-programmed.

REPROMS used in TXE4A have storage capacity for 8,000 bits of data in a single LSI package and are used to provide long-term storage where data is changed on an infrequent basis.

In total about one third of the equipment in a typical TXE4 exchange will be superseded with the introduction of TXE4A equipment. To achieve a significant overall cost saving of, say, 15 per cent for a given exchange therefore, a substantial saving has to be made on the equipment being changed – in the order of about 45 per cent. Let us now consider how savings like this are achieved.

First, because of the compactness of LSI technology, the re-designed functional areas occupy far less space than the equipment replaced. Fewer components require fewer printed wiring cards to mount them on; fewer cards require fewer mounting frames and associated plugs and sockets; fewer plugs and sockets require less shelf space; fewer shelves mean fewer racks. The amount of cabling and wiring is also reduced. In all there is less equipment to make, to test, to transport, and to install. And of course there is a big saving in floor space.

Also it is a fact that integrated circuits work faster and are able to perform more functions in a given time. Greater "processing power" therefore is available. This provides further savings in that less equipment is required to do the work.

Binary signalling and coding with

error detection techniques, has been employed throughout the TXE4A equipment. This reduces the amount of signal path wiring and gives a dramatic reduction in the number of wires constituting the inter sub-system signalling channels.

Although the basic function of the TXE4 Cyclic Store remains unaltered in TXE4A, the physical arrangements in this area have been changed completely. Whereas in TXE4 four different rack types are required, TXE4A requires only two types of racks – the subscribers A-Switch rack and the Cyclic Store rack.

The new subscribers A-Switch rack contains the customers line circuits and A-Switches and the scanning circuits for the associated terminations. This new rack provides for 720 terminations and thus, there can be up to eight such racks in a TXE4A module serving 5760 lines.

The second rack accommodates the Cyclic Store. This uses LSI Shift Registers as the storage medium instead of the bulky threaded-wire stores, and the reduced space requirements enable all the storage, duplicated for security, together with scanning and state-of-line-logic for 5760 customers, to be accommodated on a single rack.

Programmed call-setting processors called Main Control Units (MCU) control the setting of all calls through the exchange. They receive calling signals from the Cyclic Stores, cause appropriate paths to be set through the switch network, initially to associated exchange Registers which receive dialled or keyed instructions from customers and later, to the wanted termination.

The architecture of the TXE4A Main Control Unit closely resembles that of the existing design. The new equipment, however, contains additional functional units such as input and output "ports" which will enable the MCU to communicate with a separate processor and so pave the way for future enhanced facilities.

Another additional feature of the TXE4A MCU is the provision of a second "comparator" unit. Comparators are used to derive equipment number and translation information from the data being broadcast by the Cyclic Stores to all the MCUs. The present design of TXE4 MCU uses discrete components throughout. TXE4A makes extensive use of integrated circuit technology and this has greatly reduced the number of units required to perform the MCU function in an efficient way.

The change in technology has also allowed several important functional changes, which have more than doubled the processing power. Revised exchange register arrangements enable each TXE4A MCU to handle up to 96 exchange Registers compared with the present 36.

Each TXE4A program uses about 10,000 instructions to provide the present TXE4 facilities. This program is easily accommodated on two-plug-in cards, since each card can store up to 8,000 words on eight pairs of REPROMS. To cater for future needs further REPROM cards may be added to bring the total program store capacity to 32,000 words.

The net result of the re-development of the MCU therefore is to halve the shelf space required and to more than double the overall processing power, compared with the existing design.

TXE4A's reprogrammable read only memory store shows the space saving when compared with the threaded wire equivalent of TXE4 in the background.

Much of the general architecture of the present TXE4 Supervisory Processing Unit (SPU) has been retained in TXE4A but the main functions have now been implemented using integrated-circuit technology. In TXE4A, the logic sequences have, in general, been preserved. But instead of being realised in the form of hard-wired logic, the logic is stored as a program in REPROMS's. This approach has enabled the SPU logic to be accommodated on two cards whereas TXE4 required 11 cards for this purpose.

The 4,000 word ferrite-core working store used in TXE4 has been replaced by a 6,000 word Random-Access-Memory (RAM) store which can be equipped as required in modules of 2,000 words per plug-in card. The overall effect of the introduction of TXE4A equipment in the Supervisory Processing area of an average exchange has been to reduce the space occupied to about one sixth of that of the equivalent TXE4 equipment.

New pulse and signal highway techniques have been developed to operate at the higher repetition rates required by the new technology and a major advantage of the TXE4A highway systems is that highway lengths of up to 150 metres are now possible. This relaxes planning and layout constraints to a considerable degree.

Overall, a number of practical effects arise from the introduction of TXE4A equipment. There is a reduction in the number of different types of racks and different types of slide-in unit required to make up an exchange. This provides more efficient manufacture, less documentation and reduced requirements for spares, and with fewer racks and slide-in units there are savings in capital cost.

Power consumption is reduced on all but the very smallest exchanges and the larger the exchange, the bigger the saving. A TXE4A exchange also requires less floor space than an equivalent TXE4 exchange because there are fewer racks and because there is no longer a requirement for the wide Cyclic Store gangways.

Finally, exchange management efficiency is improved through the ability to input data in the Cyclic Store using a teleprinter as opposed to wiring threaded-wire stores. The reduction in equipment quantities brought about by the introduction of TXE4A equipment can perhaps best be illustrated by considering a typical exchange of 13,000 lines.

Designed using TXE4 equipment, it would require 444 racks. Designed with TXE4A equipment it would require only 352 racks (a saving of 92 racks or 20 per cent). This results in a reduction in the floor area required, from 755 square metres for TXE4 to 563 square metres for TXE4A (a saving of 192 square metres or 25 per cent).

These, then, are the virtues of the new TXE4A equipment. When the first exchange is handed over to the Post Office in 1980 it will mark the beginning of a new era in telephone exchange technology.

Mr D. H. Vogan is a head of section in Telecommunications Development Department and project manager for the development of TXE4A.

PO Telecommunications Journal, Spring 1978

TELEPHONES AROUND THE WORLD

Here is our annual international comparison of telecommunications statistics. They show countries with the highest number of telephones, and include figures to indicate the percentage growth in their systems over the previous year. The source of the figures is the American Telephone and Telegraph Company.

Operation Blizzard

THE BLIZZARDS and snowstorms which paralysed parts of Scotland and most of South-West England and South Wales during January and February not only played havoc with road, rail and other services but also presented the Post Office with a vast number of breakdowns and failures which Telecommunications staff battled to overcome often in appalling conditions.

The storms were the worst to hit Britain for 30 years and in Scotland 25,000 man hours were spent on repairing damage. The bill for stores alone was £30,000.

The night of Friday, January 27 will long be remembered in the far north. It was then that the area was struck by snow storms which were even worse than the blizzards of 1947. All road and rail links north, south and west of Inverness were cut and a state of emergency was very soon declared.

Batteries in telephone excha where mains power had failed not cope, and the few remaining head junction routes were damaged by freezing snow on wires and driving winds. The television transmitter at Rosem went out of action, and the Blac peninsula opposite Inverness almost wholly without power.

Despite the power breaks exchanges, mainly UAX's, were no tially affected as the 24-hour ba reserve maintained supply. Se exchanges lasted without mains p in fact for up to four days befor batteries ran down and caused i tion. A storm control was set up based in Inverness where the emp was on providing standby pow exchanges where batteries had charged. As soon as power wa stored the job of the control wa ected to restoring breaks affecting scribers' routes.

With temporary service provided work of control turned to perma restoration involving mainten power, construction and plan groups. Failure of the electrical created havoc with telecommu tions in the sparsely populated H lands, and in the first few days the storms began, a total o exchange isolations were reported.

Immediate action had to be tak move mobile generators to affe exchanges and the most that were the air" at any one time was 4

the height of the storms some 10,000 customers in the Highlands were without service. Within 48 hours, however, only one exchange remained isolated – Merkland in Sutherland – and the number on restricted service had been cut from 24 to two.

Merkland UAX is connected to its Group Switching Centre (GSC) by an overhead junction route 20 miles long and it was severely damaged with wires down and poles broken and buried in the snow. The road to Merkland was closed for more than a week but eventually a rotary snowblower which had been airlifted from Switzerland cleared a way and engineers were able to restore Merkland's telephone service after a break of 10 days.

Portable standby generators of varying shapes, sizes and fuel types were used to supply power until mains supplies were restored. Diesel, petrol and gas-fuelled generators were despatched from Inverness, in 15 cwt vans, land rovers, tracked snow vehicles and helicopters. When they had been installed the next problem was re-fuelling. Replacement bottles of gas are needed daily for a 1½ kilowatt gas-filled generator, for instance, while petrol generators will run for only two hours on a tankful of fuel. Locally available generators soon had to be complemented with generators hired from contractors, some of them having to be flown in because of blocked roads. They came from as far away as Manchester.

Of the total number of exchanges affected more than 80 per cent were cut off for less than two days. In one 10-day period more than 500 separate breaks were reported, ranging from replacement of drop-wires to single subscribers, to the extensive re-building of a 24 km overhead junction route. In Aberdeen (North district), where at one time 6,500 subscribers were without service, 93 per cent of faults were cleared within 10 days.

In many cases the telephone provided a lifeline for people marooned. At Aviemore a family were forced to burn furniture to keep warm and cook. Though snow was up to their roof, the telephone remained in service and they were able to tell rescue services of their plight.

Nor did the storm affect natural highland hospitality. Post Office engineers being airlifted into Durness in north west Scotland were met by the villagers who insisted on off-loading the helicopter and conveying the generator to the exchange. By the time the engineers had connected the equipment the villagers were back with flasks of hot soup, home made pies and a bottle of real highland "spirit" to provide "central heating".

But when the snow melted there were more problems caused by flooding. Underground cable faults rose to three times the normal daily level, and the normal work-force was increased accordingly to contain the situation.

In the South West's blizzard, RAF and Naval helicopters were used to fly in engineers who volunteered to bring in stand-by generators to several of the remoter exchanges in Exeter and Taunton Telephone Areas when electricity supply was lost and batteries subsequently failed. Other engineers had to abandon their vans and struggle on foot through 12 to 20 foot drifts to reach isolated exchanges.

At one stage 12 exchanges serving some 4,000 telephone subscribers went out of action completely, while Bournemouth, Dorchester and Exeter auto-manual exchanges had only about two-thirds of their normal staff on duty as snow prevented people from getting to their place of work.

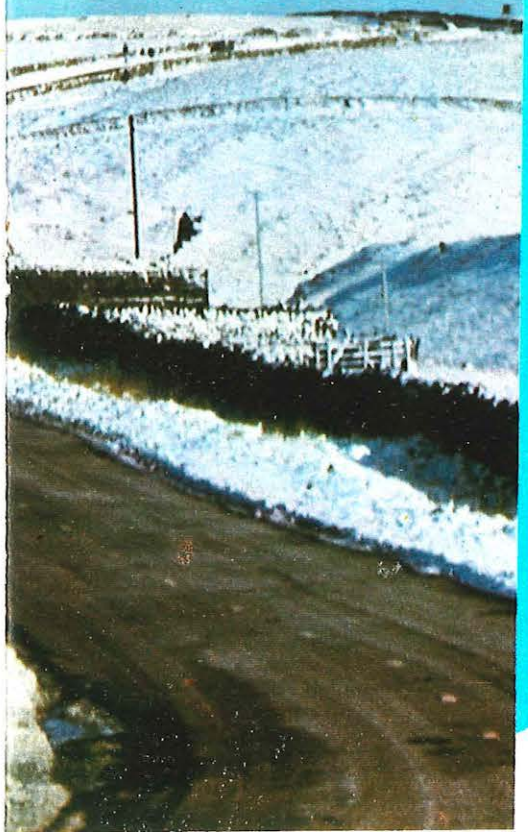
In the case of the remote North Devon village of Shebbear in Exeter Telephone Area, four engineers who made their entry from the air in a Naval Wessex helicopter, delivered a parcel containing urgent medical supplies for the local doctor as well as their own emergency equipment. Working in appalling weather conditions the team had the local exchange operational within 24 hours, giving the 650 villagers contact once again with the outside world.

Most publicised of the operations in which the Post Office played a part was the setting up of BBC "Radio Taunton" to serve people in isolated places. During the emergency technicians saw to it that within hours of receiving a request from Radio Bristol both a high quality circuit, for carrying music and news reports, and a control circuit for off-the-air contact, were provided between Radio Bristol and an emergency studio at County Hall in Taunton.

As in Scotland when the thaw set in, flooding brought new headaches for the Post Office, causing heavy damage to the underground cable network. Some 7,700 faults were reported in Taunton Telephone Area, stretching from Yeovil to Barnstaple. By the end of the week however all but about 600 had been cleared.

At one time Exeter area engineers had a backlog of 1,000 faults in East Devon – an area where 30 to 40 outstanding faults is usually considered to be high. To deal with these and similar problems throughout the region, 150 technicians were switched from route maintenance and construction work to do emergency repairs, mostly caused by water.

All in all, the Post Office coped manfully with the situation and staff in all the badly affected areas drew widespread praise for their efforts to help keep open and restore communications throughout the emergency.



Senior technician Stan Jones gets to work with a shovel to dig his van out of a snow drift at Weston-super-Mare.

THE DIGITAL WAY AHEAD

GH Bennett

THE CORE of the Post Office's operation is the provision and maintenance of facilities for transferring information and material between people and places. In the Telecommunications Business the telephone user dominates but there are many other demands, particularly for data services, which are growing at a vigorous rate. Other important services are telegraphy, television, sound programmes and possibly in the future, visual telephone.

At present data and telegraph services are the only sources which represent their original information as a signal in digital form. A telephone generates an electrical signal which as an analogue of the speech information can be represented as a waveform.

For digital transmission this analogue signal has to be converted into a digital form and the usual method of achieving this is by Pulse Code Modulation (PCM). In this process, the analogue speech waveform is sampled and the amplitude of the samples are encoded into binary numbers which can then be conveniently transmitted as digital signals.

The same process can be applied to any analogue signal such as television and sound broadcasts, but naturally these services demand a more sophisticated approach and greater accuracy is needed in the encoding process. For television an interesting proposal is that the required information can be generated in digital form within the TV camera itself. This offers the advantage that studio processes as well as transmission can all take place in the digital mode, greatly facilitating the signal manipulation that is necessary for the operation of the studio.

Telegraph signals, which currently largely arise from the telex service, are usually generated by teleprinters or in some cases from sources such as punched or magnetic tape and are already in a form suitable for digital transmission. Data signals originate from card, tape, magnetic tape and other machines as well as from line printers and computers. All these devices originate their "raw" information in a digital form.

Consider now the meaning of digital transmission as compared with analogue transmission. In the latter, the signal takes the form of a varying electrical waveform whose shape carries the relevant information. In passing

An engineer tests the terminal equipment of a high speed digital transmission system at a repeater station.

A roadside repeater installation is checked during work on the 120Mbit/s digital transmission system at Guildford.

along a cable the signal is diminished and needs to be amplified at regular intervals. Such amplification cannot be perfect and on each occasion the signal is, to some extent, distorted and has noise added to it which would, in the limit, prevent further useful transmission.

For digital transmission the signal is essentially of binary form so that it is only necessary to transmit two signal states, "1" and "0". These can be represented in a number of ways depending on the transmission medium to be used, the simplest method is to represent "1" by a voltage pulse and "0" by no pulse.

This method is quite practicable in some circumstances but it is often preferable for transmission over cables to adopt three signal states – called a ternary code. The uniqueness of all three states can be exploited and the binary signal can be converted into a ternary form which reduces the rate of signal transitions. One example is known as 4 binary to 3 ternary (4B3T) where groups of 4 binary digits are converted to groups of 3 ternary digits in accordance with a set of rules.

Optical fibre, the most recent addition to the family of transmission media, uses light as the signal source. Turning the light on and off in accordance with the binary condition to be transmitted is the obvious way to achieve digital transmission and this method is already being used for the first generation systems.

Like their analogue counterparts, digital signals suffer from degradation of the transmitted signal due to the transmission pattern and as a consequence it is necessary to regenerate the signal at intervals using regenerative repeaters. These detect the degraded signal and generate a new signal corresponding to that received. In this way a completely new signal is created at each regenerator which is virtually indistinguishable from that originally transmitted. It is possible to carry out the regeneration process time and time again as often as is required by the distance involved.

Two impairments have to be taken into account, however. The first – actual errors in the digital signal – may be due to any of several causes, but with good design and reasonable freedom from external interference the number of errors can be very low. On high grade systems, using coaxial cables for example, they may be so infrequent as to be difficult to detect.

The second impairment known as jitter, is an aberration of the signal causing pulses to vary in time from their correct position. The extent of this variation and the rate at which it takes place, is most significant in its effect on visual communication, but if very severe, can affect other services and may cause errors in the signal. Fortunately, it is possible to introduce "jitter reducers" at appropriate points and these can largely correct this phenomenon.

Most data services require information rates of 48 kbit/s or less and telephone speech generally needs 64 kbit/s. To provide these it is useful to combine a number of low rate sources on to a single, higher rate path. This is achieved by time division multiplexing and is simply the combination of several digital signals, each at a nominally fixed rate, into a higher rate signal.

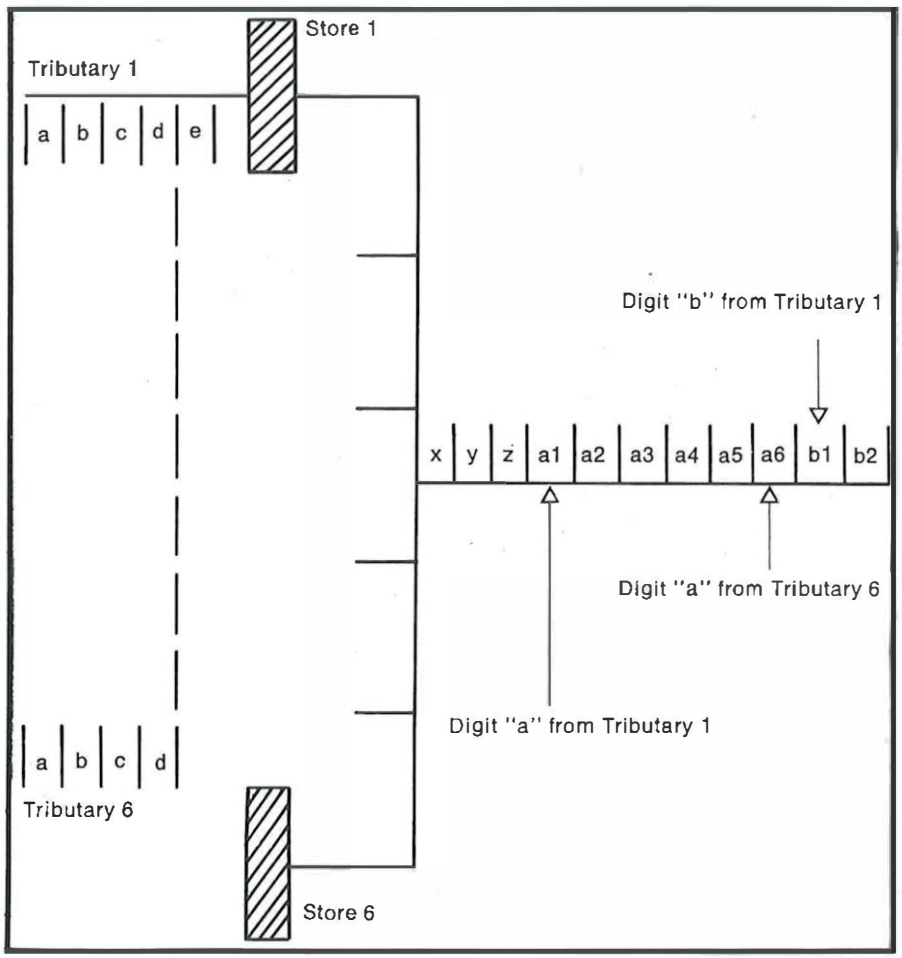
Take an example of six channels each of nominally 9.6 kbit/s. These combined would require 57.6 kbit/s. Allowing for "housekeeping" the six channels fit into a 64 kbit/s rate. But how is it actually done? The diagram below shows that one digit is taken from each tributary channel in turn and combined on to a common path at a rate corresponding to the clock or timing signal of the multiplexer.

Additional digits x, y, z – are added to provide an identification of the start of the sequence so that at the remote terminal (or demultiplexer) the digits can be correctly allocated to their respective paths corresponding to the input tributaries. It is also necessary to take into account the fact that the input tributaries may vary from their normal rate.

The process of bringing all the tributaries to the same common rate is known as "justification" and requires additional digits in the combined signal. The multiplexing process can proceed upwards through a number of rates of a prescribed hierarchy so that higher and higher line speeds can be used. The hierarchy which has been adopted by the Post Office conforms to CCITT recommendations and is 64 kbit/s (×32) = 2048 kbit/s (×4) = 8448 kbit/s (×4) = 34,368 kbit/s (×4)=139,264 kbit/s.

It will be seen that each higher order in the hierarchy has a digit rate which exceeds the numerical sum of its input tributaries. This difference is taken up by the justification process and the housekeeping digits needed for the operation of the multiplexing equipments which are such a vital element.

The way in which six 9.6 kbit/s channels fit into a 64 kbit/s rate.



Digit Rate kbit/s	Media	Nominal Repeater Spacing km	Notes
1536	Audio cables	1.83	A substantial number of systems exist. Used with 24 channel PCM. No further expansion proposed.
2048	Audio cables	1.83	A CCITT standard used with 30 channel PCM or Multiplexed Data. Now being ordered in place of 24 Channel.
8448	Carrier Cable Network	3.5	Under development.
8448	Optical Fibre	12 to 15	Demonstration trial systems exist
120000	1.2/4.4 Coax	2.0	A limited PO ordering programme. In service 1978.
139264	1.2/4.4 Coax 2.6/9.5 Coax	2 4.5	To replace 120 Mbit/s within 2–3 years.
	Optical Fibre	3 to 6	Demonstration trial systems exist.
	11 GHz Radio-Relay (one channel per carrier)	50	Under development for use at existing radio relay stations.
	19 GHz Radio-Relay (2 channels per carrier)	8 to 10	Under study for possible development.

Table showing the range of digital transmission systems which are currently available and under development.

The efficient transmission of digital signals requires a range of digital transmission systems and the table above gives a summary of those available and under development.

The interconnection of these digital transmission systems into a digital transmission network associated with the existing switching systems which function in the analogue mode, is not the most advantageous way for operation. It is not until digital switching is included that the full significance of the digital story unfolds.

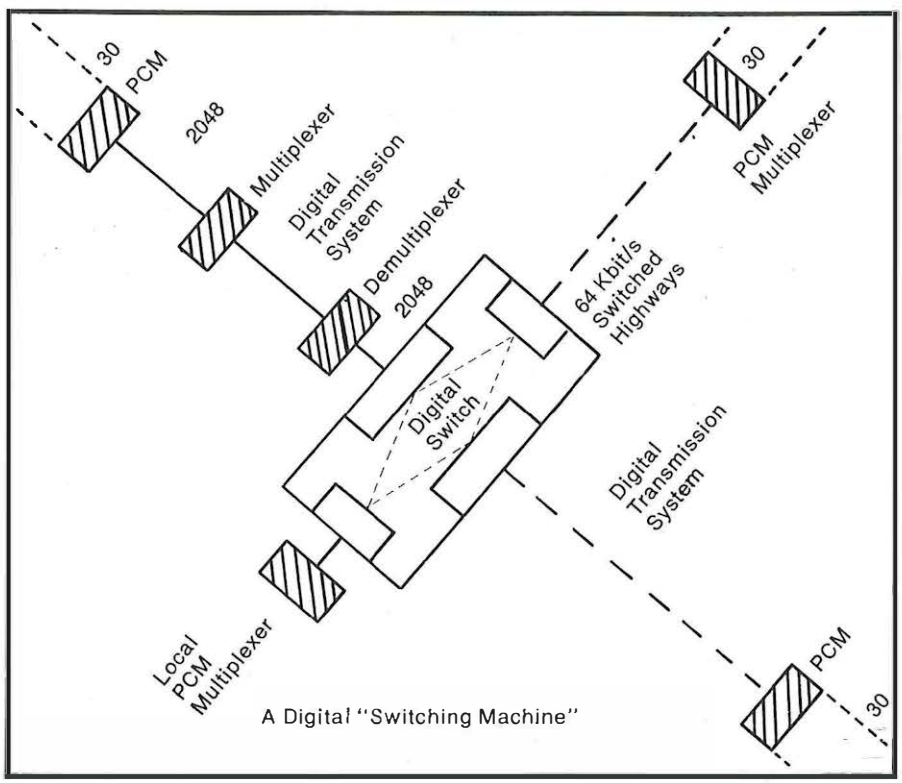
Consider the diagram below. This represents a digital "switching machine" which has the capability of interconnecting 64 kbit/s paths from a number of PCM systems connected to it. These may be remote and traverse long chains of transmission systems and multiplexers or they may be close at hand, even in the same building.

Because the characteristics of digital transmission are not bounded (within the limits of errors and jitter) by distance, then the switching machine can freely interconnect any 64 kbit/s path to any other and the overall performance characteristics will be the same in every case.

In this way there is the possibility of a "standard" performance, virtually independent of the dimensions of the network and capable of handling a range of different services without the mutual interference that in some cases is characteristic of analogue systems.

The attainment of a comprehensive integrated digital network, is of course a long term plan and many years will pass before sufficient new plant has been installed to make much impact on the present analogue network.

By the mid 1980's however, it is expected that much of the country will have an overlay of digital transmission which will be available for telephony and also for data, television and other services. Digital switching will gradually be introduced into this network and in the longer term it is possible to envisage a wholly digital connection, customer to customer, offering the wide range of services that are likely to be needed by the year 2000.



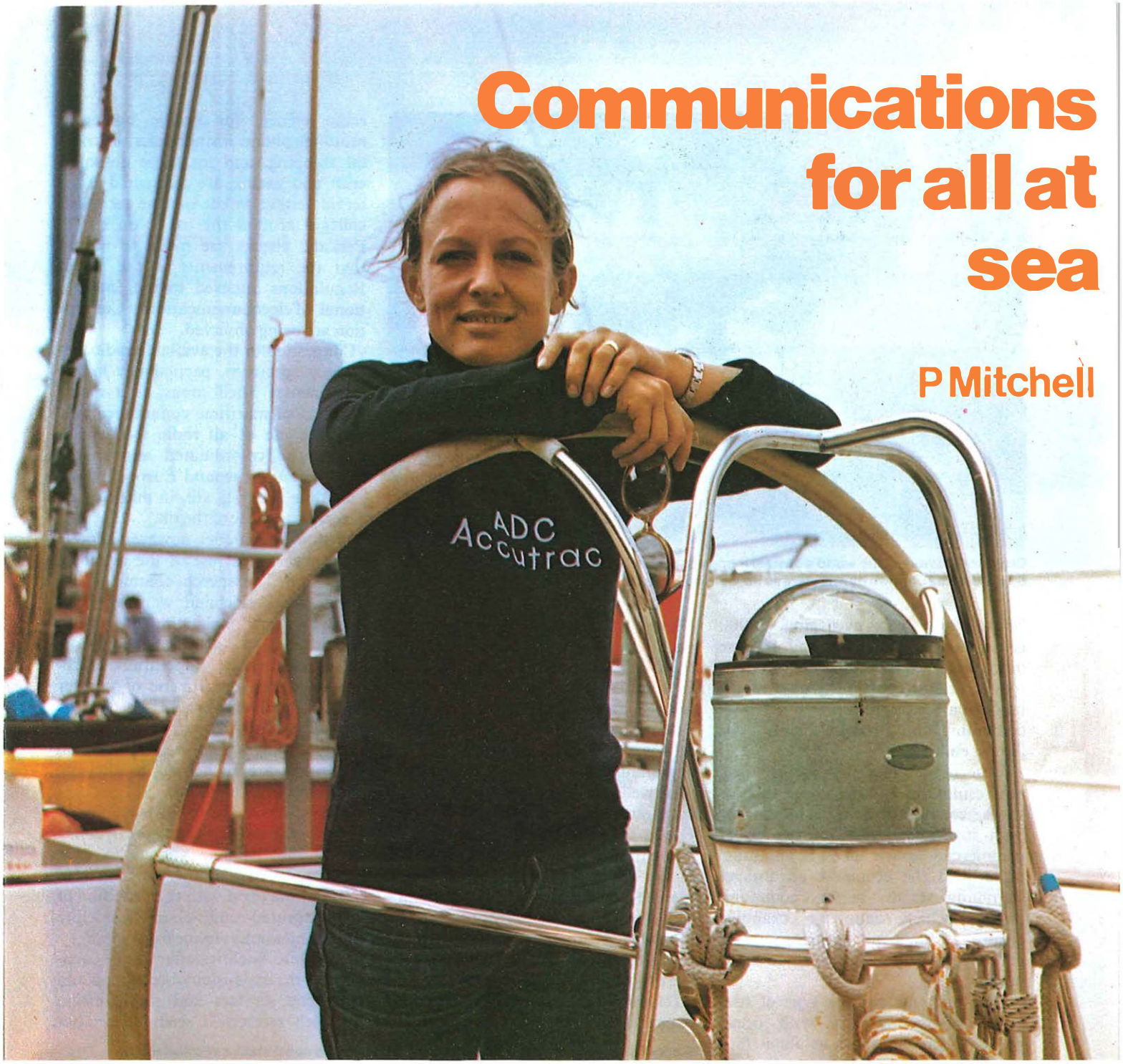
A Digital "Switching Machine"

Mr G. H. Bennett is a section head in the Line and Radio Systems Division of Telecommunications Development Department with special responsibility for digital transmission on cable and radio relays.

PO Telecommunications Journal, Spring 1978.

Communications for all at sea

P Mitchell



Round the world yachtswoman Clare Francis is one of the Post Office Maritime Service's most famous customers.

For more than 60 years the Post Office with its network of Coast Radio stations has provided a continuous 24-hour world wide ship-to-shore communications service. Recent developments have led to improved techniques and equipment as well as the introduction of a Maritime Satellite Communications System.

A LUXURY liner smoothing its way across the Pacific, a French trawler fishing in the icy waters of the Arctic and a round-the-world yacht contestant leaving Rio de Janeiro, may not, at first glance, appear to have much, other than the sea, in common. Yet these three vessels – and, indeed all types of sea-going craft – can be linked by one vital factor: their ability to keep in close touch with the United Kingdom via the Maritime Radio Service Division of the Post Office's External Telecommunications Executive. (ETE)

Almost all the telegraph, telephone and telex services now available to the public are also used for the business and social needs of seafarers, with highest priority, of course, always given to the communication needs of ships in distress.

During 1977 nearly one million radio-telegrams were exchanged or broadcast and 600,000 radiotelephone and 42,000 radiotelex calls were connected between ships and subscribers in the United Kingdom and overseas. Some 268 distress and urgent marine casualty cases were handled directly and a further 290 were intercepted and reported to shore authorities. Navigational, weather and gale bulletins numbered 50,000. A total of 350 Post Office radio officers man the coast stations, with more than half of them based at the long-range station, Portishead Radio, in Somerset.

The pattern of international shipping is continually changing and communication methods have had to be modified accordingly. The trend to larger, but fewer, super tankers, general and bulk cargo carriers and container ships is now very apparent.

Operators at work at the world's busiest long-range maritime radio station at Burnham-on-Sea, Somerset, known by mariners as Portishead Radio.

Ships which were averaging 12,000 gross tons in the 1940s and 50s are more often around 100,000 gross tons today. And of course, the days of the larger passenger liner, with its bulk communications requirement, are almost ended.

These developments, however, have not resulted in any decline in ship-to-shore communications. Indeed, the high investment costs of the larger commercial vessels have, if anything, underlined the economic advantages stemming from better communications which can, for example, ensure a ship's quick turn-round in port or its early diversion to an alternative route.

Growth in the routine type of telegraph communications with ocean going vessels continues at about four per cent a year. At the same time, more and more ships, particularly those employed in North Sea oil exploration, are using radiotelephony, where overall growth is around 12 per cent.

Radio telex facilities, which for a decade have been the main line of communication with oil exploratory rigs, are now beginning to be used more extensively by commercial deep-sea cargo vessels and this is particularly so through Portishead Radio.

Almost coincidental with the changes in commercial shipping, there has been a rapidly increasing number of small pleasure craft and yachts whose owners are finding that the provision of VHF radio telephones gives them a reasonably economical way of keeping in touch with the shore, for both domestic and safety reasons.

Although it is unlikely that any one yacht will communicate frequently, the combined effect from the 8,000 or so small craft now equipped with VHF for use in coastal waters, has good potential. A publicity campaign aimed at this new field of activity is, in fact, beginning to pay dividends.

As well as operating the maritime communications business, the Post Office, under contract to the Department of Trade and Industry and the Home Office, carries out inspections of marine radio installations to ensure that ships' radio equipment meets the necessary requirements and that the licensing terms for operating stations are properly observed.

Technical and practical operational examinations for the professional radio officer, for people operating radio-telephone installations on coastal shipping, and for those on small craft and yachts, are conducted at intervals either at the marine technical colleges around the UK or on board. Periodic checks are made to ensure that the requirements of the Radio Regulations annexed to the International Telecommunications Convention are being observed.

Congestion of the available radio frequency spectrum, particularly in the Continental Shelf areas, is a major problem of maritime communications and the use of all radio frequencies has to be co-ordinated and shared with countries around Europe, whose maritime interests are, in many cases, identical to those of the UK.

Modern techniques however allow a more economical use of the available spectrum. The speech channel itself, under single-sideband working (SSB) occupies only half the bandwidth which used to apply in double-sideband working. New operational techniques, the increasing use of VHF for short-range working and the planned use of VHF/UHF "scatter" for middle distance ranges to the permanent oil platforms, are all helping to alleviate the immediate congestion.

It now seems likely, however, that if the present growth rates, particularly for radio telephone and radio telex contact, are to continue, the long term solution may rest with the provision of an integrated multi-channel satellite communications service for shipping.

But while satellites offer ample capacity for the expansion of telegraph and telephone services and stable media for both services it seems clear that

A constant vigil is kept by Post Office staff who man the coast stations dotted round the UK shoreline.

the transfer of long-range maritime communications to a satellite system will be a gradual, years long process. Satellite communications seem likely to complement rather than displace the existing traditional radio services to shipping, particularly in sea areas adequately covered by short-range VHF where satellites may have little to offer.

Most of the 11 medium/short range coast stations operated by the Post Office have several transmitters and receivers in the same building. In the past the stations have relied on the remote siting of receiving aerials, and suitable filtering, to prevent interaction between transmit and receive communication paths. As the traffic loading has increased, however, it has become more difficult to deal with this problem and new stations and the existing ones being re-equipped, will provide adequately separated transmitting and receiving facilities, each with its own aerial system.

The introduction of single-sideband working, mandatory at coast stations since 1975, and on board ship by 1982, has led to the general re-equipping of all coast stations with SSB equipment. Use of the additional radiotelephone channels made available has materially improved the extent and quality of service.

The provision of VHF services to coastal shipping is being gradually extended so that, within the next few years, it should cover the whole of the UK seaboard. A number of interleaved VHF stations, operating by remote control from base coast stations, are already in service and a further four such stations at Cromarty, Forte, Whitby and Sullom Voe in the Shetlands, will be provided before the end of 1978.

A selective calling facility has been installed at each coast station so that it is now possible to contact ships carrying compatible call decoders, without the need for them to maintain continuous listening watch. Traffic delays, which are inherent in the present system of two hourly broadcasts of traffic lists, can, therefore be reduced.

Among improvements planned for the long-range HF service is the provision of an entirely new complex centred at the control point at Burnham-on-Sea, Somerset. By 1981, the new station, on which building work has already begun should be operating, with a receiving aerial "farm" at Somerton, 25 miles away. Transmitters for the various telegraph, telephone and telex services will be located at Rugby, Leafield and Ongar.

With 55 radiotelegraph operating positions, 12 radiotelephone consoles and nine radiotelex control points, the traffic capacity of the new station should be more than adequate for the predictable future of "orthodox" communications. About 60 per cent of long-range contacts are with foreign ships: the provision of up-to-date facilities at Burnham should help to maintain the UK position in the forefront of international ship-to-shore service.

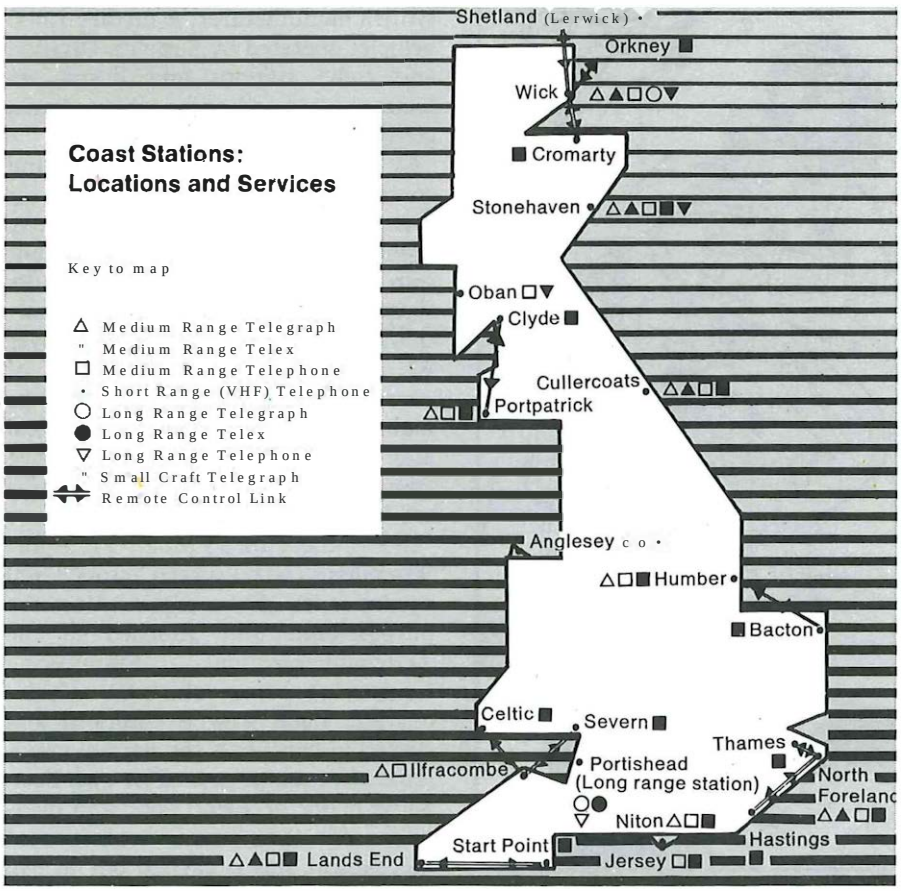
The fact that the main flow of commercial traffic with larger commercial vessels is still dependent upon what might appear technically to be outdated – telegraphic hand speed morse – needs some explanation. A typical foreign-going ship may transmit, on average only three or four short radiotelegrams per week. It has to carry, under regulation, a radio officer with morse qualifications, mainly because of the safety commitments. The equipment he uses can be much less comprehensive than that at the shore station and there is often insufficient traffic to justify the fitting of expensive radio telex terminal and control equipment aboard ship.

For these reasons there has developed, over the years, a certain professionalism in the handling of radio telegrams in morse. As Earl Mountbatten commented when he opened the new Niton radio station on the Isle of Wight: "I am glad to see morse still used . . ." It is a sentiment echoed by most people in maritime communications work.

A typical modern supertanker which needs to keep in touch with the shore at all times.

Mr P. Mitchell is head of group in External Telecommunications Executive with special responsibility for medium/short range services.

PO Telecommunications Journal, Spring 1978



Running a fleet...

In the fifth in our series on some of the many different jobs essential to the efficient operation of Post Office Telecommunications, Peter Gascoigne Midlands Regional Motor Transport Officer, outlines some of the aspects of his work.

WITH POST OFFICE Telecommunications now running a fleet of more than 50,000 motor vehicles, ranging from 6 cwt vans to giant 32 ton articulated lorries, and coping with widely varied and growing business demands amid ever-changing transport legislation, the job of the Regional Motor Transport Officer (RMTO) can never be dull.

The Midlands Telecommunications Region fleet, second only to LTR in size, comprises more than 6,000 vehicles, with models by every leading British manufacturer. A further 1,000 vehicles operated by Supplies Division and radio stations and Postal vehicles maintained on an agency basis, complete the fleet.

As RMTO it is my job to organise and control all aspects of maintenance for this fleet. Some of the vehicles have highly sophisticated equipment built into them or special Post Office designed bodies to meet particular operational needs. Between them they cover 42 million miles a year. And, of course, there is a responsibility for the maintenance of the 4,700 mechanical aids in use in the region. These range from two-inch water pumps to large tracklaying tractors.

In MTR there are 53 Motor Transport Workshops (MTW) spread across 7,900 square miles of the region. Most are purpose-built and attached to the Telecommunications Engineering Centres (TEC) from which the vehicles operate. Each MTW is equipped and staffed to cope with the normal maintenance requirements of its own fleet, while major accident work and overhaul of the more sophisticated mechanical aids is carried out in two central repair shops, each equipped with the latest machinery.

One of these repair shops specialises in major body repairs and makes special bodies for THQ, such as mobile exhibition units. The second specialises in overhaul, modification or repair of all types of mechanical aids. Every vehicle and mechanical aid has its own individual maintenance programme at its home workshop, based on mileage or, in the case of low mileage vehicles, on a time factor.

Basically the programme is aimed at preventive maintenance, designed to keep the fleet in a safe, reliable, efficient condition with a creditable appearance. Scheduled maintenance work takes up about two-thirds of the workshops' time, and the rest is spent on corrective repairs, modifications, accident work and the like.

Day-to-day control and administration of the organisation is exercised through a technical group which consists of two Assistant Regional Motor Transport Officers and seven Technical Assistants. Each has a key part to play in ensuring the smooth running of the operations.

Five of the TAs have field responsibilities. It is their role to oversee, control and co-ordinate the workshops and their resources, to liaise with the General Managers' staff and other users and, via the ARMTOs, keep me constantly in touch with the situation.

Regular meetings of the technical group are held to co-ordinate all sections, to discuss progress and common difficulties, establish objectives, and introduce Regional and national policies. In common with all managers today, financial expenditure control

Apprentice Chris Whyles and Motor Technician Mick Stilgoe discuss a front suspension unit they have removed from a 6 cwt van at Castle Bromwich with Mr Gascoigne (centre).

dominates decisions and objectives.

Among the many statistics produced for use in the financial control of the fleet, there is now a computerised costing system which gives the maintenance profile, including costs of all vehicles individually, on a quarterly basis, enabling the singling out and following up any high expenditure. It also provides comparative vehicle costs, age related costs, and so on.

A large proportion of the current account budget goes on buying spares, materials and fuel. Major items, such as fuel, oil, tyres and batteries, are controlled by Headquarters contracts, but it is my responsibility to negotiate the terms for the supply of a wide range of items to ensure that there is the right quantity of spares and materials, at the right time, of the right quality and at the best price that can be obtained.

Capital account expenditure can be divided into vehicle replacements and workshop major plant including such items as vehicle hoists, automatic vehicle washing machines and fuel installation equipment. All these items form an integral part of overall vehicle maintenance policy.

Although a book life is laid down as a guide, vehicles are replaced only when they ae considered to have reached the stage where they are no longer economically viable to maintain. During the last two years of its book life, each vehicle's condition is vetted periodically by the Workshop Supervisor and the Field TA before being included in the replacement programme being undertaken.

With a total staff of about 500, there is a considerable amount of personnel work, ranging from recruitment to retirement presentations. Training requirements, both on the job and at the Post Office MT Training College are considerable, due to the wide range of work skills covered, new technical development and the ever changing models of vehicles in service.

Driving instruction for the Region is a further responsibility. There is a team of nine instructors – all Ministry of Transport approved – who train staff to drive all types of vehicles in service, up to and including Heavy Goods Vehicle Class III.

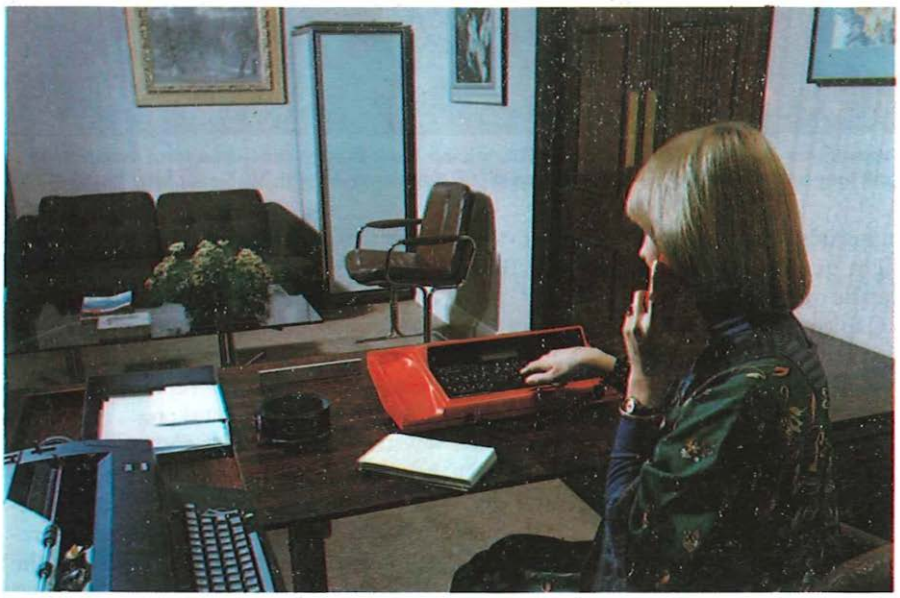
As head of a specialist Regional group, it is a fundamental part of my job to advise and liaise with all other Divisions in RHQ and Areas on motor transport matters, including the ever-changing vehicle operators' legislation. I, in turn, receive invaluable assistance and guidance from them on all aspects of our work.

The many facets of the RMTO's work lead to a job which is always full of interest, sometimes a little frustrating, never dull, but always fulfilling.

Reviewing the fleet at Leicester Telecommunications Workshop, Mr Gascoigne is accompanied by Workshop Supervisor Arthur Talbot and acting TA Charles Carnwell.

Big advance for small PABX

DF Griffiths



The CDSS1 central equipment unit is housed in a cabinet which may be sited either adjacent to or, as in this case, remote from the operator's console.

AS THE WORLD of commerce grows increasingly dependent on telecommunications in day-to-day business, it is inevitably ever more demanding in the range of features it expects to see offered. Nowhere is this more evident than in the field of the Private Automatic Branch Exchange (PABX), usually the focal point for telecommunications within any organisation.

Whatever the size – whether it be a small firm of solicitors with a single PABX simply connected to the public network, or a large multi-national corporation with a complex private network – the demands will be similar. It is only the scale which differs.

In recent years the business customer with a requirement of more than about 100 extensions has enjoyed the benefits of many improvements in the larger proprietary PABX field but until recently developments in smaller PABX equipment – for which the Post Office is solely responsible – have been less marked.

In an effort to remedy this the Post Office began a feasibility study which led to a design it later adopted as the basis for its new rental range PABX. Known as Customer Digital Switching System No. One (CDSS1), it fulfills the need for a modern, compact replacement for the existing Strowger based small PABXs. It uses Post Office technology which is among the most advanced of its kind in Europe and a target date was set for 1980.

But consider first the background in more detail. Customer requirements include a comprehensive range of extension facilities such as enquiry, transfer, call diversion and abbreviated dialling. Usually the customer has minimal accommodation and requires the equipment to blend-in with normal office type environments.

He also wants an attractive design for the operator's console – and asks for considerable flexibility coupled with ease of operation. Many of these demands can only be met economically by employing some of the most advanced switching system technology available.

The existing Strowger-based small PABXs and their corresponding extension capacities are the PABXs 5 and 6, serving up to 20 extensions, the PABX 1, serving up to 50 extensions, and the PABX 7, serving up to 100 extensions. The Post Office markets them on a rental basis and has full operational responsibility for all the 40,000 or so such systems which are now in service.

Features offered by the current rental systems are basic, and often a dedicated equipment room is needed to accommodate the switching equipment and ancillaries. Installation methods for the existing rental PABXs tend to be time consuming and demanding on labour, and the Post Office is often faced with the costly exercise of changing systems as the customer's requirements grow.

So it was obvious that something had to be done. After a study of available PABX systems and capabilities it was decided to conduct an in-house study on the problems and advantages of using Time Division Multiplex (TDM) switching with Stored Programme Control (SPC) for a small PABX

The design of CDSS1 which resulted was the product of a joint team of engineers in the Development and Research Departments of Telecommunications Headquarters (THQ). A production engineering contract was placed with Plessey Telecommunications Ltd and the General Electric Company Telecommunications Ltd, and the first pre-production trial systems are planned for early 1979.

CDSS1 is designed to serve up to 120 extensions with MF keyphones or ordinary dial phones. It will also carry 24 exchange lines and 16 auxiliaries such as tone receivers and inter-PBX circuits. The operator's console is discreet and compact, designed to match the projected new range of Post Office instruments, and offers speedy call handling in any kind of environment.

Both the operator's console and the central equipment unit (CEU) have been designed to be compatible with modern offices, and there is a dramatic reduction in the amount of space occupied compared with, say, the PABX 7 which has fewer extensions.

Central to the success of CDSS1 is the

use made of one of Europe's most advanced microelectronic chips, known as a single channel codec (coder/decoder), developed within the Post Office Research Department at Martlesham.

Because of their cost, present methods of converting analogue speech signals to digital form are commonly shared between 24 and 30 channels. The predicted lower cost of the new Large Scale Integrated (LSI) codec means that it can be used on only one channel and may therefore be used on individual lines connecting telephone customers to their local exchanges.

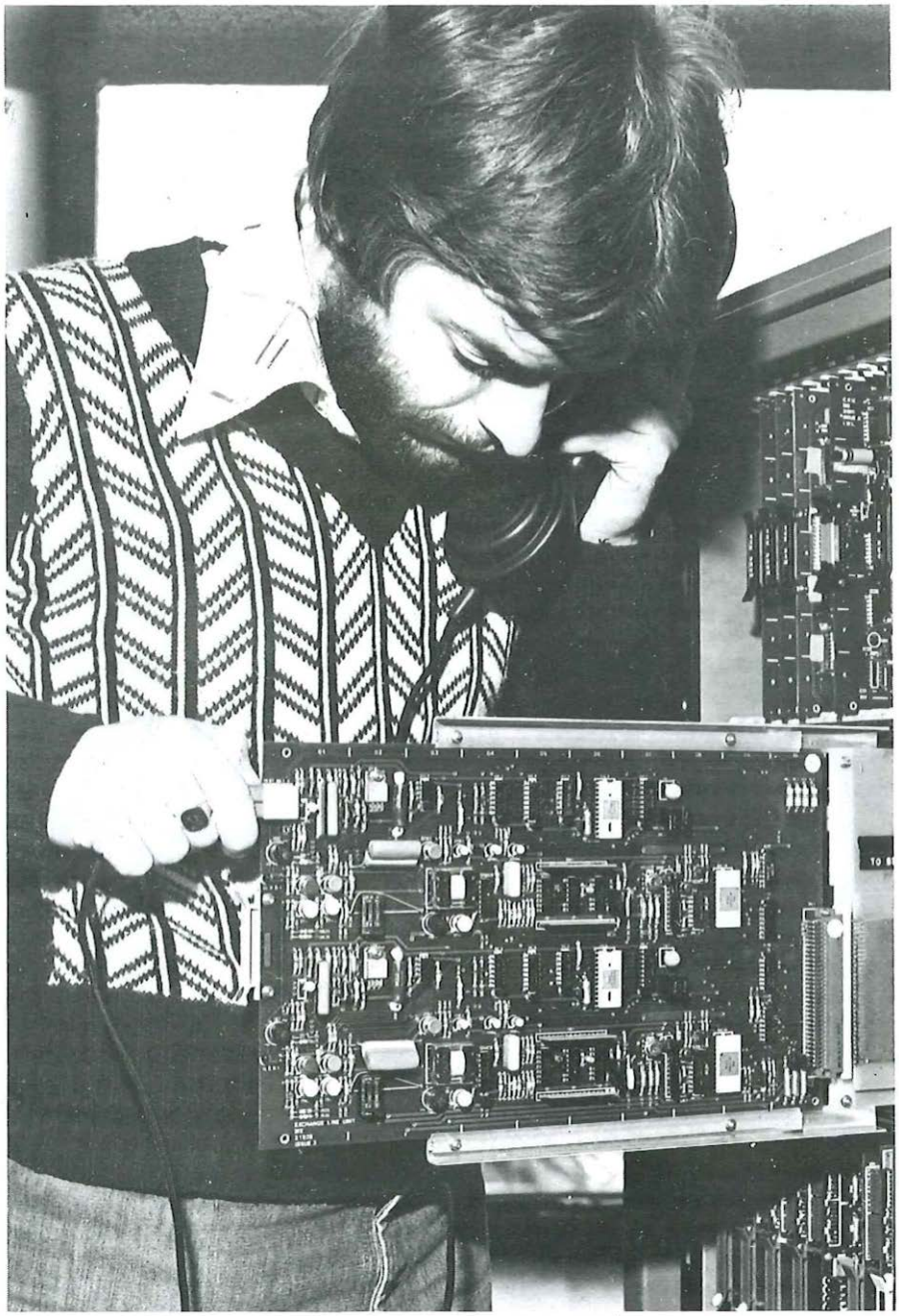
Its use on CDSS1 means that a single printed wiring board measuring about 200 mm (8 in) high and 320 mm (12.7 in) deep accommodates all the circuitry needed for four extension lines, including the four codec chips. Such a high extension packing density means that the line cards, switching and control equipment, power supply and common services for a full size system can all be housed in a single free-standing cabinet measuring about 1.6 m (5 ft) high by 0.6 m (2 ft) square – only slightly taller than a standard four-drawer filing cabinet.

The control shelf is at the top, the power shelf at the bottom and identical line unit shelves in between. The control and line unit shelves house printed wiring boards which are connected via high density connectors to wire-wrapped shelf backplanes at the rear.

Along with the Control Processing Unit (CPU) and memory the top shelf also houses the digital switch, signalling access, system clock, conference card and tone generation. The time switch itself is non-blocking and is realised on two printed wiring boards. An equivalent space switch using standard Post Office reed relays would measure over 6.5 m (21 ft) square.

Apart from the switch there are two further areas where use of fully digital techniques has resulted in dramatic space saving. One of these is in tone generation where a single printed wiring board provides up to 32 different tones pre-cadenced as necessary and the other is in the conference unit. Here a single printed wiring board can perform simultaneous conference calls for up to 32 parties.

Each of the five identical line unit shelves is designed to accommodate a maximum of 32 ports comprising six 4 port cards and four 2 port cards. Any inlet/outlet combination in CDSS1 having access to the switch is called a port. In configuring a particular customer installation the allocation of ports is fully flexible, which means that even the most unusual combinations of extensions, exchange lines and so on can be catered for.

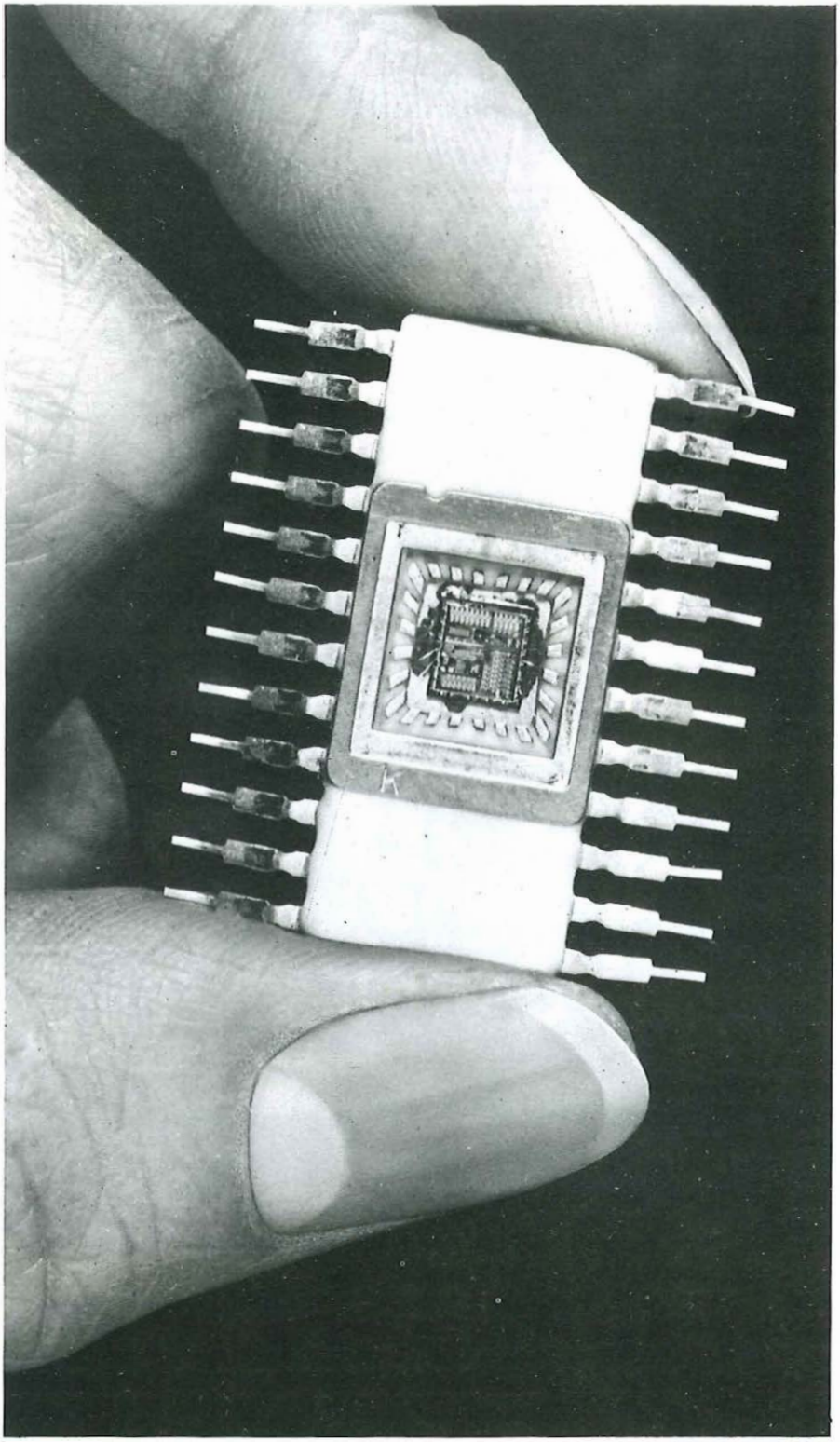


Dick Emery, a T2A, examining a printed wiring board in the CDSS1 central equipment unit.

A shelf would typically cater for 24 extensions, six exchange/inter-PBX lines and two auxiliaries (MF4 receivers etc). Growth of the system is thus modular and in a downwards direction from the control shelf. The addition of a new line unit shelf merely requires installation of the line card frame and associated cards, connection of the shelf wiring harness to the shelf above, connection to the cabinet power bus and plugging-in the appropriate distribution cables.

A crucial module in CDSS1 is the shelf multiplex card which appears at one end of each line unit shelf. It is here that the serial data streams from each of the 32 ports on a line shelf are multiplexed. They are converted into two serial data streams, one for speech and one for signalling. These data streams are then passed via the shelf wiring harness to the digital switch and signalling access cards on the control shelf. The system thus has the inherent and powerful capability of controlling signalling and speech connections entirely independently.

CDSS1 is powered direct from the mains and makes use of modern switching-mode principles to reduce size and optimise efficiency. Short term standby power will be available as a customer option. As far as the



The single channel codec, one of Europe's most advanced microelectronic chips and central to the success of CDSS1.

customer is concerned the front end is the operators console and great care has therefore been taken to design a unit which is not only pleasing in appearance but also versatile in performance.

Considerable improvements in reliability are achieved by replacing the normal mechanical keys by capacitive touch keys. The replacement of key tops by an overall plastic fingerplate reduces the usual spares problem and blends in with the attractive low profile design.

To optimise on flexibility without overloading the main CDSS1 processor, the operator's console incorporates its own microprocessor and associated programme memory. This flexibility means the console can be used to check out a faulty system to find in most cases down to card level – what failure has occurred. Thus when reporting a fault, advice can be given to the service engineer so that he can bring along the correct replacement card.

A further use for the console is in entering customer system data and extension service changes. This avoids the expense of a dedicated terminal for the purpose and allows the customers to make operational changes without contacting the Post Office.

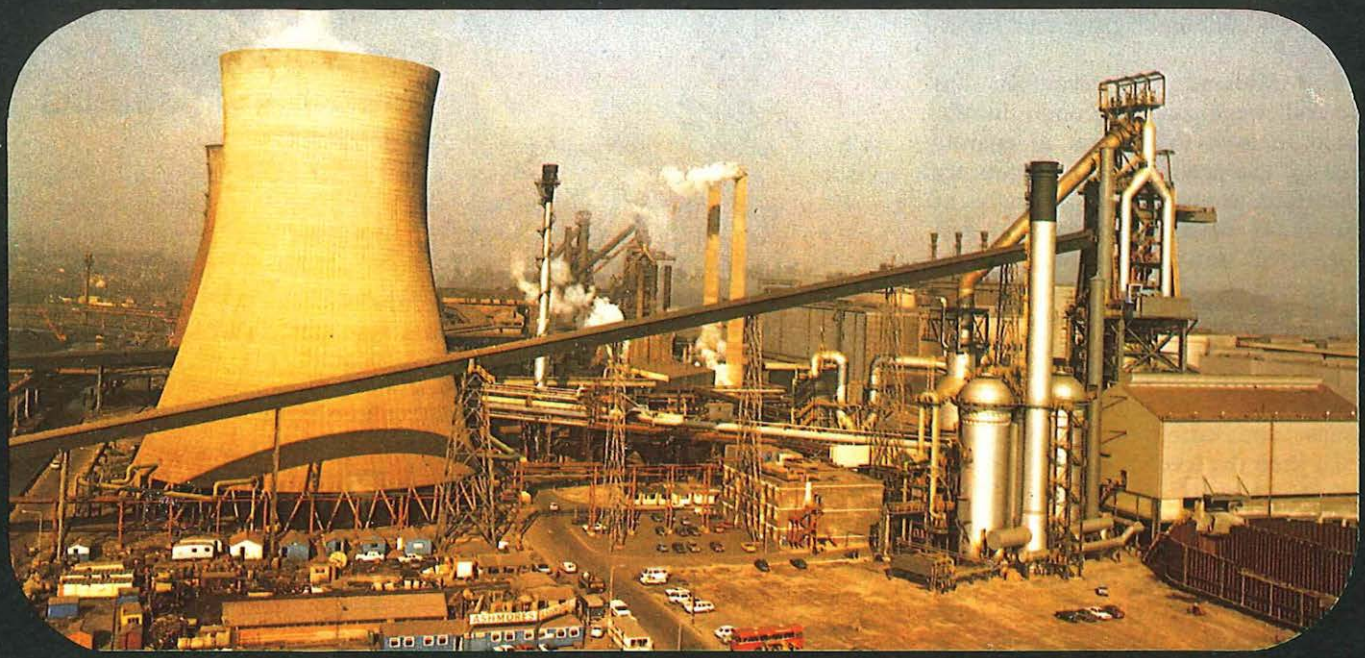
On-site maintenance of CDSS1 is normally restricted to finding and replacing a faulty card. A number of continuously run self-checking routines are built into the system to ensure, for example, continuity of speech and signalling paths. A faultsman's telephone may also be used. In the long term it would be possible to provide for fault diagnosis from a remote maintenance centre.

The provisioning procedure for CDSS1 can be managed by means of computer based records. Using this technique a customer's ordering requirement in terms of system size and facilities is entered into the computer where it is used to derive the necessary operational data. This includes such information as stock lists, installation charges and rental, initial customer data base and user instructions. The whole process can thus be automated to such an extent that the time between placing an order and delivery to site whould always bc kept to the minimum possible.

As with most new stored programme controlled PABXS, CDSS1 offers the customer a large range of facilities most of which need only software to implement. Two typical facilities available to extensions are "call-back" – which enables an extension calling an engaged extension to be rung and connected when the latter becomes free, and "call diversion" – which enables an extension to divert incoming calls to another extension.

The first customer trial was due to take place in late Spring and will be followed by pre-production trials around the end of the year. Much has been achieved but even more remains to be tackled if by the scheduled date of 1980 business customers are to see their demands being met in the small PABX field.

Mr D. F. Griffiths is Head of Group in Telecommunications Development Department and project leader for production engineering and CDSS1.



STRONGER LINKS FOR BRITISH STEEL

D Richardson & EH Ridgway

British Steel Corporation

LIKE THE Post Office and the Gas and Electricity Industries, the giant British Steel Corporation's (BSC) interests stretch to all parts of the United Kingdom. Created in 1950, the BSC today represents the fusing together of a multiplicity of large and small private companies and organisations with a very wide range of basic major products.

In recent years these have been grouped together, not geographically, but in often widely separated product divisions such as tubes, strip, plate, tinplate, stainless and chemical divisions as well as new administration centres, research laboratories and service bases.

The need for a comprehensive communications network was recognised some years ago when it became obvious that the various existing interworks circuits were inadequate for the giant new Corporation. Following a two year study by BSC the financial go-ahead was given to build a new network for both speech and data. The Corporation's planning group, based in Sheffield, began designing a suitable system and the Post Office was called in at the consultative and planning stages.

The result is the development of Corporation Telecommunications Network – known as COTEN for short – which now links more than 100 BSC sites by means of nearly 900 private circuits and carries high speed data between 10 computer installations throughout the country. When the data network and computer programme is fully operational it will be one of the most advanced in the world within an industrial organisation.

Simple economics was an important primary factor in deciding the justification for a private network for it could be clearly demonstrated that considerable savings could be made by routing the Corporation's 12,000 external calls a day away from the public switched telephone network on to private circuits. But just as important was the vital need for various computer locations, both existing and proposed, to be readily accessible to all users.

The final configuration for COTEN combined the speech and data facilities in the same supergroup trunk network. A supergroup consists of five groups each of which is capable of carrying 12 high quality speech circuits or one high speed data circuit.

In this network one group in each supergroup is reserved for high speed data (Datel 48k), and the other four are used for speech. The trunk network decided on consists of 10 supergroups linking eight terminals, all located at BSC's own premises. The locations were determined mainly by the heaviest concentration of works and offices and computer sites.

The speech network is based on six Private Circuit Automatic Tandem Exchanges (PCATXS) at Ravenscraig (Scotland), Teesside, Aldwarke (Rotherham), Port Talbot, Llanwern (Newport) and London, fully interconnected by the trunk network. High quality speech circuits radiate from the PCATXS to the various works and offices. Where subsidiary concentrations of works and offices exist remotely from a PCATX it has sometimes proved economical to route these cir-

cuits via additional groups or supergroups.

The Midlands, for example, has several large sites although insufficient in total to warrant a separate PCATX. The private speech circuits are therefore concentrated centrally at Bromford Works (Birmingham) and then "fed" to the Aldwarke PCATX by a supergroup. Other "feeder" groups or supergroups are at Clydebridge and Glasgow (both to Ravenscraig), Velindre (to Port Talbot), Stocksbridge and Workington (both to Aldwarke) and Bedford (to London).

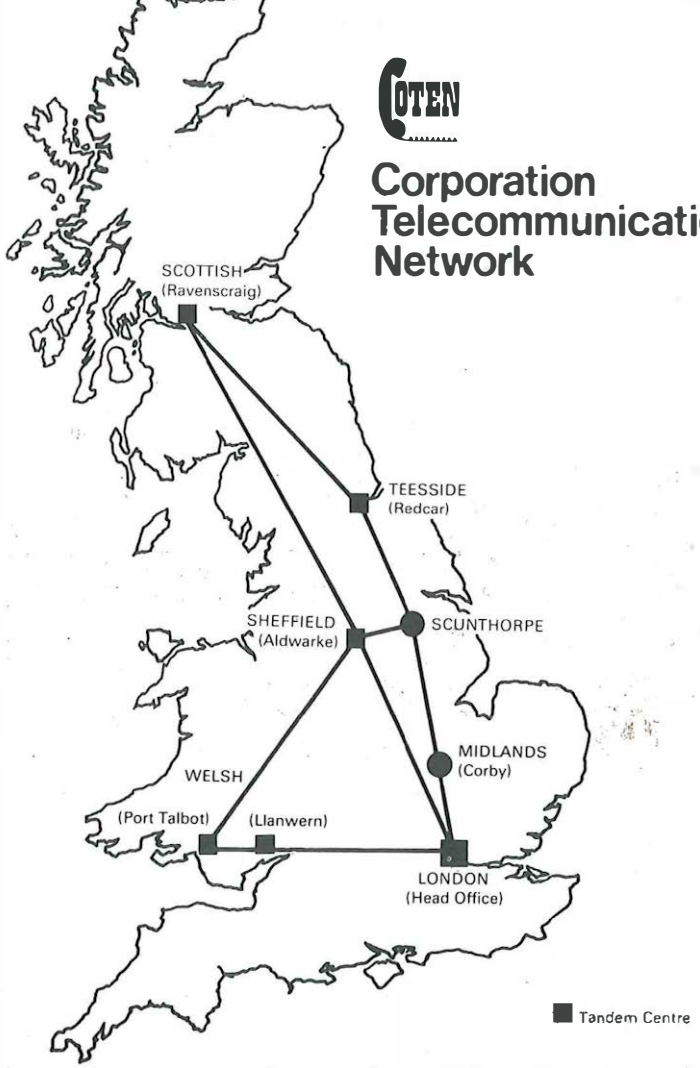
To keep the level of transmission up to the highest standards the Post Office has urged that no more than three circuits be connected in tandem on any call. It has, therefore, been necessary to provide direct links between each of the PCATXs through dedicated groups between any two PCATXs. The group between Teesside and Port Talbot, for example, is routed via the supergroups Teesside to Scunthorpe, Scunthorpe to Aldwarke and Aldwarke to Port Talbot.

All PBXs connected to the network are allocated a three-digit number. In addition the digit 7 is used throughout by PABX extension users to access the home PCATX. The first digit of the three routes the call to the terminal PCATX and the last two digits route the call within the terminal PCATX to the distant PBX.

The Corporation's ultimate goal is full desk-to-desk dialling, which is the only way for the full benefit of the network to be realised. But implementation of a fully automatic system, although proceeding, is having to be spread over a number of years. Currently about 30 per cent of the Corporation's 20,000 telephones are still manual.

With most of the planning done towards the end of 1975, the speech project was handed to North Eastern Telecommunications Region and from there to Sheffield Area who appointed a Project Manager and Project Engineer to see the job through. All other areas nominated staff in both Engineering and Marketing Divisions to have direct responsibility for their portion of the work. Regular monthly meetings were held between the BSC planning group, the Post Office and ITT who supplied and installed the PCATXs to monitor progress and thrash out problems as they arose.

The first stage of implementation was to bring into service the six PCATXs, 10 supergroups and some 700 private circuits. This huge installation



and testing programme spread over the country meant that routes became ready for service over a three month period. And because BSC wished to bring the major part of the network into service over a two week period a target date of 1 April 1977 was set for the whole.

In the event, only three circuits were not ready on time. BSC carried out a

Post Office Technical Officer Reg Walker checks test calls on the automatic tandem exchange at British Steel's Grosvenor Place offices in the heart of London

comprehensive training programme for their switchboard operators with supervisors from all the larger installations attending a two-day course at BSC's Training Centre near Sheffield. Post Office Telephone Service Representatives were on hand to help where necessary.

The second stage, the provision of the "feeder" widebands and associated equipment and circuits, went into service variously through November 1977 and so completed the basic original plan.

Inevitably with a large network, where planning takes place far in advance of final commissioning, traffic patterns change and there must finally be a period of rationalisation and adjustment of the number of circuits in the various routes. BSC have bought a number of Call Information Logging Equipments and are regularly monitoring traffic through the PCATXs and at their large PABXs. As a result, some work is already in hand to augment or contract many routes.

As already explained, for the data side of the project – which was controlled throughout by Telecommunications Headquarters – one group in each supergroup is dedicated to the transmission of high speed data. Supporting the main trunk network are a large number of Tariff T circuits to various remote data terminals and computers.

BSC is still building up and commissioning its computer program which controls order handling and administration, production planning and control. The network will provide a standard method of interfacing different computing equipments and ultimately make computers more readily and easily available to users throughout the corporation.

BSC have opted for a Packet Switching Technology similar in concept to the Post Office Experimental Packet Switched System (EPSS), now in operation. This technology gives a very high line utilisation rate and the network configuration is such that at least two circuits come into each centre providing alternative routes between all the major terminals, so largely catering for circuit failure or congestion.

The Post Office maintains the whole network with the exception of the computer terminal equipment. To keep up high service standards a Fault Reference Centre has been set up in Sheffield which monitors fault records and thereby detects any "danger signals". It also gives full assistance and provides the necessary expertise whenever and wherever needed. BSC has also introduced its own routine for monitoring the network. Using Card Callmakers and Speakersets, weekly routines are carried out from terminals to set up calls over every circuit which are then checked for return of the correct tone.

But good though BSC's communications system is, there is still plenty of room for expansion and development and the Corporation is already investigating the practicability of providing other widebands and circuits to serve more sites. In the immediate future is the probability of using the network for teleconferencing and facsimile, while farther off is the possibility of conversion to a fast-switching common control network.

COTEN, it seems, could well be just the beginning . . .

Mr D.Richardson is Senior Sales Superintendent in Sheffield Telephone Area and was Project Manager for most of the two-year period in which COTEN was set up.

Mr E.H.Ridgway is an Executive Engineer, who was Project Engineer during the same period.

PO Telecommunications Journal, Spring 1978

COTEN operators at BSC's Grosvenor Place offices are kept busy with incoming calls and helping smooth out any difficulties.

Q.8 ARE THERE ANY OTHER CHANGES, OR ADDITIONS, THAT YOU WOULD LIKE TO SEE IN POTJ?

THE FOLLOWING DETAILS WILL HELP GREATLY IN OUR ANALYSIS.
THEY WILL REMAIN CONFIDENTIAL AND WILL BE USED FOR STATISTICAL PURPOSES ONLY. WE DO NOT ASK FOR YOUR NAME.

Q.9 DO YOU WORK FOR THE POST OFFICE? YES ☐ NO ☐

IF POST OFFICE -

A) WHAT IS YOUR DEPARTMENT DIVISION? OR REGION AREA?

.....

B) WHAT IS YOUR DUTY REFERENCE? .....

C) WHAT IS YOUR GRADE? .....

IF COMPANY -

A) WHAT IS YOUR COMPANY'S NAME? .....

YOUR DEPARTMENT? .....

B) WHAT IS YOUR POSITION WITHIN THE COMPANY?

.....

C) WHAT ARE THE MAIN MANUFACTURING TRADING ACTIVITIES OF YOUR COMPANY?.....

WE ASK ALL SUBSCRIBERS TO COMPLETE THE FOLLOWING QUESTIONS

Q.10 DOES YOUR WORK INVOLVE USING COMPUTERS? YES ☐ NO ☐

Q.11 IN THE COURSE OF YOUR WORK DO YOU INFLUENCE OR DETERMINE THE PURCHASE OF - A) EQUIPMENT B) MATERIALS OR C) SERVICES?

	YES	NO
A) EQUIPMENT	☐	☐
B) MATERIALS	☐	☐
C) SERVICES	☐	☐

TEAR HERE

FOR OFFICE USE ONLY

(11)
(12)
(13)
(14)
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(16)
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Post Office telecommunications journal **Readership Survey**

THIS QUESTIONNAIRE IS CONFIDENTIAL AND ANSWERS WILL BE USED FOR STATISTICAL PURPOSES ONLY

POST OFFICE TELECOMMUNICATIONS JOURNAL

So that we may learn more about our readership and opinions of POST OFFICE TELECOMMUNICATIONS JOURNAL, we would like you to complete this short questionnaire. Please return it to us by folding as shown (overleaf) and either posting directly to us, or if you are employed by the Post Office, by returning it, where possible, through the internal mail system.

Please give your answers by placing a ✓ in the appropriate box or by writing your answer in the space provided.

FOR OFFICE USE ONLY

If you are not the original recipient of this issue of POTJ please tick here - ☐ (01)

Q.1 Are you a regular reader of POTJ - say about 3 out of every 4 issues? (02)

- YES ☐
- NO ☐

Q.2 How many other people, on average, see your copy of POTJ? (03)

- NONE ☐
- ONE ☐
- TWO ☐
- THREE ☐
- FOUR ☐
- FIVE OR MORE ☐

Q.3 Generally do you read - (04)

- ALL OF POTJ ☐
- MOST OF POTJ ☐
- ONLY ITEMS WHICH PARTICULARLY INTEREST YOU ☐

Q.4 Do you keep POTJ as a source of reference If so for how long (05)

- DON'T KEEP POTJ ☐
- UP TO 3 MONTHS ☐
- UP TO 6 MONTHS ☐
- OVER 6 MONTHS ☐

Q.5 Why do you read POTJ?

FOR OFFICE USE ONLY (06)

- A) To learn about Developments ☐
- B) To learn about New Products ☐
- C) To learn about Management Techniques & Services ☐
- D) For specific information on: ☐
  - Switching & Transmission
  - Services
  - Computer Applications
  - Other (specific Please indicate)

_____

E) Other (general) - (please indicate)

_____

_____

Q.6 Do you think that in its present form POTJ represents - (07)

- Poor value for money ☐
- Fair value for money ☐
- Good value for money ☐

Q.7 Some modifications to POTJ have been suggested. What is your opinion of each of the following?

	Favour -able	Accept -able	Unfavour -able	
A) Increase to 6 issues per year.	☐	☐	☐	(08)
B) A wider coverage of Telecomms outside the Post Office.	☐	☐	☐	(09)
C) More short news features spread throughout each issue.	☐	☐	☐	(10)

MISCELLANY

System X unveiled

The Post Office intends to have its first System X exchanges in operation before the end of 1981, some months earlier than expected, it was revealed at the "Communications 78" exhibition when an outline of the system was given by the Post Office and Britain's three major equipment suppliers – the General Electric Company Ltd., Plessey Telecommunications Ltd., and Standard Telephones and Cables Ltd.

The System X family of electronic exchanges is part of a new generation of technically-advanced equipment which will carry the Post Office telecommunications system into the 21st century. The largest single telecommunications development project ever undertaken in Britain, System X makes the most effective and economic use of up-to-the-minute technologies and techniques.

Orders for digital trunk, junction and small exchanges will be placed before the end of this year, and a new Integrated Systems Development Department (ISDD) has been set up by the Post Office to accelerate the development of System X.

The system is a joint development between the Post Office and Britain's major equipment suppliers. More than 600 engineers are working on the project, and the overall development programme is expected to amount to some £150 million.

Chip advance

One of Europe's most advanced microelectronic "chips" – used to convert analogue speech signals to digital form on a single telephone line – has been developed at the Post Office's Research Department. Known as a single-channel codec (coder/decoder) and with promise of low cost in commercial production, it is likely to have a major impact on the development of future local electronic telephone exchanges.

Present methods of digital-analogue conversion to and from pulse-code modulation (PCM,) need to be shared between 24 or 30 channels because of their cost. The predicted lower cost of the new codec allows it to be used on only one.

This means it is most likely to be applied to the individual lines linking telephone customers to their local exchanges, so paving the way for digital switching in local exchanges, with its prospects for economy and flexibility.

Testing with MAC

A £10 million system of 61 Maintenance and Analysis Centres (MACs) is being introduced by the Post Office by the early 1980s to reduce telephone faults. (See Telecommunications Journal, Winter 1976–77).

With a mini-computer which is its "brain", the task of each MAC will be to send test phone calls – at a rate of about 20 per minute spread over all the exchanges in its locality – throughout Britain's telephone network, and keep a record of what happens to them.

If they do not get through because of a fault, the MAC can trace the location and immediately alert engineers to put things right. Test calls will be made to specially allocated numbers on exchanges in the UK with more than 1,000 lines – some 3,000 in all.

Transatlantic packet

International Packet Switching Service (IPSS) – the first international public packet-switched data service outside North America – is planned to start on 1 July between the UK and the USA. Announcing the service, Mr Peter Benton, the Post Office's managing director, Telecommunications, said that once the service had been established the Post Office would seek to provide similar services to other countries.

Cable to Spain

The largest undersea telecommunications cable from the United Kingdom – capable of carrying more than 4,000 phone calls at once – has been ordered by the Post Office and the National Telephone Company of Spain, (CTNE) to go into service by the summer of 1980.

The contract for the cable – worth £18 million – has gone to Standard Telephones and Cables Ltd, with the costs for the system being shared by the Post Office and CTNE.

Running 423 nautical miles from Lands End to Rodiles, the system will carry phone, telex and other communications between the two countries and provide the UK with better links to other Mediterranean lands, particularly Italy.

More work in Libya

A £4 million major telecommunications consultancy project in Libya has been won by the Post Office, and brings to nearly £11½ million the value of contracts it has been awarded by Libyan telecommunications interests in two years.

Post Office experts will assist the National Telecommunications Company of Libya to construct a number of telephone open-wire carrier routes which enable up to 12 calls to be transmitted simultaneously over a single pair of overhead wires.

The project involves constructing 1,400 km of carrier routes to serve outlying communities of major towns along Libya's northern coast. Work started in March and is due for completion by the end of next year.

Better space links

Britain's telephone users will benefit from the launch earlier this year of a new high-capacity communications satellite which will give the UK improved telephone, data-transmission and telex links to 43 countries in the Indian Ocean region – from the Middle East to Australia and

One of the team helping build the Post Office's new earth station at Madley, Herefordshire, works on the first aerial which could become operational later this year. It is hoped to carry an article on the new station in the Summer issue of the Journal.

from Korea to countries like Zambia.

Costing, with its launching services, some £25 million, the Intelsat IVA satellite, with a capacity of 6,000 simultaneous telephone conversations plus TV links, is due to come into service in mid-1978.

Launched from Cape Canaveral, Florida, the new satellite will serve Britain through the Post Office's earth station at Goonhilly in Cornwall.

City phone aid

Dealer boards, which provide brokers with rapid, push-button access to large numbers of phone lines and enable "hot line" private circuits linking directly with bankers and dealers to be connected all to the same desk, have been specially developed by the Post Office. So successful is the equipment that it has already pulled in about £2 million worth of orders (See Telecommunications Journal, Winter 1976-77).

IDD to Paradise

The island paradise of Turks and Caicos in the Caribbean, where there are just 741 phones, has become the 76th country available to telephone users in Britain by International Direct Dialling (IDD). Kenya, the first East African country to get IDD for its 131,000 phones, and West Malaysia, with its key role in the supply of natural rubber, and a total of 250,000 phones, are other recent additions. Four out of every five telephone customers in Britain now have IDD, giving them direct links with some 360 million phones around the world.

Autotelex boost

Britain's autotelex links with France's Pacific Ocean island, New Caledonia, have gone automatic, as have those with the West African island nation, the Cape Verde Republic. This brings to 111 the number of countries which Britain's 65,000 telex users can contact direct.

LACES at Gatwick

Gatwick Airport is to be linked with the London Airport Cargo Electronic-data processing Scheme – LACES – used by 200 separate organisations involved in handling cargo landed at Heathrow for cutting clearance time for imports to a matter of hours. Operated by the Post Office's National Data Processing Service, LACES should be in use at Gatwick by the autumn of this year.

Communications 78

A display outlining the philosophy and main arrangements of System X – the all-British electronic exchange system that will revolutionise the UK's telephone system – occupied the central position on the Post Office Telecommunications stand at the "Communications 78" exhibition in Birmingham in April.

Other important developments on show included Prestel; Confravision – the conference-by-TV service; Orator – the conference by phone service; Radiopaging; Radiophone; Call-Connect System CDSS – the all digital PABX system now being developed for small-to-medium businesses; Call-Connect System EMI – a new semi-automatic PMBX system using a cordless switchboard and offering optional direct outward dialling from selected extensions; PATBX – the private automatic telegraph branch exchange which connects teleprinter calls; X-Press Callmaker – the push-button telephone with a built-in memory; and Viewphone – the phone of the future enabling users to see each other.

A record 15,255 people visited the exhibition, representing more than 40 countries throughout the world.

Mr. Peter Benton, managing director, Post Office Telecommunications, visits a classroom after opening the Post Office Motor Transport School's new home – a £1 million complex forming part of the Corporation's Technical Training College at Stone, Staffordshire.

With a staff of 40, and housing up to 150 students, the school provides training in more than a dozen different aspects of workshop practice for maintenance and repair of the Post Office's fleet of more than 75,000 motor vehicles. It also trains heavy goods vehicle drivers and driving instructors.

Beyond EPSS

A number of UK firms have been invited by the Post Office to provide information about the packet-switching equipment they could supply for a future packet-switching data-transmission service in the United Kingdom.

Possibilities for a public service are now being considered by the Post Office to follow its Experimental Packet-Switched Service (EPSS) which is due to run for about two years. The service would be based on CCITT recommendations already adopted or proposed on the international standards for such services.

Contracts

Plessey Telecommunications Ltd – £4.28 million for two 10,000 line non-director TXE4 exchanges at Bishop Auckland and Langley; a new TXK1 (Crossbar) exchange at Tiverton, comprising 5,500 lines plus STD; and orders for TXE2 exchange equipment at 12 sites in the UK.

GEC Computers Ltd – £3 million for 52 GEC 2050 processors and associated equipment for use in Measurement and Analysis Centres (MACs) to provide the Post Office with information on the in-service performance of exchange switching plant and the public telephone network.

Emergency advice

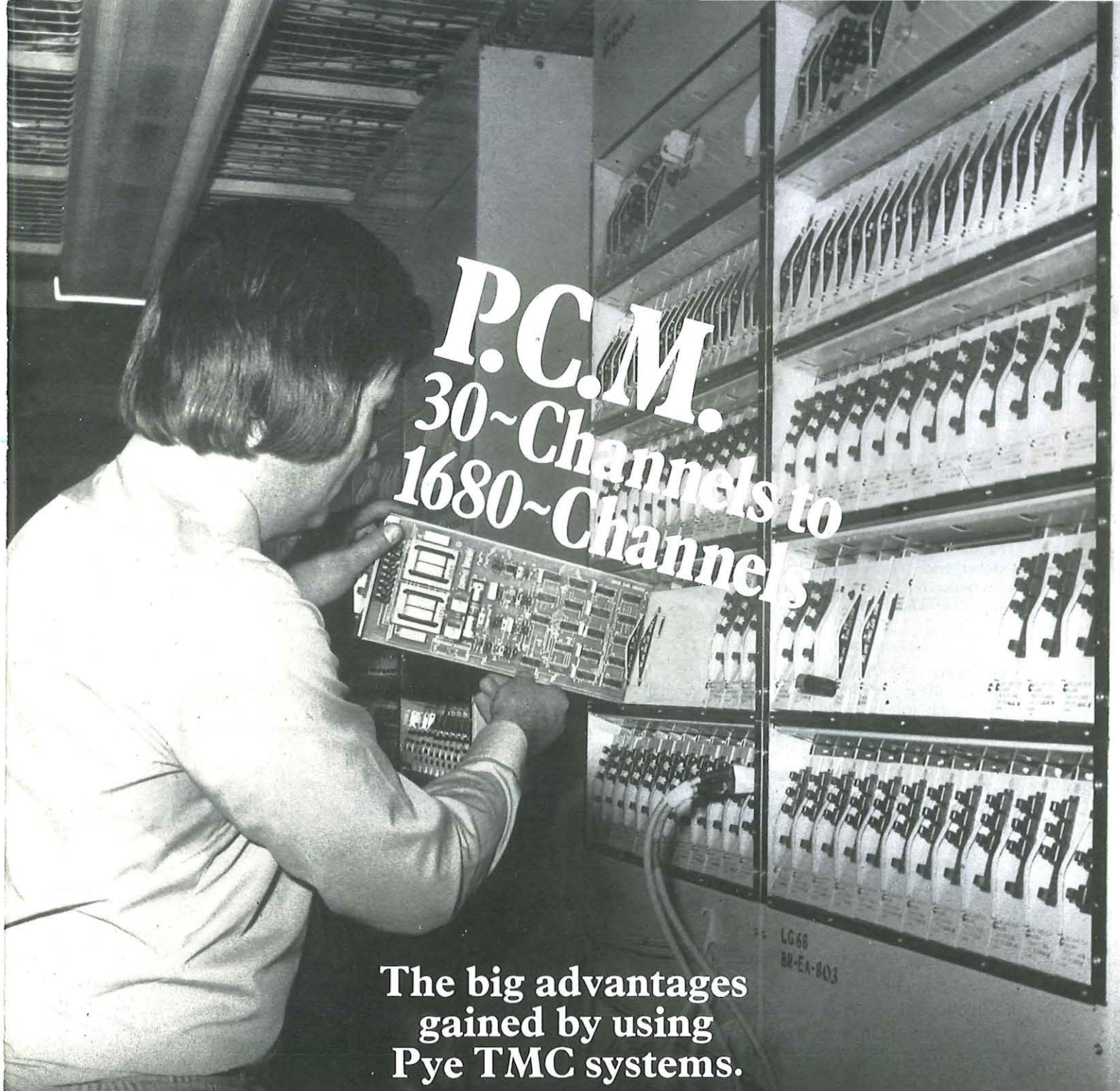
Worried friends and relatives of people involved in a major disaster can now get information quicker through a new Post Office system.

By asking his local operator or directory enquiries a caller can find the phone number of the appropriate police enquiry bureau which will give information on casualties. The service will help people who miss TV and radio announcements.

Voices in orbit

Satellites orbiting 22,300 miles above the Earth are being used by the Post Office to enable telephone customers throughout Britain to keep in touch on demand – at any time of day or night – with more than 100 vessels in the Atlantic and Pacific Oceans.

The new service uses the US maritime satellite system known as Marisat, which has two satellites – one over each of the oceans. Calls are less liable to fading and distortion, being unaffected by adverse atmospheric conditions.



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The picture shows Pye TMC 30-Channel equipment in a British Post Office telephone exchange.

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Correspondence:
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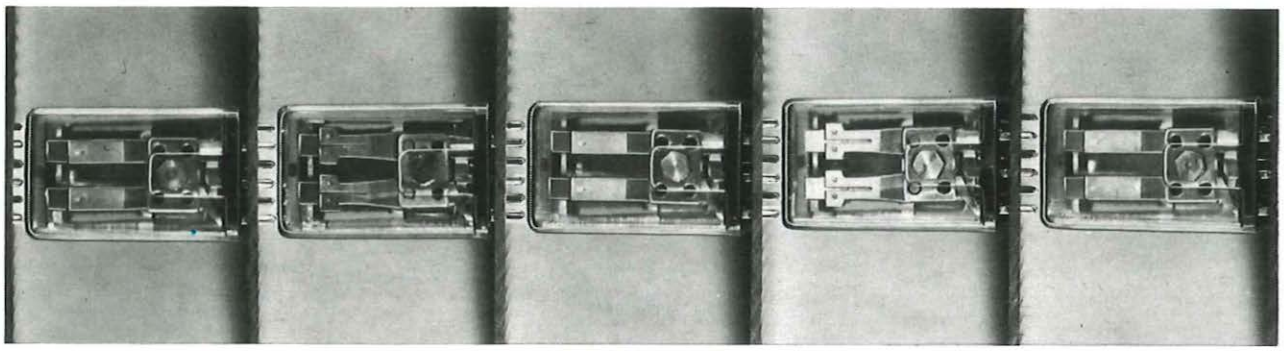
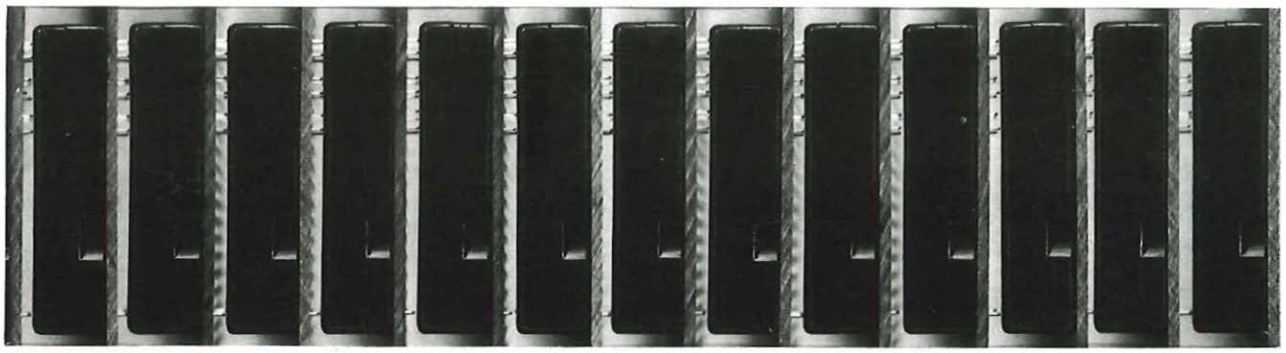


From ITT Components-a narrowed down approach to cradle relays.



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