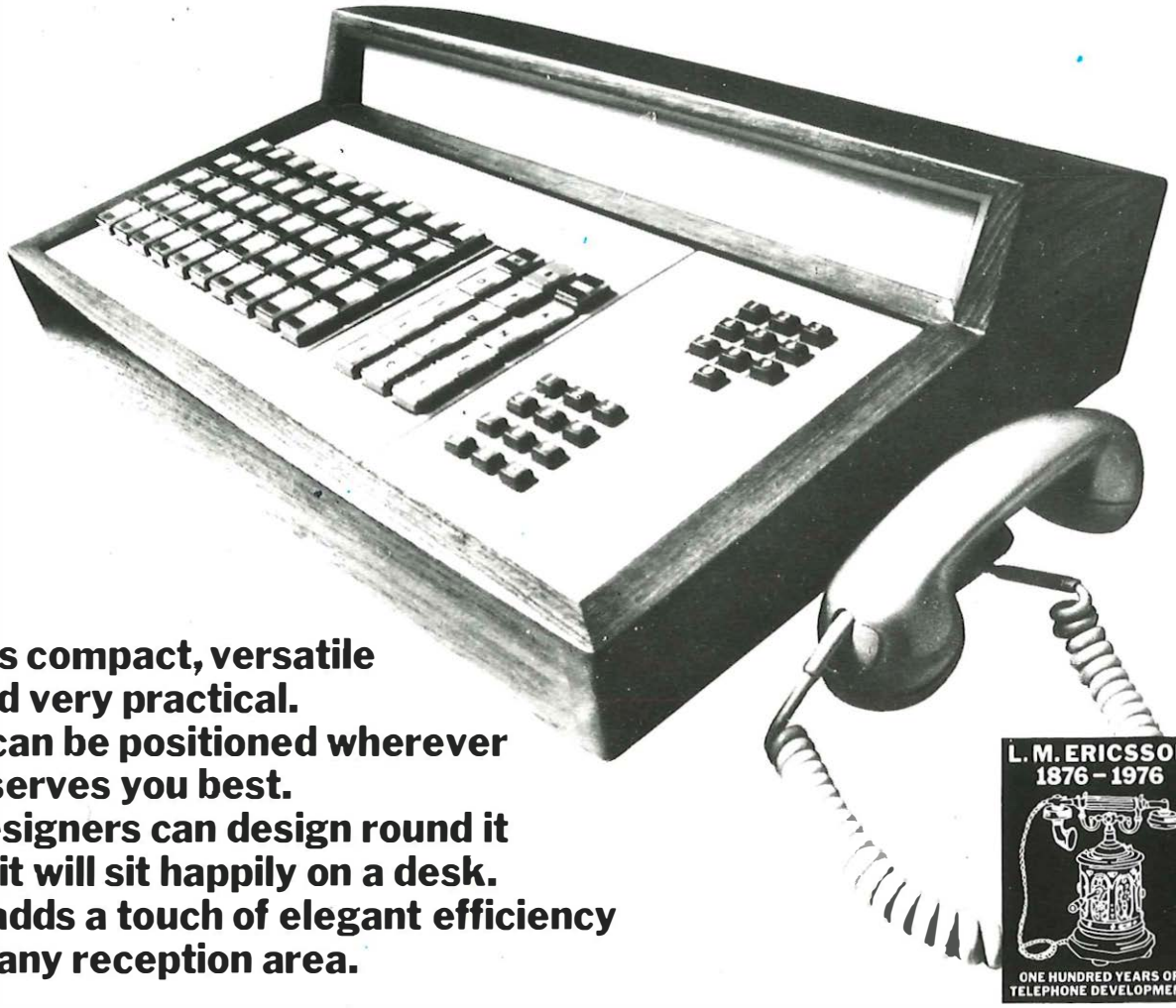
Post Office telecommunications journal

Winter 1977/78 Vol. 29 No. 4 Price 18p

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



It is compact, versatile and very practical.
It can be positioned wherever it serves you best.
Designers can design round it or it will sit happily on a desk.
It adds a touch of elegant efficiency to any reception area.

It is completely automatic and gives the operator finger-tip control of the superb ARD 562 PABX.
This exchange can be equipped with as little as 10 PO lines and 60 extensions and can be extended up to 100 PO lines and 540 extensions and from the moment it is installed you begin to save money.

You save on floor space

Compact as well as flexible, the ARD 562 needs less space for equipment and the addition of more exchange lines extensions or facilities can be simply a matter of jacking in pre-wired relay sets.

You save on STD time

Swift dependable service cuts down waiting time while 'Barred' extensions can prevent expensive unauthorised trunk calls (take a look at your phone bill).

You save on operator's time

Designed to deliver maximum efficiency with minimum effort this PABX will often allow operators to have time for other duties. Your operators work faster and stay happier.

Start to save money now

The Thorn Ericsson ARD 562 (or its smaller version ARD 561) is available on leasing, rental or outright purchase. Let Thorn Ericsson take a good look at your special telecommunications requirements – it won't cost you a penny. Write, ring or clip this coupon for all the information you need for the next move. Act now.

THORN ERICSSON

THORN

PABX Division
Thorn Ericsson
Telecommunications (Sales) Ltd
Viking House, Foundry Lane
Horsham, Sussex
Telephone Horsham 64166

SAVE TIME. Clip this coupon to your letterhead and send to PABX Division, Thorn Ericsson, FREEPOST, Horsham, Sussex
No need for stamp

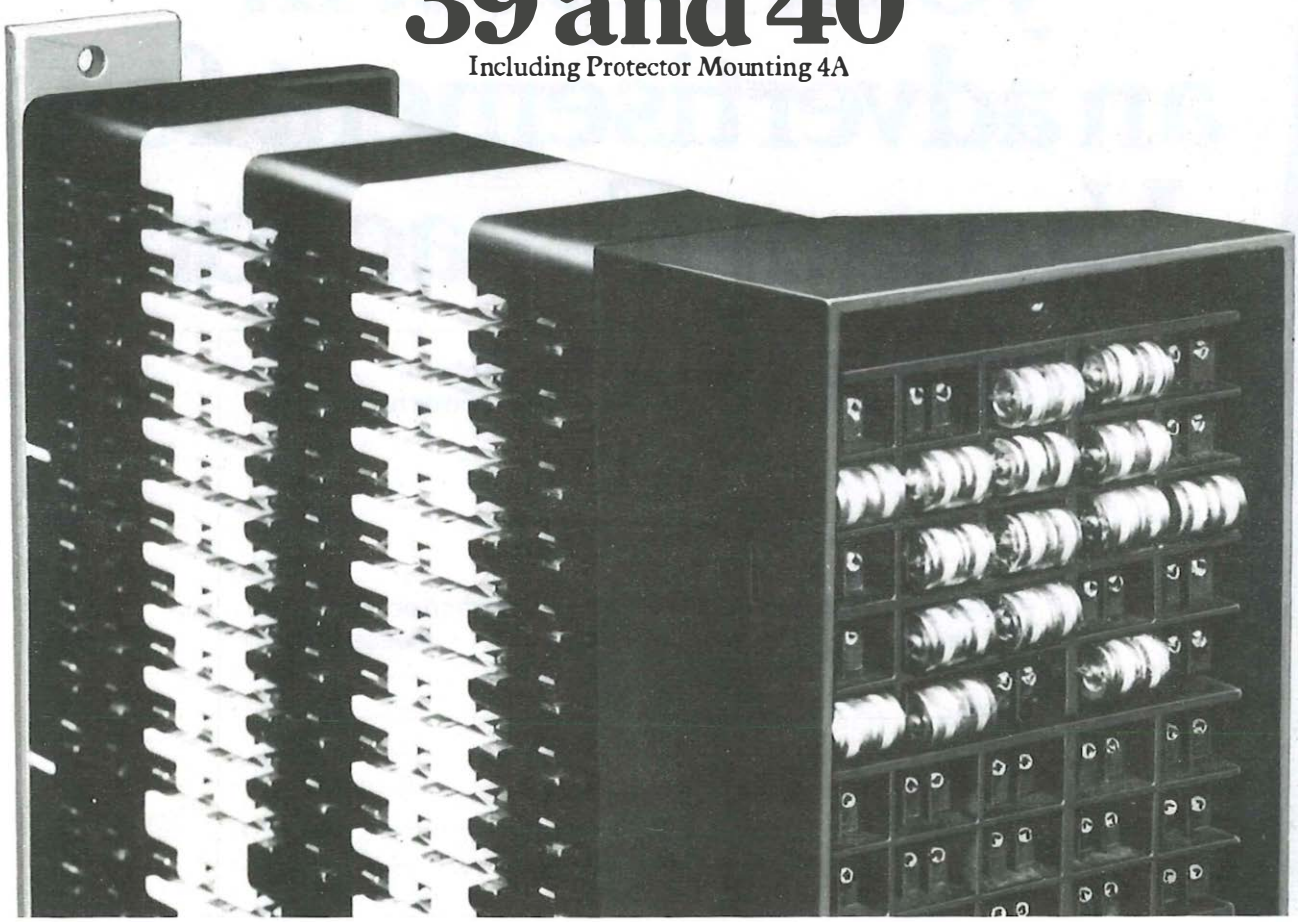
Name _____

Please send details of ARD 562 and other PABX's ☐

Please send a Technical Adviser (by appointment) ☐

Test Jacks 39 and 40

Including Protector Mounting 4A



*Main Distribution Frame**

100 pair termination units for lineside and exchange side with socket access for plug-in 3 electrode Gas Discharge Tubes to protect each line terminated against electrical surges.
In Test Jacks 39 & 40 the Protector Mounting 4A socket unit is fully wired to the line tags.

Protector Mounting 4A unit can be supplied separately for retrospective fitting to Test Jacks 37 & 38 or for alternative protection application. Test Jacks 37 & 38 . . . 100 pair MDF termination units without Protector Mounting 4A.

**Data Sheets available on request.*

Birkbys Plastics
a member of the **PLESSEY GROUP**

Birkbys Plastics Limited
PO Box 2 Liversedge
West Yorkshire, United Kingdom WF15 6QH
Tel: (0924) 403721 Telex: 55332

Manufactured under licence from the British Post Office.

NAME _____

TITLE _____

ADDRESS _____

_____

_____

Please send me further details of the range of Test Jacks.

Birkbys Plastics Limited, PO Box 2 Liversedge
West Yorkshire, United Kingdom WF15 6QH

150 P009

SIEMENS

The new compact test controller–for maximum economy of space and cost.

Siemens experience with automatic testing systems has led to the replacement of the conventional mini-computer by the new S2313 compact test controller, specially designed for the control of communications test equipment.

Just some of its unique features include IEC Bus to interface with programmable transmission test equipment, high level languages to make programming simple and quick, special test function keys for simplified control of the system, six line plasma display and integral floppy disk and printer.

Portable key pad suitable for remote operation.

These, plus many other innovations, add up to a unique cost effective system.

For full details write to: Siemens Limited, Siemens House, Windmill Road, Sunbury-on-Thames, Middlesex, TW16 7HS.

Telephone: Sunbury on Thames (09327) 85691, Telex 8951091.

In the world of communications Siemens has the answer.

Communications 78

Communications Equipment and Systems

National Exhibition Centre, Birmingham, England.
Tuesday 4-Friday 7 April 1978

You are invited to Communications 78

Communications 78 is the world's leading exposition for selling communications equipment and systems, providing an international focal point for the latest technological advances in the fields of PTT telecommunications, fixed and mobile radio communications and defence communications.

Active backing

Trebled in size since the last event in 1976, Communications 78 is being supported by more than 200 international exhibitors and has the active backing of the International Telecommunication Union (ITU), representing the interests of 153 governments; the British government through the Ministry of Defence, the Home Office and the British Overseas Trade Board; Post Office Telecommunications; the Electronic Engineering Association (EEA) and the Telecommunication Engineering and Manufacturing Association (TEMA).

Integral conference

The integral conference is being organised by The Institution of Electrical Engineers (IEE) in association with the Institution of Electronic and Radio Engineers (IERE), the UKRI section of the Institute of Electrical and Electronics Engineers (IEEE) and the IEEE Communications Society.

Communications 78 is being held for the first time at the National Exhibition Centre, Birmingham – the UK's premier exhibition complex – from Tuesday 4 April to Friday 7 April 1978. The exhibition will be open daily from 09.30 - 18.00 hrs. (17.00 hrs. on last day).

Admission to the exhibition is free to bona fide users and specifiers of communications equipment and systems. The coupon below may be presented as an admission ticket to Communications 78 or, if you require more detailed information, please complete and send it to: Tony Davies Communications, c/o Industrial and Trade Fairs Ltd., Radcliffe House, Blenheim Court, Solihull, West Midlands B91 2BG, England.

Please send me details of

the exposition ☐
the conference ☐

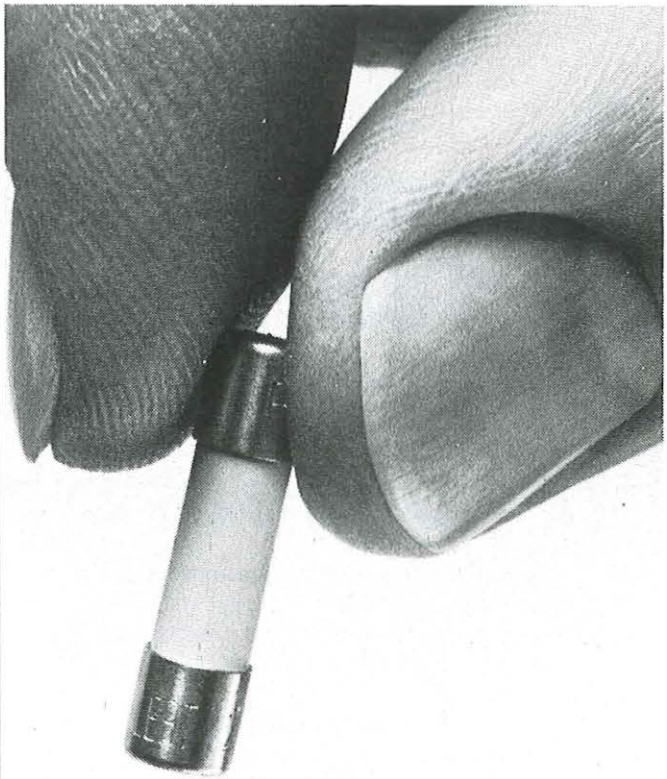
Name _____

Position _____

Company _____

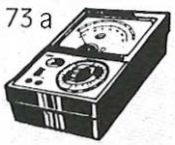
Address _____

35



Overload the Avometer 73 and it'll cost you this much to repair it.

If you accidentally connect the mains to this multimeter on any range for up to 10 seconds, it'll only cost you the price of a new fuse to repair it. Better than buying a new instrument. Better than the safety hazard of conventional fuse protection without the AVO fail-safe circuit. This improved overload protection is just one of the features which makes the Avometer Model 73 a must for electrical and electronics maintenance work of all descriptions.



Other features include: ■ Sensitivity of 20,000Ω/VDC ■ AC current included in a useful set of ranges ■ Tough, resilient case ■ Remarkably low cost.

Get in touch with us today for further details and order from your wholesaler or AVO Distributor.

Avo Limited,
Archcliffe Road, Dover, Kent, CT17 9EN.
Telephone: (0304) 202620.
Thorn Measurement and Components Division

If you want your connectors to have a good innings specify Ferranti.

Ferranti circuit board edge connectors are known for their staying power. They're designed for a far higher number of insertions and withdrawals than you're likely to make. They need to be, so that you can rely on them throughout their working life.

You'll like our other design features too. Low force spring contacts. Gold flash or full gold plating on the contacts as you wish. Terminals for wire wrapping or soldering. Many options; pitches of .100" (2.54mm)–modular connector, .150" (3.81mm), .156" (3.96mm) and .200" (5.08mm).

Contact: Connector Sales, Ferranti Limited, Professional Components Department, Dunsinane Avenue, Dundee DD2 3PN, Scotland.
Telephone: 0382 89321 Telex: 76166
Distributors: Giltech Components Ltd., 22 Portman Road, Battle Farm Industrial Estate, Reading, Berks RG3 1ES
Telephone: 0734 582131

FERRANTI
Connector Capability

Andrew Gill has never heard of TCL. He leaves that to you.

Andrew Gill is a little too young to have heard of TCL – or, for that matter, Telephone Cables. Fact is, even when he can successfully communicate by telephone with whoever he needs to, he doesn't need to know us.

Your knowledge of TCL is, however, far more important and in this respect it's really a question of not who we are but just how much you know of our service.

Besides being one of the world's biggest telephone cable-makers, we provide a comprehensive cable network planning and design department, maintain a large cable installation division with an experienced staff of engineers, surveyors, jointers and testers, and a permanent training school where qualified teachers instruct both TCL apprentices and customers' own staff in the latest methods of jointing and installation.

Not a bad profile for a company that is so little known to so many of its end-users.

TCL

the sure way of saying telephone cables

Telephone Cables Ltd., Dagenham, England. Tel: 01-592 6611. Cables: Drycore, Dagenham. Telex: 896216.

The age of the customer

Sir William Barlow, the Post Office's new Chairman, has wasted no time in setting out his priorities with regard to the Telecommunications Business and, indeed, the Corporation as a whole. During a series of visits around the Regions to meet staff, Sir William has spoken of the dawning of a new age – the age of the customer.

"I have been impressed with the experience, expertise, technical professionalism and loyalty of the majority of employees," he has said. "I now want to see that harnessed to improve our service to customers. That is crucial. The keys to commercial success are expansion, good service and aggressive marketing. This provides the firmest possible base for keeping prices down and securing customer confidence."

The Chairman has emphasised the importance of bringing a new spirit of caring and helpfulness in all relationships with customers, and of avoiding complacency and self satisfaction. "Whether we like it or not there is a gap between what we think about the organisation and what the customer thinks about us. Whether we like it or not we are not as highly regarded as we should be."

Referring specifically to the Telecommunications Business, Sir William has pinpointed two essential keys to success. One is the technology which is its stock-in-trade and in which it is capable of becoming a world leader, and the second is the people – at both ends of the line – who are at the very heart of the organisation. "One without the other spells failure", he has stressed. "But if we give each of them its proper measure of attention, the prospects of success are bright."

There are several areas in Telecommunications to which Sir William said he intends to give special attention. These include service improvement, selling more telephones and stimulating more calls, applying pressure to accelerate progress on System X (see page 15) and improving the Post Office's relationships with major equipment suppliers by overhauling purchasing procedures.

With regard to the general national decline in standards and services, the Chairman has stated: "I am determined the Post Office will lead the country out of this trough of mediocrity by setting a new example of high standards, by providing the sort of service that in our heart of hearts we want to provide and that our customers want."

Post Office telecommunications journal

Winter 1977/78 Vol. 29 No.4

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

Cover: High above a remote National Trust bird sanctuary off the North Norfolk coast, a Post Office Technical Officer cleans one of the solar panels that provide power for three telephones installed at the Warden's post. (See page 7)

Site searching in the field

MJ Mears

Down to business ... Northern Ireland Sites Group's Gerry Boyle, right, discusses possible future land development with a County Antrim horse breeder.

A KNOWLEDGE of livestock prices and ownership of a pair of Wellington boots may not be the only credentials for success among a small group of Post Office Telecommunications staff in Northern Ireland. But there is little doubt they play a very useful part.

The staff concerned are the three-strong group whose job involves searching out and negotiating for suitable sites for new telephone exchanges. Their work brings them into contact with farmers and other landowners, and being able to talk to them in their own language amid the mud and puddles of cowshed and barn is almost as important as a detailed knowledge of exchange site needs.

The Northern Ireland Sites Group is, in fact, unique in being wholly Post Office administered, whereas in other parts of the United Kingdom the Property Services Agency (PSA) acts as the Telecommunications Business's professional agents for sites and buildings. The Group liaises with architects of the local Department of Finance – the Northern Ireland equivalent of the PSA – and with a firm of solicitors which handles all legal work. The advantages are that there can be immediate reaction to site problems, and since there is no conflict of interest the Post Office is guaranteed a consistently good service.

When talking about Northern Ireland, of course, the security aspect is never far away. But it is true to say that while this does place constraints on the location of some exchanges, the main problems are similar to those faced wherever the Post Office has to look for new sites.

In Northern Ireland the site search operation as a whole can be divided into three distinct categories, depending upon whether an area is rural, urban residential or urban commercial. Each has its own problems, but in general terms the site selected should have a prospective working life of at least 60 years and should be obtained about three years before planning work begins.

Soil conditions are of vital importance as these will have a direct bearing on the cost of construction. Ideally the underlying strata of a site should be good firm clay as this provides sound bearing for the abnormally high loadings created by the telephone exchange equipment.

The site should, if possible, be at road level or slightly above for essential main cable lead-in purposes, and it should be adjacent to a main or good secondary road to allow articulated vehicles to enter the site with equipment. There are also considerations common to any developer, such as drainage, shape and size of the plot and availability of other services.

The site search programme directly reflects the present modernisation policy in which existing Strowger exchanges are being replaced with TXE2 or TXE4 types. The conflicting principles of service improvement and economy of limited resources of manpower, finance, buildings and equipment have led to the modernisation programme being phased over 20 years, and in Northern Ireland plans are for about eight TXE2 and four TXE4 exchanges a year. The long lead times, however, mean that most site searches must inevitably take place early in the programme.

Searching for sites in rural areas presents certain difficulties. Northern Ireland is predominantly rural in character and abounds with areas of outstanding natural beauty, which means that it is essential to consult local planning authorities before beginning a detailed search. Often planners may not appreciate the technical constraints governing the location of a telephone exchange and are unlikely to be impressed by a study which indicates why an exchange should be sited in a particular place.

The planner will be concerned solely with the effect that construction of a telephone exchange will have on the environment of residents in the area. He will also determine the width or type of access, and his stipulations at the outline planning permission stage can be punitive, particularly as the Post Office may already have nego-

tiated with a landowner for an agreed site for an exchange.

There are other problems. Despite its scenic beauty, Northern Ireland has a high density of overhead high-tension electricity cables. This limits the search area because agreed safety standards dictate that sites must not be within at least 50 metres of an overhead power line with a rating of 33 kv. With the natural historical development of many towns near rivers or in valleys the search can become complex.

In one instance a town was situated at the foot of a valley and had developed on either side of a river. Most of the surrounding land had a high water table and the only suitable site was refused planning permission because it would have encouraged "ribbon development" to spring up.

But discussion about the technical aspects of the search for sites has omitted the most important factor – that is, persuading the landowner to sell. Great skill is required to convince a farmer that he should part with any land which, to him, represents an inflation-proof asset. In the past, emphasis has been placed on the voluntary persuasion of a landowner to sell, but it is becoming clear that there is a growing reluctance to do so.

Urban residential areas pose a particular problem where local residents sometimes resist the presence of a telephone exchange with its attendant risk of terrorist attack. This is understandable, and a fear which the Post Office can only partly allay. Ultimately it is hoped that the need for improved telephone facilities will be recognised and the presence of the exchange accepted.

All exchanges in Northern Ireland are surrounded by security fencing, and this sometimes arouses resentment when erected in an otherwise residential area. Planning officers are sympathetic to objections on these grounds, and the Post Office is currently contesting the issue on the basis of whether an efficient public communications network or an environment free from all detrimental influences serves the public better.

In the final area of search, the urban commercial zone, the problems differ. A recent example concerned a provincial town where the question arose of infill in a shopping street where the existing telephone exchange needed to be extended. At a planning appeal the argument was raised that a "non-public attracting" building would change the character of the street which, incidentally, contains the local cattle market. The outcome however, was in favour of the Post Office and this verdict could have a significant effect on future site search strategy.

All Post Office vehicles are subject to a security check before being allowed through the protective fencing surrounding telephone exchanges.

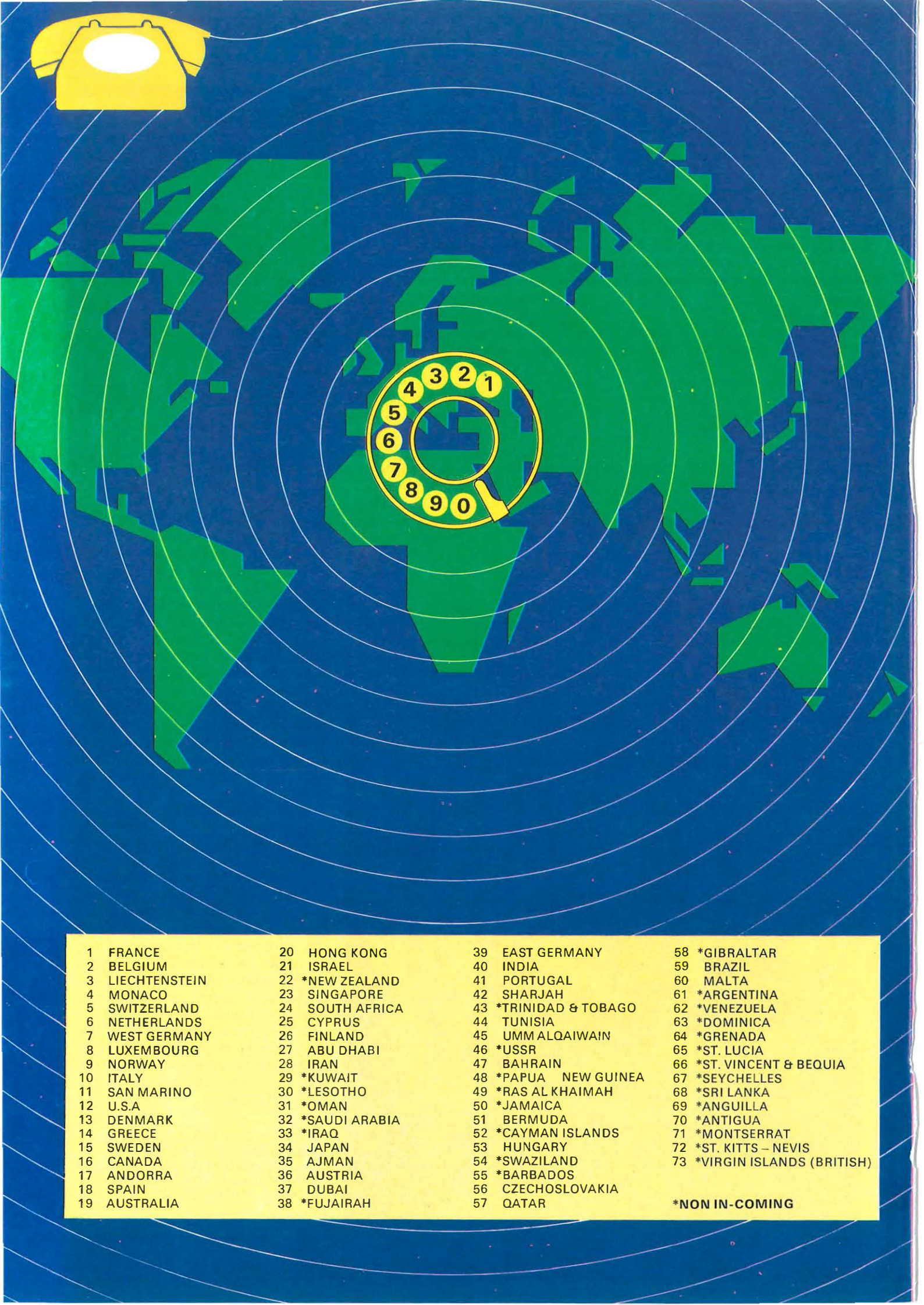
Undoubtedly one of the biggest problems facing the Post Office at present is the planning authorities' apparent lack of knowledge and understanding of the Telecommunications Business's real needs. To try to overcome this the Post Office organised a seminar to which all planning officers were invited. Attendance and initial response were encouraging and it is hoped that more co-operation will be received in the future.

The Northern Ireland Sites Group has, in fact, developed considerable expertise in all aspects of estates management, from initial site purchase negotiations to site disposals. But, in carrying out its work, the group does occasionally experience the effects of the current security situation, particularly in rural areas where the sight of a stranger tramping around fields with a map can cause considerable alarm and attract the curiosity of security forces.

The Sites Group, however, like the vast majority of people in Northern Ireland, simply carries on with its job with a determination to work as normally as possible.

Mr Harry Foy of the Sites Group, centre, looks at details of a site plan for a new telephone exchange with architects from the Department of Finance.

Mr M. J. Mears is a head of group in the Telecommunications Planning Division, Northern Ireland, with overall responsibility for the work of the Sites Group.



1	FRANCE	20	HONG KONG	39	EAST GERMANY	58	*GIBRALTAR
2	BELGIUM	21	ISRAEL	40	INDIA	59	BRAZIL
3	LIECHTENSTEIN	22	*NEW ZEALAND	41	PORTUGAL	60	MALTA
4	MONACO	23	SINGAPORE	42	SHARJAH	61	*ARGENTINA
5	SWITZERLAND	24	SOUTH AFRICA	43	*TRINIDAD & TOBAGO	62	*VENEZUELA
6	NETHERLANDS	25	CYPRUS	44	TUNISIA	63	*DOMINICA
7	WEST GERMANY	26	FINLAND	45	UMM ALQAIWAIN	64	*GRENADA
8	LUXEMBOURG	27	ABU DHABI	46	*USSR	65	*ST. LUCIA
9	NORWAY	28	IRAN	47	BAHRAIN	66	*ST. VINCENT & BEQUIA
10	ITALY	29	*KUWAIT	48	*PAPUA NEW GUINEA	67	*SEYCHELLES
11	SAN MARINO	30	*LESOTHO	49	*RAS AL KHAIMAH	68	*SRI LANKA
12	U.S.A	31	*OMAN	50	*JAMAICA	69	*ANGUILLA
13	DENMARK	32	*SAUDI ARABIA	51	BERMUDA	70	*ANTIGUA
14	GREECE	33	*IRAQ	52	*CAYMAN ISLANDS	71	*MONTSERRAT
15	SWEDEN	34	JAPAN	53	HUNGARY	72	*ST. KITTS – NEVIS
16	CANADA	35	AJMAN	54	*SWAZILAND	73	*VIRGIN ISLANDS (BRITISH)
17	ANDORRA	36	AUSTRIA	55	*BARBADOS		
18	SPAIN	37	DUBAI	56	CZECHOSLOVAKIA		
19	AUSTRALIA	38	*FUJAIRAH	57	QATAR		

***NON IN-COMING**

The growing world a fingertip away

AE Joyce

NOT SO many years ago the idea of picking up a telephone, dialling a series of digits and within seconds being able to talk to a relative, friend or business colleague in such distant places as Moscow, Bombay or Sydney was little short of fantasy. Today, due to the development of automatic international exchanges and an ever growing network of submarine cables and telecommunications satellites, that dream has become reality.

By the end of 1977 more than 300 million telephones in over 70 different countries could be dialled direct from 18 million telephones in Britain, and at the present rate of progress there is little doubt that the 100th such link will soon be celebrated. Currently 150,000 international calls are dialled direct from the United Kingdom daily.

All this, of course, has developed since 1963. It was then that a "special arrangement" enabled the first United Kingdom customers to dial their own calls to Paris. International Direct Dialling (IDD) is basically a special form of Subscriber Trunk Dialling (STD), designed to meet international conditions. But this first service across the Channel was set up by using ordinary STD facilities with the distant terminal station in France. IDD in the form in which it is now known, however, appeared in 1964 and is the product of a number of factors.

The methods and equipment used for international telephony are generally well established, and are set out in recommendations of the International Telegraph and Telephone Consultative Committee (CCITT). There is, for instance, a universally accepted system of country codes – in which the UK is always 44 – and an agreed maximum number of digits in subscribers' numbers. This framework copes with many variations within national systems. The differences in digit position on dials in some countries, for example, are dealt with by translation to a common international form in the international signalling system, and back into the appropriate national form at the incoming end.

In the UK system, charging to the caller is on the same "pulse" principle as for STD, and a reduced rate is available, except to countries having a considerable time difference. Calls can be dialled from coinboxes to Europe, but various equipment limitations make dialled intercontinental calls impracticable at the present time.

The full international number will probably contain more digits than for an inland call, and the range of charges required will also be greater. Provision for this, and for the necessary MF signalling, are the main requirements for introducing IDD at a Group Switching Centre (GSC) and giving the facility to all subscribers served by that GSC.

These are the essential requirements for a straightforward IDD service, based on STD principles. There is, however, one important addition. International calls use equipment in other countries for which payment must be made, and thus some form of international accounting is needed. Generally the accounts are based on the duration of calls. To provide this information for each route, International Accounting and Traffic Analysis Equipment (IATAE) is provided at each International Switching Centre (ISC).

When a caller dials the international access code 010, the first 0 routes him as for STD to a register translator at his GSC, while the 10 extends the call to the international register and calls in the supplementary local equipment for IDD. He then dials the country code, which selects the charge rate to be applied at the GSC and the appropriate routing to the right ISC for the country required. The country code is sent forward to the ISC, the international route is selected, and the remaining digits are dialled and passed forward in the normal way. These are translated by the international signalling system into international form and extend the call to the international and distant national systems. During this process the IATAE comes into action. When the call is answered, the connection is made and the charging equipment records on the subscriber's meter, with the IATAE recording for the international account.

The development of IDD is best considered in two ways: Its extension within the UK and the introduction of the services to other countries. These are separate in detail, but there is common ground in planning for adequate capacity in all aspects.

Within the UK, the main requirements are the provision of IDD equipment at GSCs, together with MF signalling equipment, and development has fallen into two distinct phases. In Director systems, the provision could be made comparatively simply, and this allowed IDD from London and the five provincial Director systems to be opened in 1964. For non-Director systems, however, much more development was required, and it was not until 1974 that substantial provision became possible. Considerable progress has been made, and well over half of all GSCs are now equipped, catering for a higher proportion of subscribers and a still higher proportion of international traffic. Inevitably there are problems at specific centres, but provision is expected to be virtually complete by 1981.

It is less easy to set out a long-term programme of extension to other countries, largely because of uncertainties at their ends. To begin with there must be an automatic international exchange with appropriate signalling equipment interconnected to an automatic national network. At present, for instance, service to USSR is limited to Moscow because its national automatic trunk system is not yet connected to the international exchange. In other countries the extent of the access may be limited by the adequacy of the network. Another essential is to ensure that sufficient international circuits are available to carry the additional traffic which is a usual accompaniment to IDD.

There is, too, the major requirement to agree with the distant country – and perhaps with intermediate coun-

tries – the level of payment for their services. There are recommendations applying to this, but in the end each country manages its own financial affairs and agreement is a matter of negotiation.

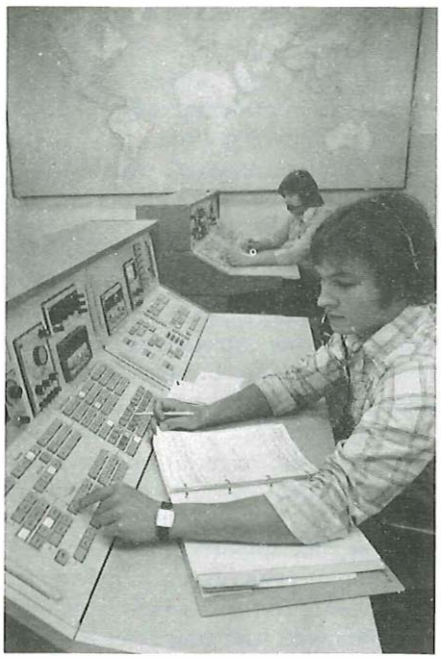
Normally the largest traffic streams are considered first. As new links become possible, proposals are made to the countries concerned, including any intermediate countries, to cover all aspects of the new service. Provision requires work in the UK on both inland and international systems, and because of the varying lead-times some parts of this may, where practicable, be put in hand before agreement is reached. Obviously on occasions some negotiation may be required and such things as numbering systems and tones in other countries have to be verified. In addition, a whole range of equipment must be tested, and information and instructions provided for operators and subscribers.

Generally liaison with other countries is by telephone and telex, although some meetings have been necessary. Experience varies, and although response is usually good, difficulties are increasing in both technical and administrative aspects as the service is extending to smaller countries. In the early days of IDD it was the usual practice to introduce two-way service simultaneously. This has financial implications, and may involve national prestige, but it remains an inflexible system and for some time the Post Office has urged, or accepted, unidirectional services if necessary.

Taken world-wide the general situation regarding IDD is one of wide variation in provision or extent of service. In many cases this is linked to the ease with which the standard national system could provide the special requirements. Overall, the UK is well among the leaders, both in national and international development with, perhaps, the particular feature that the Post Office passes on to subscribers some of the financial benefits by means of lower call charges for IDD. This, of course, has some bearing on traffic growth. Calls to the UK can be dialled to any subscriber if the originating country so desires, although in some cases the degree of access is limited at the distant end.

In quantitative terms IDD is still developing rapidly, and most statistics quickly become out of date. An obvious measure is the number of countries served, but this can raise the question: "What is a country?" Principalities in Europe, like Monaco for example, are generally regarded as countries, although telephonically they are entirely part of a large neighbour and have no separate Administration. On the other hand the remote American States are certainly not separate countries, but are telephonically independent, and involve more work for the introduction of IDD than does a 'normal' country.

A measure of development as far as the UK is concerned might be gauged from the fact that the five European countries to which the Post Office operated in 1964 had grown to nine



Technicians at the test desk of Stag Lane International Switching Centre in London check to ensure that directly-dialled calls are connected.

by 1969. A year later came the first intercontinental service to New York, progressively extended to all the US mainland in 1971, and to Canada in 1972. By 1976, the total of countries which could be dialled had grown to 29, and then with several factors allowing rapid development, the 50th country, Jamaica, was reached in May 1977. At the present rate, the 100th IDD link will soon be established.

On the inland side, as mentioned earlier, the Post Office is now well past half way in terms of equipping GSCs and catering for subscribers. The proportion of diallable traffic is much higher; by March 1978 the expected provision is about 66 per cent of GSCs and 85 per cent of subscribers.

International telephone traffic has, in fact, been growing at a substantial rate for more than a decade, and for some time it has been doubling about every four years. The introduction of IDD usually produces a noticeable but variable stimulus, but the extent of this is difficult to isolate from other changes. Forecasts of traffic are essentially in terms of 'natural growth' to which any specific 'step' stimulus from the introduction of IDD is additional.

There have been, of course, many uncertainties surrounding even natural growth during the period since 1964, but in broad terms it might be expected that the total yearly traffic then of 4.8 million outgoing calls would have grown to about 20.5 million by 1977; in fact the level is now 55.6 million calls, a direct increase due to IDD. More difficult to quantify is the condition that the natural growth rate over the period has almost certainly been greater as a result of IDD than it would have been otherwise.

From the caller's point of view, IDD is quick, simple, cheap and convenient, and is at least acceptable in its success rate. This varies to different countries but overall more than 40 per cent of attempts are successful. Many of the failures are from normal problems such as subscriber engaged or no reply but, understandably, other failures may run at a higher rate in the international service because of the number of links, the complexities of the equipment and the possible lower standards of domestic performance in some countries. Improvement of the performance of all parts of the system, where possible, is a parallel operation to development of the facility, but this is to a large extent a problem within specific countries.

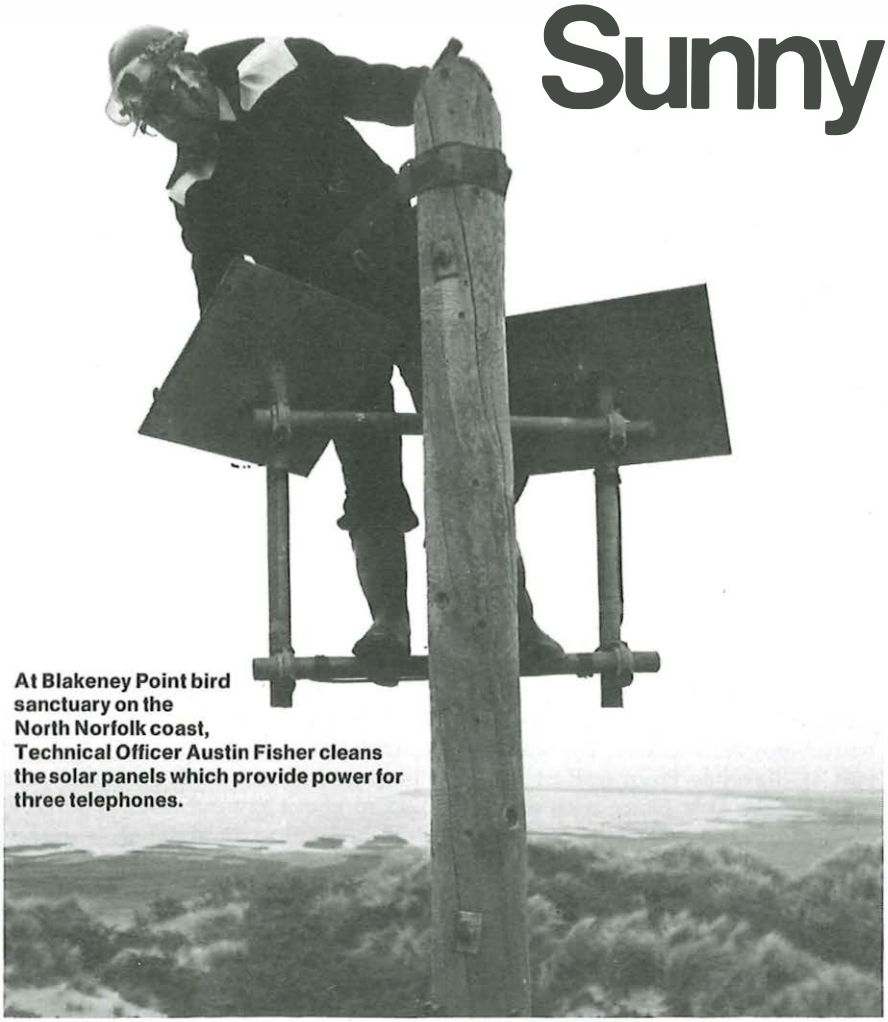
It is a fact that IDD is now well established with about 83 per cent of all international traffic now being dialled. There is, therefore, comparatively little still to be achieved in terms of traffic, but this must be seen in perspective. IDD traffic itself is growing at the substantial rate of 17 per cent per annum overall, while the remaining traffic still to be converted to IDD – only one sixth of the total – is still about twice the level of the whole volume of international traffic only 14 years ago.

IDD has been a major factor in this enormous growth. It has made a very substantial contribution to business and revenue, and given good service and financial benefit to callers.

Mr A. E. Joyce is a head of group in Service Policy Division of the Post Office's External Telecommunications Executive with special responsibility for new IDD services.

Sunny outlook for remote phones

BA Wittey



At Blakeney Point bird sanctuary on the North Norfolk coast, Technical Officer Austin Fisher cleans the solar panels which provide power for three telephones.

The output from a solar panel at Blakeney Point is checked on the radio-telephone transceiver by Assistant Executive Engineer Ken Durrant.

A SMALL, seemingly insignificant hut stands on a lonely exposed stretch of the Norfolk coast at Blakeney Point. But it is, in fact, the focal point of a Post Office experiment that could lead to easier and more economical methods of providing telephone service to people in remote areas.

For more than two years telephones in the hut – a bird sanctuary warden's post – have been powered by sunshine. Now plans are in hand to provide a similar installation on the remote Scottish island of Soay.

Sunshine or, to be more precise, solar radiation is the largest inexhaustible and environmentally acceptable source of energy available in the world. Present understanding suggests that energy from the Sun stems from nuclear reactions within its core, where the temperature is estimated to be 10 million deg c.

The amount of radiation from the Sun reaching Earth is known as insolation and is measured in watts per square metre. At the outer layers of the Earth's atmosphere insolation is 1.4 to 1.5 kw per sq m, while on the surface it is 900 to 1,000 w per sq m in clear atmospheric conditions.

Insolation in any place varies throughout the seasons of the year, as does the period each day at which maximum insolation is available. These aspects contribute to the difficulties of harnessing efficiently and economically this form of readily available natural energy.

Various systems have, in fact, been developed to convert solar energy into more useful working energy. These

John Bean, Winter Warden at the bird sanctuary, makes a call on the solar-powered telephone in his lookout.

may be divided into solar thermal devices – that is, heat collecting panels – and solar voltaic (electrical energy) devices, more commonly known as solar panels.

When using a solar cell array as a source of electrical energy, to cover periods of darkness and low radiation – where no electrical output is available – a storage battery must be inherent in the system design. Some form of lead acid rechargeable battery is used, being connected in parallel with the load being supplied. When the solar cells are activated, therefore, they not only provide electrical power to the prevailing load demand, but also charge the battery. During periods of darkness the load is supplied from the battery.

In planning a solar cell system it is important to achieve a correct balance between the size of the battery and solar array to ensure an uninterrupted supply under all conditions. Even in dull, overcast weather conditions, however, some power output will be available from the cells. Usually some form of voltage regulator is provided on the output of the system to meet load voltage limits and to ensure satisfactory charging of the battery.

In considering solar panels as a power source for telecommunications, the capital cost clearly would not be justified in installations which already have, as most do, a main electricity supply and adequate provision for standby power. But in some remote areas mains electricity is not available, and power for telephone service is provided by batteries. This method is expensive as the batteries either have to be replaced at intervals or recharged by visiting Post Office maintenance staff or local residents.

In these cases, therefore, the use of an alternative form of energy system, such as solar voltaic power, becomes attractive. As a remote location with battery-powered service, the warden's post at Blakeney Point in East Anglia provided the Post Office with an ideal opportunity to put a solar cell system to the test.

The solar panels, located on top of a 9.15 m pole so that no shadows fall on them, provide sufficient power to recharge the batteries serving a single-channel very high frequency (VHF) radio link from the warden's telephones to the exchange. The link requires 12 volts at about two ampere hours per day, and it has been shown that even on cloudy days and during winter months the panels convert sufficient energy to maintain service.

Blakeney Point is an exposed coastal site where the terrain consists of a fine sandy beach, and the surface of the solar panels has been "scuffed" by the effect of wind-borne sand. This does not appear to have affected the conversion efficiency of the system which has, in fact, continued to function satisfactorily for more than two years with only the minimum amount of attention being necessary.

The fact that solar power systems require little attention makes their use particularly attractive where maintenance trips involve hours of travelling, such as to remote Scottish islands. It is with this in mind that the Post Office is planning the second experimental installation for telephone service to several customers on Soay. Proposals are already in an advanced stage to provide power for a microwave link there with an estimated requirement at 12 volts of 10 ampere hours per day.

Soay will have a solar cell array panel about 2.5 m square, which will be pivoted between two parallel poles 2.5 m above ground level. The array will be fixed at an angle of 15 degrees to the vertical, this being the optimum angle of inclination at the island's latitude to obtain maximum power in mid-winter. A peak rating from the panel of 5.43 amperes at 17.5 volts will be supplied to a regulator, limiting the available voltage to 13.8 volts, which will feed the radio equipment.

To cover periods of low sunlight and darkness a rechargeable battery will be connected across the regulated output and in parallel with the radio equipment load. It has been estimated that one six-cell battery of 250 ampere

This old coastguard lookout houses the landward end of the line-of-sight telephone link to Blakeney Point, about three miles away.

hour capacity would be adequate but, to provide 100 per cent redundancy, two batteries will be used so that one can be removed for recharging while the other remains in service.

World-wide there is undoubtedly increasing interest in solar voltaic energy applications, and many governments have allotted substantial budgets and added impetus to research and development in this field. Experience gained by the application of solar voltaics in the American space programme and international satellites, too, has formed a foundation for the development of devices and systems for terrestrial applications.

Nevertheless, with currently available proven technology, solar power is not an economic form of energy conversion for general application in this country when compared with more traditional systems. Apart from the high initial capital investment per unit of energy provided, conversion efficiencies obtainable are low and insolation of the climate is relatively poor.

Caution therefore needs to be exercised in the use of solar voltaic systems to provide electrical energy. With increasing research now being carried out, however, ultimately it is hoped that a low-cost, high-efficiency cell will be developed which is suitable for manufacture by high-volume production techniques.

Mr B. A. Wittey is a head of group in Power Division at Telecommunications Headquarters, responsible for the design of standby power systems and the development of batteries and exotic power sources.

PO Telecommunications Journal, Winter 1977/78

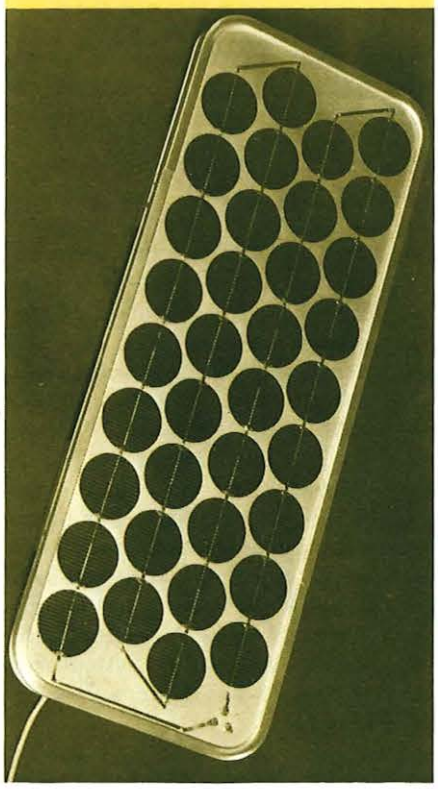
A routine test is carried out on the Blakeney Point emergency telephone for public use, which has played a part in saving at least six lives.

A solar cell is basically a photovoltaic diode with a semi-conductor junction similar to that of a transistor. It is sensitive to light energy near the infra-red spectrum, and has the mechanism to convert this into useful electrical energy. Silicon, an abundantly available element, is at present the semi-conductor material used for most solar cells. Silicon single crystal "wafers" about 0.5 mm thick are used which have a very thin diffused region on their upper surface, and these are manufactured in diameters from 90 to 100 mm to form a solar cell.

A metallic contact area is formed on the back surface of the wafer, and pick up grid wires – or "fingers" – are formed on the upper surface to provide the other electrical contact. The system of grid wires reduces power loss and prevents a high current density from traversing through a thin layer by dividing electrically the top surface of the cell into sections, at the same time allowing a large area of the surface to be presented to the Sun. The cell is finally coated with an anti-reflective material.

Each silicon wafer can develop 0.4 to 0.5 volts DC and has a short-circuit current capability of 30 milli-Amps per sq cm, depending upon the level of sunlight. Similar cells are mounted on a flat rigid substrate panel, such as glass reinforced plastic, and connected together electrically in a series/parallel arrangement to obtain the desired electrical performance in terms of voltage and current.

The whole surface is then encapsulated, normally in silicone rubber, to form an hermetically sealed array with a pair of electrical terminations.



Market intelligence makes business sense

JA Lockwood & WJA Hill

Active marketing is essential to the future success of Post Office Telecommunications, and to this end new techniques for analysing the business market are being developed.

THE cornerstone of successful marketing is good market intelligence which, in the case of business, largely means information about the specific products and services required by individual sectors. This information can be used to direct promotional campaigns at specific sectors, featuring products and services designed to assist efficient business communication within those sectors.

With regard to the existing product range of Post Office Telecommunications there are three particularly important questions.

First, how many of each item of equipment in the product range are installed on customers' premises? This information is readily available from Customer Rental Records (CRR), as introduction of this computer system is now complete.

Second, which customers, by business type, are the principal users of particular items of equipment? As yet CRR does not include Standard Industrial Classification – that is, SIC, which is the means by which the business market is broken down into sections – although it is planned.

Finally, how much revenue is generated by particular customers using specified apparatus? Again this information is not readily available because there is no direct link between CRR and the telephone billing system. To obtain these answers, a system called Marketing Information System for Telecommunications (MIST) was therefore developed.

It was recognised that it would be impractical to gather this information nationally in a short time, and it was therefore decided that a single Telephone Area should be selected as a pilot. The basic requirement was that the Area selected should be large enough to represent the spread of products throughout the business sector and that this Area should already have been converted to CRR.

West Telephone Area in London fulfilled these requirements, and a CRR printout was obtained for all business installations with two or more lines. A total of 6,300 business customers were identified within this category. Having obtained this basic information, a duplicate set of business directory records for the London Telecommunications Region (LTR) was taken, and using these the Business Classification Manual (BCM) code for each customer was identified.

The BCM is a more detailed breakdown of the market than SIC and it is used by the Post Office for deriving Yellow Pages groupings. It is, however, too detailed for use directly in MIST and conversion tables were used to select the appropriate codes from the SIC list. In addition, the latest billing printout in West Area was consulted and details of quarterly rental, non-recurring charges, call revenue and total revenue were added to the CRR printout.

With the gathering of data completed, it was then necessary to prepare it for computer processing. It was clear that this information would need to be sorted against a wide range of variables, and so a fully flexible sorting facility was obviously of prime importance. A commercially available IBM computer programme – Rapid Access Management Information System (RAMIS) – was recommended by the Post Office's Data Processing Service (DPS) and proved to be most suitable, enabling a number of analyses to be made.

MIST is, in fact, the first computer system available to the Telecommunications Business that can identify which customers rent particular items of equipment and the use they make of these items compared with other customers of the same business type renting different equipment. The main weakness of the system is that it is based on only one Telephone Area. To validate the results of this study and to broaden the range of businesses examined, it is hoped that the exercise will soon be repeated with at least two more Areas.

Analyses of the main user groups of particular apparatus, obtained from MIST, have been incorporated into a new range of marketing strategy documents – known as Product Factbooks – which are being produced by Telecommunications Marketing Department. These books will be prepared for most products within the Telecommunications Sales and Installation Plan, and bring together detailed information such as product development and improvement, supply and contractual aspects, inter-product relationships, selling features and marketing strategy and tactics.

Product Factbooks are intended to provide a framework within which marketing management at Telecom-

munications Headquarters (THQ) can develop specific recommendations for action which are consistent with the overall strategy for the product. They will also help Regional and Area management to plan and control their own selling and promotional efforts.

While MIST provides information about the existing product range it does not identify gaps and shortcomings in the present range of service. The best way in which these can be pinpointed is by detailed examinations of individual market sectors. As a result, therefore, it was decided to carry out a series of market sector studies, using market research techniques. One of the main difficulties with this approach was the selection of market sectors.

Ideally a sector should be homogenous and well defined with specific distinguishing communications requirements. This latter criterion is difficult to fulfil because in many industries communications are dictated by the requirements of the administrative centres and these are broadly similar over a wide range of industries.

Bearing in mind these factors it is desirable to produce breakdowns independent of SIC groupings. This problem is still very much a subject for discussion but one possible split could be Multinationals, Nationalised Industries (separate study for each), Manufacturing (split by size), Service (split by type) and Government (split local/national).

The sector chosen for the first study was the hotel industry because this satisfied the criteria discussed above in that it was homogenous and had special requirements. The work was carried out by marketing staff from THQ and North West Telecommunications Region, and direction of the study was guided by a group comprising senior Post Office marketing staff and a committee member of the British Hotel, Restaurant and Catering Association.

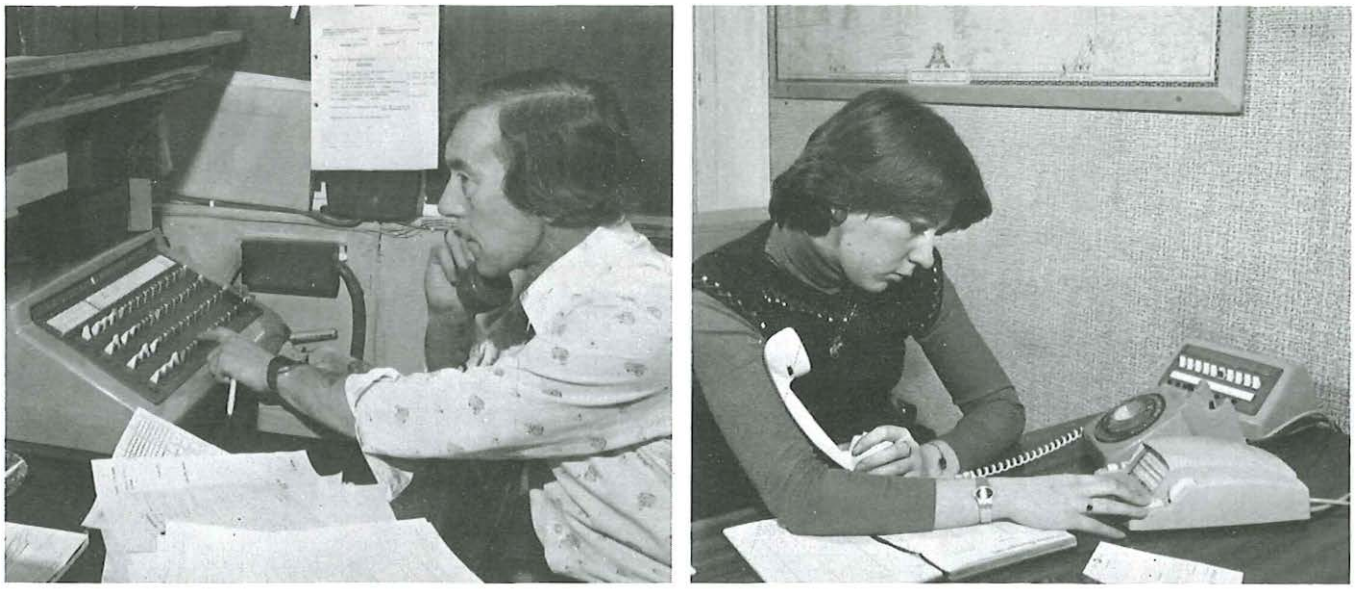
In undertaking the study a scheme was developed involving three lines of action. First, a qualitative market research survey was carried out, involving a sample of 60 hotels with more than 20 bedrooms in the North West Region. This looked at such factors as equipment installed, call revenue, difficulty of obtaining information from the Post Office, the degree of satisfaction with the quality of Post Office service.

Next, a series of interviews was organised with senior representatives responsible for telecommunications in the 10 largest hotel chains. While the first study sought the views of the hotel manager, these interviews drew on the expertise of senior managers responsible for telecommunications purchasing decisions in large groups of hotels. Finally, an analysis was made of published statistics about the hotel industry, in particular looking at the size and geographical distributions and the future prospects.

The work was completed in four months and it has considerably enhanced the Post Office's knowledge of the operation of the hotel industry and its communications requirements. For example, if the problem of marketing private branch exchange systems to the hotel industry is considered, the potential market size and growth is known, as are the specific facilities required and the cost benefits that such systems provide in the context of hotel operation. This information can answer such questions as whether it is economical to provide PBXs with facilities tailored to the hotel industry's requirements and how the Post Office should approach the problem of selling such payments.

As well as highlighting opportunities, the study has also pinpointed short-comings. It is clear, for instance, that the average hotel manager has a limited knowledge of the products and services which would be useful to him. As a result steps are being taken to remedy this problem by improving the flow of information between the Post Office and the industry. One obvious course of action is to ensure that the Area Sales Divisions are fully aware of hotel requirements.

The experience gained by this study provides a convincing argument for carrying out further schemes. Improved knowledge of the business market will, as a result, also enable the Post Office to provide a better service to the customer. In turn this should result in increased demand for Post Office products and services.



Business customers use a wide variety of Post Office telecommunications equipment depending on their needs. The Keymaster 2+10 (left), for example, is ideal for small offices; the PMBX 4+18 (centre) is used typically as a temporary measure at say, a building site; and the tape callmaker (right) is popular where there is a frequent need to dial the same long numbers.

Mr J. A. Lockwood is a head of group in Sales and Installation Division of Telecommunications Marketing Department.
Mr W. J. A. Hill is a Sales Superintendent in the same Division. Both have been involved in business market studies.

On-the-spot service for TV

JF Songi

OVER the past 20 years or so few major events in Britain have escaped the searching eye of the television camera. The funeral of Sir Winston Churchill, the 1966 World Cup tournament, the Investiture of the Prince of Wales, Princess Anne's wedding and countless other events were all captured "live" for millions of viewers throughout the country.

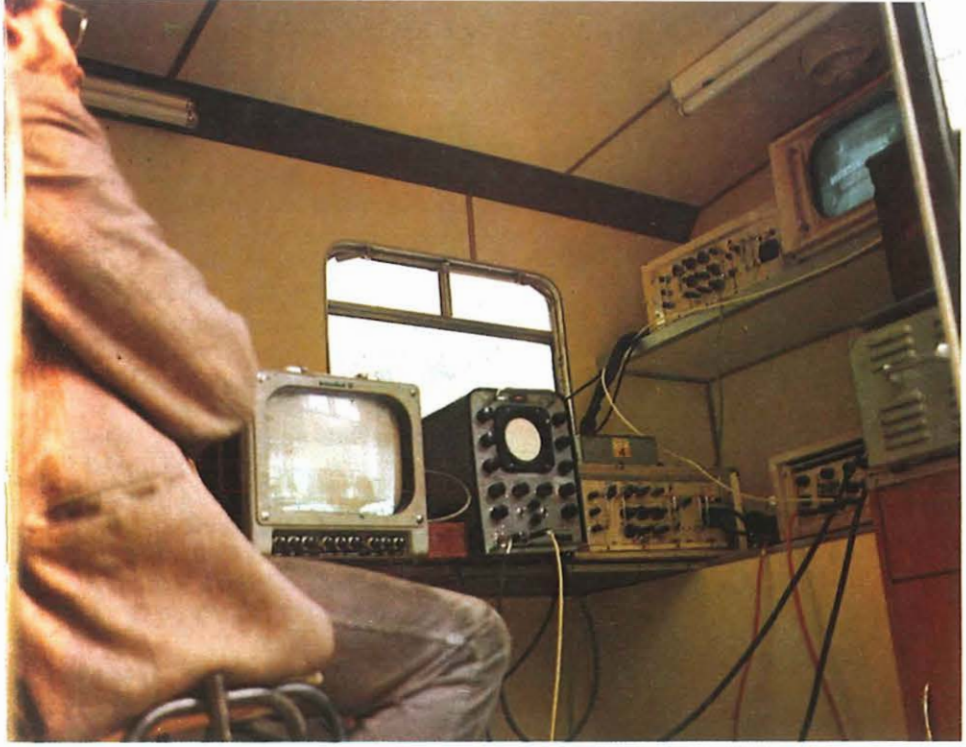
Yet few people ever realise the role played by the Post Office in ensuring these pictures reach their television screens. Providing facilities for outside broadcasts is, in fact, an important part of the Post Office's overall involvement in television transmission, which goes back to the inception of the service in the 1930s. From the earliest days the Post Office has provided the BBC with permanently leased wideband cable circuits for general transmission purposes, and in more recent years the Post Office microwave network has also been used.

For outside broadcasts where Post Office assistance is required, a routine has been developed in which the BBC and IBA approach the local Telephone Area sales office which, in turn, alerts one of five Post Office Television Outside Broadcast (TVOB) teams based around the country. The teams' role is to ensure that television signals are carried from the camera site to the studio by providing links to the nearest convenient point in the television transmission network, either by setting up cable links or, if microwave radio is used, by small portable dish aerials sited where necessary along the length of the route.

The first major outside broadcast was coverage of the Coronation of King George VI in 1937. This involved the Post Office in laying a cable in the West End of London to enable the procession to be televised "live" as it passed along its route. But celebrations were short-lived, as a couple of years later the television service closed because of the war. When it restarted in 1946, however, there was immediate demand from the BBC for circuits capable of carrying good-quality television signals from the sites of outside broadcasts back to the television studios. Provision of these circuits required specially designed vision equipment and a high degree of expertise. To meet what was obviously going to be a growing demand the TVOB service was set up in London.

As BBC coverage extended throughout the country and Independent Television started, first in London and

At a Goodwood race meeting a Post Office television outside broadcast vehicle provides transmission links to bring live pictures to viewers.



Inside the Post Office vehicle a technician monitors the pictures being transmitted.

later in the provinces, the TVOB service formed additional teams in Cardiff, Edinburgh and Manchester in 1952, and in Birmingham in 1955.

The next change in television to affect the TVOB service was the switch from VHF 405-line transmission to UHF 625 lines at the introduction of BBC2 in 1964. It became policy to duplicate all other services to this band and standard, so that a change to colour transmission could easily be made later. Basically, this change meant re-equipping the OB teams with more suitable equipment to meet the more stringent demands of the new system.

At about this time, too, closed-circuit television (CCTV) came on the scene and was able to display, to remote audiences, sporting events, religious meetings and business functions such as the recurring Billy Graham Crusades and World Championship boxing matches. Such events were seen in more than 30 venues through specially set up Post Office networks. These CCTV circuit requirements, together with broadcasters' demands for circuits to cover such important events as the World Cup, the Prince of Wales' Investiture and the General Elections, made the middle and late 1960s the busiest period ever recorded for the Post Office TVOB service.

The broadcasters are exempt from the Post Office Telecommunications monopoly in the provision of television OB circuits. Until 1965 they provided all their own radio link transmission circuits where necessary with the Post Office confining its OB activities to circuits using cable pairs. Since then, however, the Post Office has also helped meet requirements for radio links.

The equipment used to amplify and equalise the cable pairs has been specifically designed and developed by the Post Office since 1945. The first equipment was, in fact, produced by Research Department in conjunction with London Telecommunications Region and the former Engineering Department, and comprised flat frequency response video amplifiers, switchable attenuators and passive equaliser networks mounted on portable racks.

As demand for circuits grew another amplifier (No. 98A) was produced, which functioned by adjusting the frequency response of progressive stages of amplification. It was built into a suitcase-type container for easy transportation. The change to 625-line definition produced the Amplifier Video No. 1A which combined both passive and active equalising sections and this is still in current use.

Setting up cable circuits for outside broadcast purposes involves adjusting the linear transmission parameters by sending over the pairs signals that are representative of commonly occurring parts of the television picture with a known frequency content and a waveform shape that could easily show any distortion when displayed on an oscilloscope. The equalising equipments are then set to reproduce the sent waveform. The non-linear parameters are checked using waveforms, and the "noise" of the circuit is measured in this way.

By using this method the longest practical circuit that can be established using ordinary telephone pairs is about three miles, but much longer circuits can be provided if coaxial pairs are used.

In 1965, with the work load expanding, the more stringent requirements of the 625-line colour system and the greater incidence of less suitable small conductor cables, it was decided to add a microwave radio facility to the OB service. Temporary radio links when used in tandem, are capable of providing circuits of great length as each hop can cover distances of more than 20 miles.

Soon after these new techniques for route planning and setting up radio links had been acquired, they were put to the test by the demand for circuits for the 1966 World Cup soccer matches which were played in London, Sheffield, Liverpool and the

The second stage of a five-hop radio link across the Highlands of Scotland set up to transmit closed-circuit television pictures to London. The occasion was the launching by Prince Charles of an oil production platform at Loch Kishorn.

Assistant Executive Engineer Peter Cooke and Technician Joe Nicholls carry out transmission tests before live coverage of Princess Anne's wedding.

North East. The experience proved invaluable and it quickly became obvious that cable pairs and radio links complemented each other and they, in conjunction with the protection channels of the microwave network, made it possible to provide vision circuits to or from any corner of the United Kingdom.

Circuits for CCTV and television outside broadcasts are generally used to cover sports programmes, news items and national events, and any one circuit for any of these may vary from a single equalised cable pair to a multihop radio link. Two examples of the use of such circuits illustrate the difficulties Post Office staff have sometimes to face to make the provision.

When the Prince of Wales launched the world's largest concrete oil production platform at Loch Kishorn on the west coast of Scotland in July 1976, a circuit was required from there to London's Hilton Hotel to provide a CCTV display. The nearest access to the permanent network was at Rosemarkie on the eastern coast of Scotland. This meant the OB teams had to provide a 60-mile radio link across the Highlands, with five hops.

Two of the intermediate stations had helicopter access only, and the others could be reached only by Post Office snow vehicles. One of the intermediate stations was 2,500 feet above sea level. Despite these problems, however, the circuit produced such excellent pictures that the CCTV company released the recordings to the broadcasters for their news programmes.

For the Wimbledon Lawn Tennis Championships circuits are normally provided not only for the BBC and IBA but also for the National Broadcasting Company of America from fixed cameras on their recording vehicle. In 1976 NBC requested an additional circuit to be associated with a mobile camera which was to move among spectators and carry out spot interviews. The TVOB group designed a compact mobile trolley on which was mounted a battery-powered microwave radio link transmitter that could be kept in constant sight of its receiver located on Wimbledon's Ivy Tower.

The trolley proved so successful that NBC requested to use it from a helicopter so that aerial pictures could be obtained. This was achieved by pointing the transmitter horn aerial at the ground receiver aerial. An added complication was that the helicopter pilot was refused permission to remain stationary, so great dexterity was required in keeping the transmit and receive aerials facing each other.

OB work involves the provision of wideband (5.5 MHZ) circuits at any time or place at short notice, and it became obvious that the Post Office could utilise this service in any emergency requiring television or telephony circuits to be established quickly. The very nature of outside broadcasts makes the demand from the broadcasters so variable that to make the service efficient, work for exclusive Post Office purposes is needed to even the load.

It is, for instance, part of emergency restorations plans for certain permanent vision circuits, and considered when schemes for dealing with possible disasters are being dealt with. The service is also used to provide "make good" circuits for the television and telephony microwave networks and to set up circuits in advance of permanent provision for customers needing immediate service. Other uses are the provision of circuits for Confravision when temporary studios are set up, and internal CCTV. All this, of course, is in addition to the service provided for broadcasters.

Mr J. F. Songi is an Executive Engineer in Service Department at Telecommunications Headquarters responsible for providing occasional vision circuits.

PO Telecommunications Journal, Winter 1977/78

Ken French, Assistant Executive Engineer (right), and Technician Dave Peacock load a trolley designed by the London TVOB group to obtain aerial pictures requested by NBC of America during coverage of the Wimbledon lawn tennis championships.

Introducing System X

LRF Harris

System X – the family of advanced switching systems for the 1980s and beyond – is being developed in a collaborative programme by the Post Office and its three principal telecommunications equipment suppliers – GEC, Plessey and STC.

Based upon microelectronics, digital and software technologies, it is the biggest single telecommunications development ever undertaken in Britain, and already some 500 engineers are involved in the Post Office and industry.

System X is the central feature of an overall strategy for the evolutionary development of the British telecommunications network, and will pave the way for an expanding range of customers' services and facilities.

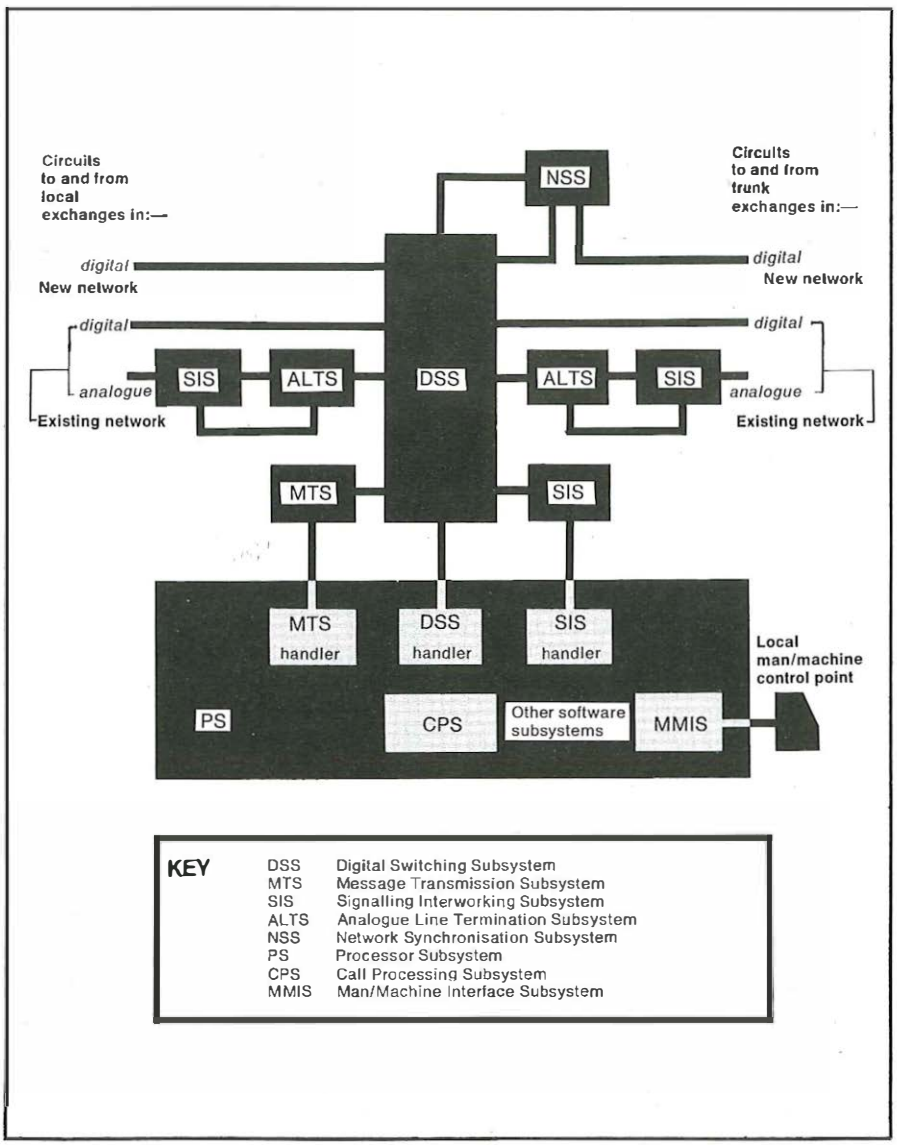
Increased cost-effectiveness – for the Post Office and its customers – is a major aim, and System X is also expected to give a major boost to the export prospects of Britain's telecommunications industry.

AS A KEY development for the future, System X is part of a revolution in telecommunications that is fast gaining momentum worldwide. Its full impact will not be immediate, but during the coming decades the techniques and concepts that go with System X may be expected to change quite dramatically the costs and capabilities of telecommunications networks, and to leave few activities of the Telecommunications Business untouched.

System X is often referred to as a family of systems because the same principles, techniques and standards – and often the same designs – will be used in many different applications. This recognises that the many different kinds of switching systems required in telecommunications networks – for local, trunk and international calls, for telephone and data services, and for operator services and maintenance – have many functions in common and can therefore be designed on the same technical basis and, in due course, can roll off the same production lines.

From this point of view, System X will have much in common with the old Strowger system in which the same standards and devices are used in telephone and telex exchanges, in group switching centres and tandem centres, and in a whole range of local systems for rural, urban and metropolitan areas. By designing System X as a family, the Post Office and industry expect to hold down the cost of its development and to obtain the advan-

Digital main network switching centre, showing the modular structure.



tages both of large-scale production and operations.

Much of the expected benefit from System X stems from the use of three major systems concepts – stored program control (SPC), common channel signalling and digital switching.

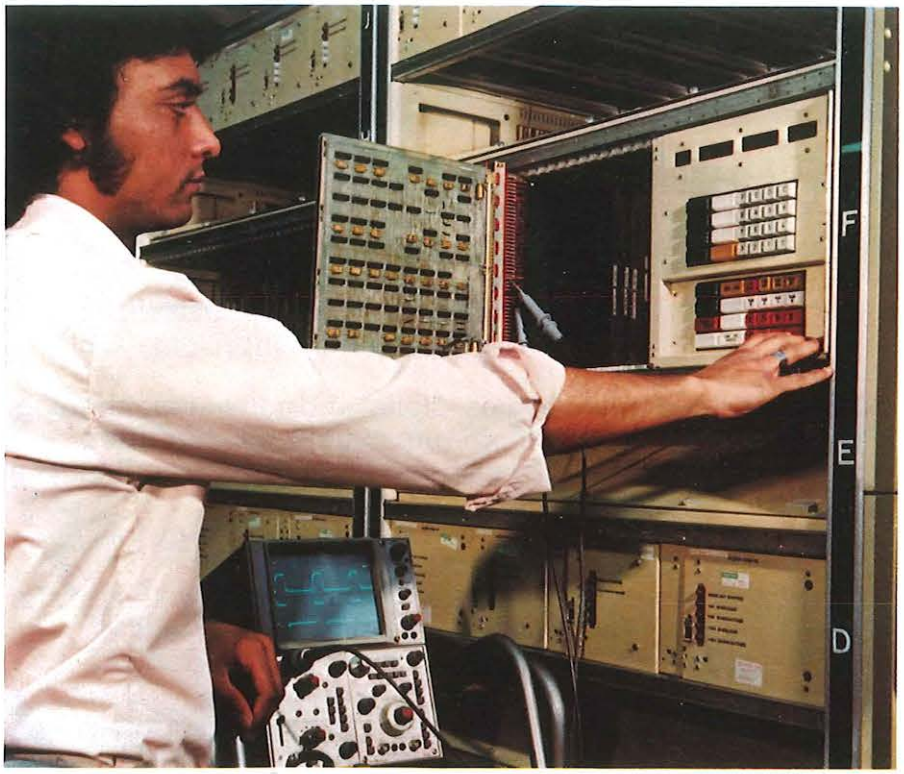
With SPC the information required to set up and control connections – including dialled signals, customer class of service information, routing and charging information – is stored and manipulated in computer-like data processors in accordance with electrically stored programs of instructions.

By using different software programs, the same equipment hardware can be adapted to meet the service and operational requirements of a variety of applications. SPC also provides considerable in-service flexibility for the day-to-day management of the system – for example, for changing number and class of service information – and for new services and facilities.

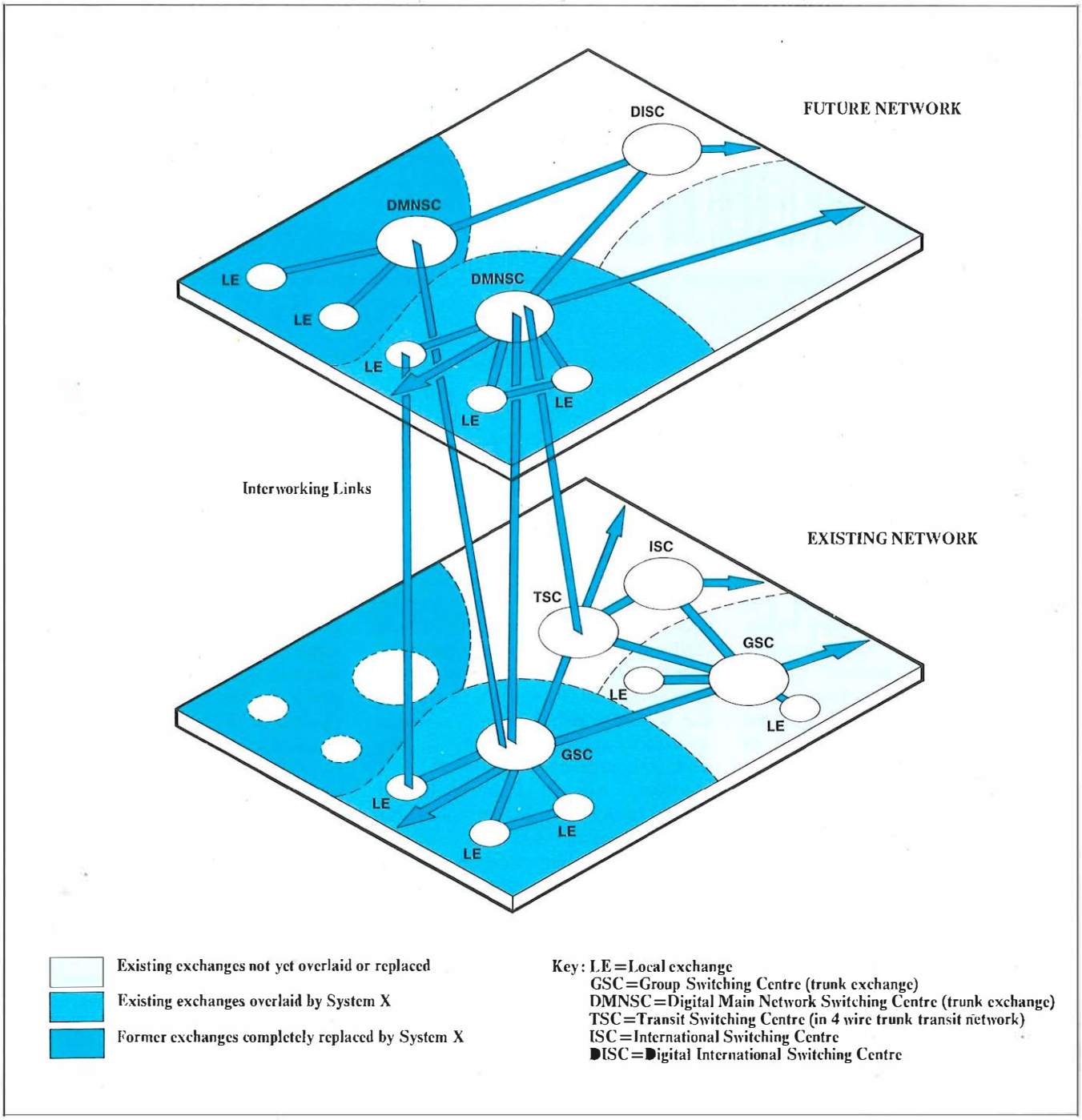
Common channel signalling means signalling information is passed between switching centres in the form of high-speed data messages over a common channel, functionally separate from the communications circuits they control. The structure of the data messages caters for an expanding range of facilities and services, as well as for the transfer of information required to manage the overall system and monitor its performance. Considerable economy arises from the use of common channel signalling because it avoids the need for signalling equipment on individual speech circuits between centres.

With digital switching, speech and other signals are switched through an exchange in digital form using electronic switching equipment "time-shared" over 30 or more connections. System X is being designed to secure economic and service benefits from the integration of digital switching and digital transmission, which is already achieving wide network penetration.

Such integration minimises the equipment required at the boundary between transmission and exchange equipment. It also provides a transmission performance that is virtually independent of distance and the number of exchanges through which calls are routed, and well suited to both voice and data services.



Processor Utilities for System X under test at the manufacturer's premises. When loaded with stored programs and network data, they can perform control functions for System X exchanges.



The overlay concept – one way of introducing System X into an existing network.

The adaptability and in-service flexibility that goes with the three basic system concepts just described is enhanced by the adoption of a modular approach to systems architecture, whereby each application can be assembled from a range of modular "building bricks".

The major modules – themselves made up of smaller modules – are the subsystems. These include processor utilities which provide data processing facilities capable of handling various service and traffic requirements, digital switching subsystems for interconnecting digital channels conforming with internationally agreed standards, and analogue line termination subsystems which convert analogue transmission signals into digital form, and vice versa.

Other subsystems include those required for interworking with existing exchanges using the diverse variety of signalling systems already in use, message transmission subsystems which perform common channel signalling functions with error protection, and local switching subsystems which exploit reed-relays in the subscriber switching stages to simplify problems of interworking with existing designs of customers' apparatus.

The modular approach applies to both software and hardware, and is expected to yield many advantages. Changing service, operational and traffic requirements, for example, can generally be met by the addition or modification of individual modules. New generations of technology can also be introduced into specific subsystems without disturbing the architecture of the system as a whole.

The ability to respond quickly to changes in requirements, to advances in technology and in meeting export needs is becoming increasingly important. Many features of System X development are intended to reduce the time and effort required to generate

The switching system test facility building at the Post Office Research Centre.

new designs and carry them through to production and use.

A standard equipment practice, for example, with well defined dimensioning rules and well suited to automatic production is being developed, together with a coherent documentation scheme common to the Post Office and the firms involved. Extensive computer-aided design facilities are also being established, together with a computerised database so that the vast quantity of design information now being generated can be exchanged between the various design teams and, in due course, made available for planning, production and maintenance purposes.

But much of the driving force behind System X is to hold down costs to customers, and many factors contribute. The extensive use of microelectronics means that there will be substantially less equipment to produce, and fewer wires to interconnect. Less time and effort will be required to install exchanges, there will be significant savings in accommodation, and many features of the system will help to hold down management and other costs.

In the longer term customers should become aware of significant improvements in the service performance of the network as a whole. But System X is unlikely to achieve any very considerable penetration before the mid-1980s, and it will not displace all the systems for many years after that. Clearly, for a long interim period, the service benefits will be distributed unevenly through the network and constrained by the more limited capabilities of what already exists in the network.

One way of overcoming some of these restraints is to introduce System X as an overlay on the existing network, connected to it, but having the minimum number and variety of interfaces with it. Carried to extremes, the approach would enable all system growth to be met by System X. But, more important, calls completed within the overlay will be free of present interworking constraints.

So the overlay approach offers the possibility of establishing a high capability network by a comparatively early date – perhaps interconnecting major cities in the first instance, and used to provide advanced data and telephone facilities, of particular value to business customers. But this is only one way in which System X might be introduced and exploited, and the possibilities continue to be explored.

System X cannot, of course, be considered in isolation. In many ways it is best regarded as the central feature of an overall system strategy that is being progressively created for the evolution of the network as a whole. That strategy is intended to harmonise System X development with other current developments – for example, in transmission and in the updating of existing systems.

Some of the longer term possibilities for which System X will pave the way must be taken into account – including the extension of digital working out towards the customer and, perhaps, the provision of a comprehensive range of voice, data and visual services over a common network.

While the longer term must be considered, however, the major preoccupation in recent years has been to lay the foundations for the development of System X itself. This has involved major effort to determine service and operational requirements, to decide on system architecture and the technology to be used, and to establish the required development support facilities and essential equipment, components, documentation and other standards.

In all this, the Post Office has worked closely with its principal equipment suppliers – GEC, Plessey and STC – in a relationship that is enabling combined resources to be co-ordinated in a common programme. A prime objective of the development is that System X will meet Post Office needs with designs that are fully competitive on world markets.

The overall programme is co-ordinated through contracts let and funded by the Post Office. Major long-term development contracts have recently been placed with the companies for the first stage of design and proving of the system. At present, two particular applications are being concentrated upon – the digital main network switching centre for tandem and trunk purposes, and a local exchange towards the lower end of the size range.

Design for these two applications is now in full swing, and these will be coming into service in the early 1980s. They will be closely followed by other applications, including international and manual board centres, and a range of local exchanges to cover the variety of situations.

From this introduction it can be seen that System X is a major development for which preparations are already being made for its production and implementation. It has many objectives – economy in capital and running costs, exportability, improved service performance and long-term evolutionary potential for a more comprehensive range of telecommunications services.

It is difficult to know which of these objectives is the most important. Fortunately, however, such is the power of the technologies of System X that it is unnecessary to decide.

Mr L. R. F. Harris is Director of Telecommunications Systems Strategy, whose Department is responsible for creating an overall systems strategy of which System X is the central feature.

PO Telecommunications Journal, Winter 1977/78

Vital links in power control

WG Goodall

ELECTRICITY supplies throughout England and Wales are provided by the world's largest power system under integrated and centralised technical control. Overall responsibility for maintaining and developing the system rests with the Central Electricity Generating Board (CEGB), and to do this efficiently and economically it relies on vital communications links provided by some 2,500 private circuits rented from the Post Office.

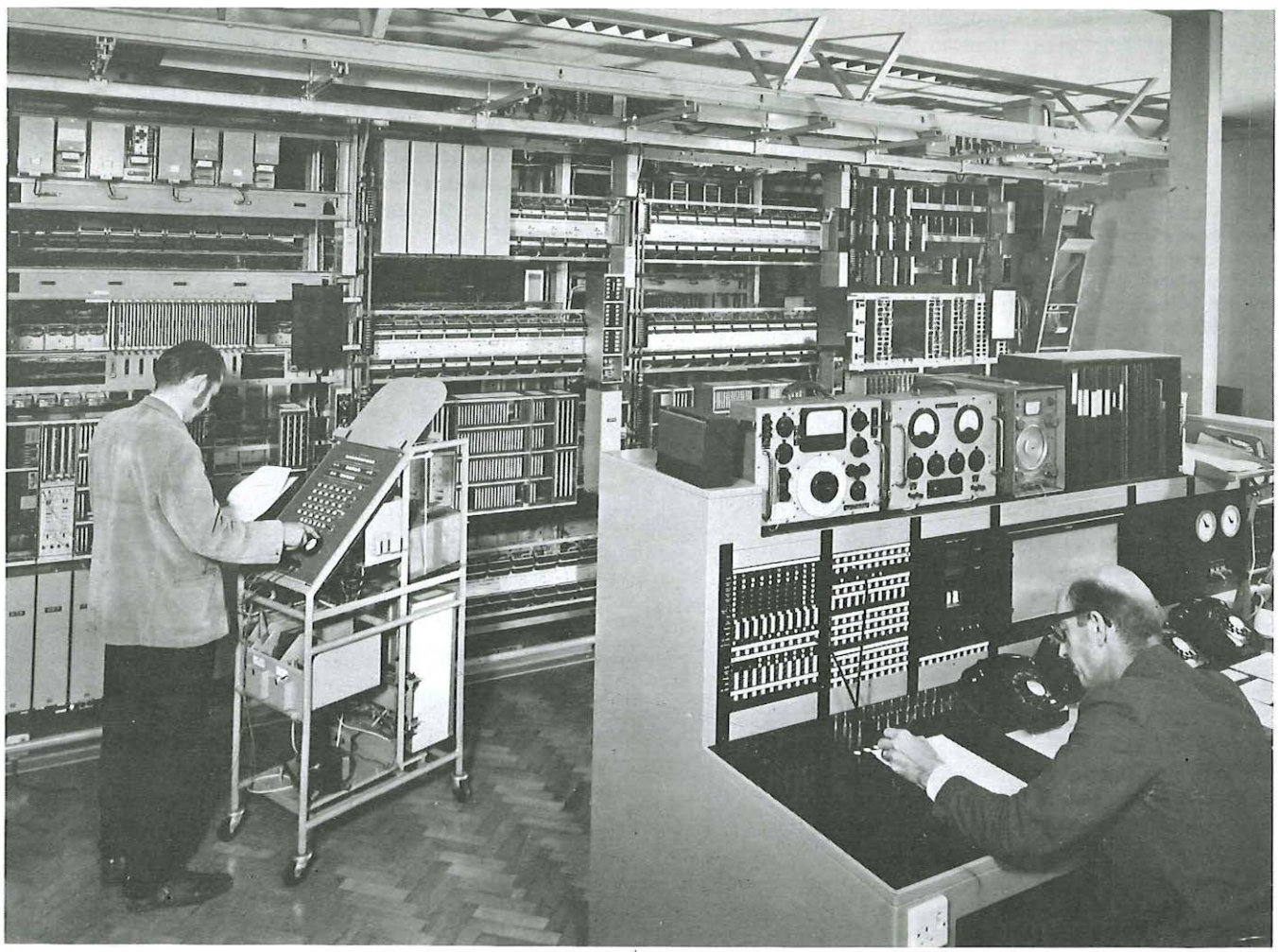
Within the CEGB network are 137 power stations and 14,500 circuit kilometres of high-voltage power line distribution. Efficient co-ordination of these geographically widespread power sources and distribution arrangements is the task of a highly sophisticated three-tier control system based on a national control centre (NCC) in London, with seven grid control centres – combining district and area functions – in Manchester, Leeds, Nottingham, Birmingham, St Albans, East Grinstead and Bristol.

To carry out their control functions all these centres require essential information on such aspects as power station outputs, power flows over the grid system and whether the switchgear is open or closed. The links for transmitting this information are part of the key role played by the private circuits.

Information transmitted over the private circuits to the seven grid control centres is assembled and displayed in front of the control engineer's desk on wall-mounted diagrams. At the NCC, however, which requires information on the complete network, a conventional wall-mounted display would be too unwieldy. Fortunately its supervisory nature allows the use of selective methods of display based on the use of duplicate high-speed computers, in which the controller can call up on a visual display unit (VDU) a particular portion of the network.

Each computer is capable of handling the total information obtained from incoming signals received over the private circuits from area control centres. The computers use this incoming information together with stored diagram data to generate the required network information and display it on the VDU. Twelve VDUs enable the complete network to be displayed if necessary.

In the same way that the power system network is designed to withstand the loss of the largest generator or power line feeder so, too, must the communication system be capable of functioning adequately if a main channel fails. Security of the complete control system is therefore based upon duplicate and separately routed radial



Telecommunications equipment undergoes testing in the control room at the Central Electricity Generating Board's national control centre.

communication links, reinforced by orbital links between control centres and major stations.

Basically, the chief functions of the CEGB's communication network are to provide speech communication facilities, telemetry – the transmission of meter readings and alarm conditions – and power system protection.

To economise on the total number of circuits required, the speech communication facility is restricted to that portion of the available circuit bandwidth below 2,000 Hz, and utilises the available bandwidth above 2,000 Hz for telemetry purposes. Under fault conditions it is sometimes essential for power system network switching to be carried out quickly, and the signalling system provided by the CEGB enables its controlling officers to have priority use of a speech channel, even though this may already be in use for non-operational purposes.

The band above 2,000 Hz is utilised to provide six low-speed data channels spaced at 120 Hz. Each channel is capable of transmitting a number of signals giving indications of meter readings at major stations.

To safeguard expensive power system equipment and lines against damage if a fault develops on the network, three forms of protection – known as Intertripping, Unit Protection and Distance Protection – are used. These depend upon the availability of a reliable communication channel to convey vital decision making information between the terminals of the system under protection.

The Post Office private circuits which convey all these forms of protection information range from the simple short-distance type using unamplified pairs to longer distance circuits requiring amplification. The nature of their protection function makes it essential that they must continue to perform satisfactorily whenever there is a fault condition on the section of the power system they are helping to protect.

To provide the CEGB with communication links having the highest possible in-built reliability the Post Office has to take into account mains independency, separated routing, special and high-grade precautions and emergency fault repair treatment, as well an ensuring the private circuits are capable of meeting the required engineering performance specification.

Protection circuits must remain operational if the public AC mains supplies fail, and these are referred to as "mains independent" circuits. When providing these circuits the Post Office takes special steps to check that all "active" equipment, such as line amplifiers, used in the routing are fed either from batteries or "no break" power supplies. This check is necessary to safeguard against routing the circuit through Post Office stations which could experience up to 15 seconds delay in changeover to standby supplies if a public AC mains supply fails.

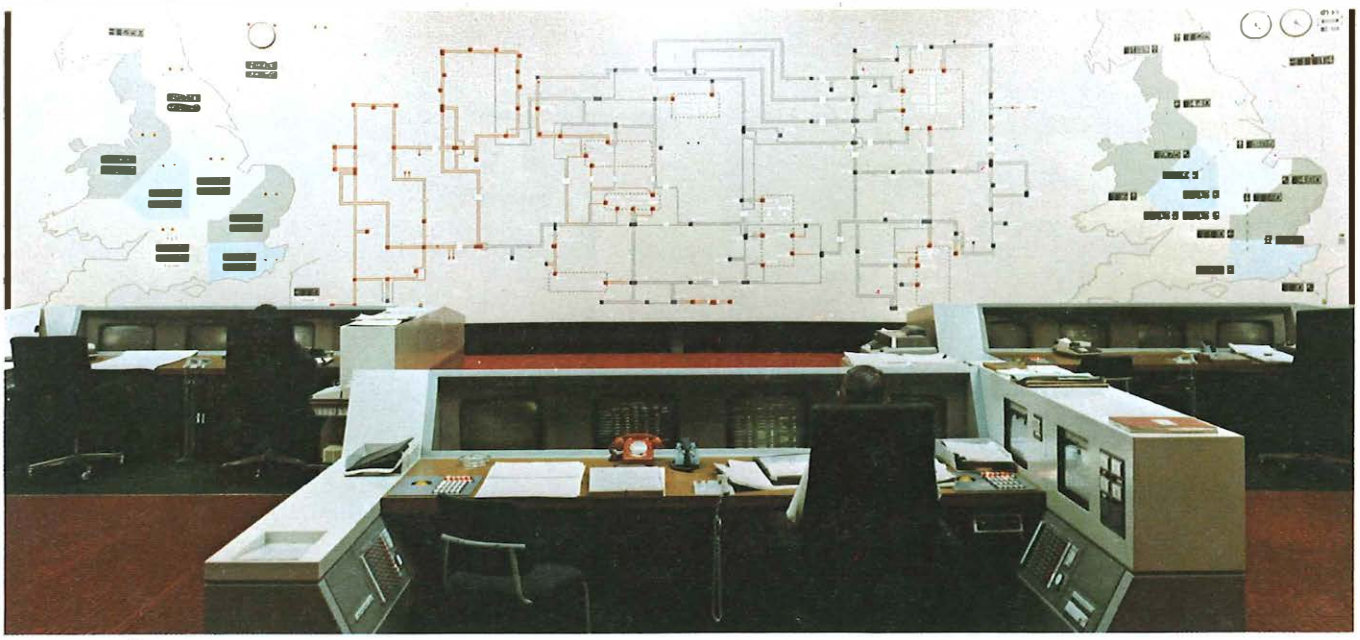
Because of the importance of grid control centres in the control and protection of the grid system, the CEGB requests separated routing of their private circuits radiating from these centres and major stations. To achieve this requirement, separated outlet cables are provided from each location and the Post Office endeavours to ensure that the separation is maintained throughout the complete routing for the life of the circuits.

If, under fault conditions, it is possible for the earth potential at a generating or grid station to rise above 650 volts, it is classified as a "hot station". Stations in this category are not dangerous for staff provided all metal work is bonded to the same earth. If a connection were to be made to an earth fed from the local Post Office exchange by way of a pair in the outlet cable, however, the difference in potential could be a source of possible danger to personnel and equipment.

To safeguard against this possibility each pair in the outlet cable is fed by way of an insulated "U"-link to the line side of a high-voltage isolating transformer. Safety precautions also demand that such outlet cables, irrespective of the amount of increase in earth potential under fault conditions, must be polyethylene sheathed within 100 yards of any station metalwork.

For many years earth return DC "phantom" signalling has been in use on CEGB private circuits, mainly because it is simple, cheap and reliable. At "hot stations" this is accomplished by providing an earth from the local Post Office exchange or repeater station and extending it over a bunched pair of wires in the outlet cable. Again the terminating condition in the CEGB station must be such that this earth is isolated by means of a suitable high-voltage isolating device.

Failure of this remote earth connec-



In the control room at the national control centre engineers use two desks for system load dispatching, switching and security, while a third is for overall supervision and control. The giant mosaic diagram shows at-a-glance the grid network and demand and protection figures.

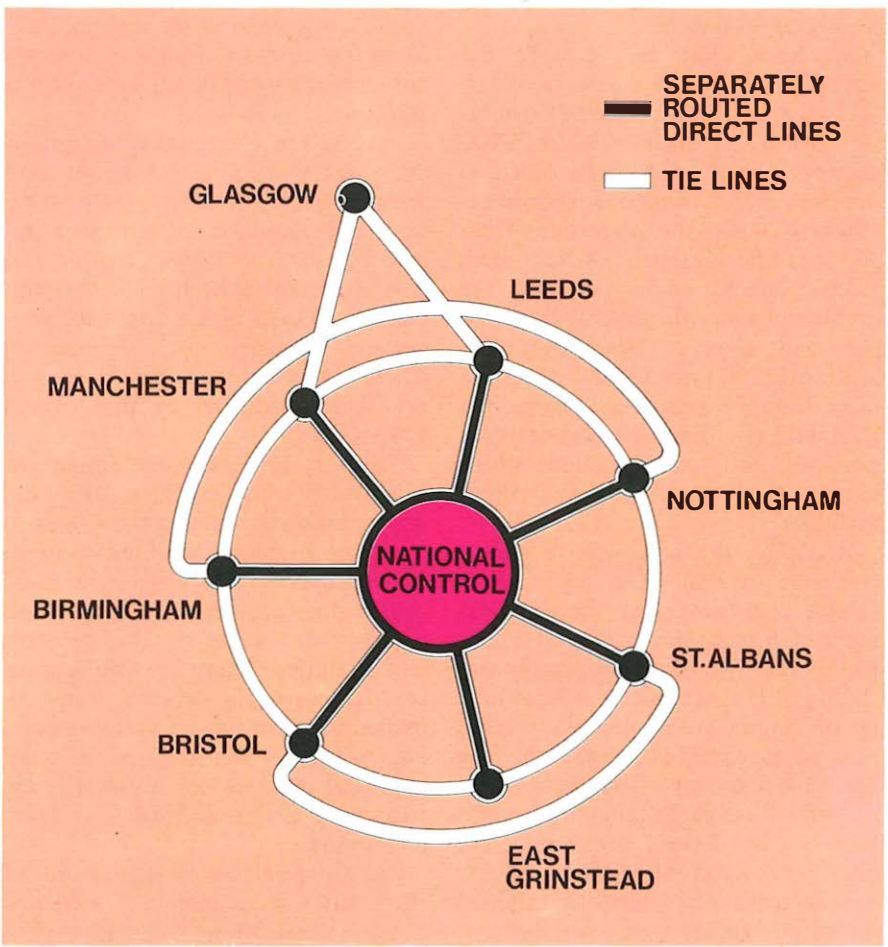
The national control centre's teleprinter room, which has links with the seven grid control centres for interchanging information such as estimated demands and transmission equipment outages. There are also links to the Meteprological Office, the South of Scotland Board and Electricite de France.

tion at a major station would result in the station and its dependant minor stations becoming isolated from each other and from the main control network. For this reason major stations requiring a Post Office signalling earth are provided with two remote earth connections, one in each outlet cable.

A high-grade circuit is one on which special precautions are taken to obtain maximum reliability. This, for preference, requires that "active" equipment should be fed from "no-break" power supplies, a mandatory requirement in the case of CEGB "mains independent" circuits. Additionally, the soldering of all interconnections and special labelling and marking of equipment and records is involved, to indicate to maintenance staff that no work should be carried out on these circuits without the prior approval of the Post Office Circuit Control.

That, basically, is the current situation. Post Office private circuits are playing a key role in ensuring that the CEGB's communication channels remain in service at all times – a vital element in the industrial, economic and social life of the country.

The CEGB control system, showing the method of interconnecting the control centres.



Mr W. G. Goodall is head of a group in Network Planning Department at Telecommunications Headquarters responsible for the planning and engineering design of private circuits.

The value of bright ideas

VCH Overton

In the past 70 years nearly 270,000 suggestions have been submitted by staff to the Post Office Awards Committee, and 53,000 awards have been made for increasing profitable business and improving productivity and efficiency.

HOW often do Post Office engineers and technicians, faced with dozens of different work situations every day, think to themselves: "Is there a better way of doing this?" The answer is probably "frequently", but how many actually sit down and do anything constructive about it?

One body that can provide the answers with a high degree of accuracy is the Post Office Awards Committee, which currently receives 6,000 suggestions each year from staff and which in 1976 authorised payment of almost £20,000 for suggestions from all over the country. Of the ideas received about seven per cent are eventually adopted, while a further 10 per cent receive "encouragement" awards. In all, since the scheme began more than 70 years ago, more than £250,000 has been awarded to thousands of staff for suggestions which cover the whole range of Post Office activities.

Originally, the idea was to enable workmen in Post Office factories to submit suggestions for the improvement of factory processes and equipment. The award was invariably five shillings (25p). Today there is, in fact, no maximum award and the highest paid so far is £600, shared by two Assistant Executive Engineers (AEEs) in North Eastern Telecommunications Region who devised a technique for carrying out jointing work on existing coaxial cables, thus causing minimal interruption of service to customers.

The minimum amount now payable for an adopted idea is £15 while "encouragement" grants are normally £10 or £12. Awards made in 1976 averaged £46.52.

The scheme proved successful from the start, and was extended in stages until it was open to all staff in 1935 following a report from a joint Committee of the Post Office Departmental Whitley Council.

On receiving a suggestion the staff of the secretariat acknowledge it and arrange for its detailed consideration by the Headquarters Department responsible for the subject matter. To ensure impartial evaluation the suggestor's identity is not disclosed. Suggestions accepted for adoption or which are worthy of encouragement are then considered by the Awards Committee.

There is, however, one important rule which often troubles suggestors and occasionally causes the Committee some problems of interpretation. This is that for the suggestion to be eligible for consideration, it must fall outside the scope of the person's official duties. There are two reasons for this: first, the scheme is not intended to reward merit in doing one's job, which is the business of staff appraisal and, second, all awards are treated as prizes and are free from income tax.

The Committee's interpretation of this rule is sometimes criticised because the dividing line is not easy to draw in some cases. If in doubt, the Committee seeks further advice.

The Committee comprises 12 high-level officers drawn from the four Post Office Businesses with a Central Headquarters chairman. It meets at least three times a year in full session and at other times as business demands. Its functions are to administer the scheme and to assess the major awards for adopted suggestions in the light of Departmental reports and the assessors' recommendations.

Assessors are normally heads of sections and are nominated by Headquarters Departments for their specialised knowledge. They give a recommendation for an award after being satisfied that the suggestion has been fully considered and any savings carefully assessed. The decision whether to adopt a suggestion rests with the Headquarters Department concerned and not the Committee, which ensures fair treatment and equity in amounts awarded.

Awards are based mainly on the net savings or net revenue accruing from implementation of the suggestion, but factors such as the degree of novelty or ingenuity and the rank and official duties of the suggestors are also considered. The Committee gives its decision to the suggestor directly.

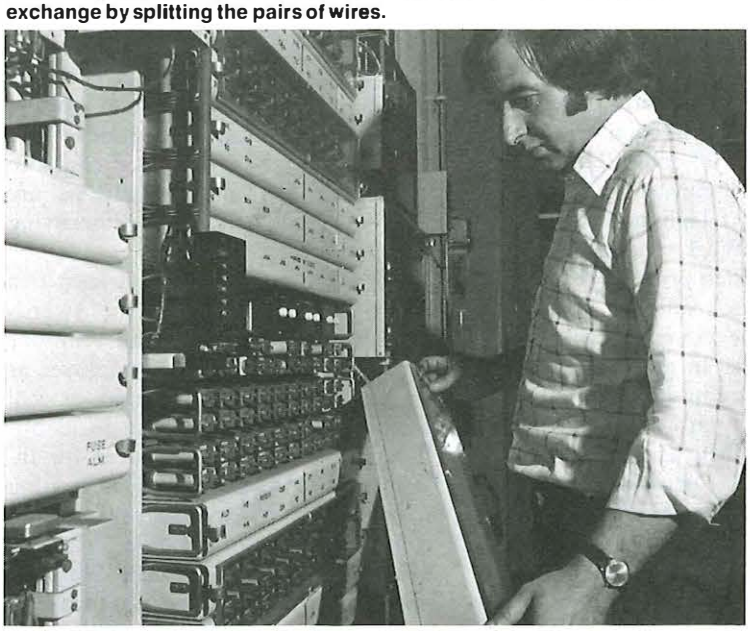
Inevitably, there is disappointment when a suggestion is not adopted, or is "anticipated". With virtually the same operation being carried out on

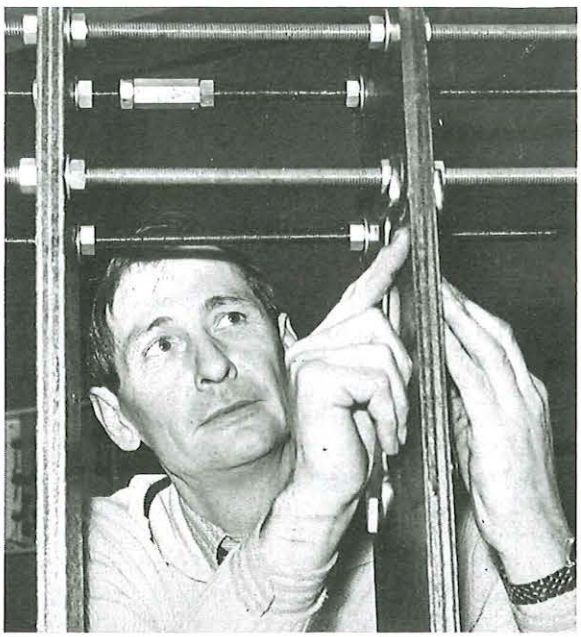
(Continued on page 24)

Assistant Executive Engineer David Drake – £350 for a suggestion to equip the subscriber apparatus and line tester (in the background) with a full range of coinbox test facilities.

Technical Officer Bob Brace – £150 for designing an outrigger which enables a printed circuit board to be pulled out of the main apparatus rack during exchange maintenance.

Technical Officer John Marshall – £500 for an idea to double the capacity of the outgoing routing equipment at London's Faraday international exchange by splitting the pairs of wires.





Technician Geoff Stanley – £200 for a device enabling exchange battery plates to be tightly clamped and immobilised while they are hoisted out of the cell, thus preventing damage.

Award winners all

Twice an award winner, Technical Officer David Kaye (right) receives a cheque for £400 from Mr Brian Woollett, General Manager of Bristol Telephone Area. The award, for a suggested space and time saving modification to wiring in small electronic exchanges, came two years after David received £500 for an idea to increase the capacity of traffic recorders in electronic exchanges.

The author (left), who is Secretary of the Post Office Awards Committee, discusses awards suggestions with Mr R. H. Jebb, the Committee's Chairman.

identical equipment in numerous centres throughout the country, it is not surprising that the same idea occurs to more than one member of the staff.

To be fair to all suggestors the Committee preserves its case files for 10 years, and careful checks are made of the secretariat's records to ensure that the originator of an adopted idea is considered for any award. Later submissions are regarded as "anticipated", although this does not necessarily preclude the suggestors from an award if, for example, they propose further improvements.

If a suggestion cannot be adopted the suggestor will receive a standard reply, usually without a detailed explanation of the reason for not adopting it. The Committee would like to be able to give reasons but unfortunately the volume of work and staff time required makes this impracticable. Replies with explanations are, however, always provided on safety matters or on evidence of bad practices. And here reference to a Telecommunications Instruction or other source often proves helpful. If an explanation is specially requested it will be provided.

In an organisation as diverse as Post Office Telecommunications the range of suggestions is very wide and many are particularly ingenious. The two AEEs mentioned earlier who were awarded the £600 provide a good example.

When a cable is diverted, it is necessary to maintain continuity of a large number of trunk circuits. The AEEs' suggested technique enables circuits to be temporarily transferred from working pairs to spare pairs in the same cable and uses short lengths of cable similar to television aerial leads to interconnect pairs at each end of the diverted section of cable. The transfer and restoration can be made in a few minutes when telephone traffic is at a minimum. Work using normal methods can then proceed on the pairs from which the traffic has been transferred and be completed in normal working hours. In this way it is possible to achieve considerable savings.

As the Committee is particularly anxious to encourage suggestions to combat fraud, last year it awarded £100 each to a Technical Officer (TO) from Cardiff and an AEE from Bristol. Their awards were for a suggestion to overcome a fault condition that could permit the irregular use of equipment by coinbox subscribers for dialled overseas calls. In these days of energy conservation the Committee was also particularly pleased to award £500 to a TO from Manchester Central Area for an idea that produced, as a by-product, considerable power savings. His modification to the Printer Meter Check Number 2A to provide a hold circuit for the 'T' magnet was proposed to improve its service reliability and to extend the life of the ink ribbon and the 'T' magnet bearing. Apart from the valuable service improvements the idea also resulted in large power savings as less current was consumed.

A modification to the TXE2 traffic recorder increased its capacity and reduced by one the number of traffic recorders necessary at most TXE2 exchanges. This resulted in considerable savings, and the TO from Bristol Area who proposed the modification was awarded £500 by the Committee.

In recent years the Committee has modified its approach to keep abreast of change by increasing its recognition of locally implemented ideas. It has acknowledged many instances where local management has found ideas both practicable and cost effective, although for various reasons they have not been considered appropriate for national use. About 25 per cent of all awards made now reflect local or limited use of an idea.

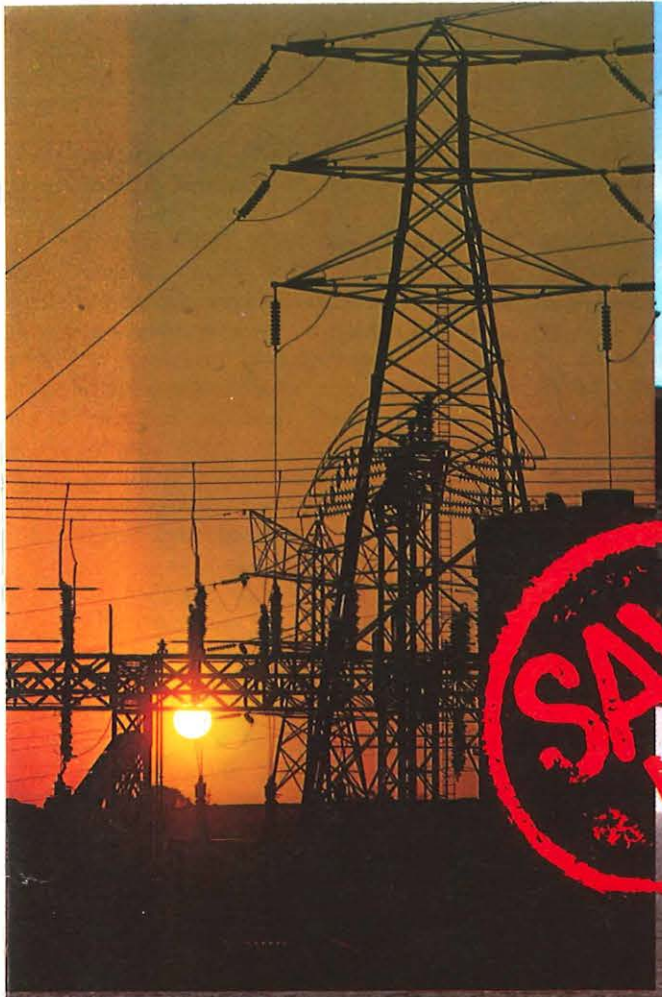
The rules of the Awards Suggestion Scheme were examined and revised last year. Many restrictions inherent in the original rules were removed to allow consideration of more suggestions of benefit to the Post Office.

The future of the Awards Scheme for suggestions looks healthy as staff response to the scheme continues to grow. The Committee says it would, however, like to see more ideas on the commercial or non-technical side of the Post Office Businesses. The technical side also has new challenges to meet each day and suggestions are welcomed, particularly for improving new technology.

There also appear to be at least two wider purposes served by the Awards Scheme. First, it helps staff relations because it appeals to the employee as an individual in his own right, as well as stimulating his initiative in identifying problems and his talent for invention or ingenuity in suggesting solutions. In this way it makes a contribution to participative management. Second, it provides management with a valuable feedback of information on problems experienced in job situations at the point where work is done. This leads to better managers.

Finally, the Awards Committee is always pleased to hear from any Post Office staff member who has a useful idea to increase profitable business or to save Post Office money. The suggestion form P2050G is available from local offices or from the Secretary, Awards Committee, 23 Howland Street, London W1P 6HQ.

Mr V. C. H. Overton is a Higher Executive Officer in Pay and Conditions of Service Department at Central Headquarters, and Secretary of the Post Office Awards Committee.



Saving energy

R Smith

FEW people these days can afford to be unconcerned about domestic fuel costs, and for many householders there is an all-the-year-round campaign to keep bills to a minimum. Unfortunately the same standards are not always applied at work.

The Telecommunications Business has long been interested in fuel economy as an aid to keeping operating costs as low as practicable, and in a bid to make staff acutely aware of the need for care in this respect a film entitled "Why me?" has been produced. It traces a day in the life of a typical employee who gives little thought to holding down the energy bill. His attitude is that the small savings he personally could make are insignificant. The point the film makes is that if every member of the 415,000 Post Office staff were more energy conscious, the total savings made would be considerable.

This situation was brought sharply into focus for the first time during the energy crisis of 1973/74, which changed economical use of fuel from

good business sense to vital necessity. A Division at Telecommunications Headquarters was actively involved in maintaining fuel supplies to the Business during those difficult times, and later a group was formed and given responsibility for producing an effective energy conservation programme to ensure adequate fuel supplies in future crises.

Basically the group's main aim is to save money by reducing fuel expenditure. The Business does not, however, try to save fuel at other expense. Indeed the Department of Energy, which controls the nation's energy policy, advises that fuel economy measures should be taken only when financial advantages will be obtained.

Fuel and electricity costs in this country have risen more than threefold since 1973. One of the main reasons, and one of the causes of the general world inflationary situation, is the depletion of fossil fuel stocks together with a continuing increase in fuel consumption. Recent Department of Energy figures indicate that the world's oil resources will be exhausted within 36 years and that coal will run out in about 170 years. These figures include allowances for likely, but as yet undiscovered, fossil fuel reserves, but no allowance has been made for the effect increased prices and possible legal restrictions may have on fuel consumption in the years ahead.

The United Kingdom's position is slightly different in that there are sufficient coal resources to last for 300 years, but North Sea oil will stop flowing much sooner. At present the North Sea wells produce about one third of the UK's oil needs and by 1980 Britain will be self-sufficient in oil. North Sea oil is, however, almost pure enough to burn in a diesel engine as it comes ashore, so there will always be a need to import some heavy crude oil to provide chemicals.

It is forecast that by 1985 the UK will be producing three times its needs from the North Sea and exporting the excess. By 1990, however, the wells will be drying up, and only half the country's requirements will be met from this source.

The Post Office is committed to limiting its fuel consumption as far as is economically feasible without affecting operating efficiency or working conditions for staff. And here it is worth looking at how the Telecommunications Business used different types of energy, excluding road transport fuel, in the year ending April 1977. No fewer than 570 million units of electricity, costing £17 million, were accounted for, while 110 million litres of fuel oil (£7·5 million), 9·9 million therms of gas (£1·8 million) and 24 thousand tonnes of coal (£530,000) were used.

This, in fact, represents a decrease in energy consumption of 1·6 per cent on 1975–76, which in turn was 11 per cent lower than during 1974–75. Since the economy campaign has been effective, the Telecommunications Business has reduced consumption by about 12 per cent. Owing to inflation, however, the fuel bill has risen by about 30 per cent in the same period.

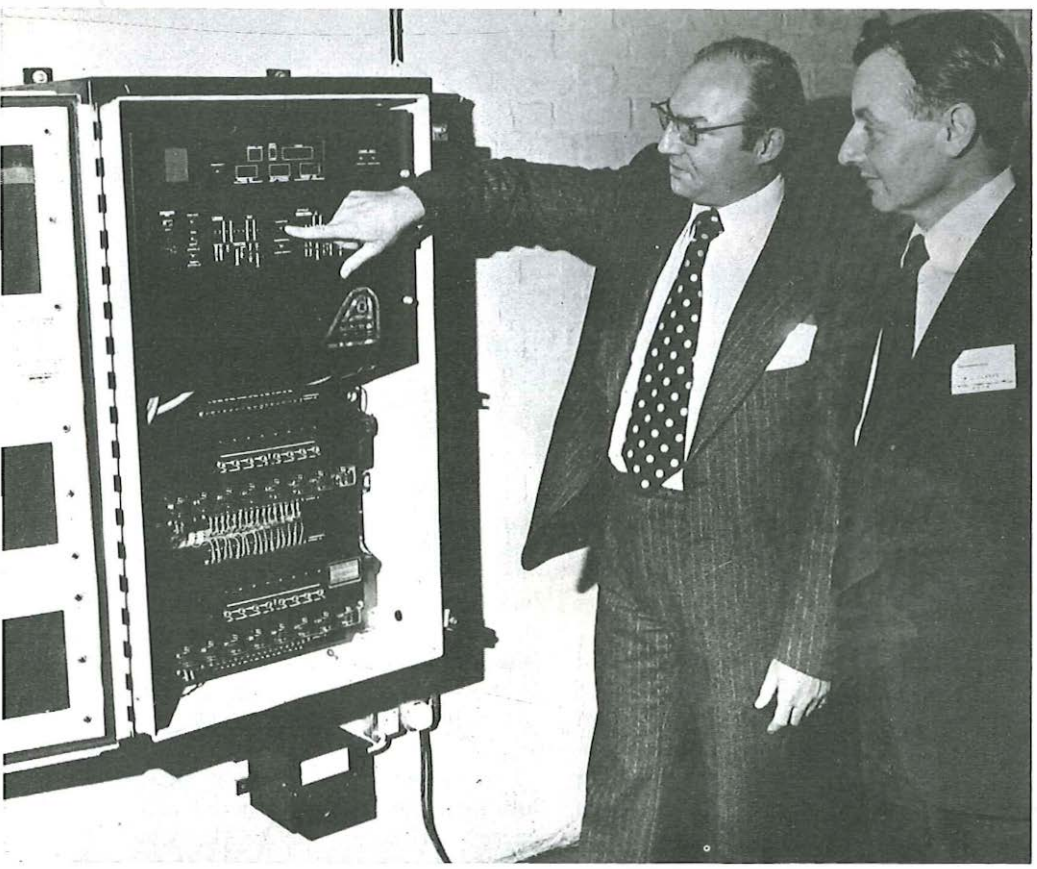
But, how exactly has the Telecommunications Business been implementing practical methods of reducing its fuel costs? Various measures have been taken, one important area being in the heating of buildings.

Many heating systems installed in these buildings are automatically switched off at night and switched on again before staff arrive the next morning. In the past, to ensure a building was always at a reasonable temperature in the morning, the switch-on-time was fixed to heat the building on the coldest day likely to occur. Obviously on most days the heat came on before necessary, but this was the most economical system until one called "Optimum Start Control" became available.

Optimum start controllers measure the temperature outside a building, compare it with the inside temperature and decide when the heat should be turned on for the building to reach the required temperature when staff arrive. These controllers are being fitted in many buildings throughout the country, and they generally reduce a building's heating costs by 15–20 per cent. In some cases savings of up to 40 per cent have been obtained, mainly through the correction of other faulty controls when optimum start control has been fitted.

Another area where significant savings can be made is the use of electricity. Tariff rates for many Telecommunications buildings are based not only on the amount of electricity used, but also on the greatest amount used in any 30-minute period. In some cases a particularly high demand can result in an unnecessarily high demand charge over the subsequent 12-month period. Savings can therefore be made by controlling both the level of consumption and by suppressing the peak demand.

In the last few years several com-



Mr Peter Noble (left), of CSL Energy Management Ltd, points out a reading on the programme control unit of the energy management system installed at Reading trunk exchange to cut the use of electricity. Looking on is Mr Alan Clarke, Energy Officer of South Eastern Telecommunications Region.

Some of the posters being used by the Telecommunications Business to highlight the many different ways of saving energy.

panies have developed "Energy Management Systems". There are variations between the different companies' products, but they all use electronic micro-processors to reduce the use of electricity, usually by switching off non-essential loads when a predetermined level of electrical load is approached. The more sophisticated systems can also provide other facilities, such as fire alarms and site security control.

These systems are expensive, but in certain installations the cost can be recovered in less than four years. A trunk switching centre in Reading was fitted with an energy management system in March 1977 at a cost of £12,000, but the estimated annual savings from this system, based on the first four months' operation, are £7,800 on an annual electricity bill of about £62,000. Further schemes are now under consideration.

In Telephone Areas clerical staff, with the support of engineers, are responsible for checking annually that a building is operating on the most economical electricity tariff. As one Electricity Board has 13 different tariffs which could apply to any one building and there are 14 Electricity Boards all with their own tariffs, it can be seen that it requires considerable knowledge to undertake a tariff review adequately. This is just the type of job for which computers are well suited.

Several Regions have produced computer programs for their own needs, but none has been suitable for national adoption. Telecommunications Headquarters (THQ) and the Data Processing Service have now produced a series of programs covering all the Electricity Boards' tariffs and following union agreement the first set of tariffs, from Midlands Telecommunications Region, are now being processed. When every Region is covered by the program a saving of about £200,000 a year on electricity bills is expected.

A powerful tool for finding out exactly how energy is being used and to identify where waste can occur is the "Energy Audit". The concept is similar to cash accounting in that records are kept on a yearly basis of all the gas, electricity, oil, etc, entering a building and how they are used.

The THQ Energy Conservation Group, in conjunction with Newcastle University, has been operating an energy audit in a number of telephone exchanges. From this exercise it is hoped to obtain an "energy index" for different types of buildings which could be included in the Client's Brief for a new Telecommunications building. This would ensure that the building was designed for minimum practicable energy use.

A problem arises where buildings have defects in the fabric – such as around doors and windows, and where walls and roof meet – through which heat can escape. Curing all these faults is a sizeable problem and the obvious solution of filling the gaps may not be the right one. With the expert assistance of Newcastle University, an investigation is now underway to find efficient and economical solutions to the problems caused by poor building fabric.

Since the use of transistors became practical for telecommunications systems the trend has been to provide more services within smaller space. This is possible because of the low power dissipation and small size of individual transistors and integrated circuits. When many transistors and integrated circuits are squeezed into a small area, however, they give off considerable heat which has to be removed by forced ventilation, or even refrigeration techniques.

Fans and chillers take up space, as well as using power, and the point is fast being approached at which the gains made by miniaturisation are lost by the need to cool the equipment. This problem is now being actively studied at THQ with a view to limiting the power consumption density of future telecommunications systems.

There is no doubt that practising economy in the use of fuel will be a permanent feature of the Telecommunications Business. In the past three years much has been achieved, but more remains to be done. Apart from the 12 per cent reduction in fuel use already made, the Energy Conservation Group estimates that a further eight or nine per cent could be saved by implementing fully measures already in use – without any adverse effect on working conditions.

Mr R. Smith is a head of group in Operational Programming Department at Telecommunications Headquarters responsible for co-ordinating the Telecommunications energy conservation programme.

On the road to sales. . .

Continuing our series on some of the many different jobs essential to the efficient operation of Post Office Telecommunications, Myrtle Fullerton, a sales representative in London's South Central Telephone Area, outlines a typical day's work.

Mrs Fullerton pauses by the River Thames to check some papers before moving on to her next appointment.

IT IS COLD, wet and blowing a gale. No, I am not on the bridge of the cableship Iris, but foot-slogging through the streets of South London to my first call of the day. A Senior Sales Superintendent once told me: "A rep must be prepared to walk in all weathers." How right he was.

On the Southbank exchange area most business customers are big. This one, Shell International Ltd, is very big indeed. It has a large PABX 4 installation with direct-dialling-in (DDI) facilities and an international private network (see Telecommunications Journal, Summer 1977). Strange to think that when I started this job, the thought of a small house exchange system made me shake at the knees.

It is a fact that big customers produce few problems. They usually have a telecommunications officer, a resident Post Office engineer and a weekly visit from a sales rep, which helps to prevent troubles arising. When I see the telecommunications officer, we discuss shifting some non-standard apparatus, the provision of external DDI extensions and a query on the trial of the Express Callmaker.

On the way to my next call I notice an empty warehouse which has a "sold" notice on it and builders at work. Entering the site office I discover that the building is being converted into offices. It's an opportunity to take the names and telephone numbers of the developer and his architects so that later I can find out the likely telephone requirements then pass them on to Sales Forecasting.

Next I arrive for an appointment at what appears to be a derelict, locked building. Eventually the customer arrives and we enter a jumble of small rooms smelling of cats and rats. No decision will be reached today, but I carefully assess the probable requirements and interest the customer in a PABX that will suit his purposes. We then go down to the basement – hopefully free from rats!

Now to site a kiosk. These don't spring up overnight like mushrooms, but result from a known or reported need – and hard work by reps. This request originated from the local Residents' Association. I know roughly where the kiosk should go and have the annual revenue of the surrounding kiosks to help me assess the need. This should be easy but there are still many factors to take into account, like children from the nearby school of whom several, it is alleged, are budding vandals.

What about that pub forecourt then? On second thoughts the landlord is probably right, it wouldn't get used only for telephone purposes on Saturday nights. But wait a minute: has he got a public telephone? No, well one quick drink later I have a signed agreement for a coin collecting box to be installed in his bar.

Now I really must find a site for that kiosk and shortly I do. It is on a well

lit minor crossroads, under surveillance, not too near a curb, not too near a wall – and right outside the secretary of the Residents' Association!

Next it is a residential call. Reps get few of these, as they can be handled by the Sales Office team, but this one is special. A home help answers the door and I'm led to a frail, blind woman who has a problem. She can lift a handset but can't operate a dial and has a speech problem which precludes the use of a Sender No. 1. Could she manage a Card Callmaker? I explain the system and guide her hand through the procedure needed. It seems ideal. Now who does she call in an emergency – her son, the doctor, the caretaker. Right, we'll provide just three cards and notch the edges for identification.

An empty building... but Mrs Fullerton notes the agent's telephone number. Later she will check who may move in and their telecommunications needs.

I head back to the Installation Office for a late lunch and a discussion with the engineers. This may be to arrange a joint visit to inspect PABX accommodation, or to talk about some cabling problem I've foreseen, or simply to establish if what appears to be a hair-brained idea to solve a customer's problem really would work.

I must also arrange a PABX meeting to be held in a few days' time. Reps chair these meetings, which bring together the customer, his private contractor and the various departments involved in the Post Office to discuss problems and check progress. I book the conference room, arrange refreshments and advise all concerned of the time and date. Afterwards there will be notes to write, problems to solve.

I settle down to some writing. Every case has to be reported to enable my sales team to take appropriate action. In due course they will issue advice notes which will get equipment ordered, send engineers on their way, ensure directory entries are made and result in a satisfied customer. As always the clock keeps moving and soon it's time to begin the 20-minute train journey home, and to reflect on the day's work.

A sales rep's job is, of course, one of great variety. My customers have ranged from multi-national companies to rag and bone men, from members of the Royal Family to an artist whose impractical ideas for telecommunications were discussed in what appeared to be an underground bomb-site.

The range of equipment is equally vast, and the advice given must be correct. To all of these people I am the Post Office. If I tell them a thing will work, it must work, and what I say will happen, must happen. This is a big responsibility. And does being a woman make any difference? Not really. It took some time to win over a few engineers, and the occasional customer still says "I thought they said they'd send a man round."

The technical aspects take some mastering, but most of the snags concern appearance. The wind and the weather play havoc with hair and make-up. And if I wear fashionable shoes, I am sure to have to make an unexpected call to a muddy site.

And the advantages? Well, I really enjoy being a sales rep. The freedom, the fresh air and the walking are all compensations, and go towards making this one of the most varied and interesting jobs in Post Office Telecommunications. It is totally absorbing, which is perhaps another snag, as it is sometimes difficult to "switch off" when I go home to begin my other job as a housewife.

PO Telecommunications Journal, Winter 1977/78

During a call at the offices of London Weekend Television, Mrs Fullerton discusses extra telex facilities with Mr Sid Blumsom, head of planning and installation projects.

Model approach to manpower planning

AJ Masterman

Manpower is a key factor in business planning, and Post Office Telecommunications is using computer models to provide forecasts of future staff movements and needs.

THE FACT that the Telecommunications Business employs nearly 250,000 people in a wide variety of work makes manpower an important commodity and one which managers must control carefully to ensure that optimum staffing levels are maintained. Over or under staffing can have a serious effect upon efficiency.

In recent years much study has been undertaken into the movement and motivation of staff to provide managers with the information necessary to make the best use of their manpower. The techniques developed and employed in most major companies are generally grouped under "Manpower Planning" and they are used to try to maintain optimum staffing levels. The Post Office puts considerable effort into this area.

One aspect now receiving considerable attention is that of "modelling" manpower systems using a computer. The ability of the computer to manipulate data very quickly makes it ideal for forecasting future staff movements. In addition, the use of computers enables managers to see the likely effects on manpower of their policies almost immediately and gives them the opportunity to test alternative policies to overcome possible future problems.

A computer modeller must decide on the degree of detail he wishes to achieve, the scale of the model and the form it will take. If the model is to be used for prediction purposes, it must also be able to respond to an external influence in the same way as the original system. This requires an examination of the real system to note accurately its characteristics. The model must be constructed to ensure that it performs consistently before it can be used for forecasting purposes. Having been constructed and validated the model then becomes a useful management tool.

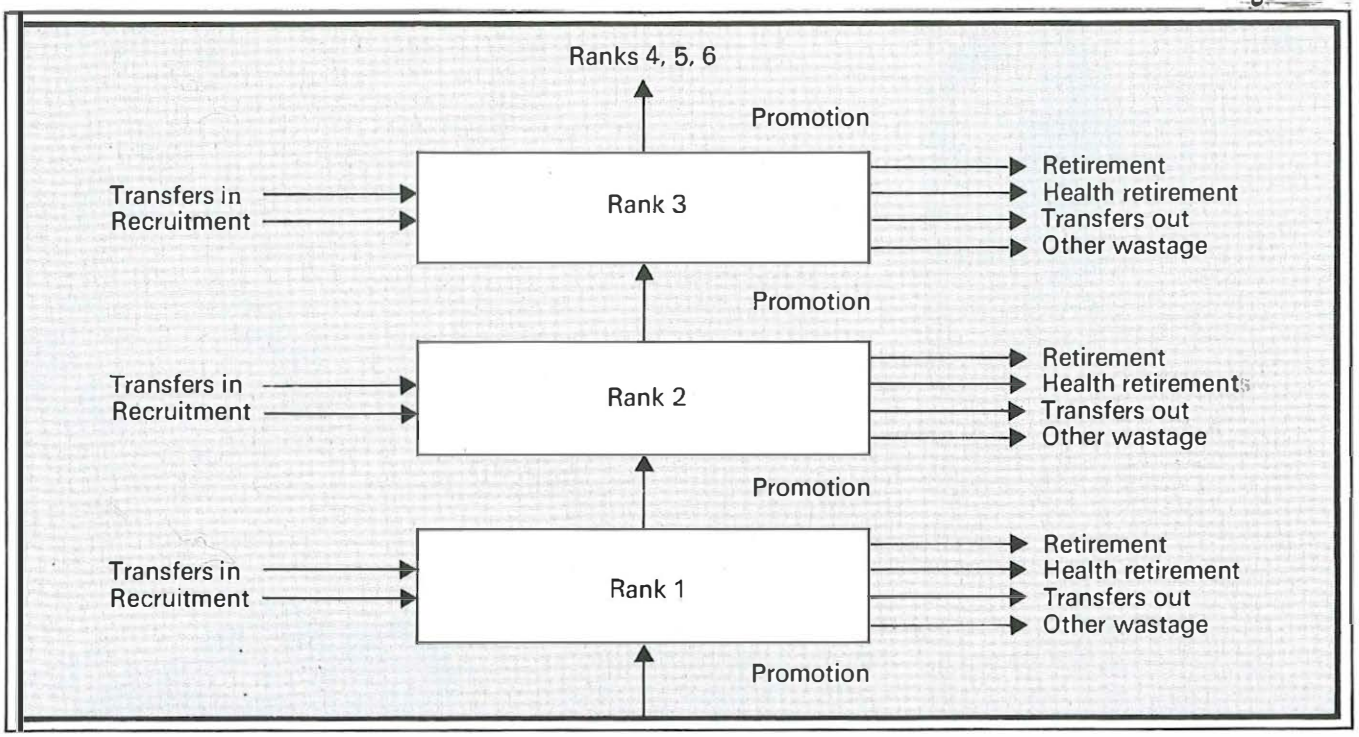
The Telecommunications Personnel Department maintains three main computer models, although others are available to study particular specialised aspects of manpower planning. All three main models may be run from a remote computer terminal which makes them accessible to all Regional and Telephone Area offices. Each model is able to simulate the movements of staff in particular sectors of the organisation and to calculate the future staffing position resulting from the particular policies tested.

The largest and most complex model is PARSON (Promotion And Recruitment SimulatiON), which is able to simulate movements of staff into, through and out of a tiered hierarchy over a number of years. The number of levels in the hierarchy may vary between three and six, and the number of years to be forecast is determined by the user. PARSON is provided with information on the numbers and attributes of people within each level of the hierarchy and on the type of policies that are expected to be followed – for example, rates of retirement and transfers.

The model will then process the data and print the staff-in-post position for each year over the forecast period. It will show the total number of people in each level and the number forecast to have left and joined during the year. PARSON is used mainly in Telecommunications Headquarters for work on the Business as a whole.

The two other models are geared to

Organisation structure of the kind that may be simulated using PARSON.



Regional and Area applications, particularly with regard to engineering staffing levels. PRIEST (Programme Regulating Intake of Engineering STaff) is a model designed to help Telephone Area management decide on the most suitable level of Trainee Technician Apprentice (TTA) recruitment. These apprentices are needed to provide the future supply for the Technical Officer (TO) grade. The model will produce a forecast of the five years' recruitment for TTAs which, in turn, will fulfil the demand for TOs over the next 10 years.

The user must forecast the 10-year demand for TOs, and this is produced manually in the local Area office. It is hoped that in the future a model will be produced to forecast this demand as well as other basic data required for PRIEST. Work on the project is currently being carried out in the North Western Telecommunications Region.

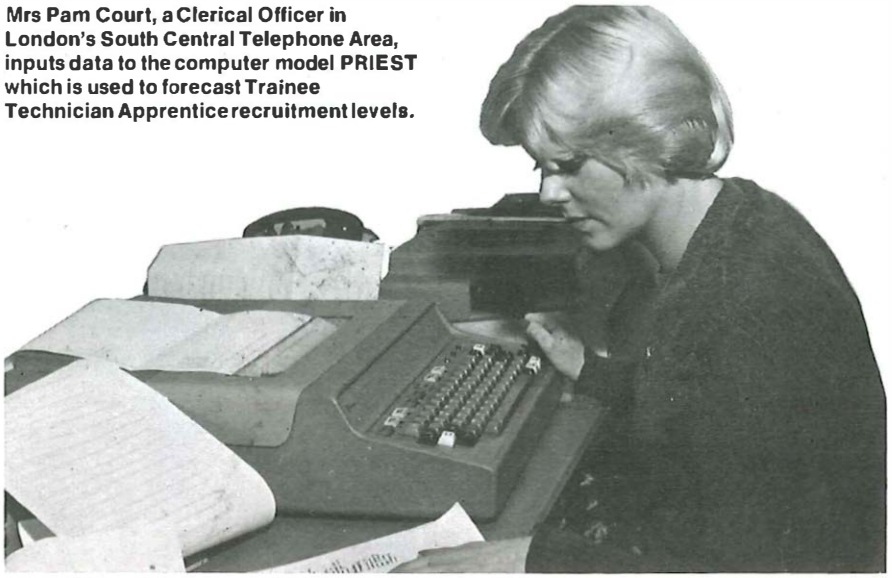
The third in the series of main models is PRIOR (Programme Related Intake to Overtime Rate) which is designed to help in planning the level of future recruitment to a small group of staff and the overtime rate for those staff. It is the latest model to be made available and is most useful in circumstances where the level of staff is expected to fall over a period of time, but where some recruitment is still taking place and where overtime may be used as a regulator to avoid undue surplus staff at any time.

The model deals with staff as a single group, ignoring distinctions of grade and skill, although it may be used for grade or skill groups separately if required. By providing information on the demand for staff in a group and the numbers who will leave that group by promotion, resignation, transfer, etc, PRIOR may be used to obtain a satisfactory combination of recruitment and overtime.

Manpower models are complicated to establish, and are restricted to certain applications which depend upon the size of the system being simulated. There is a minimum size of system that can be simulated, for the larger the system the greater its accuracy and reliability.

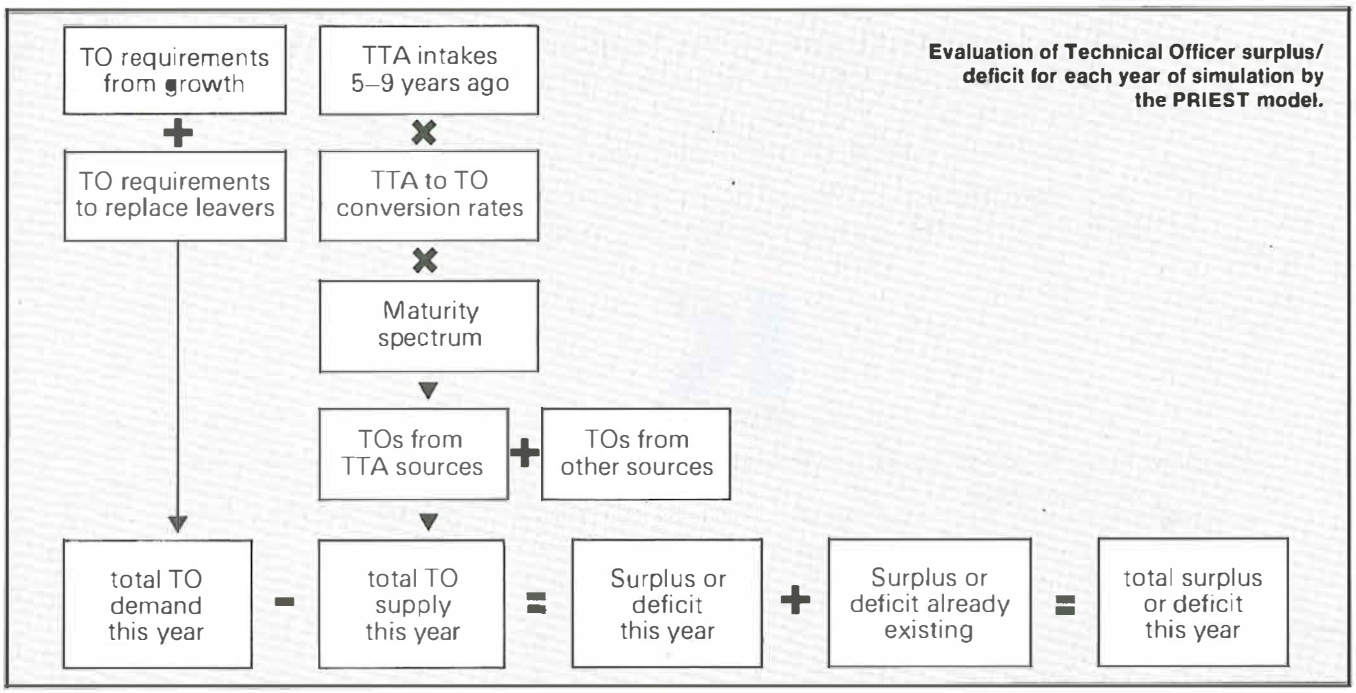
The ability to collect data quickly and efficiently is another consideration. Most models require large amounts of accurate data to be capable of reliably predicting future staffing levels. This has led to the setting up of computer based staff information files which are able to produce the data required for the models quickly and accurately. The Post Office maintains such a system known as STEM (STaff statistics systEM).

When conditions are favourable, models present a worthwhile method of forecasting likely effects of management policies, although a model is not necessarily the best answer in all circumstances. Owing to unpredictable events, while intelligent application of modelling techniques under favourable conditions does not guarantee accuracy in the real world, it does enable changes to be taken into account quickly and is still likely to be more accurate than other methods.

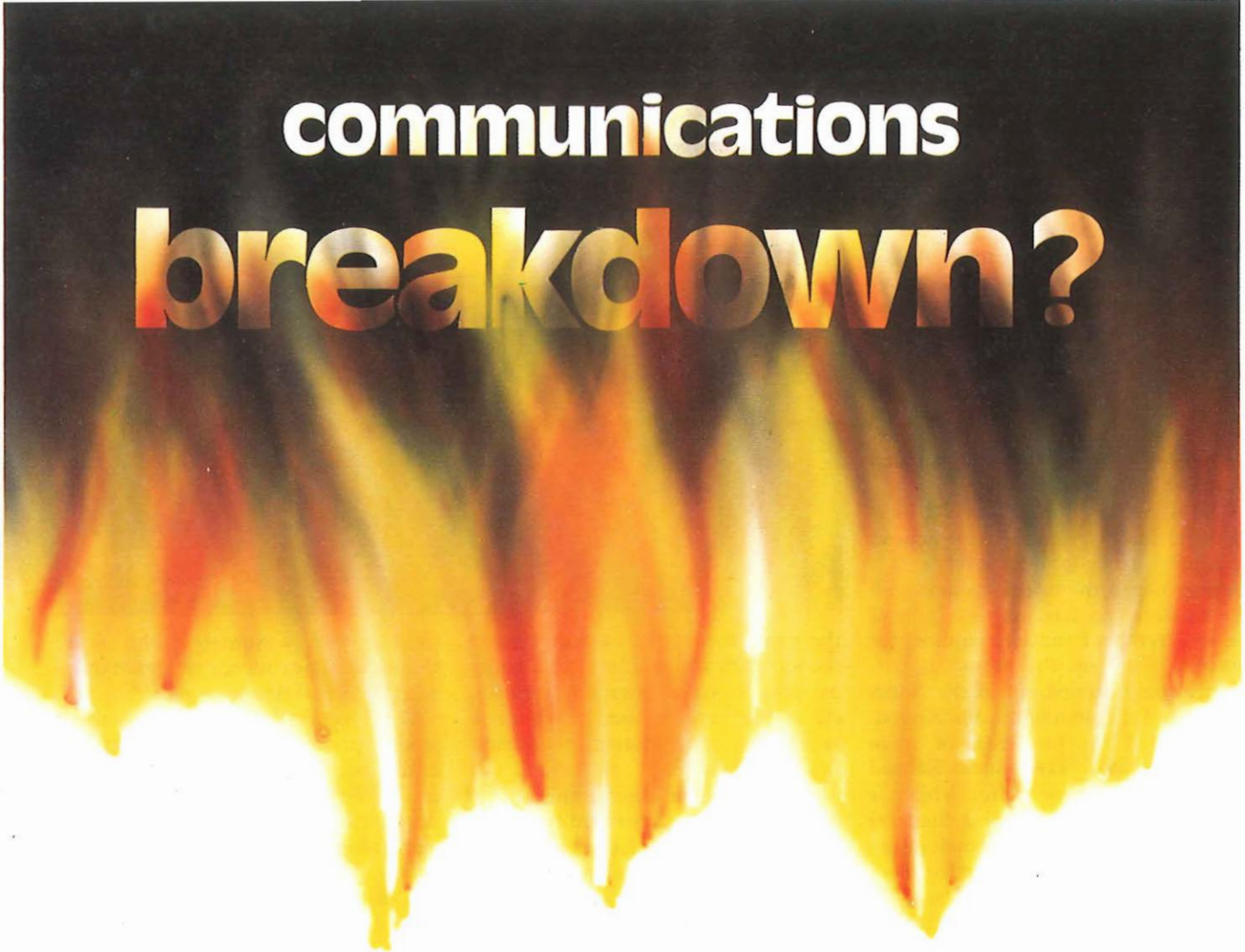


Mrs Pam Court, a Clerical Officer in London's South Central Telephone Area, inputs data to the computer model PRIEST which is used to forecast Trainee Technician Apprentice recruitment levels.

Mr A. J. Masterman was, until emigrating recently, an Executive Officer in Telecommunications Personnel Department, responsible for maintaining and advising on computer modelling.



Evaluation of Technical Officer surplus/ deficit for each year of simulation by the PRIEST model.



with a Kidde system, fire doesn't have a chance.

Fires can happen. And they do happen, every day, in every sector of industry. Even in the most sophisticated systems, employing every grain of modern technology, faults can develop. Accidents can happen.

That's where Kidde comes in. Designing systems to fight fires fast and effectively. Employing innovations such as smoke detectors, and the incredible Halon 1301 gas, which literally breaks down the elements that create fire.

In telecommunications, as in every other sophisticated industry, Kidde is there to advise, install . . . and protect.

Kidde

The Walter Kidde Company Limited, Belvue Road, Northolt, Middx. Tel: 01-845 7711 Telex: 23644

Protection Services Ltd.,
Jamestown Rd., Dublin, 8. Tel: DUBLIN 365911.

Ergon Electrics (N.I.) Ltd.,
136 Lisburn Rd., Belfast, BT9 6EU. Tel: BELFAST 662993

MISCELLANY

Design award

"Of all the great public institutions in Britain, the Post Office has possibly the longest record of concern for design," agreed the judges in awarding a Royal Society of Arts 1977 Presidential Award for Design Management to the Corporation. Sir William Barlow, Chairman of the Post Office, received the award from Prince Philip at Buckingham Palace, and heard tributes paid to the Post Office for achieving high standards of design in both the telecommunications and postal fields.

The judges praised the Post Office for a wide variety of design work ranging from stamps to telephones and from posters to equipment. They said they were impressed both by the quality and quantity of design work accomplished so far, and by the evident determination of the management to develop an awareness throughout the organisation of the contribution good design can make to the success of its full range of operations.

Business aid on film

"Modern business demands efficient communications" is the theme of a new film made for Post Office Telecommunications. Entitled "We're here to help you", it is intended for business audiences.

The film lightheartedly shows some unhappily familiar situations. These include an overworked firm's telephone operator trying to cope on an unsuitable manual switchboard, business prospects lost when callers give up and try elsewhere, and a near disaster in trying to juggle with files while coping with a call.

The film also shows how smooth office life can be when staff are given the correct equipment for their needs and use it properly. It points out that guidance on equipment suitable for particular businesses is readily available from the Post Office, and indicates that the man at the "top" is frequently the last to realise how inefficient his communications have become.

"We're here to help you" is in colour, runs for 19 minutes and is available in 16 mm format. Copies may be obtained from the Post Office Telecommunications Film Library, 25 The Burroughs, Hendon, London NW4 4AT (telephone: 01-202 5342).

Rig phase completed

Britain's most distant oil platform has been put directly in touch with the rest of the world by telephone and telex. The platform is Thistle "A", operated by BNOC (Development) Ltd, and sited 240 km (150 miles) north-east of the Shetlands.

The Thistle "A" link-up with the United Kingdom telecommunications network followed less than a fortnight after full telephone and telex services were provided to Total's Frigg gas production unit. Frigg, 200 km (125 miles) due east of South Shetland, is the most easterly British platform in the northern sector of the North Sea.

These two platforms bring to six the number of offshore sites with public telephone and telex services provided by the Post Office. The first five platforms, in fact, completed phase one of the Post Office's North Sea programme.

Thistle was the first platform to be linked up in the second phase. The others are Shell's six platforms in the Brent, Cormorant and Dunlin fields, and Conoco's Murchison platform. They will be progressively linked to the UK network over the next 18 months.

Export boost

A new type of equipment aimed at simplifying operators' tasks in handling telephone calls, and which is based on a development by the Post Office, has won its first export order. Known as OPAS (Operator Position Assistance System), the equipment owes its origins to the Post Office's Automatic Call Recording Equipment (ACRE), and has been engineered for production by Standard Telephones & Cables.

The first export order for OPAS has been placed by the Swedish Telecommunications Administration through STC's associate Standard Radio and Telefon AB. Under the order, 30 operator positions at the Orebro telephone exchange in southern Sweden will be fitted out.

By eliminating toll tickets and automating routine aspects of call procedures – such as timing call duration and determining charges according to radial distance and the applicable tariff rate – the equipment is claimed to give a 30 per cent saving in operator call handling times. On a typical coinbox call, for example, it is said to reduce from 33 to 17 the number of operator tasks involved.

The OPAS equipment consists in part of modification kits installed into existing operators' positions, providing keypads, visual display units, logic and interface circuitry. The rest is separate free-standing electronic equipment, including operator control units and common peripheral equipment.

Research Premiums

Eight members of staff at the Post Office Research Centre, Martlesham Heath, received awards in the 1977 Papers and Craftsmanship Premiums of the Gordon Radley Fund (Christopher Columbus Prize). Awarded annually, they were presented this year by Mr Richard Cannon, Managing Director Public Telecommunications, Cable and Wireless Ltd.

Papers Premiums are awarded to scientists and engineers under 30 years of age for research described in papers published in scientific or technical journals or in a comparable way. Four Papers Premiums were awarded to: **Michel Eve** (£30) for work on the propagation of light in optical fibres; **Dr Graham Davies** (£10) for studies of the dielectric absorption mechanisms of liquid organic materials in the millimetric frequency range; **John Davis** (£10) for investigating the lifetimes of aluminium integrated-circuit interconnections subjected to high-current-density im-

A purpose-built skip loader for carrying a mole plough tractor or other heavy engineering plant across difficult countryside, is put through its paces in Cardiff Telephone Area. The loader was designed and built by Powell Dyffryn to specifications laid down by Mr Bernard Wood, head of the Motor Transport Group at Wales and the Marches Telecommunications Board Headquarters.

pulses; and **Robert Walters** (£10) for work on evaluating the system used in determining the performance of computers.

The Craftsmanship Premiums are presented to technical staff for precision engineering work displaying originality in design or particularly high skill in execution. The three awards were: **John Bowie** (£30) for making the machine for joining optical fibres, and for the equipment used to test the joints; **Ken Bilton** and **John Jones** (£10 each) for the delicate work of machining accurately dimensioned components in graphite; and **Tony Barrell** (£10) for machining – to close tolerances – a 2-cwt forging in aluminium bronze for use in the cut-and-hold grapnel used in recovering deep-sea telephone cables.

In addition, **Anthony King** – at 19, the year's youngest entrant – was highly commended for a special project. This was for making a sensitive drilling machine which involved original design work, carried out with minimum supervision.

Club for Buzby

Buzby, the Post Office's promotional cartoon character, has become so popular that a Buzby Junior Club has been started for boys and girls between eight and 16 years of age. For a membership of 60p per year youngsters will get a special badge, a membership card, a newsletter and the chance to buy club items such as soft toys, glove puppets and T-shirts.

The newsletter will be issued at least three times a year, and will include articles on the telephone and activities likely to appeal to children, such as cableships and communications satellites. The first edition also includes a contest with prizes of Lake District holidays.

Communications 78

Communications 78, the major international exposition, which will be held at the National Exhibition Centre in Birmingham from 4–7 April, will include the field of PTT telecommunications equipment and systems, with particular emphasis on the converging technologies of computing and telecommunications.

The International Telecommunications Union will be among the supporting organisations, and Post Office Telecommunications will play a central support-authority role as well as hosting a PTT Telecommunications Day.

Following the exposition, an international conference on private electronic switching systems, organised by the Institution of Electrical Engineers, will be held at Savoy Place, London, from 10–12 April. The conference will discuss international experience in the use of new private automatic branch exchanges and the application of new technology to private switching systems.

Belgian link

The first telephone link in Belgium to use optical fibre techniques is to be installed along a 10.5km route between Brussels and Vilvoorde, it has been announced by GTE-ATEA. The link, which follows similar trials in the United Kingdom, the United States of America and elsewhere, will begin serving the public later this year.

Optical communications enable telephone calls to be carried as pulses of light along hair-thin strands of glass. In the Belgian trial GTE are providing the equipment and will install it jointly with RTT, the organisation which operates the country's telecommunications network.

The Post Office is currently running a feasibility trial at its Martlesham Research Centre and STC is conducting another using existing Post Office duct in Hertfordshire.

Contracts

GEC Telecommunications Ltd – £30 million for the manufacture and installation of 23 TXE4 exchanges as an extension to an existing contract for supply of exchanges of this type.

Marconi Communications Systems Ltd – Additional 30-channel pulse code modulation (PCM) systems to be installed by London Telecommunications Region. Delivery of all equipment covered by the present order is scheduled for completion by June 1978.

Matthews & Yates – £75,000 for air handling units based on a special design for use in telephone exchanges. The order follows 12 months' development by the company's research and development section working with Post Office engineers. The units will be installed in seven exchanges in London Telecommunications Region. They consist of air filtration and cooling equipment, a centrifugal fan and special silencing equipment.

Transatlantic Viewdata

Following the export of Viewdata expertise to West Germany, the Post Office mounted its first public transatlantic demonstration of the television linked telephone information system. It was shown in the United States of America at a get-together of world telecommunications experts. Although still at the pilot trial stage of development, the Viewdata information store amounts to 5,000 "pages".

Rally on the phone

The popular telephone information service provided by the Post Office on the annual Lombard-RAC International Motor Rally had even wider coverage for the 1977 event. This was the eighth rally to go "on the phone", and callers were able to dial the service at 29 centres around the country – five more than in the previous year.

For five days leading up to the event the service featured interviews with competitors and, on the day before it began, prerally reports gave news of the scrutineering. The first rally report started just 90 minutes after the competitors had set out from Wembley Stadium and was followed by regular reports, updated every few hours, on the progress of the 1,900-mile event until it ended at York five days later. Detailed results of the finish were also given.

Information for the service was telexed from the rally control centre to the Post Office's Recorded Services Unit in London, where it was recorded by Post Office telephonists. From London the recordings were sent by private circuit to the other centres in various parts of the country.

Demonstrated dependability

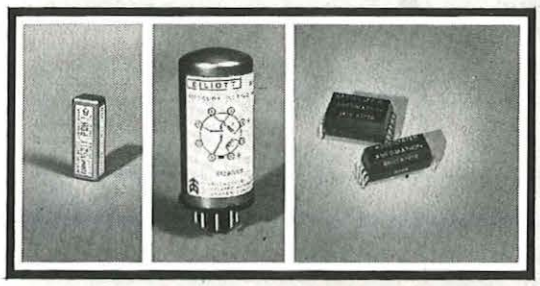
Mercury Wetted Contact Relays

No contact bounce • Low contact resistance • High power gain • High speed operation • Extremely long life

Dry Reed Relays

Long life • Fast operation Package design flexibility Multiple applications

The dependability of our Dry Reed and Mercury Wetted Contact Relays continues to increase their area of application–telecommunications–electronic process control– automatic test equipment. Relays in the range include Post Office approved types 20, 22 and 24.



Associated Automation Elliott relays

Product information from:–

Associated Automation Limited

70 Dudden Hill Lane, Willesden, London NW10 1DJ · Tel: 01-459 8070

Cables: Astomation, London · Telex: 935210

A GEC (Great Britain) Company

Publication and Price:
The Journal is published in January, April, July and October, price 18p per issue. The biennial postal subscription is £3.50, or life subscription of £6 for retired Post Office staff.

Advertisements:
Communications, advertisements copy, etc., should be addressed to Paul Johnstone, The Kemps Group Ltd., 1/5 Bath Street, LONDON EC1V 9QA.
Telephone: 01-253 5314/3871.
No official responsibility is accepted for any of the private or trade advertisements included in this publication.

Contributions:
The Editorial Board will be glad to consider articles of general interest in the telecommunications field from all sources. No guarantee of publication can be given. The ideal length of such articles is between 1,000 and 2,000 words. The views of contributors are not necessarily those of the Board or of the Post Office.

Correspondence:
Communications should be addressed to the Editor, Post Office Telecommunications Journal, Public Relations Department, Post Office Central Headquarters, 23 Howland St., LONDON W1P 6HQ.
Telephone: 01-631 2192 (editorial), 2193 (sales).
Remittances should be made payable to "The Post Office" and should be crossed "& Co." The Giro account number is 535-1006.

INDEX TO VOLUME 29

Spring 1977 to Winter 1977–78

ALPHABETICAL INDEX

GROUP INDEX

The GEC 746 puts Jackie Kawalski in touch with room 137 or her boyfriend.

Whether the call is to the same building or a different continent, it begins and ends with the familiar telephone.

The GEC 746 table telephone incorporates the latest technology associated with a rotary dial signalling instrument and is suitable for reliable operation in a wide range of climatic and environmental conditions.

All component parts can be easily replaced and the telephone which includes automatic volume regulation as a standard feature, can be provided with a wide range of optional facilities to give maximum operational flexibility.

The GEC 746 is a highly reliable telephone which is ruggedly constructed in tough high-impact plastic.

Whether the call is to the same building or a different continent The GEC 746 is an aesthetically pleasing telephone available in a range of seven colours and is equally at home in a domestic or business environment.

GEC
Telecommunications

GEC manufacture telephones for world markets: table and wall-mounting models, pushbutton telephones, switching telephone systems, and subscribers carrier equipment.

CF 8

GEC Telecommunications Limited

Telephone Division, Whinbank Road, Aycliffe, Co. Durham, England. A Management Company of The General Electric Co. Ltd., of England.

Post Office Telecommunications Journal is printed by Alabaster Passmore & Sons Ltd, London and Maidstone, and is published quarterly in January, April, July and October by the Post Office.