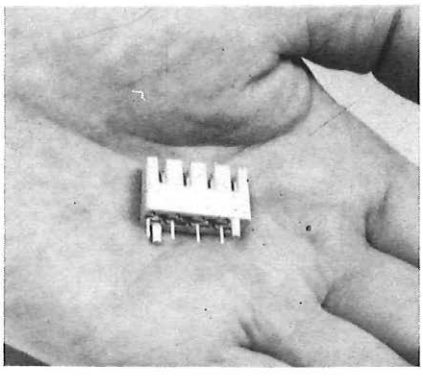
British TELECOM Journal

Autumn 1981 Volume 2 Number 3 Price 30p

KRONE

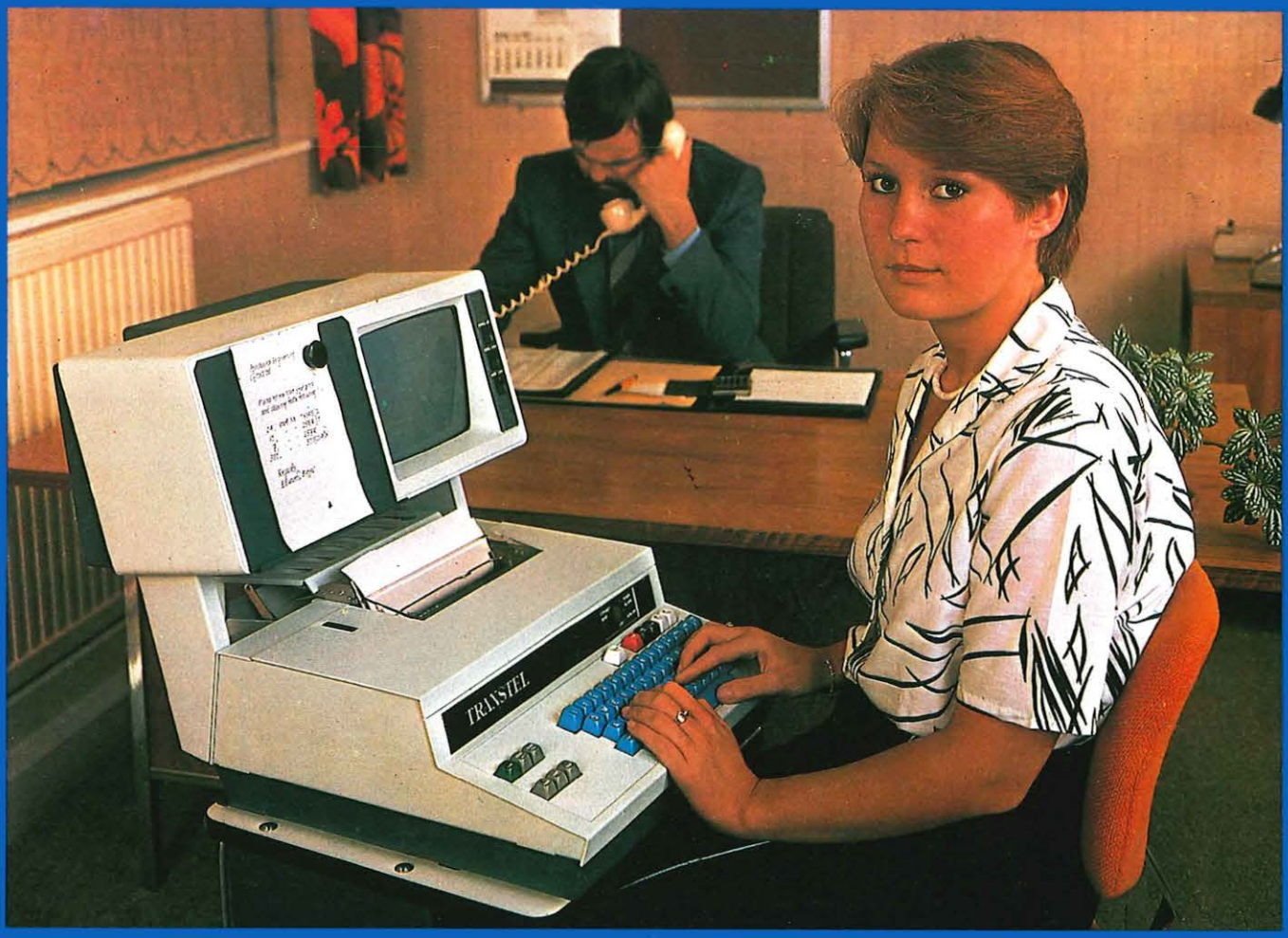
All you need a screwdriver for, these days, is to open the box.



The soldering iron and wire stripper are out as well, with Krone's LSA-Plus Telephone Connectors.
These versatile Connectors are British-Telecom-coded (the three-pole version – Strips Connexion 238A, and the four-pole version – Strips Connexion 239A) and were specially developed by Krone for use on Printed Circuit Boards.
This new time-saver is only one of a host of other sensational developments which are in the pipeline from Krone and will be with you soon.

First ideas make Technology

Krone (UK) Technique Limited, Unit 12, Eastington Trading Estate, Eastington, Nr. Stonehouse, Gloucestershire. Telephone: Stonehouse (045 382) 6866. (4 lines). Telex: 43350.



When you're preparing a message it helps to see what you're doing.

Teleprinters from Transtel use the latest microprocessor technology to provide easy editing and storage facilities from a proven memory package.
Transtel's proven design incorporates a visual display for ease of message editing and has facilities for simultaneous message preparation, transmission and reception.
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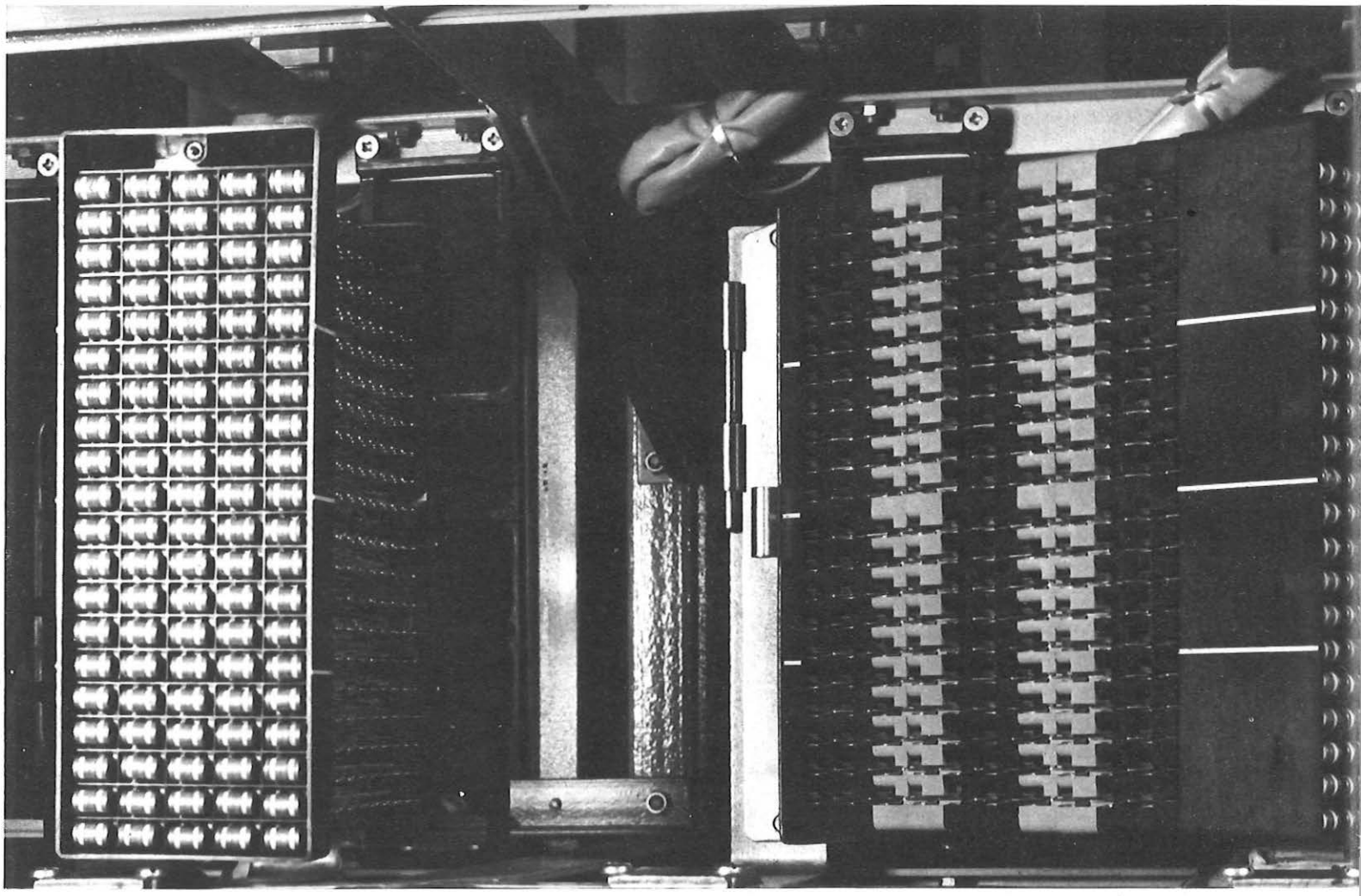
Jacks Test with Hinges



Jacks Test 39/2B. Hinge opened on right hand unit to facilitate work on wiring face of left hand Jack.

Jacks Test 39/2A 39/2B 40/2A 40/2B 42B.

Hinged versions of the existing range have been introduced to provide improved access for jumper wiring. The hinge is fitted between mounting bracket and fanning strip, with a secure latching facility.

An insulator foil protects wiring – fed through the fanning strip – from chafing against the hinge.

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4TEL. PREVENT PHONE FAULTS RIGHT ALONG THE LINE.

Because 4TEL is the only maintenance system to test every single line every night, it's very good news for telephone administrations and customers alike.

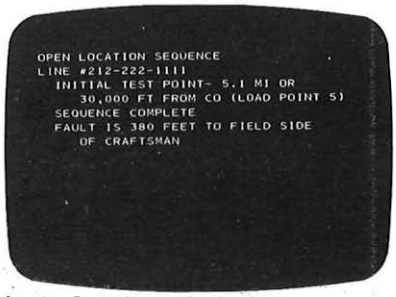
Using distributed computer control, 4TEL measures at unrivalled speed – 600 measurements a minute. In a service area with 100,000 subscribers, that means more than 2.5 million measurements in six hours.

In the daytime, 4TEL's line testing and line diagnostic capabilities allow faults to be distributed to the right faultsman first time. On each line test 4TEL is able to distinguish the nature and severity of the fault.

4TEL's powerful fault location capabilities then lead him quickly to the vicinity of the fault.

Great savings in costly cable repairs can be achieved by early fault detection through preventive maintenance programmes and by helping to eliminate wasteful changing over of pairs when faults cannot be found by conventional methods.

Installing this efficient, economical system means that the entire Repair



Service Control operation can be centralised and substantial improvements gained in the quality of customer service.

Test information is displayed on a screen or printer in the RSC in plain language so that it can be acted on immediately. A faultsman can not only be directed to the fault, but he can verify the repair while he's still on the scene.

4TEL immediately permits major improvements in responsive and preventive maintenance.

4TEL from Teradyne, one of the world's leading manufacturers of computer controlled test equipment, has been field proven in rural and urban environments and is testing 2½ million lines now.

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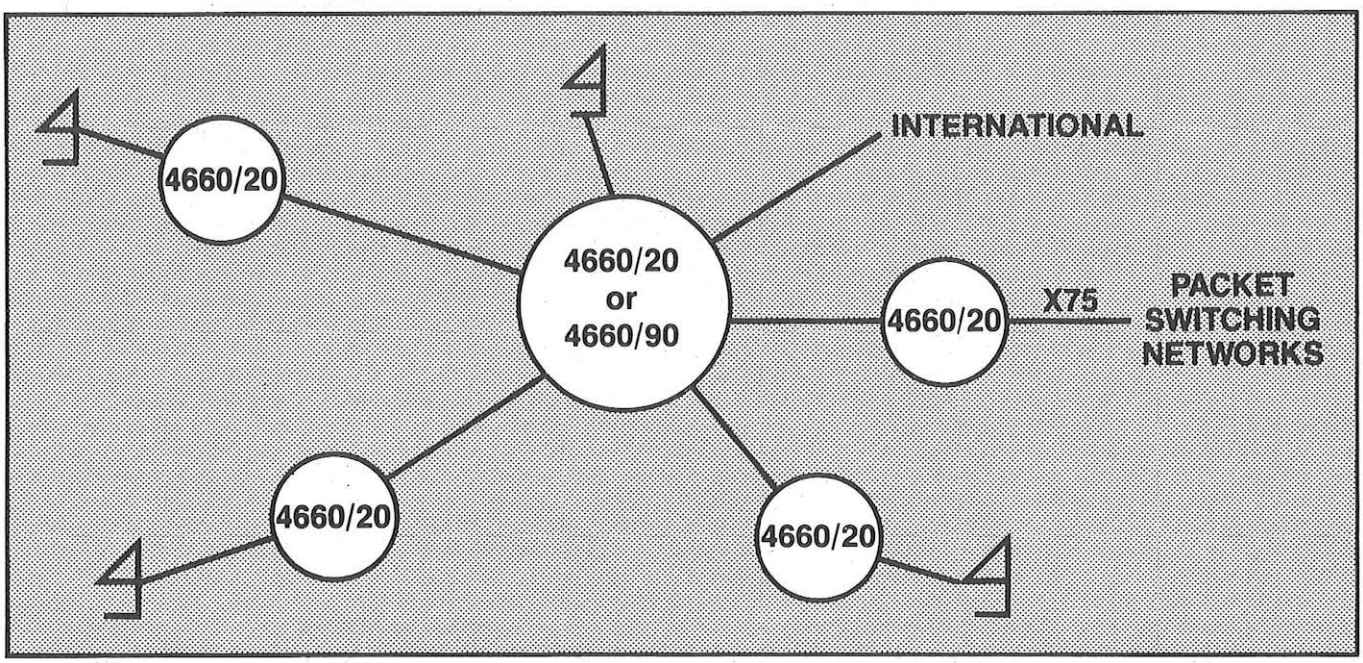

PLESSEY 4660/20

- ✻ Want a full performance micro-computer telex/data switch for the price of a concentrator?
- ✻ Would your telex network requirements be met by distributed small switches rather than a single large switch?
- ✻ Will you want interworking with packet switch networks?

Five Plessey 4660/20 systems are going into service with British Telecom for their inland network.

In one equipment, the new Plessey 4660/20 telex switch is the answer for PTTs who need a national telex network, or international gateway, and companies wanting to establish their own private telex networks.

- ✻ **Latest micro-computer technology with bubble memory**
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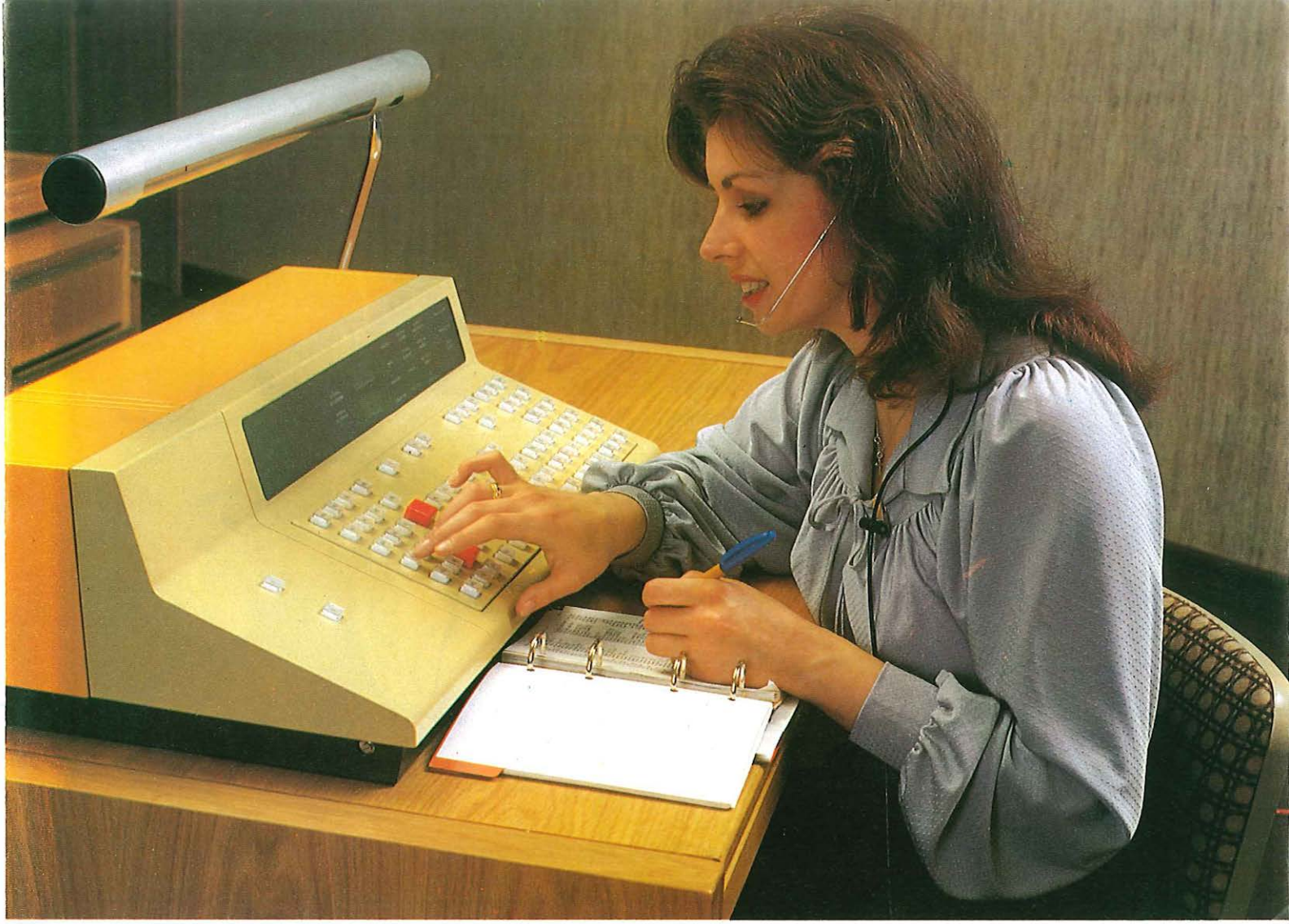

Introducing AURALITE... another powerful business communications device.

Wherever telephones are used two hours or more per day, Auralite lightweight headsets can bring increased efficiency, productivity, comfort and convenience.

Lightweight Auralite, nothing to match it

Auralite headsets replace cumbersome conventional headsets, and feature a unique acoustic voice tube, custom-fit earpieces, and an ultra-light, ½ oz capsule that's worn comfortably behind the ear or easily clipped to spectacle frames.

Auralite gives you freedom to move around

A push-together, pull-apart Quick-Release module allows you freedom of movement and automatically holds calls during temporary suspension of conversations. And the special Auralite cord permits high mobility without interrupting 'phone conversations at all.

Auralite, extensive application and benefits

Wherever telephones are widely used there's a need for Auralite. The benefits are increased efficiency and productivity, improved employee morale, and better customer service. Thanks to Auralite you can depend even more on the telephone which means a saving in travel expenses.

Auralite technology, tested in space

Auralite is a commercial version of headsets worn by astronauts.

Its solid rugged design ensures maximum durability and extremely clear transmission and reception.

For more information contact your local British Telecom office on FREEPHONE 888 and ask for the Auralite leaflet.

AURALITE*

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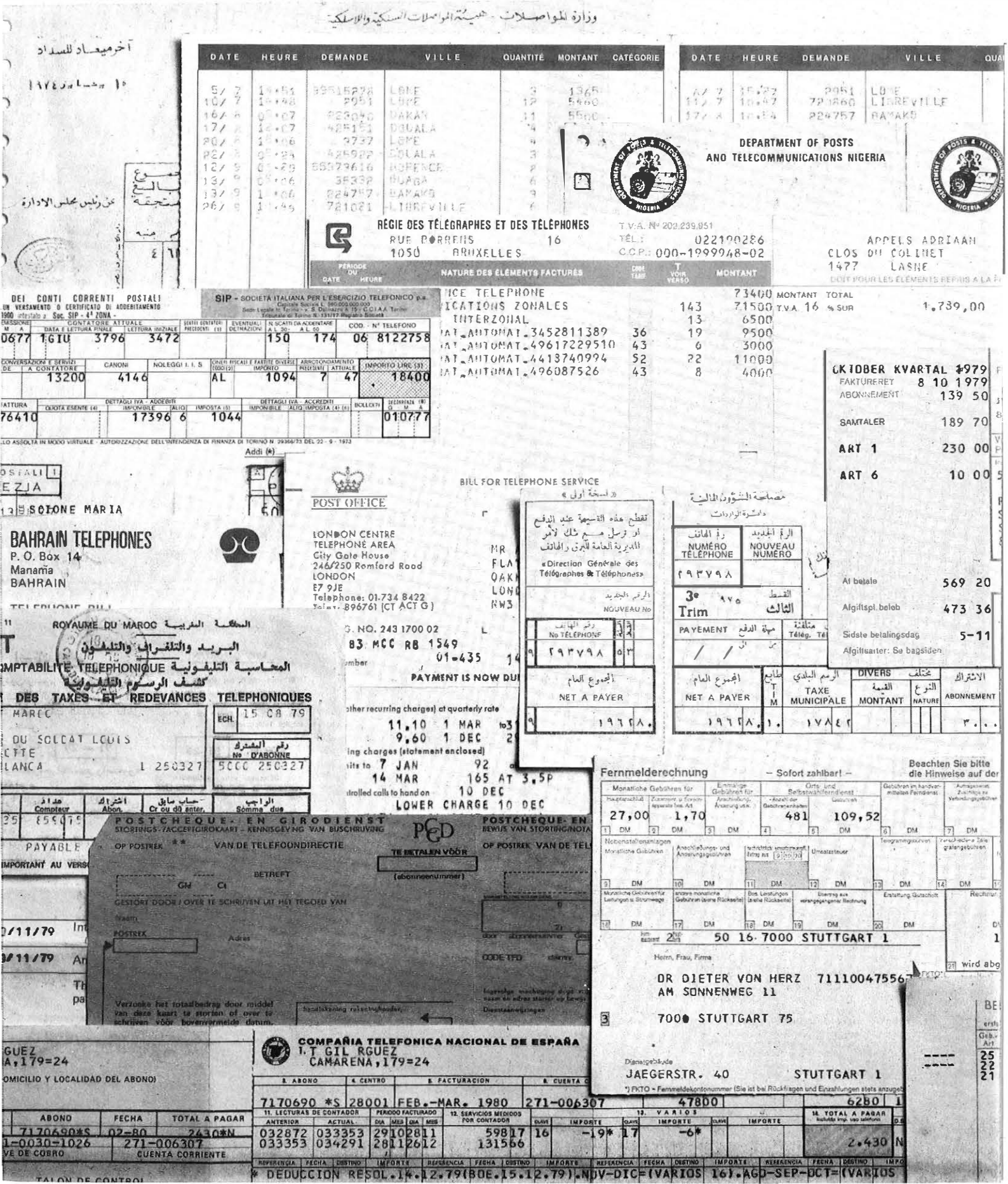
We help make these more acceptable.



We can't promise to make your subscribers actually welcome the bills you send them. However, we believe we can help you to make the bills more acceptable.

People get annoyed at having to wait for an extra telephone to be installed, or having to share a line, or not always having a clear conversation.

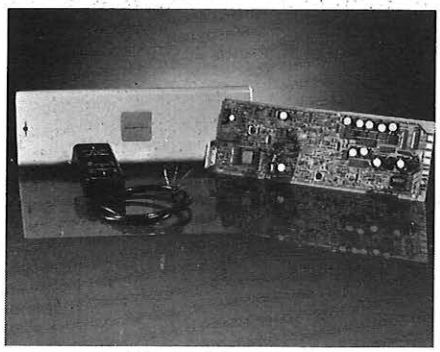
STC has the answers.

What's more, as well as making your subscribers more contented, we can help you generate extra revenue.

Here are some of the ways in which we can do it.

Extra phones, without extra cable

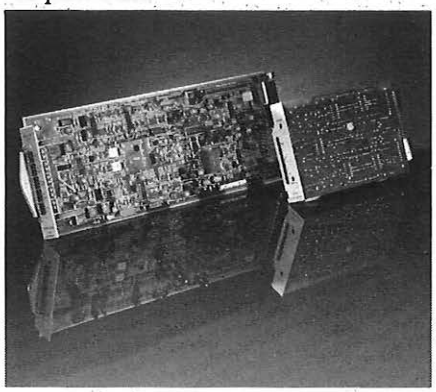
You can double subscriber service over existing cable with STC's EXTRAPHONE subscriber carrier system. Each subscriber enjoys complete privacy, and each has uninhibited access to the exchange, because they do not have to share a line.



Installation is simple and not expensive, because subscriber units can be installed and removed as easily as the handsets. This makes the system particularly attractive for temporary applications, like shows and sporting events.

Extra voices, and how to suppress them

Some communications systems introduce voice echoes which your subscribers find intrusive. STC echo suppressors overcome the problem.



They are designed compactly, with integrated circuit logic and components of proven reliability.

Built-in tone disablers remove echo-suppression during data transmission. Additionally, commissioning and maintenance procedures are simplified and power consumption is reduced.

Extra clarity, over H.F. radiotelephony

On long-distance, high-frequency radiotelephone links, increased speech intelligibility and ease of conversation make STC's Lincompex equipment a clear advantage.

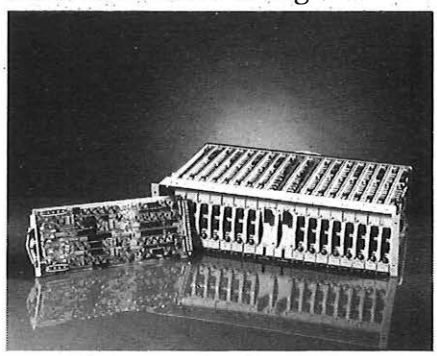
Users have said: "estimated increase in useable circuit time was up to 20%"; "marked improvement noticeable"; "greater potential call-handling capacity"; "lack of noise."

This means that there's every chance your system will be used more often, because Lincompex equipment helps conversation flow

Extra revenue: 3kHz, and all the rest

While 3kHz bandwidth channelling costs more to install, increased system capacity and savings in space make it well worthwhile. Figures show that capital cost can be recovered in well under a year.

On a typical 7-year, 15% interest loan, return on annual expenditure can be expected in the region of 360% to 490%. You not only provide better service—you make substantial savings!



For more detailed information on how STC's specialised transmission equipment can help you to improve subscriber service, complete the coupon or attach it to your letterheading.

This advertisement is one in a series presenting STC's wide-ranging capabilities in telecommunications and electronics.

To STC, Dept 810,
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Please send more information about STC's leadership in specialised transmission equipment.

- ☐ EXTRAPHONE System
- ☐ Echo Suppressors
- ☐ Lincompex Equipment
- ☐ 3kHz Channelling

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G 3/2

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STC. We help people communicate.

Monoprint Call Information Logging Equipment now available in a version suitable for main exchange traffic analysis...

...using the D.C. signalling wire, Monoprint will print out subscribers call details at the exchange. An optional extra paper reeler is also available.

Monoprint is in use by subscribers to provide a private record of calls and their costs. British Telecom also use it for their International Telephone Bureaux, to give instant information on call charges.

Monoprint - the flexible single line call information logging equipment.

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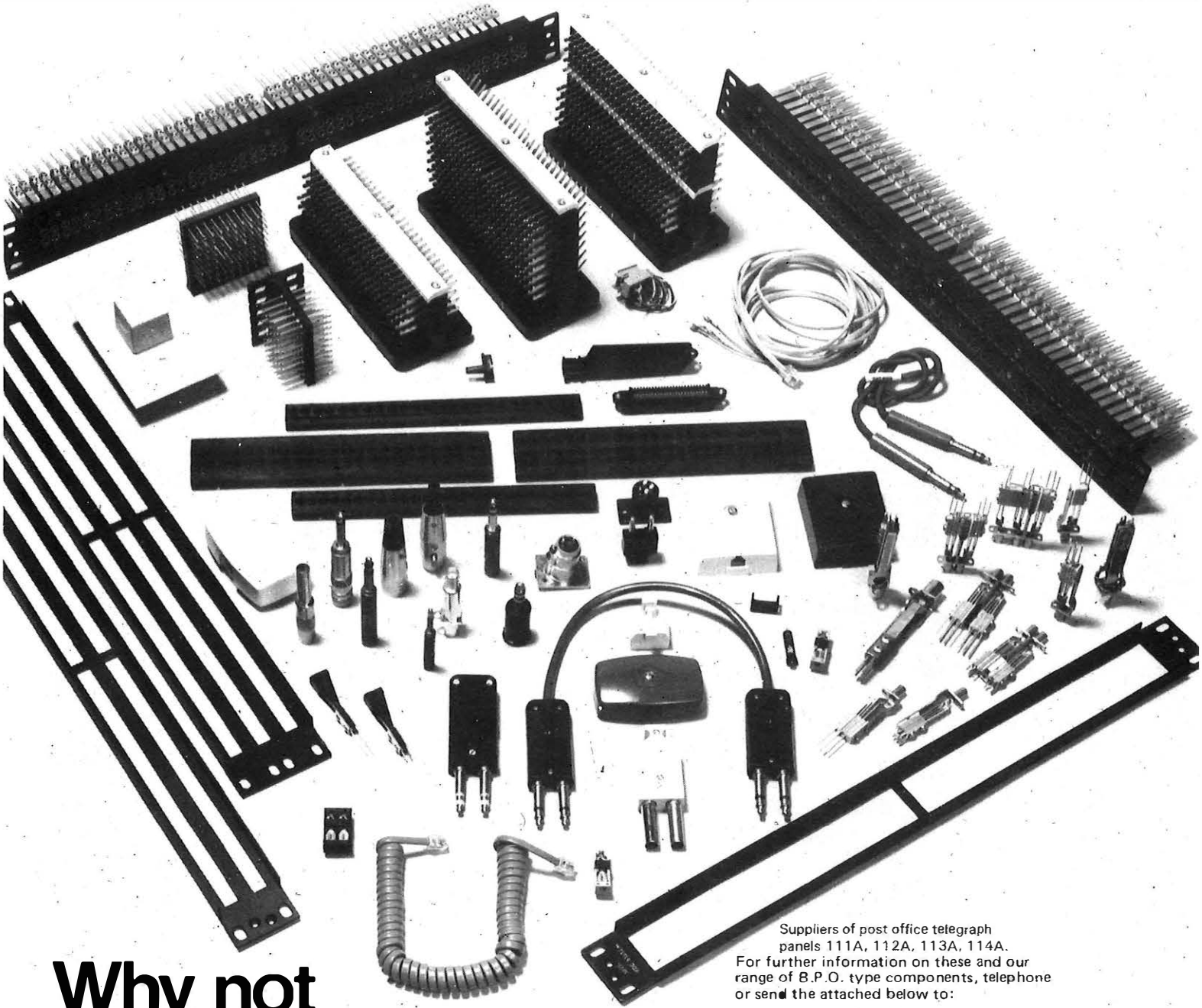

Suppliers of post office telegraph panels 111A, 112A, 113A, 114A.
For further information on these and our range of B.P.O. type components, telephone or send the attached below to:

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Announcing the most powerful computer in the GEC 4000 Series.

The 32-bit GEC 4090.

Standing high and mighty at the top of the GEC 4000 Series, the GEC 4090 is more than twice as powerful as the GEC 4085 yet compatible with current GEC software and peripherals.

Nine languages and Nucleus

Like all GEC 4000 Series machines, the GEC 4090 has a 9 language capability and is equipped with Nucleus. This award-winning central executive of the operating system is implemented not in software, but hardware. It handles important internal computer functions of protection, short term scheduling, memory management, input/output handling, semaphores and interprocess handling.

There the similarity (but not the compatibility) with other GEC 4000 machines ends.

32-bit wide store highway

Unlike other GEC 4000 machines, the GEC 4090 has a 32-bit wide store highway, a 32-bit wide mill for integer operations, a 64-bit wide mill for floating point operations and 16 Kilobytes of high speed cache storage normally achieving a 98% hit rate on processor bound jobs.

4 Megabytes of main store

Unlike the others, the GEC 4090 has up to 4 Megabytes of main store and 256 Megabytes of virtual system memory.

Comprehensive diagnostic facilities provided from the operator's console include self-test capability.

Long on advantages, short on delivery dates

Combining inherent reliability with extensive security of operation, you'll find GEC 4000s powering Prestel,* steering radio-telescopes, flying high in Nimrods as part of NATO and fulfilling vital industrial functions.

Designed, developed and manufactured in Britain, the new GEC 4090 is available on conveniently short delivery dates. An even more powerful reason for you to talk to GEC Computers.

Right from the start.

For more information contact Tony Matthews (Ext 3799) or for Export, David Finlay (Ext 3807) on 01-953 2030.

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Right from the start

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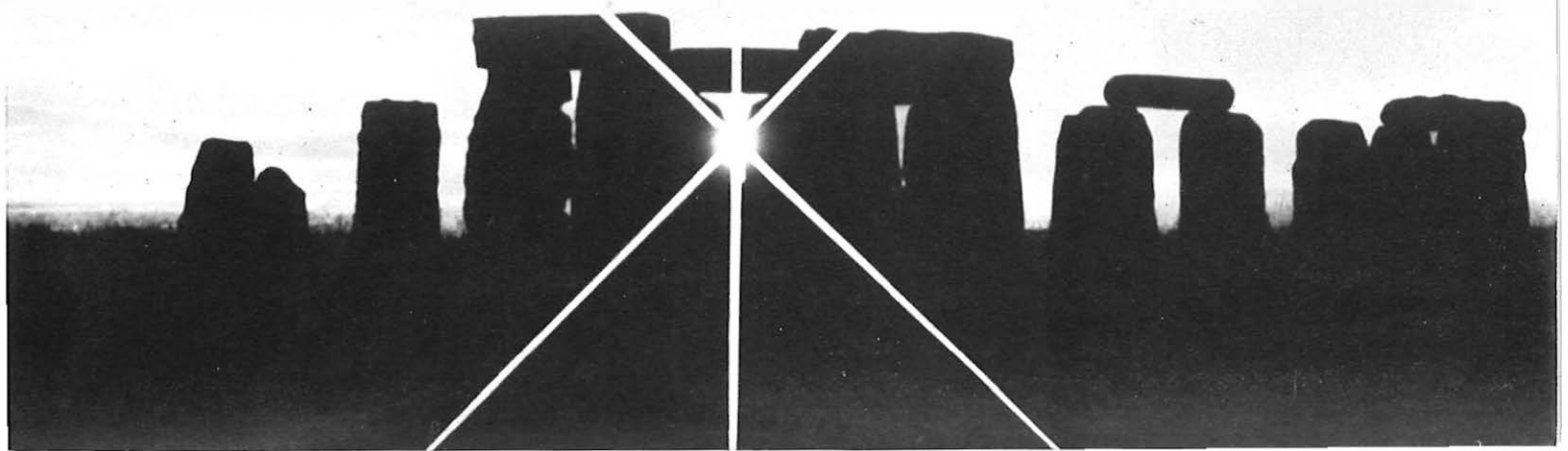


British Telecom Journal

Autumn 1981 Volume 2 Number 3

Published by British Telecom, to promote and extend knowledge of the operation and management of telecommunications.

It's the customer who counts

So British Telecommunications is finally launched. After months of planning and preparation the new corporation – now totally separated from the Post Office – is in the process of establishing itself in the new competitive environment created by the British Telecommunications Act 1981.

And although it is still very early days there are already encouraging signs that the enthusiasm of British Telecom staff will be more than equal to the new challenges which lie ahead. Some of the measures so far taken are fully explained in the special 16 page section in the centre of this issue. The recurring message is simple: the customer is first priority.

But British Telecom chairman Sir George Jefferson warns that there are problems in the organisation achieving its aims because of borrowing restrictions. In a statement on Vesting Day he said: "Until now we have been expected to dispense, in as fair a way as possible, the services we were able to provide from our share of the national resources. Those resources took the form either of money borrowed from Government or generated by the price of our services. Today we are still dependent on the same source of finance. And that is tying our hands behind our backs as we face up to the challenge of competition."

Sir George added that both British Telecom suppliers and British Telecom staff would have to change gear to seize the opportunities of competition. "If British suppliers are to maintain their position in our market they will in future need to demonstrate that they can offer products that are internationally competitive in performance, styling, technology and price, since in the new competitive environment the products we market will eventually be chosen from a worldwide range."

As far as British Telecom staff were concerned Sir George said there should be no illusions. "Our prosperity and our jobs will depend on our ability to satisfy our customers. Business once lost will be difficult to regain. Now, more than ever, the customer must have what he wants, when he wants it and at a competitive price . . . together we can do it if we get up and get at it."

And what better battle cry is there than that?

Automatically in touch

C J Wright and PJ Linney

This summer, British Telecom opened its first automatic radiophone service for customers in London, enabling them to make and receive calls from their vehicles.

Just like the telephone at home or in the office, the new automatic radiophone system will allow some 1,500 London radiophone users to make calls direct to any of Britain's 28 million telephones as well as to the 425 million telephones available on international direct dialling in more than 100 countries.

An automatic car telephone system must contain many diverse but interconnecting items of equipment. It needs mobile apparatus capable of accurately sending and receiving complete signalling codes as well as good quality speech messages. It needs radio base stations which can reliably relay transmissions to and from mobile telephones over difficult radio paths. And it needs special telephone exchanges to connect with the mobile equipment and monitor their condition in the face of two major problems – signal fading and interference.

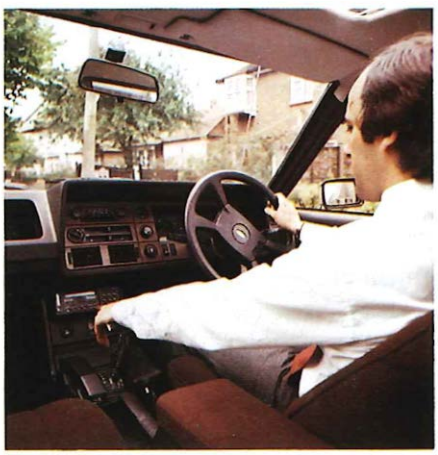
British Telecom's new automatic service will use four telephone exchanges to serve the areas covered by the old manual system. Every one of these automatic exchanges is totally electronic and can connect calls to and from mobile sets anywhere in the United Kingdom, make out magnetic billing tapes for the calls and collect important statistics about telephone traffic passing through them.

In some ways, the work carried out by these exchanges is more complex than that carried out in the more traditional types in the fixed telephone network. Like any exchange, they receive and act on dialling information to switch speech messages, although it is more difficult to pass information reliably from mobile customers who are using very high frequency (VHF) radio waves than those using the more conventional wire or cable transmission methods.

For example, users can experience fading if they move out of radio range or if they drive through a tunnel, or even become temporarily screened by a large vehicle. Unwanted signals from electrical noise or stray interference from other stations are two other possible hazards. But all these are bad enough when they affect speech messages. It is even more serious if the effect is to mutilate the signals passing between the exchange and the mobile telephone because fading or noise can stop a call or can result in a wrong number.

To minimise these problems, the special exchanges can transmit and receive all dialled numbers and identity information in a special digital code. The form of coding used allows many checks to be made on the accuracy of the information and in some cases, the exchange needs whole trains of digits to be repeated so that numbers dialled can be verified and rechecked. If a signal fades or if the carphone moves out of range, the exchange will time the loss of transmission to allow the call to continue if reasonably possible but will not allow too long a time to elapse.

The easy-to-use automatic radiophone is a boon to motorists in any car.



Signal strengths are regularly monitored to ensure they are adequate for a call, and the condition of the radio channel equipment at the outlying base stations is continually checked to ensure that it is adequate for allocation to a call. All of this adds to the complexity of the equipment but it is very necessary when dealing with customers moving around in a sometimes noisy and often variable radio field.

The mobile telephone equipment employs push-button dialling and has a repertory dialler capability. Like conven-

tional telephones, it can send and receive speech simultaneously. British Telecom's manual radiophone only allows speech to pass in one direction at a time, requiring a 'press-to-talk' feature on the handset.

The heart of the carphone is a two-way transmitter/receiver which provides the link between the user and the nearest radio station. In the early days of radiophone, equipment was massive and used valves. But modern radiotelephones are fully transistorised. They work directly from the car battery yet still achieve respectable transmitter powers of up to 20 watts and they are, of course, smaller and more reliable.

Making a call using the new equipment is simple. By means of a keypad, the customer selects a number from the memory store in the repertory dialler or keys the number required. Contact is then made with a suitable radio station after which all the information necessary for setting up the call is sent out to the exchange. A facility even exists on some sets for sending out the call without lifting the handset – in which case progress is monitored on a loudspeaker. When the call is connected, the user lifts the handset and the loudspeaker is disconnected.

A key feature of the complex system is the network of radio base stations which provide the link between mobiles and the radiophone exchange. These operate in the VHF radio band and have a usual range of about 15 miles. VHF transmission are effectively line of sight in operation, so the higher the station, the greater the range. Surprisingly, the densely-packed high buildings of London and other large cities have little effect on transmissions, partly because they help to reflect the radio signals.

London automatic radiophone service.

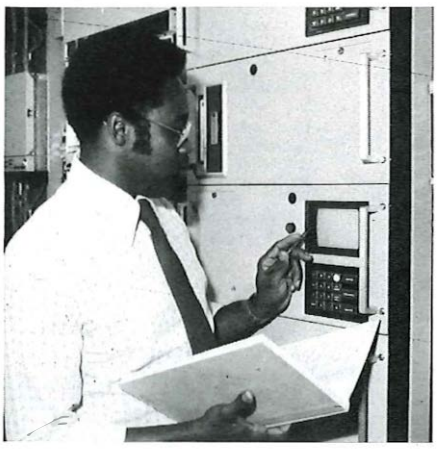
Five radio base stations are used in London to give good coverage, and a further 26 stations enable London customers to operate sets in other radiophone areas.

Each radio base station transmits and receives on a number of channels. A large London base station could have up to 15 channels with each comprising one transmitter, one receiver and a four-wire land-line to the radiophone exchange. As with the mobile equipment, both transmitter and receiver are solid-state. High output power of the transmitters is needed because space problems on many masts mean that up to four transmitters have to be combined on one aerial.

The end result is that only about 15 watts per channel are radiated – the rest of the transmitter power being absorbed by the combining process. But the resulting savings on mast space make the techniques well worthwhile. Current receivers are noticeably smaller than their earlier counterparts and need much less attention. Both transmitters and receivers are capable of checking their own performance and can report any shortcomings back to the exchange as well as to any fault reporting centre.

British Telecom has succeeded in bringing together the many elements required to provide a system capable of giving an automatic telephone service to people on the move. The service now offered to London users is one which can be extended throughout the country – yet another step in British Telecom's plans to provide a telecommunications service second to none.

Keith Pilgrim, an Esher-based technical officer specially trained in radiophone maintenance, logs the latest call details from a data acquisition display. The miniature screen displays call details and provides charging information.



Mr C. J. Wright is radiophone marketing manager for British Telecom.

Mr P. J. Linney is technical manager for mobile radio telephone systems in the mobile services division of British Telecom's Marketing Executive.

British Telecom Journal, Autumn 1981

FPStreet

To the customer's advantage

Much has already been written about the advanced technology behind the development of System X, British Telecom's new, all-electronic digital exchange system. This article looks at the introduction of System X from the customer's point of view.

British Telecom's commitment to System X is heading a massive programme of modernisation which will provide the corporation with the ability to service all communication needs by the progressive installation of computer-controlled exchanges linked by digital transmission and signalling systems.

At present most exchanges are Strowger electro-mechanical, involving many wear-prone moving parts in the setting up of each call. Such exchanges are expensive to maintain, and they are liable to familiar faults such as crossed lines, buzzes, crackles and wrong numbers. For some time, many of the oldest and most congested electro-mechanical exchanges have been replaced by modern crossbar and electronic reed relay exchanges. But even these systems operate on conventional principles, and callers voice patterns are represented in analogue form by a varying electrical current, which makes elimination of line noise very difficult.

Digital exchange systems like System X rely on the latest micro-chip technology, with no moving parts. Callers' voice patterns are represented by on-off digital pulses, making possible a much higher quality of service with line noise virtually eliminated. With System X, transmission quality will be greatly improved and calls will be connected much more quickly. System X equipment is also cheaper to buy, install and maintain than older systems, and takes up much less space.

As far as the customer is concerned, the main advantage of System X lies in the revolutionary range of new telephone ser-

FIRST SYSTEM X EXCHANGES

vices which the inherent flexibility of the system enables British Telecom to provide and it has been decided that the facilities should be marketed under the generic title of Star Services. They are entirely automatic and under customer control via a new type of press button telephone equipped with a 12-button keypad instead of a dial. As well as digits 0 to 9, there are two extra buttons ★ (star) and # (square).

Simple codes are used to operate the services, and an automatic voice guidance system is used to provide step-by-step advice and verification. The first trials of two of these new chargeable services are planned soon at Woodbridge exchange in Suffolk, which was the first System X local exchange to be opened – in July this year.

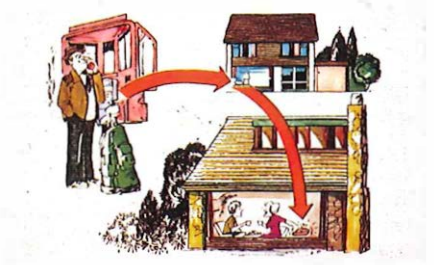
First new service is 'code calling', in which a customer can store frequently-used telephone numbers, and call them quickly and easily using just a short code.

Code calling

Customers on Woodbridge exchange will be able to store up to seven numbers but on later System X exchanges, a 27-code store will also be available.

The second new service is 'call diversion' which allows a customer to direct incoming calls to another number as and when required. There are three vari-

Call diversion



ations of this service: 'basic diversion', where calls are automatically diverted; 'diversion on engaged', where calls are diverted only when the wanted telephone is busy; and 'diversion on no reply', where a call is diverted after a few seconds if it is not answered. Customers will initially only be able to divert their calls to telephone numbers within their local call area, although when System X is more widespread in the network, calls may be diverted nationally.

Six further star services are to be introduced on System X exchanges, probably during 1983. They are:

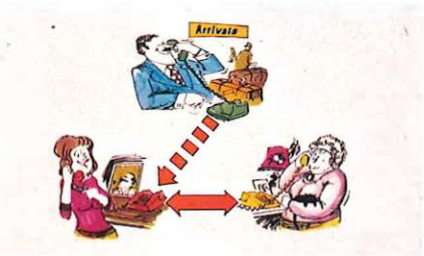
REMINDER CALL – where a customer can use the telephone to program the exchange to ring back at a specified time within the next 24 hours, or alter-

Reminder call

natively, at a specific time on a programmed basis, for instance every Monday or every weekday;

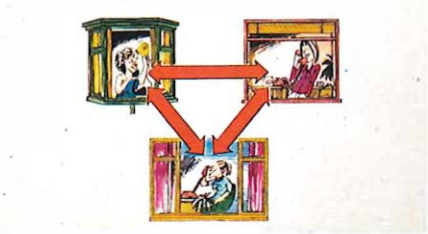
CALL WAITING – where, while engaged on a call, a customer can be made aware of another incoming call by a series of bleeps heard only by himself, and then speak to the second caller while holding the first;

Call waiting



THREE-WAY CALLING – where a customer can hold an existing call, make another, and then either switch between the calls or connect both parties into a three-way conversion with him;

Three-way calling

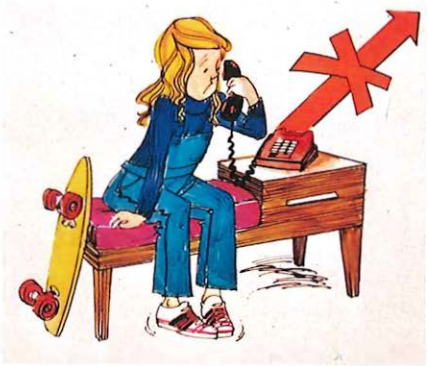


CHARGE ADVICE – where, when requested by a customer in advance of a call, the exchange rings back at the end of the call with details of the charge;

Charge advice

CALL BARRING – where two services, outgoing calls barred and incoming calls barred are incorporated. On the former, outgoing calls can be restricted by a customer as and when required with

Call barring Outgoing



various options such as international calls being prohibited. For security reasons, normal service can only be resumed by the customer using a personal code allo-

Call barring Incoming

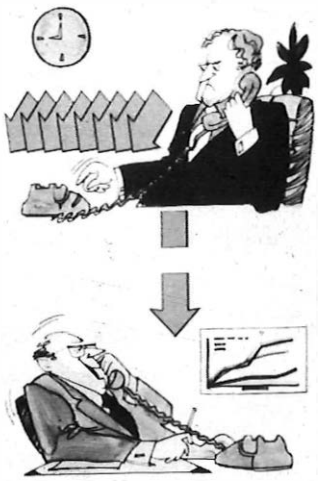
cated by British Telecom. On the latter, a customer can 'switch off' the telephone when he does not want to be disturbed. Incoming callers receive a recorded announcement;

REPEAT LAST CALL – where a customer can repeat the last number dialled using only a short code. Another option is that the number can be stored and then repeated after other calls have been made.

A separate facility will be the provision of detailed call statements (at extra cost) for those requiring them. One reason for choosing the first star services was that they can be provided on a stand-alone basis without other exchanges involved in a call needing themselves to be of System X design. When more System X exchanges are converted and calls are increasingly routed entirely over the new digital network, then it becomes possible to provide a range of more sophisticated services.

These rely on the ability of System X

Repeat last call



exchanges to 'talk' to each other over links equipped with the highly advanced common-channel signalling system

which is an essential feature of the new network.

Many different types of information, such as call charge data, or routing details may thus be passed from exchange to exchange. An example of the sort of service which becomes feasible is 'automatic reverse charge', where the call charges are required to be passed from the caller's exchange to that serving the customer who has agreed to pay for the call.

The range of services which System X is capable of providing is enormous but among those considered for introduction in the foreseeable future are:

RINGBACK – the eventual replacement for 'repeat last call' already described, where a caller finding a number engaged merely keys a code instructing the exchange to keep a check on

Ring Back

the busy number, set the call up and ring the caller back when it first becomes free;

CREDIT CALL – where the existing manual credit card service is automated

Credit Call

by having the caller keying in the credit number before setting up the call, with the charges debited direct to his account;

MESSAGE CALL – where a customer can record a message for automatic delivery to a nominated number at or by a specified time.

Message Call

Many other services are also under consideration, but their introduction is most unlikely to become reality before 1985.

As System X local and trunk exchanges are introduced, the transmission links between them and the rest of the network will be converted from analogue to digital working. Gradually an integral digital network (IDN) will be created, offering wholly digital paths between exchanges. At present, customers wishing to transmit digital information connect to the analogue network via modulator/demodulator devices (modems). This 'data' communications sector of the market is growing faster than all others, especially at the higher speeds which require the provision of increasingly complex and therefore expensive modems.

Extending the digital capability of the IDN from the System X exchange to the customer will give common access to both voice and data services such as packet switching, telex/teletex, and fast facsimile and offering higher speeds without the need for conventional modems.

In this way, British Telecom will maximise one of its major assets – the local cable network – and plans to be the first administration to open a pilot integrated services digital network (ISDN) in co-operation with selected customers by 1983. This will be based on the System X large local exchange to be installed at Baynard House in London.

Naturally most customers want to know when their exchange will be converted. The strategy currently being implemented is geared to the provision at the earliest possible date of System X facilities to those areas where demand for new services is expected to be greatest – the commercial and industrial centres throughout the country.

Current plans aim for 30 cities to have their first System X exchange by 1986, with 200 served by 1990, representing five million connections. The trunk network will be entirely converted by 1992, and about half of the UK's telephones will be connected to System X exchanges soon afterwards. Completion will be one of the major landmarks during the first few years of the 21st century.

Mrs F. P. Street is a Telecommunications Superintendent in the Residential and Customer Services Department of Marketing Executive responsible for the introduction of System X star services.

British Telecom Journal, Autumn 1981

Crimefighters on call

Crime detection in the Post Office is not new. Since 1793, when the first efforts were made to protect the King's mails, an internal detective force has maintained a watchful eye on every area of business activity, from mail thefts, once an offence punishable by hanging, through to the complex and often sophisticated technologically-based frauds associated with today's modern telecommunications. Methods may have changed, but the principles of detection have altered little through the years.

Employing nearly 300 professionally-trained staff, most of whom are drawn from serving members of the Post Office and British Telecom, the London-based Post Office Investigation Division operates nationally, conforming broadly with Post Office regional headquarters boundaries. Its Controller maintains the watchful eye of a Chief Constable over his charges and reports regularly to the Board whose role can be compared with a Watch Committee for a county constabulary.

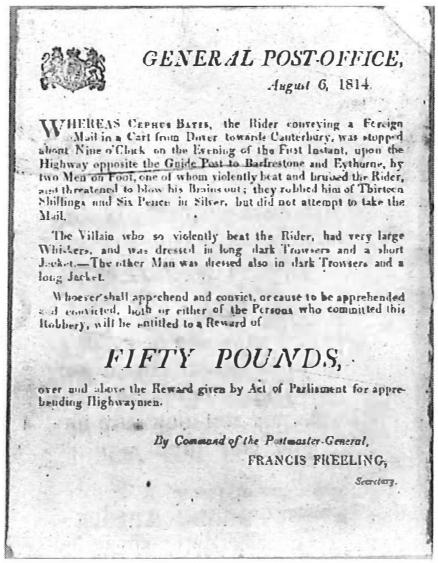
When the British Telecommunications Bill became law in October, the Division, until recently part of the old Central Headquarters, joined the new Post Office, but continues to work for British Telecom on an agency basis. This new relationship, fostered by the spirit of co-operation which the Division has always enjoyed with telecommunications staff at all levels, will not mean any reduction in effort.

Although much of the Division's work still centres around postal crime and crime prevention, from the postman who yields to temptation and steals a letter, to organised robberies involving thefts from post offices, there are still many occasions where British Telecom needs to seek the help and advice of the Investigation Division.

In all, about 5,000 incidents of crime against British Telecom are investigated each year, although only a fifth of these involve serving staff. Among the most common are installations of unauthorised equipment and coinbox vandalism, and more recently, cases of contract fraud where, for example, bribes are offered to staff by individuals or companies for irregular installations of new equipment or services.

As might be expected, POID work means frequent and close co-operation with police forces at every level. This started in the early 1800s, when a Bow Street runner was attached to the staff, and from 1829, an increasing number of Metropolitan police officers joined. This system ended a few years ago but retiring police officers with wide CID experience are still recruited into the Division to pursue enquiries into cases where suspects are members of the public. Investigation staff often work with police as part of a team in cases such as burglaries, robberies and counterfeiting, and usually play an advisory, co-ordinating and liaising role.

The General Post Office, keen to beat a spate of robberies and mail thefts in the early nineteenth century, offered large rewards to anyone apprehending the culprits.



GENERAL POST-OFFICE,
August 6, 1814.

WHEREAS CEPHAS BATES, the Rider conveying a Foreign Mail in a Cart from Dover towards Canterbury, was stopped about Nine o'Clock on the Evening of the First Instant, upon the Highway opposite the Guide Post to Bardrestone and Eythorne, by two Men on Foot, one of whom violently beat and bruised the Rider, and threatened to blow his Brains out; they robbed him of Thirteen Shillings and Six Pence in Silver, but did not attempt to take the Mail.

The Villain who so violently beat the Rider, had very large Whiskers, and was dressed in long dark Trowsers and a short Jacket.—The other Man was dressed also in dark Trowsers and a long Jacket.

Whoever shall apprehend and convict, or cause to be apprehended and convicted, both or either of the Persons who committed this Robbery, will be entitled to a Reward of

FIFTY POUNDS,

over and above the Reward given by Act of Parliament for apprehending Highwaymen.

By Command of the Postmaster-General,
FRANCIS FREELING,
Secretary.

Public call offices come in for much abuse and attention from the criminally inclined. Here there are two major problems. For example, in the financial year 1978/79, mindless vandalism cost British Telecom over £1 million in repairs, quite apart from any consequential loss in revenue. As with all crime, damage follows certain patterns. In cases such as the cutting of a handset cord, the Investigation Division will take up the enquiry and arrange a joint exercise with the police using equipment specially designed to meet that particular problem.

Theft of cash from public call offices has largely been contained, although the ingenuity of some has to be seen to be believed. Strengthened cash boxes are battered, burnt and generally abused by thieves intent on reaping the contents. Coin paths are mutilated by those intent on a free call.

But it is here that the Investigation Division's own technical aids unit comes into its own. For the past six years, the

**The fully-equipped operations room at Euston Tower helps the Investigation Division to monitor crime patterns in London.
Here officers track the progress of a team of cable thieves.**

An investigation officer inspects a cable with a London executive engineer who called in the Division following the discovery by jointers of a severed junction cable in a footway box. Extensive records held by the Division may reveal a pattern of crime and so lead to the offender.

unit has been run by an engineer whose job it is to come up with electronic wizardry designed to foil a wide range of offences ranging from fraudulent phone calls and vandalism to the technical sophistication of 'phone phreaking'. Using combinations of prototype building modules he can, on demand, supply and fit a variety of alarms on call boxes, and has even come up with a device that can identify tokens or washers, used by dishonest people to make calls from a coinbox telephone. A wide variety of electronic surveillance devices can be fitted in most locations, and this is particularly useful where investigation officers are called in to solve disappearances of papers, equipment, and even personal property.

Although the Division has no administrative powers, its role is to enquire into all cases of suspected crime against the Business, whether by staff or others, and to provide a crime prevention advisory service. This is supplied to British Telecom and the Post Office by the Crime Prevention Branch which provides a security advisor on secondment to the Businesses. The advisor is responsible for inspecting buildings and strongrooms as well as looking at procedures for cash-carrying operations. Of particular help to British Telecom is the Division's advice on telephone bomb hoax calls, and for the Data Processing Service, to ensure that safeguards are built into computer programs to prevent loopholes from being exploited.

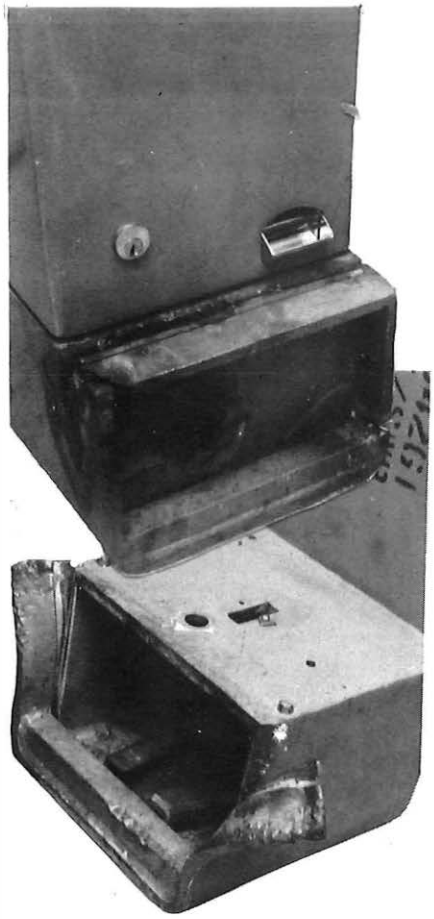
Investigation officers deal mainly with internal crime and once recruited, receive comprehensive training. The Division has its own training branch and this gives new recruits an opportunity to learn about interviewing techniques, taking statements, rules of searching, criminal law and court procedures as well as handwriting identification techniques.

Main grade entrants go through a searching two-part selection procedure and a rigorous six months of training. With the arduous nature of their duties it is no surprise to find a good team spirit and many strong personal relationships.

After a period of classroom training, IO trainees are assigned to a qualified investigation officer for field work. Dedication is essential, as the hours of work do not conform to a nine to five job. At the start of his career, an IO may find himself investigating a wide range of thefts, frauds, forgery and embezzlement. He seldom spends more than 12 months in one area although on specialised duties, the period can be up to two years.

One of the specialist sections based at Euston Tower – the telecommunications group – investigates serious and complex offences against British Telecom. Officers attached to that group are responsible for following up crimes such as avoidance of payment for telephone calls, theft of cash from coinboxes, irregular installations of telephone equipment, credit card frauds, bomb hoax calls, theft of equipment and call office vandalism.

Also at Euston Tower is a special operations room which is often used to combat crime against British Telecom. The room, with a large illuminated map

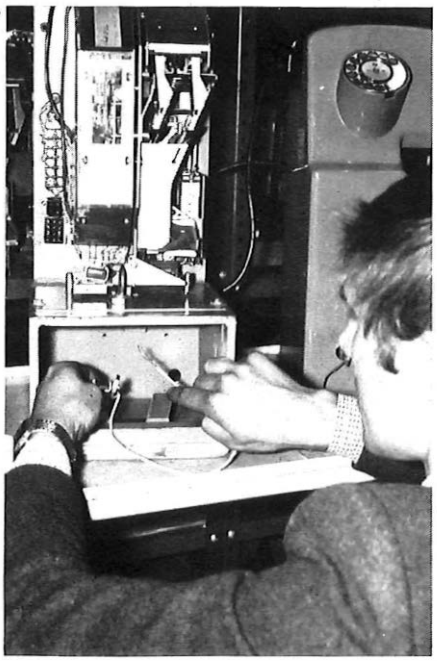


These two dramatic examples of coinbox vandalism highlight a problem that costs British Telecom over £1 million every year.

Postal officer Mukesh Pandya sits atop a huge pile of recently-recovered stores items.

CATEGORIES OF CRIME AFFECTING BRITISH TELECOM
Theft by burglary or breaking
Theft of money – telephone coin boxes
Theft of official cash/property
Theft of private property
Fraud – Girocheques
Betting frauds
Wilful delay/destruction – telegrams
Malicious, obscene or offensive telephone calls
Evasion of payment for telecommunication services
Wilful damage to official property
Divulgence of information
Charges affecting the character of staff
Secret documents lost/compromised
Unclassified cases – (a) radio offences
(b) other crime

The technical aids officer – a trained engineer – seconded to the Division, fits an alarm in a colnbox destined for a kiosk subject to a high level of vandalism. The Investigation Division can provide a wide range of alarms to meet most situations.



of London, a battery of telephones and radio telephones linked to the Division's own vehicles, is normally used to plot the activities of forgers or thieves using London Post Offices to make fraudulent withdrawals from Savings Bank accounts or the 'dropping' of stolen postal orders.

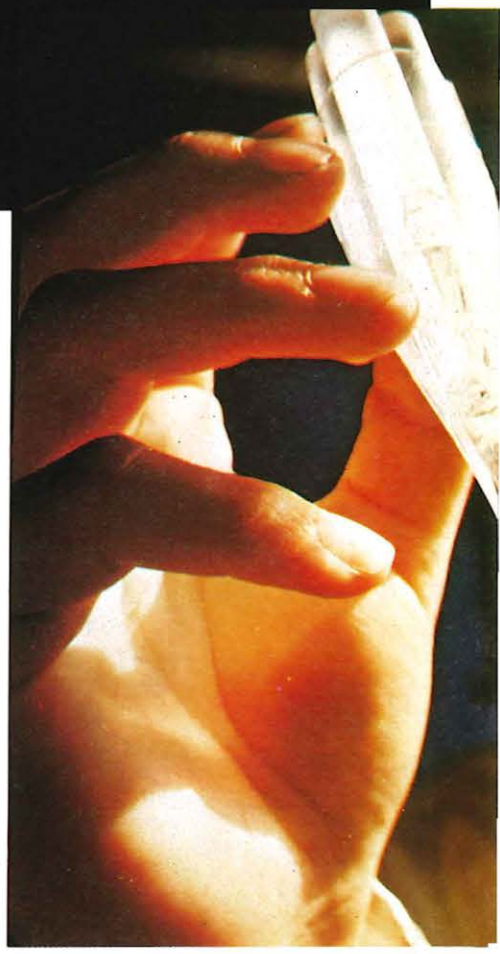
But the crackle of the radio-transmitter sometimes signals that the telecommunications group is on the track of a gang of cable thieves. These warning signals enable the route of the villains to be plotted and notified to police as they make their way across London. One enterprising thief who had manufactured a sophisticated device for opening self-sealing cash containers was astonished to be arrested as he left a call office. He had been tracked by divisional staff in vehicles reporting through the operations room for several hours.

In a recent interview, the Division's Controller, Bryn Jones, made it clear the job of the Division was one of fact-finding. "It's up to management to decide action where staff are involved".

In recent London swoops connected with the theft of stores, thousands of pounds worth of equipment was recovered. As a result, stores control procedures have been tightened up. Despite occasional misunderstandings, British Telecom staff are keen to co-operate and appreciate all the Division's efforts to combat crime.

The security of British Telecom is well served by the staff of the Investigation Division. As British Telecom begins a new life, the 188-year-old link with the Post Office will not be broken. Although POID will remain in the new slimline Post Office, it will continue to serve British Telecom, intent as always on winning the war against crime.

Hair-thin highways of the future



New orders worth £15 million for a further 6,400 km (4,050 miles) of optical fibre – hair-thin strands of glass capable of carrying thousands of phone calls, computer data and television pictures – have been announced by British Telecom Chairman Sir George Jefferson.

Outlining the corporation's plans to commit itself to an optical future, Sir George said that it was expected that during the 1980s, 100,000 km of fibre would be bought and installed to create a network embracing all Britain's major cities. Already more than 200 km have been installed throughout the country and the map shows how the expanding network should look by 1985.

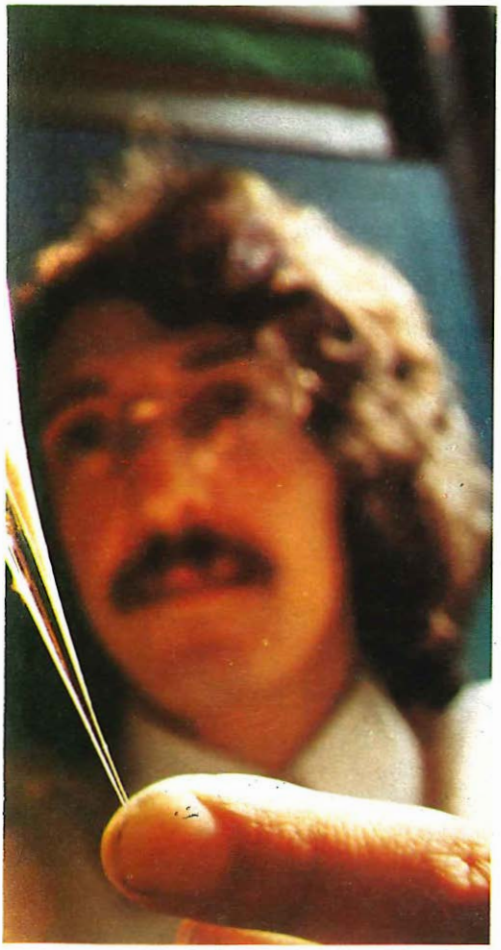
Optical fibres are made from the world's purest glass. A block eight kilometres (five miles) thick would be as transparent as a window pane. Phone calls are transmitted along the fibre as rapid on-off pulses of light, each lasting seven thousand-millionths of a second. The links form part of the country's high-speed digital network being set up under British Telecom's £2 billion-a-year modernisation programme. In this network, calls are sent as streams of on-off impulses instead of in traditional waveform.

Digital transmission reduces costs, gives clearer speech and, most importantly, increases flexibility in the way the network can be used. It also paves the way for the introduction of advanced services such as video-conferencing, high-speed data and fax. In a digital network, these can be sent together with the original speech in comparative ease, without interfering with each other.

Already, Britain's digital network has grown to the point where it can provide digital 'highways' between the main centres of population. British Telecom plans to provide digital private circuits based on this network within the next 12

Martlesham technician David Colthorpe uses a laser to ensure that spun fibre is coated concentrically with silicon resin to prevent tiny cracks appearing on the surface.

Fibres made at British Telecom's Research Laboratories at Martlesham begin as a rod of super quality glass an inch in diameter. The rod is then mounted in a furnace and the end heated until it becomes soft enough to be drawn into fibre five thousandths of an inch thick.



months. Optical fibres will account for about half the long-distance trunk network capacity in 1990. They will contribute massive savings in the cost of running and enlarging the national telecommunications network.

Sir George Jefferson said: "Just as motorways were begun as super highways designed to carry traffic swiftly between major towns and cities, British Telecom is busy introducing glass fibre super highways, to carry our particular kind of traffic more efficiently and effectively than is possible with conventional cable".

Landmarks to date include:

1977 – Europe's first public phone calls over optical fibre, using the Martlesham-Ipswich link.

1979 – First stage orders placed for the world's most comprehensive optical network – 3,600 km of fibre made up into 450 km of cable, to be installed on 15 routes.

1980 – First operational link in service.

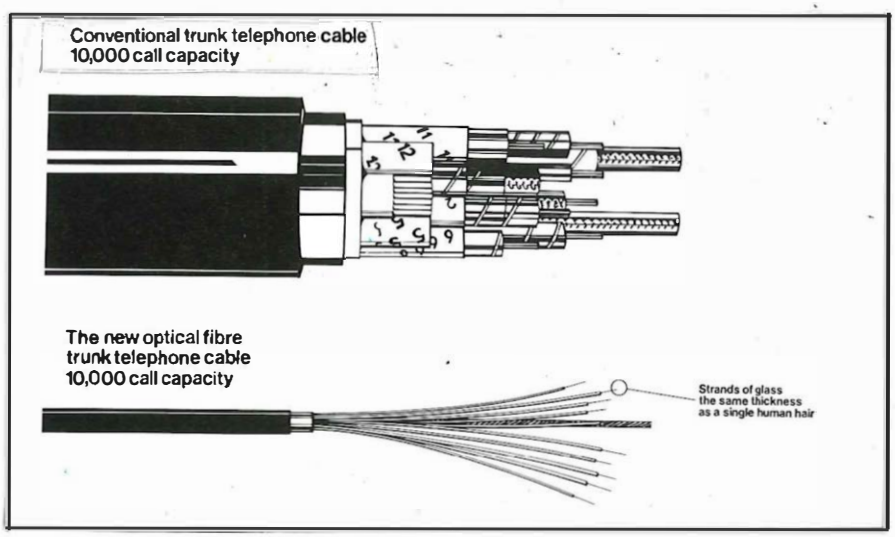
1981 – Second stage orders for 6,400 km of fibre, to make 800 km of cable to be installed on 24 routes from 1982 to 1985.

1981 – Order placed for world's first operational fibre link using an advanced system – monomode technology with long-wave radiation – to be in service by 1984.

Optical fibres' main attractions are:

- Less amplifying equipment needed to boost telephone calls over long distances.
- Small size of optical fibre cable compared with conventional cable with copper conductors.
- Immunity to some kinds of interference, such as crosstalk.
- Use of a cheap, widely available raw material (glass made from sand) instead of expensive imported copper.

With present-day technology – known as multimode transmission – a pair of fibres can carry nearly 2,000 phone calls. Typical cables are ten times lighter and thinner than conventional inter-city telephone cables. Already, British



Telecom researchers at Martlesham have sent light signals for 27 km in monomode fibre in the laboratory, and these signals can carry four times more phone calls – 8,000 instead of 2,000.

The object is to increase the interval between amplification to at least 30 km, which would enable the equipment always to be housed in British Telecom buildings, instead of having to place it in manholes at the side of the road.

The new optical fibre network now ordered includes one monomode long-wavelength system – a 27 km (17 mile) link between Luton and Milton Keynes. Due to be completed in 1984, it is currently the first of its kind in the world. It will be able to carry nearly 2,000 phone calls.

On line for better route planning

RR Stacey

Recent developments in telephone traffic route forecasting, including the introduction of new computerised techniques, are allowing a more flexible approach and savings in area office effort.

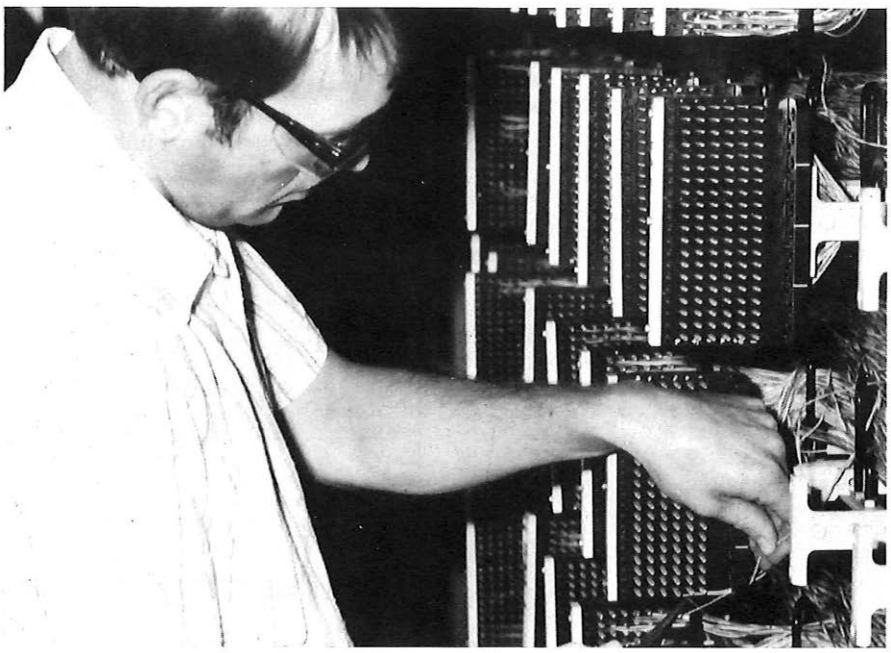
Many factors influence the forecasting of telephone route traffic. Business policies, plans and prospects, coupled with the long-term modernisation strategy, decide how much finance there is to meet current and forecast growth in telephone routes. Money available in a given period determines how far planners can go towards meeting their estimates.

Increases in route sizes are then carefully allocated on a route-by-route basis to ensure that the sum total does not exceed financial limits. The computerised annual schedule of circuit estimates (ASCE) details these changes, and itself influences cable and equipment planning as well as providing an authority for engineers to provide the circuits.

Traditionally, it has been usual to prepare individual traffic route forecasts by determining the trend of past records of measured telephone traffic, and applying that trend to a starting point. But this method is only satisfactory where the factors that have affected the route in the past are expected to remain constant in the future. The combination of an unsettled economy and a slowing down in connection growth creates an uncertain future that cannot be calculated from past information.

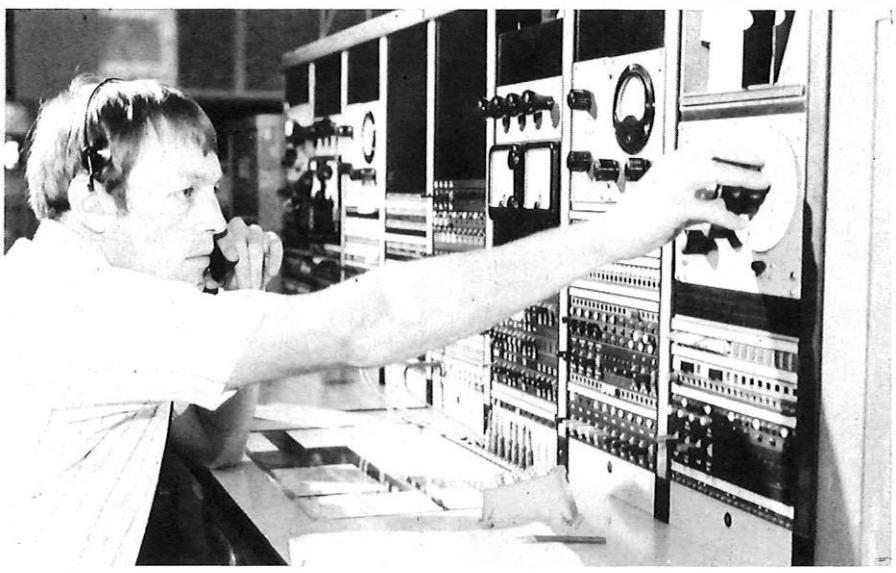
Studies have also revealed that forecasts produced by the traditional methods are, in fact, no better than might be obtained by applying common growth rates or sub-dividing a bulk forecast total for a group of routes into individual routes, taking the opportunity to incorporate the influence of the business's expectations into the bulk forecast.

For the longer term, individual route forecasts are often aggregated to form an assessment of the total demand for an item, such as transmission equipment or relay sets of a particular type. Thus the



Growth on the Colchester to Glasgow 74 route meant that this year 10 new circuits had to be provided. Technical officer Mick Brighton 'jumpers' the final circuit . . .

. . . and (below) checks the transmission levels at different frequencies from the trunk test position at Colchester exchange.



effect of all the forecasts becomes more significant than the individual route forecasts themselves. The individual forecasts, however, are still needed for circuit provision and to allow maximum flexibility in transmission plant planning where they contribute to the demands on cable, line systems, and so on.

The integrated forecasting process requires all forecasts to reflect a common set of agreed assumptions about British Telecom prospects and this has led to developments in route forecasting which could considerably ease forecasting work in telephone area offices. These developments may be summarised as a new ASCE computerised system; main network growth control; junction network growth control; forecasting adjustment; common growth rate forecasting and broadband monitoring.

The new ASCE computerised system is now operational. From the original simple concept some years ago of a computer system which simply sorted and printed ASCE entries and required a complete reinput each year of forecasting data, the system has recently been developed into a flexible database which needs less frequent updating and is capable of being manipulated in a number of ways.

A single file holds all traffic and circuit information together with other data which allows analysis for various purposes. The published ASCE forecasts relate to the current financial year (year 0) and the following eight years (years 1 to 8) although provision is made on the file for a further year (year 9). It is published four times a year on microfiche and is also available on magnetic tape for other computerised systems.

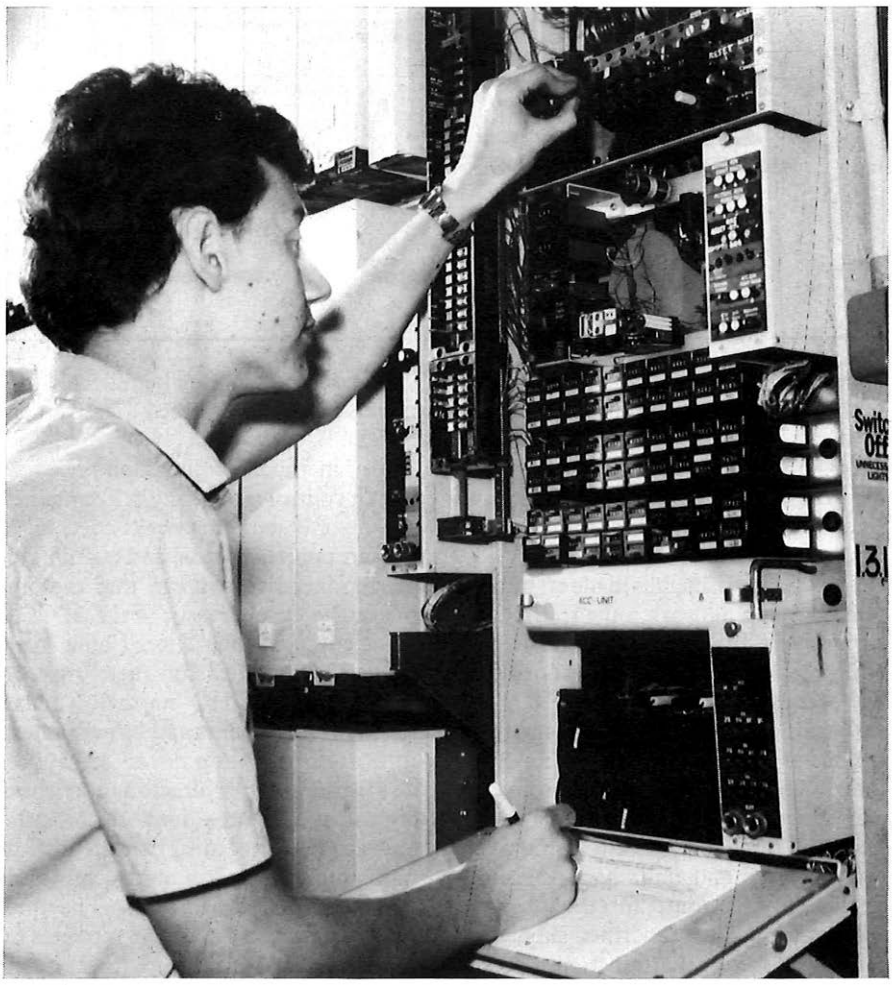
Since it begins at the current financial year, the file is rolled on 1 April each year, with the completed financial year being discarded and a further year being added at the end. At 1 April 1981, for instance, the 1981 ASCE file became the 1982 ASCE file, the year 1980/81 being discarded and a new year 9 (1990/91) being added.

There is also no need to revise and input a route forecast unless the forecaster considers it needs changing but any forecast not amended or adjusted for three years is automatically output for confirmation. The ASCE file can be updated at any time but timing of input and ASCE production are determined by availability of forecasting guidance and the needs of ASCE users rather than by the system itself.

The integrated forecasting process brings together all factors having a bearing on traffic forecasts and provides for main network routes – broadly those carrying trunk traffic – a way of assessing

Clerical assistant Louise Smith checks a microfiche display from the annual schedule of circuit estimates (ASCE) which will be used to help plan future circuits in Colchester Area.

Regular traffic records are essential in planning route growth. Here technician Stephen Goodridge takes the latest meter readings from the traffic recorder at Colchester exchange.



the bulk totals to which the routes should conform. Bulk totals of the current achieved traffic levels are determined by placing each route's achieved level into a morning, afternoon or evening busy hour category. Growth rates derived from the integrated forecasting process may then be applied to these totals to produce the forecast bulk traffic totals for the routes in each category.

This forecast can then be broken back to individual route basic forecasts, so that the route outgoing traffic forecasts are effectively influenced by, and integrated with, the switching unit forecasts which in turn reflect the business's prospects. After this basic route forecast has been determined, adjustment can be made for rerouting of traffic, new routes, and other changes to the network.

A BTHQ assessment is made of the bulk totals of main network route traffic forecasts at ASCE year 5. This is discussed with regional and board headquarters and preliminary targets are agreed in the early part of the year and final targets by the end of July when the full effect of the integrated forecasting process can be seen and achievement for the previous year is known. These forecasts are then broken back to areas and units and eventually applied to the route forecasts by the adjustment process described later.

It can be shown that junction network traffic (which is largely local fee traffic) grows in line with the total originating traffic in the exchange busy hour; this is one of the bulk components agreed annually at area, region and board, and BTHQ levels. From this growth rate it is simple to construct a junction network 'envelope' of total traffic, providing the level of traffic for the current financial year (the forecast start point) has been validated and all additions and subtractions of traffic due to planning changes throughout the ASCE period are known. This envelope can then be reflected into the ASCE by the forecast adjustment process.

This method of junction network growth control is virtually self contained and the only item that needs checking is the start point. Regional and board headquarters need to confirm that the outturn in the October issue of the ASCE is consistent with their agreed bulk totals and can set targets for their areas to achieve this. BTHQ normally makes checks on start points and growth rates.

The exercise of 'top down' control on the main and junction networks forecasting requires individual traffic routes to be adjusted so that the total of traffic forecast on routes is consistent with the agreed bulk forecasts. The time-consuming activity of aligning targets by going back over each route forecast and adjusting it can now be dealt with by the new ASCE computer system allowing groups of routes to be aligned with specified overall targets.

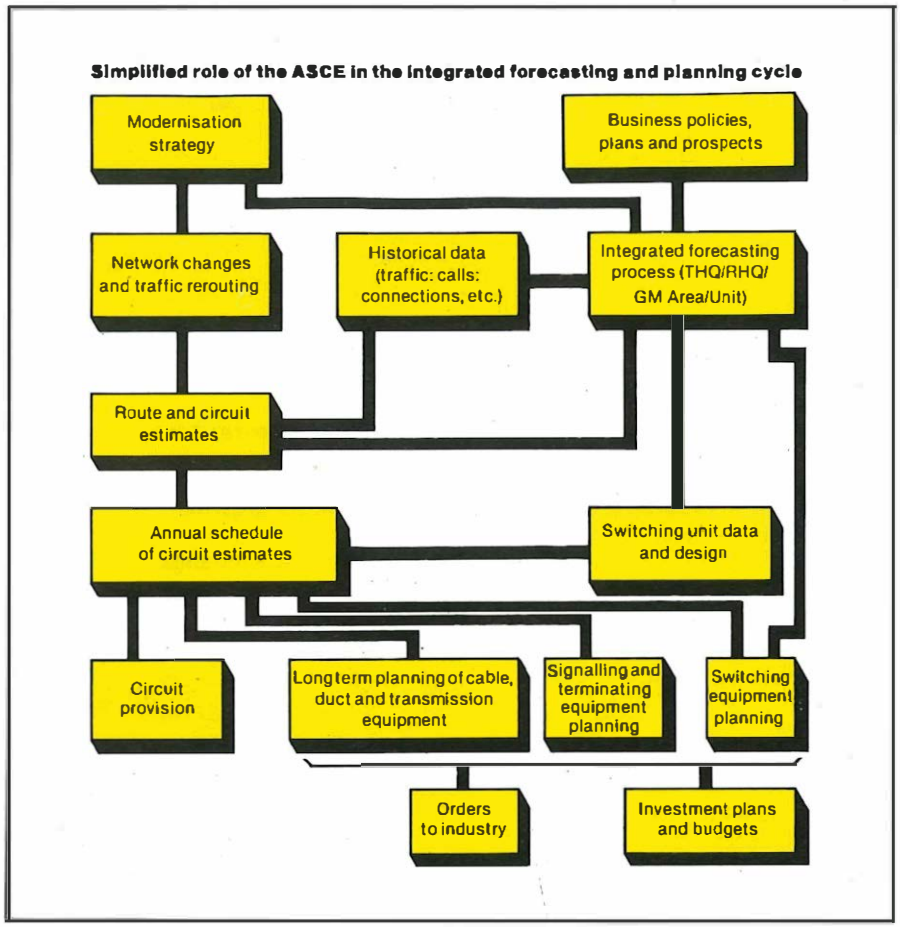
Individual routes, such as routes to and from international units, may be excluded from adjustment or have different adjustments applied as a result of different growth trends.

Part of the integrated forecasting process allows grouping of routes on individual units into main traffic groups (MTG) according to specified characteristics. Studies have shown that if a route has the same busy hour as the MTG in which it is contained and if the growth of the MTG and the route are not significantly different, then the MTG growth rate may be applied to the route rather than calculate an individual forecast. A scale has been published to allow a forecaster to decide whether a route's growth rate is significantly different from its MTG growth rate and therefore requires an individual forecast. For very small routes, the MTG growth rate is usually preferred.

Once a route forecast is determined, it is possible to allow it to remain unchanged on the ASCE file for three years at least, the later years being extrapolated as the file is rolled each year. There is, therefore, need for a simple monitoring process to ensure that the forecast remains valid and this can be done by setting limits around the forecast based on the spread of measured traffic levels on the route over the last two years. If measured traffic on new records falls within the limits then it is not necessary to change the forecast. If more than one new record falls outside limits, then the forecast must be re-examined and if three in 12 such records fall outside, then the forecast must be changed.

This broadband monitoring technique can be used for routes carrying over five erlangs and it is considered ideal for all suitable routes with route graphs.

Although the trends in route forecasting have encompassed the concept that in many instances, individual trending of route forecasts is not necessarily better than applying bulk methods to forecasts in the longer term, the new techniques available are still sufficiently flexible to permit detailed individual route forecasts to be prepared.



Mr R. R. Stacey is a head of group in Network Executive's Exchange Systems Department responsible for the development and operational running of the ASCE.

British Telecom Journal, Autumn 1981

At midnight on 1 October, British Telecommunications came into being. Creation of the new corporation marks the final break between Britain's telecommunications services and the Post Office and launches British Telecom into a new environment which will largely be dominated by competition.

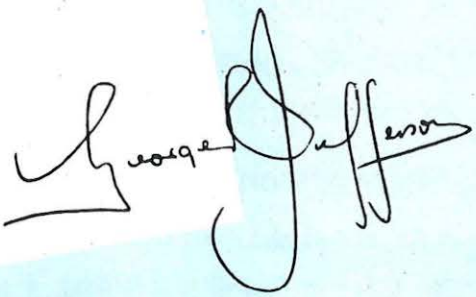
Basically, the British Telecommunications Act 1981 gives the Government wide powers to relax the telecommunications monopoly. Although final decisions have yet to emerge, the main provisions are to allow the private supply of extension phones and other types of terminal equipment for use in British Telecom's network and to allow greater freedom in the use of British Telecom's private circuits. It is also possible that competing networks might be allowed.

Competition will be introduced in stages over the next few years and liberalisation will probably begin with simple attachments such as telephones, callmakers and modems. Later stages will include private automatic exchanges and other more complex equipment.

This special 16-page section looks at the effect a freer market will have on the organisation, details the steps being taken to meet the new challenges and outlines the many exciting new technologies now under development. It also looks at the history of telecommunications during the past 100 years and the valuable export role now being played.

'We really do mean business'

I am delighted to have this opportunity to send a message to British Telecom Journal readers.
We are entering an exciting new era, unlike anything we have known before. The launching of British Telecom as an independent business, facing competition in many areas of our activity, presents us with both challenges and opportunities and gives us the chance to show our customers and competitors that we really do mean business.
We have many strengths: unrivalled experience in telecommunications, superb research laboratories, dedicated staff, a growing list of new products and services to offer to customers and the determination to respond quickly to their needs and to provide the right equipment at the right price.
British Telecom has geared itself to respond to these challenges. Spearheading our drive on the market is a reorganised sales force backed by a new management structure better able to make the fast decisions necessary for our prosperity in the more competitive world we now face.
It will not be easy; we will require all our determination to succeed.
We all have an important part to play.
I believe that with the necessary skill and drive, British Telecom will have a thriving future.



The British Telecommunications Bill received Royal Assent on 27 July 1981 and became the British Telecommunications Act 1981.
The Act established a public corporation called British Telecommunications and on 1 October 1981 transferred the property, rights and liabilities concerned with the provision of telecommunications and data processing services from the Post Office to the new corporation.

Facing up to competition

This article by Mr Frank Lawson, Director of Marketing Executive's Residential and Customer Services Department, looks at the ways in which British Telecom is gearing itself to meet the challenges it will face as its monopoly is relaxed.

The British Telecommunications Act will give the Government wide powers to ensure that its policies, aimed at a broad-based liberalisation of the telecommunications market, are implemented. In short, it means that British Telecom will face competition and that the Government will have much wider powers of direction over it.

The Act is essentially enabling legislation in that it provides the powers but sets only a loose framework. The way the powers will be used is still largely a matter of conjecture since, although the Government has made a number of public statements about its intentions, the final Government package has still to emerge.

Indeed, since the details of the new regime are to be a matter of Government policy rather than legislative, changes of direction will be possible at any time. The extent of changes made by the Government of the day will be influenced by how far customers are satisfied with British Telecom service. Obviously, the objective is to set and achieve high standards of service, and be ready to react flexibly to any changes.

The monopoly is defined in the British Telecommunications Bill in very similar terms to those in the Post Office Act 1969. But the Government has made it clear that it intends to change the scope of the monopoly, and with this in mind, the Secretary of State for Industry now has far-reaching powers both to issue licences, and to direct British Telecom to issue licences for activities which the Government wish to permit. In the 1969 Act, only the Post Office had this power.

The major aim of the new arrangements will be to free the terminal market by allowing most types of competitive terminal equipment to be linked to the network. In fact, for over 20 years, British Telecom has encouraged the provision of attachments to the network by private enterprise in the non-integral area. Already, more than a thousand have now been certified.

The Government still envisages a leading role for British Telecom and has insisted that customers must have at least one instrument supplied and maintained by British Telecom for each direct single exchange line – the 'prime instrument' policy. Justification for this stems mainly from the need to have a reliable and clearly-specified termination (which can be most easily provided by British Telecom), to ensure that at least one instrument has a known good performance and assured compatibility with the network and to minimise the maintenance 'demarcation' disputes which have proved a significant problem throughout the United States.

With multiple exchange lines, there will be a monopoly in the maintenance, but not the supply, of the switching devices (excluding digital SPC systems using the new technology). In this policy, the Government has recognised that switching systems interact with the network and that British Telecom's knowledge of the network qualifies it to ensure proper inter-working and to reduce maintenance demarcation problems.

One major change will be that the setting of standards which private or British Telecom attachments

Plug and socket telephones are to be installed nationwide following recent trials. They will simplify installation and allow customers to buy and plug in their own telephones

must meet will no longer be the responsibility of British Telecom. The British Standards Institution (BSI) has been given this job and the Government has announced that those standards will include criteria to ensure that equipment which conforms to the relevant standard(s) and is connected correctly to the network for its designed purpose will, among other things, be safe to network staff, cause no damage to the network, cause no interference to the network or other users, and conform to appropriate transmission and signalling requirements and operating protocols.

Telephone shops will be playing an increasingly important role in selling British Telecom equipment and services to the customer. One of the most recent shops is at Southampton. There are plans to open 70 such shops in the next year.

BSI-published standards will incorporate a description of network characteristics, interface requirements and any necessary operating methods. Some routine test requirements may also be published. Authentication of all customer terminal apparatus signifying compliance with standards is likely to become the responsibility of an independent body, probably the British Electrotechnical Approvals Board.

To give users a clear indication of whether telecommunications apparatus is approved for connection to the network, clauses were added to the Bill requiring appropriate marks to be shown on such apparatus, including any limitation as to its use. Similarly, information advertising the devices will be required to state whether or not they are approved, and for what uses.

The liberalisation programme is designed to be gradually spread over three years. Although the timing of the liberalisation of particular classes of attachments is still a matter for debate, and the precise way in which different classes of attachments fall within the three-year programme has not yet been published, it seems likely that the early stages of liberalisation will include items such as simple telephones, callmakers and modems. The later stages will include PBXs and other similar relatively complex devices for which evaluation will take time to complete and for which standards will be more difficult to write.

British Telecom will react to liberalisation by competing vigorously where it is in its interests to do so. Re-thinking on tariffs will also be necessary to comply with the Government's wishes that to ensure fair competition, British Telecom should not cross-subsidise competitive services in themselves or from profits from its monopoly services.

A wide range of new products and services are to be introduced to broaden and improve still further the existing range. For the residential customer, this will mean a wider choice of Special Range and feature phones. To meet the needs of the business customer, three new computerised switchboard systems, Monarch, Herald and Regent have been introduced.

Other proposed new products will extend the range of loudspeaking telephones, answering/recording machines and call making equipment. The need to improve private circuit provision has been recognised, and a task force manager with special responsibility for this work has been appointed and is already achieving results.

British Telecom believes that it should continue to be the national provider of telecommunications networks and network services and facilities as this brings considerable benefits to the customer. For example, British Telecom can improve existing networks and plan to implement new ones on a national basis in the most efficient way. Wasteful duplication is avoided and through its influence in international telecommunications circles, British Telecom can optimise the development of compatibility between networks in other countries.

An old exchange battery room at Aldershot has been transformed into a bright new business centre where customers can see the latest telecommunications equipment which British Telecom has to offer. Here the Herald call connect system is being demonstrated.

Although the Secretary of State's original statement on liberalisation provided for British Telecom

Every day, nearly 2000 telephones are installed by British Telecom to customers throughout the country. Maintenance is an equally vital factor and British Telecom's performance in this area is continuing to improve.

This new tabletop payphone will be a boon to many customers.

to remain wholly in charge of the network, the recent controversial report by Professor Michael Beesley (a study commissioned by the Government) proposed that parts of the British Telecom network should be sold to private enterprise. The report also suggests that resale could lead to the establishment of competitive switching and transmission networks.

Mercury gets green light

The Government will shortly licence the private Mercury consortium to provide a telecommunications network in competition with British Telecom, Mr Kenneth Baker, the Minister of State for Information Technology, said yesterday.

Mr Baker told a Business Telecom conference in London that excellent progress had been made in discussions between the Department of Industry and the Mercury consortium of Cable and Wireless, British Petroleum and Barclays Merchant Bank, in resolving the technical issues.

Mercury will aim primarily at the business market and its preliminary plans include about 1,300 kilometres of fibre optic cable to be laid between the main cities.

Consortium will compete against Telecom

By Guy de Jonquières

THE INDUSTRY Department said yesterday it hoped to approve soon plans by a Cable and Wireless consortium to launch an independent business communications service in competition with British Telecom.

But Mr Kenneth Baker, the Department's Minister responsible for information technology, said in London that several points of detail had still to be settled with the consortium and with British Telecom before a licence could be issued.

Before the new service can start, it must receive permission from the Home Office to use the radio frequencies which it needs to link customers in city centres.

The project's backers are also pressing for authority to connect the service to British Telecom's network in the UK.

The consortium, which also includes British Petroleum and Barclays Merchant Bank, plans to build its own network by laying optic fibre cables in ducts along British Rail track.

Fibre-optic lines will rival BT

By Peter Large, Technology Correspondent

THE Government "hopes shortly" to issue a licence to Cable & Wireless for a new phone network competing directly with British Telecom for the rich business traffic.

Mr Kenneth Baker, the Minister for Information Technology, announced this at a business communications conference in London yesterday. He said there remained "a number of points of detail" to be settled between C&W and BT and these were being dealt with urgently.

The £50 million Mercury network planned by a consortium of C&W, BP and Barclays will use fibre-optic cables running alongside railway tracks to link major cities, with radio providing the final link to offices.

The Home Office said last night it had completed what was asked of it in the allocation of radio frequencies. The main point remaining at issue was how much C&W should pay BT to connect Mercury with the national phone network. That connection is not vital to the start of Mercury but C&W wants it in the licence.

Mr Baker said the Government would make sure that Mercury was not "a mere duplication" of services available from BT. He hoped Mercury would open new markets — markets for which BT itself would be competing.

The Minister also said that the first products in the new free market for telecommunications should be settled before Christmas; by early next year the first value-added private services should be licensed. He noted the number of new products and services BT had already produced before the competition began.

Mr Baker said he was appointing an informal advisory panel to help him in any cases of dispute over licences with BT.

Professor Michael Beesley, of the London Business School, whose report underpinned the Government's decision to remove most of BT's monopoly powers, has begun another study for the Government on the longer-term implications of "liberalisation."

The Government has sought reactions from interested parties and British Telecom has vigorously opposed the more extreme recommendations made by Professor Beesley. The Government recently announced its decision to allow competitors to provide 'added value services'. This means that private companies may now lease circuits from British Telecom, add on an additional service – such as data processing equipment – and resell it as a single package to customers. The details of how this liberalisation will work still have to be arranged but in principle it can be welcomed: new 'added value' services can bring more business for the network.

The Government has recently indicated that it intends to license a system called Mercury, a separate network proposed by Cable & Wireless, Barclays Bank and BP to provide some trunk services although many details have still to be decided. Nor by late summer had it pronounced on 'resale' but the situation is that arrangements for liberalisation are highly flexible and will be implemented at the discretion of the Secretary of State.

The Government will decide on the extent of liberalisation, when, how and in what order it is implemented and what kind of standards and authentication of standards are to be adopted. There will, of course, be discussions with interested parties including British Telecom.

British Telecom recognises that it is very much on trial regarding its response to competition, its speed of provision, its selling ability and in the range and variety of products it intends to introduce. It is, however, an exciting time and British Telecom can be guaranteed to respond vigorously and in a determined way with a positive and constructive approach to the challenge of competition in all the different forms in which it is likely to emerge over the next few years.

Tomorrow's world starts here

That could well be the motto of British Telecom's research team. Its technological achievements over the past decade have helped transform the humble telephone into a modern day Aladdin's lamp – able to summon up anything from a technical drawing to a timetable, from computer data to a commodity price index.

Add a television set and the telephone provides a reference library, entertainment centre, shopping guide, advisory service and lots more besides. This has been made possible by Prestel, the world's pioneering viewdata system developed at British Telecom's research laboratories at Martlesham, near Ipswich.

Viewdata allows virtually unlimited information stored on distant computers to be called up, sent through the telephone network and displayed on a modified television or terminal. It is still the world's only public system and is within local call reach of two-thirds of Britain's telephone customers.

Prestel is now a worldwide service and is expanding its technology as well as its horizons. An 'electronic mailbox' service has just opened which enables users to send messages to each other. Using a simple keyboard, customers merely tap out their message, address it to another Prestel user and it appears on the recipient's screen as soon as he or she next uses Prestel.

And consider the automatic telephone system in which 90 per cent of the world's 500 million telephones can be dialled direct from almost anywhere in Britain.

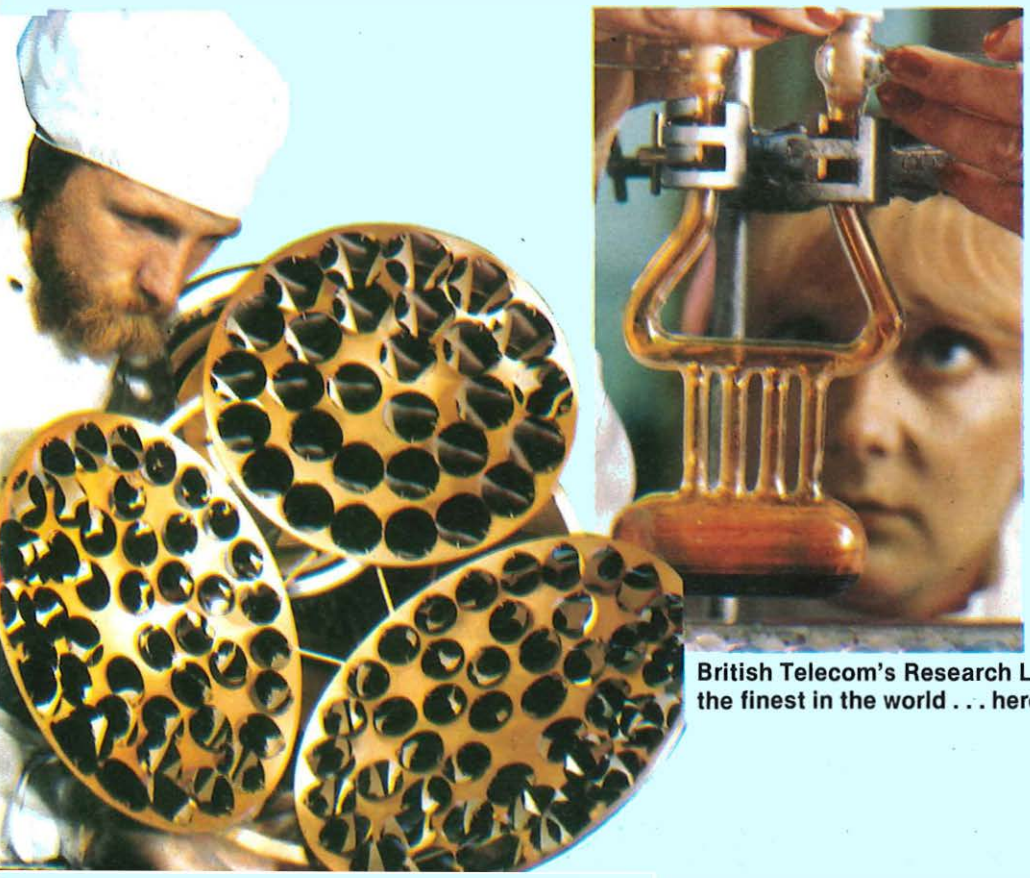
The reliability of the network of undersea cables spanning the oceans results from research by British Telecom which led to the development of transistors able to operate in amplifiers three miles under the surface for 25 years without failing.

Latest advances in cable technology are clearly transparent – optical fibres made of glass so pure that a block five miles thick made from it would be as transparent as a window pane (see page 10). Optical fibres are hair-thin strands of glass through which information is sent in the form of rapid pulses of light. They are already starting to replace the 'electricity along metal wire' method of telecommunications, especially for longer routes.

But current telecommunications trend is the shift away from an analogue system, where messages are sent as a continuous electrical signal, to digital, where signals are on/off bursts of electricity or light. Playing a leading role in this new digital world is the ubiquitous silicon chip which can pass through the eye of a needle and yet contain as many as 100,000 transistors and interconnections.

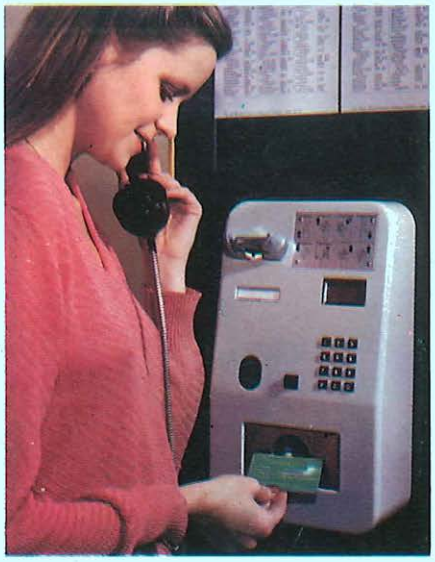
Designing chips at Martlesham has become so complex that computers are now used to plot circuits which are then drawn by an electron beam.

Many of these microchips are being designed



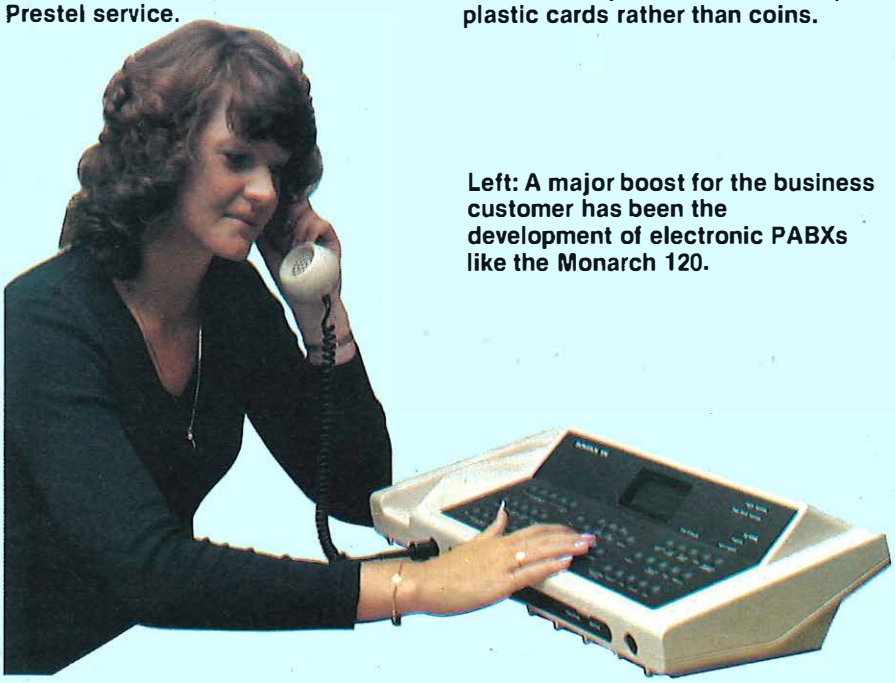
British Telecom's Research Laboratories at Martlesham are among the finest in the world . . . here staff work on a variety of projects.

Travel agents are now the biggest single business users of British Telecom's pioneering Prestel service.



The cashless society is now a step nearer as British Telecom tries out 200 'cardphones' which accept plastic cards rather than coins.

British Telecom has recently placed orders worth £15 million for optical fibre cables, the hair-thin glass strands, a pair of which can carry nearly 2,000 telephone calls.

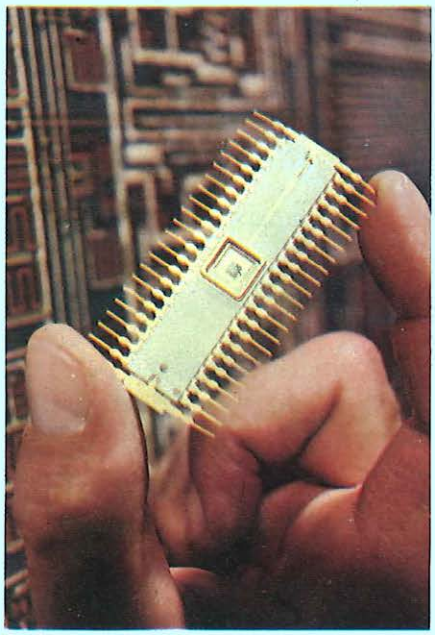


Left: A major boost for the business customer has been the development of electronic PABXs like the Monarch 120.

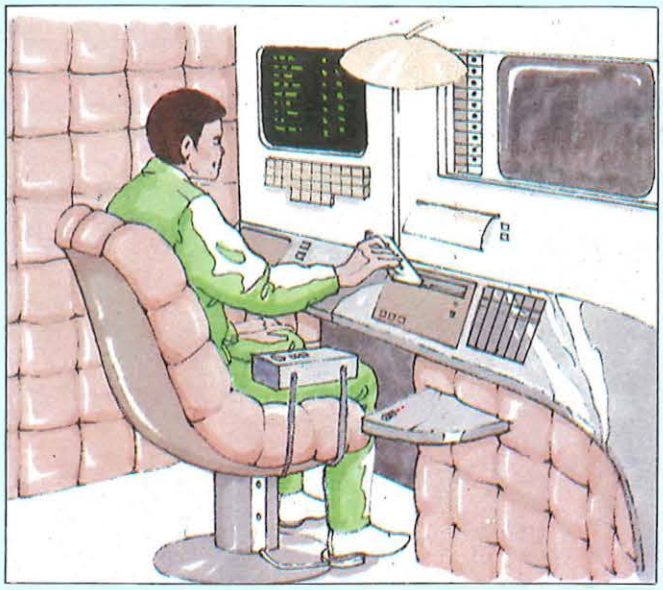
Below left: At the heart of almost all British Telecom's new technology is the ubiquitous microchip which is revolutionising electronic development throughout the world.

Below centre: Neil White, station manager at Goonhilly earth station in Cornwall with models of the first communications satellite, Telstar and the latest in space, Intelsat V with a capacity of 12,000 circuits and two television channels.

Below: By the end of the decade, five million British Telecom customers will be connected to System X exchanges.



Above: British Telecom's three-strong cableship fleet is among the most modern in the world and is fully equipped to lay and repair cables in the deepest water.



Top right: Looking to the longer term, could this be the office of the future . . .?

Right: By 1983, British Telecom is hoping to introduce a service using small rooftop dish aerials which will enable businessmen with their own internal networks to communicate via satellites 23,000 miles out in space.

specifically for System X, the family of digital exchanges being introduced throughout Britain to give Britain's telephone customers a much faster, more reliable service as well as many special facilities. On System X, calls are clearer and connected virtually as quickly as the number is tapped out.

The first System X exchange opened more than a year ago in the City of London. It has been switching about a million calls a month between 40 local exchanges with fewer than one in 10,000 calls failing. The first local exchange at Woodbridge, in Suffolk, is also now in service. By the mid-1980s, all major business centres will be linked by System X. While by the start of the next decade most people will be experiencing its benefits.

As technological advances enhance the network's ability to handle all kinds of information, from speech to pictures, text and data, a parallel improvement is planned for the equipment which will be plugged into it. Many visual services become feasible and a special section at Martlesham is devoted to research in this area.

On trial already is slow-scan television which can bring pictures along ordinary telephone lines. A camera sends a frame down the line every few seconds. This is ideal for applications such as surveillance or calling up drawings from a distant location. Also being tested is telewriting – a system which enables a drawing to be made on a television screen using a light pen and then transmitted to one or more locations instantly. This adds a new dimension to long-distance tuition. Another important concept for the future is teleconferencing, bringing the picture-phone and enabling busy executives to meet without having to leave their desks and embark on a time-consuming journey.

There is little, in fact, that the telephone and the network cannot or will not be able to do as British Telecom prepares to face what is guaranteed to be a very exciting future.

Streamline selling holds the key

The creation of a vigorous new sales force, tailor-made to meet the needs of both business and residential customers, has been one of the major steps undertaken by British Telecom to meet the challenges it will face in the new competitive environment. Here Hamish MacRae, head of the Sales Strategy Division, and Alan Fowler, head of sales reorganisation group in the Residential and Customer Services Department, look at the events leading up to the re-organisation and outline the vital role which field and office sales staff must now play.

The existing field sales system was set up in 1948 although sales re-organisation, as an idea, had been under discussion in Post Office Telecommunications for about 10 years. But the lack of a political and emotional catalyst to co-ordinate the divergent interests had prevented conclusive action.

In 1979, the determination of the new Conservative Government to introduce fresh legislation and competition in the telecommunications area provided the necessary impetus to unite all interests in a joint determination to provide an organisation which could compete effectively with all-comers.

By the end of that year, a joint group of Telecommunications Marketing and Personnel Department sales training experts had visited the United States to discuss with American counterparts and account executives the US experience and to identify the areas of organisation where the American systems could be improved.

Armed with this information at the beginning of last year, British Telecom's newly-formed Business Systems Department set about the development of a new field sales organisation, while the Residential and Customer Services Department produced a parallel sales office organisation.

A marketing sales representative demonstrates the potential of the world-beating Monarch 120 to an interested customer in a telephone area's sales bureau.

The plans which flowed from these activities were quickly approved. It was then a case of agreeing the pay and personnel details with the trade unions. The negotiations which followed must rank among the most detailed and difficult ever undertaken by British Telecom management and trade unions, and the highly competitive sales organisation which emerged is a tribute to the skill of all those who were involved.

The problems involved in moving from management of a protected monopoly market to a thrusting commercial environment are not always easily understood, but the main differences are the needs for active selling rather than passive service, the selling of customer benefits not just hardware, and working to targets to meet planned objectives. A field organisation with more than one level of salesman and individual rewards for effort and achievement are also highly important to the success of the scheme.

To meet these criteria, it was decided to appoint 50 major account managers (MAMs), 135 field sales managers (FSMs), 465 marketing account executives (MAEs) and 310 marketing services representatives (MSRs) to service the top 300,000 business customers. Each of these jobs carries a basic salary, supplemented by an achievement-related bonus, while each MAM and FSM will be supplied with a 1600cc car. Holders of other field jobs will drive 1300cc five-door hatchbacks.

MAMs will be selected for high personal and selling qualities and will be responsible for servicing the biggest accounts. They will be allocated up to five major accounts on a personal basis and, because their responsibilities will cover the nationwide interests of the companies in their care, they will normally be based in regional offices.

MAEs will be trained, first in management consultancy-type skills and, secondly, in telecommunications systems and hardware. They will be personally responsible for servicing the account of individual customers and will be supported by a Business Prospect Card System (BPCS). They will regularly visit customers at the top end of the local market to establish mutual confidence on the basis of the MAE's understanding of the customer's business.

MSRs will handle small demand, 'shift and change' and system scheduling work which cannot be dealt with by telephone. They will also be responsible for any visiting for service or image creation purposes, irrespective of whether the visit is business or residential in character.

Their duties will include programmed visits at the small installations end of the Business Prospect Card System programme. This job aims to provide

service in an area where American companies have been particularly vulnerable to competition. MAEs and MSRs will report directly to field sales managers who, in turn, will report to area sales managers and will be responsible for planning and executing the local field selling strategy.

Special selection and training processes have been produced by Telecom Personnel Department for both internal and external candidates for all the new jobs and already the worth of these methods is being proved by the very high quality of recruits. The level of interest shown by applicants wishing to

Above left: Field sales manager Graham Peddar, a tutor at the new sales training centre in Bournemouth, sets off in his British Telecom-supplied car to visit a regional major account manager to discuss the content of a new course.

Above right: The team behind the new sales field force. Every month, the Sales Reorganisation Implementation Working Party, chaired by Hamish MacRae, has been meeting in London to hammer out the complex details of the launch.

move from private sector companies to British Telecom is very high.

The detailed job of designing targetry, bonus and implementing procedures for the field force has fallen to Business Systems Department who with the help of several teams of consultants, have produced the basic material to let the re-organisation process flow forward to regional and area sales management. Overall co-ordination of the implementation has been organised by the Sales Re-organisation Implementation Working Party, a large group of managers from Headquarters, Regions and Boards meeting regularly. Prestel Headquarters and International Executive have also taken lively interest in the process.

The result of all this activity is that the field sales organisation project is now well on its way and soon British Telecom will have an effective top class competitive organisation in operation, capable of coping with all-comers.

But creation of a thrusting new field sales force is, of course, only part of the story. Equally important will be the contribution of sales office staff who will process the orders obtained from the major business customers and deal with minor requirements which do not require a visit, from the office desk. The sales office will also be responsible for the highly significant small business market which numbers around two million customers plus, of course, British Telecom's 14 million residential customers.

Briefly, the objectives of sales office re-organisation are to provide a sound basis for office selling activities, better service to customers, effective support to the field force, improved skills and motivation and better job opportunities for office staff.

Major changes within the sales office will be the introduction of the commercial officer grade and the division between business and residential customers. Commercial officers will deal with business customers from the office desk, and support the field force by processing orders obtained by MAEs and MSRs. They will also deal with the simpler requirements of larger business customers and be responsible for dealing with and selling from the desk to the small business customer not covered by the field force.

Clerical officers in sales will continue to handle the residential side of the Business, promoting awareness and purchase of British Telecom products and services in this field. They will also provide other essential support activities in sales offices. The core of the sales office organisation will still be teams of clerical officers and commercial

The administrative hub of the new organisation is the area sales office, manned by teams of clerical officers and commercial officers who will deal with business customers by telephone.

officers, supported by clerical assistants working to a sales team manager who will continue to be responsible to a sales officer manager who, in turn will report to the area sales manager.

In short, the work of all British Telecom sales staff is vital in securing the future of the organisation and its staff. There will naturally be problems to overcome before the new organisation is fully effective in every area but the worst difficulties have already been tackled – and having overcome the giants there is no reason why British Telecom needs to be deterred by the pygmies.

From Bell to Buzby . . .

A story of progress

The National Telephone Company, the GPO, Post Office Telecommunications . . . For more than 100 years the development of Britain's telephone network has been the responsibility of these organisations.

Now as the technological revolution continues apace and the silicon chip, System X and optical fibres spearhead an even more exciting future, British Telecommunications has been created as a separate corporation to guide one of Britain's major growth industries towards the 21st century and beyond.

Below are listed some of the major events which have helped make Britain's telecommunications system one of the best in the world.

How it used to be – a busy switchboard 70 years ago.

The Queen makes the first public STD call in 1958. Every BT customer can now dial direct.

1879:– Britain's first telephone exchange opens in Coleman Street, London, shortly after Graham Bell demonstrated the first phone in America. Exchanges are set up in the big cities.

1891:– Phone calls from London to Paris herald the birth of the international phone service.

1896:– Marconi calls on the Post Office's engineer-in-chief to demonstrate 'telegraphy without wires'. Immediately the GPO goes all out to help Marconi develop wireless. Telephone dial invented.

1912:– National Telephone Company's system formally transferred to the Post Office. Britain's first public automatic exchange opens at Epsom.

1922:– Wireless manufacturers approach the Post Office for permission to broadcast. The BBC is established and in 1923 is given a GPO licence to broadcast. Also in 1922, the first teleprinter trials take place. Ten years later telex and private telegraph services will start.

Part of the Post Office's transport fleet in 1919.

1927:– London to New York radiotelephone service begins.

1930:– 'On-demand' trunk service introduced.

1936:– TIM – the speaking clock – introduced. Today it receives 431 million calls a year.

Buzby – for five years the star of many advertising campaigns.

1953:– Agreements were signed on 1 December between the British Post Office, the American Telephone and Telegraph Company, the Canadian Overseas Telecommunication Corporation and the Eastern Telephone and Telegraph Company for the provision of a transatlantic telephone cable.

1954:– A new inland telex service was established using a separate network integrated with international telex circuits. A submarine telephone cable was laid by *HMTS Monarch* between Aberdeen and Bergen, Norway. This cable, 300 nautical miles in length, was the world's longest submarine cable.

1956:– The first transatlantic telephone cable was laid between Oban in Scotland and Clarenville

in Newfoundland, a distance of 2240 miles. After crossing Newfoundland, a further submarine cable was used to complete the connection to the mainland of North America, some of the circuits terminating in Canada and some in the US.

1958:– On 5 December, Her Majesty the Queen inaugurated STD by making a call from Bristol Central telephone exchange, the first to have these facilities. The first automatic telex exchanges were opened at Shoreditch (London) and Leeds.

1959:– The transatlantic telephone cable (TAT 2) was laid by HMTS Monarch.

1960:– The conversion of the inland telex service to automatic working was completed.

1961:– The Anglo-Canadian cable (Cantat 1) was laid by HMTS Monarch, as the first section of the submarine telephone cable network linking the Commonwealth.

1962:– The Post Office satellite communications station at Goonhilly Downs was brought into service. The station used a British-designed dish-type aerial which was the first of its type. Dish-type aerials were later adopted throughout the world for satellite communication. The station took part in the first transatlantic television transmission made via an artificial satellite – Telstar. This was the first broadband active communications satellite and was launched into orbit from Cape Canaveral on 10 July. It circled the earth once every 158 minutes at a height of between 600 and 3500 miles. The day after it was launched, Telstar was used to transmit the first high-definition television pictures across the Atlantic.

1963:– On 8 March, International Subscriber Trunk Dialling (ISD) was inaugurated allowing London customers to dial Paris numbers. The commonwealth transpacific cable (Compac) was laid between Canada and Australia.

1965:– Intelsat 1 – Early Bird – the first commercial communications satellite was launched into a synchronous orbit of 22,300 miles on 6 April. Datel introduced by the Post Office. The Prime Minister, Mr Harold Wilson, opened the Post Office Tower in London, then Britain's highest building. The microwave tower was designed to carry aerials covering some 130 stations throughout the country.

1966:– The first fully-operational production electronic telephone exchange in Europe (a TXE2) was opened at Ambergate, Derbyshire.

1967:– The final section of the South East Asia Commonwealth (Seacom) cable linking Australia, Hong Kong and Singapore became operational.

1968:– Post Office installed world's first PCM exchange at Empress telephone exchange in London.

1969:– Post Office ceased to be a Government Department and became a Corporation on 1 October. A second aerial at Goonhilly was

Britain's first telephone exchange opened at Coleman Street in the City of London in 1879. One hundred years later, and just a few minutes walk away, stands Mondial House, one of the biggest telecommunications centres in the world.

The changing face of British telecommunications.

GPO

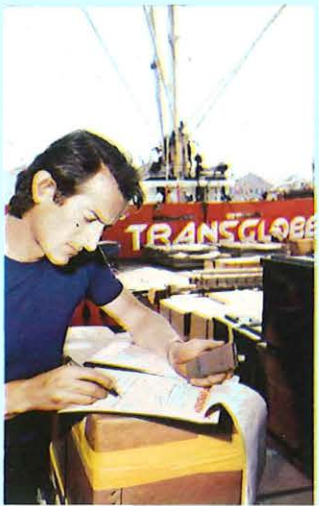
Post Office Telecommunications

POST OFFICE

British TELECOM

Since 1936, telephone users have been able to dial the speaking clock service. Here, Pat Simmons, for many years the voice on the end of the line, takes a look at the equipment at Kelvin House in London.

First introduced in 1973, radiopaging has now gone nationwide enabling users to keep in touch when on the move.



Keeping families together throughout the world – more than 100 countries can now be dialled direct from Britain just 18 years after the first such link was established between London and Paris.

Keeping in touch with the world . . . the latest aerial at Goonhilly helps link Britain by satellite to countries throughout the world.

completed. In July, Goonhilly was the European terminal for the television coverage of Man's first steps on the moon at the time of the Apollo 11 moon landing.

1970:– The world's first telephone directories produced by a fully integrated computer printing process, were completed for the Post Office. ISD was extended to allow London subscribers to dial New York numbers.

1971:– Transatlantic dialling was extended. Six British cities: Birmingham, Edinburgh, Glasgow, Liverpool, London and Manchester were able to dial direct to the whole of the mainland of the US. In July Post Office announced development of one-plus-one subscribers' carrier system by which two subscribers can speak simultaneously on one line. Confravision, the world's first public bothway television system giving conference facilities to groups of people in different cities, was made available by the Post Office in its special studios in Birmingham, Bristol, Glasgow, London and Manchester.

1972:– A third aerial was completed at the Post Office Satellite Communications Station at Goonhilly, making the station the largest in Europe and the first in the world to operate simultaneous commercial services through three satellites. The ten millionth telephone exchange line was installed in the UK.

1973:– The Post Office adopted the hovercraft principle for moving pre-packed containers of submarine cable weighing up to 70 tons at their new Southampton cableship depot. The world's first commercial international Confravision link was set up by the Post Office between London and Sydney, Australia.

1974:– The world's first commercial international Confravision service was opened between the UK and Sweden. ISD was extended to additional countries including New Zealand making UK subscribers the first in the world able to dial the Antipodes.

1975:– Two new Post Office cableships, the *Monarch* and the *Iris* were launched. These were the first cableships in the world to be designed for rapid cable loading using the 'pan loading' system developed by the Post Office.

1976:– The Post Office opened the world's largest international exchange at Stag Lane, Edgware. Buzby, the 'bird on the wire', was introduced to help stimulate telephone calls. A Pathfinder experimental stored program control exchange opened at Martlesham Research Centre. Also at Martlesham both waveguides and optical fibres were demonstrated for the first time.

1977:– First measurement and analysis centre introduced at Aldershot. This equipment is used to measure the quality of telephone service. And the first of a range of special telephones introduced, the Mickey Mouse, the Classic and the Compact (Silver Jubilee version). The full service of the experimental packet switched service (EPSS) opened. And the United Kingdom became the first nation in the world to have direct dialling telephone links with 50 countries throughout the world.

1978:– First telephone calls in Europe using optical fibre transmission. Prestel, the Post Office viewdata service, launched on trial for the first time.

1979:– System X, a family of technologically advanced electronic telephone switching systems and the biggest single telecommunications development ever undertaken in Britain, is launched.

1980:– First test of optical fibres underwater. An eight-point improvement plan was announced and plans to introduce Teletex – a new electronic text communication service – formulated.

Selling to the world

It is, of course, common knowledge that British Telecom is responsible for the development and maintenance of Britain's telecommunications system. What perhaps is not so widely realised is the commitment and growing influence the new corporation has in the world's export markets in terms of its technology, its know-how and its experience.

An obvious example is Prestel – the public viewdata service invented and developed by British Telecom – which links a computer-based store of information by telephone line to a suitably-adapted television set. Prestel now has a background of more than 18 months operational experience as a full public service – which is unmatched by any international rival – and many overseas telephone administrations have expressed a keen interest in developing similar services in their own countries.

Already six administrations – Austria, Italy, Hong Kong, Netherlands, Switzerland and West Germany – have bought Prestel systems. Each system sold abroad involves not only the sale of the computer programs, which are needed to drive the service, but also the computers on which Prestel exclusively operates.

Recognition by the International Telegraph and Telephone Consultative Committee (CCITT), and widespread acceptance of Prestel viewdata display standards also provides excellent opportunities for British manufacturers of a wide range of equipment. Also a substantial new industry is growing up around the terminals, adaptors, recorders, printers and keyboards associated with viewdata systems. Yet another export opportunity has arisen with the Prestel International service, whereby executives all over the world can retrieve vital business information over international telephone lines.

Probably British Telecom's best known export venture however, is Telconsult its overseas consultancy service set up to sell its operational and management knowledge quite independently of United Kingdom manufacturing export aspirations.

The most effective platforms for British Telecom to show off its equipment and services are major international exhibitions like this recent one in Geneva.

Six overseas administrations have already bought Prestel systems and with its International service, business executives throughout the world can retrieve information.

Mr Frank Thomas, former director of Overseas Liaison and Consultancy, advises a Middle East client representing an overseas administration.

Established as an independent organisation within the business, Telconsult draws upon the vast knowledge and practical experiences of British Telecom's staff to provide teams of consultants for a wide range of specialist tasks throughout the world. These teams advise not only on the technical aspects of equipment and standards, but also on the vital administrative and financial functions.

At any given time, Telconsult has a staff of more than 100 working abroad on assignments covering every facet of running a public telephone business. For example:

* In the United Arab Emirates, staff are currently working on a management science project designed to increase the efficiency of manpower resources and improve service standards to the customers of Emirtel, the telephone administration of UAE.
* In Kenya, Telconsult is helping to establish a sound financial accounting system.
* In Libya, some 60 British Telecom staff are planning and supervising a major national coaxial cable network, and also planning and constructing open wire carrier systems.
* In Venezuela, Telconsult has the task of planning and modernising local line networks.

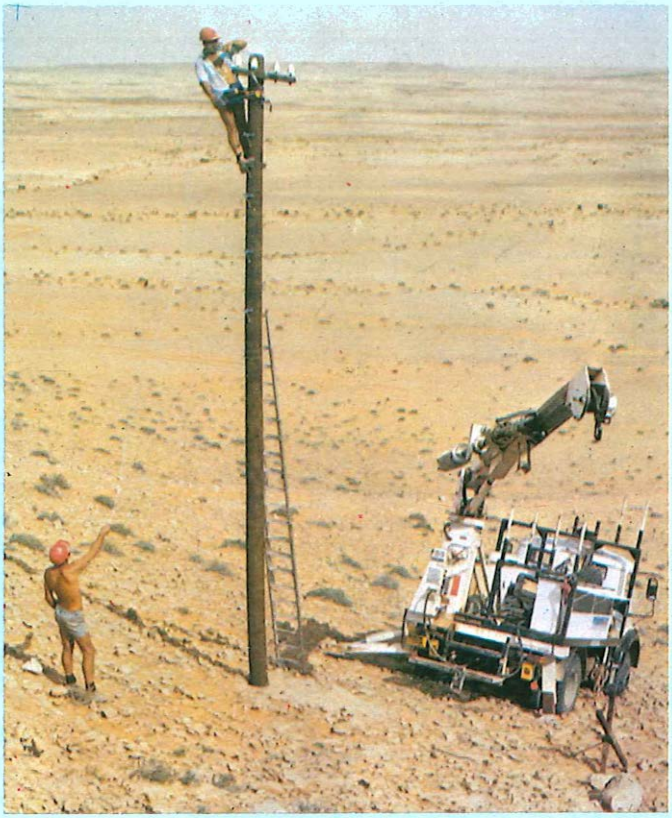
In all, Telconsult is currently involved in projects in more than 15 countries on four continents, and as well as creating confidence in British telecommunications equipment is also helping establish a favourable climate for British exports.

It is also a fact, of course, that British Telecom's own requirements for new systems or products take into account their export potential. This approach recognises British industry's need to have products which not only compare well in terms of innovation, quality and reliability with those of overseas manufacturers, but which also hold their own against fierce international price competition. A recent example is the new Monarch digital exchange system, and a small public exchange version, now in service in Scotland, could find substantial overseas markets in rural communities.

Another example is the major optical fibre network being developed for extensive UK use. As well as improving the quality of transmission for British customers, it will help industry to bring forward the remaining development work needed to produce inexpensive and reliable transmission systems for offer overseas.

But perhaps the most significant way in which British Telecom has shown its commitment to industry and the export drive is through its approach to the research and development of the revolutionary System X, the technically advanced family of electronic digital exchanges produced in partnership with GEC, Plessey and STC.

In a unique move, the partners have formed British Telecommunications Systems Limited, a company whose aim is to promote System X throughout the world. Chaired by Christopher Chataway, BTS is owned in equal proportions by the four participants. It was conceived from the start with exports in mind and has been designed to be fully competitive in



Telconsult in action – here engineers help to construct an overhead route as part of a £4 million contract for Libya.

One of the data services operated by British Telecom is the International Packet Switched Service to the United States and Canada. Here, a technical officer uses a datascope to test for errors in the system.

world markets. The largest single telecommunications development project ever undertaken in Britain, representing an investment of over £150m, it is capable of providing a total, digitally-based telecommunication system.

System X has been demonstrated at major international telecommunications exhibitions in Geneva, Singapore, Rio de Janeiro and Bahrain and much interest has been shown by overseas administrations in the varied planning options which System X offers. British Telecom is firmly committed to it and through BTS is working in partnership with the British manufacturing industry to exploit its export potential.

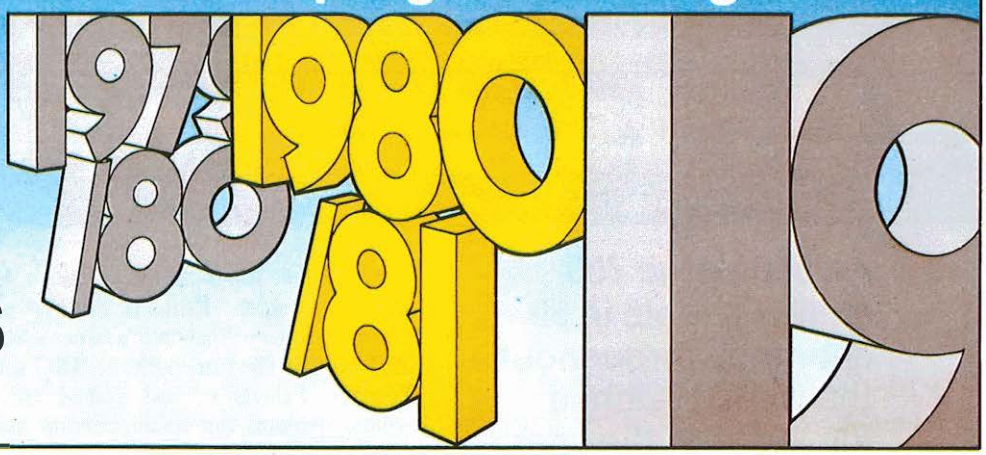
A further way in which British Telecom's services are helping exports, is by encouraging overseas firms to base their major international communications networks within Britain where the provision of international services, offering fast and easy connections to all parts of the world is highly developed. International Direct Dialling (IDD), for example, is available to over 100 countries from 98 per cent of all the UK's 28m telephones.

World-wide telex services are also available, with automatic dialling provided to more than 150 countries and Data services cover a wide range of speeds and options, including the International Packet Switched Service to the USA and Canada. In addition, British Telecom is a leader in its international leased circuit provision offering a competitive service in terms of lead-times and cost.

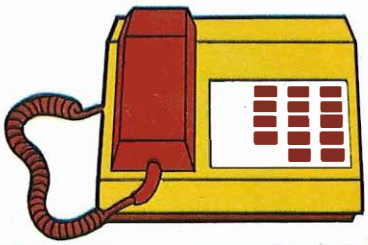
There can be no doubt that British Telecom recognises that, as a major business in its own right, it has a responsibility to promote British industry and encourage British exports, and that it is fully committed to doing so – both now and in the future.

A review of British Telecom progress during 1980/81

The year in figures

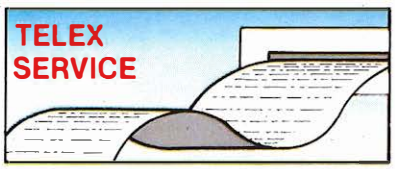


TELEPHONE SERVICE



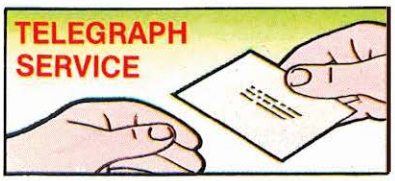
	1980-81 Result	% Growth over 1979-80	1979-80 Result	% Growth over 1978-79
Size of System				
Total working connections	18 418 000	4.7	17 592 000	7.5
Total working stations	27 870 000	4.2	26 737 000	6.9
Call office connections	77 000	0.0	77 000	0.0
Shared service connections	1 350000	—10.0	1 509 000	—3.0
Growth of System				
Net demand for connetions	1 558 000	—18.0	1 901 000	—13.4
Net supply of connections	1 763000	—8.8	1 934 000	—0.5
Penetration				
Stations per 1000 population	498	4.4	477	7.0
Traffic				
Inland effective calls: trunk	3 335 000 000	2.4	3 257 000 000	7.8
Inland effective calls: local	16 840 000 000	1.4	16 600 000 000	5.7
Continental: outward calls	79 503 000	5.6	75 287 000*	19.5
Inter-continental: outward calls	37 001 000	19.1	31 045 000*	29.7
Telephone usage				
Calls per connection	1127	—4.2	1176*	—1.8
Local exchanges				
Total	6315		6260	
Strowger			4542	
Crossbar			514	
Mixed Strowger/Crossbar			45	
Electronic			1137	
Mixed Strowger/Electronic			22	

TELEX SERVICE



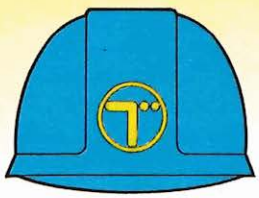
Size of System				
Total working lines	90 000	4.9	85 800	7.9
Traffic				
Inland calls	95 769 000	5.2	91 009 000	9.4
External outward numbers of minutes	226 215 000	7.6	210 278 000	13.5

TELEGRAPH SERVICE



Telegrams				
Inland	2 963 000	—12.1	3 372 000*	0.7
External: UK originating	3 323 000	—17.2	4 014 000	—8.0
UK terminating	2 999 000	—12.4	3 424 000	—7.4
UK transit	3 158 000	—7.5	3 414 000	—12.1

TELECOM STAFF



(Part timers count as half)				
Telecom HQ	3 786	**		—
Executives	35 381	**	23 697	—
Regional HQ	14 082	**	15 264	—
Telephone Areas	193 476	**	201 095	2.6
Total	246 725	2.7	240 056	2.8

* Amended figures

** Since THQ was reorganised and RHQ/THQ boundaries changed, a comparison would be misleading.

Outsize broadcast!

An estimated 750 million people in 59 countries throughout the world watched the event of the year as it happened – the marriage of the Prince of Wales to Lady Diana Spencer. It was all made possible by the efforts of a small but dedicated band of engineers and technicians from British Telecom.

British Telecom has a responsibility for carrying television signals and has been directly associated with providing television services since the mid-1930s. The first major outside broadcast in the world was the coverage of the coronation of King George VI in 1937. For this, the Post Office provided an underground circuit in the West End linking all points of interest along the route, into which television cameras could be plugged.

Along with many others, the London Region outside broadcast group were crystal-ball gazing earlier this year in an attempt to determine the date of the Royal Wedding. General consensus was that it was to take place in November. It came as a surprise therefore when the date was announced as July and a shock when the place was St Paul's. For many years, the permanent cable network at Westminster Abbey had been built up for such an occasion as this. St Paul's could present some difficulties . . .

Within hours of the announcement, telephones in the outside broadcast (OB) planning office began ringing. Already, American television companies wanted to place orders for circuits. It was soon clear that the demand for OBs would be greater than for any previous event. One US company alone would have taken up all resources, their confirming telex being 13 feet long! So to be fair to all customers, some demands had to be restricted to give everybody a fair crack of the whip. By the time both the BBC and Thames Television had placed their orders, demand for vision circuits had climbed to 60.

There are two ways of providing vision circuits from a site to a studio – either by line, using video amplifiers, or by microwave radio links. Where vision

circuits go by line, the length and type of cable are the deciding factors. Using coaxial cables, it is possible to go three or four miles before it becomes necessary to fit a repeater. Ordinary local and junction cables are also used but because of the greater attenuation it is normally only possible to use them up to one mile. Microwave radio links must have a line-of-sight path between transmitter and receiver enabling much greater distances to be covered.

As planning for the big day progressed, it was realised that the number of simultaneous links required was greater than had previously been thought possible. But as the BTLR OB group had gained a reputation as innovators over the years, a solution had to be found. By carefully selecting frequencies and transmission methods, the group was able to find 15 links from various sites into the London Telecom Tower. Because of insufficient space on the normal aerial galleries for all links, the former revolving restaurant was opened up as the microwave pick-up point.

Every television company had its own plans. For example, all the BBC remote sites along the route from Buckingham Palace were linked to their control room at St Paul's. Thames Television on the other hand had all their remote sites fed via the London Telecom Tower to their Euston studio. The US NBC chose to have all theirs routed to the Palace.

By the time all the final orders were added up, a total of 80 vision circuits had been requested. With a normal average of five vision circuits a week, the target of 80 presented planners with a headache. More equipment was needed and so the OB group asked other regions for help – namely from teams in North West, Midland, Wales and the Marches and Scotland.

As well as 15 radio links, 54 video amplifiers were used to provide vision circuits over a wide range of lines. In case of amplifier breakdown, a temporary repair workshop was set up in London and manned by a technician from Birmingham Factories. In the four days before the wedding, 27 amplifiers had to be repaired.

Although both BBC and Thames provided some of their own vision

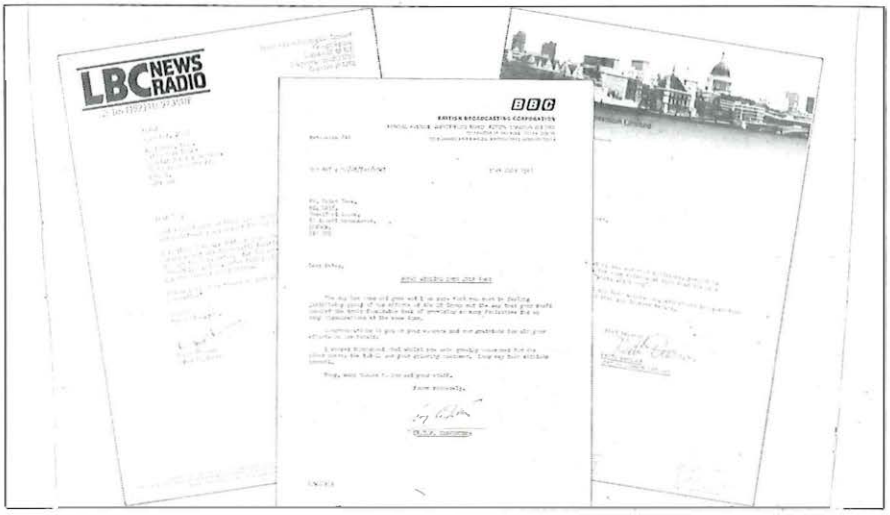
Author Peter Cooke (right) and outside broadcast engineer Steve Barrow carry out an on-site survey from the roof of the Abbey Life insurance building to check a line-of-sight radio path back to the Telecom Tower.

circuits, British Telecom were asked to supplement these. British Telecom circuits covered the route from Buckingham Palace, along the Mall, Trafalgar Square, Strand, Fleet Street, Ludgate Circus and St Paul's. All sound was routed over British Telecom lines.

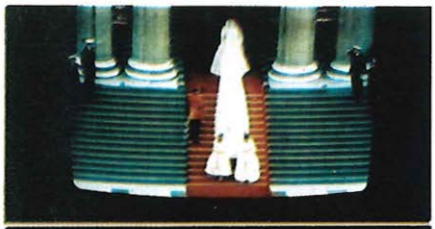
But vision circuits were not all. Also

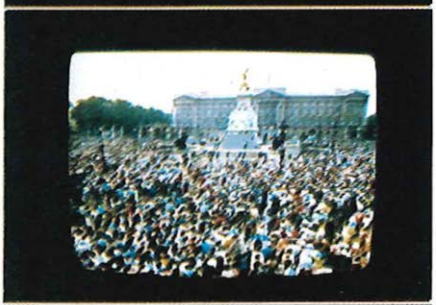
provided for the day were 168 commentary circuits, 340 control lines and 75 temporary exchange lines using approximately 750 miles of cable. A tremendous amount of extra work was put in by the four inner London areas, Centre, City, South Central and North Central. Without their invaluable help, the outside broadcast would not have been possible.

All the stops were pulled out at St Paul's and Buckingham Palace by the external groups responsible but the normal complement of 25 OB staff in London Region could not have provided such a large network on its own and had to seek help from other regions. The request resulted in six staff from Manchester, two from Birmingham and three from Cardiff, but even this was not enough, so contact was made with past members of the group who had moved on to other work. The response was overwhelming and as a result, another 15 television experts joined making 51 in all.



Some of the congratulatory messages received by British Telecom.





Because of the great overseas demand, main line vision links from the Tower to Goonhilly and Madley were fully booked. To increase capacity, a new system was tried. The vision signal was sent from the Tower to Martlesham, then by using a lorry-mounted small dish earth satellite station there, it was transmitted up to the Orbital Test Satellite and back to Goonhilly, a trip of 44,000 miles – rather longer than the usual 300. International Telecom staff then had the problem of routing all the outgoing circuits via satellites in geostationary orbit over the Atlantic and Indian Oceans.

Although preparations had been going on for several weeks, it was not possible to have all the circuits ready until the weekend before the wedding. Only then was it possible to sort out the final problems. With 15 radio links working in such close proximity and with their frequency separation not as wide as usual, it was thought that crosstalk interference would be a problem. If this had happened, pictures from one television company could have been sent to another's studio!

The Monday and Tuesday before the wedding saw both engineering and production rehearsals and by Tuesday evening, all was ready. Because of the early start on the following day, staff had to stay in London overnight and be at their appointed places by 5.30 am. At 6.00 am, one of the amplifiers at St Paul's went faulty and had to be changed for the last remaining spare!

Transmissions started at 7.30 am and from then on everything worked perfectly. After the ceremony and as the procession moved away from St Pauls on its way back to Buckingham Palace, sites along the route were able to be closed down – although this did not mean that work had finished for the day! Circuits still had to be tested and working for the honeymoon departure from Waterloo station. Finally, as the Royal train pulled out en route for Broadlands in Hampshire, it was all over.

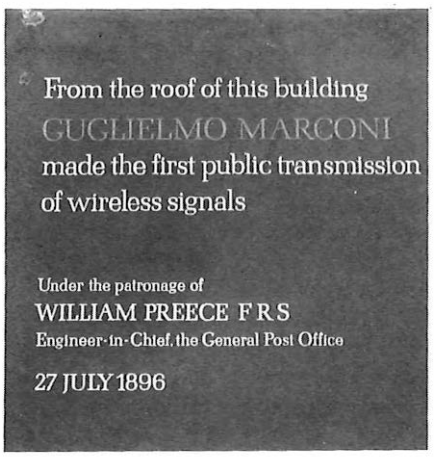
The thousands of hours spent in planning and preparation had all been worthwhile and British Telecom history had been made by providing the biggest outside broadcast the world has seen. Credit for the whole exercise went to the London Region OB group and to the hundreds of clerical and engineering staff on external and internal planning and provision. Everyone had an important part to play and their efforts ensured that a unique day was shared by millions of people throughout the world.

Mr P. J. Cooke is executive engineer in charge of London Region's outside broadcast group and was responsible for the Royal Wedding broadcast arrangements.

British Telecom Journal, Autumn 1981

Co-operation is the key

In this, the first in an occasional series of articles written exclusively for **British Telecom Journal** by contributors from the manufacturing industry, **Bill Greening,** marketing manager of Marconi Instruments, stresses the importance of close co-operation between supplier and customer.



A commemorative plaque on the wall of Postal Headquarters building in London's St Martin's-le-Grand is a constant reminder of the close co-operation between the founding father of radio, Guglielmo Marconi, and the then General Post Office.

From those early and exciting days, the GEC Marconi group of companies has grown worldwide and today, with an annual turnover of £1,000 million, there are 12 UK and 13 overseas companies, and with an additional 11 overseas offices, it employs some 50,000 staff around the world .

One of these companies, Marconi Instruments, now based at St Albans in Hertfordshire, was set up in 1941, and among the first items to go into production were signal generators. Other early contracts included one for the manufacture of test equipment, used to test the line characteristics of coaxial cables. This equipment was the result of a paper published by two Post Office Research Department engineers over 25 years ago, and tests the level of 'white noise' using principles now accepted as a worldwide standard.

Those familiar with maintaining telecommunications networks will no doubt recall the days when all testing was accomplished with an oscillator, level meter and multimeter! Today, as networks become more sophisticated and as electronic switching and high-speed digital communications play an increasingly vital role, maintenance planning is needed more and more to get the best from the service provided – even though the reliability of main equipment continues to improve.

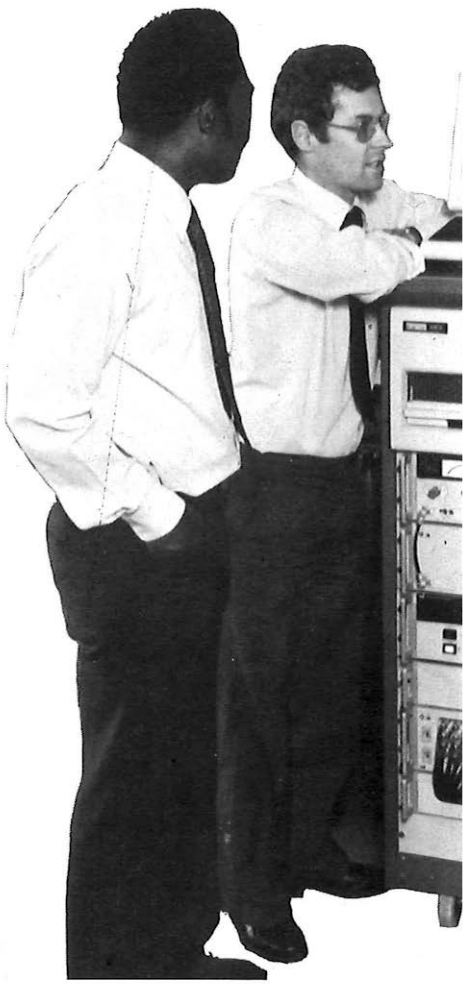
Despite widespread use of built-in test equipment, the problem of fault-finding once an alarm has been raised still exists. It is here that conventional test equipment still has a large role to play. Modern techniques which have speeded the advance in exchange and transmission equipment design are also available to the test equipment manufacturer.

Microprocessors and large-scale integrated circuits are now common in modern test instrumentation, and of course have many advantages. Portable instruments can be more compact and far more powerful. Conventional instruments can be easier to use and can also now be linked to equipment which controls small systems, and measurements – previously impracticable, are now a reality.

The pace of telecommunications development today means that a test equipment manufacturer must clearly define customer needs, both present and future and in the most cost-effective way. But this can only be achieved if the manufacturer works closely with the customer and balances his requirements with a consideration of the technical problems and costs involved.

The manufacturer is, of course, keen to ensure that an instrument has a worldwide market, not only making it more worthwhile from his own point of view but ensuring that one customer does not have to bear all the development costs. This he can do by considering the views of potential customers throughout the world and by incorporating as many useful features as possible. The customer has the experience to ensure that any proposed solution matches existing maintenance philosophies.

Perhaps these points can be best illustrated by studying a few examples. Take the need for selective level measurements on frequency division



multiplex (FDM) basebands. Such measurements have been required for many years and their purpose is to measure the power in a small proportion of the spectrum occupied by a FDM baseband. This is achieved using a tunable voltmeter with a clearly defined bandwidth to enable either the power in a single channel to be measured or alternatively the level of a pilot tone.

Probably one of the most common examples is the LMS 12/AC. This instrument can be tuned by carefully operating two knobs, and takes about 30 seconds to set up. But because an operator often has to take many measurements during the day, much time is spent adjusting the instrument rather than getting on with the real task of locating and rectifying faults.

But the mighty microprocessor has changed all this. It has enabled instruments such as the LMS 12D to be designed, which while retaining the advantages of manual tuning for peaking to a signal, can be tuned in just two or three seconds by entering the required frequency on a keyboard similar to that of a calculator.

Co-operation between customer and manufacturer has further speeded the tedious task of searching for one overloaded channel. The LMS 12D can measure the power of a group – which consists of 12 channels. Thus groups not containing the overloaded channel can be quickly eliminated resulting in a 12-fold increase in measurement speed. The same instrument can also form the heart of a measurement system which takes continuous measurements on many basebands and compares the results with pre-set limits. This is a great help in network maintenance as it identifies precisely where problems occur, at a fraction of the cost of manual intervention.

Marconi area manager Steve Gledhill demonstrates an automatic surveillance system to Wesley Pile and Roger Woodcock from BTHQ. The system checks frequency division multiplex (FDM) basebands in repeater stations.

Selective level measuring sets undergo reliability approval checks at Marconi Instruments, St Albans.

Design engineer Rob Walker at Marconi Instruments checks the monitoring error rate on a prototype 246C tester before it is submitted to British Telecom for approval.

Another example is in the area of bit error rate testing. These tests are the fundamental measurement on primary level (2048 kbit/s) pulse code modulation (PCM) systems and clearly show the high degree of co-operation between customer and test equipment manufacturer. With the advent of electronic switching came a major re-think of the way in which this measurement was made, and as a result, it was realised that a new instrument was required.

During the close co-operation between the manufacturer and the customer, in which all related measurement requirements were also examined, it was found that the function of a signalling tester could also be incorporated into the bit error rate tester at a minimal extra cost. The result is a tester known as the 246C which also offers a facility for processing the bit stream to aid further measurements by other, as yet undefined, instruments. The happy result is that instead of two instruments, the customer has just one unit capable of performing all the required tests while the manufacturer has a much more marketable product.

Naturally, major test equipment manufacturers value the co-operation they enjoy with British Telecom and other PTTs throughout the world. It not only helps meet the demands of their customers, but ensures a healthy export business – and that surely, is good for everyone.

New cable tester

A new automatic two-unit test set designed to carry out acceptance and other tests on trunk and junction cables has been developed by British Telecom. Known as the tester 206B, it supersedes the electromechanical tester 206A which has now become a maintenance liability.

The electronic circuitry of the 206B uses reed relays for switching and the binary coded signalling ensures synchronisation between the testers at all times. Both units are of the same physical dimensions. The near-end unit contains the control and meter facilities while the far-end unit acts as a slave under the control of the near end.

For test purposes, the equipment is set up at each end of a cable. Five wires in the cable are designated 'control' wires and carry the control information from the near end to the far end unit. The tester is connected by means of test leads to two four-wire circuits at any one time. On completion of the test cycle, the second four-wire circuit is reconnected as the first and a new one is connected as the second. The complete cable is tested in this manner.

Up to 24 tests can be made by the equipment when it is used in conjunction with a standard resistance box and a frequency analyser. Both units of the tester are powered from either 240V AC or 12V DC which allows use with local battery, generator or mains supply.

Assistant Executive Engineer Mykul Husbands (foreground) and TCL engineer Des Carr, monitor a junction cable test at Mansfield exchange on a new operational automatic two-unit test set. The first of its kind, the unit completes a test cycle in 20 seconds.

British Telecom Journal, Autumn 1981

Quality of telephone service April 1980 to March 1981

Figures in brackets indicate performance during the year April 1979–March 1980

Local automatic telephone service	Calls connected successfully	**63.6%**	(62.7%)
	Calls which obtain 'engaged' or 'no reply'	**28.2%**	(28.8%)
	Calls that fail due to the customer	**6.8%**	(6.9%)
	Calls that fail due to the Post Office	**1.4%**	(1.6%)
STD automatic telephone service	Calls connected successfully	**65.0%**	(63.5%)
	Calls which obtain 'engaged' or 'no reply'	**24.2%**	(25.0%)
	Calls that fail due to the customer	**7.9%**	(8.2%)
	Calls that fail due to the Post Office	**2.9%**	(3.3%)
Repair service	Yearly fault reports per telephone	**0.6**	(0.63)
	Fault reports cleared by end of next working day	**75.9**	(58.3)
Inland telephone operator service	Calls answered within 15 seconds	**88.9%**	(85.5%)
International automatic telephone service (IDD)	Calls connected successfully	**38.4%**	(36.3%)
	Calls that fail in the international automatic exchanges	**2.5%**	(2.8%)
	Calls that fail due to other causes	**59.1%**	(60.9%)
International telephone operator service	Calls answered within 15 seconds	**78.0%**	(60.0%)

Enterprise Incorporated

It is acknowledged that prime place in the development of telecommunications belongs to the United States. This, the seventh in our series on overseas administrations, looks at the way in which private enterprise has influenced the US scene.

With an area of more than nine million square kilometres, a population of nearly 222 million and some 1,500 separate telephone operating companies, the United States is in a league of its own when it comes to telecommunications system size and organisation. It has nearly 185 million telephones in use, and in just one state, California, there are more than 18 million telephones, compared with the national UK total of nearly 28 million.

During the past ten years, the system has been growing at an average annual rate of 4.3 per cent (UK 6.4 per cent), and overall investment expenditure in 1979 amounted to $18,259 million. About 80 per cent of all telephones are served by 'Ma Bell', nickname for the American Telephone and Telegraph Company (AT&T), although the independent companies cover 50 per cent of the US land mass and control more than 30 million telephones, a system size larger than any in Europe.

The complexity of telecommunications is hardly surprising considering the US is nearly twice the size of Europe (excluding USSR), and development of telecommunications services, relying so much on private enterprise. has been very different from the more ordered European administrations.

The structure of the US telecommunications services stems from that day in March 1876 when Alexander Graham Bell invited Mr Watson in from the next room. The first telephones, rented in pairs, were offered to the public in 1877. The Bell Company then grew, changing its name until eventually it became the American Telephone and Telegraph Company (AT&T), taking on Western Union, who had to concede that Bell was the true inventor of the telephone. As part of its growth, the Bell Company licensed individuals and others to set up telephone companies and manufacture equipment.

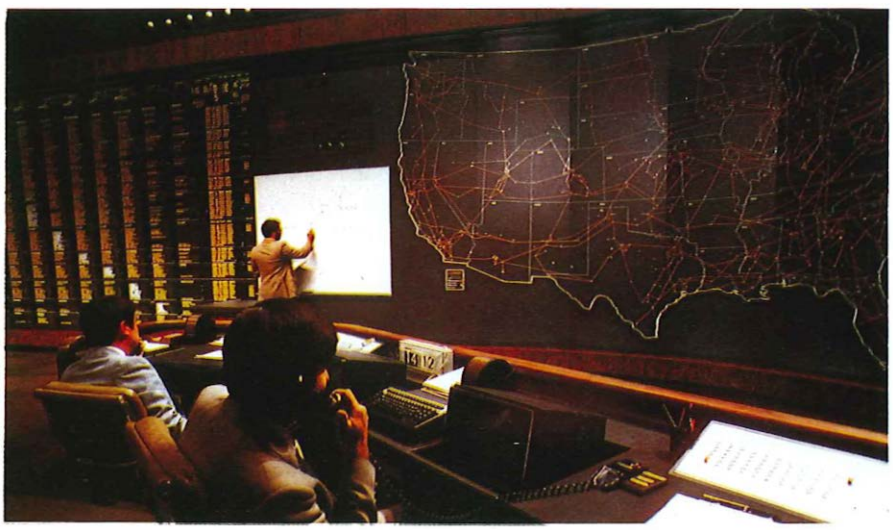
By the turn of the century, the American telephone scene comprised a multitude of small companies, most independent of each other, offering phone services in competition within one community. Among these were companies in which the Bell Company had either a controlling, or important, shareholding. In 1907, the Bell Company created a strategy of 'one system, one policy, universal service' with the objectives of creating local monopolies either by acquiring the local independent, or by retiring from the competition where dual services were being offered. Secondly, they made certain that all US subscribers could interconnect whatever company offered the local service and merged the Bell licensee companies into a smaller number of regional companies to put them more under Bell's control.

By 1897, the Independents had realised the need to join together to present a united front to the Bell System and the Government; so the Independent Telephone Association of America was formed, to become, in 1915, the United States Independent Telephone Association (USITA), the name it carries today.

Between its foundation and 1912, relations with Bell were difficult. Bell's policy of acquisition – it acquired nearly half a million independent telephones in the three years up to 1910 – was hardly likely to endear it to some Independents, and there were still areas of strong competition between Bell and some independent companies both seeking to serve the same community.

In 1912, after the election of Woodrow Wilson, as President who had campaigned strongly against monopoly, the

The network operations centre in Bedminster, New Jersey, where AT&T manages its domestic network.



Postmaster General began preparing the legislation to nationalise the telephone industry. The then Bell Vice-President, N C Kingsbury, who realised that Bell was at peril, announced the 'Kingsbury Commitment'. This pledged Bell to dispose of its stock of Western Union Telegraph Company; to stop its acquisition policy (with some exceptions); and to make arrangements for trunk connection with independent telephone systems. This managed to defuse the opposition until after the first World War, when Bell continued its policy of reconciliation, and E K Hall, Vice-President of AT&T, confirmed to USITA that it was in both parties' best interests to have two strong groups in the industry.

From that time, the Independents were allowed to develop alongside Bell with each contributing to a nationwide compatible system. The Independents were particularly important in bringing telephone service to rural America and have also been in the forefront of technological developments. Almon Brown Strowger was of course an Independent and his dial and two-motion selector system is thus rightly claimed by them, as is the first working handset telephone.

As far as organisational structure is concerned, the tendency of the independent operating companies has been one of consolidation – although once there were some 8,000 separate companies, there are now fewer than 1,500.

Independents have also, in some cases, been joined together in groups. The most dominant of these is General Telephone and Electronic Corporation (GTE) with over 45 per cent of Independent telephones, and of the remaining 15 operating groups, eight are in the top 25 Independent operating groups or companies. Indeed, it is the five largest Independent groups who each control more than one million Independent telephones. The twenty-fifth largest company, the Rock Hill Telephone Company of Sun Carolina, has 43,500 telephones, about a tenth the size of the average British Telecom telephone area.

Each carrier is regulated by State bodies for each State in which they operate, and is overseen by the Federal Communication Commission (FCC). Companies can only alter tariffs with the agreement of regulatory bodies, the State bodies dealing with connection, rental, local and in-State trunk (toll) calls, and the FCC with between-State and international calls. The FCC can also regulate on overall tariff policy, for instance, where they feel that tariffs could be discriminatory.

In matters other than tariffs, the FCC has to be careful not to encroach on the prerogatives of the State regulatory bodies and may have to phrase its decision as "this may be done where State bodies allow it to be done". Executive FCC decisions can be overruled by the Judiciary, and of course decisions by either of these bodies can be superseded by changes in the law brought about by the Legislature.

Small Independents often face advertising problems larger telcos do not. Standard Telephones of Georgia has put its campaign for long distance calls in the driver's seat with the phone-car – a concept which draws a parallel between travel and communication with the emphasis on price.

The first major incursion into the telephone companies (Telcos) monopoly was the 'Jordaphone Decision' in 1954. In this, the FCC allowed a privately supplied answering machine to be connected to the network, where the State authorities also allowed it. The second major case occurred in 1958, when the Judiciary overruled an FCC decision that the 'Hush-a-phone', a clip-on attachment to a handset microphone that acted as a baffle and allowed conversations in noisy surrounding, was harmful to the telephone service, and declared that any blanket bar on 'foreign attachments' was illegal. This decision upheld the subscriber's right to use physically interconnected equipment in a way that would benefit him, as long as it did not harm the telephone network or the company's operations.

The final, and possibly most famous, of the major FCC decisions which broke the Telco monopoly of apparatus provision was the 'Carterfone Decision' of 1968. Again made against AT&T, it ordered tariff restrictions against customer-provided equipment to be lifted. The Carterfone – already around for 10 years – was an acoustic coupler allowing a mobile radio to be interconnected to the telephone network.

Since the 'Carterfone Decision', all telephone and data terminal attachments to the telephone network whether supplied by the Telcos or by the customer, must meet the technical requirements of the FCC. These are intended to make sure the network is protected from harmful operations of terminal equipment. But technical requirements do not cover service quality since these are considered determinable by market forces.

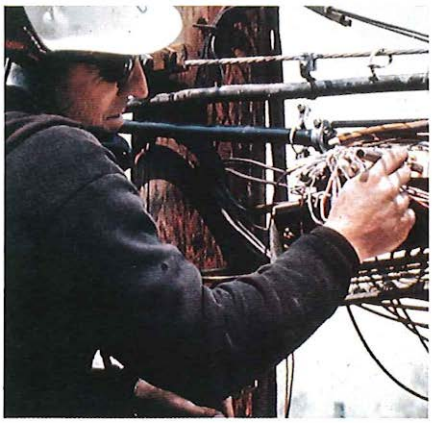
The effect of these regulations is to allow any company to compete in the terminal apparatus market, and a 1976 study, which identified the market penetration of interconnect companies as only five per cent, predicted a 20 per cent potential by 1984.

As well as the terminal market, the FCC is beginning to allow competition on the switching and transmission side. Already services competing with MTS (Message Telephone Services) and WATS (Wide Area Telephone Services) have been allowed, and Telcos providing local exchange services have been obliged to allow these competitive services to originate and terminate on their equipment. WATS is a system where companies pay monthly for unlimited call use of the trunk (toll) system within specific distances.

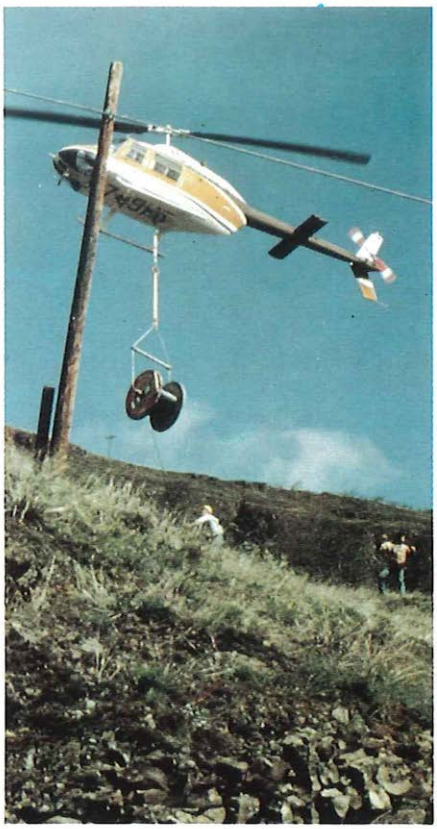
The problems now faced by the Telcos are not just concerned with competition, but with the basis of competition. Currently, all the Telcos are regulated, and this includes control of the tariffs they can charge and the machinery which has to operate to allow a tariff 'hike' or increase. Telcos must give long notice of a tariff hike with a complex method of justifying the increase based on costs and rate of return. Companies coming into competition with the Telcos are not as

severely constrained and in some areas are not regulated at all. The Telcos also point out that in the past they have had to bear the expense of innovation in the technical and marketing fields, during which their profitability was closely regulated, while new competition can come along and immediately benefit from the results of this expenditure. And a fair charge for the part of the existing network used by competitors to offer enhanced services by 're-selling' the basic service with their enhancement – known as value added network services (VANS) – may not be contributing sufficiently towards the investment and capital cost of the full network.

Competition with the traditional telephone companies falls into two groups. Some competitors have set up their own networks (switched or private circuits) offering data, telex, facsimile or voice communication to specialist users. For instance, Western Union offers a wide variety of leased services and terminals, and even a limited voice service as well as its major role as a domestic telex centre. These companies are essentially carriers, and are obliged to meet most of the problems of the regular telephone companies. Some major names (such as IBM and Xerox) are now coming into this field, particularly where private satellities are used to relay and switch high-speed data for major government or business users.

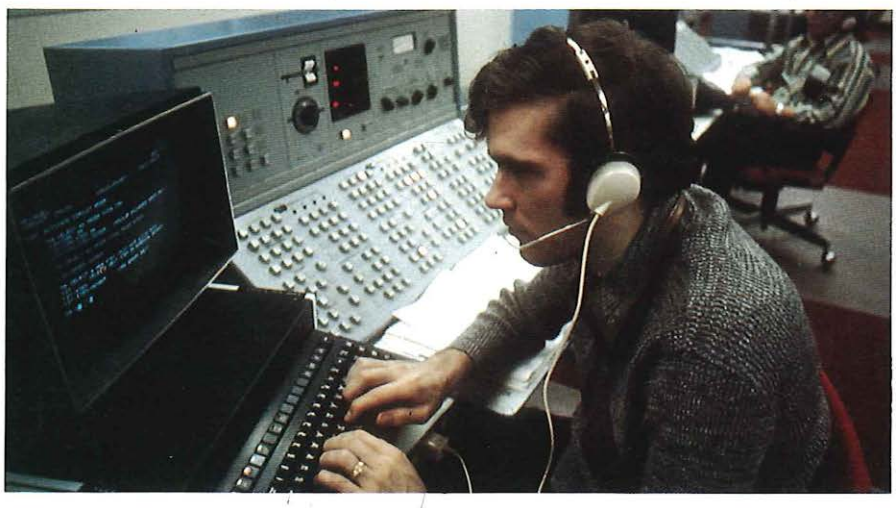


An Illinois Bell Telephone Company engineer checks out an aerial cable.



At a remote location near Hood River, Oregon, engineers from the United Telephone Company of the Northwest 'string wire' with the help of a helicopter.

A Chicago-based AT&T technician working on an Electronic Switching System 4, a high-capacity, all-electronic toll switcher.



Other competitors offer the value added network services. These companies lease private circuits from major carriers, and on an additional service such as processing equipment, and resell as a single package to customers. Finally it must be remembered that with recent changes in regulatory law, any company can compete in the terminal market so long as the equipment offered has been tested and registered by the Federal Communications Commission.

The structure of the US telephone network has grown up from the entrepreneurial use of private capital in a competitive market. Clearly as each entrant has made its mark, it has tried to limit competition (AT&T even successfully sued a manufacturer selling slip-on covers for telephone directories as providing an illegal attachment to telephone company property). The most recent evidence of this is the actions of the regulated telephone companies – that is the Bell and USITA companies – in trying to stop what they consider to be 'unfair' competition from the unregulated companies.

What relevance does this have to the UK? Obviously it is not a situation that can be directly repeated here as the baseline is dissimilar. However, British Telecom is now in a somewhat similar position to the US Telcos prior to the Carterfone decision, and has even less time to gear itself to competition than the US carriers, since the potential competitors have had time to learn their tactics, in part in the US market itself. But British Telecom is aware that the US companies were prepared to meet competition head on – and not merely in the market-place. AT&T with 1979 profits at $6 billion, more than any other US firm, has had plenty of time to meet the competition.

Public interest has been identified with the opening up of markets, rather than the opposite, and in the future, the US may be expected to produce an even greater diversity of types of organisation offering telecommunications linked goods or services.

The authors – **Mr O. P. Sellars, Mr J. J. E. Swaffield** and **Mr J. F. L. Stubbs** – are members of the international comparisons group in the Service and Performance Department of BTHQ.

British Telecom Journal, Autumn 1981

Computer support for development

MHJ Yates

Martlesham assistant executive engineer Colin Upton tests a general purpose input/output module used in the MSSS system.

For the past four years, a microprocessor systems support service – MSSS – which offers a wide range of practical aid to British Telecom engineers working with 'micros' on development projects, has been provided by the computer applications group at Telecom Research Laboratories.

Help – from simple advice to providing advanced system hardware, assembled in modular form so that users can select an appropriate group of circuit boards or 'cards' to meet specific requirements – is on hand for a wide range of telecom projects. Typical applications are the simple control of laboratory test equipment, precise temperature control of a hydrogen-oxygen flame used in the manufacture of ultra-low-loss optical fibre, and will soon include remote supervision and control of microwave radio links at Newcastle.

Since the service started in 1977, more than 300 systems with 2,000 boards are now in regular use. Access is easy with all items available directly from Research Laboratories Component Stores.

When microprocessors are used in equipment design, both hardware and software aspects must be looked at together at all times during product development. The balance of this association varies during the development period, but often the tendency is to concentrate on the flexible software parameters to the detriment of the hardware. Where the MSSS system scores is in concentrating on the hardware aspects, and offering an established range of tested cards with full supporting documentation so that users can concentrate on the specific design features of their own system software and interfacing hardware.

The first contact that many MSSS users have with the service is on one of the microprocessor training courses run at the College of Engineering Studies, Horwood House, and at British Telecom Research Laboratories, Martlesham (see *British Telecom Journal*, Autumn 1980). These two-week courses start with a short series of lectures to ensure that all students have a fundamental understanding of the use of digital integrated circuits and the basic operation of microprocessors.

They are then introduced to the 'M triple S' as the service is known colloquially, and a specific design project. At Martlesham, for example, students develop the software control system for a model railway layout. This is not as easy as it at first seems because model trains are superb generators of unwanted electrical signals: but by the end of the course, all students are aware of the need to pay attention to the detailed interaction between hardware and software in a system.

At first sight, the range of cards available seems overwhelming. But because it all started from a single card, the central processing unit (CPU), it can be appreciated in simple stages. The CPU card should really be called the 'something-of-everything' card, because as well as the microprocessor chip, it also has chips used to provide 1024 bytes of random access memory (RAM) for variable read-write working memory and up to 4096 bytes of programmable read-only memory (PROM) for program memory.

These latter devices retain their information when power is removed from the system, ensuring that the program cannot be corrupted and is always available. The most important device to the new user is the universal synchronous/asynchronous receiver/transmitter (USART) – which, with the clock generator and line interface, enables a visual display terminal or teleprinter to be coupled to the card.

Having switched the system on, take as an example, the interconnection of the CPU card to a teleprinter and power supplies. The processor chip requests the first instruction from the program memory – but as no program has yet been provided by the user the procedure comes to a halt. At this point, fortunately, software support comes into play – the first 2048 bytes of PROM is already programmed on the card with a program called the MSSS monitor.

This communicates with the teleprinter, initially typing out the signing on message 'MSSS MON' and then asks for a typed command on the keyboard. This program can be compared with that contained in a pocket calculator, which, when switched on, illuminates

Dave Nelson, an AEE, checks the print out on the MSSS system which is being used as a precision temperature controller in the manufacture of low loss optical fibre at Martlesham.

A MSSS application module is tested by Dave Nelson in the Martlesham design laboratory. In the background other engineers work on equipment associated with MSSS.

MSSS Family of boards

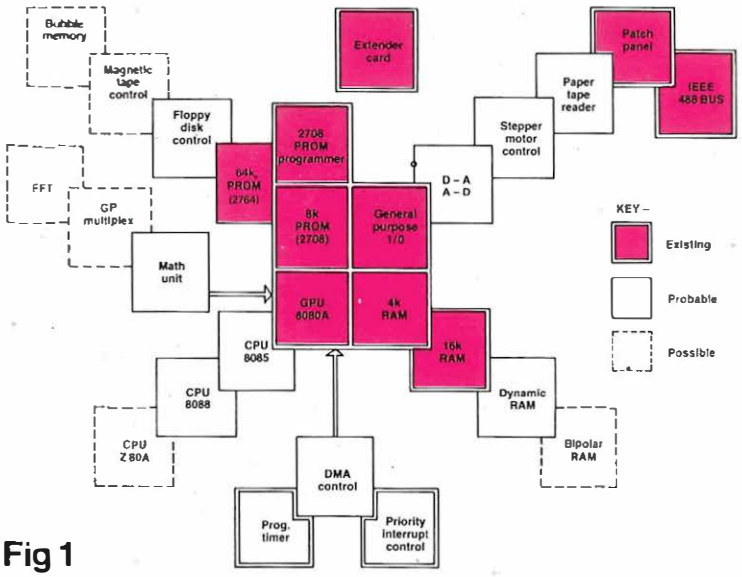


Fig 1

the display and waits for the keyboard to be used.

The use of the system monitor is described in the handbook information provided with the CPU card. Essentially it provides a facility to display the contents of any or all memory locations, to change the contents of read-write memory, to load program instructions into read-write memory from a paper tape source, to punch paper tapes with information taken from memory, and to take a program from any starting point.

But many users need more than the CPU card, and it is for this reason that the System Support Service is provided. One of the more common demands from users is for a large-capacity memory bank where cards are available to provide a mixture of RAM and PROM up to the system limit of 64 kbit/s. PROMs, which can be erased by exposure to high intensity ultra-violet light, are often a good idea enabling the program to be easily modified during the development stages of a project.

These PROMs are programmed with information taken from RAM or from a master PROM connected into the copy socket on a PROM PROGRAMMER card. Another major use is for communication purposes. Some cards can give up to six serial links for data modems; up to 48 parallel lines for general purpose customer interfaces, and also for an interconnection standard which is known as IEEE-488. Another card can provide time-sequencing signals for the program being executed by the CPU card.

The Microprocessor Systems Support Service also provides two sub-boards which offer improved processing. The first is a calculator module, capable of performing complex arithmetic functions. The second is an 8748 processor, with its own program memory, which can be separately programmed to perform any specific task. These sub-boards can operate while the main processor continues with the normal program so providing a significant improvement in system performance.

An essential feature of the service is the provision of documentation, and this is now arranged in three stages. The first is the brochure, a full-colour, four-page pamphlet, which advertises the service and products on offer. The second is the 'profile' which gives a detailed description of all available items together with the ordering information. This also forms part of the introductory section of the handbook. Finally, there are the detailed handbook sections for each card, and one copy of the appropriate section is supplied with each card. On top of this, all customers are circulated with a quarterly newsletter.

The service continues to grow and currently the greatest need is to enhance the processing power of the system. This is now being tackled in two ways. First, a CPU card using the 8085 processor chip, is about to be introduced. This is both faster and has software compatible with the 8080 processor. Based on a design from another part of Research Laboratories, the card will be a welcome addition to the range. And by the end of the year, a CPU card based on an enhanced 16 bit range of procesor chips, is to be introduced, and will be the start of a new range of super-processors.

The support side of MSSS activity continues to expand and already some cards are being supplied ready-built. By the end of the year, all cards will be supplied 'ready to run' and will be backed by a maintenance exchange service for operational systems handled by Factories Division. With this added feature, the Microprocessor Systems Support Service is confident that its systems will be used more and more throughout British Telecom.

Mr M. H. J. Yates is an executive engineer at British Telecom Research Laboratories and is responsible for the development of MSSS within BTRL.

British Telecom Journal, Autumn 1981

Silverstone connection

Above: As cars race by on the track engineer Michael Newbery checks the dish aerials used in the specially constructed microwave link at Silverstone.

Below: Close to the action in the pits British Telecom installation inspector Gordon Titmus keeps in touch with the nerve centre by radiophone.

A tailor-made microwave system designed by Midlands Region staff and specially constructed at British Telecom's Birmingham factory complex, proved a real winner during the British Grand Prix at Silverstone earlier this year.

The system, based on a 60-circuit link between the race track and Northampton Derngate exchange, was able to by-pass completely the small local electronic exchange and enabled motor racing enthusiasts, the world's press, ground staff and the drivers themselves to take advantage of a track-side telecommunications service which was generally agreed to be second to none.

Nerve centre of the whole operation was a miniature exchange behind the grandstand which British Telecom engineers kept in touch with by radiophone. By carefully monitoring the system any faults could quickly be reported and speedily repaired.

'Operation Silverstone' as the project became known, involved the installation of 70 new extension lines and provision of a mobile caravan with the new press-button payphones in addition to the permanent public kiosks. In the international press tent there was a bank of telex machines and multi-lingual telephone operators helped foreign correspondents send their reports back to their own countries.

But British Telecom did not only provide telephone and telex links. Dish aerials situated high above the track beamed microwave signals by direct line of sight to the top of the British Telecom switching centre at Northampton and in this way television pictures were transmitted around the world.

The decision to build the special system was taken to avoid Coventry Area staff having to provide extra equipment and a new local cable at Silverstone exchange – all of which would lie mainly unused most of the time. The British Grand Prix meeting is held at Silverstone every two years.

Tractor boost for Scotland

This unique go-anywhere vehicle is proving a boon to engineers in the north of Scotland. Powered by a massive 6½-litre diesel engine, the County Tractor is being used to pull out old telephone cables from ducts in hilly terrain.

It arrived in Inverness from South West Telecommunications Board where the motor transport group declared it "surplus to requirements" after using it experimentally for mole ploughing. It is similar to the earth scrapers used on motorway construction but without the bucket attached to the back.

Biggest snag about the vehicle is driving it on public roads because it has a top speed of only 16 miles per hour. But once on site, however, engineers have found that it will go anywhere. It has four wheel drive and power steering and can work where no other vehicle could manage.

British Telecom Journal, Autumn 1981

MISCELLANY

Woodbridge working

Britain's first System X all-electronic local telephone exchange at Woodbridge in Suffolk is now in full-time service.

Initially providing telephone service to about 1,000 customers, the new exchange had been carrying test calls since January as part of a planned commissioning programme. Woodbridge exchange will be extended to serve up to 6,000 customers and provide 'star' services such as code calling and automatic call diversion (see page 4).

The System X unit at Woodbridge is one of a co-ordinated family of all-electronic telephone exchanges using microprocessor-controlled digital switching technology. The system gives customers a better service which will become increasingly noticeable as the whole network becomes modernised during the next few years.

Two 'star' services being introduced at Woodbridge later this year will be automatic call diversion and code calling, where frequently-used numbers can be stored in the exchange 'memory' and called quickly and easily using a personal code of one or two digits. This will be followed by an itemised billing facility next year. Later more star services will be added – call waiting, reminder call, three-way calling, charge advice, call barring and repeat last call.

New brief

Mr Philip Ashcroft has been appointed Solicitor to British Telecommunications following the creation of the new Corporation. Mr Saul Rothstein, who was Solicitor to the Post Office, has now retired.

Mr Ashcroft (54) was appointed deputy to the Solicitor to the Post Office in 1980 when the post was created in readiness for the separation of the two businesses. In 1974, he was appointed legal adviser to the Department of Energy.

Mr Rothstein, Solicitor to the Post Office since January 1976, was previously Director of the Advisory Department. He first joined the solicitor's office in 1949.

Plug for sockets

The nationwide launch this autumn of a scheme to fit telephone socket outlets for all customers asking for a new line or an extension telephone follows a highly successful trial programme which has been running in Taunton and Carlisle since May this year.

Already described in detail – see *British Telecom Journal*, Spring 1981 – the plug and socket scheme will simplify the installation of telephone service in and around the home. It will also simplify the sale of some British Telecom equipment, leading to a significant change in the telephone service when telephones will be available from some 40 shops by next April, most within department stores.

All new installation work on residential and business lines will incorporate the new system, which is a British development conforming to European safety standards. Its design is highly efficient and is expected to reduce the telephone fault rate.

Under the British Telecommunications Act 1981, all telephones will be candidates for this kind of plug and socket installation, whether they are supplied by British Telecom or from approved manufacturers.

Better than ever

Latest British Telecom statistics show a marked improvement in the quality of the telephone service.

Figures to the end of June have revealed that the percentage of fault reports cleared by the end of the next working day has soared from just under 50 per cent in 1978/79 to nearly 86.2 per cent – and is still rising.

The number of successful inland calls has risen to more than 63 per cent with just 1.3 per cent failing due to equipment faults and insufficient plant. And the number of successful international direct dialled calls has risen to more than 40 per cent. Major reasons for failed calls were dialling errors, satellite or international cable faults, or problems in the distant country.

A major factor in this improvement has been British Telecom's sustained drive during the past two years to improve the state of its old underground cables.

Three up for Madley

A new £7.5 million aerial – Madley 3 – has been brought into service and is helping to link Britain with Australia and the Far East.

This third aerial at British Telecom's Herefordshire earth station can handle 2,000 telephone calls and two television programmes at the same time by using an Intelsat IVA communications satellite in geostationary orbit 22,300 miles (35,700 km) over the Indian Ocean.

Madley 3 will help British Telecom keep abreast of rapid growth in intercontinental telephone calls, which are doubling every four or five years. Able to operate in winds up to 100 miles an hour, the 102-foot diameter aerial will later be joined by two more dishes, one to work to the European Communications Satellite and the other to an Atlantic Ocean Intelsat V satellite.

Further aerials are planned for British Telecom's first earth station on Goonhilly Downs, Cornwall, while a third earth station at a new site in Wiltshire is to be built to meet increasing demand.

Paging further

Radiopaging now covers two-thirds of the country and by the middle of next year will be a nationwide service. Until October, the service was available only to London customers and users in seven other major cities.

The service was introduced in London in 1976 and subsequently extended to Aberdeen, Birmingham, Bristol, Cardiff, Glasgow, Liverpool and Manchester. The new nationwide service is being provided by the allocation of 40 national paging zones. VHF radio transmitters in each zone are controlled by computers known as paging control equipment.

One of the attractions of this network is that it can be tailored to suit individual needs. It does this by allowing customers to select the zones in which they wish to be paged. And group calling, which allows up to 99 pagers to be alerted by a single call, is now available.

Eurodirectory debut

British Telecom is to join with five other nations in the European Economic Community to produce, by September next year, a 1,100-page commercial telephone directory covering all six countries.

France, Belgium, the Netherlands, Germany and Italy are the partners in this enterprise, which aims to increase the flow of information to importing and exporting companies within Europe.

Six national editions will be printed in the language of each country and will have a preface, index and a classified section sub-divided into industries and trades. And like Yellow Pages, it will be split into particular activities within each sector.

British Telecom is compiling a comprehensive list of exporters, and a free entry will be offered to any appropriate UK exporting company to appear in the other five European editions of the directory.

New Atlantic cable

Agreement has been reached to study the prospects for a new telephone cable between Europe and North America. Expected to cost more than £150 million, the new cable could well use optical fibres over its 3,500-mile route. It would more than double the combined capacity

of transatlantic links when it comes into service by 1988.

The cable – called TAT 8 – is needed to cater for continuing massive growth in calls between the two continents, and in particular between the US and Britain – by far the world's biggest transoceanic telephone route.

At present, cables provide some 7,000 telephone circuits between Europe and North America, rising to 11,200 when TAT 7 – a cable now being manufactured – comes into service in 1983. With increases in circuit capacity resulting from the introduction of the Intelsat V series of satellites, a new cable coming into service in 1988 would restore the balance between the two technologies by the end of the decade.

Tariff decision

Changes to British Telecom tariffs, which were introduced for main services from the beginning of November, took account of observations made by the Post Office Users' National Council following the initial proposals earlier this year.

As a result, business exchange line rentals have been increased by £4.25 a quarter to £21, instead of £25, while residential exchange line rentals will be increased by £1.50 a quarter to £13.50. There have been a range of minor reductions on the time allowed for the unit fee on both trunk and local calls.

At the standard rate, the time allowed for trunk calls has been reduced by about 14 per cent while on local calls during the cheap rate period, time allowed has been reduced by one minute to eight minutes.

The maximum connection charge for business lines has been increased by £5 to £80 and to £70 for residential lines. Higher installation costs for private circuits are being introduced in two stages in response to POUNC objections. The first half of the increase took effect in August and the balance will be levied on new orders received from 1 February next year.

Rates for some intercontinental calls have been reduced, and there are changes in payphone call rates as well as increases in telegram charges.

Telegram speed-up

Faster handling of telegrams to and from ships in distant waters has been introduced by British Telecom. New equipment at Portishead long-range radio station will enable messages from ships anywhere in the world to be received, transmitted and delivered by telex in less than five minutes.

Using a new computerised message switching system, radiotelegrams will be received on electronic printers with memory store and edit facilities and then be routed direct to the Telegram Retransmission Centre in London. From there, messages are either sent automatically to business centres on telex, or transmitted to the nearest delivery route or via the appropriate international route.

Prestel's world service

British Telecom's Prestel service has been extended worldwide to cover seven countries, the US, Australia, Hong Kong, the Netherlands, Sweden, Switzerland and West Germany.

Users in these countries will have access to closed user group facilities, specialist information on shipping and commodities, plus all the information held on the UK service, which has now risen to 185,000 pages. Information providers from all over the world will be able to join the 560 already using Prestel as a fully-commercial publishing medium.

The announcement follows the successful conclusion of a market trial of an international Prestel service which opened in April last year. Some 400 users in 23 countries around the world experimented with Prestel for closed user group applications, for specialist and for general information.

And a new information service for

freight forwarders and exporters has been launched by British Airways Cargo on Prestel. Using 150 colour viewdata terminals for the system provided by Radio Rentals, British Airways have produced a 2000-page database containing up-to-the-minute details for shipping goods.

Contracts

GEC Telecommunications Limited – £7.6 million for digital line equipment and digital and analogue multiplex equipment. It includes the first order for 140 Mbits/s multiplex equipment.

Mitel Telecom Limited – More than £10 million for the supply of private automatic branch exchange equipment – a fully electronic PABX known as the Regent.

Rediffusion Radio Systems Limited – More than £900,000 for radiopaging transmitters and their associated racks. The transmitter uses only solid-state circuitry, has a dual-frequency capability and produces a 100 watt output in the 150 MHz band.

Ferranti Electronics – Nearly £750,000 for six small dish aerials for use by customers of the new business satellite service with Europe. The aerials bring to 12 the number of small-dish terminals British industry is supplying to British Telecom for trials with the Orbital Test Satellite.

Harris Corporation – £1 million for microwave radio links. With 2 ft parabolic antennae, the microwave radios will be installed on London rooftops in the first phase of British Telecom's £17 million programme to provide the capital's business community with one of the most advanced telecommunications services in the world.

Fairey Winches Limited – £500,000 for special winches which are to be supplied as kits for attachment to British Leyland four-ton cable laying and general purpose vehicles.

New Pacific link

The go-ahead for a new 8,000-mile telephone cable across the Pacific linking Australia, New Zealand, Fiji, Hawaii and Canada was announced in Vancouver at the beginning of October following an international conference.

Called Anzcan, the cable is due to come into service in 1984 at a cost of more than £200 million. It will replace an existing cable called Compac which has been in service since 1962. It will be about 20 times bigger than Compac and able to carry 1,380 simultaneous telephone calls. British Telecom will have an interest of about 10 per cent in the new cable, and will use it primarily to provide a third route for calls to Australasia.

The cable will also cater for growth between Australasia and Canada – Australia is the project's largest shareholder. Standard Telephones and Cables of Britain will supply the main system while the Nippon Electric Company will be responsible for the link from Norfolk Island to New Zealand.

Seadog, a remotely controlled submersible, is the latest addition to British Telecom's 'navy' which maintains the network of undersea cables linking Britain and its islands, with Europe and distant continents.

Seadog – the picture shows a model of the machine with British Telecom's Captain Lang in front of his cable ship 'Alert' – has been designed for burying, inspecting and repairing underwater cable at a depth of up to 300 metres.

Operations are controlled from any one of British Telecom's three cable ships to which Seadog can be linked by an extendable umbilical cord.

Depending on seabed conditions, Seadog can cut trenches up to a metre deep at a rate of two nautical miles every day. It is extremely manoeuvrable and 'flies' over the seabed to detect buried cable either visually or magnetically. It takes on water to ballast itself to its proper working weight and then drives along the bottom of the sea on tracks. Equipment includes grippers and cutters used to recover and repair cables. Trials of Seadog (6½ m long, 4 m wide and 3½ m high) will be held early next year.

Lower charges

The cost of telephone and telex calls from the UK via satellite to ships at sea has been reduced in an attempt to encourage the use of maritime communications. There are to be further reductions early next year when the new satellite station at Goonhilly, Cornwall, comes into operation, working to the Inmarsat – International Maritime Satellite Organisation – system.

Currently, nearly 700 ships are equipped for satellite communication. Conservative estimates put the number of suitably equipped ships at nearly 3,000 by the end of 1988.

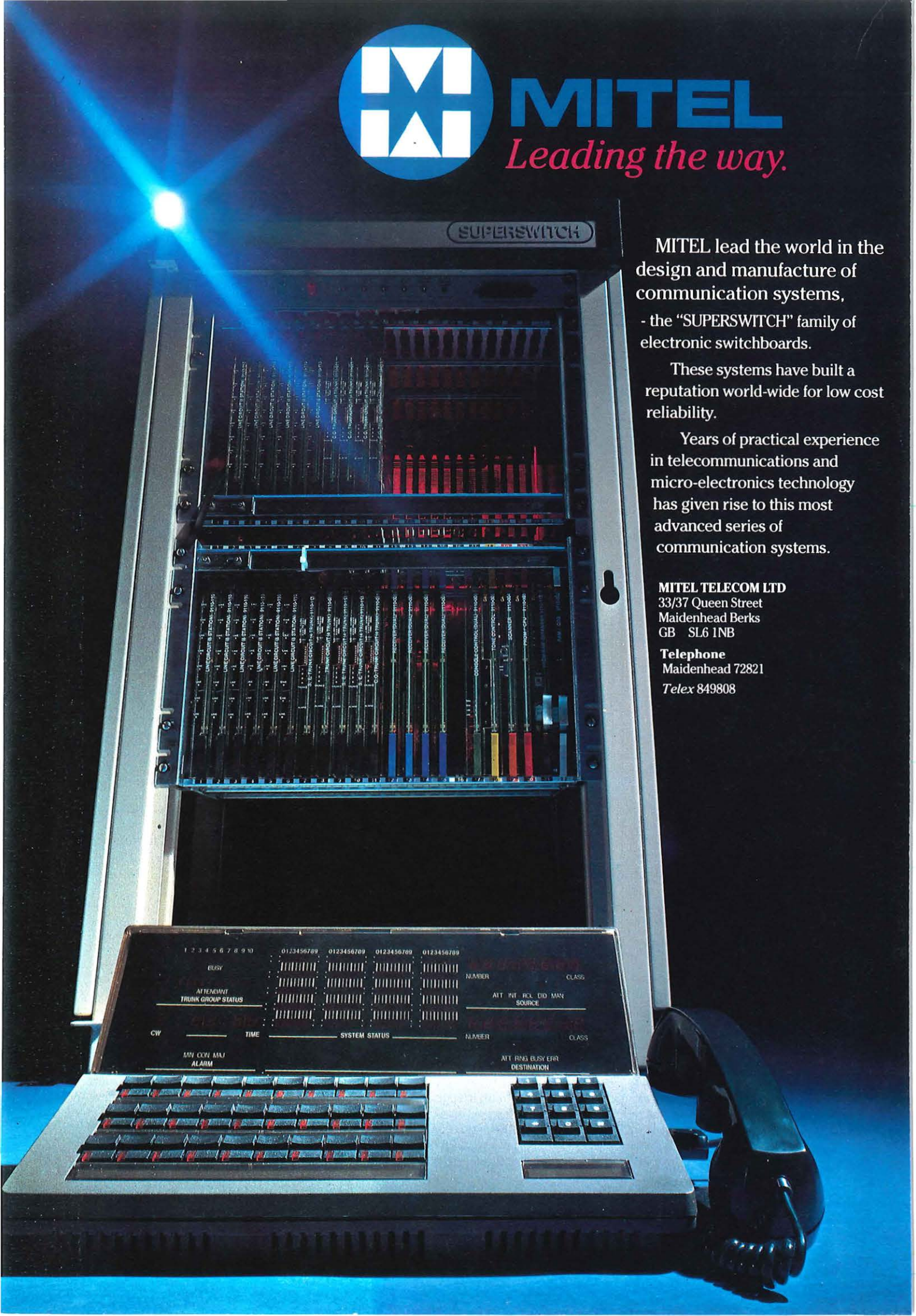
Informal meetings

British Telecom London Region are again holding a series of monthly informal meetings during the winter.

The new season began on 26 October with a talk by Chairman Sir George Jefferson and is to be followed on 17 November by City Area GM, Dr Peter Troughton, who will discuss the effects of competition in the City of London.

Further topics include 'The London overlay network' (15 December), a debate on competition (20 January), 'Crime and British Telecom' (18 February), and 'A new look at personnel' (17 March).

The meetings are open to British Telecom staff only and are held at Camelford House beginning at 5.00pm.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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 1,500 words. The views of the contributors are not necessarily those of the Board.

Correspondence:
Communications should be addressed to the Editor, British Telecom Journal, Public Relations Department, 23 Howland St., London W1P 6HQ.
Telephone: 01-631 2192 (editorial) 2193 (sales).

Publication:
British Telecom Journal is published in February, May, August and November.

Registered International Standard Serial Number ISSN 0260-1532.

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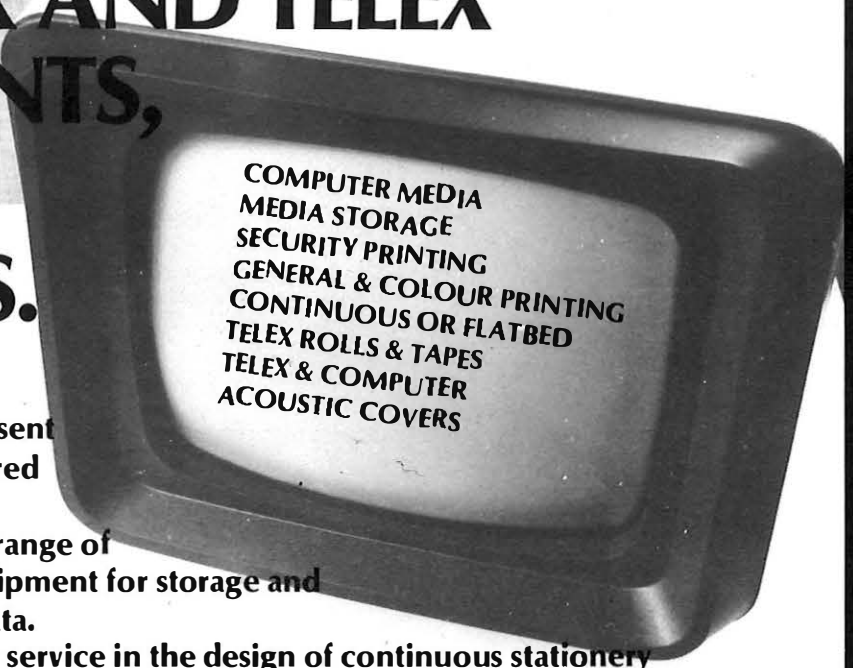

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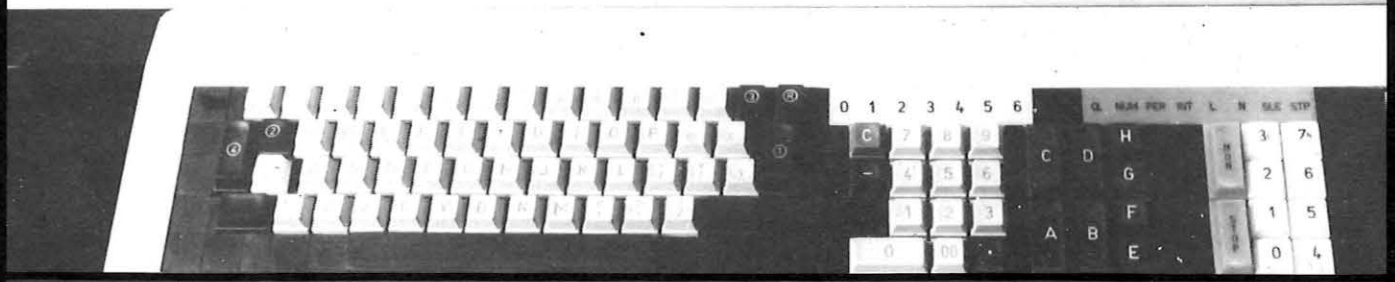

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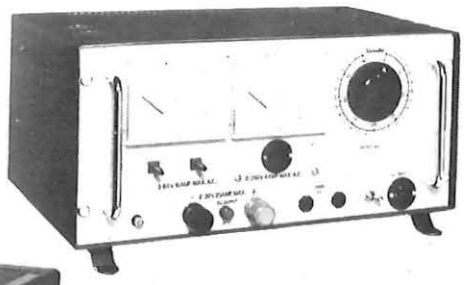

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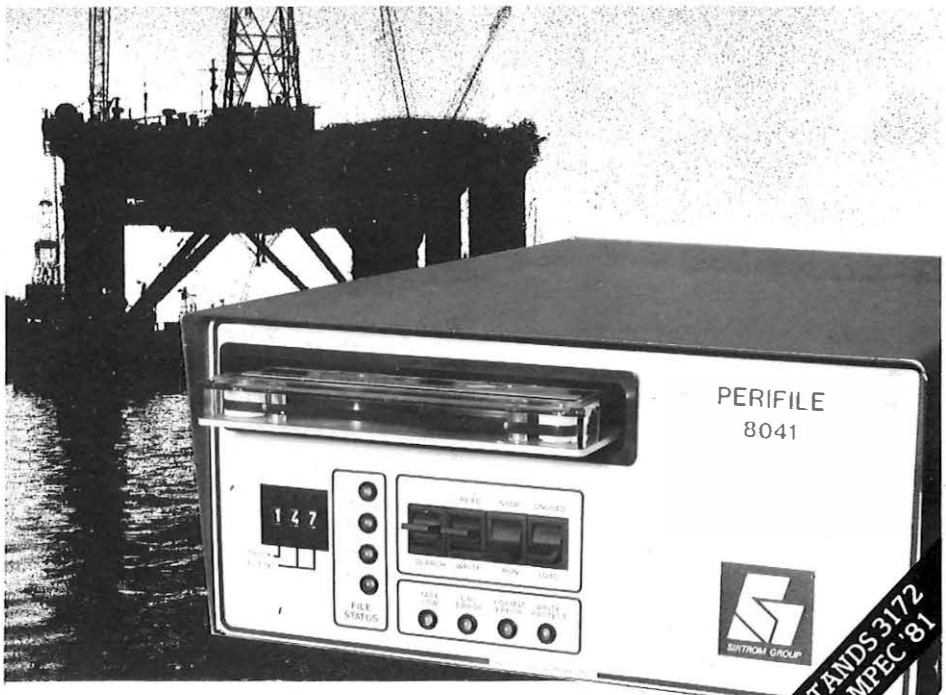

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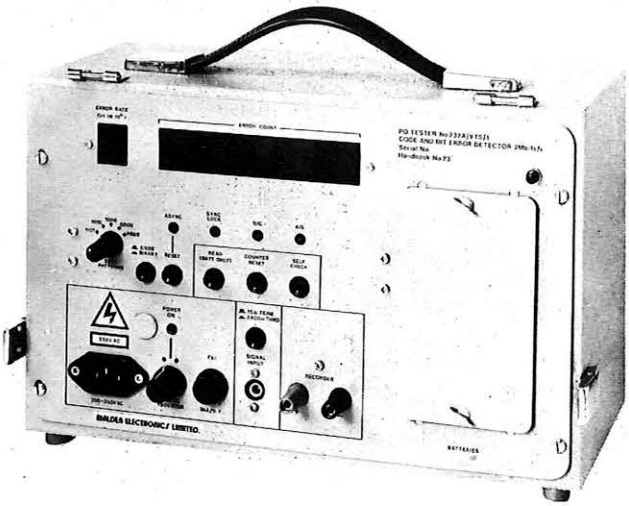
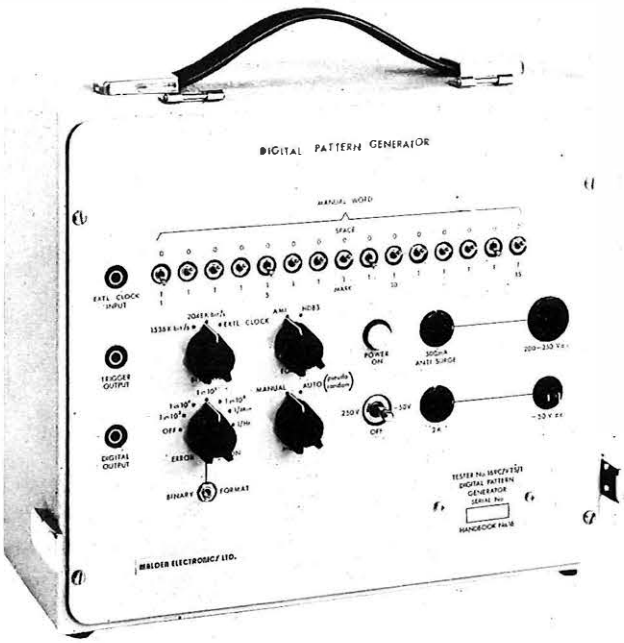
- AIS LED lights for 'all ones' pattern
- Operates from internal batteries or 200/250V ac
- Battery condition lamp fitted
- When on batteries display holds for 5 sec after Enable button is pressed
- Output for Recorder is fitted





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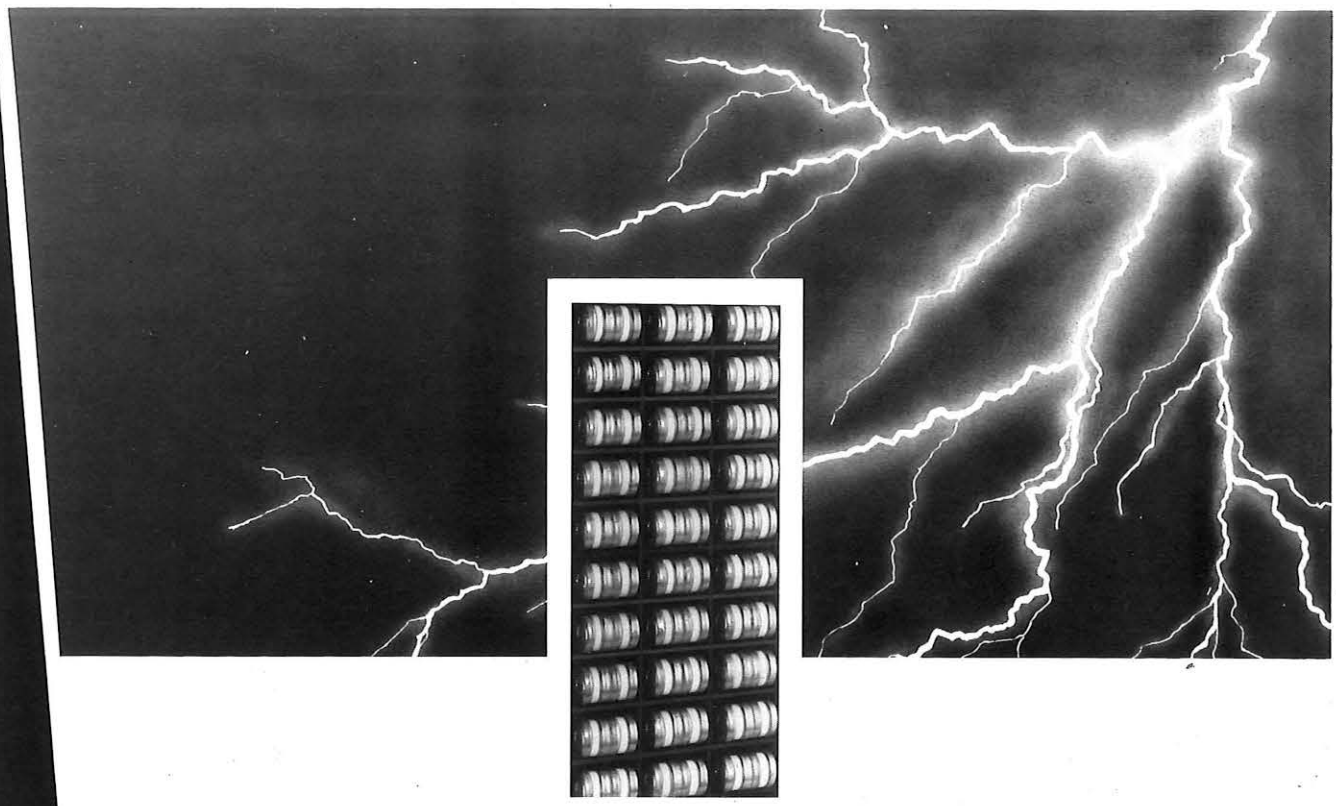

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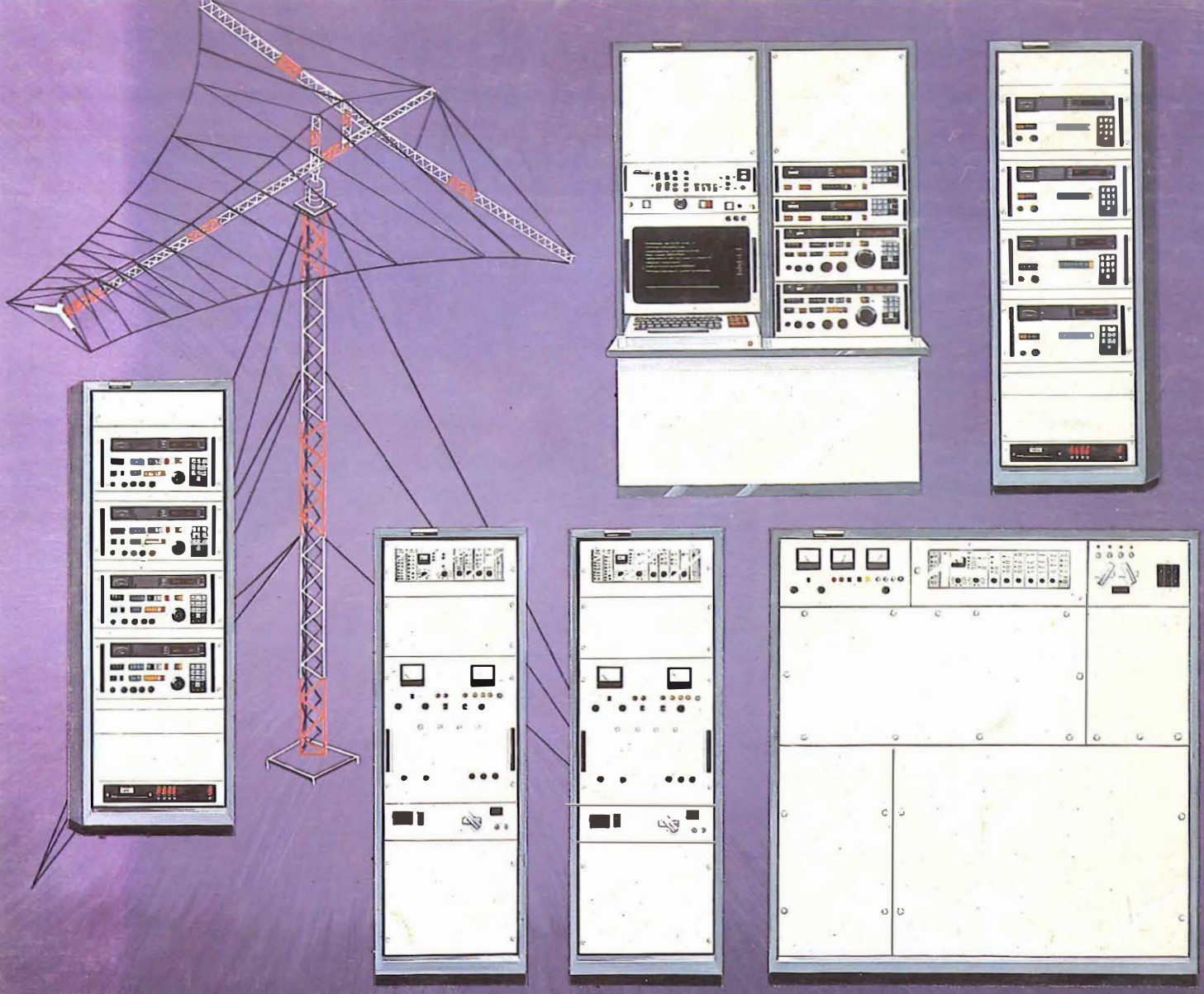

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