British TELECOM Journal

Autumn 1980 Volume 1 Number 3 Price 24p

Krone opens the door to better telecommunication connections

Paving the way to improved telecommunication connections is a Krone speciality, as is the service which we are giving to many telecommunications authorities around the world.

The illustrations below depict two highly-successful examples. Krone's revolutionary LSA quick-connection contact system . . . housed in one of our smartly-designed Distribution Cabinets.

The advantages are tremendous.

The Krone LSA eliminates all soldering, screwing and wire-stripping, helping to increase the capacity of traditionally - connected exchanges while still saving on long-term operational costs.

Krone boxes and cabinets – made of glass fibre reinforced polyester – are corrosion-resistant, thermally-insulated and have been designed to make installation easy and maintenance totally unnecessary.

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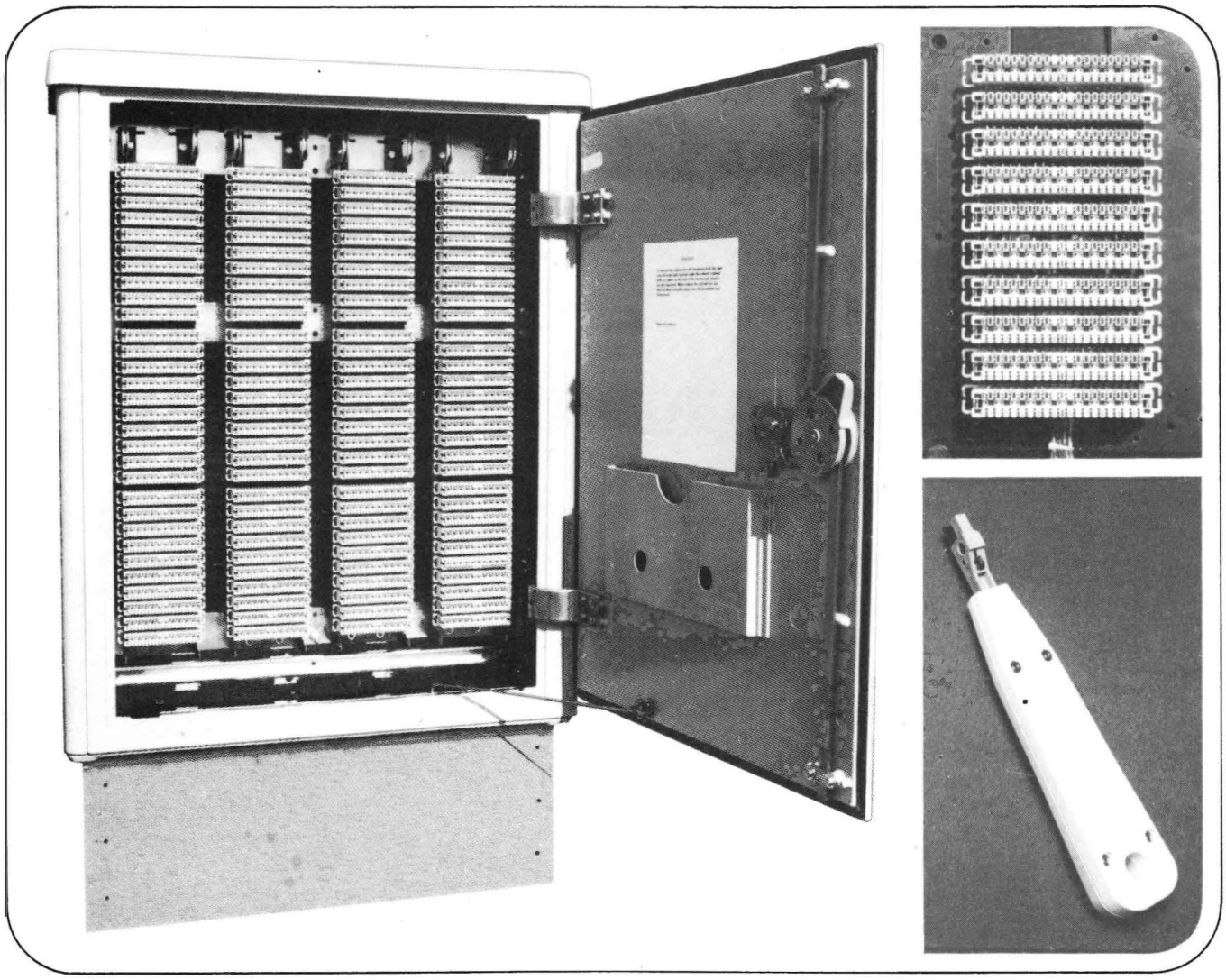

KRONE

Krone (UK) Technique Limited, Unit 12, Eastington Trading Estate, Eastington, Nr. Stonehouse, Gloucestershire.
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ATTS 20
For automatically assessing the distortion and margin of lines, or terminals.

TCT 10
A portable test set for telex and telegraph line or terminal testing.

Plessey is now manufacturing a second gateway for the British Post Office, for installation at the new Keybridge House centre. This will be the world's largest telex exchange in terms of the number of trunks connected and of switched traffic volume.

But 4660 is also sufficiently versatile to satisfy more modest requirements. The model 20, now in production for the BPO, can provide the beginnings of a new network, or can be integrated into an existing one.

There is also a range of Plessey telegraph and telex test equipment available to cater for the needs of the network users.

Whatever your network requirements — Plessey 4660 can provide an optimum solution.

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Telephone: Poole (020 13) 5161
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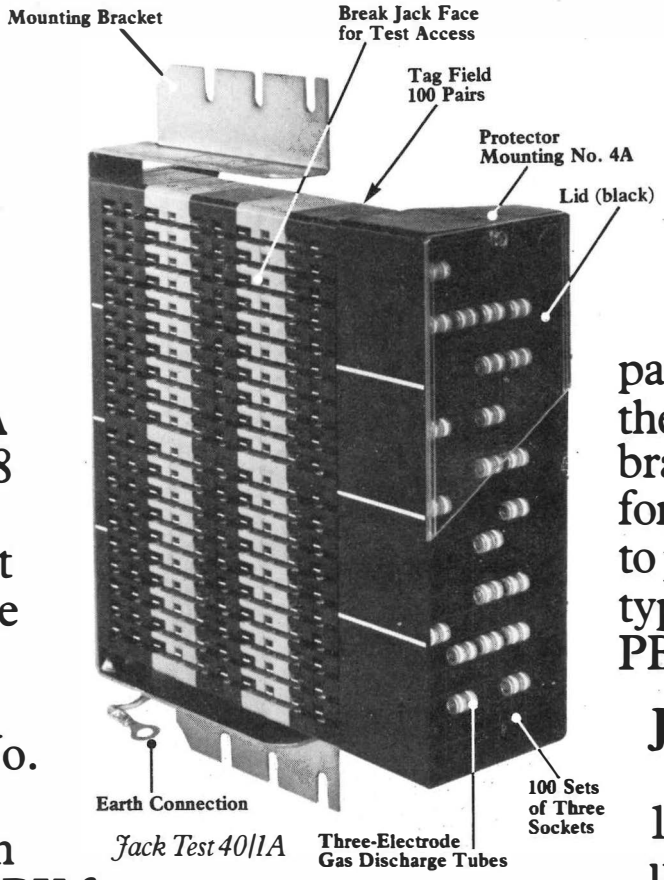
0600 2 0329

M.D.F termination



Jack Test 40/1A

Jacks Test Nos. 37/38/41A

Jacks Test Nos. 37/38 provide 100 pair termination with test access for the lineside and exchangeside of Main Distribution Frames. Jack Test No. 41A is designed for mounting directly on British Post Office PBX frames.

This range supersedes Fuse Mounting No. 10064 and Jack Test No. 33 and fixings are compatible.

Cable connection is made to wire-wrap tags and jumper wire connection to solder tags. The cable and jumper tags are aligned in planes separated to permit adequate access for wire wrapping and soldering operations.

Jacks Test Nos. 37/38 enable a 3200mm (10ft 6in) rack type MDF to accommodate up to 1000 pairs on each side of the vertical. Mounting brackets are suitable for immediate bolting to pre-rack and rack type MDFs as well as PBX frames.

Jacks Test Nos. 39/40/42A

100 pair termination units, pre-wired to Protector Mounting No. 4A with socket access for 3 electrode gas discharge tubes (Protectors No. 14A), protect switching equipment from potentially damaging high voltage surges on subscribers' and junction lines.

Protector Mounting No. 4A

Available separately, this unit is for retrospective wiring to Jacks Test Nos. 37/38/41A to convert them to Jacks Test Nos. 39/40/42A respectively.

Birkbys Plastics

a member of the **PLESSEY GROUP**

Birkbys Plastics Limited, PO Box 2, Liversedge
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Telephone: Heckmondwike (0924) 403721
Telex: 55332

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TITLE _____

ADDRESS _____

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Please send me further details of the Jack Test range.

Birkbys Plastics Limited, PO Box 2, Liversedge
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IBM 1750 – 100 to 760 extensions
IBM 3750 – 240 to 2560 extensions

AMP have designed a new splice for the telecommunications industry. Already it has been approved by most of the worlds leading P.T.T. authorities.

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The Tel-Splice has been developed for use with telephone wiring systems. It splices cable with two or three wires in a butt configuration allowing a straight splice or three wire tap.

Many of its integral features were incorporated to overcome the present difficulties of conventional insulation piercing connectors.

The Tel-Splice comes in a single size to accept any solid copper wire from 0.4mm-0,9mm dia., including the modern thick wall insulation types. Previously up to three different connectors were needed to cope with these wire sizes.

Whereas conventional splices use insulation piercing contacts AMP have used insulation displacement. This is more reliable and copes easily with varying wire sizes and insulation thickness. The resultant connection produces a gas tight joint.

In order to terminate the Tel-Splice an inexpensive and easy to use ratchet hand tool is available for all types of cable. The tool can be simply operated with minimal instruction. For volume applications splices are supplied in cartridge form.

The splice housing is of chemical resistant thermo-plastic. In order to prevent mis-matching of wire and contact, individual wire entry ports have been incorporated. It can be supplied with a special non-silicon grease which has been inserted into the housing giving added protection against moisture and contact degredation.

Reduced labour costs, easier installation and competitive price make Tel-Splice an important development.

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"DIGICOUNT" is a compact, hand held, self powered, robust, simple to use unit for counting LOOP DISCONNECT PULSES to POST OFFICE LINES, where the number dialled is displayed on a sixteen digit LED display driven from internal CMOS devices.

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NEW

"DIGICOUNT"/MF4

"DIGICOUNT"/MF4 is a hand held, battery operated tester suppiied in the same package as "DIGICOUNT" (See above).

"DIGICOUNT"/MF4 is uniquely designed so that the unit decodes and displays all the 16 DTFM codes as dialled, with full LED Alpha-Numeric display as illustrated below reading from left to right.

1 2 3 4 5 6 7 8 9 0 * + A B C D

Actual display size

"DIGICOUNT"/MF4 has selectable AUTO/NON-AUTO/MANUAL RESET. Guard times, input sensitivity and other operating parameters will be agreed to meet customers requirements prior to delivery.

For further information please contact:

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Still waiting to order your **Trend Teleprinter?**

COME ON!

It's always the same when a new product is introduced. Some people jump right in with an order. Others hold back to make sure the equipment lives up to their technical expectations.

In the case of our Teleprinter, boldness certainly paid off.

From the beginning, the Trend Teleprinter has delivered its promises. It has proved as fast, quiet, simple and trouble-free as we had expected. In fact, it has given us some pleasant surprises. Even the last copy is readable enough to be photocopied. Its reliability record exceeds our most optimistic predictions.

Of course, we haven't been standing still. After we introduced the original RO version, we added a KSR, ASR and other options. You can even have a special version with an electronic memory if you want. Or an Auto-answer facility. Or one compatible with the ICL Series 1900. We can even deliver you a special message-switching version.

Thousands of these printers are now in customers' hands. Usually, the only time we hear from them is when they want to re-order!

So come on, if you're still waiting. A demonstration is free.

Trend Communications Limited Knaves Beech Estate, Loudwater, High Wycombe, Buckinghamshire, HP10 9QZ, England.
Telephone: Bourne End (06285) 24977
Telex: 849408 Trend G.

Scandinavia: Trend Electronics, Britisk-Skandinavisk A/S, Tangmosevej 99, 4600 Koge, Denmark.
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... and representatives throughout the world.

TREND®

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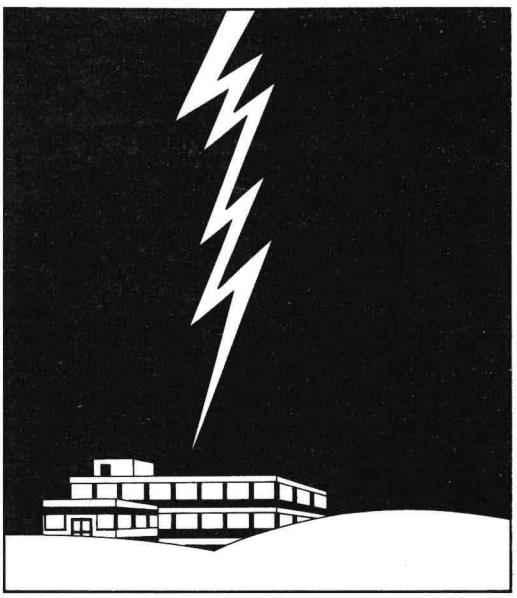
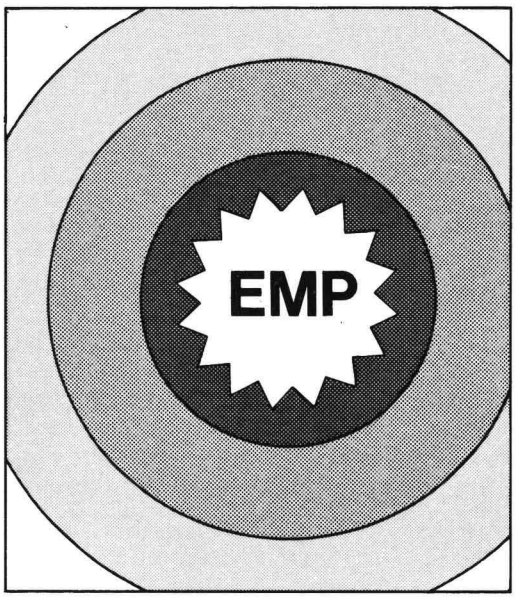
PHILOM applied technology DATA COMMUNICATIONS DIVISION

x

Wherever the surge comes from, we can arrest it!





Faster than a lightning strike.... faster than a nuclear strike.... we talk in Picoseconds and Picofarads for the protection of systems from Electro-magnetic Pulse (EMP) due to nuclear explosions.

M-OV have made surge arresters to protect telecommunications equipment around the world for years, but now with the advent of all kinds of information transmission systems, equipment worth a huge sum is at risk every minute of the day from lightning strikes.

Computer terminals, microprocessors, semiconductor units etc., can all literally go up in smoke unless all that investment is protected by another, very much smaller but no less important investment: the installation of M-OV surge arresters!

Our work on EMP arresters proves that we have the technology to safeguard your equipment, whatever it may be, but most important of all at M-OV we understand the critical importance of testing. So every arrester runs a gauntlet of rigorous tests *before* it leaves us. That's why our success rate is so high.

So, before your 'memory' gets wiped clean by overvoltage, get in touch with M-OV!

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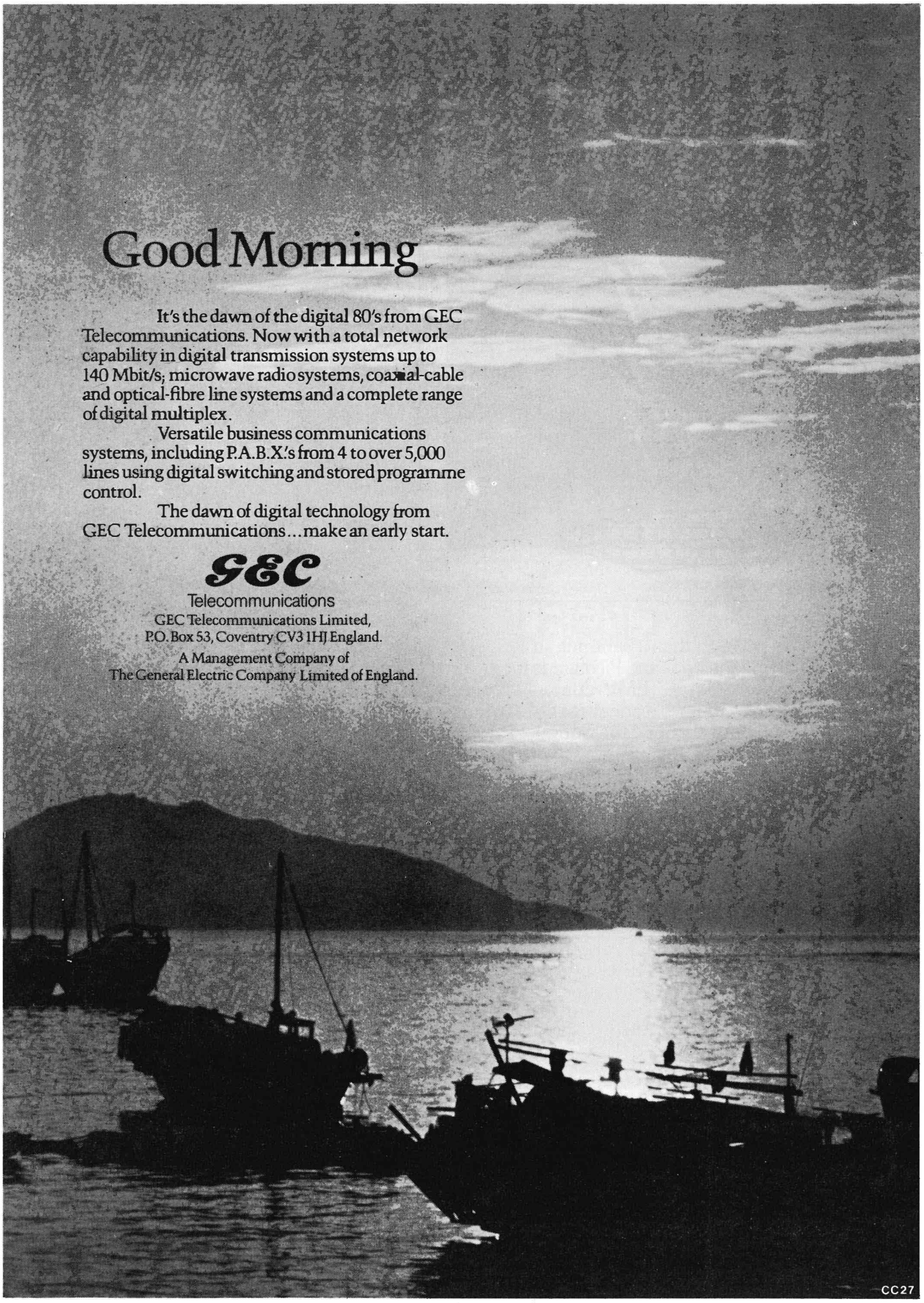
Good Morning
It's the dawn of the digital 80's from GEC Telecommunications. Now with a total network capability in digital transmission systems up to 140 Mbit/s; microwave radio systems, coaxial-cable and optical-fibre line systems and a complete range of digital multiplex.
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British Telecom Journal

Autumn 1980 Volume 1 Number 3

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

Cover: In the £1 million Clean Room complex at Martlesham, engineer Phil Flavin loads a two-inch wafer chuck into the electron beam micro-fabricator used in the manufacture of integrated circuits. (See page 9).

The value of research

Forty years ago crippled British bombers limping home from raids on Germany were a familiar sight on the Suffolk skyline as they made for the safety of Martlesham airfield. Today, a distinctive tower dominates the area, and the runways from which Spitfires and Hurricanes once took off, are now covered by British Telecom's renowned Research Laboratories.

But the switch from wartime airbase to one of the world's leading telecommunications development centres has done little to diminish the air of drama and excitement at the site. In recent years Martlesham has become synonymous with all that is best in telecommunications research and major developments such as System X, Prestel and the silicon chip are ensuring that British Telecom will be able to provide its customers with service which is second to none.

The value of research and development – on which British Telecom is currently spending some £135 million a year – was underlined recently by new Chairman Mr George Jefferson, whose visit to the laboratories followed a highly successful Open Week (see page 16) when more than 3,000 guests from Parliament, industry, universities and polytechnics, Government departments and other research establishments were shown the work that is being undertaken at Martlesham.

Mr Jefferson said he had been "most impressed" with what he had seen. The objective of research was to identify and develop ways of making services better and more economical for customers and the work done on System X was a fine example of what could be achieved.

System X combined with other developments, such as optical fibre transmission, will, of course, make the UK's network as advanced as any in the world. "But," warned Mr Jefferson, "this cannot be done on the cheap. There is no way in which the UK can be provided with the kind of telecommunications system it will need in the decades ahead without the expenditure of very large sums of money. We recognise the need to control public sector expenditure, but unless we can find ways of matching finance to the real need, the ability of commerce and industry in the UK to be world competitive will be seriously impaired by lack of good enough Telecom network."

Earlier during the Open Week, Mr John Whyte, deputy managing director, Telecom, had a similar message for the dozens of journalists from home and abroad who attended the special press day. "Our goal is excellence, our aim is improvement and our motivation the service to customers," he said. "We are devoting a lot of resources to a wide range of research and never have the challenges to our business been greater."

Mr Whyte added that although the main thrust of present day research was aimed at exploring new techniques and technologies for switching and transmission systems and for customer and management facilities, a large part of the budget was devoted to improving present services to make them more effective or economical. And surely there are few who would argue with that . . .

Providing the right number

M McDonagh

It's the paperback with a cast of millions which isn't afraid to name names. It's Europe's biggest printing job and this year it celebrates its centenary. In short it's Britain's most popular reference book – the telephone directory – a familiar feature in most homes and offices.

In 1980, British Telecom plans to publish 47 million books and 145 editions of the telephone directory. It will use 42,000 tonnes of paper and after compilation, transport and distribution, will cost £47 million.

All this, of course, is a very far cry from the days before 1880 when there were no telephone directories at all. People simply asked the operator for the number or the name of the person they wanted.

The first directory published by the Telephone Company Limited of 36, Coleman Street, London, was a slim volume with a mere 416 entries. Numbers could be obtained by name or a name could be reached by looking up a number. And there was a list of classified merchants as well, an early form of Yellow Pages. Advertising also made a discreet debut on the front covers of directories during the 1880s – for cigarettes, wine and health salts.

In the early days there was little choice as to when people could use the phone. Early directories explained that service was available between 9am and 4pm on Saturdays and office hours during the week with no service on Sundays. It was not until 1889 that a continuous service was offered to customers.

Directories also boasted of the prowess of the system – in the first year, London's private company handled 6,000 telephone calls. In today's London, more than 4,000 *million* calls are handled each year and around 20,000 million are made within the UK.

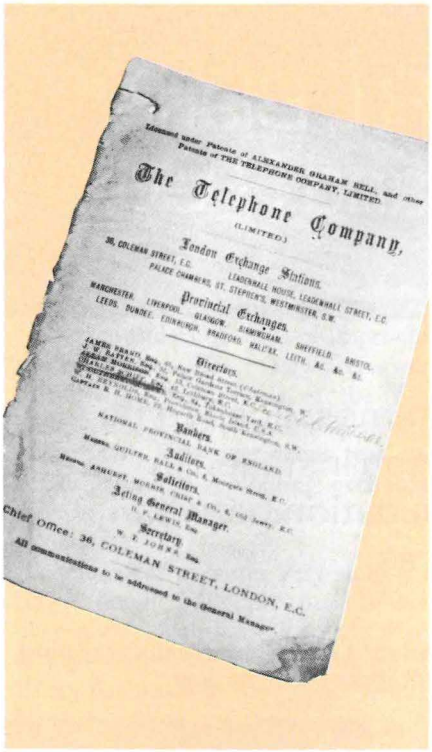
By the Edwardian era, telephone directories had become thicker, smarter and national. And by 1912, the different companies were brought under the umbrella of the Post Office.

Advertising continued to play its role in telephone directories up until the Second World War – Harrods had its distinctive lettering and green background on its advertisements; Daimler advertised its chauffeur-driven holidays at the best hotels. But the war changed all this. The message on directories was – be brief. Communications were essential to the war effort and had to be treated with discretion.

By 1953, advertising had returned to telephone directories but reflected a changed lifestyle. Daimler was still advertising – but were now suggesting that people should drive themselves.

By 1970, directories had taken on the format of today and to keep pace

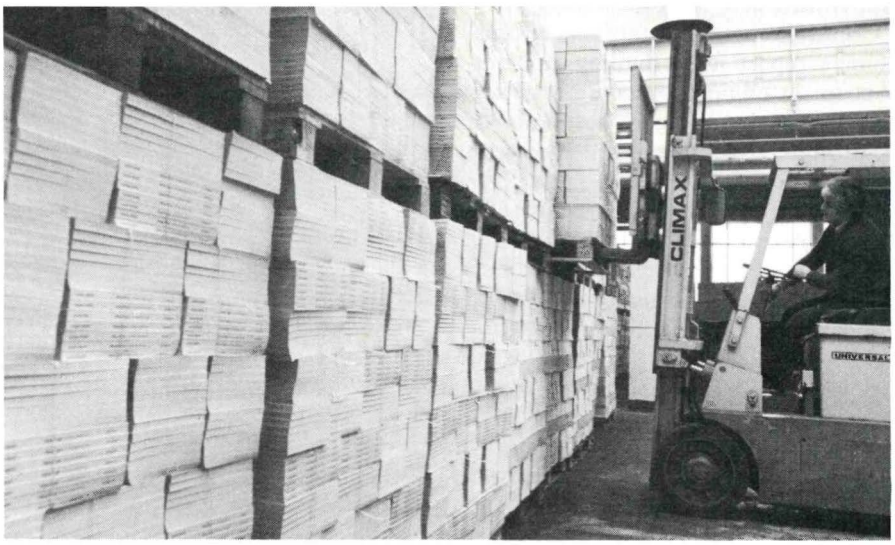
Telephone directory pages being assembled on a light table before being transferred to plates for printing.



The first telephone directory published a hundred years ago.

The quality of the printing is checked as the first of millions of pages come through the machine.

Some of the millions of telephone directories issued each year being moved from the printing works on the first stage of their journey to customers.



with the growing number of entries – they grow by about one million a year – pages were compiled by computer, recorded on magnetic tape and fed to photo-composing machines. Since 1976, they have been printed on A4 size paper which made it possible to fit an extra 30 entries on each page.

A set of directories contains 24 million entries. There are 82 alphabetical and 63 Yellow Pages volumes. Computerised printing of directories means that much more up-to-date information can be included. It is now possible to prepare a directory ready for printing in 45 working hours – a fraction of the time taken manually.

Now that production methods have been refined, attention is being turned to the content of the directories, with the aim of tailoring them more closely to customers' needs. Studies have shown that only 10 per cent of people look in the directory for a number, compared with 50 per cent who rely on memory and 25 per cent who refer to numbers previously noted. Forty per cent of calls to directory enquiries are for numbers in current directories.

One solution has been to make directories easier to use by reducing their coverage, and directory restructuring is about to take place in a number of areas. This move follows the successful introduction four years ago of restructured directories in Manchester, where the area's two alphabetical volumes – A-K and L-Z – were replaced by four new books, Manchester Central, North-East, North-West and South. Customers now receive the directory of their area but each book also covers the Central Area.

Restructuring proved the best way to cater for growth in Manchester's telephone network. If alphabetical directories had been retained they would have had to split into three volumes – customers were already finding two books cumbersome and preferred to ring directory enquiries.

But despite some criticism the scheme proved successful – as shown by a drop in calls to directory enquiries. Lincoln, York, Sheffield, Newcastle and Bristol now have restructured directories and there are plans to introduce similar schemes in the future.

Ms M. McDonagh is an information officer in Public Relations Department's Features and Information Bureau.

British Telecom Journal, Autumn 1980

Repair centres get the message

R L Blann and R Cox

Telewriters – machines which enable handwritten messages to be transmitted from one terminal to another – have been installed in London's City Telephone Area to improve communication between Customer Service Division and repair service centres.

With telecommunications playing an increasingly important role in society in general and the business world in particular, faults in equipment and the network cause delay, waste and frustration resulting in lost revenue and high costs. And nowhere does this apply more than in the City of London – one of the world's greatest centres of commerce.

Usually as soon as a fault occurs customers report it by dialling '151' direct to the engineers at the repair service centre (RSC). The fault is immediately diagnosed and passed to the appropriate engineering group for attention, thus enabling a repair to be completed in the shortest possible time. Sometimes however, a customer may wish to discuss his problem with the Customer Service Division in the telephone area office (TAO) because he wants more information or is dissatisfied with the speed of repair.

On these occasions it is vital that British Telecom is seen to deal with the complaint quickly and efficiently and for this reason, speedy and efficient communications between Customer Service Division and the RSCs are of paramount importance.

In LTR City Area, part of the Customer Service Division is located in the telephone area office at Southwark Bridge, and the RSCs with which it needs to deal are situated in Bermondsey, Faraday, New Cross, Southwark, Walworth and Wapping exchanges. The obvious method of relaying customer complaints and fault reports to the RSCs by telephone presented a number of problems.

For engineers, having to answer the telephone and write down a long list

Telecommunications traffic superintendent Alison Roose calls Wapping repair service centre to warn them a fault report is on its way.

of enquiries or fault reports was disruptive to their workflow as well as time-consuming. In Customer Service Division there were often difficulties in getting through because the engineers were busy or because working hours did not coincide. Similar problems arose when the engineers wanted to report back – customer staff already spend much of their working day on the telephone talking to customers.

After considering ways of improving the situation, three telewriters were installed experimentally at the TAO and at New Cross and Walworth exchanges. The experiment was successful and the remaining exchanges were brought into the network as soon as possible.

A telewriter operates very simply. A conventional ballpoint pen is connected via a pantagraph to the shafts of two very accurate potentiometers. Every pen position can thus be defined by the positions of the right and left potentiometer wipers and hence by two DC output voltage levels.

The right hand and left hand voltages are then applied to the inputs of two voltage-controlled oscillators allowing all lateral movements of the pen to be represented by two frequency modulated signals. A third oscillator provides a signal to indicate when the pen is lifted off the paper. These signals are transmitted to line within normal voice frequency range.

At the receiving end, the right and left signals are demodulated and applied to two, very fast, precision DC motors whose output shafts are linked to the pantagraph. The pen lift signals are also demodulated and applied to a solenoid which controls the raising and lowering of the pen. Thus under the control of the two motors and the pen-lift solenoid the pen at the receiving end reproduces exactly the movements of the pen at the transmitting end.

If for any reason during transmission connection between the two machines is broken or spurious signals such as speech intrude on the line, an automatic lock-out device causes transmission to cease and a visible alarm shows on the telewriter instructing the writer to 'wait'. The machines use a standard-sized paper roll and movement of the pen to a special position will advance the paper by a fixed amount at both ends of the link.

The telewriters are connected to the City Area private automatic branch exchange, and are thus fully interconnected. An additional benefit is that they can be used for communication

The message arrives via the telewriter at Wapping. Gwen Foley, clerical assistant, shows it to assistant executive engineer Nicholas Hay, officer-in-charge.

The transmitted message is then handed to technical officer Buzz Johns who will initiate action to repair the faulty line.

between the exchanges. The main advantage of the telewriter of course is that messages can be transmitted to a terminal without the need for someone to answer.

The telewriter answers automatically after a pre-determined number of bursts of ringing tone and switches to the unattended mode in readiness to accept messages. Customer Service Division can transmit messages at any time and this gives the engineers a written list to deal with as soon as they are free.

Conversely, when the engineers reply, customer service staff have a written list of answers waiting for them. The system also means that time is not being spent writing down long telephone messages.

In practice, Customer Service Division often send messages late in the afternoon when many engineers have finished work. The engineers will study the messages on arrival next morning and replies will be waiting for Customer Service staff when they start work.

Further advantages lie in the improved accuracy implicit in written communication and the fact that identical written copies are available at both ends of the link. No special skill is required to operate a telewriter other than the ability to use a telephone and to write with a pen.

Generally the telewriters have been well received by all those involved with their use. The only complaint has been that, although it reproduces handwriting faithfully, it does not improve it!

Mr R. L. Blann is a senior telecommunications superintendent in LTR's City Area Customer Service Division.
Mr R. Cox is a telecommunications traffic superintendent in the same division.

British Telecom Journal, Autumn 1980

New dial tone on line

RT Farrow

A new dial tone more suited to the multi-frequency telephones now being introduced, has been developed by British Telecom. Its implementation will result in service improvements and a further step towards international harmonisation.

When authority was given for the development and subsequent trials of multi-frequency (MF) keyphones in 1974 it was realised that a change of dial tone would be necessary if they were to be used widely in the network. This was because the complex harmonics in the current dial tone extend into the range of signals used for MF signalling and could create difficulties in the recognition of the initial MF signalled digit.

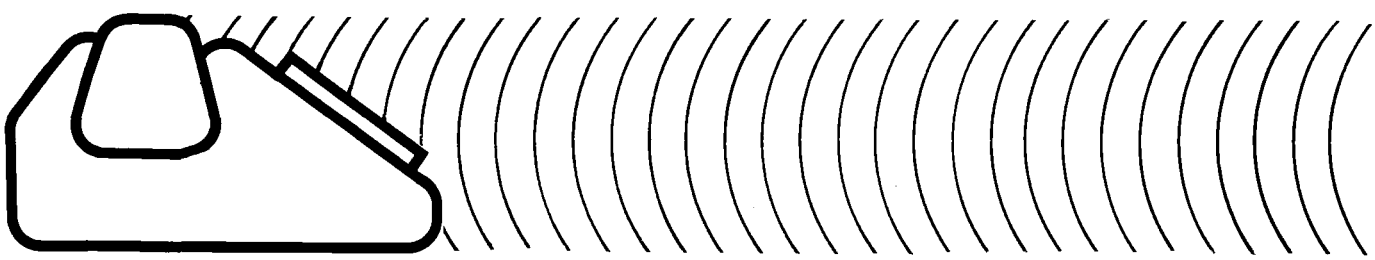
There were also other problems with the existing dial tone. On certain out-of-area exchange lines which were allocated a 300–3400 Hz frequency range within a frequency division multiplex (FDM) transmission group assembly, some audible power was lost, and difficulty in hearing dial tone was sometimes experienced.

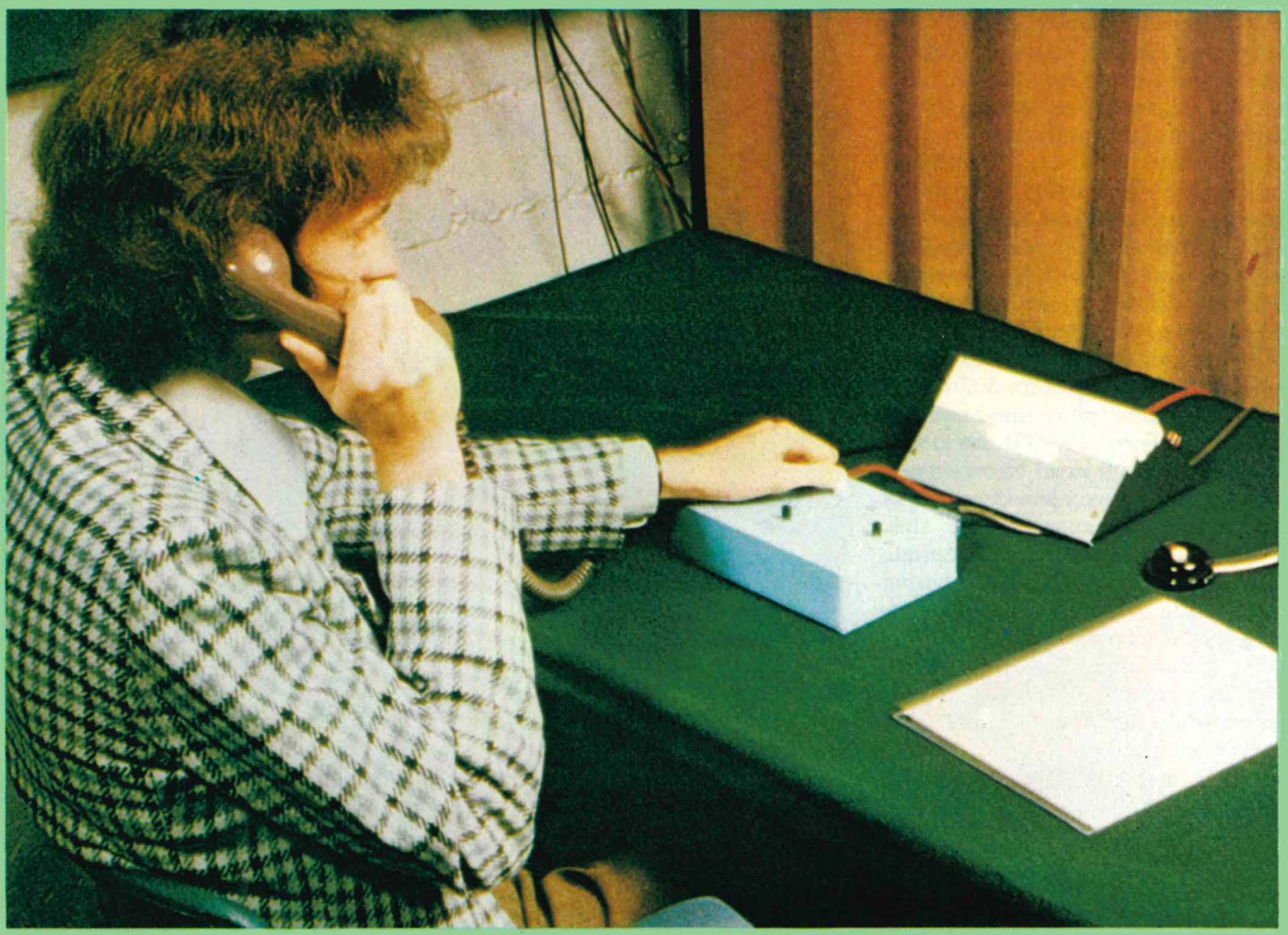
Also the automatic recognition of dial tone required for certain facilities presented design difficulties, particularly on PABXs and a change in the design of ringing machines had resulted in a lower volume signal at the receiver leading to some complaints of inaudible dial tone.

With the introduction of MF signalling, it had been intended that MF tones should be sent to line through the telephone regulator to allow the tones received at the exchange to be closely defined and to be at a higher level than the internationally recommended minimum. A number of other countries were at a similar stage and discussions at the Conference of European Posts and Telecommunications Administrations (CEPT) and the International Telegraph and Telephone Consultative Committee (CCITT) were aimed at rationalising approaches to ensure that solutions to the problem were not markedly different between each country.

Although use of a regulator would overcome crosstalk problems by limiting the level of tones on short lines and the use of a regulated output would make recognition of MF tones in the presence of dial tone easier, CEPT recommended the use of unregulated tone output. There were also technical reasons for not having a regulator in MF push-button telephones as this would tend to restrict the power reaching the oscillator, thus increasing the 'warm up' time.

Serious consideration was therefore





Tony Cox of Human Factors Division at Telecom Research Laboratories, Martlesham, assesses a proposed frequency for the new dial tone.

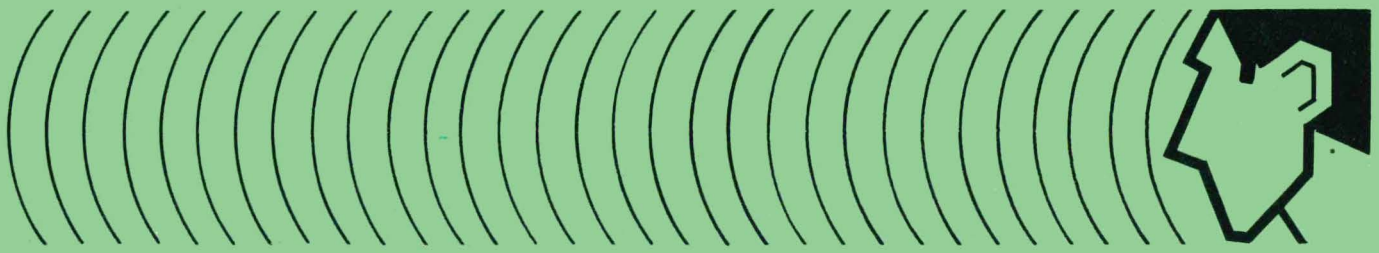
given to the adoption of a new standard dial tone. Telecommunications Headquarters Service Department sponsored work in the Human Factors Division of Telecom Research Laboratories (TRL), to carry out experiments to determine the most suitable new tone. This was essential to avoid, or at least minimise, the need for customer re-education. Ideally the tone was required to include mixed frequencies to produce the 'warble' effect of the old tone. It was also required to be sufficiently different from other tones to ensure that its use was understood by customers.

Tests were carried out to determine the reaction of a number of THQ staff to a range and mixture of tones. A smaller number of options were selected to form the basis of TRL tests using people outside British Telecom. Although a single frequency tone (as used for number unobtainable advice) was used in Europe, it was clearly demonstrated that the use of mixed frequencies, as used in North America, would be preferable.

The analysis of the human factors research work showed that the tone most acceptable to customers was the combination of 440 Hz and 350 Hz tones. It also met the technical and international requirements, and it was agreed within British Telecom that it should in future be adopted as the UK standard.

In 1974, a project was sponsored to study the feasibility of the electronic generation of ringing current and supervisory tones. It was aimed at providing tones within closer frequency limits than the previous mechanical equipment allowed, and provided most flexibility in the introduction of new tones. There was already a problem in that a number of manufacturers had ceased making ringing machines so there were considerable supply difficulties for both new machines and for spare parts. Thus the introduction of the new dial tone could be made cheaper by the adoption of electronic generation, although it was agreed that interim arrangements would need to be made.

Trials of the new dial tone, together with the use of MF keyphones were instigated at both director and non-director exchanges. These required the



provision of converters in the exchange, so that exchanges where a reasonable demand for MF keyphones could be expected were chosen to justify the cost of the computers.

Leatherhead and Chislehurst exchanges in the London Telecom Region were selected and trials held in 1976. Almost all the customers on the trial exchanges found the new dial tone acceptable, although many felt that wide publicity would be needed to help with its identification.

In late 1977, plans were finalised to introduce MF telephones and new dial tone more widely. First, it was necessary for telephone areas to write to all customers, giving six months notice of the proposed change. Before this, THQ had written to all appropriate suppliers of attachments advising them of the change. A THQ circular, and later a Telecom Instruction were drafted which included letters to be sent to customers.

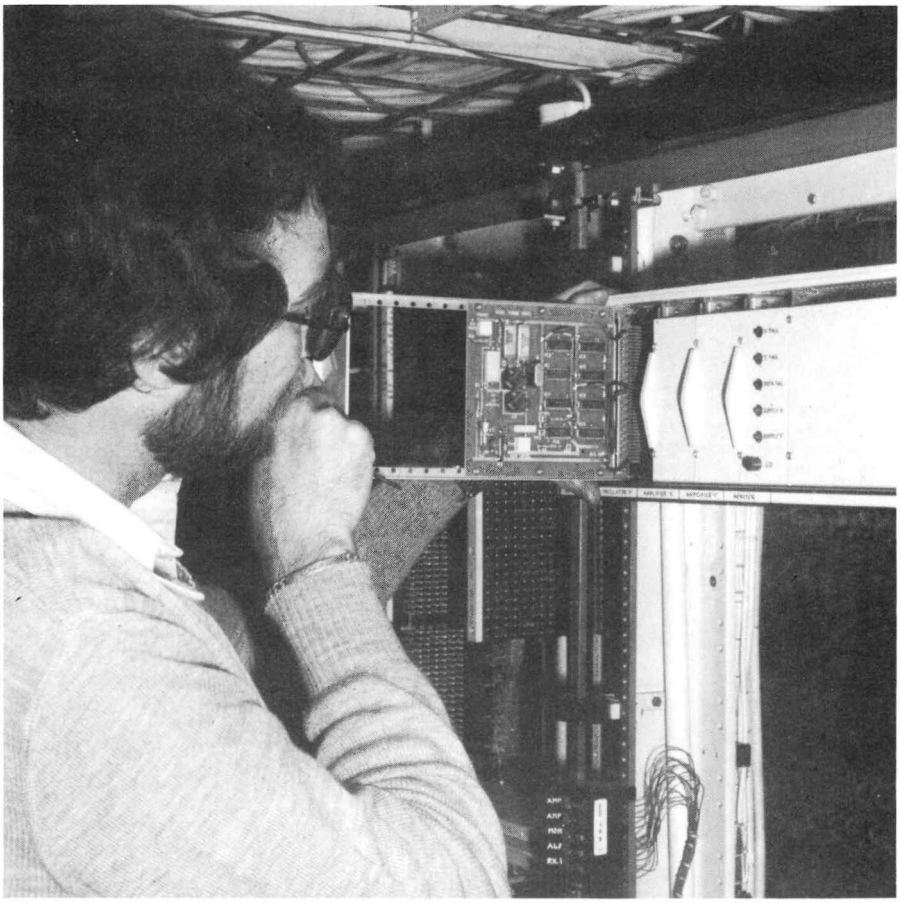
Meanwhile a 10-year programme was drawn up to provide MF working and new dial tone at all large local exchanges, which were planned to have a reasonable in-service life, before conversion to System X working. Additionally there were considerable benefits arising from the provision of new dial tone at exchanges where the digital private automatic branch exchange (PABX) now known as Monarch (see *Telecommunications Journal*, Spring 1978) was parented.

The programme of introduction began in March last year. So far about 100 exchanges have been converted and considerable thought is being given to providing new dial tone at all TXE2 and UAX exchanges. There are benefits from a customer service viewpoint in having common dial tone throughout the country, apart from all the service improvements.

New dial tone is to be provided initially at System X and TXE4A exchanges throughout the country. On the basis of the current exchange modernisation programme, now already under way, new dial tone is expected to have been provided at all exchanges by the early 1990s.

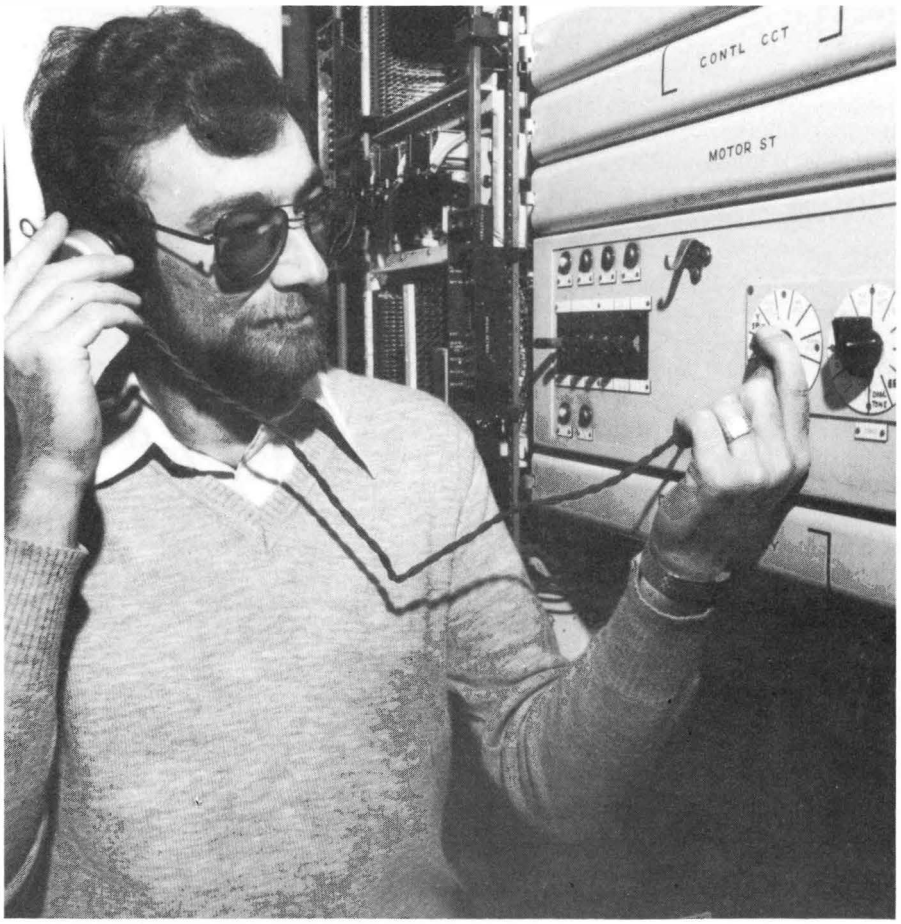
Mr R. T. Farrow is a head of group in Marketing Executive's Residential and Customer Services Division and is responsible for call facilities and exchange services policy.

British Telecom Journal, Autumn 1980



Technician Bob Swetman inserts an oscillator unit into the new dial tone equipment at a North London Exchange . . .

. . . and later listens in to the audible tone level.



The quest for smaller chips

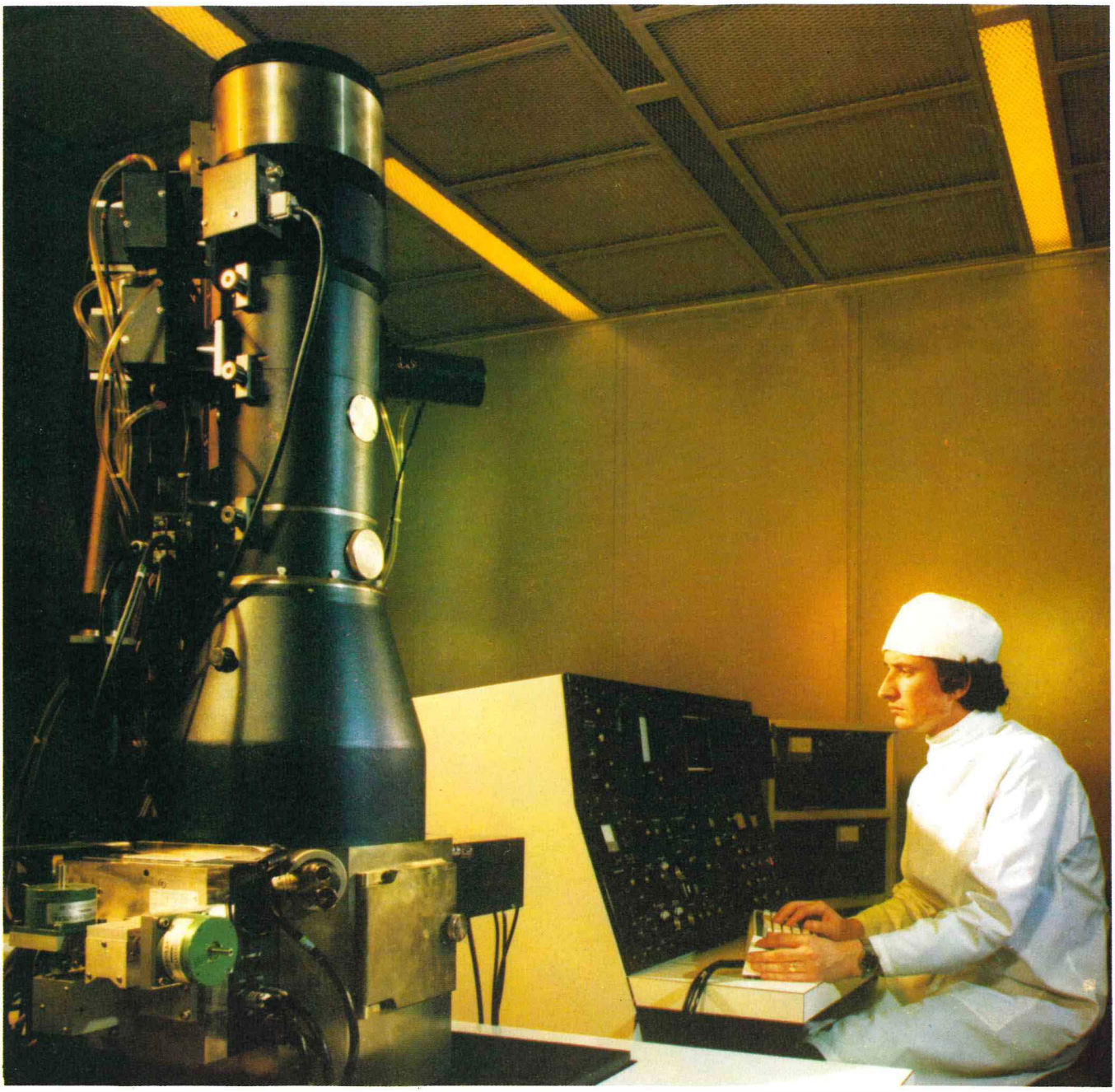
M E Jones

Electron beams are being used at British Telecom's Research Laboratories to investigate still smaller integrated circuits needed to develop advanced digital transmission, data communications and terminal equipment.

During the 1980s, British Telecom's service to its customers will improve both in the quality and range of facilities it offers. At the heart of the new technology will be integrated circuits, or microchips as they are so frequently called.

These form the basis of the electronic revolution currently affecting every walk of life. There is at least one integrated circuit in every calculator or digital wrist-watch, tens in every tele-

Executive engineer Phil Flavin controls the electron beam microfabricator.



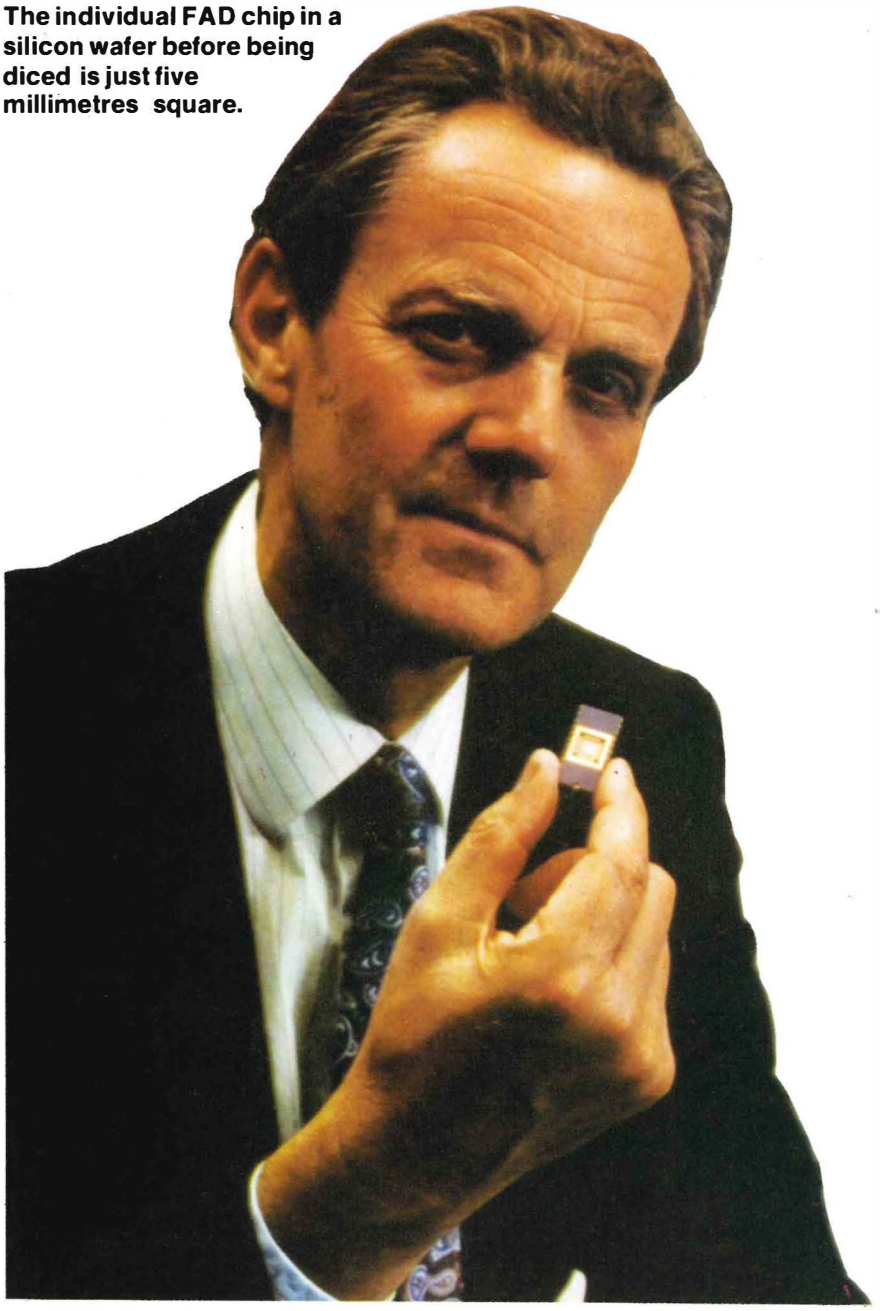
vision, hundreds in a mini-computer and many thousands in even the smallest System X telephone exchange. Each consists of a tiny chip of silicon onto which a complex pattern of metallic conductors and semiconductor transistors has been formed.

These minute individual elements form the building blocks of the integrated circuit, the first of which was made about 20 years ago and contained just a few individual transistor circuits. Today it is possible to build tens of thousands of transistors on a single chip, and with so many circuits available, one chip can perform a range of very sophisticated operations.

The advanced digital network currently being installed by British Telecom uses many different types of integrated circuit – a lot of which are identical to those used for other purposes and are readily available from commercial sources. But there are some applications which are either unique to the network or which, for technical reasons, need specially-designed integrated circuits. Recent examples of such circuits are CODEC which converts analogue speech signals to and from pulse code modulation for digital transmission, and FAD which is a 7000-transistor general purpose chip designed for digital filtering and level detection.

To ensure that these special circuits are designed to the correct specification, and are available when needed for system application, a complete facility exists at Martlesham Research Centre to design, develop and produce custom integrated circuits for prototype equipment. If successful, these designs can be offered to commercial suppliers who can then manufacture production quantities. This facility enables system engineers to incorporate specialised circuits at an early stage during development of new equipment – both CODEC and FAD circuits are Research Laboratory products. And it ensures that customers can be offered the most advanced equipment at the earliest opportunity, and that costs are kept down by using the least number of components.

Charles May, Research Director at Martlesham, holds the TRL-developed chip. The individual FAD chip in a silicon wafer before being diced is just five millimetres square.

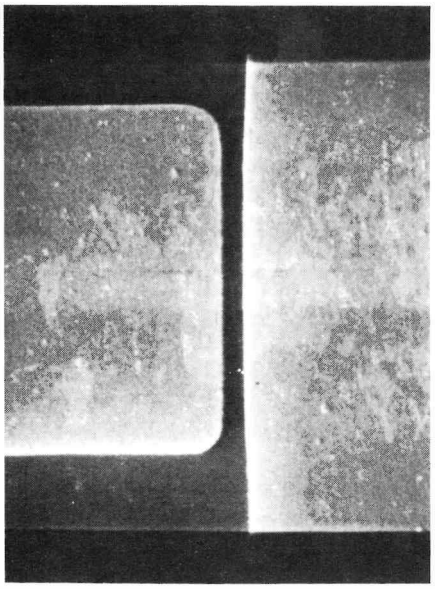


To make an integrated circuit, a set of mask plates has first to be produced using information from design data. Each mask consists of an optically flat glass plate coated with a thin chromium layer onto which a pattern is etched. This pattern is transferred to the semiconductor wafer by coating the wafer with a special polymer, known as a resist, which forms a thin light-sensitive layer. Ultra-violet light is shone through the mask on to the coated wafer in a process similar to photographic contact printing. After exposure, the resist areas onto which light has fallen dissolve and the underlying material appropriately etched or coated. As each mask plate is printed in sequence, and in registration with previous exposures, the patterns which define the component transistors, capacitors and resistors are formed in a thin three-dimensional structure.

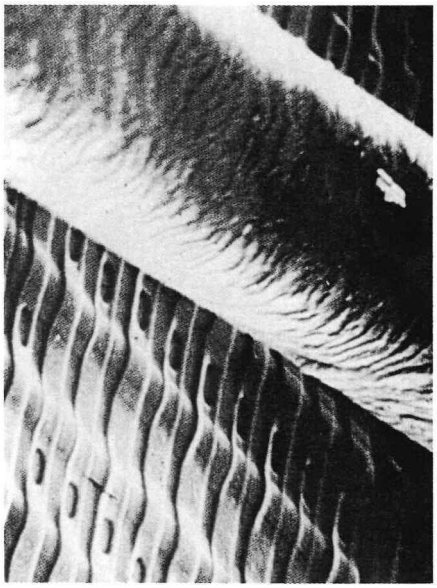
Accurate and perfect pattern dimensions are critical in manufacturing a mask set for successful wafer fabrication. The complete circuit is drawn either 250 or 500 times the required size and is then photographically reduced to generate a plate – called a reticle – of a single circuit at ten times the finished size. The reticle plate is again photographically reduced, and stepped across a mask plate to produce a complete array of patterns at their ultimate size.

Recent advances have resulted in an astonishing reduction in the dimensions of the circuit elements. A typical linewidth found in integrated circuits during the early 1960s was about 100 microns, while today's are typically five microns and will shortly drop to about two microns. With 25,000 microns in one inch – even this paper is between 25 and 50 microns thick – manufacturing equipment has become highly sophisticated and inevitably very expensive.

This decrease in linewidth not only



The gap between these two metallic conductors has been made by electron beam lithography and is just one micron across. There are 25,000 microns in an inch.



A human hair dramatically highlights the scale of the conductors on the chip's surface.

enables complex integrated circuits to be made, but also means that circuits can operate at much higher speeds. Even now, researchers at Martlesham are looking at the possibility of using devices for advanced systems which operate at frequencies so high that their circuit dimensions are too small to be readily made by optical methods. These devices, made in silicon, or in the newer semiconducting materials based on gallium arsenide, will play an important part in future developments such as complete optical transmission systems.

Although optical pattern generators can both speed and improve the reticle fabrication process, they, like existing methods, suffer from diffraction effects, which as circuit dimensions decrease, and begin to approach the wavelength of light, start to degrade the line edges. They also lack flexibility in that they cannot directly pattern semiconductor wafers or mask plates.

Hence the trend to electron beam lithography, where a beam of electrons is focused on to an electron-sensitive resist. This unexposed resist consists of many thousands of atoms bonded together in long chain molecules. Exposure to electrons breaks these long chains which can then easily be dissolved away, thus differentiating between the exposed and unexposed areas. The electron beam itself is produced by heating a tungsten filament to a high temperature in a strong electric field inside a vacuum. The electron source acts much as a thermionic valve. The beam of electrons is focused by a series of magnetic lenses to form a small spot on the wafer. Unlike optical techniques, in which diffraction effects start to degrade the line edges, the use of the electron beam will successfully achieve the small dimensions required in the advanced devices under development at Martlesham.

Capable of being turned on and off at high speed, the electron beam can be precisely deflected over areas of about one square millimetre. Both functions are controlled by computer, thus allowing the beam to 'write' patterns. The computer not only takes care of the elaborate control system, but also offers great flexibility in manipulating circuit design data which is transferred directly from the circuit design facility to the microfabricator on magnetic tape. Once transferred, data can be used to write the same pattern at different sizes on one wafer, or alternatively, several totally different patterns can be written side by side. This flexibility and speed of response will be invaluable for future circuit development.

At first, the major centres for electron beam lithography development were in America and Japan. But more recently, the use of electron beams for experimental semiconductor device fabrication has expanded. One UK company, Cambridge Instruments, has been developing and marketing electron beam machines and has made important sales in both America and Japan. Apart from their installation at Martlesham, further machines are being used by GEC, Plessey, the SRC's Rutherford Laboratories and the Royal Signals and Radar Establishment. Martlesham keeps in close touch with both the manufacturer and the other industrial, governmental and university organisations who are fully committed to developing the technology.

One of the problems in using such small dimensions in integrated circuits is that of dust contamination and its effect on yield. With current linewidths now substantially smaller than most airborne dust particles, all fabrication work must be undertaken in special 'clean' rooms in which the air is constantly filtered, and the room temperature and humidity controlled. This is important because temperature variations can expand the wafers and so misregister the components, and high humidity can detrimentally affect the adhesion of the resists. Temperature is controlled to within one degree centigrade and the humidity to five per cent.

Air enters the clean room through a false ceiling totally covered by filters for removing particles as small as 0·5 micron, and leaves through a perforated floor taking any dust directly away from the room. Most of the other contamination comes from the clothing and skin of the staff who use the equipment. To combat this, rooms are ergonomically arranged and staff wear overclothes and shoe covers made with artificial non-fibrous materials. Both the electron beam microfabricator and the optical mask-making facilities are located in the same clean room suite, thus making full use of both technologies.

With this new equipment, the Research Centre will play an important role in developing faster and more complex customer-built integrated circuits for the 1980s which will not only give customers more, but will play their part in the introduction of more advanced System X electronic switching exchanges.

Dr M. E. Jones is head of section at the Telecom Research Laboratories, Martlesham, and is responsible for the development of electron beam lithography.

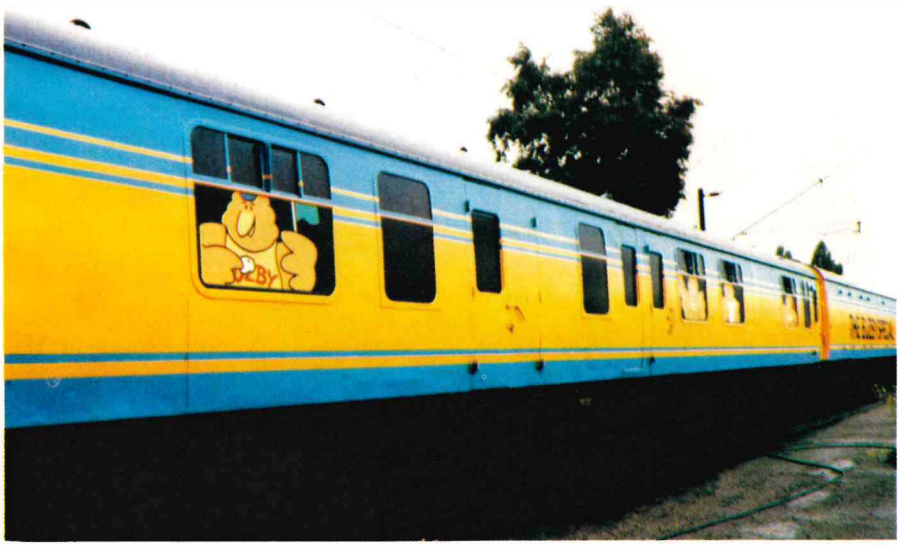
British Telecom Journal, Autumn 1980

The interior of one of the Buzby Special coaches awaits its visitors.

The use of a special exhibition train to tour the country displaying telecommunications equipment has proved a novel and exciting way of presenting and promoting British Telecom to many thousands of customers over the past few years.

Buzby on the right lines

DC Francis



The Buzby Special at Enfield during its 1980 tour.

Visitors to the train are shown a range of new telephones.

This year is the fourth that British Telecom has taken to the rails to run its novel touring exhibition and the first time in the new livery. It is a concept which began in 1977 – Silver Jubilee year – when the first tour had a royal flavour.

British Rail hires to clients a variety of coaches including reception, exhibition, hospitality, seminar, cinema and storage cars. After detailed negotiations with regional Telecom offices, an itinerary is presented and prepared with British Rail. A timetable has to be based on a sensible and workable geographical route, and complicated and lengthy overnight journeys – such as Gloucester to Thetford and Leeds to Norwich – have gone without a hitch. On one rare occasion, at Cambridge, the train arrived 'back to front' and had to travel to Ely to turn round.

Sites are chosen for accessibility and convenience to visitors – many of whom are local businessmen who come to see – and order – some of the many products and services on display in the train. The aim is to use centrally-situated station platform sites although this is not always possible

because of British Rail's operational requirements. Sidings and loading bays are alternatives to platforms and often have the advantage of car parking facilities and a quiet situation.

As the time approaches for each annual tour, the operational group in Marketing Executive responsible for national exhibitions meets representatives from the exhibition group in Publicity Division who arrange the contract with British Rail, commission a designer and appoint a contractor to build the displays. British Telecom engineers from the same group install and maintain all the telecommunications equipment in the train. And to complete the teamwork, local area staff provide exchange lines to a point near the site.

Although the Buzby Special is organised by Marketing Executive, local telephone area staff take over its operation on arrival and for a day it is their exhibition. They send out invitation, welcome customers aboard and generally arrange the visit to the best advantage. In its first year, the train was used primarily as a public relations exercise, although orders were not discouraged. But since the first year, the train has become far more marketing orientated, and many telephone areas have been quick to exploit the opportunities the train presents. Most areas in fact have decided to use the train primarily to spread the telecommunications word throughout the local business community. But a lesson learnt over the years has been the need to work at the way customers are invited to visit the train. Telex, letters, newspaper advertisements, telephone calls – all work to some extent, but some areas have proved that one of the best ways is to invite business customers by personal letter and to make a firm appointment. A few days before the train arrives, they are given a gentle reminder by telephone. Customers are then met on the train by one of the staff, usually the sales representative with whom they normally deal.

In one attempt to attract residential customers at Southend-on-Sea, Buzby – alias the local sales manager – was even spotted cavorting in the sea with two ladies.

Up to 20 sit-down lunches can be provided in the seminar coach by British Rail Traveller's Fare staff, and when the train arrives, the local General Manager hosts local civic dignitaries, members of the Chamber of Commerce, the Rotary Club and influential businessmen. Practice in the past has been to follow lunch with, for example, a short Prestel demonstration or to show a suitable film highlighting products and services on offer. The seminar coach can also be used to great effect before and after lunch for presentations to other groups of visitors.

Over the years the displays in the exhibition coach have been aimed primarily at business customers, and are as comprehensive as possible, ranging from basic telephones to datel services and from switchboards to radiopaging. Working within the constraints of the confined width of a railway coach, good design and sensible product siting has created an illusion of space that has to be seen to be believed. But even the enthusiasm and facilities of British Telecom staff were somewhat stretched one day in Llandudno, when some 2,740 visitors passed through the train.

Last year, more than 25,000 visitors climbed aboard the Buzby Special and ordered well over £150,000 worth of equipment and services. With the value of this year's orders confidently expected to exceed this, it looks as if the train is indeed on the right lines, and given a continued green light, will speed to even greater successes in the future.

Mr D. C. Francis is a senior sales superintendent in the Residential and Customer Services Department of Marketing Executive and is part of the team responsible for national exhibition and display policy.

British Telecom Journal, Autumn 1980

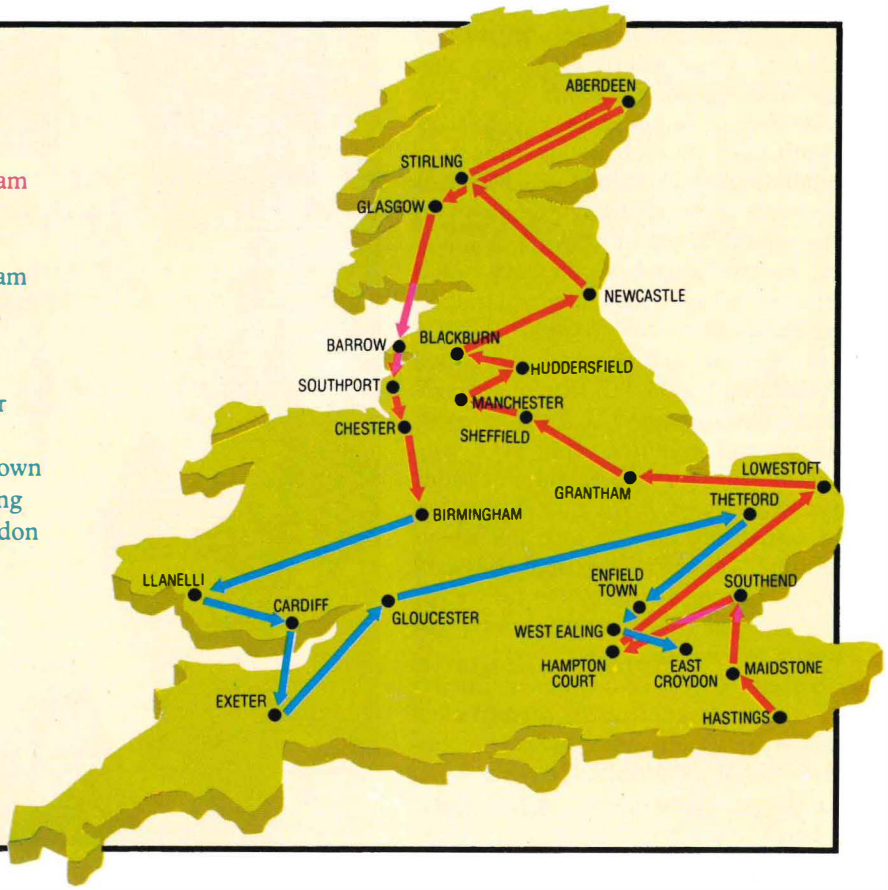
The Buzby Special's 1980 itinerary

JUNE

M2	Hastings
T3	Maidstone
W4	Maidstone
T5	Southend
F6	Hampton Ct.
S7	Hampton Ct.
S8	Hampton Ct.
M9	Lowestoft
T10	Grantham
W11	Grantham
T12	Sheffield
F13	Manchester
S14	Manchester
M16	Huddersfield
T17	Blackburn
W18	Newcastle
T19	Stirling
F20	Aberdeen
M23	Glasgow
T24	Glasgow
W25	Barrow
T26	Southport
F27	Chester
M30	Birmingham

JULY

T1	Birmingham
W2	Llanelli
T3	Cardiff
F4	Exeter
M7	Gloucester
T8	Thetford
W9	Enfield Town
T10	West Ealing
F11	East Croydon



System X

‘I am proud, on behalf of everyone concerned with the project, to be able to tell you that this exchange has been an all-British team effort right the way through, from the drawing board to the completed product. It has been achieved by a group of major British organisations pulling together in a project of unprecedented complexity in the history of British telecommunications’

— Mr Peter Benton

Best in British achievement

Mr Peter Benton, managing director, British Telecom, with a circuit board at Britain's first System X exchange at Baynard House.

Britain's first System X telephone exchange – the modern all-electronic design for the 1980s and beyond – was inaugurated in London in September by British Telecom Managing Director Peter Benton. It represents one of the major components of the Business's forthcoming modernisation programme.

Located at Baynard House in the City on a site where, 400 years ago, the first Queen Elizabeth was entertained to a banquet by the Earl of Pembroke, the exchange is a junction tandem unit, switching telephone calls between some 40 local exchanges in the capital. It began working in July – six months ahead of schedule – and since then has switched several million calls.

Mr Benton said the exchange stood for all that was best in British achievement. It symbolised British research, design and manufacturing skills, the cream of British communications technology and British determination to deliver not only on time but ahead of time. It also represented the stepping stone to a whole new future for the British telecommunications industry as a whole.

System X is a co-ordinated 'family' of processor-controlled digital electronic telephone exchanges ranging from small local units for rural areas to large trunk and international centres handling thousands of calls

Baynard House, an important new British Telecom landmark in the City of London.

simultaneously. It is the heart of a new generation of integrated telecommunications equipment capable of providing a whole new range of services and carrying the nation's telephone network into the 21st century.

Partners in the £150 million System X development are British Telecom, the General Electric Company, Plessey, and Standard Telephones and Cables. Overseas promotion of System X is being carried out by British Telecommunications Systems Ltd, a company formed by representation from these four organisations.

Every exchange in the System X family can be built up from basic "building blocks" or modules. This modular technique allows exchanges to expand in harmony with the growth of the number of customers they serve, or the calls they carry. It also allows the system to cater for advances in technology without major redesign.

Already a major extension of this first exchange is under way at Baynard House to form part of the permanent digital switching network in London. The unit is also the first step in a major programme to modernise the nation's main network. The first System X trunk exchange in this programme is due to come into service next year at Cambridge as well as a local exchange coming into service at Woodbridge, Suffolk.

This will pave the way for a new digital 'grid' based on the large trunk exchange in the System X family, that will link the main population centres of the country before the end of the decade. By the mid-1980s, a further 30 centres will have main network trunk exchanges.

In conjunction with local and tandem System X exchanges at these centres, this new grid will become a multi-purpose digital communications network bringing the benefits and facilities of System X to the nation's business community at the earliest possible opportunity. It will enable British Telecom to provide a comprehensive, economic and flexible range of voice, data and visual services.

Baynard House itself will play a key role in this development. It will be fitted out with an eventual £100 million of modern telecommunications equipment, including further exchanges in the System X family.

British Telecom Journal, Autumn 1980

The further 30 centres to have System X main network trunk exchanges by the mid 80s are Aylesbury, Belfast, Birmingham, Brighton, Bristol, Cardiff, Coventry, Edinburgh, Glasgow, Guildford, Ipswich, Leeds, Leicester, Liverpool, London, Luton, Maidstone, Manchester, Middlesbrough, Newcastle-upon-Tyne, Nottingham, Oxford, Portsmouth, Reading, Sheffield, Slough, Southampton, Southend-on-Sea, Stoke-on-Trent and Wigan.

A glimpse into the future

Optical fibres, integrated circuits, slow-scan television, lasers, digital transmission equipment . . . these together with a host of other exciting techniques developed to carry Britain's telecommunications system into the 21st Century went on public display at Martlesham in September when British Telecom Research Laboratories held their first Open Week.

About 1,400 guests from the Civil Service, industry, users, university and research organisations attended along with many senior staff from British Telecom. Two complete days were set aside to show press and broadcasting representatives around and on the final day more than 9,000 staff, families and friends took part in an informal visit, including shows by clubs and societies.

The increased tempo and complexity of modern research and development is perhaps best illustrated by the fact that when Research Department last threw open its doors at Dollis Hill in 1966 it was possible in a day to see most, if not all, of the laboratories. At Martlesham, the mass of equipment, both in conventional laboratories, and in special-purpose accommodation makes this impossible. A 'shop window' approach had to be adopted, therefore, and 19 exhibits were mounted to give a representative illustration of work in hand. These were positioned in convenient laboratory areas mostly in or close to the main laboratory block.

In his introduction to the guests Mr Charles May, Director of Research, referred to four significant developments that had taken place in the short time that the laboratories had been at Martlesham:

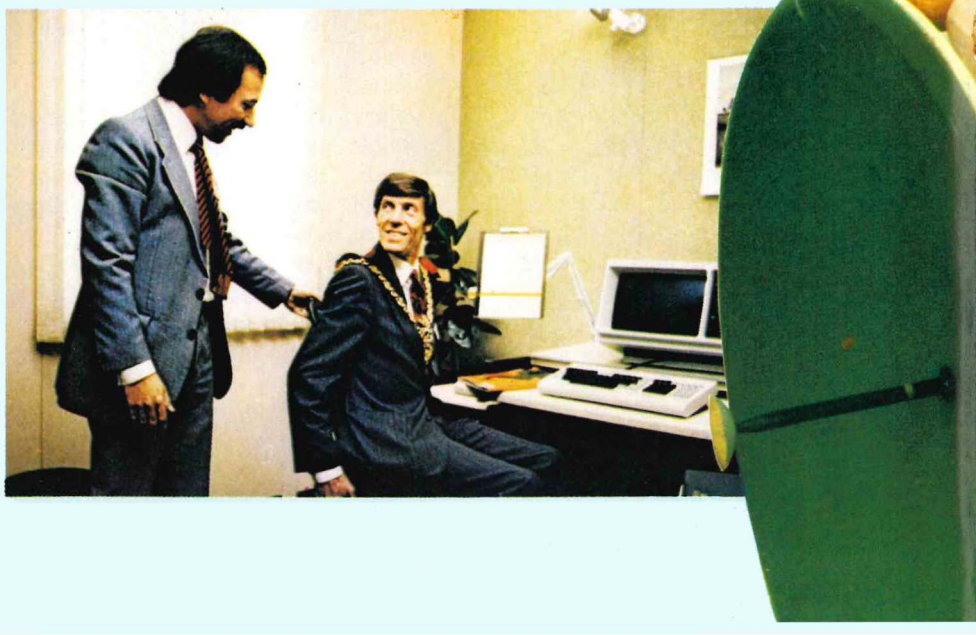
* Prestel – the world's first viewdata service.
* The 'double crucible' method of producing optical fibres.
* The most reliable transistors in the world, used for submarine cables.
* Voice guidance systems to help customers use the new facilities to be provided by introduction of System X.

Overall, the work undertaken at Martlesham can be conveniently divided into three categories:

* Applied research in materials and technology directed towards new improved and more flexible systems for the future;
* Work to improve the basic transmission network;
* Work towards the services and facilities provided for both business and domestic customers.

Integrated circuitry – the mighty microchip – is the technology on which the services and equipment of

The 'office of the future' is demonstrated to the Mayor of Ipswich by Human Factors head of group Ray Bell.



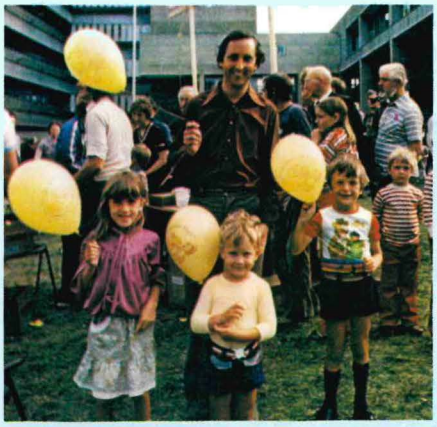
the future will depend and these may be designed with the help of computers in the laboratories. Once proved they can be carried directly into production using the same design masks and technology, thus avoiding lengthy development delays.

Until recently, working computer aided design (CAD) systems have been of American origin, but a technique called Polygon, which incorporates two-screen layout using colour displays has now been developed at the Research Laboratories, and was perhaps one of the most interesting things demonstrated.

Conventional cable systems still represent a large existing investment and will be converted, where appropriate, to digital working. A range of new methods to test cables well beyond their originally designed frequency ranges was on display.

Existing radio-relay routes need similar conversion, complicated by the need to restrict bandwidth usage, and techniques for achieving greater telephone capacity than existing FM-FDM links have been proposed. These are to be investigated by extensive field trials. Studies and experiments to assist frequency sharing between satellites and terrestrial radio, and to control interference in radio networks were also shown.

Optical fibre exhibits concentrated on second generation 'longwave' systems, operating at 1.3 to 1.6 micrometres, intended for long inter-city and submarine links. Their great advantage will be their increased repeater spacings which can be as far apart as 100 km.



A festive feature of the Open Week was 'family day' when more than 9,000 friends, relatives and guests were invited to see the work of the Research Laboratories.

Development of new under-sea optical fibre cable systems was also illustrated, and to complete the work on transmission, some interesting and advanced work on the detection of buried plant was demonstrated. On the switching side, the System X test facilities at Martlesham were thrown open and also exhibited in some detail were the voice coders using large scale integration.

A reflection of British Telecom's new competitive image resulted in a wide selection of exhibits concerned with new services and facilities for the customer. These ranged from examples of the need for human factor considerations when new services or facilities are introduced to guidance systems for use with System X exchanges. New ways of employing television technology, slow-scan surveillance, information retrieval, and various forms of conferencing using digital processing to reduce the transmission rates required were also on display. Also highlighted was the new Orator audio-conferencing system alongside a laboratory development for loudspeaking telephones, incorporating echo cancellers to reduce voice switching.

Carved above the main entrance at the old Dollis Hill centre was the motto 'Research is the door to tomorrow'. That still remains true today. The door is open, and every effort is being made at Martlesham to ensure that new technologies and products come through that door as quickly as possible to serve a growing number of customers.

Some of the many projects currently being undertaken at Martlesham.

Business grows with telex

P Corbishley and P G Hunt

Development of digital switching techniques in the UK's 50-year-old telex service is ensuring that the system will meet the needs of today's modern business community.

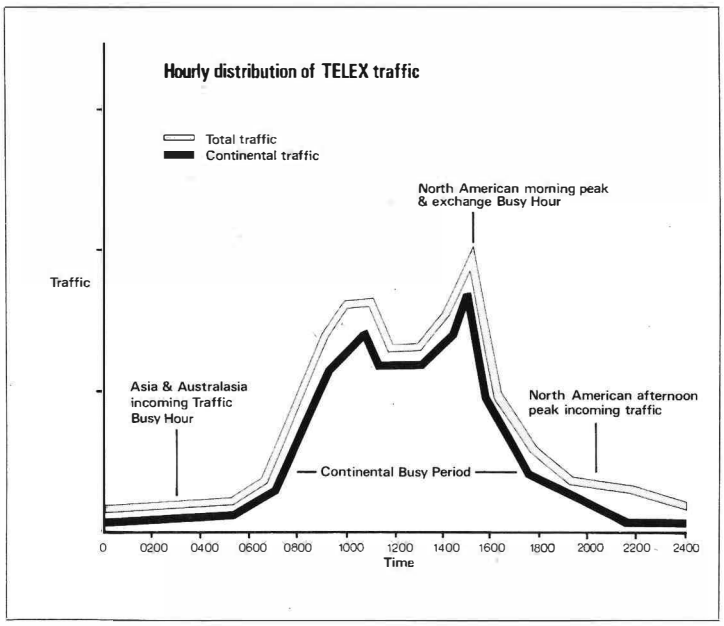
It has become a fact of life during the last 10 years that to survive, the small firm, as well as the multi-national corporation, must market its wares globally. This has resulted in a secure written communication form which can provide evidence of delivery. Telex offers this service, and in recent years has not only become part of the language but its terminals are now a vital piece of office furniture.

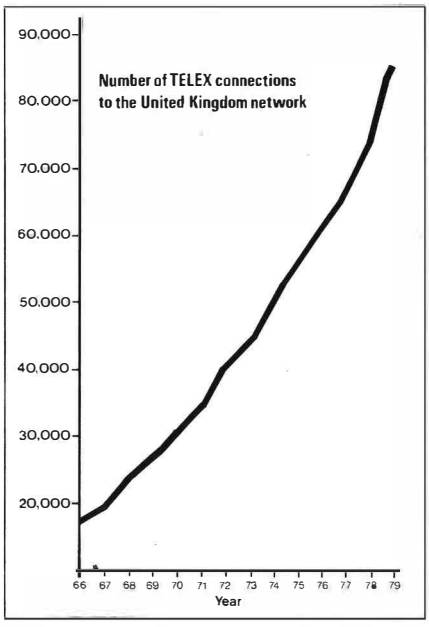
The Post Office first offered a public switched telegraph service under the name of 'telex' in 1932. Because there were so few telex users at that time it was decided to route telex traffic over the established telephone network. This can be compared closely with the present-day datel services used for the transmission of data over telephony circuits.

As the telephone network became larger and more automated, it became less economical to maintain all telephony trunk plant to the standard required for the small amount of telex traffic. As a result, many routings became unsuitable for telex and the network concept for the service was soon in danger. In 1947, a special working party was established to resolve these problems and its findings led to the establishment of a dedicated telex switching and transmission network in the early 1950s. At first, the service used manual switchboards but by 1968, the service became fully automatic with a total of about 14,000 customers.

Today, there are more than 80,000 telex terminals with access to more than one million users in 130 countries throughout the world. The growth pattern is reflected worldwide and is synonymous with the expansion of international commerce, illustrating its value to business.

Telex offers to customers a service which can transmit and receive printed messages, with a copy of the transmitted text being retained by the sender. But the addressee need not be present during the receipt of a message since it will be reproduced auto-





matically on the teleprinter although customers can still directly converse with their distant correspondents.

Each terminal is fitted with a mechanism that contains the identity of the customer. This is known as the 'answer back code' and for British Telecom terminals, consists of the customer's number followed by the telex title. The format of the 'answer back code' provides a means of quickly identifying the called station to verify that the call has been correctly routed. By requesting the 'answer back code' during or at the end of a call, the originator can be confident that the connection has been maintained.

The teleprinter has the four-row keyboard layout of a typewriter and transmits the International Telegraph Alphabet Number 2 (ITA 2) at a maximum rate of 400 characters per minute. Its similarity to the typewriter permits any competent typist to operate a telex machine.

For calls to inter-continental destinations, the customer first gains access to the international billing equipment by a dialled code, then enters the required number on the teleprinter keyboard. All other destinations are obtained by simply using the dial. Direct access to most overseas telex terminals can be obtained in this way with 98 per cent of calls being connected automatically. European traffic accounts for a high proportion of calls switched by gateway exchanges in the UK and since European office hours coincide with our own, most traffic is concentrated between 9 am and 6 pm.

The British Telecom network forms a national linked numbering plan with zone exchanges situated in London, Birmingham, Bristol, Glasgow, Leeds and Manchester. These exchanges are fully interconnected as a fundamental requirement of the direct selection routing principle and are an essential feature of the national transmission plan. As well as this backbone, network traffic volumes justify direct trunks between the London gateway exchanges and each of the national area exchanges.

International links were first forged between nations, their dominions and their trading partners. Consequently,

Now in common use, the teleprinter 23A forms a vital part of the modern office.

these commercial centres have become the focal points of telex. Many of the routes radiating from Great Britain were established to link the Commonwealth countries, and still remain, making London a major telex switching centre.

In the early 1970s the advent of low-cost computers and data storage was beginning to have an impact on switching methods. Modern telex exchanges using stored program control (SPC) techniques were being developed and in some cases introduced into service.

Low-cost computers and data storage systems have brought with them a revolution in switching techniques.

Technical officer O'Neil Bartley monitors a suspected faulty line terminator card at the St Botolph's stored program control gateway telex exchange. In the foreground, an unmanned teleprinter checks traffic patterns.

Just some of the facilities now possible include:

★ Centralised data storage and processing of exchange operating statistics and diagnostics with rapid access.

★ Speed, code and protocol conversions to permit interworking between signalling types and different services.

★ Provision of private user groups for customers such as public utilities, computer users, and public telegraph services.

★ Flexibility by software command of terminator definitions.

★ Provision of customer facilities such as short code selection for regularly-used connections and auto call and recall for connections failing due to a called customer being occupied.

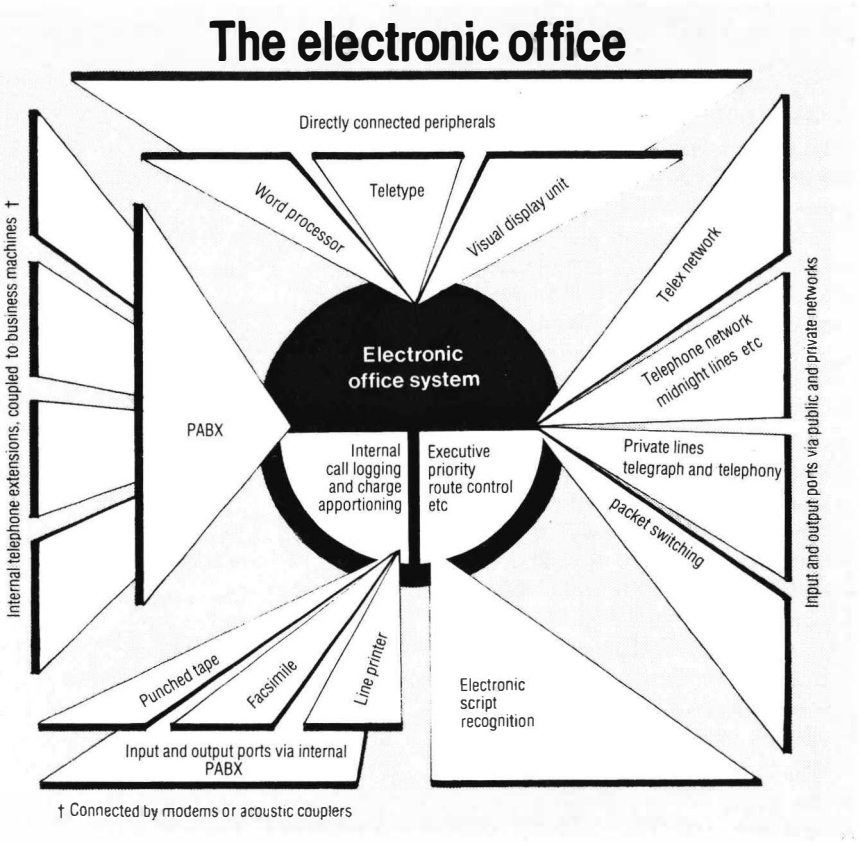
★ Message store and forward.

The automatic store and forward service will not only be used by traditional telex users, but by the automatic business systems which may be permanently connected to the network. The facility allows a customer to send an individual message to one or several terminals. Delivery instructions are entered as either individual addresses or as codes identifying a list of pre-recorded addresses. And customers will be able to state the time of day for which delivery is required.

But perhaps the greatest advantage of the service is its ability to make multiple delivery attempts to each address. Because of the high volume of telex traffic on international routes during business hours, customers frequently encounter service signals, indicating network plant shortages or the occupancy of distant terminals. If the store and forward unit identifies such problems it can carry out a series of re-attempts automatically or inhibit message retransmission until route congestion subsides.

The ability to switch telex messages will extend the electronic mail-box principle to every user and customers with traditional terminals will no longer have the tedious task of making multiple call attempts.

Automatic office systems are already using 'messages' switches to interwork communicating word-processors with telex and other private telegraph systems. The high cost of SPC exchanges capable of providing such facilities and the essential concentration of trunk groups to interconnect switching points within the network, means that there are certain minimum size constraints for exchange designs.



Some administrations have designed telex networks combining concentrators and parent exchanges as one way of overcoming this problem. British Telecom has not adopted this policy as the topography of the British Isles is such that economical traffic densities are possible without intolerably long customer lines. But there are exceptions – two SPC time division multiplex (TDM) concentrators belonging to the States of Guernsey and States of Jersey Telecommunications Boards have been connected to the mainland telex network.

Although most British telex exchanges are of the Strowger type, a large proportion of international traffic is carried by an SPC TDM gateway exchange at St Botolph's House in London. On order is a second SPC gateway and 9 inland SPC exchanges to replace more than 20 of the 52 existing Strowger types. The microprocessor revolution has also brought about significant changes in terminal equipment. The latest generation of teleprinters incorporate electronic storage systems for holding messages and allowing their correction during assembly before transmission at automatic speeds.

Some terminals have visual display units (VDUs) as well as hard copy facilities to help with message preparation. Internal directories within the terminal's memory which can be addressed for automatic message transmission to single or multiple destinations with minimal operator intervention are also now possible. Some machines even allow messages held in store to be accessed using a unique code by an incoming caller, thus providing an electronic mail box retrieval system within a terminal.

Talks on using System X to encompass non-speech services continue to make progress and it would be reasonable to assume that the telex service in this country could eventually be parented on a new digital network, so closing an evolutionary circle. Internationally, such an integration will take many years to evolve, and by then, the need for the existing 50 baud service may well have been eclipsed.

It is evident that telex is in greater demand than was ever envisaged by its pioneers. Today, almost 50 years after its inception, it remains the only fully interconnected international non-speech service.

Mr P. Corbishley and **Mr P. G. Hunt** are both executive engineers in the Network Executive's Exchange Systems Division. They are currently on secondment to Plessey Controls at Poole in Dorset.

British Telecom Journal, Autumn 1980

Progress makes its mark

This, the third article in our series on foreign administrations, looks at the Federal Republic of Germany, a country whose system is strikingly similar to that of the UK.

Twice in 25 years, the German people have seen their money and securities devalued to the point of worthlessness. Today, the Federal Republic of Germany is Western Europe's strongest economic power and its per capita gross national product now exceeds that of the United States. Its telephone system has recently overtaken the UK's to become the largest in Europe and the third largest in the world.

The Republic is similar in size and population to the UK and is composed of 11 autonomous states (Länder). The Deutsche Bundespost, unlike British Telecom, is a Federal Administration (Civil Service) department and is solely authorised to establish and operate both domestic and international telecommunications, including the use of radio frequencies. Also it provides all postal services, conducts banking and savings operations and transports passengers and goods.

Deutsche Bundespost (DBP) operates at three organisational levels. At national level is the Federal Ministry of Postal and Telecommunications Affairs – the regulatory and policy-making body. The second level comprises 18 regional directorates of Posts and Telecommunications responsible for implementing and administering policies, two engineering centres and two engineering colleges as well as the Social Welfare Office.

Only at local level, in complete contrast to the UK situation, are DBP's Posts and Telecommunications services separated. Here, 107 telecommunications offices form the first link in the chain between the Bundespost and its customers. Each office, on average, is just over half the area and caters for just over half the number of connections of its 61 UK counterparts – the telephone area offices.

Unlike British Telecom, the Bundespost does not itself carry out major research and development programmes although through the Telecommunications Engineering Centre (FTZ) sets specifications and tests and approves equipment and components.

Financial arrangements for the Bundespost are very different from British Telecom and indeed other European PTTs. Although part of the Federal Administration, the Bundespost is not allowed by law to obtain Government subsidies. The Federal fund devoted to PTT services comes from their operation and is kept separate

The telecommunications tower in Frankfurt rises to more than 330 metres above the city.

from other Federal Government funds. Also in law, loans may only be used to procure fixed assets, and can only be in the form of debentures or bonds, treasury bonds, bills payable and loans against borrowers' notes. Generally, telecommunications profits more than cover postal deficits, except in the early 1970s when the DBP as a whole ran at a loss.

Although the administrations of both the UK and the Federal Republic have a similar system size, and telephone penetration, the telecommunications section of the Bundespost appears to employ considerably fewer staff. But British Telecom operates in different ways to the DBP which, for example, provides only a minimal operator service, contracts out much of its provision of service work and maintenance of customer-owned PBXs and does not conduct its own major research and development programmes which are given to universities and industry. If adjustments of staff numbers are made to reduce each administration to common work areas, then staff numbers in relation to total stations is about the same for both administrations.

It is interesting to note that Bundespost officials do not have the right to strike and appear not particularly concerned about the situation. Staff are represented by councils and there are three trade unions to which DBP staff may belong. About 80 per cent of staff are union members.

Two different career paths may be followed in the telecommunications section of the Bundespost – the telecommunications service and the telecommunications engineering service. The former are clerical and administrative positions, the latter of a technical and engineering nature. Promotion inside each is possible without examinations. Vacancies are advertised and selection is made on qualifications, performance and experience, although crossing hierarchies usually involves passing examinations and interviews. Most 'management' jobs are held by graduates.

By mid-1972, full automation was achieved by the Bundespost in the domestic network. Indeed, calls for operator help are now limited to exceptional cases and only then at a tariff rate at least twice as high as the highest day dialled charge. Equally, very few operator facility calls are available and directory enquiry calls are chargeable. This is unlike the situation in British Telecom where there is a comprehensive operator service, representing a basic philosophical difference concerning the role of an operator service in a fully automated system. All subscribers have access to international dialling (IDD) and about 98 per cent of foreign calls are direct dialled.

The latest call offices are constructed of synthetic material.

Microfiche is being used at directory enquiry positions.

The Bundespost have almost exclusively an electromechanical switching system (mostly rotary) with no crossbar although 0.2 per cent of corrections are on stored program control (SPC) electronic exchanges. Comparable UK figures are 90 per cent electro-mechanical (75 per cent Strowger, 15 per cent crossbar) and 10 per cent electronic. In the UK, the first System X SPC tandem exchange was brought into service earlier this year, and the first System X local exchange is expected at the turn of the year. For both countries, it is anticipated that by 1985 only SPC exchanges will be ordered.

With one public call office to every 400 people as opposed to one to every 700 in the UK, the Federal Republic has nearly twice as many, although a quarter of the Bundespost's call offices are in public places to which 24 hour access is not available. Customers are billed each month with two months to pay before cut-off, although outgoing calls are barred after one month. About 75 per cent of customers pay by direct debit.

High Bundespost telecommunications profits in recent years have been

accompanied by several tariff reductions and changes in tariff structure, including the introduction of local call timing. Even so, pricing a UK typical telephone bill at the tariff levels applying in other countries shows that German tariffs are among the most expensive in Europe and dearer than in the UK. Also no distinction is made between business and residential rentals. Special schemes exist for pensioners and welfare cases.

Generally, the quality of service is similar to that given by British Telecom, although fault incidence and fault clearance rates are significantly better. As in the UK, it is expected that there will be one telephone per household by the mid to late 1980s.

Telegraph traffic in the Republic is handled on the automatic telex network. Both British Telecom and the Bundespost each currently handle about eight million originating messages a year and the DBP expect this annual traffic to stabilise from 1985 at around seven million.

The Federal Republic has the largest self-contained telex network in the world. Despite its size, the Deutsche Bundespost point to higher densities in such countries as Monaco and Switzerland and believe there is still room for expansion. But unlike the UK, they do not train customers' telex operators. And by the end of this year, their telex service will be fully absorbed into the new circuit-switched integrated data network (IDN). Teletex, a standardised national service to allow work processor interconnection at 2400 bit/s over the IDN, is expected to be introduced in the mid-1980s and may cause a substantial decline in 'conventional' telex traffic.

Excluding data carried by the telephone system, there are currently three types of data service offered by the DBP – that carried by the telex network (low speed), that by the Datex network (up to 48 kbit/s) and that carried over leased lines. By the end of this year, the DBP will have most of their data communications on IDN although it is interesting to note the existence of a separate Datex network. During next year, a packet switching service with speeds up to 48 kbit/s is planned for introduction. The DBP is also active in a number of international data networks. Subscribers have access to the Tymnet and Telenet services in North America and also to Euronet – a database network linking European countries, including the UK.

The administration was one of the first to operate the new Telefax service enabling documents to be transmitted via the public telephone network. Facsimile machines can be leased with full maintenance provided.

Viewdata (Fildschirmtext) – the software for which was purchased from British Telecom – is likely to be introduced over the public switched network in 1983, while Videotext, the television service, also currently on field trial, is expected the following year. Both services are suffering from political pressures – Fildschirmtext, because of concern over how to keep control of the information displayed, and Videotext, because newspaper proprietors wish to run the service to absorb expected redundancies caused by a resultant reduction in circulation. Equivalent services – Prestel, Ceefax and Oracle – are already available in the United Kingdom.

Trials of electronic mail have already begun and a system is operating between Frankfurt and Washington/New York. Customers simply take a sheet of A4-sized paper to the local main Post Office and in six seconds, the information is with the distant main Post Office, where it is enveloped and delivered. A national electronic mail system (Telebrief) is expected to be introduced within the next year and is seen as one good reason for keeping Posts and Telecommunications combined. In the UK, an electronic mail system (Intelpost) was established between London and Toronto in mid-1980 and plans are in hand to extend the service both nationally and to other countries.

Other services with which the DBP is involved include provision of radio and television transmission and broadcasting equipment radio frequency allocation, radiopaging, citizens' band (27 MHz) radio – introduced in 1976 – and cable television.

But without doubt, the most striking feature to emerge from any comparison of telecommunications systems in the Federal Republic and the UK is the extent of similarity between the two – in size of country, of population and of telephone system, and in the proportion of different equipment types within the network. Results, too, are very similar except where practices differ greatly.

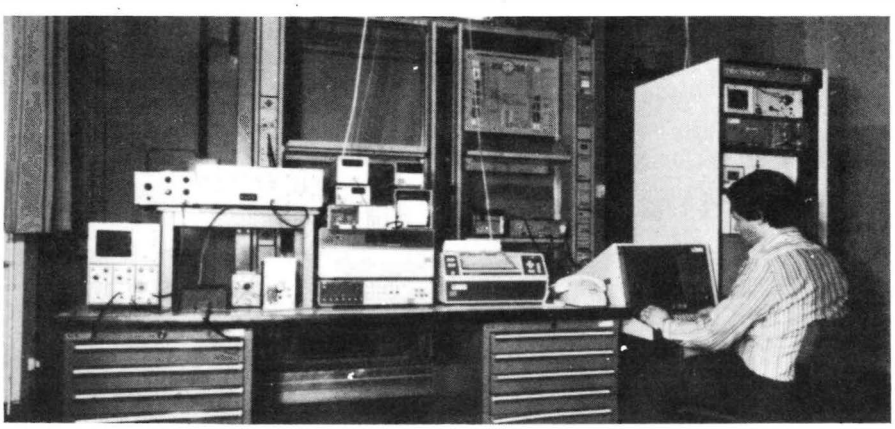
The Federal Government and Bundespost are together striving for independent financial viability for both Posts and Telecommunications. The general feeling is that this will not be any more easily achieved by separating out Posts, nor by allowing private competition and no split from the Government is foreseen. Here, at least, it can be said that the approach of the Federal Republic does differ from UK experiences of the last decade.

In the next issue of British Telecom Journal, the authors will take a look at telecommunications in Spain.

The authors – **Mr O. P. Sellars, Mr J. J. E. Swaffield, Mr J. F. L. Stubbs** and **Mr S. Lunt** – are all members of the international comparisons group in the Service and Performance Department at THQ. They acknowledge the help of Peter Quander of the Deutsche Bundespost.

British Telecom Journal, Autumn 1980

This terminal tests optical fibre transmission characteristics.



Profit down but Business buoyant

INCOME

IN

£3558·9m

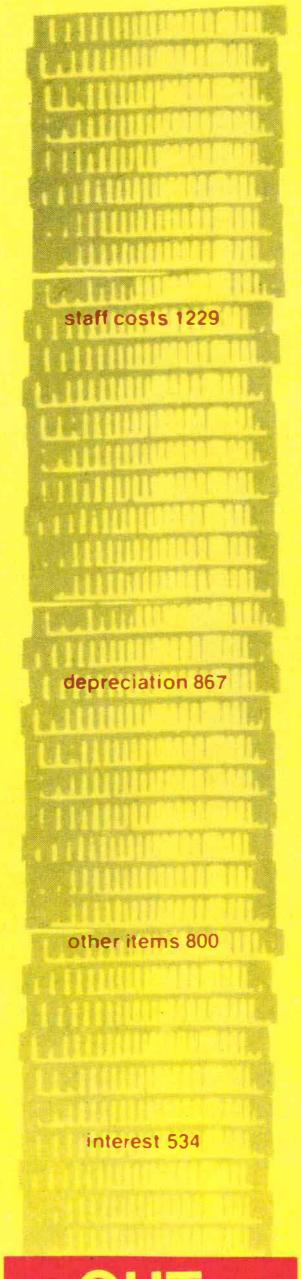
Despite a series of problems which had resulted in an adverse effect on the quality of service to customers, business had remained buoyant and British Telecom had recorded an impressive array of achievements. That, in summary, was the year 1979/1980 which ended with a profit of £236 million including exceptional gains from property sales and discount for early repayment of loans. Profit for the Post Office Corporation as a whole was £297 million. Although the telecommunications profit level was below the previous year's £347 million total, the Business had continued to meet government agreed objectives.

But former Chairman Sir William Barlow commenting on the Report and Accounts said that escalation in costs which had led to the lower profit level was a disturbing feature. "We must continue to hold our costs and market our services vigorously if we are to reverse recent trends", he said.

On a brighter note Sir William said that during the year British Telecom had installed two million telephone lines, brought forward the installation of the first System X exchange to July, successfully launched Prestel and laid the foundation of a massive service improvement campaign. While some problems on quality of service were due to industrial action, a large proportion of those in providing service were caused either by plant shortage or the continued use of out-of-date equipment. "This is the legacy of under-investment over a number of years under the policies of various governments", said Sir William.

"In recent years the whole of our capital spending has been financed by cash generated by the business but, even with our present rate of profits, it will not be possible to remain self-financing during the next few years and some borrowing will be necessary. He added: "It is quite clear that failure to maintain the investment programme will inevitably affect provision and quality of service as well as losing opportunities for improving productivity and lowering our costs."

EXPENDITURE



OUT

£3429·8m

The year in figures

A review of British Telecom progress in the year 1979/80

	1979-80 Result	% Growth over 1978-79	1978-79 Result	% Growth over 1977-78
TELEPHONE SERVICE				
Size of System				
Total working connections	17 592 000	7.5	16 359 000	8.5
Total working stations	26 737 000	6.9	25 020 000	7.6
Call office connections	77 000	0.0	77 000	0.0
Shared service connections	1 509 000	−3.0	1 555 000	−1.5
Growth of System				
Net demand for connections	1 901 000	−13.4	2 195 000	16.7
Net supply of connections	1 934 000	−0.5	1 944 000	10.9
Penetration				
Stations per 1000 population	477	7.0	446	7.5
Traffic				
Inland effective calls: trunk	3 257 000 000	7.8	3 022 000 000	11.8
Inland effective calls: local	16 600 000 000	5.7	15 700 000 000*	7.5
Continental: outward calls	75.3	19.5	63.0	19.6
Inter-continental: outward calls	31.0	29.7	23.9	34.2
Telephone usage				
Calls per connection	1175	−1.8	1197*	0.0
Local exchanges				
Total	6260		6231	
Strowger	4542		4730*	
Crossbar	514		455*	
Mixed Strowger/Crossbar	45		56*	
Electronic	1137		976*	
Mixed Strowger/Electronic	22		14*	

TELEX SERVICE				
Size of System				
Total working lines	85 800	7.9	79 500*	11.0
Traffic				
Inland calls	91 009 000	9.4	83 190 000	11.0
External outward numbers of minutes	210 278 000	13.5	185 285 000*	16.7*

TELEGRAPH SERVICE				
Telegrams				
Inland	3 300 000	0.6	3 281 000	2.5
External: UK originating	4 014 000	−8.0	4 363 000*	−5.0*
UK terminating	3 424 000	−7.4	3 697 000*	−7.0*
UK transit	3 414 000	−12.1	3 886 000*	−7.2*

TELECOM STAFF				
(Part timers count as half)				
Telecom HQ (inc Research, Development and Procurement)	23 697	**	24 477	2.2
Regional HQ	15 264	**	12 951	0.6
Telephone Areas	201 095	2.6	196 019	2.3
Total	240 056	2.8	233 447	2.2

*Amended figures

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

On course with the microprocessor

D L Gaunt

"The mighty micro", "The silicon revolution", "Micro chips with everything." These are just a few of the evocative phrases used by the media to describe the microprocessor.

But exciting though the advance of microelectronics is, there are problems in keeping up to date. To help overcome this, a number of specialised courses are being provided by British Telecom, and one group providing such training is the Technology Executive's Personnel Division based at the British Telecom Research Laboratories at Martlesham.

In existence for just over a year, the group was set up to alleviate the enormous demand for places at the Post Office College of Engineering Studies, Horwood House, where microprocessor courses have been provided for the last three years.

The present course – which has already undergone several updates and one major revision – is essentially a practical one. Only a third of the time is spent in formal lecturing, the rest being divided into set exercises, self-tuition exercises and project work. Any pattern of instruction should have objectives, and this course is no exception. By the end of the course a student should be able to decide if a microprocessor is needed for a particular application and if so, which type; write and correct simple programs; connect together a basic microprocessor system, including suitable peripheral devices, and critically evaluate that system.

After an introductory lecture to get everybody 'thinking microprocessors', each student is given a commercially-available microcomputer specially designed for teaching purposes. In this way, real practical experience can begin as soon as possible. This particular microcomputer was chosen because it enables each operation to be observed one step at a time, with all parts of the system connected to light-emitting diodes (LEDs).

By observing these LEDs and deciphering their meaning students can get a detailed understanding of complex operations. A logical sequence of lectures and set exercises over the next three days gives an insight into the workings of a microprocessor and also of some of the other integrated circuits connected to it.

Having gained an appreciation of the microcomputer – considered here as the central processing unit (microprocessor) plus memory and peripheral chips – students are now introduced to the 'microprocessor systems support service (MSSS)', more prosaically called 'the stores micro'. This is a modular system that can be used for applications requiring only a single card, right up to those using all of the microprocessor's memory capability. The reason for the name 'stores micro' is that the cards are available in kit form from Research Department stores as standard items.

Design of MSSS cards is by the electronic design and development group at Martlesham who are constantly expanding the range of cards available. Figure 1 shows those that are provided or planned so far. Those cards used for the course are shown shaded. With such a flexible approach, great variation is possible, but the MSSSs used in training represent typical systems that could well be met in practice. Figure 2 (see page 28) shows a block diagram of the system.

The central processing unit (CPU) card contains just over 4,000 memory locations of programmable read only memory (PROM), and 1,000 of random access memory (RAM). The PROM is used to hold a monitor pro-

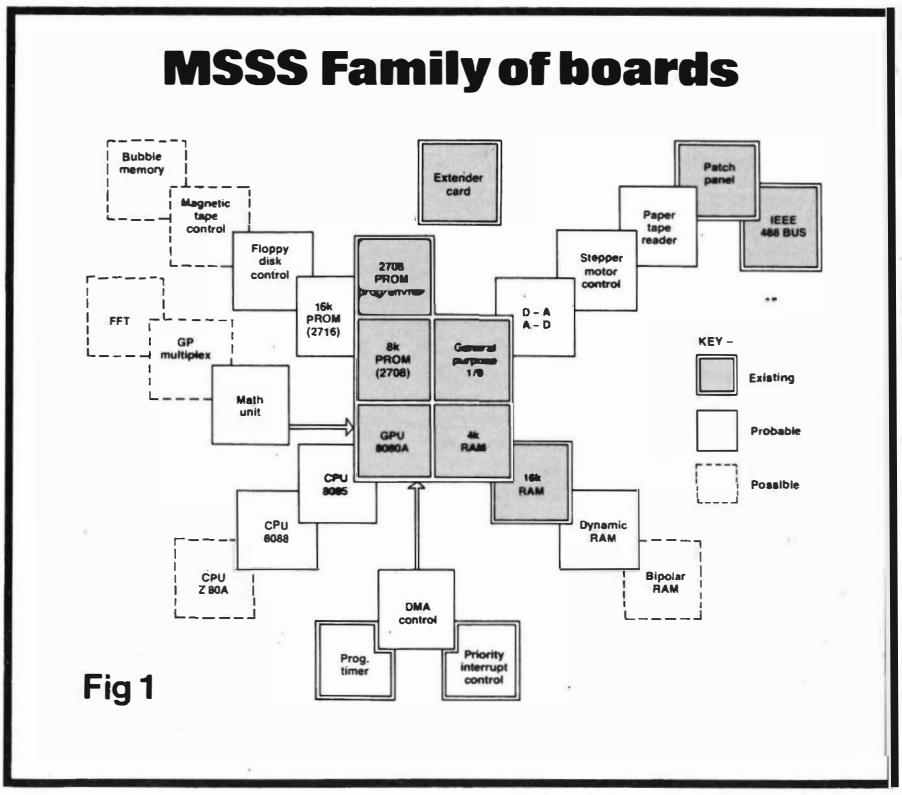


Fig 1

The microprocessor systems support service (MSSS) is one of the most important aspects of training. Here students use the MSSS to control a small model railway layout.

Soon after the training course begins, students are introduced to a commercially-available microprocessor specially designed for teaching purposes.

The complete microprocessor training system

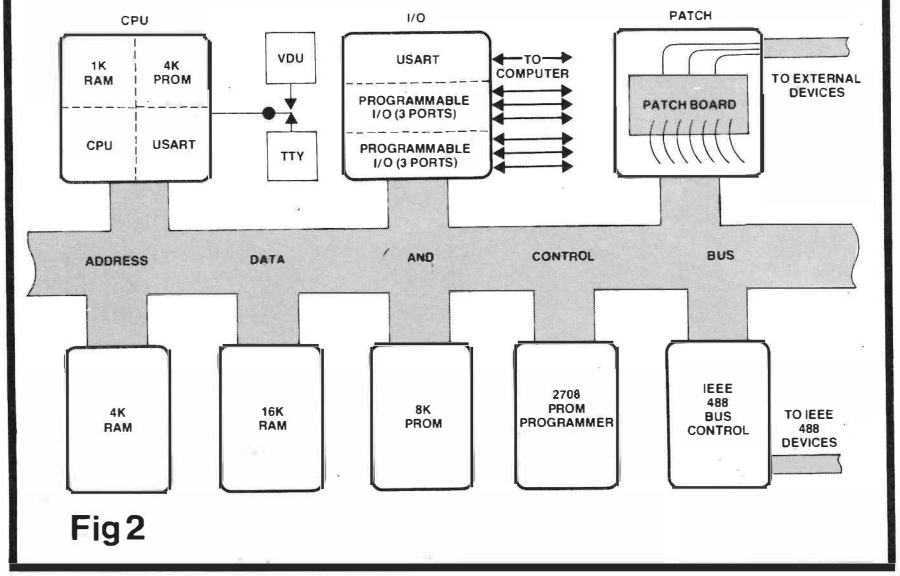


Fig 2

gram which is used to start the system, examine and change programs and data, and fault (de-bug) programs. The RAM is used by the monitor for temporary storage. Also on the card is the actual microprocessor (CPU) and a universal synchronous/asynchronous receiver transmitter (USART). The USART is used to communicate with serial devices such as a visual display unit or teletypewriter.

The 4K RAM card is used to hold programs that are being written and developed by the students, the 16K RAM card being used if an extra long program is written. When the student's program has been completed it can be transferred to PROM on the 8K PROM card, preventing it from being accidently erased. Additional 'library' routines and extended monitor facilities can also be included.

The PROM programmer card allows the transfer of programs from RAM to PROM. The type of PROM used is one that can be re-used many times, since a program can be erased by exposing the integrated circuit to ultra-violet light. This type of chip is therefore called a UV-erasable PROM. The general purpose input-output (I/O) card provides 50 input-output lines, 48 of which are grouped together to form six blocks of eight lines each. These blocks, or ports, can be programmed via the CPU card to function as either input or output lines. The remaining two lines are used as single serial input and output lines via a USART device.

The IEEE488 Bus card is a special interface card which allows communication with devices that use the American protocol number IEEE488. The extender card is used for maintenance and the patch card allows extra components to be patched into the system for interface and testing purposes.

Figure 2 shows that the USART in the I/O card goes 'to computer'. This is a medium-speed data line to a minicomputer belonging to Research Department's computer control of experiments group. This minicomputer contains programs that aid the user to develop his or her own programs. One such program is called an assembler. Its purpose is to allow short codes, which represent instructions – for example LDA might mean 'load accumulator' – to be entered. This is called the source program. The assembler converts the source program to the binary 1s and 0s required by the microprocessor. This is called the object program and contains the information which goes into memory.

Students now go through a series of self-tuition exercises which teach them how to use the MSSS and associated minicomputer, so that at the beginning of the second week they are able to construct and use small programs. They are now ready for the final stage of the course, the project.

This consists of a small 00 gauge model railway layout which the students, working in groups of three, must control using the MSSS. This is not as simple as it sounds. Train position is signalled by reed relays that are actuated when the train passes over them. Points are operated remotely by energising solenoids. So to achieve anything at all, the students must be able to input and output information via the I/O card at the correct time and in the correct sequence.

And lest it be thought that the use of a model train set is pure frivolity, the problems encountered are very real and serious. For example, the reed relays do not operate just once when the train passes over them; they can operate several times, sometimes when the train is nowhere near! Also when the train is running it generates electrical interference which can play havoc with an unprotected program. But writing a working program is only part of the project. Students are expected to produce good documentation of their work and give a convincing demonstration at the end. All these things are essential in producing an efficient and usable microprocessor-based product.

And the course does not stand alone. It is one of a series of related courses produced by mutual co-operation between Telecommunications Personnel Department at Horwood House, Data Processing Executive's terminal support group at Charles House and TE's Personnel Division at Martlesham, with Research Department providing back-up support. Personnel Department at Stone and International Executive at Leafield are also entering the microprocessor field and have been involved in discussions. Putting all these groups together, it may confidently be said that British Telecom training in microelectronics at least equals any other scheme offered in the United Kingdom.

Teaching microelectronics is very demanding, often exhausting, sometimes frustrating, but never boring work with immense job satisfaction. Anyone who feels that he or she has an aptitude for teaching but still wants to keep up with technology can, in this field, achieve those goals.

Mr D. L. Gaunt is a head of group in the Technology Executive's Personnel Division and is responsible for development and provision of electronic training within the Executive.

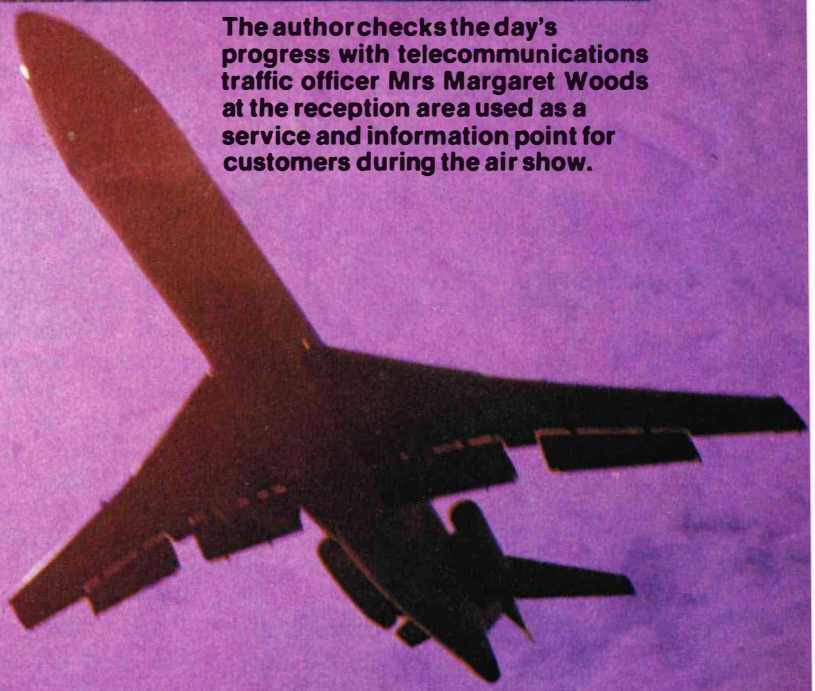
British Telecom Journal, Autumn 1980

FARNBOROUGH INTERNATIONAL 80

Top flight links at Farnborough

A E Luck

The author checks the day's progress with telecommunications traffic officer Mrs Margaret Woods at the reception area used as a service and information point for customers during the air show.



Picture a small country town. Imagine, every two years, this town to be built in five months, inhabited for two weeks and demolished in a month. Think of the problems in providing a communications system to cater for the needs of half a million visitors. Think of a system containing nearly 1,000 exchange lines and about 2,000 extensions. Envisage the value of such a town, which, in two weeks, helps earn for Britain hundreds of millions of pounds in exports. And finally, think of the problems facing the local telephone area office given just nine months' notice of the details of the ever-increasing telecommunications requirements.

The town . . . Farnborough International Airshow. The telephone area . . . Guildford, in Surrey.

The first of the post-war air shows was held at Radlett – Hertfordshire – in 1947. Then a yearly event, the show moved in the following year to Farnborough in Hampshire. Because the aircraft industry was adjusting to new peacetime conditions and levels of production, the first show was not large. Held in just two hangers, Post Office involvement was minimal. But by 1949, with many companies experimenting with the jet engine, the show mushroomed, and this time incorporated a large tented area. Each subsequent show has reflected a continuing growth, and there has been a corresponding increase in demand for

Airshow's telecommunications control centre is manned throughout the show. Here inspector Mick George points out a detail on the distribution diagram to senior technician Mick Read.

Like any other exchange, Airshow has its own main distribution frame. Technicians Ted Clifton (standing) and Trevor Dooner wire in another customer's line.

telecommunications services.

By the late 1960s, the show had established itself as a regular biennial event, and in 1974, Farnborough saw the first fully international airshow to be held in this country. Records show that even in 1955, about 200 direct exchange lines were needed – by 1980 this figure had reached 726. And even this figure excludes a wide variety of telex, private circuit, datel, Prestel and broadcasting services.

The site on which the show is held forms part of the Royal Aircraft Establishment. The organisers are given permission to use the RAE's runways and flying control facilities. Exhibiting companies hire space in two large tented areas – bigger in area than four large football pitches – while the smaller open-air display area covers some 10,000 square metres. There are, in addition, eight rows of chalets comprising 260 units ranged along a hillside overlooking the airfield. It is here, in these chalets, that thousands of visitors, many of them potential customers, are entertained as they watch aircraft put through their paces in the hope of clinching firm orders in this multi-million pound business.

Back in 1955, the Post Office installed a 10-position CB manual exchange, located in the old Farnborough exchange building, and capable of meeting the then anticipated growth. After each show, the equipment was mothballed until the next event. It was not long before the manual exchange had grown to 15 positions. Traffic continued to increase, and by 1970, full automatic facilities had to be provided for Airshow exhibitors and visitors by connecting exchange terminations over junction quality cables from nearby Aldershot group switching centre.

This is the only local unit with adequate switching capacity to handle the high level of traffic generated. But more recently, some of the lower calling rate lines from the Airshow have been connected to Farnborough exchange, a satellite exchange in the Aldershot linked numbering scheme. For routing and charging calls to and from the show, all connections, whether connected to Farnborough or Aldershot, form part of the hypothetical 'Airshow' exchange, for which there is even a special directory published for the benefit of exhibitors and distributed to directory enquiry centres throughout the country.

Planning and developing facilities for each forthcoming show must start as soon as the previous show closes its gates. All the planners can do at this stage is to use their forecasting skills based on intuition and a basic outline supplied by the organisers, the Society of British Aerospace Companies (SBAC) long before any details can be finalised. With just 18 months effective working time between shows, the problems of long-term planning are obvious.

Most of the ground covered by the tented areas and chalets has been tarmacadamed, and under this lies a complex and permanent distribution network, developed over the years and installed by Guildford Area staff. More than 3,000 pairs of wires, complete with main cable joints and distribution points lie dormant between shows, but ever prepared to burst into action. This network, as well as the incoming cables from the serving exchanges is terminated on a main distribution frame in one of the few permanent on-site buildings. Here also are housed the stores used for the exhibition and there is also a separate area for staff welfare accommodation.

Each new cable development must be completed by the end of March before the show opens. The following day contractors arrive to begin the massive task of erecting about 100 miles of the steel tubing needed to support the blue and white striped tent material. British Telecom installers follow closely on the heels of the contractors, picking up the cables from their underground hideaways, and extending them up the steel framework to form a blossoming overhead network, complete with strategically-placed distribution points.

With exhibitors renting areas within the huge tents varying from a tiny 15 square metres to an impressive 700 square metres, telecommunications staff must ensure that the telephone feeds are brought down at precisely the right point in each stand area. This work is controlled from a temporary installation office in the Airshow ground where engineers collect and work from a mass of site, tent, stand, and cable plans.

A month before opening, exhibition stand erectors begin to arrive, and begin building the stylish displays so familiar at all trade shows. Activity increases to fever pitch as each trade – carpet layers, electricians, carpenters, and by now, about 30 British Telecom engineers and technicians – contributes its skill at the right time. This year, all exchange lines – except for private branch exchanges – were

wired into jack sockets which allowed telephones to be delivered to the stand after all the work had been finished.

This simple but effective measure not only helped to control stores but reduced the chances of damage caused by contractors. One very popular item this year was the Premier Call Connect System, installed on a number of the larger stands. Lack of space on some of the exhibitors' displays led to the unusual step of siting some customers' private automatic branch exchanges – PABXs 5 and 7 – in centralised British Telecom accommodation with both extensions and exchange lines being served via the Airshow main frame. This meant that automatic PBX facilities could be provided for a customer, even though no stand accommodation was available at the time PABX installation should have started.

Of the 16 public call offices provided this year, six were of the new 'blue payphone' type and proved particularly popular with the many overseas visitors and others who needed to make international calls. The Area's Customer Service Division manned a specially-designed mobile unit which served as a centralised service and information point. On board the Portakabin Kabmobile was an 18-extension PBX providing service communications for on-site British Telecom installation and maintenance staff.

Faults were reported first to this unit, and then to the technicians who were ready to handle any emergency. Two telephones in the unit were available for visitors and as they were fitted with local meters, each call could be priced and paid for on the spot. Likewise, there were two attended telex machines which enabled visitors to send and receive messages.

Another unusual aspect of the Area's work arises from the presence of international companies. The SBAC includes a telecommunications order sheet in the brochure sent to exhibitors, and these begin to arrive on Sales Division desks about nine months before the event. It is not often that a sales clerical officer has to negotiate installation details with customers as far afield as Italy, Argentina or the USA! Later on, of course, similar needs switch to the Accounts Division which sends bills to customers all over the world.

No summary of Airshow telecommunications would be complete without mention of broadcasting facilities. Like all the other services, broadcasting requirements get more demanding each time and need the full-time attention of a local technical officer throughout the show. This year, 11 music quality lines and five television quality lines, each with its own associated control circuit, were occupied 'live' for about 30 broadcasting hours during the show period.

Guildford Area staff feel justly proud ique requirements every two years, and are aware that their efforts are making a positive contribution to one of the country's biggest revenue-earning industries. With talks already underway between British Telecom and Airshow organisers SBAC, staff at Guildford have no doubt that Airshow 82 will be the biggest and most demanding yet.

Mr A. E. Luck is Guildford Area deputy general manager and has special responsibility for the telecommunications requirements at the Farnborough Air Show.

British Telecom Journal, Autumn 1980

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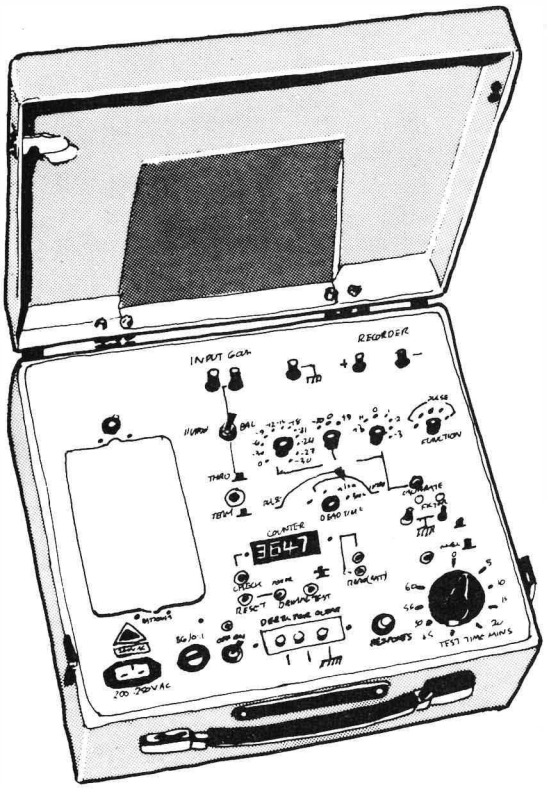

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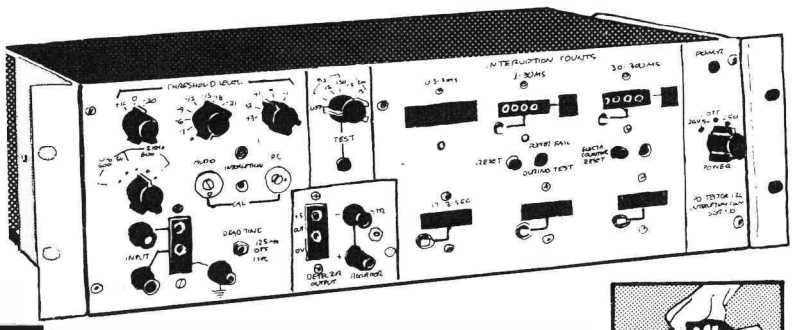

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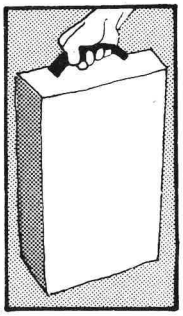

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MISCELLANY

Prestel sales boost

Britain's attack on the international viewdata market has been reinforced with the signing of a new three-year agreement between British Telecom and Aregon Group Limited, the Prestel-compatible viewdata specialists.

The deal will help to sell Prestel to overseas administrations, a field in which Britain leads. British Telecom will also be buying software from the Deutsche Bundespost Aregon's network which enables Prestel users to gain access to other stores of information or databases as well as the information held on Prestel. It will have international marketing rights for this 'third party' link software which will be given a UK market trial in 1981.

Better Danish links

A new undersea telecommunications cable – the UK-Denmark No 3 – was brought into service during October more than tripling Britain's seabed connections with Scandinavia.

Owned jointly by British Telecom – who contributed half the cost – and the administrations of Denmark, Norway, Sweden and Finland, the £15.3 million cable can carry 4,000 simultaneous telephone calls, and can handle telex and data material between the five countries.

The new link, laid between Winterton on the Norfolk coast and Rømø in Denmark is one of several major undersea systems which have been or are being planned by British Telecom in close co-operation with other telecommunications authorities around the world. During the next four years, British Telecom is spending £1,500 million a year to boost the telecommunications network.

Price increases

Commenting on the report of the Post Office User's National Council which rejected proposals which are to add 17 per cent to revenue in the full year 1981/82, British Telecom Managing Director, Peter Benton said that there was no alternative.

He listed three options open to British Telecom. These were, firstly, to meet Government cash limits by drastically reducing service manpower and harshly cutting investment for growth – thus seriously harming service to customers and disrupting the telecommunications manufacturing industry: secondly, to borrow the money but this was prohibited under the government's cash limit rules: and finally to narrow the gap with internal economies, investment reductions and then to close the gap by price increases. This, said Mr Benton, is what British Telecom was proposing to do.

Price adjustments include an 0.5 pence increase in the telephone call unit fee to 4 pence, rental increases to £16.75 per quarter for a business line and £12 per quarter for a residential line, a new maximum connection charge of £75 for business and £65 for residential, and various increased charges for apparatus.

These changes mean that the average quarterly residential bill will rise by about £6.50, while the average quarterly business bill of £178 will rise by some £33.

Twenty-five years ago, two Post Office Research Department engineers published a paper describing a method of testing the line characteristics of coaxial cables. Today, these principles, known as white noise testing, are a worldwide standard.

To commemorate these achievements, Marconi Instruments Limited presented engraved mementos to the authors at a celebration dinner in London recently. The picture shows Marconi Instrument's managing director Dr Colin Gaskell with recipients Mr J. S. Whyte, now British Telecom deputy managing director (right), and former Head of Division Mr Robert White.

PSS launched

PSS, Britain's new public data communication service which uses packet switching – a technique where an apparently continuous stream of data is sent as a series of self contained blocks – has been launched.

Each block or packet is routed automatically through the network by means of coded 'address' information given at its start. Any given message may occupy one or more packets.

For computer users packet switching provides a flexible and reliable way of linking different computers and terminals; allows terminals working at different rates to communicate with each other; allows packets to be rerouted along a different path through the network to avoid a route failure and enables a large number of separate terminals to link up to a computer over a single high capacity highway.

PSS is being introduced in phases with its initial operation based on packet switching exchanges at London, Reading and Bristol. Later this year the network will begin to be extended to the rest of the country's main centres of population when PSEs at Birmingham, Cambridge, Manchester, Edinburgh, Glasgow and Leeds are progressively brought into service.

Telethon success

London Telecommunications Region played a major role in Thames Television's Telethon, the two-day American-style extravaganza of fund-raising entertainment staged for the first time in Britain in aid of London's deprived and handicapped children.

Two hundred and fifty exchange lines were laid on free of charge at the special studios in Wembley Conference Centre for the star-studded marathon which enabled thousands of television viewers to ring in and pledge donations amounting to £1¼ million. For every call received at the centre, British Telecom pledged 3½ pence, the unit cost of a call.

One hundred lines were installed by

North West Area engineers on the main stage, and phones were equipped with neon-lit handsets which flashed when a call came through. Many of the incoming calls were answered by visiting celebrities.

Contracts

Marconi Communications Systems Limited – £9 million for a new generation data modulator/demodulator (modem) for use in the Datel 600 service. Also more than £1 million for tropospheric scatter equipment to link the Phillips Petroleum Maureen platform in the North Sea with Mormond Hill land station in Aberdeenshire.

GEC Telecommunications Limited and Plessey Telecommunications Limited – £45 million for major follow-on orders for the 120-line Monarch PABX. Monarch is the only entirely-British digital stored program control PABX, and was developed and designed by British Telecom.

GEC Telecommunications Limited – Over £5 million for microwave radio equipment to expand and rearrange the network to provide circuits for the second ITV channel.

Pirelli General and Telephone Cables Limited – £2.5 million for new coaxial cable to link new microwave radio circuits for the new ITV channel into the network centres.

Trend Communications Limited – £1.5 million for teleprinters and other telex network equipment. The order includes the supply of teleprinters 40A and 41A for the Metropolitan Police Force.

ITT Creed Limited – £25 million for 12,500 model 2300 teleprinters and ancillary equipment for use in the telex network.

Marconi Communications Systems Limited – £2.75 million for the provision of a steerable dish aerial and super-high-frequency radio equipment as part of British Telecom's first maritime aerial system.

Informal meetings

Once again, London Telecommunications Region are holding a series of monthly informal meetings throughout the winter.

The 1980/81 season includes a talk by Mr Tony Booth, LTR Director, with the title London Tomorrow (11 December). Other topics include the Supply of Engineering Stores (20 January), Why X (18 February) and Trunk Planning (17 March).

The meetings are open to British Telecom staff only, and are held in Camelford House beginning at 5 pm.

Dial an album

Pop music fans in London can now dial a different record album every week – thanks to British Telecom's new service introduced in September and scheduled to run throughout the winter months until April.

Replacing the cricket score on code 154, the new music service features a different album every week and supplements Dial-a-Disc, which last year received 112 million calls nationally.

New data service

A new service for sending data over the public telephone network, providing simultaneous both-way transmission at four times the speed previously available, has been introduced.

Known as Datel 1200 Duplex, the new service offers full duplex data transmission at 1200 bit/s over single exchange line connections to the public telephone system. The new facility offers customers many new applications such as on-line graphics, software development and advanced financial programs.

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Contributions:
The Editorial Board will be glad to consider articles of general interest in the telecommunications field from all sources. No guarantee of publication can be given. The ideal length of such articles is between 1,000 and 1,500, words. The views of contributors are not necessarily those of the Board.

Correspondence:
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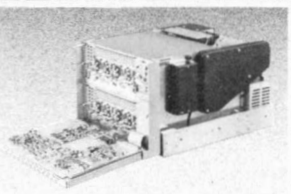

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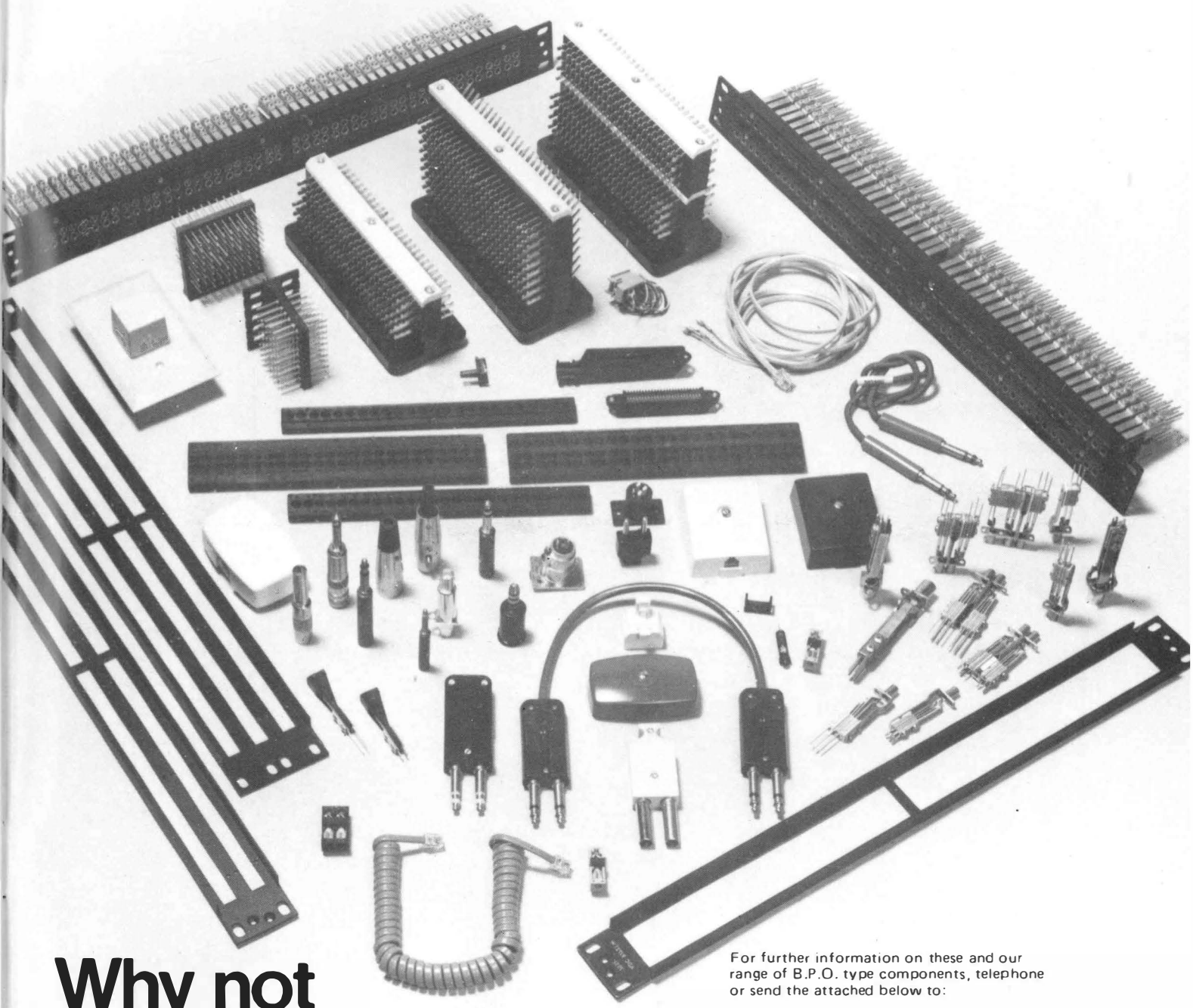

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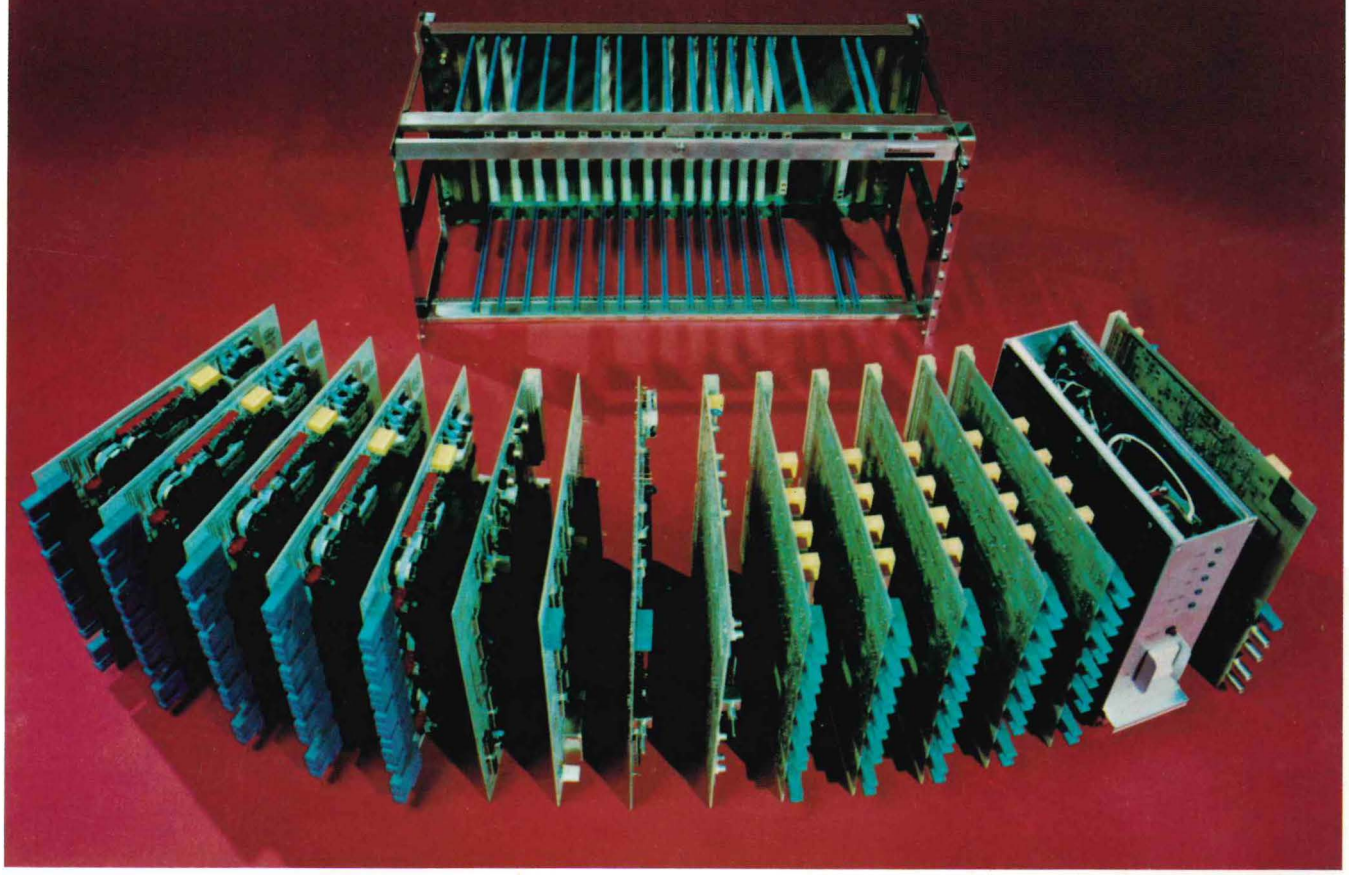

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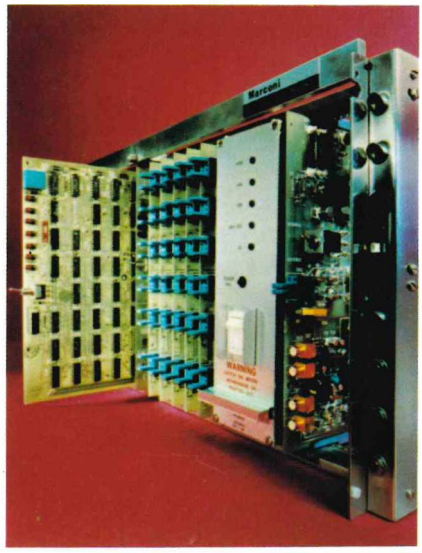

As well as the basic 30-channel equipment, Supergroup and Hypergroup codecs will be available shortly, which will assist further in the introduction of digital working.

To find out more about Marconi's digital transmission systems, please contact Tony Trewin on Extension 556.

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W	7 14 21 28	4 11 18 25	4 11 18 25
Th	**1** 8 15 22 29	5 12 19 26	5 12 19 26
F	2 9 16 23 30	6 13 20 27	6 13 20 27
Sa	3 10 17 24 31	7 14 21 28	7 14 21 28
Su	4 11 18 25	1 8 15 22	1 8 15 22 29

	April	May	June
M	6 13 **20** 27	**4** 11 18 **25**	1 8 15 22 29
Tu	7 14 21 28	5 12 19 26	2 9 16 23 30
W	1 8 15 22 29	6 13 20 27	3 10 17 24
Th	2 9 16 23 30	7 14 21 28	4 11 18 25
F	3 10 **17** 24	1 8 15 22 29	5 12 19 26
Sa	4 11 18 25	2 9 16 23 30	6 13 20 27
Su	5 12 19 26	3 10 17 24 31	7 14 21 28

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	July	August	September
M	6 13 20 27	3 10 17 24 **31**	7 14 21 28
Tu	7 14 21 28	4 11 18 25	1 8 15 22 29
W	1 8 15 22 29	5 12 19 26	2 9 16 23 30
Th	2 9 16 23 30	6 13 20 27	3 10 17 24
F	3 10 17 24 31	7 14 21 28	4 11 18 25
Sa	4 11 18 25	1 8 15 22 29	5 12 19 26
Su	5 12 19 26	2 9 16 23 30	6 13 20 27

	October	November	December
M	5 12 19 26	2 9 16 23 30	7 14 21 **28**
Tu	6 13 20 27	3 10 17 24	1 8 15 22 29
W	7 14 21 28	4 11 18 25	2 9 16 23 30
Th	1 8 15 22 29	5 12 19 26	3 10 17 24 31
F	2 9 16 23 30	6 13 20 27	4 11 18 **25**
Sa	3 10 17 24 31	7 14 21 28	5 12 19 **26**
Su	4 11 18 25	1 8 15 22 29	6 13 20 27

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