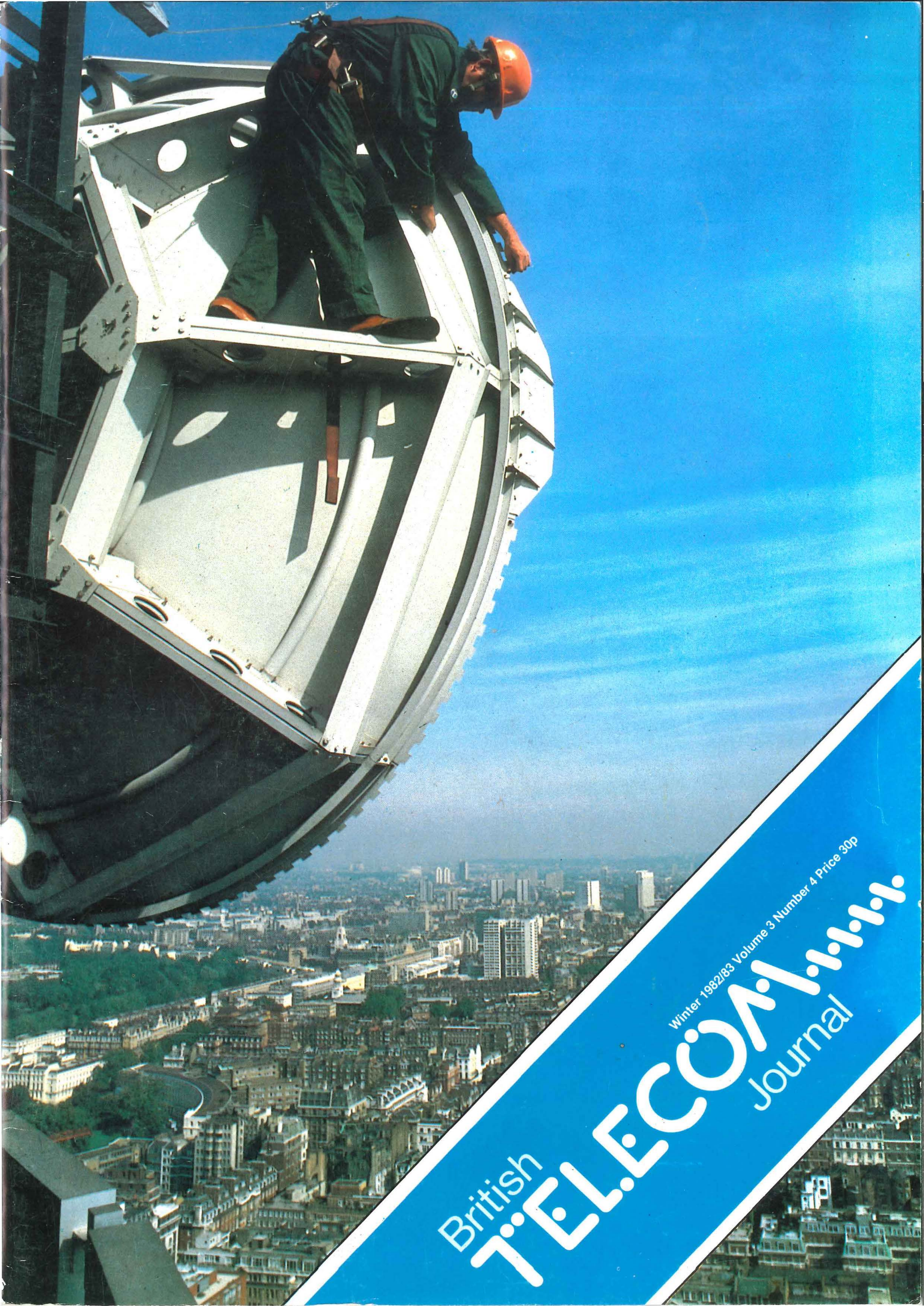

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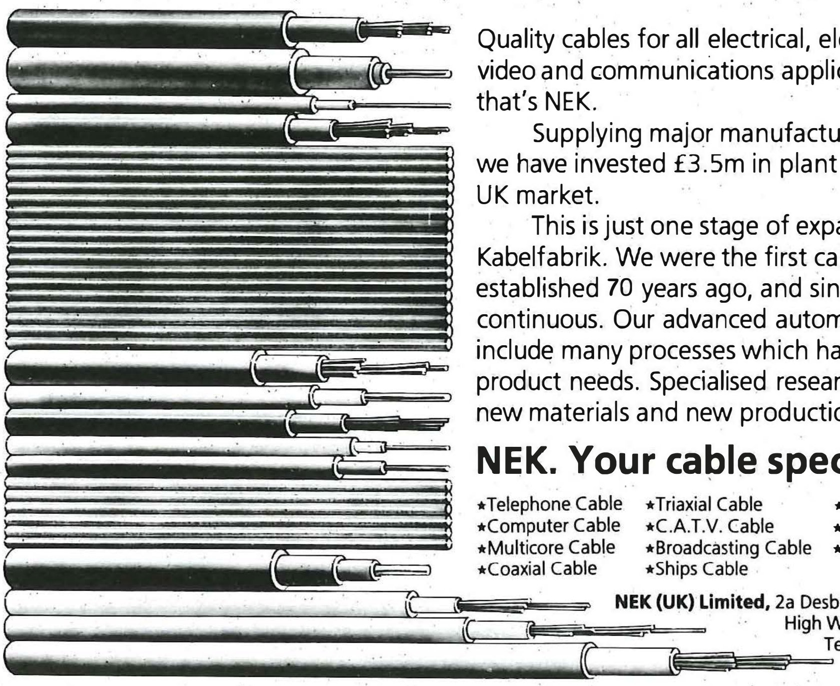
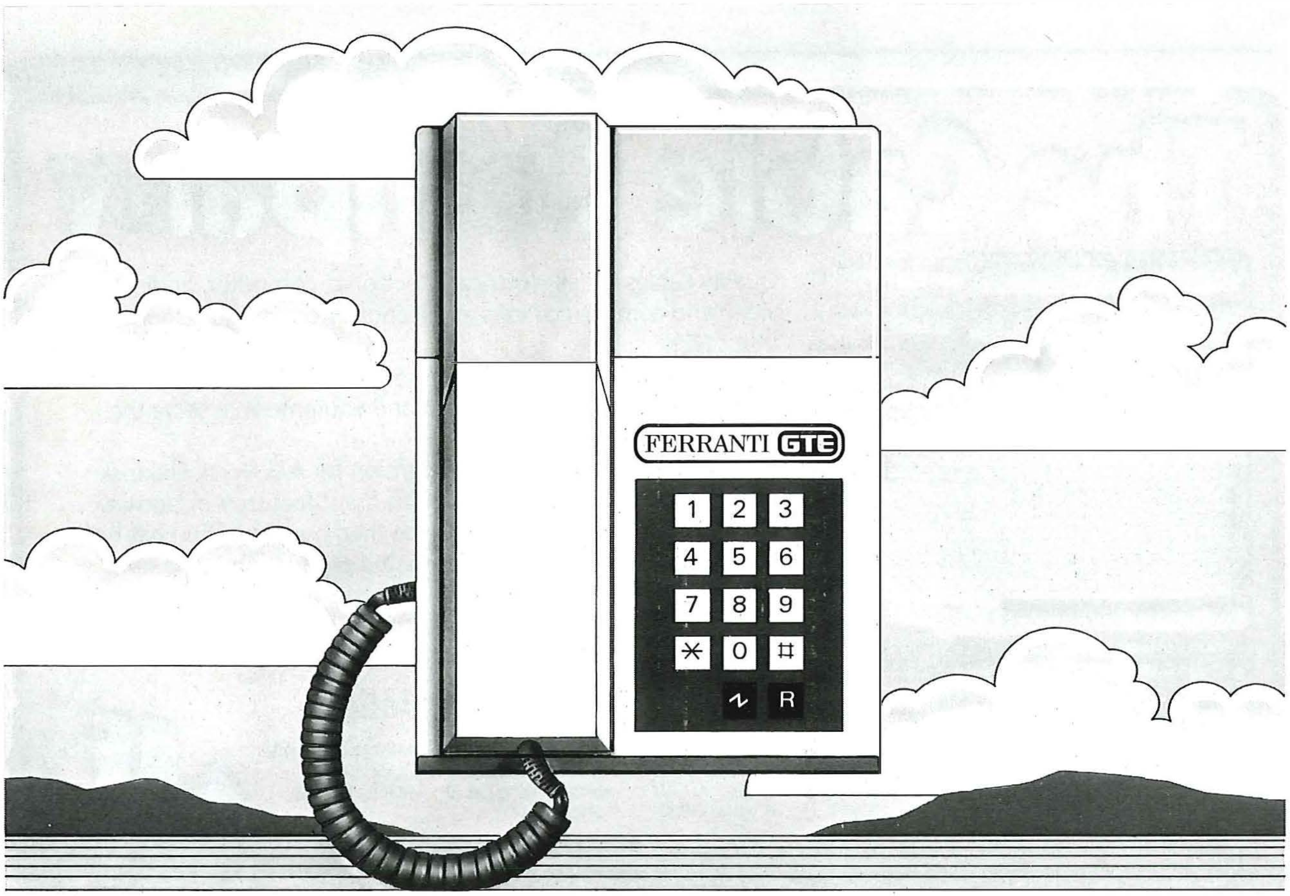
Winter 1982/83 Volume 3 Number 4 Price 30p

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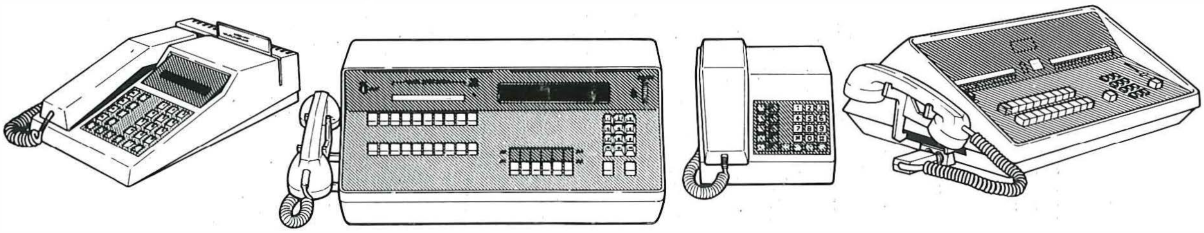

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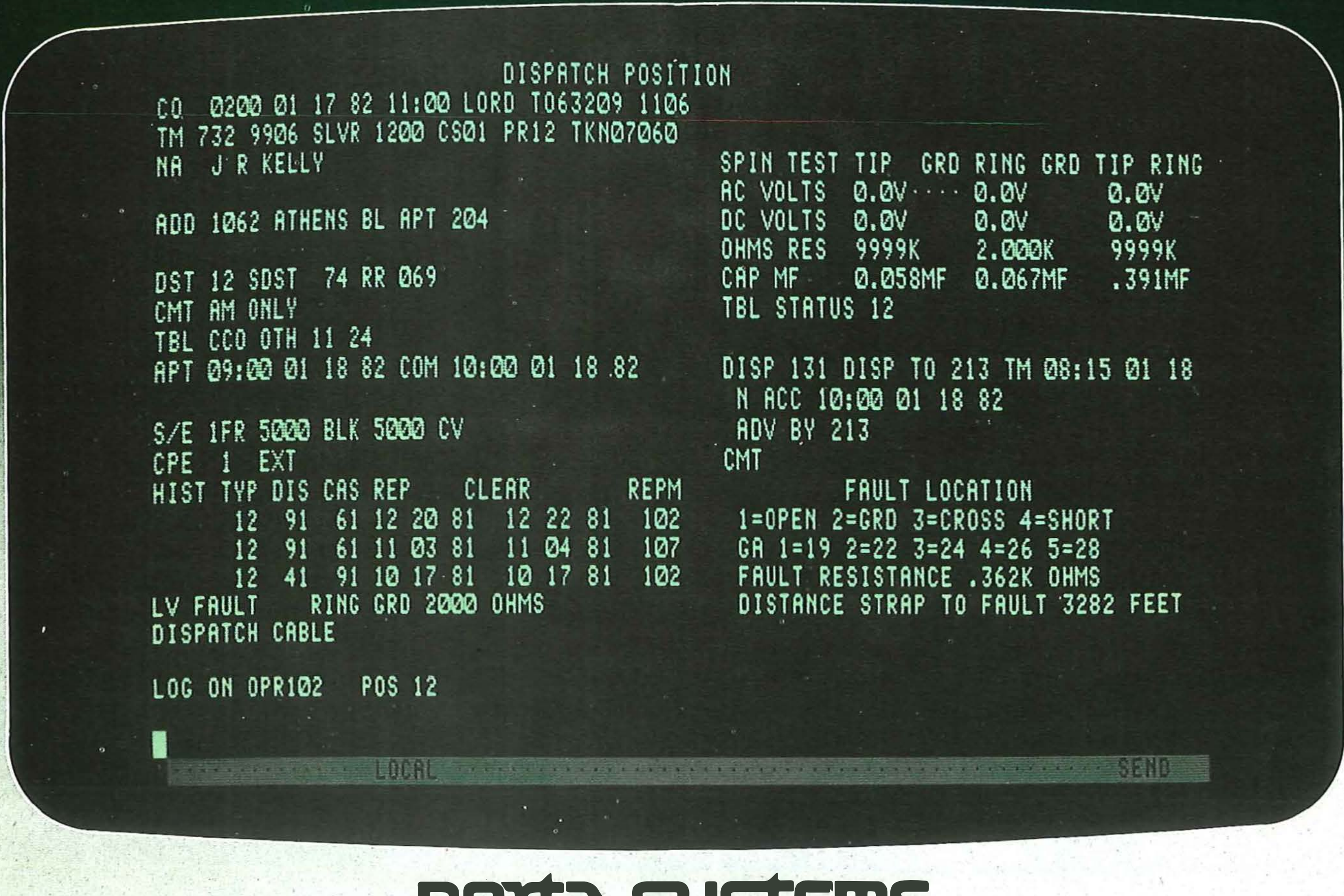

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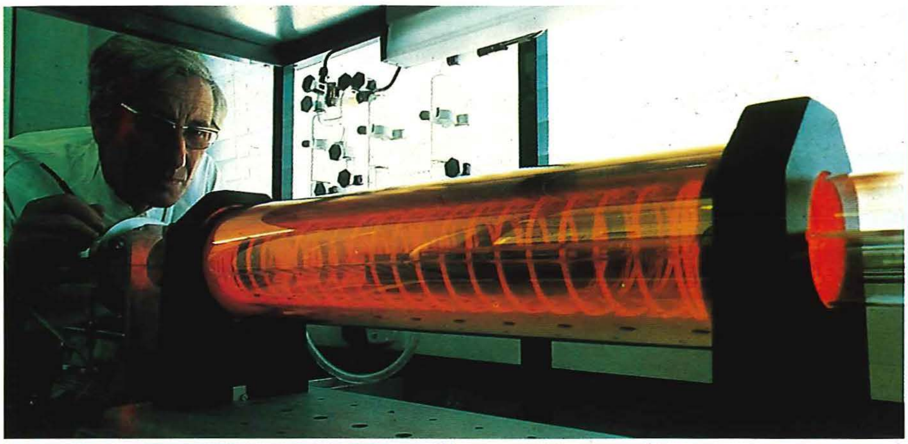

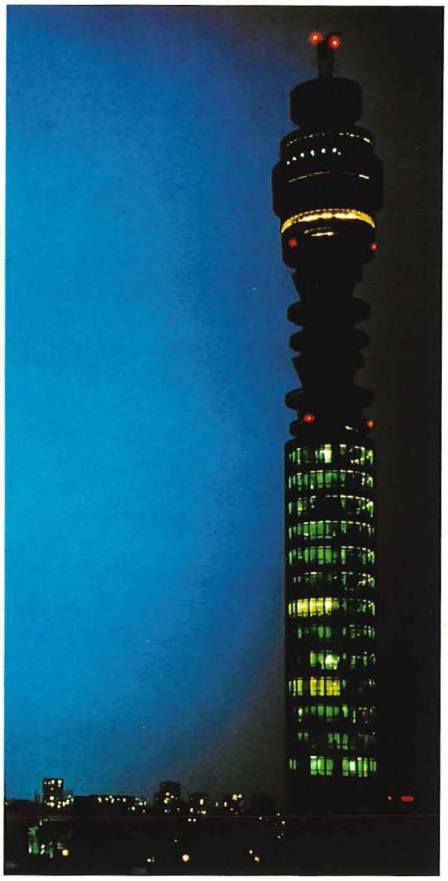

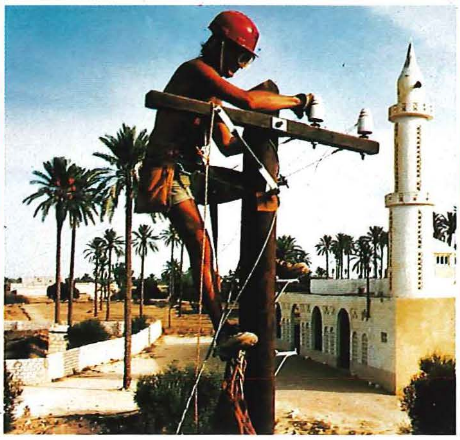

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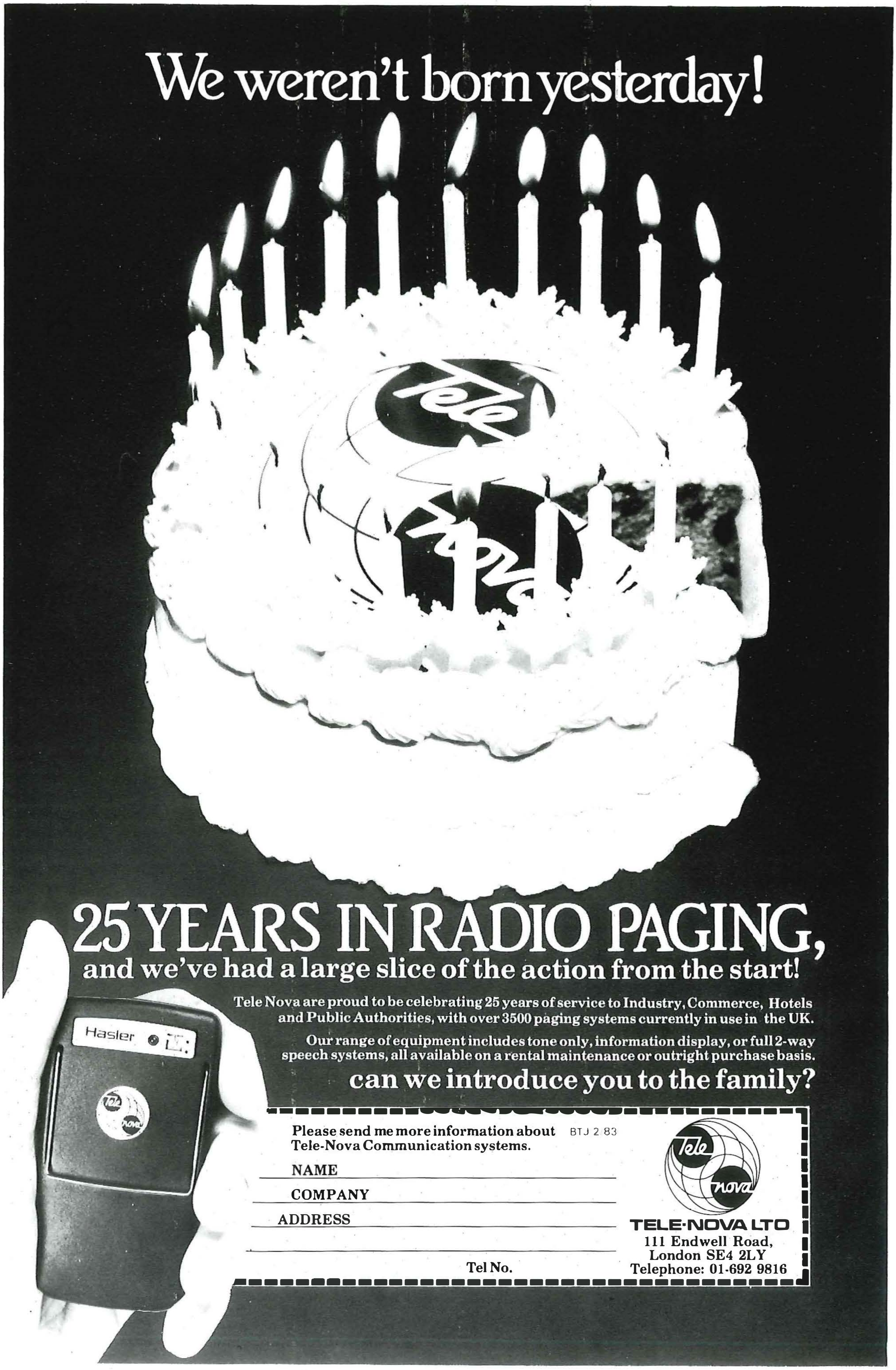
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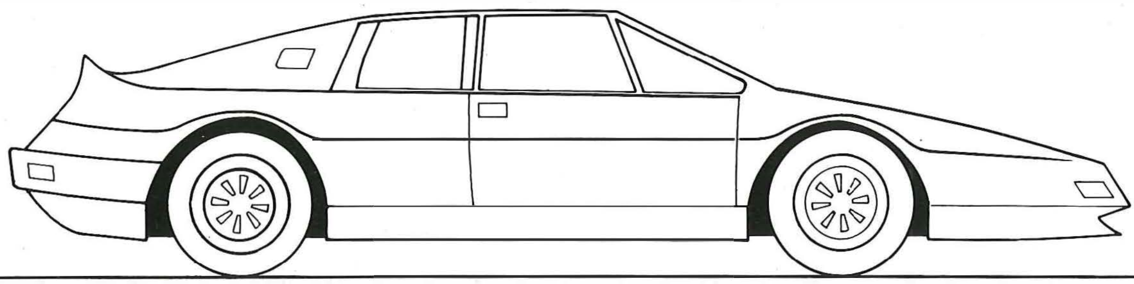

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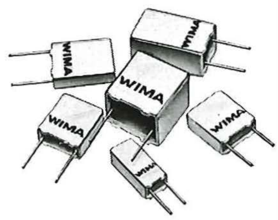

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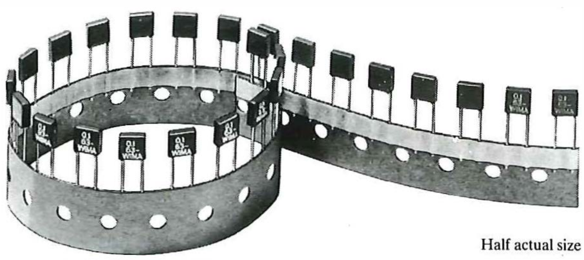

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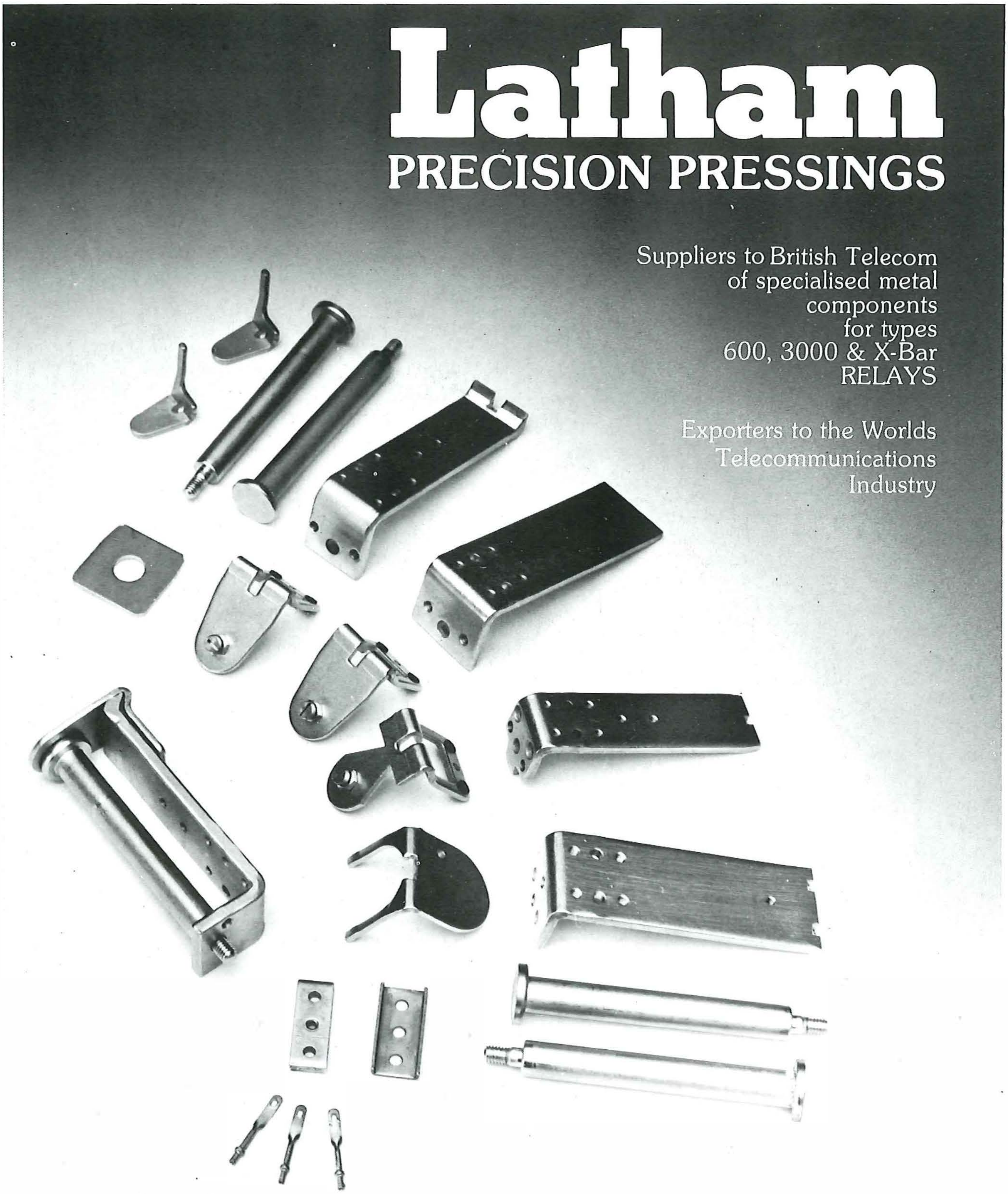

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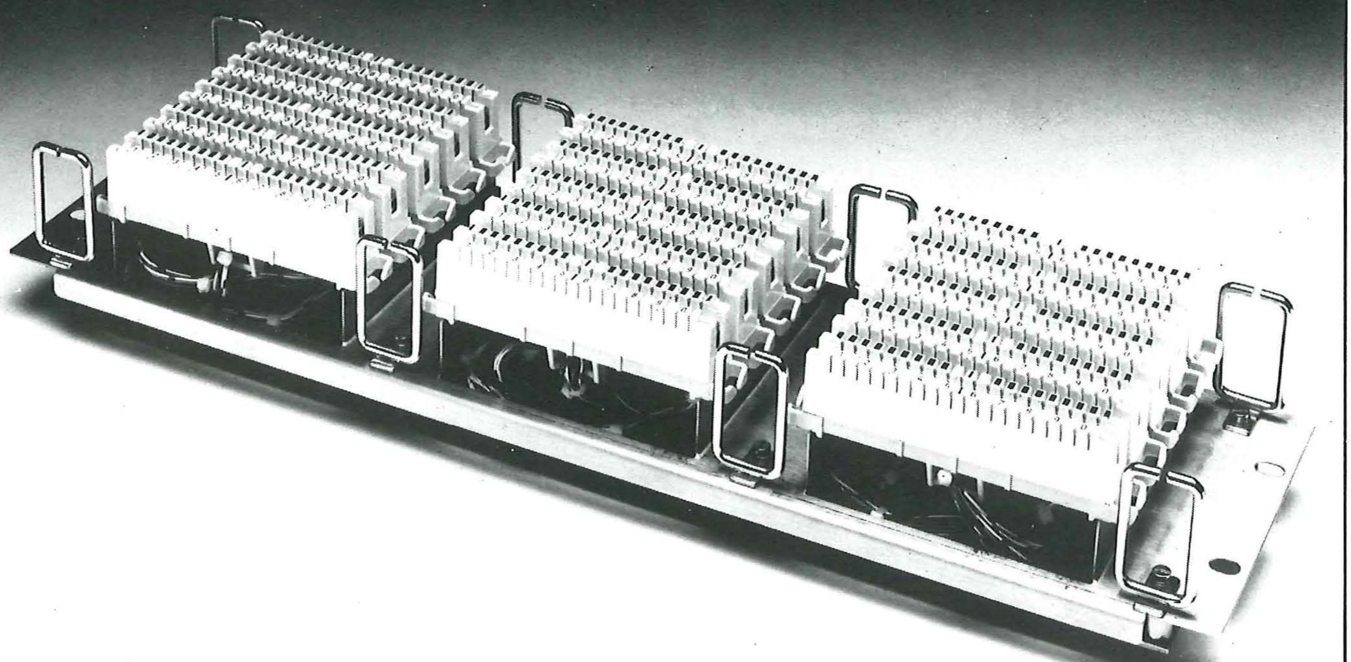

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Logical Technology

British Telecom Journal
Winter 1982/83 Volume 3 Number 4

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

Cover: Alan Howard, BTL aerial rigger, making final adjustments to one of the microwave dish aerials on the London Telecom Tower which brought Channel 4 to the nation's TV screens in November last year. The distribution network for the new station, worth more than £7.5 million, was completed by British Telecom in less than three years.

Fair competition

The Telecommunication Bill was presented to Parliament last November and is now in its Committee stage. British Telecom's Board has stressed that if the political decision that the Corporation should be converted into a public limited company in the private sector of the economy is confirmed then the arrangements must be such that the new company will be a success.

British Telecom must have commercial freedom to operate freely in a market that is becoming increasingly competitive and while the Government has said that this is its intention, competition must be fair – British Telecom needs no special privileges nor undue restrictions.

The Bill requires all systems operators to have a Government licence, and establishes the Office of the Director General of Telecommunications ('Oftel') to regulate the industry and in particular to enforce the observance of the terms of licences. Oftel will not be under the direct control of a Minister, so the industry should be free of short-term political pressures as far as Oftel's activities are concerned.

But the terms of licences, and the role of Oftel, must not stifle initiative nor introduce a new bureaucracy. In particular, the temptation to restrict systems operators from making the profits that will attract new equity and loans must be resisted.

Services to the community must remain a cause for concern. The introduction of competition in the network will push prices closer to costs. But telecommunication costs should continue to fall in real terms, and it should be possible to reassure customers that this relative adjustment can be achieved without pricing service out of their reach.

British Telecom must accept a continuing responsibility for providing services to remote and rural areas, public call offices, and the 999 service. It should be possible to make arrangements that will be fair to the community and investors alike.

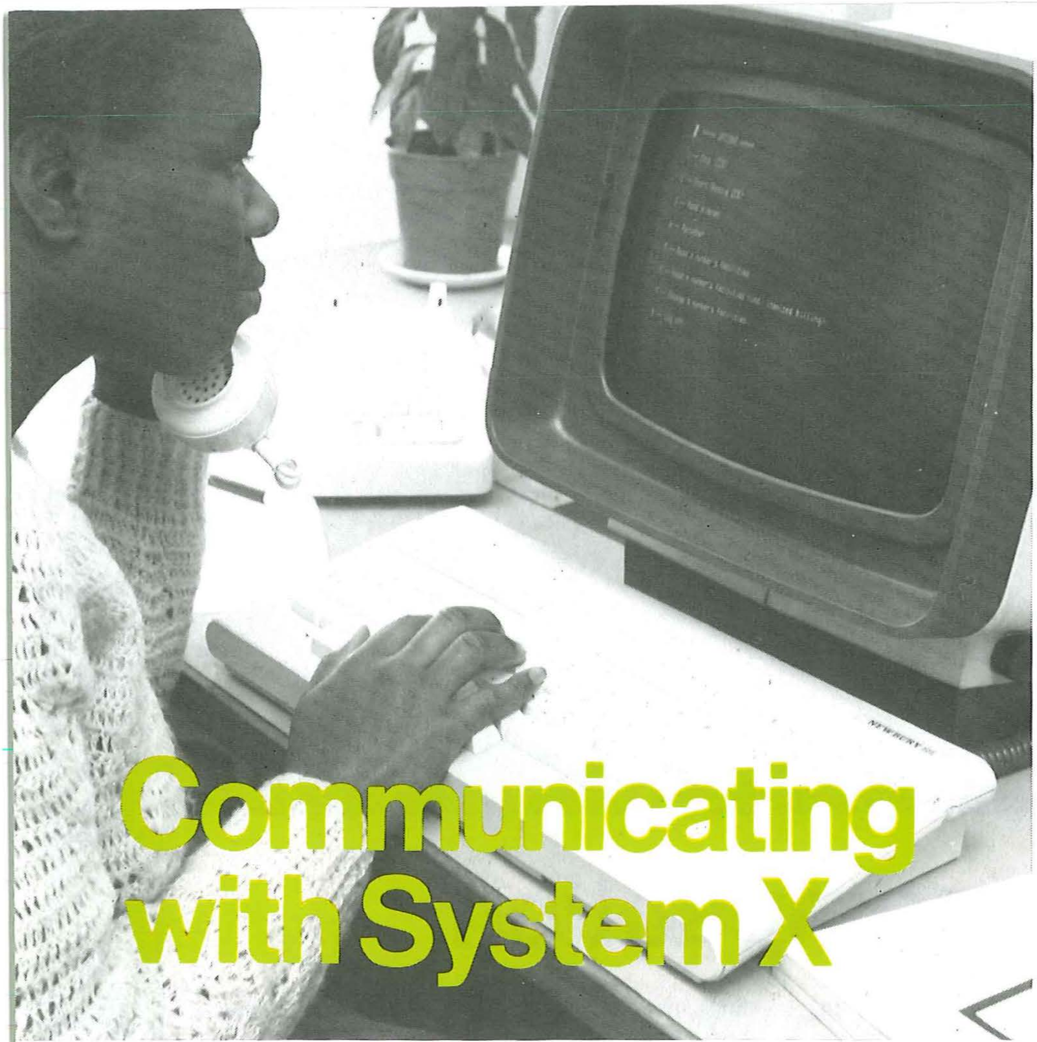
Industry Secretary Patrick Jenkin's intention to establish the UK as a world force and centre of excellence in telecommunications will only be achieved if British Telecom, as a public limited company, is able to attract continuing investment to expand and modernise the network and provide the services which customers want.

A small price to pay

For two years now the cover price of *British Telecom Journal* has remained at 30 pence despite ever-spiralling production costs.

To maintain the high standards we have set ourselves and to ensure that the *Journal* continues as the major source of reference for telecommunications developments in the UK, it is regretted that the price will be increased to 36 pence from the Spring issue this year. At an overall cost of only 12 pence per month, we feel the *Journal* remains excellent value for money.

The revised method of deduction from pay for staff will shortly be announced in the *Post Office* and *Telecom Gazettes.* Details of annual postal subscription payments will be announced at a later date.



Communicating with System X

In the trial now underway sales staff take calls direct from System X customers and key in orders for a variety of services such as abbreviated dialling.

T D Nathan and D Johnson

A 'user-friendly' man-machine language translator, currently on trial in Cambridge Area, has been developed for System X so that administrative staff can access exchange information more efficiently.

System X, the computerised digital switching telephone system, is being introduced by British Telecom over the next few years and the concept of a 'user-friendly' interface will become an integral part of its operations and maintenance centres (OMCs). Already early implementation is providing valuable feedback for engineers.

One of the benefits of its introduction is that administrative staff can interrogate and change the system directly, using visual display terminals (VDTs). This will mean that accounts staff can read a meter or take a customer out of service for non-payment; that sales staff can start service to a new customer or provide a new facility; that the repair service control can test customers' lines, and so on. Customers' queries will be dealt with faster and services provided more efficiently. Fewer mistakes will be made, because the person who takes the enquiry will, potentially, have the ability to see it through from beginning to end.

If a customer rings the sales office for example, asking for a new 'star' service (such as abbreviated dialling or call transfer), authorised staff on duty will be able to provide the service at once using the computer terminal. By the time the customer replaces the receiver the new service will be waiting – giving first class service to the customer and immediate revenue benefits to British Telecom.

For this to happen, it is necessary to ensure that users can communicate with System X exchanges using a 'language' familiar to them, and which expresses coherently the task being performed. Lynch pin of this new method is a computer language which everyone can use, even if he or she has never used a computer, or even a typewriter, before. In its basic form, System X man-machine language (MML) works at a very low-level; it uses abbreviations of English words followed by as many as 20 different numbers each separated by special punctuation in what is a completely rigid format.

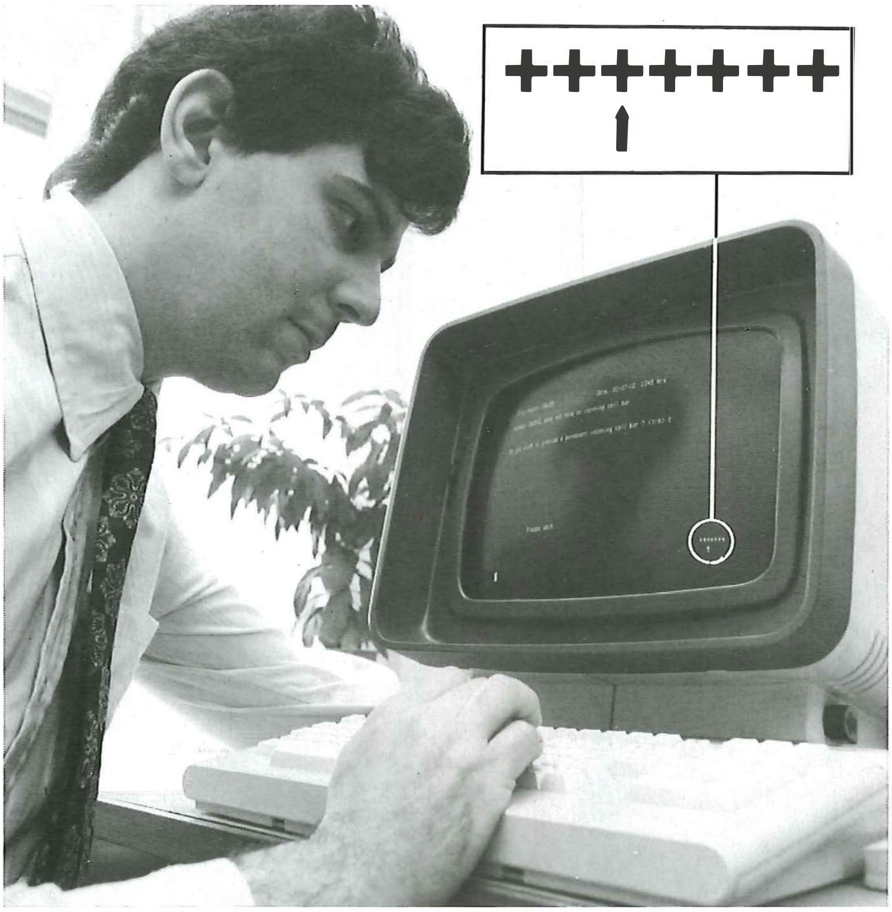
The existing system, with its abbreviated error messages is for specially trained engineering staff. Staff soon become, by their familiarisation, extremely competent at interpreting the messages, and time would be lost if unnecessary translations were made.

But what is good for the specially trained engineer is not necessarily right for administrative staff. If the MML were too complex, exchange engineers may have to be called on to make changes, thus introducing delays and possibly misunderstandings. It was apparent that an 'extended' language was required and a solution, using a computer to translate from System X MML into a user-friendly interface based on everyday English, has been developed by a small team of occupational psychologists and System X development engineers within British Telecom.

The translator presents users with a 'menu' of choices as seen opposite. The cursor is positioned in the top left of the screen and can be moved down to whichever option is required. After the initial selection has been made, the computer prompts for any further information required. If the option 'outgoing call bar' is selected for example, the computer will ask for the telephone number on which the bar is to be placed. When all the necessary information has been gathered, the translator will send the relevant MML commands to System X, and interpret the replies.

While it is doing this a 'comfort indicator' appears on the screen to tell the user how long the wait will be, and what proportion of the wait is outstanding. An arrow starts at the left hand end of the scale and proceeds to the right. When it reaches the right hand end the waiting period has finished. The length of the scale is varied to indicate the length of predicted wait.

When the translator has completed its transaction with the System X processor it prints out the result to the VDT screen and to an associated slave printer. The replies it prints out are always in plain (Telecom!) English – for example, 'Line number 208784 has been renumbered 207871'. Also printed out is the name of the user's office with date and time, enabling administrators to keep track of



Co-author of this article Timothy Nathan of Occupational Psychology Division sets up the comfort indicator. This appears on the screen and an arrow moves from left to right along a scale to show waiting time.

```
   001753  01  0788  13-01-83

IN-SUB:2764,2,0,1,,33;

   001753  01  0788  13-01-83  1125

READ REPORT
RESOURCE: ASSS   SUB 2764 ( 2)   STATE: EQ
PARAMETERS
     2,         0,        1,          ,
    33,          ,         ,          ;
     ,           ,

   001753  01  0789  13-01-83
```

A System X man-machine language transaction likely to be understood only by trained engineering staff.

*** **MAIN MENU** ***

1 — Read a number's facilities
2 — Change a number's facilities
3 — TOS
4 — Star services
5 — Meter reading
6 — Log off

An example menu.

all changes to customers' lines.

Sometimes the translator must ask supplementary questions before it can complete the task. These can take the form of questions requiring extended answers such as 'What is the telephone number?'; they can be yes/no questions like 'Is the meter to be removed (y/n)?'; or if there are a number of alternatives they can be presented as a menu.

Whenever the user is asked for an input the keyboard is configured so that only valid keys can be used. So, if a telephone number is required, only the numbers and hyphen are 'live' on the keyboard; with a yes/no question only the y and n are live. This method reduces the risk of invalid or incorrect commands being sent to System X. Much of the best research and knowledge from human factors experiments has been incorporated into the translator.

The translator is based on the 'on-line' program produced by System X Software Engineering Division, but several new features have been added. The on-line program was originally designed to speed up the testing of System X exchange models. It runs on the range of micro-processors with integral floppy disk systems, known within the business as SBCs (small business computers). It is planned to make the translator more economical, and to provide several important extra facilities by transferring it to a multi-user multi-processor system (Mumps). This will enable the expensive disk system to be shared between a number of users and allow a number of VDTs to share lines to more than one System X exchange.

The program simultaneously handles input and output to System X, disk, terminal and printer equipment, via program-controlled buffers. It is able to send specified commands to System X and to analyse responses. The program receives its instructions from control files, which tell it what messages to pass to System X and to the screen, and what processing to perform.

Control files are written in an application specific high-level language based on the keyword:parameter principle such as menu:options. Powerful combinations have been borrowed from established languages allowing sophisticated translations.

The ability to pre-process commands, to analyse responses and to report to the user the exact information that is required makes the translator a very powerful tool. Possible applications of the program are many and varied. It could be used to translate computer interactions into foreign languages to enable exchange systems and computers to be used abroad without modification, or where the public need to access computers previously only available to the specialist. The translator can be configured to communicate with any System X equipment, and indeed with most other computers.

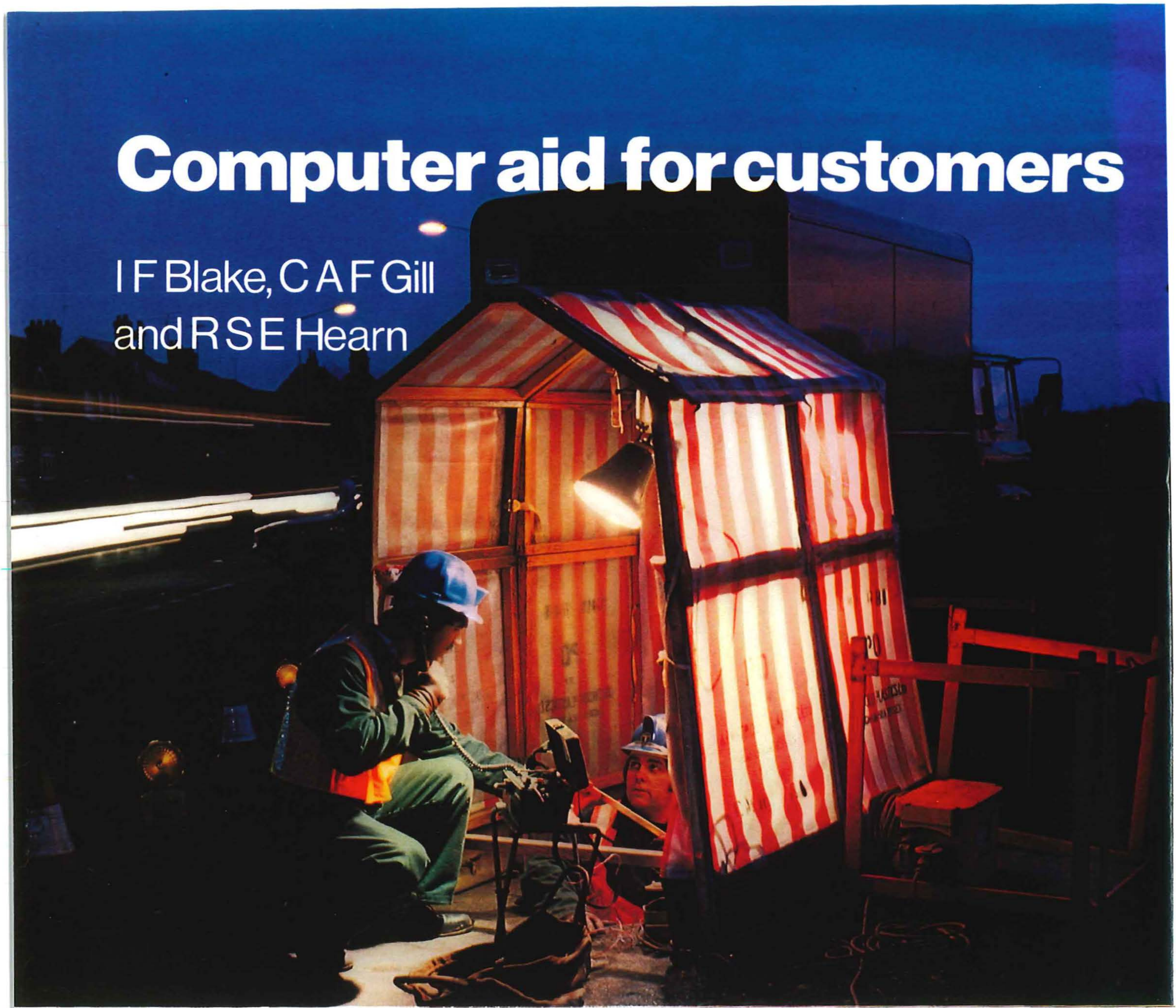
Development work being done now will enable the translator to be attached to several different computer systems so that they can all be used from the same VDT, and furthermore a single user could perform transactions which interact with several different computers. This means that a consistent man-machine language can be used with different computers without changing their design. In short, the potential is almost limitless . . .

Mr T. D. Nathan is a psychologist in Occupational Psychology Division, specialising in the introduction of new technology.

Mr D. Johnson is a head of group in System X Software Engineering Division responsible for the production of System X testing tools.

Computer aid for customers

I F Blake, C A F Gill and R S E Hearn



Maintenance and repair of underground cables can often mean working round the clock for British Telecom engineers.

If a telephone doesn't work, a customer expects it to be quickly repaired without costing a small fortune. British Telecom has 18 million other customers, who between them made about 17 million fault reports last year. The current objective of the repair service, which handles all telephone fault reports, is to clear them by the end of the next working day. And last year this was achieved on average in 80 per cent of cases.

The repair service intends to move towards tighter clearance targets where this is economical and to respond flexibly to commercial needs by making a variety of maintenance options available to customers. At present, it is handicapped by the largely manual system of record keeping and fault recording in repair service controls, (RSCs) and by the inability of RSCs to test a large proportion of customer's lines. Modernisation of the repair service is, however, under way. Two computer projects – administration of RSCs by computer (ARSCC) and remote line testing (RLT) – are among a number of linked projects being introduced to overcome deficiencies in the system.

In existing RSCs, all customer installation details and fault histories are kept on cards. These can, of course, easily be misplaced, and entries are sometimes illegible. But the main disadvantage is that cards are not readily accessible to fault reception staff, particularly in large RSCs where there are often well over 100,000 cards.

Without this information, receptionists are in a weak position to discuss a customer's installation or recent fault history, or to advise the customer when fault clearance can be expected. RSC management is also handicapped without up-to-date information on RSC performance and workload. This inhibits their ability to deploy repair staff to the best advantage to cope with varying fault loads without service to some customers deteriorating.

Two ARSCC systems have been developed to overcome these problems, in which most paper documents are replaced by readily accessible computer-controlled files where permanent customer information, fault history and current fault reports can be stored and processed. Of the two systems, ARSCC(E) (electronic) has been designed for larger RSCs handling more than 70,000 fault reports every year, and ARSCC(D) (docket) for the smaller RSCs.

In ARSCC(E), all fault report handling from reception to recording of clearance details uses visual display units (VDUs), while ARSCC(D), a docket printed by

The ARSCC(E) system of handling fault reports with exclusive use of visual display units is being used at Edinburgh RSC . . .

. . . while smaller RSCs use the ARSCC(D) method with its associated dockets.

the computer after the receptionist has entered fault report details, is used for handling the fault until entry of handling and clearance details have been entered into the computer during or at the end of the process.

First computer hardware orders for both systems are being supplied by Honeywell, the size of machine dependent on the RSC's annual fault report handling rate. Each ARSCC(E) repair control officer (RCO) is provided with a VDU. By entering commands at the keyboard, the RCO can display all aspects of customer installation information, such as equipment installed, routing and any hazards to be found at the installation, and a six-month fault history. Further commands allow the RCO to raise a customer fault report record (FRR) which can then be redirected to appropriate duties within the RSC to progress fault clearance. FRRs appear on the VDUs in the form of ordered lists (the oldest/highest priority FRR at the top) and the RCO selects individual FRRs from these lists to progress them further. Each field faultsman is represented on ARSCC(E) by a work list, which contains FRRs currently in hand with that faultsman.

When a customer reports a fault or difficulty and dials 151, the reception RCO in the RSC enters the faulty telephone number on the VDU keyboard. ARSCC(E) responds with an FRR display. If the report is new, the FRR will be blank and the receptionist enters details of the report. If the report is in hand, the FRR will contain details of the position and the receptionist may offer the customer information about clearance prospects. For new faults, ARSCC(E) displays a 'fault clearance commitment', based on current clearance performance for the type of fault being reported. The receptionist may also offer the customer an appointment and register the appointment date and time on the FRR.

The reception RCO will then transfer the FRR either to the diagnostic testing duty, for further testing, or to the fault distributor, for issue to field staff. RCOs enter progress information on the FRR as fault clearance progresses. When the fault is cleared, the clearance information is entered, and the FRR is closed. ARSCC(E) automatically makes an entry in the fault history record for the customer installation. The fault history is retained on the computer database for six months for immediate access, after which it can be inspected on a microfiche reader.

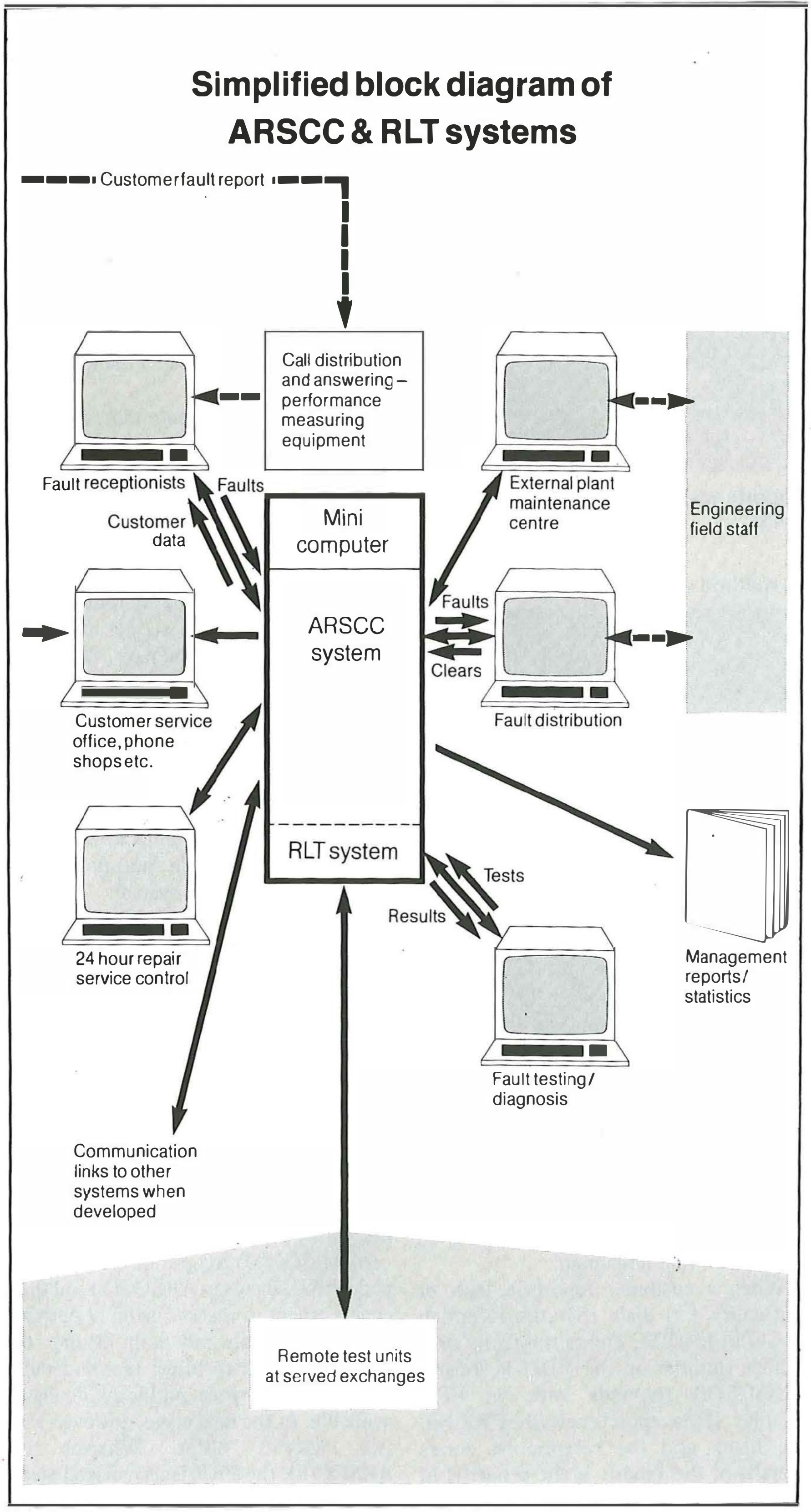
These facilities ensure that customer reports, once raised, cannot get lost. Additional features ensure that fault clearance targets are met by applying warning indicators to those FRRs which are in jeopardy of missing performance targets.

A major advantage of a computer-based system such as ARSCC(E) is its ability to perform comprehensive statistical analyses on the field information – one which has not so far been provided to RSC managers. Current statistical packages provide information concerning carried-forward faults (TIP2) and fault duration. Other statistics list the 50 oldest faults in the system and yet others provide a compatible output to the national fault analysis system.

A field trial, currently being conducted at Edinburgh and Eltham in South London aims to identify the most useful performance figures and provide them in a form suitable for the RSC manager. ARSCC(E) provides a comprehensive records maintenance facility to cope with the necessary changes to the customer database brought about by advice notes. Future versions of ARSCC(E) will obtain such information from other computer systems currently being developed to mechanise advice note procedures.

All ARSCC(D) receptionists are equipped with VDUs as in ARSCC(E) and this enables them to access customer permanent information and fault history, to raise FRRs and to insert report details supplemented by test and local details if available. At the next stage, however, the two systems differ. Whereas in ARSCC(E), the FRR is transferred electronically to the next RCO in the fault processing chain, in ARSCC(D) a fault report docket is printed and is used to process the FRR.

Test and distribution RCOs do not have individual VDUs but they may enter diagnostic and handling information into the computer via a common VDU if desired. If not, they enter details in manuscript on to the docket. On completion of the FRR, details of the cleared



A simplified block diagram of ARSCC and RLT systems.

fault are input to the system, as well as any outstanding handling details. As in ARSCC(E), customer service division is able to interrogate the database to obtain details of customer fault history without any help from staff working in the RSC.

An important feature of ARSCC(D) is its ability to process and output locally a range of management control and statistical information. Facilities include analyses of in-hand faults, fault clears and repeat faults. All these give local managements more effective monitoring facilities than are currently available. A field trial of an ARSCC(D) system is being carried out at East Grinstead, Sussex.

Existing RSC test equipment has a number of limitations, not least because customer line plant and equipment on many local exchanges can only be tested over long test junctions which introduce measurement inaccuracies. New remote line test (RLT) equipment has been developed to overcome these limitations and to enhance the test facilities available to the RSC.

RLT consists of a VDU, known as the controller, situated in the RSC, and a switchblock with private circuit access to remote units (RUs) mounted in local exchanges. The RU and controller are both microprocessor-based. Under control of data sent from the controller, the RU sets up test access and performs tests with results being returned to the controller for display. The RU has been designed to work with all existing exchanges except System X which has its own testing facilities. Lines can be tested individually or in a series of tests by operating a single key. If there are dangerous voltages on the line a warning message is flashed on the video screen and further testing is prohibited.

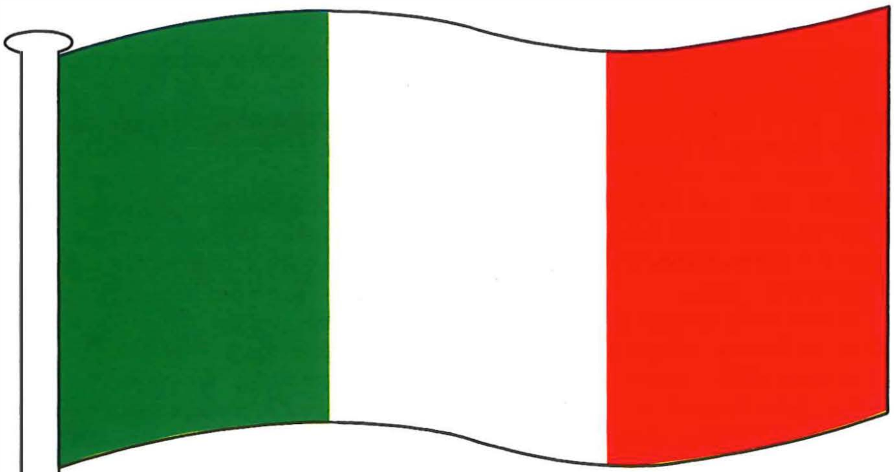
As well as providing and improving on existing test facilities, the RLT offers improved test access and extra facilities to the 40 per cent of exchanges where access is at present unavailable.

Additional features include AC voltage test, measurement of resistance to battery contact faults, and check of coin pulses and signals from MF4 senders. Pulses can be sent to test subscribers' private meters, and the howler can be applied remotely. The system offers software interpretation of test results for the receptionist and enables local management to set test limits. Suspect lines can be automatically retested and the RLT has a local line automatic routine (LLAR) function which can be used to test lines at night.

RLT systems are being tested at Guildford and Carmarthen RSCs The next stage of development will be to integrate the ARSCC and RLT systems using common VDUs so that RLT test details can be inserted automatically into the ARSCC database.

Mr I. F. Blake, Mr C. A. F. Gill and **Mr R. S. E. Hearn** are all executive engineers in Network Maintenance Policy and Repair Division involved in the modernisation of the Repair Service and working on the development of the RLT and the ARSCC(D) and ARSCC(E) systems.

The Italian scene



This, the twelfth in our series on overseas administrations, looks at Italy, a country whose economic and political instabilities have been reflected in the development of its telecommunications.

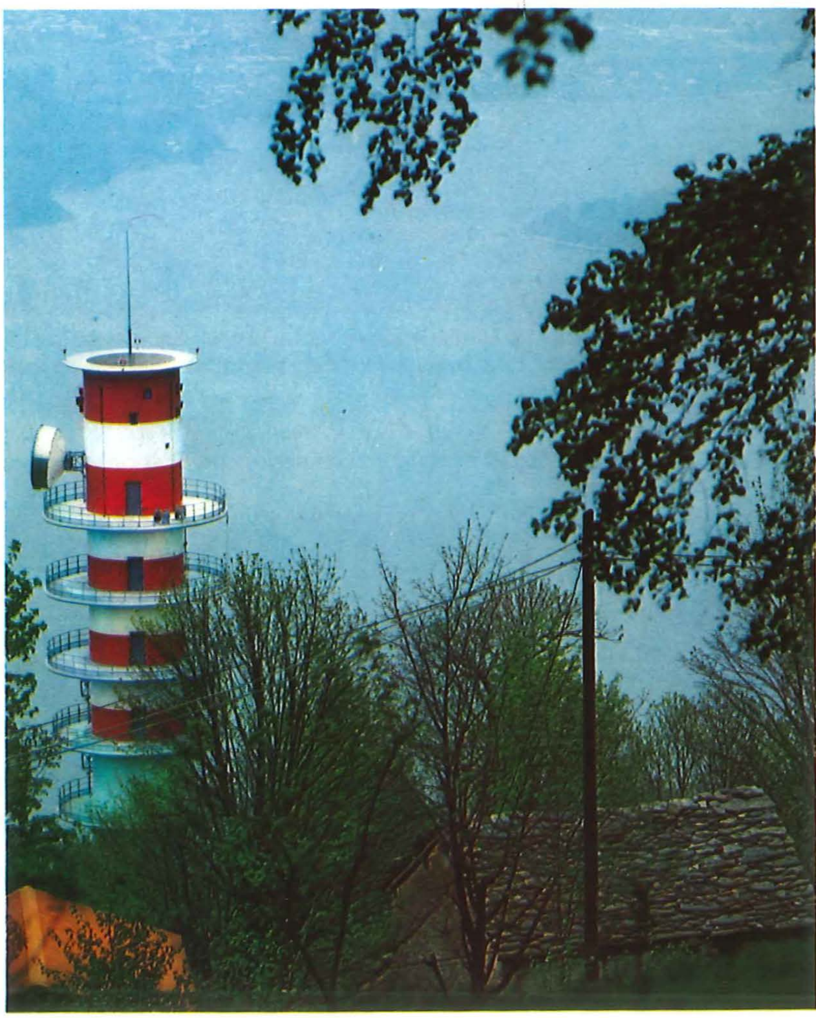
Although Italy has a population similar to that of the UK it covers an area of over 300,000 square kilometres, compared with the UK's 240,000. Italian wealth is generated in the rich heavily-industrialised northern half of the country while the south, known as the Mezzogiorno, is predominantly agricultural and one of the poorer areas in Europe.

Socio-economic conditions in Italy are largely responsible for the instabilities that have seen more than 40 different coalition governments since the last world war. With this background, it is not surprising that the development of telecommunications has been fragmentary, nor that the current structure of the telecommunications sector is complex by British Telecom standards.

To understand the inland telephone system, it is necessary to be aware of its geographical composition. Divided into 21 compartments, Italy is further split into 231 districts, 1,397 sectors, and 1,933 local networks. Each of these four strata is individually described by the name of the town housing its principal exchange (or 'centre').

Italy's telecommunications services are managed jointly by the State through the Ministry of Posts and Telecommunications (which operates through Azienda di Stato per i Servizi Telefonici – (ASST), and the administration's Direzione Centrale per i Servizi Telegrafici e Radio-elettrici), and by the STET (Società Finanzaria Telefonica

A microwave radio tower near Lake Como in northern Italy.



pa) group companies (SIP, Italcable and Telespazio) operating under State franchise. ASST is responsible for all trunk traffic between 37 specific districts and also runs the international service between Italy and Europe, and other Mediterranean Basin countries such as Algeria, Cyprus, Egypt, Libya, Morocco, Tunisia and Turkey.

The bulk of the inland telephone service is run by Società Italiana per l'Esercizio Telefonico (SIP), which provides the Italian main network, all primary telephones and all local services, as well as the trunk service not run by ASST. Formed in 1964 by the merger of five independently franchised companies – each responsible for a different region – SIP is a corporation listed on the Italian stock exchange.

SIP, however, is 81 per cent owned by STET, a large holding company for telecommunications and electronics, which is in turn controlled by Institute per la Ricostruzione Industriale (IRI), the government body on which Britain's National Enterprise Board was modelled. In this field of activity, STET also controls most telecommunications equipment manufacturers (including Italtel, Selenia, Elsag and SGS-ATES) and a major research centre (CSELT). SIP is responsible for providing all services necessary for data transmission, provision of radiomobile paging and telephones, transmission media for cable broadcasting, introduction of video-telephone and the new telematic services.

Telegraph services are operated by the administration, which provides telegram and telex services for the inland as well as for part of the international area. The domestic telegraph service, contrary to the experience of most European countries, is still widely used with 24 million outgoing inland telegrams in 1980. The telex network – 41,000 lines in 1980 – is currently less than half the size of that of the UK but growing more than twice as quickly.

All other international services are provided by the two other STET operating companies, Italcable and Telespazio. Italcable, originally founded to plan, lay and operate submarine cables, operates all intercontinental telephone, telegraph, telex and data services, and Telespazio is responsible for providing and managing satellite telecommunications systems to be used by the companies providing telecommunications services.

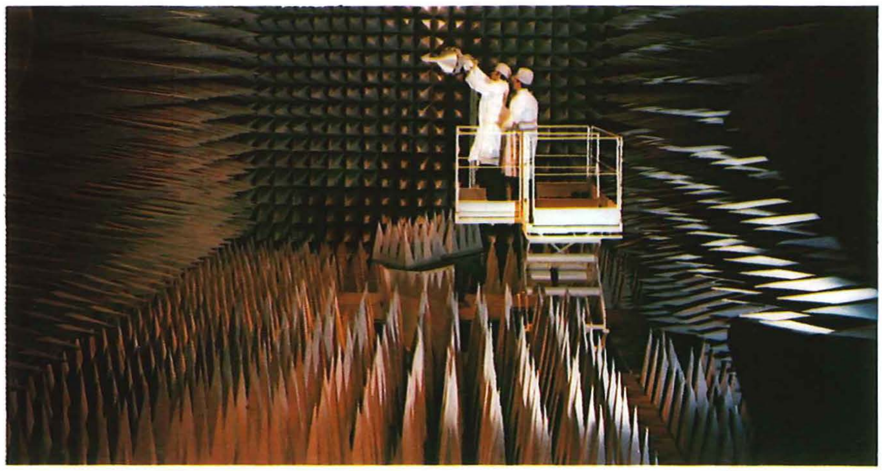
The development of telematics has led to the creation of new services most of which are still in the experimental stage waiting for final definition and standardisation by the international authorities such as CCITT and CEPT. New services, in particular videotel, telefax and teletex are basically designed to respond to the needs of new classes of users.

The videotel service – the name given in Italy to Prestel – reached the field trial stage with 1,000 users last autumn. This phase will last about two years and public introduction of this service by SIP will be in 1985. SIP will also act as data provider for videotel and has, in an advanced stage of development, a data bank which will provide information of public interest, details on telephone products and services as well as other information.

As far as telefax is concerned, at the end of 1982, SIP had 4,400 terminals installed. The development of this important service is such that by the end of 1985, SIP is forecasting as many as 15,000 terminals.

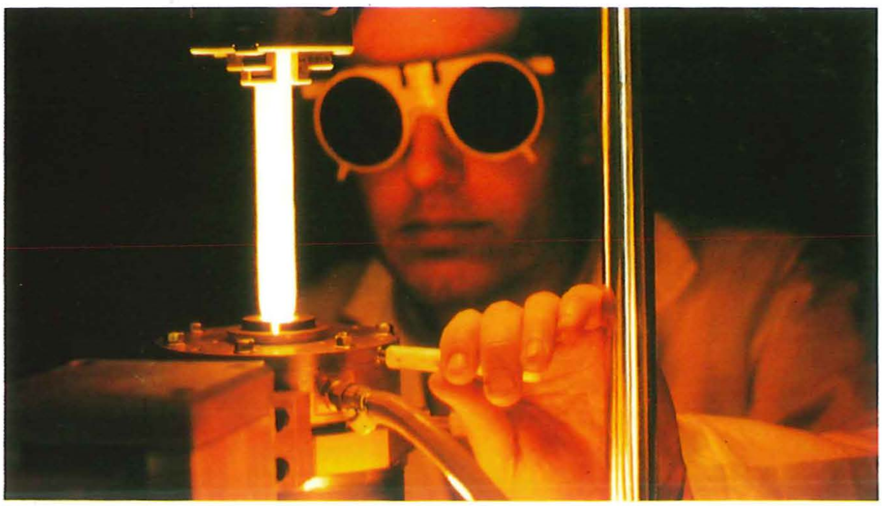
The teletex service in Italy will be introduced, in line with other European administrations, between now and 1985. At present, a number of trials and transmission experiments on the networks are being carried out in cooperation with manufacturing companies. Other important services which will be expanding are videoconference, mobile service, telemedicine and office automation.

Particular emphasis is being placed by SIP on the videoconference service. At present the operating company with the research institute of the P T Ministry has set up a trial between Rome and Milan after which, in the second quarter of this



The antennas of the Intelsat V satellite are tested inside an anechoic chamber at Selenia, one of the high technology manufacturing companies of the STET group.

As in the UK optical fibres are a vital part of telecommunications development in Italy.



Videoconferencing is one of several new services on trial in Italy.

year, a further European trial will be carried out.

Following improvements to the mobile service, demand for it is now high and is this year expected to grow to 7,000 subscribers. To this end SIP has presented a project to the P T Ministry for a second generation system to be in service this year. Telemedicine and office automation are services in which the STET Group is directly involved through its operating and manufacturing companies with initiatives geared to the future.

Telephone subscriptions in Italy are made in the form of a legal contract, normally binding for a year, and automatically renewable unless two months notice is given. This seems to work in favour of the subscriber and caters for most normal circumstances under which a subscriber might wish to cancel. Cancellation is allowed following an increase in tariff or rental, or if a subscription is taken out elsewhere or continued by another party instead.

In addition, rebates are mandatory if bad service is provided to the customer. Customer contact is strongly encouraged in SIP, and potential subscribers frequently visit sales offices rather than ordering by telephone or mail. Forty per cent of new subscriptions are made this way. This policy has led to a recent boom in demand for new telephones – at the end of 1981, SIP had 20 million stations in service, about two thirds of British Telecom's total. Users in Italy are obliged to rent the primary telephone from SIP but are free to buy additional sets on the open market provided that they are approved by the P T Ministry.

Overall, Italian telephone penetration stands at only 35 per cent of total population compared with 50 per cent in the UK. Partial compensation for this is the high density of public call offices. These include public telephones – often in cafes – where a fee is paid to an attendant, as well as the coin-operated type. Whereas the latter used to be operated by 'gettoni' – coin tokens available at Post Offices, bars and cafes – these are now increasingly being superseded by direct use of money, or by magnetic cards.

In Italy call tariffs for any distance and time combination are more expensive than in the UK with the exception of local calls. These are charged at a flat rate – currently about 4p – and are untimed. Local call areas in Italy, however, are small compared with those in the UK and contain many fewer subscribers, with the result that the local call pricing level is not as advantageous as it may first seem. Beginning this February, the timing of local calls (six minutes for 4p during the day and 20 minutes at night) will be introduced in local networks with more than one million subscribers. This scheme includes Rome and Milan.

As in other European countries, reduced rates apply during specific periods at night. To allow a better flow of traffic over the 24 hours, different reductions – some up to 50 per cent – apply for as many as four cheap rate periods.

The Italian telephone network is predominantly carried underground, almost entirely by coaxial cables, although microwave circuits are also used for 10 per cent of lines. Exchange plant is mainly step-by-step, although 25 per cent of equipment is crossbar and a growing proportion electronic.

Investment in telecommunications in Italy in 1981 is at about the same rate as in the UK. Although in 1979 and 1980, SIP incurred small operating losses – mainly due to the inadequacy of local rates – the company has since made a complete economic recovery and at the end of 1981 made a profit of 255 billion lire (£106 million). In the same year, investments totalled 2,250 billion lire (£932 million) of which about 60 per cent was self-financed compared with 90 per cent for British Telecom. Investment is growing, however, as technological advances begin to be felt: Italtel, STET's largest equipment manufacturer, is currently introducing a new digital exchange system, Proteo, and a second generation of Proteo is being developed with some collaboration from the American Company, GTE. By the end of the decade, well over 500 billion lire (£207m) will have been spent on its development.

The first experimental digital units, concentrating on local switching were installed five years ago. Despite initial, significant software problems, transit and inter-continental lines are now in operation. These are connected to the Proteo switching centres by the Sintra digital transmission system, using both digital multiplex units and line equipment over cable and radio link microcoaxial carriers.

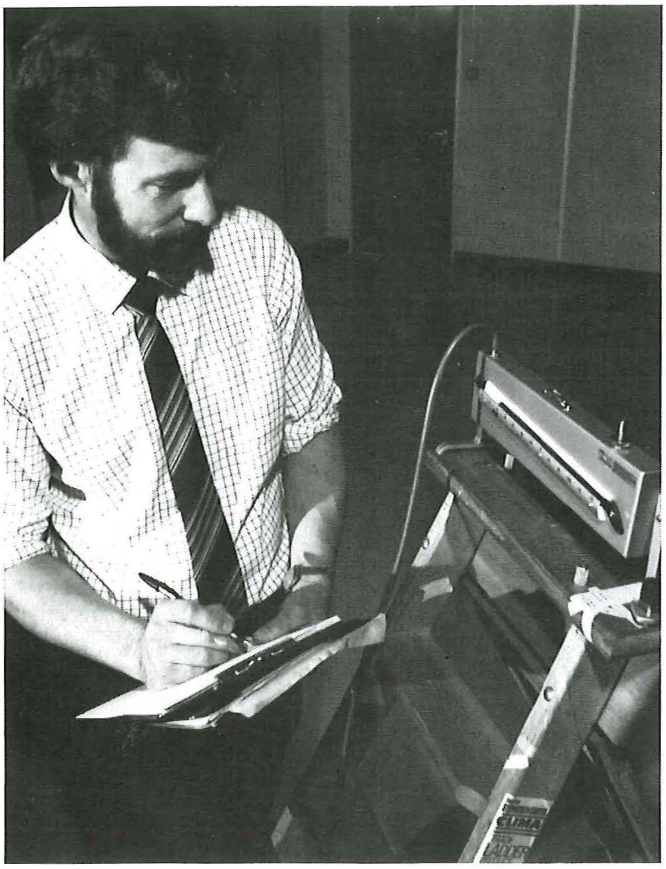
Official forecasts for penetration of the digital system by 1990 are 30 per cent for local networks (average 10km radius), 70 per cent for district networks (25km) and 50 per cent for trunk networks where it is hoped to use optical fibres to augment the coaxial transmission system.

Successive Italian governments have stated the rationalisation of the telecommunications industry as an objective. To this end, an important step is the cooperation agreement between Italtel and GTE in the switching field – an agreement that has been extended also to Fiat's telecommunications subsidiary, Telettra.

A comparison between Italy and the UK throws up several similarities such as size and population but although future reorganisation is due, Italian telecommunications structure remains vastly different from that of British Telecom. Ⓣ

The authors – **Mr P. H. Dabbs, Mr J. J. E. Swaffield, Mr D. A. Long, Mr I. Sarwar** and **Ms C. M. C. Aust** are all members of the international comparisons group in the Service and Performance Department of BTHQ. They acknowledge the help of **Mr M. Benedetti** of International Relations, STET.

British Telecom Journal, Winter 1982/83



Guildford assistant executive engineer Alan Austin (left) checks the pressure drop across the adjustable air delivery slots using a manometer with the help of clerk of works technical officer Peter Woodward.

Keeping cool with System X

D Watts

The need to cool high heat density telephone exchanges has led to the development of modular cooling units, and new methods for assessing cooling plant reliability.

Before the introduction of electronic exchanges like System X, the heat density of telephone exchange equipment was rarely excessive and in most cases it dropped considerably during periods of low traffic. Modern exchanges, however, can emit three times as much heat and in the event of cooling failure a rapid rise in room temperature occurs. To achieve high cooling system reliability from plant with moving parts such as fans, pumps, and compressors, a high degree of cooling plant modularity is nearly always necessary.

In the past, the number of major cooling plant items was selected on the basis of experience. In many cases a significant proportion of cooling plant was installed in preparation for long-term exchange growth. When planning the cooling for new high heat density exchanges however, the risks associated with learning from experience are unacceptable. A simple formula has, therefore, been developed by British Telecom, so that planning engineers can select the required number of cooling plant modules confident that specific traffic-based reliability targets will be met. This method can also be used to assess the effect of upgrading existing plants.

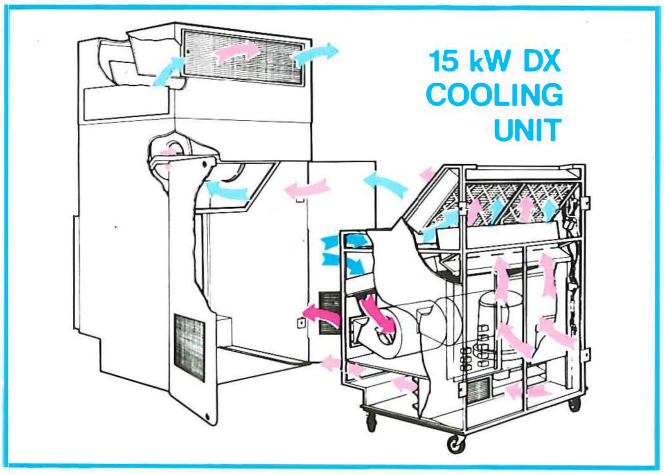
Tabulated data for use with the formula takes into account the room temperature rise tolerable in the event of partial failure of modular cooling plant so that the probability of reaching critical room temperatures is minimised. Costly provision of idle standby point is unnecessary, as the total cooling capacity of the modular plant is equated to the summer design heat load. When exchange growth is envisaged, capital expenditure can be deferred by delaying the installation of additional cooling modules until they are required.

The combination of reliability studies and practical cooling failure tests, has highlighted other factors significant to cooling philosophy for modern exchanges. British Telecom normally makes full use of outside air during cooler months and at night to reduce the running costs of refrigeration. This is possible because there is no requirement to humidify the incoming air. In some cases it becomes possible to achieve high reliability with fewer chillers, if it is arranged that plants automatically revert to full outside air cooling in the event of refrigeration failure. It is also important to limit the number of items on which cooling is dependent.

Direct expansion refrigeration plants give better reliability than systems which introduce another element such as water. Plants with both chilled water and cooling tower pumps give low reliability unless automatic full outside air fallback facilities are incorporated. Manual changeover arrangements are disregarded in terms of statistical reliability, since the integrity of the cooling plant would depend on staff availability.

Good routine maintenance is essential. Regular functional checks must be carried out on automatic changeover equipment for pumps, and components must be replaced at the end of their predicted useful life. Even with modular cooling systems, failed items must be repaired without delay to preserve high overall cooling system reliability.

Modular high reliability self-contained cooling units have now been developed by British Telecom for use with new telecom-



Above:
The 15kW refrigeration section can be completely removed and replaced but can also be totally accessed for servicing or replacing components. Here, Peter Kiff (right) executive engineer in BTHQ's Building Services Division, and Alan Austin check over the refrigeration unit.

Above left:
These two suites of System X type equipment at Baynard House in London generate about 15 kilowatts which without efficient cooling in a confined space, would rapidly increase the ambient room temperature.

Left:
Airflow from a 15kW cooling unit.

munications systems. These are normally installed along one side of the apparatus room, and require only a wall aperture and power supplies to bring them into service. Cooling is either by direct refrigeration or outside air, depending on the surrounding external conditions. If a refrigeration compressor should fail the unit automatically reverts to full outside air.

Microprocessor control – specially developed by British Telecom – is also incorporated and is the first such application in the UK. An electronic display gives a plain language read-out of detailed information such as set points, damper position and temperatures. All maintenance is carried out from the front of the units and component parts have been made easily accessible. The entire refrigeration section can be quickly removed and replaced in the event of a serious failure.

Production units have been fully tested and proved to give full design capacity with high external temperatures. Cooling plant capital costs are lower with this type of unit, and no additional space is required for chillers. In some cases local factors may prevent the use of self-contained units. It may, for instance, be impossible to cut wall apertures in some buildings, and in noise sensitive situations it may be better to locate plant on the roof.

Experience with TXE4 exchanges has highlighted the difficulties of integrating cooling supply air diffusers and cables into a common overhead grid. For System X it has been decided that discrete trays should be used for cables, leaving specific, unobstructed areas through which cool air can fall. At all large exchanges, air is distributed through a ventilated ceiling. This method of air distribution is more flexible than ductwork and diffusers, and enables large quantities of air to be introduced without draughts. It will also redistribute air if there is a partial air supply air failure.

Since overhead cable trays are used the ventilated ceiling chosen is of the slotted type with each slot being adjustable from the underside without the need to remove panels. The slots run at right angles to the exchange equipment suites, with, in the case of System X, two slots above each rack. The ventilated ceiling covers the racked equipment area only with bulkheads on all four sides, leaving the gangway clear for the fixing of busbars to the structural ceiling. Room air is returned via apparatus gangways to grilles on the front of the modular room units.

A simplified cooling policy has also been developed for smaller exchanges. Wherever possible, air will be discharged below the structural ceiling from grilles on the cooling units, without ductwork or a ventilated ceiling. The lower traffic handling capacity of these exchanges results in lower reliability targets. Modular mechanical ventilation without chilling is proposed for buildings which will not be permanently staffed.

When any new telecommunications system is under development, changes to estimated heat output, density, and disposition are to be expected. Inevitably, measured figures will produce further discrepancies. System X, has been no exception, and it is also intended to incorporate newer switching technologies as they arise.

The modular cooling philosophy, and flexibility of ventilated ceiling air supply at larger exchanges, will give planning engineers freedom to introduce new exchange equipment designs without changing cooling plant practice. Ⓣ

Mr D. Watts was formerly head of the cooling systems group in the Building Services Division of BTHQ.
He is now responsible for planning and maintaining cooling systems in British Telecom London.

Measures for success

Labour productivity is difficult to measure and inadequately approached by many managers and engineers. Efficiency alone does not ensure high productivity – the usefulness of the work done must be taken into account. Here, **Mr H. Tomlinson,** British Telecom's Director, Special Studies, Inland Division, suggests a working definition of labour productivity and looks at ways of measuring productivity improvement.

Managing an engineering-based industry can never be simple combining as it does, ordinary business problems with special difficulties – and opportunities – presented by dynamic engineering technology. One aspect of such management is the improvement of labour productivity consistent with good quality. Both productivity and quality are commonly referred to but neither is easy to define, particularly in such an intricate system as a public telecommunications network.

The quality of British Telecom's telephone service is good in most respects. It is not yet the best in the world, but it is well up in the field. Whatever productivity gains have been made have therefore, not been at the expense of quality. There is, in telecommunications system engineering, a simple and powerful maxim: 'Do it once and do it right'. Properly understood and applied it leads to high quality with high productivity. A business gets both or neither.

But why is productivity so difficult to define? Although the word is commonly used there is no universally accepted meaning. The *Concise Oxford Dictionary* simply says: 'capacity to produce; quality or state of being productive; production per unit of effort; effectiveness of productive effort, especially in industry.'

The word was rarely heard in the UK before the early 1960s when it drifted over with the flow of management lore from North America. Most UK managers thought of it then as a sloppy equivalent to 'efficiency' – and a good many still do.

Efficiency is, of course, a powerful scientific and engineering concept and in any sound system:

efficiency = output/input.

Because output and input are measured in the same units, it is a pure number, less than unity. Labour output is usually measured in terms of 'standard' hours worth of work done and input in hours of labour expended (or paid for!). The ratio is often called 'performance'. The snag is that it is too easy to do efficiently the wrong job.

The lesson of the early 1960s about labour productivity in the telecommunications world was first learnt by studying American methods and later from our own contributions. From that a working, and admittedly imprecise, definition was established that:

productivity = useful output/input and labour productivity = useful output/labour input.

In the situation where all outputs are represented in terms of a common unit and the required outputs are fully predetermined there is little difference between productivity and efficiency. Such situations often exist in manufacturing industry, where production quantities are specified, optimum methods prescribed, supervision close, employee discretion nil and measurement easy. This situation does not exist, to any large extent, in telephone service operating companies offering large ranges of services involving continuous customer choice as well as employee initiative and discretion. Thus another equation emerged:

productivity = efficiency × usefulness

Since usefulness is not itself easy to define or measure exactly in practice, the equation is not a sound basis for productivity measurement in a telephone service environment. It does, however, have two valuable derivatives. The first is that efficiency and usefulness are each worth pursuit, separately or together, and the second is that to be truly productive, the questions 'What are the useful products of this process?', 'Why do we do it?', "How best can we measure our useful output?", must be repeatedly asked.

But why put such strong emphasis on labour productivity? The fact that the cost of labour is usually a substantial fraction of the cost of running a business can hardly be ignored. In the case of British Telecom, labour costs are almost half the total cost of the service, and so improvement in labour productivity can contribute much to economic soundness. Since labour costs are the most difficult to manage, it is sensible for managers to give them careful attention.

Before 1940 there was some attention to work efficiency mostly by individual supervisors and managers. Work measurement had been applied to switchboard operating from the early years of this century, and individual engineering supervisors are known to have applied approximate work measurements from even earlier dates. Overall there was little urge to seek improvement.

The period from 1946 to the early 1960s was one of struggling to patch and extend the network, to overcome backlog problems, and to reconstruct as was feasible. Much work was done on labour efficiency involving method study and work measurement, with the development and application of systems for telephone construction work and to switchboard operating and allied duties.

From about 1962, attention has increasingly swung to true labour productivity improvement. Although efficiency has not been neglected, there has been a great struggle to understand and exploit other aspects of productivity improvement, such as redesign of processes to reach the desired output more directly, elimination or reduction of unnecessary intermediate steps, improved organisation, substitution of capital investment for labour where economical, better motivation of managers and better control of manpower.

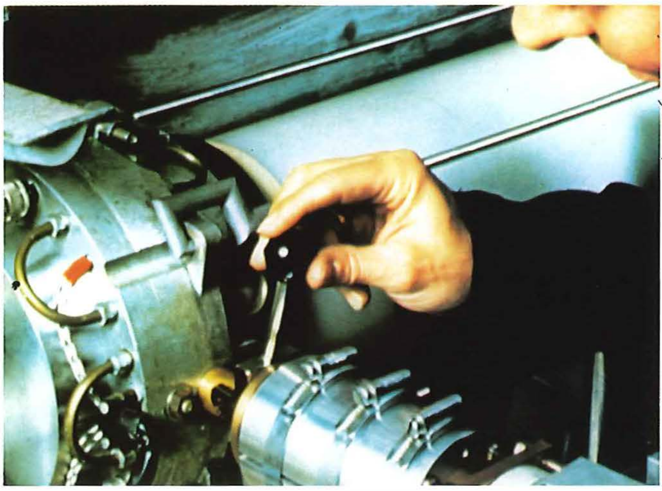
Accurate measurement of productivity is difficult and complex but some rough indications can be obtained by using comparatively easily obtained and readily understood figures. For instance, an extremely crude indication comes from 'stations' per employee. Figure 1 (on page 14) shows the ratio for British Telecom, plotted over the years 1971/82. There is also a close relationship between telephone penetration and labour productivity, at least for well run administrations, and that UK performance compares favourably with the rest.

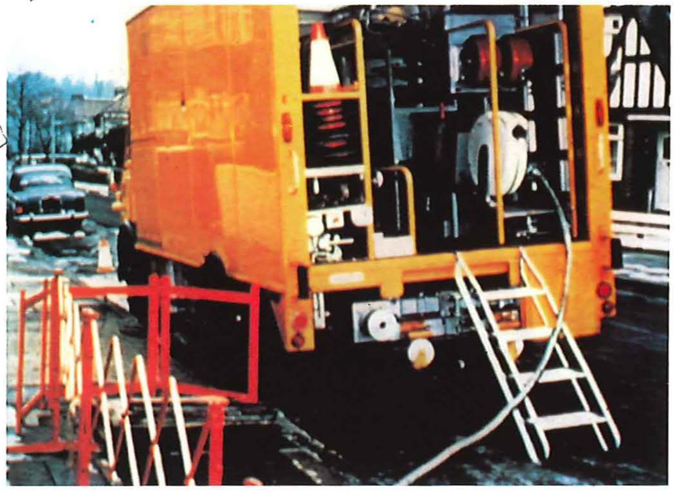
There are, in fact, several good reasons why higher labour productivity tends to go with higher telephone penetration. A large element of labour is roughly proportional to system growth rate and another large element proportional to system size. Telephone system growth tends to follow an 'S' curve and so for highly penetrated systems the growth related labour element decreases relative to system size.

Again, high penetration means closely spaced telephones which eases staff location and reduces travel costs. Large systems make for the efficient use of plant and help to introduce advanced technologies both of which increase the effectiveness of use of labour.

In 1950 all trunk telephone calls were manually connected and about 30 per cent of customers were served by manual exchanges. Figure 2 shows what would have happened to the operator force had telephone use grown to its present level, without any changes in methods of handling. It also shows what has actually happened to the operator force and indicates, roughly, the main factors involved. The question to be asked is, how much of this labour reduction should count as labour productivity improvement?

Clerical/Executive effort is not only related to system size but also to system use. Figure 3 shows actual clerical staff numbers at 1960, what would have happened to those numbers had 1960





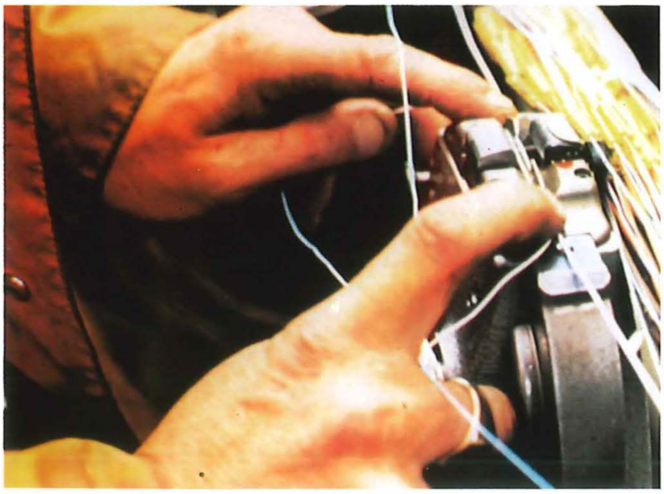
Above:
Injection moulding is now used to close cable sheaths.

Above right:
Rodding and light cabling vehicles are now widely used.

Right:
Poles are now erected using a special mobile unit.

Bottom left:
Cable jointing machines are now in common use.

Bottom right:
Using a dropwire dispenser, one man can install an overhead feed.



working practices continued, what has actually happened to the number employed and some of the main factors involved.

The largest group of British Telecom employees are engaged on engineering work. Figure 4 shows the actual number of engineering employees at 1960, what might have been expected to happen to that number had 1960 working practices continued, and what has actually happened over the past 20 years.

In British Telecom, labour productivity improvement can be attributed to:

★ Improved technology
★ Substitution of capital investment for labour
★ Working method changes
★ Computerisation
★ Management and staff motivation and
★ Manpower planning.

These factors are rarely involved singly. Examples of productivity improvement attributable to improved technology, capital investment, working method changes and computerisation are evident, but those examples involving motivation and manpower planning are less so.

Measurements are needed to motivate and manage, and there is little justification for productivity measurement if it is not aimed at, and used for, productivity improvement. In the early 1960s, a series of productivity measurements were developed, all in the general form:

productivity =
useful output/labour input.

By 1979 there were 24 of these measurements. They were effective management tools, because they focused

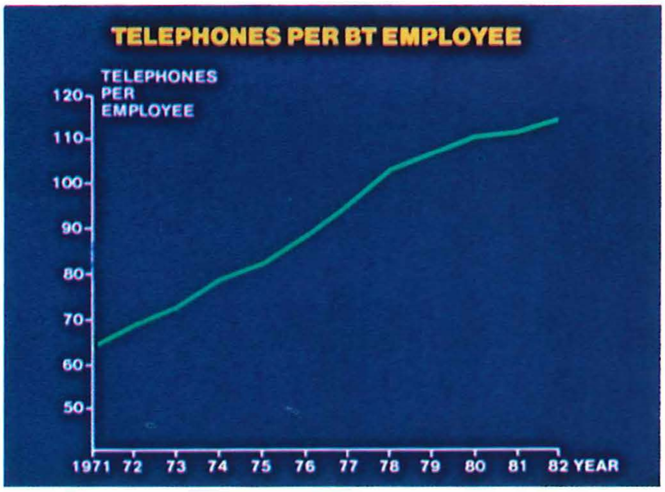


Figure 1

Figure 2

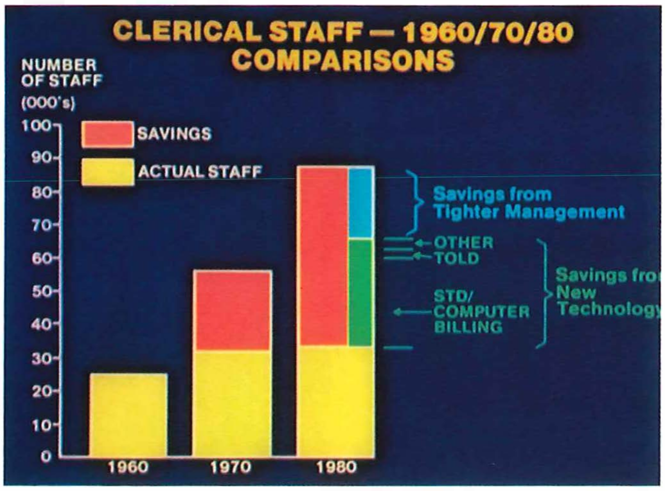


Figure 3

Figure 4

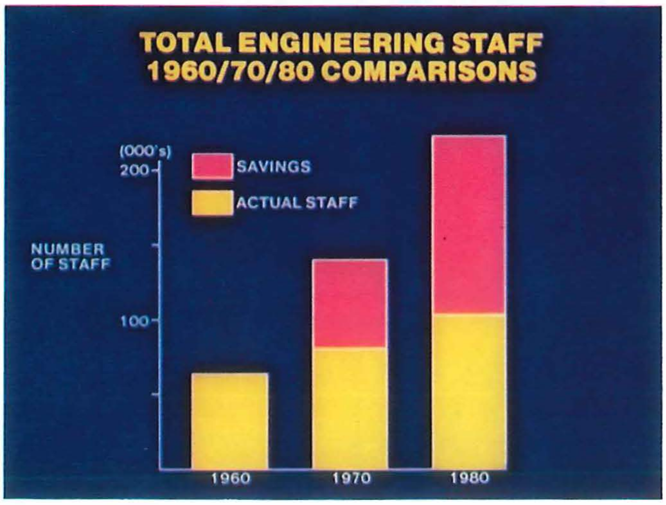


Figure 5

PRODUCTIVITY IMPROVEMENT INDICES (PII)

PII No	
1	Overall
2	Customer Installation
3	Other Capital Account
4	Maintenance
5	Other Engineering Current Account
6	Marketing and Sales
7	Billing and Support Services
8	Operator and Customer Service

attention on the end product and the labour expended. There was, however, a major drawback because a single 'product' had to be selected as representing the useful output. In a telecommunications operating business the outputs are many and the mix varies greatly. There was a reluctance to change 'products' because of the loss of continuity and a high level of 'factoring out' had to be done.

Apart from occasional stocktaking, managers need to know whether their productivity is better or worse and at what rate it has changed. With this in mind British Telecom introduced a new system of productivity measurement called Productivity Improvement Indicators (PIIs). In this system a set of products is selected to represent reasonably useful output. There can be as many or as few such products as needed to cover the activity and, while end products are preferable, transfer products can be used. Every product should be easily measurable (and auditable) and the labour involved must also be able to be measured.

For each product, the output in year one is divided by labour expended (kilomanhours) during year one to give a products/kmh ratio. That ratio is applied to the products for year two to yield hypothetical kilomanhours for year two – the kilomanhours that would be expended to get the products at the year one productivity rate. The actual year two kilomanhours can be compared with the hypothetical quantity, and the resultant ratio is a true productivity improvement measure.

In British Telecom's PII system, more than 200 products are used, but hypothetical and actual kilomanhours are combined to yield eight improvement indicators – one for the overall inland labour force and seven for component activities (see figure 5). If the organisation changes, the PII system can change to reflect it. New products can be added and old ones can be dropped with little or no difficulty.

The system is well ahead of any other and is proving a useful analytical and motivational tool. It is perhaps not universally popular because it is a hard and uncomfortable system, exposes areas of ignorance and problems conveniently hidden by earlier systems, is auditable, and relies wholly upon facts. And not everyone adapts easily to the concept of a differential rather than absolute system.

As far as manpower planning is concerned the central issue is simple – if the right number of people with the right skills are not in the right places, output will not be achieved, and if there are too many people anywhere, anytime, there will be no productivity. It can in fact be convincingly argued that managers are better off with slightly too few than with too many staff. To advance productivity in a complex, dynamic, interactive industry involving initiative and judgement at modest low levels, it is the managers who need to be skilfully and carefully squeezed.

If a business has staff of low skills with high wastage rates, manpower planning is not essential or difficult. If however, as in the case of British Telecom, a substantial proportion of the staff is highly skilled and natural wastage is low, manpower planning is very necessary and very difficult.

Over the years managers and engineers have made the dominant contribution to increasing labour productivity. They may also be able to contribute to the solution of the resultant problem of how society should react to the situation in which a fraction of the potential workers can comfortably produce all that society can reasonably consume.

British Telecom Journal, Winter 1982/83

Quality of telephone service April 1981 to March 1982

Figures in brackets indicate performance during the year April 1980–March 1981

Local automatic telephone service	Calls connected successfully	**63.3%**	**(63.6%)**
	Calls which obtain 'engaged' or 'no reply'	**28.4%**	**(28.2%)**
	Calls that fail due to the customer	**7.0%**	**(6.8%)**
	Calls that fail due to British Telecom	**1.3%**	**(1.4%)**
STD automatic telephone service	Calls connected successfully	**64.9%**	**(65.0%)**
	Calls which obtain 'engaged' or 'no reply'	**24.4%**	**(24.2%)**
	Calls that fail due to the customer	**8.0%**	**(7.9%)**
	Calls that fail due to British Telecom	**2.7%**	**(2.9%)**
Repair service	Yearly fault reports per telephone	**0.58**	**(0.60)**
	Fault reports cleared by end of next working day	**79.6%**	**(75.9%)**
Inland telephone operator service	Calls answered within 15 seconds	**87.4%**	**(88.9%)**
International automatic telephone service (IDD)	Calls connected successfully	**41.1%**	**(38.4%)**
	Calls that fail in the international automatic exchanges	**2.2%**	**(2.5%)**
	Calls that fail due to other causes	**56.7%**	**(59.1%)**
International telephone operator service	Calls answered within 15 seconds	**78.0%**	**(78.0%)**

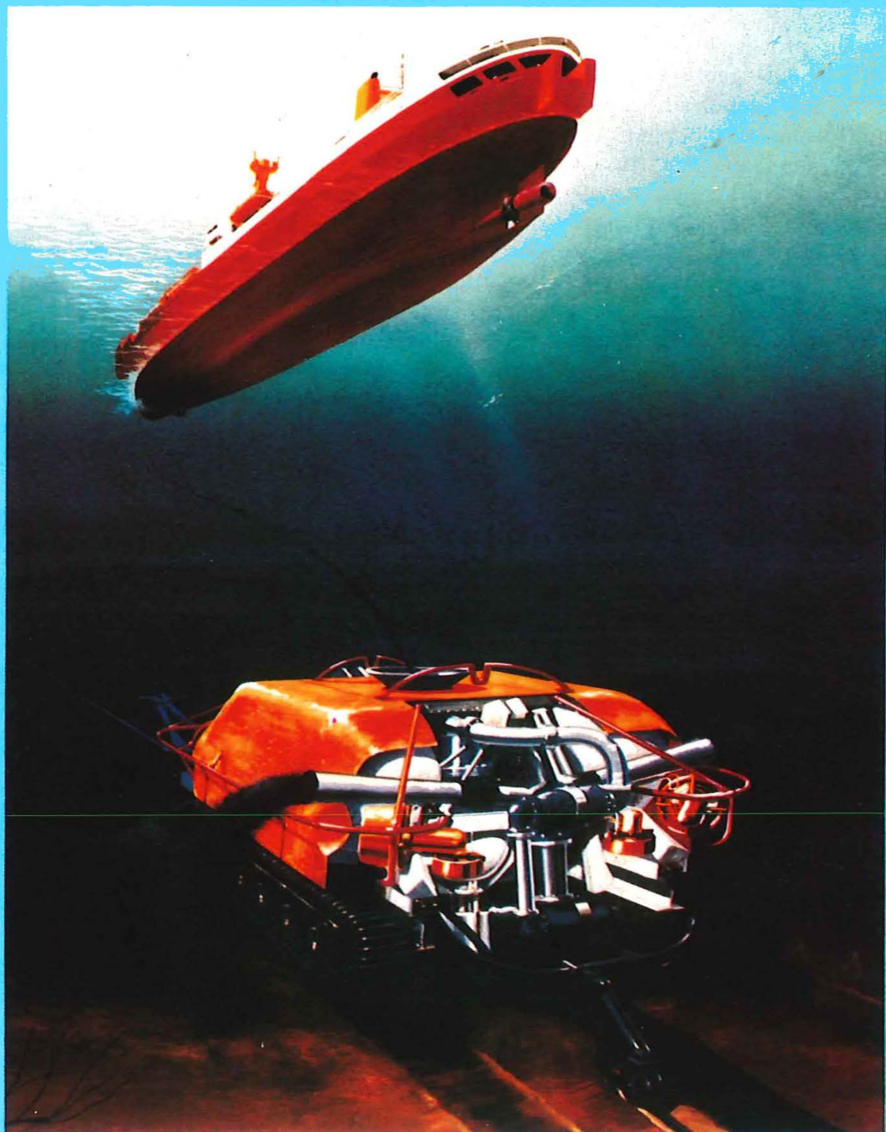
Making tracks on the sea bed

P Vincent-Brown

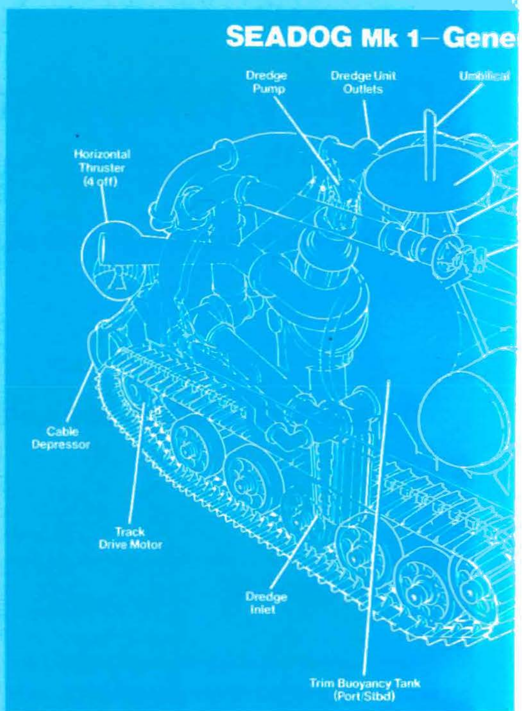
A remote-control underwater tracked vehicle, designed to bury and inspect submarine telecommunications cables in depths down to 300 metres, is soon to begin sea-proving trials from the British Telecom cable ship *Monarch.*

Jointly developed by British Telecom International (BTI) and Yorkshire-based company Slingsby Engineering, a 15 tonne craft, called Seadog, will help to reduce persistent damage to submarine cables from fishing trawl gear by burying cables into the sea bed.

Submarine cables are a vital part of the worldwide communications network, and so must be very reliable. Since the mid-1960s, the administrations responsible for cable operations – the United States, Japan, Canada, France and the United Kingdom – have been looking hard at finding new ways of protecting cable, particularly against damage caused by fishing trawl gear. For cables laid in waters deeper than a kilometre, the only protection is the polyethylene sheathing. But in shallower waters, cables are given an additional one or two layers of helically-wound steel armour wire, although this has not always been enough to combat modern trawling techniques. Despite lengthy research, it was eventually accepted that further developments in armouring would be impractical and uneconomic. An alternative method of protecting submarine cable is by burying it.



Looking very much like a futuristic tank, the 20-foot long Seadog can bury cables up to a depth of one metre, as well as helping to inspect, recover and rebury cables during maintenance work. Seadog is controlled from a support ship on the surface through an umbilical lifeline connected to an on-board operations control cabin. With the aid of thrusters and buoyancy tanks, the vehicle can swim to the ocean floor. Once there, it moves along on caterpillar tracks, locating the



submarine cable using video cameras and magnetic sensors. Using high and low pressure water jets, the vehicle can cut a trench under the cable while travelling on seabed surfaces which can range from sand to clay.

Seadog can operate in depths up to 300 metres and currents of up to three knots using horizontal and vertical thrusters. These are controlled by a lever providing horizontal and vertical translation and control. When on the seabed, the track units take over and are powered by hydraulic motors mounted in the drive sprockets of the two tracks. Independent servo-valve control provides variable speed forward and reverse motion and differential steering.

Weight has been kept to a minimum on Seadog which has been built on a glass-reinforced plastic chassis holding the various sub-systems, buoyancy and trim, thrusters, tacks, trenching system, manipulator, video and cable detection systems. Buoyancy is adjusted by pumping seawater into and between tanks contained within two large pressure vessels. All mechanical functions are hydraulically powered and electrically controlled.

The vehicle digs trenches using a suction dredge pump, beneath which is a tubular inlet pipe which can be pivoted and extended to vary the trench depth. On the front is a general purpose manipulator which can be used to place acoustic markers as well as helping with cable cutting and attaching cable grippers during recovery and repair.

Seadog's eyes are in the form of three video cameras, one fore, one aft and the third, a high definition camera, mounted on the manipulator arm. There is also a 35mm stills camera which is used for photographic records. Lighting is achieved through nine individually selectable tungsten iodide lamps and a Xenon flash unit.

Cables are located and tracked using an active magnetic cable sensing system which relies on the ferromagnetic content of the cable and special 'transmit and sense' coils in the tracking system. These coils are contained in a head located on a trailing arm stowed in the vehicle when not in use. Initial positioning of the head is manually controlled from the control console. An alternative cable detection system relies on sensing the magnetic field radiated from a submarine cable when a 25Hz current is injected at the shore station.

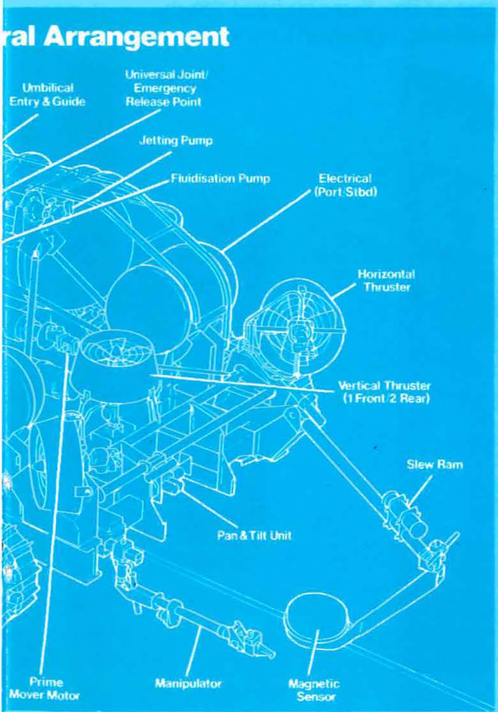
Seadog's lifeline is the umbilical cable which is used to transmit power to the vehicle from the control cabin and also provides data and video links for remote control.

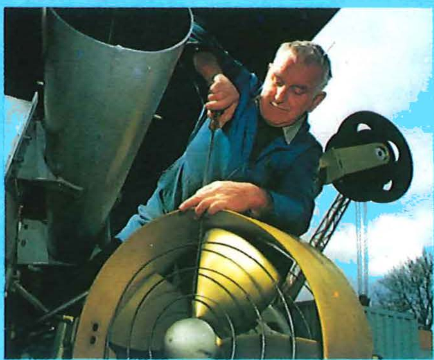
The vehicle has also been fitted with a magnetic compass, and information from this, along with depth, altitude, and pitch and roll sensors, is displayed on the control console. The operator can also use an acoustic navigation system which details the position of Seadog in relation to the support ship. Other acoustic systems are also provided to enable Seadog to avoid obstacles, to provide information about the trenches and to place acoustic markers.

Trials with *CS Monarch* will be extensive and are designed to test fully the system and establish working methods before it becomes fully operational later this year. By then, a full programme of work on high-capacity cable systems is envisaged and with the interest shown from offshore energy industries, Seadog looks set to have a promising commercial future.

Mr P. Vincent-Brown is a head of group in British Telecom International's Marine Division based at Southampton and is responsible for the Seadog project.

British Telecom Journal, Winter 1982/83





Above:
Seadog began underwater trials in Loch Linnhe early last year. Further sea trials are taking place this year using *CS Monarch* as support ship.

Left:
A Slingsby Engineering technician makes final adjustments to one of the thrusters used to power Seadog to the ocean floor.

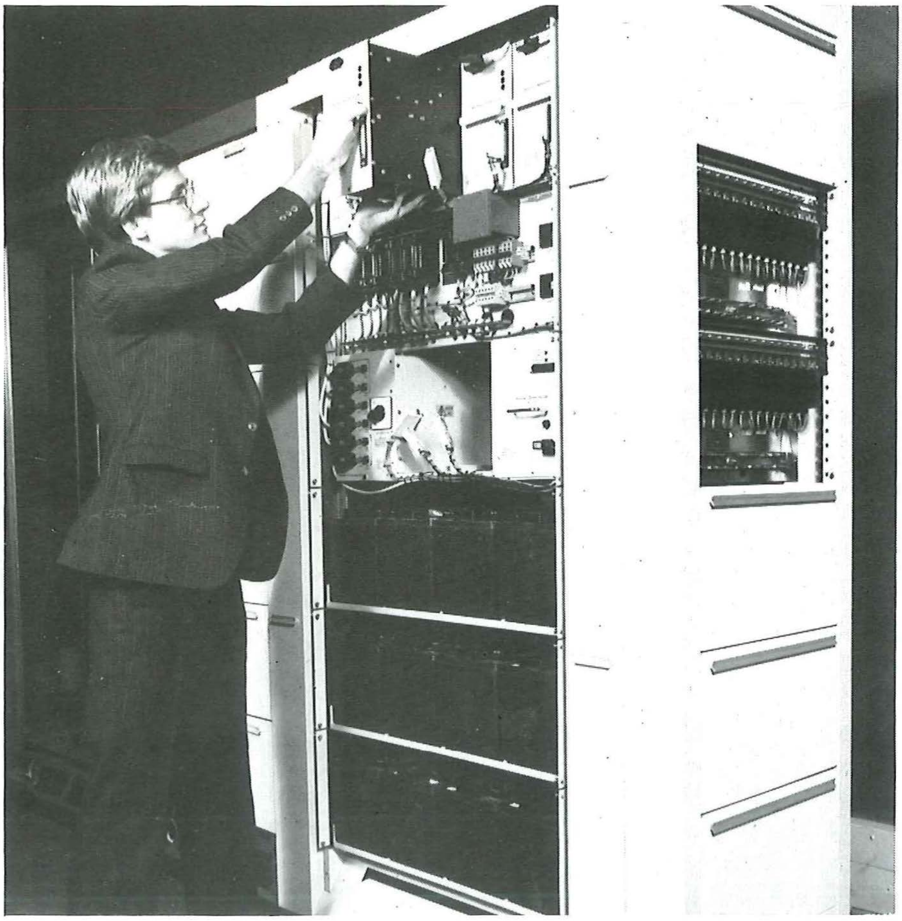
First in the world!

R New
and BA Wittey

A world-first complete rack-mounted power system for telephone exchanges has been developed by British Telecom.

Executive engineer Martin Hutchings (left) and Ray Kingdom demonstrate the power of the new equipment. The block they are holding is equal to the power value of one of the larger batteries behind.

Design engineer Ray Kingdom replaces one of the five compact 28amp rectifiers in a power equipment rack (PER) being tested in London.



Development of dc power systems in British Telecom aims to produce power plant which is aligned with equipment needs and practices. Modern needs are for greater flexibility and for the power equipment to be fully compatible. These aims are now possible with the use of switch mode rectifiers and sealed secondary lead cells for power storage. Full advantage is now being taken of the technological developments in both these areas, to produce a power equipment rack (PER) for installation en-suite with telecommunications equipment. It will provide all the necessary conversion and power storage from the public mains input (240V ac) to the secure dc supply voltage and its development is a world first.

Earlier developments in dc power supplies produced a modular central power plant which brought advantages of standardisation and enabled production and planning to be concentrated on a range of standard sizes. Central plant, however, has the disadvantage that the weight and nature of the equipment require special accommodation. Problems are compounded by the need to provide accommodation at the initial building stage for power equipment of sufficient size to meet the ultimate telecommunications equipment load which may be some five to 20 years in the future.

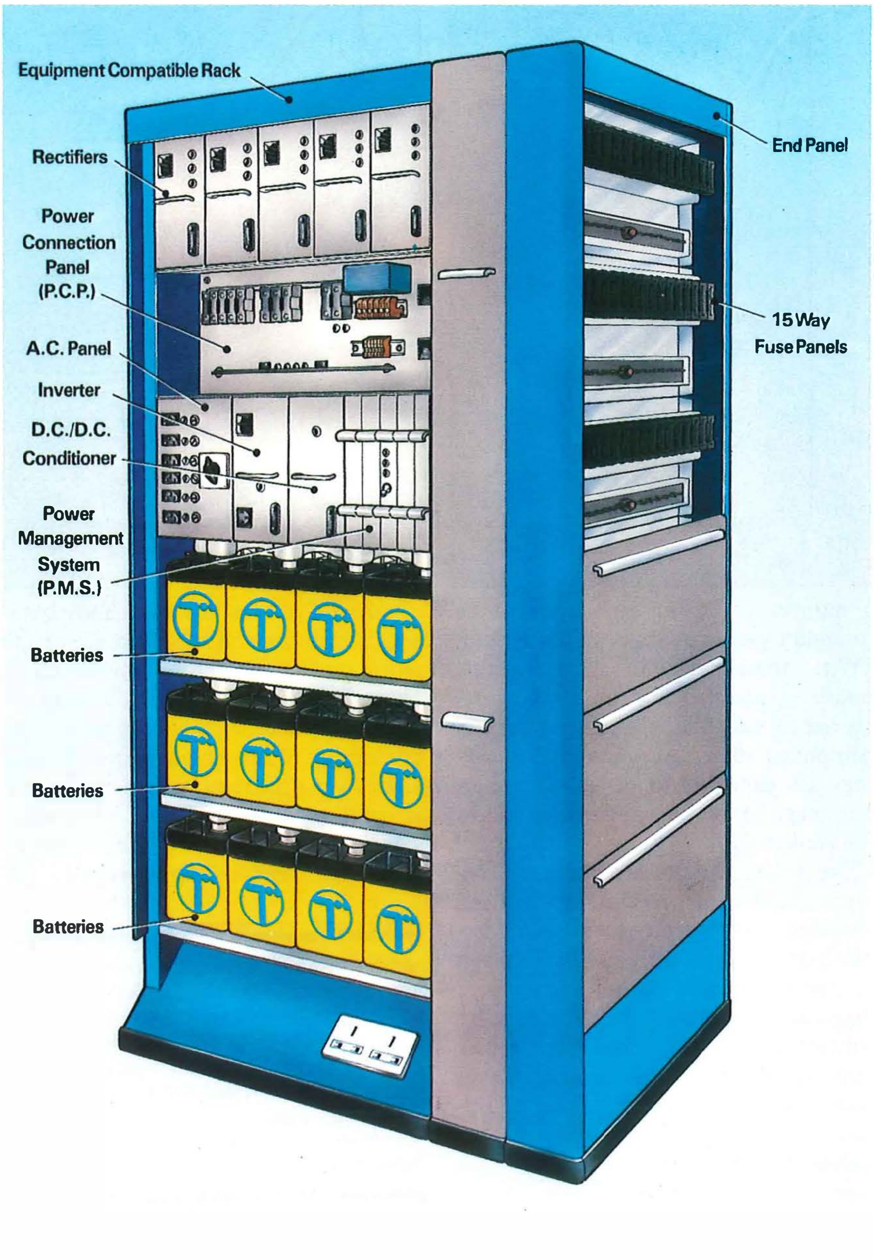
Distribution is usually via aluminium bars from the power plant to the equipment area and has to be planned at an early stage because of long lead times for installation. Long main distribution bar routes are also vulnerable to faults.

With British Telecom's modernisation programme based on large-scale installation of System X, future needs were carefully examined to ensure power development was proceeding in line with modern system requirements. System X brings a number of changes in equipment practice and those significant to dc power are a large reduction in accommodation needs for exchange equipment, reduced ordering and installation lead time scales, a possibility of providing modular exchange systems, and factory assembly and testing of completed exchange switching systems with installation and commissioning on site in weeks rather than months or years.

It was clearly identified that as well as providing a cost-effective and secure electrical power supply, the dc power plant should satisfy two further basic requirements – equipment environmental compatibility to allow maximum use of accommodation and flexibility of power provision to meet changing needs.

These are met if the dc power system can be part of the complete telecommunications installation, installed on site at the same time, or made available for factory incorporation and commissioning. So far, this has been impracticable owing to the bulky nature of power equipment, the need for battery ventilation to remove products of electrolysis and the interconnection requirements of power supplies demanded by existing telecommunications equipment powered directly from the negative 50V supply.

The power equipment rack in detail.



To determine the direction of development, the five major factors taken into account, in addition to the basic requirement to provide power economically at the prescribed levels, were reliability, flexibility, installation, maintenance, and cost. An early production unit was unveiled last October at the International Telephone Energy Conference in Washington DC, USA. A programme for major British Telecom installations is planned and will start from January next year.

Within the rack, power equipment is mounted on shelves, three for batteries, one for rectifiers and one for special units. The remaining space is used for a connection panel and gives flexibility to meet the thermal demands of natural convection cooled equipment. The rectifiers and special units are designed on a sub-shelf module to allow interchangeability and the selected arrangement is five units to a shelf. This concept of small interchangeable unit modules enables great flexibility to be achieved to match power to the load. Keystone to the development is modern technology which offers the sealed, maintenance-free battery with a design life of at least 10 years.

A major factor is realising the power rack concept was the decision to use switch mode power units operating at 20kHz to reduce the size and weight of the rectifier and filter equipment. The present development is based on a 1.5kW unit and a shelf configuration which provides up to four operational units and one standby unit operating in parallel to give up to 6kW output, the 1.5kW unit gives flexibility and the small size aids installation and maintenance.

Under normal operating conditions, dc power is supplied at a voltage of 5.4.5V with a fall to 44V at the end of the battery discharge period. The principal change from present practice is an increase in maximum operating voltage from 52V to 55W, acceptable for most new equipment. This has been adopted to enable a simple battery float, constant potential charging arrangement to be used with the wider voltage range and leads to reduced capital cost and improved reliability.

Power distribution within an exchange will in future be at medium voltage (240/415V ac) up to the power equipment rack. This will simplify installation and allow planning flexibility. Battery reserve will be at the power equipment terminals providing a buffer against disturbances on the main supply.

The supply to each rectifier is at 240V single phase ac which allows them to be used on either single or three phase electricity supplies. The dc connection panel brings together the various outputs and provides a focal point for monitoring and protection. Fused outputs are used from each of the rectifier units and solid links from the battery. 1.5kW converters or 500VA inverters are available as module units for the PER to provide limited power for special purposes. These are fed from the dc connection panel in the same way as the switching or transmission equipment.

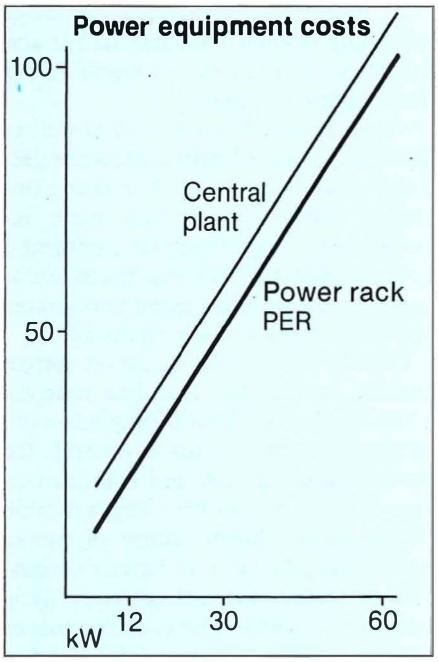
The distribution to telecommunications equipment is from a suite distribution panel mounted adjacent to the power rack. These panels have a capacity of 75 circuits each of 20 amp rating but normally loaded no more than ten amps. The main distribution is reduced to a short length of cable from the power equipment rack to the suite distribution panel, is easily installed, and overcomes most of the problems associated with distribution bars.

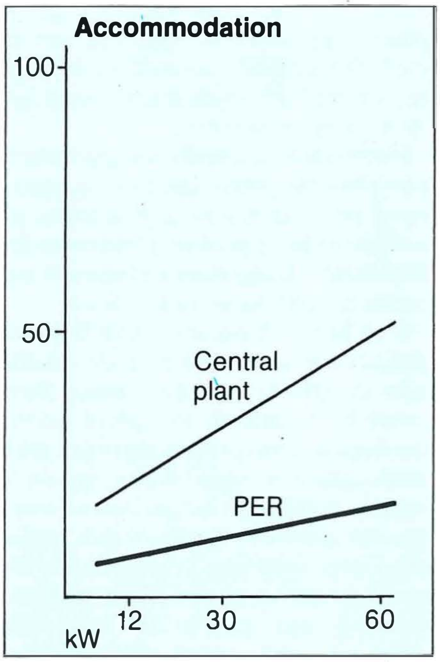
This closer integration of power with telecommunications equipment offers the opportunity to use data processing and maintenance facilities provided as part of the switching equipment on a shared basis and will enable remote operations and maintenance centres (OMCs) to supervise both the telecommunications service and the power supply.

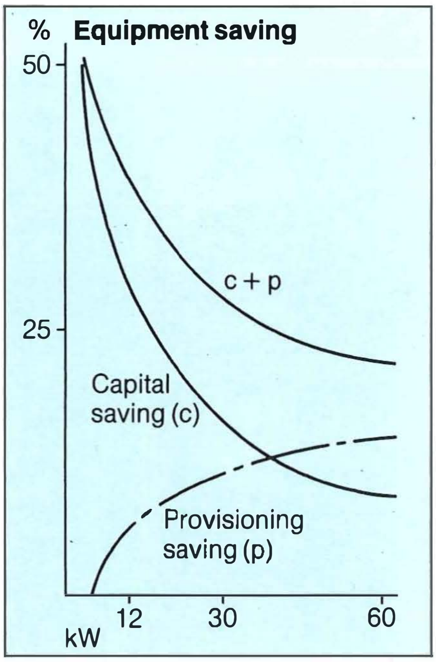
A microprocessor unit is being developed to provide a range of facilities in a Power Management Sub-System (PMS) compatible with the associated telecommunications system. The complete PMS will comprise a microprocessor on each PER and an interface processor to connect a number of PERs to the exchange general information system. The primary function of the PMS microprocessors is to monitor power equipment condition on that rack remotely as well as locally, and to extend alarm facilities with pre-determined priorities to the OMC and to respond to alarm interrogation with status reports.

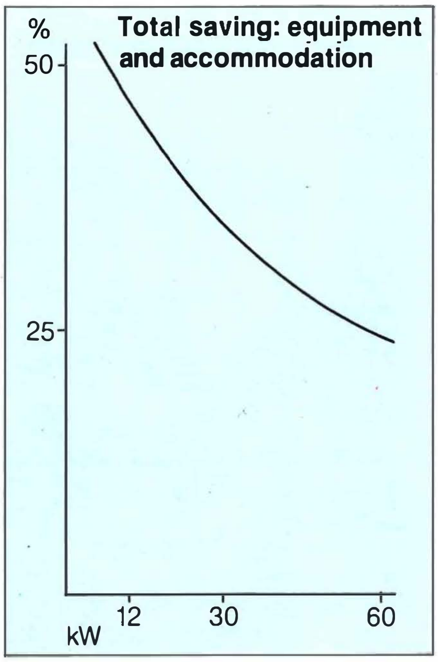
Battery performance will be verified by monitoring the battery discharge voltage and current during an annual test discharge controlled automatically by the PMS. The processor will also be capable of adjusting power to, healthy or faulty units, under automatic or manual control and provide regular calendar routines. In the event of failure, all controls are returned to the power equipment to maintain the stand-alone integrity of the power rack.

The intention is to integrate the PMS with the exchange information system to enable overall performance to be monitored at a common point. Highways will be extended from the individual PMS units to the maindata systems via an interface unit. This is necessary to enable









a number of power rack units to be brought together onto a common system.

With these 'en-suite' power units, power is planned and installed as required to meet the telecommunications equipment loads. Accommodation savings are expected to be significant as power can be installed in the same area as the equipment.

The system also allows for unit replacement maintenance methods to be used enabling power maintenance to be undertaken off site, and testing and repair can be undertaken at a central point where diagnostic equipment is available. By concentrating work load on repair centres, adequate work is available to keep staff conversant with the equipment. This is expected to result in higher standards, improved reliability and reduced total power costs.

In these days of rapid change and expansion, flexibility and reliability are prime requirements of any system which is likely to evolve and take advantage of technological changes as they arise. The availability of a complete power package virtually off the shelf, which can be and integral part on exchange equipment suite is a major advance in the field of telecommunications engineering.

Mr R. New is a head of section in Energy, Transport and Accommodation Division of Network Executive and is responsible for dc power system development.

Mr B. A. Wittey is a head of group in the same division responsible for power equipment design.

The network master plan

K W J Lonnen
and J Fieldhouse

Development of an overlay national digital switching and transmission trunk network by 1988; 12 million System X connections installed by 1992 and all large Strowger local exchanges to be removed from the network by about the same time. These are three of the main challenges British Telecom has set itself for the next decade to create a telecommunications network capable of meeting the needs of the information society rapidly emerging in Britain today. The scale of this task can be measured by the simple fact that it took about 60 years to build up today's automatic network to its present 19 million connections.

Digitalisation of the network is the largest and most complex interrelated task ever undertaken within British Telecom and will swallow a total expenditure of £6,000 million over the next ten

From left to right, systems planning engineers Ray Murphy and Jim Williams from British Telecom London headquarters meet Ken Lonnen, head of network planning and performance division in IDHQ, and Phil Copping, head of section in the same division, to discuss the current year's plan.

years at today's prices. Such an ambitious task needs an effective planning framework if it is to be carried through on time, at minimum cost and in such a way that customers obtain improved facilities at the earliest date.

The network master plan (NMP) provides this framework within which all modernisation planning can take place in a coherent, directed manner, and in a form amenable to analysis which will confirm its internal consistency and that intended objectives are met. Physically the NMP, which is prepared and published annually, consists of 11 volumes, the first of which contains the strategic guidance to modernisation policy. The 10 other volumes contain plans for each region drawn up by regional planners and based on guidance in the first volume.

The NMP emerged after strategic studies had been carried out at THQ from the mid-1970s with the aim of determining the best way of converting the existing analogue network into an integrated digital network (IDN). A report on those studies was published in 1979 and among the major conclusions was that the conversion to a digital network should be as rapid as possible and that eventually digital working should be extended to customers premises to form an ISDN. With these broad aims set, the next question was how could the transition to the desired digital network be best achieved.

It was immediately apparent that maximum benefit from digital systems, and the most economical and efficient means of conversion from the old to the new network, could only be achieved if all planning was carried out in a co-ordinated and coherent manner. This implied a total network approach to digital planning and it followed that what was needed was a master plan on which all planning could be based and which could be regarded as a key control document.

Formal proposals for such an all embracing plan were first aired, and rapidly accepted, towards the end of 1979 and early 1980. At the same time, as part of the reorganisation of THQ, the Network Strategy Department (NSD) was set up and charged with the responsibility for establishing the NMP, recognising, of course, that responsibility for determining the best means of achieving strategy objectives for a particular plant sector rests firmly with the operational department concerned. General agreement having been reached on the purpose and content of the NMP, preparation of the first plan began early in 1980 and the first annual report was published in December of that year.

The annual cycle begins towards the end of each year with the revision of overall network policy and strategic objectives by NSD. Work on this, of course, is continuous but it is around this time that tentative ideas must become definite proposals for submission as part of the annual modernisation review. Aim of this review is to assess the practical effects of the strategy so far and point the direction which modernisation policy should take in the course of the following year.

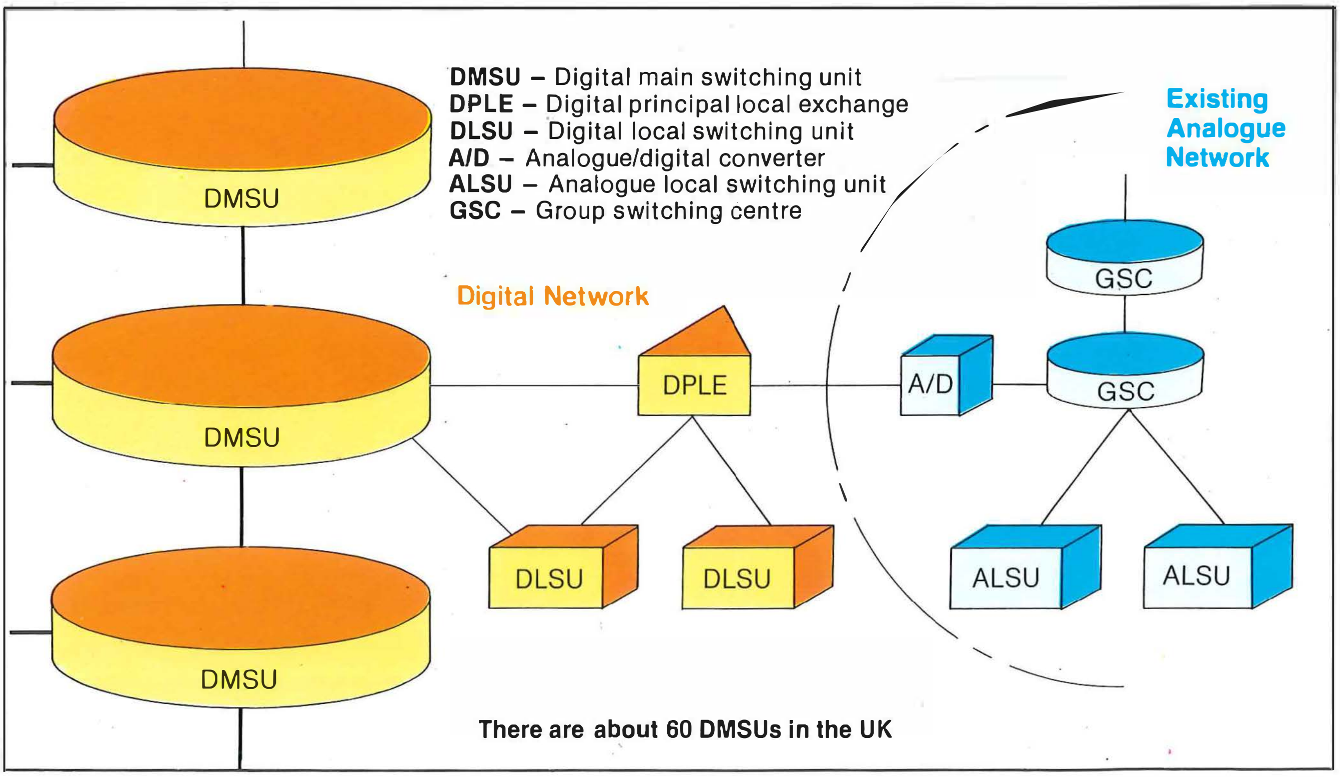
Providing approval is obtained, proposed strategy and objectives are published and distributed to operational departments within Inland Division Headquarters (IDHQ). It is a fundamental aspect of the plan that operational departments should be responsible for ensuring that the right action is taken to achieve the strategy objectives, and for devising the checks to assure senior management that objectives will be met.

Guidance from operational departments is prepared between November and January. NSD's vital role in this period is to ensure that the guidance produced conforms to the strategy objectives and is consistent from one section to another. With so many people and departments involved there is inevitably the possibility of misunderstandings and misinterpretations and these must obviously be eliminated as far as possible.

At this point regional and area planners come into the picture. Their plans must be based on the latest sales rolling forecast of exchange connections and traffic forecasts which become available from April each year. Regions play the key role in turning a set of generalised objectives into a practical plan, which, for example, in the switching sector, names exchanges and puts dates and sizes on the planned introduction of digital equipment. From these plans, a national picture can be built up of the equipment reqirements year by year to achieve strategy objectives.

But no modernisation plan can ever be

How the old and the new networks come together.



achieved without the proper resources. For this reason a link between the NMP and the British Telecom five-year investment plan is of fundamental importance. Regions return their practical plans to IDHQ in July for assessment and operational departments check that targets have been met and objectives achieved within the sphere of their own responsibility. NSD ensure that there is a consistency of plans between each of the sectors.

The final event in the cycle is the preparation of a report to senior regional and IDHQ management. This is produced co-operatively by NSD and operational departments. It assesses the practical implications of the plan, identifies problems which have been exposed and suggests, if necessary, new aspects which need investigation or call for more detailed attention. It also compares the degree to which the real plan meets the policy aspirations expected. Provided the report indicates satisfactory progress, the NMP is endorsed as the basic document for all modernisation planning for the following year.

As a direct result of increased commercial pressures over the last two or three years, the attitude of British Telecom towards deployment of System X has been subject to a change of emphasis. Whereas previously modernisation policy was directed more towards replacing outdated equipment with improvement in the quality of service the major objective, emphasis has now shifted to maximising the profits of the Business. A crucial factor has been co-operation between marketing and planning staff to ensure that System X will be deployed speedily to places where local marketing needs have been identified.

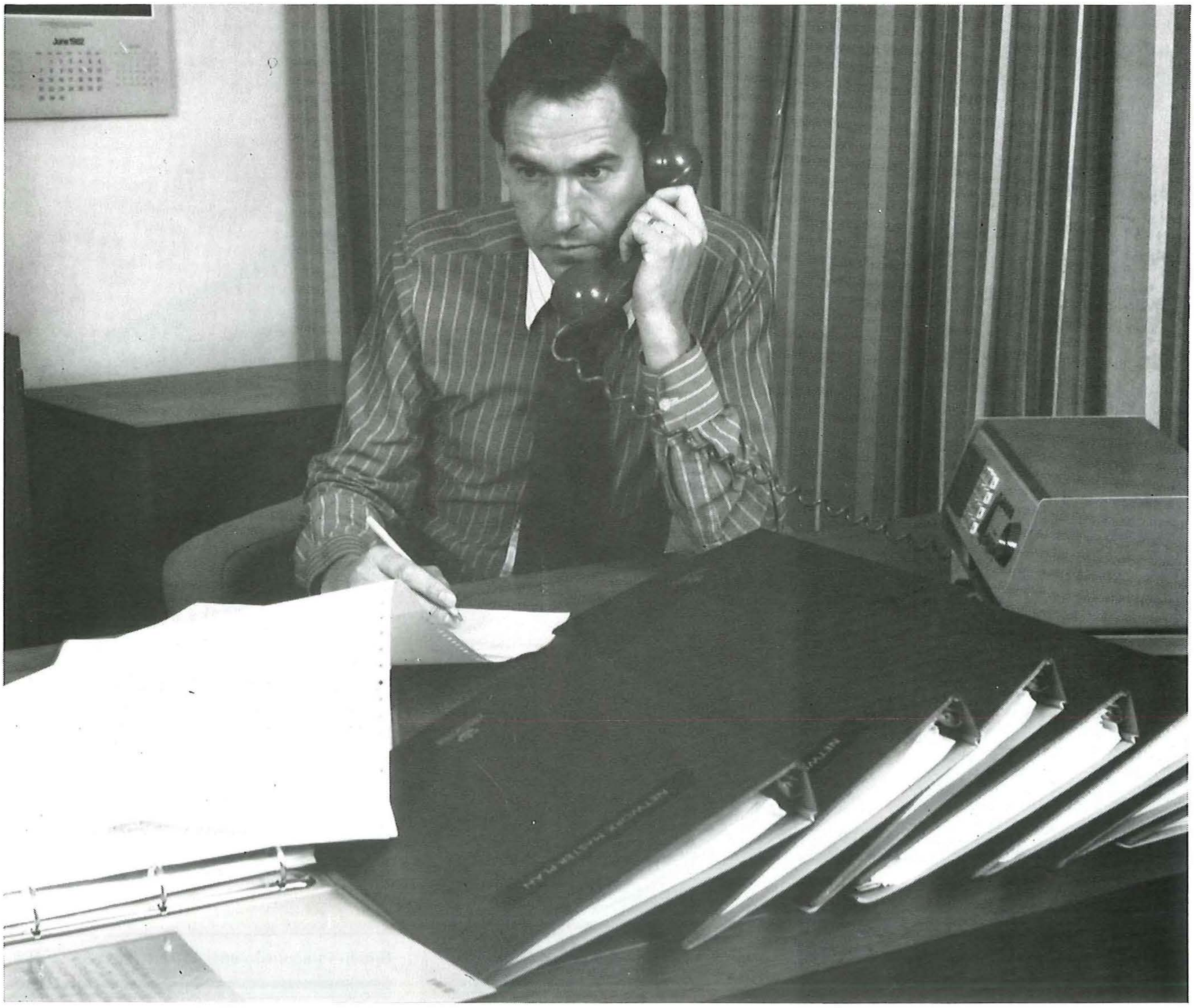
A question often asked is what value can be placed on the NMP when underlying policy assumptions on which it is based can suddenly change. But without the NMP, it would be much more difficult to implement such changes speedily and coherently. The NMP is a prime document for providing a sense of direction and only by using its common and clearly understood objectives, can competition be met and overcome. The aim must now be to further develop flexible attitudes and procedures which will enable any necessary change in objectives to be quickly and easily assimilated. That fundamental policy changes were so readily accommodated in last year's NMP is itself a reflection of strength of the NMP concept, and the commitment of those involved.

Mr K. W. J. Lonnen is head of the network planning and performance division in BTHQ.

Mr J. Fieldhouse is head of the network master plan co-ordinating group in the same division.

British Telecom Journal, Winter 1982/83

John Fieldhouse, head of the network master plan co-ordinating group, deals with another query from a regional headquarters.

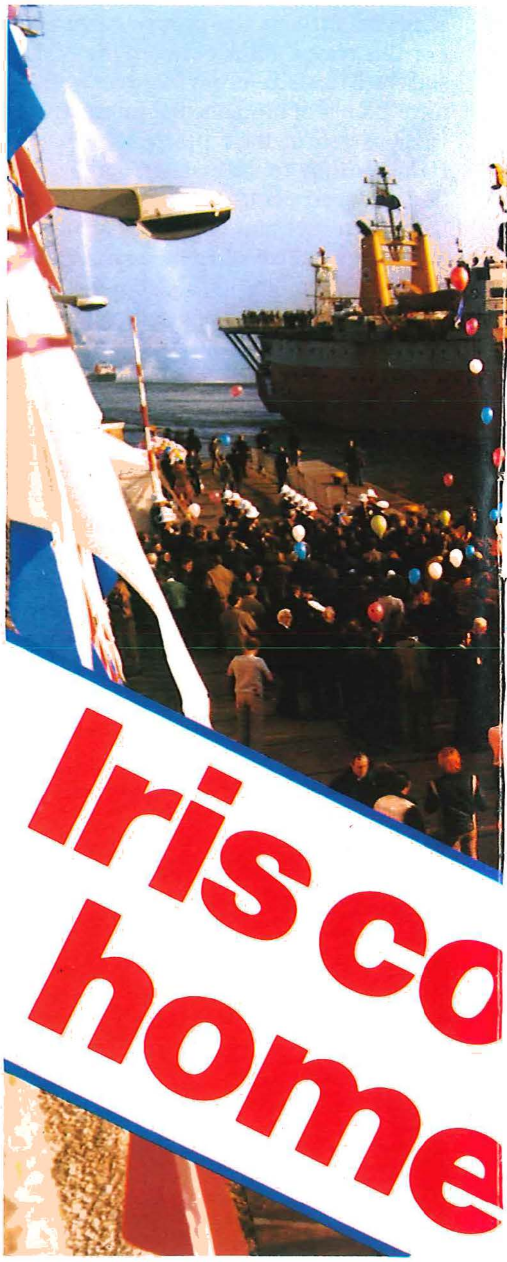


Icebergs towered 200ft above the waterline, 100 mph gales lashed her decks and always there was the threat of Argentinian attack. But the danger, the biting cold and the desolation of the South Atlantic were literally oceans away as British Telecom's cableship *Iris* sailed proudly into Southampton – her mission with the Falklands Task Force successfully accomplished.

After being away for seven months and covering more than 45,000 nautical miles, *CS Iris* came home to an emotional welcome – and an almost immediate refit to prepare her again for her civilian role as one of British Telecom's three cableships maintaining 18,000 miles of undersea telecommunications cables in oceans and coastal seas around Britain.

Chartered by the Ministry of Defence as a despatch vessel because of her shallow draught, stability and manoeuvrability, *CS Iris* carried stores, mail and military personnel from ship to shore and ship to ship during the conflict (see *British Telecom Journal*, Autumn 1982). And despite the rugged conditions in which she worked she returned to Southampton almost unscathed requiring only cosmetic repairs.

During her spell in the South Atlantic nearly 50 British Telecom staff – all volunteers – served on board *Iris* along with personnel from the Royal Navy. Captain Alan Fulton was awarded the OBE and chief steward Dick Barrett received the BEM.



Above:
Friends, relations and British Telecom staff line the quayside at Central Marine Depot, Southampton to welcome home *CS Iris* after her long voyage from the South Atlantic.

Right:
Captain Alan Fulton is greeted by his wife as *CS Iris* docks at Southampton.

Left:
British Telecom and Royal Navy staff relax together as *CS Iris* approaches the end of her journey home.

Far right:
Captain Fulton is joined on the bridge of *CS Iris* by British Telecom chairman Sir George Jefferson as the ship sails towards Southampton.

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Go-ahead for Bureaufax

K J Webb

An operator transmits a facsimile document in the London Bureaufax office.

Bureaufax, British Telecom International's (BTI) facsimile bureau/document (re) transmission service which has now grown into one of the largest of its kind in the world accessing more than 60 overseas destinations, has recently been given the green light following a two-year trial.

Thirty of the overseas destinations are accessed on a bureau-to-bureau basis using high-speed digital facsimile machines for transmission to a Bureaufax office in the destination country. The overseas office then arranges delivery of the document copy to the addressee. In most cases delivery can also be arranged by the London Bureaufax Office direct to a destination subscriber's facsimile machine if required. Overseas customers with facsimile machines can send documents direct to the London Bureaufax Office as well. A further 31 countries, without Bureaufax offices of their own, are accessible on this basis. Documents can also be accepted by Bureaufax for inland addressees.

Documents are submitted to Bureaufax in various ways – by facsimile, post, Expresspost or by hand. In the latter case this may be at any one of 16 Bureaufax counter offices throughout the UK as well as at the main London Bureaufax

A customer fills in a Bureaufax message form in his office ready to despatch to an overseas destination.

Office. Also, by arrangement with the Post Office, documents for Bureaufax transmission can be accepted at any of the 80 or so UK Intelpost centres around the country. Increased acceptance facilities are under consideration.

Diagrams, drawings, legal documents and correspondence, can all be sent via Bureaufax and a message form, available at counter offices, can be used by customers for writing messages. The service can prove invaluable to businesses and even residential customers without facsimile machines of their own or whose correspondents do not have a machine.

For businesses with facsimile machines, Bureaufax can overcome machine compatibility problems and international time zone differences by accepting documents from most types of machine for onward transmission. If a customer has more than ten pages to send internationally by Bureaufax, the operators will arrange to ring back for acceptance of the document copy, possibly saving the cost of a trunk call.

Bureaufax charges, including 15 per cent VAT, are £2.02 per A4 page to Europe, Canada and the USA (New York City and Washington DC), £4.03 per page to the rest of the USA and the Caribbean area and £6.90 per page to other overseas destinations. No additional charge is made for separate transmission of addressee details. A VAT-inclusive handling fee of £2.02 per address is payable for each transaction. A discount arrangement is applicable for international transmission of documents in excess of 20 pages, making it cheaper to send longer documents abroad.

In the case of documents for inland addressees, a VAT-inclusive charge of £1 per page is applied with a £1 handling charge per address. This is reduced to 51p per page plus 51p handling charge for documents transmitted by facsimile (by the sender) to a Bureaufax counter office for collection by the addressee.

With Bureaufax now established, the intention is for its development to continue. The service is not immune from competition, and aggressive marketing will be undertaken to promote Bureaufax's attributes and value for money. Further digital facsimile machines are to be provided for the London Bureaufax Office and also at selected counters where traffic levels continue to justify them.

In the longer term it is hoped to expand Bureaufax according to customer needs and developing technology to ensure provision of the best possible service. This will mean further increasing the accessible overseas destinations enhancing customer access and delivery arrangements, extending equipment compatibility as required and adding automatic features to the service.

Further information about Bureaufax may be obtained from the main Bureaufax Office on 01-250 1117.

Mr K. J. Webb is head of the Bureaufax marketing group in British Telecom International Business Services.

Testing together

A J Watchorn

This, the second in an occasional series of articles written exclusively for *British Telecom Journal* by contributors from manufacturing industries, reviews a new STC line tester now on trial in Guildford Telephone Area.

STC – telecommunications pioneers

Standard Telephones and Cables plc this year celebrates its centenary in the United Kingdom. Initially a subsidiary of Western Electric, the company first entered the growing market for telephones, exchanges and apparatus and was soon competing in bids to the National Telephone Company. Indeed, it installed many of the early large exchanges, including Liverpool Central, Holborn and Manchester.

It was not until 1906, however, that telephone equipment was manufactured in the UK by Western Electric from a factory in North Woolwich. In 1924, a young still small company called ITT took over the international interests of Western Electric. The following year, Standard Telephones and Cables was formed and has subsequently grown and now has more than 24,000 staff and 17 major manufacturing locations.

ITT's interest in STC is now 35 per cent, giving UK shareholders a controlling interest for the first time. STC's export successes include a record order for telecommunications equipment – providing the Anzcan undersea cable system. At home, it is sole supplier to British Telecom for all TXE4 type electronic exchanges.

Regular meetings to discuss progress have been invaluable throughout the trial. Here Bob Gregory, assistant executive engineer in charge of the repair service centre at Guildford exchange (left), executive engineer Tony Manvell and author Tony Watchorn study system circuitry.

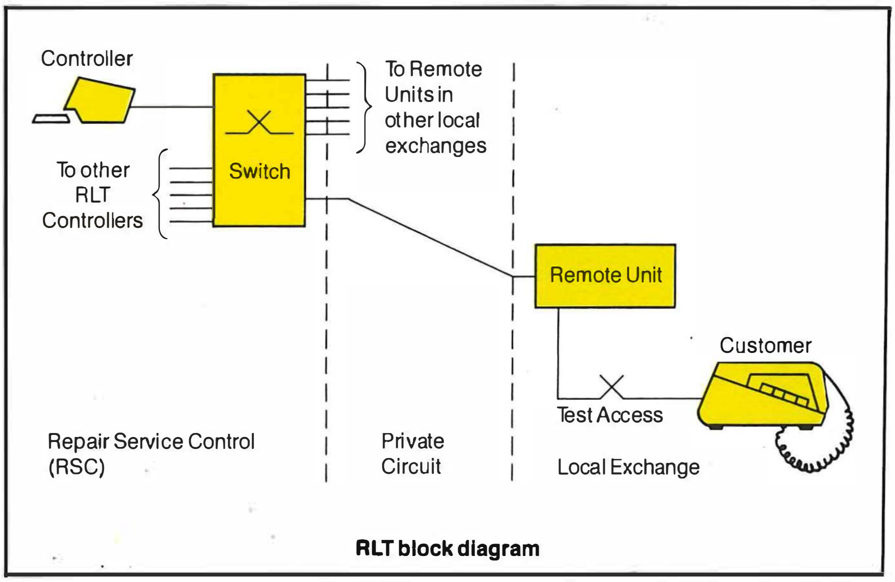
Ever-increasing demands in the United Kingdom for more and more telephones place a great strain on British Telecom to maintain high standards of service to all its customers.

With this in mind, Standard Telephones and Cables (STC) set out to design and develop a new system of line testing equipment to help solve some of the problems. The project proved to be so interesting that it received a stream of visitors from overseas administrations, all of whom were highly impressed.

Because of the obvious potential for further improvements to the line testing system, British Telecom sponsored a development with STC which has now resulted in a new remote line tester (RLT) undergoing field trials in Guildford Telephone Area.

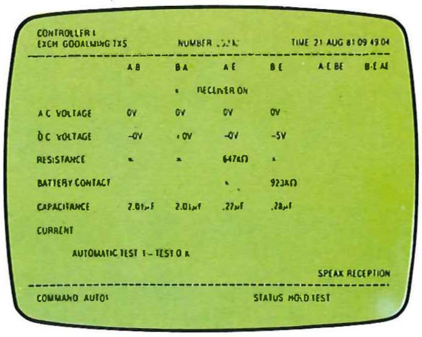
The RLT is a microprocessor-based system which identifies faults in subscriber lines and telephones. It consists of remote test units located in exchanges and is operated from central control terminals in the RSC. Tests are applied in an automatic sequence or selectively under manual control, with a printed record output available on demand.

The equipment has two major elements – the controllers and remote units. Heart of the system is the controller, a dedicated intelligent VDU which allows access to,



RLT block diagram

How the remote line tester works.



A typical display from an RLT screen.

Tony Watchorn of STC and Bob Gregory check out a card on a remote unit at Bramley exchange. The unit is linked to a controller at Guildford.

The remote line tester control and display provides invaluable information about conditions. Technical officer Mick Wheeler keys in a command for the computer to interrogate a line.

and control of, the exchange-based test unit.

Remote units are commanded by the controller, to carry out testing on customers' lines and telephones. Each remote unit comprises a group of slide-in circuit modules in a cabinet, which can be mounted on an equipment rack. All its functions, including the sending of messages to and from the controller, test access, and test sequences and calculation of results, are microprocessor controlled.

The remote unit automatically operates its own self-calibrating device at regular hourly intervals thus maintaining accurate measurements. It also has its own built-in self defence which enables it to search for any alternating current power on the line under test. The remote unit then gets on with the job of testing, if it is safe to do so.

A printer is also located at the RSC and is especially necessary when the remote units are instructed to routine customer's lines automatically. During this unmanned operation, the list of results are output to the printer. Just one printer in an RSC can record all the results from several controllers.

The tester's main advantage over most existing test apparatus is that it performs these test functions via data links, any distance from the RSC. It can test customers' telephones, line plant and pay-on-answer coinboxes.

Further field trials of the system are taking place in British Telecom's Carmarthen Area as well as in the Leuven area of Belgium. British Telecom has commissioned a further 20 systems from STC and these will be delivered later this year.

Mr A. J. Watchorn is principal engineer with the Information Terminals Division of Standard Telephones and Cables plc, and is based at the company's New Southgate factory.

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MISCELLANY

New country exchanges

A £20 million programme to bring modern telephone facilities to 400 small rural communities during the next three years has been announced by British Telecom. A new telephone exchange, called UXD5B, uses advanced digital microelectronics to meet the communications needs of remote villages.

The new exchange – a product of British Telecom research and development – will ensure that customers in country areas receive the same telephone facilities provided to other parts of Britain on its larger System X electronic exchanges.

Exchanges providing advanced facilities – repeat-last-call, short-code dialling and automatic diversion of calls to an alternative number – are normally most cost-effective in sizes suitable for larger communities and a scaled-down version of these larger exchanges would be an expensive way of providing advanced telephone services to small communities. Telecom's new small exchange – specifically designed for rural application – provides these facilities at no greater relative operating cost than that of providing them on a larger scale in towns.

The UXD5B exchange is derived from an advanced digital call-connect system – the Monarch 120 – now being produced in quantity by GEC and Plessey for British Telecom to offer to its business customers. It follows an earlier version, designated UXD5A, many of which are now in service in Scotland. The installation programme of 50 UXD5A exchanges now being completed in March and installation of UXD5B will start immediately afterwards.

Search for site

British Telecom is concentrating its search for a suitable site for the nation's third satellite earth station in the Wiltshire/Dorset/Somerset border area.

The need for a third station is urgent if the UK's position as a world leader in international telecommunications is to be maintained.

Almost all incoming television programmes, such as the recent pictures from the space shuttle Columbia and the Commonwealth Games in Brisbane, arrive in Britain via a satellite and an earth station. Outgoing programmes such as the Pope's visit and the Royal Wedding also pass through them. Earth station sites need to be free from electrical interference and, ideally, be located in a natural bowl where land contours provide natural screening from interference.

The country's smallest payphone has been launched by British Telecom. Nine inches by seven inches, the unit weighs less than 7lb and accepts 2p, 5p, 10p and 50p coins, refunding unused coins at the end of a call.

The payphone is particularly useful for small businesses. Typical users will be hairdressers, pubs, clubs, wine bars, garages, surgeries and shops.

The phone can be left permanently coin-operated or at the turn of a key, can be switched from a payphone to an ordinary phone and back again. After a successful trial in the London area last year, the phone is becoming generally available, and will be introduced throughout the country during the course of the next few months.

Increases deferred

Following the announcement of half-year profits of £268 million for the six months to September, British Telecom has deferred tariff increases until July. Originally, plans were to increase tariffs by 3.3 per cent last November.

Other moves are to introduce a rebate scheme for customers using under 100 units a quarter, extension of cheap rate to cover all bank holidays, abolition of the £10 take over charge for existing customers moving premises, and more reductions on direct dialled international calls.

The whole package adds up to a £340 million saving for customers.

An era ends

A new £85 million undersea cable, running between Britain and the Netherlands, will enter service next year and carry up to 4,200 simultaneous phone calls. It will meet the growing demand for telecommunications between Britain and its partners in the system – the Netherlands, West Germany and Belgium.

The cable will form part of the southern North Sea network of 11 submarine cables giving a total capacity of about 14,000 telephone circuits.

This latest cable closes a chapter in telecommunications history, which began when the first analogue telephone cable between the UK and France opened in 1891. The new link will probably be the last analogue cable to land in the UK. All future submarine cables to the continent are planned as optical fibre systems, in which calls are sent as digital pulses of light along hair-thin strands of glass.

Speeding calls

Microchips will soon be helping many of British Telecom's operators speed phone calls and bring savings of more than £3 million a year. New automatic call recording equipment (Acre) – a British Telecom invention – will save up to 20 per cent of an operator's time in connecting some calls, enabling telephonists to devote more time to helping customers. A contract to supply the equipment has been placed with the Bracknell Division of British Aerospace Dynamics Group. ▶

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Acre (see *British Telecom Journal*, Winter 1979/80) harnesses the power of microprocessors to abolish the time-consuming task of writing details of operator-handled calls on a paper 'ticket'.

Following a successful trial of Acre at Eastbourne, British Telecom is now to install the equipment on over 2,000 of its operator positions in switchboards throughout the country – about half of the total.

Business sockets

British Telecom has launched a new range of phone sockets for business customers. New-style sockets were introduced a year ago, initially for residential customers only.

Special floor-mounted multiple outlet sockets, trunking outlets and desk mounted units have been developed for office use to allow telephones to be resited easily and quickly following room re-arrangement.

Contracts

Trend Communications – more than £5 million for the Puma telex terminal. This brings the total amount of orders for the Puma to over £13 million since its launch in 1981.

Grand Met Subsidiary High Technology Electronics Ltd – £200,000 for display and memory cards used in the computerised City Business System Dealer Board.

GEC Telecommunications Ltd – £14 million order for 30-channel pulse-code modulation (PCM) equipment.

British Aerospace Dynamics Group – To manufacture automatic call recording equipment (Acre). Work on this order, worth several millions of pounds, will be carried out at the Plymouth factory of British Aerospace.

Pressac PLC – To manufacture line jack units which will form an important part of British Telecom's Rapide Connection System.

Fidelity Radio – More than £1 million for cordless telephones. This initial order, covers the design, development and the supply of the cordless telephone system.

Ferranti Computer Systems Ltd – A £2 million PT7 network for phase two of the mechanisation of order handling (MOH) system.

Ferranti GTE – Nearly £1 million for the Rhapsody telephone. This additional order now brings the total number of Rhapsody units supplied or on order by British Telecom to around 50,000.

Digital Microsystems Ltd – £1.4 million for 29 HiNet Local Area Networks (LANs) with an option on a further 31.

Sponsored by BT

British Telecom is to help two universities produce information technology experts who will run the advanced telecommunications systems of tomorrow. In partnership with the universities of Aston and York, British Telecom will develop new degree courses for training 60 students to become electronic engineers with skills in telecommunications and computing.

British Telecom will pay the universities £100,000 a year for new equipment and additional teaching staff. This support will be guaranteed for at least five years.

Higher target

The next round of British Telecom tariff changes will be held down to an increase of no more than 3.3 per cent on customers' current bills – well below even the current forecast reduced inflation rates, it has been announced by Chairman Sir George Jefferson.

He said the increases would not be before April which was a deferment of five months from the original date, and that a low-user rental rebate scheme would be introduced at the same time.

The last time British Telecom's major tariffs rose was in November 1981. Since then reductions worth more than £200 million to customers have been announced – including a package of concessions worth £8 million over the recent Christmas holiday period.

Customers report

British Telecom customers throughout the country are being given a quick, easy way of saying what they think of the corporation's services, by telephone. It is being done through a new British Telecom system called Telcare (Telecom Customer Attitude Research), now being extended to all British Telecom Areas.

Telcare operates through independent research agencies who call a sample of British Telecom customers shortly after they have been dealing with Telecom or using its services.

Cheaper calls abroad

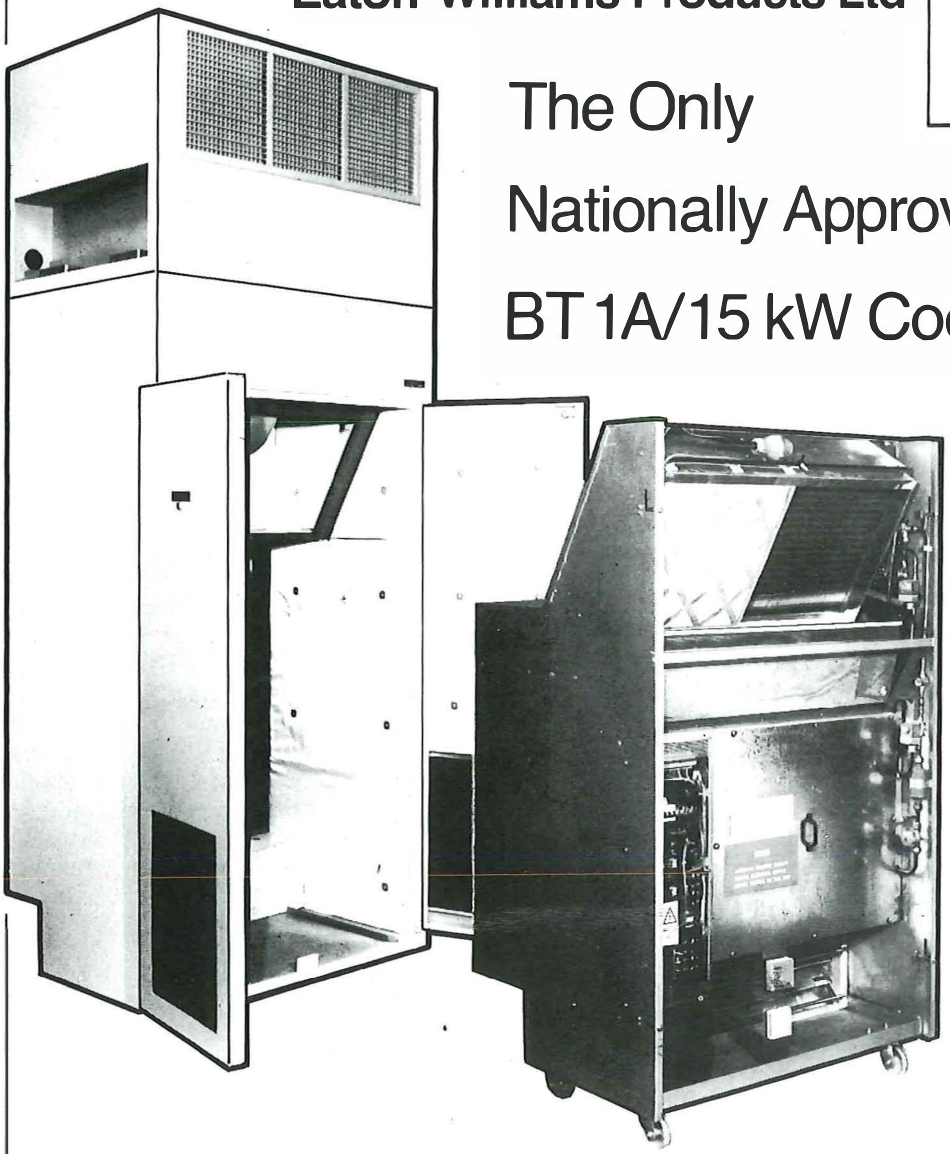
Charges for customer dialled international phone calls to 62 countries have been reduced by British Telecom. Some calls will be up to 20 per cent cheaper and customers' bills will be cut by £30 million a year. British Telecom is reducing the charge for all direct dialled calls to countries in most parts of Africa, the Middle East, Central and South America (charge band 5A), and Australia, New Zealand, India and the Far East (charge band 5B).

New director

Mr Colin Williams took up the new British Telecom post of commercial director, National Networks in December. He will be responsible for management reporting, control and accounting systems within the newly formed National Networks business. He will also advise on tariffs, within the Telecom corporate policy for tariffs, and will create and manage the National Networks business plan.

Eaton-Williams Products Ltd

The Only Nationally Approved BT 1A/15 kW Cooling Unit



The BT 1A/15 Cooling Unit is a free-standing, self-contained air-conditioning unit, quiet in operation and specifically designed to provide an inherently reliable cooling system for British Telecom System X and TXE 4 telephone exchanges.

Cooling is provided by a direct expansion (DX) close-coupled refrigeration system arranged so that the cooling coil and the air cooled condensers are both contained within the BT 1A/15 unit. The unit is designed for upward airflow with return air from the room entering the unit at low level on the front, through a modulating volume control damper, it then mixes with fresh air drawn in at the rear of the unit. In this way the recirculating air and fresh air ratio can be varied to obtain as much 'free' cooling as possible from the fresh air. Cooling air is supplied to the room at high level.

The unit is designed to provide a sensible cooling capacity of 15 kW with external ambient conditions between the limits −7°C and 32°C. Reduced cooling capacity available up to 40°C.

The micro-processor control system is designed to maintain the room condition at 24°C ± 4°C by optimum use of outside fresh air to obtain as much free cooling as possible under suitable outside ambient conditions. This is done by automatic modulation of the fresh and recirculating air volumes with supplementary use of the direct expansion cooling system.

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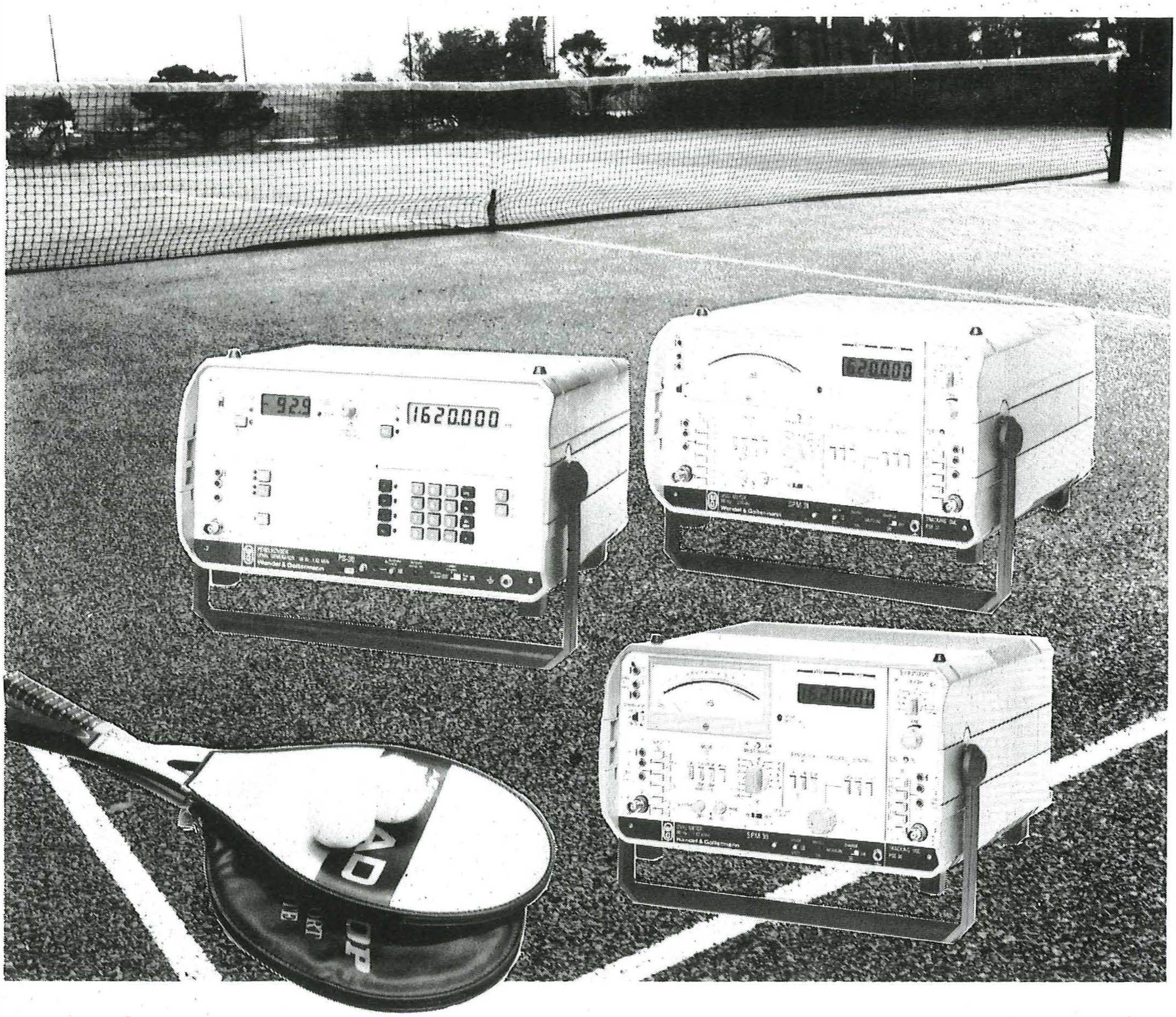

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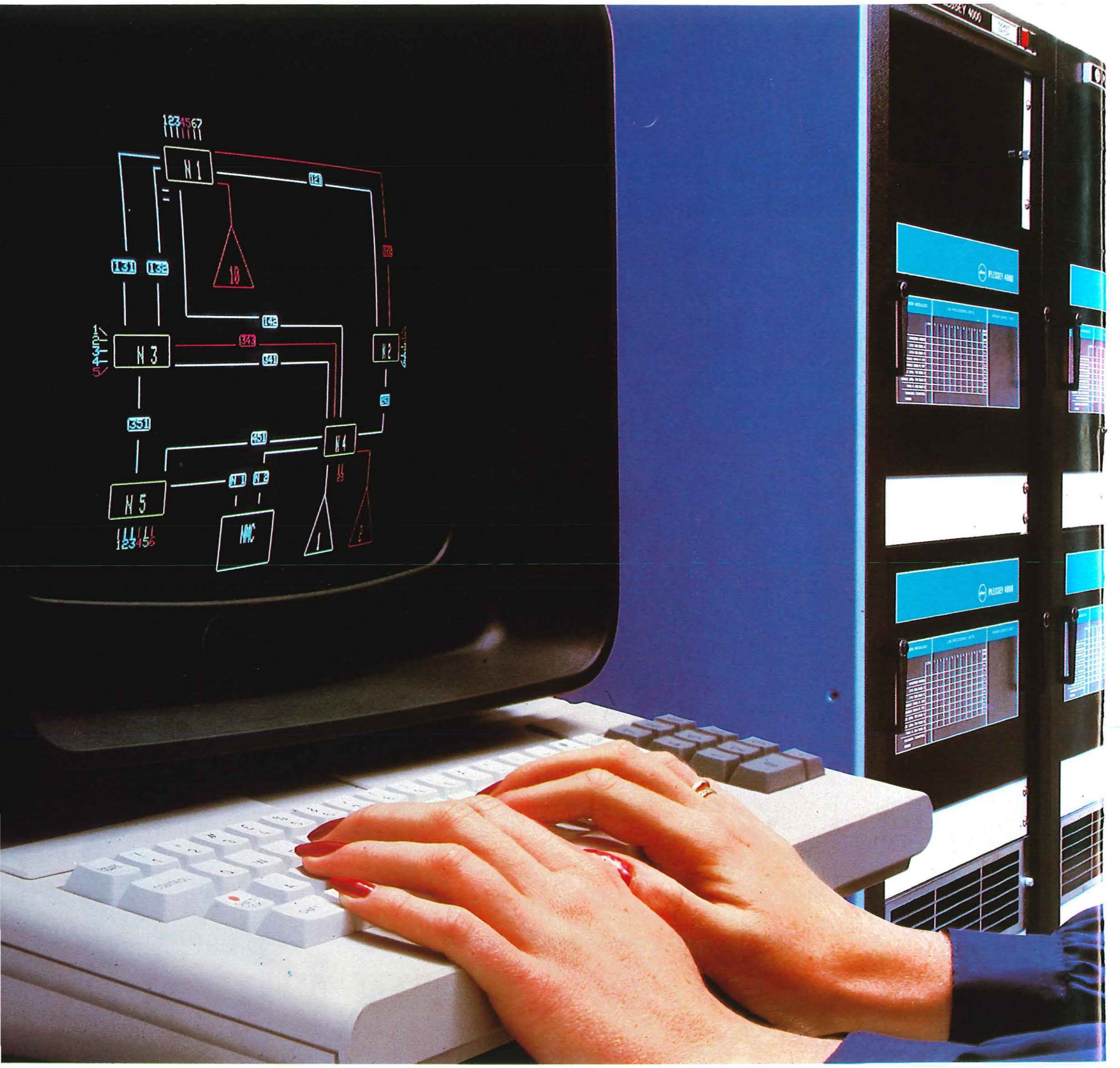

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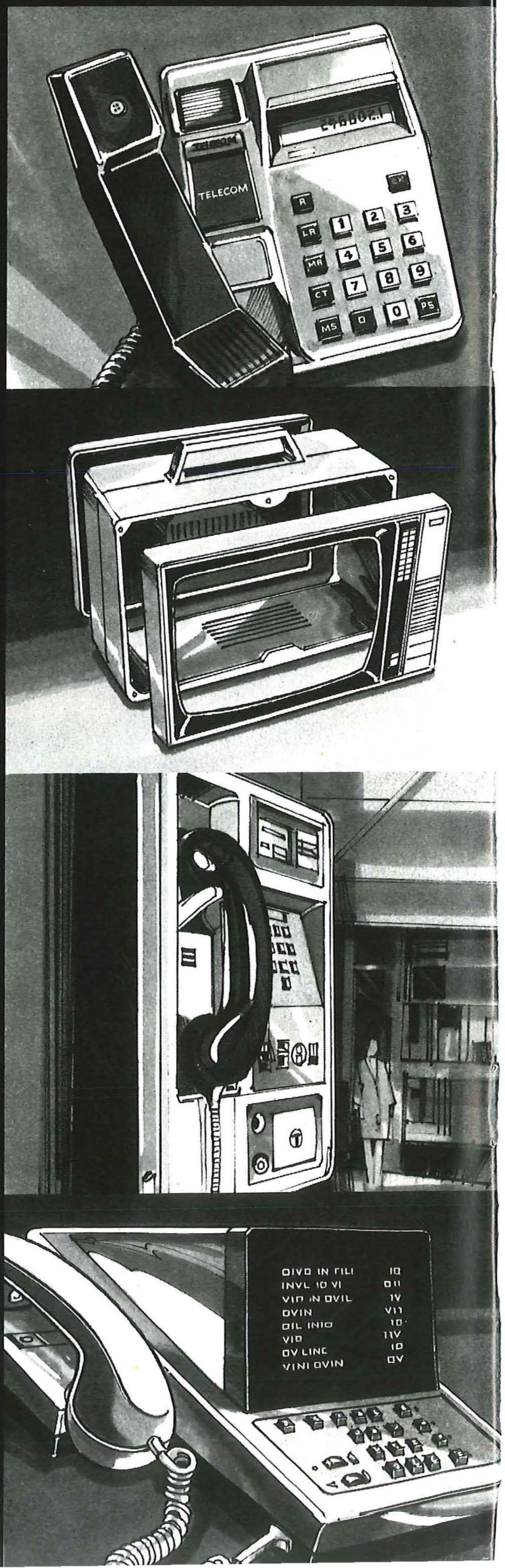
TELECOM

The idea of holding an international conference over the phone will probably strike you as little less than revolutionary.

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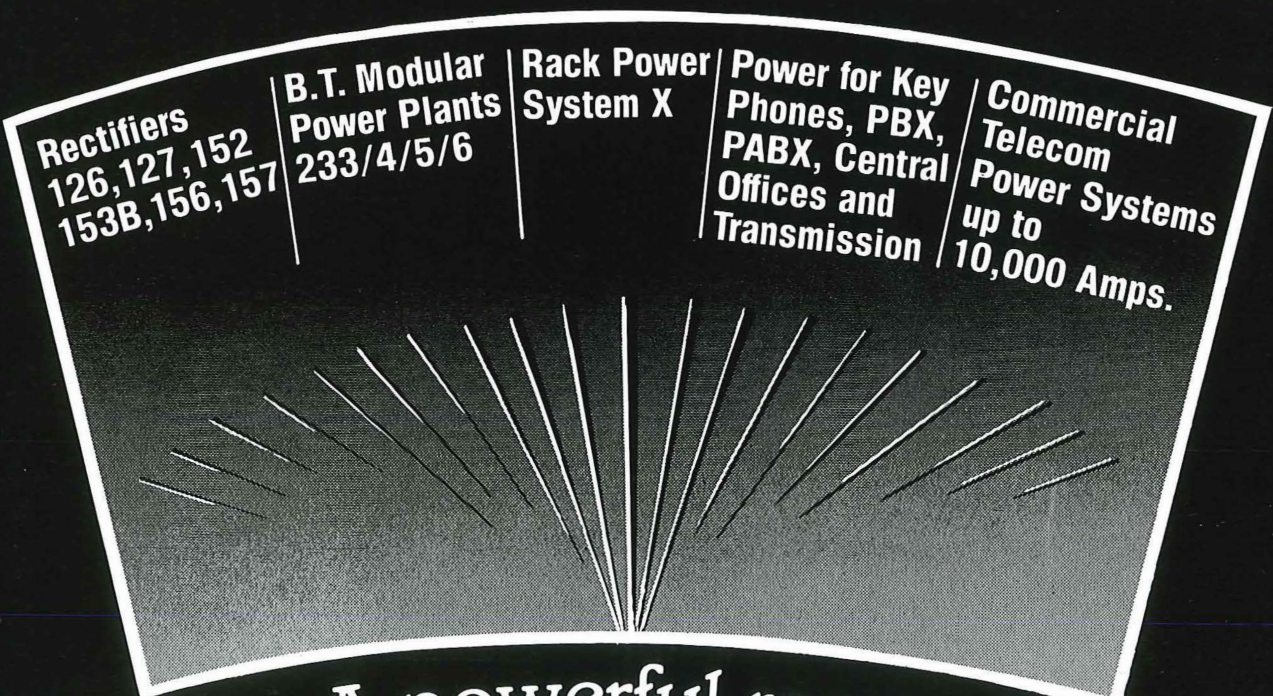

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