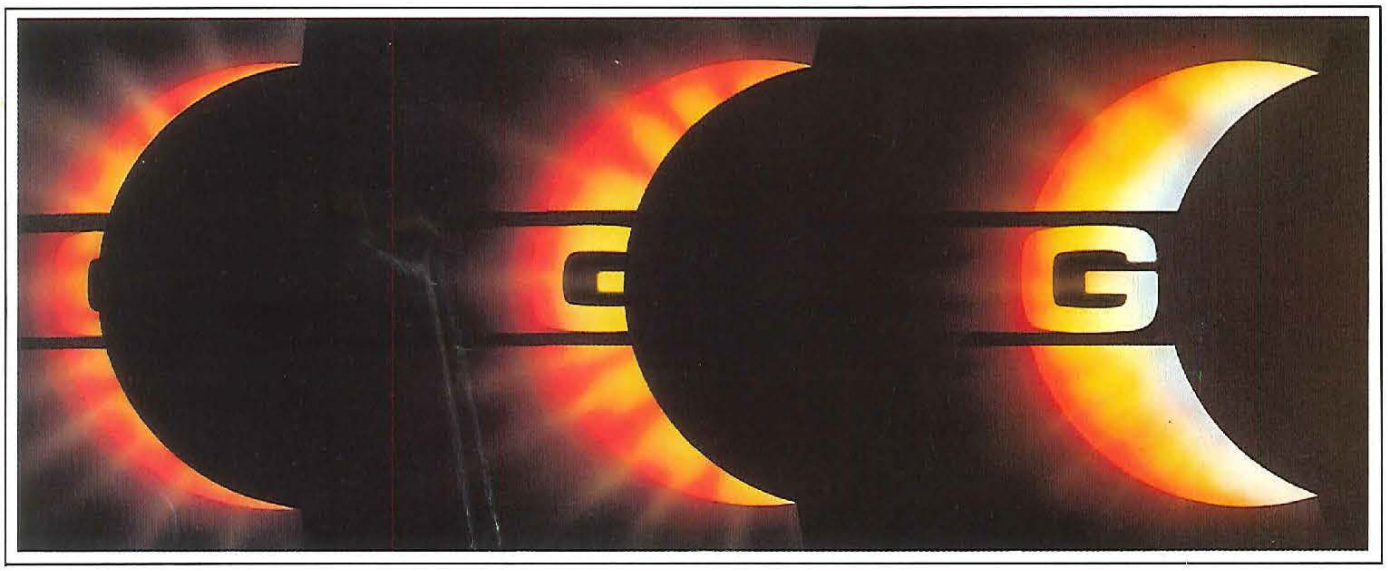
British TELECOM Journal
Price to BT staff 60p
June 1988

Network special: £2 billion a year bonanza

COLLECTORS ISSUE

see centre pages

THE DAWNING OF A NEW ERA IN TELECOMMUNICATIONS



New 'World' dawns

The phrase 'Collector's Issue' appears on the front cover of this, the last-ever issue of *British Telecom Journal*. As detailed in the centre pages, the *Journal* is to be replaced with an entirely new magazine *British Telecom World* in September.

In fairness to our loyal readers, many of whom collect the *Journal* and keep their own mini-libraries of back issues, the new magazine will continue to provide essential reading for anyone interested in telecommunications. But its scope and readership will be much wider and, as a result, its contents, style and presentation will be different.

As its title suggests, *Telecom World* will be looking at the whole sphere of telecommunications both at home and abroad. Overseas markets are of ever growing importance to British Telecom and the UK supply industry and the new magazine will reflect this trend.

Of course, *Telecom World* will continue to feature the latest technical developments and research breakthroughs, but in a way that its predicted 80,000 readership will readily understand. Whilst it is hard to present complex issues to a well-informed and expert audience without appearing to be patronising in tone, the inherent dangers of an approach which is too technical are even more serious – there is little point in articles claiming a world lead in technology if only a handful of people can interpret the significance of the contents.

Nuts and bolts aside, communications are about people and human interest stories about the men and women behind the scenes will be a regular part of the new contents mix.

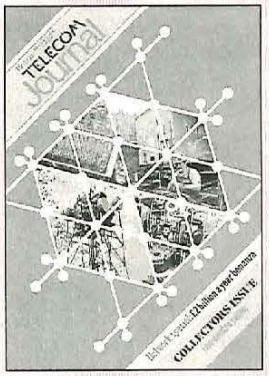
It goes without saying that every *Telecom World* reader will be a telecommunications user and therefore a customer in their own right. Many will also be involved in the supply and purchasing of equipment and will find *Telecom World*'s customer-orientated approach easy to equate with on both a personal and professional level.

The new magazine will be mailed to readers' homes and how to subscribe to it is detailed elsewhere in this issue. Make sure of your copy by ordering it today.

Network

Also on the cover of this issue is a 'Network Special' banner relating to a series of articles about network developments starting on page 32. Stories look at the concept of a 'thinking' network and how the planners and strategists are shaping up for the future. Optical fibre is a common thread running throughout the features and the effects of progress on business customers are discussed in detail.

Whilst it would be impossible to cover such a broad topic in one sweep, we hope that this in-depth look at a subject which is at the very core of British Telecom's business will prove to be of interest and use to readers.



Cover: The UK network is like a giant spider's web of communications with strands linking together the whole of the nation. The living heart of British Telecom, it accounts for the lion's share of the company's annual £2 billion investment programme as well as a large proportion of its income. This special issue looks at some aspects of this enormous subject, aiming to give a flavour of what is involved in running the network and the frontiers of technology it encompasses. See extended feature on page 32.
Cover design by Raygraphics.

In this issue

British Telecom Journal is published by British Telecommunications plc to promote and extend knowledge of the operation and management of telecommunications. See page 97 for subscription details.

Remote Exchange Management...

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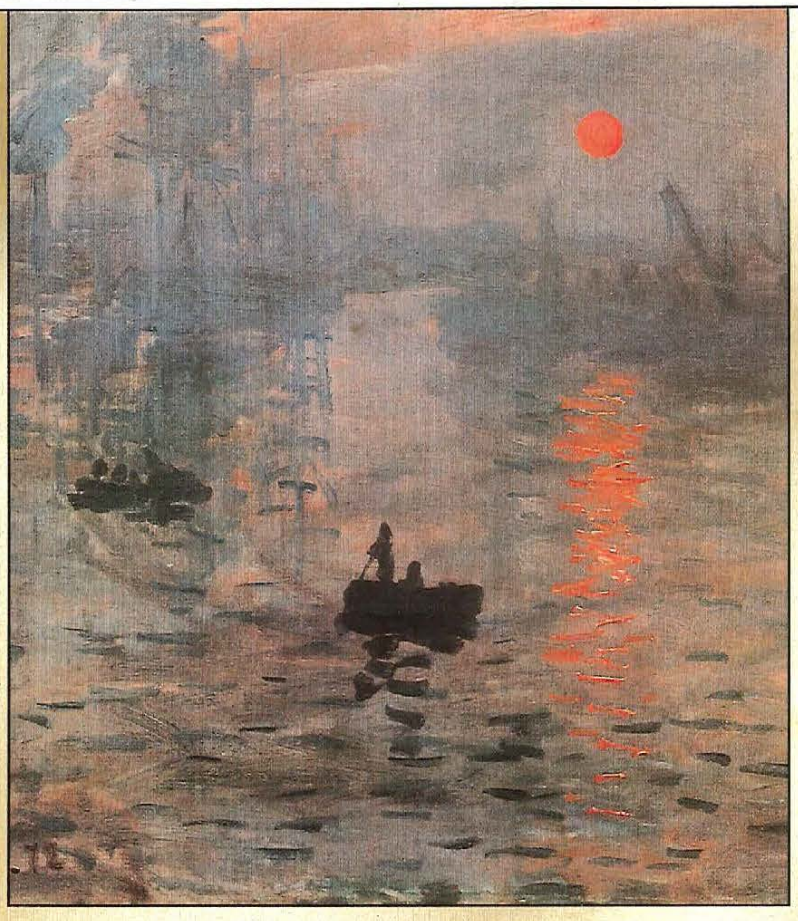

FROM MONET, THE ART

His love of reflections never deserted him;
his mastery of light became legendary. The artist: Claude Monet.
The picture: "Impression – Soleil Levant", said to be the
inspiration for the entire Impressionist movement.

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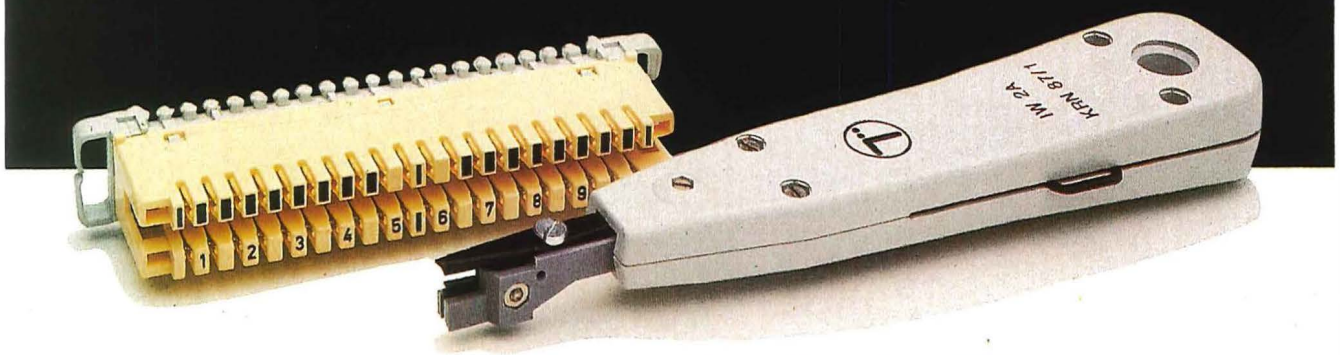

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British TELECOM

The communications requirements of Britain's police forces are more complex than others in the public sector and, in terms of technology, represent one of British Telecom's fastest moving markets.

BT's Government National Accounts division has set up a Police Requirements Group (PRG) to identify information technology needs; to design and execute tailor-made solutions and to liaise

Brothers in Law

Gordon Giles

with the company's local districts to ensure that each force receives high-quality service.

The group recently chalked up an important success with the supply of a large digital voice and data network to Essex police and is currently working on the design of a similar network for the Thames Valley force.

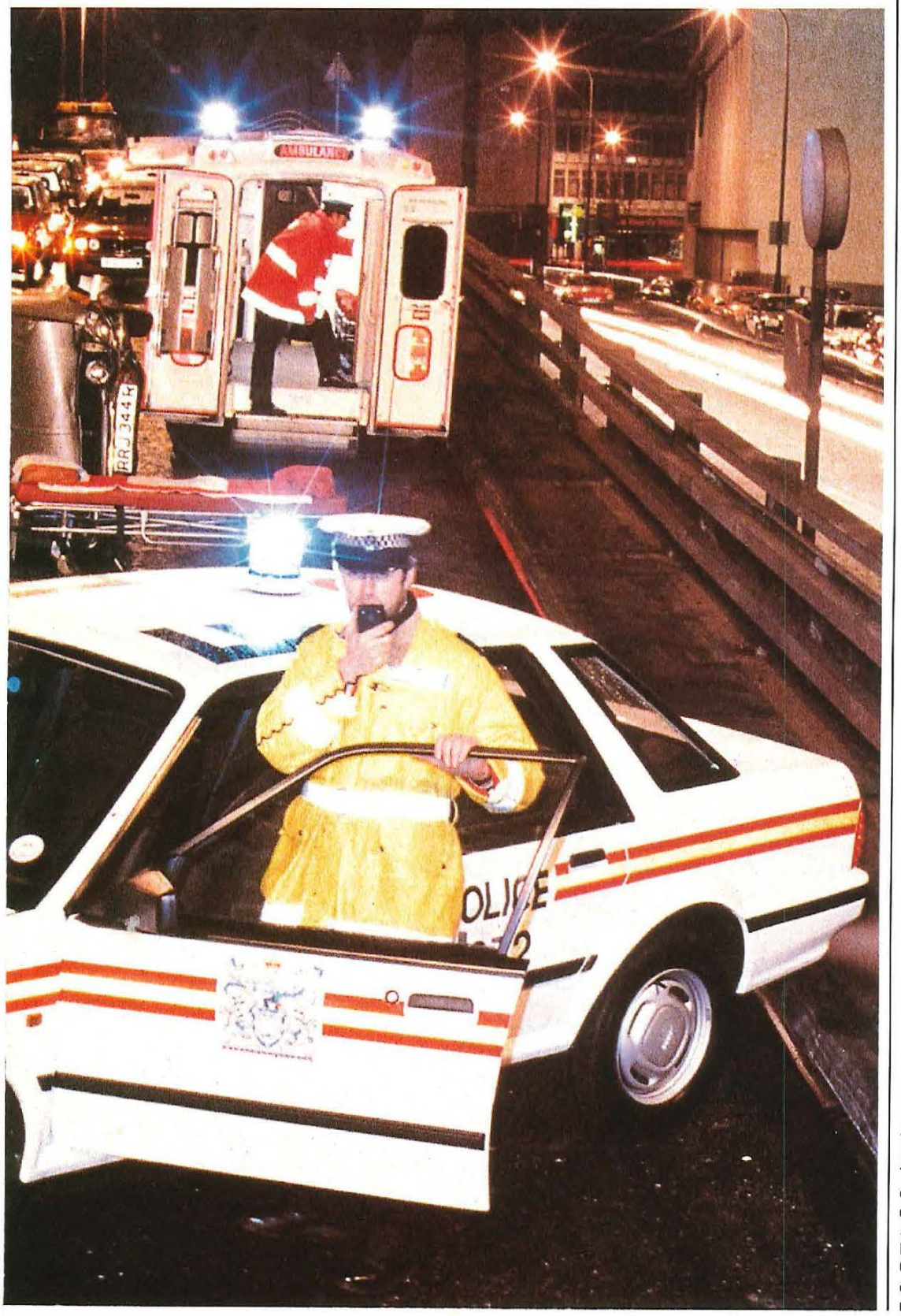
Supported by a former Chief Superintendent, the group is well aware of the difficulties and dangers facing the police and it pulls together the best in IT to overcome them.

The police control room – nervecentre of operations – has to respond to an emergency with quick decisions and the immediate mobilisation of resources.

It depends on a command and control system which functions smoothly and instantly.

A successful system must be able to: ▷

A recent issue of the *British Telecom Journal* examined BT's activities as a major Information Technology (IT) company in the public sector. This article looks at BT's special relationship with the police.



Opposite: the police have always been one of BT's priority customers with special needs requiring specialist communications systems.

Left: the speed with which the police respond to an emergency alert is critical. They also have to remain in communication with their own force and other services. British Telecom's Police Requirements Group offers a wide range of communications and messaging equipment.

Members of the Police Requirements Group (PRG). A separate group within BT's Government National Accounts division, PRG's exclusive responsibility is to provide solutions to the individual communications needs of every UK police force.

- receive an alert on an exchange line, private circuit or radio land line on a central console with recording facilities.
- locate police resources in the vicinity of an incident and put up on screen photographs and plans of the area showing such things as hazardous materials and possible escape routes for suspects.

BT solutions are built around the already proven ADEKS and Touchdown systems incorporating telephony and radio communications.

Other relevant BT equipment includes photovideotex personal computer databases of pictorial and graphic information and audio conferencing to allow emergency briefings to be held immediately.

As a supplier of the 'backbone' microwave radio carrier links in either digital or analogue formats, BT can cater for force-wide or national radio communications and data transmissions.

A comprehensive range of fixed car and portable phones is available using the Cellnet network. Recently developed car phones are activated simply by voice, and also being studied at the moment are mobile data systems with computer screens inside patrol cars.

Mobile officers can also be equipped with radiopagers which can receive phone numbers or alpha-numeric messages irrespective of location.

Computers cannot solve crimes but they can greatly assist crime investigation and help reduce time spent on reporting, logging and administration.

But many of the computer systems developed for police use have proved to be incompatible. The BT group, however, is able to supply a fully integrated system by tailoring software around individual needs rather than taking off-the-shelf software and compromising on flexibility.

In-house, the group can generate programs for accident, crime and firearm statistics, crime recording and intelligence, fleet management, incident logging and resource allocation.

BT's network 'highways' – the public data network, the public telephone network and private digital networks – can be used to provide computer solutions locally, regionally and nationally.

On a local/regional level, terminals can be linked to mainframes so that one terminal can be used to access the whole range of a police force's computer applications. More importantly, gateways can be provided that link local to national networks. This way, individual terminals in the police network can send messages to any other terminal with links and inter-connections within and between forces all over the country.

Computer 'hacking' is one of the fastest growing forms of crime and the protection of the highly sensitive information processed through police computers is a very real concern.

In partnership with the police, BT has exploited the latest technology to develop protected information systems.

Information stored on computer discs can be protected from unauthorised access by passwords. Data transfer – whether via the telephone network or cellular radio network – can be protected by encryption. As well as ensuring that the information is indecipherable by eavesdroppers, this also demands authentication from the recipient before the message is transmitted.

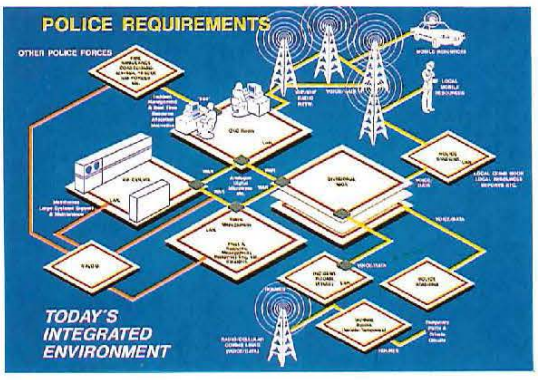
Police forces needing a secure office environment can be supplied with special computer workstations and printers, and a recent innovation is a medium-level security device to 'scramble' voice transmissions over the telephone network.

In the past, major projects in the police sector would have been met by one of the large computer companies, with BT supplying the lines. Nowadays, the complete requirement will be designed, installed and commissioned by BT with a major computer company supplying the hardware.

Each member of the BT team has a number of police forces to cover, and maintains regular personal contact with them. Perhaps the most important part of the job is understanding their individual needs, what they want from the IT industry, and in reshaping BT to respond to this market.

Team members can, of course, draw on Government National Accounts IT specialists, network design managers and voice/data engineers to help where needed.

Police forces are becoming increasingly aware that BT is a major IT systems house and supplier, and are turning to the company's proven project management, not only to bring together the complex systems they need to do their fast moving and dangerous job, but also to look after and maintain these systems for years to come.



Mr G Giles is a Senior Consultant with BT's Government National Accounts Division.

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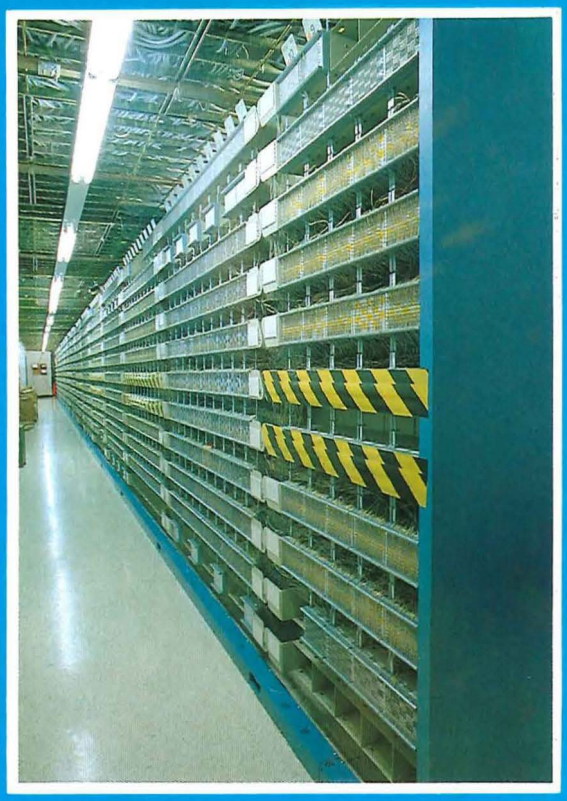

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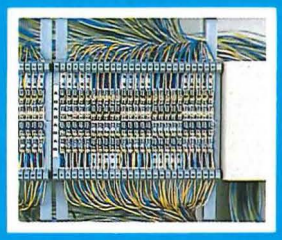

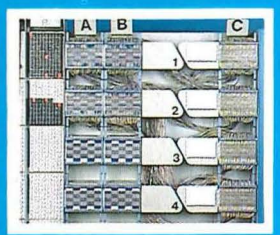

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Vanquishing the vandal – the psychology of crime

Nearly 30 per cent of all public payphone faults can be directly traced to vandalism, according to official British Telecom statistics. In an attempt to discover just who is responsible for this damage and why they do it, a study was conducted by the Psychological Research Group.

Part of the motivation behind the study was to feed the results back into the design and manufacturing process in order to develop equipment which could prove more resistant to attack.

The research involved finding and interviewing the culprits who indeed shed some light on the issue:

"If the telephone did its job, I'd be quite happy to leave it in peace."

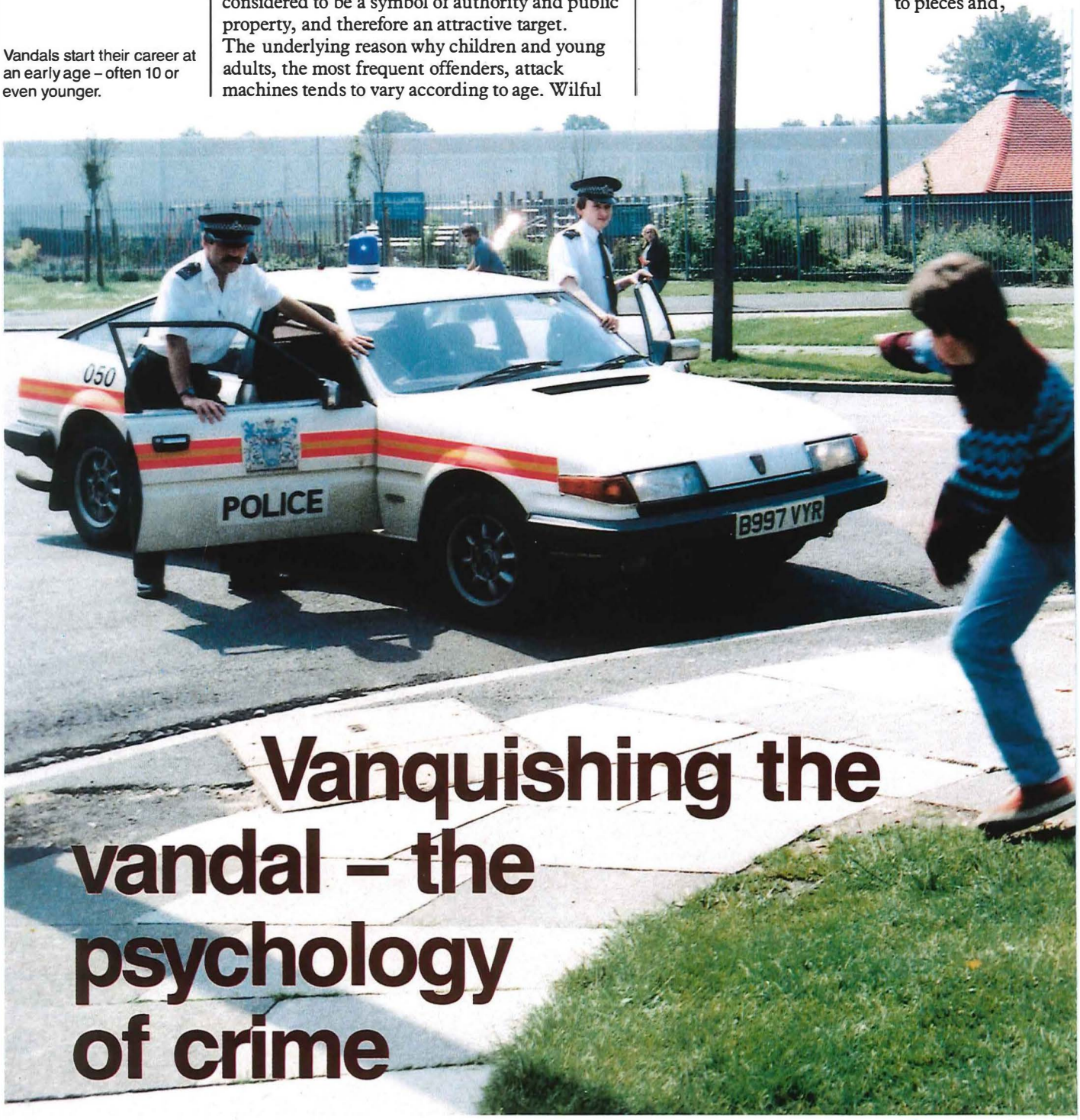
"I smash up the phones in boredom and out of frustration not having any job. If I had a job and some money I wouldn't want to do anything like that."

The researchers found that payphone vandalism is a complex issue, and that the payphone was considered to be a symbol of authority and public property, and therefore an attractive target.

The underlying reason why children and young adults, the most frequent offenders, attack machines tends to vary according to age. Wilful and wanton damage is more the province of the very young while damage with intent to defraud increases with age.

It is generally found that the type of person who becomes a telephone vandal is male, under 20, and from the lower socio-economic groupings, although this can vary enormously. According to the report up to 50 per cent of males in this grouping may have caused some form of damage to a public phone in their youth.

Vandals can start their career at a surprisingly early age, often at 10 or even younger, when vandalism is very much a game. One of the earlier forms of child's play is taking things to pieces and,



Vandals start their career at an early age – often 10 or even younger.

says the report: "Respect for property is subjugated to play needs, possibly without much awareness and little concern about harm to others."

One 11-year-old boy and his friends enjoy the thrill of destroying things and are not afraid of being seen – it's all part of the game, he said: "When people are in the box we wedge the door with a piece of wood so they can't get out. If there's a hole at the back of the box you can wee over someone's leg while they are using the phone."

As the vandal becomes older, aggression and anger become more evident. The researchers found that many vandals were low achievers at school and had few outside interests. They had become rebellious, creating problems at home, and were anti-everything. This type of vandalism coincided with puberty, and the telephone was often the victim of anger and frustrations that could not be expressed anywhere else.

For example, a 17-year-old girl who was interviewed had been caught smashing up a phone booth after an argument with her boyfriend; ▷

Above: the cashless Phonecard system has effectively eliminated payphone outrages by theft-motivated attack.

and a 17-year-old student said: "I just don't like phones. I think they should be free. Everything is money. I begrudge having to pay money for the phone."

Beyond puberty, the more deliberate desire to defraud became evident, with damage as the likely result. A 22-year-old youth advised how he used to attack phones to get the money, but was caught and fined for doing so. "The telephone is the quickest way to get money. It's like a safety deposit box and you can go out at 12 o'clock at night and get the money. I don't do it anymore now, I have a job," he said. However, the pioneering decision by British Telecom to adopt the Phonecard system has effectively eliminated payphone outages by theft-motivated attack for this cashless payphone service.

From roughly 19 years on, the majority of vandals stop most forms of abuse and cease such childish pursuits. An 18-year-old law and economics student explained how he and his friends used to smash up telephone kiosks for fun: "In a way an isolated box is more appealing. It's like a little old lady walking down the street. We used to put lighter fuel on the telephone and set light to the buttons. I've never taken any money, that's a more serious crime. There's a difference between theft and vandalism, vandalism is a joke, stealing is stealing.

"I don't do it anymore now. I get annoyed when I go to a telephone box and see it vandalised, it really annoys me. I don't think it's enjoyable anymore, for you are just inconveniencing other people for the enjoyment of yourself."

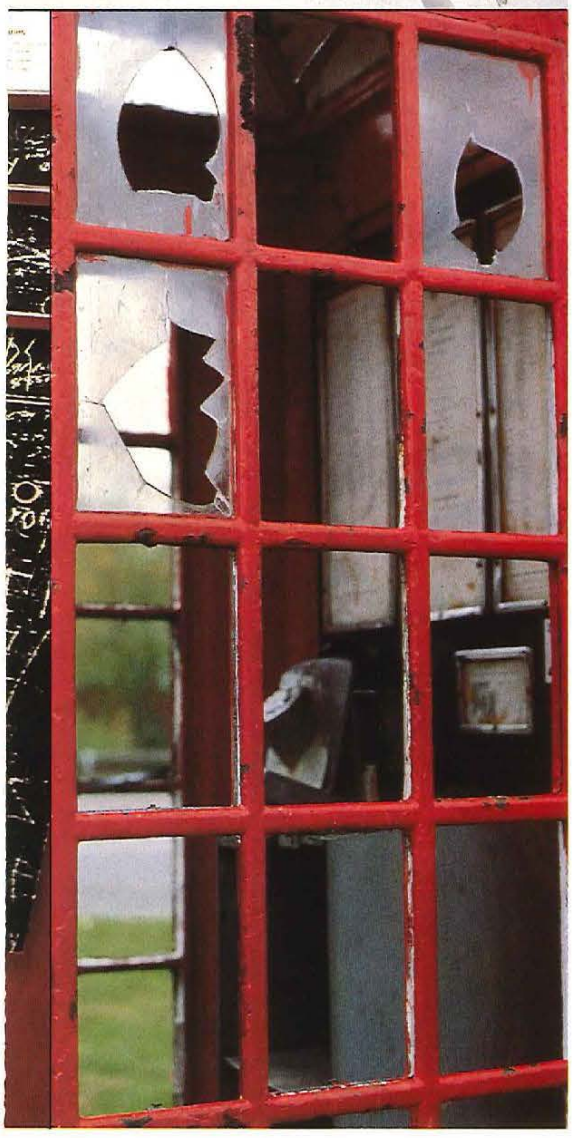
Those who do continue with vandalism have usually moved outside society. An interview with a 23-year-old punk from the Gorbals found he frequently smashes up things, including his own squat. "I'll have a go at anything if I'm in a bad mood," he explained.

Apart from categorising the vandals, the researchers also made recommendations regarding design, siting and servicing of payphones. They found that out of several apparatus designs the simplest ones appeared to be the least provocative. Some designs, and frequent failure to work, encouraged vandalism. A 20-year-old youth said: "I recently tried to phone from six or seven phones before I found one that worked. I got absolutely livid with the last one, and had there been a suitably heavy object around, I would have done my worst with it."

And a 17-year-old confessed: "If I go into a phonebox and it doesn't work, I smash it up. Say I really want to make a call and I go into the box and it's 999 calls only, that's when I start to get really angry."

So the report points out the importance of quick servicing and repair, and the need to defuse anger when a telephone is out of order, for example by means of a notice of apology. Often a '999 calls only' display encourages those who interpret this as an indication that the cashbox is full and a worthwhile target.

Another recommendation was frequent 'housekeeping' so that the telephone boxes



always look good. Vandals are more likely to attack dilapidated telephones and kiosks than those in pristine condition, and payphone booth appearance should be made more friendly and welcoming. Constantly maintaining smart appearance is an indicator of the telephone comany's respect for its clientele, explains the report.

The report also calls for a significant expansion in the public payphone population, and suggests siting more of them in groups. Reducing the size of the protective covering would also reduce attacks as the vandal would be faced with an unfamiliar environment, would be less concealed, and would have less room to manoeuvre tools and implements.

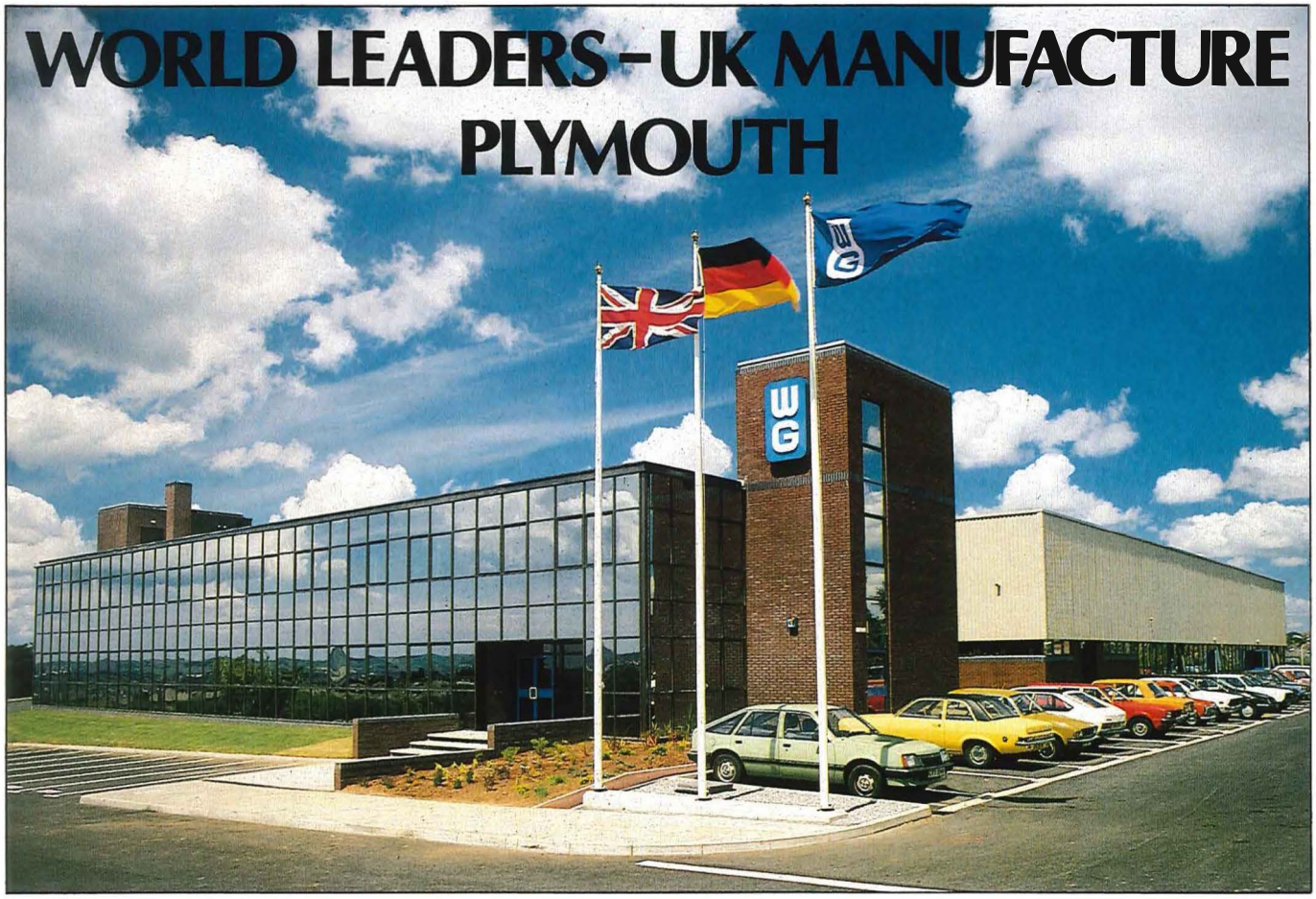
Landis & Gyr who commissioned the study presented these findings to an international seminar attended by a large number of Telecoms Administrations. Their UK subsidiary, Landis & Gyr Communications Limited, have worked closely with British Telecom in interpreting the results. A spokesman from the UK company, which supplies Phonecard equipment to BT, advised that the reaction of vandals to the Phonecard system was generally very reassuring; but there was always scope for improvement and in co-operation with BT every effort would be made to improve the availability of the Phonecard service to the user public. ■

British Telecom's efforts to combat attacks on public payphones by criminals and vandals are succeeding according to the latest figures. A recent survey showed that 92.3 per cent of payphones were working, exceeding BT's own target of 90 per cent. Mr Mike Bett, Managing Director of UK Communications, has promised this figure will be increased to 95 per cent by 1990. BT has been losing £19 million annually through theft and vandalism, and in recent months a concerted effort has been made to track down organised gangs who have made a healthy living from attacking payphones, sometimes using sophisticated equipment and taking away the complete phone in the back of a van. Earlier this year there were 8,000 theft-motivated attacks on payphones in just a two-month period. Mr Bett said the criminal world has been given a severe warning that BT is serious in stopping them and will prosecute whenever possible. A programme of education in schools is also being carried out to tell teenage vandals of the impact that damaging payphones could have. The number of phonecard phones which help to discourage theft and vandalism as they contain no cash, is also being increased. There are at present 11,000 in service, and the target is for 20,000 over the next 18 months.

The time taken to repair faults on public payphones has also been tackled by BT. Mr Bett said customers can play an important part in this by reporting faults. Work is also being carried out on automatic fault reporting and detection systems. Mr Duncan Lewis, Director of Strategy, Products and Services said the speed of reporting faults has been improved by making sure the majority of callboxes were visited every day. The time between a payphone becoming faulty and being repaired has been reduced to an average of two days, whereas in the past it has taken two to three days to find out a phone wasn't working, then a further two days to repair it.

Left: thieves and vandals were responsible for more than 500,000 serious attacks on Britain's public payphones last year, costing BT £19 million in repairs.

WORLD LEADERS - UK MANUFACTURE PLYMOUTH



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And before delivery, every cabinet is quality approved at the factory, using standard British Telecom test procedures.

Already, exchanges based on the five-shelf cabinets have been installed at five British Telecom pilot sites, and more are on order.

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Telephone: 0273 675261.

Credit cards have established themselves as the modern way to pay bills. But their success has led to new opportunities for fraud costing credit card companies tens of millions of pounds a year. Now British Telecom's Cardway can beat the criminals and authorise transactions in just 15 seconds.

Tough deal for card sharps

Since the introduction of the credit card there have been two methods of trying to beat fraud. Firstly there is the hot card list which details all stolen cards. Although this is updated regularly a stolen card could be in circulation before it appears on this list, which relies on the shop assistant checking it for each transaction.

The second method is the retailer's floor limit — the amount set by the card issuers above which any credit card transaction must be authorised by them. This requires the retailer to make a phone call to the card issuer's customer service bureau. Each card issuer's bureau gives an authorisation number which is written on the credit card voucher, guaranteeing payment. One benefit of this system is that as soon as a card is stolen the customer service bureau is aware of it, and stolen card transaction attempts are not authorised.

But, if the value of the transaction is lower than the floor limit, it is unlikely to be referred to the service bureau by the retailer.

To eliminate fraud, every transaction should be authorised. Referrals to customer service bureaux become more time-consuming as transactions increase at the points of sale, so card issuers decided that a method should be found to automate this procedure. British Telecom was asked to provide the network for such a system.

The requirements of the communications network were that it should be both fast and reliable, with the capacity to handle a large number of transactions at peak retailing times. It should also be a national service so that any shop outlet could be served. After considering these needs it became clear that such a system should be based on the Public Data Network. On this basis Cardway Dial (formerly TPad Dial) was introduced.

Credit Authorisation Telephones were developed by various terminal manufacturers which connect to Cardway Dial. These terminals have a card wipe which reads the magnetic strip on credit cards. When a retailer wishes to process a transaction the card is wiped through the terminal and the amount is entered on the keyboard. The terminal automatically dials the local Public Data Network Cardway Dial node.

At the node the authorisation request is converted into packets and routed over the Public Data Network to the appropriate card issuer's computer. The computer, typically a Tandem or an IBM System 88, carries out checks to see that the card has not been stolen and that the amount of the transaction is within the purchaser's credit limit. Once the transaction is cleared the computer sends back an authorisation code which is displayed on the terminal LCD. The typical time for such a transaction is 30 seconds, compared with 90 seconds for a manual telephone authorisation.

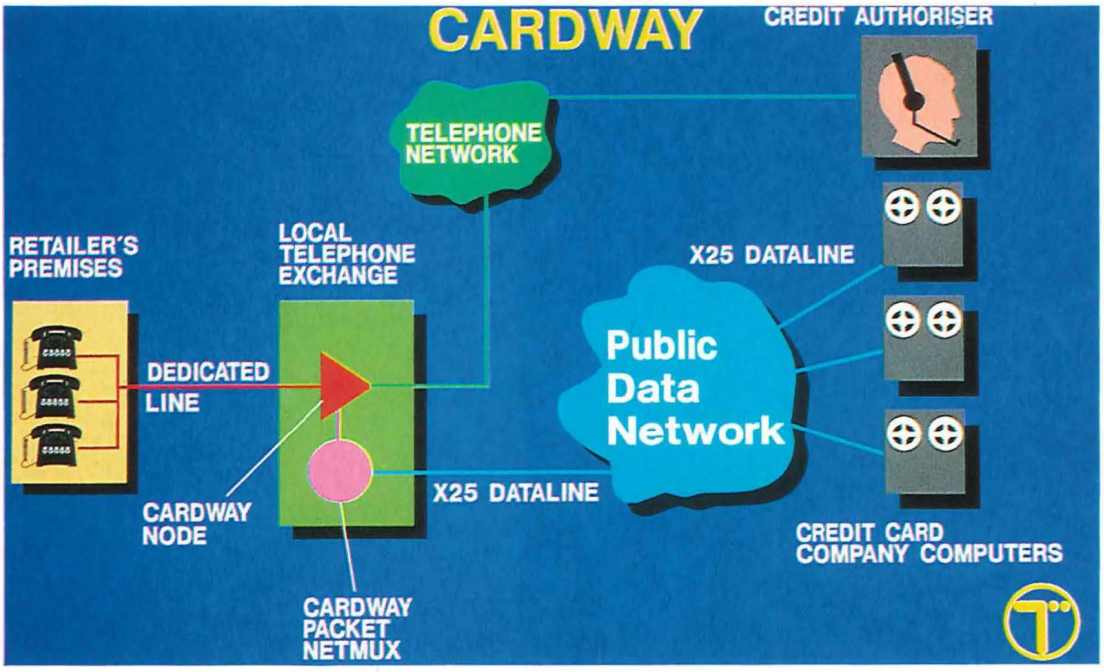
Whilst the Cardway Dial transaction is taking place the shop assistant is free to complete the sales voucher, filling in the authorisation code to guarantee the retailer payment. Should there be any problem, the card company computer commands the retailer's terminal to establish a voice link with the card issuer's customer service bureau.

The costs associated with Cardway Dial are based on the rental of a standard business PSTN line. PSTN call costs are typically one call unit per transaction and a Public Data Network usage charge of 1.20 pence which is charged to the appropriate card company.

A company called On Line Card Services was formed by the four major card issuers, Access, American Express, Barclaycard and Diners Club International, to be responsible for placing terminals in retail outlets. As all transactions are authorised, fraud is virtually eliminated, making significant savings to the card issuers. Several thousand of these terminals are now in use, authorising millions of transactions each month over Cardway Dial.

Recent developments have further automated ▷

When a retailer is presented with a credit card he wipes it through the terminal and enters the amount. Half a receipt is printed, signed by the customer, and after checking the rest of the receipt is printed at the press of a button.



Opposite: using Cardway, a retailer can authorise a credit card payment in just 15 seconds.

payment by card. New terminals have been introduced which print vouchers automatically, freeing retailers from preparing them by hand. The card issuers' computers have now been expanded to allow them to capture all the details of the transaction, meaning that retailers with the new terminals do not have to sort credit sales vouchers to submit them to the companies — everything is done automatically.

British Telecom has now introduced Cardway, a faster version of Cardway Dial. As speed is a major consideration at the point of sale, time spent on card transactions had to be reduced.

Cardway differs from Cardway Dial in its method of access to the Public Data Network. With Cardway, the PSTN has been replaced by dedicated lines and a data concentrator. This means the terminal only has to dial '11' with MF signalling instead of the slower loop disconnect dialling of seven to ten figure numbers. Apart from this it works on the same principle as Cardway Dial.

Combined with the card issuers' host computer systems and the new type of terminals, Cardway makes paying by credit card fast, convenient and simple for both the customer and the retailer. When a retailer is presented with a credit card he wipes it through the terminal and enters the amount. The terminal prints half a receipt displaying the amount of the transaction, and the customer is requested to authorise this by signing it.

The signature is then checked, the enter button pressed, and the rest of the receipt is printed. This is torn off and returned with the card to the customer. No further paperwork is necessary, and the total transaction time is around 15 seconds.

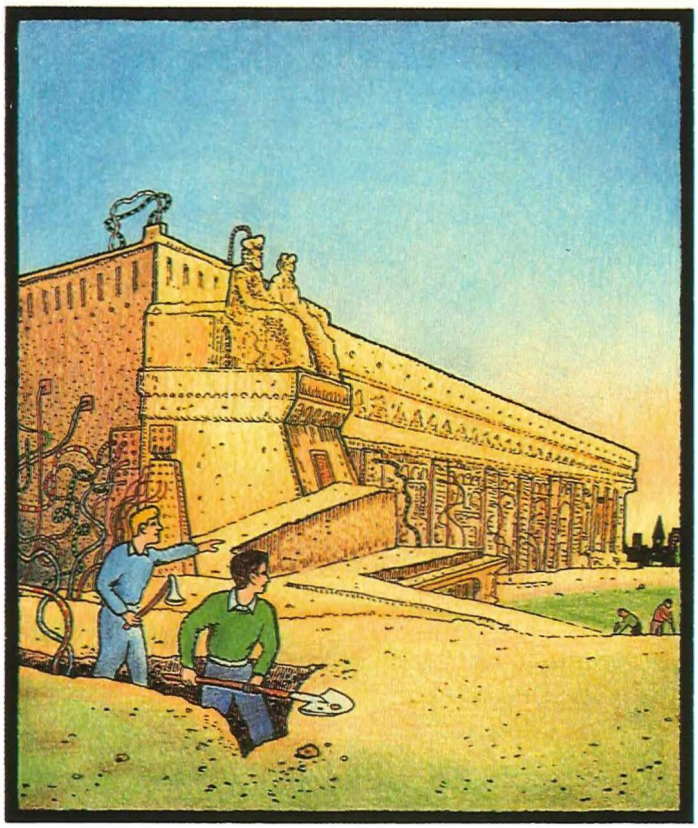
Whilst this has been taking place in the retail outlet, all the required information has been passed over Cardway to the card issuer's computer and has been captured. The transaction has been authorised and the retailer's bank account will be credited with that amount the next working day. This system can also make refunds and reconciliations. A voice link can be established as with Cardway Dial if required.

Cardway concluded a successful pilot in five London exchanges in 1986 and has been expanded to a total of 95 locations to provide national coverage of Britain's major shopping centres. Communication costs for Cardway are based on a rental structure dependant on how close a retailer is to a Cardway node and on a usage charge per transaction.

Cardway has had a positive reaction from the major card issuers who combine it with a terminal to offer as a complete package to retailers. Systems currently using Cardway are Barclaycard's PDQ, Access's Accept, The American Express Data Capture System and Lloyds Bank Card Point. Each of these systems makes paying by card faster and easier, for which Cardway can claim a good deal of the credit.

The Art of Communication

fig. 1



WHILST OTHERS WERE WORKING ON EVER MORE ELABORATE SWITCHING SYSTEMS, S.T.C HAD COME UP WITH SOMETHING ALTOGETHER MORE INNOVATIVE...

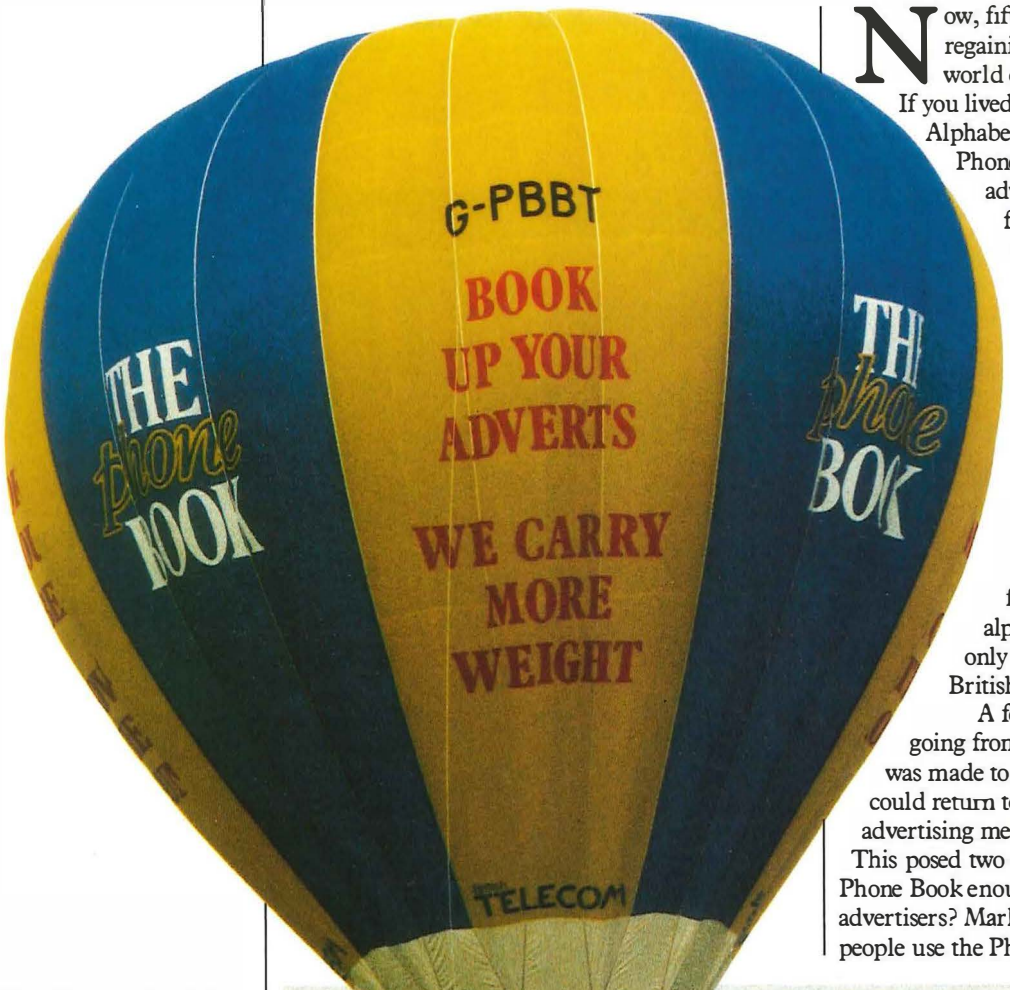
. . . Managed Transmission Networks. Distributing intelligent multiplexers in the network and using optical fibres means STC Telecommunications can create world leading Flexible Access Systems. This innovative application of technology has made us the largest company in Europe committed to both communications and information technology. For your information pack simply contact: *L. Marriott at STC Telecommunications, Oakleigh Road South, New Southgate, London N11 1HB. U.K. Tel: 01 368 1234 Telex: 21917 STC NS-G*

STC TELECOMMUNICATIONS

This hot-air balloon is used to promote the Phone Book and increase awareness of it as an advertising medium.

Phone books fly the flag

Roger Watson



Now, fifty years on, the Phone Book is regaining its position as a force in the world of directory advertising.

If you lived in London in the 1930's, your Alphabetical Telephone Directory (as the Phone Book was called) was filled with advertising. It had adverts on its front and back covers, inside and out. There was more advertising on the spine, and even on the three cut edges.

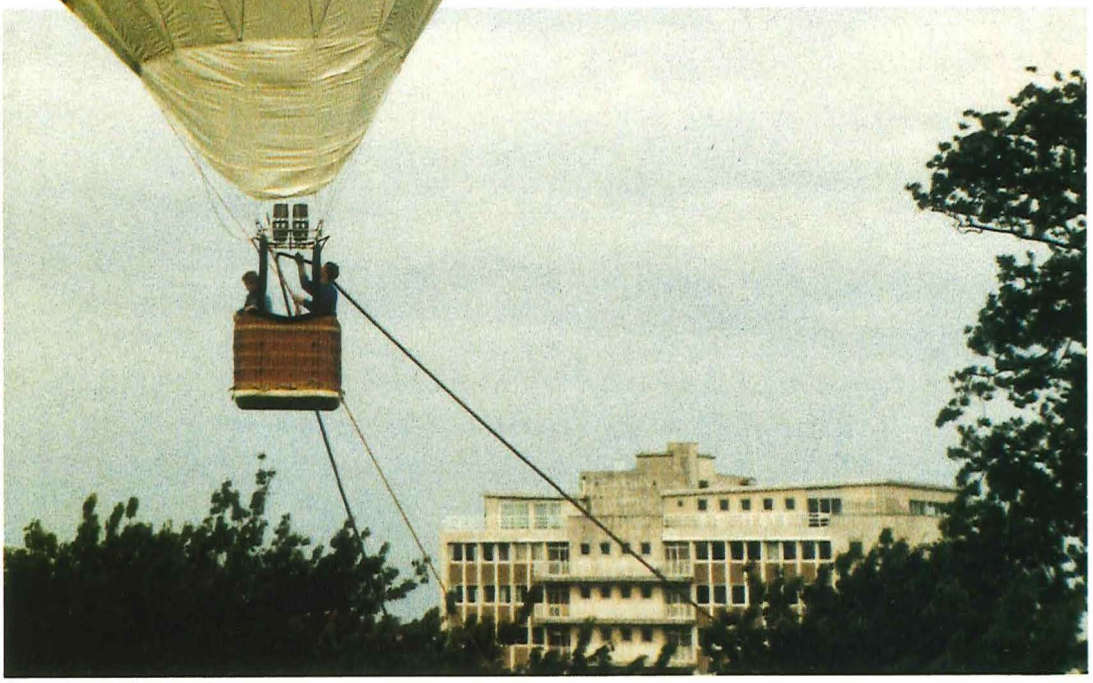
Inside, within the number listings, were boxed adverts, banners and whole page adverts; and a leaflet tucked inside from the United Electric Factories Ltd, selling light bulbs.

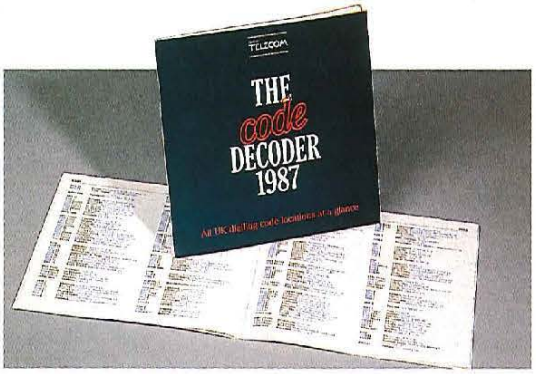
Then, in the 1960's, this advertising was channelled wherever possible to the fledgeling Yellow Pages. The alphabetical directory from then on only carried adverts for utilities like British Gas.

A few years ago, with Yellow Pages going from strength to strength, a decision was made to review whether the Phone Book could return to its former glory as an advertising medium.

This posed two questions. First, do people use the Phone Book enough to make it interesting to advertisers? Market research showed that in fact people use the Phone Book more often than any

The Phone Book is undergoing drastic changes to make it more efficient and easier to use. But as its design advances towards the 1990's, the Phone Book marketing team are looking back to the 1930's for inspiration in their drive to increase advertising revenue.





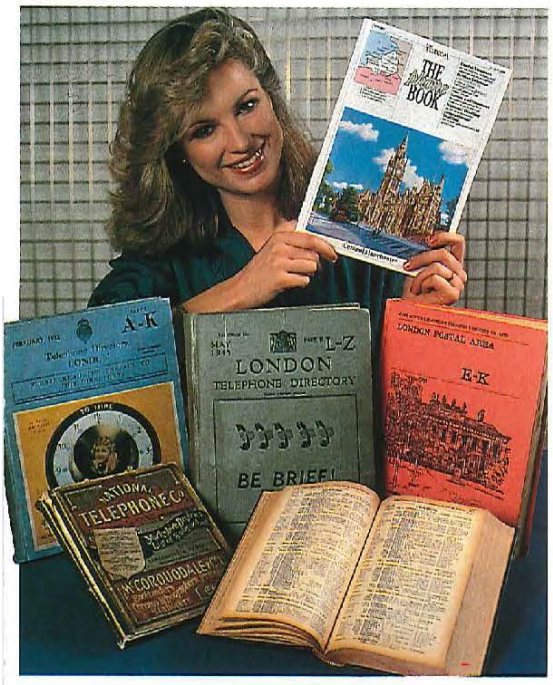
other directory, and it's mostly business numbers they are looking for.

Second, what would then make organisations advertise? It was felt that broadly there were two approaches. Some advert types, like outside back covers, were similar to adverts in a magazine: people would be attracted to them by chance. Unlike magazines, the Phone Book is delivered to every home and business with a phone, and once there stays with them for eighteen months. Alternatively, other types of advert would be located on the same page as the advertiser's normal free entry. This would let the advertiser describe himself in his own terms, give more information about himself, and polish his image as someone who cares for his customers.

The marketing team felt they had a viable product and that the time was right. Now things are moving fast. Already many books feature boxed adverts within the columns of listings. For example, Liverpool's new book published this month has 400 such adverts; South Manchester has over 500.

A new glossy Centre Page advertising section brings the glamour of full colour to many books; and back covers are once again a lucrative source of revenue. Most covers now carry paid-for adverts at anything up to £20,000 a time.

Each Phone Book is sealed in a clear polybag. This protects the book while it is being delivered, and has also enabled advertisers like Barclaycard and GUS to advertise on a loose insert inside the polybag. Phone Books are the first directory of their kind in the world to have this protection. Next year they will carry over 50 million inserts into homes and businesses nationwide.



Advertising makes the Phone Book more attractive and useful to BT's customers, reducing the load on Directory Enquiries. Customers use DQ for phone number information 635 million times a year, but they use the Phone Book twice as often.

Changes have also been taking place in the look of the Phone Book number listings. In June 1987 the listings changed to a new typeface – the first new one in years. And by December this year all current Phone Books will be using it.

'Phonebook' typeface picks out the name and phone number, which is what most people look for, in larger letters. It prints the address in smaller type. While easier to read, it is also slightly smaller overall so it reduces the size of the book.

Developing this theme, books which have the same exchange name in more than half their entries now only print that exchange name at the top of the page instead of repeating it hundreds of times on every sheet.

Several Phone Books now have two separate listings, one for Residential customers and another for Business & Services. This will be taken up nationally by 1989. It will make the Phone Book easier to use, and will also mean that more space can be saved in the Residential section: first, by only printing the first example of each surname (but with the name repeated at the top of each column); then in books in major cities, by adding an extra column of listings to every page.

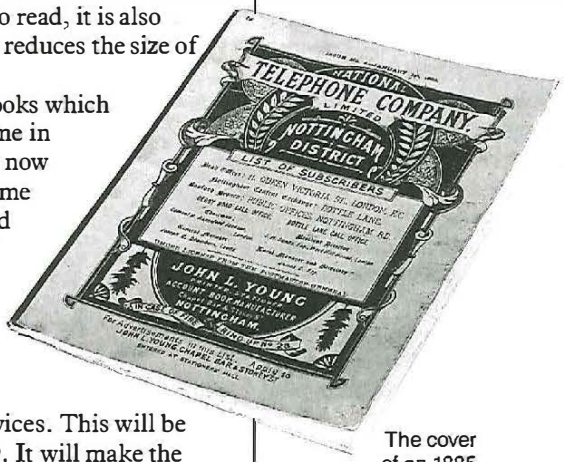
These space savings will make room for postcodes. Starting in 1989, Phone Books will be postcoded. This will encourage customers to use them as a familiar source of information.

Around 60 per cent of calls are for business customers who only make up 20 per cent of Phone Book entries. By increasing the number of separate editions of the Phone Book this imbalance can be partially corrected and production costs reduced at the same time. That's an idea the Phone Book team are looking at with interest.

The Phone Book in 1990 will be very different from 1980's model. It will be more useful than ever. Already it is the flagship of a new portfolio of products which includes the successful Code Decoder, the prestigious Executive Code Book and the new Residential and Hotel Code Books now on trial. Many of the innovations are new, but in some cases it is a question of going forward – to the past!

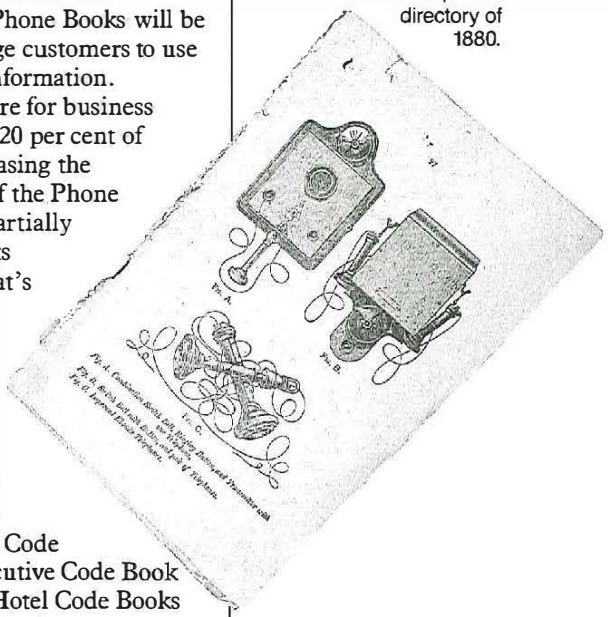
Left: the invaluable Code Decoder is part of the portfolio of products linked to the new Phone Book.

Below, left: the Phone Book has been through various incarnations over the last 100 years.



The cover of an 1885 phone book.

A page from the first London telephone directory of 1880.



Mr R Watson is a member of the Phone Book marketing team.

Not far as the crow flies but a quantum leap in the technology and facilities available – that's why those who have moved east to Docklands seldom look back as this view does from Wapping to the City.

When the last ship set sail from the Docklands in 1981, ringing down the curtain on two centuries of history, it left behind a huge area of appalling inner-city decay. The idea then that international banks, Fleet Street newspapers, fashionable design companies and City brokers would soon be scrambling to relocate in such areas as Poplar, Wapping and Millwall would have seemed preposterous.

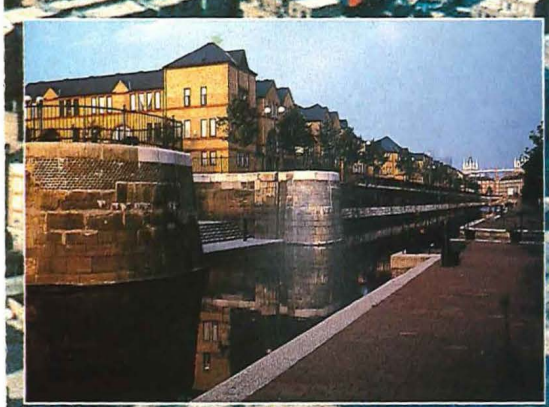
Yet triggered by the Big Bang in the City, the chain reaction has started and the infrastructure to make all this possible is coming together at an extraordinary rate. The Docklands Light Railway and the London City Airport have given the area better local and international passenger transport connections than ever before. Yet even these two important developments are not as crucial to the working of the new Docklands as is the construction of a world-beating ▷

Despite protests by traditional East-enders to the 'Yuppie invasion' London's Docklands have changed for good. This article looks at the important role British Telecom has played in helping to transform the area into a high-tech hub of industry and commerce — attractive to business and home-builders alike.

Inset: with Tower Bridge in the background, South Quay, Wapping, is not only a central but highly desirable part of town.

Resurrection success – it's champagne on the Docks!

Above: on board the quick and efficient Docklands Light Railway.



Main picture: the London Teleport has been augmented by a British Telecom Business Centre to cater for today's world of high-technology commerce.

telecommunications system – a project of major importance to British Telecom.

In the past, Docklands lived by trade: handling, processing and moving millions of tons of cargo. The new Docklands will trade in information: importing, exporting and distributing it almost entirely in the form of digital pulses that make up today's telecommunications signals and computer data systems.

The London Docklands Development Corporation, LDDC, formed in 1981, had the formidable task of converting the sad, run-down area whose *raison d'etre* had vanished with labour troubles and containerisation to Tilbury and Rotterdam, into one of the world's most successful 'enterprise zones'.

If the LDDC was to achieve its initial objectives of attracting more of the square mile city businesses, it had to provide a telecommunications infrastructure without rival.

British Telecom, East London Telecommunications and Mercury were all invited to assist in the Docklands revival. British Telecom, like Mercury, took the opportunity of the interference-free Dockland site to locate its International Teleport. As roads were rebuilt to accommodate more traffic, ducts were laid and BT cables installed in them. Sophisticated cabling was matched with sophisticated switching equipment and the 'green field' site gave British Telecom the opportunity it has had nowhere else in the UK – to start with the best of today's technology, working to plans drawn up to meet future needs.

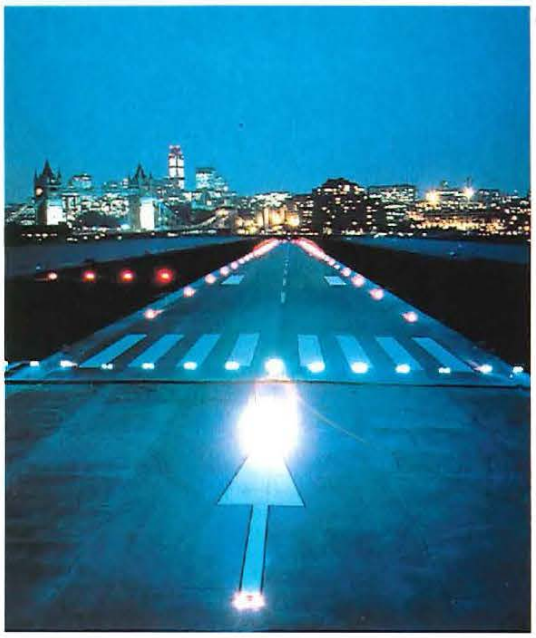
In the early days of the project, a British Telecom Business Centre was set up alongside the LDDC's own office. As major schemes like the 12 million square foot Canary Wharf development emerged, the local business presence of British Telecom was a great stimulus to convincing developers of the workable realities of Docklands.

Invaluable

The LDDC was always determined to cut through red tape and move at a speed unusual for local government and quangos. It was impressed that British Telecom, large though it is, was also able both to react and take initiatives swiftly in this prime site where time is invaluable. The London Teleport, for example, went from the idea to the opening in less than one year and is handling satellite traffic around the world – and around the clock.

The project's success, however, goes beyond satellite transmission, fibre optic cables and System X. Effective marketing has been the key to the developments in the eight square miles and British Telecom has helped in the staging and implementing of events designed to impress.

Livenet, for example, is a joint production of Queen Mary College, University of London, LDDC and British Telecom, where a series of public conferences have been held on Heron's Quays, with speakers in a variety of different locations coming together through the medium of video conferencing. The first ever video



Centre: London City Airport gives Docklands convenient international connections.

conference chess match was played by Gary Kasparov in the Docklands against five players in Canary Wharf and five in the US over simultaneous transatlantic satellite links through the London Teleport.

Docklands is destined to become the City that never sleeps – catching the Tokyo close is as important to British Telecom's large corporate customers as is catching the Wall Street and Chicago openings. In order to meet the needs of these customers BT has established a dedicated centre at Quay House – a few yards from the Docklands Light Railway – where customers can discuss their needs via a single contact point. And BT has skilled staff on duty, night and day to deal with any problems which can range from a broken handset to a major breakdown in a big switchboard.

The team – engineers, sales people and business consultants – is supported by the latest diagnostic equipment and new customer service tools, such as a computerised diary system for booking in and co-ordinating repair and installation appointments.

British Telecom has put a lot of effort into retraining its engineers and reorganising its support systems, so customers get the help they need when they need it, 24 hours a day.

Once established in Docklands, each business customer becomes the specific responsibility of an individual BT account manager whose job it is to see that the customer receives prompt, efficient fault repairs and equipment maintenance, fast response to orders for new services and considerate treatment at all times.

From BT's point of view, Docklands is a showcase project which within two or three years, will represent the kind of efficient, high-capacity digital telecommunications network that will be available across the UK by the mid 1990s.

British Telecom will be able to deliver all the voice data and text services its customers need down one single, optical fibre network which will enable a customer to connect a huge range of telephones, computer terminals, video systems and fax machines – even security TV cameras – into the same socket.

All major business sites will be linked into the optical fibre network and there will be direct fibre optic links to the City, enabling a high proportion of day-to-day business to be conducted over lines without copper wiring.

The result, for many people, will be their first dramatic demonstration of the speed, clarity and the extra service opportunities that come with end-to-end fibre optic connections and digital exchange switching.

British Telecom's Business Centre gives a real sense of the exciting possibilities opened up by the 'Communications Revolution'.

Investment

There are working demonstrations of all the equipment and services that go together to help different types and sizes of business get the most out of their investment in telecommunications: from radio pagers to fax machines, from mini-switchboards to dealing systems for securities firms, and from international video conferencing to private viewdata networks.

But it's not just businesses and events in the Docklands. The residential mixture in all parts of the Docklands is changing and working methods are also changing. Foreseeing a trend towards increased working from home, British Telecom has planned the Docklands network so that each new residential customer has the option of adding an extra phone line to the initial installation – for the day when a home fax or modem is needed.

Docklands is an area of great opportunities and great challenges. Just as the choked docks of the 50's and 60's helped strangle the old docklands and prevent them from adapting to the needs of container distribution, so a business community becomes choked without adequate communication facilities. British Telecom is doing its best to ensure that that day will never dawn. ■

A toast to the Telegraph...

The Daily Telegraph was one of the old Fleet Street stalwarts. Like its tabloid and broadsheet rivals, however, it had gone wholeheartedly into the era of 'new technology' ▷

The rebuilding of the importance of London's Docklands has already revolutionised the City's approach to traditional activities. This article looks at how British Telecom helped the Daily Telegraph to come to terms with the move from Fleet Street.

with a move that began in early 1987, to London's Docklands. Its first Dockland's site, however, was a printing works, which opened in Westferry Road in September 1986.

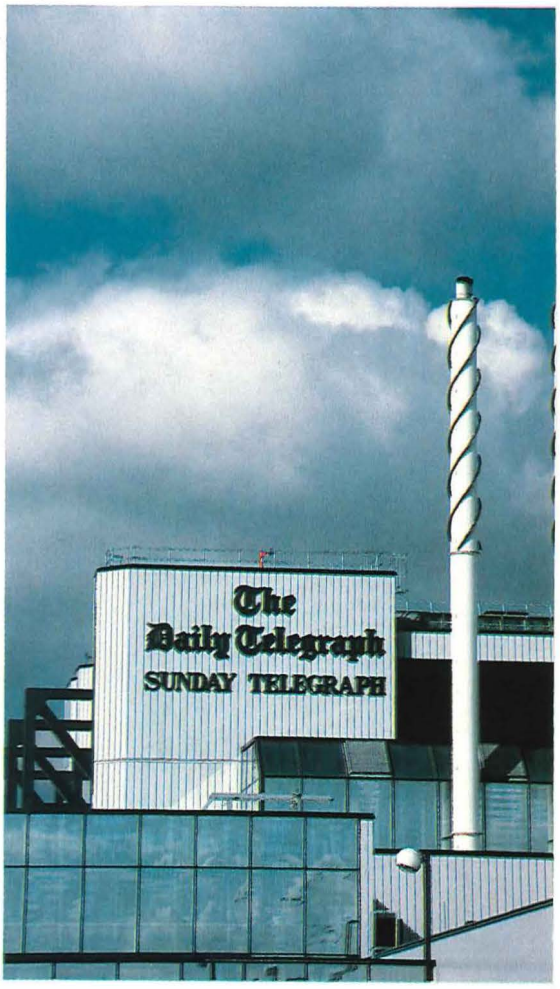
The problems of isolation could have been daunting and the Daily Telegraph had to address the problem transferring all its staff from one site to another, whilst maintaining telephone links with them all and with two printing works in geographically remote locations.

The mixture of communications media used by the Telegraph is impressive – ordinary voice links within and outside the buildings and between sites, text incoming on phone lines, telex, fax, agency newswires, links with the Stock Exchange and the House of Commons, and so on. From the look of the place, it seemed as if there was no suitable infrastructure but as far as the telecommunications links were concerned this was far from the truth.

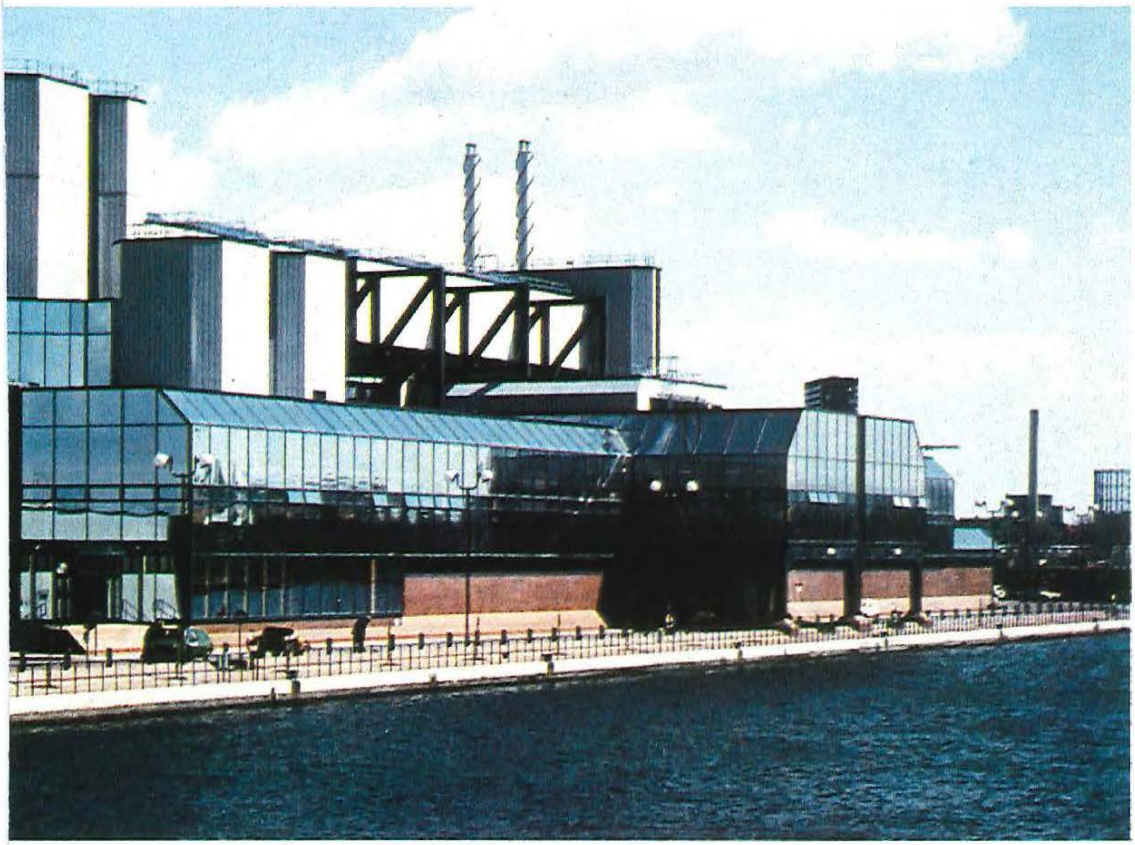
The logistics of the move were awesome, involving gradual transfer of over 1,000 ordinary telephone extensions in four months, installation of the new switch, re-ordering of direct incoming services such as agency news services, automatic call distribution and an Atex system which – amongst other things – the journalists use to compose their prose.

The SX2000 big switch was selected for the prestigious new location and Mitel, ICL and British Telecom were approached to put forward solutions.

The problem was how to transfer gradually from the ITT switch in Fleet Street and, over a three month period, keep all communications going between Fleet Street, South Quay and the Trafford Park (Manchester) and Westferry Road (Docklands) printing depots, whilst waiting on delivery of the switch from the manufacturers.



Main picture: the *Daily Telegraph* building on the Isle of Dogs.



British Telecom recommended that its DMSIA multiplexer was used with four MegaStream links, giving a total of 120 speech paths providing for 512 extensions at South Quay. This solution meant that temporary extensions were run through to South Quay, whilst awaiting the British Telecom supplied SX2000, which could be used in reverse, once the volume of staff exceeded that in Fleet Street, to provide extensions from the SX2000 to the old building.

This so enthused the Daily Telegraph that it also opted for BT to supply all the internal cable distribution, most of their modems, their telephones and most of their phone lines, along with MegaStream links, KiloStream links, telex, telegraph and associated digital and analogue network services.

The communications infrastructure of a paper like the Daily Telegraph is extremely complex – and critical to its actual production. The heart of the South Quay operation is the Atex system, which holds all information coming into it, whether from external news agencies, correspondents, direct data links, telex, or the journalists at their terminals in the buildings. This means that many incoming lines go direct into the central processing unit so that journalists can pull out and manipulate information as required, re-entering their own refined, rewritten texts.

In a UK first, British Telecom's Northern London District worked with the Daily Telegraph to link an X25 Packet SwitchStream link direct into the Atex photocomposition system connecting the Atex system to other systems around the world.

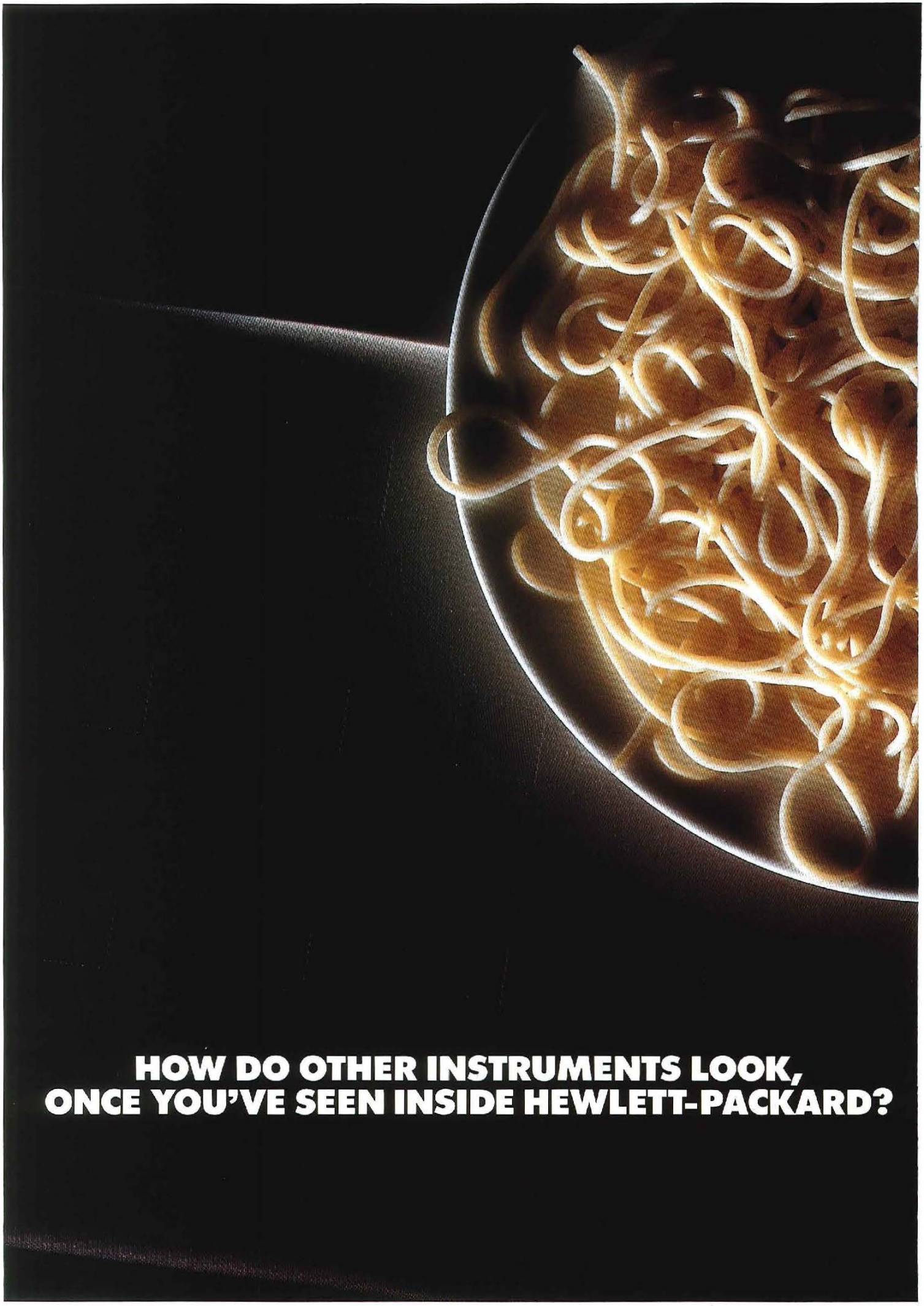
The Houses of Parliament are connected by two direct KiloStream lines into the Daily Telegraph. All news agency services and The Stock Exchange have direct links into the Telegraph and, in addition to the main switching system, there is also a 97 line automatic call distribution system and the huge pressfax machines, which transmit pages to the printing works.

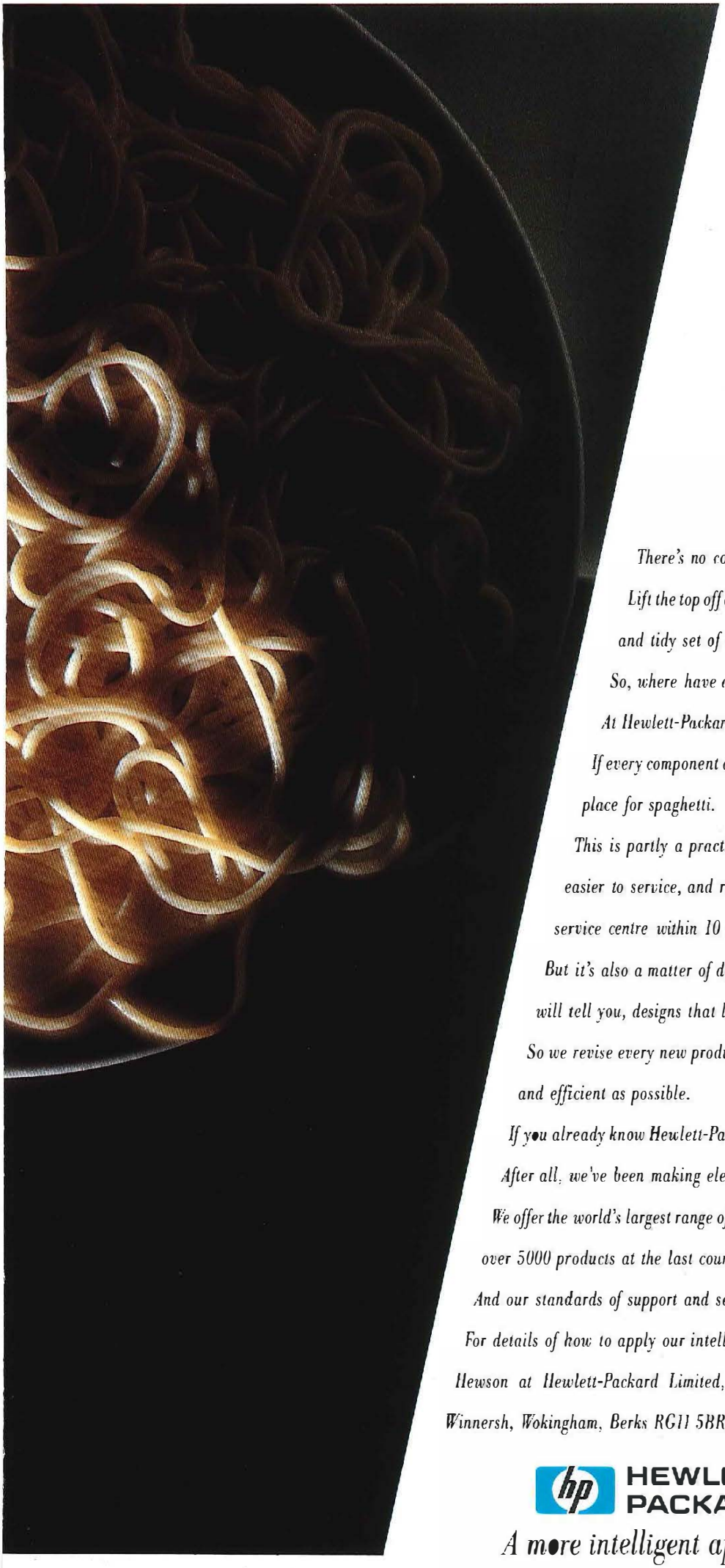
When the majority of the staff had transferred from Fleet Street, in August 1987, the British Telecom and Daily Telegraph team worked solidly for 16 hours, changing the DMSIA over from receiving at South Quay to sending to Fleet Street, reversing the previous operation. At the same time, the SX2000 was brought online, whilst still maintaining communications by fax and phone between Fleet Street, South Quay and both printing works.

The DMSIA has now been withdrawn and all operations were transferred successfully to Docklands, just nine months after the process began. British Telecom is currently in the process of providing extra MegaStream circuits on the request of the Telegraph.

The Daily Telegraph's move was therefore effected without a break in communications of any kind.

Left: no time is lost transmitting pages to the printing works.


HOW DO OTHER INSTRUMENTS LOOK,
ONCE YOU'VE SEEN INSIDE HEWLETT-PACKARD?



There's no comparison.

Lift the top off any Hewlett-Packard instrument and you'll find a neat and tidy set of circuit boards.

So, where have all the wires gone?

At Hewlett-Packard, we believe that good design doesn't need them. If every component and every board is in the right position, there's no place for spaghetti.

This is partly a practical consideration. It makes your instrument easier to service, and recalibrate. So it's usually in and out of our service centre within 10 days.

But it's also a matter of design philosophy. As any design engineer will tell you, designs that look better usually work better too.

So we revise every new product design until the layout is as logical and efficient as possible.

If you already know Hewlett-Packard, none of this will surprise you. After all, we've been making electronic instruments since 1939.

We offer the world's largest range of test and measurement equipment, over 5000 products at the last count.

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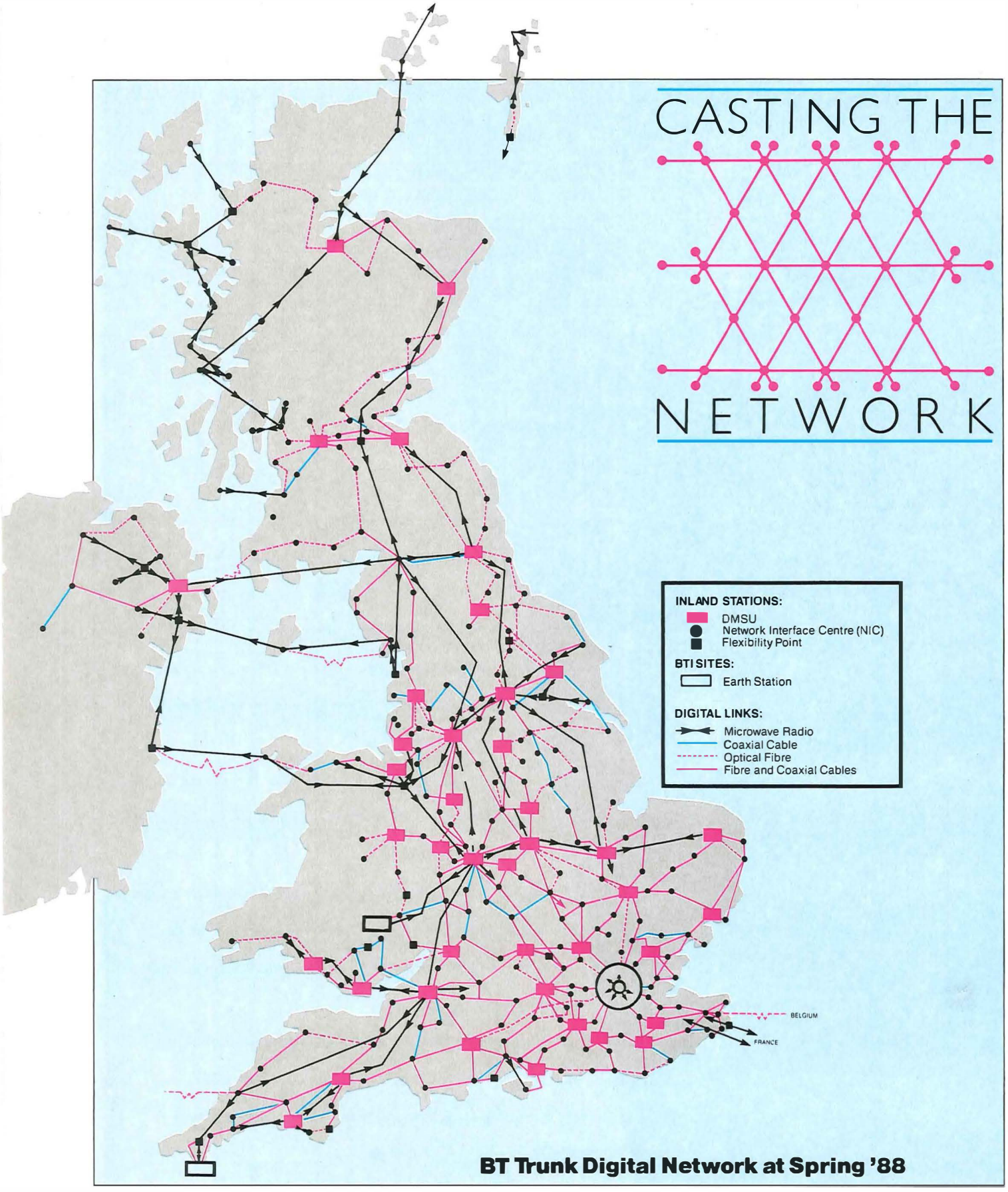
HEWLETT PACKARD

A more intelligent approach



'Thinking' technology opens up new worlds

The idea of a 'thinking' network which can decide whether to route a call to a person's home or office or whether to store a message for a while to take account of global time differences, is no longer science fiction.

To those who already feel that the telephone and associated paraphernalia is an infringement of their liberties, the prospect of being 'stalked' by an invisible technology may sound horrific. There will always be those worried by the consequences of progress. But according to John Tippler, British Telecom's Director Networks, there is nothing at all to worry about.

"Thinking networks will not have the qualities of human thought that the phrase implies. But they will be able to carry out some operations automatically and will be programmed to do rountine tasks more rapidly," he said.

Mr Tippler's network responsibilities account for the lion's share of the company's £2 billion a year investment programme. The UK Communications network also generates a significant proportion of BT's income.

With such huge sums of money being pumped into network developments, the pace of change is, not surprisingly, rapid. The 11 network-related features in this special issue of the British Telecom Journal examine some of the steps currently being taken. No single publication, however, could do justice to the entire subject and this supplement highlights only some of the strands in the giant 'spider's web' of communications links which make up today's network.

Strategy

Features look at how a network strategy is formed and how the planners do their job. Optical fibre technology is central to several stories as this, together with the concept of digital transmission, is one of the cornerstones of change, the other being the 'intelligence' in the new exchanges and network.

The future of private circuits, which go back to the very beginning of telecommunications, is discussed and other articles look at the Flexible Access System programme which will bring fibre initially to business customers, and later to homes and smaller businesses; and the Digital Derived Services Network which is being set up this year to revolutionise the provision of network services and cut costs at the same time. Another article deals with the thorny problem of computer integration and BT's lead in breaking down the barriers caused by incompatible systems.

Some exciting and highly diverse developments – all with the network as the common theme. John Tippler, from his offices on the eighth floor of British Telecom Centre in Newgate Street, London, has a bird's eye view of how tomorrow's network is taking shape and the opportunities that will become available for both business and residential customers. "A whole new world of possibilities is about to open up," he said.

Although the pace of change is breathtakingly fast, there has been a 'snowball' effect in network developments – particularly during the 1980's.

In fact, work on electronic switching systems began at the end of the Second World War and, by 1949, researchers at Dollis Hill – the forerunner of British Telecom Research Laboratories, Martlesham Heath – had demonstrated a 99-line electronic exchange. This development paved the way for the System X and AXE 10 exchanges now being installed at the rate of two a day.

Said Mr Tippler, "The concepts behind today's network really date from the 1960's, but devices and software had not reached the necessary stage of development at that time. The tools for the job came in the 1980's, hence the enormous task taking place now of transforming the network from its origins rooted in the old Strowger and crossbar technologies."

The new network will provide a reliable, low-cost service with multiple capabilities which will deliver what the customer wants. The advantages to the business customer of optical fibre and digital technology have been well publicised. Perhaps the most exciting is the 'one big office' idea in which companies with branches scattered throughout the country will be able to have a free interchange of voice and data over a truly Integrated Services Digital Network (see article on private circuits on page 67).

Reliability

Business will also benefit from the inherent reliability of the network which stems from more reliable technology and greatly reduced human intervention in setting up and modifying services. Eventually, customers' needs will be catered for by programming alone – the need to alter physical wiring will be very much reduced.

But Mr Tippler is keen to point out that private customers will also benefit from the new network's impressive specifications.

"The cost of using the phone is reducing now in real terms, and the failure rate for trunk calls has dropped by a third in the last 12 months," said Mr Tippler. "I expect hardly any calls to fail by the early 1990's and all customers – not just businesses –will benefit from that."

Speed has dramatically increased – calls will be connected just one second after the customer's finger lifts off the button, even when they cross the ocean. And Star Services, such as call transfer and conference calling, are not just for businesses either, he said. For example, by using System X, a mother in Sidcup could talk to her son in Scotland and her sister in Scarborough at the same time. Other advantages to the private customer include itemised billing, previously unworkable under the old technology.

"Every telecommunications user in the country will receive a far better service from the new technology than it was ever possible to provide before," said Mr Tippler, "but the technology will not do it by itself: it is the skill and dedication of all our people which will make the services possible."

John Tippler, Director, Network.

CASTING THE NETWORK

Predicting the unknown

A strategy for the 21st century

Bob Partridge

At the heart of British Telecom is the UK Communications network which not only generates a significant proportion of the company's income, but is also the destination of a large share of its £2 billion a year investment programme. The job of the Network Strategy Unit (NSU) in UKC Network Headquarters is to provide a strategy which will enable the network to evolve to meet the challenges of the 1990's and beyond.

A network strategy is a framework within which planning and implementation can take place. It needs to be detailed enough for BT's Board to be confident that the network's quality, costs and features are meeting business objectives. Just as importantly, it needs to be expressed in terms of evolution plans that the development, planning and operational specialists in Network HQ can build upon.

NSU, with its staff of 36, produces an annual Network Strategy Review – a top-level document covering these areas – which is put before the Board with the Market Strategy and the annual Network Plan.

Five Network Evolution Plans are being produced to explain the strategy in engineering terms covering the access network; core network; network intelligence; operations and management; and predictions for the next 10 to 20 years.

Telecommunications in the UK have changed rapidly over the last few years and will continue to do so. Formulating strategy is not therefore just a matter of trying to understand customer needs, technological opportunities and cost trends, but is also influenced by the present and future commercial and regulatory environments.

Balancing all these factors to form a coherent way forward is the job of the network strategist.

Coping with all the future unknowns is a major challenge which is done by providing flexibility in the network. However this can cost a lot of money and it also increases the complexity of the network, especially in the control and management systems. The evolution path must therefore 'position' the network in terms of both capacity and intelligence flexibility to ensure that it will be able to respond to demands for new and as yet unknown features at an acceptable cost.

Following major modernisation programmes on trunk and junction digitalisation and local exchange replacement, network strategists are now looking at ways of reducing costs still further and continuing the improvement of quality of the basic network service. The creation of a low cost, top quality basic network, with features like fast call set up and itemised billing, is an essential first step on the road to success in the 1990's.

The second step is the enhancement of this quality basic network to enable new services to be deployed rapidly and economically through the 1990's. The evolution strategy to achieve this has been a major task for NSU over the last 12 months. Experience with the Derived Services Network, which supports services like Linkline 0800 and Premium Rate 0898, has shown a big demand for new features and services but, in the future, competition will be very strong from aggressive specialist companies.

It will be necessary to respond to this challenge more quickly than is possible by enhancing the software in each individual digital exchange, and the strategic approach of utilising a few Intelligent Network Databases (INDB's) to provide enhanced services and applications is an attractive option for the 1990's. These INDB's would interact with digital exchanges via the CCITT7 signalling network. A considerable amount of work on developing the potential of this approach is now being done by both BT and other leading telecommunications network operators. UKC is aiming to establish a competitive 'Advanced Services Network', by exploiting the capabilities of the Digital Derived Services Network and INDB's in conjunction with the high quality, low cost basic network.

In NSU the job of formulating the ten year evolution strategies falls on two sections, one under Ron McCann which concentrates on network intelligence and the core network, and the other under Peter Lisle which concentrates on the access network and operations and management. Major areas of strategic interest

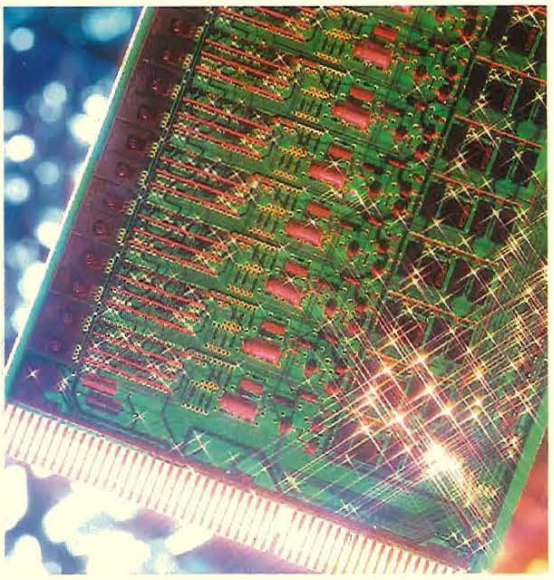
currently being tackled in these sections include the support and management of private circuits, the deployment of optical fibre in the local access network and the implementation of a structured network management hierarchy to create a network that may be managed as a single entity with consequent cost and quality benefits.

Responsibility for bringing together all network evolution aspects, including market needs, rests with Peter Carling's section. Establishing a clear understanding of all network costs and their trends as a result of the strategies is the responsibility of Jean Davies and her section.

As well as formulating strategy for the next ten years, NSU also have a small section, under John Bateman, looking 10 to 20 years ahead. Although it is difficult to predict environmental influences on the network beyond 1995, it is essential to consider long term developments to ensure that the 10 year strategy will not be compromised by significant changes just beyond that period.

In addition to its work on mainstream network strategy, John Ames in NSU is responsible for the formulation of the UKC research and development strategy. With £53 million to spend in 1988-9, UKC has the biggest single divisional budget at BT's Martlesham laboratories.

A further aspect of the unit's work is support of the Corporate strategy for dealing with major suppliers such as STC, and Plessey-GEC. A sound relationship with key suppliers is important when it comes to the delivery of cost effective and reliable goods – on time. There is also a need for BT to use equipment which is close to that used by other operators to avoid increasing development costs associated with new technology like optical fibre in the local access loop.



Opposite: System X exchanges like this one in Brixton are the backbone of the network modernisation programme.

Left: a System X printed circuit board.

The alternative of radically adapting products to meet BT specific needs is time consuming and costly and is reflected in prices and availability dates. Setting a network standards policy to ensure that the company utilises European, World or other accepted standards wherever possible is another key element of the role of NSU.

The Network Strategy Unit has a tremendous range of responsibilities, and to function effectively works closely with experts throughout the company and is continually building its awareness of new ideas outside the business through discussions with both suppliers and leading telecommunications operators in Europe and the USA. ■

Shall we put the first exchange in space on Mars or the Moon?

Mr R Partridge is Manager of BT's Network Strategy Unit.

CASTING THE NETWORK

Planning ahead – a demanding task

Brian Down

The network planner's job is to ensure that a quality network is always available to support the British Telecom products using it. Planning starts when a demand is forecast, and is completed when the equipment is installed and ready for use.

The network consists of the plant provided to give access between any two or more BT terminations at customers' premises or to provide access to the interface with other networks such as International or Mercury.

An access network provides the plant between the customers premises and local exchange, together with that needed for the local end of private circuits and access from other licensed operators. The second main element, the core network, consists of all the exchanges in the network, the transmission plant that interconnects them together with the line plant used for longer haul private circuits and other non-switched services.

The network carries a vast spectrum of BT products ranging from a simple trunk or local call through to Linkline calls and MegaStream services. Overall there are around 70 products, ranging from Premium Rate Services which require dedicated high technology equipment, to fax machines which use the basic telephony network.

Network planning begins with forecasting the likely traffic flow of each diverse product line. Forecasting starts with an annual integrated forecast (IF), which aims to ensure that all forecasts used for planning the telephony network are consistent and based on approved, common, key assumptions.

Alongside the preparation of the IF, which merely provides the level of the forecasts and the growth rates, the planner has to consider the latest policy on routing and strategy together ▷

CASTING THE NETWORK

Right: planners need to consider the capacity of existing plant (like this System X exchange) while forecasting future traffic levels.

Mr B Down is BT's switching network planning manager.

with the dates at which units are expected to be in service. Information on these items is contained in the Network Master Plan, a nationally controlled document.

The resulting forecasts are input into a computer data base as the Annual Schedule of Circuit Estimates or ASCE, which is the basic forecasting database for the planning and provision of routes and circuits on the switched network. ASCE is read into a number of computerised planning systems which control the trunk and junction transmission plant, together with the trunk and local exchanges.

In addition to the PSTN requirements shown in the ASCE, network plans have to include demand for capacity from services which are not part of the switched network such as telex, BTI frontier links and KiloStream. These requirements are passed directly to the planners concerned. In today's competitive environment, networks are obliged to allow other licensed operators to interconnect with its network. These forecasts, along with those of administrations such as Telecom Eireann, are also fed into the planning system.

Once forecasts are available, plans can be drawn up to provide the necessary equipment. Systems planning consists of two basic elements – capacity planning and new services or product planning.

Forecast

In order to perform these tasks the planner needs to know what has already been installed, what has previously been planned and what the forecast traffic level will be.

The capacity planning process involves taking a forecast for future plant use and converting it into an ordering plan to provide for, amongst other things, equipment for installation in exchanges and cables into the ground.

The various planning systems therefore convert forecasted traffic levels into required equipment which is then compared with the level of provision already planned to determine when the supply of various components such as cables or exchange processors will be exhausted. In order to determine the quantity of additional capacity to be purchased the planner also needs to know the intended design life. Is it, for example, in the long-term cheaper to install a 12 pair fibre cable which will last three years or a more expensive 24 pair?

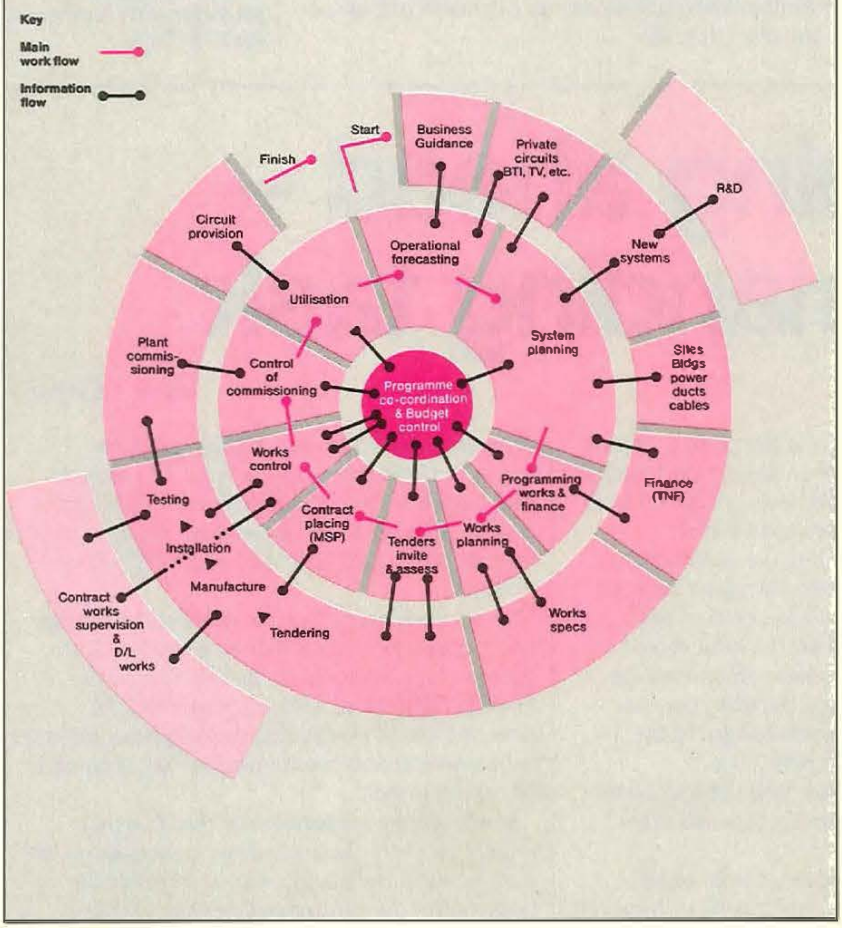
At the centre of the planning cycle are two key elements, project and budget control. Project control monitors the progress of plans to fruition, making changes as necessary to ensure that dates are met. Good budget control is also vital to ensure that money for new equipment is most effectively used and accounted for.

The end result is plant in the ground or equipment installed in exchanges which can be used to provide customers with the best possible services.

Forecasts, and probably strategy, will change considerably by the time equipment is utilised, and the utilisation teams in both trunk regions and districts will have to adapt the network in order to meet day-to-day demands.

The final turn on the plant provisioning cycle is the feedback to the planners on just how the plant has been used, in order that plans can be modified – the planning cycle is then ready to turn again to provide more equipment to meet customers' ever increasing demands. ■

Provision of network plant



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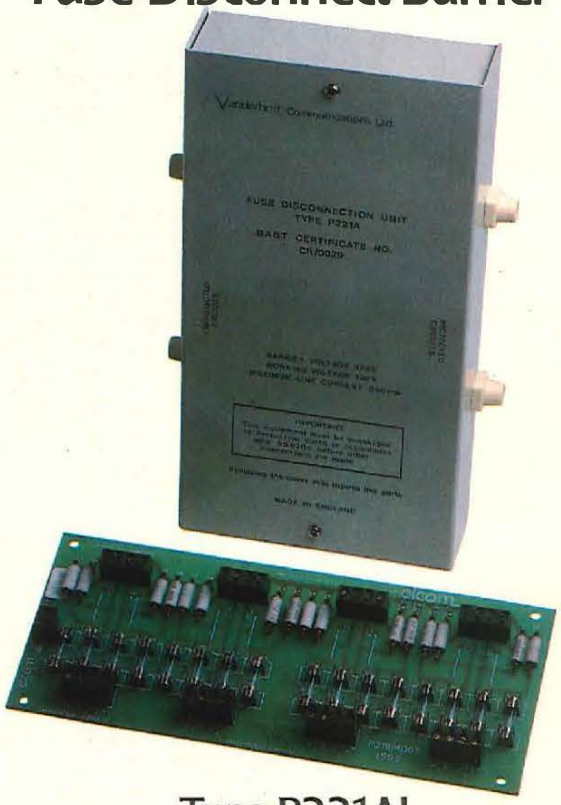

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A flexible friend for business customers

CASTING THE NETWORK

Ian Dufour

Flexible access systems are a means of providing the normal range of services to business customers through an 'optical pipeline'. The first systems, carrying private circuits, are already in service and widespread implementation through the 1990's is expected.

Optical fibres are already widely used in British Telecom's trunk and junction networks with over 300,000 kilometres of fibre installed and commissioned. This is because optical fibres and their transmission systems first became economically attractive on long high-density routes and gradually became viable on shorter and lower density routes.

Until recently, application in the local access network was ruled out on cost grounds. But the evolution of the core network towards fewer switching nodes, with fully digital exchanges and digital transmission systems linking them, changes the economics so that optical-fibres are now starting to have a place in the local access network.

BT is treating this introduction of optical-fibres in several phases, the first of which is the provision of direct optical fibres and their associated electronics – known as flexible access systems – to major customer sites. Other developments may include optical-fibres feeding street electronics, sited in cabinets or underground housings, and in the longer-term providing fibre to all customers.

The key elements of flexible access systems are:

- a single-mode optical-fibre cable network;
- flexible software-controlled primary-multiplexers located at customers' premises along with the appropriate higher-order multiplex and opto-electronics;
- a digital service access switch to handle both analogue and digital private circuits;
- software to monitor and control the hardware and to interface with BT's existing operational computer systems.

The cable network is dimensioned and laid down at the outset to avoid constant piecemeal addition. The target sites are 25-lines upwards. In practice, the cable network is laid down with 96-fibre cables breaking down to 48 and 24-fibre cables. Generally the 24-fibre cables lead to a joint serving a number of customer sites.

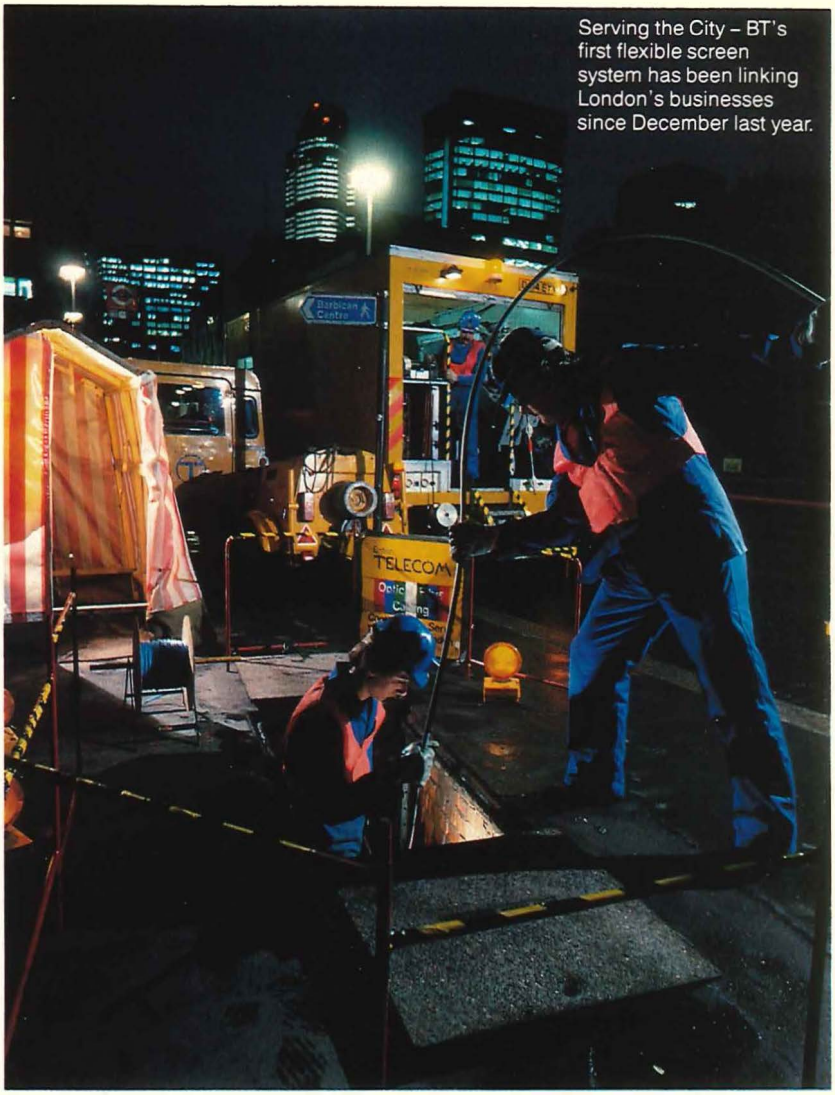
Each customer site usually has four fibres but these may in some cases be fed from two diversely routed spine cables. The customer entry cables are therefore of two or four fibres and these are usually met by a four fibre fixed-count cable or by means of 'blown-fibres' described in a separate article on page 59.

The equipment at the customer site includes opto-electronics, higher-order multiplex and the appropriate number of primary multiplex each of which occupies a digital transmission stream running at 2 Mbit/s. It also includes protection-switching to duplicate the fibres and transmission equipment, standby batteries, line-testing aids and a cabinet – an assembly referred to as the Customer Service Module.

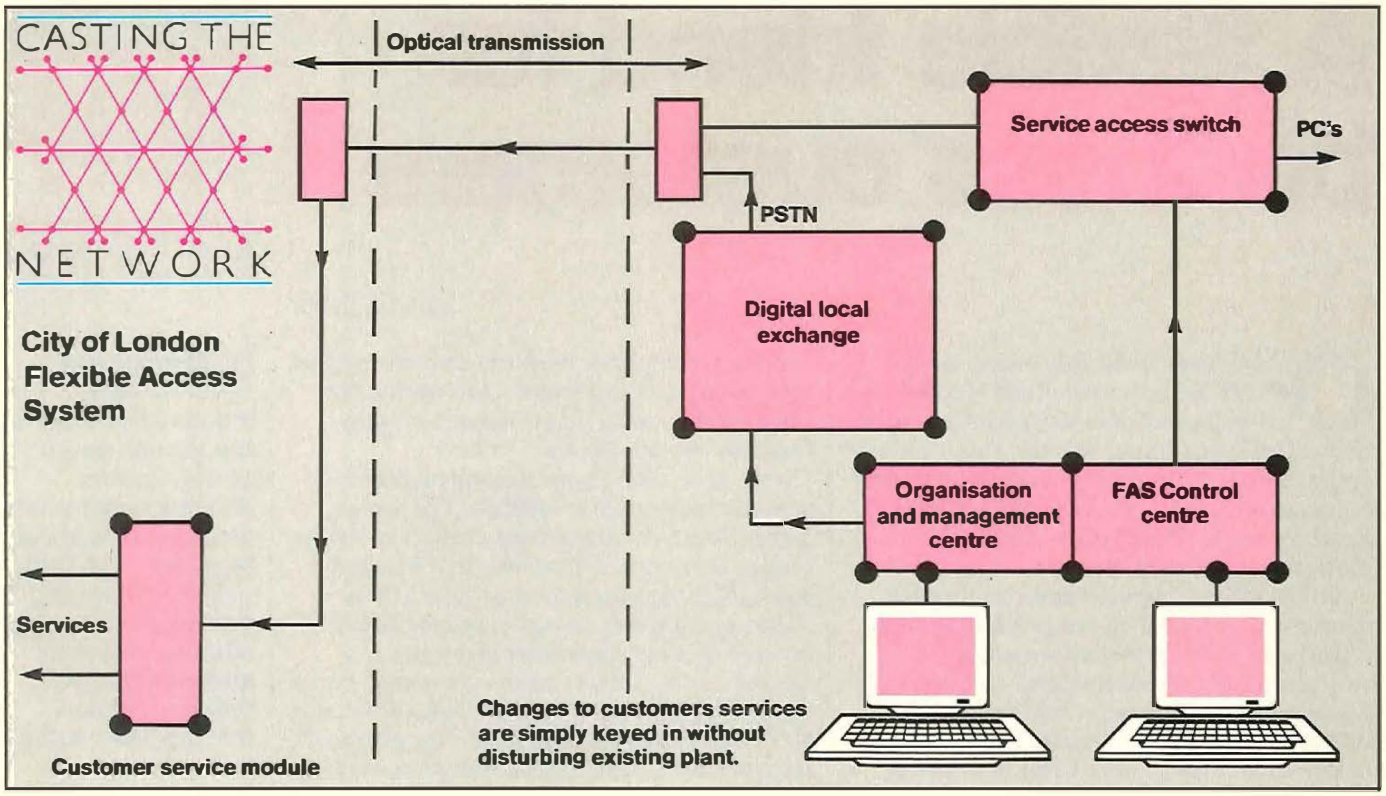
At the node, opto-electronics and higher-order multiplex equipment is installed. The Service Access Switch is a digital cross-connect switch for private circuits and is provided in those nodes with a large concentration of private circuits.

The way equipment is used, however, differs between switched and private services.

As the flexible access system is a common bearer for all services it has to interface with a wide range of customer premises equipment. The principal switched services are analogue telephony serving telephones and PABX's, with a variety of ▷



Serving the City – BT's first flexible screen system has been linking London's businesses since December last year.



signalling systems including MF4, and digital telephony (ISDN).

The simplest of these is a primary-rate ISDN access for an ISPBX (Integrated Services PBX). Here the service is presented to the customer at 2Mbit/s and the 2Mbit/s stream is routed to a 2Mbit/s port at a digital local exchange. A signalling system is already agreed between British Telecom and ISPBX suppliers, and is known as Digital Access Signalling System 2 (DASS2).

The next to consider is analogue exchange lines. Here the lines are grouped together onto one or more primary multiplex and each 2Mbit/s stream is again taken to a local exchange 2Mbit/s port. The signalling interface is also DASS2 although in this case it is a future development of the ISDN version. This interface is critical to the economics of flexible access systems.

Private services differ to switched services in that the customer to node link is only one part of an end-to-end service where the remainder of the circuit may not be on a similar system. The interconnection arrangements and particularly the service management arrangements are therefore far more complex.

Primary-rate digital MeagaStream is the simplest service in which the flexible access system acts merely as a transmission bearer. Other private circuits – speech band, 64 kbit/s and Nx64 kbit/s – are grouped together on a common primary multiplex and 2Mbit/s stream and routed to the Service Access Switch.

Here, they may be routed back to another customer on the same switch through another switch to another customer; broken back to analogue through a node located multiplex or, in the case of digital private circuits, sent into the managed private core network.

A feature of this sort of network is the need to minimise visits to customer premises and to have a high degree of configuration flexibility and status monitoring from a control centre.

The network configuration capability arises through cross-point control of the Service Access Switch and dynamic timeslot allocation to line-cards at the primary multiplex. Also circuit

Engineers install optical fibre in an underground cable chamber.

characteristics, such as send and receive gains, are under software control.

All the electronics are under continuous surveillance both for faults and error-rate degradation. Some diagnostic features are built in and the protection switching can be controlled through the software as well as automatically. Initial systems call for a separate access control centre but, in the long-term, the control may be integrated with other established control centres.

The system is not just a long-term aim but, for private circuits, a reality today. The first flexible access system was brought into service in December 1987 in the City of London. It is based on three nodes with one control centre and is dimensioned to serve several thousand customer sites.

The cable network is already largely in place and one node has over 15,000 single-mode fibres terminating within it. The same node has one 2,048-port Service Access Switch using System X technology operational, another in course of installation and several more planned. Two other nodes will have 2,048-port switches.

The network is currently being extended to Docklands. Both these networks will have switched services added in conjunction with DASS2 developments on the local exchange by early 1990. At that time, flexible access systems are expected to be installed in other parts of London and other major cities.

Telecommunications operators in most advanced countries are looking at ways of introducing optical-fibres into their local access networks. BT is internationally recognised as being in the forefront of progress in this field, as it has been throughout the implementation of optical-fibre transmission generally. ■

Mr I Dufour is Divisional Manager of Network Systems Engineering Transmission.

Splitting the cost

Passive fibres prepare for action

CASTING THE NETWORK

Keith Oakley

Whilst British Telecom is currently deploying fibre to major business customers under the Flexible Access System programme, research is also under way into economic methods of deploying fibre to smaller customers, perhaps including eventually single line residential households.

Right: more laser light sources added to the existing fibre network could broaden the market for services such as Cable T.V.

CASTING THE NETWORK

Below: in a passive optical network lead fibre from an exchange could be split into 128 individual customers.

The Flexible Access System (FAS) uses just four fibres to support many lines at each customer site. Even though fibre prices are dropping dramatically, installation and maintenance costs demand that a system designed for smaller customers must use less fibres.

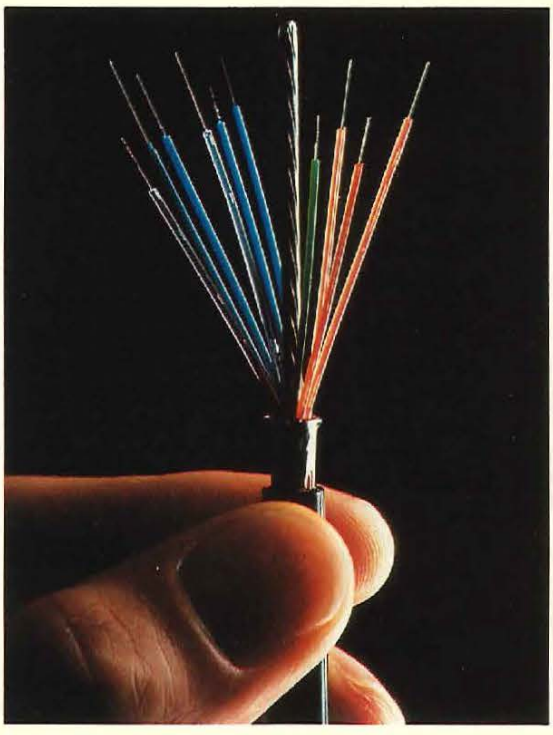
One method to achieve this is to run a 140 Mbit/s fibre system from the exchange to a multiplexor in a street cabinet with 2Mbit/s fibre systems onward to the customer. But this option is unattractive because of its high initial cost, the practical problems of siting and powering street multiplexors, and the difficulty of upgrading for new services.

Research work is now concentrated on using passive arrays of fibre splitters instead of active multiplexors in the street. An array of fibre splitters might allow for example, one fibre from the exchange to be split into eight fibres to individual customers.

Light sent from the exchange is therefore spread equally over each of the customers. Special circuitry extracts the digital signal destined for a particular customer and converts it into the particular service, for example an exchange line or private wire, required by the customer.

In the opposite direction, bursts of light sent by each customer are timed to arrive at the exchange one behind the other allowing for the different line length, and thus propagation time, for each customer. Studies are still continuing into whether the upstream and downstream transmission will use one or two fibres but a single fibre duplex system with a fibre splitter at each end to separate the go and return signals is a possibility.

The concept, dubbed TPON (Telephony over a Passive Optical Network), currently proposes a further 16-way split so that one fibre at the exchange could connect to 128 customer fibres.



The system could support 240 exchange lines distributed randomly between those 128 customers. A customer, therefore, could receive one 64 kbits channel for an ordinary PSTN line, another customer two channels for a 144 kbits ISDN service and another four channels for three exchange lines and an audio private wire. Providing a new service to a customer requires only the installation of a simple line card.

Three different subscriber terminals are envisaged:

- business TPON – providing four to 20 lines to a medium sized business customer;
- street TPON – a 15-30 line street mounted unit that would provide customer service through conventional copper dropwires or underground lead in;
- house TPON – a one to two line unit for a residential customer.

The key developments for TPON are low cost lasers, receivers and splitters. Because it will take some years to sufficiently reduce costs, the business and street versions which share these costly items over several lines are likely to be economic much earlier than the single line systems.

There are many operational advantages in a system like TPON. It has built-in fault detection mechanisms, remote maintenance and service provision features. The customer receives high-quality high-reliability digital transmission with fast provision of new services.

It solves one of the external planners' traditional worries – how many pairs do I put in? The fibre infrastructure represents a low initial investment. Most expenditure is incurred only as terminals are added when a customer is actually signed up.

But perhaps its most significant advantage is that it 'future proofs' BT's Access Network. Given the development of suitable technology in the 1990's, each fibre can support possibly hundreds of wavelengths – in effect different colours of light, although none of the wavelengths are visible light. Each wavelength could support 32 traditional TV channels or a smaller number of large screen high definition TV channels.

By adding additional laser light sources working at new wavelengths to an existing fibre network future new services such as Cable Television, Broadband ISDN and Video Telephony can be offered selectively to those customers who want them without disturbing existing telephony customers.

Therein lies the key challenge – to develop and deploy a fibre-based network that is an attractive alternative to copper for today's telephony services yet provides a springboard to the exciting new services of tomorrow.

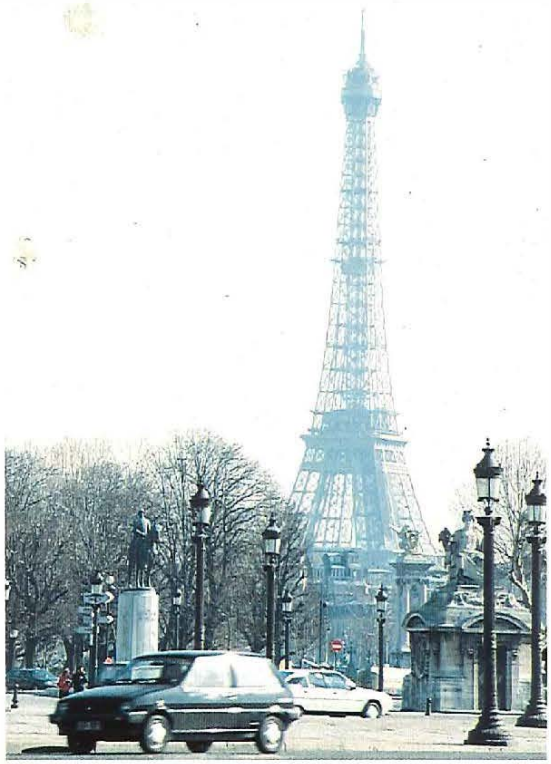
Research into the passive optical networks concept at British Telecom Research Laboratories, Martlesham Heath, is addressing the many technical and operational issues of such a radically new network.

To focus that research a demonstration system has been built at BTRL and discussions are now underway with industry that will hopefully lead to equipment being available in the early '90's. ■

Mr K Oakley is head of Access Network Technology.

Tailor-made telecommunications – Nokia Style

Telecommunications authorities, cellular network operators and dedicated network users worldwide are looking for more than a mere equipment supplier. They are looking for a company that can become a partner in development – a company that understands and can fulfill their real needs in telecommunications. In short, they are looking for the Nokia Style.



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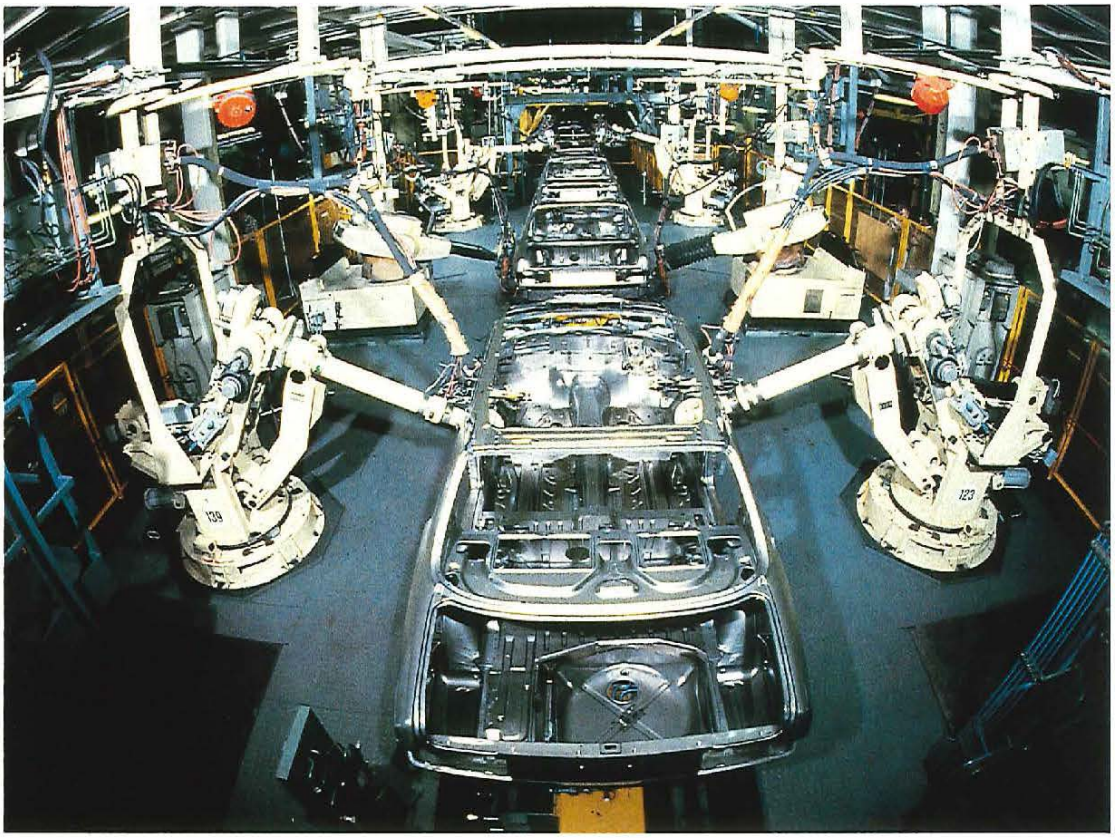
CASTING THE NETWORK

Norman Sigrist



The rapid passing of information between departments is vital to manufacturing companies, and increasing the speed and volume of this exchange is a key challenge facing the West's manufacturers over the next decade. British Telecom is taking the lead in computer integration, marrying incompatible systems and forming a common communications network.

The first large scale international demonstration of Computer Integrated Manufacture (CIM) is taking place this month, and BT has been selected to act as systems integrator for the UK cell. Nine such cells will demonstrate an integrated manufacturing application, and each of these cells will then be linked via a local area network to illustrate a complete CIM operation. The demonstration is at the Enterprise Networking Event '88 International in the USA.

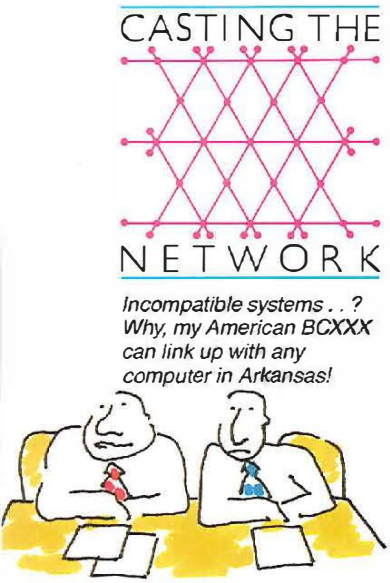
Computer Integrated Manufacture and how best to achieve it has become a central issue as failure to harness high technology in this crucial application could have considerable impact on the European and US economies in the future. As things stand in many large manufacturing operations, the key departments run their own, often incompatible computer systems. So distributing data between departments such as accounts, production, sales and marketing, purchasing, design and so on around the company is not as efficient as it might be. That is why a common communications network capable of integrating information from all these incompatible systems is necessary.

Open Systems Interconnection (OSI), as such a network is termed, has become one of the hottest talking points around the CIM general debate. And even while the dialogue continues round the world, two OSI specifications have emerged as early implementations for which open communication systems will be written: Manufacturing Automation Protocol (MAP) and Technical and Office Protocols (TOP). Already MAP and TOP compatible products are beginning to be marketed all over the world, and a number of user groups have been set up in the USA, Europe, Japan and Asia.

The emergence of these two standards, coupled with the fact that computer companies, software houses, large manufacturers and telecommunications operators are now seriously talking together about CIM, presents British Telecom with an excellent opportunity to become the first choice for OSI systems integration. As a company, BT is uniquely placed to offer systems integration consultancy to all Britain's major manufacturers. The potential is enormous.

Indeed, it is this potential that has drawn BT ▷

Above: industrial robots in the welding plant at the Daimler Benz computer integrated factory.



into playing a key role in this first large scale international demonstration of CIM. Major manufacturers such as General Motors, Boeing, British Aerospace and Kodak, have got together with the world's leading computer companies and telecommunications organisations to create the largest ever real life demonstration of CIM.

The systems integration for the UK cell, which is funded by the Department of Trade and Industry, is being carried out by specialists from BT's Systems Software Engineering Centre (SSEC) in Belfast. It has been built at the Melton Mowbray headquarters of the Production Engineering Research Association. BT's team from the SSEC are also systems integrators at the event, where they will be linking up with their opposite numbers in all the other eight cells to interconnect the total network.

Apart from the physical demonstration, ENE '88i is highly significant as a real landmark in the drive towards CIM, and a major international endorsement of MAP and TOP as the OSI standards.

There has been considerable resistance to MAP and TOP from proprietary protocol supporters, anxious that either their protocols should become the standard or else, as is more likely, that confusion should reign, so there would be no standard protocol and thus they could protect their market niches.

So why is BT in such a good position to exploit the systems integration business with the widescale implementation of CIM and OSI? Quite apart from being at the right place at the right time, British Telecom has the expertise and the technology to deliver OSI today.

British Telecom has committed itself to the international CCITT standards, and the technical requirements have been anticipated and developed against internationally agreed criteria. This means that X25 and X400 protocols, the key to integration in both local and wide area networks, have assured connectability across national borders without the problem of yet another closed communications system.

This means that BT can offer the ability to access networks as wide as the customer demands through compatible international gateways and delivery systems. The products, the protocols and the delivery systems are known and tested even if they have not yet been universally marketed.

As X400 has shown, many hardware manufacturers have held back from developing the necessary software with the result that in the UK British Telecom has been seen to be taking a lead with X400 as a message handling system.

Users are now starting to demand a role in the framing of standards which need no longer be the technically exclusive preserve of service providers and hardware and software manufacturers. The manufacturing industry has shown with the development of MAP and TOP how standards can be set to meet particular user needs and objectives. That process has to be fostered, particularly by BT who must not impose network limitations on the market but make sure that it knows what the customer is likely to need and then provide it. This may sound obvious but one only has to look at how data comms have been vendor-driven rather than market driven over the past decade to realise what a fundamental change this represents.

From the customer's standpoint, buying systems and products within OSI standards gives the reassurance that he is not buying an obscure one-off piece of technology, or a system which will be quickly superseded. OSI offers a framework for the future as well as a standard for today, and it is seen as independent of any single manufacturer or telecoms provider.

Below: computer integration is crucial as failure to harness high technology in manufacturing could have considerable impact on Western economies. Here, microprocessors are being inspected on their way through an oxidation kiln in a CIM factory.

Transmission

British Telecom currently offers a range of differing services for data transmission. Private circuits, or leased lines, are 'bit transparent' transmission links over which any systems can operate. They are well established in the UK for companies' own internal data comms over either a local or wide area, including connection to international networks. By definition they are inflexible, confined to a defined network or series of circuits between customer sites. But they do offer substantial bandwidth capability and the capacity to move larger volumes of data at high quality, at high speed, point to point. With digital transmission, private circuits offer speeds up to 2Mbit/s with a high degree of flexibility in line usage. Digital technology allows for speeds much higher than 2Mbit/s if customers need it.

Then there are the switched data services using X25 protocols to full CCITT standards. Currently these offer the flexibility of switching but with more limited bandwidth capability and

restrictions on the speed and quantity of data which can be delivered. They offer some interworking capability at the lower levels of OSI architecture.

Before examining the benefits of integration on a totally open basis, the choices should be considered. Private circuits offer secure point to point data communications in a range of transmission speeds depending on customer need. They are capable of being built into large networks to support businesses' investment in IT with the flexibility to use FAX, video conferencing and CAD/CAM transmission over the same circuit.

Private circuits using digital transmission can be supplied in speeds from 2.4kbit/s to 2Mbit/s with a high degree of flexibility in the higher speed circuits to combine voice with data. At 2Mbit/s a circuit can transmit the equivalent of 120 pages of A4 text per second, with the scope to increase volume still further as major businesses expand their experience in data transmission.

Higher speeds allow high volume transmission with no loss of quality or integrity, and with very high levels of reliability standards. Speeds up to 140 Mbit/s can be provided with current technology.

The public data network (PDN) offers a dedicated switched digital network designed for data which uses both X25 and X28 access protocols.

Access

The PDN allows any company to access the switched data network without the need to invest in a private or leased line. It's highly flexible and customers only have to purchase the access equipment needed to get into the network.

Customers can access any other computer using the network in the UK, and via its international protocols and gateways the PDN can connect to 80 other networks in other countries. PDN supports open standards, allowing transparent connection between different makes of hardware.

Like the telephone, the PDN is flexible, allowing for company growth or site relocation without major new investment. To get full use from X25 datalines the customer needs a synchronous terminal with X25 hardware/ software protocol support.

One of the most recently introduced advances in OSI is X400 messaging. Developed to CCITT X400 standards, the service transfers 'messages' in enveloped documents rather than in streams of data on a store and forward basis. Differences in protocols, hardware, software and document architecture are handled implicitly by the X400 software. Not only does X400 handle transmission from different computers, it can also interconnect with other messaging systems such as Fax, Telex and electronic mail.

Clearly the potential is there for British Telecom to be a major provider of data transmission, either for companies who want to manage and control their own data comms, or those who merely want to access data services much as they do the telephone service at the moment.

The scope, given both options, is enormous. OSI is not just for major multi-national manufacturers with huge logistical problems. It can also offer advantages to much smaller entrepreneurial companies who have adopted IT and CIM as central to managing their business and its planned growth.

Of course it's all very well to glibly say we have the technology, but how should BT market such a capability? Our initial approach will focus on joint development projects, possibly with the support of the Department of Trade and Industry. Our objective at this early stage would be to perfect our product portfolio and gain a number of reference sites. This would enable us to gain some specific applications experience and help us to later promote BT as a hardware independent CIM strategy consultancy developing solutions from a standards perspective.

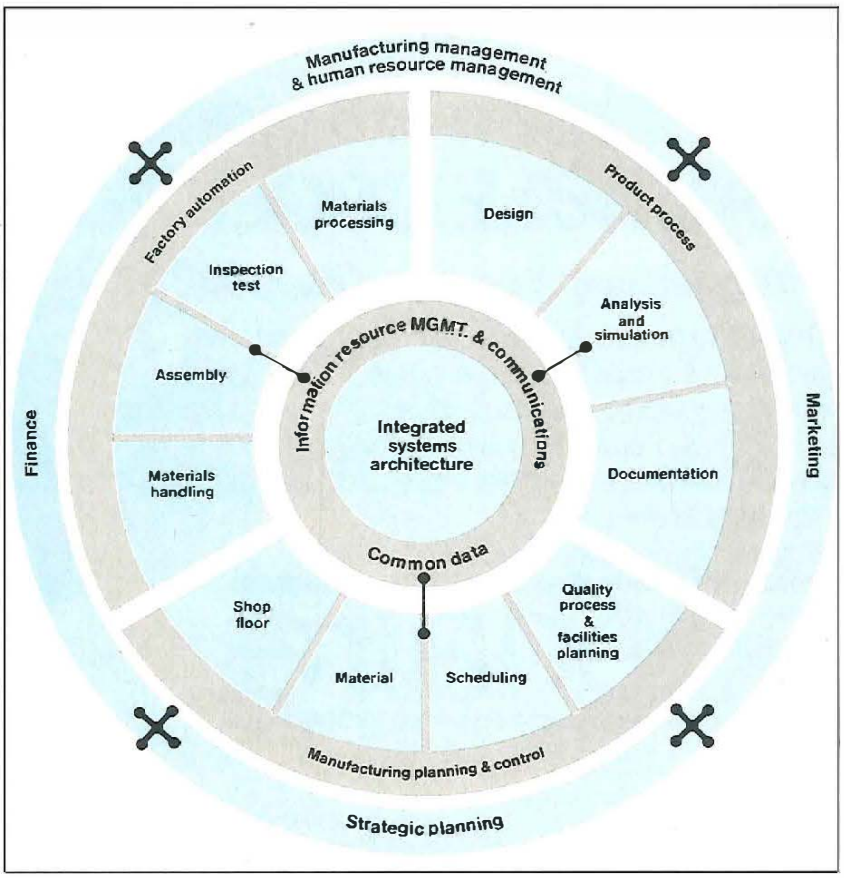
The CIM market has already developed beyond the pioneer stage. Once the major manufacturing organisations have invested in CIM, then so will the medium sized companies. This will have profound implications for BT Districts who will not only have to handle these accounts, but will also have to develop the required product knowledge, software skills, and "consultancy selling" approach.

The opportunities for BT are vast. So would be the cost of allowing a competitor to steal a march in this marketplace. But our ability to build a real CIM systems integration business will depend on a high degree of cross-company co-ordination and agreement.

CASTING THE NETWORK

Below: the integrated systems architecture shows how key departments need efficient interconnection.

Mr N Sigrist is Marketing Manager with BT's Industry Sector.



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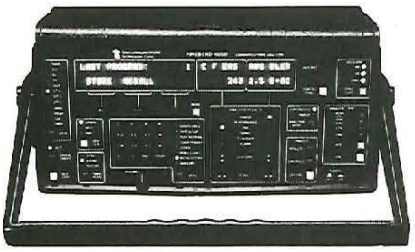
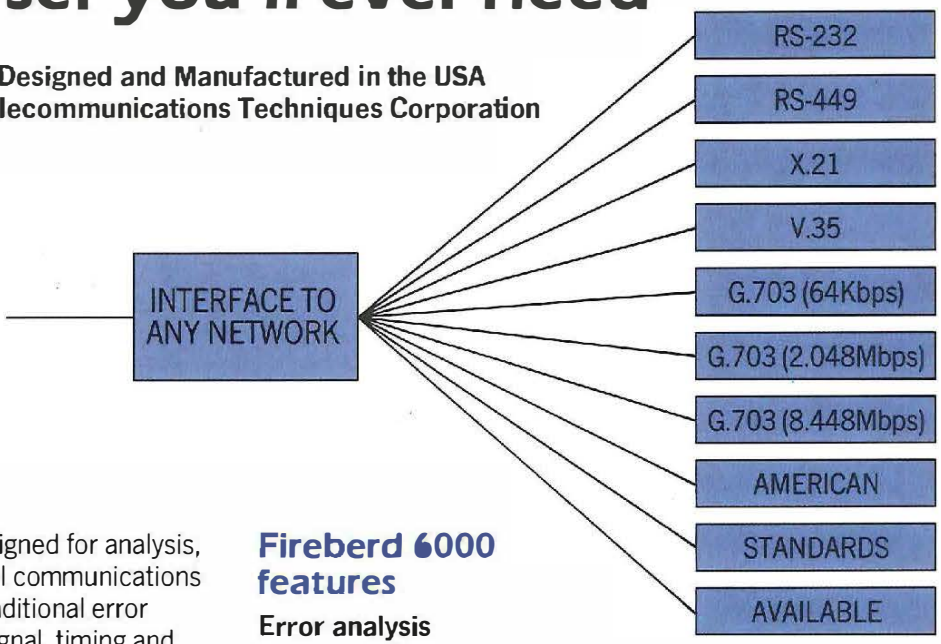


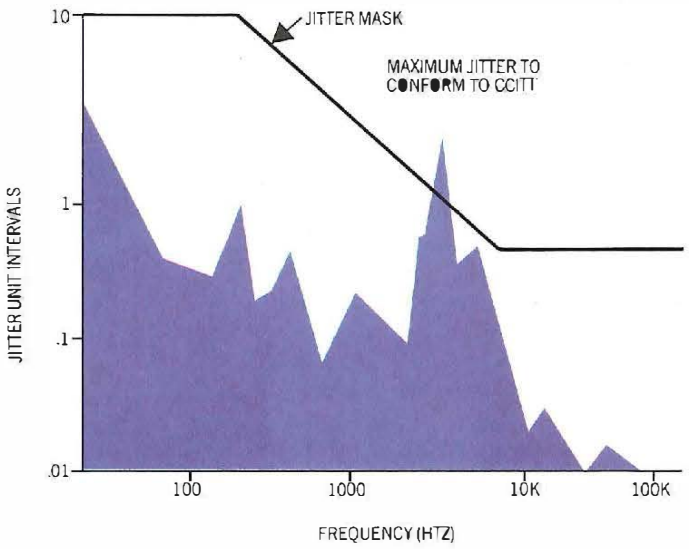
Fireberd 6000



The Fireberd 6000 from Techalog is designed for analysis, evaluation and troubleshooting on digital communications systems and equipment. It surpasses traditional error measurement instruments by offering signal, timing and performance analysis.

With the Fireberd 6000's range of versatile data interfaces you can link up to systems conforming to any data communications standard. There is a built-in RS-232 data interface, and modular interfaces available for V.35, RS-449, X.21, V.10/V.11, V.24/RS-232, MIL-188, G.703, (64Kbps, 2.048Mbps and 8.448Mbps), DSO, DS1, DS1C, DS2 and more.

Fireberd 6000 can perform over 50 diagnostic measurements. It is easily expandable, with a growing array of interface modules and accessories. And, quality and reliability are backed up by a one year warranty.



Fireberd 6000 features

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On-line error analysis

- ★ CRC4 checking.
- ★ Frame word error analysis.

Timing analysis

- ★ Frequency counters, inverted clock detection, clock slip measurement.

Jitter generation and measurement

- ★ Allows the G.703 64Kbit/s and 2048Kbit/s interfaces to generate and measure timing jitter impairments.
- ★ Also allows performance of spectral analysis in accordance with CCITT recommendations 0.171 and G.823.

Performance analysis

Performance analysis measurements include:

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★ % severely errored seconds (SES) ★ % sync seconds
★ % sync loss seconds ★ % error free seconds
★ % available seconds ★ sync loss seconds.

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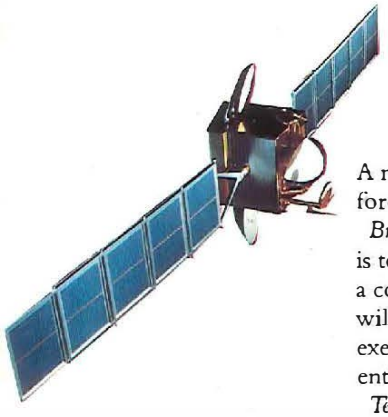


BEST OF BOTH WORLDS

A new magazine is about to take its place at the forefront of telecommunications publishing.

British Telecom World, a high-quality quarterly, is to be launched in September to plug a gap in a complex and often bewildering market. It will quickly become essential reading for executives, managers, engineers and enthusiasts throughout the industry.

Telecom World will replace the *British Telecom Journal* which ceases to exist after being published – in various guises – for three quarters of a century.

The *Journal* chronicled the development of an infant telecommunications industry and watched it grow through computers, microchips, space satellites and the use of microwave technology, lasers and optical fibre.

Many of these developments were pioneered by British Telecom or its predecessor the Post Office and it was appropriate for the industry's magazine to be introspective in its approach. But in today's customer-driven and fiercely competitive market such an approach is no longer valid.

The team, left to right: deputy editor Martin Burr, editor Justin Quillinan and business manager John Klee.

Practically everyone is a telecommunications user these days. It is possible to 'telecommute' to the office, take part in a board meeting in another part of the country, link up with computer databases and to buy clothes and household goods without leaving the armchair.

The new magazine *Telecom World* will address this rapidly growing and changing market both at home and overseas. In the same way that technology is shrinking global barriers, *Telecom World* will seek to reflect the international nature of the telecommunications business with a vastly increased overseas readership and regular contributions from experts and writers from all over the world.

At home, *Telecom World* will extend its coverage beyond the confines of British Telecom to present more of an industry-wide view with articles written from a customer's standpoint. News and features will look at products and people, ideas and inventions and will present them with flair, imagination and, where appropriate, humour.

Writing of the highest standard, top quality photographs and graphics and an in-depth knowledge of the industry which could only come from sources within British Telecom will add to *Telecom World*'s authority as a reliable and effective source of information and to its impact on the magazine scene.

Given that everyone has an interest in telecommunications from the youngsters who know more about computers than their parents to remote farmers who rely on videotex for up-to-date information, *Telecom World* will offer something for everyone.

The people behind the services, the young, the old and the disabled will all feature in the spotlight from time to time. Politics both at home and abroad has an important bearing on the industry and will not be ignored.

Of course, new products and exciting research projects will be covered in an easily digestible, but unpatronising style and there will always be scope for the nostalgia behind an enthusiasts' industry with a past which has touched everyone's lives.

There is no way of escaping the world of telecommunications but it takes expert knowledge to get the best out of it. Get the best of both – with *Telecom World*!

Your Telecom World team

A small but highly professional team is behind the launch of *Telecom World*.

With ready access to senior management figures within British Telecom and throughout the UK communications industry and backed by an editorial board of technical and business experts, their job will be to present and deliver the goods.

Editor Justin Quillinan, deputy editor Martin Burr and business manager John Klee are more used to putting others in the spotlight than in sharing it.

Justin has been a professional journalist for 17 years with experience ranging from evening paper and radio journalism to public relations and magazine production in both public and private sectors. "We have the team, the backing and the material to make *Telecom World* the best. The potential for growth both within the UK and overseas is enormous," he said.

Martin, ex-newspaper journalist and former features editor and chief sub-editor of *Mayfair* magazine, commented: "Being in at the start of a brand new magazine is an exciting experience for any journalist – particularly when the magazine offers the range and scope of *Telecom World*."

John, an administrator with ten years' experience in British Telecom and the Post Office, stressed that *Telecom World*'s predecessor, the *BT Journal*, had always been held in high regard within the company. "*Telecom World* is taking the best of the *Journal* and adding to it to make the magazine essential reading for suppliers, customers, staff and anyone involved in the communications business," he said.

The need for change

As British Telecom has grown and evolved, its flagship publication has had to keep pace with that rapid development.

Telecom World has not just sprung into independent being. The pedigree of its predecessor the *British Telecom Journal* remains important to readers and advertisers. But the new magazine goes far beyond a mere cosmetic facelift.

The need for change can be seen in a line of illustrious publications going back to the early days of this century. The *National Telephone Journal* gave way in 1914 to the *Telegraph and Telephone Journal* which 40 years ago became the *Post Office Telecommunications Journal* and finally evolved into the *BT Journal* in 1980.

In the first issue of the *Post Office Telecommunications Journal*, the editor told readers, "In some respects the features of the old *Journal* will be apparent. There will be, as it were, family likenesses, but naturally the newcomer will have its traits attributable to the admixture of new strains. Its manners will be in the modern mode. The new *Journal* will have the forward look, and have a character and individuality of its own – especially character." These words, although penned 40 years ago, still ring true today as the *BT Journal* passes the torch on to *Telecom World*.

In the early days of the *Journal*, an article proudly announced how television had been extended as far as Birmingham, relayed from London by means of a chain of low-power highly-directional radio stations. That was in 1949, yet less than 40 years later the *Journal* was able to report on how the whole world watched the wedding of Prince Andrew and Sarah Ferguson live on television thanks to satellite and microwave technology.

A recent issue of the *Journal* announced how three-dimensional synthetic images of a moving human head can now be generated by computer, making video-telephony over the existing network a marketable possibility in the next decade. Pure conjecture? Possibly, but so was the idea of television in Birmingham not so long ago.

However telecommunications develop and expand in the future, *Telecom World* will be reporting from the frontlines where the boundaries between science and science fiction are blurred, carrying on old traditions but in a new and exciting way.

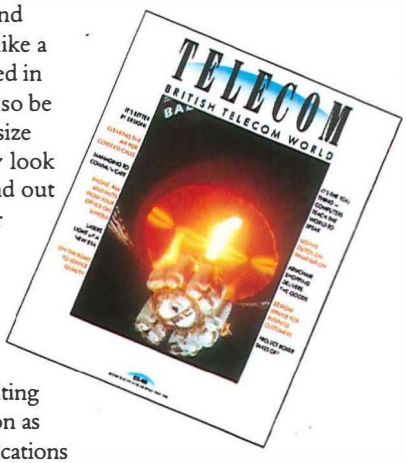
Her Majesty the Queen had her finger on the pulse of history in 1958 when she opened the country's first STD exchange at Bristol and dialled the first call. The Journal *covered the new technology and* Telecom World *will continue to be in at the forefront of important developments.*

AN IMPRESSIVE **PEDIGREE**

Designed to succeed

Telecom World has been designed by Trickett and Webb, one of the country's leading design-consultancies and winners of various prestigious design-awards. The company redesigned *Graphics World* – a magazine for the professional design industry – and being chosen to design for their peers was a recommendation in itself.

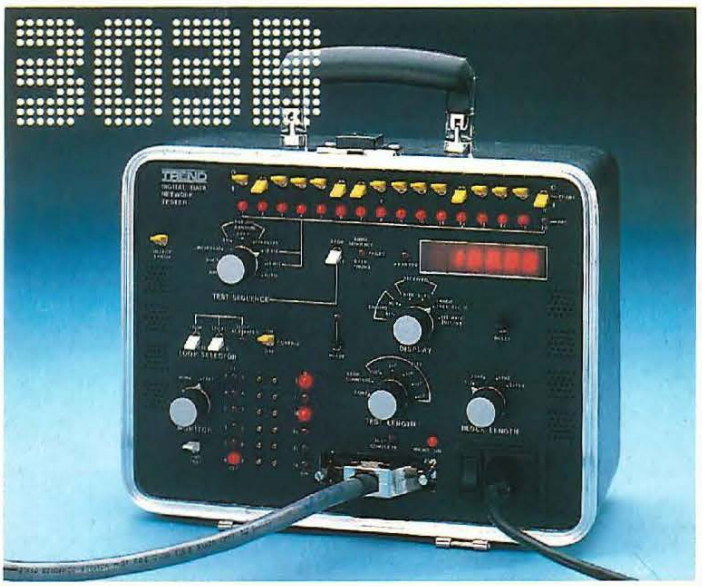
After extensive consultation it was decided that *Telecom World* should be perfect bound which means having a spine somewhat like a paperback novel rather than being stapled in the centre like most magazines. It will also be what is known as a bastard or irregular size slightly larger than *BT Journal*. This new look will, we believe, make *Telecom World* stand out amongst other publications on a desk or display stand.



"The brief to ourselves: A good read, exciting but not fashionable — to reflect its position as the leading magazine of the Telecommunications Industry, we hope you like the result."
BRIAN WEBB, TRICKETT & WEBB.

TESTERS

To keep communications open – trust in Trend



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CASTING THE NETWORK

Optical fibre – a clear winner

Peter Lines

In the early days of high capacity digital transmission, signals were carried over long distances by coaxial cables. Now they account for only a quarter of the trunk network, and with telecommunications advancing at a rapid pace, the 1980's has proved itself to be the decade of the optical fibre transmission system.

Right: optical fibre is not only smaller in diameter and more lightweight than coaxial cable, it also costs a great deal less.

Opposite bottom: optical fibre was used for the first time in an outside broadcast for coverage of the wedding of Prince Andrew and Sarah Ferguson.

Optical systems have dominated the trunk network modernisation programme, amounting to 44 per cent of its total. They are now being provided in large numbers in the junction network as well as parts of the access network where business customer demand is high. But a small number of 140Mbit/s systems are still being added to some routes where spare coaxial tubes exist, and on the London-Birmingham-Manchester route 565Mbit/s systems have been provided on the old 60MHz analogue cable which was installed in the early 1970's.

The special advantages of optical fibre are small diameter lightweight cables, low cost compared to coaxial cable, and low fibre loss allowing the regenerator spacings to be measured in tens of kilometres. This leads to increasing system reliability because the number of intermediate regenerators is reduced.

Early fibres were of the multimode type with an optical core diameter of 50 micrometres, but once the manufacturing and jointing problems had been solved it was the introduction in 1984 of singlemode fibre with its much smaller 10 micrometre core which really allowed mass provisioning of systems.

The workhorse of trunk modernisation was the 140Mbit/s singlemode optical system. More than 1,000 of these systems have been provided with regenerator spacings of up to 40 kilometres, and all equipment has been installed in surface buildings where maintenance access is much easier. More recently the 565Mbit/s optical fibre systems have been introduced on the same singlemode fibres. The circuit capacity of 7,680 channels is four times that of the 140Mbit/s systems.

Where do we go from here? Development work is already taking place in industry, backed up by studies at BT's Martlesham Research Laboratories, for a system operating at 2.4Gbit/s - that is 2,400Mbit/s. This system should arrive in the early 1990's and its capacity will be 16 times greater than that of today's 140Mbit/s system. The technology will also soon be available to increase the regenerator spacings to about 100 kilometres. Such distances are already being achieved on single span optical fibre submarine cable systems.

In the junction network where low-cost copper pair systems have dominated, optical systems have taken a little longer to build up to today's high level of provision. Here eight and 34Mbit/s systems, combined with multiplex equipment, have produced a cost-competitive range of systems which are now being installed in large numbers. More recently there has been a large demand for 140Mbit/s systems to cope with the enormous programme of junction modernisation work over the next three years or so.

Microwave

The BT microwave radio network was established during the 1950's and now comprises more than 200 towers and structures linked together in a mesh network covering the entire country, and accounting for 31 per cent of the trunk network. Microwave radio also provides a number of international routes with cross-water links to France, Eire, Northern Ireland and several Scottish Islands. Until 1981, the main systems in use were 1800 channel FM/FDM analogue systems operating in the four and lower six GHz bands, and 960 channel systems in the two and six GHz bands. The upper six GHz band also provides the network for the distribution of TV programmes from the BBC and ITV studios to the transmitters dotted around the countryside.

BT's first digital radio system operated in the previously unutilised 11GHz band and was the first 140Mbit/s digital radio equipment to be brought into operational service in the world. The 11GHz network was used to provide a rapid nationwide coverage during the early phase of trunk network modernisation. Since then a variety of different system types have been brought into operation in the bands below 11GHz, generally to replace the ageing analogue telephony systems but in some cases to rapidly provide new capacity in advance of the provision of cable based systems.

The latest digital radio systems have come far since the early technology of 11GHz. Now L6GHz systems are being brought into service using 64 Quadrature Amplitude Modulation (QAM) which enables the spectrum to be used far more efficiently, whilst at the same time having powerful transversal equalisers (TVE's), and Forward Error Correction (FEC) as standard features to combat the effects of multipath fading. Results from the 64QAM systems pilot trials in North Wales have been very encouraging with performance well within the Network targets.

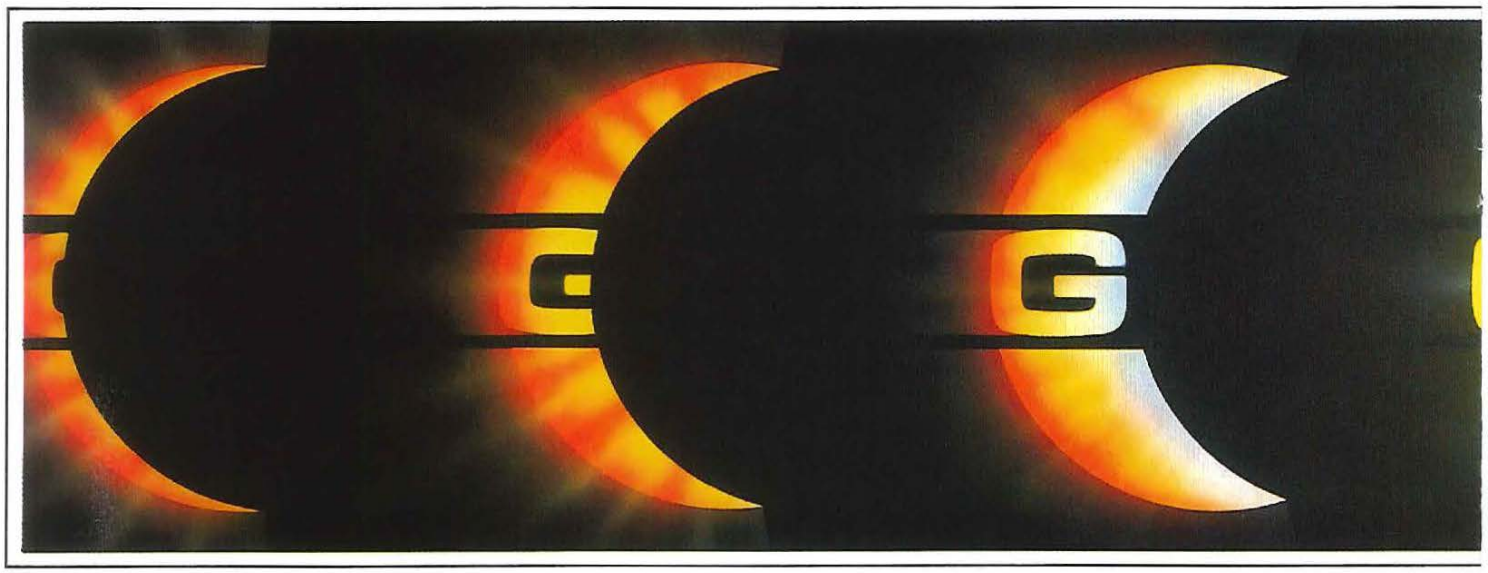
For the future, radio has two avenues to explore.

Above: a microwave radio station in Newcastle.

Firstly, in the trunk network, the development of even more spectrally efficient systems such as 256QAM systems is already in hand by several manufacturers. These systems should eventually permit capacities to be increased to 565Mbit/s. Secondly, in the access network, the use of radio is beginning to expand quite rapidly with the growth of cost-effective and easily installed 18GHz 2/8Mbit/s rooftop-mounted equipment for Megastream service. Within the Access network modernisation programme there is the potential for radio to serve rural communities. Point to multipoint radio is more cost-effective than using cable based solutions where long overhead feeds to isolated homesteads are involved. Feasibility studies and trials of two Ghz point to multipoint systems are being conducted in two districts this year to evaluate such an application. ■

Mr P Lines is Manager of the Transmission Systems Division's Core Network.

REVEALING A MAJOR NEW



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CASTING THE NETWORK

Getting to the route of the problem

Planning British Telecom's digital trunk network is a complex business as it consists of hundreds of exchanges nationwide, linked by tens of thousands of cable and radio system sections. And it is constantly being upgraded to cope with increased demands. Now a new mainframe-based system has been designed to cope with large-scale network planning problems.

Yes, I know Dijkstra did it back in '59, but he didn't have a network to support.

Interactive Optimised Transmission Network Planning (IOTP) has been devised by the Network Systems Division and its first operational release has been tailored to the needs of the national Trunk Network planners.

The heart of any planning system has to be a demand routeing algorithm. If you were given a starting network of nodes or exchanges, existing capacity linking them, and a set of demands for future capacity between pairs of nodes, how would you find the optimal route for each demand through the network? (''Optimal'' might mean, for example, most efficient use of existing capacity and cheapest requirement for building new capacity.)

For one or two demands, it's possible to solve a problem like this by inspection. But for larger numbers (tens of thousands in the case of the Trunk Network) you would clearly need a foolproof algorithm to determine the routes automatically.

Of course, any textbook will tell you that such algorithms for simple networks have been around for many years. The classic example dates back to 1959, and a computer scientist called E W Dijkstra.

Dijkstra's algorithm determines a route step-by-step. Starting at one of the terminal nodes of the demand, Dijkstra works outward through the network keeping track of the cheapest path to each node it encounters. It stops when it gets to the target node.

Dijkstra is thoroughly reliable and straightforward to implement – and there are many variants dealing with more specialised cases, like restrictions on the numbers of steps allowed to get to a node, or restrictions on the capacity you can build on a link between nodes.

So if network routeing problems are really so easy, why are the IOTP team so proud of their system? The answer is that networks in the real world have a lot more to them than the idealised examples you'll find in a textbook.

Taking the Trunk Network as an example, for a start the planners have to find not just one but two (or more) routeing paths for every demand. And the paths also have to be diverse, sharing no piece of transmission equipment. This is to ensure reliability, so that not all the transmission capacity between any two nodes is dependent on one piece of cable or radio link.

Another difficulty for the planners is the multiplexing structure of the Trunk Network.

A single digital telephone speech circuit works

Right: the trunk network is constantly evolving – here an extension to the System X Digital Main Switch Unit (DMSU) is being installed at the Baynard House digital trunk exchange in London.

at 64 kilobits per second. It's obviously not practical to provide separate physical routeings for every individual circuit in the country, so devices called multiplexors are used to combine up to 30 circuits into a single channel, working at two megabits per second.

Rather like minor roads feeding a motorway, four of these two megabit per second channels can in turn be multiplexed up to a single channel at eight megabits per second, which can be further multiplexed up to 34 megabits per second, and finally up to great data highways working at 140 megabits per second. Each 140 megabit facility can carry nearly two thousand speech circuits. Channels with even greater capacity are currently being installed at 565 Mbit/s and are planned for the future at two gigabits per second.

Routeing

Solving a demand routeing problem takes on some of the features of planning a long car journey. You have to plan your way via minor roads to the nearest motorway junction (a multiplexor), leave the motorway (de-multiplex) somewhere close to your goal, and find your way through more minor roads to your destination.

Another major requirement of the planners is that they come up with a sensible evolution of the Trunk Network over a period of years. It's not sufficient to treat a network plan as a one-off; not if this year's plan requires you to dig out all the cable you installed last year.

There are many more detailed constraints to consider. For example, there are numerous types of demand – such as public capacity, generally available for all, and private capacity, for particular customers like large companies. Different demand types might well have their own dedicated transmission facilities, and perhaps work under differing routeing rules.

In addition, the planners also have to remember that particular nodes have their own special requirements. For instance demands for domestic capacity must not be routed through international exchanges – and preferably not through the busier exchanges like those in London, Birmingham and Reading.

So there's nothing simple about planning a real network – and features like multiplexing are not found in the textbooks.

IOTP is a breakthrough because it has been designed to work on real-life network problems. It's based on a network data model complex enough to incorporate features like multiplexing and geographical constraints, and its routeing algorithms are sophisticated enough to take account of features like route diversity and different types of demand.

While it's not feasible to incorporate every detail of any given network – so the expertise of the Trunk Network planners, for example, is still required for a long time yet – IOTP does much more than solve idealised textbook-class problems, and should become a valuable decision support tool for planners.

A prototype version of IOTP has already proved the worth of the whole approach, with the business savings predicted by just one study being enough to cover around a quarter of IOTP's development costs.

The Trunk Network planning release of IOTP has been written in FORTRAN running under MVS/TSO, and will be installed on an IBM-compatible mainframe at the computer centre at Oswestry. It will access an IDMS database of planning information, and is capable of handling full-scale Trunk Network planning problems.

IOTP has been designed with the future in mind, and is intended to be flexible enough to cope with new network structures, technologies and planning strategies. Now the ASU are considering future versions to assist with wider applications of optimal network planning.

So, IOTP is a system for the real world, with a great deal of sophistication and promise. But it's perhaps reassuring to know that at its heart – struggling away under the constraints of multiplexing, time evolution and all the rest – is a version of the tried and tested Dijkstra's algorithm, which by the end of a typical planning run will possibly have been called millions of times. ■

Striking a blow for cheaper fibre

Mike Howard

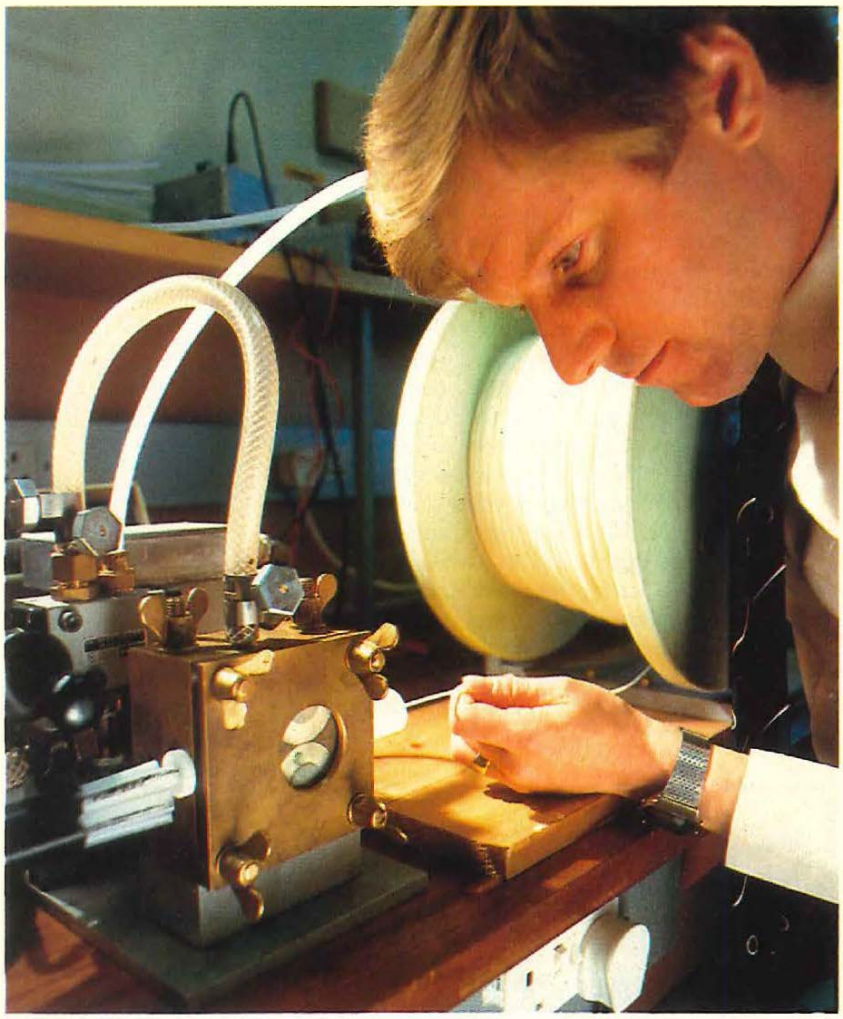
A revolutionary breakthrough in optical fibre installation is being made available to districts in their drive to modernise the local, or Access, network. The technique, known as Blown Fibre, involves positioning a lightweight bundle of optical fibres into a pre-installed six millimetre bore tube by blowing with compressed air.

The technique sounds delightfully simple, but the reality is a little more complicated and much fundamental research was necessary to make it a viable field technique.

The conventional optical fibre cable structure is designed to protect fibres from tensile and radial stresses, maintain adequate optical performance after installation and give them environmental protection over their design lifetime.

There are several factors affecting optical performance once the cable has been laid, particularly hydrogen absorption loss and stress corrosion.

The presence of hydrogen causes excessive optical loss in optical fibre, an effect known for many years. The hydrogen can be generated from electrolytic action of the metallic parts of the cable (for example, the metallic central strength number) in the presence of moisture.



Above: extensive research has gone into the revolutionary blown fibre concept.

Moisture also plays a part in accelerating the failure of an optical fibre that has been stressed upon installation. So cable designs must protect the fibre from stress.

These are by no means all the factors that cable designers and manufacturers have to take into account. But they give an indication of the complexity of cable design, and therefore cost.

It was while studying cable structures in an attempt to come up with more cost-effective designs that engineers at British Telecom's Research Laboratories at Martlesham hit upon the revolutionary idea now known as blown fibre.

The essential components of the system are: the lightweight fibre bundle; the pre-installed tubing and the means of blowing – called the blowing head.

- The fibre bundle consists of individually coloured and buffered fibres held in a symmetrical formation, together with a ripcord to aid stripping, by a coating of foamed polyethylene. The bundle has an overall diameter of two mm and weighs two gm/metre.

  Original fibre bundle designs utilised multimode fibre and contained seven individual fibres without a ripcord. But for access network use we have standardised on single-mode bundles of four fibres. Further development work is continuing on other bundle sizes.
- The blown-fibre tubing is a small diameter tube, currently six mm bore, extruded from low-density polyethylene. The polyethylene is specially doped with additives to provide a low-friction static-free bore. Bundles of these tubes are given an oversheath of polyethylene for outdoor environments, or PVC when fire resistance is required – as in a building. The sheath incorporates an aluminium foil, not as a moisture barrier, but to aid stripping it without damaging the individual tubes. The foil also acts as a heat sink when shrinkdown closures are used. Currently available bundle sizes are two, four and seven.
- Operation of the blowing head is as follows: fibre bundle is initially inserted into a hypodermic tube and is then taken up by rubber drive wheels. The wheels are driven under constant torque just high enough to overcome the effects of the pressure drop along the air-sealing hypodermic tube and to feed the fibre unit off the drum.

Airflow

As the fibre enters the blown fibre tube it comes under the influence of the air-flow from a compressed air source. The unit is carried along by aerodynamic drag and hydrostatic forces distributed along the whole of its length as it travels through the tubing, at an average rate of 30 metres per minute.

The simplicity of application and flexibility of blown fibre is clearly recognised worldwide if the volume of enquiries received is any indication.

Blown fibre tubing is installed using conventional cabling techniques, although the tubing is far lighter and easier to handle. Tubing is interconnected using leak-free pressure connectors. It would be possible to construct an entire network of empty tubes with the minimum capital cost and then install the fibres on demand.

In use, blown fibre has proved to be remarkably flexible and can be blown through numerous rightangle bends and even up vertical risers. Although it is possible under certain conditions to blow longer distances, a planning limit of 600 metres has been set to cater for most field environments. This limit restricts use of blown fibre to the distribution network.

But engineers at Martlesham are meeting the challenge of extending blowing distances. Two methods have been proposed – tandem blowing and end loop feeding (ELF).

Tandem blowing, as the name suggests, is a technique of operating two blowing heads in series up to 600 metres apart. Single head blowing requires operator control of the blowing rate. With tandem blowing, the coordination of two operators 600 metres apart was impractical. The solution is a clever little device called a "buckle detector" installed either side of each blowing head. Its function is to control the installation speed independently at each blowing head by monitoring fibre unit position. This technique can be extended to considerably more than two blowing heads in series.

Blown fibres! . . told you it would never work.

End loop feeding is a method by which excess fibre is rewound at the end of a 600 metre blow then blown for a further 600 metres. Further rewinding and blowing stages are possible, governed only by the initial length of fibre available. The ELF machine is designed to rewind fibre into a container in such a manner as to allow its subsequent removal without leaving twisted or tangled loops.

Both techniques have been tried succesfully in the field achieving blow lengths of up to three km.

Interest in blown fibre has been so great that development has gone hand in hand with District demand for operational experience. To date it has been necessary to restrict the availability of blown fibre whilst some of the technical and production problems were solved. In addition, the support that could be offered was targeted on Districts involved in early implementation of flexible access systems (FAS). Later on this year blown fibre will be made available to all Districts, but this will not include the range-extending devices whose development is yet to be completed. They should follow shortly afterwards.

Developments are continuing in the areas of tubing sizes to relieve duct congestion problems. Investigation into materials and blowing techniques, to extend blowing distances and simplify installation, are also continuing.

The installation of optical fibre in the local network by more conventional cabling means would require a number of different fibre count cables, both internal and external, all requiring splicing activity. Our current most reliable method is fusion splicing, a time-consuming and costly operation. More cost-effective solutions like mechanical and elastomeric splicers can significantly degrade optical performance and prejudice future upgrading.

Blown fibre offers an exciting opportunity to solve many current problems. It is an alternative to more costly cable designs, it is easily installed, installation does not degrade optical performance, and it offers the opportunity for spliceless links direct from exchange equipment to customer premises. ■

CASTING THE NETWORK

Mr M Howard is head of Access Network Operations.

CASTING THE NETWORK

Super services derived from digital revolution

Rick Manterfield

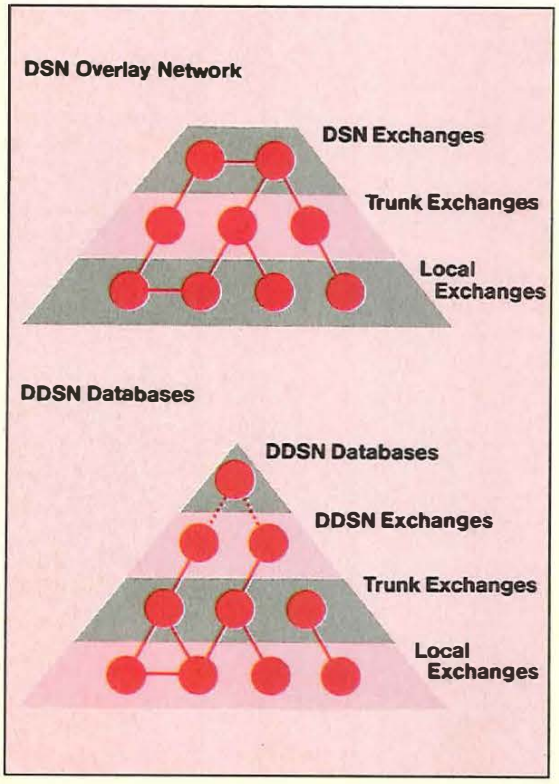
A revolution in the provision of network services is taking place this year. Called the Digital Derived Services Network (DDSN), it will speed up improvements to the services offered and at the same time cut costs.

The traditional public switched telephone network (PSTN) consists of a large number of exchanges throughout the country, including local and trunk exchanges. Its structure is commendable for the provision of basic services but changes to existing services, or the provision of new ones, involves the modification of a large number of exchanges and this results in expensive implementation and lengthy timescales.

The idea of the Derived Services Network is to provide a limited number of exchanges that overlay the traditional PSTN so the introduction of new services, and the enhancement of existing services, can be achieved by modifying only a small number of exchanges.

Each call entering the DSN is logged and details of the called customer, the call duration and the area of the calling customer are all recorded. This information allows detailed bills to be derived and special billing arrangements to be adopted such as the sharing of revenue between BT and the called customer. The DSN also provides additional routing capabilities, so the overhead of analysing complex calls in the PSTN can be avoided.

The DSN already exists in an analogue form ▷



CASTING THE NETWORK

Below: DSN will handle the LinkLine 0800 service in which the called customer pays the bill so that the call is free to the person ringing.

using Strowger exchanges and eight DSN exchanges are distributed around the country. These will, however, be replaced by the digital version which will offer better performance in terms of transmission and post dialling delay and extra features.

The digital version makes use of the 5ESS PRX exchange, manufactured by APT – a consortium of AT&T from the United States and Philips. Eight digital exchanges are located at the same sites as the analogue exchanges, and a ninth digital exchange is to be located in London.

DSN is designed to handle services requiring specialised routing and charging and the existing set up covers:

- LinkLine 0800 in which the called customer pays the bill so that the call is free to the calling person ringing
- LinkLine 0345 where the calling customer pays a local fee rate, irrespective of location, and the called customer pays the balance between the local rate and the normal charge.
- Callstream 0898 in which the calling customer is charged at a premium rate to gain access to a recorded announcement or other information and revenue is then split between BT and the called customer.

Digital DSN is being provided in a number of phases as part of an evolutionary package and began with three early units in London, Guildford and Cambridge which were accepted by BT in November 1986 and have been used to gain early experience of the 5ESS switch.

The first phase of the proper package consists of five additional units in Glasgow, Manchester, Leeds, Birmingham and Bristol and the upgrading of the early units. It is expected to enter service shortly after an extensive period of testing and quality demonstration.

When ready for service, a programme is planned for the transfer of customers and traffic from the analogue version and the benefits of DDSN will soon be apparent.

Databases

The pace will hot up in phase two when, for the first time in BT, network databases are to be introduced at the top of the network hierarchy. The idea of the network database is that it has an overall view of the network, so features can be introduced that are based on conditions in the network as a whole. It will be possible for example, to route calls on a percentage basis for customers with a number of answering points dotted around the country.

Furthermore, the percentage distribution can be changed at the touch of a few buttons and customers will be able to invoke changes on demand.

To help run and manage such a complex network, it will be necessary to provide additional maintenance facilities and user-friendly interfaces to the customer. There will also be a unit to provide specialised call announcements and to receive additional digits from multifrequency telephones so that particular departments of a company can be automatically selected.

The DDSN represents a major step in the evolution of the BT network. Timescales are tight and the whole project team in head office and in the field, from long range planners to in-service support, is striving to provide unbelievable capabilities by the end of this year. ■

Mr R Manterfield is DDSN Project Manager.

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Flourishing plant supports a growing network

CASTING THE NETWORK

Ray Seacombe

Telephone poles and streetside cabinets immediately spring to mind when the subject of external plant is mentioned. But although they form the most visible part of the External Plant Division's work, there are many more less public aspects to the team.

Everything from the largest vehicle-mounted mechanical aid to the smallest splicing connector for just two copper wires, via manholes, jointing chambers, cabling aids, tools, test equipment and the cables themselves performs a vital role in the construction of the external network.

From the beginning of commercial telecommunication the use of timber poles as a means of support for wires and cables has remained substantially the same.

Over the years Scots Pine (Pinus Sylvestris), also known as European Redwood, has been the predominant species used, although from time to time exotic sounding woods such as Jack Pine, Iron Bark, Ponderosa Pine, Lodge Pole Pine and Wallaba have been tried.

All dead wood will decay in time if exposed to the right conditions. Preservatives are used to slow down the rate of decay, but though many chemical formulations have been tried in the past, creosote impregnated into the timber under pressure has been used from the turn of the century, and is still considered the most effective for the species used by BT.

Not everything remains unchanged from when the telephone was first used. Man-made poles have been tried from time to time.

Galvanised steel sheet and mild steel tubes have been used in the past, concrete columns and laminated wood have been considered, and glass reinforced plastic or stainless steel hollow poles are available today. But on grounds of cost, wooden poles remain the preferred choice. Even so, hollow poles which do not need to be climbed and on which developments continue are still the best solution where climbing hazards such as spiked railings exist close alongside the installation.

The interface between the pressurised main cables and the grease-filled distribution cables is usually the Cabinet Cross-Connection. Traditionally of cast iron, reinforced plastics and sheet steel constructions are now used to provide improved environmental control within the cabinet.

The cabinet provides a flexible system of interconnection between the exchange and distribution cables. This is achieved by "terminating" the cable pairs through numbered holes in column-mounted fanning strips, and jointing together using underground cable connectors. This system, however, demands high standards of workmanship and can become very untidy and unmanageable if exposed to frequent re-working of interconnections.

Recently, as an alternative, modular systems have been designed and introduced. Employing the latest terminating technology, interconnections are achieved between the permanent cable terminations by means of jumper wires run along designated paths between the exchange and distribution columns. This methodical approach provides a readily managed tidy cabinet with lower fault potential from necessary re-working of interconnections.

This feature, together with the ability to provide up to 2000 terminations in a standard cabinet shell, makes the modular system a particularly attractive proposition at busy City Centre sitings.

Although many items of highly sophisticated and expensive equipment for the testing and maintenance of the new digital optical fibre routes are coming into use, it is still necessary to keep up-to-date with equipment for the copper circuits. An example of such an item is the linesman's telephone which, with the modernisation of the local network and the introduction of new telephones meeting British Standard 6317, needed to be updated.

This new phone, known as the Telephone 286A, provides loop-disconnect and multi-frequency signalling for direct interfacing to all types of telephone exchange. It will also interface with ▷

Below: the use of timber poles to support wires and cables has remained virtually the same from the beginning of commercial telecommunications.

CASTING THE NETWORK

Opposite top: a rodding and light cabling vehicle. Units like this are specially developed by BT's Underground Cabling Systems Group.

Mr R Seacombe is Manager of the External Plant Division, URC Network Engineering headquarters.

the differing types of telephones at customers' premises.

The new product is smaller, lighter and able to stand more arduous field conditions than its predecessor (Telephone 704), but because it is supplied against a 'black box' specification will be available in the field in several physically different variants.

Most underground cabling in duct is now carried out by one of the high productivity specialist cabling units such as the Rodding & Light Cabling Unit, the rather heavier Medium Cabling Unit or the Light Cabling & Jointing Unit – a vehicle designed and equipped for multi-skill working. The latter unit enables a two-man crew to pull in and joint cables at the smaller end of the range, usually up to 100 pair. Like all the specialist units, it is designed to make the task of cabling safe, efficient and, as far as is practicable, effort free.

These specialist Units are not, of course, available as 'off-the-shelf' items. They are specially developed by British Telecom. Part of the role of the Underground Cabling Systems Group, currently based at Carlton House, Wembley, is to design and develop such equipment, matching the facilities offered and the equipment carried to the cabling task.

To the lay person a cable jointing chamber may seem to be no more than an uninteresting hole in the ground, but there are, in fact, quite severe design problems associated with those which are in the form of manholes. These are, in effect, underground rooms with entry from the surface through a shaft in the roof. The structure has to satisfy the complicated British Standard requirements for design in reinforced concrete, and withstand loads imposed by traffic and soil pressure for a working life of at least 40 years.

We have recently evolved a range of standard manhole designs which fully satisfy current British Standard requirements and are suitable for use in many situations. But in urban areas there are often difficulties, such as other buried plant, building foundations, and cellars, which prevent the construction of a simple shape. In other situations multi-storey manholes are needed to cope with the cable layouts. In the past, the design of these more complex shapes of manhole constituted a lengthy civil engineering analysis problem.

The External Plant Division has now written its own programmes for the computer-aided design of manholes. Structural analysis is undertaken on a small business computer, together with the production of all necessary design information including details of steel reinforcing bars. This work is now carried out so speedily that Districts

It may be just a hole in the ground to you. But to me it's a meticulously designed jointing chamber conforming to British Standard requirements.

can obtain all the necessary construction information by return of post.

Blown fibre – the technique of blowing lightweight optical fibre down a small tube with compressed air – will revolutionise cabling when it is made fully available in the Districts.

The potential of this system is enormous. 'Pre-cabling' with empty tubes, and installing the fibres only when they are needed, gives tremendous flexibility of design and can result in considerable economic advantage. This is especially true of the tortuous routes required for 'in-building' installations such as those now being connected to the new City Fibre Network in the business quarter of London.

This article has only been able to discuss, and even then not in great detail, just a few examples of the work of the External Plant Division. There are many more aspects to our daily task, amongst which are safety harnesses, roadworks guarding equipment and a whole host of specialised tools. ■

CASTING THE NETWORK

Going public – merger plans for private circuits

Andrew Muir

Private circuit networks go back to the earliest days of telecommunications but future developments will lead towards a merger of private and switched services to form a truly Integrated Services Digital Network.

Private Circuits are second only to the Public Switched Telephony Network (PSTN) in terms of product size and account for over 10 per cent of the turnover of British Telecom's inland services.

They consist of point-to-point connections ▷

Right: MegaStream offers a high capacity facility which can be used for videoconferencing equipment.

which are provided through the BT network but which are not routed through the switching units of the PSTN. In practice, the product range extends from simple telephone extensions to international networks interconnecting the diverse offices of large multi-national companies or organisations.

In networking terms, private circuits have existed since the infancy of telecommunications with the earliest point-to-point telegraph links being based on similar networking principles to many of today's products. The traditional, and still dominant, private circuit is the analogue circuit, carrying speech or data traffic between two or more customers' terminals, with a variety of circuit terminating arrangements offered to the customer.

Analogue private circuits are routed through the BT network on the same transmission bearers as those of PSTN and are fully integrated with PSTN traffic at the circuit level in order to optimise the loading of active repeaters within the network. This integration results in a generally unstructured network which, although efficient in transmission terms, requires manual intervention at cross connect points to establish or reroute each individual circuit.

Over the past five years, the traditional analogue private circuit has been complemented by new digital products marketed under the KiloStream and MegaStream banners. KiloStream offers the facility to transport digitally encoded signals at rates up to 64 Kbit/s and consequently lends itself to applications such as high-speed facsimile, slow scan TV, data and voice transmission. MegaStream offers a high capacity facility at 2 Mbit/s and above which can be used for applications such as the linking of large PABX's and video conferencing equipment.

The introduction of KiloStream has offered the potential to establish a managed private circuit network within the overall BT network and hence to introduce advanced routeing, monitoring and fault location techniques.

The heart of the managed KiloStream Network is the automatic Cross-Connect Equipment (ACE) which is capable of interconnecting some 1,800 circuits within each unit under the control of a Remote Control Equipment (RCE) with terminals at X-Stream service centres. The ACE also provides concentration of alarms and a means of accessing the network to assist remote testing along the length of each circuit.

The current KiloStream network consists of 70 interconnected ACE nodes – many encompassing more than one ACE unit – which serve a number of multiplexing sites within the ACE catchment area.

At each multiplexing site, individual KiloStream circuits are broken out of the managed network and are extended down to customers' premises on copper pairs or, increasingly in the future, on optical fibres. At the customers' premises, the circuit is terminated in a Network Terminating Unit which presents a standard CCITT data interface and additionally provides the facility to alarm and test the KiloStream circuit on an end-to-end basis.

One of the most important features of the managed KiloStream Network is the ACE/RCE's ability to automatically monitor and correlate alarm reports from the Network Terminating Units, Multiplexes and ACEs. This allows remote test access and interrogation, by circuit number, and provides an end to end perspective of each circuit routed through the network.

The alarm and monitoring information is analysed at specialised X-Stream service centres located at strategic points of the UK, enabling rapid action to be taken to locate and restore circuits in the event of a fault occurring in any part of the BT network. The interrogation of the circuit conditions at the Network Terminating Units also enables a fault to be isolated to either the BT network or the customers' terminal equipment, thereby ensuring that the correct remedial action is taken as expeditiously as possible.

An equally important feature of the managed KiloStream network is the ability to remotely route circuits through the network from one Multiplex site to another hundreds of kilometres away. The remote routeing facility is under the control of the GENETIC computer system and enables circuits to be routed with the minimum of provisioning delay and resources and with the maximum of network ultilisation efficiency.

The establishment of the managed KiloStream network, with its remote monitoring and routeing facilities, marks an important stage of the progressive migration towards totally managed telecommunications networking principles. The logical next stage of this migration is the extension of the concept to MegaStream services with the potential for a further extension to encompass existing analogue private circuits.

Future extensions of the migration process during the 1990's will open the door to more wide ranging networking facilities, including advanced remote routeing techniques. These trends will bring the architecture of the managed private circuit network increasingly closer to that of the PSTN and ultimately to the concept of a true Integrated Services Digital Network. ■

Right: KiloStream can be used for applications like high-speed facsimile in which an A4 page can be sent in less than a second.

Mr A Muir is Private Circuit Network Implementation Manager.

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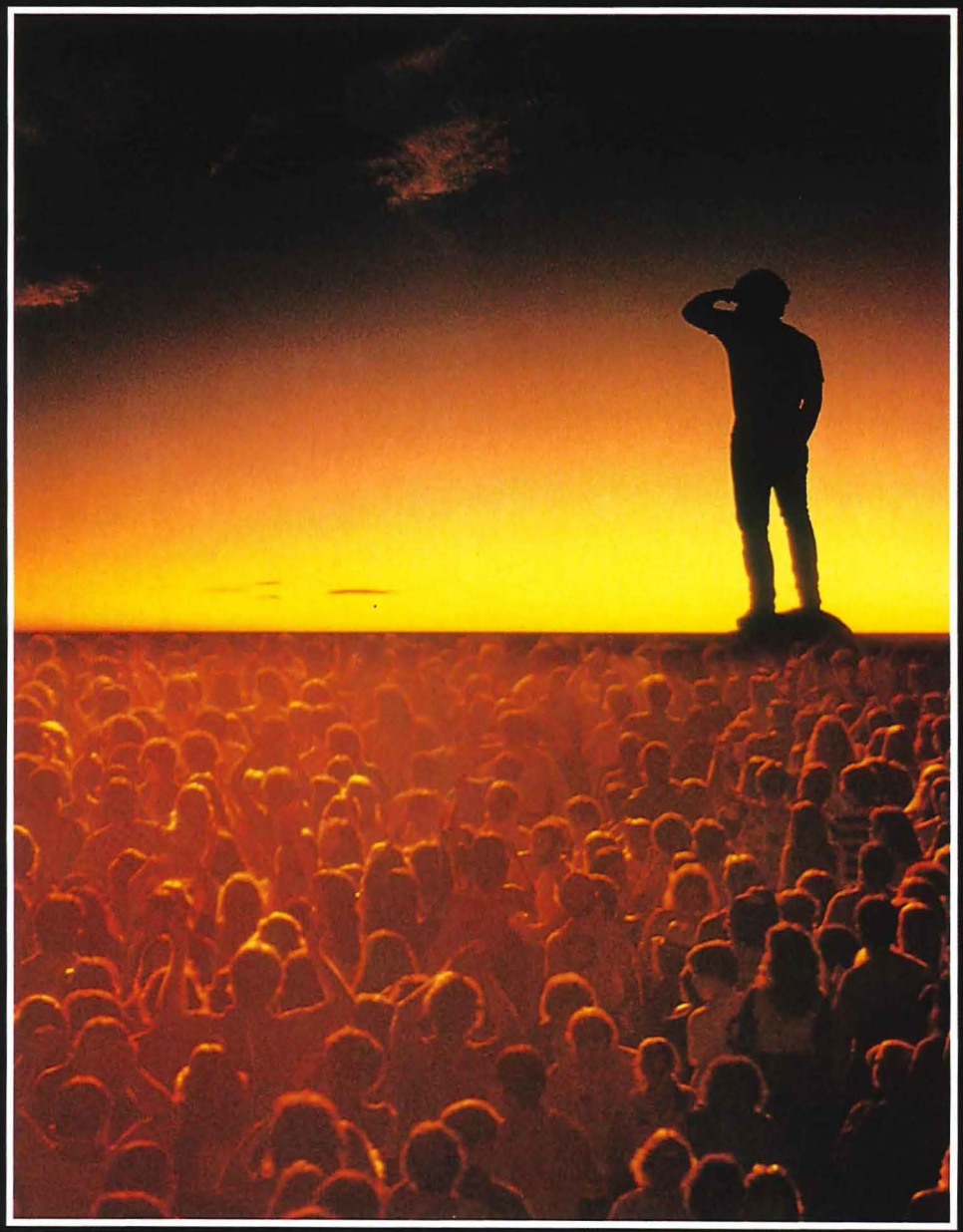

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The most advanced digital public switch available, it is uniquely tailored for the world ISDN market and represents a great sales success for the new major force in telecommunications, GPT. Created by the formation of GEC Plessey Telecommunications.

This success can be measured by the 10 million lines ordered to date and owes much to System X's concept of design evolution. A concept which makes the switch "Future Proof" – allowing new features and facilities to be added as they are demanded by the customer.

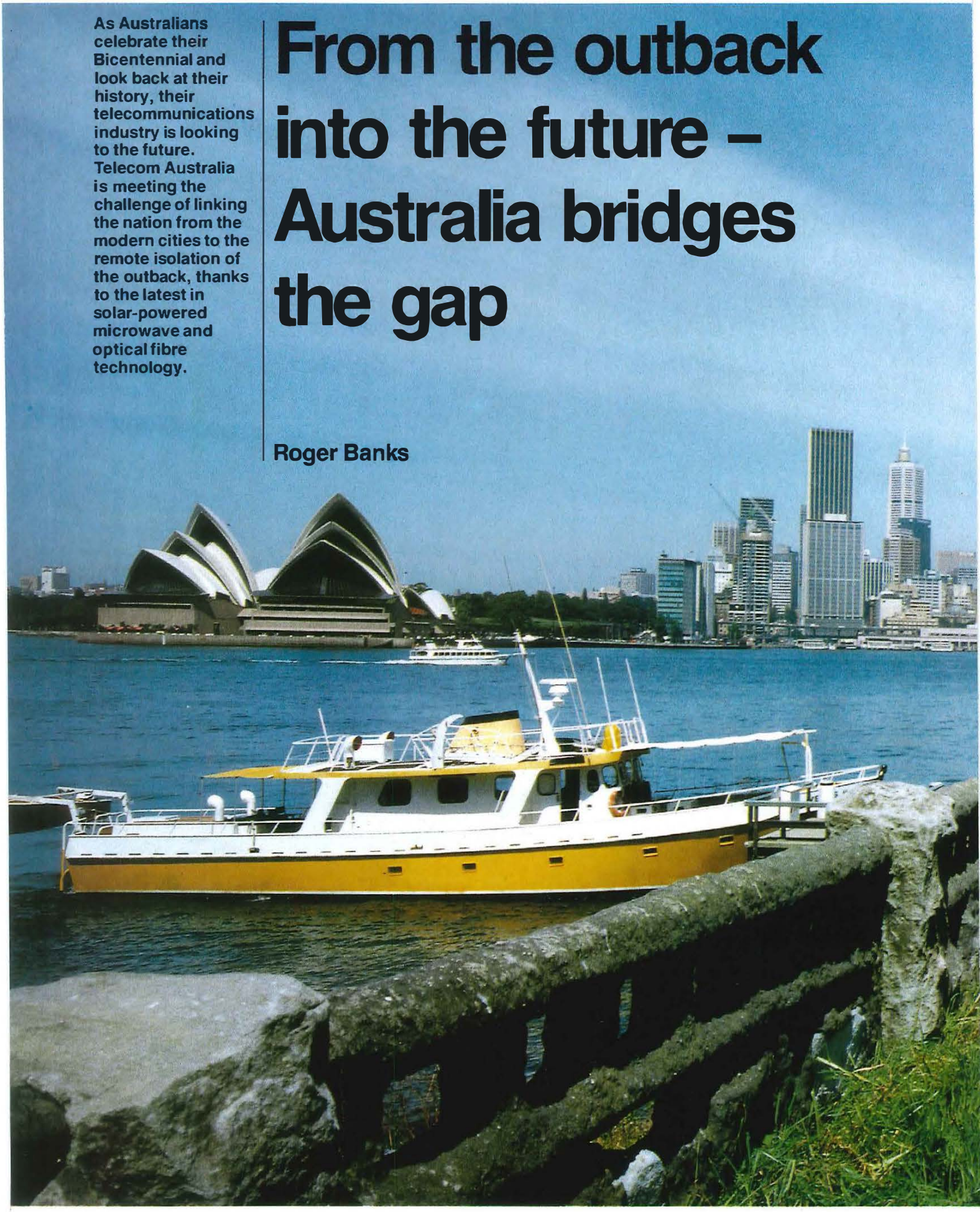
In practice, PTT's gain through dramatically lower operating and maintenance costs, while customers benefit from the finest voice and data communications technology in the world.

System X

From the outback into the future – Australia bridges the gap

As Australians celebrate their Bicentennial and look back at their history, their telecommunications industry is looking to the future. Telecom Australia is meeting the challenge of linking the nation from the modern cities to the remote isolation of the outback, thanks to the latest in solar-powered microwave and optical fibre technology.

Roger Banks



Semaphore was Australia's earliest means of communication over any distance and in 1853, nine years after Samuel Morse invented his electric telegraphy system, the nation enthusiastically embraced the technology, assisting new settlements to spring up in increasingly far-flung areas.

Isolation – between Australian communities and from Britain – was the pioneers' greatest hurdle, followed closely by such a varied, often rugged terrain and an equally harsh climate.

Charles Todd, an assistant astronomer from Cambridge University, organised a team of men and tons of equipment to cross vast tracts of unexplored central Australia from 1870-72, installing a 2880km open-wire telegraphic link between Adelaide and Darwin. Todd's team crossed hills, deserts, swamplands and swollen rivers to complete the Overland Telegraph route which, in turn, met a submarine telegraphic cable to Java and from there a cable to England.

Eight years later, barely four years after Alexander Graham Bell invented the telephone in the United States, Australia tested and soon installed its first telephones. Their first exchange appeared in Melbourne in 1880, and by the end of the decade other Australian cities had established their own.

However, until Federation in 1901 each Australian colonial settlement – roughly located where today's capital cities are – went about the business of establishing its own telecommunications network. A truly national network became the objective when the Post-Master General's Department was formed that year, its charter to oversee the delivery of postal and telecommunications services to a young and growing nation.

The Southern Hemisphere's first (and the British Commonwealth's second) automatic public exchange was opened at Geelong in Victoria in 1912.

An English engineer, Harry Percy Brown, came to Australia in 1923 to be Director-General of the PMG, as the department became known. Nicknamed 'Horse-Power' Brown, and later knighted, Brown held the post until 1939. He made significant contributions to telephony, telegraphy, wireless, broadcasting, ▷

A Telecom Australia workman inspects a pillar with the Sydney Harbour Bridge and Opera House in the background.

The people of Mundi Mundi Plains near Broken Hill in New South Wales have their own comfortable blend of old and new amenities such as a solar-powered call box.

training, research and even public relations.

During the 1940's, Australia started to install the first semi-automatic trunk exchanges, and by the late 1950's plans had been formulated to move completely to Subscriber Trunk Dialling.

The PMG was divided into two statutory authorities in 1975 – Telecom Australia and Australia Post – following the Vernon Report to Federal Parliament which recognised that a combined PMG model was no longer able to meet the challenges of the rapidly-expanding Australian telecommunications and postal marketplaces. At that time there was little talk about competition in telecommunications. It was taken for granted that the supplier would have a common carrier monopoly, with some competition in Customer Premises Equipment and Value-Added Services. The real impact of technological developments started to take effect by 1980 and the competition aspect arose. Debate on deregulation, ownership and monopolies has since gathered pace.

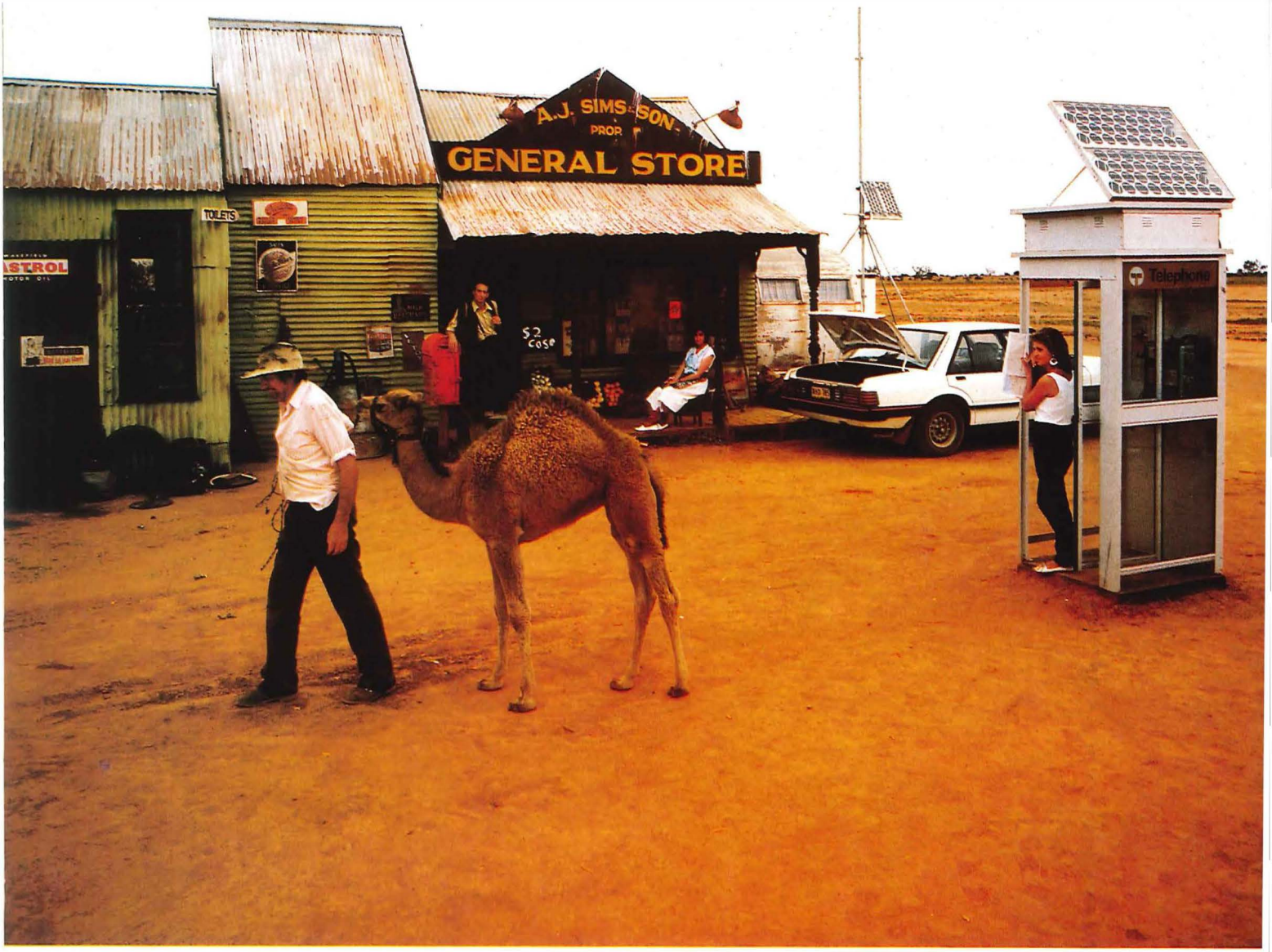
Australia's telecommunications industry has always been dynamic and – in their Bicentennial year when they report to the Federal Minister for Transport and Communications, Senator Gareth Evans – they are facing further refinement of their role as the national telecommunications provider. From a handful of people who ran the first telephone exchange in the heart of Melbourne serving fewer than 50 customers, the present-day national staff of almost 90,000 look after seven million services.

The tapestry of Australian telecommunications has always had at least one common thread binding its purpose: to overcome the 'tyranny of distance', as Telecom Australia services a geographical area larger than the United States or Western Europe.

The 'Outback', as the sparsely-populated interior is known, can be harsh and unforgiving. Its population is physically isolated in a way that many British people would find almost unimaginable.

There are large areas of Australian country where a drive equivalent to that from Lands' End to John O'Groats would connect two moderately small townships, perhaps passing only one small community on the way. Herein lies the real challenge for the providers of a national telecommunications network.

Essentially, Australia has two quite distinct



customer bases: those who live in its modern cities or provincial centres, and those who reside in its more remote areas.

Adelaide engineer Alfred Traeger invented the pedal wireless in the early 1930's which enabled radio to reach out to Outback stations years ahead of formal telephonic communications. His invention, combined with the Royal Flying Doctor Service founded in 1929 by the Reverend John Flynn, gave the people of the Outback their first live communications link, a basic life-support mechanism which was uniquely Australian.

Outlying

As telephone services progressively reached outlying communities, they were initially via overhead wires which were inevitably susceptible to the vagaries of climate, inquisitive wildlife and destructive fires. Today customers in the remotest parts of the country are receiving an uninterrupted service via an Australian-developed technology – digital radio concentrator systems (DRCS). In most areas commercial power is still not available, so the DRCS systems are usually run by reliable, inexpensive and environmentally-compatible solar power, and overhead wires have given way to small masts with a solar collector and an antenna.

Taking telephones to the Outback has also meant careful consultation with Aboriginal and Torres Strait Islander communities where hundreds of different dialects are spoken. Extensive social research in the rural and remote areas of Australia has provided Telecom Australia with insights into the requirements of an isolated people. Not only do their telecommunications needs have to be ascertained, their permission also has to be gained before equipment can be used or plant installed on their land.

To bridge what is largely a cultural gap, Telecom Australia has worked hard to produce careful guidelines for its field staff and planners. Under the £240 million Rural and Remote Areas Program, which began in 1985 and is due for completion by 1992, outlying and island communities are visited by Telecom staff accompanied by Aboriginal or Torres Strait Islander representatives. Videotapes of the work that needs to be done are shown to tribal elders and the keepers of communal land or sacred sites, and the people are given a few months to decide ▷

The Digital Radio Concentrator System is bringing modern automatic communications to outlying Australian homesteads such as this one in far western New South Wales.

for themselves how they can best utilise the available network.

Bridging the physical gap between communities and either their major service towns or points beyond means it now takes minutes and not days to order vital goods and services or obtain information of a medical or agricultural nature. Children and relatives who must travel to the cities for work or education can keep in touch – an important factor for a family-oriented rural population.

Today's Australian telecommunications network is a clever hybridisation of at least three generations of telephonic equipment. Fully-computerised digital exchanges are replacing older technologies (including cross-bar and step-by-step equipment) in the cities, and rural areas are starting to get transportable computerised exchange equipment that will meet the needs of an often transient population.

Optical fibre cable not only links Melbourne to Canberra and Sydney, but – along with a microwave radio route through the monsoon-prone upper half of the Northern Territory – will also mean secure, high-speed, high-quality data and voice transmissions between Darwin and Adelaide by year's end. This north-south route duplicates Todd's historic Overland Telegraph route, and a similar project will connect Perth and Adelaide to the Eastern seaboard by 1990. Important business and residential optical fibre trials are already underway.

Viatel

Value-added services are being introduced quickly, with a successful national videotext service, Viatel, enjoying one of the world's best and fastest levels of penetration (apart from France, where terminals were distributed free of charge).

Travtel, a Viatel spinoff service which helps travel agents book accommodation and tour arrangements, is also popular. One of its top 10 users is an agent on a huge North-West Shelf oil rig off the isolated northern coastline of Western Australia!

Australia's first cellular mobile telephone services were introduced last year, and already 85 per cent of the population of 16 million is covered by a ground-based CMTS network.

Growth is far outstripping expectations – initial estimates were for 150,000 CMTS units to be operational by 1995, but that has been upgraded to at least 250,000 units by 1993 and 350,000 by June, 1995.

Telecom Australia provides the sole carrier network for almost 30,000 units and has endorsed nine other suppliers to the Australian market. It is the market leader with three different CMTS styles – hand-held, transportable and car-mounted. As Australian suppliers are being required to meet minimum local content levels of 35-35 per cent almost immediately, imported CMTS units are not being connected to the network.

This has spawned another new local manufacturing industry and necessitated the importation of crucial surface-mounted microchip technology which can now be used by other local industries interested in micro-miniaturisation. Likewise, work on the optical fibre cable network has fostered a healthy local cable-making industry which is now successfully vying for export contracts.

Telecom Australia has invested in satellite technology by taking up 25 per cent of the equity in Aussat, the nation's domestic satellite operator. Among other satellite services, there are plans to bring mobile telephone services to remote areas during the 1990's.

A fixed cellular network in the next generation is possible and, with designers working on a mobile telephone no thicker than a pocket calculator, the concept of universally mobile telecommunications is no longer a fantasy.

Some universally important telecommunications inventions or adaptations have had their nucleus in Australia, not the least of which was the world's first solar-powered microwave radio transmission system between Darwin and Alice Springs in the late 1970's. In the same decade, Telecom Australia's Research Laboratories trialled a digital exchange prototype and validated the principles of digital switching which are now being applied to the first generation of Integrated Sevices Digital Network equipment. Broadband ISDN and further digitalisation projects are being investigated by researchers, as are non-hierarchical networks.

An Australian packetised voice, data and video switching invention known as 'queued packet synchronous exchange' was recently developed by a team of people from Australian Telecom and the University of Western Australia, and now the IEEE is standardising the QPSX protocol for world markets. Its potential has been underscored with a number of contracts for initial field trials with major Bell operating companies in the United States.

Australian Telecom is also about to launch a new standard telephone, the Touchfone 200, for its customers and the broader international market. The sleek new basic unit, the world's first fully-electronic telephone, will be able to handle additional modules to upgrade its functions.

From humble, isolated beginnings, Australians have overcome all odds to forge a telecommunications network that not only meets its multifarious internal needs, but also sits comfortably alongside its international peers when quality and diversity of service are weighed against cost. The fact that Telecom Australia has to cope with great distances and isolation as well as its dichotomous urban/rural customer bases, has stood it in good stead with the International Consultative Committee for Telephony and Telegraphy (CCITT) where, despite a relatively small population, it has wielded a disproportionately large influence in a number of global telecommunications decisions.

Australia's telecommunications tapestry is as colourful as it is diverse and its potential is enormous, given the pioneering spirit of the population.

Mr E R Banks is Executive Director of Corporate Strategy with Telecom Australia.

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So it's even easier to feel you've got the best closure for the network.

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The difference is material.

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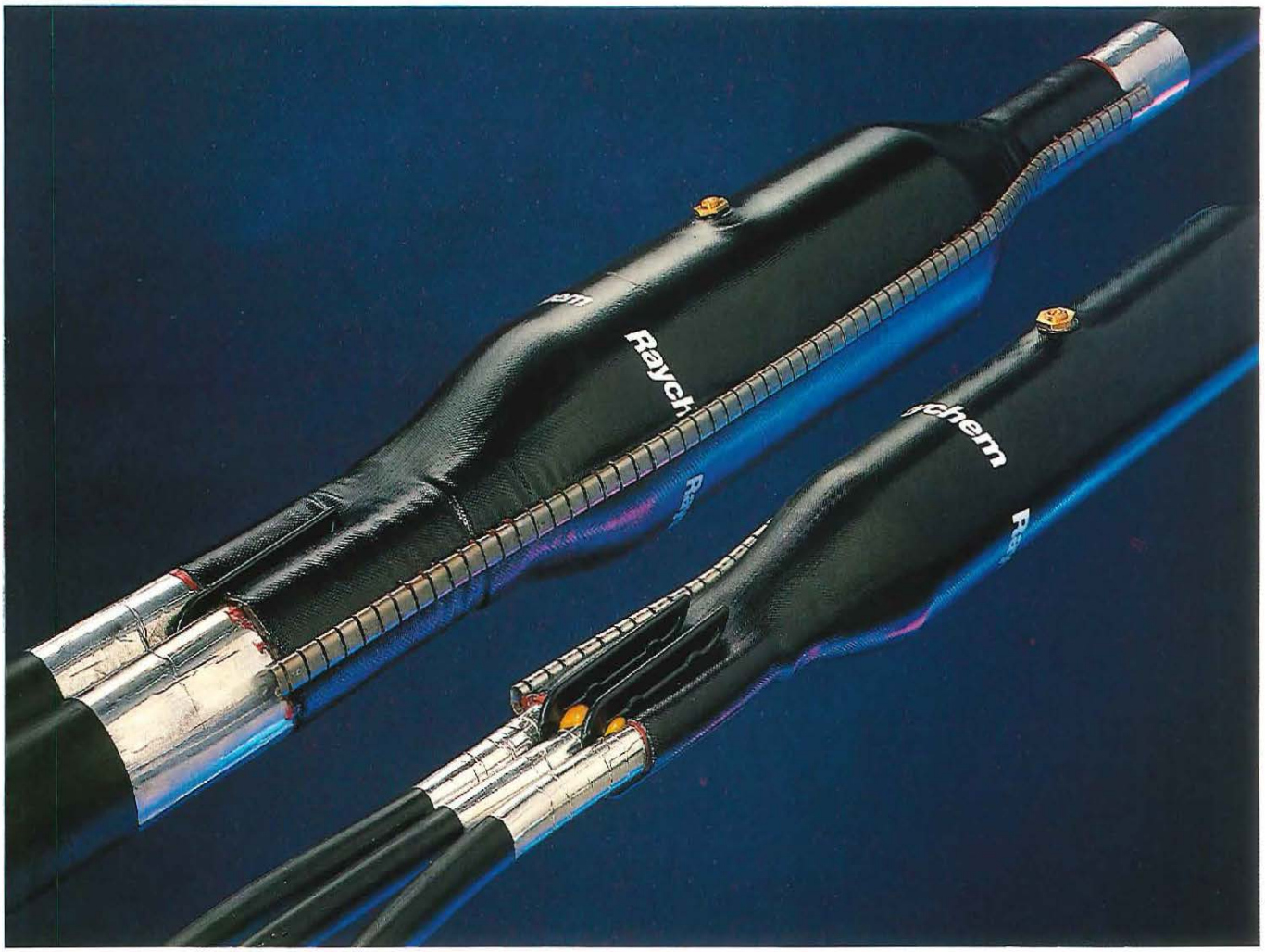


Raychem Limited, Telecommunications Division, Faraday Road, Dorcan, Swindon, Wiltshire, SN3 5HH. Telephone: 0793 482171/2/3. Telex: 449409.

Hey Prestel! – a magic service or white elephant?

Jane Austin

It was a world-first at its launch and later won a coveted Queens Award for Technology. It has a turnover of around £13 million and trades at a profit. And every year there is a staggering total of 470 million accesses to the service. A 'white elephant'? Hardly. But for some reason there are still critics who apply this description to Prestel, BT's national videotex service.

Now part of Dialcom UK, the newly formed electronic messaging and publishing division, Prestel pioneered BT's drive into information and messaging services, at a time when Telecom Gold, now a market leader, wasn't even a twinkle in a marketing manager's eye.

Prestel was launched in 1979 in a glare of publicity. It had a worthy 'Value Added' objective – to increase call revenue on the network, particularly after 6 pm when traffic levels traditionally dropped. Enthusiasts believed that everyone in the country with a TV set would welcome an on-line encyclopaedic database with open arms but, not surprisingly, this approach proved to be rather over-ambitious.

There is no doubt now, looking back to 1979 with the benefit of nearly ten years experience, that mistakes were made. The Prestel project seemed dazzled by its own technology and left unanswered the important question – "What do customers want?" By 1980 the user base numbered 3,035, frame accesses totalled 142,000 per year and there were 140 Information Providers. (Today, Prestel has 9.1 million accesses per week, 80,000 terminals attached to the network, and over 1,300 Information Providers.)

What went wrong? Why did Prestel fail to fulfil its early promise? Today, the PC boom is taken for granted. Offices are automated, people communicate electronically and children can seemingly use computers before they can walk. It is easy to forget that in 1979 none of this had happened. The 'technofear' element was underestimated and this, together with the high cost of hardware, resulted in massive market resistance. Prestel was too radical for its own good and was preaching to a market which showed little sign of being converted.

The turning point came when one business sector seized upon the advantages of videotex. The travel industry wanted a fast, user friendly, efficient and low cost method of dealing with millions of holiday bookings. Prestel provided the solution. Prestel Travel (now the BT Travel Service) became the flagship service and today more than 90 per cent of all ABTA travel agents are users.

The initial success led to a change in marketing direction, and the setting of more realistic (and achievable) objectives. After all, if the travel sector could utilise a tailored Prestel solution what about other areas such as finance, agriculture and education?

By the mid-80's Prestel had blazed a trail through these and other sectors giving birth to its vertical sector philosophy, later adopted by mainstream BT. A watershed had been reached, Prestel was looking at customer problems and offering solutions, not, as in the past, the other way round.

Opposite, top: when Prestel was launched in 1979, enthusiasts believed that everyone in the country with a TV set would welcome an on-line encyclopedic database into their living room with open arms.

Left: from armchair shopping and banking to booking train tickets and checking up on oil companies, Prestel can deliver the information. It can even send a Valentine message.

Opposite, bottom: more than 90 per cent of all ABTA travel agents use the BT Travel Service.

Below: Prestel has been tailored to offer valuable aids in education.

Financial Services Act transformed the way in which business was done. BT's products and services (Citiservice, Home and Office Banking, BT Insurance services) had to match the pace of change and anticipate new customer demands.

A particularly fertile breeding ground for new vertical sector services is Private Prestel. It offers private communication and information facilities for inter-company departments, sales forces and retail operations. Blue chip companies like British Gas and Mobil are among Private Prestel's many customers who include white goods ▷

Another important milestone was the introduction of Gateway, opening up a wealth of data on external host computers to the Prestel user. The simple, user-friendliness of videotex was thus harnessed to the sophistication of company mainframes, with Prestel at the front end. There are now more than 85 Gateway links on Prestel offering access to recognised host databases such as American Express, Littlewoods, Norwich Union and the Bank of Scotland.

The strategic importance of Gateway was that it turned BT's attention to non-videotex or ASCII based services. For some applications these would be a better 'delivery mechanism' than Prestel. Today, videotex services are marketed alongside their ASCII counterparts, such as Password Electronics – an integrated, on-line database for electronics engineers.

The vertical sector services spawned by Prestel now thrive as businesses in their own right, and target the retail, financial, travel, insurance, legal, agricultural and eduction sectors. Each is organised into a small, flexible business unit, which has to respond quickly to the needs of the market.

Recent examples of this are the financial and insurance Sectors, where Big Bang and the

manufacturers, energy companies, supermarket chains, the pharmaceutical industry, electrical companies, the computer industry and marketing consultancies. Long distance phone calls, telex and post are things of the past for enlightened retailers who use the system to check and order stock, instantly, on-line.

Whether a customer is accessing a mortgage quotation, industry news, stock exchange quotes, schools courses or rail timetables, he/she will benefit from constant enhancements to the basic quality of service.

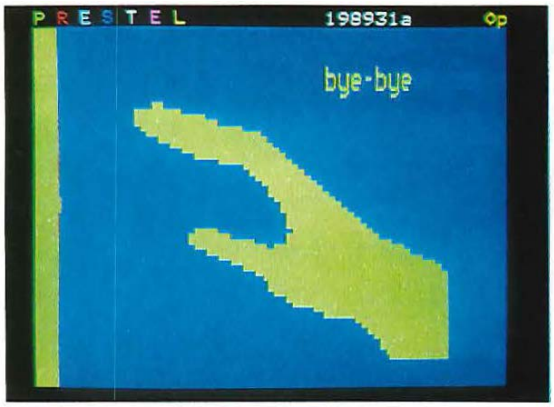
Keywords, enabling express-speed routing to Prestel's one third of a million pages, have been introduced and 100 per cent of all UK telephone customers can now access the service at local call rates.

Future plans include the upgrading of the network itself, to tackle the common inheritance of the eighties — networks and computers which are incompatible. In making the technology transparent to the customer, and concentrating on the end service a new, intelligent network will utlimately emerge. This will offer customers a menu of BT's value added services from just one source.

Prestel has proved itself to be a survivor in the cut-throat information supply market. It has certainly made mistakes, and not only learnt from them, but paved the way for other BT services to follow.

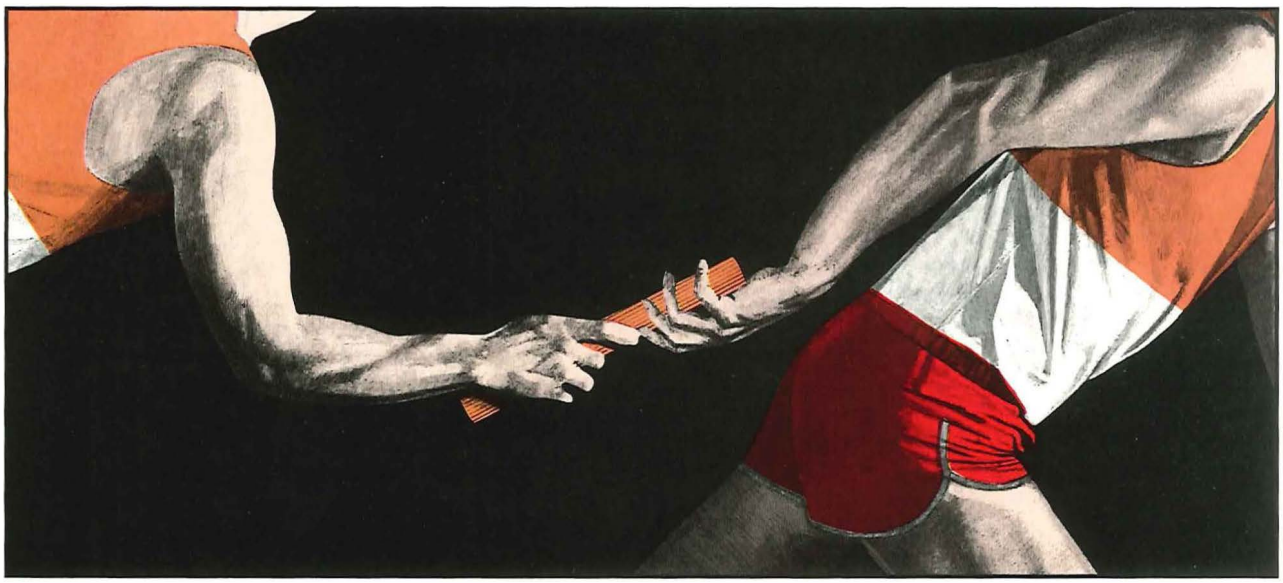
Like all parts of British Telecom, Prestel is both blessed and cursed by the high profile which occasionally puts it under a searching media spotlight. It is now pushing into the 1990's with a strong base in information, messaging and transaction services, and leaving the false optimism of 1979 behind.

Perhaps, soon, the diehard critics will too.



Miss J Austin is Public Relations Manager with British Telecom Enterprises.

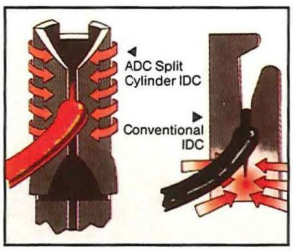
MAKE THE ADC CONNECTION: QUICK, DEPENDABLE, FLEXIBLE



The reliable telecommunications connection solution

The QDF wire management system from ADC provides fast, reliable connections for all wire termination requirements.

QDF offers systems solutions for a range of applications from the customer premise PABX and data networks to the central exchange MDF installations.



Featuring ADC's revolutionary split cylinder insulation displacement contact (IDC) technology, QDF offers all the advantages of IDC, with the reliability of traditional wire-wrap or solder terminations.

A non-orienting tool provides fast, uniform terminations, and ADC's unique split cylinder strips and cuts the wire, while making a firm, gas-tight connection.

Every QDF magazine features built-in strain relief ensuring reliability and undisturbed connections.

The QDF system includes protection magazines, as well as termination magazines for economical connection where protection is not required. In addition the QDF system includes protector modules, test/patch cords, impact and manual installation tools and other accessories.

QDF: the front runner in wire management systems.

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ADC Europe Ltd.

Foundations of a 'cable

The first transatlantic optical fibre cable is due to be completed this summer with a potential capacity equivalent to 40,000 simultaneous telephone calls. But just 22 years ago telecommunications history was made when the first transatlantic telephone cable (TAT1) came into service providing just 36 circuits to the US and Canada.

The whole TAT 1 project took three years to complete at a cost of £12½ million, and during this time the system had to be planned, manufactured and installed, requiring the development of new machinery and techniques for placing the cable in deep waters.

It was designed to link both the US and Canada to the UK with facilities for some circuits to be leased to other West European countries, giving them direct communication with the US and Canada. TAT 1 provided 30 telephone circuits to the US and six to Canada as well as a number of telegraph circuits to the latter. Most were for communication with the UK, and the remainder were permanently connected through London to give direct circuits to Germany, France, the Netherlands, Switzerland, and a circuit for Denmark which also carried US traffic with Norway and Sweden.

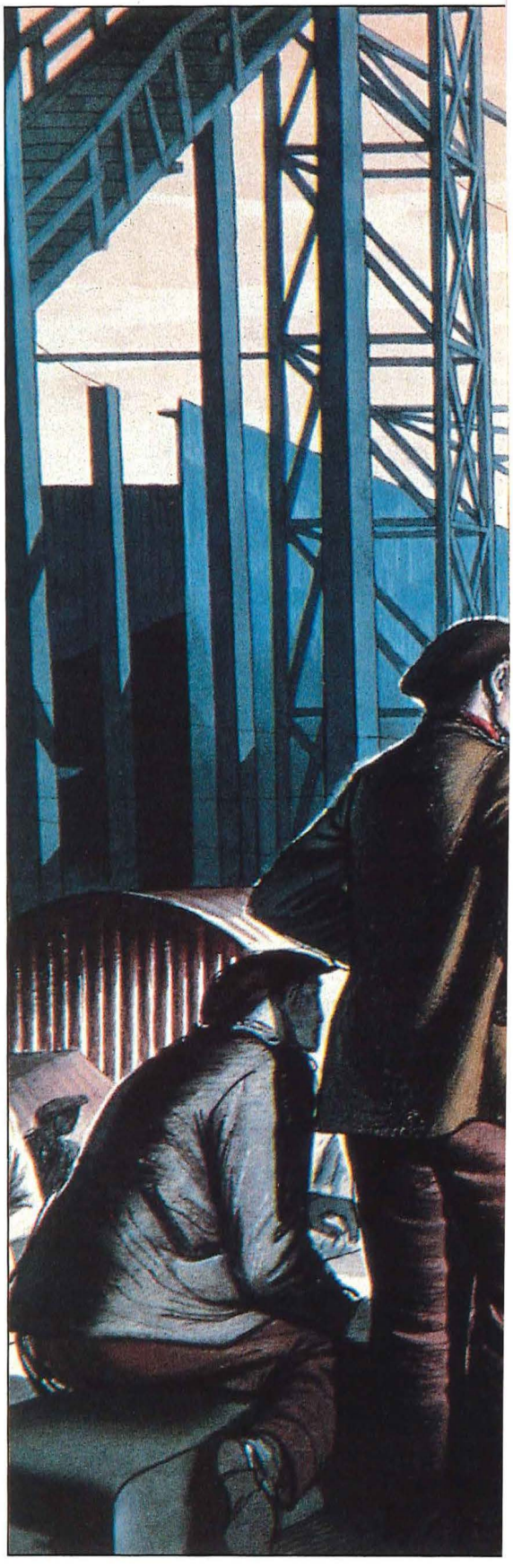
Telegraph links between the UK and America had been in existence from the middle of the previous century, and 1927 saw the first commercial radiotelephone service between the two countries. Initially this was just one circuit, with an average of 2000 calls per year. The cost of calls was prohibitive; in 1928 the basic rate for calls to New York was *reduced* to nine pounds for three minutes' conversation. The system was subject to atmospheric disturbance and fading, and at best had a limited number of frequencies available for circuits.

In the 1920's and 30's the feasibility of a telephone cable between Europe and America was frequently discussed, but always seen as having too many technical difficulties, notably the need for the cable to be divided into sections and to have repeater stations installed along its length to boost the signal across such a great distance. The repeaters had to have sufficient strength and reliability to work below two miles of ocean because of the obvious problems in adjusting and repairing them once they had been laid.

Repeaters

It was only with the development of coaxial cables with polyethylene insulation, carrier frequency equipment and broadband submerged repeaters that transatlantic telephony by cable could be realised. This equipment was gradually developed just before and during the Second World War.

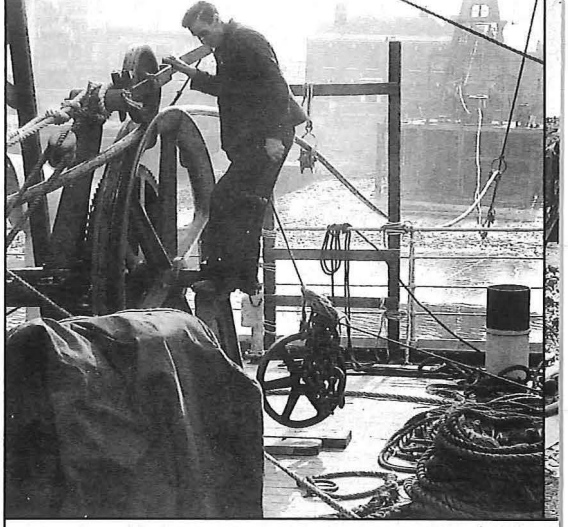
Research on repeaters in the United States led in the early 1950's to two repeatered cables being laid between Havana and Key West in Florida. In Britain work was mostly done on repeaters suitable for the medium depths in which cable would be laid around the coast and to the European mainland. In 1943 the first submerged repeaters (suitable for depths of 200 fathoms) ▷



'elationship'

Gwen Jones-Lewitt

The launching of the cableship *Monarch* which laid the first transatlantic telephone cable.



Right: the cable being fed to *Monarch* from the Telecom works.

were laid in the Irish Sea between Anglesey and the Isle of Man. This was followed by considerable development in submarine coaxial cables and submerged repeaters linking the UK with Germany, the Netherlands, Belgium and Denmark. Once these small experimental projects had been seen to work successfully, it was then possible to begin the more ambitious transatlantic one.

On 1 December, 1953, the Postmaster General announced that the agreement for the first transatlantic telephone cable had been signed. The scheme was to be undertaken by the Post Office Engineering Department, the Long Lines Department of American Telegraph and Telephone Company, Bell Telephone Laboratories and the Canadian Overseas Telecommunications Corporation. Half of the shares were held by the American companies, 40 per cent by the Post Office and nine per cent by the Canadian Corporation.

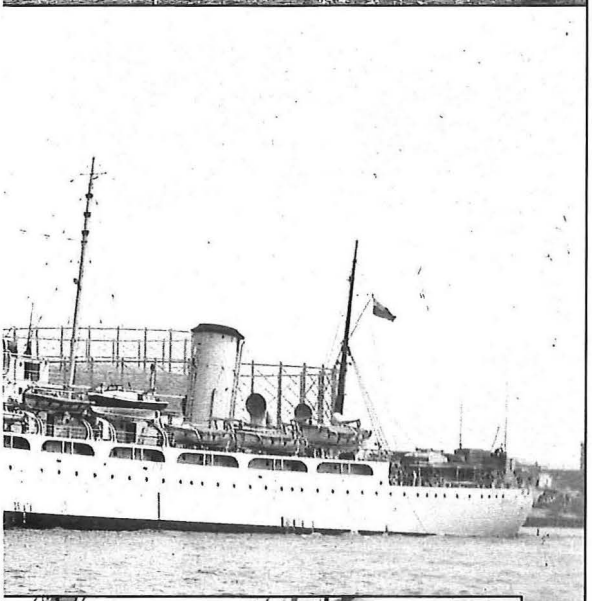
One of the first difficulties encountered was in selecting a route for the two cables required as the shortest, and perhaps the best, were already occupied by telegraph cables. In the winter of 1953 suitable sites to land the cables were chosen in Newfoundland and Scotland.

The Scottish site was a few miles south of Oban, and was linked to an improved coaxial cable line to carry 900 inland and transatlantic circuits via Glasgow to International Exchange, London. On the other side of the Atlantic, the cables came ashore at Clarenville, Newfoundland, then crossed the Cabot Strait to Sydney Mines, Nova Scotia. From Sydney Mines to the US border a line-of-sight microwave radio link completed the system. In New Brunswick, Maine, the route branched to Montreal to connect with the Canadian network.

The main Atlantic link, designed by Bell Laboratories, consisted of two cables (one for each direction of transmission) with 51 one-way flexible repeaters installed at 37-mile intervals along each cable. The Post Office two-way repeater system, with rigid repeaters spaced about 20 miles apart, was developed at the Dollis Hill Research Station, and was used for the shallow waters of the 300-mile Cabot Strait, enabling transmission in both directions over a single cable. Armoured cable, protected by steel, was necessary to safeguard against damage by ships' anchors and trawler gear. Almost all of it was manufactured in a new factory at Erith, Kent.

Centre: *Monarch* leaving Greenwich for the USA to start cable laying.

Apart from the short shore ends, the whole of the transatlantic cable was laid by the cableship *Monarch. Monarch,* built for the Post Office in 1945 to replace the ship of the same name destroyed during the war, was the only existing cableship capable of conveying the 1500 nautical miles of cable which had to be laid in one piece across the deepest part of the Atlantic. The ship had been employed in 1952 laying cable for Bell Laboratories in the United States, and in replacing an 800 mile stretch in the middle of one of the early transatlantic telegraph cables. TAT 1, however, was so revolutionary that the whole of *Monarch*'s cable laying machinery had to be either replaced or modified. The size of the cable engine drums had to be altered to avoid damaging the flexible repeaters as they were being introduced. Nevertheless, the use of these repeaters brought extra benefits. Their structure enabled them to pass along the ship's laying gear while it was still travelling, although at a reduced speed. When laying rigid repeaters it was



Left: the Scottish end of the cable is laid from *Iris* at Oban.

necessary for a cable ship to stop each time.

The first lengths of cable were manufactured in February 1955, and in March *Monarch*, equipped with new cable-laying gear, undertook trials off Gibraltar. Shortly afterwards work began on laying the first transatlantic cable, from west to east.

Each cable was to be laid in three continuous lengths complete with repeaters. At the end of June 1955 *Monarch* laid 200 miles of shore end cable from Clarenville. After picking up a fresh supply of cable it returned to the buoyed cable-end of Clarenville and, avoiding the North Atlantic icebergs, laid the 1500 nautical miles across the Atlantic to Rockall Bank. The journey was uneventful, apart from the severe storms which occurred near Rockall, the result of Hurricane Ione. In the meantime cableship *Iris* sailed for Oban to lay the Scottish end cables. *Monarch*, reloaded with cable, returned to Rockall Bank to lay the last 500 miles towards Oban where the final joint was made with the shore end cable on 26 September, completing one cable link. Speech could then be transmitted in one direction and answered by radiotelephone to test the system.

The project continued once weather conditions in the Atlantic improved the following spring. By April *Monarch* had left to install the single cable across Cabot Strait, and by the end of May *Iris* had laid the Scottish shore end of the second cable. *Monarch*, starting from the end of this cable, laid the main deep-sea section in August, to which the Clarenville shore end was joined on 14 August. TAT 1 had been completed, three months ahead of schedule.

At the inaugural ceremony at Lancaster House in London at 4.00 pm on 25 September 1956, the service was opened by the Postmaster General who spoke to the Chairman of AT & T calling from New York, and to the Canadian Minister of Transport. The 250 people present listened with individual earphones to the first conversation over the transatlantic telephone cable. TV cameras recorded the event.

In the first 24 hours of public service there were 588 London-US calls and 119 from London to Canada. This was the start of a substantial increase in the number of calls made. During the first full week of operation the number of calls to Canada was 85 per cent higher than the average weekday traffic over the radiotelephone circuits; calls from Canada were 100 per cent higher. Calls made at the full rate to the United States were up by 60 per cent and at the cheap rate by 50 per cent. Business callers were the main users of the service. Except for the busiest period between 3.00 and 5.00 pm (10.00 am and 12 noon New York time) calls were connected within about 10 minutes and, as the *Post Office Magazine* proudly announced in 1957, "It is rare for any call to be delayed beyond an hour, except for causes outside the operator's control." During its first year of service TAT 1 carried twice as many calls as the radio circuits had done in the previous 12 months — about 220,000 calls between Britain and the United States, and 75,000 between Britain and Canada. This brought in £2 million revenue to be shared between the three countries.

The first transatlantic telephone cable was regarded in 1956 as a major technological achievement, not least as a base for future research and improvements, developments which have led to the sophisticated transatlantic project of 1987.

Bottom: the final splice in the TAT 1 cable.

Miss G Jones-Lewitt is a research assistant with BT Archives.

BIX*

External Cross Connect System

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Martlesham Medal winner Bill Ritchie with the 'juke box' style video disc handler.

Bill's a winner, says juke-box 'jury'

A research engineer who developed a switched star multi-service network, the most advanced operational cable TV system of its type in the world, is the latest winner of British Telecom's Martlesham Medal – the prestigious award named after BT's leading information technology centre.

Mr Bill Ritchie has spent almost two decades developing and improving telecommunications transmission systems. His world-leading switched star network which is now being installed and operated by Westminster Cable TV Ltd, is an important step in the development of the integrated television and telecommunications local networks of the future.

The pioneering system is a series of firsts: the first and only one in commercial service in the UK which was designed from the outset to integrate electrically the distribution of television and telecommunications signals; the first and only commercially operational system in the world capable of providing fully interactive video library services, meaning full bandwidth moving pictures; and the first TV system in the UK to use optical fibres as a major means of distribution.

Mr Ritchie joined British Telecom in 1949 as a youth-in-training. After working as a technician and gaining a BSc in Electrical Engineering he realised his long-standing ambition to work in research and development by moving to the, then, Post Office research department at Dollis Hill in North London. After 10 years of research on microwave radio systems in 1980 he was appointed head of the digital transmission research division and began his work on broadband networks.

Following the recommendation of the

Government's Information Technology Advisory Panel (ITAP) which advocated the introduction of multi-service networks, Mr Ritchie and his team undertook the design and deployment of a wideband network for commercial applications which would carry a range of TV and related services and also be capable of enhancement to carry data and telephony.

Entertainment television was to be the initial service, but the network was to be capable of carrying telecommunications. It was a difficult brief as Mr Ritchie and his team were virtually starting from scratch, having to design and specify equipment prototypes, identify commercial manufacturers, and take the designs through to manufacture. The system then had to be commissioned and installed, all within a two year timetable.

First trial transmissions were made over the network in 1984, and in April of the following year BT began installation of the Westminster Cable TV network. The first customers were connected in June 1985.

The initial system was designed to carry 32 TV channels, 12 FM stereo radio channels and provide a series of text services including local community information. It will also give customers access to BT's Prestel and Telecom Gold (Mail Box) services. Customers can receive videotex on unmodified TV, and the system can also provide video door entry security services using customers' existing sets.

Currently on trial on the network are important new services including: Video Library which enables customers to select for individual viewing the film of their choice from interactive video discs; Photo Videotext offering magazine quality still pictures which can be selected by customers. This service is especially suitable for advertisements; Point to Point Data Transmission up to 9.6 Kbits/second; and Viewphone which is a point to point view telephone service enabling customers on the network to see and speak to each other.

Other services which the network has the capability of providing include telephony, switched video telephony, high speed data services (up to 64 Kbits/second) with access to the packet switched service, home shopping, home banking, Electronic Yellow Pages, and video games. With further enhancement the network can provide high definition TV, the next generation of TV picture standard, giving vastly improved picture quality and making large TV screens possible.

The network is now used by thousands of customers, including major London hotels, and it has come to be recognised as the most advanced operational multi-service cable TV system of its type in the world.

A switched star network architecture was chosen to be most suited to carrying TV and non-entertainment services. It combines the high-information bandwidth of TV networks with the two-way transmission and switching capability of telecommunications networks.

The problem Mr Ritchie and his team initially faced was to reach a compromise between the relatively cheap but inflexible tree-and-branch network architecture and the prohibitively expensive star configuration.

At this time cable TV had almost exclusively used a coaxial tree-and-branch network. It is an economical method of distributing TV and an effective means of controlling customer access.

But when it comes to handling the very large numbers of individually routed signals required for a comprehensive interactive service package, problems of congestion, delay, addressability, and security become severe. Also, since all information is delivered to every part of the network, increase in capacity can only be achieved by augmenting the whole network, including the final customer link which involves most of the cost.

A star network largely overcomes these problems but the cost and engineering complexity of broadband links from the head-end to each customer is prohibitively expensive at the moment.

In a switched star network, communication between the head-end and a switch point located near to the customer is by shared trunk circuits. Communication between switch points and the customer is by individual links which carry only the information requested by the customer. The switch point acts as a common access point and message concentrator, effectively utilising the head-end-to-switch-point transmission capacity.

The system's optical transmission comprises groups of single-model fibres, carrying eight video channels per fibre, which radiate from the head-end to remote switches, usually street-sited. Hubsites act as relay and fan-out points.

The fibres are divided into two groups. For TV distribution, optical tapping is used to broadcast channels to groups of switches. And for interactive services, which require individual channels to be established between customer and head-end, groups of fibres are dedicated to each switch.

The control room at Westminster Cable TV.

All hardware alarms and fault reports are routed via the control system to the Control Room which also contains equipment for continuously monitoring the off-air and satellite programme sources. Each fault report is logged as it arrives, and it stays current until it is cleared. Long term trends and problems can be identified as fault statistics are generated from these records. Error messages generated as a result of software problems are sent to the Computer Room and dealt with in a similar way. ■

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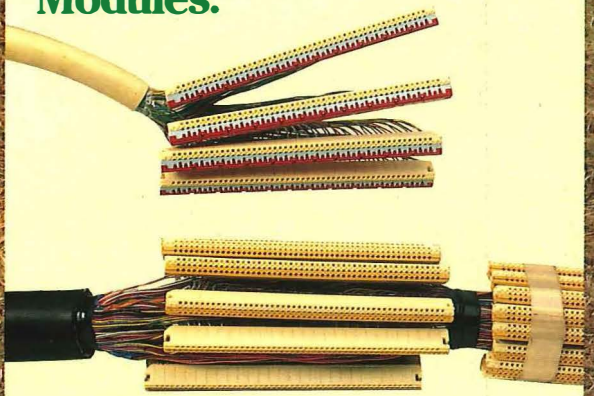

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Active service

British Telecom has dramatically increased the quality of service offered to customers in the last year. The new Quality of Service Report, the second in a six-monthly series, shows substantial improvements in BT's performance in areas which most affect the daily lives of customers.

And BT will be offering compensatory payments in cases where installation or repair performance slips below specified standards, a unique commitment as no other telecommunications company in the world has made such a promise.

The report says that 90 per cent of faults are now cleared within two working days, compared with 74 per cent in March 1987. Customers can now report faults 24 hours a day, seven days a week to staff who can be relied on to pass the information on to the repair service. At the same time BT is putting into place the procedures, systems and equipment which will support managers and staff in their aim to repair faults within half a day (five working hours) for business customers and one day (nine working hours) for residential customers. Minor faults that do not affect service should be rectified within three working days.

The compensatory payments will come into effect from April 1989, and if BT takes more than two working days to restore service on one of its lines it will pay the customer five pounds for every extra day's delay. Or BT will accept liability for claims for loss up to £5,000 for business customers and £1000 for residential customers where such a loss can be proved.

Performance figures for the installation service have also risen significantly. Now 60 per cent of business installations are carried out in six working days compared to 28 per cent in March 1987. And 62 per cent of residential installations are now carried out in eight working days compared to last year's figure of 18 per cent.

Market research has shown that customers want installation work to be carried out by agreed appointment for a convenient day and time, and they expect BT to keep the appointment without fail. This is the quality of service which BT has set itself to meet by March next year.

Operator services have improved with 87 per cent of operator calls and 81 per cent of directory enquiry calls being answered in 15 seconds. Operators now handle more than a billion calls a year and the directory enquiry service in particular is growing rapidly. In certain parts of the country at certain times of the day it is often impossible to get through first time and BT is working to reduce the congestion both in the network and directory inquiry service. A trial scheme is being run by which large business users of the service have their own terminals and direct access to directory data bases, with ex-directory numbers removed.

A national average of 92 per cent of payphones are now in working order, fulfilling BT's promise of 90 per cent made last October when the working figure was 76 per cent. It is now hoped to bring March 1990's target of 95 per cent serviceability forward a year (see Vanquishing the Vandal, p12).

The whole of the UK network is being modernised. The new digital and optical fibre trunk network has been fully installed and more than 60 per cent of trunk call traffic has been transferred onto that new network. In the rest of the network two new digital exchanges are being installed a day – a far quicker pace than is being achieved by any other telecommunications company in the world (for an in-depth look at the network, see Casting the Network, p32).

Other forthcoming developments aimed to improve BT's service to customers are the new customer service system and itemised billing.

Falklands calling

The Falklands is one of five new countries that can now be dialled direct by British Telecom customers from anywhere in the UK. The other four are The Central African Republic, The Marshall Islands, Micronesia and Mali. Together, they bring to 185 the total number of countries available through BT's International Direct Dialling service, 98 per cent of the world's 600 million telephones.

There are about 60 telephones listed in the Falklands, most belonging to the growing number of shipping and fishing companies. The new service will give them easier access to services such as facsimile and data transmission.

Calls will be routed via the Telecom Tower in London to Madley satellite earth station in Herefordshire. They will then go to an Intelsat satellite in stationary orbit above the equator and down to another earth station in Stanley.

International Direct Dialling is celebrating its 25th anniversary this year. The first direct dialled call was made from London to Paris in 1963.

Man-handling cable

A £6 million record-breaking optical fibre cable between Britain and the Isle of Man has been successfully inaugurated by a video call between London and Douglas.

The cable carries speech, data, text, graphics, facsimile and pictures on laser light pulses which travel the entire 56 miles of each thin glass fibre without intermediate boosting. This achievement makes it the longest 140 Mbit/s unregenerated system in Europe – and probably the world – in commercial service.

The new cable was supplied by STC Submarine Systems. It is the latest step in converting the Isle of Man network to digital operation by 1990. Manx Telecom Ltd, the BT subsidiary responsible for running the Isle of Man's telecommunications services, has already installed 126km of optical fibre in links between its exchanges on the island.

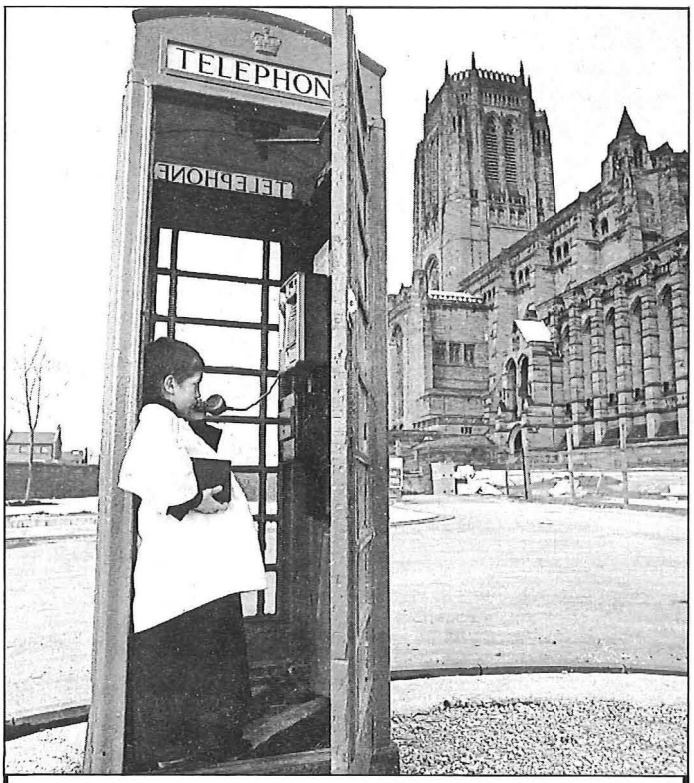
A £7.2 million submarine fibre cable has also been successfully laid by BT between the UK and the Republic of Ireland.

When it comes into service this summer it will become the world's longest optical fibre cable in use without the need for intermediate boosting. It runs 80 miles (24 miles longer than the Britain/Isle of Man link) between Porth Dafarch, near Holyhead, Anglesey and Portmarnock in the Irish Republic. The cable is jointly owned by BT and Telecom Eireann, and has been supplied by Submarcom.

It has 12 fibres of which six will be in use immediately the cable comes into service. Each pair of fibres will support a system operating initially at 140 Mbit/s which will give each pair of fibres a capacity of nearly 2,000 simultaneous phone calls.

The cable was laid by BT's cableship CS *Alert*, in collaboration with her sister ship CS *Monarch*. To avoid the risk of damage to the link by activities such as trawling, both the Irish and the Isle of Man cables were buried about a metre below the seabed during laying by ▷

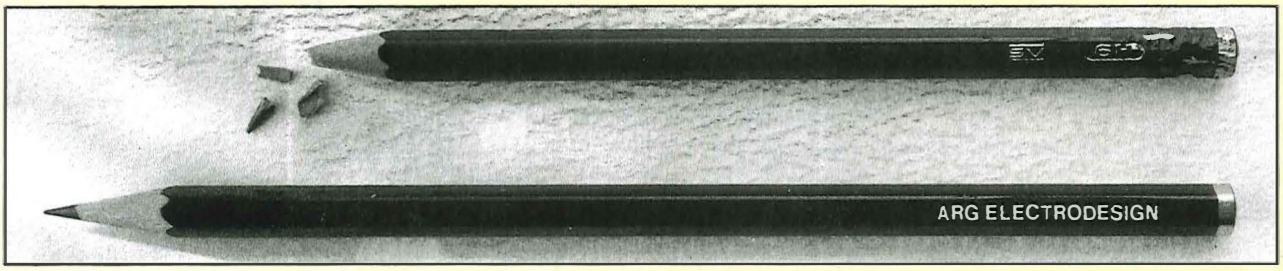
HEAVENLY CALL



Architect Sir Giles Gilbert Scott's most famous design was Liverpool's Anglican Cathedral which took 70 years to complete and was his biggest achievement.

But Scott's smallest work has also been part of the nation's way of life for half a century – the old red telephone kiosk. It was created by Scott in 1927 when he won a competition to design a new phone box for the GPO. He followed that success with a modified design in 1936 to mark the Silver Jubilee of King George V.

British Telecom has recently marked the range of Scott's talent in Liverpool by presenting one of the red kiosks to the cathedral (above).



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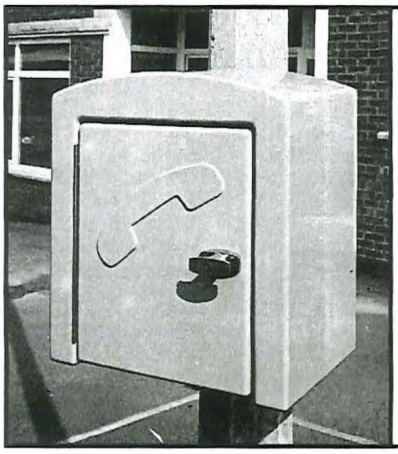
Schemes available: (i) Full-time 9 months, or 12 months (for those going on to do research), (ii) 6 months at University plus 6 month industrially-based project, (iii) Part-time over 2 or 3 years. For UK applicants the course is supported by SERC Advanced Course Studentships and by Industrial Scholarships.

Further details are available from the Telecommunications Admissions Tutor, Department of Electronic Systems Engineering, University of Essex, Colchester, CO4 3SQ England. Tel: Colchester (0206) 872418. Fax: (0206) 873598 (GPs 3/2 Auto).



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BT's special purpose seabed plough.

The Manx cable was laid by MV Flexservice 3. This is a multipurpose twin-screw vessel designed primarily for all kinds of laying work in the North Sea. Her twin screws and four transverse thrusters - two in the bow and two astern - are controlled with the aid of a computer. These enable her to maintain a fixed position over the seabed irrespective of tidal flow and wind speed and direction - essential for cable laying and jointing.

Caring by computer

One of the world's most challenging computing projects is being introduced throughout British Telecom to transform its service to customers.

Already more than five million telephone customers are benefiting from this multi-million pound development, and by the end of next year all 23 million customers will be able to experience its advantages.

The project - British Telecom's Customer Service Systems (CSS) - is already in use in seven out of BT's 28 districts.

All staff in each district who deal with customer orders for service or equipment, enquiries about phone bills or faults can have instant access to one integrated database about customers. This database contains information about lines and equipment rented, recent phone bills, faults and other service details.

Each time a customer calls with an enquiry, the customer service employee taking the call is able to see at a glance when and why the customer called previously, who dealt with it and the action taken. If several problems are raised during the same call - such as mentioning an intermittent fault on the line while querying a bill - they can be dealt with by the same individual then and there.

If a particular problem proves too complex for first line staff, it is passed to a specialist who also has access to CSS.

On receipt of an order from a customer, the CSS computer automatically creates a list of the necessary jobs to be undertaken and these are immediately transferred to the appropriate departments for action. No time is wasted in getting the job on the move.

Development of the major customer-interface facilities took less than three years - extremely short for a project of this scale. It was started following a detailed study in 1983, headed by Mr Iain Vallance, now Chairman of BT. This revealed a number of fundamental weaknesses in the computing systems then being used by staff in dealing with customers' enquiries.

The main shortcoming was inaccessibility of information caused by incompatibility between different computer systems. Because of the need to transfer information from one system to another, information about the same customer could be out of date and inconsistent. As a result, customers making enquiries would often have to make several calls to different departments within BT. And if these persons were not available when customers called back later with a follow-up enquiry or to check progress, they often found that staff in other units were unaware of the situation. CSS will end this telecom shunt.

The design and development of CSS is an all-British project, executed by BT with assistance from Logica. There is nothing comparable to it anywhere in the world, and already enquiries from Japan, the USA and Europe indicate that it may prove to be a significant foreign currency earner.

A typical district has about 5,000 staff serving 750,000 customers. Its CSS computers will store up to 500 million characters - equivalent to several thousand copies of the Encyclopaedia Britannica.

Following the first pilot implementation in 1986, introduction of CSS is now fully underway. The districts where CSS is already in use are: South Wales (Cardiff, Swansea and Newport), Thameswey (Reading, Slough and Guildford), East Midlands (Northampton), Liverpool, Manchester, Sheffield and Lincoln, and the North East (Newcastle, Middlesbrough and Sunderland). During the next few months it will be implemented in Severnside (Bath), South Downs (Brighton and Portsmouth), South Midlands (Bedford and Luton) and Northern Ireland.

Kenya talks

British Telecom Teletrade is negotiating with Communication Supplies Limited (CSL), a London-based export and marketing company, for the further supply of 107 UXD5 exchanges and related transmission products and services for use in the Kenya rural telecommunications network.

CSL have previously obtained substantial contracts with the Kenya PTC supported by equipment supplies and services from British Telecom Teletrade which were featured in the last issue of the *British Telecom Journal*.

Scotch eggheads

British Telecom is to establish a £5 million centre of excellence in advanced technology in Scotland. It has decided to site its latest Systems and Software Engineering Centre in Glasgow.

The new centre, the fifth to be established by BT's Research and Technology Executive, will employ graduates from Scottish universities and polytechnics to meet BT's continually expanding need for expertise in developing high-technology systems.

These centres design and develop computer-based systems and associated software for other parts of British Telecom.

About 15 staff will be employed initially, and this is eventually expected to grow to more than 100.

Fingers do the talking

Yellow Pages have launched a new telephone service, the most sophisticated and comprehensive of its kind in Europe.

Called Talking Pages, it is being trialled in Brighton and Bristol until the end of the year, and offers a hugely-expanded Yellow Pages computerised database operated by specially-trained staff.

By further developing the database to include such information as opening hours, credit cards accepted, special terms and services offered, users need only the most minimal knowledge of the company to get the required information.

For example, the user may say to the operator, "I drove past a restaurant in North Street with a French-sounding name, can you help?" The operator would then key in 'restaurants' and the name of the street and arrive at a list of the ones situated there. From here the operator would be able to advise which of those were French, based on data given by advertisers. Once the name of the restaurant had been arrived at to the user's satisfaction, the operator would be able to give additional information such as days and hours of opening, size of restaurant, price range, credit cards accepted and if car parking was available.

Each registered business telephone line in the Brighton and Bristol Yellow Pages areas is listed on Talking Pages, but additional comprehensive data is provided by those who advertise in the service. This would mean that, using the restaurant example, if there were no advertisers in the restaurant section a list of ones in that street would just be given to the caller.

The service is free to advertisers until September. Those using the Brighton service are charged at M rate, 38p per minute peak and standard rate and 25p per minute cheap rate nationally. For Bristol the local standard rates apply in the Bristol area and normal BT rates apply for calls made into the area. Since the amount of information and the service's success depend ▷

East can now meet West through British Telecom's world-leading voice translation system which has just been extended to Japanese.

Bridging the language barrier, it allows people who do not speak a word of each other's language to communicate directly.

The computers at the heart of the system can recognise the spoken word - be it English, French, German, Spanish, or now Japanese - and deliver a translation almost instantly.

A speech synthesiser then reproduces the message in the other language as well as displaying it in text on the screen.

on the number of companies who take part, the premium charge rate M is being made in Brighton to test whether it is possible to reduce the cost of advertising by gaining income from service users. A comprehensive research programme seeking user and advertiser reaction is taking place in both areas, and this test period will be used to determine final advertising and call rates.

Brighton and Bristol were chosen to introduce the service because their mix of population base, commerce, industry and tourism provide the required test environment. Brighton is also an appropriate choice as it was there that Yellow Pages was launched 21 years ago.

Callers throughout the UK can use the service from 8am-9pm daily. The Brighton number is 0898 900 800, and Bristol's is 0272 299 992.

A new page

Pakistan's largest radiopaging system is to be supplied by British Telecom. International Products Division (IPD) has won a contract to provide the local radiopaging system at the Aga Khan Hospital and Medical Centre in Karachi. The network of 200 pagers, used mainly to contact hospital staff, will give quicker response to emergencies.

The contract was awarded to Teletrade, an IPD export unit marketing telecommunications equipment worldwide.

The Aga Khan, a general hospital, is one of the largest and most modern in Pakistan.

Matter of fax

A compact, portable facsimile machine recently launched by British Telecom breaks new ground in the business equipment market. Selling at £995, the CF9 is not only the first fax terminal priced at under £1,000 but it also has the same features as many machines currently costing twice the price. It weighs just under eight pounds and is little bigger than a modern portable typewriter.

The UK fax market has grown rapidly since 1985 when 20,000 new fax machines were installed. By 1986 that figure had more than doubled, and in 1987 an additional 96,000 were sold in the UK. BT estimates a total of 180,000 new installations in 1988.

Beneficial service

British Telecom has won a major information technology order worth more than £8 million for a scheme to help the Department of Health and Social Security (DHSS) in the payment of benefits.

The project is to place computers in 500 DHSS local offices throughout the country. BT has also supplied 850 M4000 microcomputers and upgraded 1,700 existing machines as well as providing two larger M6000 Unix-based minicomputers and associated software. The two contracts make up BT's largest ever order for information technology systems.

The order, for the DHSS's Local Office Micro Project (LOMP), is an extension of an existing contract worth £10 million under which BT supplied 2,900 microcomputers. It follows government legislation requiring the DHSS to implement two new benefit procedures, Social Fund and Income Support Assessment.

The computer equipment will enable DHSS staff in the local offices in England, Wales and Scotland to assess complex Income Support claims and administer applications to the Social Fund.

Belize bid

British Telecom is to acquire a 25 per cent share of the equity stock of Belize Telecommunications Ltd (BTL).

BTL is a recently formed public company responsible for national and international telecommunications services. The Belize government will retain a 51 per cent holding in the company while 24 per cent will be offered to the country's citizens.

BTL is currently starting a programme to double the size of its domestic network to meet customer demands. The introduction of new equipment, including digital exchanges, will mean an improved quality of service.

Mr John King, Managing Director of British Telecom's Overseas Division, said that apart from financial investment, BT will continue to make available its considerable operating and technical expertise to the venture. He added that the cost of the shares, which will be in cash, amounts to less than one per cent of BT's net assets.

Royal money-box

An historic K6 red telephone kiosk has been used as a giant money box at an agricultural show in Australia.

The kiosk was presented to the British Pavilion of the Sydney Show by BT's Teletrade Services, with the assistance of the Overseas Coordination Unit, and raised 2,700 Australian dollars for the Save the Children Fund. And sealed bids to purchase the kiosk included one for 5,000 Australian dollars.

Princess Anne, whose favourite charity is the Save the Children Fund, was in Sydney to open the show and was told that the kiosk had originally come from Ashford in Kent where it was sited at the junction of Sandringham Drive and Queen's Walk.

Former Chairman dies

Sir William Ryland CB, Chairman of the Post Office Corporation from 1971-77, died recently aged 74.

Under a series of Ministers, Sir William was the principal architect of the total recasting of Post Office Telecommunications between 1964 and 1977. Former Managing Director of British Telecommunications Inland Division, Mr J M Harper believes it was as a direct result of Sir William's oversight that the business disciplines of industry were substituted for the administrative practices of a government department, and that it was due to him that modern management techniques were instituted.

Sir William rose steadily through the Post Office hierarchy after starting as an apprentice engineer in 1931. During the war he became a colonel in the Royal Engineers Postal Section. Principal Private Secretary to two Postmasters General, Sir William was Director of Inland Telecommunications from 1961-65, and Managing Director of Telecommunications from 1967-69. He took over as acting Chairman in November 1970.

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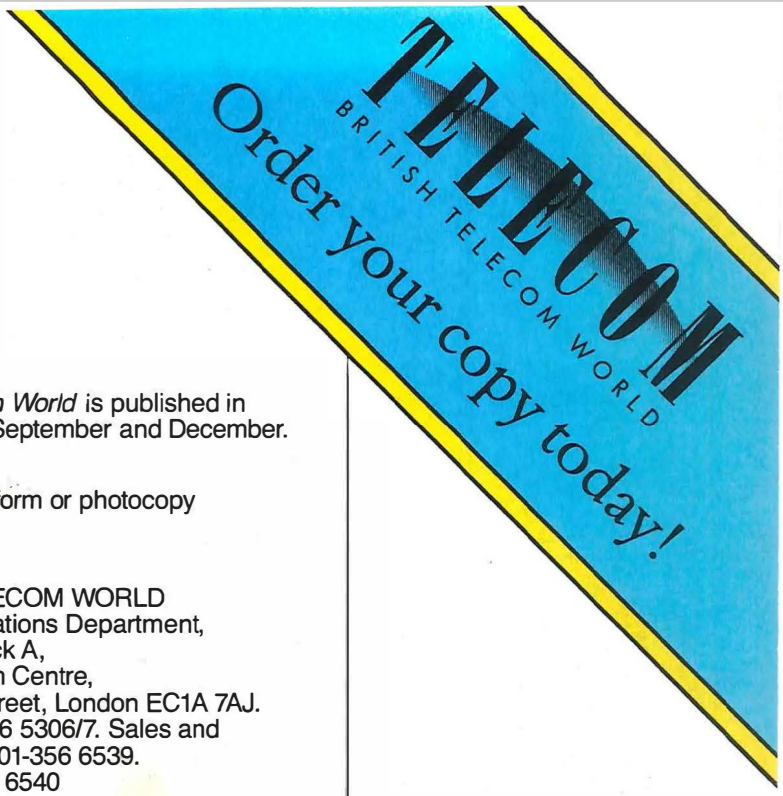

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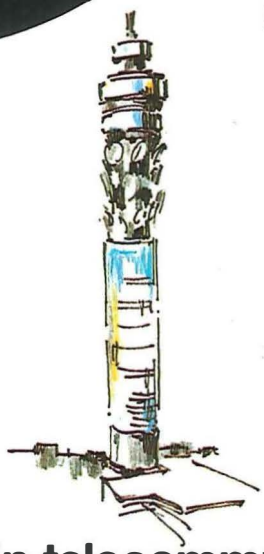

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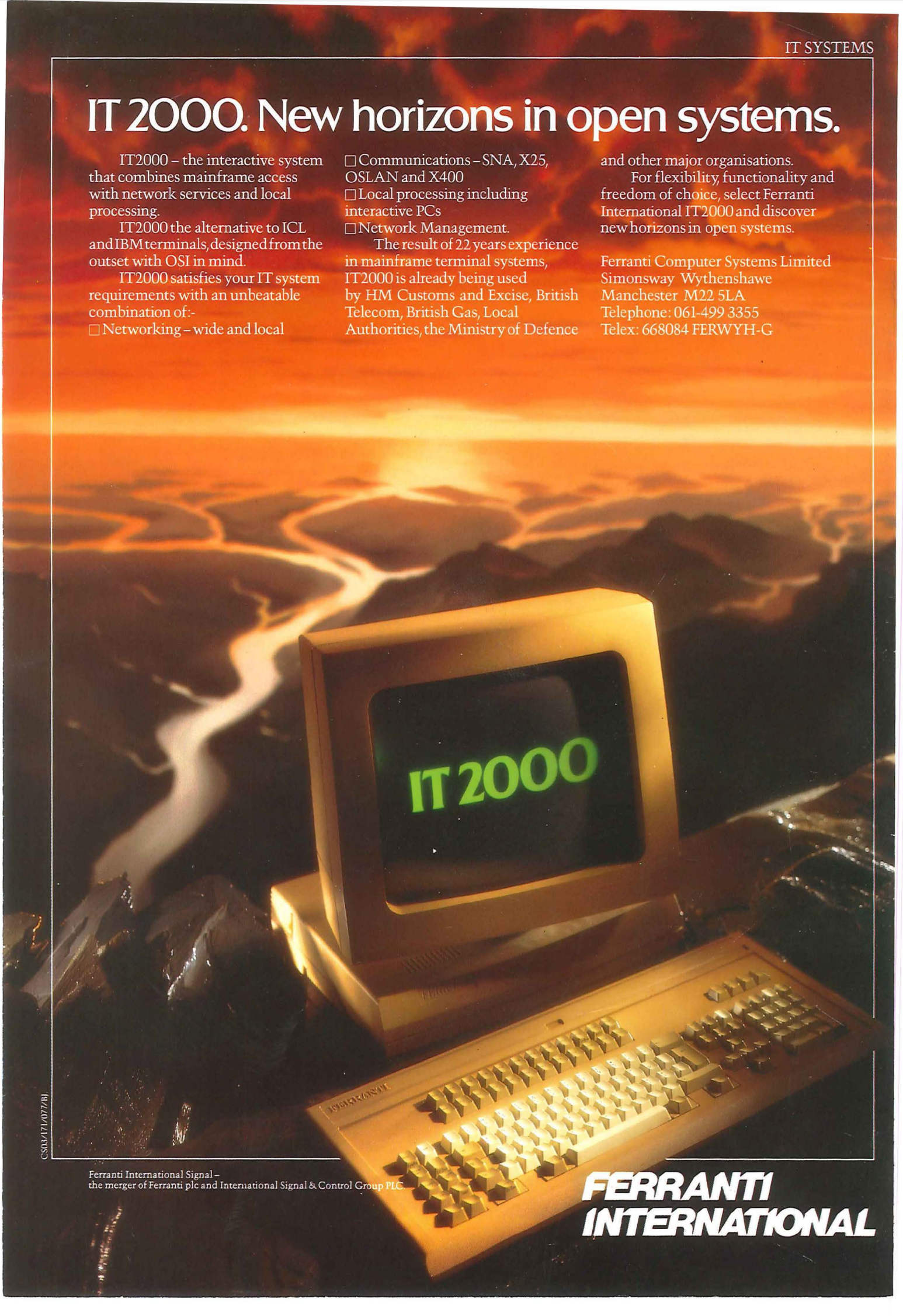

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