Maintenance News

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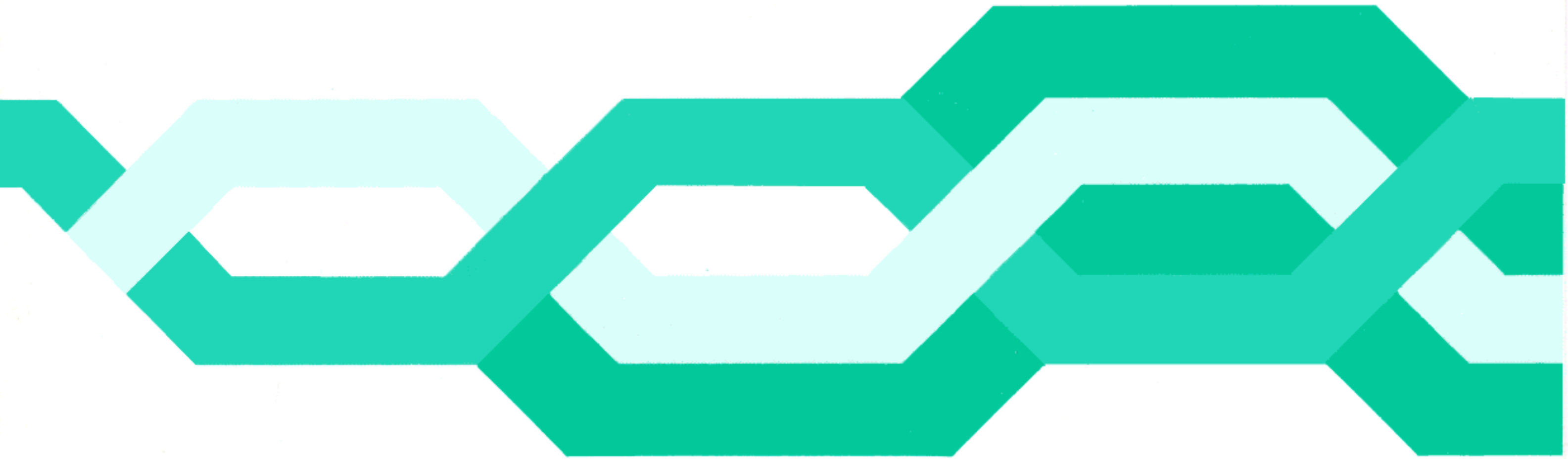

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Maintenance News

Maintenance News aims to provide a medium for two-way communication between maintenance engineers throughout British Telecom. If you want to write about anything you may have seen in *Maintenance News*, or indeed, about any maintenance topic, send your letter to: The Editor, Maintenance News, Room 301, 203 High Holborn, London WC1V 7BU. Say what you like, but the Editor may tone comments down if he decides to publish. Do please give your full address.

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Editorial

Many bright ideas emerge as a direct result of someone wanting to do a job more effectively – often spurred on by a need to be a little more precise for technical reasons. Such is the background to the National Networks' article on RAPID in this issue. This ingenious solution brought about because of a need, has a direct bearing on the quality of service offered to our customers. If such an article stimulates similar thoughts in the minds of our readers, then *Maintenance News* is playing a useful role.

Also in this issue, Frank Lawson's timely article does much to unravel the mysteries of the new BABT approvals scheme.

My own contribution – entitled 'Fifty up' – focuses on the expanding range of electronic units being repaired by Area Repair Centres. The large numbers of items repaired by Areas reflects credit on those concerned. The high-technology devices used in today's electronic equipment often requires the sophistication of automatic test systems to reduce out-of-service times to a minimum. This is yet another aspect of ensuring that Areas can give an effective back-up to customer service.

–Editor

Star Services on analogue exchanges

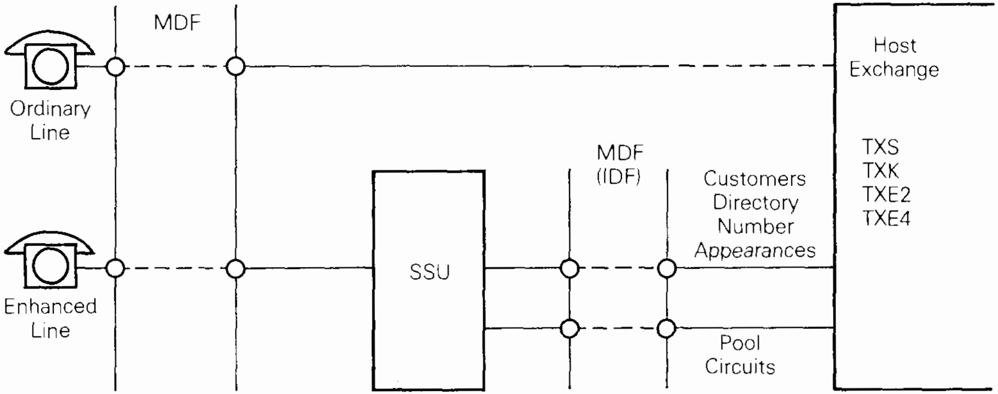
by **Carlyle Smith** and **Allan Hogg** LES5.4.1

System X exchanges will provide a range of additional facilities for customers connected to them. Despite British Telecom's plans for the rapid introduction of System X (digital) exchanges into the network, there will still be a significant number of lines connected to non-digital (analogue) exchanges well into the 1990s.

For this reason British Telecom embarked upon a programme for the enhancement of analogue exchanges to provide the top eight facilities – known as Star Services. A pilot scheme for analogue enhancement was launched in 1982 when a number of firms were invited to tender for the supply of suitable equipment. Two manufacturers, TMC and IBM, were selected, and each contracted to supply equipment for enhancing 50,000 lines in some 200 analogue exchanges.

The replies to the tender suggested a number of approaches to analogue enhancement. However, both the TMC and IBM equipments can be described loosely as 'front-end black boxes'. These 'black boxes' are processor-controlled switches which are connected between the customers' lines and the host exchange line circuits via the MDF and IDF. Figure 1 shows the arrangement. →

Figure 1. Star Services using a 'Black Box'



The eight Star Services being provided were chosen after consideration of the marketing potential and their ease of implementation. The services are:

Code calling

By using a short dialling code, frequently-used numbers can be recalled from a store and passed to the host exchange; the store capacity is 27 short codes.

Repeat last call

By using a short special code the last digits dialled by the customer can be extracted from a store and passed to the host exchange.

Charge advice

Provided a request is made immediately prior to or during a call, the customer will be rung at the end of the call and the call charge given.

Reminder call

A reminder call can be programmed to mature either within 24 hours of the request being made, or in accordance with a weekly programme.

Call diversion

The customer can use one of three forms of diversion to have calls diverted to another nominated number: divert all calls, divert on no reply, and divert on busy.

Three-way calling

A customer engaged on an incoming or outgoing call can bring in a third party, thus creating a three-party conference call.

Call waiting

A customer engaged on a call will be alerted by a short tone if another call is made to his number. He then has the option of ignoring the new call, or accepting it after having put the existing call in hold.

Call barring

The customer can bar incoming calls; he can also bar all outgoing calls or he can select the categories which he wishes to bar, for example NND, ISD and so on.

All the above services are customer controlled; and appropriate announcements are given to the Star Service customer concerning the state of the equipment or the call in progress. The announcements are stored in semiconductor read-only memory (ROM).

For some services – call waiting for example, it is necessary to leave the customer's normal calling equipment free while an outgoing call is in progress. This is achieved by steering outgoing calls through a common pool of exchange circuits. Pool circuits are also used for three-party and diverted calls.

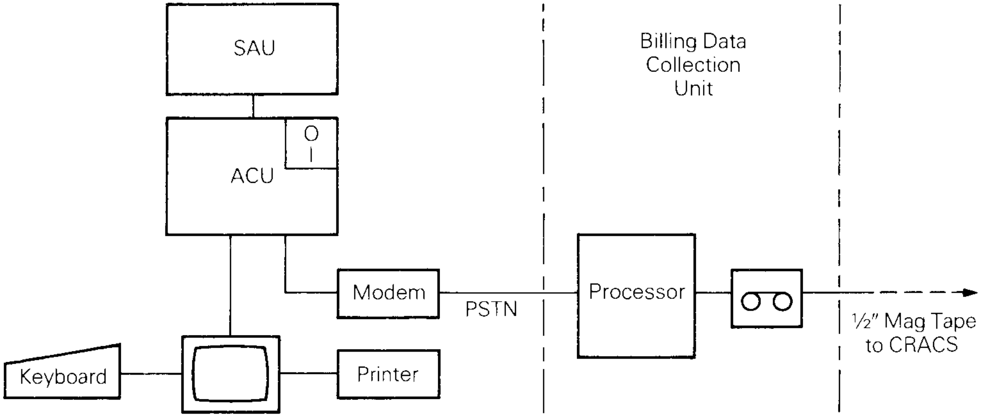
Call Charging

SSUs can generate call charging data for those customers connected to them. This data can be used for the production of itemised statements as well as for obtaining the bulked value of call units used. Itemisation of calls is not being offered as part of Star Services; but the itemisation data will be used to provide customers with a summary of Star Service call charges.

The mass storage medium for call charging data is magnetic cartridge, or magnetic tape using a cartridge format. The tapes or cartridges produced by SSUs are processed at the Cartridge Reading and Control Centre (CRACS), which produces an input suitable for one of the four billing computers which produce telephone bills. CRACS also processes System X call charging data, and by using the System X formats for SSU data, a common software package can be used at CRACS.

Although the IBM and TMC Star Service Units (SSUs) both use the 'front-end black box' philosophy, there are important differences between them. The following descriptions highlight these differences.

Figure 2. The IBM Star Services Unit



IBM SSUs

The IBM SSU consists of a service access unit (SAU) and an administrative control unit (ACU), as shown in Figure 2. The SAU has two identical and independent switching sub-units, each having a 480-port microprocessor-controlled non-blocking switch. One hundred and eighty ports are used for terminating lines from customers, and a similar number are used for connection to customers' calling equipment on the host exchange. All outgoing calls are made through a pool of 35 lines on the host exchange. Incoming calls are completed by connecting the customer's exchange appearance to his line appearance. The two sub-units share a recorded announcement system (RAS), a common − 50V DC supply for feeding line current, a ringing voltage supply and the interface to the ACU.

The ACU is an IBM Series 1 minicomputer, and provides backup storage, maintenance facilities, and data input and retrieval facilities. The backup storage medium is a 1 megabyte diskette, and holds – in addition to certain data and programming information relating to the Series 1 – call records, exchange data, and customers' facilities data. Communications with the ACU is through a VDU and keyboard, and hard copy can be obtained from a printer.

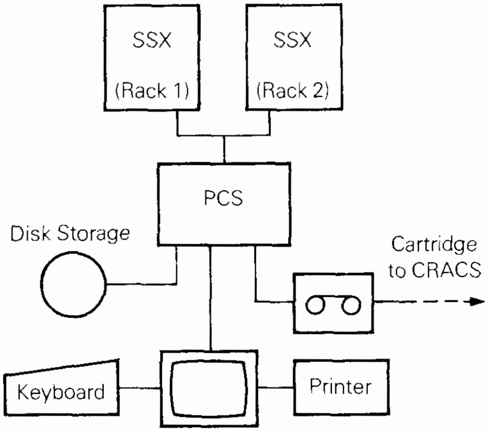
Charging data from IBM SSUs is collected by a central data processing system, sometimes called a billing data collection unit (BDCU). The BDCU will poll each of the 139 IBM SSUs once every hour using the pstn. Output from the BDCU is on ½ inch magnetic tape using a cartridge format; it is therefore suitable for direct input into CRACS.

The BDCU also provides a further level of backup for Star Services data, such as customer activation status, time reminder service calls and so on. In the event of a diskette failure the SSU will call on the BDCU to 'down-load' the data.

TMC SSU

The TMC SSU, like its IBM counterpart, consists of a switch – the Star Services Exchange (SSX), and a control computer – the peripheral control system (PCS). The arrangement is shown in Figure 3. The SSX has 12 identical and independent switching sub-units, each capable of handling 48 Star service lines. Each 48-line module has its own microprocessor, announcement machine, outgoing pool lines and so on; but they all share the alarm card, and, of course, the PCS. While all outgoing calls from the IBM SSU use pool lines, the TMC SSU steers its outgoing calls either over pool lines, or the customer's exchange appearance, depending on the Star Services which are activated when the call originates.

Figure 3. The TMC Star Services Unit



The PCS is a Data General Eclipse minicomputer, with Winchester disk as well as diskette for backup storage. It performs the same main functions as the IBM equivalent; however, call charge data is stored on magnetic cartridges, which are sent to CRACS for processing.

Maintenance Philosophy

The basic approach adopted is to diagnose faults down to PCB level on-site, change the faulty parts, and repair off-site in Area Repair Centres (ARC) where possible.

There will inevitably be some cases where the SSU faults are beyond the ability of the exchange maintenance staff to cure. To cover this aspect regional back-up groups are being trained, and a fault escalation procedure will operate in stages from exchange to Region, Region to THQ and THQ to prime contractor.

To implement this philosophy British Telecom HQ has arranged:

- For the training of staff to an appropriate level for their particular function, that is,
  Tier 1: for on-site maintenance staff so that the equipment can be operated efficiently and faults located and cleared speedily.
  Tier 2: for Regional back-up staff who will have a second training course designed to provide them with a greater in-depth knowledge of the system. They may also have specialist test gear for locating obscure faults.
- For spares to be held
  On-site: generally speaking those cards which, if faulty in service, could cause loss of service to some or all of the customers connected. Consumable items are also held.
  Off-site: generally those cards which, if faulty in service, would cause a degradation of →

customer service. Additionally some complete units – for example, VDUs and printers and so on are held in reserve.

- A 12-month warranty for the equipment. During this period, faulty boards will be returned to the contractor by Regions, or ARCs, for a free exchange. Both British Telecom and the prime contractors will want to inspect any faulty equipment to look closely for any design or component problem that may appear, and to check the system's reliability.

Arrangements for the repair of any faulty equipment after the expiry of the warranty period differ for each contractor. For faulty IBM boards, the present policy is not to repair, but to replace with new ones. However we are still negotiating with IBM for a change to the present arrangements, thus enabling British Telecom to repair faulty cards.

In the TMC case, the Company are providing British Telecom with all the necessary information to enable the ARCs to undertake the normal repair functions, and the new Computer Aided Record System (CARS) will be used to check failures.

The performance of the enhancement systems will be closely monitored in the early stages of customer service. Statistics generated by the SSUs, the SSU exchange fault log and customers complaints will be used to:—

- Monitor traffic patterns
- Monitor the use of the individual services for marketing
- Check the equipment provisioning standards
- Monitor the reliability of the equipment, and
- Highlight any design problems and component failures that occur.

Initially, these statistics will be collected monthly, but will be reviewed in the light of experience gained and extended when the time is judged to be right.

Implementation

The allocation of sites between the two contractors was made on a regional basis. London is shared between both companies; TMC has for the four southernmost English provincial regions, and IBM the remainder of the UK. Installation of SSUs started in June 83 and was due for completion early this year. At the time of writing 5 units have been handed over by the contractors in Cheltenham, Stroud, Chippenham, Clerkenwell and Belgravia. Thus we are already providing a significant number of our customers with a range of services, that would normally be available only on processor-controlled exchanges, like System X.

(01-432 2456)

Seek and ye shall find

by **Claud White** LLS2.6.4

Effectively, the Health & Safety at Work Act requires those who excavate in streets, to locate electricity cables, to avoid risking injury to personnel. Here, Claud White introduces the Locator 8A which, together with a cable plan, enables the line of a buried cable to be determined.

There are two ways of locating buried power cables. One uses a simple low-frequency detector which picks up the 'mains hum' given off by a loaded cable. The Locator 2A is a typical example of this method. The other uses a generator and receiver combination – the Locator 1 family being examples of this method. The new Locator 8A combines both detection techniques, resulting in greater versatility.

Locator 8A

To meet British Telecom's immediate needs, proprietary equipment was bought from Electrolocation Ltd. Known as the Cable Avoiding Tool (CAT) and Genny, this equipment is already widely used by other national utilities, local authorities and major contractors.

CAT – the receiver unit – is known as Receiver Locator 8A, and the Genny (short for generator) is the Transmitter Locator 8A. Together they form the Locator 8A.

Tests under field conditions gave good results and – after some design improvements at our request – plant buried at depths over 2.5 metres has been located.

The CAT

The receiver has a unique twin search coil aerial system enabling it to locate the presence and position of buried underground plant by sensing its energy field. Three switch-selected operating modes are possible:

P – power mode. This picks up the 50Hz emission from most loaded power cables. A 50Hz signal may also be picked up from other nearby cables or metal pipes.

R – radio mode. Metallic plant is detected from re-radiated radio signals. Such signals are to be found on telephone and electricity cables and, although not present everywhere, provide a useful extra locating method. This mode is particularly useful in locating live but unloaded high-voltage feeder cables.

G – induction mode. In this mode the transmitter (Genny) is used to induce a signal into metallic plant, which can then be detected with the CAT (Receiver Locator 8A).

The Genny

The Transmitter Locator 8A is a low power signal generator used to apply a specific signal (known as a discriminating signal) to buried cables and pipes, so that their location can be readily detected. There are three methods of applying this signal:

Induction. By setting the function switch to 'I' the signal can be induced onto buried metallic plant, through up to two metres of cover – provided the transmitter is above, and in line with, the plant.

Magnetic Coupling. The function switch is set to 'C', the signal clamp is placed around the cable or pipe – subject to a limit of 75 millimetres diameter. The clamp is waterproof and can be used with a suitable rod to apply a signal to a cable in a flooded jointing chamber.

Direct Connection. The signal can be connected directly to a metallic duct, cable sheath or pipe at an accessible point, using a lead terminated with a large crocodile clip. A remote earth connection, about 10 metres away from the transmitter, is required, to ensure that a strong and distinctive signal flows along the cable sheath or pipe.

The transmitter can also be used as a metal cover locator – a useful facility after road resurfacing – to find 'lost' covers. With the transmitter held horizontally, just above ground, it gives a sharp change of signal when it passes over the edge of a buried cover.

Rules

Procedures for identifying buried cables differ somewhat between busy city centre, suburban residential area or an industrial site. But certain rules always apply:

1. Identification is an important part of positive location. This means applying the transmitter signal to the cable at an access point where it can be identified with certainty – including British Telecom's own plant.

2. Sweeping with the receiver in its P or R modes indicates the position of buried metallic plant. Its identity is then checked by applying a transmitter and tracing the plant.

3. Where possible, 'clamping' or 'direct connection' is preferable to 'induction' for applying the transmitter signal.

4. When the identity of a cable is vital, go through the normal procedure, then reverse it by inducing the transmitter signal onto the cable and tracing it back to the original point of application.

Safety first

When struck by digging tools, buried electricity mains power cables can cause severe injury to the person using the tool. It is stressed that no locator will detect and locate all buried live mains cables. TI A2 DO117 covers the safety practices applicable to excavation work to minimise the risk of striking an electricity mains cable.

(01-739 3464 Ext 7343)

The BABT rules – OK?

by **Frank Lawson,** Director, Regulatory Affairs (RA)

More and more people – British Telecom staff and customers alike – are becoming aware of the BABT. At the same time, as the Government's liberalisation programme rolls forward, more and more people notice the approval label on their new telephone. Some must wonder at the significance of the logo – a telephone handset above the initials BABT at the beginning of the approval number. It is likely that only a few of these people know that those initials stand for The British Approvals Board for Telecommunications – or realise what the significance of them may be.

Background

So who are BABT, what do they do and why were they established? To answer these questions let us look first at some aspects of the telecommunications regime of this country before the Telecommunications Bill became law in 1981. The need for ensuring that all equipment connected to our telecommunications system to meet certain standards had always been apparent.

Essentially, British Telecom – when still part of the Post Office – needed to ascertain that any apparatus – connected directly or indirectly – would not endanger our network or any of our personnel, and that subscribers would be able to enjoy satisfactory communication with one another. To achieve this British Telecom (formerly Post Office Telecommunications) published sets of technical requirements against which all apparatus could be tested for compliance. These took the form of Post Office Requirements (POR) – for apparatus under monopoly control, such as telephones and certain Datel modems – and Technical Guides (augmented by Suppliers' Information Notes) for attachments which we ourselves had liberalised.

Suppliers applied by submitting full technical documentation to us, and their equipment was usually subjected to physical testing. We had a vested interest in approving a wide range of attachments, reasoning that the greater their number, the greater the use of the network and so the greater our revenue. Because of this the charges for testing never fully represented the expertise and time of our attachment evaluation staff, or the expensive test equipment involved. These staff built up a warm reputation with suppliers because of the help they gave in enabling the technical requirements to be met.

New regime

The Telecommunications Act of 1981 sought to introduce changes in this area in two ways, both designed to achieve more competition. The first of these was by increasing the range of attachments and services that were open to competitive supply – eventually to include all subscribers apparatus. The second was to ensure that British Telecom could not compete unfairly with private suppliers over these new markets. We had to recognise that – however impartially British Telecom had in fact behaved in the past – a procedure whereby the organisation was set up as 'judge and jury' over their competitors was no longer appropriate.

Because of this the new Telecommunications Act provided for the Secretary of State for Industry to appoint two independent bodies, the first to prepare independent standards for telecommunications apparatus and a second to test and approve the apparatus against these standards. The British Standards Institution were given the responsibility for setting standards and for them this entailed extending their traditional procedures to encompass a new range of standards.

In the same way the British Electrotechnical Approvals Board (BEAB) were approached, to organise the new regime of attachment approval. Telecommunications was to them a completely new field and in recognition of this a subsidiary was formed – the BABT. Such a move could not be achieved without suitable finance and British Telecom, among others, made funds available to them in the form of a loan.

It may seem strange to some that we should make such a move to help a new body perform a task that had always been our own – stranger too, that the Director of British Telecom formerly in charge of such approvals work should make his experience available to them by sitting on their Board of Management! But this should just be seen as positive proof that we welcomed the new independent regime and had nothing to be afraid of when faced with competition.

How BABT works

So how exactly does the BABT function and what are its powers? The first point is that BABT is a wholly-owned subsidiary of BEAB. Both organisations are essentially non profit-making companies limited by guarantee. Control is through a Board of Management and, in addition to British Telecom, BSI, BEAB and the Department of Trade and Industry, various trade and wholesale associations are represented together with the Electricity Supply Industry. It is based at Hersham near Walton-on-Thames in Surrey.

The standards prepared by the BSI may be approved by the Secretary of State for Industry, which renders them mandatory requirements. BABT's sphere of control is primarily with apparatus covered by such standards but it can be extended beyond this as explained below.

In accordance with the authority from the Secretary of State for Industry, BABT undertakes the authentication of telecommunication subscriber apparatus in two categories. The first is apparatus which is subject to The Telecommunications Apparatus (Marking and Labelling) Order 1982 and the second is that which is not. In broad terms the former category relates to apparatus which is likely to be supplied by retail for domestic use – such as simple telephones. All the apparatus included within the scheme must be 'marked' either with a green circle – designating approval, Figure 1 – or a red triangle, Figure 2 – showing that the apparatus has not been approved.

All such apparatus submitted to the Board for approval is tested not just for safety to, and compatibility with, the British Telecom network but also for safety in normal household use, that is 'user safety'. Apparatus not within this

APPROVED for use
with telecommunications systems
run by British Telecommunications
in accordance with the conditions
in the instructions for use.

A/0000/AA/1984/AA

Figure 1. The Approved mark. The circle is coloured green.

PROHIBITED from
direct or indirect connection to
any telecommunication system
run by British Telecommunications.
Action may be taken against
anyone so connecting this apparatus.

Figure 2.The Prohibited mark. The triangle is coloured red.

category but approved by BABT must bear an Approval Mark quoting its approval number but not the green circle.

Essentially, BABT's procedure for approving apparatus is much the same as that previously employed by British Telecom. It differs in one important detail in that BABT do not have their own test laboratory. As a consequence, once the details of an application are known they are put out for tender for testing. The actual testing may then be subcontracted, either to British Telecom's own laboratories or to BSI's test facilities at Hemel Hempstead. BABT have also introduced a procedure known as Manufacturers' Delegated Testing (MDT) by which accredited UK manufacturers may submit their own test results. The MDT procedure is, of course, carefully monitored by BABT, to ensure that all relevant standards are met.

Another new procedure has been to enable checks to be made on manufacturers of approved apparatus to ensure that the equipment supplied is constructed exactly as it had been approved. Although these factory visits – which are conducted at evaluation and annually afterwards – are charged for, they may be seen as a necessary step to ensure that standards continue to be met. They are necessary, because BABT are not as well placed as British Telecom were previously to detect any deterioration in compliance.

On completion of the approval, the supplier is issued with a certificate and this is copied to British Telecom so that our register of approved apparatus may be updated.

Special tests

Suppliers may seek approval for apparatus which does not fall completely within the scope of an approved standard and BABT have introduced a procedure for dealing with such applications, known as the Special Investigation Test Schedule (SITS). A supplier may submit a product for approval which is within the scope of an existing approved standard, but which incorporates a design or construction which had not been envisaged when the standard was written, and for which appropriate requirements and tests had not, therefore, been included.

Some simple apparatus may not lie within the scope of a standard and again the SITS procedure may be involved. Also, when a standard prepared by the BSI has been approved by the Secretary of State but is not yet effective (there will usually be a delay period to enable industry to meet the new standards) the SITS procedure may be used to call up such a standard. If a SITS is required for an approval, a BABT Technical Committee is convened with representatives from BABT, British Telecom, BSI and DTI and an appropriate trade body. They may agree to ratify the SITS but only by unanimous agreement. →

If a piece of apparatus does not meet approved standards, or the conditions of a SITS, it may be possible for the application to be placed before a Certification Committee to determine whether or not the details of non-compliance give rise to a risk as defined in the Secretary of State's approval document for a standard – safety hazards, degradation of service to others, for example. Should it be decided that no risk arises, approval may be granted notwithstanding the non-compliance.

The range of apparatus for which BABT are the primary approval authority is effectively defined by the approval of relevant standards and as such will increase dramatically over the next few years. They are already responsible for simple extension telephones, modems (and devices incorporating modems such as facsimile terminals) and for telephone plugs.

Professional bodies

The introduction of such profound changes has not, of course, taken place overnight and several people have expressed disappointment at the slow rate of application submitted to BABT. Some have suggested that suppliers have been put off by the higher prices charged by BABT. Certainly charges are higher, but this is due in no small part to the fact that BABT must charge in full for the work conducted – being unable to offset the charges with network revenue – and the new requirements to test for user safety.

There can be no doubt, however, that BABT are a thoroughly professional body, with an organisation and the procedures to cope with the rapidly changing telecommunications situation in this country, with complete impartiality.

(01-357 3211)

This is FACT

– computerisation of trunk and junction cable defects

by **David Haffenden** TSO2.1.1

Responsibility for trunk (MU) cable maintenance rests with our maintenance group in National Networks, Trunk Services, Head Office (NN/TSO2.1.2).

Junction cable (CJ) is likely to become a LCS (Local Communication Services) responsibility. Until the transfer takes place, however it remains our concern.

At Area level, however, LCS staff maintain all MU and CJ cable, and the reports mentioned in this article are (at the time of writing) originated and processed in the LCS Areas or Regions. NN headquarters and their district offices will use some of the computer outputs described, as one means of monitoring the standard of MU cable maintenance. A report is required whenever a defect is found on a MU or CJ cable.

The recording and analysis procedures using the A298 and A209 forms, were computerised by British Telecom Midland. All their Areas started to use the system in 1980. From this, the national system – known as FACT – was developed. FACT – Fault Analysis of CJ and MU cables – aims to analyse details of all the located and cleared defects on both MU and CJ networks, and to provide a permanent fault history for each cable.

The analysis is performed on an Area, Regional and National basis. The system also gives information on the performance and upkeep costs of the MU and CJ cable networks – information previously provided by Areas and Regions on A2686 forms.

How it works

It starts with the collection of data by the External Plant Maintenance Centre (EPMC). Each MU or CJ cable defect reported to the EPMC is recorded on an A8805 form under the following coded headings:

- Date defect reported
- Cable code (MU or CJ)
- Cable number
- Type of cable (carrier or coaxial)
- Location of defect (between AP7 and 8)
- Type of faulty plant (lead sheathed cable or Case, Repeater)
- Position of defect in network (cable in duct or aerial cable)
- Cause of defect (corrosion or damage by British Telecom staff)
- Class of defect (effect on service)
- Date and method of repair

The A8805 information is transferred at the end of each month to a floppy disk. This is done either by the Area or Region by means of a small business computer (SBC). The VDU screen displays an outline of the A8805, and this has been found to improve the reliability of information transferred to the disk.

A pointer indicates the 'field' of required information, and this moves across and down the screen as entries are made. The operator has the opportunity of correcting information before it is finally transferred to the disk. The SBC program vets the data for input errors, such as an undefined 'cause of defect' code.

When all the information for a particular month has been entered onto the floppy disk, it is transferred to the IBM computer at Harmondsworth where it is stored. Three months' data for each Area is merged to form one quarter's dataset. For example, the merged data for the June quarter for Tunbridge Wells Area in South East Region, becomes: SETW. June dataset.

As well as the current quarter's data, the computer also holds a cumulative dataset for each Area containing details of all defects for the previous four quarters.

The FACT program

This is held on Harmondsworth's IBM computer and can be accessed by Areas and Regions when required. The various outputs are despatched to appropriate destinations by the Computer Centre. Figure 1 shows the five sub-programs of the FACT program.

Manhour program – this is run at the end of each quarter by TSO2.1.2 to access the dataset holding details of manhours used on all classes of work, on an Area, Regional and National basis. This dataset belongs to Organisation, Performance & Systems Department (OPSD). The program extracts from the manhour dataset details of manhours expended on the classes of work applicable to MU and CJ cable maintenance, and stores them for subsequent use in the following sub-programs:

Area quarterly program – this is run at the end of each quarter by an Area or Region on the Area's two datasets mentioned above. The program updates the cumulative dataset so that – in the case of the Tunbridge Wells example – it now holds details of the defects for the 12 months ending June. At the same time, the printed information listed below is provided:

- Analysis of MU cable defects – this gives the Area a rolling 12-month analysis of all the defects that have occurred on the MU network they maintain – carrier, coaxial or optical fibre cables. The details of each defect for individual cables are grouped together and printed in MU numerical order.

  This enables fault-prone cables or repeat faults, particularly Case Repeater (CR) defects, to be readily identified for further investigation and remedial action. The March quarter's outputs are retained by the Area as a permanent record for the fault year.
- Analysis of CJ cable defects – a rolling 12-month's analysis of all defects that have occurred in an Area's CJ network, the layout being similar to that for the MU cables.
- Outstanding temporary repairs – lists, in cable order, the defects that have been recorded as 'awaiting repair' on either of the two previous outputs. It provides local management with details of the work needing completion to restore the mechanical, pressure and electrical standards of the individual cables.
- Summary of outstanding repairs – lists the temporary repairs contained in the above output, showing the numbers of additions and repairs completed during the quarter, together with the number outstanding at the beginning and end. It is sub-divided to show the type of work required for completion.
- Summaries of MU and CJ cable defects – separate outputs for MU and CJ cables giving a breakdown of the totals for the various causes of defects, segregated into cable types, effect on service and method of permanent repair.
- Performance and fault indexes – this replaces the old manual A2686 procedure and provides fault rates and other statistical information for the various types of cable in the MU and CJ cable networks.

Regional quarterly program

This is run by each Region, and combines the Area cumulative datasets for each Area within the Region to update the Regional cumulative dataset, and to produce two outputs:

- Regional summaries of MU and CJ cable defects – a combination of each Area's summary within a Region.
- Regional performance and fault indexes – provides the Regional fault rates and other statistical information, and is a combination of the Area outputs.

→

Regional annual program

This produces a permanent fault history for both the MU and CJ cable networks within the Region. Details of each defect are listed in MU and CJ numerical order together with the name of each Area where the defect occurred.

Annual national program

This program, run by TSO2.1.2, combines all the Regional cumulative datasets to produce national outputs as follows:

- Summaries of defects on all MU and CJ cables – a combination of all the appropriate Regional outputs.
- Permanent fault history for all the MU cable network – this becomes part of the historical record of each MU cable for which TSO2.1.2 is responsible.
- Performance and fault indexes – this is a combination of all the Regional outputs.

Future developments

Since this computer project was devised, the business has split into LCS and NN. Future developments to the program will depend upon the needs of the two separate businesses.

(01-432 1303)

New thoughts on lead-acid cell maintenance

by **Jim O'Connor** ETA1.1.1

This article, which is intended for maintenance staff and their managers, gives current thinking on operation and maintenance of lead-acid secondary cells. These two closely-related topics are treated under separate headings.

Cost savings

The work, which started some years ago, has now reached the stage where recommendations to change the operating regime can be made with a high level of confidence. These changes offer major savings in time and running costs and, in many cases, a considerable extension of the service life. A future article will deal with the modifications and planning rules for existing power plant.

We are also aware of the main problems associated with the maintenance of cells, and some guidance on prevention and cure is offered. But we still rely heavily on the knowledge and experience of our maintenance staff for information on service problems – and suggestions for cures. So, keep sending in those fault dockets and A646's!

Operation

Batteries in British Telecom systems have to operate within the voltage 'window' dictated by the equipment being supplied with power. There are two distinctly separate ways of complying with this window:

- open circuit float, and
- constant potential float.

The older Power Plants 210 and 225 use the 'open circuit float' method of working. This requires that the two (or more) batteries fitted to the plant are given refresher charges at monthly intervals. Work started several years ago has demonstrated that by removing one cell from each battery – from 25 to 24, hence raising the float voltage to 2.15 volts per cell – the refresher charges can be dispensed with altogether.

As a result, both time and electricity are saved; battery life is extended, and the amount of topping-up water required is reduced. An additional benefit is the reduction in the acidity of the atmosphere in the battery room – reducing corrosion on overhead ironwork and air ducts, and a considerable reduction in the ventilation requirements.

This is called 'modified constant potential float' working, and has also been used to overcome some difficulties on TXE4A exchanges, caused by transients on the DC busbars.

The follow-up article from British Telecom Midland – mentioned above – will refer to the practical implications of the Power Plant modifications.

Modern power plants use the 'constant potential float' method of working. This involves floating the battery at between 2.25 volts and 2.28 volts per cell. At this voltage all cells are maintained in a fully-charged condition, so periodic recharging is unnecessary.

Unfortunately, the total voltage swing between the charged and discharged states is beyond the equipment working tolerances, so 'end cell' switching – with its added complications and fault liability – is introduced.

Maintenance

Three main problems exist with lead-acid cells:

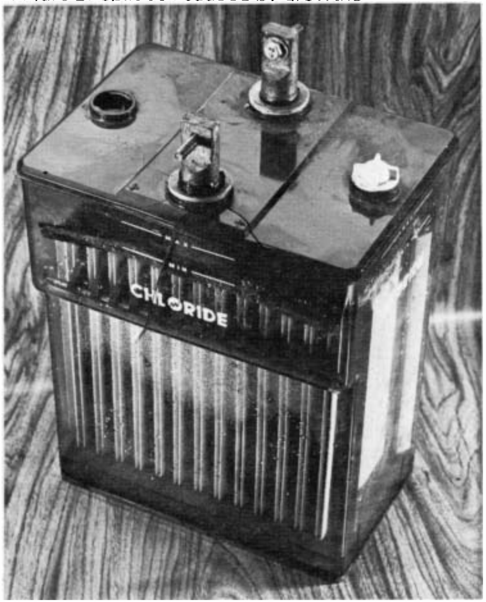
- corrosion of positive pillars – specially those made by Chloride – shown by the nodules in Figure 1
- corrosion of the commoning 'group burn' or bar of the positive plates in cells made by Tungstone, when used in Power Plants 210 and 225.
- leaking cell lids on Cells, Secondary 22.

Figure 1. Corrosion of the Positive Pillar

Pillar corrosion is caused by surface imperfections created during the moulding of the pillar. They arise because a low antimony alloy was introduced by Chloride to reduce the incidence of group bar flaking. The imperfections allow acid to creep under the rubber ring, forming a local cell. It is this reaction which is thought to cause the growths which subsequently split the cell, as shown in Figure 2.

Chloride are now using a high antimony alloy which should remove the problem, but we can now expect a worsening of group bar flaking which, though unsightly, does not appear to cause any serious problems in service.

Figure 2. Split cell caused by growths



A recommended cure where pillar corrosion occurs, is to remove the rubber ring, scrape off the corrosion and wash thoroughly with hot water. Finally, grease the pillar with petroleum jelly mixed with lanolin. Do not replace the rubber ring, and do not use ammonia or soda to neutralise the acid – hot water is both better and safer.

Group bar corrosion is caused by bad burning-up of this component during cell building on site, and only occurs on Power Plants 210 and 225. A cure for the problem has been devised in Coventry Area (BT Midland) and details have been circulated.

We do not expect to see this problem on power Plants 233, due to the higher float voltage, which greatly reduces the rate of corrosion.

Leaking cell lids are a nuisance rather than a serious fault, although damage to the battery rack can be caused. It is caused by acid migrating through small gaps in the seal between the lid and the box. Chloride have devised a cure, and will quote for repair on a reasonably favourable basis.

Maintenance savings

There are a number of experiments under way aiming to save time on maintenance. These range from ways of further reducing topping-up water for open cells, to semi-automatic charging of Power Plants 210 and 225. Further recommendations will be circulated to Regions when we have a clearer picture of the results. (01-432 5104)

RAPID Panning

by **Bryn Taylor** NN Eastern District TSO2.E.1.3

Imagine you are standing at the top of a 100 metre tower trying to shine a searchlight at a 3.7 metre diameter target on another tower 50 km (over 30 miles) away. Imagine, too, that the required accuracy is now increased, and the beam must be aimed at the centre of the target to within a few hundredths of a degree. That was the position the external microwave provision group – the riggers – found themselves in not once, but many times, last year. Instead of a searchlight, it was a 3.7 metre diameter dish aerial; instead of a light, it was a microwave radio signal. Although radio waves behave in a similar way to light, they cannot be seen by the eye, so this makes the alignment task more difficult.

Digital transmission

The microwave radio network has been used for many years to provide vision circuits all over the country for both BBC and IBA transmissions, as well as a number of long-haul telephony routes. It is now being used to provide many of the thousands of digital circuits required for the British Telecom modernisation programme.

In the past, aerial alignment – or panning, as it is known – was carried out by the riggers turning the aerial panning bolts with a spanner to move the aerial slowly from side-to-side (azimuth panning), and up-and-down (elevation panning), while the incoming signal strength was measured. This procedure was repeated until the maximum signal strength was found.

Apart from being slow, this method did not give the accuracy required for the new digital systems. Like all radio signals those used for digital transmission are not 'steady' but, due to atmospheric conditions, vary from minute to minute. These variations are normally small and in no way affect the performance of the system. But they do mask the true point of maximum signal, thus reducing the alignment accuracy.

Towards the end of 1982 it became clear to those of us working on microwave provision in Eastern District, that system provision dates and standards of performance on the new digital links were not going to be met using these methods. What was needed was a method of moving the aerials quickly and, at the same time, very precisely.

The Idea

Various methods for moving these large aerials were considered including hydraulic and pneumatic pistons but, in the end, it was felt that an electrically-driven linear actuator was the most suitable device for this application. This type of actuator is reasonably small, easy to power and, because it can be driven from a 12 volt source, is electrically very safe.

To enable the actual position of the aerial to be determined, a linear potentiometer needed to be mounted on the actuator. The resultant voltage from the potentiometer could then be fed – together with the power and controls signals – through a multi-way cable to the control equipment located in the radio station.

To achieve a fully panned system it would be necessary to pan the aerials at both ends of a 'hop'. By connecting the remote and near-end controls together by an audio-bandwidth circuit, control information could be sent to the far end, and positional information passed back. With the aerial position and the incoming signal strength information available, the point at which maximum signal strength occurred could be found quickly and accurately using an x-y plotter.

The Design

With these thoughts in mind, a preliminary design was produced, and work on a prototype RAPID (Remote Aerial Panning and Indicating Device) – mark 1 – started in January 1983. The actuator had to be made to fit onto the aerial mounting and this was achieved by means of brackets designed to temporarily take the place of the panning bolts. Figure 1 shows the elevation actuator with the 'top' box.

To obtain sufficient power to drive the actuators, a 5 ampere-hour 12 volt battery was fitted in the actuator control box and charged from the 'bottom' control box (Figure 2), over the multi-way cable. The positional information was obtained by feeding the linear potentiometer with a precision 10 volt supply and measuring the voltage across the potential divider. This had the advantage of making one degree of aerial movement equal to a change of about one volt, the total aerial movement available being about five degrees either way.

This prototype was successfully

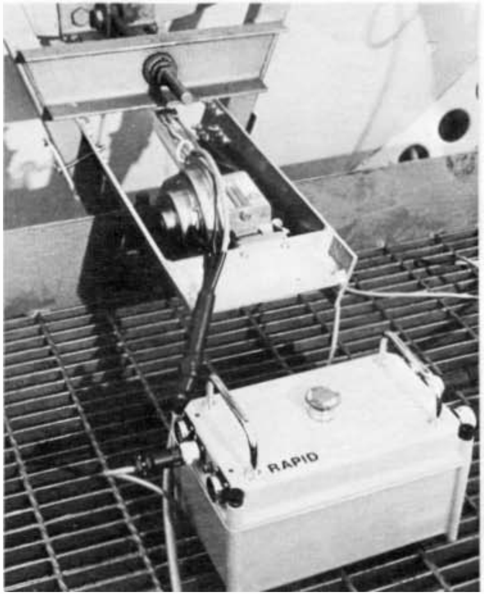


Figure 1. The aerial elevation actuator and 'top' box

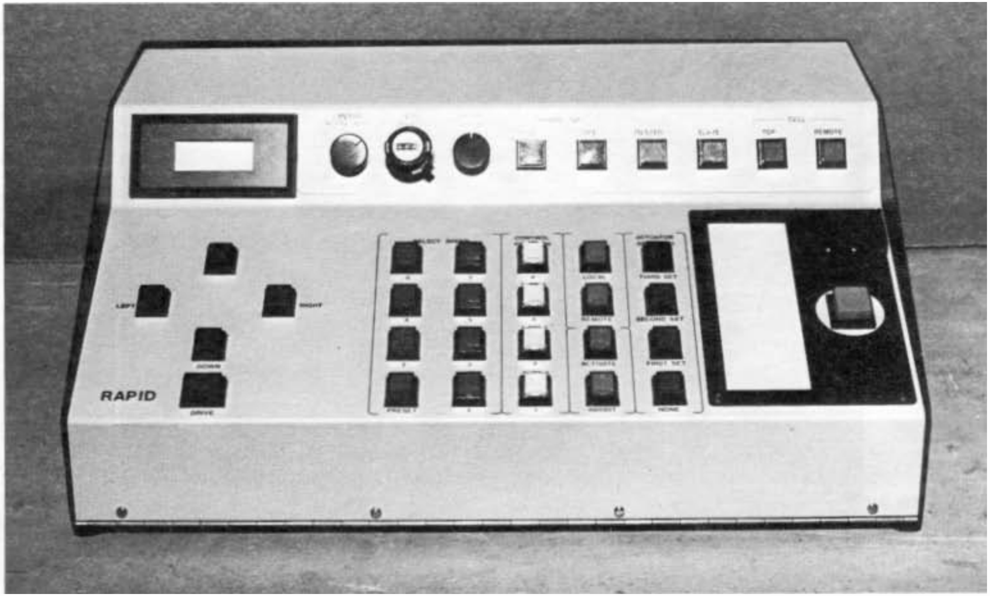


Figure 2. The RAPID 'bottom' control box

demonstrated, and support for further development was obtained. The mark two version was produced in February 1983 and this has been in continuous use since then. Typical results are shown in Figure 3. Plot A shows the response as the aerial is moved across the line of shoot.

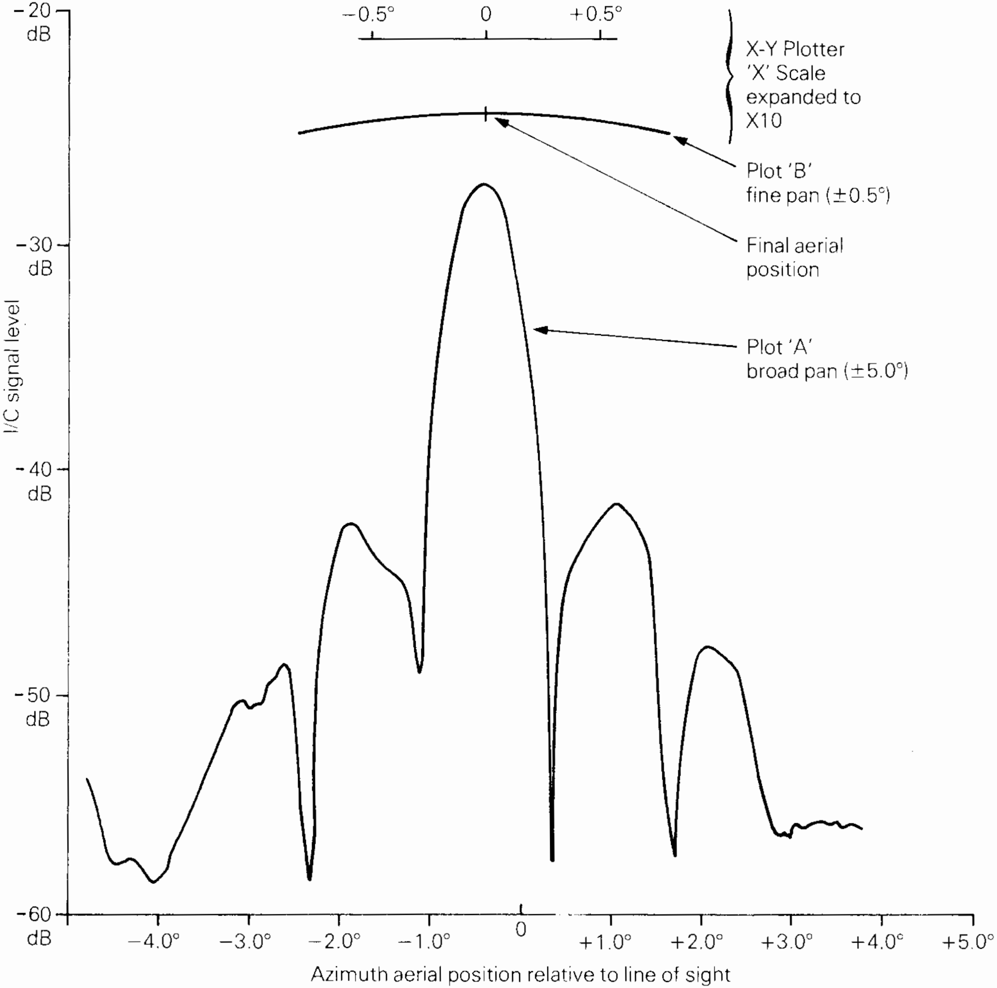
From this the approximate position of the centre is found. The sensitivity of the x-y plotter is then increased to expand the centre of the main lobe (plot B). The aerial is then driven to the centre of this curve. When this has been done, the aerial position is correct to within a few hundredths of a degree. This procedure is then repeated for the elevation pan. Having panned all aerials on the 'hop', the aerial parameters are checked and, if these are within specification, the aerials are then locked in position and the actuators removed.

Installation of the actuators and control equipment can be completed in about half a day and, provided no aerial faults exist, a six aerial hop (three at each end) can be panned in a day leaving the second half of the second day to recover the equipment. This is a considerable saving over the manual method which has, in some cases, taken a number of weeks to complete the same operation. At the same time the accuracy of alignment is greatly improved. Figure 4 shows a rigger on an aerial tower using a local control unit.

In addition to the normal panning operations, RAPID can also be used, under computer control, to produce aerial contour maps which enable in-depth investigations into aerial performance to be made. This facility has already been used to identify and remedy one serious design fault.

Production of four fully-developed sets is well under way and it is hoped they will all be in use by the time this article is published. The equipment will help National Networks meet →

Figure 3. A typical aerial response from the X-Y plotter



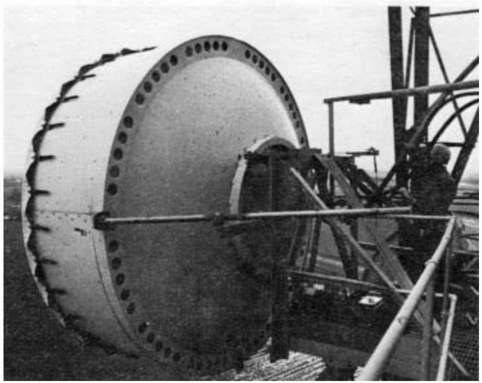


Figure 4. A rigger using a local control unit on a microwave dish aerial tower

the tight schedules set for the provision of the new generation of radio systems. At the same time, as a result of the optimised system performance, it will also enable British Telecom to offer the best possible quality of service to customers.
(0206 575222 Ext 230)

What is TCSE?

by **Jim Clark** OPS1222

That was the question asked by Alan Short in his Spring 79 article. Now, the introduction of CRAM (Call Revenue Apportionment Method) has increased the interest in TCSE.

This article is intended to enlighten those who still live 'in the dark' and those who wonder what all the fuss has been about.

Trunk Call Sampling Equipment (TCSE) – an electro-mechanical system – has been in use for more than 15 years. It is connected to register access relay sets to record statistical details of STD calls. About 190 equipments are fitted at 153 selected GSCs, covering about 80 per cent of originating STD traffic. The equipment samples three to four calls every hour, recording details of time, date, source of origin (ordinary or coinbox), duration, meter pulses and destination. The information is punched on 5-channel paper tape by reperforator 5C or 6A and processed by computer at Bristol to produce Area, Regional and National summaries.

What makes TCSE so important?

It is the main source of information on trunk call characteristics – holding time, conversation times, and metered units for example. When combined with 'effective call' meter readings, TCSE provides an accurate measure of the UK STD call revenue each month. TCSE also provides average meter units on an Area basis for use in the Call Revenue Appointment Method (CRAM) of calculating Area revenue.

This, with other related information on rentals and so on, enables the business to identify levels of income. Each month TCSE statistics, with other information, provide the British Telecom Board with detailed forecasts of the financial position of the business for the current year. Additionally, TCSE statistics are used to review and formulate changes to the existing tariff structure and to monitor the effects of such changes.

Errors could lead to mis-timing tariff changes and setting charges at the wrong level. This, in turn, could mean that we fail to make the best use of equipment in terms of profitability for British Telecom.

The accuracy of the results depends on the quality of both the maintenance of the TCSE and the data submitted. As the equipment gets older, more effort is required to maintain the TCSEs in serviceable order – particularly the reperforators. On top of this, bias can be introduced into the statistics because, following regrading in GSCs, all of the 'A' leads are not always reconnected to the equipment, and those that are do not always conform to the correct sampling configuration.

With the move to local profit centres it is now more important than ever to give accurate figures at Regional and Area level, and the maintenance of individual TCSEs becomes critical.

What developments are in hand?

- Works Specification 4040 changes the method of consecutive sampling (Mark II). The start and end of day is to be at 0800 hours and start of the week at 0800 hours on Monday. This will simplify tape handling for maintenance staff, as will the introduction of long tape tails. It will also enable monitoring of AC8 and DC2 relay sets.
- Further replacement of existing reperforators with a modern design.
- A new suite of computer programs which are able to handle both consecutive sampling Mark I and II and which also gives additional information on rejected calls.

What can you do?

If you've got a TCSE in your exchange:

- Ensure that a tape is sent in on time each week.
- Ensure that the tape is cut in the right place. Large blocks of data are lost if the tape is cut at the wrong section.
- Make sure that the reperforator is properly adjusted.
- Check the headers to make sure that they are O.K.
- Ensure that the routine tests on both the reperforator and the equipment itself are carried out in accordance with the TI's.
- Check the weekly 'exceptions' report and make full use of the direct print facility available from your Regional TCSE liaison contact.
- Check the 'A' lead connections and the grading of the TCSE within the GSC.

→

The future

Like many other things, TCSE will be replaced eventually by System X and other modern systems. It will however be with us for some time yet and, while it is, it will remain a very important tool in the management of our business.

OPS1222 are always pleased to help. Get to know your Regional TCSE contact who can pass your problems to us.

Various TIs were published over the years relating to TCSE and are listed below. Gradually the relevant parts will be re-published in the new ISIS scheme.

TI K2 E0012 Trunk Call Sampling Equipment (TCSE)

Appendix C deals with the interpretation of Exceptions reports.

TI E6 G4101 TCSE Maintenance. This is a general instruction – para 4 deals with out-of-service arrangements.

TI E6 R5760 TCSE – Functional test maintenance routine instruction.

TI A6 C3021 Design of Main Network Switching Centres.

TCSE Principles – Para 3 deals with selection of circuits.

TI A6 C3022-34 Design of Main Network Switching Centres TCSE There is one of these for each region giving details of UAX indicators for each TCSE.

(01-432 5404)

'Fifty up'

by **Ron Quinney** LCS/LES 1.5.4

Maintenance News 17 (Autumn 80) referred to the introduction of Area Repair Centres (ARCs). At that time, it was difficult to convince Areas that they should set up their own electronic repair facility. The main reason was that forecasts of equipment populations were not easy to obtain – especially in the customer apparatus field.

Soon, however, investment programmes were announced to replace traditional electro-mechanical items – such as payphones and teleprinters – with electronic microprocessor-controlled systems. As well as this, there was a boom in sales of Herald and Monarch customer switching systems (now called call routing apparatus – CRA), coupled with the exchange modernisation programme (TXE4 and 4A, TXD) and the digital network (pulse code modulation (PCM) systems).

All these factors gave the necessary added boost to those Areas which, until then, had been unconvinced, and many quickly realised the wisdom of being able to support important customer services locally. Unoccupied spaces in operational buildings were sought and quickly converted into ARC accommodation.

The heading for this article, although a little frivolous, refers to the 50th Area to establish an ARC – and this accolade was given to BTL's South East Area at Thamesmead in May when it was officially opened. There are in fact 58 ARCs, some Areas having more than one because of the diversity and volume of work handled in those Areas

The size of the job

The following example illustrates the quantity of repair work that can arise from equipment in service. Assume a particular electronic unit has a population in an Area of 1,000 and, on average, it goes faulty once in every four years. Statistically, 250 faulty units would require repair every year.

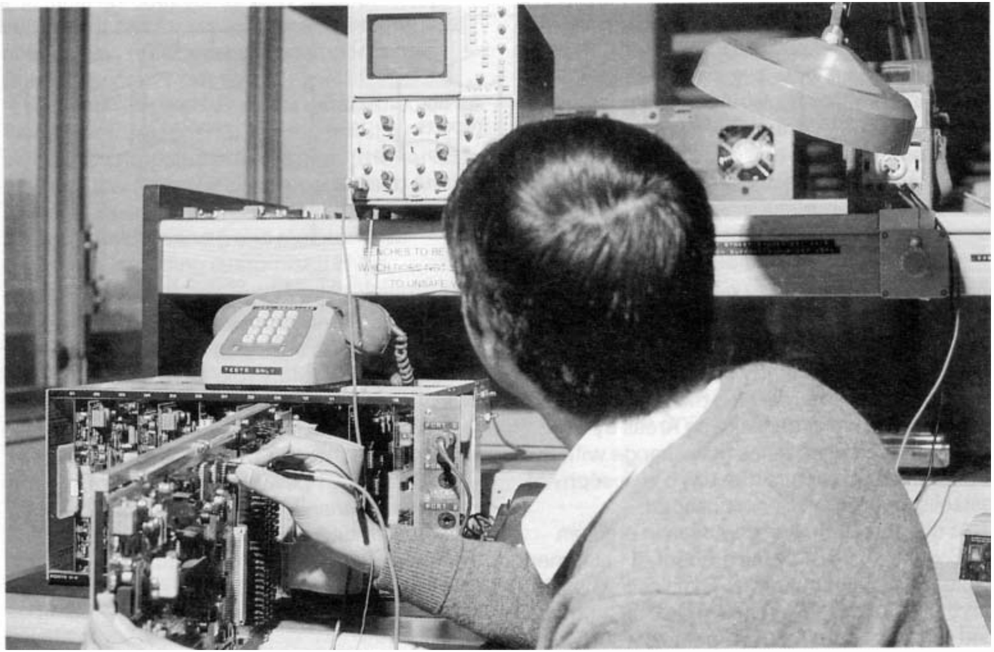
Often, for various reasons, more faults than average occur in the early lifetime of a new equipment and this causes a hump in the repair work-load. Added to this are the items changed 'as a precaution' by maintenance engineers – adding as many as 33 per cent (1 in 3) to the number of items entering an ARC.

From the estimates available for the installed population of electronic units of 30 million by 1990, the anticipated repair workload then is likely to be 3.5 million units each year. If these were equally spread across the 61 Areas, each would require facilities to have 57,000 units repaired annually – or 1,100 every week.

Although it may be decided that some of this work will be repaired elsewhere, clearly many of these items will be repaired locally – and this is where the ARCs come in. The advantage of this philosophy is that it not only ensures essential expertise will be available locally to cope with 'crisis' situations but, when British Telecom becomes a public limited company (plc) there will be nothing to prevent ARCs taking on prestige work from outside.

Any additional work for non-British Telecom systems will help to reduce the unit repair cost for both the in-house repair work and the work for outside. Thus, more effective use will be made of our resources.

ARCs have already proved their worth to many Areas by coping admirably with the huge numbers of Herald and Monarch units which suffered from unpredicted early failures during 1982/83. The inconvenience to customers was greatly reduced by the prompt and efficient response given by the ARC organisation.



ARC support

To back up the work in Areas, a team of engineers in LCS central office develops repair techniques for all new products repaired in ARCs and ensures that test programs (software) are available when fault diagnosis lends itself to the application of automatic testing equipment (ATE).

Since the original provision of Membrain ATE systems to 10 ARCs – the subject of an article in MN 13 – other, smaller ATEs have been evaluated and supplied to many ARCs. The marketplace is constantly surveyed for new test equipment to enable ARCs to retain their place in the forefront of testing technology.

The photograph shows an engineer in London's Baynard House ARC testing a Monarch line card – just one example of the wide cross-section of units repaired in this prestige centre.

ARC computers

During 1983, small business computers (SBC) were installed in all ARCs to allow essential data on units sent for repair to be collected centrally. First it was necessary to introduce a common fault docket A8807 (see MN21) and to develop software to simplify and standardise the fault recording system in ARCs.

The software has been much improved since it was first released and further developments will be introduced as the need arises. For example, some ARCs will receive multi-terminal computers to allow more rapid data entry. At LCS central office, the data is entered monthly onto its computer, and reports are generally available on request giving essential management information, such as:

- average out-of-service times
- average cost of components used in repair
- average repair times
- delays at manufacturers during warranty
- fault history information

These facts are available for every unit or →

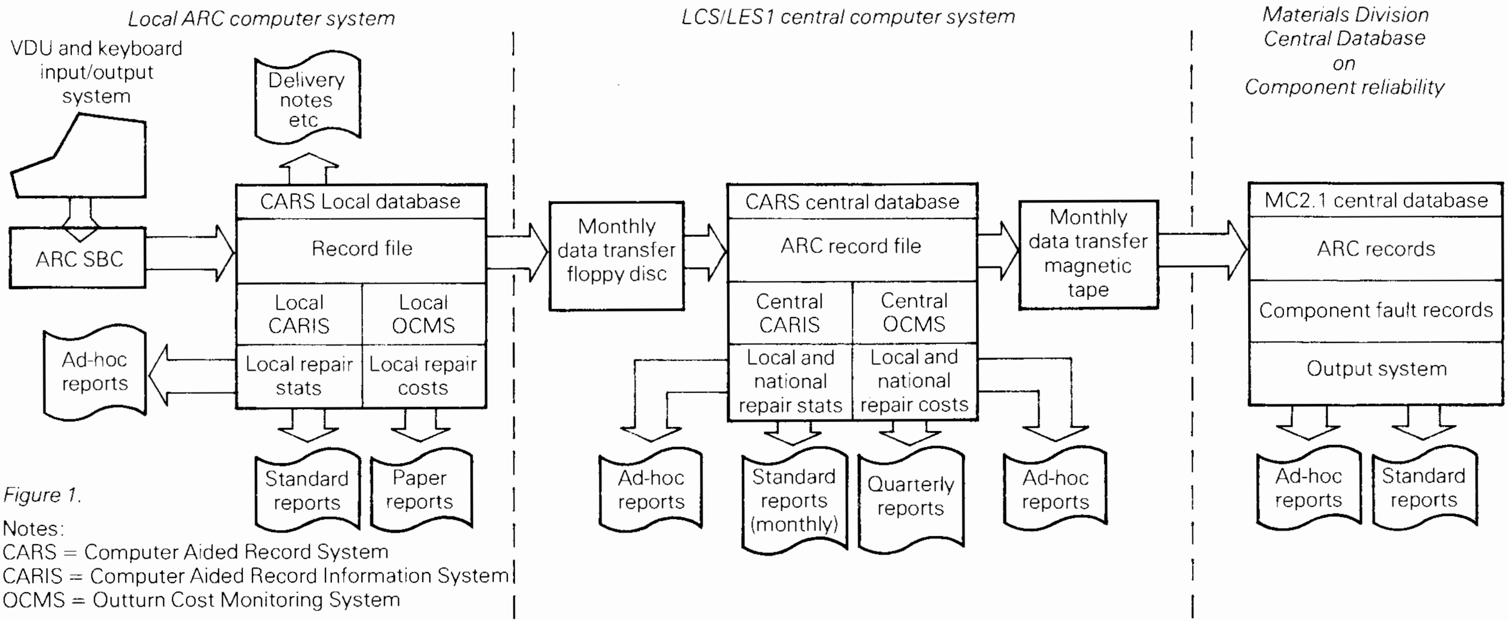


Figure 1.

Notes:
CARS = Computer Aided Record System
CARIS = Computer Aided Record Information System
OCMS = Outturn Cost Monitoring System

system type handled by ARCs, and for any ARC. Of particular importance is the availability of data on the length of time units are at manufacturers while still under warranty (usually the first 12 months) – for it must be remembered that British Telecom has paid for these units and no revenue can be earned while they are out of service.

As more experience is gained, the CARS system as it is called (CARS stands for Computer Aided Record System), will enable updating of repair cost data, thus enabling competitive charges to be raised for repair work. The flow chart in Figure 1 shows the basic ingredients of the CARS facility.

The way ahead

Now, having reached fifty up, British Telecom can look forward to reaching the goal of at least one ARC in each of the existing Areas by 1985. Although Area boundaries may change with the introduction of districts, the basic philosophy of establishing ARCs has not changed.

At the outset, the concept was to open an ARC when justified by the amount of equipment liable for repair in that Area. That liability has, if anything, increased. What is more, the number and variety of computer peripherals – such as printers, visual display terminals, disk drives and so on – has increased to such an extent that repair work areas are being extended.

Currently, the future role of Telegraph Workshops is being explored with a view to incorporating much of their undoubted expertise into the ARC network. This will be a particularly valuable asset in view of the merging of precision mechanical technology with state-of-the-art electronics, especially in the world of tape drives and printers. The future is challenging and exciting.
(01-432 2806)

Electronic component fast response service – FRS

by **Andrew Pagan,** Materials Department, M6.3.2.4

If you are a component user – whether for maintenance, repair, or manufacture – you are continually faced with the problem of obtaining those components quickly from a reputable source. A new service has been introduced to help you.

The rapid introduction of new electronic equipment has forced changes in the methods of supplying replacement components for British Telecom systems.

Materials Department have established a Fast Response Components Service (FRS) for electronic component distribution. The service provides a wide range of components to Area Repair Centres (ARCs) and other British Telecom field planning and maintenance engineers, including customised chips, 'obsolete' components and lower volume long lead-time items. It is being supported by LCS/LES, and the recently-formed Materials and Component Centre is providing technical expertise to ensure quality and reliability of products. The items have been selected for their popularity for general useage or applications on specific systems with a known maintenance requirement.

The service has been designed to receive telephone orders and give same day despatch by first class post. This ensures that users know immediately which items are in stock and the quantity available. In this instance, Materials Department do not require any follow-up paperwork and orders should be annotated 'CONFIRMATION OF TELEPHONE ORDER' and sent to the Area office for accounting purposes.

Paper requisitions (A1063/A6310), facsimile and telex messages are other acceptable methods of ordering but they obviously do not give instant information on stock positions. The A1603/A6310 under-copies should be sent to the Area office for accounting.

The FRS catalogue and price list give details of all product ranges stocked and future editions will include components for other call connect systems and products. If you have problems obtaining components please contact us – we may be able to include your item with other new products to be stocked.

The system has been developed to meet customer needs and is flexible enough to allow for changing requirements. Comments on the current system or on future improvements are always welcome.

Catalogues and further details can be obtained from Andrew Pagan on 0793 484572.

On reflection

Here we look back to *MN14* (Spring 79) and invite some of the authors – or their successors – to comment on their articles . . .
John Bloxham, of BTNEs RSIC, writes on TXK1 Computer Fault Analysis, and introduces us to CAMEO 3.

Much has happened since Alan Kelly wrote his article for MN 14. Postal arrangements have been improved, Regional statistics are produced, and the Data Processing Centre (DPC) has moved from London (Barbican) to Bristol.

In 1982, support for TXK1 was devolved from Telecom HQ in London to Leeds, (see MN 21). This resulted in an improved service to Regions and Areas in terms of assistance and information. At present, 343 from a total of 371 TXK1 local exchanges submit data for processing, mostly on a four-weekly basis.

Bristol DPC processes an average of 80 punched paper tapes each week; and the return of analysed information consists of up to six Sections, as described in MN 14.

The relatively few TXK1 local exchanges not making use of computer analysis, usually give the reason that they do not generate sufficient data to warrant processing. But if those exchanges submitted data several times within the six-month memory period, the computer could provide useful statistical information, and perform several routines automatically.

The computer also minimises the effort required in several manual routines, such as →

Stop Press

checks of the fault data collection circuitry, equipment monitor, teleprinter control and teleprinter.

The TXK1 support group are at present evaluating an interactive system of on-line microcomputer assistance to exchanges – known as CAMEO 3. This will be useful both to large local exchanges or a group of small exchanges interconnected by means of a concentrator.

CAMEO 3 analyses the raw data and provides a VDU display of the fault categories in much the same way as fault blocks are printed out by the batch system.

Alternatively, users are able to sort fault data according to their own pre-selected key parameters. The remedial action taken to clear identified faults is also recorded, and it is possible to set adjustable alarm thresholds to monitor the quantity of fault report messages received from each exchange. It can accept and validate the records generated by the three systems in a TXK1 local exchange which are normally output to the exchange teleprinter. These are:

- Automatic Line Insulation Tester (ALIT)
- Artificial Traffic Equipment (ATE), and
- Equipment Monitor (EM)

CAMEO 3 complements the existing off-line batch processing scheme, which cannot be done economically on a microcomputer.

Cable Pressurisation Equipment

Before Victor Spiceley retired, he wanted to remind exchange maintenance staff responsible for ECP racks, about a useful tool – and the last chance to get one.

The Extractor Gauge Pressure (Code 113633, section 5TA) was provided some years ago for removing the pointers from No 2 Pressure Gauges – and the No 3 – on the comparatively rare occasions when zero drift occurred. This happened after prolonged use when resetting was necessary – the old TI E3 G5051 refers.

There is now very little demand for this item. Either our gauges are very reliable, or the cruder 'two screwdriver' method (not recommended, by the way) has been used!

Because of the small demand, there is a proposal to discontinue this tool during 1984. So, if you wish to add one to your tool-kit while stocks remain, please take action now. (The cost to your Area will be £1.75 each).
(01-904 0253)

Corrosion of Line Jack Units

Some recent failures have come to light on Line Jack Units.

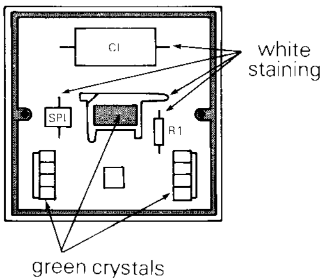
Failures are caused by moisture collecting on the printed circuit board (pcb) and causing electrolytic corrosion. This is detected as low insulation resistance, or a noisy line.

Visually, it is hard to detect from the back of the pcb, but can be seen as white staining around the mounting pillars, or green crystals appearing on the contacts.

If any Line Jack Units are suspected of failing due to this moisture problem, could you please send them to me at the address below, together with any relevant details. Although the quantity returned so far has been small, we want to see if it is representative of the total population.

Thanks for your help R. Coates, BTE/SE2.1.1, Room 302, Anzani House, Trinity Avenue, Felixstowe, Suffolk IP11 8BX.
(0394 275944)

Showing the position of corrosion



If you have a contribution to offer to *Maintenance News* other than a letter to the editor, please forward it to your *Maintenance News* agent listed below. The Editor cannot publish anything to do with current awards suggestions, neither can he be held responsible for technical inaccuracies in authors' submitted text.

Send your contributions to..

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