WHAT WAS MAKING THE NEWS IN AUGUST
Troubles for EE small machines

THE first definite action in the computer field following the merger of English Electric and Elliott-Automation is likely to be a rationalisation at the lower end of the EE computer range.

Technical troubles with the System 4/10 have been reported. The machine, announced last year, was not originally designed for the RCA Spectra 70 range and therefore the presence of another System 4 computer, the Model 35, is also believed to be well below expectations.

While Elliotts have a successful range of machines in the smaller range, the 900 and 4100 series, these are not easily compatible with System 4. Their direct substitution would certainly pose a problem and ruin the idea of an integrated range of machines.

One possibility would be the further development of the experimental 84 computer which was designed by English Electric engineers at a recent conference at Manchester. This is designed as a process control machine, but it could offer basic compatibility with the remainder of the EE range.

The position of the Elliott 4100 series would also appear to present some long term problems. There is a growing demand for integrated systems, and the current system is not designed for such a purpose. To meet this need, Elliotts plan to introduce the 4100X model, which will be compatible with the 900 series.

NCR have been building up their computer manufacturing strength in recent years. They have several large contracts in progress and are ready for a rapid expansion and increased production.

The interest in, and use of, computing systems by our leading consulting engineers, scientists, and economists indicates that perhaps the climate is ripe for a rapid expansion and more general acceptance of such techniques here.

Professor S. Gill recently commented on our 14 years of immaturity, and our need to seize the opportunity now. He was speaking of the even more advanced ideas on computer grids now being talked about.

The need for action on simple conversational systems is even more urgent. Politicians debate national data services, giant corporations pour endless money into hypothetical management schemes, and isolated re-search scientists are left to ponder the problem.

Meanwhile, the need for computational facilities is like Alice, always growing. The US industry offers today and unless UK is prepared to conquer the market now, the entire area of business will slide from our grasp before it is ever established here.

ESSEX COMPUTER OFFICERS

At the inaugural meeting of the Essex branch of the Data Processing Management Association, Mr J.E. Webb, the BBC, was elected chairman; Mr R. Leach of Solicitors' Law Stationery Office, secretary, and Mr J. Wilson of Ford Motor Co, treasurer.

EDP facilities on Burroughs E3000

A NEW family of electronic accounting systems, the E3000, has been added to the already extensive Burroughs range. The first two machines in the series are the E3200, which will be the smallest in the family, and the E3500, the largest.

Prices for the E3000 are from about £540 to £9,070, depending on the several options available. Monthly rental charges vary upwards from £414 and delivery periods in the US are currently quoted as between 60 and 90 days. The system is not yet being sold or manufactured in the UK at the moment.

The E3500 has the ability to directly read data from ledger cards. The data is written in plain language on the card and also recorded on a magnetic strip for machine sensing. Other features include solid state electronics, automatic arithmetic functions and a modular core memory, expandable from the basic 30 words to 100 words.

Each system is designed to fit the customer's particular requirements, with programming done by Burroughs. Packages are permanently held in the machine's program control centre, and a user may specify any number of centres, any one of which can be selected in seconds.

Extractions which can be added to the basic system include a ledger card reader, which automatically picks up the information stored on the magnetic strips of the ledger cards and passes this to the main machine. The Burroughs A4000 Automatic Ledger Reader can hold up to 500 ledgers and reads at 48 cards a minute.

Complete input

This provides a complete input through the magnetic coded ledger cards, the keyboard, the ledger reader or any combination of these. Normal output of processed information from the system is onto ledger cards or journals, with extra available to give punched card or paper tape output for subsequent computer processing.

The E3500, at the other end of the scale, includes all the features of the E3000 except the magnetic coded ledger card facility.

As all computing functions are handled automatically, retraining skilled accounting machine operators in use of the E3000 is claimed to be quick and easy.
Britain's first major time-sharing system inaugurated

HARD SELLING on the theme that a time-sharing terminal is as important to a modern engineer as his slide rule, was the key to the first public demonstration in this country of De La Rue Bolt's GE 265 time-sharing service, announced in Computer Weekly last week.

Based on a GE 235 computer and a Datunect 20 controller, the system is claimed as the first in Europe offering direct access to a general purpose machine. Its introduction in the UK follows GE's successful developments in the US where 21 265 systems are in operation. The only other system in Europe is in Toronto.

At present there are about 20 UK customers connected or contracted to use the system. They consist mainly of engineering and scientific users and include such firms as W. S. Atkins and Partners, consulting engineers, who already have considerable experience of terminal use on the Univac-based system of CBI Ltd.

First in Europe

Other users include Imperial College and London University, the GPO, the National Physical Laboratory and the Ministry of Technology. Commercial customers include Hambro and Co, British Petroleum, George Wimpy and the Steel Company of Wales.

Although the London system is the first in Europe, Mr. Henri Des- beaux, managing director of GE-Bull, told Computer Weekly that it would not be too long before such a system was introduced in France, a dominant centre of GE activity in Europe.

The heart of De La Rue Bolt's time-sharing service is this GE-265 system located at the company's head office in Southwark Bent, London. Shown in foreground is the GE-235 computer and control terminal with tape decks to the right. Other units in the system are the Datunect 30 communications computer and a random access file.

Grid network

Considerable experience in the operation of GE-265 system is available from the USA, where some of the 21 centres have been in operation since 1965.

Mr. J. Stanford Smith, vice-president and general manager of the Information Systems Division of GEC (USA) told Computer Weekly that they expected the pattern of development in the UK to be similar to that in the USA.

For instance, it is expected that demand to use BASIC, GE's own conversational language, will steadily increase even among users familiar with ALGOL and FORTRAN, as they come to know the advantages of the language.

The system starts in London with the advantage of a large library of basic programs, plus BASIC, ALGOL and FORTRAN. For about £70 a month a user installation providing from five to 10 hours' terminal time can be set up.

Rapid growth

American experience indicates that a rapid growth in such systems will come from institutions and users and a rapid growth in installations. For example, GE's 265 installations in the US have grown from one to 21 in about three years.

The main problems of GE, and other computer users, in this area have been keeping up with the demand and some users have found it worthwhile to have terminals from more than one system to ensure that they have access when "all lines engaged" conditions begin to build up.

Software house open

The Californian software house, Information Development Company, has now opened an office at Burlington, Massachusetts, IDC is the present company of K. R. and Partners (Computer Consultants) Ltd, of London.

£900 PRIZE FOR A GAME

The Dutch Journal of Accountancy and Business Economics is offering a chance for inventive individuals or groups, to win £900.

Competition is required to devise a management game based on the business of a fictitious firm and similar to those used by business schools or management training courses.

The game, which may be devised by an individual or a group, should contain one or more didactic objectives and clearly distinguishable from the other variables of the game.

Variables to be manipulated should include such items as production, sales, research, selling, price, promotion and others. Computer simulation work involved should be included to indicate how line computer work is possible.

Entries can be made until September 1st, 1968, and the competition will be judged by an independent panel of three professors. All details are available from Societats MA, c/o Dr. D. G. van der Heijden, Utrecht, Netherlands.

HYBRID SUCCESS

Since January, EAL have received orders totalling £211,000 for their 680 medium-scale analogue/hybrid computer.

The five machines, all due for delivery this year, will be used in research and development work. These computers are to go to Haecker Siddeley Dynamics, one to the Yarrow Admiralty Research Department, and one to Cambridge University.

PROCESS MACHINE FOR POWER STATION

THE first process computer to be employed in a West German nuclear power station will be used at 200 MW installation at Offhaim on the River Neckar. The machine will be a Siemens Type T5 first announced in the autumn of 1966.

Monitoring of operations at the plant and of the on-line calculation of nuclear physics data will be carried out by the installation which will have 16k main store of sorting units along with additional store, punched card equipment, display units and a large number of interconnecting tele-type wires.

Computers of the Siemens 309 series have already been installed in nuclear research centres and thermal power stations. The largest of these are those at the Energy Research Centre, in Karlsruhe, where the computers are taking monitoring and logging facilities.

A important fault identification is included in installations at Stair-meterkast, Denmark, Gerau, near Stuttgart, and Les Avins at Brussels.

Ownership of the Middle Duna Hydro electric power stations in Austria will also be controlled from a central computer installed at Piesting.

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More mobiles for Vietnam

The US Army, which has sent 18 mobile computers based on the NOR 500 to Vietnam during the past six months to handle spare parts inventories, has ordered an additional 18 to arrive next week. The order, the biggest received for this equipment, is worth $265,000.

Each installation consists of a pair of trailer trucks, one housing the central processor and peripheral units and the other containing software and desk space for the operators. A mobile unit will generate power for the computer and field lighting and air conditioning.

UNIVAC ORDERS

RECENT orders for Univac 9000 computers have been placed by Pacific Motors of San Francisco, Charles Leech and Co of Evansville, Indiana; the Reserve National Life Insurance Co, Of Oklahoma City; and the C & I Manufacturing Co, of El Campo, Texas. The American Life Insurance Co, of Franklin, Pennsylvania, has ordered a 9000 system for their operations in Australia. An order for a 9000 system has also been placed with W. M. Jackson Inc, of Metuchen.

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The customer terminals for the De La Rue Bolt time-sharing service is built by Data Dynamics Ltd of Exeter, England and is easily fitted into an office, they comprise a Telotype Model 33 ASR with the necessary electronics installed in the terminal.

The terminals, which are valued at about £350, provide input and output facilities to the computer system and provide keyboard functions closely similar to those on GE installations in the US. They operate via the GPO Data Line and are also available for general high speed data transmission applications.

The terminal shown here is in the offices of W. S. Atkins and Partners, one of the first users of the new system.
COMMERCIAL JOBS WITH AN ONLINE SYSTEM

MOST on-line computer terminal systems are designed for use with busy central computers, in such a way that the terminal is given the appearance of an operator’s console. It is argued to provide a high level of service to the operator, allowing him to call on as much computer time as he wishes. This has the disadvantage that there is no control over job mix, and unless excessive excess main processor capacity is available, response times deteriorate rapidly as the day progresses. It is necessary to keep the terminal based back-up service in the event of machine breakdowns.

There is a whole field of commercial work which is based on on-line systems. However, these systems tend to be relatively expensive, and, what is even more reasonable cost, are best provided by a common service. This is to provide an on-line service of files produced as part of their business. The departmental files of companies could be produced as part of the business.

By E. J. Dickens,
management services manager of Cape Universal Building Products Ltd

batch processing, such as the invoicing of sales and the updating of stock record files.

An inquiry is made, question is made, and the order is placed with the order file for customer PA123. An inquiry order is issued to the cash department, access to the customer file to update the account, and the order, with the outstanding order file to pay, are all to be done in the scheduled despatch date and value. This is the order process, the order is given details of the customer's file and the variety of questions about the status of the order.

OVERSELLING

The computer industry is poised to high technology and high expertise, corresponding to its involvement with hardware and software, respectively. Mr Norman Leyland, investment officer at Brainson Centre, Oxford, speaking at a lunch arranged by the Data Processing Managers Association, said that the software industry has often lacked properly trained personnel, and the problems faced were not necessarily so attractive, said Mr Leyland. The software industry was in the position of having to sell software, and what was the market at present was the same issue. Software, a 20-year-old research engineer with experience of machines at the rate of a million per second, reducing the time required to test a typical assembly to around 2 seconds. However, compared with 30 minutes using conventional computer testing techniques, the Swiet digitiser allows the unit to be tested at C90, bringing it within the range of most companies' computer systems. This benefit is derived from using printed circuit boards. Printed circuit boards are compared by the Swiet digitiser as a diagnostic aid.

HONEYWELL LAUNCHES DIGITAL TESTER

HONEYWELL has introduced a portable test unit for printed circuit board assemblies which it hopes will revolutionise the computer service philosophy.

The Honeywell Swiet digital tester (it is named after its inventor, Dr Peter Seikin) is a 20-year-old research engineer with experience of machines at the rate of a million per second, reducing the time required to test a typical assembly to around 2 seconds. However, compared with 30 minutes using conventional computer testing techniques, the Swiet digitiser allows the unit to be tested at C90, bringing it within the range of most companies' computer systems. This benefit is derived from using printed circuit boards. Printed circuit boards are compared by the Swiet digitiser as a diagnostic aid.

FIGURE 1

FIGURE 2: Organisation of the computer to provide inquiry answering facilities.

FIGURE 3

FIGURE 4: Timings for handling two questions from terminals, showing how each second could be used to the limit. These timings will vary with the type of backing storage and computer used, but are based on a small computer using exchangeable disc storage. The critical factor is the access time to the backing storage.

INQUIRY PROGRAM (2 questions processed)

Spare part processing

Action Equipped Prices

Spare processing time 800 msec

Total 7.4 sec

Total 1.4 sec

(5 seconds per question average)

Total 1.4 sec

(5 seconds per question average)

Total 1.4 sec

(5 seconds per question average)

Over 100 100

msec msec

msec msec

msec msec

msec msec

msec msec

msec msec
Atlas successor an influence in the New Range design

IN June this year, Professor Tom Kilburn of the Computer Science Department at Manchester University was appointed a CBE in the Birthday Honours. It was a most popular distinction for the man most closely associated with the university’s design of the stored-program computer, and most appropriate too on the silver jubilee of the first run of the first computer.

A month earlier, more than 10,000 people took advantage of the university’s Open Day to inspect the department’s latest creation, a computer entitled MUS. This machine has received much less publicity than it deserves, for it was built with ICL help and its design has been influenced in, though not determined by, the design of the New Range.

MUS3 ancestor and is worth describing. Computing science at Manchester started with the Mark I, which is said to have been the first digital computer able to store completely both a useful program plus data within itself.

This was followed by the Mark II, known internally as Meg, and sold commercially as Mercury. It appeared on May 10, 1954, and was itself succeeded by Atlas in December, 1962. All three computers were sold by Ferranti, which owned a factory near West Gorton.

To single out a few of the many computing developments embodied in these three computers, the Mark Iautocode, the Atlas page system and the Atlas paging system are all recognised as significant and influential steps forward. Atlas in its turn has also become obsolete, with only one still in use, and we come to MUS itself. The “S” incidentally, does mean fifth, machine to be developed at Manchester. As well as Marks I and II and Atlas, there was another system which was out of the mainstream of development, being essentially a test-bed for transistors.

These were then new-fangled devices being moosed as a possible replacement for thermionic valves. The result, which appeared in 1956, was sold as the MV703 by Metropolitan-Vickers Ltd.

All these computers up to Atlas were produced by the Electrical Engineering Department of the university and it was not until 1964 that the Computer Science Department was formed.

The computing world scene has altered substantially in the decade between Atlas and MUS, the most significant development being the formation, of ICL, which took over Ferranti’s commercial computing interests.

Manufacturer support is essential for an academic establishment working on limited funds, and as Ferranti had provided invaluable assistance with the earlier machines, so ICL has been heavily involved with MUS. A further connection was the purchase of an ICL DE58, with a Science Research Council grant, as a hardware and software test-bed for MUS and eventual companion in a multi-processor configuration.

Atlas was the starting-point for MUS design, though many different people contributed ideas. Incidentally, contrary to what was implied in an earlier Software File (May 31), J. K. Illiffe was not the main source of inspiration; in fact MUS design was under way before J. R. had formulated his basic language machine idea.

MUS has a three-level hierarchy of storage devices, plated wire, core and drum. The plated wire memory has a capacity of 52K 32-bit words and is four-way interleaved. It contains a fast-sof software system which reconfigures addresses if memory slack grows out.

Cycle time is 250 nanoseconds, which compares with approximately

25 YEARS OF CHANGE

The two pictures on this page provide an illusion of the enormity of changes that have taken place in computing in the past quarter of a century. Above is the Mark I, with rows of valve trays which were later replaced by the Williams Improvisation of the main memory. They are still called after Professor F. C. Williams, who led the Mark I development team.

Housed in the more business-like setting of the seventies, MUS is undetectable in appearance. The processor alone could be that of any large ICL machine, which reflects the invaluable help provided by ICL during construction. The experimental nature of the machine is maintained by the intense testing activity in the background, and by the elaborate system of communication in the foreground.

The Primary Operand Unit (FROG) forms the addresses of the CPU to minimal access delay. The first of these is the Instruction Buffer Unit (IBU), which prefetches the instructions (these vary in length between 16 and 80 bits). An important part of the IBU is an eight-entry Jump Prediction Unit, which is associatively accessed and so able to trap loops.

Operands are referred to by name, or in high-level languages, rather than by address, and for accessing purposes are divided into two types, Primary operands are those specified directly in the instruction, and secondary operands have a more complicated data structure and are accessed indirectly.

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Two problems for data networks - costs and standards

The early development of computer communications consisted of adding modems to the telephone network to provide data transmission. The switching element of the telephone network also proved useful for relatively slow connections to terminals but for higher line speeds or line utilisation for clusters of terminals the most economical systems proved to be private networks using leased lines supplied by the PTTs and fitted with modems.

One of the earliest of these private networks was the SITA high level network serving a large group of airlines. SITA is a world-wide organisation based on a high level network principally in the USA and Europe. It is being extended now. SITA operates the public switched packet switching network. The network actually combines the properties of packet and message switching - a precedent which has been followed by the Spanish TNEA.

SITA is typical in that it serves a widely spread group of users with common interests and the high level network has some of the properties of a public network because a number of separate computer networks, each with central processors and many terminal concentrators are interconnected on one computer system. Like public data networks it is also designed to carry traffic between the main processors.

Among the countries in which the telecommunications companies or PTTs are building packet switching networks for service are the UK, France, Spain, Canada, USA and Japan. Among the best known companies, the principal projects in Europe are the CYCLADES system in France and the European Information Networks, sometimes known as the COST 11 Project which will begin operation with a five node network.

The map above shows three of the more important network projects. A complete picture of the network in Europe would make a very interesting picture of a private network of one UK bank makes an impressive map by itself.

There can be no doubt that, when the demand for computer communications reaches a certain point, it can be met more effectively by a public network. If it is in the interests of the public to transmit information and switching is concentrated to give economies of scale. The trick is to find the common requirements which must be met by a public network and to establish the common standards. These are the problems which have occupied many years of effort and are just beginning to show some real progress.

Before we discuss the problem of standards, let us first look at the available technology and how it is likely to develop in the near future.

In the matter of transmission technology, prediction is easy because the trends in technology have been steady, while practical progress is retarded by the vast capital expenditure involved.

Economical transmission, whether voice or data, is only possible in large groups of channels. Communication costs per channel decrease with time and in an extraordinary way as the group handled increases. Coastal cables, for example, begin in about 1900 with 600 circuits per pair of cables and have recently reached 16,000 circuits on the same size of tube at about one-fifth of the cost of the per pair. The Post Office is usually present, about the cost of facilities for which the public pays only indirectly in the form of an overall tariff, but in the case of transatlantic cables the publication figures that show that TAT 1 with 36 channels costs £2M/s km, CANTAT 1 with 80 channels costs £1M/s km and the recently opened CAN TAT 2 from Cornwall to Nova Scotia with 1,440 channels costs £1M/s km.

When a part of this is diverted data transmission, we shall be the backbone of an effective computer communications network which trunk transmission costs are very low. Therefore the general pattern in the matter of transmission cost - that of high bandwidth communications which must be embraced, on a smaller basis, will be the backbone which comes from the telephone traffic.

The telephone network is employed circuit switching to cause this is appropriate for telephone call which is of low duration compared with writing and time line time is past, with analogue transmission, it has used frequency and a vision multiplexing. At digital transmission takes over here to be replaced by time division multiplexing. Because all telephone conversations have the same bandwidth and frequency occupancy this bandwidth through the call, it makes sense to allocate each one a fixed block of FDM, or a fixed time slice in TDM cycle.

For computer communications, on the other hand, none of these techniques is necessarily appropriate. The data rates in common usage between 100 bit/s and 4,000 bit/s more, and the individual messages are often very short. Because so many of them are concerned with control functions, red tape or acknowledge functions, both of the communications and the applications. All these factors point to a new style.

By DONALD DAVIES

Superintendent of Research of Computer Science System Physical Laboratory

PROGRAMMING & SYSTEMS PERSONNEL

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Preparing to meet the challenge of new developments

By Dr. ROLF GÜNTHER

Building the networks

From page six

Flexible method of multiplexing and switching

If we regard circuit switching with its individual channels as the extension of its network through the use of multiplexing as one extreme of a spectrum, while on the other extreme we have a network of redundant or 
"dynamically overlaying" - all variations on the same theme as the technique. Packet switching is the natural method of switching to go with demand assignment multiplexing because it also handles small units of information - packets. The problem is, however, that the basic ideas and 
advantages of both methods are the same, so that the packet networks and the channel networks compete with each other in the same way that they compete for the same communication channel.

A good example of demand assignment in an extreme form is the Aloha system, first used in the University of Hawaii, and now proposed for use in satellite communications. As a part of a packet switched network, Aloha is a computer network in which the nodes are connected by a 
direct radio link or via a satellite. In this case, there is no dedicated traffic, it is determined at the time of the call when a packet is transmitted. This allows for a smooth and efficient way to control the communication channel.

The audacious technique used in Aloha is the so-called "think and speak" or "think and listen" rule, which is a way to determine whether the channel is busy or not. If the channel is busy, the node waits until the channel is free before transmitting. This allows for a smooth and efficient way to control the communication channel.

In Aloha, the network is designed to be as flexible as possible, allowing for a variety of communication scenarios. The Aloha system is designed to be scalable, allowing for the addition of new nodes or the removal of existing ones as needed. The Aloha system is also designed to be robust, allowing for the network to continue to function even in the presence of network failures or other issues.

The Aloha system is designed to be secure, allowing for the efficient and secure transmission of sensitive data. The Aloha system is also designed to be efficient, allowing for the efficient use of bandwidth and the minimization of network congestion. The Aloha system is also designed to be fault-tolerant, allowing for the network to continue to function even in the presence of network failures or other issues.

These are just a few of the advantages of the Aloha system. The Aloha system is a flexible, scalable, robust, secure, efficient, and fault-tolerant network design that is well-suited to a wide range of communication scenarios.

Building the networks requires the careful design and implementation of a variety of complex technical systems. The Aloha system is just one example of the many different approaches that are being taken to build the networks of the future.
The back-seat driver

MUCH Of the diesel-fired fun left in the once glamorous sport of motor racing could be lost for ever if racing teams follow the lead of Team McLaren, one of the world's top racing car stalwarts, which is now using an on-board telemetry system to monitor driver performance.

For its Colvile-era cars in the US, McLaren chose a 32K Data General Nova 2 minicomputer for the monitoring operation, and the software for the machine was written jointly by Data General and McLaren Engineers Inc of Detroit. The car itself is fitted with 14 sensing devices for monitoring functions such as fuel flow, oil and water temperature, and pressure, the ride height of the wheels and the accelerator position. These are all fed into the machine via an on-board radio transceiver and telemetry equipment.

McLaren will use the data output by the Nova 2 telemeter to assess the performance of the car both before and during races and McLaren rates the accurate fuel level measurement facility as especially useful. Data General, in particular, got its first real race test when the first time in May before this year's Indianapolis 500 to prepare the Sato/Andretti McLaren for the race.

Unfortunately, the McLaren car did not win. In fact it retired before the end of the race due to a heavy rear-end accident, according to the magazine Autocar.

Motor racing enthusiasts will know that the winning car was a works Eagle from the Dan Gurney stable driven by Bobby Unser. The Eagle was driven by Johnny Rutherford while the winning #50 in the McLaren car that did not have the benefit of computer monitoring.

Card punch option on 2100 system

CUSTOMERS of the Birming- ham-based data preparation bureau, Computer Punching Services, can now have 30-column punched cards produced for them on an American 2100 key-to-disc system, as an alternative to the magnetic tape normally created by this equipment.

Interscan believes that the punched card facility on the 2100 at CPS is the first of its kind in the country. The complete 2100 system comprises a 32K Alpha B processor, linked to 10 key- board/VDU data input terminals, a 2.2 Megabyte disc store, a 1600 bpi tape drive and a high speed 80-column punch card.

Meanwhile, at a Home Office data preparation centre at Tew- worth, Surrey, 22 keyteyboards interscan 2100 systems are being used to capture criminal statis- tics data sent in by police stations and courts all over the country. The information is required for processing on a Home Office ICL 1900 series computer in London.
**Under lock and key**

AFTER nearly four years' investigation into the feasibility of developing integrated computer systems to process personal records, the Police Association of Great Britain (LAMSA C) (Local Authorities and Management Computer Committee) has concluded that "Not only are such systems feasible but they could also have a number of valuable applications in the future." 

In a report published last week, the committee detailed their investigations over a period mainly on a study of Hampshire Police. They have also outlined a computer system which would provide a "highly skilled" and "efficient" approach to record keeping and data processing in the police force. The report says that apart from certain minimum criteria prescribed by the Home Office, there is no standard procedure for designing a similar system at present.

The contents of the personal files reflect the wide ranging nature of the data that such systems could be encompassed on any individual, under the broad rubric of "data protection legislation." The purely factual information and "other data" could be filtered out, for instance, based on Routine Orders detailing personal information to be collected and classified in accordance with general data protection regulations.

The report gives details of the sources of input to the files, existing procedures for data collection and update and reasons for accessing the system. The Home Office Inter-Departmental Committee on Security has already obtained certain details, for example, for the purpose of convicting an officer's family in preparing a legal action and for police re-enrolment. Access would be extremely difficult in the event of a change of system. A separate set of criteria, such as production of a "lock-in" order, would be required to ensure that the information was not available on a third party basis.

The report concludes that the only thing that a full computer system could do would be to enhance the efficiency of the system. It mentions that the Home Office is "not likely to be of interest to the Home Office in the future". It further explains that the "advice to the Home Office is that it should continue to use the existing system".

**Selective direct mail service from ITT**

The new service is a development of the ITT hotline to provide a computerised directory of human resources available to all concerned with the sale and promotion of direct mail. The new directory, which has been part of the service for over three years, is now available to all customers. Each directory contains the same information as the original directory, but is updated on a regular basis.

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Interactive computing helps study problems

By T. J. MARTIN and A. SYKES
UKAEA, Culham Laboratory

WM. A solution process benefits from human intervention, or can it be fully automated? The basic criterion which is used to determine the suitability, or otherwise, of the interactive approach to given problems is firmly established in research environments.

The potential value of man-machine interaction is easily illustrated. Consider Figure 1. It is obvious to the human eye that point A is outside the general region R and point B is inside. But to get a computer to recognize this is a considerable problem.

The problem met in a scientific environment can be classified into three groups. Problems, usually of a routine nature, that are best done by conventional batch computing.

(ii) Difficult or exploratory problems that cannot be formulated for purely automatic computing; they require man intervention and therefore a problem originator, and hence the interactive approach is almost essential.

(iii) Problems that can benefit by varying extents from interactive computing, whether just in the program development stage, possibly throughout.

We believe the greatest benefit obtainable from interactive computing, as opposed to batch, computing is not the possible time savings, useful though these may be, but the improved understanding that a problem originator can obtain by interactive study of problems of the type where solutions are not unique.

Most of this work at Culham Laboratory has been used in interactive computing effectively in different kinds of applications. These include field design calculations, computer simulation of plasma, root finding, data analysis and design. Here we discuss just two typical applications.

(i) The first is a problem dealing with visualisation. The intense temperature of a plasma would instantly vaporise any material substance, so a plasma must be kept well away from the walls of its container. This can be achieved by electromagnetic forces, usually applied by coil windings around the container.

Since plasma containment devices are often of toroidal shape, and the windings spiral around, it is difficult for the draughtsman to draw, and for the designer to know the full consequences as. Will the start and end of a winding match up? Will there be space between the windings for a probe in a specified position?

Mathematically, however, the windings are usually very simple, typically being defined by just three or four parameters. So interactive graphics facilities can be used to assist, as follows.

The windings are shown on a visual display screen for the set of parameters specified by the designer. He can then view the winding from any position, and adjust the parameters at will.

Unlike architectural applications, where hidden line removal for arbitrary (as opposed to rectangular) shapes is a difficult problem, the filamentary windings are best discussed with intensity variations — that is, brightness near lines, and dimming distant lines. This is a very simple and effective technique, while Figure 3 shows a perspective view of the system, representing cylindrical coils on a rectangular base.

The "menus" list provides both for the construction of standard shapes, and the possible upper constraints and perspectives. These "intensity variations" depend on some of the variation effect in reproduction: they are reproduced from polarized photographs which are taken by a field camera from the display.

The VDU used at Culham is a Digital Equipment 338 which allows several levels of intensity, which were used for this work.

Figure 4 shows the contours of the field produced by a coil winding. The contours are then fed to the computer and actual magnetic fields are calculated. The calculated fields are then compared with the plot to verify accuracy.

(ii) The second example is the design of finite elements mesh. The method of finite elements analysis has become popular for the solution of harmonic or biharmonic equations in field or stress analysis. The common domain element used is an equilateral triangle, and the first step is the subdivision of the region of interest into a mesh of these basic triangular elements. Next, the edges of the domain, the triangles must be divided in order to represent the boundary; but numerical analysis tells us; these must be as nearly equilateral as possible, as the error in the eventual solution depends on the mean height of the triangles rather than on their smallest angle.

Interactive control in the triangulation process is that any acceptable sequence will require more detailed information in certain areas, and hence any defects by moving corners will be shown. The "menus" select keywords: ZOOM (zooms on in on a specified part of the picture); MOVE (moves an indicated node to an indicated position), and UNZOOM (undoes the MOVE).

To refine the mesh is equally simple, the keyword FINE (and the number of the input triangle is subdivided by the program into triangular parts.)

The final result of a single node adjustment, plus some additional refinements, is shown in Figure 5. The mesh is now ready for presentation to the numerical program of the program to obtain the desired field or stress solution.

Most of this work at Culham was done on an ICL 1900, coupled to a Digital Equipment PDP-11 which has a 238 display running under the Echo 3 monitor. The Lancedata ICL 1900 computer was used for interactive work.

This facility was, however, only available to privileged users; as a whole 338 users can be re-run in fold-out for interactive work.

The present system comprises an ICL 47/90 with sock types of output, coupled to a Computer Technology Modular One, a Charter 1500 refresh display, and several storage tube displays.

The Multiplot operating system is used, and this normally provides two roll-in roll-out storage means, each of 56k words (approximately 25,000 32-bit words), some small service streams, and a 2000k production stream. As at peak times, streams of up to 5000k (returns in normal view) are available. The system is ideally suited to interactive work.

The GHOST graphics package has been developed into a very versatile interface. It is written in the language of choice and the processing onto output, line printer, display, storage tube (more usually) the $1200 graphics resources. The program is short circuit the processing information directly onto the output device.
They say that when, in the tenth of fierce competition from IBM, Burroughs won the contract to supply Joe Bamford's rapidly growing JCB excavator business with handling and warehousing systems worth £500,000 (CW 7 February 1972), the self-made owner of the company told the granting sales team: 'Oh, so you've shown me that you can do the job. But I warn you, if I find that the system you sell us doesn't match your promises, I'm not doing any deals to suit it back to you.' I'm going to bring every member of the press I can lay my hands on up here. I'm going to dig a notably great hole outside the building and I'm going to drop your £500 into it.'

Everything about J C Bamford, from the man down, is several degrees larger than life. The business began with a thirtythree-year-old welder in a JCB tooling kit, with the 170c C battering rams. The kit was sold to John Deere. 1963, late in JCB's 10th year, JCB moved into the purpose-built new factory at Uttoxeter, with which Bamford's company now occupies a 50-acre plot on the outskirts of Uttoxeter, where it has a 500,000 square foot site and a workforce of 2,000.

JCB now has plant covering 800,000 square feet standing in its own JCB-landscape grounds at Rocester, Staffordshire, which at present include two artificial lakes and a helicopter landing pad. In the pipeline are a private airfield, and a 50-bed hotel to house the 5,000 visitors a year who come to marvel — and buy. JCB turnover is currently running at £5 million a month (Bamford's family business down the road at Uttoxeter, with which JCB merged last year, turns over a steady £50 million) and the aim is £100 million in 1979, give or take a year.

The JCB Centre has a 500,000 square feet standing in its own JCB-landscape grounds at Rocester, Staffordshire, which at present include two artificial lakes and a helicopter landing pad. In the pipeline are a private airfield, and a 50-bed hotel to house the 5,000 visitors a year who come to marvel — and buy. JCB turnover is currently running at £5 million a month (Bamford's family business down the road at Uttoxeter, with which JCB merged last year, turns over a steady £50 million) and the aim is £100 million in 1979, give or take a year.

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