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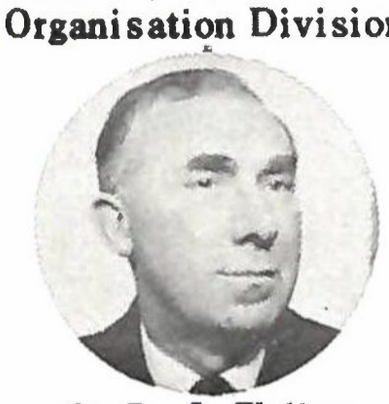

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Atlas Computer Laboratory

Science Research Council, Sports and Social Association

The association was inaugurated on 10th March 1967, and became affiliated to the Civil Service Sports Council on 1st May 1967.

The following clubs have been accepted into membership of the association.

Atlas Computer Laboratory
Daresbury Nuclear Physics Laboratory
London Office
Radio & Space Research Station
Royal Greenwich Observatory
Rutherford High Energy Laboratory

The Royal Observatory Edinburgh are affiliated to a regional association which is more suitable for their requirements.

Through the S R C association, clubs will be able to apply for financial assistance for development of their facilities from the Civil Service Sports Council.

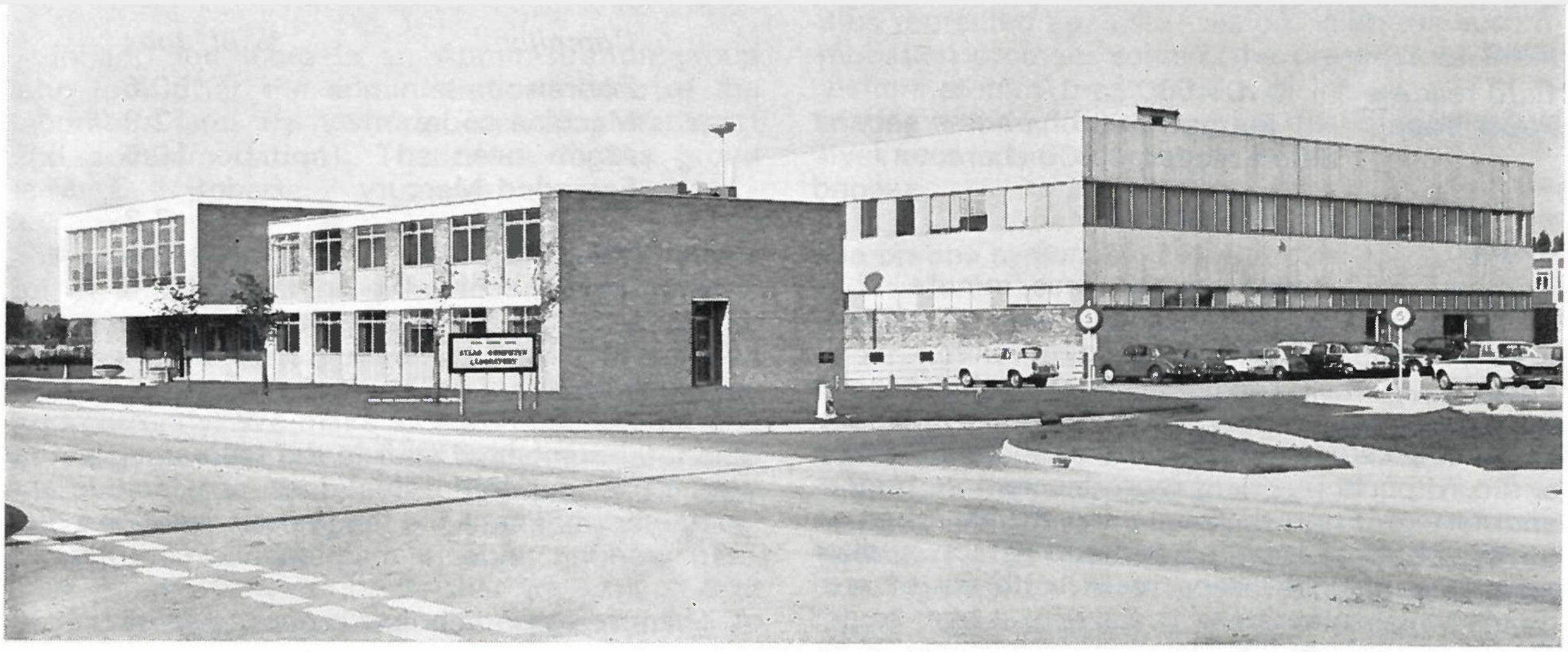
The committee of the association, which consists of four officers and a representative from each club, will meet at least three times a year to consider any matter placed before it by a club.

The aims of the association are to :

1. Act as co-ordinating body between sports and social clubs within the association for the purpose of encouraging the pursuit of amateur sport and recreation.
2. Liaise between the various clubs within the association and the Civil Service Sports Council.
3. Encourage the formation of clubs within the S R C at establishments where none exist.

All members of clubs affiliated to the association are eligible to play for the Civil Service in representative matches. If any club has a member who is outstanding at a particular sport, the Secretary should forward details to the secretary of the association.

The Civil Service Sports Council also arranges inter-departmental competitions in most sports, and it is hoped to enter S R C teams in these events.



a computer for all purposes

the work of the Atlas Computer Laboratory

R. F. Churchhouse

The Atlas Computer Laboratory was set up in 1961 with Dr. J. Howlett, then Head of the Computing Group at AERE, as Director. The laboratory was originally administered by the former National Institute for Research in Nuclear Science and was incorporated in SRC in April 1965. The aim of the laboratory is to provide computing facilities on a large scale – with all necessary supporting services – to research workers in universities and government laboratories. More specifically, to be a place to which they can turn when faced with problems needing more computing power than their local installations can provide. No charge is made to university users for any work done for them but Government users are charged at a rate which represents the cost of operating the laboratory.

The laboratory is on a site adjacent to the Rutherford High Energy Laboratory and the Atomic Energy Research Establishment (Harwell) of the UKAEA. Its main equipment is a large Atlas installation which was ordered from Ferranti (later merged with ICT) in the summer of 1961. A building was designed with the special needs of the computing service in mind and was ready for occupation in January 1964. The machine was installed during May and June of that year and a regular one-shift service was started in October. This has been extended as demand has increased and at the time of writing we are running three shifts five days a week; we expect to take up the weekend gradually over the next twelve months.

the computer

The installation is made up as follows:

main frame

Central Processor,
- 48K core store (2 μs cycle time)
- 96K magnetic drum store
- 8K fixed store (0.4 μs access time)
- 16K working store

The word length is 48 bits. The fixed store holds the basic routines and uses the working store as working space

disc

16¾ million word Data Products disc (added Dec. 1967)

magnetic tape

16 Ampex TM.2 decks
2 IBM 729 Mark IV decks

input

Card readers	2 ICT 600 card/minute
Paper Tape	1 Ferranti 300 character/second
	1 Elliott reader, 1,000 character/second

output

Printers	2 Anelex 1,000 lines/minute
	120 character/line
Card Punch	2 ICT 100 card/minute
Paper tape	2 Teletype 110 character/second

This is backed up by standard equipment for tape and card punching, card reproducers, interpreters and sorters. From the beginning we have had an off-line Benson-Lehner Model J graph plotter driven by magnetic tape, with a library of programs which may make it easy for a user to get output in the form of point plots, histograms or continuous curves, including stereoscopic pairs for display of three-dimensional structures. This mode of output is so important that we have recently taken delivery of an SC4020. This is a microfilm plotter which can produce graphics on hard-copy, microfilm and cine film.

The machine runs at an average speed of 350,000 instructions per second. Floating point addition takes 1.8 to 2 μs, multiplication 5.9 μs, organisational instructions 1.6 to 2 μs. In machine code, inversion of a 100 x 100 matrix takes 17 seconds, sorting 5,000 floating-point numbers into numerical order takes 1 second. The operation of the machine is automatic and is normally under the control of a permanent resident program called the Supervisor, which monitors all its activities, organises the time-sharing of input, output and computation and of a number of programs held in the store at the same time.

One part of its action deals with automatic transfers between the core store and the magnetic drums, and enables the programmer to work as though the two formed a continuous directly-addressable store of 144K words. It also makes possible the use of many different compilers, and in fact Atlas users can (and do) write in Fortran, Algol, LISP, IPL-V, the Atlas Autocode produced by Manchester University, the Autocode produced originally for the Ferranti Mercury computer and since greatly extended, and several others.

The level of activity can be gauged from a few operating statistics. In a typical week we run 2,500 jobs, input a million cards and 24 miles of paper tape, print two million lines of output, punch 60,000 cards, handle 1,500 reels of magnetic tape. We have nearly 1,000 projects on our books from university users and are usually doing work on 600 of these. A recent survey showed that the distribution of the work load amongst the main languages is:

Compiler	*% of Jobs*
Fortran	50.6
Machine code	12.9
Algol	10.6
Extended Mercury Autocode	7.3
Atlas Autocode	3.6
Others	15.0

organisation

The total number of staff in the laboratory is now about one hundred. This does not include the computer maintenance engineers, who are ICT staff working under a maintenance contract.

There are four technical groups :

(i) The Operations group receives work (some of which is in manuscript and needs to be punched on to cards or paper tape), processes it through the main computer and any auxiliary machines, such as the SC4020, and despatches the results to the users. The head of the group is Mr J. E. Hailstone.

(ii) My own responsibility, the Programming group is concerned mainly with basic software – for example, changes or extensions to the Supervisor to incorporate new ideas or extensions to the installation – compilers and library programmes. It has built up an extensive library of programmes in Fortran and Algol. A small group are writing the software for the Sigma-2 Atlas on-line system. A number of programmers are engaged in more specialised activities associated with applications of computers, such as developing a system suited to the analysis of statistical experiments and an information retrieval project.

(iii) The Support group gives help and advice to users and is responsible for maintenance of the library programmes and various large 'packages' (such as the crystallographic programmes and the programmes for space research). This group also organises programming courses. The head of the group is Miss Barbara Stokoe.

(iv) There are posts for individual research: the laboratory has given fixed-term contracts of employment to research workers of established reputation whose particular interests

demand the use of a large-scale computer, or who are interested in exploiting the powers of the machine in novel ways. It has been the policy wherever possible to arrange that the holders of these posts also have some academic connection, such as a university or college fellowship.

In addition there is an Administration group who look after the administration needs of the laboratory and its visitors (including transport and accommodation). The head of this group is Mr C. L. Roberts.

As can be imagined, we have had to give a lot of attention to the office-management aspect of the operation of the service, so as to ensure that the very large volume of work (with all its associated paper) is handled quickly, efficiently and correctly. We make as much use as possible of modern office machinery and, of course, we use the computer itself to produce all our accounts and statistics.

A point worth noting is that we expected to have significant numbers of people wanting to spend time in the laboratory, to develop large programs, so we planned the building to provide pleasant and practical accommodation for visiting users, in small single offices which can be booked a week or so ahead. These have proved very popular indeed and have made life far easier, not only for the visitors, but also for the permanent staff of the laboratory, who are thus protected against invasion. With the accommodation problem solved, the presence of many visitors, with a great variety of interests is stimulating and contributes a great deal of intellectual liveliness to the laboratory.

the on-line system

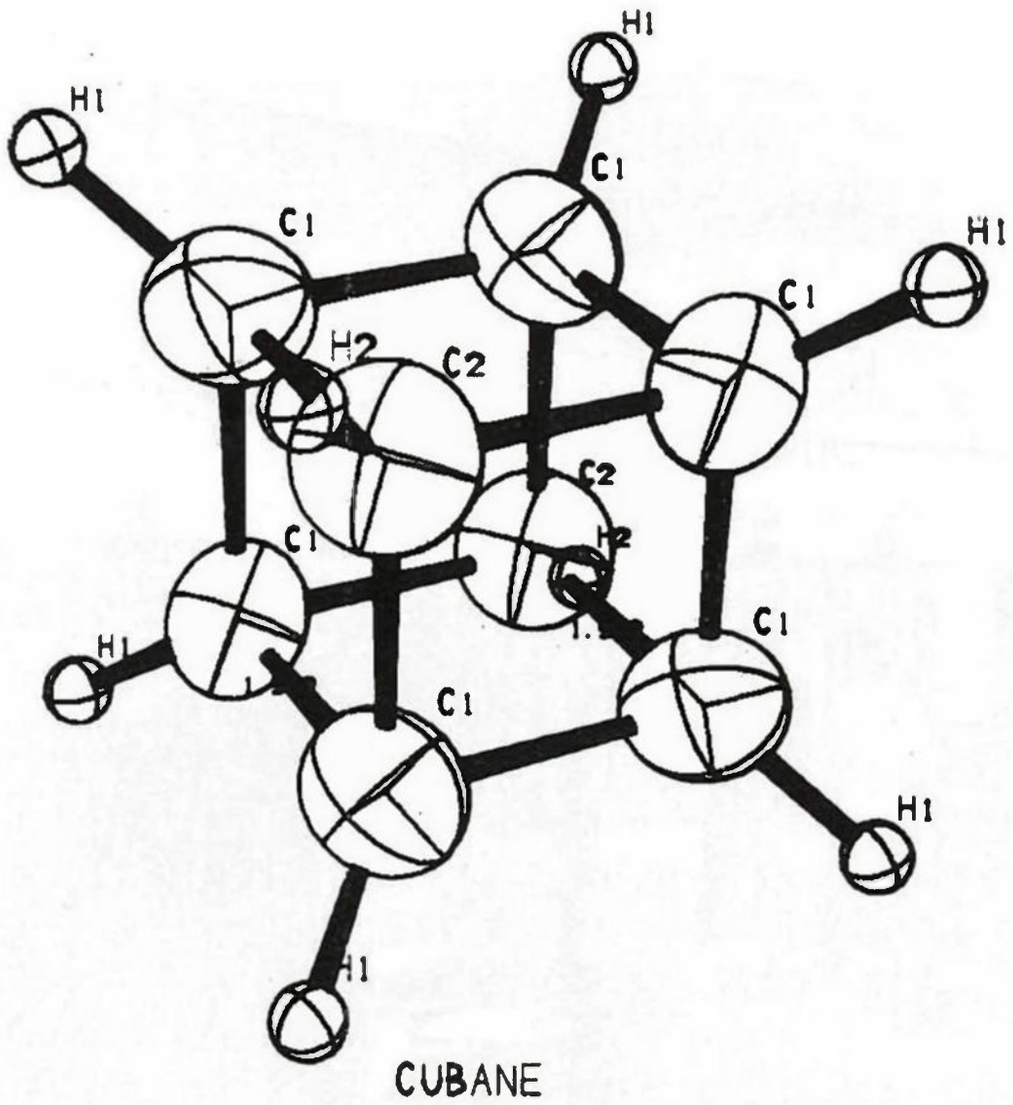
A small on-line system is being put together. In order not to downgrade the efficiency of Atlas the consoles are attached to a small computer, the S.D.S. Sigma-2, and this computer communicates with Atlas via the Data Products disc. There are very interesting technical problems on both the hardware and software sides. On the hardware side there is the problem of interfacing the Sigma-2 to the disc. Here we have had the good fortune to have Peter Wilde of RHEL Electronics group loaned to us for a year and he

General view of the machine room

has designed and built the interface. All the software required for the on-line system is being written by a small number of members of the Programming group. We at present have six teletype consoles, but hope to increase this number before very long.

some examples of work done on Atlas

Big users of Atlas include the Meteorological Office, crystallographers, space research and people interested in survey analysis. At the other end of the scale quite small amounts of machine time may suffice for the development of some of our most important system programs (extensions to the Fortran and Algol Compilers, the Supervisor program etc.) as well as work on aspects of pure mathematics research (number theory, group theory, etc.). Here are brief accounts of some of the projects in which the machine is used. These are not necessarily the biggest users, but between them they give some idea of the wide range of application of the computer. I have made no mention of the more obvious applica-



CUBANE

Cubane and Convolutes
Examples of graphic output of SC.4020 graph plotter.

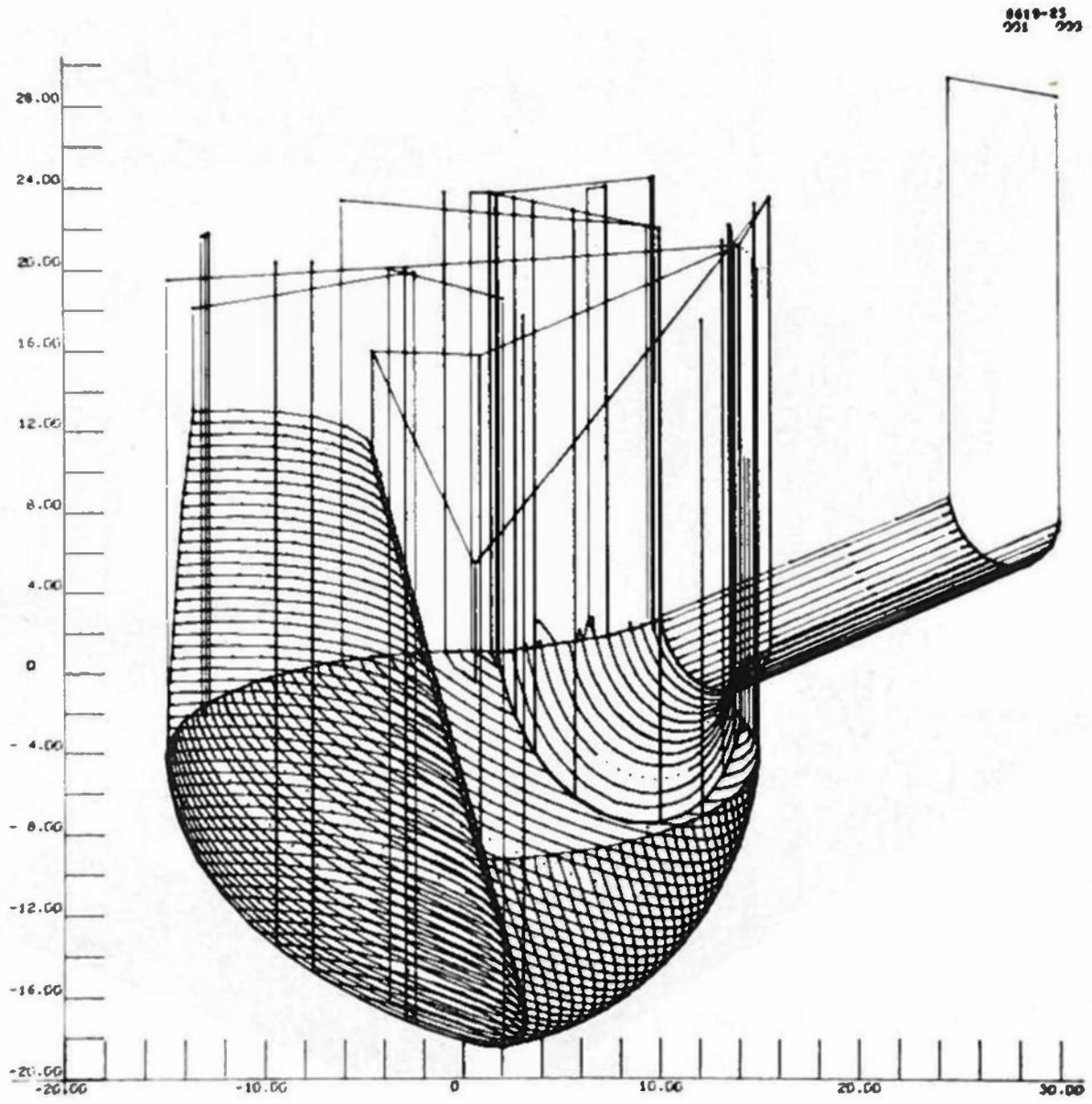
tions of computers, such as the solution of partial differential equations. Although no-one is surprised to find computers being used for such work, such problems tax the skill and ingenuity of the most experienced numerical analysts and, indeed, one of our Fellows (Dr. Joan Walsh) is working on problems of this type.

crystallography (J. C. Baldwin)

Crystallographers have an inherent ability to use as much computing power as is made available to them and therefore they form a significant group among the users of a machine of the size of Atlas. By placing a crystal in a beam of X-radiation and studying the resulting diffraction pattern, it is possible to determine the approximate positions of the constituent atoms. Refinement of these and other parameters continues until close agreement is reached between the observed and calculated patterns. When complete, the crystallographer will wish to know the relative distances and angles between various atoms. Programs for these calculations are provided by an American system known as X-Ray 63 which has been adapted and expanded for running on Atlas and is currently used by research groups from fourteen universities.

literary concordances (D. B. Russell)

COCOA is a system which enables users to carry out quantitative analyses of literary texts punched on cards or paper tape. It can provide a count of the frequency with which words appear in a given text and for each occurrence of selected words; a reference showing where that particular occurrence appears; together with a small amount of its context. All occurrences of a given word are concorded for easy manual reference. This work was undertaken when it was discovered that several university linguists were in need of such a program.



Convolutes

simulation and analyses of compiler systems (P. Bryant)

The Brooker Morris Compiler Compiler system, which is a tool for easing the writing of compilers, has been exploited in the writing of a simulation compiler with the object of studying various facets of computer systems, in particular a study of the Atlas drum and disc interaction and also some multi-access problems. The compiler has also been used in a variety of industrial problems.

Work is also proceeding on the evaluation of computers. This work breaks down into three main sections namely the hardware, the operating systems and the compilers and we hope that the results will provide some guide lines in determining the factors which influence a computer's performance.

space research (Miss Barbara Stokoe)

The Atlas laboratory is processing data received from the satellite Ariel III, which was launched from Western Test Range, California, USA, on 5th May, 1967.

Information is received from the satellite by several tracking stations around the world, and these are sent to RSRS Slough, where the information is digitised onto $\frac{1}{2}''$ magnetic tape. These tapes are sent to AWRE Aldermaston, who perform a preliminary run, producing a further $\frac{1}{2}''$ tape. This is sent to the Atlas laboratory, who process it, (using a program initiated by AWRE), producing tapes of a form suitable for the five experimenters – Birmingham, Manchester and Sheffield universities, RSRS, and the Meteorological Office at Bracknell.

The average rate of receipt of tapes from AWRE is three per week, and the machine time involved is in the region of three hours per week.

analysis of surveys (Mrs. Judy Lay)

We have available a program called MVC (Multiple Variate Counter) written by A. J. T. Colin of London University (now at Lancaster). There is a continual large scale demand for this program. Of seventy-two surveys currently being processed, thirty-five are medical; examples of these include various cancer studies; peptic ulcer; convulsive disorders; tuberculosis; coronary study; bronchitis in the Welsh steel industry; congenital malformation; and jaundice in infants.

Examples of other surveys include various surveys about students, graduates and school children; population movement from 1851–1901; reaction to televison programmes and local radio; industrial studies; hospital manpower; and bird movement study.

statistical program package, ASCOP (B. E. Cooper)

ASCOP is a comprehensive statistical system. It has good editing and checking facilities, and data presented for it can be stored on magnetic tape for later use. Instructions are in the form of english sentences or Fortran-like equations, and may be formed into subroutines. The system is being extended continually, for example, to incorporate tabulation and graph plotting facilities, making it useful in the survey analysis field. It is currently being implemented on a number of other computers. ASCOP is useful for anyone who wishes to perform statistical analyses on data.

information retrieval (R. F. Churchhouse)

Information concerning about 5,000 articles in a dozen computer science journals has been written on magnetic tape. The information retrieval programs make it possible for a user to find out what papers have been written on topics in computer science, or works by particular authors. When a paper is retrieved, the papers to which it refers or which have referred to it, are also retrieved. This simple method of retrieval is very powerful since it leads to papers both earlier and later in time than the one initially found and thus provides leads for further retrieval. A search through the complete file takes less than ten seconds of computing time on Atlas.

work in collaboration with NERC

During 1967 an investigation was carried out by T. N. Gover of the Atlas laboratory into the computer requirements of the Institute of Geological Sciences, a branch of the Natural Environment Research Council (NERC). In the report that followed it was suggested that in order to make the data collected and held by each department universally available, a data bank should be created. In order to assess the feasibility of such a scheme, pilot projects are being conducted at the Atlas laboratory. A team of three, Gover, Miss Harvey and Mr. Turnbull of IGS, started work in December 1967. Coding has now reached an advanced stage and it is hoped that geologists will be able to put fairly simple requests for information to the system during this summer.

time series analysis (P. Kent)

In the examination of a problem one often obtains a sequence of data readings which vary in a consistent manner. For example, the air temperature at noon each day would vary with the seasons. In addition to this basic cycle there

would be fluctuations from day to day and long term changes over periods of many years. The components of such a sequence can be separated and examined by means of 'Time Series Analysis'; a system of programs for the analysis of time series, written in America for the IBM 7090 computer by Sir Edward Bullard and others, and now in use on Atlas. The program, known as BOMM, has already been used in the analysis of daily water flow in the river Indus, temperature fluctuations at the bottom of the English Channel, electro-encephalograph records, and fluctuations in the national grid. It should also be of use in the fields of astronomy, geophysics, and economics.

radiative transfer (I. P. Grant)

We have developed new methods of solving the equations of radiative transfer numerically using difference techniques based on well-known principles of invariance. Such principles have been used before to calculate the reflection and transmission of light by plane scattering layers, but not to compute light fields within the layer.

Apart from tests to verify theoretical results concerning accuracy and numerical stability of the methods, the first practical application of these ideas has been to compute estimates for the radiation emerging from the top of the earth's atmosphere for wavelengths in the 8–150μ region in the presence of cirrus cloud, a problem of interest to a project for atmospheric temperature sounding by artificial satellite proposed by by joint groups at Oxford and Reading universities.

pure maths
(A. O. L. Atkin, J. Leech, J. K. S. McKay)

At the present time three of our Fellows are engaged in pure maths research (Dr. Atkin on number theory; the others on group theory). In addition another Fellow, Dr. Paterson, is working on theorem proving by computers. The work being done in these areas is particularly interesting for new results are being discovered which would not have been found if computers had not been available. The laboratory helped to sponsor and organise a highly successful conference in Oxford last summer on the use of computers in algebra and it is hoped to organise a similar conference relating to number theory in August 1969.

lessons learned

The laboratory has been providing a computing service for nearly four years, and very intensively for the past three years. The use made of this service shows how great is the need. We get work from every university in Great Britain, the demand is increasing and there is a steady increase in the general levels of size and complexity of the problems put on the machine. It is particularly pleasing to observe the rising demand from workers in the non-physical sciences – sociologists, psychologists, educationalists, biologists and others – as they begin to appreciate the help they can get from a powerful computer and a quantitative approach to their problems.

The Atlas laboratory is operating as a national facility for universities, and to a smaller extent for government research laboratories; it is a great deal bigger than anything else to which the universities as a whole have access and is comparable with anything in Europe. The scale of operations is great enough to justify the provision of many technical and administrative services and we have come to the conclusion that these are valued almost as highly by our customers as is the computing power of the installation. Simple things like the supply of cards, paper tape, coding forms and stationery generally are very important; people need ready access to card and tape preparation equipment and to desk calculators for odd checks and minor pieces of arithmetic; help in arranging transport and booking accommodation is very welcome; and of course somewhere to work is essential. On the technical side, and taking for granted the vital need for first class basic software and library programs, we found a great demand for a general advisory service for users. To satisfy this demand we created the 'support group'. In order to improve communications between the distant users and the support group we have recently installed a Telex. This has the great merit of producing at low cost a printed copy, essential where modifications to programs are concerned.

Finally, all experience has confirmed the view with which the laboratory started out, that the presence of research activities in the building and easy contacts with the academic world and with other computing centres are essential to the intellectual health of the members of the laboratory. A large-scale computing service is really a very sophisticated and highly professional undertaking which makes demands at all levels and is always needing both stimulation and criticism; without these it is fatally easy for the people who are providing the service to become stale and unenterprising, and the standard of the service to decline.

GLOSSARY of computer terms

FORTRAN, ALGOL, etc. are languages which allow the user to express a problem without a knowledge of the machine's order code.
COMPILER, program which does the necessary conversion.
HARDWARE, the actual electronic equipment within a computer system.
SOFTWARE. the programs.
INTERFACE, can be either hardware, software, or a combination, to facilitate the joining of two (otherwise incompatible) pieces of hardware.
BITS, binary digits. i.e., 48 bits = 48 binary digits of either 0 or 1.

four special merit awards for SRC

Four special merit promotions have recently been announced involving scientists in four establishments. The recipients of the awards are in widely differing disciplines, but it is unusual for a Department to receive four such awards.

The award is made at PSO level to research scientists of exceptional quality, and because it does not involve additional administrative duties, the promotion does not interfere with the individual's research work.

Dr. A. O. L. Atkin
Atlas Computer Laboratory

Dr. Atkin has been working over the last four years on congruence properties of the coefficients of modular forms, on congruence subgroups of the classical modular group. More recently he has been working in collaboration with HPF Swinnerton-Dyer at Cambridge on non-congruence subgroups of the modular group, which turn out to have remarkable p-adic properties. Many of the discoveries involved would not have been possible without the use of computers.

The first SRC Sports Day did not attract favourable weather and in consequence, the attendance figures were not as good as they might have been. Conditions were not very comfortable for the competitors, but the standards were high and the honours fairly evenly distributed among the competing establishments. We are indebted to Harry Cook and Barry Briscoe for the report and to Robin Butler of RSRS for the photographs.

This, the first of what SRC Sports Association hopes will be many Sports Days, was essentially an exploratory occasion, and was arranged to provide competitive sport for as many of the Council's staff as could attend. It was decided that competitions would be run for cricket, tennis and bowls, the exact nature of the tournaments being left to the organisers to determine in the light of entries received. Both cricket and tennis enjoyed good support but unfortunately the entries for the bowls competition fell away and this had to be cancelled. It is hoped that it can be revived next year and with longer notice many bowlers will be able to participate.

The cricket competition was run on a 'knock-out' basis, with each side batting for a maximum 15 overs and with restriction on the number of overs any player could bowl. Five entries were received, with results as follows:

1st Round RGO (35 runs for 0 wickets in 7 overs) beat RSRS (34 runs for 10 wickets in 10.4 overs)
Semi-finals RHEL (60 runs for 7 wickets in 15 overs) beat RGO (54 runs for 8 wickets in 15 overs)

LO (75 runs for 1 wicket in 10 overs) beat Atlas (74 runs for 4 wickets in 15 overs)

Final RHEL (45 runs for 6 wickets in 13.3 overs) beat LO (44 runs for 9 wickets in 15 overs)
Supplementary Round Atlas (97 runs for 9 wickets in 15 overs) beat RSRS (64 runs for 6 wickets in 15 overs).

The supplementary round was arranged to give all participating teams at least two games during the day. The only 'seeding' resorted to was to put RHEL and Atlas in separate halves of the competition to ensure they played against teams from less familiar establishments.

Atlas support for Atlas

Manchester University's Atlas computer was damaged by fire on the evening of Sunday May 4, but a very swift first-aid programme was arranged between Professor Sumner of Manchester and Dr. Howlett of the SRC's ACL, whereby at least part of the Manchester work could be continued until repairs could be effected.

A telephone call to Dr. Howlett on the Sunday night produced quick results and on Monday it was arranged to allow one hour in twenty-four for the University's work, and a full eight hours on Saturdays.

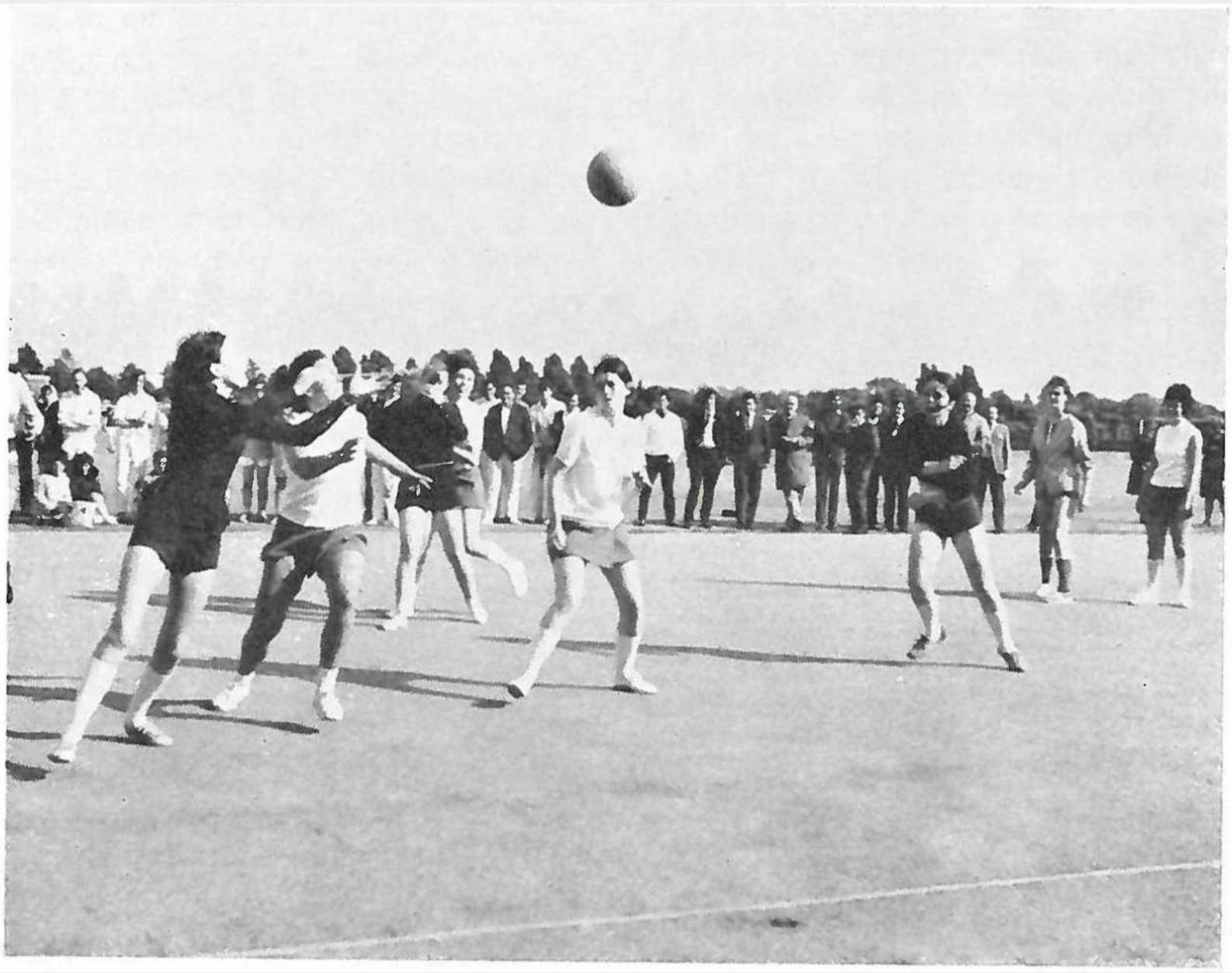
The first programme was run through within twenty-four hours of the fire and the results available at Manchester on the following morning.

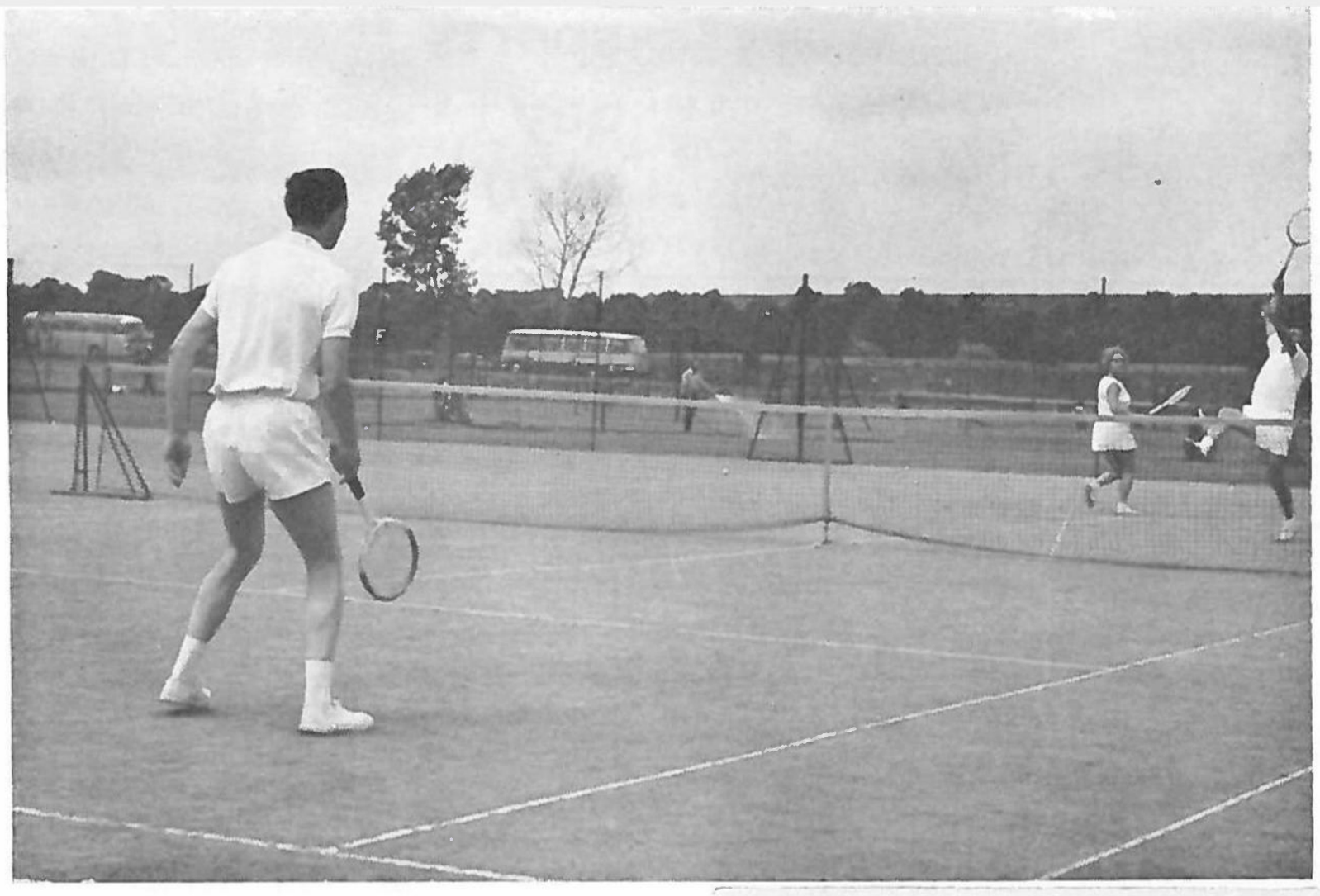
The May Council meeting formed part of a two-day visit to the Abingdon area, where members stayed at the Cosener's house and visited the Atlas and Rutherford Laboratories and the Astrophysics Unit at the Culham Laboratory. They met many of the staff, and a selection of the work was presented and discussed. Members expressed appreciation of the work, and of the arrangements made by the three Laboratories for the visit. Among the specific items approved at the May meeting were a supplementary grant of £400,000 to Professor H. H. Rosenbrock (UMIST) for researches into the design of multivariate control systems for industry, and up to £66,000 for enlargement of the core store of the computer at the Institute of Theoretical Astronomy, Cambridge.

Mr. C. Jolliffe formerly Director of UST Division will take over the Science Division and Dr. A. W. Lines, formerly second in command as 'Head of Division', is appointed Director of the Engineering Division. The Science Board, with Professor Kornberg as Chairman, will be responsible for the support of research and post graduate training in biology, chemistry, enzyme chemistry and technology, mathematics and physics (other than nuclear physics, astronomy, space and radio research). It will also be responsible for Atlas Laboratory and for the arrangements for university use of neutron beam facilities and of the services of the Physico-Chemical Measurements Unit. The Engineering Board will be responsible for the support of research and post graduate training in aeronautical and civil engineering, mechanical and production engineering, control engineering, metallurgy and materials, computing science and polymer science.

QUEST Loss

Dr. John Baldwin local correspondent from ACL who is to spend a year at the University of Maryland under Professor Jim Stewart to assist in implementing crystallographic programming package Xray-70 on the University Computer. Then he will work on its conversion for use at ACL. Dr. Baldwin adapted the Xray-63 package now in use from the US programme. His bellringing interests were featured in Quest (in January 1969).





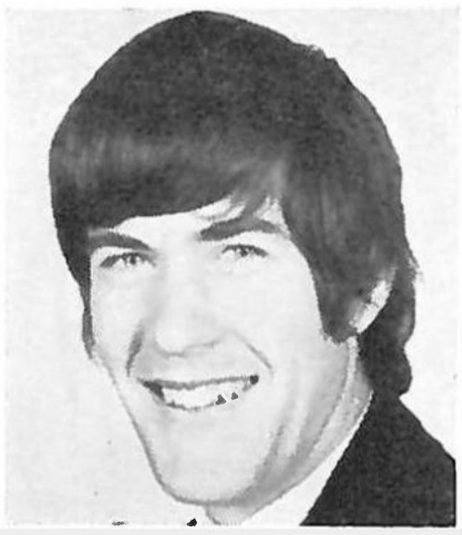
In the picture above the Horners are countering a tricky shot from Mike Claringbold and Lorna Green of Atlas on their way to the final.
Photo P. Hicks.

sports day 1970

netball

A great deal of shouting made the netball final easy to find *(picture on left).* The game's first appearance at Sports Day proved it a top choice. The final fought out between teams from RGO and Atlas was one of the most exciting of the day. Spectators lined the court yelling determinedly for one side or the other–or both–and the goals went 1–-0, 1—1, 2—1, 2—2 with RGO just taking the lead until Atlas broke through at 12—12 to go 13—12. With the ball whipping from end to end and the players changing direction and formation with lightning frequency, RGO held on, drew level and, in the very last seconds of the game, scored one last goal to win by 14—13. Netball is definitely here to stay!

Adrian Buckel, ACL
see page 8



QUEST Vol 3 No 4 October 1970

from the computers

The next four pieces are from computer folk – at work and play.

1. film analysis

At Daresbury, as at many other high energy physics laboratories, machines used for the manual measurement of pictures taken with bubble and spark chambers have been connected on-line to a computer. A programme in the computer is used to direct the operators and to check their measurements, with a view to eliminating errors which would otherwise result in the event being measured failing to pass through the subsequent analysis programmes.

The Daresbury system has been built up in modular form using standard components wherever possible. All forms of local output (*eg* punched cards, punched paper tape) have been eliminated, and communication between operator and computer is achieved by means of visual displays and keyboards rather than by the use of typewriters. The computer programme has been written in Fortran to facilitate programme modification and testing.

One machine has been equipped with a storage display scope, on which the display can be built up piece by piece and retained throughout the measurement of a picture. The operator's instructions are successively displayed, and a reconstruction of each measurement is made on the display, together with a representation of each track as determined by the computer from the measurements. Thus, at any instant, and in an easily understood way, the operator is shown not only what she should do next, but also all that she has already done. Any errors detected by the computer are brought to the attention of the operator by means of an audible alarm, and an error code displayed on the screen.

The photograph on the cover of this issue of *Quest* shows an operator studying the scope screen, on which are displayed the instructions (on the left hand side), the reconstruction of the measurements (crosses), and the representation of the two tracks the operator has finished measuring.

2. film producers

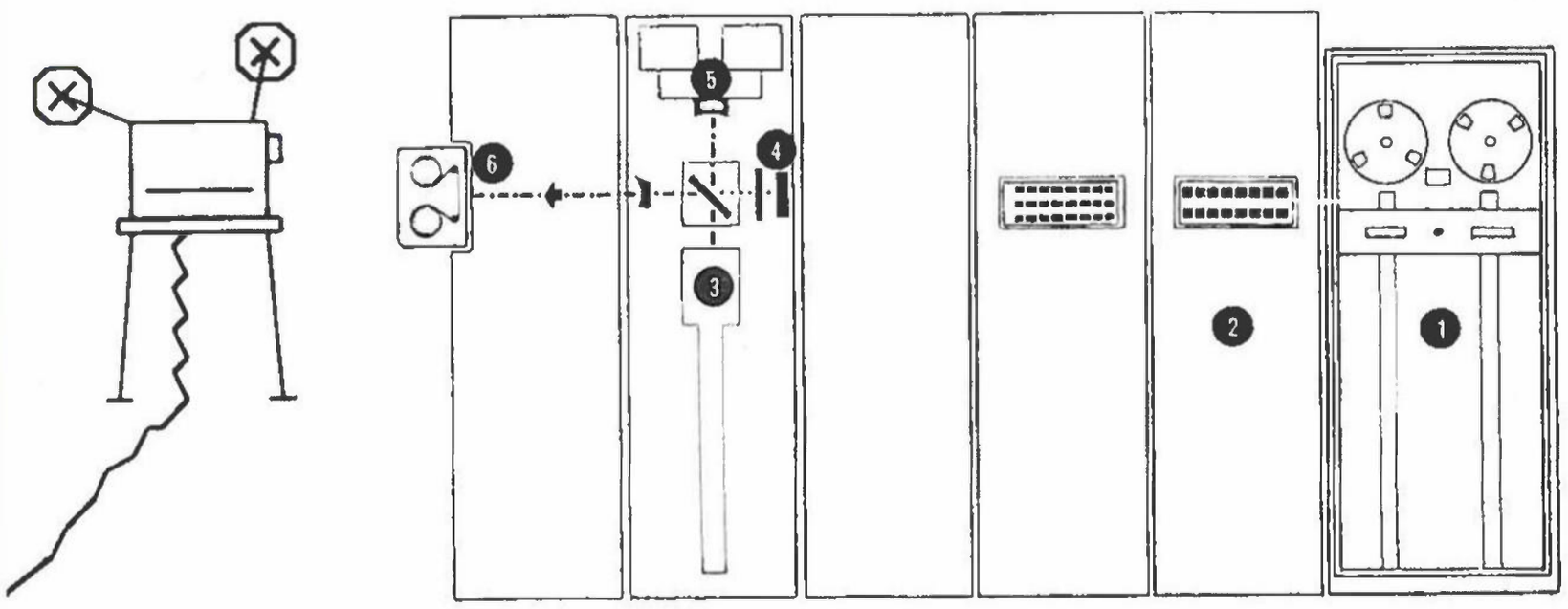
Paul Nelson

To many people, computer output means reams of fan-folded paper containing numbers and cryptic messages. The words are generally in one case only, *ie* capital letters, and to read very much of this soon proves irksome. This particular form of output originates from line-printers and still provides for the bulk of directly readable material produced by computers.

Sometimes electro-mechanical graph plotters are used as a means of summarising previously extensive numerical results. Trends in plotted data are readily seen and, of course, objects may be drawn and viewed from different angles. If character sets are made up using lines then both upper and lower case characters, as well as different alphabets, become freely available.

Although reasonably priced, the electro-mechanical graph plotter is not always fast enough to cope with some requirements. Recently, the more expensive Cathode Ray Tube (CRT) terminal has come to the fore. The simple form known as a Visual Display Unit or VDU is somewhat similar to a television set in appearance, but is only capable of displaying numbers and alphabetic characters. These characters are formed by electronic processes on computer command and are then displayed on the face of the CRT. Usually, both case sets are provided for in the 'hardware' or electronics of the terminal.

The full graphics terminal is more elaborate in that it is also capable of producing lines at any angle and may be activated by using a keyboard and light-pen. The latter is able to detect the displayed data and send signals to the computer as to the location of the 'hit' or detection point. Connected in this manner, whereby electronic signals are transmitted in either direction between computer and terminal, provides for what is known as 'on-line interaction'. The input may optionally be used to modify the output, the changes taking place virtually instantaneously. Alternatively, the computer may be programmed to produce a set sequence of pictures.



SD-4020 Microfilm Recorder (left)

1 Magnetic Tape Deck
2 Buffer Unit
3 Cathode Ray Tube
4 Forms Flash Unit
5 16mm or 35mm camera
6 Photo-paper camera

These terminals with no mechanical inertia to overcome provide for high speed output. The graphics terminal can display complex drawings in seconds and it is from such a device that cine-films can be made. A camera is positioned in front of the screen (see diagram) and is set off in synchronisation with the picture changes. The general appearance of these films is mainly one of lines, alphabetic characters and symbols on a high proportion, in area, of uniform background. They have more in common with cartoons than of normal, or continuous tone, films. The lines and characters may be positioned as the result of highly complex mathematical calculations carried out by the computer, which an ordinary animator would find virtually impossible to match. And it is in this area that computer films are of importance in the teaching and scientific applications field. Artists are also becoming increasingly interested in these products as a means of expression.

Graphic Terminals are not generally suited to quantity production of high quality film output and machines have been specially developed. One such device known as a CRT microfilm recorder manufactured in the USA by Stromberg DatagraphiX is installed at the Science Research Council's Atlas Computer Laboratory, Chilton.

The microfilm recorder operates from instructions prepared on magnetic tape, produced by programs running on an ICL Atlas computer. In some installations these recorders are connected 'on-line' to the computer, *ie* connected by information-carrying cables, for immediate response. Standard programs save the user knowing in detail how lines and characters are specified to the recorder. For example, he could draw a cross by punching the following statements on two program cards:-

CALL LINE (300, 500, 700, 500)
CALL LINE (500, 300, 500, 700)

The commands are then automatically recorded on the magnetic tape in the form required by the recorder. The information is later read from the tape into a buffer store, and after decoding electronically, the electron beam within the CRT traces out the two lines in rapid succession.

Pointing at the tube face are either a 16 mm. or 35 mm. camera and a camera containing photo-recording paper for enlarged 'hardcopy' prints. In addition to lines, characters formed by extruding the electron beam through an etched matrix can also be displayed and recorded. The aperture setting remains fixed for a particular type of film, and since the CRT and cameras are in a light-tight cabinet the shutters generally remain open during the time a job is running. The time-interval between frame advances varies depending on the information content of the frame or picture. Whilst the film is being advanced under tape command, further display instructions are held up until the film is again stationary. Typically, lines and points are plotted at the rate of several thousand per second.

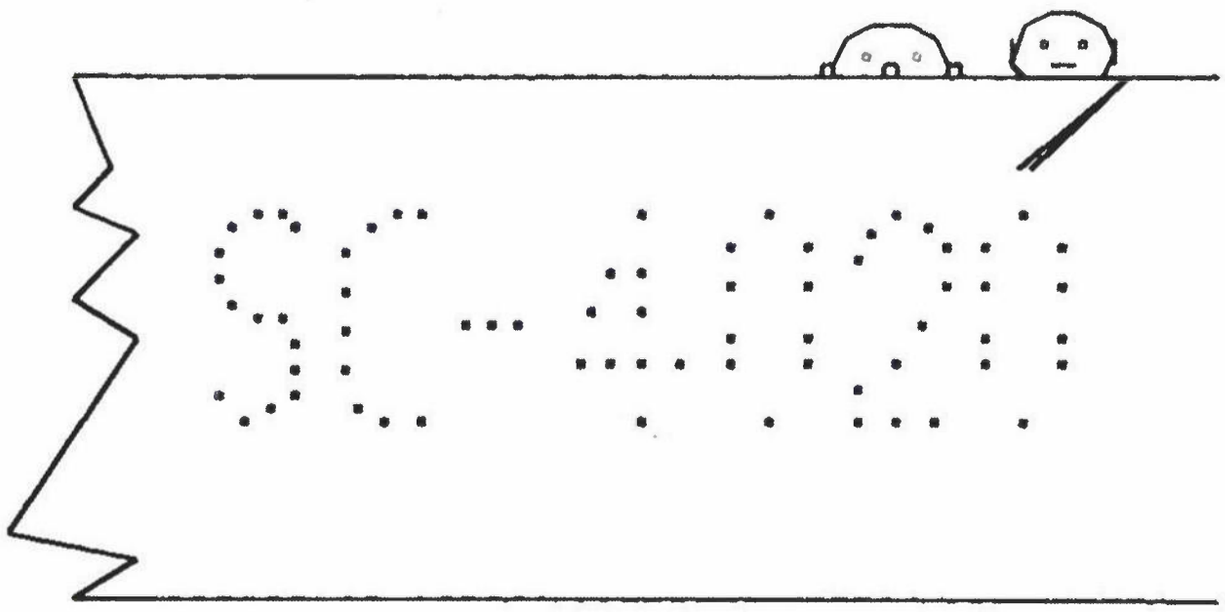
To produce a cine-film, the 16mm cine camera is used with black and white negative stock in 400 foot cassettes. It is possible to use colour stock, but as the phosphor of the tube emits light mainly in the blue region of the spectrum, the colours that can be obtained are rather restricted. By making use of a form slide projector, provided for superimposing constant information on the displayed data, but using colour filters, the blue trace may be combined with a coloured background in order to provide colour variations. The addition of a second, different colour filter, replacing the shutter itself allows for further modification in the colours. Opening and closing the now translucent shutter at suitable instants during the production of a frame give two colour plots on a third background colour.

The black and white film is processed in a small 16mm/35mm table-top microfilm processor at either $3\frac{1}{2}$ or $2\frac{1}{2}$ feet a minute, but colour film, when used, is sent to a commercial film processing laboratory.

Cine-films of any length are readily produced from short sequences by printing from A and B chequerboard rolls which is a method for preventing joins on the print from showing on projection. Some difficulties have been experienced with high contrast prints made on silver stock since the line work is very fine in certain instances. Although Diazo film appears suitable for printing on, at the moment sprocketed feed printers do not seem to be available. This material is exposed to ultra-violet light and processed in ammonia vapour at a speed of approximately 20 feet a minute for this type of work.

In order to retain interest, camera effects such as zooms, wipes, mixes and fades are possible on the displayed objects using suitable computer programs provided for manipulation.

A film made to illustrate the routines available has been produced with a sound-track on magnetic stripe running at 16 frames per second. The professional who made the sound-track did so under protest as



from the computers

from the computers

the film industry standard is 24 frames per second. However, as computing costs are high, the small drop in quality in this instance with this particular sound track can probably be justified!

The film uses the forms-flash to show a background picture of the Atlas Computer Laboratory with the title of the film – 'FOCUS' – drawn by the microfilm recorder, superimposed. Various routines provided for simulated camera effects and for achieving other necessary functions, such as line-thickening, are shown. Then follows a sequence describing the method used by a contouring routine for handling randomly distributed points having known values. A dramatic view of the earth rotating produced from a program originating from the American Space project, and generated from over eight thousand pairs of numbers representing the coastlines of the world, is accompanied by suitably stirring music. This gives way to a sequence of the British Isles being rapidly drawn as if by hand. The information representing this map contains even more points or pairs of numbers than that used for the whole world in the previous example, giving much greater detail. These values were obtained using a digitiser, a machine that automatically punches out the co-ordinate as a hand-held pen traces the outline. A zoom-in settles on the Atlas Computer Laboratory again and a final 'mix' brings up the word 'END'.

Paul Nelson is a programmer with the Atlas Computer Laboratory. The film 'FOCUS' which is described here was shown at the 1970 British Industrial Film Festival, held at Brighton in June. Copies are available on loan from the ACL Library.

3. fish to watch

Adrian Buckel

I keep fish as a hobby; and when one day in February another member of our shift suggested having an aquarium in the entrance hall of the Atlas Laboratory, I agreed to help set up the tank and look after the fish. The Director and department Heads were all willing, so work was started and Mr. Roberts (Admin) and his staff were very helpful in setting up the aquarium. A poster describing fish that would live happily together in a community tank was hung on the entrance hall inviting volunteers to buy them. The response was very good – despite requests for Piranhas!

The tank measures 54 ins x 10 ins and is 15 ins high. It holds 29 gallons and has two under-gravel filters. We only have one heater as the tank stands above two radiators but usually a tank of this length needs two to keep the temperature between 78° and 80°F. The fish are fed twice a day by my wife Gaynor *(see picture)* who also switches the lights on at 8.30 a.m. and off at 5 p.m.

At the moment we have six different types of plants in the aquarium. They are Crypocoryne, Echinodorus, Vallisneria, Synnema and Micranthemum, also Aponogeton which has grown very well and has flowered many times. By this time next year the plants should be well settled and growing much thicker and faster.

After having trouble with fin nipping by Tiger Barbs, weak fish dying, and very hard water, the fish are settling down now and the guppys are breeding regularly. None of their fry have survived as there is not yet enough cover for them. A pair of Zebra Danios have spawned (the eggs being eaten), and a

4. computericks

INTRO
If FORTRAN is incomprehensible
And to speak it, you feel, indefen-
sible:
Then just read these verses
In our tongue(?) from Atlas –
And their FORTRAN seems less
reprehensible!
ED

1 There was a programmer from
Cuidad
Who made love to an engaged
card-reader; he'd
Scarcely begun
This ILLEGAL FUNCTION
When it monitored C TIME
EXCEEDED.
FRED

2 There was a nice punch girl
called Dora,
Whose dress shimmered like the
aurora,
The card reader action
Was a fatal attraction –
'Twas a difficult job to ignore
her.
APOLLO

3 There was a young coder from
Aix
Who fed the computer cream
cakes
When it started to burp
They gave it some turp –
Entine and ran the LOG.
FRED

4 One Supervisor was a woman,
The other wasn't quite human,
When they ran off together,
SHE was as light as a feather,
But IT had to come in the van.
APOLLO

5 *(Written on discovering the perpetrator of some unrepeatable doggerel about 'Fred' and 'bed' chalked on the author's blotter).*
There is a Yank student called
Rosenthal
Whose dog-ends on my floor
are oft squozen. Till
He happens to light
Some old gelignite,
We shall have to endure his vile
prose and all.
FRED

pair of Red Platys may soon have some young. These three types of fish are the only ones in the tank at present that will breed there: all the rest must have special conditions to breed. Except for guppys and platys, most of them are egg layers.

Below is a list of the fish we have. A little about them each is headed by the scientific and the popular name of the fish.

Lebistes Reticulatus or Guppy

The Guppy is one of the best known tropical aquarium fishes. Most of the males are very colourful: no two have the same coloration. The Guppy is a live-bearing fish: it has up to 70 fry a time, and a female is fertile when only three months old.

Xiphophorus Maculatus or Platy

The Platy is another live-bearing fish, having up to 70 fry a time, but not quite so colourful as the Guppy. There are red and black Platys in the tank.

Brachydanio Rerio or Zebra Danio

Zebras are egg-laying fish from India, not so colourful but very active. One pair have spawned in the tank.

Barbus Tetrazona or Tiger Barb

As mentioned earlier Tigers tend to nip fins; despite this drawback they are very colourful. Origin Thailand, Sumatra and Borneo.

Rasbora Heteromorpha or Harlequin

These little fish look very nice in a school of a dozen or more in a well planted tank. Origin Malaya and Sumatra. Not easy to breed, but when they do they lay their eggs on the under side of leaves.

Gymnocorymbos Ternetzi or Black Widow

Black Widows are found in Paraguay. They are egg layers, and very good community fish.

Hyphessobrycon Flammeous or Flame Tetra

Sometimes called Rio de Janeiro Tetra as they are found in rivers in Rio de Janeiro. We have not got any Flame Tetras yet, but they have been requested.

Hyphessobrycon Innesi or Neon Tetra

This very pretty little fish found in Peru and Western Brazil is seen in the community tank in many homes. The rear lower part of the body is red, the throat (as you could call it) is white and a blue/green neon line runs from the eye to the caudal peduncle (base of tail).

Hyphessobrycon Gracilis or Glowlight Tetra

Coloration is the only difference between the Glowlight and the Neon: the Glowlight has an orange instead of blue/green line, and the rest of the body is silver. Origin Guiana.

Gyprinocheilus Aymonieri or Sucking Loach

The worker of the tank, origin Thailand, called Sucking Loach because of the sucker around it mouth which enables it to stick to the sides of the tank or leaves of plants. Is a very good scavenger so helping with the maintenance of the tank. The Sucking Loach has not been bred in captivity.

Corydoras Paleatus or Mottled Catfish

A request for a catfish was made so I chose the attractive C Paleatus which often sits at the front glass and amuses onlookers with a frequent wink of the eye. Unfortunately our little catfish died which I was on holiday.

Adrian (picture in 'newsfront') and Gaynor (seen left) are Computer Operators at the Atlas Computer Laboratory.

Betta Splenden or Siamese Fighting Fish

In Siam these fish provided sport, much the same as cock-fighting did in England before it became illegal. The wild Bettas are found in Paddy Fields in Thailand, Cambodia and Indonesia. When breeding, the male Betta builds a bubble-nest at the surface and the eggs are put into this nest and cared for by him. Our Betta died from dropsy only two weeks after we bought him.

Pterophyllum Eimekei or Angel Fish

Another well known tropical fish, with one drawback: they grow to 5 ins which is twice the size of any other fish in the tank, so we may have to move them and get some smaller ones later.

from the computers

interactive graphics

A grant was made to continue and extend earlier work supported by SRC in the application of advanced computer techniques to design problems in electrical and electronic engineering. The Department of Computer Science at Edinburgh University receives £314,986 for a four year programme for 'Interactive Graphics applied to Electronic Design'.

Much of the work is fundamental in character but many aspects are of interest to industry (close co-operation is maintained) and should lead eventually to the discovery of novel design techniques and new methods of problem solving as well as advances in the efficiency of man-machine interactions.

The grant provides for a PDP-10 computer made by the Digital Equipment Company. The configuration provided will allow simultaneous access by eight users. Used in conjunction with the existing PDP-7 system, which contains a cathode ray tube, it will be possible to exploit the PDP-10's rapidity and accuracy combined with the experience and insight of a human designer. This approach has already proved promising in the design of printed circuit wiring boards. Other applications include the analysis and display of the flow of power in electricity distribution networks and the design of electronic filters for particularly exacting requirements.

ps

Now the postal strike is over we give a very warm thank you to everyone who kept the communications systems going, particu'arly to those who bore the brunt of it – like office services, registries, messengers, drivers, voluntary carrier pigeons, the telephone girls who kept London Office on the line and the staff who manned the 'answering service' rota. The overall effect seems to be an increase in the use of corn plasters and visits to the cobbler, but several inches lost around some circumfe-ences. Pathfinding has improved and full marks go to the Rutherford and Atlas drivers who rushed things round the Thames Valley on the service organised by the Secretary of Atlas, Mr. C. Roberts, covering our own establishments, the UKAEA's and various universities, not to mention all the single deliveries dropped off on the way. Establishments north and south looked after other main centres and the crisis found most people ready, literally, to go out of their way to deliver important letters, pensions and everything necessary to keep SRC going at the speed of the twentieth century.

Doug House, ACL

new to Quest

To replace Bill Napier, ROE, and Fred Lunnon, ACL, who have left the Editorial Board, we are pleased to welcome Jim Campbell, ROE, and Doug House, ACL. We also express our thanks to the retiring members for their support.

Doug House has been Deputy Head of Operations at ACL since 1964. Before this he served with the Royal Naval Scientific Service since leaving school, first coming into computer work in 1956 as an engineer until he joined SRC and changed to operations. Previously he had worked at the Royal Naval Physiological Laboratory in underwater blast and applied physiology and had taken part in some experiments as a 'guinea pig'. His main spare time interests lie in sport, particularly cricket and golf – his handicap is 12 !

Jim Campbell is a Senior Scientific Officer engaged in space research at ROE.

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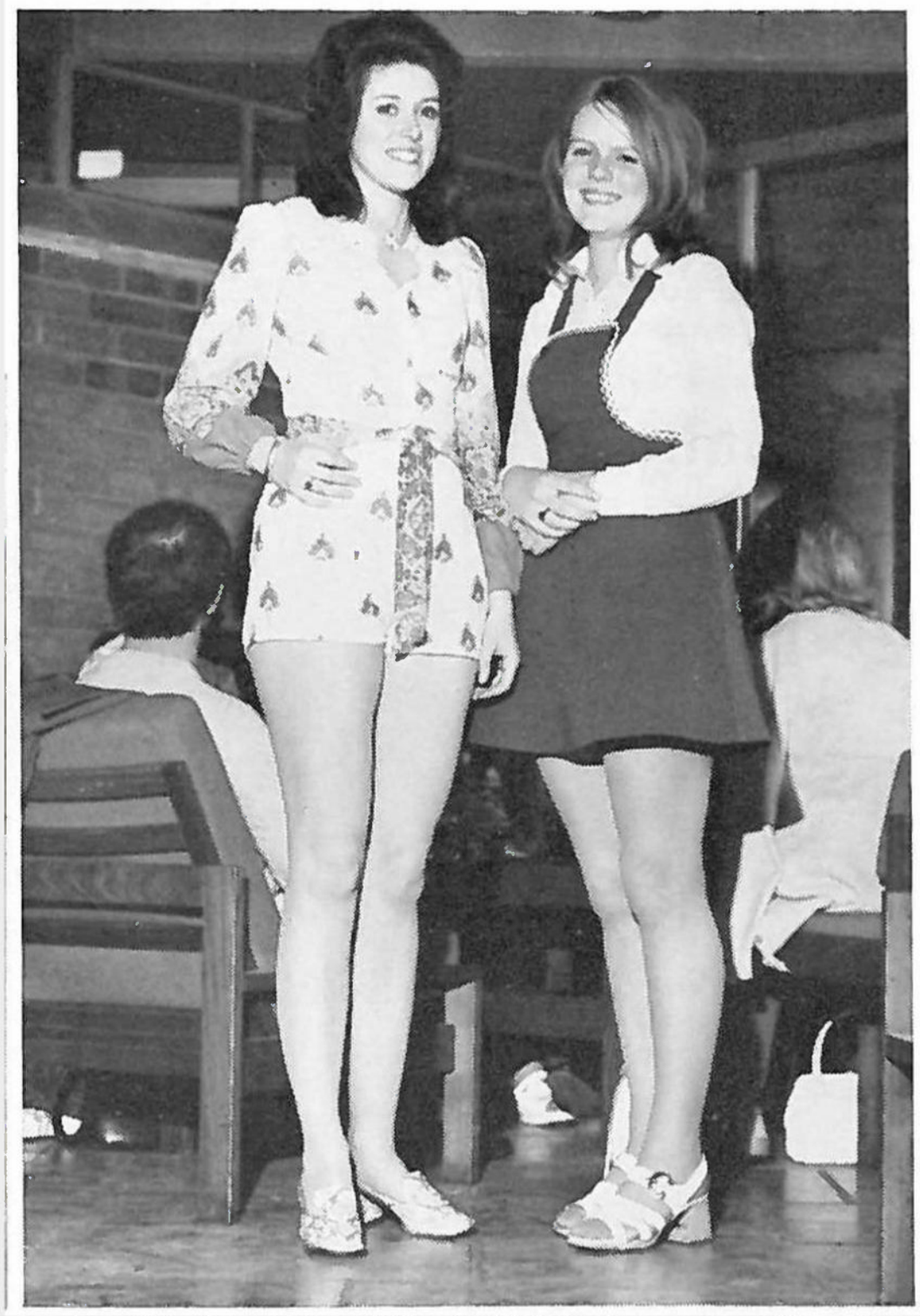
Sports Day Social



Above the Atlas Netball team who won all their games and the cup.
l to r (back row) Judy Wilson, Nora Rowland, Elizabeth Ellaway, Julie Bryant and Gill Weedon.
(front row) Anna Thompson, Ann Walter, Lorna Claringbold and Judy Herring.

Above an Atlas batsman caught out by Mike John RSRS (wicket keeper) with John Halley (r) fielding. Photo P. Hicks

atlas aids BBC

In July the Atlas Laboratory was approached by the BBC's Tomorrow's World programme for help in producing a sequence on Computers and the Animation Industry. The aim was to show how a computer could be used to aid the professional animator in the design stage of his work. The Laboratory's facilities were used to show how a D-MAC pencil follower could be used to input the key frames in an animation sequence. Sample timing of the animation was done using the display on the Laboratory's PDP 15 and final pieces of film were produced using the SD 4020 microfilm recorder (see Quest Oct 1970 p. 6 for technical details). The operators certainly enjoyed seeing bloodhounds and cats coming out on the film in place of the more conventional scientific plots. The programme was televised in September.

newsfront

welcome to atlas

families day

About 250 people attended an informal Families Day held in the Laboratory on Saturday 4 September. They had plenty to see – our new Computer Block, Atlas S 2 and SD 4020 operational on normal work, the PDP 15 being run up after its recent move, 1906A undergoing commissioning trials.

Demonstrations by AERE Fire Brigade of rescue from a car crash, and mouth to mouth resuscitation by Ricky Eaton of the Rutherford Laboratory Safety Section attracted many people, so did the SRC film 'Insight'. At the end of their tours everybody appreciated the refreshments prepared and served by Gillian Keats, Trude Trewin, Joan Markham and Synolda Butler.

Thank you Robbie and all the 'Adminers' for a very successful day.

animation

Animation at Atlas

On July 30, the Atlas Computer Laboratory held a one-day symposium on computer animation. The Laboratory's interest in the subject stems from the use of its SD 4020 microfilm recorder in the production of research and educational films. Probably the largest user is the Open University and John Richmond of the BBC gave an interesting talk showing how computer animation relates to the rest of the TV programme. He showed a number of excerpts from the Foundation course in Mathematics which has been screened this year.

Films were given by Jon Ogborn of the Nuffield Foundation's Science Teaching Project and Professor Judah Schwartz of the Massachusetts Institute of Technology. Professor Schwartz spent the summer at the Laboratory and showed a number of the films he had made to demonstrate electric fields of moving charges. These have an artistic beauty independent of the content of the film. This also applies to the work of Professor Roger Hockney of Reading University who stimulated the evolution of galaxies of 50,000 stars – on a severely contracted time scale!

The symposium was held in the Rutherford Laboratory Lecture Theatre from 10.30 am to 8.00 pm. It was attended by about 150 people and a repeat of the film portion drew over 100 people the following week. The Symposium received, on the whole, favourable press reviews. Here are two of them:

'It was also one of the best organised meetings that has been attended recently running very close to the scheduled timing and with a standard of presentation of a very high order – for once the visual aids were well handled, part of the proceedings and not a makeshift addendum to them. One might well add "Others please copy" . . .'

Film User Sept 1971.

'The subject of computer animation flared into prominence in the last fortnight when a one-day symposium was held by the Science Research Council at the Atlas Computer Laboratory in Didcot. This seems to be the spiritual home of the craft in Britain . . .'

Financial Times 10 August 1971.

answers

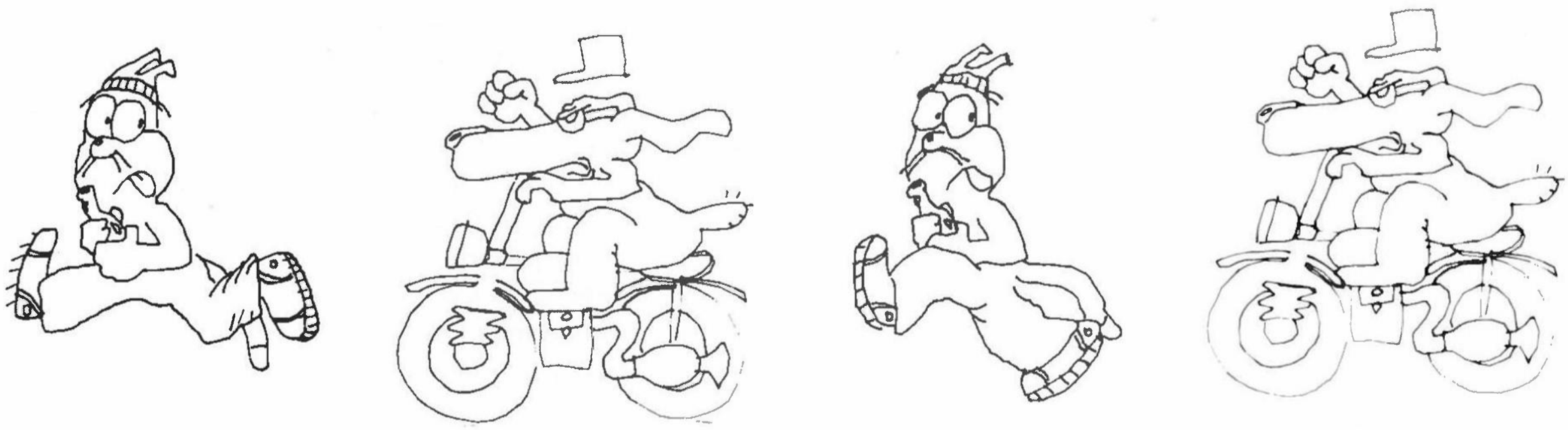
— see page 20 before you look at these.

Solution to 'logic'

Perkin is 28, Quentin 11, Rosemary 22, and Sadie 14.

Answer to quote quiz

Extract from an SRC advertisement for Executive Officers for LO published early in 1966.



more bytes

A bigger and better Computer just installed at the Rutherford Laboratory will be a great asset to the University and SRC groups who are the main users of the Laboratory's services.

The new computer, an IBM System/360 model 195, is six times as powerful as the model 75 which it replaces and cost about £3M. The Laboratory's Computer and Automation Division (under W. Walkinshaw) are particularly proud of the fact that they had it installed, accepted and working on-line in only fifteen days.

The central processor of the model 195 has a capacity of 2 megabytes, and is supported by a block multiplexor and a fast access fixed head file. Early this year the installation will be fitted with a disk store of 800 megabytes and high speed tape units. In 1973 it will be converted to a System/370 model 195.

Among the first users of the 195 will be the film analysis groups from Birmingham, Glasgow, Durham and Oxford and theoreticians from most of the university high energy physics groups. Atlas users have not yet been identified but are expected to come mostly from chemistry, plasma physics and astrophysics.

"We started in a small way with one hundred and fifty people and now we employ twenty."

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QUEST Vol 5 No 1 January 1972

3 space on atlas

Barbara Stokoe

It all started in 1963. But we never realised what was going to hit us!

Those were the early days of the Atlas Laboratory. We had no machine – not even a building; but we were laying the foundations of what was to come. A small nucleus of people, temporarily housed in the Rutherford Laboratory, we had the dedicated purpose of starting up what was to become a major computing laboratory. Buildings, machines, software were our goals – and their potential users. Partly with the latter in mind, we held a one-day symposium to which many people interested in space research were invited, and many papers were given on the problems which they were then considering. Little happened for some time after that, apart from a small number of jobs which were used to try out the software on our embryo machine, now in Ferranti's factory at West Gorton, Manchester. The author looked after these jobs, with the result that all future 'space' jobs tended to come to her.

In the early days of the international collaborative programme with the United States, the satellites UK1 and UK2 were produced – to be re-christened Ariel 1 and Ariel 2 on their successful launches. None of the data processing for these satellites was performed at Atlas, and not much attention was paid to this side of the experiment – with the result that AWRE Aldermaston received an SOS to do something with all the data from Ariel 2 about two weeks *after* the launch! Which they nobly did, with many very fair comments about inadequate notice. As a result, when UK3 was planned much more note was taken of the data processing requirement, and Van Raalte of AWRE was involved at the early design stages.

There are 3 basic parts in the processing of UK3: (a) digitisation (performed at RSRS); (b) preliminary checking (performed at AWRE); and (c) separation of results (performed at Atlas). It was agreed that AWRE would do the considerable amount of programming involved in the project – with considerable help and advice from Atlas on (c).

Everything remained quiet for a while until about February 1967 when testing started on the Atlas work. Due to staff shortage, AWRE decided to use staff from their Foulness station to do the programming, and a large amount of effort was needed to keep the four programmers there happy – all married women who obviously did not want to come and spend any time at Chilton. They also did not have any experience of Atlas or its very powerful operating system or facilities. But with good-will on all sides progress was made, and shortly after launch in May 1967, we were able to give the experimenters some results. Then there was a short breathing space of a few months while modifications were made to the digitiser at RSRS.

In November, we were in business again at full production; starting at about three hours a week, and increasing over the years to a peak of ten hours. In addition to this, the experimenters themselves particularly Sheffield University, carried out much of their subsequent work at Atlas. They were willing to use our facilities to maximum advantage, including our brand new microfilm plotter, which enabled them to make sophisticated use of their results. Taken over-all, this has been a highly successful project, and is now just about completed.

Future work in store in this field includes UK4 (which we hope will be successfully launched by the time this appears) and the S68 experiment on the ESRO TD1A satellite.

For UK4, RSRS have replaced the role which AWRE filled in UK3; and much of the programming itself has been done at Atlas. Production is planned on our brand new ICL 1906A computer, now in the final stages of commissioning. This has of course created problems, since much of the testing has had to be done on other machines. Things are further complicated by having aboard a US experiment, from the University of Iowa, with the consequent difficulty of communications. We expect to use at least ten hours of 1906A time per week on this project.

We have taken over the processing for S68 from Edinburgh Regional Computing Centre. TD1A is planned for launch in February 1972. We plan to do the production work on the neighbouring RHEL 360/195, on which the Atlas Laboratory are entitled to 20% of the time for use on non-nuclear-physics work. Two members of staff are now working full-time on the programming of this project and we expect to take up a large amount of our 195 share with S68 – an hour a week may be the end result.

And so from small beginnings . . .

Footnote to Technology — an engine from the age of steam

(see pp 9-20)

Above: traction engine Red Gauntlet with Ken Humphries of Atlas Laboratory (left) and his 'steam gang' mates Jack Green and Ron Coventry from Burghclere. Restoration of this general purpose Burrell traction engine has been a spare time hobby for the gang led by Jack Green who made up to pattern by a good old-time 'steam age' blacksmith and some specialist welders made a new fusable plug crown housing, by reducer method, to a very high standard. The team put in nearly 1,000 hours' work and 17 of these had to be spent inside the fire box – 4 feet x 3 feet x 4 feet.

The engine was used for general haulage and farm work in the west country until the owner brought it to Jack for restoration. It weighs 11½ tons, has a capacity of 75 hp (6 steam) and moves at 4 mph in the small gear and 10 mph in the large gear. Now that the engine is fit again it works for its keep at sawing, hauling and tree pulling. It can pull out 14 large trees, root complete, in 7 hours.

Like the Scarlet Pimpernel, the gang say, it turns up in all sorts of places – occasionally at rallies but more often at charity functions. These are seldom refused unless dates clash. The gang are always there ready to answer questions but it is Ken who is usually pushed to the front.

Ken is an experimental worker V at the Atlas Laboratory. He is going to bring the engine to the next Families' Day on Saturday July 15.

Hemisphere Observatory. The Atlas Laboratory programme includes a new large computer. How far these plans can be implemented will depend on the funds actually made available and there is already an indication that the growth rate beyond 1974/75 is unlikely to exceed 3½% pa. A further major uncertainty is that a Government decision has yet to be taken on whether, as the Council hopes, the High Flux Beam Reactor can be built.

new library for Rutherford

The Council approved construction of a new library building at the Rutherford Laboratory. When the Laboratory was opened it was planned that the library needs would primarily be met by the main AERE library, but this has never been satisfactory and the two libraries are now quite independant. There is a growing need for adequate space for the stock of books and pre-prints, and for reading and study by the Laboratory staff and the many university visitors. The new library will be in the form of a bridge connecting two of the Laboratory buildings. Approval was also given to expenditure by the Radio and Space Research Station for an increase in the core store of the 1906A computer by 32K and for an additional exchangeable disc transport to handle large data files. These additions are needed in connection with the control centre for the UK-5 satellite now being set up at RSRS – the first time a satellite in the Ariel series will be controlled from the UK.

thankyou Atlas!

Quest is grateful to the people at the Atlas Laboratory who replied to a recent readers' survey and made some very good suggestions.

Council considered the first report of the SRC Computer Review Panel which had been set up to rationalise the Council's computer requirements as whole. Apart from the new DNPL computer, already approved, and the plans for the Atlas Laboratory, the immediate and additional needs of the Boards, Establishments and London Office were found to be small. It was clear, however, that the requirements were constantly growing and changing and Council felt that the Panel had carried out a useful review and agreed that it should continue in existence, reporting annually in relation to the Forward Look.

The Panel had been requested by Council to look at the feasibility of charging for computer use and a subsidiary panel had been set up to consider the problem in more detail. Council accepted the recommendation that the introduction of charging would be feasible; in the case of entitled users (such as Establishments or universities that had received Council approval to an entitlement of computing time) this would have to be on a notional basis, since there was as yet no general system of charging for computer use in the universities.

computer facilities

Council welcomed the proposal that the Atlas Laboratory should provide a substantial part of the Natural Environment Research Council's (NERC) future computing needs, initially estimated at one hour a week on the IBM 360/195 and five on the ICL 1906A. A small NERC group will be located at ACL and to co-ordinate computer policy between SRC and NERC, the latter will be represented on the ACL Committee. The initial minimum annual cost to NERC will be about £50,000.

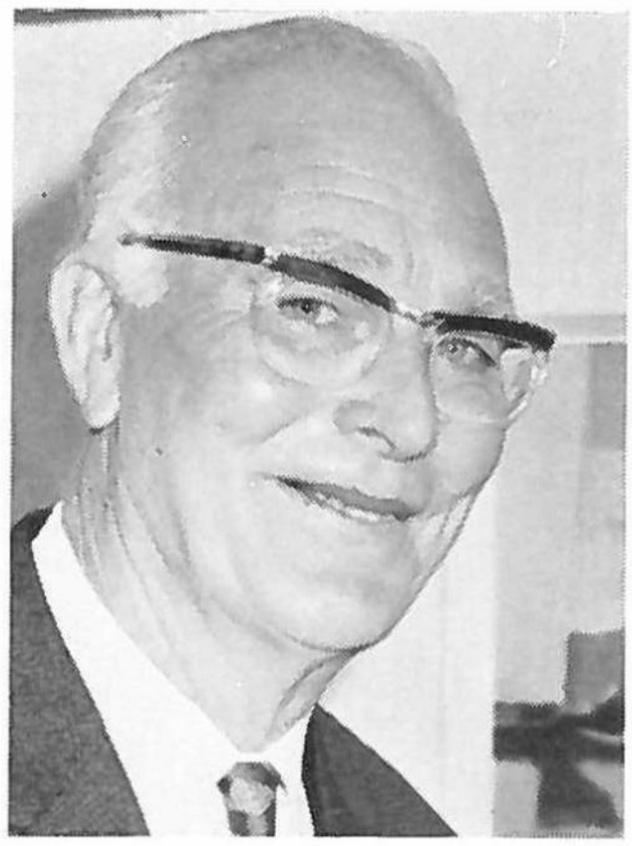
Proposals from the Nuclear Physics and Science Boards for the purchase of thirteen terminals — twelve British universities and one at CERN — to be linked to the ICL 1906A and the IBM 370/195 at the Atlas and Rutherford Laboratories were approved by Council. This experimental scheme will allow university scientists and engineers to have access to these powerful computing facilities.

A request from The Atlas Laboratory for additional office accommodation and conference facilities was also approved by Council.

Atlas loses two

The first two people to retire from the Atlas Computer Laboratory left this year. Mr W H J Hayes and Mr W J Parmenter have been with ACL since it opened in 1963.

Above: Mr & Mrs W H J Hayes and (r) Dr J Howlett Director of ACL who made the presentation from the staff *(see below)*



Mr W J Parmenter, ACL *(see below)*

Mr Hayes was the chargehand responsible for all industrial staff and the Laboratory Shop Steward for nine years. At a dinner, held at the Bear Hotel Wantage, attended by seventy people, Mr Hayes was presented with an inscribed tankard from the Atlas and Rutherford shop stewards. The staff of ACL gave him a carriage clock, an appropriate memento of his earlier career as a driver. He drove for MRU, RAF Milton in the 39-45 war, the Lambourn volunteer ambulance crew for 20 years and the Rutherford Laboratory (1960-63). For thirty years he was Police Sergeant Hayes of the Berkshire, later Thames Valley, Special Constabulary.

Mr Parmenter, Senior clerk of works, was the second to retire. At a presentation ceremony he was thanked for his contribution to the present high standards of the building services at ACL.

DOILY cartoons

The staff of the Atlas Computer Laboratory hold an open day nearly every year on a Saturday. Visitors are shown how the Laboratory is run, the different sorts of problems that the computers can tackle and how the work fits into the whole research programme of the Science Research Council.

This year the Graphics Section ran a number of programs using the interactive display on the PDP15. In one program, aptly named DOILY, the user can define a simple line drawing and then elaborate it by superimposing copies of the original, which are rotated and expanded to give an elegant kaleidoscope effect. By outputting the completed picture to the SD4020, visitors were able to collect their works of art later in the afternoon. Probably the most successful one was Dr Howlett's well-known signature which turned into a most interesting composition.

The other program which collected a crowd was a simulated Fruit Machine which paid out winnings – in lengths of paper tape!

The Graphics Section also showed computer generated films made in various parts of the world. These included animation of a frog jumping, from the Massachusetts Institute of Technology, a Navajo folk story from Colorado and the *Tomorrow's World* program made at the Laboratory last year.

The Safety Group from the Rutherford Laboratory crossed the road to take part and gave a demonstration of kiss-of-life revival for operators who have come into contact with an electrically 'live' computer.

About 300 people came, many were families and friends, and they showed great interest.

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answers to puzzles

see pages **14** *and* **16**

nutcracker 11: Hartlee

(the detailed membership are:

	Old Ctee.	*New Ctee.*
Chairman	*Gideon*	*Coutts*
Treasurer	*Hartlee*	*Gideon*
Secretary	*Ferguson*	*Hartlee*
Whitley Rep.	*Redbreast*	*Ferguson*
Ctee. Member	*Coutts*	*Redbreast*

blow that: 6. If John then blows out N, Peter follows with 7-N. John cannot influence the result if Peter plays perfectly.

Lawrie Wright

There is still perhaps a tendency for those in the "outside" world to regard administration in government bodies with faint amusement: thoughts, no doubt, of rigid hierarchies, high wing collars and quill pens spring to mind. Ridiculous of course but it is as well for us to remember these days that those who don't adapt tend to slide backwards at a faster and faster pace. Clearly, as administrators concerned with the business of research, we in SRC cannot afford to foster an image of old world charm.

Computers are modern tools that, used intelligently, can assist the administrative task enormously. A project is now under way in London Office to provide a data processing service for the staff dealing with research grant applications. It will also be capable of dealing with the vetting and payment of claims under the grants after they are made.

We have the use of time on ICL 1906A computer at the Atlas Laboratory through a remote terminal installed in an office on the fifteenth floor of State House.

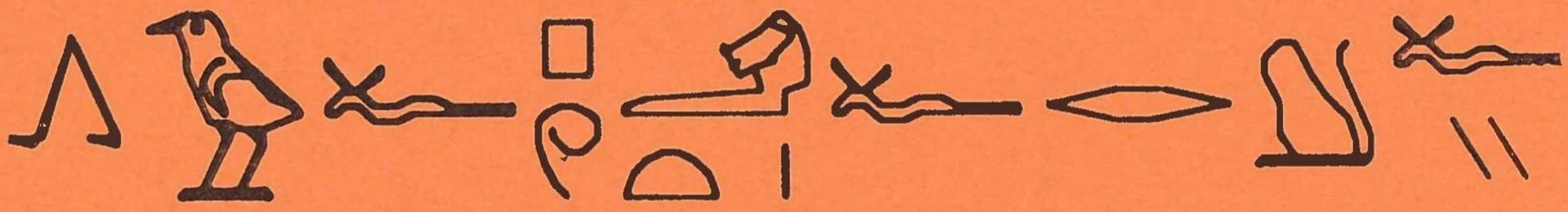
Plans and specifications prepared during the last year were tested with a pilot run in the past few months and now the 'parallel running' stage (the new and the existing systems operating together) has started. Student awards work will be the next area to receive attention.

It is worthwhile to try to remove the drudgery associated with any repetitive process. In large administrative systems most transactions are perfectly straightforward – cheques in a bank, proposal forms in an insurance company, orders and invoices in private companies, and so on. They offer no challenge to the people processing them, other than to get through them as quickly as possible, and are the ones best handled by computers. The more unusual cases, those that are rejected by the computer because they do not conform to the sets of rules that the computer applies in each case, are the ones best handled by people. And because the cases are unusual, and therefore more interesting, there is greater satisfaction in dealing with them.

The idea that large numbers of staff can be replaced by computers has not much currency these days. Most suitable work for computers (usually large volume processing) has been mechanised in some way or other over the years to a point where the introduction of computer processing is merely the next logical step. And now that there are data-processing machines sophisticated enough for smaller scale operations, they may be used to increase operating efficiency and capacity, rather than just to make savings.

Staff in London Office will find that their jobs change as the potential of the computer system makes itself felt. I think that the change will be for the better.

Lawrie Wright is a London Office O and M Officer assigned to the 'computerisation' team.



6 ἀει

BA 0650 PE τις; τους λογους γαρ ἰσφερεις καινους ἀει.
BA 0807 PE ξυνεθεσθε κοινῃ ταδ' ἱνα βακχευητ' ἀει.
BA 0881 CO ὁ τι καλον φιλον ἀει.
BA 0896 CO ἀει φυσει τε πεφυκος.
BA 0901 CO ὁ τι καλον φιλον ἀει.
BA 1261 KA ἐν τῳδ' ἀει μενειτ' ἐν ᾧ καθεστατε.

1 ἀελλαις

BA 0873 CO μοχθοις τ' ὠκυδρομοις τ' ἀελλαις θρῳσκει πεδιον

the Atlas computer writes greek

Susan Hockey

Among the more unusual uses of the computers at the Atlas Laboratory has been the development of programs to analyse literary text. One of the earliest was the COCOA program, which was developed for the Atlas computer in 1967 and has now been rewritten for the 1906A. It can be used to count up the number of words in a literary text and print out concordances listing each word in the text, surrounded by its context, with a reference to its location in the text. So far we have processed texts in all the main European languages as well as Arabic, Persian, Sanskrit and Armenian.

Because the computer can only recognise 64 characters which consist of the English ('Roman') alphabet, numerals and a few mathematical symbols, languages that are not written in our alphabet have to be transliterated into 'computer' characters. Even languages written in the same alphabet sometimes need extra characters to mark diacritics such as French accents and German umlauts.

Greek is fairly straightforward since it has only 24 letters in the alphabet which means that each can be matched to a roman letter, eg B for beta and W for omega, and we only have to resort to mathematical symbols to mark capitals and diacritics. But for Persian and Arabic which have alphabets longer than ours, we have to use some non-alphabetic characters for the alphabet itself. The alphabet used for Persian text looks like this:

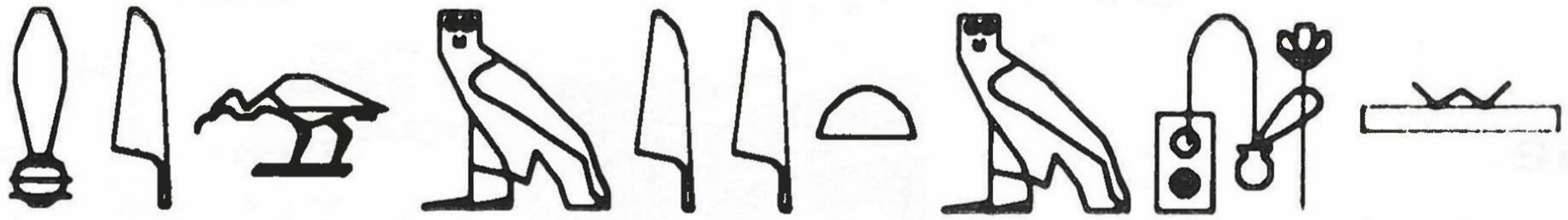
A B P T=J C H X D * R Z) S $ I @ V & E U F Q K G L M N W (O Y'

However getting the text into the computer is only a small part of the problem. How can we get it out again in the original script? The normal output from COCOA is on the lineprinter which can only print the characters which went into the machine and is therefore not suitable for scripts that have been transliterated. To get over this problem we have devised a way of converting the computerised text back into the original script by using the laboratory's visual display system. We draw the characters of non-roman alphabets on a grid on the VT15 display of the PDP 15 computer using a 'light pen', as shown in the picture (right).

The characters are then stored on a disc ready to be recalled by another program. The disc has room for four character sets or 'fonts', each consisting of up to 256 characters which means that more than one alphabet can be stored together; a useful capacity when referencing Greek text in Roman capitals for instance.

The processed text is fed to the SD4020 on a magnetic tape from the Atlas or the 1906A computers. The characters appear on a small cathode ray tube to be photographed and output either on 16 mm or 35mm film or on photo-recording paper ('hard copy'), which can be split up into pages. The film is useful for storing several copies of a concordance in a small space, while the hardcopy gives easier access to a particular page.

Since any character can be plotted in any size anywhere on the screen, we can write titles and headings without defining extra characters for them. The lines are all straight so we can produce curves by drawing a series of short straight lines that will look

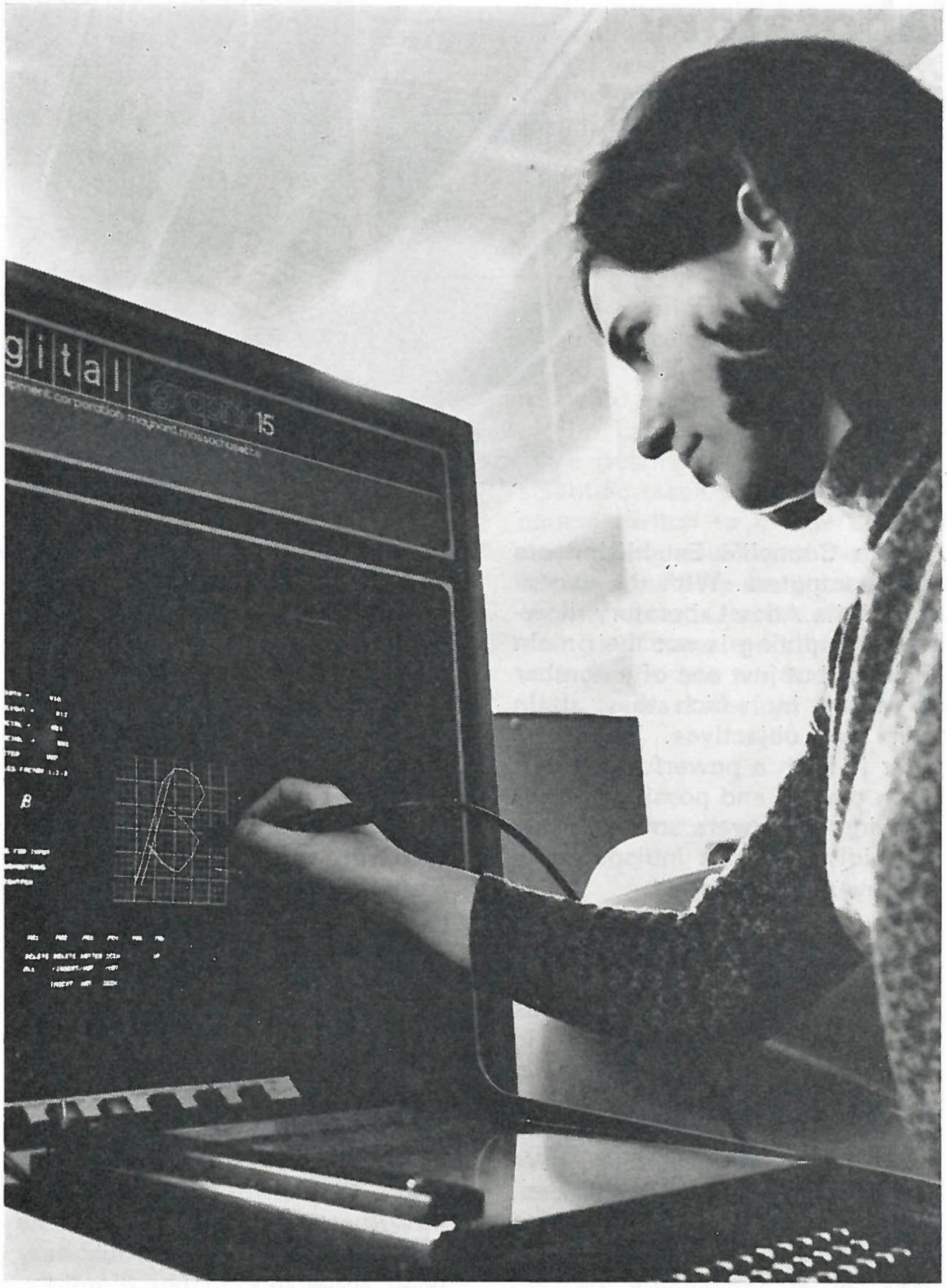


Above: Egyptian hieroglyphs; and left: part of the concordance to Euripides' Bacchae.

like one smooth curve when reduced to print out size. We can produce a thickened effect by drawing doubled lines that join up to look like one when the characters are reduced.

There is no problem in coping with Arabic or Hebrew which are written from right to left: the SD4020 simply types backwards. The spacing between characters is set by the program. At first this caused problems in Arabic and Persian, where most but not all of the letters are joined on to the following one. Then, again, the letters of the Arabic script are written in different forms depending on where they occur in a word, so that the letter B for instance has four different forms. The program therefore includes the rules for writing the script and choosing the right form of the letter on output so that we can simply input all four in the transliterated script as 'B' (thereby keeping the number of input characters below 64).

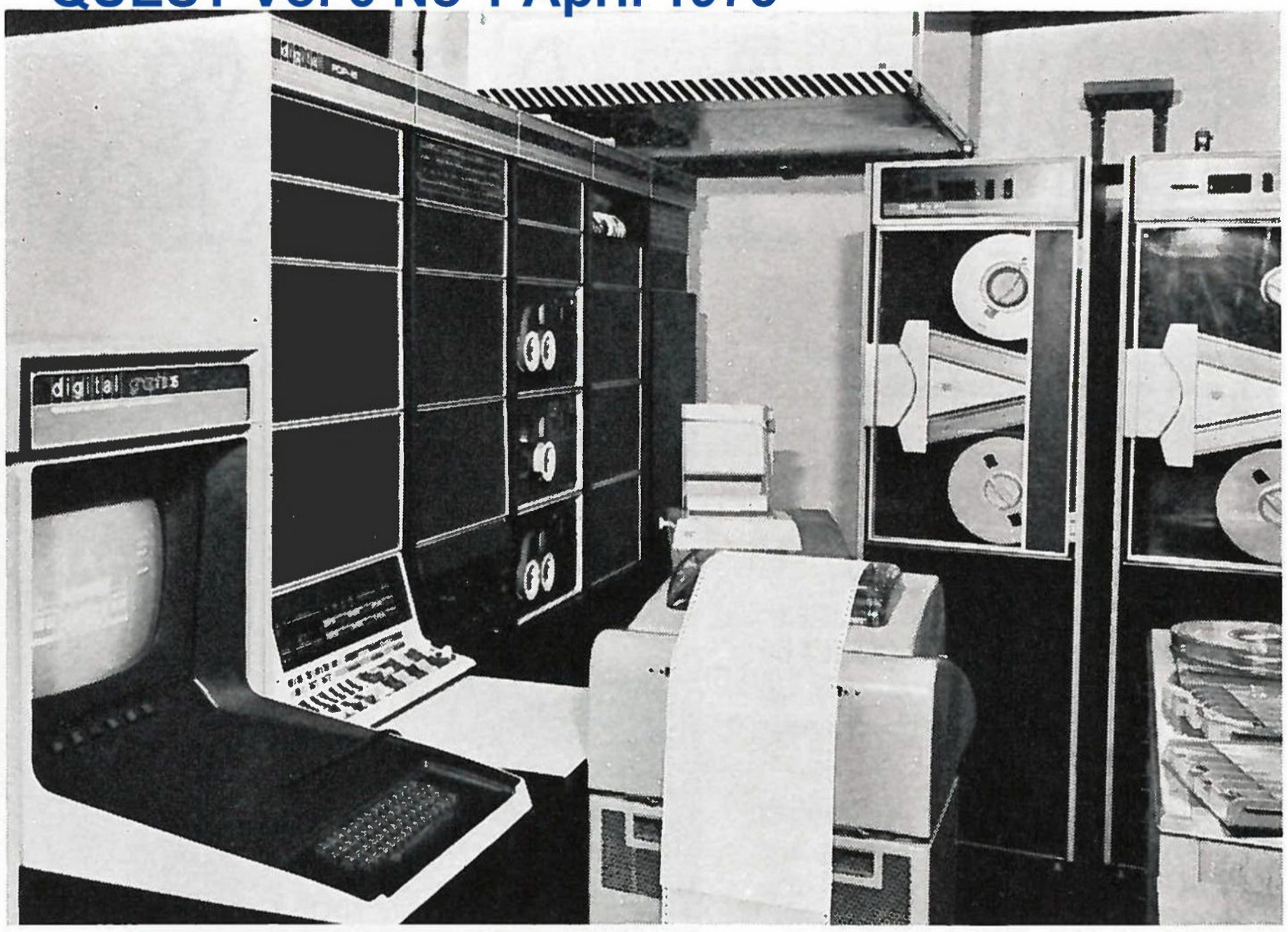
We have used COCOA to analyse the poems of Hafiz, a Persian lyric poet who lived in the 14th century AD. 495 of his poems survive; each consisting of about 10 couplets. A complete concordance of the text (over 71,000 words) produced nearly 4,000 pages of Persian. We have also been working on concordances of Greek drama. One play, Euripides' Bacchae has been completed on Atlas, but the others, all the works of Aeschylus, Sophocles, Euripides and Aristophanes are to be processed on the 1906A after the closure of the Atlas computer. These concordances will be used for research into the literary style of the authors.



Susan Hockey drawing a Greek β on the VT15 Visual Display System with a 'light pen'. The double line will appear as one thick line and the curves rounded when the character is output on the SD4020 microfilm recorder. Susan is a member of the Applications Software Group at the Atlas Computer Laboratory.

The advantage of our method of printing non-Roman scripts is that the same method can be used for all of them. Already we have Hebrew and Armenian character sets available and work has begun on Russian. To show that the same basic method can be used for non-alphabetic scripts, we have experimented with some cuneiform, which is syllabic, and some Egyptian hieroglyphs (illustrated above) which are a mixture of phonetic and ideographic characters.

the computer laboratory is changing



In the picture is the Atlas Laboratory's PDP 15 interactive graphics display machine which is used for generating animated films.

J Howlett

All the Council's Establishments have computers. With the exception of the Atlas Laboratory, however, computing is not their main business but just one of a number of means by which they attain their real objectives. The computer is such a powerful and versatile device, and possibilities for applying its powers so wide, that it rapidly becomes indispensable wherever it is installed.

At the Atlas Laboratory our business is computing. Of course, the computing is still only a means to an end, but the ends are outside the Laboratory – in other parts of the Council, in other Research Councils and Government organisations and, most of all, in universities. We exist to give computational support, in its widest sense, to research and development projects carried on outside the Laboratory. We also have our own research and development projects whose aim is to improve and widen the scope of this support.

Recently the Laboratory has been reassessing its role and, as a result, has embarked on a change of policy. To explain this a little history is necessary. We were set up in late 1961 as part of the NIRNS group: at the time the universities were badly underprovided with computing resources and many research workers had a near-desperate need for some real power. The Laboratory's terms of reference were such that we could give computing support without charge, and with very little formality, in pretty well any field. All we looked for was an assurance that the work could not be done on the university's own computer and that it had been planned and programmed with reasonable efficiency.

'We set a new standard . . .'

We started a regular service in October 1964 with this very open style and, to put it mildly, we have never been short of business. The Atlas computer was far more advanced and powerful than any machine then available to university people in Britain – or in Europe, for that matter. The staffing, equipment and organisation of the Laboratory were equally far beyond anything in the universities.

I don't see any reason to be coy about this; we set a new standard, and we have had the satisfaction of seeing it followed by the universities when re-equipping their own computer centres since.

The climate now is very different from what it was when we started. In 1966 a Joint Working Group on Computers for Research published a report (the "Flowers Report") that displayed the university situation very clearly and set out a programme of re-equipment. As a result the Computer Board was set up, and to date has put about £28M's worth of machinery into university computing centres. British universities, taken as a whole, are now as well equipped as any in the world. In these new circumstances it is natural – and necessary – to ask if there is still a need for a central service of the kind which we have been providing. The conclusion which we (and our masters) have come to is that there is most certainly a need but for a different kind of service: one that the Atlas Laboratory is well designed to provide.

There are several parts to the argument. Take first the need. In many important but difficult theo-

retical problems – the study of atomic and molecular structures or the prediction of observable properties of substances from atomic data, to name two examples – progress can only be made with the help of computers. There are many research groups with ideas for tackling such problems. They need great computing power, special ancillary hardware (such as visual displays of output) and special software. Most important of all they need to know that they can use the resources for quite long periods if their project is going to take two or three years or more to complete. It is this kind of support that university computer centres find difficult to provide. People from all over the university want their services and they must respond to them.

freedom to choose . . . a new style

Here the Atlas Laboratory has two great advantages. One is that we are not tied to any single institution, discipline or project, and therefore have freedom to choose what we shall use our resources for; the other is that we are part of an organisation – the SRC – which has powerful machinery, in the form of its Boards and subject committees, for assessing research projects in the whole field of pure and applied science.

When we put all these arguments together, the right rôle for the Laboratory becomes obvious. We should support research workers whose needs cannot be met by their own university; but because we are committing scarce and expensive resources, perhaps for a long period, the project must be able to stand up to the scrutiny of Council's experts. What this means is that applications for computing support are treated in just the same way as any others made to the Council but the grant, if given, is not one of money but of time on one of our computers and, perhaps, other resources.

An applicant might be awarded an input/output terminal so that he can use the computer from a distance. We have several already, such as the card-reader/line-printer in Professor Burke's Department of Applied Mathematics in Belfast, through which he and his colleagues use about ten hours a week on the ICL 1906A.

If the application has got through the Council's mill we can be assured that our resources are being used on work of good scientific quality. And the research worker can plan his project with the assurance that he will get the support he has been promised, and will not have to worry about being squeezed out when he is only half way through.

This is all quite simply stated, but it describes a really important change in our method of working. It should mean that the resources of the Laboratory are used in a more positive way in support of scientific research. One cannot of course switch to a new style of working overnight, and the transition is bound to be gradual. But we are already very much into the swing of it and everything seems to indicate that we are providing what is wanted, just as we did in 1964.

Dr J Howlett CBE is the Director of the Atlas Computer Laboratory.

Daresbury runs faster with IBM 370/165

Trevor Daniels

After four years of service, the IBM 360/65 main computer at Daresbury Laboratory has been replaced by a system based on the much more powerful IBM 370/165. In addition to a much faster processor, this system includes new tape drives, new disk drives and a new fixed-head file, all of which are faster and hold more data than their predecessors. The new tape drives are self-loading, which makes tape mounting faster and gives the operators more time to attend to their many other pressing duties. The new disks and the fixed-head file give the system about 850 million bytes of one-line storage compared with about 500 million bytes available to the 360/65.

The new hardware can carry out extensive checking and corrections and can detect and automatically put right many errors that would have proved fatal to the running of the 65 computer. This facility is very important to Daresbury Laboratory where the many on-line links demand a high reliability. We hope that the new features will make the 165 system even more reliable than the 65 has been.

Users have already benefitted from the improved turn-around time, but as the new system is controlled by the same number of operators the volume of card and paper handled had to be reduced before we could make full use of the power of the new system.

getting things done . . . on the spot

To achieve this we have made two important changes. The first was to provide a Users' area within the main computer hall, containing a card reader and card punch machine. This is separated from the main computer mach-

continued on next page

Council commentary continued

The Council confirmed that 3950 awards should be allocated in 1973 and agreed that planning for the Forward Look should be based on an increase of about 1.5% per annum in the number of post-graduate awards at universities, the increase in the polytechnics to be considered later in the light of the Polytechnics Working Group's report.

New Buildings at Rutherford and Atlas

During 1972 the Council approved proposals for an extension at the Atlas Computer Laboratory, a library for the Rutherford Laboratory and a 70 MeV injector for Nimrod, including the necessary building work. When tenders were obtained, it was clear that building costs had risen greatly since the first estimates of costs had been prepared and that reference back to Council was required on all three schemes. In addition, revised estimates had been made for the Nimrod injector equipment. The Atlas Laboratory extension design had been simplified following Council approval in July 1972, but even so the total cost had risen slightly. The building and civil engineering works on all three schemes had been combined into a single invitation to tender and work was scheduled to begin on March 19 – the date required to fit work on the injector building into the Nimrod operating and closure schedule.

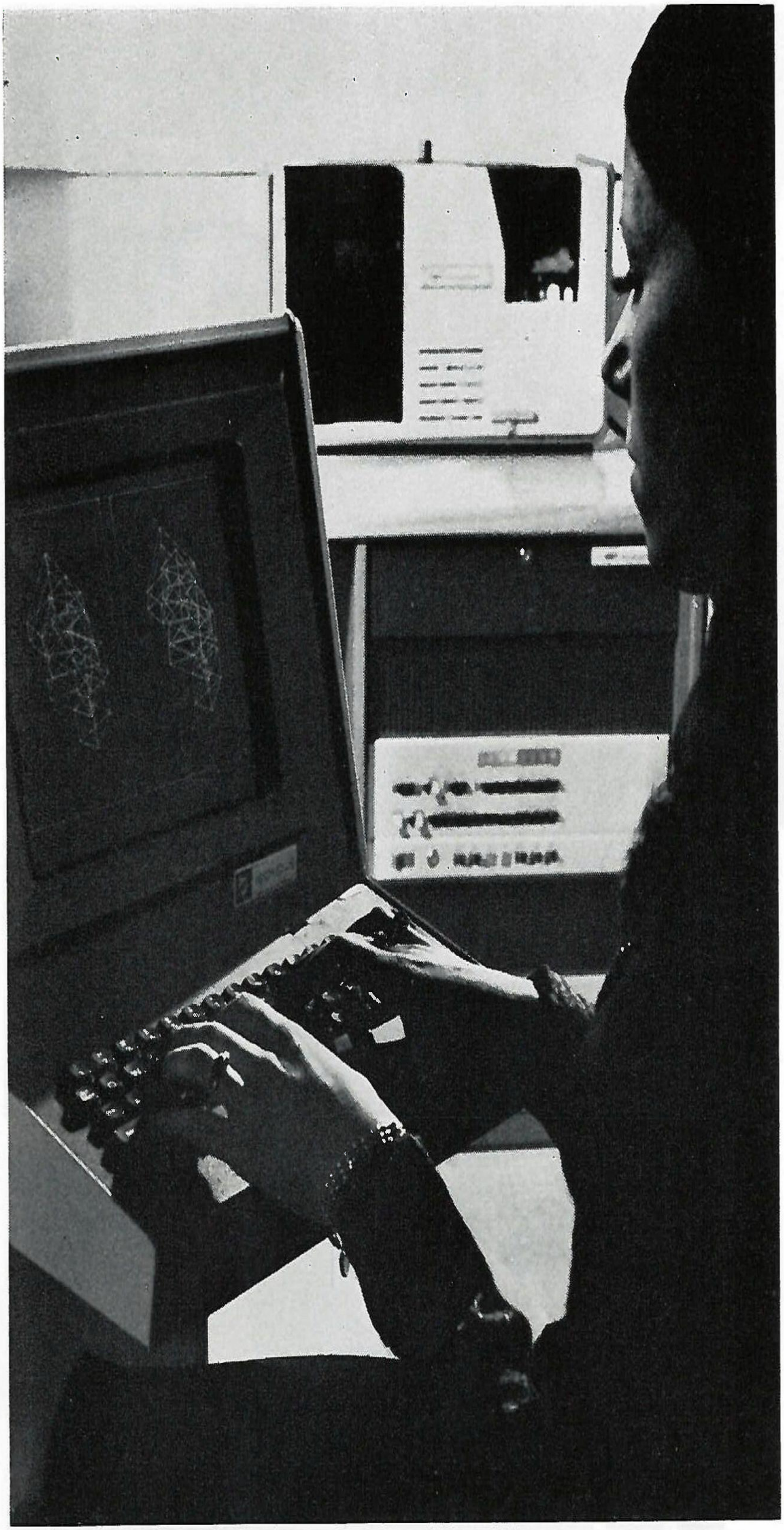
In February, subject to confirmation being obtained from DES and the Treasury that the unit building cost for each of the three schemes was reasonable, the Council approved the simplified Atlas Laboratory extension at a cost of £87,000 and agreed to seek DES approval for the construction of a new library at the Rutherford Laboratory, at a cost of £158,000, and for extra-mural capital expenditure on the Nimrod injector project of £1,171,000 (£221,000 building costs and £947,000 equipment costs).

Location of SRC Facilities

In January the Council agreed that the Nuclear Structure Facility, which they had approved in November, should be sited at Daresbury, subject to planning permission. They also agreed that a northern laboratory need not be confined to nuclear physics. In addition the Council initiated a general study of the regrouping of SRC's various intramural activities.

Centre: Seen on the Council visit to the Rutherford and Atlas Laboratories in May, l to r: Professor S F Edwards FRS, Chairman designate of SRC, Dr G H Stafford, Director RHEL, Sir Brian Flowers FRS, SRC Chairman, and Dr J Howlett, CBE, Director, ACL.

newsfront



'Lets see what I can do with this magnet . . .'

Seen left: A visitor to the Rutherford Laboratory stand at the Physics Exhibition in London, looking at a magnet design produced on-line to the IBM 370/195 computer at the Rutherford Laboratory. The design can be seen in 3-D through special spectacles.

That such a complex job can be done from so far away is due to GEC Computers' Remote Job Entry System 2050. Connected over telephone lines, the work station has a 300 lines a minute lineprinter, a card reader capable of reading 400 cards a minute and a teletype console. It can also communicate with various interactive programmes in the computer.

GEC also provided the photograph.

'It worked . . . but now it's had its time too'

'It works and about time too'. Historic words in the world of computers, for they were the first program run by Professor David Howarth and his team as a simple test routine on the line printer of the original Atlas computer.

Appropriately it was David Howarth, now Head of the Institute of Computer Science at London University who used those words again to run the final program in the computer when it was shut-down after eight years of service by SRC Chairman, Sir Brian Flowers, on Friday, March 30. An invited 'family gathering' of many of those who had been associated with the machine since its inception, watched the ceremony.

Introducing the speakers, Director Jack Howlett referred to the presence of Lady Cockcroft, to Dr Pickavance 'father of the Chilton site' and to Basil de Ferranti, who represented the original Atlas manufacturers and later amused the audience with anecdotes of early Atlas days.

Before pressing the close down button, Sir Brian pointed out that he was closing down a computer and not a Laboratory! In future the Laboratory would provide a more specialised service for specific projects rather than continuing its earlier role of topping-up the computing power of the universities.

Now parts of the machine will depart – some, no doubt to the breakers yard but others to immortality in the Science Museum.

Seen above (l to r) at the closing ceremony:

Sir Brian Flowers FRS, Chairman of SRC, who joined the Computer Board in 1965.

Mr Basil de Ferranti, Director of International Computers Ltd and of Ferranti Ltd, the Firm who built the original Atlas computer;

Dr Jack Howlett, CBE, Director of the Atlas Computer Laboratory;
and Professor David Howarth, Head of the Institute of Computer Science at London University, who ran the first and the last programs on the first Atlas computer, 1965-1973.

Change of Name
At the same meeting Council approved the renaming of the Rutherford High Energy Laboratory as the Rutherford Laboratory, the Daresbury Nuclear Physics Laboratory as the Daresbury Laboratory and the Radio and Space Research Laboratory as the Appleton Laboratory (see page 10).

The measurement of photographic intensities usually involves weeks of tedious visual estimation but a microdensitometer—a machine recently installed at the Atlas Computer Laboratory—will do the job in a day. This machine will provide a service for the many groups throughout the country using X-ray crystal structure techniques to determine molecular structure.

The technique of X-ray crystallography involves exposing a suitable crystal to a narrow beam of X-rays. The wavelength of the X-radiation is around 0·1 nanometers which is very close to the spacing between adjacent atoms in the molecules of which the crystal is composed. This means a diffraction effect occurs—the beam of X-rays interacts with the electrons in the crystal and a number of diffracted beams result, emerging from the crystal at various angles. The intensities of the various diffracted beams vary widely and depend upon the distribution of electrons in the crystal. If the crystallographer can measure these intensities then it is possible to work backwards, using rather complicated mathematical techniques, to derive the positions of the electrons, and hence the atoms, in the crystal. Such results are quite accurate—the distances between atoms in a molecule may be calculated to within a few parts in ten thousand and molecular geometries can be accurately determined. Within the limitations imposed by the need for a crystalline sample the technique is of general application. Simple structures such as diamond have been studied in great detail and workers have recently determined the structures of biologically significant molecules such as RNA and haemoglobin, with thousands of atoms to one molecule.

The Atlas microdensitometer will play its part in the collection of the data needed for a crystal structure analysis. In a typical experiment a crystal is mounted at the centre of a cylindrical cassette containing a pack of 3–5 pieces of X-ray film. The crystal is rotated in a beam of X-rays and the resulting diffracted beams are recorded as small black spots on the films when they are developed. A set of ten film packs, each containing 200–1,000 spots, makes up the initial data for the crystal structure determination. After digitization it is necessary to estimate the relative intensity (blackness) of each spot.

It used to be a crystallographer's nightmare estimating these intensities by visual comparison with a set of calibrated intensities. Now it can be done automatically with the aid of the computer controlled microdensitometer. Each film is mounted on the drum of the machine and the drum then rotates at 4 revolutions per second. During each revolution an optical system measures the intensity of the light transmitted through the film at points every 0·1 mm around the drum. After each revolution the optical system is moved at 0·1 mm intervals along the axis of the drum and in this way the whole film is covered in the steps of 0·1 mm in each direction.

Mrs Lorna Claringbold operating the Photoscan machine.

The measured intensity values are pathed to the computer, which has sufficient time between readings to compute the intensities of all the spots on the film, despite the fact that readings are taken at the rate of 14,000 per second. The use of a pack of films in the cassette enables a greater intensity range to be covered

continued on page 10

continued from page 7

than would be possible with one film, since intensities fall off by a factor of about 3 when the diffracted X-rays pass through each piece of film.

The machine requires one operator and can process a pack of films in an hour, extracting up to a thousand spot intensities. The complete data for a crystal structure can thus be collected in a day. The accuracy is limited by the experimental conditions and the quality of the films, rather than by the machine, which should certainly be sufficient for the average structure determination.

The microdensitometer is not of course limited to processing X-ray films although it will spend most of its time doing so. There are a wide number of applications which require accurate density measurements from photographic films on transparencies. For example, the machine has occasionally been used to digitize X-rays of miners' lungs for pneumoconiosis studies, or photographs of handwriting for optical character recognition work.

Michael Elder is a senior scientific officer in the Applications Software Group at the Atlas Computer Laboratory.

Appleton Laboratory

Lady Appleton at the unveiling ceremony

The renaming of the Radio and Space Research Station as the Appleton Laboratory—after the late physicist Sir Edward Appleton, CBE, KCB, FRS, who was connected with the Station's work for many years—was celebrated late last year by the unveiling of a plaque to commemorate the change of name.

Former Secretary of State for Education and Science Margaret Thatcher and Lady Appleton participated in the unveiling ceremony.

The Council has also decided that the names of the Rutherford High Energy Laboratory and of the Daresbury Nuclear Physics Laboratory be changed to the Rutherford Laboratory and to the Daresbury Laboratory respectively. These changes are in line with the Council's policy of encouraging the widest possible use of expertise available in the laboratories.

No changes in name are contemplated for the Royal Greenwich Observatory, the Royal Observatory, Edinburgh, or the Atlas Computer Laboratory.

Promotions

Mr H Hurst has been promoted to Computer Manager, Senior Principal Scientific Officer, at the Rutherford Laboratory.

Mr M W Message is now Senior Principal, Establishment Division.

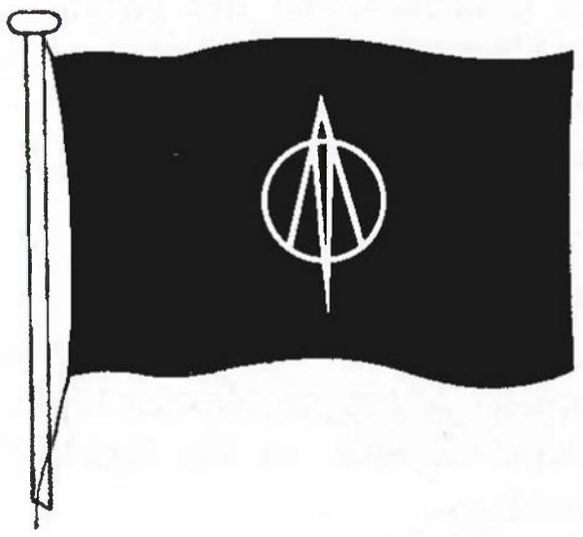
Finite Elements at Abingdon

Finite element methods are a computational technique widely used in structural engineering which have been applied more recently to problems of fluid dynamics. In March this year The Cosener's House, Abingdon—the hostel of the Rutherford and Atlas Laboratories—was the pleasant setting for a symposium on the subject organised by the Atlas Laboratory.

About thirty engineers and scientists attended the three day meeting. Papers were presented on various applications of the method, computer program packages, numerical techniques and computing requirements of finite element calculations. An "Any Questions" session concluded the occasion with Tony Egginton of London Office chairing a panel of SRC Committee members who answered participants questions about SRC policy in the field of engineering computing.

A social programme and symposium dinner was held at which Professor Sam Edwards, FRS, Chairman of the Council, gave a down-to-earth address.

Summing up, Jean Crow, Symposium organiser, discussed increased collaboration between Universities and the Atlas Computer Laboratory in engineering computing. Dr Jack Howlett, Director of the Atlas Computer Laboratory, concluded with the vote of thanks. All agreed on the success of the occasion.



SRC Racing Flag

The SRC have now been represented in all three of the annual inter-departmental offshore races (see *Quest* Vol. 6 No. 2 1973 and Vol. 5 No. 1 1971). The next will be held on October 11–13 and anyone interested in crewing should contact Martin Hall at the Appleton Laboratory. The Chairman, Professor Edwards, has kindly agreed that from now on we may race under the SRC motif. We expect to be the first crew to do this and hope that it will not be the only respect in which others follow our lead.

The offshore race is organised by the Civil Service Sailing Association, who have monthly meetings discussing sailing topics at the Civil Service Recreational Centre in Monk Street, S.W.1. They also have twenty-five associated sailing clubs and organise offshore cruising and racing in their two 6-berth boats throughout the season. At the time of going to press crewing opportunities are still available.

The SRC crew in *Shar* during the CSSA Interdepartmental Offshore Races last October. Unfortunately gale warnings forced the crews to abandon the Cross-Channel race in favour of three races in the Solent. Twelve boats took part in the races and the SRC crew, which came in fifth place, missed a prize by just 107 seconds over eleven hours of racing. Anyone interested in entering an SRC team of three Enterprise dinghys for the Portcullis trophy this month, should contact Martin Hall at the Appleton Laboratory. The SRC crew shown from bottom left to right are: Richard Hilken (ACL); Tony Damerell (RL); Alan Bishop (RL) at helm; Ken Somerville (ROE); and Martin Hall (AL) skipper.

Rutherford and Atlas Chess Tournament

This year the title has been won jointly by Bill Turner of the Applied Physics Division and Peter Hemmings of the Computer and Automation Division. Both players scored eight points out of a possible nine and were undefeated in the tournament rounds.

The tournament which was first held in 1967 is run on the Swiss system (usually nine rounds). More than thirty of the sixty odd players at the laboratory take part.

Although there is a high standard of chess played at the laboratory, which boasts a few county players, Bill Turner has stood out through the consistency of his game. He has won the tournament every year, sharing the title on only three occasions.

The Rutherford and Atlas chess players meet local teams for friendly matches. There is also a "lightening" tournament held on the annual SRC Sports Day and providing there is enough support there is likely to be an annual SRC Tournament.

One of the games at this year's tournament: Players V J Riddle (Black) and W Turner (White). Bill moves first each time:

1 P – Q4, N – KB3
2 P – QB4, P – K3
3 N – QB3, B – N5
4 Q – B2, P – B4
5 P – K3, N – B3
6 N – B3, O – O
7 B – Q3, P – KR3
8 O – O, Q – N3
9 P – QR3, P x P
10 P x P, B x N
11 P x B, Q – B2
12 R – K1, P – QN3
13 N – K5, P – Q3
14 N x N, Q x N
15 B – B4, B – N2
16 P – B3, KR – Q1
16 P – B3, KR – Q1
17 Q – Q2, Q – Q2
18 B x P, P x B
19 Q x P, Q – K2 (to protect knight)
20 P – Q5, P – K4
21 P – N4, P – K5
22 P – N5, N – R2 (if . . Q – B1, Q x N, P x B, R – K7 followed by P – N6 wins)
23 R x P, Q – B1
24 R – K8, Q x R
25 B x N(CH), K – R1
26 B – B5(CH), K – N1
27 Q – R7(CH), K – B1
28 Q – R8(CH), K – KZ
29 R – K1 (Checkmate)

Peter Hemming (left) and Bill Turner contemplate their next move.

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Atlas compete against Appleton for the netball cup

Rutherford 'B' team, winners of the football cup. From left to right, top row Jim Taylor, Peter Hemmings, Jeremy Ireson and Malcolm Edwards. Bottom row Martin Guest. Ron Lawes and Bob Brvne

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Dr Howlett (centre) presents cheques to Ken Moye (left) and Mr Roger Childs

Suggestions Scheme Award

The presentation of the largest award ever given since the commencement of the SRC Suggestions Scheme was made at the Atlas Computer Laboratory on 10 May. Dr Howlett performed the agreeable ceremony, handing over cheques of £100 each to Mr Roger Childs and Mr Ken Moye. The award was for their suggestion of modifying the 1906A lineprinter to use Atlas printer ribbons during a period when 1906A printer ribbons were difficult to obtain. Dr Howlett, remarking on the simplicity of the device, a brass bush which had been made by Ken Moye, said how pleasant it was to see such excellent co-operation between the Administration and Scientific sides.

The editorial board hard at work! From left to right Harry Norris (Rutherford), Shirley Lowndes (Daresbury), Bill Burton (Culham), Carol Rivers (London Office), John Alexander (Royal Greenwich Observatory), Ian Arnison (London Office), Doug House (Atlas) and Alan Powell (Royal Greenwich Observatory. Photographer: Geoff Gardiner local correspondent for Appleton Lab.

GERONIMO

Atlas Computer Laboratory held a Families Day on 29 June. Picture shows Mr Doug House, Head of Operations Group, at the 1906A main console explaining the GERONIMO system to visitors. This is used for displaying operator information.

QUEST Vol 7 No 2 1974

Home Control for our Latest Satellite

UK-5 centre at Appleton Laboratory*

E DOYLE†

UK-5, or Ariel 5 as it will be known when it is in orbit, is the fifth in a series of British scientific satellites. It has been designed and constructed for the SRC by Marconi Space and Defence Systems at Portsmouth to serve as a platform for six scientific experiments—five British and one American.

These experiments will be used to study different and complementary characteristics of stellar X-ray sources, and the data obtained from them will provide a comprehensive picture of the radiation from the X-ray sources, together with accurate identification of the source positions. Four of the experiments are designed to point directly at a selected source and study it in detail, while the other two continuously scan the whole sky as the spacecraft spins and can give early indication of unusual events whilst simultaneously accumulating information about many different sources.

The launch aboard a scout rocket is expected to take place in the near future from the Italian 'San Marco' launch facility in the Indian Ocean off the coast of Kenya near Mombasa.

There are almost two hundred known X-ray sources and during the first year of operation the spacecraft will be pointed at up to one hundred of these which have been selected for detailed observation by the 'pointing' experiments. At the same time the scanning experiments will be collecting information about all the known sources and possibly about some which have not yet been identified. The pointing direction of the spacecraft is changed when commands from the ground open small gas jets. There is enough gas on board for at least one year's operation of the satellite.

Once the spacecraft is in orbit all its operations will be directed from the Ariel 5 control centre which has been built at the Appleton Laboratory in Slough. Commanding and telemetry reception facilities at the NASA ground stations at Quito and Ascension Island will be used to provide direct contact with the spacecraft while NASA data links will be used to relay commands from Slough to these stations and to transmit to the control centre telemetry relayed in real time from them. The telemetry is recorded and simultaneously monitored as it reaches the control centre and a variety of devices are used to display the information on spacecraft performance and status which is contained in the telemetry. Once the data from a pass have been collected in the Control Centre they are passed to the ICL 1904A computer at the Appleton Laboratory, or if this is not available, they are transmitted over Post Office DATEL 2400 data links to the 1906A computer at the Atlas Laboratory, Chilton, or to a similar machine at British Airways, Heathrow.

The UK-5 control room at the Appleton Laboratory

These large computers are used to process the data and to calculate the current pointing direction, drift rate and orbit positions, to check the experimenters' data, and then to transmit all this information over data links back to the control centre, where it is recorded on magnetic tape. In the control centre the information required by each experimenter is selected and is transmitted over GPO DATEL 600 data links to the experimenter at his University where it is recorded in a suitable way on his own computer. This use of data links enables the experimenter to obtain results within an hour of the time at which the spacecraft was commanded to transmit the data, and makes it possible for him to make changes to his experiments within a very short time, and therefore to make the best possible use of this opportunity to study stellar X-ray sources.

* See also Satellite technology UK-5, Quest vol 5 no 2, J F Smith.

† Dr Elizabeth Doyle was until recently Software Systems designer for UK-5 at the Appleton Laboratory.

Regrouping of establishments

At its April meeting Council, after extensive consultation with all interested parties, including staff side, took a number of decisions about the regrouping of activities in establishments.

High energy physics
Support for high energy physics will be concentrated at the Rutherford Laboratory. Work at Daresbury Laboratory in preparation for CERN experiments which are already approved (such as the $e^{-}\gamma$ and muon programmes) will continue there, but work in support of all new proposals will be the responsibility of Rutherford.

A substantial part of the computing now carried out at the Atlas Computer Laboratory will be transferred to Daresbury where it will support a growing variety of work outside the field of high energy physics. The transfer will begin in 1976 and take several years to complete.

Interactive computer facility
The interactive computing facility recommended by the Engineering Board is to be set up, using as its base that part of the Atlas Computer Laboratory remaining at Chilton.

National computing campus
Discussions are under way between the SRC and the Department of Industry to consider the possibility of establishing a national computing campus to which the interactive facility would be the initial SRC contribution.

Transfer of staff
Specific plans for transferring staff will be worked out progressively with the staff and trade union sides and every effort will be made to ensure that movement of staff will be on a voluntary basis and full account will be taken of personal circumstances.

Liquids and Solids
Atlas held its fifth symposium on the subject of "Computational Physics of Liquids and Solids" at Queen's College, Oxford in April. While the majority of the hundred participants were from the UK there were speakers from the USA, France, Italy, Holland and other European countries, showing the high level of interest in this field.

By the end of the symposium it was clear that high speed electronic computers have made a tremendous impact on the theory of liquids and solids. As one speaker remarked "Computer simulation methods have not so much replaced theory, but have made a theory of liquids possible".

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SRC's new microfilm recorder

F R A HOPGOOD

The Atlas Laboratory has taken delivery recently of an FR 80 microfilm recorder to replace its SD 4020 which has been SRC's main graphical output device for the last seven years.

The attraction of a microfilm recorder for graphical output as against a pen-plotter is mainly its speed and flexibility. As well as being able to produce graphs on sensitized paper (called "hardcopy" for some unknown reason), the SD 4020 can output to both 16 mm and 35 mm film. In a typical year, the SD 4020 produces about 1,700,000 pages or frames, of output. We estimate that it would take about two hundred pen-plotters to generate a similar amount of output!

Production of cine films

Users of Atlas' graphical facilities come from all parts of SRC. Probably the largest user of hardcopy is the Neutron Beam Research Unit at Chilton. Other large users include satellite data processing and the JASIN project organised by the Department of Oceanography at Southampton University. One of the more novel uses is, of course, the production of cine films. It is surprising how many of the large computer projects find this method of displaying results attractive. Films have been made on such diverse topics as galaxy evolution, effluent dispersal in the Solent and textile design.

The decision to replace the SD 4020 was made about three years ago. The machine is a mixture of valve and solid state circuitry. It has become increasingly difficult to maintain and we have had to cannibalise two tape decks in order to keep the third one in a working condition. Even with a full-time engineer, the machine now only averages about 70% up-time in the prime shift.

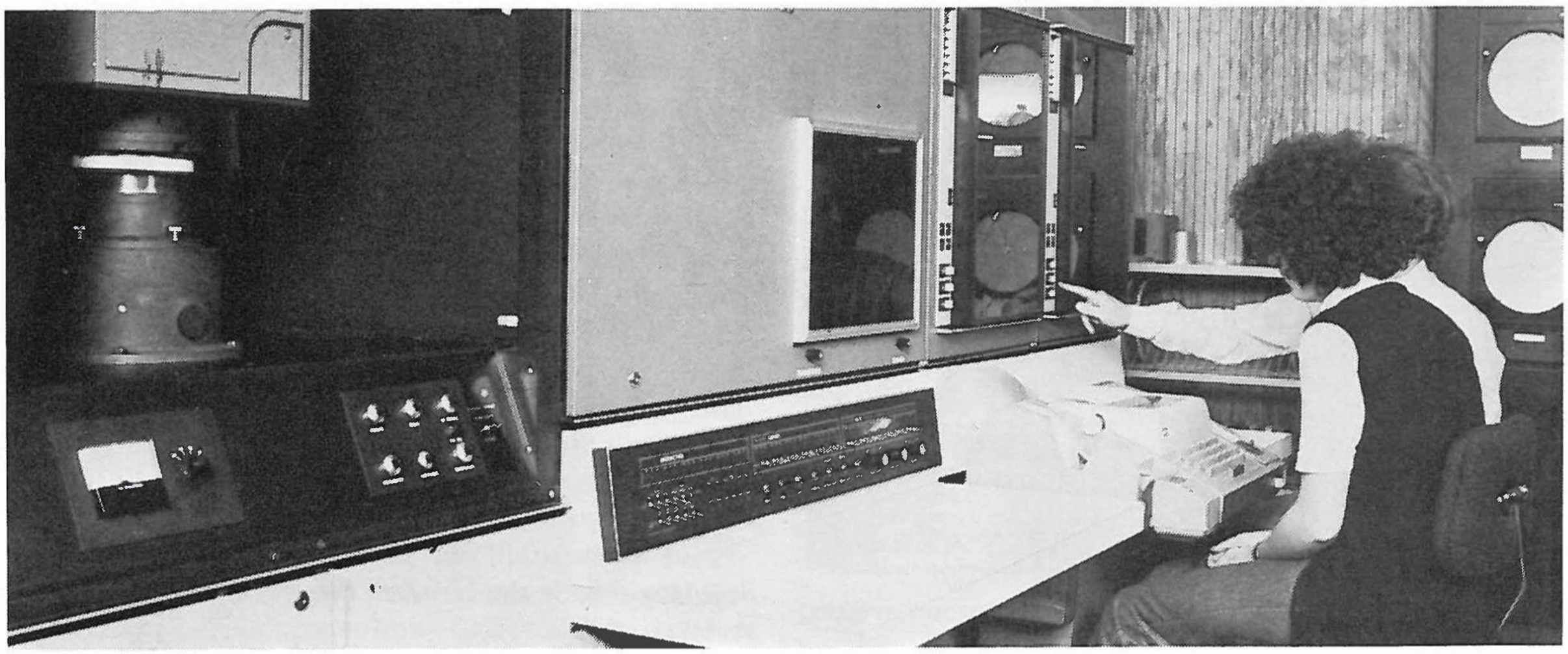
Most accurate

The FR 80 microfilm recorder, manufactured by Information International Incorporated (III) of Los Angeles, was a natural successor to the SD 4020. It is both the most versatile and most accurate of the recorders currently available. Like the SD 4020, it has hardcopy, 16 mm and 35 mm cameras. In addition, it has a microfiche camera capable of producing fiche at a reduction of forty-two or forty-eight times. This allows four hundred pages of output to be contained on a single fiche. With the world paper shortage, microfiche is becoming the standard interchange media for large volumes of text.

New features

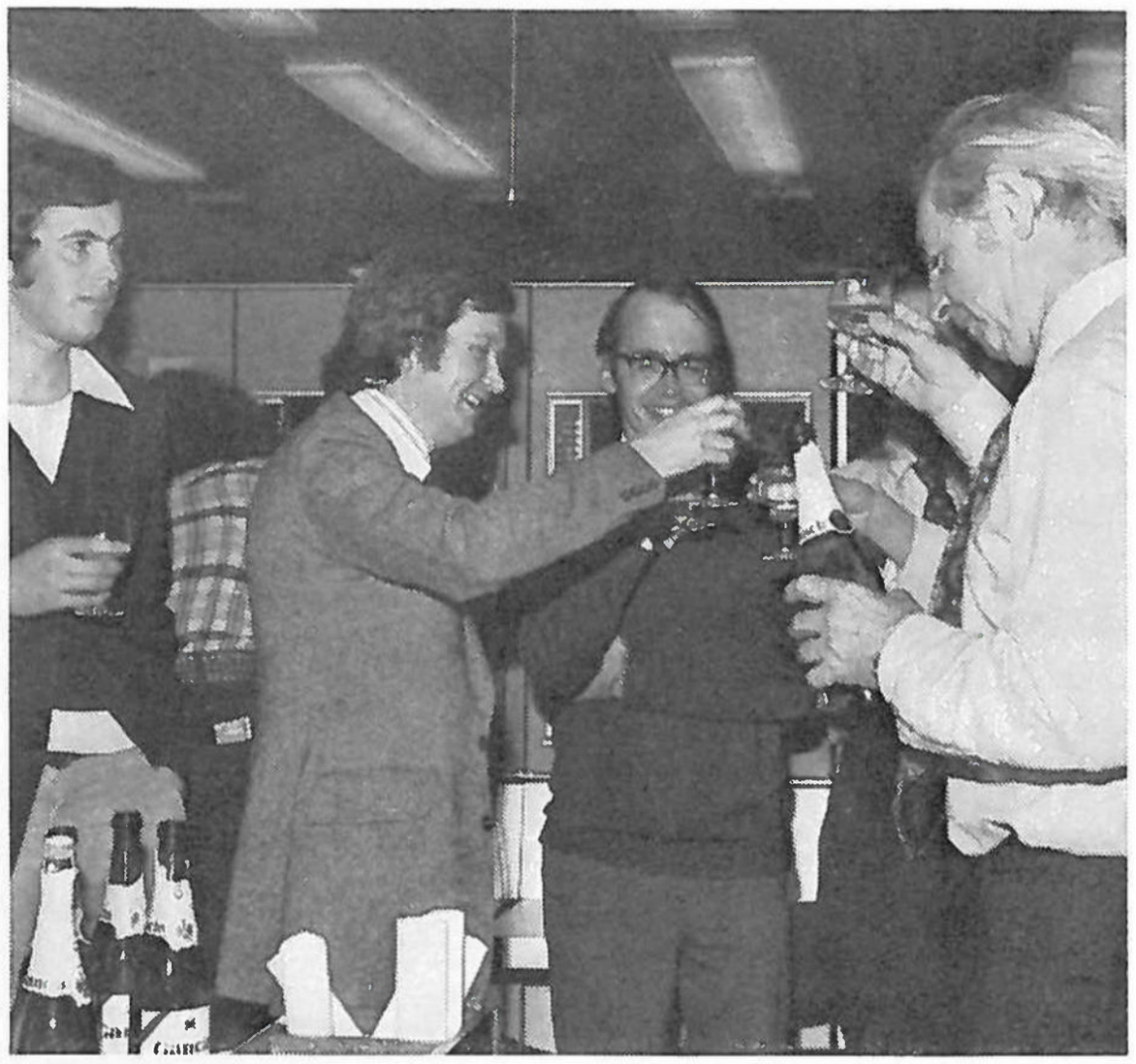
Our particular FR 80 has a number of recently-introduced features which probably make it the most

A magnetic tape being loaded on the FR 80, the contents of which, when run, will be photographed by the microfiche camera seen in position on the left of the picture



sophisticated recorder in the world today. A colour filter system incorporated in the 16 mm and 35 mm cameras allows multi-colour output to be produced directly on the recorder. Over two hundred distinct colours can be generated which gives the user another dimension to his output. This large range of colours is possible because two hundred and fifty-six different intensity levels can be produced.

Even though the order for the FR 80 was not placed until last October, III managed to deliver the machine before Easter—but not without some trials and tribulations on the way. Its journey to the Laboratory was delayed initially when it was found the contractors' truck sent to take the machine from the factory to the airport was not large enough, with the result that it missed the first plane out of Los Angeles.



Celebrating acceptance of the FR 80 are (from left to right): Dave Daniel, Mike Daniels (of Information International Inc), Eric Thomas and Dr Howlett

Installing the machine

Eventually, it arrived at the Atlas Computer Laboratory and there was a sigh of relief as it was successfully squeezed into the lift to take it to the first floor. The manufacturers' measurements had indicated that the machine was EXACTLY the same size as the lift so there was no room to spare—luckily, the only damage to paintwork was to the lift and not the FR 80!

Next came the film processor. This was obviously too large for the lift and the only way up was via three short flights of stairs, with a corner to negotiate at the end of each flight. However, several strong men made short work of this task and surprisingly quickly everything was in its place.

One minor hitch since installation has been that due to late delivery of a calorifier, one wing of the building is denied supplies of hot water whenever film processing is going on!

Some careful manoeuvring as the FR 80's film processor, weighing about 400 lbs, is taken up to the first floor

Acceptance tests

Hardware acceptance tests began as soon as the machine was installed while at the same time programmers were rapidly putting the finishing touches to some eight months' work rewriting the graphical software for both the 1906A and 360/195 computers so that it would work with the FR 80.

Early in May, the full range of acceptance tests was completed—not without some celebration—and a user service introduced at the beginning of June.

Bob Hopgood is the Head of the Basic Software Group at Atlas.

Dr Jack Howlett CBE

When the octal number 70044772 ("idling in execution . . .") re-appeared on the Atlas computer console at 15.00 hours on 15 August 1975, it signalled the end of a luncheon party and presentation to Jack Howlett, Director of the Atlas Computer Laboratory on the occasion of his retirement.

The Laboratory staff, together with a small group of friends and colleagues, gathered together to give him an informal luncheon party and afterwards Mr Christopher Jolliffe, one time Director of Science Division, presented him with a hallmarked sterling silver tumbler cup (a copy of a travellers' wine cup in use during the sixteenth and seventeenth centuries).

In addition he was given a presentation piece constructed from parts of the Atlas and 1906A computers, and the original Atlas Visitors Book containing evidence of the national and international groups with whom the Laboratory has been in contact.

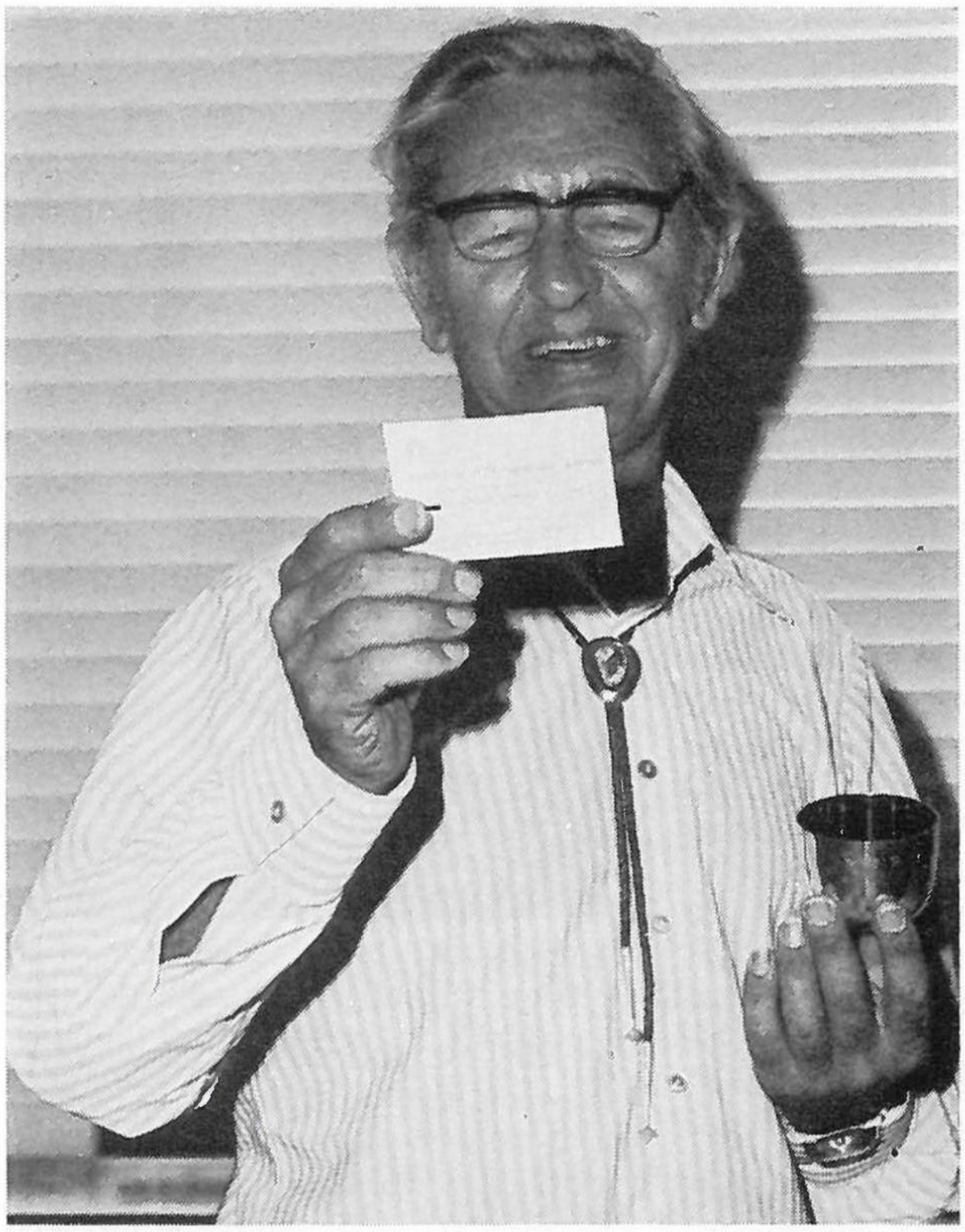
In making the presentation, Christopher Jolliffe referred to the happy choice of Jack Howlett as Director of the Laboratory, after the very difficult negotiations in 1961 which led to the purchase of the Ferranti Atlas 1 and the decision to make this powerful computer available not only to AERE and the high energy physicists of RHEL, but to ensure that other disciplines in the UK universities would also have a substantial share of the new resource.

Supporting the good wishes, Bob Churchhouse, formerly head of Programming Group and now at Cardiff University, reminded everyone of the rapid growth of computing and computers and the great influence that the Laboratory had exercised under Jack Howlett's leadership.

In thanking everyone for the gifts and the flowers for his wife, Joan, Dr Howlett noted that he had now worked for his living for 40 years almost to the day, and described the exhilaration of a young numerical analyst working for the LMS railway when his hard won hand calculations proved correct as a 50 ton steam locomotive was run up to leave the rails at the predicted 105 mph! He referred to the debt he owed to Professor Douglas Hartree, the distinguished numerical analyst, his supervisor at Manchester University and to the early days at Harwell when he was invited to set up the computing section. He was still capable of wonderment at this remarkable device—the computer—and hoped that the initiatives and flexible approach to new problems which had marked the years of development of the Laboratory would continue to flourish under the new organisations to be established by SRC.

Later, in accord with local custom and at the request of the girls from Data Preparation, he was taken away to be dressed in an "emperor" costume complete with a laurel leaf crown, and given a scroll, which took the form of a diploma "for long and faithful service" and amongst other well applauded qualities for "being the best boss we've ever had!"

In switching the Atlas console to a display "70044772" (idling in execution . . .) Dr Howlett completed the final plans for Atlas; the console was to be on permanent display in the reception lounge. It is clear however that in his retirement Jack Howlett will be far from idle and he looks upon the years ahead as yet another phase of working for his living. Already he has a full calendar and will still play an active role in the computer world. With a truly international circle of friends and acquaintances, he will indulge his capacity to lead an interesting and varied life.



Dr Howlett admires his presentation gift —a silver tumbler cup (a copy of a traveller's wine cup)

Picture shows from left to right, computer staff: Lynn Nash; Sheila Coleman, Pauline Field; and Tony Rooker

Data Processing at State House

The ICL 1906A computer at Atlas Computer Division is now being used to assist in the administration of research grants awarded to Universities, Polytechnics etc. Proposals for the system were presented in March 1972. After testing, instruction manuals were prepared and formal training sessions were instituted. Clerical records were then converted to the computer system and the two systems ran satisfactorily in parallel for four months until the new system of administration became fully operational in April this year.

Transaction forms and claims are received in the Data Processing and Control Unit at State House from the registries, committee secretariats and institutions. They are sorted into batches and the information punched on to computer input cards. This information is verified. The cards are then run through the card reader of a CTL Satellite 1 terminal which transmits the information to Atlas over a Post Office data link.

Once the transactions have been processed by the computer, a variety of "update reports" are produced by the terminal listing various details held on the computer records. Data can be extracted to produce lists and analyses for committee and management purposes. Payable orders are also produced from the system to be posted to Institutions in settlement of claims.

The use of the Atlas computer will be further extended in the new year when it will be used to assist in the administration of SRC studentship awards.

A Lewis

Regrouping of Central Computing Facilities

In April the Council approved the proposed distribution of computing work between the Rutherford and Daresbury Laboratories. This involved the transfer to Daresbury of Science Board computing for X-ray crystallography and related subjects, together with applications group staff posts.

The Council agreed to take direct responsibility for central computing and to establish a single Facility Committee to supervise the management of central computing at both Laboratories. This Committee will, when it is set up late in 1976, take over the continuing functions of the Atlas Computing Committee and the Computer Regrouping Co-ordinating Committee. This completed the Council's planning of the SRC computing regrouping.

The Council also approved the purchase of a second IBM 360/195 processor and one Mbyte memory store at a cost of up to £1·6M (subject to DES approval) and the transfer of the existing 360/195 at Rutherford into the Atlas Building. This will allow the two processors to be run as a coupled system sharing the existing peripherals. The existing 1906A will continue in operation with only a small additional staff. An 80% increase in Chilton capacity is expected in the upgrading without any increase in the recurrent costs. Enhancements to the Daresbury IBM 370/165 were approved to allow purchase of an additional Mbyte memory and a third channel and enhancements of the tape and disk drives at a capital cost of £275K. Proposals for further upgrading of the Daresbury computer are awaited.

Finite elements

'Finite elements', a 10-minute colour film which is the first engineering film to be generated entirely by computer, had its premiere at the Royal College of Art in May. The film, which was made by the Atlas Computer Division of the Rutherford Lab in collaboration with the Royal College of Art was produced using the specially developed ANTICS computer animation software on an ICL 1906A computer, together with a computer-controlled microfilm recorder. The same techniques were also used to generate the sound-track music.

As well as introducing the engineering technique of finite element analysis, the film sets out to demonstrate the potential usefulness of the computer in solving practical engineering problems. It also illustrates the use of computer animation and film making as a general research tool, showing how masses of numerical information can be analysed and how models can be tested in all sorts of possible situations.

COMPUMAG '76

A three-day international conference on the computation of magnetic fields – COMPUMAG – was organised by the Rutherford Lab in April at St Catherine's College, Oxford. It was attended by more than two hundred delegates from fifteen countries.

Highlight of the conference was the specially set up magnet design workstation, shown right. Based on a GEC 4080 computer linked by a 4800-baud Post Office line to the Rutherford Lab's IBM 360/195 computer, the workstation enabled delegates to use the Lab's GFUN magnet design software running on the IBM computer together with additional computer-aided design programs running on the GEC 4080 machines.

Magnet design work began at the lab as part of its High Energy Physics development programme, but its potential for applications in other fields was soon realised, and the GFUN software has now been used by several outside organisations and research centres including British Rail and International Research and Development Co, for applications in such fields as magnetic levitation and Tokamak magnets for fusion experiments.

Central Computing

At its July meeting the Council approved a proposal for upgrading the Daresbury IBM 370/165 at a cost of £670K plus VAT. At present insufficient funds are available to undertake the whole of the upgrading and the Council therefore, authorised the Chairman to approve the placing of orders for the individual items if and when funds became available. The Council also noted that discussions were being held between SRC, International Computers Limited and the Department of Industry on a computing project (The Distributed Array Processor).

(ii) *Interactive Computing Facility*

In November 1975 Council agreed in principle to an interactive computing facility being established under the auspices of the Engineering Board. The Council has now approved the first steps in its establishment by agreeing to the enhancement of the PDP 10 computers at Edinburgh University and UMIST (which will be part of the network which will form the facility) and to the purchase of an initial instalment of terminals.

SRC Golf tournament

The 1976 inter-establishment golf tournament was held on June 4 at the Wentworth Club, Virginia Water.

Seven teams from Rutherford, Daresbury, Appleton, London/ Swindon Office and RGO competed for the Brian Flowers Trophy, the best four net returns over 36 holes from each six-man team deciding the winners.

This year the winners were Rutherford 'A' team (Brian Parkinson, Jim Valentine, Doug House, Peter Gregory, Geoff Manning, John Jenkins) with a final score of 593. Rutherford 'B' team came second with 603 and Daresbury 'A' team third with 615.

The best individual scores were:

Best gross score over 36 holes
John Delury, Appleton, 166 gross.

Best net score over 36 holes
Jack Moore (handicap 20), Appleton, 142 net.

Best net score over morning 18 holes
Bob Cunningham (handicap 18), Daresbury, 64 net.

Best net score over afternoon 18 holes
Jim Valentine (handicap 10), Rutherford, 74 net.

Computer Networks

Two computer network units have been set up at the Rutherford Lab.

The Network Unit of the Computer Board and Research Councils has been set up to look into the short-term development of communications links between computers at universities and Research Council establishments throughout the country. Although it operates from the Rutherford Lab, the unit, called the Network Unit for short, is not part of the SRC. It is funded jointly by the Computer Board for Universities and by the SRC on behalf of all the Research Councils.

Director of the unit is Mervyn Williams, formerly Director of the Post Office's Telecommunications Development Department. Mr Williams has been a member of the SRC Computing Science Committee, the Department of Industry's Computers, Systems and Electronics Requirements Board and the Computer Agency Council.

Networks between university establishments and Research Council Institutes have been formed mainly within geographical regions. There are also United Kingdom wide connections to the three large computing centres in the Universities of Manchester and London and the Rutherford Lab. The aim of the unit is to lay a foundation for rationalising and extending existing networks in a form that will be compatible with one another and with national developments being undertaken by the Post Office and the Department of Industry.

The other unit is the Secretariat of the Department of Industry's National Committee on Computer Networks. Chaired by the ex-director of the former Atlas Lab—Jack Howlett, this committee has been set up to look into national computer network requirements in the 1980's. The Secretariat at Rutherford is headed by Donald Audsley, formerly head of the Technical Operations Division of the Space Documentation Service of the European Space Agency.

Recently the NCCN Secretariat has been involved in contacting computer mainframe, mini-computer and terminal manufacturers to stress the importance of formulating and adhering to standards in data communications. The object of the exercise which has involved contacting some 140 UK manufacturers and more than 60 editors of national and international computer and communications journals, is to ensure that the problems of setting up networks with computers of different makes are minimised

Finite elements

'Finite Elements'—the computer-generated film produced by Atlas Computing Division—has now sold more than 100 copies, to places as far afield as the US, Sweden, Norway, the Netherlands, Iraq, Iran, Switzerland, Canada, Brazil, Denmark, Australia, South Africa and New Zealand.

The film is now being marketed by Compeda, a new company formed by the National Research Development Corporation of London to handle a wide range of computer-produced material for engineers. Compeda will be assigning marketing rights for the film to specialist agents in the US and other countries, and is expected to arrange for foreign language soundtracks to help overseas sales.

Mr P J Bowles

Rutherford Lab's Chief Engineer, Mr P J Bowles, retired at the end of June, thus bringing to an end, a 30 year association, first with AERE and since its inception, the Rutherford Lab.

Mr Bowles was educated at Manchester University where he obtained a First Class Honours degree. This was followed by a two year graduate apprenticeship with Rolls Royce; he remained with the firm for a further two years obtaining his M Sc by external thesis.

He joined AERE, Harwell in 1947 and eventually became Head of the Engineering Division and Deputy Chief Engineer. After completing a number of major projects for Harwell, he became Project Head for Nimrod, the 7 GeV proton synchrotron which was built for the newly formed National Institute for Research in Nuclear Science. Not only did he successfully complete this very difficult project but he then went on to build a large part of the Rutherford Lab.

His outstanding services in the fields of both electrical and mechanical engineering (he is a Fellow of both the Institution of Electrical Engineers and the Institution of Mechanical Engineers) resulted in the award of the OBE in 1966.

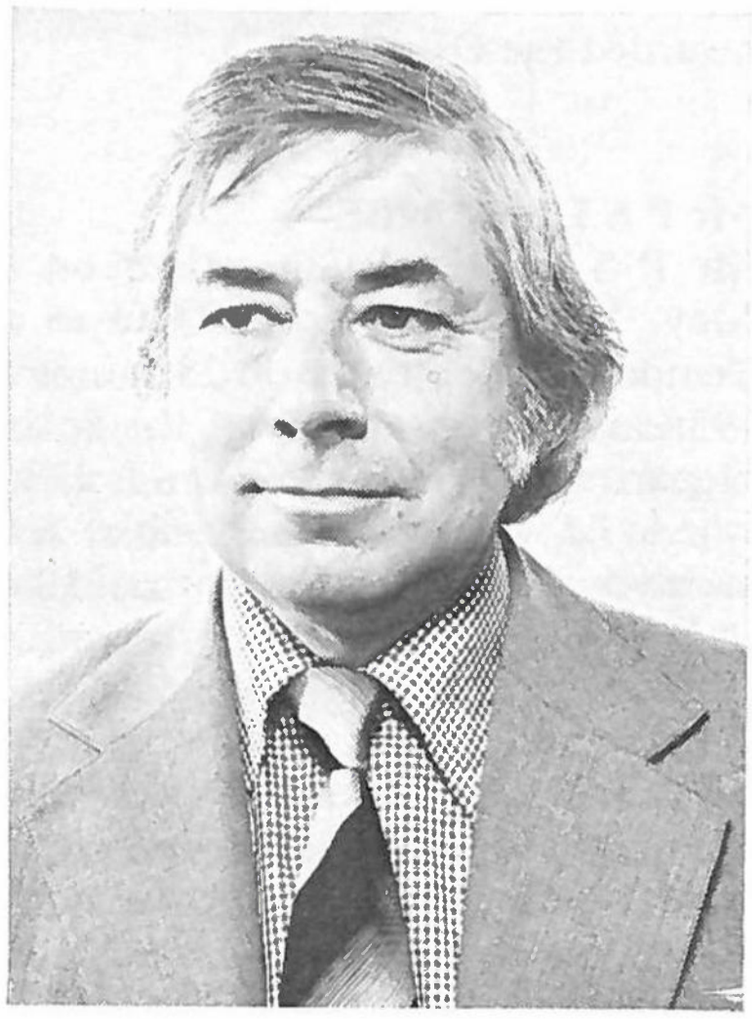
Although now retired from the Rutherford Lab, he still has one major project to complete—the new SRC headquarters at Swindon a project far removed from his wartime experiences with Rolls Royce but perhaps not so very different to his first job at the age of 14 with a firm of builders!

From left: Dr Stafford, Director RL and Mr and Mrs Bowles

Atlas v Appleton

Four teams entered the netball competition, from London Office, Daresbury, Appleton and Atlas. The Daresbury team were the winners, thus retaining the cup that they won in 1976, winning all of the five games that they played and beating the Atlas team by 26 goals to 4 in the final.

Mr C W Trowbridge



Mr Trowbridge obtained an external London University Honours degree in Physics after joining AERE Harwell as a Scientific Assistant in 1957.

At the Rutherford Lab, his work on ion source development and optics calculations for the Oxford Electrostatic Generator (1961-67) involved the extensive use of digital computers for the solution of electrostatic field problems.

In 1967 he became leader of a group dealing with computational aspects of work in Applied Physics Division. The introduction of interactive graphics techniques in computer aided design of apparatus, also the development of new algorithms for the solution of three-dimensional non-linear electromagnetic fields, has led to the use of these techniques in laboratories throughout the world.

Last year he chaired the first International COMPUMAC Conference on the computation of magnetic fields held at Oxford.

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Computational science at Daresbury

A new Division, the Theory and Computational Science Division, came into being at Daresbury Laboratory on 1 October 1977, with Professor P G Burke on a joint appointment with Queen's University, Belfast, as its Head. The Division consists of the existing Theory Group and a new Computational Science Group.

It was in 1976 that the Council decided that support for computing in quantum chemistry, crystallography and atomic and molecular physics would be transferred from the Rutherford to the Daresbury Laboratory, all these being fields connected with experimental work to be carried out with radiation from the Synchrotron Radiation Source (SRS) now under construction at Daresbury. Four members of staff have now made the 'quantum jump' between Rutherford and Daresbury to form the nucleus of the Computational Science Group, the Group being augmented by transfers from within Daresbury and by external recruitment.

The Group is presently involved in four projects: (i) the calculation of precise wavefunctions and energies for bound state molecules, (ii) photoionisation and electron scattering from atoms and molecules, (iii) the SRC Microdensitometer Service to X-ray crystallographers, with associated computational support for X-ray diffraction data analysis, and (iv) the crystal structure search and retrieval program, which provides on-line facilities for the interrogation of all known structural data of organic crystals on the SRC Interactive Computing Facility DEC-10 computer in Edinburgh. In all the above the aim is to provide computational backup to research workers in the universities, and wherever possible to organise the projects in collaboration with university groups. To obtain the right degree of interaction with the academic community, it is anticipated that the Group will organise a number of one-day and weekend meetings covering relevant sectors of physics and chemistry. Indeed one such study weekend has already been organised, held at Daresbury on 10-11 December 1977, on the subject of 'Correlated Wavefunctions', and two one day meetings, one on the subject of 'Lattice and Lattice Defect Energy in Solid State Physics' on 12 January 1978, and another on 'Photoionization of Atoms and Molecules' on 16 February 1978. The primary aim of all these meetings was the discussion of the possibility of collaboration with University Departments in the future development of these fields.

FR 80 makes a film of the book

Members of the Atlas Computing Division of the Rutherford Laboratory successfully carried out a feasibility study last Spring to determine whether the FR80 could be used for high quality printing of scientific data.

They did this using bibliographic entries (including chemical formulae) from the data base of molecular structures maintained by the Cambridge Crystallographic Data Centre. The Centre accumulates references to organic crystal structures—mainly from periodicals—and each year publishes a book of the entries for that year.

To be of use to the research community, the book has to be printed quickly which means that conventional printing methods cannot be used because of the difficulty of proof reading thousands of very similar complex chemical names and formulae.

Computers are used to produce five different types of index (main bibliography, author, formula, permuted formula and compound name) from the one set of data and do the typesetting.

The magnetic tapes carrying the information for 1976 which were sent to the Rutherford staff early last year contained 2762 references and 1313 cross references, listed in five different formats. The printers added 20 introductory pages to the 817 produced at Rutherford from these references and the book was published last Summer.

Encouraged by the success of the first book made using the FR80, the Centre began work on a larger cumulative volume (15,993 citations in six types of index) containing all the references published in the previous eight volumes. This second book was processed at Rutherford in the Summer and published in December 1977.

Rutherford staff are now busy with the 1977 volume.

33.26 **Piperidine hydrochloride**
$C_5H_{12}N^+ Cl^-$
J K Dattagupta N N Saha J Cryst Mol Struct, 5, 177 1975

33.27 **bis(Isonicotinato) magnesium tetrahydrate**
$2C_6H_4NO_2^- Mg^{2+} 4H_2O$
M B Cingi A C Villa C Guastini D Viterbo
Gazz Chim Ital, 104, 1087 1974

33.28 **4 - Cyano - pyridine - N - oxide**
$C_6H_4N_2O$
K I Hardcastle M J Laing T J McGauley C F Lehner
J Cryst Mol Struct, 4, 305, 1974

33.29 **Isonicotinic acid**
$C_6H_5NO_2$
F Takusagawa A Shimada
Acta Crystallogr Sect B, 32, 1925, 1976

33.30 **Piperidino - thiosemicarbazide**
$C_6H_{13}N_3S$
C H Koo H S Kim C H Chang
J Korean Chem Soc (Daehan Hwahak Hwoejee 19, 85 1975
Also classified in 8

An extract from the first book to be made using the Rutherford Lab's FR80, a precision microfilm recorder