atlas

COMPUTER
LABORATORY

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SCIENCE
RESEARCH
COUNCIL
PUBLISHED 1969

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List of Illustrations

Brochure designed by HMSO/Leonard Lawrance
Brochure cover: Abstract based on model of Babbage's difference engine

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What it is

Though initially set up under another scientific body, the Atlas Computer Laboratory has come under the Science Research Council since this was formed on 1st April 1965 within the Department of Education and Science. The same Department administers also the Agricultural, Medical, Natural Environment, and Social Science Research Councils. The Laboratory houses the large I.C.L. Atlas computer, which was ordered in 1961, and all the ancillary machinery and supporting services needed to operate a powerful computer efficiently.

Where it is

The Laboratory is on the west side of the A34 (Birmingham to Winchester) trunk road, 14 miles south of Oxford, map O.S. 158 (1 inch) reference 480; 865. The nearest station, Didcot (Western Region), is 5 miles away; London Airport is 45 miles away; and the City of Oxford (Nos 12/112 —Oxford to Newbury) buses pass the site. There is a map on page 24.

The postal address is

Atlas Computer Laboratory,
Science Research Council,
Chilton, Didcot, Berkshire.

Telephone

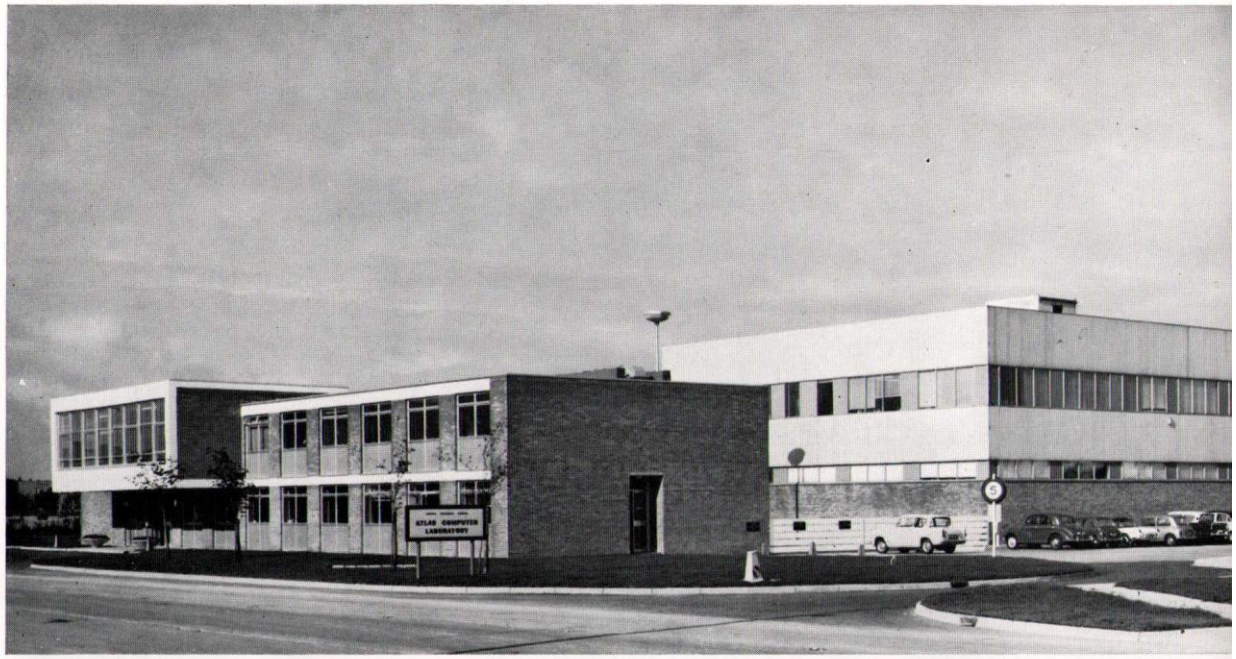
Abingdon 1900 Ext 6296 (Receptionist)

What it is for

The Laboratory provides a computing service to research workers in all British universities free of charge. It offers this service also to Government and other Treasury-supported research organisations

1 The building from outside
2 The 'think' room

1



2

at a charge which works out at roughly £200 an hour. Bodies that are part of the Science Research Council itself, such as the Radio and Space Research Station, are not charged for this service.
Broadly, the aim is that the Laboratory shall be a place to which the research worker can turn when he has to attack a problem which demands computing power on a greater scale than his local machinery can supply.
In addition to this service work, the Laboratory offers professional help and advice to its users. It supports research projects by means of contracts with universities and by offering Fellowship appointments. It also pursues research and development projects of its own.

How it is run

The organisation of the Laboratory is simple and expresses the needs:
to process work through the installation as quickly and efficiently as possible;
to provide and maintain (in some cases in collaboration with the makers of the machine, I.C.L.) the software needed in support of this;
to keep intellectually alive, and therefore efficient, by means of research acitivities and contracts with outside bodies, notably universities.

The personnel

The Director, who is responsible to the Council for the whole Laboratory.

The Operations Group, responsible for all the processing activities—reception and despatch, card and tape punching, operation of the computer and ancillary machines.

3 Entrance hall and general reception

3

4 Postal reception and despatch

4

The Programming Group, responsible for all basic software, assembling the program library, specifying and producing special 'packages' (as for crystallographic calculation, statistical analysis, and information retrieval).

The Support Group, responsible for helping users to get their work through the installation, management of program libraries and packages, and for educational services including programming courses.

Individual Research Workers, selected for their individual distinction and their need for large scale computing facilities; in several cases they have been elected to University Fellowships.

The Administration Group, responsible for the general running of Laboratory. The Atlas Laboratory uses the services of the adjacent Rutherford High Energy Laboratory whenever possible—for example, payment of salaries and of accounts, personnel work, maintenance of buildings.

The Machine

This is the state of the installation at the middle of 1969.
On page 22, there is a note of what future developments are currently envisaged.

Store:
48K core (K = 1,024 words of 48 bits each; access time 2 μsec/word).
8K fixed (read-only) store (access time 0·8 μsec/word).
16K working store (access time 2 μsec/word).
96K magnetic drum store (transfer rate 4 μsec/word; access time up to 12 msec).
N.B. The core and drum store appear to the user as 144K of continuous core store.

Magnetic Disc File

Data Products model 5045, capacity 16·8 million words, with dual access from both Atlas and Sigma 2 (transfer rate for 512 48-bit words 6·5 msec; average access time 195 msec).

Magnetic Tape

16 Ampex TM. 2 decks (1 inch tape, transfer rate 64,000 characters/sec)
2 IBM 729 Mark IV decks ($\frac{1}{2}$ inch tape, transfer rate 62,500 characters/sec at 556 bits/inch, 22,500 characters/sec at 200 bits/inch)

Input

Card readers—2 ICL (600 cards/min)
Paper tape readers—2 Ferranti (300 characters/sec);
1 Elliott (1,000 characters/sec)

Output

Printers—2 Anelex (1,000 lines/min, 120 characters/line)
Card punches—2 ICL 100 cards/min)
Paper tape punches—3 Teletype (110 characters/sec)
Teleprinters—2 Creed 75 (one for magnetic tape operators, one for main operators)

N.B. The paper tape equipment will handle 5, 7, or 8 track tape, both for input and output.

Multi-Access Facilities

SDS Sigma 2 computer (32K core store of 16-bit words, cycle time 1 μsec) providing file handling facilities at Teletype consoles and enabling users to initiate jobs on Atlas

5 Library

6 Data preparation area with machine room in background

5

6

7 Machine room showing tape readers, card readers, printers, card punch, and magnetic tape decks.

atlas

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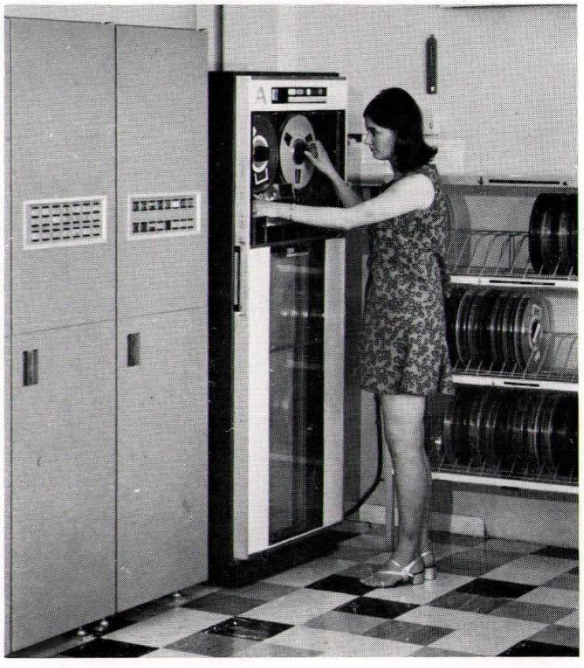


9

8 University user punching paper tape

9 SC4020 Microfilm plotter

10 Engineers' console and closed circuit television

10

11 Engineer testing
packages in the core store

11

Ancilliary Equipment

Microfilm plotter—Stromberg Data-graphics model SC4020
Reproducers —2 ICL (100 cards/min)
Interpreters —3 ICL (22 characters/sec)
Card Sorter —1 ICL (750 cards/min)

Data Preparation Machines

Card punches—11 IBM Type 029
Card verifiers—4 IBM Type 059
Flexowriters—7
Teleprinters—2 Creed Type 54

The Speed of Atlas

Averaged over a typical day of varied work, the machine obeys instructions at about 350,000 a second

The times for basic operations are

Floating point addition—1.8 to 2.2 μsec
Floating point multiplication—5.9 μsec
Organisational instructions—1.6 to 1.8 μsec

The times for some complete programs are

Evaluate a polynomial of degree N—9N μsec
Form the scalar product of two vectors each of order N—13N μsec
Invert a matrix of order 100—14 sec
Find all the eigenvalues (all complex) of a matrix of order 24—2 sec
Sort 5,000 numbers into order—1 sec

As a test of the routines for high-precision arithmetic, the machine has calculated

π to 5,000 decimal places in 20 mins
$\sqrt{2}$ to 10,000 decimal places in 14 mins

The languages it accepts

Atlas has an elaborate automatic operating

system which takes care of many of the tasks which, with a simpler computer, fall on the machine room staff. This contributes greatly to the speed with which complete jobs can be put through the installation. In particular this system, called the Supervisor, makes it easy to change from one programming language to another and thus to process a succession of jobs written in different languages. Among the 30 or so languages we can accept, the most important are
Fortran
Algol
Machine code (ABL)
Atlas Autocode
Extended Mercury Autocode

What it is doing

The machine is now—Autumn 1969—working 24 hours a day from 1600 Sunday until 0800 the following Saturday.

Each week we

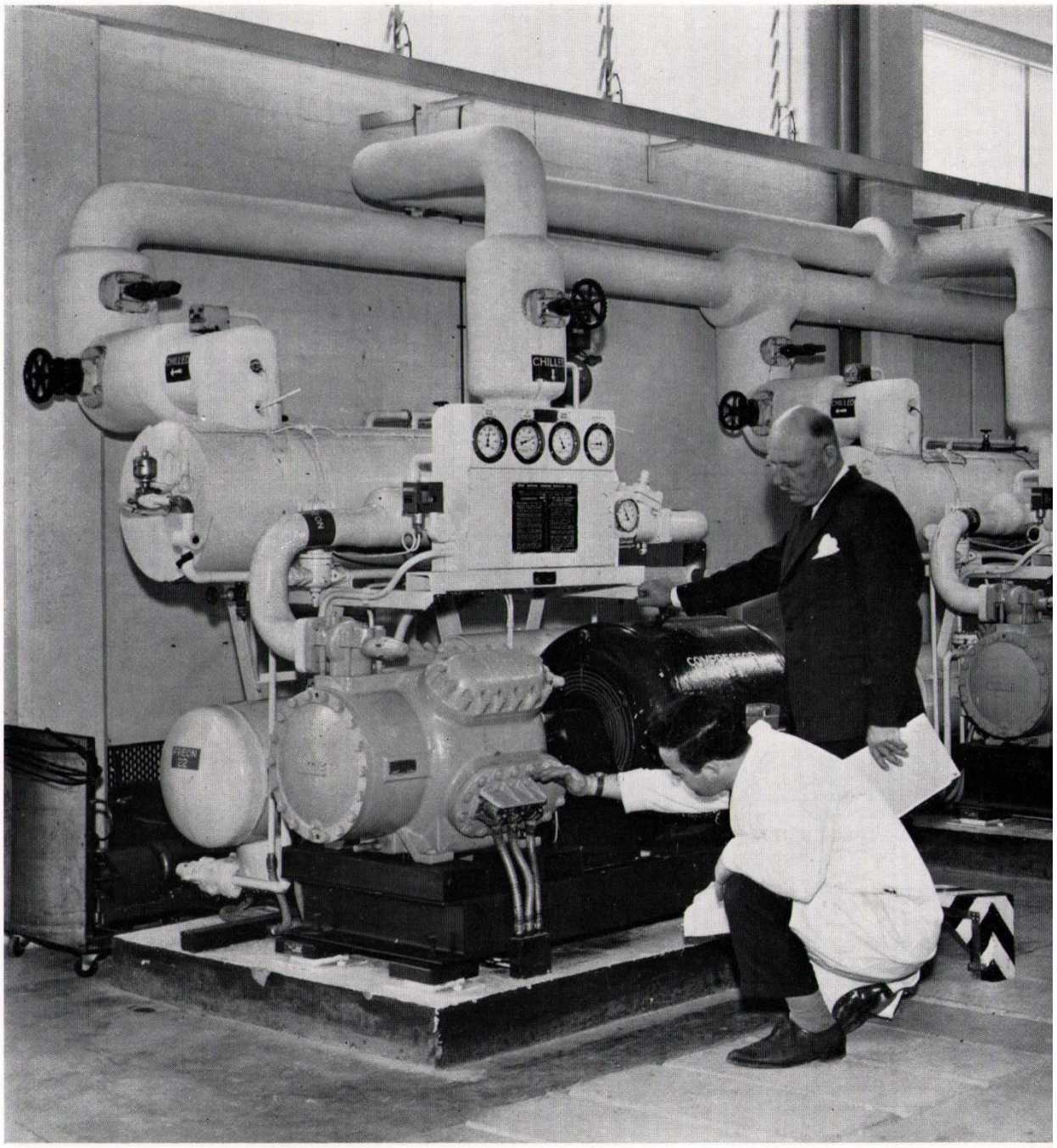
run 2,500 complete jobs;
read in a million cards and 30 miles of paper tape;
print 2 million lines of output;
punch 30,000 cards;
handle 1,500 reels of magnetic tape.

Of this load, about

75 per cent comes from universities (we have 600 separate projects on our books and usually work on 200 of these each week);
15 per cent comes from government and similar laboratories—the Meteorological Office has been a regular user from the start and has written programs which stretch the machine to its limits;

12 Air conditioning plant
(compressors)

12



13 Main entrance

13

10 per cent is for the research and development work of the Atlas Laboratory itself.
Almost all fields of study are represented in this work load. Naturally, the physical sciences take most of the time, but there is a significant and increasing use by sociologists, psychologists, economists and others.

The distribution of the university work is roughly

Mathematics	17%
Physics	20%
Chemistry	17%
Engineering	22%
Medical/Biological Sciences	6%
Social Sciences	8%
Others	10%

The value of a typical week's work, at current commercial rates, is about £45,000.

Research

The Laboratory undertakes and supports research in four ways

1. it has its own research program;
2. several members of the regular staff have research interests of their own;
3. it is able to give contracts to senior members of universities for specific investigations;
4. it has a small number of posts for individual research workers who need the resources of a powerful computing installation to enable them to tackle their problems. They are not burdened with any of the day-to-day obligations of the Laboratory, and in several cases their posts have been linked with Fellowships of Oxford or Cambridge Colleges.

Plans for the future

The Laboratory is now (October 1969) making plans for a large increase in its computing power. As a first step, an I.C.L. 1906A is to be installed in mid-1971. This will have 256K words (24-bit) of 650 ns core store, two fast magnetic drums, each holding 2M characters, a fixed disc of 741M characters, exchangeable disc units and a comprehensive set of peripherals. A number of remote terminal stations—probably six initially—consisting of card reader, line printer and teletype keyboard will be located in universities and other centres and connected to the computer by data transmission lines.

An interactive visual display system, consisting of a PDP 15 computer and a VT 10 display (all made by Digital Equipment Corporation) will be delivered in the summer of 1970. This will be linked to the 1906A when that is delivered, and also to the SC 4020 microfilm recorder and to a D-MAC graphical input table which will be delivered in late 1969.

A large extension to the computer block will be built; to house the new equipment. This should be ready for occupation in May or June of 1971.

14 Sigma 2 computer providing multi-access facilities

15 Everyone meets for coffee or tea in the common room twice a week

14

15

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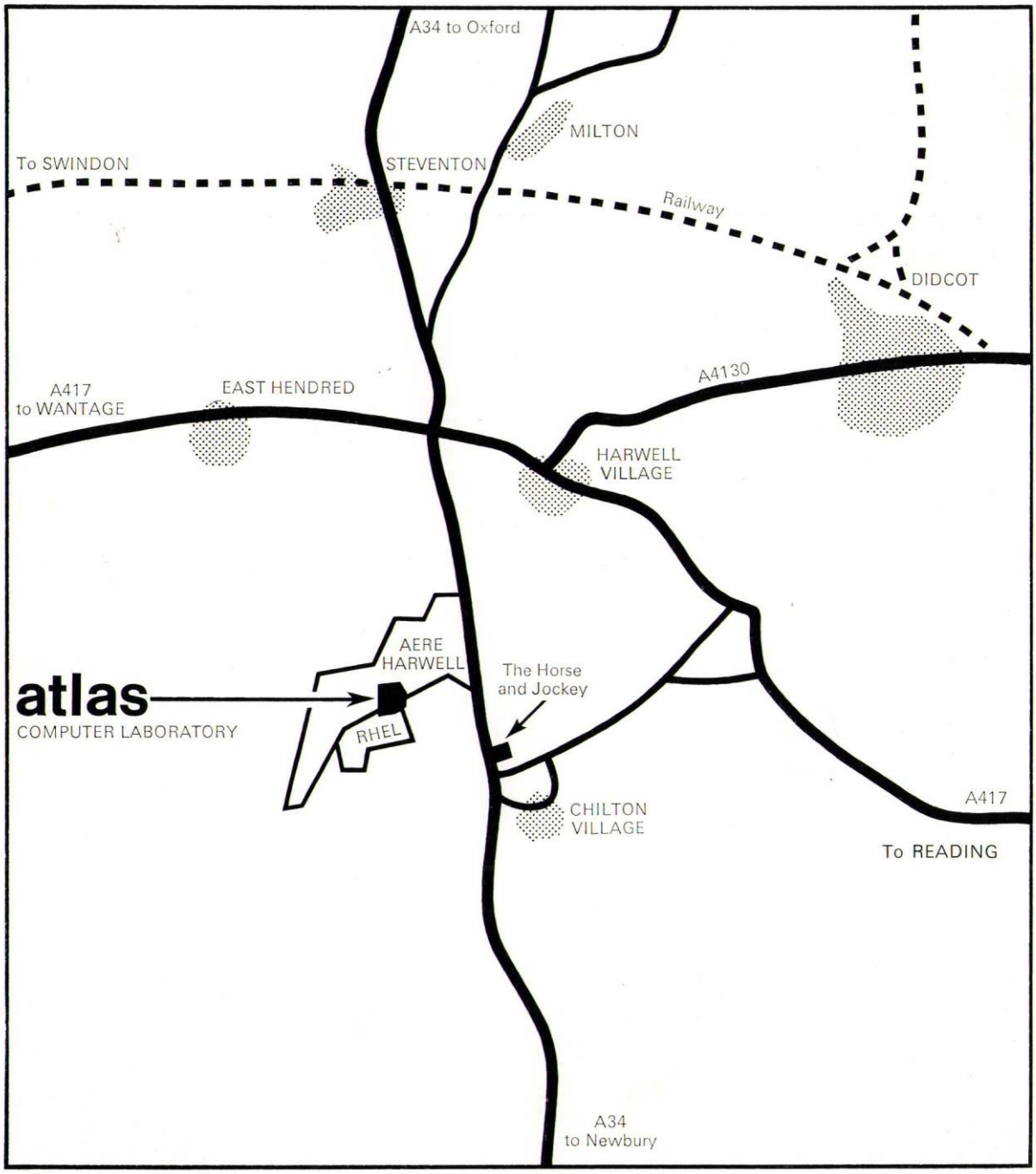

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