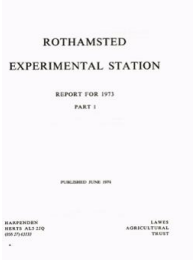
This work is licensed under a Creative Commons Attribution 4.0 International License.

Thank you for using eradoc, a platform to publish electronic copies of the Rothamsted Documents. Your requested document has been scanned from original documents. If you find this document is not readible, or you suspect there are some problems, please let us know and we will correct that.

Report for 1973 - Part1

Full Table of Content


ROTHAMSTED
EXPERIMENTAL STATION
REPORT FOR 1973
PART 1

Computer Department

D. H. Rees

D. H. Rees (1974) *Computer Department ;* Report For 1973 - Part1, pp 230 - 237 **- DOI: https://doi.org/10.23637/ERADOC-1-130**

This work is licensed under a Creative Commons Attribution 4.0 International License.

COMPUTER DEPARTMENT

D. H. REES

This Department is responsible for the centralised computing service which is available to all Institutes in England and Wales supported by the Agricultural Research Council (ARC). Facilities are also provided on a selective basis to the Agricultural Development and Advisory Service (ADAS) either directly through this department or indirectly through other departments and institutes. Scottish Agricultural Research Institutes have access to the Edinburgh Regional Computing Centre (ERCC) and compatibility of major programs common to both centres is maintained through a high-speed telecommunication link.

Broadly there are two classes of computer user. There are those either directly involved or closely connected with agricultural research who seek relevant, reliable, well-documented and easily usable computing facilities. The others are those who have to create, develop, maintain and support these computing facilities. The work in this department is directed towards these latter objectives.

Because of the institutional basis of the research service it is not possible to give a comprehensive review of the role of computing in agricultural research. In order to improve this position the ARC 'Advisory Committee on Computing' has supported a proposal that institutes be invited to collaborate with this department in the preparation of an overall independent report. Such a report could be more detailed using the conventions of the underlying computer science and technology disciplines. It is also believed that this report would be of interest to the wider computing fraternity. Meanwhile, the present report will continue the style of previous years, and which is deemed to be more appropriate to readers of the *Rothamsted Report*. The department is organised into sections and the report is based on this structure. For the reasons given earlier, only some of the activities are described and it would be invidious to name only those whose work has been selected. Therefore names will be given only as a convenient reference for the reader wishing to make further enquiries.

Computer operations and services

Equipment. The following equipment changes were completed during the year.

Five of the ten EDS 8 disc drives in service were replaced in two stages by nine EDS 60 disc drives. This increased the total disc storage capacity nominally by 500 megabytes. Sixty-four kbytes of core store were added, bringing the total to 512 kbytes. Two 120 kbytes per second nine-track magnetic tape drives were also brought into service, bringing the total number of drives to six. Wherever possible the installation and commissioning of this equipment was carried out during the weekends and the acceptance tests were either supervised, or carried out, by departmental staff on behalf of the Technical Support Division (TSD) of the Central Computer Agency (CCA). As can be seen from Tables 1 and 3, there has been a marked increase in throughput during this period and there can be no doubt but that these enhancements have enabled this to take place with only a moderate rise in the number of operating hours. A further 192 kbytes of core store, a disc controller and additional communications buffers are scheduled for delivery during the first quarter of 1974.

Operations. The annual overall performance is summarised in Tables 1 and 3, and for

https://doi.org/10.23637/ERADOC-1-130

This work is licensed under a Creative Commons Attribution 4.0 International License.

comparison these include the corresponding results for 1972. The total operative hours, 5184, was 16% up on 1972 and averaged about 20·5 h per day. A similar increase in demand during 1974 could saturate the service. However, some savings in the housekeeping overheads are possible as the system becomes even more reliable. Hopefully, ICL will also provide more efficient fault recovery procedures which still account for a substantial part of the overheads. System development was greater than usual, partly because of the joint field testing of Multijob M800 and also because of the enhancement programme now under way on the 4-70.

TABLE 1

4-70 performance

	1972	1973
Operational hours	4474	5184
	%	%
Productive time		
multiaccess	46·0	40·9
batch only		26·3
housekeeping	45·3*	17·6
system development		6·2
Unproductive time		
failures (all causes)	3·3	2·9
routine maintenance	4·6*	3·8
additional engineering		1·3
Unaccounted time	0·8	1·0
	100·0	100·0
Working days	251·5	252·5
Operational hours/working day	17·8	20·5
Job units	122 696	282 047
Job units/working day	488	1 119
Average time/job unit—minutes	2·0	1·1
Failures (all causes)	613	452
Average loss/failure—minutes	14·5	20·3
Average failures/working day	2·4	1·7

* Individual percentages not available for 1972

There was an exceptionally large increase of nearly 130% in the number of job units run in 1973. This must not be confused with the number of user jobs because a user job is made up of several job units, the number varying between 2 and 5 depending on the particular job. Returning now to Table 1, there was an encouraging reduction of 25%

TABLE 2

Distribution of faults

Total faults	452	
	%	
Software		
multiaccess	31·7	
batch	12·0	
		43·7
Hardware		
multiaccess	26·1	
batch	18·1	
		44·2
Operator errors		3·5
Outside causes		8·6*
		100·0

* Includes 5·1% (23) failures during power emergency

https://doi.org/10.23637/ERADOC-1-130

This work is licensed under a Creative Commons Attribution 4.0 International License.

in the number of major system faults. The distribution of these faults as between hardware, software and other causes is given in Table 2.

The near equality of faults due to hardware and software is an encouraging pointer to the improved reliance of the Multijob system. The increase to 20·3 min (Table 1) of the average lost time due to major faults is misleading because there was a serious incident during the year which accounted for over 35 h of lost time but was attributed to only three faults. Discounting this period, the average lost time per fault reduces to 15·7 min which, although slightly greater than the 1972 figure, appears to be reasonable when account is taken of the greater complexity of the equipment and of the great increase in operational demands. There were 62 trouble-free days throughout the year but the longest consecutive period is still limited to four days, and this occurred only twice.

TABLE 3

Distribution of work by institutes under M750 or M800

	ETUs		Job units	
	1972	1973	1972	1973
Total	1 155 314*	2 824 097	122 696*	282 047
	%	%	%	%
RES				
Computer Department				
Systems work	10·8	12·9	13·0	8·4
Other work	11·1	13·0	13·4	15·5
Statistics Department	25·8	21·9	18·3	17·0
Other departments	6·2	5·4	3·6	4·3
	53·9	53·2	48·3	45·2
National Vegetable Research Station	13·3	10·6	15·0	15·3
National Institute of Agricultural Engineering	12·7	10·5	14·3	15·6
Grassland Research Institute	6·6	5·2	4·3	5·1
East Malling Research Station	4·5	6·0	7·1	5·9
Glasshouse Crops Research Institute	1·8	2·9	2·2	2·7
Letcombe Laboratory	1·8	1·7	2·1	1·6
National Institute for Research in Dairying	1·6	1·8	2·2	2·2
National Institute of Agricultural Botany	1·5	3·1	1·3	2·3
Meat Research Institute	2·3†	1·1	3·2†	0·6
Others (<1% ETU)		3·9		3·5
	100·0	100·0	100·0	100·0

* Adjusted to bring last year's nine-month totals up to a full year
† Individual percentages not available for 1972

Turning now to Table 3, this gives the distribution of demand between institutes under standard Multijob M750 and M800. The distribution is expressed as percentages of the total elapsed time units (ETUs) and job units. ETU is a single measure of the computing resources utilised during the execution of a program. There was a surprisingly sharp increase of over 140% in the total ETUs in 1973. This was slightly greater than the increase in job units already noted. Undoubtedly more work per unit of time was possible with the larger configuration and this led to a reduced turn-around time which then stimulated the work demand. The greater reliability of M800 has also produced quicker successful completion of work which again stimulates demand. The more resilient M800 may also have resulted in more complete and reliable system journals, which are the basic documents on which Table 3 is based. It seems likely that the incomplete 1972 data may be an under-estimate of total activity for that year. Therefore the 130% increase during 1973 is probably an over-estimate. The ratio of the ETU/job units was 10·6 in 1972 and 10·0 in 1973, and thus the general profile of the work has not changed.

https://doi.org/10.23637/ERADOC-1-130

This work is licensed under a Creative Commons Attribution 4.0 International License.

However, there can be no doubt but that there was a substantial increase in work and that this was particularly noticeable during the multiaccess period. There the demand for service continues to grow at a rate far greater than recorded for the batch service. Because of this growing demand for multiaccess service it is becoming imperative that data be obtained about the internal performance of the system under working conditions. To this end, a software monitoring system is being set up here in collaboration with ICL in order to collect the basic data during a working session. This, it is hoped, will provide a real measure of response time, job turn-around time, job loading and scheduling, core loading, etc.

Operations advisory and documentation services. The general increase in activity has been reflected in the larger demands on the advisory services. On the basis of a sample conducted during the middle of the year, it is believed that over 4000 telephone enquiries were made from outside institutes during 1973. Most of these were dealt with promptly, although about 800 were reported as requiring more detailed investigation. As so many of the calls were non-urgent a new scheme has recently been introduced by which users may submit their queries to a single central file which is then printed out once daily, examined and answers placed into files reserved for each user. The hope is that this will reduce the number of telephone calls and thus the interference with the investigations into the more serious enquiries.

About 71 documents of all kinds were produced during the year and work is well advanced on the production of a local Multijob User Manual.

ERCC link, punching and allied services. The increased work load on the 4-70 inevitably led to a reduction on the Edinburgh link. During 1973 there was a 25% drop in the amount of traffic transmitted both ways on this service. Most of the work was concerned with the further developments on the major common statistical programs. It seems likely that more use will be made of this service as users become more interested in non-numeric procedures, many of which are available on the IBM 370/155 at Edinburgh. The service is adequately reliable for our purposes and was available for 85% of the total scheduled requirements. Of the 197 hours when it was not available only 16 hours (8%) was directly attributable to a failure on the DCT 132 terminal.

Again, the increased activity on the 4-70 was not reflected in the general punching and allied services workload. However, last year's workload was untypical in that it included a very large 'once-off' job of converting historical insect data to punch cards. This is now proceeding on an accession basis. Despite this reduction it was interesting to note that more outside institutes than ever are using these services. Taking into account known commitments, one can expect to see this section fully occupied.

The large increase in the 4-70 workload was not reflected in postal cost, which only increased by 10%. With one exception the postal services appear to satisfy most institutes' needs. In the one case referred to it has been necessary to employ the new Datapost service in order to achieve a 24-hour delivery of mail after it has left Rothamsted.

Three Multijob courses were held during the year, and until we can attract a full-time training officer, pressure of other work is likely to limit the availability of courses during 1974.

Further details of the ERCC link, punching and allied services can be obtained from Fearne. Details of other matters in this section can be obtained from Boston.

Programming

Systems. The following sections are concerned mainly with the introduction and

https://doi.org/10.23637/ERADOC-1-130

This work is licensed under a Creative Commons Attribution 4.0 International License.

experience with the last release of Multijob M800. The next version of Multijob, M900, is due for release early in 1974 and should be working here by the spring. (Gledhill)

M800 field tests. Like many other operating systems, Multijob can be considered as a group of highly connected procedures and as such are very expensive to test thoroughly. Although the major components of the system can be validated, the only effective means of checking the interactions between these parts is to expose it to users. For this, ICL relies on a volunteer site, and Rothamsted offered facilities for the field testing of M800. Most of this was done outside the multiaccess sessions so that the general user was not seriously disturbed. Testing was carried out in a controlled manner with the assistance of departmental staff, and reached a climax when M800 survived 20 hours of multiaccess testing when abnormal situations were deliberately created in an attempt to break the system. After this extensive set of tests, M800 was released on 8 March 1973, on schedule, and has been in general use ever since. It is worth noting that the wider body of users have exposed further errors in the system and that more needs to be done to put matters right. Nevertheless, M800 is a marked improvement on previous versions and without this additional resilience we could never have supported the large programme of work.

M800 enhancements, maintenance and utilities. During the year new versions of M800 were generated to accommodate the additional equipment. As already stated, errors still occur and investigating faults, collecting the evidence and writing up reports continues to be a significant distraction to the system programmers. Despite the handicap of fragmentary documentation, however, several valuable changes have been made locally. No attempt will be made to describe these changes as it would require detailed knowledge of the Multijob system. The general objectives of these changes are to make the system more reliable, convenient and relevant for the user; to provide more useful data for management control and to prepare for the important changes which lie ahead with the introduction of the high-speed serial printers, the communications processor and eventually the remote job entry terminals. Studies are also being made on longer term objectives, particularly on those which would simplify the presentation of work because it is believed that these are still a deterrent to many potential users.

M800 new facilities. Most of the design work for a system to connect medium speed serial printers to the 4-70 has been completed, and the implementation is well advanced. When operational, institutes will be able to print more of their output locally with full control over their printing needs. Eventually this system will be integrated into the more flexible queuing arrangements which are expected in the next release of Multijob, M900. The design stage of the communications processor project is now well advanced and the work already undertaken to allow more flexible printing arrangements with serial printers will be of direct value to this project.

Scientific and Application Programs

Numerical Algorithms Group. Formerly known as the Nottingham Algorithms Group (NAG) this project has been given a new status, but with its objectives unchanged. NAG is concerned with the preparation of a library of high quality programs and procedures which are well-documented and available on a wide range of computing systems. This department is sharing with universities in the implementation of this library on the System 4 under Multijob. (Beasley)

General Survey Program. Part 2 has been completed and the *User Guide* published in October. Part 1 has been successfully used at Rothamsted for the past 18 months and

https://doi.org/10.23637/ERADOC-1-130

This work is licensed under a Creative Commons Attribution 4.0 International License.

will shortly be tidied up and the revised *Guide* issued. This program is also available at the ERCC and there is growing interest in making it available at other outside organisations. For example, in collaboration with the Mathematics Department of Imperial College, this program will shortly be transferred to their CDC computer. A further consequence of this exercise may be a less machine-dependent version of GSP which should facilitate the transfer to a wider range of systems and in particular to the ICL 1900 series. (Yates)

Languages. The MACRO Language Processor, designed and first produced by Dr. P. Brown (Kent University), has been transferred to Rothamsted. This language, also known as ML1, is a powerful way for dealing with non-numeric operations. The macro technique is a method whereby a sequence of operations is uniquely identified by a name which can then be invoked within a program merely by referring to that name. In this way, many complex operations can be represented more simply for the general user. However, as is so often the case with generalised programs, the operations in terms of processor time appear to be relatively costly, and an investigation of this position is being currently undertaken. (Bicknell)

Further studies on versions of Fortran were carried out and the ERCC sub-system SIM, which includes both the ERCC Fortran and IMP language, has been set up under Multijob. A reference set of programs developed by the US Navy has been used to test these versions against the standard ANSI Fortran. This work has been extended to include new developments within ICL. The prospect of further changes to standard Fortran are being carefully studied. Guidelines describing some general principles for making transportable Fortran programs have been produced. (Clark)

A language guide on BASIC in Multijob has been prepared and an alternative version of this language, now available in M800, has been checked out. The COBOL compiler has been added to the list of languages available on the 4-70 and will be used for a special project to be described later.

Library and utilities. Work continues in the development of the Rothamsted library and many new items have been added after careful confidence checks have been carried out. After further difficulty, the linear program package LP400 has finally been checked out and is now available in the library. Further work to simplify the presentation of CSMP continues and a number of high level plotting routines have been developed. Although most of this work has been carried out in Fortran, a number of specialised routines have been written in Usercode.

Information retrieval. This is now a topical subject of enquiry and relates to both scientific and textual data. For example, the plant breeders are expressing considerable interest in setting up gene data banks which would subsequently be handled by the TAXIR (Taxonomic Information Retrieval) program. Work is in hand to set up this system on the 4-70. The position with regard to more general information services is now being considered by an ARC Sub-Committee on Library Services. Some members of this Committee are anxious to get working experience with a system for generating current awareness notices and it is hoped that a start can be made using the ERCC link. (Hersom)

Sponsored programming, advisory and consultancy support. Members of the Section have continued to give special attention to individual problems where their contribution is deemed to be essential for the effective implementation of the project. For example, the Physics Department's agromet data logging project continues to have the support of this

https://doi.org/10.23637/ERADOC-1-130

This work is licensed under a Creative Commons Attribution 4.0 International License.

department. The advisory services were maintained and investigations carried out into basic ICL software errors. The mathematical consultancy service has been strengthened by a new member of the staff and interesting mathematical problems are now being posed by workers at institutes who take a system view of their research.

Project costing. At the request of the ARC a new version of this centralised service will be set up at Rothamsted to provide routine project costing reports to all institutes. This program will be written in COBOL and marks a new line of interest within the department. (Fearne)

Tele-communication

Network. Only one additional private circuit was added to the network this year, and this linked the Weed Research Organisation to Rothamsted. A contention technique for connecting two teletypes to one computer input was installed at NIAE. Investigations were made on 165 transmission incidents and of these about one-third were attributed to System 4 software and equipment faults, a little more than one-third to PO lines and equipment, and about 10% to remote teletype faults. The mean time between faults for the local teletypes decreased from 497 hours in 1972 to 389 hours in 1973, whilst the combined 'switch on' time increased by 14%. The Centronics 101A serial printer was connected to the system through the time division multiplexor and demonstrated to users. (Martin)

Communications processor. Undoubtedly this has been the major source of interest and activity within this Section. A detailed specification was prepared and submitted to four companies. Their proposals were evaluated and a contract was placed with Honeywell for a H716 processor with 24k (2-byte) words of core, 1·8 megawords of disc storage and communications equipment for six remote job entry terminals, ten videos or printers and up to 50 teletypes. The H716 will be linked to the 4-70 through a 48k bit per second ICL interface. The H716 will be delivered during March 1974 but the ICL interface is not scheduled for delivery before October 1974. The software design is well advanced and coding will commence shortly after the delivery of equipment. (Moore)

Multijob enquiry and report

Because of the continuing disagreement between ICL and Rothamsted about the suitability of Multijob for our purposes, ICL sponsored an investigation early in the year under the independent Chairmanship of Dr. L. H. Underhill (UKAEA). He was assisted by a team composed of C. R. Aldridge (ICL), H. J. V. Gledhill (RES), J. Richardson (ICL) and T. Shaw (ICL). The investigation was completed in five weeks and included discussion with Rothamsted users and visits to two outside institutes. A Report was published during the summer and presented to the Advisory Committee on Computing at their November meeting. A summary of the Report was circulated to all institutes. The Report, which runs to over 100 pages, is detailed and implies considerable knowledge of Multijob and as such could not be adequately condensed here. However, some personal observations on the investigations and on the recommendations are pertinent:

1. Many of the background complaints were based on earlier versions of Multijob. The enquiry was carried out after M800 had been introduced for general service and there was a noticeable improvement in system reliability.

2. Even so, there remainded a hard core of incidents which confirmed the need for the further development of Multijob. The problems of maintaining a resilient system, of

https://doi.org/10.23637/ERADOC-1-130

This work is licensed under a Creative Commons Attribution 4.0 International License.

reducing overhead costs and of improving the sources of information for management control were all referred to in the Report.

3. Although 18 recommendations were made in the Report, the general conclusion was that ICL and Rothamsted should get together to resolve their problems in detail. This was already taking place and it is hoped that many of the recommendations agreed between us will be adopted.

4. The investigation was conducted with enthusiasm and energy, but the team would have welcomed more time to probe matters more deeply.

5. Some of the issues raised and the experience gained will be valuable in the preparation of a case for the replacement computer.

6. The strongest criticism came not from the general user but from members of this department. It would appear that any move to satisfy this department will more than satisfy the user.

Staff

There is still a strong national demand for experienced computer staff in all grades, and because salary arrangements are less flexible here the problem of attracting and retaining staff remains. During the year 22 new staff joined the department, and 20 left. Machine operative graded staff accounted for about 70% of these movements. This is too long a list to be given in detail.

Rees attended a Symposium on 'Computers in Research and Education' at the Sperry-Univac International Executive Centre, Rome. Gledhill presented a paper on 'Computer Processing of Automatically Recorded Data' at the Third NIAE Data Logging Symposium. He also attended a Post Office/NCC Telecommunications Course. Yates was invited to take part in an International Symposium in Statistical Design and Linear Models, held at Colorado State University, Fort Collins, and he delivered a paper on 'The Early History of Experimental Design'. He also visited Waterloo University, Canada, and the Research Statistical Services Branch of the Canadian Department of Agriculture in Ottawa. He attended the 39th Session of the International Statistical Institute and meetings of the International Association for Sample Surveys, both in Vienna. He is one of the Vice-Presidents of this Association.

https://doi.org/10.23637/ERADOC-1-130