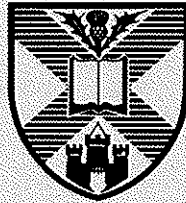


UNIVERSITY OF EDINBURGH



EDINBURGH REGIONAL
COMPUTING CENTRE

Ninth Annual Report

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COMPUTING CENTRE

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1 August 1975 to 31 July 1976

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MEMBERSHIP OF EDINBURGH COMPUTING COMMITTEE

Nominees of the Educational Policy Committee	Professor E A V Ebsworth, (Convener) SC.D., M.A., PH.D., F.R.I.C., F.R.S.E. Mrs M M Barritt, F.B.C.S. Professor F H McClintock, B.SC., M.A., HON.LL.D.
The Director Edinburgh Regional Computing Centre	Dr G E Thomas B.SC., M.SC., PH.D., M.I.E.E.
The Deputy Director (Local Systems)	Dr J G Burns, B.SC., PH.D.
Representatives of the Research Councils	Dr J M M Cunningham, B.SC.(Agric), PH.D. F.R.S.E., F.I.BIOL. (from January 1976) Mr F Morley Professor N W Simmonds, SC.D., A.I.C.T.A. F.R.S.E., F.I.BIOL. (to January 1976)
Representatives of the Users' Committee	Mr H M Dewar, B.PHIL., B.A. Mr A F Purser, B.SC., A.R.C.S. Dr E J C Read, B.SC., PH.D.
Representatives of the Faculty of Science	Dr I F Christie B.SC., PH.D., F.I.C.E., F.I.P.H.E., M.I.W.E. Dr J Muir, B.SC., PH.D.
Representative of the Faculty of Medicine	Professor J R Greening, PH.D., D.SC. F.INST.P., F.R.S.E.
Representative of the Faculty of Social Sciences	Mr A J Bijl, B.ARCH., R.I.B.A., R.I.A.S. M.B.C.S.
The Professor of Computer Science	Professor S Michaelson, B.SC., A.R.C.S. F.R.S.E., F.I.M.A.
Secretary to the Committee	Dr Y Nadeau, M.A., PH.D.

REGIONAL COMPUTING ORGANISATION
MEMBERSHIP OF THE MANAGEMENT COMMITTEE

University of Edinburgh	Professor E A V Ebsworth, SC.D., M.A., PH.D., F.R.I.C., F.R.S.E. Professor S Michaelson, B.SC., A.R.C.S., F.I.M.A., F.R.S.E. Dr J Muir, B.SC., PH.D.
University of Glasgow	Professor A M Potter, M.A., PH.D., (Convener) Professor J C Gunn, M.A. Mr J M Black, B.A.
University of Strathclyde	Professor A M Rosie, PH.D., F.I.E.E., M.I.E.E. Professor D S Butler, M.A., F.I.M.A. Mr L McGougan
Research Councils	Dr N W Simmonds, SC.D., A.I.C.T.A., F.R.S.F., F.I.BIOL. (until February 1976) Dr J M M Cunningham, B.SC.(Agric), PH.D., F.I.BIOL., F.R.S.E. (from February 1976)
Computer Board	Professor H H Rosenbrock, PH.D., D.SC., M.SC., F.I.E.E.
Director	Dr G E Thomas, B.SC., M.SC., PH.D., M.I.E.E.
Secretary	Mrs D M Baker, M.A.

Senior Staff of the Edinburgh Regional Computing Centre

(as at 31 July 1976)

Director	G E Thomas, B.SC., M.SC., PH.D., M.I.E.E.
Deputy Directors	J G Burns, B.SC., PH.D. P E Williams, B.SC.
Administrative Officer	D B Marshall, T.D., M.A., B.COM.
Principal Computing Officers	W Aitken, B.SC. F E J Barratt R E Day, B.SC. A Gibbons, B.SC., PH.D. G E Millard, B.SC., A.R.C.S. G M Stacey, B.SC., PH.D. P D Stephens, B.A. D B Taylor, B.SC., D.PHIL. J K Yarwood, M.A., M.SC.
Senior Computing Officers	M D Brown R A F Chisholm C C Davies W D Hay, B.SC., D.PHIL. S T Hayes, B.A. R G Kirsopp, B.SC., PH.D. A McKendrick, B.SC., PH.D. R R McLeod C H Nicholas, B.SC. A D Nolan, B.SC., M.SC. D D M Ogilvie, B.SC. R B Vaughn, B.SC., M.SC. J Wexler, B.A.
Computing Officers	K A Aitchison, B.SC. P W Allan, B.SC., M.SC. A M Anderson, B.SC. J H Butler, B.SC. M J Cross, B.SC., PH.D. J I Davies, B.ENG. K D Dietz, M.A.SC., B.A.SC.

H P Drummond, B.A.
 K M Farvis, B.SC., M.A.
 J G Fordyce
 B A C Gilmore, B.SC.
 W M Gordon
 L C Griffiths, B.SC.
 N Hamilton-Smith
 R Hunter
 D F Inglis
 A Kettler, B.SC.
 W A Laing, B.SC.
 C McArthur, B.SC.
 R L Middleton, B.SC.
 N S Millar, B.SC.
 N K Mooljee, B.SC.
 B R P Murdoch, B.SC.
 J M Murison, B.SC.
 D J W Stone, M.SC.
 D O Sturgess
 W Watson, B.SC., M.SC.
 J M Blair-Fish, B.SC.
 M J Dow, B.SC.
 J Henshall, B.SC.
 J C Meredith, B.SC.
 L Morris
 J Robertson

Assistant Computing Officers

Executive Officer

Ninth Annual Report

Introduction

In the course of the year Dr Cunningham succeeded Professor Simmonds as the representative of the Research Councils on the Management Committee of the Regional Computing Organisation.

On the Edinburgh Computing Committee Mrs Barritt was appointed by Educational Policy Committee to replace Professor Whittington on the latter's resignation from the chair of Accountancy. For the Research Councils, Dr Cunningham replaced Professor Simmonds during the year and Mr Morley succeeded Dr Jamieson. The representatives of the Users' Committee came to the end of their period of service, and that Committee re-appointed Mr A F Purser as its representative in his new capacity as convener of the Users' Committee, and it appointed Mr Dewar and Dr Read to serve in the positions vacated by Mr Schofield and Mr Lutz.

On the regional side the main event of the year was the delivery of the ICL 2980 which is now housed in the new building at the Bush Estate. Its arrival had been prepared for by preliminary work carried out by ICL and ERCC staff working together on the 2970 delivered in July 1975. Towards the end of the year the region could look forward with some degree of confidence to transferring in the near future a fair proportion of its work from NUMAC to the 2980, but the provision of interactive services for the region as a whole seemed much more uncertain.

There was, and still is, continuing anxiety about the local interactive service on EMAS. The present system has reached saturation point and the mainframe which supports it is obsolescent. Proposals for an independent file store, seen as necessary to protect the weakest part of the service, have met with recurring delays. Plans for replacement of the System 4 have been submitted to the Computer Board, but it is unclear when and how the Board will respond.

The saturation of EMAS was caused, at least in part, by the difficulties with the service provided to the region by NUMAC, which had the effect of diverting work to the local service; for it quickly became clear that the misgivings expressed in last year's report were justified. In January the Region was still unconvinced that it would obtain from NUMAC computing equivalent to that provided on the 370/158 as had been the RCO's understanding of the decision of the Computer Board. The users made their dissatisfaction vocal; Senate heard of their grievances.

Foreseeing that the strain on EMAS might become intolerable, ERCC prepared and discussed with the Users' Committee a scheme for rationing access to that service. It was envisaged that the scheme might also be used in future to financial purpose by allowing slots to be reserved for paying users.

For ERCC, like other parts of the University, has had to give thought continually to its future funding. On the local side fruitful discussions with the University Accountant led to a better understanding of the basis on which ERCC could expect University support. At the same time discussions were initiated between members of the Edinburgh Computing Committee and the Planning Group of Educational Policy Committee to try to determine the general level of services which ERCC is expected to provide and the financial support which it is entitled to expect.

In a difficult financial situation ERCC has been fortunate to be able to use the skills of its staff to financial advantage; the contract with SRC to manage the System 10 and that with ICL to write compilers for the 2900's will bring in money. It can be foreseen that, more than before, ERCC will have to supplement its funding by selling its services to paying customers and correspondingly curtailing its services to University users.

It is on the regional side, however, that ERCC has the greater cause for financial anxiety. No takeover of the Computer Board's responsibility by UGC or any other agency will take place at the end of this quinquennium. The Computer Board for its part finds it progressively more difficult to meet its financial commitments. Already the region is advised that it will receive no supplementation of its 1975-6 grant for the 1976-7 financial year: in real terms this, of course, represents a reduction in support. The University of Edinburgh, inasmuch as it alone holds official responsibility for the regional side of ERCC, finds itself in a very exposed situation.

Regional Services

As noted in last year's report, the Computer Board required the Centre to transfer its IBM service from the 370/158 to machines at Newcastle University. This transfer took place at the end of September and the service thereafter passed from direct control of the Centre and is described elsewhere in this report.

The last report also noted the arrival of the ICL 2970 as an interim measure, to make up in part for the delay in the delivery of the ICL 2980. The prime purpose in installing the 2970 was to allow a service to be developed on that machine and so enable more effective use of the 2980 when it was delivered. It was agreed within the Region that a pilot service to users should be provided on the 2970 when its scale equalled that of an ICL 1904S. In the event the operating system VME/B proved to be in a fairly early stage of development and it was only with the June 1976 release of the system that a reasonably reliable user service could be contemplated. By that time the long-awaited 2980 had arrived on site and all efforts were necessarily directed to preparing it for service as soon as possible after acceptance trials. These trials were carried out in July and the machine accepted on 22nd July. A user service in fact started in mid-August.

The experience gained on the 2970 in the use of VME/B was very valuable and certainly led to a much earlier user service on the 2980 than would otherwise have been possible. In addition, the 2970 was used for the investigation of ICL's alternative operating system for 2900 series machines, VME/K, the development and proving of locally written compilers for FORTRAN, ALGOL and IMP, and the testing of communications.

Interest in VME/K stemmed from the Region's desire for a small and highly efficient operating system well suited to the provision of multi-access facilities. It seemed possible that VME/K would be a more suitable vehicle for a Regional service of this nature than VME/B, even if it provided a less extensive range of facilities. Investigation of VME/K, which would not have been possible without ICL's active co-operation, began early in 1976. So far, however, the system has not lived up to its early promises and it became clear as the year progressed that for the foreseeable future any user service would have to be based on VME/B. The Region has considerable reservations concerning the ability of VME/B to provide the scale of interactive service that is required in the Region and assessment of VME/K is continuing.

The ERCC compilers referred to above are those available on the 4-75s and, in the case of FORTRAN and IMP, on the IBM machines at Newcastle. These compilers were transferred to run under VME/B and so provide for a simple transfer of user work to the 2900's.

The testing of communications facilities has proved a very long-drawn-out and unsatisfactory process. Initial difficulties arose mostly with the specially commissioned package in the ICL 7905 to permit connection of the Region's HASP work stations, but more recent difficulties stem from basic inadequacies in the design and implementation of the operating system's communications-handling software. These difficulties have not by any means been overcome and will have a very serious effect on the distribution of the 2980's power to users in the three universities.

Regional Communications

The year has seen the introduction of the wideband circuits linking the three universities and providing onward connection to the 2980 at the Bush Estate. These circuits are used in conjunction with time-division multiplexors in each location, so providing for a high degree of flexibility in setting up particular communication channels.

The node processor at Edinburgh went into full service during the year and effort is now being concentrated on the consolidation and refinement of the facilities it provides. For various reasons node processors had not been commissioned in Glasgow and Strathclyde by the end of July 1976, but trials had been made between Edinburgh and Glasgow of node-to-node communication and it is expected that node processors will go into operation at both Glasgow and Strathclyde in the Autumn of 1976.

The development of high-speed-communications hardware for the various Modular Ones throughout the Region, noted in last year's report, has continued, and HDLC and EPSS versions are almost ready for testing. The production in bulk of the original version working to IBM binary synchronous communications standards proved a major burden, which was significantly eased by the acquisition early in 1976 of a semi-automatic wire wrapping machine. In addition to speeding up the wiring of printed circuit boards, this machine has virtually eliminated the wiring errors which occur on hand-wired boards, the identification and correction of which is an exceedingly time-consuming process.

It is still the Region's belief that an effective front-end processor for the 2980 is most likely to be obtained by using home-produced software, particularly since this will simplify connection to the network. No work has however been possible on such a project during the year and present indications are that little progress is likely to be achieved until it becomes possible to modify the communications-handling arrangements within the 2980 operating system. This may become possible at some time in 1977.

Regional Service at NUMAC

The transfer of the regional service from the 370/158 to Newcastle did not go smoothly and severe problems remained for users and Centre staff throughout the year. The final two months of the 370/158 were very busy; it was clear that many users were attempting to complete projects before the move and so the usual Summer decline in usage did not take place. In addition, system staff had a substantial task in ensuring the smooth hand-over to Newcastle of users' files, magnetic tapes and vital system components.

Of these, user files moved smoothly, though interacting hardware and software problems at Newcastle, especially on the 360/65, caused access problems for several months. By Summer 1976, the draining system and file space allocation procedures had still not been fully brought into service by NUMAC. There were frequent teething troubles in incorporating magnetic tapes from Edinburgh into the Newcastle tape library; it was a month before accounting data were being collected sufficiently reliably to enable charges to be levied for work done. However, it is clear that charges would not have been justifiable for a substantial proportion of the jobs submitted in that period.

There were regular exchanges in the early months between RCO and NUMAC management in an effort to progress towards the equivalent service which the RCO had been led to expect. The version of OS mounted by Newcastle was not that in use on the 370/158. This new version took time to get working and introduced its own collection of new bugs. In addition, there were operational problems. Operations and system staff from Edinburgh made extended visits to Newcastle during the early weeks to help increase familiarity with OS and maintain a flow of information between the RCO and NUMAC.

While these efforts were being made to improve the quality of the service at NUMAC, prolonged discussions were taking place on the quantity of service to which the RCO was entitled. The stumbling block at the outset was that the Computer Board had advised NUMAC to provide the RCO with the equivalent of its 370/155 level of service, but had advised the RCO that it would receive the equivalent of the 370/158 level. Added to this discrepancy was the difficulty of properly equating the computing power of the four computers involved (i.e. 370/155, 370/158, 360/65 and the 370/168). In addition, it was recognised that the 360/65 could never provide more than half of the 370/158 throughput during the critical prime shift. An agreed schedule and allocations, to which NUMAC would endeavour to adhere, were worked out in due course although, as there remains a 20% allocation on the 360/65 to non-RCO use during the day, it is clear that no solution satisfactory to the RCO is forthcoming.

The extent of the problem was acknowledged by NUMAC by the secondment for three months from December 1975 of the Computer Manager at the University of Durham to co-ordinate the OS service. This secondment was followed by the appointment of a permanent OS Co-ordinator at NUMAC. These individuals have alleviated the problems and their efforts are gratefully acknowledged by the Region. The RCO also very much welcomed the establishment of an OS Advisory Group with joint RCO/NUMAC technical membership. This Group meets every five weeks in Newcastle to advise NUMAC on OS service issues. This interchange has resulted in improvements in details of the service.

The Region's main concern remains the 'Linked System'. (In this arrangement the spooling files, managed by HASP, reside on common disk storage and are accessible from remote terminals at all times, regardless of which operating system is in use.) The introduction of this system was scheduled for September 1975. Although the first stage, shared spool software on MTS, was put into service in May 1976, organised testing under OS had not begun by July 1976, and the prospect of it being proven by the start of the new academic year was bleak.

The transfer of Regional services to Newcastle has caused serious difficulties both for the Region and for NUMAC. We must record our thanks to the staff of NUMAC for all their efforts to provide the Region with a service.

EMAS

The transfer of the Regional IBM service to Newcastle placed a further load on the System 4-75 complex which supports EMAS. The throughput increased steadily until March 1976, largely as a result of users being forced to work at progressively later (or earlier) hours. Since March the work load has been nearly constant showing little of the normal seasonal dip in July/August and, for all effective purposes, the System is saturated.

There are now some 1400 accredited users of whom about 1000 are active in any period of one month. Normally 1200 console sessions per day are provided, each averaging thirty minutes, and a substantial batch load is processed overnight.

Users continue to show preference for video terminals, normally operated at 1200 baud, and for fast hard-copy terminals, normally operating at 300 baud, and teletypes now account for little over half of the current provision of some 250 terminals. Further details are shown in Appendix A (iv).

The service is available on full 3-shift operation from Monday to Friday and latterly service on alternate Saturdays has been offered. ICL preventive maintenance and air-conditioning work is carried out at weekends.

Hardware reliability has been fair, with a satisfaction factor of approximately 97% for both machines. The mean time between failures at approximately 25 hours is more evident to users and is just acceptable at present. The ability to reconfigure EMAS, noted last year, has continued to play an important role in reducing disruption to users.

A major service requirement at Edinburgh, if the increasing demands are to be contained, is that a user be able to move work fluently to the Regional 2980. Inadequate communications currently prevent this but we would hope that the coming year will improve the situation.

As reported last year, ERCC failed to obtain the co-operation of ICL in replacing the CDC disks. The file store continued therefore to represent the most exposed element of the EMAS complex, and ERCC proceeded to develop a proposal with Telex Computer Products to replace the obsolescent fixed disks with modern 200 Mbyte drives. This proposal was placed before the Computer Board in March 1976 and led to a further series of delays and discussions with ICL. ICL eventually indicated that they did not wish to tender for provision of the equipment and would not charge a licence fee for the attachment of Telex equipment. Economic events had by this time overtaken the proposal, and a response from the Computer Board cannot be expected before February 1977. In the meantime, the proposed equipment has risen in price although it would still cost only 40% of equivalent ICL equipment.

The System 4's will reach their tenth birthday in 1978-9 and ERCC have devoted considerable thought to the replacement of EMAS which they currently support. On account of the economic uncertainty replacement may have to be delayed as late as 1980-1, but it is currently considered that ICL 2900 architecture is capable of supporting a service equivalent to that offered by EMAS.

With this possibility in mind, Edinburgh local staff have developed compilers (ALGOL, FORTRAN and IMP) and a scientific subsystem for 2900 machines, and a contract for these products has been concluded with ICL. This software, which is at the moment entirely batch-oriented, is currently in service on the Regional 2980. Investigations by members of the Department of Computer Science using the 2970 installed in their accommodation have also led to an intimate knowledge of the machine and could serve as the basis for multi-access provision in the future.

Local Communications

As reported last year, capital provisions were made in March 1975 amounting to about £42,000. These covered two main areas, firstly improved graphical output facilities which have been progressively introduced to service during the year, and secondly new synchronous communication hardware to enable the implementation of the ISO standard SDLC.

SDLC working has now been introduced, at considerable development effort, on all but one of the links to local terminal control processors and it remains to establish a link to the Edinburgh node using these standards.

The Network Control Processor is thus now almost completely equipped with autonomous-transfer communication equipment, and this has enabled ERCC to meet a substantial increase in traffic -- especially to the line printers now associated with the remote TCP's.

Submissions to the Computer Board in March 1976 led to a modest grant of £22,000 which allowed us to refine further the connections to remote TCP's and to increase slightly the number of terminals that can be supported. The principal innovation is that plans are now well advanced to utilise 48 Kbaud links to the Appleton Tower and Buccleuch Place. This will remove throughput limitations, especially for TCP's situated in the George Square area.

Our attempts to establish a link between the local network and the System 10 network, which uses DECNET protocols, have continued to be frustrated by funding difficulties.

System 10

The System 10 provided by the SRC, for which ERCC are responsible under a Management Committee chaired by Professor Michaelson, has enjoyed a stable year of operation although it has become heavily saturated.

During the year the SRC received the report of a working party chaired by Professor Rosenbrock and accepted its main recommendations concerning the provision of an interactive network. The proposals included substantial upgrading of the Edinburgh and Manchester System-10 installations, together with the transfer of their management to the Rutherford Laboratory of the SRC. These proposals led to prolonged negotiations towards the development of a contract under which the University would run the Edinburgh installation on behalf of the SRC. The negotiations are now about to conclude.

In the meantime the first phase of the upgrade programme, a KI 10 processor and new memory, have been delivered and commissioned.

Central Area Services

Data Capture

With increasing experience, the work rate and accuracy achieved on the CMC Key-to-Disk system improved during the year. In June, the Data Preparation staff completed nearly 8,000 hours of effort keying and verifying a 2% sample of the 1851 Population Census, supported by an SSRC grant to the Department of Sociology. To help ensure completion of this project by that date, in response to the continuing shift away from punched cards, a seventh key station was installed. There were several changes of staff and one more vacancy was frozen, further reducing the total complement.

Special Services Computer

A PDP 11/40 was acquired from University funds. This computer, which is housed in Buccleuch Place, is intended to perform the following functions:-

- (1) to provide Remote Job Entry, including direct and dial-up connection, to the local and regional networks and to distant sites such as NUMAC, Cambridge and the Rutherford Laboratory. The existing Satellite One service will eventually be phased out.
- (2) magnetic tape handling, including entry into the network of files on 9-track 800 or 1600 bits-per-inch tapes;
- (3) magnetic tape content analysis;
- (4) interactive digitising, to be developed after the attachment of the Ferranti Freescan digitiser and a graphical display tube;
- (5) graph plotting for the Central Area users.

Accommodation

In the central site, removal of the Regional 370/158 left space available at 4 Buccleuch Place. ERCC registered with the Development Committee its desire to continue to occupy the site, since it was felt that the accommodation might be required to provide a centre for a data communications network in the central area, to provide closed shop and/or high security peripheral support, or to house any equipment which might need to be removed from the Computer Science accommodation in the James Clerk Maxwell Building. Part of the vacated space was earmarked to house a PDP 11/40 funded by the University which would function as a special-services satellite supporting initially a 9-track magnetic tape unit, the Ferranti Freescan digitiser, and the Calcomp plotter. Part of the accommodation was rented for the year to NERC to house the PDP 11/45 serving the Institute of Geological Sciences.

The future housing of ERCC facilities in the centre continued throughout the period to be a matter of negotiation with the Central Area Development Subcommittee. In the summer term a proposal was finally put forward to the Development Committee which envisaged that ERCC staff should move from Alison

House to 58--60 George Square, while the computing equipment currently in Alison House would be housed temporarily at 4 Buccleuch Place, to be moved eventually to the basement of the Appleton Tower. This project required internal restructuring of 55--60 George Square, conversion of existing accommodation in the basement of the Appleton Tower, and the improvement of communications within the George Square accommodation and between it and the basement of the Appleton Tower. The Edinburgh Computing Committee supported this plan and agreed to spend some of its capital reserve towards it. However, as consideration of this project proceeded, its cost began to appear prohibitive and a return to Alison House had to be contemplated.

On the King's Buildings site ERCC negotiated successfully with the Users' Committee of the James Clerk Maxwell Building an allocation of accommodation in phase 2A of that building for ERCC and ICL staff associated with the development of the 2900, and for additional staff associated with the System 10 to be operated by ERCC for the SRC.

The building at the Bush Estate to house the Regional ICL 2980 was completed in April 1976. It has capacity to house twice the equipment which it currently holds.

Staffing and Organisation

The staffing of ERCC changed little during the year. As a result of the transfer of the regional service to NUMAC, four additional operators had to be employed so that a 3-shift service could be maintained to fit in with the NUMAC work-schedule. The extra cost resulting from this requirement was borne by the Computer Board.

Under the contract entered into by ERCC and ICL for the provision of ALGOL and FORTRAN compilers for the 2900 systems, three computing officers and one computing assistant had to be assigned by ERCC to the project. Of these four posts three were filled by internal re-assignments and one by recruitment. The cost of all these staff was well within the payments agreed by ICL.

It was foreseen that conclusion of an agreement to provide an interactive computing service on a System 10 provided by the SRC would require the recruitment of twelve staff. Their salaries, as well as an estimated overhead for ERCC management, would be provided under the contract.

Two vacancies in the regional section of ERCC were frozen. Progress was made towards an agreement on the form of a rolling contract to be offered to staff dependent on continuing funding by outside agencies.

The terms of the Pay Code did not allow awards of special increments to be contemplated. Five recommendations for promotion of staff who had reached the top of their salary scales were considered by the Staff Assessment Panel and four were approved.

Appendix A (i)

370/158 and NUMAC OS utilisation during 1975-76 by participating Institutions

Institution	No of Jobs	Proportion of Total Jobs	Notional Costs	Proportion of Total Job Costs	File Storage Costs	Proportion of Total File Costs	Combined Costs	Proportion of Total Combined Costs
Edinburgh University	92504	36.70	£109,456.15	17.57	£ 26,444.44	25.43	£135,900.59	18.70
Glasgow University	64867	25.74	£262,250.38	42.11	£ 36,265.78	34.88	£298,516.16	41.07
Strathclyde University	24294	9.64	£151,415.54	24.31	£ 12,765.22	12.28	£164,180.76	22.59
Other Universities	3666	1.45	£ 9,304.37	1.49	£ 929.50	0.89	£ 10,233.87	1.41
Research Councils	30861	12.24	£ 41,046.06	6.59	£ 13,999.72	13.46	£ 55,045.78	7.57
Treasury Supported*	12657	5.02	£ 20,086.93	3.22	£ 3,848.83	3.70	£ 23,935.76	3.29
Commercial Users	216	0.09	£ 178.93	0.03	£ 211.65	0.20	£ 390.58	0.05
ERCC Regional Use	9459	3.75	£ 12,063.74	1.94	£ 8,281.97	7.97	£ 20,345.71	2.80
Overheads	13523	5.37	£ 17,039.96	2.74	£ 1,237.31	1.19	£ 18,277.27	2.52
TOTALS	252047	100.00	£622,842.06	100.00	£103,984.42	100.00	£726,826.48	100.00

*Includes Edinburgh University Data Processing Office

NB Jobs excludes file transactions

NB Newcastle is not included

Appendix A (ii)

Utilisation of 370/158 and NUMAC OS in 1975--76
by University of Edinburgh and Research Council

Faculty or Sub-Faculty or Research Council	Computer Transactions (excluding file storage)	Notional Cost	Proportion of Total Cost
		(£)	(%)
Arts	708	1291.41	0.58
Divinity	55	78.03	0.03
Law	14	7.77	0.00
Social Sciences	10359	26899.44	12.16
Music	—	—	—
Medicine	4996	8572.47	3.87
Dentistry	256	246.37	0.11
Veterinary Medicine	29	21.47	0.01
Physical Sciences	56850	61084.56	27.61
Engineering	2489	6985.29	3.16
Biological Sciences	2056	5707.17	2.58
Miscellaneous	5062	8133.52	3.68
Data Processing Office	4495	9922.48	4.49
Computing Service (Local)	9630	16873.09	7.63
Computing Service (Regional)	9459	20345.71	9.20
ARC	25353	36872.58	16.67
MRC	3024	11278.78	5.10
NERC	2484	6894.42	3.12
	137319	221214.56	100.00
Other Universities	92827	472930.79	
Treasury-funded Users *	8162	14013.28	
Commercial Users	216	390.58	
	238524	708549.21	

* Excludes Edinburgh University Data Processing Office

Appendix A (iii)

Analysis of Utilisation of 4.75 in 1975-76

Faculty or Sub-Faculty or Research Council	Cost	Proportion of Total Cost
	(£)	(%)
Arts	5858.57	0.47
Divinity	1667.32	0.13
Law	559.07	0.04
Social Sciences	43162.01	3.44
Music	0.54	0.00
Medicine	35490.46	2.83
Dentistry	2394.08	0.19
Veterinary Medicine	714.24	0.06
Physical Sciences	652923.14	51.97
Engineering	47783.91	3.80
Biological Sciences	58408.66	4.65
Miscellaneous	60524.98	4.82
Computing Service (Local)	164476.42	13.09
Computing Service (Regional)	55159.60	4.39
ARC	44194.81	3.52
MRC	5069.58	0.40
NERC	45132.94	3.59
Other Universities	17234.73	1.37
Other Treasury Funded Users	13686.53	1.09
Commercial Users	1822.47	0.15
	1256264.06	100.00

Appendix A(iv)

EMAS Service – Facts and Figures 1975–76

General	Average weekly interactive service	100 hrs
	Total number of accredited users	1400
	Total number of student users	500
	Average weekly number of active users	800
	Average weekly notional income	£25000
Performance	Average weekly system uptime percentage	98%
	Average weekly satisfaction percentage	97%
	Mean Time between failures (Hardware)	30 hrs
	Mean Time between failures (Software)	1560 hrs
Interactive Service	Average weekly number of console sessions	5500
	Length of average console session	30 mins
	Average weekly interactive console hours used	2750
	Average CPU time used per session (including paging)	75 secs
	Average CPU/CONNECT time ratio	2.5 sec/min
Background Service	Average weekly number of batch jobs	650
	Average CPU time used per job	150 secs
On-Line File System*	Total number of on-line user files	25,000
	Total amount of on-line user material	760 Mbyte
	Average number of files covered by backup	8,000
	Average file size	30,000 bytes
Archive Store	Total number of files on archive	107,590
	Total amount of archive material	5,168 Mbyte
	Average file size	50,000 bytes
	Number of archive magnetic tapes	230
	Average restoration time	20 mins
	Total size of on-line archive index	5.75 Mbyte

The file system consists of 8 units, each of 160 Mbyte effective capacity. On each unit 25% is required for the spool system and for temporary user files. The minimum loss of file space in the event of hardware failure is 2 units. The archive cycle thus attempts to balance the user permanent file space at about 750 Mbyte to permit some resilience and allow adequate weekly growth.

Appendix B

List of User Departments (1975-76)

(i) University of Edinburgh

Accounting and Business Method	Mathematics
Agriculture	Mechanical Engineering
Anaesthetics	Medical Computing and Statistics Group
Anatomy	Medical Physics
Animal Health	Medicine
Archaeology	Medicine (Western General Hospital)
Architecture	Meteorology
Architecture Research Unit	Molecular Biology
Artificial Intelligence	Music
Astronomy	New Testament Language Literature and Theology
Bacteriology	Nursing Studies
Biochemistry	Nursing Research Unit
Botany	Ophthalmology
Business Studies	Otolaryngology
Chemical Engineering	Pathology
Chemistry	Pharmacology
Child Life and Health	Physical Education
Civil Engineering and Building Science	Physics
Clinical Chemistry	Physiology
Community Medicine	Pollock Halls
Computer Science	Preventive Dentistry
Criminal Law	Program Library Unit
Criminology	Psychiatry
Data Processing Office	Psychology
Dental Surgery	Public Law
Dictionary of the Older Scottish Tongue	Radiotherapy
Economic History	Respiratory Diseases
Economics	Restorative Dentistry
Educational Sciences, The centre for Research in	Social Administration
Educational Studies	Social and Preventive Dentistry
Electrical Engineering	Social Anthropology
English Language	Social Sciences, Faculty Office
Fire Safety Engineering	Sociology
Forestry and Natural Resources	Statistics
French	Surgery
General Practice	Therapeutics
Genetics	Tropical Animal Health
Geography	University Library
Geology	Urban Design and Regional Planning
Geophysics	Veterinary Medicine
Geriatric Medicine	Veterinary Pathology
History	Veterinary Surgery
Human Genetics	Zoology
Linguistics	

(ii) Research Council Institutes and Units

ARC	Animal Breeding Research Organisation
ARC	Animal Diseases Research Association
ARC	Unit of Animal Genetics
ARC	Hannah Research Institute
ARC	Hill Farming Research Organisation
ARC	Macaulay Institute for Soil Research
ARC	Poultry Research Centre
ARC	Rothamsted Experimental Station
ARC	Scottish Horticultural Research Institute
ARC	Scottish Institute for Agricultural Engineering
ARC	Unit of Statistics
ARC	Scottish Plant Breeding Station
MRC	Unit for Research in the Epidemiology of Psychiatric Illness
MRC	Brain Metabolism Research Unit
MRC	Clinical and Population Cytogenetics Research Unit
MRC	Medical Sociology Unit Centre for Social Studies
MRC	Psychology (Warwick)
MRC	Radioimmunoassay
NERC	Institute of Marine Environmental Research
NERC	Institute of Geological Sciences
NERC	British Antarctic Survey Unit
NERC	Institute of Terrestrial Ecology

(iii) Other Universities

Cardiff
 Dundee
 Glasgow
 Heriot-Watt
 Manchester
 Newcastle
 Nottingham (Computer Centre and Geography)
 Open University
 Stirling
 Strathclyde
 Swansea

Appendix C

Financial Statement for the year 1 August 1975 to 31 July 1976

<i>Income</i>	£	£	<i>Expenditure</i>	£	£
Computer Board direct grants			Staff costs		
Basic grants: Local	93 000		Academically related		336 030
Regional	<u>285 000</u>		Other		249 028
		378 000	Casual		<u>40 832</u>
Earmarked capital grants: Telecommunications	23 500				625 890
IDMS	3 240		Materials & services		
Wideband equipment	<u>21 148</u>		Travel and subsistence	8 947	
		47 888	Computer materials & expenses	83 938	
Fully charged-out services			External service charges & rentals	304 412	
Research Councils			Telecommunications	99 549	
Commercial & Treasury supported		425 888	Engineering development	30 758	
SRC (PDP10 operation)	158 994		Information & training	14 127	
ICL access to 2970	46 474		General expenses	<u>40 736</u>	
ICL software contract	6 500				582 467
NERC grant towards IDMS	22 000		less Stocks in hand		<u>28 902</u>
Edinburgh University DP Office	23 000				553 565
Other universities	2 850		Overheads		
	10 815		Edinburgh University services		47 800
	<u>5 807</u>		Transfer to Local capital reserve		38 000
Recoveries		276 440	Bad debts written off		139
Third & fourth shift usage		65 536			
Edinburgh University	1 740				
Other universities	<u>5 753</u>				
		7 493			
Administrative services					
Edinburgh University contribution		56 772			
Balance brought forward from 1974/75		448 587			
Local surplus	22 464				
less Regional deficit	<u>608</u>				
		21 856			
			Surplus for year carried forward to 1976/77		
			Local		36 358
			Regional		<u>820</u>
					37 178
					<u>£ 1 302 572</u>