

UNIVERSITY OF EDINBURGH



EDINBURGH REGIONAL
COMPUTING CENTRE

Thirteenth Annual Report

EDINBURGH REGIONAL
COMPUTING CENTRE

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1 August 1979 to 31 July 1980

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Membership of Edinburgh Computing Committee

Nominees of the Educational Policy Committee	Professor C.B. Wilson (Convener), BSc,PhD Mrs M.M. Barritt, FBSC Dr J.C.P. Schwarz, MA,BSc,PhD
The Director, Edinburgh Regional Computing Centre	Dr G.E. Thomas, BSc,MSc,PhD,MIEE,FBSC,FRSE
The Deputy Directors Edinburgh Regional Computing Centre	Dr J.G. Burns, BSc,PhD Mr P.E. Williams, BSc
Representatives of the Research Councils	Dr D.P. Blight, BSc,MSc,PhD,CEng,FIMechE Mr S.M. Lawrie
Representatives of the Users' Committee	Mr T.W. Jones, MA Mr A.F. Purser, BSc,ARCS Dr D.J. Rees, BSc,ARCS,PhD
Representatives of the Faculty of Science	Dr M.A.D. Fluendy, MA,DPhil,CChem,FRSC,MInstP,FRSE Professor P.G. Jarvis, MA,PhD,FilDoc,FRSE
Representative of the Faculty of Medicine	Professor D.C. Flenley, BSc,MB,ChB,PhD,FRCPE,FRCP
Representative of the Faculty of Social Sciences	Professor M. Anderson, MA,PhD
The Professor of Computer Science	Professor S. Michaelson, BSc,ARCS,FRSE,FIMA,FRSA
Secretary	Dr J.Y. Nadeau, MA,PhD

Regional Computing Organisation
Membership of the Management Committee

University of Edinburgh	Professor M Anderson, MA, PhD Dr M.A.D. Fluendy, MA, DPhil, CChem, FRSC, MInstP, FRSE Professor S. Michaelson, BSc, ARCS, FRSE, FIMA
University of Glasgow	Mr J.M. Black, BA Professor A.M. Potter, MA, PhD Professor G.A. Sim, BSc, PhD
University of Strathclyde	Professor D.S. Butler, (Convener), MA, FIMA Dr D.E. Kidd, BSc, PhD Professor A.M. Rosie, BSc, MSc, FIEE, FIEEE
Research Councils	Dr D.P. Blight, BSc, MSc, PhD, CEng, MIMechE
Computer Board	Professor R.E. Burge, BSc, PhD, FIP
Director	Dr G.E. Thomas, BSc, MSc, PhD, MIEE, FBCS, FRSE
Secretary	Dr J.Y. Nadeau, MA, PhD

Senior Staff of the Edinburgh Regional Computing Centre
(as as 31 July 1980)

Director	G.E. Thomas, BSc, MSc, PhD, MIEE, FRSE
Deputy Directors	J.G. Burns, BSc, PhD P.E. Williams, BSc
Administrative Officer	D.B. Marshall, TD, MA, BCom
Principal Computing Officers	W. Aitken, BSc F.E.J. Barratt R.E. Day, BSc A. Gibbons, BSc, PhD W.D. Hay, BSc, DPhil C.A. Mackinder, CEng, MIEE, MBIM, MIIM A. McKendrick, BSc, PhD G.E. Millard, BSc, ARCS A.D. Nolan, BSc, MSc, MBCS G.M. Stacey, BSc, PhD, MBCS P.D. Stephens, MA D.B. Taylor, BSc, DPhil J.K. Yarwood, MA, MSc
Senior Computing Officers	M.D. Brown, MBCS R.A.F. Chisholm C.C. Davies K.M. Farvis, BSc, MA B.A.C. Gilmore, BSc, MPhil W.M. Gordon L.C. Griffiths, BSc N. Hamilton-Smith, BA S.T. Hayes, BA R.G. Kirsopp, BSc, PhD, MBCS W.A. Laing, BSc, MPhil C.D. McArthur, BSc R.R. McLeod J. Maddock R.L. Middleton, BSc N.S. Millar, BSc N.K. Mooljee, BSc H.M. Moores, BSc B.R.P. Murdoch, BSc J.M. Murison, BSc

Computing Officers

C.H. Nicholas, BSc, FBCS
 D.D.M. Ogilvie, BSc, MBCS
 D.J.W. Stone, MSc
 D.O. Sturgess
 J. Wexler, BA
 A. Anderson, BSc
 J.A. Blair-Fish, MA, PhD
 J.H. Butler, BSc
 M.J. Cookson, BSc, MSc, MPhil
 M.J. Cross, BSc, PhD
 W.S. Currie, BSc
 J.G. Fordyce
 R.J. Hare, BSc
 J. Henshall, BSc
 A.I. Hinxman, BSc, MSc, PhD
 G. Howat, BSc, PhD
 A.G. Kettler, BSc
 C. McCallum, BSc, PhD
 D.B. Mercer, BSc
 L. Morris
 J. Phillips, BEng
 R.J. Pooley, BSc, MSc
 C.R. Rees, BSc
 A. Shaw, BSc, MSc
 R. Soutar, BSc
 H. Talbot, BSc
 B.A. Tate, BA, PhD
 W. Watson, BSc, MSc

Assistant Computing Officers

C. Holden, BSc
 D. McKelvie, BSc, MSc
 A.M. Robertson-Smith, BSc
 N. Stroud, BSc, DPhil

Executive Officer

J. Robertson

Reprographics Manager

D.J.L. Stewart-Robinson

Thirteenth Annual Report

Introduction

On the Regional Management Committee, Professor A.M. Potter replaced Professor J.M. Lamb as a representative of the University of Glasgow. On the Edinburgh Computing Committee, Mr P.E. Williams joined the Committee, the University Court having agreed that both Deputy Directors of the Edinburgh Regional Computing Centre would be members; Mr T.W. Jones and Dr D.J. Rees replaced Dr M.A.D. Fluendy and Mr J. Tansley as representatives of the Computer Users' Committee; Dr Fluendy remained a member of the Committee replacing Dr I.E. Christie as a representative of the Faculty of Science.

The Regional Management Committee approved a new constitution for the Regional Computing Organisation which was accepted by the constituent bodies and came into effect on 1 August 1980. The new constitution relieves the Management Committee of any financial responsibility. The University of Edinburgh becomes financially responsible for the operation of the 2980 on behalf of the Regional Computing Organisation. The financing of any future common service will be a matter for agreement between the participating universities. The Regional Management Committee retains responsibility for the planning and allocation of central resources, the co-ordination of locally controlled resources and the planning and development of a communications network within the Region.

The main local computing system, the twin 4-75 installation, had served the University well for ten years and was due for replacement. The Computer Board agreed that the new local mainframe should be an ICL dual 2972 system running under the EMAS operating system developed in Edinburgh. To minimise disturbance to users the new machine was installed over the summer of 1980. The system 4-75s closed on 13 June and the other local machine, an ICL 2970, shortly afterwards. Thanks to the co-operation of the Regional Management Committee local users were able to transfer temporarily to the Regional 2980 until the new machine came into service.

EMAS became the principal operating system for the 2980 in early January 1980, replacing the manufacturer's own system VME/B. Under EMAS, the 2980 at last began to provide the service for which it had been obtained.

Effective communication with the Regional network was achieved and a substantial inter-active service became available for the first time. Use increased steadily. The 2980 faced its most testing period during the summer of 1980 when it dealt successfully with the needs of the local Edinburgh users as well as the normal Regional load.

A scheme to control interactive access during peak periods was introduced for trial on the 2970. The scheme is based on the issue of shares to users. 'Funds' are issued each week in proportion to the number of shares held and are 'spent' if the computer is used during a congested period. The scheme was extended to the 2980 during the summer of 1980 and will operate on both the 2980 and the 2972s in session 1980-81.

Policy on support for external computing from ERCC funds was reviewed. The Edinburgh Computing Committee agreed that support should continue but decided that there should be no growth in the cost of external computing in the next few years. The University of Manchester Regional Computing Centre is to be Edinburgh's main overflow site for large scale computing now that it has become one of the two national computing centres.

At the same time as we embarked on the replacement of the University's mainframe computers, we were aware of the growing importance of distributed computing with much greater computing power being held in departments. This is a fast developing area and it is by no means certain what direction it will take in the next few years. ERCC's strategy is to support a particular software environment, rather than specific machines. This will allow flexibility as new hardware becomes available.

The Committee for Distributed Computing was found to be rather unwieldy and was split into two. A revived Computing Equipment Panel is responsible for assessing technically proposals for computing equipment. A reduced Committee for Distributed Computing has the broader remit of advising the Edinburgh Computing Committee on the development of distributed computing within the University.

Regional Services

It was reported last year that the decision had been taken to change the operating system on the Regional 2980 from VME/B to EMAS. During the summer of 1979 a number of extensions to EMAS were produced, all directed towards improving facilities for batch users, including the handling of users' magnetic tapes and the provision of a batch command language. Better support of remote job entry terminals was also provided.

The changeover from VME/B began in October 1979 and the bulk of users (and their files) had been transferred to EMAS by 1st January 1980, when

EMAS became the principal service on the 2980. VME/B work was then relegated to a lunchtime and late evening slot each day, for those few users who still required VME/B-specific facilities. Use of the VME/B service tailed off rapidly and the service was discontinued completely in July 1980.

Meanwhile use of EMAS increased rapidly. By March 1980 a third shift became necessary and at peak periods the machine was typically supporting over 60 interactive users as well as five batch streams. The far more accessible and effective service that EMAS was able to provide, both for batch and interactive users, completely converted those users in the region who had reservations concerning the ability of EMAS to provide the facilities they required, and use by those in Strathclyde in particular grew considerably.

The move to EMAS has therefore proved highly successful and the 2980 is at last fulfilling its intended role as a major computing resource in the Region.

EMAS

This was an important year for the EMAS services based at The King's Buildings. A submission was made to the Computer Board for the replacement of the twin ICL 4-75 installation involving the significant upgrade of the ICL 2970 to a 2972 dual processor configuration. As a result of the careful preparatory negotiations with the Computer Board secretariat and ICL, the Board were able to approve the University's request immediately at its meeting in September 1979. This quick approval was vital to the University's wish to effect the replacement programme during the long summer vacation in 1980.

The contract with ICL was noteworthy in several respects. It involved a 'hardware-only' deal since the University wished to run the EMAS 2900 operating system rather than the manufacturer's software. This allowed ICL to offer the equipment to Edinburgh University at a specially discounted price. Additionally, the normal terms of payment on government contracts were specially negotiated, the nett benefit being that delivery of the new equipment was assured well before it became the critical item in the summer replacement schedule. Since the University had specified the operating system and ICL were only responsible for the provision of the hardware, the Computer Board charged the University with the task of proving that the total system did achieve the projections made in the submission.

Two special distinct but co-operating projects were initiated at the beginning of 1980. The first involved the specification and implementation of the alterations required to the 4-75 machine hall over the summer vacation. The object of the second project was to provide the smoothest possible transition of users from the existing 4-75 and 2970 services to the new 2972 service. The

major problem here was to examine the 150,000 on-line and archived user files and to convert and transfer all those files which are relevant to an EMAS 2900 based service and which users still required.

It was decided at an early stage in consultation with the Universities of Glasgow and Strathclyde that the 2980 at the Bush Estate, whose service was based on EMAS from the beginning of the year, should provide an interim service to former 4-75 and 2970 users when their services were terminated. The twin 4-75 installation was decommissioned in the middle of June and the 2970 at the end of July. Users lost very little service as their files were moved over a weekend in each case and they were able to log in at the beginning of the next week and access all their files in the newly enlarged EMAS 2900 archive store. The number of 4-75 user files which were actually converted to EMAS 2900 format was in excess of 52,000 totalling over 3,300 megabytes of information. The 2972 service was scheduled to begin in time for the start of the 1980-81 academic year, that is by the beginning of October.

The reliability of the 4-75s and 2970 mainframes in their last year of service was very acceptable and improved on the previous year's figures though not quite reaching (in the case of the 4-75s) the heights of the 1976-78 period. The 4-75 service was again heavily overloaded especially in the first half of the academic year. The overall hardware performance of the 2970 was very good and for long periods it had a high mean-time-between-failures figure, the only problem coming from the obsolescent central processing unit. A summary of some key facts and figures is given in Appendix A (v).

Communications

Work on the rationalising and integrating of the communications network and its software has continued and the effects are beginning to be seen in improved reliability and much increased throughput. There is however still plenty more to be done.

Another aspect of networking that has been considered is the problem of keeping track of the state of each of the main components of the network. Preliminary work has been done on the provision of a network enquiry and information facility, which would provide users and the Centre with a continually updated account of the state of each host, node and terminal concentrator, together with an indication of the load on each component. Following encouraging experiments a case was put to the Computer Board for funds for such a facility and this case has been approved and equipment ordered. The expected service date is 1 October 1980 for an initial version.

A case was put to the Computer Board for a machine to provide a link between the network and the Post Office's National Packet Switched Service.

This has also been approved and the equipment ordered. It will enable users in Edinburgh to access machines throughout the UK and link on to networks in Europe and the United States. Much of the development work necessary in producing such a link is concerned with control of access and accounting for use of external networks. It also involves, however, the "bridging" of local communication standards to the international X25 standards, and this work will be valuable in the eventual move of the whole of the Centre's network to X25 standards.

Last year's report discussed the proposal to construct a pilot high speed local network. Work on this has gone ahead very actively and a 10 station network using the Cambridge ring design is being built. The intention is that this should link the terminal concentrators, nodes and front end processors in the Centre's machine room at The King's Buildings, thereby placing a realistic service load on the ring network and in the process improving the switching capability of the central network. Service operation is planned for early 1981.

Distributed Computing

There has been growing interest in the use of independent departmental mini-computers and microcomputers within Edinburgh University and local Research Council establishments over the last two years. The ERCC has in the past provided assistance with operating systems and other software for departmental computers and, where required, their connection via a communications network to the EMAS mainframe computer service. During the year, the ECC has taken major steps in order to better serve the growing community of distributed computer users.

All groups concerned with continued support to computer users of all types in Edinburgh have stressed the importance of widely used, portable operating systems and languages to protect the user's software investment in these times of rapid evolution of computer hardware, and to allow applications to be shifted between different computers as requirements alter.

Consequently, with the approval of the appropriate bodies, the ERCC has adopted the following related policies to constitute a basis for support to distributed computing users:

- (a) Support on ICL 2900 mainframes under EMAS is extended to cover the Pascal programming language. Training courses in Pascal programming and ERCC Advisory Service coverage of Pascal will begin in the autumn term of 1980. FORTRAN-77 is also supported on EMAS.
- (b) Departmental mini-computer support will be based on the UNIX operating system. At present this is mainly used on PDP-11 computers. However, microcomputer implementations are becoming available.

Pascal and FORTRAN are amongst the wide range of languages available under the UNIX system.

- (c) Microcomputer support will be based on the UCSD operating system (initially on three types of microcomputer already in use in the University). ERCC Training Unit and Advisory Service coverage of the UCSD System will be provided. Pascal and FORTRAN-77 are languages available under the UCSD system.
- (d) Communication will be established between these systems in order that programs and data can easily be transferred to the computer system most appropriate to the task in hand (e.g. large statistical analyses to EMAS on the ICL 2900s, real-time data collection to the UCSD system on a microcomputer, etc.). Unnecessary expenditure on high cost peripherals may be avoided by the use of centralised facilities (such as graph plotters, high quality printers, etc.). Communications are seen as the mechanism by which support can be improved to distributed users (e.g. mail, help and information systems, software libraries, etc.).
- (e) The ERCC will undertake a project to provide an independent filestore which can be used for the secure storage and sharing of information between all computer users in Edinburgh.

At the start of the 1980-81 academic year, the University had a clear policy on which it can now start to develop its computing resources. Communications facilities and network-wide services (such as a filestore, printers, plotters, etc.) figure centrally in this development. Portability of computer software is being encouraged through the adoption of standard languages across all the types of computer systems to be supported.

Already, preliminary means of connection to the existing communications network are available to all UCSD users on a chosen range of microcomputers and our central mainframes stock a growing range of useful software for their use. A viewdata system which provides a microcomputer information service is available to them over the same communications network.

External Services

The level of use of Cambridge and Manchester has not altered but in the latter case it was constrained by our allocation. A request to increase the percentage of resources at Manchester for Edinburgh use failed.

Although the number within the University who continued to use the Newcastle service was small, some individuals made substantial use of resources. The transfer of Research Council users of Newcastle to the 2980 was effected without any major problems.

The communications involved in accessing the remote sites are a potential source of difficulty but with the exception of the Manchester link no significant problems were experienced. There were several factors contributing to the difficulties with the Manchester link which it is hoped to resolve in the coming year, but the present level of service is most unsatisfactory.

DECsystem-10 Installation (SRC Interactive Computing Facility)

General Policy

The year opened with the SRC's Interactive Computing Facility Committee (ICFC) considering the computing needs of existing and potential users of the ICF, how best these might be met in relation to the DECsystem-10 installations at Edinburgh and UMIST, and other possible means of providing interactive computing facilities. In November it was decided to replace the machine at UMIST by a PRIME 750, and retain the DECsystem-10 at Edinburgh, converting it to a faster and larger machine with a KL CPU, 512 kwords of memory, and increasing its disk capacity. In this the Committee was recognising the need for the ICF to retain a major DECsystem-10 centre to provide first, software compatibility for a number of users with DECsystem-10 specific programs and, second, a programming environment particularly rich in features useful to the Artificial Intelligence community.

The KL1091S configuration proposed was intended to serve some 40 concurrent users (instead of the previous 25) and allowing each an increase in job size coupled with more processor power. It was felt that the machine would cater well for the increasing expectations of this group of users over the next 5 years. During this period the Edinburgh DECsystem-10 staff would study the applicability of linked, powerful single-user systems to the needs of AI and of other ICF users, since these systems, it is thought, will eventually supplant the central 36 bit machine. The plan for the 1091S configuration involved the retention of the existing DECsystem-10 network with nodes at Chilton, UMIST, Sussex and Dundee to provide remote access, for users requiring DECsystem-10 services, from anywhere in the UK.

This plan was eventually accepted by the SRC in February 1980, with the arrival of new hardware at Edinburgh timed for August 1980 and the new service opening in October. A requirement of the ICF management was for a reduction in operating staff to one full-time equivalent and this has been met by siting the new machine in the ERCC main machine room where it can be serviced by the operators there in parallel with their duties on the EMAS machines. Although this means that the DECsystem-10 will no longer have its

own operators, the users will enjoy covered running 24 hours per day from Monday to Friday (except on public holidays) instead of the earlier 2-shift cover. Much of the time and energy of the installation staff, particularly over the last six months of the year have been spent in preparing for the changeover.

Systems & Communications Matters

Over the year the central installation hardware has done well giving a 3% improvement in timesharing hours and a doubling in the mean-time-between failures (from 76 to 153 hrs) with most of the improvement being in software failures. As a new machine was to be installed, the hardware and software on the existing machine were not changed significantly during the year, except that the 7-track tape drive was converted, giving the installation two 9-track drives. In the second half of the year shortage of disk space became both continuous and acute (although a much better situation obtains on the new configuration). In May a communications processor was installed to act as a protocol-converting gateway between the DECsystem-10 ANF-10 network and the X25 based SRCNET. This gave access from any terminal on the ANF-10 network to any machine on SRCNET and vice versa. It also provided access for ANF-10 users to ARPANET via the ELECTRIC system.

Machine Usage

Overall there was a drop of 5% in machine usage in comparison with 1978-79 – but this is wholly attributable to paying usage (-22%) most of it in 1978-79 being by a single group. There was a 14% increase in SRC project (or other SRC allocations) usage. Good use has been made of background batch (18% of all) which was introduced just before the year started. Background batch runs through all time bands, although of course with little progress in peak time, but is charged at discount rate only.

Accommodation

The integration of our facilities in the central area of the University was completed in December 1979 with the opening of the new computer room in the basement of Appleton Tower. This houses the special services PDP11/40, running under DEIMOS, which processes all remote job entry work destined for NUMAC and supports a wide range of peripherals. Also in this computer room are the digitiser, an Apple microcomputer (for data entry to the network), a TCP and communications equipment.

A further development in Appleton Tower is the conversion of part of the former Chemistry Laboratory on Level 4 to a Microcomputer Teaching

Laboratory. In the first instance, this will be used by the new Information Systems I course due to start in October and will house ten Apple II Microcomputer systems, a Terak 8510a system, printers, EMAS terminals and experimental devices. The laboratory will also be available to the Centre's users to prepare for and run their own courses, and for evaluation.

The replacement of the System 4-75 computers in the James Clerk Maxwell Building on the King's Buildings site has provided an opportunity for the renovation of the computer accommodation on the ground floor of Phase 1A of that building. A major overhaul of the false floor, the ceiling, the electrical and communication wiring has been completed prior to the installation and commissioning of the ICL 2972 installation and the DEC 1091S.

Staffing and Organisation

The ERCC has adapted its staff complement and organisation during the year to reflect the expanding variety of computing services required by its users.

The adoption of EMAS for use on the regional 2980 service and the decision to base the replacement local service on 2900 hardware, again using EMAS, required that this software and the staff concerned should be organised within a single team. The two teams of systems programmers that have in the past supported the "Regional" and "Local" services were therefore merged under the management of Roderick McLeod.

To meet the support requirements of users of microcomputer systems and of those departmental computers that use the UNIX operating system, several new posts have been established and the emphasis of the related functions in user support and in operational areas of the Centre is being expanded to embrace the distributed service as well as those that are centrally located.

The demands on the team of staff committed to the provision of compilers for use within the University and which are marketed by ICL have increased and a new post has been filled in this area of activity.

A three year project to provide a subset of the NAG library of mathematical and statistical routines for use on microcomputer systems and using the Pascal programming language has received support from the Computer Board and two temporary posts will be provided within the ERCC, under the supervision of Dr D.B. Taylor.

Appendix A (i)

Utilisation of 2980 in 1979-80
by Participating Institutions

Institution	Computing Costs	Proportion of Computing Costs
	£	%
Edinburgh University*	349,994.91	49.97
Glasgow University	13,425.77	1.92
Strathclyde University	200,145.97	28.58
Other Universities	3,422.33	0.49
Research Councils	67,418.09	9.62
Treasury Supported	22,608.76	3.23
Commercial Users	8,031.19	1.15
ERCC Regional Use	7,118.72	1.02
Overheads	28,151.00	4.02
TOTALS	700,316.74	100.00

*Including ERCC local use

Appendix A (ii)

Utilisation of 2980 in 1979-80
by University of Edinburgh and Research Councils

Faculty or Sub-Faculty or Research Council	Notional Cost £	Proportion of Total Cost %
Arts	2,973.35	0.7
Divinity	98.06	0.02
Law	122.07	0.03
Social Sciences	51,711.03	12.18
Music		
Medicine	21,407.88	5.04
Dentistry	3,153.36	0.74
Veterinary Medicine	474.95	0.11
Physical Sciences	122,136.97	28.77
Engineering	22,087.39	5.20
Biological Sciences	39,180.64	9.23
Miscellaneous	25,108.63	5.92
Data Processing Office		
Computing Service (Local)	61,540.78	14.50
Computing Service (Regional)	7,118.72	1.68
ARC	39,494.39	9.30
MRC	2,466.51	0.58
NERC	25,457.19	6.00
Totals	424,531.92	100.00
Other Universities	216,994.07	
Treasury Funded Users	22,608.76	
Commercial Users	8,031.19	
Totals	672,165.94	

Note The heading "Computing Transactions" used in previous years, as a measure of the number of jobs processed, is no longer appropriate with the transition to a multi-access service.

Appendix A (iii)

Utilisation of NUMAC in 1979-80

Faculty or Sub-Faculty or Research Council	Notional Cost £	Proportion of Total Cost %
Arts		
Divinity		
Law		
Social Sciences	38,747.18	30.86
Music		
Medicine	56.64	0.05
Dentistry		
Veterinary Medicine		
Physical Sciences	48,213.89	38.40
Engineering Sciences	127.72	0.10
Biological Sciences	470.43	0.37
Miscellaneous	2,212.12	1.76
Data Processing Office		
Computing Service (Local)	1,786.51	1.42
Computing Service (Regional)		
ARC	27,191.93	21.66
MRC	4,229.22	3.37
NERC	2,523.84	2.01
	125,559.48	100.00
Other Universities		
Treasury Funded Users	7,910.04	
Commercial Users	84.05	
	133,553.57	

Appendix A (iv)

Analysis of Utilisation of 4-75 and 2970 EMAS
in 1979-1980

Faculty or Sub-Faculty or Research Council	Cost £	Proportion of Total Cost %
Arts	12,094.97	0.87
Divinity	1,490.49	0.11
Law	4.34	
Social Sciences	90,464.90	6.52
Music	26.94	
Medicine	39,016.98	2.81
Dentistry	2,393.30	0.17
Veterinary Medicine	1,076.88	0.08
Physical Sciences	553,936.96	39.93
Engineering	84,143.40	6.07
Biological Sciences	96,742.33	6.97
Miscellaneous	89,451.48	6.45
Computing Service (Local)	225,301.22	16.24
Computing Service (Regional)	16,370.15	1.18
ARC	67,866.10	4.89
MRC	3,565.68	0.26
NERC	41,670.37	3.00
Other Universities	13,235.70	0.95
Treasury Funded Users	35,641.01	2.57
Commercial Users	12,945.32	0.93
Totals	1,387,438.52	100.00

Appendix A (v)
EMAS Service – Facts and Figures 1979-80

		4/75s	2970
General	Average weekly interactive service	100 hrs	75 hrs
	Total number of accredited users	1650	330
	Number of student users	530	40
	Average weekly number of active users	1000	200
	Peak weekly notional income	£34,000	£8.500
Mainframe Performance	Average weekly system uptime percentage	98.9%	98.3%
	Average weekly satisfaction percentage	98.2%	96.9%
	Mean Time between failures (Hardware)	70 hrs	95 hrs
	Mean Time between failures (Software)	4000 hrs	212 hrs
	Mean Time between any failure (including communications network)	36 hrs	31 hrs
Interactive Service	Average weekly number of console sessions	6000	2000
	Length of average console session	20 mins	15 mins
	Average weekly interactive console hours used	2000	500
Background Service	Average weekly number of batch jobs	550	150
	Average CPU time used per job	120 secs	120 secs
On-Line File System*	Total number of on-line user files	17,500	5,000
	Total number of on-line user material	800 Mbyte	300 Mbyte
	Average file size	45,000 bytes	60,000 bytes
	Average number of files covered by back up	6,000	2,500
Archive Store	Total number of files on archive	150,000	11,600
	Total amount of archive material	9,000 Mbyte	950 Mbyte
	Average file size	60,000 bytes	82,000 bytes
	Number of active magnetic tapes	900	150
	Average restoration time	10 mins	10 mins
	Total size of on-line archive index	7.0 Mbyte	0.3 Mbyte

* The 4.75 file system consists of 8 units, each of 256 Mbyte effective capacity.
The 2970 file system consists of 8 units, each of 100 Mbyte maximum capacity.
On each unit 25% is required for the spool system and for temporary user files.
The archive cycle attempts to keep the file capacity occupied by permanent user files at 50%, leaving approximately 25% for weekly growth.

Appendix B

List of User Departments (1979-80)

(i) University of Edinburgh

Accounting and Business Method	Greek
Agriculture, School of	Human Genetics
Anaesthetics	Linguistics
Animal Genetics	Machine Intelligence Research Unit
Animal Health	Mathematics
Archaeology	Mechanical Engineering
Architecture Research Unit	Medical Computing & Statistics Unit
Artificial Intelligence, School of	Medical Neurology
Astronomy	Medical Physics & Medical Engineering
Biochemistry	Medical Physics (Western General Hospital)
Botany	Medicine
Business Studies	Medicine (Western General Hospital)
Cardiology	Meteorology
Chemical Engineering	Middle English Dialect Atlas
Chemistry	Molecular Biology
Child Life and Health	Music
Civil Engineering & Building Science	New Testament Language Literature and Theology
Clinical Chemistry	Nursing Studies
Community Medicine	Ophthalmology
Computer Science	Oral Medicine & Oral Pathology
Conservative Dentistry	Otolaryngology
Criminal Law	Pathology
Dictionary of the Older Scottish Tongue	Pharmacology
Economic History	Physical Education
Economics	Physics
Educational Sciences, The Centre for Research in	Physiology
Educational Studies	Politics
Electrical Engineering	Pollock Halls
Extra-Mural Studies	Preventative Dentistry
Fire Safety Engineering	Program Library Unit
Forestry & Natural Resources	Psychiatry
French	Psychology
General Practice	Radiotherapy
Geography	Regional Hormone Laboratory
Geology	Rehabilitation Studies Unit
Geophysics	Respiratory Medicine
Geriatric Medicine	Science Studies Unit

Secretary's Office
 Social Administration
 Social Anthropology
 Social Sciences, Faculty Office
 Sociology
 Sociology, Centre for Educational
 Statistics
 Surgery
 Surgical Neurology

Tropical Animal Health
 University Library
 Urban Design and Regional Planning
 Veterinary Computing Group
 Veterinary Medicine
 Veterinary Pathology
 Veterinary Pharmacology
 Veterinary Physiology
 Zoology

(ii) Research Council Institutes and Unit

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	Poultry Research Centre
ARC	Rothamsted Experimental Station
ARC	Scottish Horticultural Research Institute
ARC	Scottish Institute of 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	Reproductive Biology Research Unit
MRC	Radioimmunoassay
NERC	Institute of Geological Sciences
NERC	British Antarctic Survey Unit
NERC	Institute of Terrestrial Ecology
NERC	Freshwater Biological Association
NERC	Scottish Marine Biological Association

(iii) Other Universities

Cardiff	Newcastle
Dundee	Nottingham
Durham	Open University
Glasgow	Reading
Heriot-Watt	Stirling
Leeds	Strathclyde
Liverpool	

Appendix C

Financial Statement for the year 1 August 1979 to 31 July 1980

	Income	Expenditure		
	£	£	£	£
Computer Board direct grants				
Recurrent grants: Local	273,012		711,391	
Region	587,963		417,301	
	<u>860,975</u>		<u>86,131</u>	1,214,823
Earmarked capital (Region)				
Systems Software	1,725			
Applications Software	27,943			
	<u>29,668</u>			
Fully charged-out services				
Research Councils		890,643	26,435	
Commercial and Treasury supported			156,547	
Edinburgh University			328,190	
Other Universities			339,573	
ICL software contracts			130,553	
			<u>29,802</u>	
			23,359	
			<u>118,862</u>	
			1,155,321	
			<u>12,067</u>	1,143,254
SRC Contract				
SRC net payments	140,323*		81,400	
Sale of Computer time	57,972		16,400	
Sale of memory	800			97,800
	<u>199,095</u>			
Recoveries				
Administrative services				
Edinburgh University contribution				
Balances b/fwd from 1978/79				
Local	141,488		65,000	
Region	121,301		85,000	
	<u>262,789</u>			150,000
Balances c/fwd to 1980/81				
SRC Contract (underpayment)				
			127,504	
			<u>113,182</u>	240,686
				<u>£ 2,854,640</u>