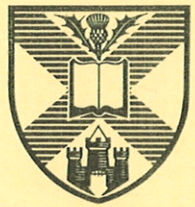
ISSN 0306–0667

UNIVERSITY OF EDINBURGH



EDINBURGH REGIONAL COMPUTING CENTRE

Twelfth Annual Report

EDINBURGH REGIONAL COMPUTING CENTRE

Twelfth Annual Report

1 August 1978 to 31 July 1979

CONTENTS

MEMBERSHIP OF EDINBURGH COMPUTING COMMITTEE

Nominees of the Educational Policy Committee	Professor C.B. Wilson (Convener), B.Sc., Ph.D. Mrs M.M. Barritt, F.B.C.S. Dr J.C.P. Schwarz, M.A., B.Sc., Ph.D.
The Director, Edinburgh Regional Computing Centre	Dr G.E. Thomas, B.Sc., M.Sc., Ph.D., M.I.E.E., F.R.S.E.
The Deputy Director (Local Systems)	Dr J.G. Burns, B.Sc., Ph.D.
Representatives of the Research Councils	Dr D.P. Blight, B.Sc., M.Sc., Ph.D., C.Eng., M.I.Mech.E. Mr S.M. Lawrie
Representatives of the Users' Committee	Dr. M.A.D. Fluendy, M.A., D.Phil., C.Chem., F.R.I.C., M.Inst.P. Mr A.F. Purser, B.Sc., A.R.C.S. Mr J. Tansley, B.Sc.
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. Professor P.G. Jarvis, M.A., Ph.D., D.Fil.
Representative of the Faculty of Medicine	Professor D.C. Flenley, B.Sc., M.B., Ch.B., Ph.D., F.R.C.P.E., F.R.C.P.
Representative of the Faculty of Social Sciences	Dr M. Anderson, M.A., Ph.D.
The Professor of Computer Science	Professor S. Michaelson, B.Sc.,A.R.C.S., F.R.S.E., F.I.M.A.
Secretary	Dr Y. Nadeau, M.A., Ph.D.

REGIONAL COMPUTING ORGANISATION
MEMBERSHIP OF THE MANAGEMENT COMMITTEE

University of Edinburgh	Dr M. Anderson, M.A., Ph.D.
	Dr M.A.D. Fluendy, M.A., D.Phil., C.Chem., F.R.I.C., M.Inst.P.
	Professor S. Michaelson, B.Sc., A.R.C.S., F.R.S.E., F.I.M.A.
University of Glasgow	Mr J.M. Black, B.A.
	Professor J. Lamb, D.Sc., Ph.D.
	Professor G.A. Sim, B.Sc., Ph.D.
University of Strathclyde	Professor D.S. Butler, (Convener), M.A., F.I.M.A.
	Dr D.E. Kidd, B.Sc., Ph.D.
	Professor A.M. Rosie, B.Sc., M.Sc., F.I.E.E., M.I.E.E.
Research Councils	Dr D.P. Blight, B.Sc., M.Sc., Ph.D., C.Eng., M.I.Mech.E.
Computer Board	Professor R.E. Burge, B.Sc., Ph.D., F.I.P.
Director	Dr G.E. Thomas, B.Sc., M.Sc., Ph.D., M.I.E.E., F.R.S.E.
Secretary	Dr Y. Nadeau, M.A., Ph.D.

Senior Staff of the Edinburgh Regional Computing Centre

(as at 31 July 1979)

Director	G.E. Thomas, B.Sc., M.Sc., Ph.D., M.I.E.E., F.R.S.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.
	W.D. Hay, B.Sc., D.Phil.
	A. McKendrick, B.Sc., Ph.D.
	C.A. Mackinder, C.Eng., M.I.E.E., A.M.B.I.M., M.I.I.M.
	G.E. Millard, B.Sc., A.R.C.S.
	G.M. Stacey, B.Sc., Ph.D., M.B.C.S.
	P.D. Stephens, M.A.
	D.B. Taylor, B.Sc., D.Phil.
	J.K. Yarwood, M.A., M.Sc.
Senior Computing Officers	M.D. Brown, M.B.C.S.
	R.A.F. Chisholm
	C.C. Davies
	K.M. Farvis, B.Sc., M.A.
	B.A.C. Gilmore, B.Sc., M.Phil
	W.M. Gordon
	N. Hamilton-Smith, B.A.
	S.T. Hayes, B.A.
	R.G. Kirsopp, B.Sc., Ph.D.
	C.D. McArthur, B.Sc.
	R.R. McLeod
	R.L. Middleton, B.Sc.
	N.S. Millar, B.Sc.
	N.K. Mooljee, B.Sc.
	H.M. Moores, B.Sc.

	B.R.P. Murdoch, B.Sc.
	C.H. Nicholas, B.Sc.
	A.D. Nolan, B.Sc., M.Sc., M.B.C.S.
	D.D.M. Ogilvie, B.Sc.
	D.O. Sturgess
	D.J.W. Stone, M.Sc.
	J. Wexler, B.A.
Computing Officers	K.A. Aitchison, B.Sc.
	A.McD. Anderson, B.Sc.
	J. Blair-Fish, M.A., Ph.D.
	C. Boldyreff, B.A.
	J.H. Butler, B.Sc.
	W.P. Cockshott, B.A., M.Sc.
	M.J. Cookson, B.Sc., M.Sc., M.Phil.
	M.J. Cross, B.Sc., Ph.D.
	W.S. Currie, B.Sc.
	J.G. Fordyce
	L.C. Griffiths, B.Sc.
	J. Henshall, B.Sc.,
	A.I. Hinxman, B.Sc., M.Sc., Ph.D.
	A.G.R. Kettler, B.Sc.
	W.A. Laing, B.Sc., M.Phil.
	D.B. Mercer, B.Sc.
	L. Morris
	J.McL. Murison, B.Sc.
	J. Phillips, B.Eng.
	R.J. Pooley, B.Sc., M.Sc.
	A. Shaw, B.Sc., M.Sc.
	R. Soutar, B.Sc.
	B.A. Tate, B.A., Ph.D.
	W. Watson, B.Sc., M.Sc.
Assistant Computing Officers	G. Howat, B.Sc., Ph.D.
	C. McCallum, B.Sc., Ph.D.
	D. McKelvie, B.Sc., M.Sc.
	A.M. Robertson-Smith, B.Sc.
	N. Stroud, B.Sc., D.Phil.
Executive Officer	J. Robertson
Reprographics Manager	D.J.L. Stewart-Robinson

Twelfth Annual Report

Introduction

Professor D.S. Butler became Chairman of the Management Committee of the Regional Computing Organisation on that office passing, by rotation, to the University of Strathclyde. Professor G.A. Sim replaced Professor A.M. Potter as a representative of the University of Glasgow, and Dr D.P. Blight replaced Dr J.M.M. Cunningham as the representative of the Research Councils. Dr M. Anderson and Dr M.A.D. Fluendy replaced Professor E.A.V. Ebsworth and Dr J. Muir as representatives of the University of Edinburgh.

On the Edinburgh Computing Committee, Professor C.B. Wilson became Convener on Professor Ebsworth's demitting the office he had held with distinction since the formation of the Committee. Dr J.C.P. Schwarz was elected by the Educational Policy Committee to serve in place of Professor F.H. McClintock. Dr J.M.M. Cunningham was succeeded by Dr. Blight as a representative of the Research Councils. The Faculties of Science and Medicine nominated Professor P.G. Jarvis and Professor D.C. Flenley to serve respectively in place of Dr J. Muir and Professor J.R. Greening.

The Regional and Local Management Committees both established Working Parties to consider and make recommendations on the future constitution of the Regional Computing Organisation. That Organisation was in any case due to be reviewed, but the proposed redistribution of funding responsibility between the UGC and the Computer Board gave an added motive. As the Working Parties deliberated, it became clear to each independently that the constitutional question could not be debated separately from the financial one, nor could the funding question be divorced from the future of the 2980, its function in the Region, and the operating system that would serve that function.

Constitutionally the Working Parties expressed a wish to see the Regional committee structure simplified to allow each participating university to retain financial responsibility for running the

Regional facilities in its care. What was seen as the main function of the Region was the common planning of capital developments, the allocation of central resources, the co-ordination of locally held resources, and the planning and development of a communications network within the Region.

The Working Parties found themselves compelled to look at the operation of the main existing Regional facility, the 2980. It appeared that the machine was still not providing a generally acceptable service to users in the Region: although there had been improvements in both hardware and software, reliability in both respects was still poor; VME/B was still gravely deficient in effective communication and was also very inefficient at providing an interactive service. For these reasons it was recommended to the Regional Management Committee that EMAS be adopted as the operating system for the 2980. EMAS 2900 had, in the meantime, proved its reliability on the Edinburgh 2970. The Regional Management Committee accepted this recommendation and made a submission to that effect to the Computer Board.

The expanded Computing Equipment Panel, renamed the "Committee for Distributed Computing", set about its task of examining how departmental and sectional developments made possible by the newly-evolving computer technology could be made to harmonize with the planning of equipment for, and with manpower development within ERCC. All departments were asked for their computing plans for the next three years. They responded very willingly. The information gathered is being slowly assimilated and will have its effect on ERCC developments and on the effort which ERCC staff will devote to distributed computing in the University and its environs.

In the course of the year the performance of the Local twin 4-75 installation deteriorated markedly. Even the additional capacity represented by the newly-introduced 2970 could not hide from the users the deterioration in service. A case for the replacement of the System 4s by a dual ICL 2972 system was urgently presented to the Computer Board.

Regional Services

It has been a further disappointing year for the Regional 2980 service. Software reliability has been acceptable, though not outstanding, and there has been a gradual improvement in hardware reliability. The overall performance of the system has still, however, fallen short of users' expectations and, apart from a surge of use around the start of 1979, usage throughout the year has remained static. The transfer of the bulk of users from NUMAC did not produce the hoped-for increase in work on the 2980, many users preferring to run their work on alternative local facilities.

Interactive facilities were exercised during the autumn of 1978 and proved to be of some value to system-development staff, but were found to be too demanding on system resources for their extension into the user service to be contemplated. In addition it has not proved possible to establish the long-awaited connection to the Regional network, and communications have continued to be direct to a few RJE terminals.

This situation was considered by the Regional Management Committee, who were particularly concerned that the 2980 could not provide the substantial interactive service originally intended. The use of EMAS rather than VME/B was reconsidered and the decision to change to EMAS was taken. This change is expected to take place during the latter part of 1979, by which time a number of extensions to the existing EMAS system requested by 2980 users should be available. Trials at Christmas and Easter indicated that in the absence of batch work well over 100 terminals could be simultaneously supported while maintaining a good response, and a smaller number, between 60 and 70, in parallel with a substantial batch component.

The proposal to use EMAS on the 2980 was discussed with representatives of the Computer Board and approved by the Board at their meeting in July. To judge by past evidence, there will be no difficulty in attracting users to a machine running an EMAS service, and there should be no difficulty in establishing a full connection

to the Regional network. The main task to be undertaken is the transfer of existing VME/B users' work to EMAS with as little inconvenience as possible. One or two VME/B packages present special problems, in particular the database package IDMS, and a residual VME/B service is likely to be required for these until the summer of 1980. Although it is disappointing that so much effort over the past three years has failed to result in a service acceptable to our users, there is every reason to believe that under EMAS the 2980 will start to fulfill its intended role as a major computing resource in the Region.

EMAS

The EMAS service provided by the twin 4-75 installation has again borne the main computing requirements of the University. As in previous years it has been heavily overloaded. Users have therefore experienced considerable inconvenience, especially during term, when the system carried its teaching load. This congestion was further aggravated by a significant fall in the reliability of the hardware from the high levels achieved in the previous three years. System 4-75 serviceability deteriorated by 2.5% to 96.1% and this deterioration compounded by the problems in the communications network, produced an overall rate of reliability that was the worst for many years. To some extent this was offset by the fact that the mean time between failures was no shorter than it had been in the previous year.

The ICL 2970, despite its limited amount of filestore (400 Mbyte), contributed increasingly through the year to the EMAS facilities available to the Edinburgh University user both in quality and quantity. No access control or resource limit was applied during the year, and the users who made the effort to move their work promptly to EMAS 2900 were therefore given a glimpse of what an interactive service based on more powerful hardware should be like. The reliability of the hardware has gradually improved and the rather low average serviceability of 93.8% is due mainly to the poor performance of the six-megabyte magnetic drums. Despite being under constant development, the new operating system, EMAS 2900, proved

very reliable. The characteristics of the two EMAS services are summarised in Appendix A(vi).

The submission to the Computer Board, mentioned last year, for equipment to enhance the 2970 to a more realistic configuration met with only limited success, yielding only half the file store originally requested and no main-store upgrade. The increase in file-store capacity to 800 Mbyte which took place in July 1979, however, did allow the only restrictions which were applied on the 2970, i.e. on file space, to be eased, and without this increase the development work necessary to implement the decision to run EMAS 2900 on the RCO 2980 would have been severely held up.

However, the more important outcome of the Computer Board's deliberations was that they were prepared to consider a submission from the University in the summer of 1979 for the complete replacement of the twin 4-75 installation in the following year. After full consultation with the Computer Board and the user community, a proposal was prepared for submission to the Computer Board in September 1979 for the replacement of the System 4s by the significant upgrade of the existing 2970 to a powerful ICL dual-processor 2972 configuration. The choice of computers of the ICL 2900 series satisfied one of the prime operational requirements, viz, that the service replacing that provided by the System 4s should continue to have the characteristics of EMAS.

Communications

The Regional and Local communications-software teams were integrated and Dr W.D. Hay was appointed as Communications Manager. The team now has responsibility for all the ERCC-operated components involved in the transfer of a message between a user's terminal and the destination machine, including front-end processors, but excluding communications software in mainframes.

On the network side the main effort has been concentrated on improving throughput and reliability. Although a good deal has been achieved more work will be needed as the load on the network continues to increase. The need for higher speeds of communication

than can be provided by the normal type of connection provided by the Post Office, for example to support operations such as file transfer, was mentioned in last year's report and a number of existing high-speed networks have been examined, both in the U.K. and the U.S.A. A minimum speed of at least 1 M bit/sec is required. There is not at present any implementation which is obviously the best, nor can components of any network yet be purchased. It is therefore proposed to construct a pilot network, so as to establish the most suitable technology for a campus network and also to gain a clearer picture of the type of use likely to be made of such a network. One hope is that a network could greatly relieve the load on the various switches on the existing network, all of which are nearing saturation and many of which are nearing the end of their useful lives.

External Services

Significant but declining use was made of the OS/MVT services offered by Newcastle University on their IBM 360/65 and 370/168 systems. MVS was introduced on the 370/168 in Spring 1979 and caused users relatively few problems. Otherwise the service remained stable and was easily accessed either by submitting card decks at RJE stations or by detaching jobs from EMAS. During the year, all but IBM-specific and Research Council work was progressively moved off Newcastle onto the local systems. As in previous years, use of the ATMOL package by theoretical chemists swamped all other usage.

Limited use of remote services at Cambridge University (IBM 370/165), University of Manchester Regional Computer Centre (CDC 7600) and University of London Computer Centre (CDC 6600) was made by a few users who required access to specific packages not available locally.

System 10

The year opened with the machine move, mentioned in last year's report, from the North Computing Hall in the Department of Computer Science to self-contained accommodation within the ERCC area of the

James Clerk Maxwell Building. At the same time staff associated with the installation were re-accommodated in offices immediately adjacent to the new machine room. This closer cohesion has been a major factor in improving the general functioning of the group. The moving of the machine, which was accomplished in 10 days, has produced the expected benefits. System reliability, which had been causing concern, has improved over the year, and crashes for all causes, except for software failure, were fewer, giving a nett improvement of 30% over the previous year. At the same time the availability of the machine in time-sharing hours improved by 11%.

Usage of the machine was up by 10% although this increase was attributable to one user group which in fact took 20% of all usage.

Apart from some improvements in communications facilities, mainly the addition of a front-end machine (PDP 11/15) for a connection to the Rutherford Laboratory's twin IBM 360/195, the hardware of the installation has not changed during the year. The latest version (6.03A) of the TOPS-10 monitor was installed in April. Other software additions are: APL(SF), a fuller version of APL with shared files, PASCAL, and SCRIBE (a documentation system).

A considerable amount of documentation has been produced and distributed during the year and has been made available for reading on the users' terminals also.

The Systems Manager (Dr W.D. Hay) was transferred to other duties within the ERCC on 1st May, and, since then, Mr K.M. Farvis has acted in his stead. This temporary reduction in systems effort has brought about a reduction in user support for a number of items of software, as systems staff have not been available to solve the more deep-rooted problems of the users.

Towards the end of the year, there was an acute shortage of disk space. Although the SRC has been asked to fund more disk space, the resolution of this problem is bound up with the future of the DEC system-10 as a whole. During the year the SRC's Interactive Computing Facilities Committee (ICFC) has been considering the computing needs of present and potential users in relation to the facilities now provided at Edinburgh and UMIST, and in relation to

other means of satisfying requirements by multi- or single-user minis. A survey of user requirements has been carried out by the Edinburgh and UMIST Users' Committees and the management of both installations have provided costings and other information, as requested by the ICF management, on possible future arrangements at both places. The decision of the ICFC is said to be imminent.

Data Capture

The 800 bit/in magnetic-tape drive on the CMC Key-to-Disk system was replaced by a 1600 bit/in drive. This change reflects the predominant requirement of users for higher-density tapes, though 800 bit/in tapes can still be created on the special-services PDP 11/40 at Buccleuch Place Lane.

Usage

Statistics of usage and lists of Users are given in Appendices A and B.

Accommodation

There has been some delay in the anticipated removal of central-area computer facilities from Buccleuch Place Lane to the new computer room to be constructed in the basement of the Appleton Tower. Conversion work had been expected to start in January 1979 but only started in June.

Staffing and Organisation

Dr G.E. Thomas was absent on sabbatical leave and the deputy-directors, Mr P.E. Williams and Dr J.G. Burns, acted as directors, each for half of the year.

The Local and Regional communications-software teams were amalgamated and placed under the direction of a single manager: Dr W.D. Hay was appointed to the post.

There was no significant change in the staffing of the Information Services, but, in the Advisory Service, four advisers left: two transferred to database work, one to the Communications group, and the fourth left to raise a family. Suitable replacements were found, but the number of applicants was noticeably smaller.

The Database Systems Unit grew, primarily so as to support external contracts for the Fortran Interface Sub-system to IDMS. Local users have benefited in that the Unit is now better equipped to advise and assist users who have large or complex file-handling requirements.

Appendix A(i)

Utilisation of 2980 in 1978-79
by Participating Institutions

Institution	Computing Costs	Proportion of Computing Costs
	£	%
Edinburgh University	69,705.83	30.96
Glasgow University	2,381.29	1.06
Strathclyde University	58,408.76	25.94
Other Universities	977.95	.43
Research Councils	10,826.61	4.81
Treasury Supported	3,779.98	1.68
Commercial Users	5,579.20	2.48
ERCC Regional Use	22,666.73	10.07
Overheads	50,815.96	22.57
TOTALS	225,142.31	100.00

Appendix A(ii)

Utilisation of 2980 in 1978-79
by University of Edinburgh and Research Councils

Faculty or Sub-Faculty or Research Council	Computer Transactions	Notional Cost	Proportion of Total Cost
		£	%
Arts	416	1,281.50	1.00
Divinity	-	-	-
Law	38	50.84	.04
Social Sciences	6,327	15,660.49	12.28
Music	-	-	-
Medicine	2,157	3,200.89	2.51
Dentistry	632	1,672.52	1.31
Veterinary Medicine	-	-	-
Physical Sciences	194,838	33,519.26	26.29
Engineering	21	10.69	.01
Biological Sciences	770	5,306.76	4.16
Miscellaneous	6,210	9,002.88	7.06
Data Processing Office	-	-	-
Computing Service (Local)	11,289	24,316.54	19.06
Computing Service (Reg.)	18,051	22,666.73	17.78
ARC	2,662	5,303.76	4.16
MRC	82	83.80	.07
NERC	1,235	5,439.05	4.27
	244,728	127,515.71	100.00
Other Universities	10,356	61,768.17	
Treasury Funded Users	3,944	3,779.98	
Commercial Users	1,439	5,579.20	
	260,467	198,643.06	

Appendix A(iii)

Utilisation of NUMAC OS in 1978-79
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	23,190	18.07	131,549.88	24.01	48,651.30	35.97	180,201.18	26.37
Glasgow University	29,787	23.22	63,195.58	11.53	36,257.63	26.80	99,453.21	14.56
Strathclyde University	21,480	16.74	267,914.16	48.89	17,091.12	12.63	285,005.28	41.71
Other Universities	37	.03	73.69	.01	126.27	.09	199.96	.03
Research Councils	25,910	20.20	46,347.80	8.46	10,196.27	7.54	56,544.07	8.28
Treasury Supported	6,902	5.38	9,502.53	1.74	4,175.51	3.09	13,678.04	2.00
Commercial Users	62	.05	307.04	.06	27.00	.02	334.04	0.05
ERCC Regional Use	9,327	7.27	6,151.29	1.12	12,944.03	9.57	19.095.32	2.80
Overheads	11,600	9.04	22,913.60	4.18	5,811.97	4.29	28,725.57	4.20
TOTALS	128,295	100.00	547,955.57	100.00	135,281.10	100.00	683,236.67	100.00

NB jobs exclude file transactions
NB Newcastle not included

Appendix A(iv)

Utilisation of NUMAC OS in 1978-79
by University of Edinburgh and Research Councils

Faculty or Sub-Faculty or Research Council	Computer Transactions (exc. file storage)	Notional Cost	Proportion of Total Cost
		£	%
Arts	30	21.76	.01
Divinity	-	-	-
Law	41	215.09	.08
Social Sciences	8,981	72,563.69	28.36
Music	-	-	-
Medicine	1,155	1,996.51	.78
Dentistry	53	67.51	.03
Veterinary Medicine	100	245.18	.10
Physical Sciences	4,418	82,986.93	32.44
Engineering	496	3,009.36	1.18
Biological Sciences	1,400	2545.44	.99
Miscellaneous	2,124	6,449.65	2.52
Data Processing Office	1	3.42	-
Computing Service (local)	3,260	10,096.64	3.95
Computing Service (reg.)	8,371	19,095.32	7.46
ARC	20,445	36,539.50	14.28
MRC	2,902	7,577.46	2.96
NERC	2,563	12,427.11	4.86
	56,340	255,840.57	100.00
Treasury Funded Users	9840	13674.62	
Commercial Users	82	334.04	

Appendix A(v)

Analysis of Utilisation of EMAS
in 1978-79

Faculty or Sub-Faculty or Research Council	Cost	Proportion of Total Cost
	£	%
Arts	13,241.94	.72
Divinity	684.33	.04
Law	45.58	-
Social Sciences	148,907.77	8.06
Music	3.01	-
Medicine	46,788.76	2.53
Dentistry	3,595.73	.19
Veterinary Medicine	1,866.39	.10
Physical Sciences	822,037.37	44.51
Engineering	73,948.00	4.00
Biological Sciences	130,525.01	7.07
Miscellaneous	96,174.18	5.21
Computing Service (Local)	247,909.95	13.42
Computing Service (Reg.)	32,334.67	1.75
ARC	101,857.95	5.51
MRC	6,988.85	.39
NERC	57,158.09	3.09
Other Universities	20,250.08	1.10
Treasury Funded Users	34,816.63	1.89
Commercial Users	7,743.85	.42
	1,846,878.14	100.00

Appendix A(vi)

EMAS SERVICE - FACTS AND FIGURES 1978-79

		4/75s	2970
General	Average weekly interactive service	100 hrs	75 hrs
	Total number of accredited users	1650	240
	Number of student users	500	35
	Average weekly number of active users	800	150
	Peak weekly notional income	£44,000	£3,500
Performance	Average weekly system uptime percentage	97.6%	98.6%
	Average weekly satisfaction percentage	96.1%	93.8%
	Mean Time between failures (Hardware)	73 hrs	75 hrs
	Mean Time between failures (Software)	4000 hrs	248 hrs
	Mean Time between any failure	33 hrs	17 hrs
Interactive Service	Average weekly number of console sessions	6500	2000
	Length of average console session	25 mins	15 mins
	Average weekly interactive console hours used	2700	500
Background Service	Average weekly number of batch jobs	700	160
	Average CPU time used per job	200 secs	110 secs
On-Line File System*	Total number of on-line user files	20,000	4,500
	Total amount of on-line user material	800 Mbyte	260 Mbyte
	Average file size	40,000 bytes	58,000 bytes
	Average number of files covered by back up	6,000	2,000
Archive Store	Total number of files on archive	125,000	5,900
	Total amount of archive material	7,400 Mbyte	440 Mbyte
	Average file size	59,200 bytes	74,000 bytes
	Number of active magnetic tapes	450	90
	Average restoration time	10 mins	10 mins
	Total size of on-line archive index	6.2 Mbyte	0.15 Mbyte

* The 4-75 file system consists of 8 units, each of 200 Mbyte effective capacity. The 2970 file system consists of 4 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 (1978-79)

(i) University of Edinburgh

Accounting and Business Method
Agriculture, School of
Anaesthetics
Animal Genetics
Animal Health
Archaeology
Architecture
Artificial Intelligence
Astronomy
Bacteriology
Biochemistry
Botany
Business Studies
Chemical Engineering
Chemistry
Child Life and Health
Civil Engineering & Building Science
Clinical Chemistry
Classical Archaeology
Computer Science
Conservative Dentistry
Criminal Law
Data Processing Office
Dental Surgery
Dictionary of the Older Scottish Tongue
Economic History
Economics
Educational Sciences, The Centre for Research in
Educational Studies
Electrical Engineering
English Language
Extra-Mural Studies
Fire Safety Engineering
Forestry & Natural Resources
French
General Practice
Geography
Geology
Geophysics
Geriatric Medicine
Greek
History
Human Genetics
Linguistics
Machine Intelligence Research Unit
Mathematics
Mechanical Engineering
Medical Computing & Statistics Group
Medical Faculty
Medical Physics
Medical Physics (Western General Hospital)
Medicine
Medicine (Western General Hospital)
Meteorology
Molecular Biology
Music
Neurology
New Testament Language Literature and Theology
Nursing Studies
Oral Medicine and Pathology

Otolaryngology
Pathology
Pharmacology
Physical Education
Physics
Physiology
Politics
Pollock Halls
Preventive Dentistry
Program Library Unit
Psychiatry
Psychology
Public Law
Radiotherapy
Regional Hormone Laboratory
Rehabilitation Medicine
Respiratory Diseases
Restorative Dentistry
Science Studies Unit
Social Administration
Social Anthropology
Social Medicine
Social Sciences, Faculty Office
Sociology
Statistics
Surgery
Therapeutics
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 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 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 Medical Sociology Unit Centre for Social Studies
MRC Reproductive Biology Research Unit
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
Newcastle
Nottingham
Open University
Stirling
Strathclyde

Appendix C

Financial Statement for the year 1 August 1978 to 31 July 1979

Income	£	£	£
Computer Board direct grants			
Recurrent grants: Local	205 077		
Region	495 449		
		700 526	
Earmarked capital grant: Region		12 960	
			713 486
Fully charged-out services			
Research Councils	244 337		
Commercial and Treasury supported	89 753		
Edinburgh University	19 030		
Other universities	5 977		
ICL software contracts	94 049		
		453 146	
SRC Contract			
SRC net payments	149 378		
Sale of computer time	14 532		
		163 910	
Third and fourth shift charges for NUMAC usage		7 623	
Recoveries		98 980	
Administrative services		100 295	
Miscellaneous receipts		4 906	
Edinburgh University contribution		623 029	
Balances b/fwd from 1977/78			
Local	149 574		
Region	122 350		
SRC Contract	1 911		
Computer Board	10 238		
		284 073	
Balance c/fwd to 1979/80			
SRC underpayment		7 745	
		£ 2 457 193	

Expenditure	£	£
Staff costs		
Academically related	586 990	
Other	359 881	
Casual	61 883	
		1 008 754
Materials and Services		
Travel and subsistence	25 261	
Computer materials	123 613	
External service charges and rentals	246 178	
Mainframe maintenance	357 585	
Telecommunications	95 460	
Engineering development	32 833	
Information and training	29 881	
General expenses	82 820	
	993 631	
Less Stocks-in-hand	15 802	
		977 749
Overheads: Edinburgh University services		
ERCC	76 597	
SRC Contract	12 246	
		88 843
Payment of Glasgow Data Transfer services losses		27 643
Bad debts written off		1 915
Contribution to costs of Appleton Tower conversion		24 500
Transfer to capital reserve		65 000
Balance c/fwd		
Local	141 488	
Regional	121 301	
		262 789
		£ 2 457 193