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UNIVERSITY OF EDINBURGH



EDINBURGH REGIONAL
COMPUTING CENTRE

Tenth Annual Report

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COMPUTING CENTRE

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1 August 1976 to 31 July 1977

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MEMBERSHIP OF EDINBURGH COMPUTING COMMITTEE

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The Director
Edinburgh Regional Computing Centre

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B.Sc., M.Sc., Ph.D., M.I.E.E.

The Deputy Director
(Local Systems)

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Mr F. Morley

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Dr E.J.C. Read, B.Sc., Ph.D.

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Professor S. Michaelson,
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Secretary to the Committee

Dr Y. Nadeau, M.A., Ph.D.

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Research Councils	Dr J.M.M. Cunningham, B.Sc.(Agric), Ph.D., F.I.Biol., F.R.S.E.
Director	Dr G.E. Thomas, B.Sc., M.Sc., Ph.D., M.I.E.E., F.R.S.E.
Secretary	Mrs D.M. Baker, M.A.

Senior Staff of the Edinburgh Regional Computing Centre

(as at 31 July 1977)

Director	G.E. Thomas, B.Sc., M.Sc., Ph.D., M.I.E.E.
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 W. Watson, B.Sc., M.Sc.

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 K. Burgoyne, B.Sc.
 M.J. Dow, B.Sc.
 J. Henshall, B.Sc.
 C. McCallum, B.Sc., Ph.D.
 B.A. Tate, B.A., Ph.D.

Executive Officer

J. Robertson

Tenth Annual Report

Introduction

There was no change during the year to the composition of the Edinburgh Computing Committee. On the Regional Management Committee Dr D.E. Kidd replaced Mr L. McGougan as one of the representatives of the University of Strathclyde. Professor Ebsworth became Convener of the Committee on the Chairmanship passing, by rotation, from the University of Glasgow to the University of Edinburgh. The Computer Board took the decision to discontinue its practice of having a representative on the Management Committees of the Regions. This decision of principle is regretted. However, Dr K. Root, a member of the Computer Board Secretariat, has attended regularly the meetings of the Regional Management Committee; his presence has been of considerable assistance.

Our last report forecast that a fair proportion of Regional work would be transferred to the ICL 2980 in the course of the year. We are proved wrong. In spite of the efforts of ERCC and ICL staff, the user service available on the 2980 remains negligible. ICL have had to recognise that they will not be able to meet the specifications of their contract. The last months of the year were devoted to negotiations between ICL and the Computer Board on how our broken expectations could be repaired.

As hope receded of the 2980 providing the required service to the Region in good time, our reserve towards NUMAC turned to attachment. So far NUMAC has shown understanding of our difficulties, but we cannot expect that understanding to persist if by January 1978 Regional work does not start being transferred to the 2980. It is our anxiety that, after that date, NUMAC may want us to withdraw our work, while we may still be inadequately served by ICL machines. Our Research Council users especially will need to safeguard their access to NUMAC facilities until the Region can offer them what they require. They look to the Computer Board for protection.

While Regional systems came short of our hopes, the Local EMAS system performed beyond expectation. The access control that came into operation helped to rationalise usage at peak times. Surprisingly, more work was put through the system than in the preceding year, and the system's overall hardware performance also improved.

Present performance did not, however, make us forget the system's obsolescence. We continue to press the Computer Board for replacement of the file store and for an indication of when we can expect replacement of the mainframe. By the end of the year there were indications that the Board were looking seriously at our proposals and that they had scheduled replacement of the System-4's for 1980-81.

Financial austerity continued to prevail. A Vacancies Committee examined all requests by the Director for the filling of vacancies as they occurred. In this climate of austerity the Local budget was well-defined nonetheless: ERCC knew what support the University of Edinburgh would give, and what income it could expect from contracts with commercial firms. The Regional side of the budget, however, was not assured of its income from outside firms and the financial year ended before the universities of the Region had agreed on how to distribute any deficit. In the event, enough external income was generated to balance expenditure, and such an agreement did not prove immediately necessary.

Regional Services

We reported last year that the Region's ICL 2980 was handed over in July 1976, and that a user service began in mid-August. We also reported that considerable difficulties were being experienced. These difficulties have continued throughout the year under review. In November 1976 an approach was made to the Managing Director of ICL in an attempt to obtain further action by the company to solve some of the basic problems with the operating system which were still preventing the attainment of an effective Remote Job Entry service to four terminals. This approach produced an immediate reaction and a number of serious faults were cleared during the next two to three months. A start was also made on the provision of a supplementary software package (SNAP) to provide better control of work, especially from an RJE station. This development has proved valuable but is still incomplete. The solving of some communications problems has, however, exposed further ones and work has continued throughout the year on the resolution of these, so far with very limited success in terms of the quality of user service available at Remote Job Entry stations.

In consequence, although a sustained attempt has been made throughout the year to provide a service to the Research Councils and the three universities in the Region, most users have preferred to remain on the IBM machines at Newcastle, where a more rapid and predictable service could be obtained. Usage of the 2980 has peaked at about 400 jobs per day (a quarter of the number processed on the 370/158 when that was at Edinburgh) of which only about 200 represented genuine user jobs.

The use of Newcastle obviously cannot continue indefinitely, and the continued inability of the 2980 to provide an acceptable basic batch service from RJE stations is a source of great concern. In the absence of reliable communications and a substantial workload it is difficult to assess the 2980's potential for providing an effective service to the University and Research Council community, and there are fears that the resolution of communications problems, with the consequent increase in workload, may expose further deficiencies in the operating system's ability to support a high-volume open-shop type of service.

The first year of service of the 2980 has thus been extremely depressing. An immense amount of effort and a great deal of money have been expended both by Regional staff and by ICL, but so far this has not succeeded in enabling the 2980 to take back the work currently run for the Region at Newcastle. The production of as complex an operating system as VME/B to even its present level is a considerable achievement, but the system contains major shortcomings in areas critical to the type of service the 2980 is required (and was obtained) to provide. Many of these shortcomings are recognised by ICL and it is believed that steps are being taken to correct them, but this is a process that will certainly take at least two years to complete.

In addition to the fundamental difficulties already described, there have also been performance problems and the 2980 failed to meet its contractual level of performance by the deadline of 1st June 1977. At the time of contracting it was expected that this requirement would be easily achieved. Whether the final performance level, which provided for a substantial multi-access component, will ever be attainable with VME/B seems open to doubt. In the circumstances, therefore, attention was turning by the end of the year to the possibility of using the 2900 EMAS operating system which was being developed with notable speed and success on the 2970 by local staff of ERCC and the Department of Computer Science. This development seems likely to lead to a system capable of going into service by October 1978.

In addition to the EMAS development, the Region's 2970 at Edinburgh has been used through the year for the development by local ERCC staff of the FORTRAN(G), ALGOL(E) and IMP compilers, both as stand-alone compilers and as part of the Scientific Jobber batch sub-system, and by various other university staff for the development of a variety of program packages. These have included SPSS, XRAY, a FORTRAN pre-processor for IDMS and an integer programming package for the ICL programming system. The latter two developments are under contract to ICL, and the

FORTRAN(G) and ALGOL(E) compilers, together with the Scientific Jobber, have been adopted by ICL as standard components of both their VME/B and VME/K operating systems. The 2970 has also been used by staff from Glasgow University to assist them in the preparations for the installation of their own 2976. During the year an encouraging improvement in the performance of the 2970 hardware has taken place and has generally been quite acceptable.

Regional Communications

The past year has been one of further consolidation and refinement of network facilities, and of further progress towards an integrated network linking the three universities of the Region. A connection from the Edinburgh node to the ICL 2980 was established and it is expected that this connection, despite its limited scope, will also be used in the node processors in Glasgow and Strathclyde. Node-to-node links have been established, but have not been used so far to any great extent for service. A link was also made between the Edinburgh node and the 4-75 front-end processor. It has been of considerable value.

Further progress has been made during the year in the establishment of a comprehensive standard regional protocol, known as NSI. In this development, which is essential to the expansion of regional communications, a considerable amount of pioneering work has been necessary. Although similar requirements exist elsewhere, and are becoming more common, so far no network has completely solved the communications protocol requirements necessary to support all types of service and there is certainly no accepted standard. In this development close contact is being maintained with other networks in the United Kingdom and in particular with the Network Unit recently set up jointly by the Computer Board and the Research Councils. A member of the Region has also served on the relevant EPSS study group.

High speed communications hardware for Modular Ones, developed at ERCC, has been installed in the nodes in all three universities of the Region. An initial version of this hardware to support HDLC communications (the latest ISO standard) has also gone into service. Altogether, the period of developments to Regional communications seems to be nearing its end and a fairly stable period of service can now be envis-

aged, during which thoughts must turn to the expansion of the network in conformity with the recommendations being developed by the Network Unit.

Regional Service at NUMAC

The Region remained heavily dependent on the batch service of the IBM 370/168 and 360/65 at Newcastle University. Following the tribulations of the preceding year, our users' concern was to see a stable and reliable service. However, a further major upheaval was anticipated with the move to 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 Linked System has now been in service since February 1977, and during this period the service has been stable and its reliability generally acceptable. System maintenance has been done on a regular basis and there is a steady flow of accounting and disk-management information back to our support units and our users. Visits by Newcastle's External Advisors have continued, but on a much reduced frequency, there being few problems which cannot be resolved locally or by a telephone call. Analysis of the accounting data for selected weeks during the year has produced the figures given in Appendix A(v) which show the frequency and cost of usage of popular packages and of the main languages. It is no surprise to find that SPSS and Fortran head their respective sections.

The OS Advisory Group has continued to meet at intervals of approximately six weeks to maintain, at a technical level, an interchange of ideas and a forum for discussion of future plans. During the first half of the year it was heavily concerned with the Linked System. Latterly it has looked for ways to cope better with the unavoidable facts that the 360/65 can only provide about half the day-time service the Region used to expect from its 370/158, and that the complexities of the Linked System have further eroded the available resource.

As the year ended, two matters were requiring consideration. The first was the rate of withdrawal from Newcastle of all RCO work which cannot be classed as "IBM specific", and it is clear that this will take longer than both we and NUMAC had hoped and expected. The second matter is the eventual rationalisation of the NUMAC installation to a single standard IBM system, coupled with the inevitable demise of the ageing 360/65. As Newcastle now plan to introduce IBM's MVS system on the

370/168 in mid-1978, our users may yet have to undergo a further major change before they are finally able to remove their work from NUMAC.

We wish to record our thanks to NUMAC for their help in a period of difficulty for both our organisations.

EMAS

We reported last year that EMAS was effectively saturated for interactive work and that the only obvious avenue of relief was to enable the fluent transfer of work to the Regional 2980. Considerable effort has been spent in refining the spooling system on EMAS to enable users to route work to and from the 2980 and thus allow the full Edinburgh network access to that machine. Unfortunately, the 2980 communications support has not improved during the year and, as yet, no benefit has resulted.

On EMAS itself Appendix A(iv) summarises the position and, compared with 1975-76, shows a 10% increase in the number of interactive sessions and a substantial increase in the batch load. This has been achieved in the first case by users working even earlier and later in the day, whilst the increased batch load is due to several factors which include the inability to progress work (which may often be ideally interactive) during the day because of the introduction of rationing of prime-time resource, moves to distribute the workload more evenly between the two processors and, as noted above, the lack of any significant new batch resource. Pressure has also grown on the file store and a genuine change in the pattern of work is underlined by an increase in the average file size by 30%.

We continue to offer service on alternate Saturdays and are currently considering a Sunday evening service. The operating system has been relatively stable during the year, the only major change being a re-organisation of the archive system which has resulted in the average retrieval time from the archive store being halved.

Hardware reliability has been good with a satisfaction factor of 99% and a mean time between failures of 75 hours. However, the mean time between any failure, including, for example, environmental and communication failures, remains at 25 hours, a figure we would like to increase. During the year several slow peripherals were released having been replaced by equivalent devices on the Network. No hardware upgrades were undertaken to the System 4's during the year but we have recently been advised by the Computer Board that 1/8 Mbyte of core store has been

allocated from the Aberdeen machine and this will be installed toward the end of 1977 resulting in both machines having 1 Mbyte of store.

For the third year in succession we can report on our attempt to replace the CDC fixed disks which currently support the EMAS file store. Last year we indicated that the Computer Board might respond by February 1977 to our 1976/77 submission, which was repeated, with full Regional support, as the only proposal to the Board from Edinburgh for 1977/78 funding. A favourable response was received in May 1977 although the Board was then unable to advise us when funds would be available. Subsequently, in early September, we were advised that the project could proceed in 1977/78. Telex, who were the preferred supplier in our proposal, had meantime withdrawn because of the delays, and a final choice has now been made of an amalgam of equipment which provides an interface to the System 4's via a Logical Signal Processor supplied by System Reliability Ltd. from a disk subsystem consisting of CDC 300 Mbyte units attached to three disk controllers supplied by System Industries Ltd. The complete file store will be supervised by two PDP 11/34 processors for which ERCC will provide the software. Particular attention has been paid to hardware resilience and to data integrity in the overall design, and initial deliveries of hardware are expected in early 1978.

The final agreement to this equipment opens important pathways to the future. In particular, the replacement to the System 4's, now scheduled by the Computer Board for 1980-81, must integrate with our conscious policy of reducing dependence on monolithic mainframes, and the general architecture now adopted for both the communications and file-store support permits of a flexible approach to several mainframe strategies.

Specifically, the investigation of 2900 series architecture noted last year has now progressed to the point where an EMAS implementation, now supported by an ERCC project team, has run successfully on 2970 and 2980 machines. Detailed hardware differences have as yet prevented a 2960 implementation and we must regret that ICL have not given sufficient care to genuine hardware compatibility between various models in the 2900 range.

Notwithstanding the above, the EMAS 2900 project now forms our main hope of obtaining significant supplementation to EMAS from 2900 series hardware. An immediate consequence was that we required to connect 2900 machines to our terminal network. ERCC, with the help of the Computer Science Department, the Physics Department, and ICL, have implemented a New Range Peripheral Interface (NRPI) for

PDP11 equipment, and this has been used to connect a PDP 11/20 belonging to the Department of Computer Science to the AM1 interface provided on 2900 series which is a partial implementation of NRPI.

Finally we should report that we have been able to make weekend sessions available to a Computer Science project funded by the SRC. These sessions have consisted of the application of an interactive benchmark (from which the 'Glasgow' benchmark grew) to EMAS. EMAS was constructed with a sophisticated variety of internal monitoring aids and the combination of these with the externally observed behaviour as seen by the Edinburgh Remote Terminal Emulator (ERTE) has been applied to a variety of hardware configurations and software strategies. This has significantly advanced our understanding of the behaviour of complex interactive systems, knowledge which is being applied to both present and future implementations.

Local Communications

The year has been mainly one of consolidation and rationalisation. University funds were allocated which allowed two upper/lower case printers to be attached to the Network, one in the Central Area and one at JCMB. Modest enhancements in several Terminal Control Processors (TCP) have been possible and the Chemistry Department has allocated funds to install its own TCP in late 1977.

The 48K baud links mentioned last year are now in service, that to Buccleuch Place running at an effective 24K baud whilst the second to Appleton Tower currently supports the Computer Science TCP at 9.6K baud and will shortly also support both the Social Sciences and East George Square TCPs at the same speed. These latter developments, together with similar developments at King's Buildings and in Hope Park Square, are evidence of a move towards private on-campus wiring with a consequent reduction in GPO involvement. Funds have been allocated to develop the necessary line-driving equipment for these private links. There has also been a swing from GPO to private modems on GPO circuits and substantial University funds have been allocated to this end.

SDLC protocols continue to be supported in the local environment but regional implementation remains beset by delays. Latterly, however, a prototype has been running between the Edinburgh node and Buccleuch Place with some success. It remains disappointing that an obsolete 2780 emulator introduced two years ago to

support temporarily the traffic between EMAS and NUMAC pending SDLC support on the node remains the mainstay of this important link.

Edinburgh have also implemented and introduced on ERCC workstations the regionally agreed high-level protocols which define the Network Standard Interface (NSI). In this context we have also specified, provided software for, and commissioned two new workstations for the Research Councils, one at the Scottish Horticultural Research Institute, Invergowrie, and the other at the West of Scotland College of Agriculture, Ayr.

SRC funding became available during the year to effect a connection to the System 10 and so to DECNET, and also a link to the Rutherford Laboratory 360/195 complex. Hardware has been delivered and software development is now commencing. The link to DECNET will also permit an onward link to Dundee University's System 10 for certain users with specialised needs and Dundee have agreed to limited access.

Finally we can record the successful development of the Network Monitor. This project, based on a PDP-11 and partially funded by the Computer Board and the University, is now in regular service and allows detailed analysis of traffic on various links within the Network at large. It has successfully identified several obscure faults, including one on the Rutherford 360/195, and funds have recently been allocated to improve its portability.

System 10

The contract between the University and the SRC to run the Edinburgh installation was finally concluded and became effective from 1st December 1976 to 31st July 1980. Arrangements for the second year from 1st August 1977 have also been concluded and during 1977/78 we will negotiate the 'rolling' aspect of this contract. Under this arrangement the contract is reviewed every two years with a view to extension to a new four-year term or agreement to terminate.

Hardware upgrades to the installation during the year included a new disk sub-system and a substantial upgrade of the communication facilities. Links have now been established to both UMIST and the Rutherford Laboratory using DECNET protocols and a comprehensive network is now developing. Further hardware upgrades including more disk storage and a sophisticated plotter have recently been agreed.

The Department of Computer Science, where the machine is housed, have indicated that they wish to recover the space as soon as is reasonably possible and plans are being developed to relocate the installation within the ERCC. This will lead to a closer integration of both the staff and the communications facilities to our mutual benefit. The connection of the SRC Abacus project in Strathclyde University provides an example of these benefits: that project was able to share bandwidth on a regional 48K baud link. We would expect similar opportunities to arise in other situations.

Data Capture

The Centre's main data capture service has continued to be based on the CMC Key-to-Disk system located in Alison House. It has performed well during the year with very reliable hardware and a further improvement in work rate. While this has helped to offset the effect of further reduction in staff due to a frozen vacancy, we are now unable to exploit the full capacity of the system for much of the time, and longer delays than in the past arise with non-urgent work. However, users have benefited from the proximity of the new PDP 11/40 system which provides a rapid and reliable entry point into the network for their data.

The special-services PDP 11/40 computer, announced in our last report, has now been in service for nearly a year. Its capabilities have increased as new facilities have been added to the locally developed DEIMOS operating system. It has taken over nearly all the functions of the Satellite One system, though the latter is still being retained to provide a dedicated remote-job-entry station for the ICL 2980. The 11/40 is now operated on a three-shift basis, giving users remote access to EMAS, NUMAC, 2980, Cambridge, Rutherford and ULCC, in addition to a range of local services. Typically, 6,000,000 lines are printed weekly but it is a measure of progress away from the punched card that less than 10,000 cards are read on many days. Large data files are now generated on Key-to-Disk and held on magnetic tape; smaller files are prepared similarly or are punched on cards and read once into EMAS or OS and then processed on disk, often by a job detached from EMAS rather than submitted on cards.

Funds have been approved for the attachment of further equipment to the 11/40. During this year a new card reader interface, a Tektronix graphical display device, and additional core store have been installed, and in the coming year we expect to add paper tape equipment, a mark-sense card-reader, a graph plotter, larger disk capacity and interactive digitising.

Usage

On the NUMAC Service the Edinburgh University usage has only fallen slightly but the proportion due to file charges has risen substantially. Within the University a diminution in the use of NUMAC by the Physical Sciences has been compensated by a comparable increase in the usage by the Social Sciences. There is no significant alteration in the pattern of usage on the 4-75. (See Appendices A and B.)

Accommodation

Throughout the year ERCC continued to plan to move from Alison House into houses on the east side of George Square, with associated computing equipment to be housed in the basement of the Appleton Tower. Funds were made available, and work has started on the conversion of the houses in George Square. The new accommodation provides additional space and improved facilities for both staff and users. In addition, a covered link is being erected between 59 George Square and the basement of the Appleton Tower, thus providing a through route for students between their lecture rooms in the Tower and tutorial rooms in 55-7 George Square. Funds have not yet been allocated for the necessary conversion of basement space in the Appleton Tower into a new computer room.

In the James Clerk Maxwell Building some reconstruction work that became necessary to rehouse staff displaced by the introduction of the SRC System 10 was paid for from money obtained under the SRC contract. Work was also required to provide fire safety. Provision of the necessary funds was discussed with the Development Committee and the Computer Board.

At the Bush Estate various small adjustments to the building housing the ICL 2980 continued to be made throughout the year.

Staffing and Organisation

The future and functions of the PDP 15 were reviewed and it was decided to transfer the responsibility for the services provided on that machine to the Department of Computer Science. Support will continue to be provided to existing users but new users will be discouraged except insofar as their work can be done more appropriately on the PDP 15 than on any other machine.

The Finance Sub-Committee of the Edinburgh Computing Committee was given the additional remit of examining the staffing levels within the different ERCC functions. A Vacancies Committee was additionally established with the function of scrutinising all vacancies to decide whether they should be filled.

During the year, the Advisory Service reached and has subsequently maintained its full numerical strength. This has enabled advisors to provide the desired level of service to users and to devote sufficient time to make worthwhile individual contributions to other areas of the Centre's activities. Documentation now has more of the effort it deserves, as a result of the decision to second our Documentation Officer to the 2900 EMAS Team with responsibility for its documentation, and to appoint one of our most experienced advisors as an additional Documentation Officer, also on a full-time basis.

The RCO agreed in March that a replacement be sought for Dr John who had headed the Regional communications team. Attempts to recruit were unsuccessful and we had to look to our own resources. Dr Hay, with SRC assent, agreed to a role as part-time manager of a new communications project team which included both local and regional staff. The team is backed by a Network Policy Committee which first met in July and whose role will evolve during the coming year.

Appendix A (i)
 NUMAC OS Utilisation During 1976-77
 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	51167	21.70	£ 89,532.95	14.11	£ 29,942.33	36.76	£119,475.28	16.69
Glasgow University	80186	34.00	£260,313.54	41.01	£ 26,308.17	32.30	£286,621.71	40.02
Strathclyde University	30257	12.83	£186,593.99	29.40	£ 9,773.76	12.00	£196,367.75	27.42
Other Universities	444	0.19	£ 417.93	0.07	£ 162.77	0.20	£ 580.70	0.08
Research Councils	32730	13.88	£ 38,593.27	6.08	£ 8,772.43	10.77	£ 47,365.70	6.61
Treasury Supported*	10340	4.38	£ 12,651.42	1.99	£ 3,018.59	3.71	£ 15,670.01	2.19
Commercial Users	114	0.05	£ 203.52	0.03	£ 19.20	0.02	£ 222.72	0.03
ERC Regional Use	9930	4.21	£ 16,145.66	2.54	£ 1,918.79	2.36	£ 18,064.45	2.52
Overheads	20647	8.76	£ 30,251.80	4.77	£ 1,528.78	1.88	£ 31,780.58	4.44
TOTALS	235815	100.00	£634,704.08	100.00	£ 81,444.82	100.00	£716,148.90	100.00

*Includes Edinburgh University Data Processing Office

NB Jobs excludes file transactions

NB Newcastle not included

Appendix A (ii)
 Utilisation of NUMAC OS in 1976-77
 by University of Edinburgh and Research Councils

Faculty or Sub-Faculty or Research Council	Computer Transactions (excluding file storage)	Notional Cost	Proportion of Total Cost
		(£)	(%)
Arts	861	547.56	0.29
Divinity	2	0.61	0.00
Law	7	1.08	0.00
Social Sciences	12394	36623.06	19.01
Music	2	0.56	0.00
Medicine	3929	5385.88	2.80
Dentistry	305	298.06	0.15
Veterinary Medicine	262	120.94	0.06
Physical Sciences	12648	39933.87	20.73
Engineering	2135	3608.37	1.87
Biological Sciences	3591	5345.87	2.78
Miscellaneous	5618	9328.00	4.84
Data Processing Office	3771	7734.57	4.02
Computing Service (Local)	9413	18281.42	9.49
Computing Service (Regional)	9930	18064.45	9.38
ARC	27571	32347.25	16.79
MRC	2536	8809.92	4.57
NERC	2623	6208.53	3.22
	97598	192640.00	100.00
Other Universities	110887	483570.16	
Treasury Funded Users*	6569	7935.44	
Commercial Users	114	222.72	
	215168	684368.32	

*excludes Edinburgh University Data Processing Office

Appendix A (iii)
Breakdown of Usage of NUMAC OS Service
(370/168 and 360/65)

University of Edinburgh

Packages				Languages			
Name	Calls/week	% resource used	Average cost/call (£)	Name	Calls/week	% resource used	Average cost/call (£)
1. SPSS	154	6.61	1.02	1. FORTRAN (Edinburgh)	169	31.64	4.45
2. SORT	108	3.23	0.71	2. FORTRAN (IBM level G)	140	7.41	1.26
3. GENSTAT	30	0.59	0.47	3. IMP	60	7.41	2.94
4. ATMOL	26	27.61	25.27	4. WATBOL (batch Cobol)	60	0.25	0.10
5. BMD	18	1.26	1.67	5. PL/I	15	0.78	1.24
6. TRIP	14	1.00	1.70	6. FORTRAN (IBM level H)	1	0.07	1.67
7. MDS	14	0.24	0.41				
8. CAMAP	12	1.32	2.62				
9. ESP74	11	0.34	0.74				
10. LINEEDIT	8	0.08	0.24				
11. COAEDEX	3	0.04	0.32				
12. PURGE	2	0.05	0.59				
13. GLIM	1	0.01	0.24				

Research Councils

Packages				Languages			
Name	Calls/week	% resource used	Average cost/call (£)	Name	Calls/week	% resource used	Average cost/call (£)
1. GENSTAT	148	23.64	1.26	1. FORTRAN (IBM level G)	133	29.05	1.72
2. SPSS	27	2.71	0.79	2. FORTRAN (Edinburgh)	129	13.80	0.85
3. COMPREG	25	1.91	0.60	3. IMP	54	6.89	1.00
4. SORT	15	0.94	0.49	4. FORTRAN (IBM level H)	13	8.36	5.07
5. RGSP	13	2.05	1.24				
6. BMD	4	0.47	0.93				
7. ASYP2	3	0.51	1.34				
8. MPS	2	0.07	0.28				
9. GLIM	1	0.05	0.39				

Notes 1. Other package and language usage by either the University or Research Councils is insignificant. The total usage comprises:

	Packages	Languages	Utilities, etc.
Edinburgh University	42.38%	47.56%	10.06%
Research Councils	32.35%	58.10%	9.55%

2. The figures are derived from the period May to July, 1977.

Appendix A (iv)
 Analysis of Utilisation of 4-75
 in 1976-77

Faculty or Sub-Faculty or Research Council	Cost	Proportion of Total Cost
	(£)	(%)
Arts	13556.10	0.98
Divinity	1527.60	0.11
Law	207.93	0.02
Social Sciences	48962.31	3.55
Music	7.10	0.00
Medicine	34031.92	2.47
Dentistry	3990.53	0.29
Veterinary Medicine	977.39	0.07
Physical Sciences	677246.93	49.10
Engineering	47263.33	3.43
Biological Sciences	71633.81	5.19
Miscellaneous	84539.40	6.13
Computing Service (Local)	207752.49	15.06
Computing Service (Regional)	34883.54	2.53
ARC	66866.60	4.85
MRC	5251.95	0.38
NERC	37428.44	2.71
Other Universities	21043.73	1.53
Other Treasury Funded	18245.17	1.32
Commercial Users	3872.14	0.28
	1379288.41	100.00

Appendix A (v)
EMAS Service – Facts and Figures 1976-77

General	Average weekly interactive service	100 hrs
	Total number of accredited users	1,400
	Total number of student users	500
	Average weekly number of active users	800
	Average weekly notional income	£27,000
Performance	Average weekly system uptime percentage	99%
	Average weekly satisfaction percentage	99%
	Mean Time between failures (Hardware; 4/75's)	75 hrs
	Mean Time between failures (Software)	1,560 hrs
	Mean Time between any failure	25 hrs
Interactive Service	Average weekly number of console sessions	6,000
	Length of average console session	30 mins
	Average weekly interactive console hours used	3,000
	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	800
	Average CPU time used per job	250 secs
On-Line File System*	Total number of on-line user files	25,000
	Total amount of on-line user material	1,000 Mbyte
	Average number of files covered by backup	8,000
	Average file size	40,000 bytes
Archive Store	Total number of files on archive	115,000
	Total amount of archive material	6,000 Mbyte
	Average file size	55,000 bytes
	Number of archive magnetic tapes	400
	Average restoration time	10 mins
	Total size of on-line archive index	5.8 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 (1976-77)

(i) University of Edinburgh

Accounting and Business Method	Medical Computing and Statistics Group
Agriculture	Medical Physics
Anaesthetics	Medicine
Anatomy	Medicine (Western General Hospital)
Animal Health	Meteorology
Archaeology	Molecular Biology
Architecture	Music
Architecture Research Unit	Neurology
Artificial Intelligence	New Testament Language Literature and Theology
Astronomy	Nursing Studies
Bacteriology	Nursing Research Unit
Biochemistry	Ophthalmology
Botany	Otolaryngology
Business Studies	Pathology
Chemical Engineering	Pharmacology
Chemistry	Physical Education
Child Life and Health	Physics
Civil Engineering and Building Science	Physiology
Clinical Chemistry	Politics
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	Rehabilitation Medicine
Economics	Respiratory Diseases
Educational Sciences, The centre for Research in	Restorative Dentistry
Educational Studies	Social Administration
Electrical Engineering	Social Anthropology
English Language	Social Sciences, Faculty Office
Fire Safety Engineering	Sociology
Forestry & 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 Physiology
Human Genetics	Veterinary Surgery
Linguistics	Zoology
Mathematics	
Mechanical Engineering	

(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	Mammalian Genome 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
 Newcastle
 Nottingham
 Open University
 Stirling
 Strathclyde
 Swansea

Appendix C

Financial Statement for the year 1 August 1976 to 31 July 1977

	<i>Income</i>		<i>Expenditure</i>		£
	£	£	£	£	
Computer Board direct grants				Staff costs	
Recurrent grants:	Local	112 200		Academically related	402 724
	Regional	<u>418 500</u>		Other	303 783
		530 700		Casual	<u>41 166</u>
			617 789		747 673
Earmarked capital grants:	Local	12 500		Materials and services	
	Regional	<u>74 589</u>		Travel & subsistence	12 250
		87 089		Computer Materials	108 731
				External service charges & rentals	160 336
Fully charged-out services				Mainframe maintenance	303 371
Research Councils		161 846		Telecommunications	103 408
Commercial & Treasury supported		58 641		Engineering development	32 830
Edinburgh & other universities		3 767		Information & training	20 969
Edinburgh University DP Office		8 047		General expense	65 290
Ferranti software contract		1 710			807 185
ICL software contracts		40 723		<u>11 551</u>	795 634
Access to 2900 computers		<u>132 218</u>	406 952	less Stocks-in-hand	
				Overheads: Edinburgh University services	
SRC Contract				ERC	53 500
SRC gross payments		74 509		SRC	<u>14 000</u>
Recoveries of Edin Univ contribution & Sales		6 901			67 500
Residual income PDF 10 agreement		<u>4 167</u>			
			85 577		
Third & fourth shift charges				Transfer to Capital Reserve	38 000
Recoveries		5 633		Bad debts written off	301
Administration services		73 373		Balance due to SRC (in 1977/78)	22 943
Edinburgh University contribution		75 413			
Edinburgh University contribution		511 707		Balances carried forward	
Balances brought forward from 1975/76				Local	73 659
	Local	36 358		Regional	<u>67 912</u>
	Regional	<u>820</u>	37 178		141 571
					<u>£ 1 813 622</u>
					£ 1 813 622

