UNIVERSITY OF DUBLIN

TRINITY COLLEGE

COMPUTER LABORATORY

ANNUAL REPORT 1974/5

CONTENTS

Section 1 Introduction

In retrospect, 1974/75 was a year of austerity in which a continuation of normal growth in demand for service could be partially met only by further "tuning" of operations, both technical and financial. In the technical area, considerable effort was expended in the revision of existing software to make optimum use of the disk storage installed last year while control software techniques were developed which made possible the unattended running of the system to extend the availability of the terminal service without an increase in operating staff. In the financial area carefully timed bulk buying of supplies successfully reduced the impact of inflation while fixed-price lease contracts concluded last year for certain items also proved very valuable in this respect. Where possible, rented items were also replaced by newer equipment where this offered better performance for the same price.

The future, however, gives rise to increasing concern and while there were some indications that the question of major equipment replacement may soon receive more detailed consideration, the time scale required for both decision and delivery is likely to be dangerously long. It must also be stressed that our equipment costs are now very unrealistic for the computing capacity installed since repayment of the main capital cost finished in 1973/74 and replacement, even without expansion, will entail a major increase in costs.

Section 2 Machine Utilisation

2.1 Computer Activity

The two main features of computer activity during the year were the continued growth in the level of demand and the increasing use of the GUTS system. The overall growth in usage can be seen from Table 1 which reflects an increase of 47% in CPU time made possible partially by an increase in in operating hours but mainly by further software improvements

It can be seen that this increase took place almost entirely in the areas of Academic activity, up by 52%, and Systems Support which more than doubled. However, since two-thirds of the use recorded under Systems Support consist of GUTS user activity which cannot be more precisely analysed, most of the increase in this area is also attributable to a rise in productive work.

The number of hours during which GUTS service was available rose by 125% to 2,449.17 hours during 1974/5 and some details of this activity are provided in Table 3. From this it can be seen that 41,288 jobs were submitted to the system via GUTS representing 48% of the 86,600 jobs processed in total during the year. This does not necessarily represent 48% of the total time used since GUTS is more suitable for jobs of short duration but nevertheless it does represent a very sizeable fraction of the Laboratory's total work-load.

Another aspect of Table 1 which deserves comment is the fact that Library usage has shown an almost negligible increase and administrative use has actually dropped by over 5% in-spite of an increase in the volume of data handled, particularly in the Library area. This is an indication of the improvements which it has been possible to make in the programs concerned as a result of the equipment changes made last year and the use of the GUTS system for some work in these fields.

Table 4 which provides details of academic use by department is shown this year in a slightly modified form to include actual CPU time. It shows an increase of over 57% in academic use and some changes in the ranking of departments within the table. The actual increase in academic computing is significantly greater than might appear from the table because of the considerable amount of work now processed on the B1700 research and teaching processor located in the Department of Computer Science and which for technical reasons does not come within the scope of the usage recording programs on which the figures in this report are based. It is believed, however, that in addition to diverting much research work that might otherwise have been performed on the main system, this machine absorbed a very significant amount of undergraduate work during Trinity Term and prevented what otherwise would have been a major overload on the System/360.

Two other tables, Table 5 and Table 6, which analysis Library and Administrative computer use are also included for the first time.

Table 7 in this year's report indicates the total of 73.53 hours of maintenance time. This is the time during which the entire system was "down" and does not include those times during which breakdowns permitted the provision of a degraded service. The most significant aspect of this figure is the fact that it has increased by 32% over the previous year.

2.2 Ancillary Operations

Card punching activity for the year is shown in Table 8. It is interesting to note that inspite of the overall increase of 47% in computer usage, the total volume of cards punched has fallen by 4%, the decrease being most noticeable in the

academic sector where card volumes fell by 19% even though this was the area of greatest expansion. This is attributable to the impact of GUTS and the increasing volume of data now entered directly through terminals.

Table 3 gives an indication of the level of terminal activity and it can be seen that during the "log-on" requests were received 31,599 times and users spent a total of 12,356.32 man-hours working at terminals. Terminal use was closely monitored and based on observed demand one machine was moved to the Library in December 1974.

Analysis of Computer Use

Total Monthly CPU hours per User Category

Month	User Category				
	Library	Academic	Admin.	Outside	Systems Support
10/74	8.0669	115.7345	31.6492	3.6651	37.0709
11/74	12.9337	84.2707	14.3668	3.3302	27.4663
12/74	9.0933	96.5235	19.2266	3.1562	32.3339
1/75	13.0680	179.2528	21.4602	5.8124	39.6082
2/75	11.7391	116.0168	18.9321	6.5314	45.1125
3/75	10.9331	88.9813	22.0360	5.5171	43.9370
4/75	12.2607	105.8695	28.9564	5.8088	55.9146
5/75	14.2611	95.6155	27.3090	4.9101	50.3837
6/75	12.2288	101.8929	18.7823	7.1322	33.5771
7/75	22.1783	112.5050	20.0512	6.4505	43.9771
8/75	22.4599	139.4223	15.9469	6.6254	36.2594
9/75	7.3901	77.2426	21.3905	10.6294	42.1454
	156.6130 (151.5596)	1313.3274 (863.6173)	260.1072 (275.3117)	69.5688 (61.7168)	487.7861 (202.0765)

- This table shows the total demand on the Central Processing Unit, the main component of the system. It is an easily obtained measure of activity but must always be a fraction of the elapsed time and does not reflect the use of peripheral devices.
- Corresponding totals for 1973/74 are shown in brackets.
- "Systems Support" includes central software maintenance, etc., and 323.3258 CPU hours of GUTS usage, which it is not feasible to analyse, by Library, Academic and Administrative users.

Table 1

Analysis of Computer Use
Percent of Total Monthly Use per User Category

Month	User Category				
	Library	Academic	Admin.	Outside	Systems Support
10/74	4.11	58.99	16.13	1.87	18.90
11/74	9.08	59.19	10.09	2.34	19.29
12/74	5.67	60.20	11.99	1.97	20.17
1/75	5.04	69.16	8.28	2.24	15.28
2/75	5.92	58.50	9.55	3.29	22.75
3/75	6.38	51.91	12.86	3.22	25.63
4/75	5.87	50.70	13.87	2.78	26.78
5/75	7.41	49.68	14.19	2.55	26.18
6/75	7.04	58.69	10.82	4.11	19.34
7/75	10.81	54.84	9.77	3.14	21.44
8/75	10.18	63.17	7.23	3.00	16.43
9/75	4.65	48.64	13.47	6.69	26.54
Overall	6.85	57.42	11.37	3.04	21.32

- "Systems Support" includes time required for central software maintenance, central systems software operation; and "house keeping" activities. In addition, approximately two-thirds of it is comprised of certain GUTS usage, by Library, Academic and Administrative applications, which it is not feasible to analyse further.

- The percentages in this table are based on the CPU Times shown in Table 1.

Table 2

Analysis of GUTS Activity

Month	GUTS Availability (Hours)	Terminal - hours used	User "Log-on" Requests	Jobs Submitted via GUTS
10/74	115.22	738.83	1684	2441
11/74	132.23	874.18	1942	3277
12/74	181.48	857.60	1936	3017
1/75	205.42	1122.80	2595	3979
2/75	208.17	1442.93	3829	4531
3/75	184.53	1099.67	2941	3524
4/75	210.53	1253.10	3521	3902
5/75	225.70	1108.98	3116	3815
6/75	209.47	801.70	2303	2809
7/75	271.08	1061.15	2743	3708
8/75	239.77	959.52	2438	3142
9/75	235.57	1034.50	2551	3143
Total	2449.17	12354.96	31599	41288

Table 3

Analysis of Academic Use by Department

Department	CPU Hours*	Percent of Total Computer Use
Engineering	353.7129 (211.0756)	15.46
Computer Science	326.7595 (292.0870)	14.29
Statistics	226.7808 (177.4128)	9.91
Genetics	99.7048 (13.0818)	4.36
Chemistry	85.5445 (13.8396)	3.74
Graduate School of Engineering	42.7809 (21.6549)	1.87
Physics	41.1014 (52.1910)	1.80
Economics	29.2378 (18.0146)	1.28
Education	19.3135 (8.7265)	0.84
Physiology	16.9952 (0.0630)	0.74
Pure Mathematics	16.5705 (15.4672)	0.72
Geography	14.7412 (10.9532)	0.64
Applied Mathematics	13.9518 (6.8561)	0.61
Psychology	6.4314 (0.6325)	0.28
Biochemistry	3.5569 (0.9838)	0.16
Political Science	3.3684 (0)	0.15
Zoology	2.3886 (2.3203)	0.10
Botany	1.9152 (3.1511)	0.08
Pharmacology	1.8933 (2.5693)	0.08
Geology	1.3717 (3.6324)	0.06
Others	2.8961 (3.0083)	0.14
General Academic Use (Not specifically allocated)	2.3105 (5.8963)	0.11
	1313.3274 (863.6173)	57.42

* 1973/74 figures are shown in brackets

Table 4

Analysis of Library Use

Application	Percent of Total Computer Use		
	Development and Maintenance	Production	Total
Accessions System	0.44	1.25	1.69
Catalogue System	0.63	3.94	4.57
SDI Service	0.06	0.41	0.47
Other	0.12	-	0.12
Total	1.25	5.60	6.85

Table 5

Analysis of Administrative Use

Application	Percent of Total Computer Use		
	Development and Maintenance	Production	Total
Admissions	0.14	0.47	0.61
Student Records (Old System)	0.23	1.01	1.24
Student Records (New System)	1.15	-	1.15
Examination Processing	0.04*	-	0.04
Wages	0.27	1.17	1.44
Salaries	4.43*	-	4.43
Debtors Ledger	0.75	1.42	2.17
Creditors Ledger	-	0.29	0.29
Total	7.01	4.36	11.37

* Control of these activities has not yet passed from development staff to the Operations Section so it is not possible to differentiate between development and production machine usage.

Table 6

Computer Activity

Total System Elapsed Hours

Month	Machine Use				Maint-enance	Total Activity
	GUTS	OS Alone	Other	Total		
10/74	115.22	376.97	0.0	492.19	2.93	495.12
11/74	132.23	282.17	9.08	423.48	4.90	428.38
12/74	181.48	241.52	5.35	428.35	1.23	429.58
1/75	205.42	344.85	0.0	550.27	14.22	564.49
2/75	208.17	293.20	0.0	501.37	4.07	505.44
3/75	184.53	261.07	0.0	445.60	4.22	449.82
4/75	210.53	314.85	0.0	525.38	14.70	540.08
5/75	255.70	272.10	19.25	547.05	9.17	556.22
6/75	209.47	198.12	52.73	460.32	7.47	467.79
7/75	271.08	261.44	54.90	587.42	3.75	591.17
8/75	239.77	264.94	25.72	530.43	4.35	534.78
9/75	235.57	244.55	25.95	506.07	2.52	508.59
Total	2449.17	3355.78	192.98	5997.93	73.53	6071.47

GUTS : Gothenburg Universities Terminal System

O.S. : Operating System/360. This is the main multi-programming control program in use.

Other : "Stand-alone" use of the system without the normal control program.

Table 7

Data Preparation

Cards punched by Laboratory staff for	
- Academic Users	8600
- The Library	64500
- The Administration	184800
- Outside Users	12200
Cards punched by outside agencies :	20700
Cards punched by users themselves :	524000
Cards punched automatically by the computer :	398000

Table 8

Section 3 Application Development

3.1 Library

In the field of library work, 1974/5 was largely a year spent on the consolidation of the existing applications. Considerable work was carried out on the optimisation of existing procedures to take advantage of the current central equipment and software and the success of this is demonstrated by the fact that the computer time used by the Library during the year increased by only 3% although the volume of records handled and the cumulative size of the files increased by considerably more than this. Much effort was also spent on the documentation, for operational and maintenance purposes, of the existing applications and on the simplification of the associated procedures carried out by Library personnel.

One major innovation was the installation of a terminal in the Library in December 1974 to enable Library staff to directly enter and amend locally produced catalogue records. This was proved very successful and is now used so extensively that at peak times Library personnel must also use an additional terminal in the Laboratory.

3.2 Academic

The most striking feature of academic activity during the year was its continued growth and its ability to use as much computer time as could be made available to it. Clearly, saturation level has not yet been reached in this area which has accounted for most of the overall increase in usage of 47%.

A feature of academic use during the year was the noticeable effect of the research and teaching processor which relieved the central system not only of much computer science research activity but of a significant amount of undergraduate work during Trinity Term.

As mentioned in previous years, the limited establishment of the Laboratory has given rise to a method of working which tends to favour those users with technical computer ability. A strong effort was made during the year within the existing framework to improve the level of user service provided with the object of easing this situation and while it met with some success, a set-back was suffered in September due to unexpected staff turn-over in the Programming Group which provides this advisory service.

3.3 Administration

As in the case of Library work, most activity in the administrative data processing area was aimed at the consolidation and improvement of existing applications and the success of this is evident in the reduction of computer time for administrative purposes by nearly 6% inspite of the normal increase in volumes and a significant increase in development time due to program testing for the new student records system.

Development of this latter system by the Joint Working Group has proceeded satisfactorily although the implementation schedule was revised so that the new procedures will be introduced in Trinity after the post-registration processing for 1975/6 has been completed. No major difficulties were encountered in the integration of the different components of this system developed to a common standard by the computer centres in UCC, UCG, and College and it seems likely that such co-operative system development work may profitably be extended to other areas of administrative computer systems in the near future.

No new major applications were implemented during the year in the financial area although the ledger system was extended

to cover post-graduate fees and student incidentals and a number of changes were made to the payroll systems such as the modification of the wages programs to permit payment by cheque rather than cash. One particularly successful project was the use of the computer to analyse the salary file to assess the impact of proposed changes associated with national wage rounds and with the Devlin proposals together with the production of a "ready-reckoner" to ease the burden of implementing these. This latter document is now produced regularly when wage rounds become due and has also been made available to the NUI colleges.

Section 4 Central Service Development

4.1 Equipment

Since no additional capital was available during the year, equipment changes were limited to those which were possible within the existing rental budget. All changes made were in the field of data communication and were as follows. The existing IBM 2702 Transmission Control Unit was replaced by the newer IBM 3704 machine at approximately the same rental. This made possible the provision of one additional terminal entry port, the adoption of a common communications interface standard for all eight ports in the interests of operational flexibility, allows the operation of terminals at several transmission speeds, and since it is a programmable device, offers considerable scope for the future introduction of improvements tailored to local needs.

The introduction of the new Transmission Controller made possible the replacement of the existing six IBM terminals by seven Digital Equipment Corporation terminals of a more suitable type and at a cheaper price. These machines which have the added advantage of being Irish made, are a mixture of visual display units operating at over four times the speed of the older machines and printing terminals operating at twice the speed and with the added advantage of a line length compatible with the central printer.

Finally, the new standard interface made possible the use, within the College, of special direct link units built by the Laboratory to eliminate the pair of modems which would normally be required for each circuit at a cost of several hundred pounds each.

4.2 Software

During the year approximately half the system programming capacity of the Computer Laboratory was spent on the installation of new computer accounting system purchased from the Gothenburg Universities Computing Centre and

scheduled to record all computer usage from October 1st, 1975. This new system will provide a much greater measure of control and facilities for more extensive analysis of all computer work and will express all usage realistically in terms of cost. It requires each individual computer user to pre-register with the Laboratory and this was done for regular users in September in preparation for the changeover at the beginning of the College year. A feature of the system which may, unfortunately, become important in the future is its ability to set a limit on the amount of work which any one user may perform and therefore make possible the introduction of a rationing scheme if necessary. The balance of systems programming effort was spent in the introduction of performance and operational improvements on the existing system rather than on the introduction of new facilities. The performance improvements contributed significantly to an increase in the ratio of CPU time to Meter Time from 33% in 1973/4 to 44% in 1974/5 and the operational improvements included the introduction of software facilities to permit running of the GUTS system for extended periods without the presence of an operator in the Computer Room. The introduction of the new IBM 3704 Transmission Controller and of the new terminals also made considerable demands on the remaining systems programming capacity during the year.

Section 5 Other Activities

5.1 Teaching and Publications

Five issues of the Computer Laboratory Newsletter appeared during the year and one of these was accompanied by revised material for the Computer Laboratory Users' Guide.

A short course for users on "Job Control Language" was held in early April just before the beginning of Trinity Lecture term and was attended by users from several departments.

Mr. A. Tucker, Systems Analyst, continued his regular lectures at ASLIB courses and was guest lecturer at an international seminar on Library Automation held in Paris by IBM in October 1974. He also lectured on Library Automation to students on the Diploma in Information Studies course. The Assistant Director lectured on computing to fourth year medical undergraduate students and the Director lectured on Systems Management for two terms to M.Sc. students and on Data Processing to M.B.A. students in Michaelmas term.

A presentation entitled "Administrative Data Systems - A Co-operative Development Effort" was made by the Director and Assistant Director at the Conference of Irish University Administrators held in Cork in March of 1975.

5.2 Sale of Computer Services

The amount of computer time sold during the year showed a very slight increase over 1973/74 although this is not regarded as significant. The revenue from this activity shows an apparent increase from £6,520 in 1973/74 to £12,230 in 1974/75. This reflects in part the fact that the payback commitment to IBM under the terms of the Education Allowance Agreement is now much reduced due to the age of the machine together with the fact that provision for such payback made when closing last year's accounts were unduly conservative. It is not anticipated that a significant change in revenue will occur during the coming year.

5.3 External Contacts

The Laboratory was host to SEAS 75, the main annual conference of SEAS, the SHARE European Association, in September. This is a major event among European users of large IBM systems and was attended by 272 participants from 17 countries. The success of the event was due in no small measure to the excellent co-operation of the many college departments concerned in the provision of facilities and ancillary services. The Director continued to serve on the Executive Board of SEAS during the year.

System development staff from the Laboratory continued to participate in the activities of the Joint Working Group on Information Systems in co-operation with colleagues from all the NUI colleges and the HEA.

Close co-operation took place at an informal level with computer staff in UCC and UCD and an exchange scheme for the training of operations staff took place during the year with the latter institution.

The Assistant Director, Mr. Doherty, continued to play an active role in the planning of the Central Admissions Office and was appointed one of the College Directors on its board and an observer at the Central Council of UCCA in the United Kingdom.

Section 6 Future Developments

6.1 Short Term Development

The current financial situation will limit the expansion of service during the coming year to such improvements as can be achieved with existing resources. Efforts will continue to improve the throughput of the system by careful monitoring of the work-load and "tuning" the system to match it. It is also likely that operating hours may be slightly increased by the extension of "unattended" operation which should also provide more flexibility in matching operator schedules to the characteristics of the work-load to further increase performance. The Department of Computer Science is actively engaged in linking the research and teaching processor to the main system within the existing GUTS framework and the Laboratory has provided a medium speed entry port facility for this. This port will also be used by a terminal with off-line data recording capability in the Accountant's Office and work is in progress to transfer much of the financial data preparation work and data validation procedures to this machine thereby relieving pressure on Computer Laboratory facilities and providing a more efficient system with better control.

6.2 Long Term Growth

In last year's Annual Report the need for urgent action to initiate replacement of the existing system was stressed. The passing of yet another year during which the expected growth in demand has been maintained but no decision about system replacement taken has added further urgency to the problem. Some encouragement may be taken from the fact that additional information was requested by and supplied to the HEA in August of 1975 but bearing in mind the probable time it will take to reach a positive decision and the likely delivery time of one to two years for replacement equipment a period of further over-load and increasing risk of major system failure seems inevitable.

APPENDIX A

EQUIPMENT

The specifications of the equipment currently installed are as follows:

1 x IBM 2044 Model H Central Processing Unit with 262,144 bytes (256K) of core storage and with

- One Multiplexor Channel
- Two high speed multiplexor channels
- Single disk storage drive in CPU
- Store and fetch protection
- Floating point arithmetic
- Console printer keyboard
- Interval timer
- Commercial Feature (full 360 instruction set)
- High Speed General Registers

1 x IBM 2841 Model 1 Storage Control with

- File Scan
  and
- Record Overflow

1 x IBM 2415 Model 4, Magnetic Tape Unit and Control (2 drives) with 9-track compatibility, i.e., 800 b.p.i. tape at 15000 b.p.s. or 1600 b.p.i. tape or 30000 b.p.s.

1 x IBM 2821 Model 2 Control Unit (for 1403 printer)

1 x IBM 1403 Model 2 Printer with Universal
Character Set feature and interchangeable
Chain Cartridge adapter
Print Positions: 132
Maximum Rated Speed: 600 lines/minute
Chains: Normal - PN3
Also Available: TN modified for Library Use QN2.

1 x IBM 2501 Model B2 Card Reader with Card Image Feature

1 x IBM 1442 Model N2 Card Punch with Card Image Feature
Speed: 91 to 256 cards/minute depending on
number of columns punched.

8 x IBM 2260 Display Stations Model 1 with alphameric
keyboards

1 x IBM 1053 Model 4 Printer with pin-feed platen and
accelerated carriage return

4 x IBM 2311 Model 1 Direct Access Storage Units

1 x IBM 2314, 2312 and 2312 Model A1 Direct Access
Storage Facility (5 spindles)

1 x IBM 3704 Transmission Control Unit

2 x ASR 33 Teletype Terminals in user locations

4 x Decscope terminals in the Laboratory and user locations

3 x Decwriter terminals in the Laboratory and user locations

1 x B1700 System in the Department of Computer Science
comprising:

- B1714 CPU and SPO including 40K memory
- A9480-12 Dual Disk Unit
- A9115 Card Reader
- A9249.2 Line Printer

APPENDIX B

STAFF

The Laboratory has a staff of 26 organised as shown in Figure B.1. The functions of the main groups are as follows:

DEVELOPMENT STAFF

This section is responsible for the development of new applications, as follows:-

Systems Analysts study the requirements of new systems in the library and administrative fields and design computer based procedures to implement them.

Programmers write and test the computer programs called for by the Systems Analysts' designs. They also act as advisors to academic users who do their own programming.

Systems Programmers. Systems Programmers are responsible for the generation and maintenance of internal control programs needed to run the computer.

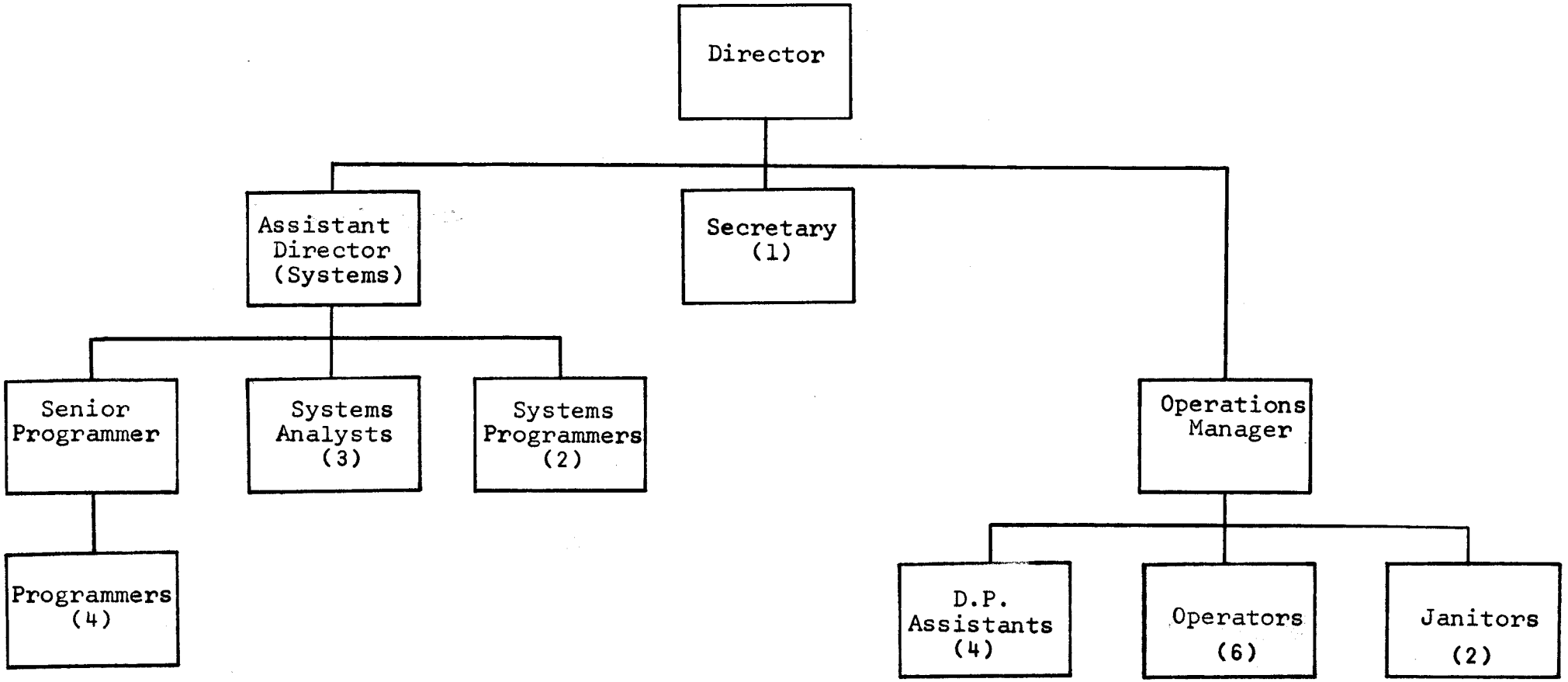
OPERATIONS STAFF

This section is responsible for the day-to-day operation of the Laboratory and duties are as follows:-

Data preparation and control is performed by Data Processing Assistants and consists of card punching and verification, reception and dispatch of work, and control of the magnetic disc and tape library and of documents in process.

Computer operation is performed by Operators who are normally organised into teams of two people, one of whom is shift leader. Operators work permanently on a shift rota.

Janitors work on permanent night shift and are responsible for general security.



C O M P U T E R L A B O R A T O R Y

O R G A N I S A T I O N

30th September 1975

Figure B.1

APPENDIX C

ACCOUNTS

COMPUTER LABORATORY

Year Ended 30 September 1975

	Actual	Budget
Cost of Staff:	£	£
- Salaries	91,061	98,000
- Wages	6,085	5,000
Rentals of Equipment	16,298	17,000
Purchases of Ancillary Equipment	13,640	12,200
Maintenance	15,392	14,000
Consumable Supplies	7,648	8,200
Cost of External Services	394	600
Insurance Charges	816	700
Miscellaneous Expenses	1,980	2,200
Recurrent Cost for Year	153,305	158,000

Income from Sale of Computer Services - £12,230

APPENDIX D

GLOSSARY

CPU	:	Central Processing Unit. The major component of the computer system which in the College System/360 is an IBM 2044.
CPU Time	:	Time during which the CPU is actively processing and not waiting for a peripheral device to complete some ancillary operation.
Elapsed Time	:	Overall time span from start to finish on the whole system. Individual components may not be active for all of this period.
GUTS	:	Gothenburg Universities Terminal System. A comprehensive set of control and service programs to permit the use of keyboard terminals for general computing purposes on an IBM system operating under O.S. with HASP.
HASP	:	The Houston Automatic Spooling Program. A Control program to marshal the queue of incoming jobs, schedule them for processing, and release their results to the appropriate output device. It works in conjunction with O.S.
Joint Working Group	:	The Joint Working Group on Information Systems established on TCD's initiative to share systems resources by the co-operative development of new systems which, when completed, can be operated independently by the participants who currently include the NUI colleges and TCD with HEA observers in attendance.
Meter Time	:	Time during which one or more jobs are active in the system, as recorded by meter.

Modem	:	Modulator-demodulator unit, one of which is normally required for signal conversion purposes at each end of a data transmission line.
OS	:	IBM System/360 Operating System. This is the main complex of control programs and program libraries needed to run the machine.
SDI Service	:	The current awareness service based on individual interest profiles operated by the Library.
SEAS	:	The SHARE European Association. A European association of scientifically oriented users of large IBM computers.