UNIVERSITY OF DURHAM

UNIVERSITY COMPUTING LABORATORY

REPORT OF THE DIRECTOR

1957/1958.

1, Kensington Terrace, Newcastle upon Tyne, 2.

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ANNUAL REPORT, 1957/1958

1. General.

In October, 1955, a circular from the University Grants Committee asked Universities to indicate their need for an automatic computer. Groups which had previously been considering computers independently in Durham and Newcastle combined to reply to the circular and as a result the University was told in April, 1956, that it might order a Ferranti Pegasus computer.

A report on the work to the end of the first year of any department necessarily contains a history of growth from nothing to normal activity. The University Computing Laboratory has experienced just this growth from the moment of ordering the computer, but strenuous efforts have been made to reach the normal state quickly so that full benefit could be obtained from the costly equipment that had been installed.

2. Building.

Several buildings were offered as accommodation for the computing laboratory by the Durham Colleges and King's College, and of those the one selected was the house occupied by the Bursar of King's College and his department. The date on which the Bursar could vacate the premises depended on the completion of a chain of moves within King's College; I wish to thank all those involved at any stage for enabling this completion by the target date. Even warmer thanks must go to the Bursar for allowing the contractors to demolish an important part of his building before he had moved. The construction of the computer room and the other modifications were continued into November, 1957. It is only due to the continuous attention of the architects, Messrs. W. B. Edwards and Partners and the cooperation of the contractors, Messrs. Harry Kindred (Newcastle) Limited, that the computer room was ready to receive the computer when it arrived on 1st November, 1957, the first day of the month in which Messrs. Ferranti Limited had promised delivery eighteen months previously. The computer room had been designed with a removable section in the rear wall so that the computer could be carried whole into the room; the engineers sent by Messrs. Ferranti Limited were thus able to install the computer quickly - it

was passing its acceptance tests unofficially several days before its examining board could congregate. The computer was handed over to the University on 25th November, 1957.

3. Appointments.

Dr. H. I. Scoins, M.A., D.Phil., and Dr. P. A. Samet, B.Sc., Ph.D., were appointed to lectureships in the laboratory. Dr. Scoins was previously in the Theoretical Physics group, King's College, while Dr. Samet came from the Royal Aircraft Establishment, Farnborough.

Mr. J. Eve, B.Sc., who was a research student with Dr. Bolton, Physics Department, King's College, was appointed as Research Assistant; during the year Mr. Eve's thesis entitled: "Theoretical studies of electronic interactions in atomic systems" was accepted for the Ph.D. degree of this University.

The post of Computer Operator was filled by Miss E. D. Barraclough, B.Sc., who had worked on a Pegasus computer at Messrs. Armstrong Whitworth Limited, Coventry.

Mr. R. W. Walker and Mr. L. Mitchell have been appointed Computer Engineers.

4. Donations.

We are most grateful for the generosity of Messrs. Merz & McLellan, C. A. Parsons & Co. Ltd., and A. Reyrolle & Co. Ltd., whose gifts greatly assisted the University with the capital cost of the computer.

5. Official Opening.

The laboratory was officially opened on 21st January, 1958, by Sir George Thomson, LL.D., Sc.D., F.R.S., O.M. in the presence of representatives of some local industrial organisations and of the University. Sir George named the computer FERDINAND, (Ferranti Digital Numerical Analyser Newcastle and Durham) by causing it to display its name in outline on paper tape. This name had been suggested by Mrs. H. C. Bolton. Later in the day the computer was demonstrated to many visitors from both within and outside the University who had braved the snow-storms.

Those attending the official opening were:-

Sir George Thomson.
The Vice-Chancellor.
The Pro-Vice-Chancellor.
Dr. A. T. Bowden (representing C. A. Parsons & Co. Ltd.)
Mr. J. Christie (representing A. Reyrolle & Co. Ltd.)
Mr. W. Dixon (representing Merz & McLellan).
Dr. C. Rounthwaite (representing Head, Wrightson & Co. Ltd.)
Mr. J. G. Hopkins (representing Thomas Hedley & Co. Ltd.)
Mr. S. de Ferranti.
Professor G. S. Rushbrooke.
Professor W. F. Cassie.
Professor J. L. Burchnall.
Professor G. D. Rochester.
Dr. K. Mitchell.
Mr. E. Smart.
Professor W. B. Edwards, Architect.
Mr. E. M. Bettenson, Registrar.

6. Lecture Courses.

The lecture courses offered by the laboratory are of two types in content; the first teach methods of programming the computer, while the second deal with mathematical methods appropriate for automatic computers and topics in the theory of computers and their applications. Courses of both types have been arranged for members of the University and for interested persons from industry. Limitations of space and the number of applications have forced the duplication and even triplication of courses so that usually the University and industrial courses have been distinct; in future, if there are vacancies on a course aimed at one group, applications from members of the other group can be accepted, while if the course is full, an effort will be made to provide an additional course. With these restrictions, members of the University may attend courses without fee.

Before Ferdinand arrived and even before the laboratory had been established, programming courses had been held in Newcastle and Durham. Accordingly, when the machine began operation on 29th November, 1957, about 130 people had received an introduction to its use. Subsequently, many of these returned to gain practical experience with the computer and to use it for their problems. One programming course has been held at Middlesbrough in conjunction with the Constantine Technical College. The experience with the first programming courses and with those held later in the laboratory, has shown how valuable is the student's early practice on the computer itself and the machine time allotted to students on courses has been steadily increased.

After the degree examinations, two short courses on a simplified method of programming were held for undergraduates. These are believed to be the first undergraduate courses offered in a British University, but the interest shown in them was so great that similar courses will be arranged annually. It should be noted here that programming courses which are intensive and which include considerable practical work on the computer in the laboratory impose a great strain on all members of staff and it has been very pleasing to observe the way in which the heavy load has been borne.

Of the second type of course, the principal ones have been those on Numerical Analysis to students in the final honour schools of Mathematics in both divisions of the University. These courses have been attended also by members of staff and post-graduate students in other departments. For the principal scientific applications of automatic computers, a sound knowledge of the methods of numerical analysis is essential and courses of honours standard will continue to be arranged.

Appendix I shows the full list of courses held.

7. Library.

A library of books and journals on computing and allied topics has been collected in the laboratory and, under Dr. Samet's attention, the collection is growing rapidly as the volume of material published swells. The library contains volumes of mathematical tables for reference only, but most of the other books are available for short-term loan.

The accessions to the library have been catalogued by the staff of the King's College Library and I wish to thank the Librarian of King's College for enabling the existence of our books to be recorded in both the King's College Library and the Science Library at Durham.

Permission has been obtained from the copyright owners, Messrs. Ferranti Limited, to duplicate the specifications of Pegasus Library sub-routines; Dr. Eve has prepared this material for printing by the Printing Department of King's College and it is now possible for any University user of the computer to borrow a set of specifications for as long as necessary.

Many manufacturers have sent details of their computers and technical manuals for the library; this literature is much appreciated and I hope that they will continue to communicate developments.

The following gifts of books have been received and warmest thanks goes to all the donors. It is sad to record the death of one of our benefactors, Professor D. R. Hartree, F.R.S.; his leadership in the field of automatic computing will be greatly missed.

Donor	Volume
Professor Hartree.	Proceedings of the Conference on Automatic Computing Machines, Sydney, August, 1951.
Mathematics Laboratory, Cambridge.	EDSAC 2.
Manchester University.	Mercury Autocode.
Army Research Development Establishment.	High Speed Digital Computer AMOS Intercode Handbook.
Messrs. Ferranti Limited.	Conference on Linear Programming.
Messrs. International Business Machines Limited.	Linear Programming - Computation Seminar, 1949, 1950 and 1951. (On permanent loan).
Messrs. Remington Rand Limited.	Annotated Bibliography on Large Scale Digital Computers.

In addition, Dr. Gilles, Glasgow University, enabled the library to buy a copy of the Index of Mathematical Tables while awaiting the appearance of a new edition, and Dr. Mitchell, King's College, helped the library to obtain a complete set of the journal, Mathematical Tables and Aids to Computation.

A list of the journals in the library is given in Appendix 2.

8. Colloquia.

Colloquia arranged by Dr. Scoins have been held at approximately fortnightly intervals during term. The topics have ranged from specialist ones on the speaker's recent research to general descriptions of the applications of automatic computers in particular fields. The meetings have been well attended by members of various departments of the University and by visitors from industry. We are grateful to all the guest speakers for their interesting lectures and the stimulating discussions that they provoked.

Mr. J. H. Wilkinson.	National Physical Laboratory.	"Problems which computers have made trivial".
Dr. D. C. Gilles.	Glasgow University Computing Laboratory.	"Experiments in the solution of Eigen-Value Equations with Infinite Boundaries".
Dr. S. Gill.	Ferranti Limited, London.	"Horner's Method in Binary Arithmetic".

Professor W. G. Bickley.	Imperial College, London.	"Some Matrix Methods for the solution of Partial Difference equations".
Dr. E. S. Page.	Durham University Computing Laboratory.	"The distribution of the number of vacancies on a line".
Dr. D. W. J. Cruickshank.	Leeds University, Chemistry Dept.	"Calculations in Crystallography".
Mr. R. P. B. Yandell.	Powers-Samas, London.	"The logical design of the Powers-Samas Program controlled computer, (P.C.C.)"
Dr. C. M. Reeves.	Imperial Chemical Industries, Billingham.	"Algebra, the arithmetic of labels".
Dr. S. Vajda.	Admiralty Research Laboratory, Teddington.	"Linear Programming".

9. Visitors.

Among visitors to the laboratory during the year, in addition to those whom we welcomed on the open day, were:-

Dr. M. V. Wilkes, F.R.S., Director, University Mathematical Laboratory, Cambridge.
Mr. J. Corner, Atomic Energy Authority.
Mr. D. W. Hooper, Chairman, British Computer Society.
Major R. Miles, Chairman, Head, Wrightson & Co. Ltd.
The Duke of Northumberland, Chairman of Court of the University.
Lord Ridley, Chairman of King's College Council.
Emeritus Professor W. E. Curtis, F.R.S.
Emeritus Professor Sir Westcott Abell, K.B.E.
Mr. A. J. Barnard, City Treasurer, Norwich.
Professor C. Orloff, University of Belgrade.
Professor P. C. Hammer, University of Wisconsin.
Dr. P. A. Young, Director of Research, Head, Wrightson & Co. Ltd.

10. Staff.

During the early part of the Michaelmas Term Dr. Scoins worked in the Mathematics Section of the National Physical Laboratory, Teddington; Dr. Scoins's visit was the first acceptance of an invitation from the N.P.L. to all University Computing Laboratories and I wish to thank the Director of the N.P.L. and the staff of the Mathematics section for making the stay such a profitable one.

Dr. Samet attended a symposium on "Mechanical Translation of Languages" in April, 1958, at Birkbeck College.

Dr. Scoins and Dr. Eve visited Glasgow for a lecture on "Parallel Programming" by Dr. Gill.

Drs. Page, Samet and Eve attended the International Mathematical Congress at Edinburgh in August, 1958.

Dr. Eve and the Computer Engineer, Mr. R. W. Walker, attended a course on the engineering aspects of the computer at Messrs. Ferranti Limited.

Members of staff have lectured and demonstrated Ferdinand to groups of University colleagues in visits arranged by the A.U.T., and to members of the Mathematical Association, British Computer Society, Office Management Association and King's College Engineering Society.

Dr. Page lectured to members of Glaxo Laboratories Limited at Barnard Castle. Requests for similar lectures and demonstrations have been more numerous than it has been possible to arrange; this demand shows a pleasing interest in automatic computers and it is hoped that all those wishing to visit the laboratory will be able to do so in the near future.

11. Research Activities.

Dr. Page has completed his work on the distribution of vacancies on a line and has prepared a paper for publication. Miss Barraclough and Dr. Page have calculated tables of characteristics of sequential tests for a normal distribution and have studied the accuracy of the Wald approximations. This work is being continued.

Dr. Scoins has begun an investigation of methods of solution of Laplace's equation for general boundaries; Dr. Samet has started work on the transliteration of Braille; Dr. Eve is considering some combinatorial problems arising in theoretical physics.

During the year he spent in the University, Mr. J. M. Henley completed a widely applicable simulation programme for the single server queue.

Complete programmes and subroutines for general use have been prepared by members of staff and others working in the laboratory. The routines available include the solution of the Fredholm integral equation of the second kind by an iterative method (E.D.B.) and by finite differences (E.S.P.); input and output routines (E.D.B., J.E., and P.A.S.), diagnostic programmes (G. C. J. Midgley), complex arithmetic interpretive routine (G.C.J.M.) and demonstration programmes (E.D.B., P.A.S., and H.I.S.), difference tables (E.D.B.) and Fourier Synthesis (P.A.S.)

Among the calculations programmed by other members of the University were gravity terrain corrections (M. H. P. Bott, Geology, Durham), crystallographic structures (H. Stadler and colleagues, Chemistry, King's), a model in geomagnetism (F. J. Lowes, Physics, King's), a model of primrose evolution (J. L. Crosby, Botany, Durham), hydrodynamical flow (G. Eason, Mathematics, King's), Andrade creep (J. Congleton, Metallurgy, King's) and X-Ray dose distributions (M. J. Day, R.V.I.)

The following Publications have appeared during the year:-

J. Eve: A theoretical study of the fluorine molecule: (Proc. Roy. Soc. A, 246, p.p. 582-589, 1958).

E. S. Page: A Note on Round Off: (Computer Journal, 1, 10, 1958).

E. S. Page: Quality control Abstracts. (New York, 1958).

H. J. Godwin and P. A. Samet: Table of Real Cubic Fields: Read by title March, 1958: To appear in Proc. London Math. Soc.

12. Use of the Computer.

The performance of the computer throughout the year has been most satisfactory and credit is due to the engineers, and in particular, to Mr. H. D. Bowes of Messrs. Ferranti Limited, who has been in charge of maintenance for most of the period; the proportion of good machine time to the total time available weekly has been well above ninety per cent. with very few exceptions.

For several weeks after the computer was handed over a considerable amount of machine time was unused; the idle time in each week has decreased progressively and by the end of the year it had been necessary to run the computer occasionally in the evening. Initially just one industrial user required the machine; as a result of courses held in the laboratory, other firms have begun to use the computer. A similar pattern has been observed with University users; initially one member of a department has obtained results from the computer and subsequently, others have brought their computations to the machine. The laboratory staff have programmed a few calculations for other members of the University, but this is a restricted service which can only extend to those problems for which most of the programmes already exist, or which bear on the research interests of a member of the Computing Laboratory. Members of the following departments have developed production programmes for the computer:-

King's College.

Chemistry, Education, Mathematics, Mechanical Engineering, Metallurgy, Philosophy, Physics, Royal Victoria Infirmary, Zoology.

Durham.

Botany, Geology, Mathematics.

The machine time used by the University greatly exceeds that used by industry. This experience confirms the emphasis that was envisaged when the laboratory was established; important as the industrial side of the laboratory's work is for its financial assistance, the principal activities of the laboratory are those of an academic department of the University, and as such it is right that the principal part of its cost is borne by the University.

E. S. Page.

APPENDIX I

LIST OF COURSES HELD

DATE	TITLE	LECTURER	LOCATION	NO. OF PERSONS ATTENDING	
				UNIVERSITY	INDUSTRY
Epiphany and Easter, 1957.	Programming	Dr. E. S. Page Dr. J. Eve	Newcastle Durham	35 15	
Epiphany and Easter, 1957.	Programming	Dr. E. S. Page Dr. J. Eve	Newcastle Durham		73 20
Michaelmas, 1957.	Programming	Dr. E. S. Page Dr. J. Eve	Middlesbrough		31
March, 1958.	Programming	Staff of the D.U.C.L.	D.U.C.L.		15
Epiphany and Easter, 1958.	Programming	Dr. P. A. Samet	D.U.C.L.	20	
Epiphany and Easter, 1958.	Programming	Dr. H. I. Scoins	Durham	12	
January, 1958.	Advanced Programming	Staff of the D.U.C.L.	D.U.C.L.		24
Epiphany, 1958.	Advanced Programming	Dr. E. S. Page Dr. J. Eve	D.U.C.L.	12	
May, 1958.	Simplified Programming	Staff of the D.U.C.L.	D.U.C.L.		16
June, 1958, Two Courses.	Simplified Programming	Staff of the D.U.C.L.	D.U.C.L.	69	2
Michaelmas, 1957. Epiphany, 1958.	Numerical Analysis	Dr. H. I. Scoins	Newcastle	1	18
University Year 1957/1958.	Numerical Analysis for Maths. Honours.	Dr. E. S. Page Dr. H. I. Scoins Dr. P. A. Samet	Durham D.U.C.L.	10 9	

APPENDIX II

LIST OF JOURNALS

Mathematical Tables and Other Aids to Computation.

Journal of the Association for Computing Machinery.

Communications of the Association for Computing Machinery.

Computers and Automation.

Computer Bulletin.

Computer Journal.

I B M Journal of Research.

Machine Translation.