

Computing at Heriot-Watt

The Early Years, 1960 to 1970

While attending a Computer Science reunion dinner recently [*19th August 1995, Class of 74*] and listening to some of the reminiscences, it suddenly struck me quite forcibly that the early history of the development of computing at Heriot-Watt had never been put into writing and that I was probably the only surviving pioneer with a possession of the necessary knowledge of these exciting early days. This is an attempt to rectify the situation. Some of the dates may be slightly in error since the detail is coming from memory and not from any document archive.

I joined the Department of Mathematics at Heriot-Watt in September 1960, one of several new mathematicians to arrive at around the same time. A number of members of the department seemed to have left almost simultaneously prior to our arrival, leaving only the Head of Department, Raymond Smart, and his deputy, Tom Scott. I have many fond memories of these early days at Heriot-Watt, the old and new members of the department quickly developing excellent working and personal relationships.

The Ferranti Sirius Computer System

Shortly after my arrival, we heard that the Scottish Education Department had agreed to fund the acquisition of a Ferranti Sirius digital computer for Heriot-Watt. This news was received with considerable excitement, since most intensive computational activities were performed at that time using Facit desk machines, involving a considerable amount of manual “handle turning” to perform even simple arithmetic calculations. The Sirius was therefore the first “real computer” at Heriot-Watt, certainly of the digital variety, although I vaguely recall the existence of at least one analogue computing device in Engineering.

To prepare for the arrival of the Sirius, it was decided that Tom Scott and I should attend a Sirius machine code programming course offered by Ferranti. The course was held in central London in July 1961. I remember finding it extremely challenging, since mastering both programming concepts and the detail of low level machine language for the first time is quite demanding. However, the intellectual effort was more than compensated by the thrill of realising that it was possible to make a machine perform a wide variety of different activities, hence the term “universal machine”, and I remember with particular pleasure completing the final course exercise - to write a Sirius machine code program to factorise any (small) integer. From that day, I was “hooked” and my own subsequent career changed direction.

The Sirius arrived in May 1961 and was installed in the basement of the Chambers Street building under the joint control of the Departments of Mathematics and Electrical Engineering. The latter department provided a technician, Bob Baxter, to look after the system on a day-to-day basis. I was given the responsibility of organising training courses, initially for members of staff. These were based on Sirius Autocode, a low level programming language by modern standards, but significantly easier to learn and use than machine code. The courses were typically of three days duration and various members of staff became enthusiastic Sirius users as a result.

The Sirius computer was, of course, primitive by today's standards. A "second generation" machine, meaning that it was transistor rather than thermionic valve based, the Sirius had a memory capacity of 4000 decimal digits, implemented using nickel delay line storage. It had neither magnetic tape nor magnetic disk secondary storage. All input and output was based on the use of paper tape. Creed teleprinters were used to prepare the input tapes and to convert the paper tape output into readable paper form. Users of the Sirius developed peculiar skills to enable them to make manual changes to paper tapes, either by covering up holes using opaque sticky tape or by inserting extra holes using a small hand punch. Despite its limitations and unreliability, the Sirius was quite heavily used, particularly during term time. It remained Heriot-Watt's main computer system until replaced by an Elliott 4130 in June 1969.

Use of Other Programming Languages and Other Computer Systems

After the installation of the Sirius, I remained for some time the only person in the Department of Mathematics with any significant interest in computing. This changed in the Autumn of 1963 with the arrival of Allen McTernan in the department. Allen was one of the most stimulating individuals I have ever met, with an incredible range of knowledge, interests and, most importantly, ideas. He had a remarkable capacity for being deeply involved in numerous activities and issues at any point in time, caring passionately about all of them. After his arrival, he and I became good friends and worked together extremely closely as colleagues. His name will feature regularly throughout the remainder of this account, since his contribution over the next few years deserves to be fully recognised. Sadly, the University lost a unique member of staff, with Allen's sudden and untimely death in December, 1989.

After his arrival, Allen quickly began to use the Ferranti Sirius and we agreed to share the running of the Sirius Autocode training courses now being offered to both staff and to students. Allen was also keen to introduce the use of other more modern programming languages, since Sirius Autocode had both major limitations and very little future. Our first initiative was to offer five day programming courses in Algol 60. Since the Sirius did not possess an Algol 60 compiler, any Algol 60 program written at Heriot-Watt was processed on an English Electric KDF9 system at the Regional Computing Centre at Edinburgh University. This took Heriot-Watt into the use of punched cards, rather than paper tape, and into the organisation of a van collection/delivery service.

The Algol 60 system on the KDF9 had some strange quirks. Even if your program did not require any input data, you had to provide at least one data item and read it in. I recall spending hours trying to find an obscure bug in an Algol 60 program, which turned out to be the mispunching of a zero data item, which my program did not actually require, as the letter "O".

Shortly after the introduction of Algol 60 as a programming language, it became clear that the needs of the various engineering departments could be better addressed by offering FORTRAN as an alternative. This led to the introduction of FORTRAN training courses and to the use of a Univac 1108 computer system at the National Engineering Laboratory in East Kilbride. Heriot-Watt was becoming multi-lingual.

A little later in the period covered by this document, we started to prepare for the arrival of the Elliott 4130 computer system referred to above. For a period of some months, prior to its delivery, yet another van collection/delivery service was put into operation, this time to the University of Stirling where a similar system had already been installed. The wonders of rapid, on-line access to remotely located computer systems had yet to be experienced.

Academic Developments

Academically, the early 1960s were extremely exciting at Heriot-Watt culminating in the granting of University status in 1966. I remember reading around that time a paper in the Communications of the Association for Computing Machinery (CACM) containing recommendations on the nature and contents of an undergraduate degree course in Computer Science. Using the model in this paper as a basis, I put together an outline course structure for an Honours B.Sc. degree course in Computer Science and submitted it to the University Senate for approval. The proposal was accepted, after a few minor changes, and the new degree course commenced in the Autumn of 1966, the first course of its kind in Scotland and one of the earliest to be introduced by any British university.

To take responsibility for this new course and for the ever growing requirement to provide a computing service for all university staff and students, the University established an independent Computer Unit in 1967 and I moved from the Department of Mathematics to head the newly created department. Not surprisingly, Allen McTernan also moved into the new organisation, as did Bob Baxter from the Department of Electrical Engineering. We relocated to the basement of the Chambers Street building in 1967 and we were soon joined by Hunter Davis as a Lecturer in Computer Science, Don Godfrey and Chris Crook on the programming side, and Kathryn Muir as Secretary. Other early arrivals included Moira Martin and Ian Hogg as Programmers, Ian Aitchison as a Lecturer, and David Marwick, initially as a Programmer for a few months before transferring to the academic side in June 1970.

Our accommodation in the basement of the Chambers Street building was, to put it mildly, far from ideal and required members of staff with high levels of tolerance and a well developed sense of humour. For example, the antiquated plumbing, which surrounded us, suffered badly from “water hammer” and emitted many loud, weird and wonderful sounds. As a result, new members of staff experienced a version of “Scottish pipe music” which rapidly lost its appeal after a few days.

Hunter Davis proved to be an excellent choice on the academic side and contributed greatly from the time of his initial appointment to the development of both undergraduate and, more significantly, postgraduate activities in Computer Science. Our first research student, Emil Kramer, joined us in 1968, leaving his home city of Prague shortly after the Russian invasion of Czechoslovakia. A 1-year M.Sc. degree course in Computer Science was introduced in 1970 and Emil Kramer duly graduated with a Ph.D. in Computer Aided Design in 1971.

These were exciting, challenging and exhausting times for those involved since there was so much to be done to build up both a new academic environment to support the B.Sc. and M.Sc. degree courses and to establish a proper computing service for the rest of the University based on obtaining approval to replace the Ferranti Sirius with a more powerful and more up-to-date computer system. In addition, prior to Heriot-Watt gaining University status, Allen McTernan and I had been working on one further important development which was reaching fruition around the same time. This is the subject of the next section.

For the record, a name change from “Computer Centre” to “Department of Computer Science” occurred in 1969, to reflect the importance of the development of the academic side of the department. A physical Computer Centre was also established in 1969 in a very old building in the Grassmarket, adjacent to the Mountbatten Building, to which we relocated from the bowels of Chamber Street. The replacement Elliott 4130 system, referred to earlier, was also installed in the new location. Lastly but most importantly, the first Honours graduates in Computer Science emerged into the wide world in 1970, as planned.

Computer Application Services (CAS)

From the very beginning, Allen McTernan and I shared a common vision of working more closely with the outside world. Staff were, of course, encouraged to engage in part-time consultancy activities but we both held the view that we could only fully satisfy the needs of external organisations, certainly in terms of computer based collaboration, if we could create a group within the department dedicated to this task on a **full-time** basis.

Fortunately, in the mid-60s, Allen and I had established a good working relationship with the Scottish part of the Ministry of Technology, having run short “computer literacy” education and training courses for some Min. Tech. staff. In particular, we got to know a senior civil servant, George Bloomfield, who proved to be extremely receptive to our ideas.

With George’s encouragement, we formulated and submitted a proposal requesting a grant of “pump prime” the creation of such a full-time consultancy group. To our delight, the proposal was approved and, at the beginning of 1969, the first members of the group “Computer Application Services (CAS)” were appointed, including Ian Dalton who was to play such an important part in establishing CAS as a viable entity. In his previous assignment, Ian had been heavily involved in using various computer systems for engineering calculations and computer aided design, including an AEI 1010 at the National Coal Board in Edinburgh and an IBM 1620 Model 2 at the University of St. Andrews.

Put simply, CAS was dedicated 100% to external consultancy and was expected to be fully self financing, except for the initial “pump priming” grant, through consultancy income. It was anticipated that approximately 50% of CAS income would come from technical consultancy and the other 50% from organisations involved in commercial data processing. The first year in the life of CAS showed these initial assumptions to be wrong since the bulk of the income was generated from technical consultancy only. As a result, some painful decisions had to be taken to ensure the survival of CAS and it was only through the professionalism and dedication of Ian Dalton that CAS came through this difficult period. Remarkably, CAS has continued to survive and prosper for over 25 years now, unlike many companies in the computer industry which have failed to adapt to rapid and never ending technological change.

In Retrospect

In retrospect, the period from 1960 to 1970 was one of great significance and excitement in the history of Heriot-Watt and in the development from scratch of computer related activities. By the end of that decade, an excellent foundation had been put in place based on three separate but synergistic initiatives. Firstly, the academic subject of Computer Science had been established both at undergraduate and postgraduate levels. Secondly, a healthy service oriented Computer Centre had been created to support the computing needs of all staff and students at the University. Thirdly, through the development of Computer Application Services (CAS), the University was well placed to support external organisations requiring assistance to solve challenging technical problems through the use of computer based techniques.

I count myself privileged to have been in the right place at the right time to play a major role in these exciting and rewarding developments. This account has also tried to identify some of the other “key players”, but there are also many other “unsung heroes” who made significant contributions during this period.

Acknowledgements

My thanks to Hunter Davis and Ian Dalton who perused the first draft of this document, corrected some dates, and contributed some additional facts and memories.

Alex Balfour

August, 1995