Computer Conservation Society

Aims and objectives

The Computer Conservation Society (CCS) is a co-operative venture between the British Computer Society, the Science Museum of London and the Museum of Science and Industry in Manchester.

The CCS was constituted in September 1989 as a Specialist Group of the British Computer Society (BCS). It is thus covered by the Royal Charter and charitable status of the BCS.

The aims of the CCS are to

- ◇ Promote the conservation of historic computers and to identify existing computers which may need to be archived in the future
- ◇ Develop awareness of the importance of historic computers
- ◇ Encourage research on historic computers and their impact on society

Membership is open to anyone interested in computer conservation and the history of computing.

The CCS is funded and supported by voluntary subscriptions from members, a grant from the BCS, fees from corporate membership, donations, and by the free use of Science Museum facilities. Some charges may be made for publications and attendance at seminars and conferences.

There are a number of active Working Parties on specific computer restorations and early computer technologies and software. Younger people are especially encouraged to take part in order to achieve skills transfer.

Resurrection

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News Round-Up

The splendid achievement of the Bombe Rebuild team was recognised at a formal ceremony at Bletchley Park in April, when BCS President John Ivinson presented the team with a commemorative plaque. The occasion was the AGM of the BCS Specialist Groups. Outgoing CCS President Ernest Morris and Bombe Rebuild Project Leader John Harper both made presentations at the event.

- 101010101 -

Roger Johnson is the new Chairman of the Society, following his election at the AGM in May. Roger is a founder member of the Society, who served on the Committee as Treasurer from the beginning in 1989 until he stood down to concentrate on his duties as the President of the BCS. He has remained on the Committee ever since. Roger is also a member of the BCS Council, and Honorary Secretary of IFIP.

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We are happy to report that immediate past Chairman Ernest Morris has agreed to remain on the Committee.

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Two former past Chairmen, Graham Morris and Brian Oakley, both decided to step down from the Committee at the AGM. We wish them well in their retirement.

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Membership of the Society stood at 762 at the time of the AGM.

In his valedictory Chairman's address at the AGM, Ernest Morris made a point of thanking all members who have paid the voluntary subscription over the past year. As a direct result, the Society's finances were healthier at the end of the financial year than they had been at the beginning.

- 101010101 -

There is now a Web site for the "Our Computer Heritage" project (discussed in full in this issue on pages 12-14). Readers can keep up to date by accessing <www.ourcomputerheritage.org>.

- 101010101 -

Users of the Pegasus simulator PegEm will be pleased to know that at last we can provide versions of the key Pegasus documents on CD-ROM. These include the Pegasus Programming Manual by George Felton, the Pegasus Library Specifications and the Pegasus Library Programmes. Chris Burton has scanned all these documents and converted them to PDF (Portable Document Format) images. He will send the CD to anyone who wants it upon receipt of £4.00 to cover media, postage and packing, with deliveries starting in late September (for contact details see page 28).

- 101010101 -

An article describing "the rescue of the 1986 BBC Domesday system from its technology dead-end on videodiscs and the BBC micro" has been published in the quarterly Web journal *Ariadne*, and can be accessed at <www.ariadne.ac.uk/issue36>.

- 101010101 -

Ted Codd, widely accepted as the prime driving force behind the development of the relational database, died in April aged 79.

Bombe Rebuild Project

John Harper

This report will include the normal update on progress and will also make a strong plea for help with our repetitive assembly work.

All 12 miles of cableform are fitted. Terminations are complete at the Jack Frame and at the three BTM plugboards that act as Umkehrwalze (reflectors). The pins that plug into the top and bottom of the Letchworth Enigmas are in place and will be inserted as Letchworth Enigmas are fitted. These Enigmas are now starting to take shape and we have produced our first assembly using specialised jigs. Wires and tags are available and are currently being made up into subassemblies. We could do with extra hands assembling these: please see below.

The Jack Frame is now complete, so other than not having any covers fitted the rear view of the machine is as if complete.

We are now successfully making the menu cable. The special plug mouldings are now around one third complete: the rest should be finished over the next three or four months.

Commutators are being made at a steady rate. This should allow all Letchworth Enigmas to be completed and fitted by this time next year. This will not quite be the end of the rebuild but the end will then be in sight.

Drums are the other major assembly task. We now have virtually everything in place in terms of materials, tools and jigs to be able to 'parcel out' more assembly work. Much is already in hand but more help is needed.

Other than the Letchworth Enigmas and the Drums, the lubrication system and relay and resistor section are still to be completed.

The lubrication system is a 'one shot' pumped arrangement which feeds 177 metering valves through small pipes. After some difficulty establishing what we needed, we are now making good progress. We now have a pump, which although not exactly the correct model will get us started. Various firms are providing the unions etc and we now have sufficient information to make the multi-way pipe unions starting with brass castings.

The relay and resistor section is making slow but sure progress. The manufacture of 104 high speed relays is well under way. A German firm has been able to supply the special resistor clips and these are currently being fitted. The other relays are being reworked or made with new coils. However we do not know, as yet, how to make special contacts involving precious metals. In one case these have to be welded to steel supports.

One thing that is now solved is our shortage of 'china' fuse holders. It turns out that these were an American standard fitting in the 1930s and 1940s. Our call for help on our Web site resulted in American supporters finding all that we needed.

One subassembly that we have not made much progress on is the Cross and Connect Plugs. These are often used between Letchworth Enigmas to cut down the number of menu cables used. However a menu can be plugged up without these, so as long as they are available in about a year's time we will not be delayed.

Returning to our call for help with assembly, it would not be reasonable to use up space in going into every detail. However here are some examples relating to drums.

- Fitting around 20,000 very small grub screws into brush supports;
- Using a special jig, feeding bunches of thin piano wire into ferrules, then crimping and cropping each set;
- Fitting these into the brush supports above and assembling these into a special pre-drilled disc.

These tasks can all be done 'on a kitchen table' using the jigs and any necessary hand tools that we will provide where required.

For those able to visit Bletchley Park, you need to be aware that we have moved the Rebuild to a better location, in fact to where the shop used to be. We are still in the process of settling in but soon hope to display various panels around the walls. Our Bombe can now be seen far better than before. The simple barriers go virtually all round so that all sides can be seen.

We are very proud to have received from the BCS a plaque in recognition of all the effort that the team has put in (see page 2).

Our Web site has been updated recently to include most of what is reported above. Please go to <www.jharper.demon.co.uk/bombe1.htm> and select 'Latest News'.

Contact: <bombe@jharper.demon.co.uk>.

Mil-DAP Working Party

Brian M Russell

We have just heard that, during one of the torrential rain showers at the end of July, the West Gorton Main Building roof sprang a leak (again). Water got into the store room at the back of the MTA workshop where the Mil-DAP is being stored. No-one has been in to check yet, but it seems likely that the Mil-DAP got wet. It should survive OK though — after all, it is in a military enclosure designed to stand up to salt spray in a warship or a helicopter!

Unfortunately, survival has not been the case for the commercial production of DAPs under CPP. In March, the owner of Cambridge Parallel Processing announced that he had had enough and would close the company down completely. No more DAPs will be made. He paid the remaining employees to the end of March but otherwise washed his hands of it leaving them with no redundancy or notice period payments. They even had to form a UK company themselves in order to acquire the assets and liabilities and then close themselves down. Otherwise it could have taken months before they could even apply to the government for their compensation. For the last few days while they had access to the office, they could only do some clearing up, collect some (limited) memorabilia and use the place as a job centre.

Some of the staff, including some of our ex-ICL colleagues who were the original inventors of the DAP, have found employment elsewhere, either in the computer industry or outside. Some have retired and some are still looking for jobs. We wish them and their families all the best for the future at this difficult time.

Where does this leave the working party? Some small progress has been made in trying to recover the DAP software from the Perq-1 which was so recently acquired from CPP. We can only push on to conserve what we can in the knowledge that the DAP has now become well and truly a part of history.

Software Conservation Working Party

Dave Holdsworth

George 3 now has some scanned documentation, and a CD should be available soon. Leo III optimism seems to have been unfounded. A full copy of ICL's VME/K has recently been unearthed.

CCS Collection Policy

The Committee of the Society has formulated a policy statement concerning procedures for dealing with computers of historical interest that come to the Society's attention. This is published in full below.

1. The Society has no Collection of its own, and no premises in which to house one. There is no intention to change this.
2. When the Society hears of historic equipment which is becoming available for conservation, it will attempt to find a suitable home for it in one of the following major collections:
   - The Bletchley Park Museum Trust
   - The Science Museum, South Kensington
   - The Museum of Science and Industry, Manchester
3. The Society will also alert other collections to the availability of surplus equipment, where the major collections are unable to offer to house it, if it fits the appropriate area of interest. Members who know of such collections are asked to ensure that the Secretary is aware of their location and subject matter.

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Timesharing History: a Researcher's Findings

John Deane

I must say that I don't have enough depth of historical reading to write anything approaching a thorough article on timesharing. The following items have come to my notice as part of a data gathering exercise to describe Australia's first timesharing computer, Cirrus. I expect this article will produce some indignant responses, but you should blame the editor for his encouragement!

The subject is not well covered in the historical material I have looked at — and what has been written is often wrong. Part of the problem is one of definitions, and another is that the necessary information may be hidden rather deeply.

As far as definitions go I do not intend to be very careful. My target system is a single processor handling interrupts and multiple user programs simultaneously. On the other hand, I am ignoring systems which support multiple users all running from the same application, such as Sage or Joss. I am also ignoring the history of interrupts — which could start with Stanley Gill's magtape subroutines for Edsac before 1955, or maybe the Dyseac or Univac around the same time.

I will present my findings as a timeline with comments. Please don't put too much faith in it — my selection is far from definitive.

1956 "Design Objectives for the IBM Stretch Computer" by S Dunwell (*Proc Eastern Joint Comp Conf* 1956, pp 20-22). This overview describes parallelism but doesn't suggest interrupts, let alone multiple user programs.

1957 "The Lincoln TX-2 Computer Development" by Wesley Clark of MIT (*Proc Western Joint Comp Conf* 1957, pp 143-145). This was developed from ideas in Sage and includes "instead of one instruction counter, the TX-2 has 32 such counters which are assigned separately to different users of the computer". Wow! That's impressive, though the following discussion suggests they hadn't worked through the details.

1957 "Parallel Programming" by Stanley Gill was a paper presented to the BCS on 16 Dec 1957: it is the first paper in the first edition of the *Computer Journal* (1/1, April 1958 pp 2-10). The paper discusses hardware interrupts with a single program, but the recorded discussion that follows includes timesharing.

1958 "System design of the Gamma 60" by P Dreyfus (*Proc Western Joint Comp Conf 1958*, pp 130-133). Not seen. Also Mark Smotherman says "The Bull Gamma 60 was the first multithreaded computer" and describes multiple processors but doesn't cover timesharings aspects clearly (see www.cs.clemson.edu/~mark/g60.html.)

1958 Honeywell announced the H-800 in 1958. This was an early (and much ignored) timesharing system, but I don't know what was actually announced in 1958! See www.cs.clemson.edu/~mark/h800.html.

1959 "Time sharing in large fast computers" by Christopher Strachey (*Proc ICIP*, Unesco, June 1959 pp 336-341). Those who don't ignore it take this as the fundamental timesharing presentation.

1959 John McCarthy "invented computer timesharing" at MIT in 1959 (*Encyc Comp & Comp Hist*, though other articles credit Strachey).

1959 B J Loopstra, Edsger Dijkstra and Carel Scholten wrote the software for the Dutch Electrologica X1. Maurice Wilkes identifies this as "one of the first commercial computers" to support timesharing ("Time-sharing Computer Systems", 1968). But sources I can find are vague about the X1's capabilities, ie
www.digidome.nl/electrologica_modellen.htm, and
www.science.uva.nl/faculteit/museum/X1.html.

1959 "Multiprogramming Stretch: feasibility considerations" by E F Codd et al in *Comm ACM* 2/11 1959, pp 13-17. This theoretical study emphasises interrupt handling and suggests that multiple users could be supported. It credits Gill, the Lincoln TX-2 work, plus Strachey, the Gamma 60 and other material in *Proc IFIP* June 1959.

1960 Honeywell H-800 first installation in December 1960: see www.cs.clemson.edu
and
http://ed-thelen.org/comp-hist/BRL61-h.html#HONEYWELL-800.
The second reference is a wonderful transcript of a 1961 survey which concludes "Unique system advantages include ability to run up to eight programs simultaneously without any special programming or special instructions". Also the "Honeywell 800 Executive manual", 1960, describes the timesharing hardware, which appears to be inspired by the French Bull Gamma 60, but simplified: see
www.spies.com/~aek/pdf/honeywell/H800_programmersRefMan.pdf.

1961 Orion appeared as a New Product (*Comm ACM* 4/2 Feb 1961, pp 110-113). This interesting item outlines the well developed timesharing design: "in general, probably four programs will be found to be the most usual combination to run at once, though provision is made for many more programs".

1961 "The simulation of the Orion timesharing system on Sirius" (*Computer Bulletin* 1961, 5/2, page 51). Not seen.

1961 CTSS demonstration by Fernando Corbato on an IBM 709 at MIT in 1961 after McCarthy's suggestions (*Encyc Comp & Comp Hist*). This was a somewhat crude user swapping system, but it worked.

1961 "The Manchester University Atlas Operating System, Part 1: Internal Organisation" by Tom Kilburn et al, *Computer Journal*, Vol 4, Oct 1961, pp 222-225. The prototype Atlas was working in "Autumn 1961", though the full timesharing system was not available until 1964 (it's one of my all time favourite machines).

1962 Cirrus ran in December 1962 at the University of Adelaide. The Cirrus team knew of Gill's and Strachey's papers, the Honeywell system and Atlas (at least).

1963 Ferranti Orion I first ran in January 1963, according to the Comprehensive Computer Catalog: see
www.aconit.org.hbp/CCC/cclist60.htm.

I'm not about to draw any neat conclusions from this!

Editor's Note: John Deane is a member of the Australian Computer Museum Society. He is currently researching an article on Australia's first timesharing computer, Cirrus, which was developed at the University of Adelaide. He can be contacted at <john.deane@csiro.au>.

Simulators

Simulators for a variety of historic computers, including Edsac, Elliott 903, Pegasus, the Manchester University Small-Scale Experimental Machine and Zebra, can be found at our FTP site. Access details are on page 18.

From Cog Wheels to Turbo Pascal

Don Hunter

In August 1933 DH Lehmer published a paper[1] in which he describes a machine with 30 cog wheels which he used to solve a problem in number theory in only 12 seconds.

Each wheel had a different prime number of teeth and a small hole drilled a little way inward from each tooth. The problem was to find a number, x, which made an expression a perfect square. Although the numbers in the expression ran to 18 decimal digit integers or so, the problem was solvable easily in modular arithmetic for each of the primes chosen for the cog wheels; it does need at least 18 wheels to reject spurious solutions.

The hole was plugged for each x making the expression a perfect square. The gears were driven by a common shaft and a flash of light was seen after 56523 had passed, solving the original problem.

I recall programming this in Pascal on a VAX/750 about 20 years ago and noticed that it also took 12 seconds! Recently I have repeated the problem on a 100MHz 486 PC with different languages, achieving the following results:

Language	*Time*
Turbo Pascal	1.5 seconds
Meridian Ada 83	4.5 seconds
RHA Algol	33 seconds
Erik Schonfelder Algol	13 minutes 32 seconds
Elliott 903 Algol	43 hours 33 minutes
Zebra Algol	too large for compilation

If anyone would like to try this please get in touch.

Don Hunter is at <don@gnhunter.demon.co.uk>.

[1] "A photo-electric number sieve", *Am Math Mo* 40, pp 401-406.

Our Computer Heritage

The presentation on the Society's project entitled "Our Computer Heritage" at the London Science Museum after the AGM in May attracted an audience of over 70 people, and was followed by a stimulating discussion.

Project chairman Simon Lavington was the principal presenter. He explained that the project was originally designed to provide an audit of all artefacts relating to early British computers. This audit would show what had survived, where it was stored and how to access it.

The word 'Artefacts' is to be interpreted in the broadest possible sense, including hardware, software, brochures, photographs, personal notebooks and memorabilia, audio tapes of pioneers and so on. Such artefacts are at present located in museums, libraries, company archives, government establishments, private houses and probably in other places too.

The scope of the audit is British computers designed and built in the period 1945-70 (see diagram). There were around 80 different types of computer in this period, ranging from one-off designs to quantity-production machines. In total, just over 2000 of these 80 designs were installed.

After discussion with partners and other interested bodies, a second objective has been added to the project: to provide some interpretation of what each of the items is, its contemporary context and its longer term significance. This would make the audit significantly more valuable, both to researchers and to non-experts. Information would be included on the destinations and applications of each commercially available computer that was delivered. The technical specification of each type of computer would be presented in a way that could be readily understood by modern users; the performance would be related to a wide range of past and present machines.

The CCS is fortunate to have attracted the support of several important partners for the *Our Computer Heritage* project. At the time of writing, these include: the National Archive for the History of Computing, the Science Museum (South Kensington), the Museum of Science and Industry in Manchester, the National Museums of Scotland and the National Archives (formerly the Public Record Office).

Diagram: Our Computer Heritage

The outcome of the project is to be a Web-accessible multimedia database, maintained by a host organisation which would supply the server and the resources needed to run it for a period of at least 20 years. The project's budget requirements are estimated to total around £300,000. Of this, approximately £120,000 would be sought from a grant-awarding body such as the Heritage Lottery Fund (HLF). A further £160,000 would be accounted for by just over 1000 days of volunteer labour, at an agreed notional equivalent of £150 per day. The balance of £20,000 would be contributed by a host organisation, which would also provide office space for three years. The volunteer effort would be mainly supplied by CCS members.

Initial talks with the HLF have suggested that the proposed project organisation and objectives are broadly in line with the criteria specified by grant-awarding bodies such as the HLF. The project team is currently evaluating possible host organisations and possible sources of funding. The BCS has expressed some interest in the project and has recently made certain proposals assisting the implementation. Discussions are ongoing.

The precise details of the project are still flexible, and the session after the AGM had the purpose not just of reporting progress to date, but also of stimulating discussion as to the best way forward. Representatives of partner bodies also gave their views, most notably Jenny Wetton of the Museum of Science and Industry in Manchester, who spoke of her experience with a forerunner exercise, the National Computer Collection Listing Project.

Other speakers included Mary Croarken (Warwick University), representing the National Archive for the History of Computing (NAHC) in Manchester, Jeffrey Darlington of National Archives (formerly the Public Record Office) in Kew, and Nick Webb, BCS Specialist Groups Support Manager.

The project team is looking for enthusiasts with specialist knowledge of specific machines who can help with the creation of the database. A number of these attended the presentation: anybody who did not and feels they can help should contact Simon at <lavis@essex.ac.uk>.

Family Ties: the DEC PDP-11

Kevin Murrell

Introduced in 1971, the PDP-11 provided the most complete and continuous series of compatible machines ever produced. From departmental systems to embedded controllers, the flexible design of the PDP-11 ensured a life of more than 30 years, with many systems still providing reliable service today.

Design Struggles

By 1970, Digital Equipment Co Ltd (DEC) had built a successful business on the PDP-8 series of minicomputers, but needed to produce a new system to counter offerings from Hewlett-Packard and Honeywell. While previous DEC systems all had a word size of a multiple of six bits, IBM had made the 8-bit byte the industry standard in 1964 with the introduction of the 360 mainframe series, so Digital's new machine was to have a 16-bit word size.

A new design, codenamed Project-X, designed by Ed DeCastro who had worked on the PDP-8, was started by Digital in 1967, but subsequently dropped. This led to DeCastro leaving Digital and forming Data General. Whether Data General's first machine, the Nova, was the Project-X machine or not, it soured relations between the two companies forever.

Work started again on the new design, this time known as the Desk Calculator project, a name chosen to avoid generating any interest from the rival PDP-10 team at Digital! By late 1969 the replacement design was very late, and Digital turned to its guru, Gordon Bell, who was on sabbatical at Carnegie Mellon University. Bell hated the initial designs but worked with Digital to produce the PDP-11, which was finally launched, on paper at least, in 1970.

The design goals were to have a wide range of machines in performance and extendibility, an increased addressing capability, a rich machine code, a generous set of working registers, and a fast and flexible interrupt system. Not all of these were complementary.

The hardware was all based around a new bus known as Unibus. All communication between processor, memory, and peripheral controllers used the Unibus. This asynchronous bus ensured all devices, however fast or slow, could operate at their highest speed on a common bus. From a single accumulator in the PDP-8, the PDP-11 moved to eight general registers, and that was soon upgraded. The single interrupt bit of the PDP-8 was replaced by a multilevel, priority driven interrupt system which overcame the slower interrupt handling of early machines.

Best laid plans...

It was initially decided that a microcoded processor was not appropriate for the range of machines envisaged, but given the need for memory management and floating point options, all subsequent processors were microcoded. One of the range, the PDP-11/60, included a writeable control store to enable additional instructions to be defined, and was used by Digital to emulate the PDP-8 instruction set, providing the development team with the fastest PDP-8 ever!

While increased memory addressing was solved initially with the 16-bit address, within two years an extra two bits were added, and memory mapping introduced. By the end of the series this had increased again to 22 bits.

The common bus approach for all processor communication also began to run out of steam, and in later models a private memory interconnect bus allowed much faster processor memory transfers. In the high end systems, the PDP-11/70 for example, fast disc and tape peripherals were also connected via a dedicated bus system, the Massbus.

In 1975, Digital launched the microcomputer line of the PDP-11, and used a new bus called QBus. QBus was cheaper to produce and allowed physically smaller systems, but was slower than Unibus, and QBus still went through the pain of an increasing address bus size.

Digital, as always in those days, made available all the function specifications and circuit diagrams of the equipment, and soon an entire DEC compatible industry was launched. Aside from the processors, all the other components were available from OEM manufacturers, and generally a lot cheaper than Digital.

In 1975 Digital released the PDP-11/70. This fast top of range machine included cache memory, Massbus disk and tape controllers, and a dedicated memory bus. Despite being based on an early processor set, the 11/70 became the benchmark machine to which later models were always compared.

It was only intended to produce 1,000 11/70 machines as this was the stop gap before the launch of Digital's new "wide word machine". In fact, over 10,000 PDP-11/70 machines were produced.

The new "wide word machine" was expected to be a small PDP-10. However the 10 series was cancelled and work started in earnest on growing the PDP-11. This development led to the Vax Series — initially the Virtual Address eXtension of the PDP-11. In fact, the first Vax model was known as the PDP-11/780, and only later as the Vax 780.

Although some 30 different PDP-11 models were produced, including the personal Professional series, primarily there were only five different processors in the Unibus models. Inevitably, there were compatibility issues, but by and large the machines in the series were all code compatible. In fact programmers were obliged to use certain obscure tricks to determine which physical machine the code was running on!

Given the range of hardware available, the PDP-11 was an ideal machine for developing embedded control systems. Applications could be produced on full size departmental systems with all the development aids available, and code produced to run in ROM on discless systems embedded in devices ranging from Digital's own terminal servers and storage controllers, to spectrum analysers and radiography machines.

In 1991 Digital announced the PDP-11/94 and 93 systems, the last of the range. However, Mentec, which purchased the rights to the design and much of the system software, continues to produce PDP-11 processors and support system software today.

System Software

There were almost as many different operating systems for the PDP-11 as there were models, but three in particular deserve mention.

RSX and its variants was the workhorse OS for the 11, and was used for everything from discless process control to departmental systems. RSX-based air traffic control systems in the UK used a single disc-based machine to boot and maintain over a hundred smaller RSX systems used for processing radar data and displaying flight approach information graphically to the controllers.

RSX was also the basis for the VMS operating system used in the Vax series. Many of the early VMS utilities were ported directly from RSX, and used the PDP-11 compatibility mode of the Vax to run.

Early versions of the Unix operating system and the C programming language were developed on a PDP-11, although outside Digital. It grew by sharing code though academic channels, and began what is now recognised as the Open Source movement. Famously referred to as "Snake Oil" by Digital's founder Ken Olsen, it wasn't until much later that Digital produced a sanctioned Unix for the 11 called Ultrix. Even Linux today still contains odd anomalies and code which were specific to the PDP-11.

Digital Standard Mumps, or DSM, was an operating system, programming language and database management system all in one. DSM was never widely promoted by Digital, but found its home in medical administration systems in both the US and the UK. This very fast database system was ideal for handling clinical records, and still is very much in use, albeit with modern machines which present exactly the same interface as the PDP-11 did.

PDP-11 systems are still very much in use today and are only now being gradually replaced. It is a tribute to the flexible design, the wide range of functionality and performance, and Digital's spawning of the OEM market, that has given the series such diverse usage and long life.

The ubiquitous Intel x86 range still needs to run another 10 years to beat the longevity of the PDP-11 design!

Editor's Note: Kevin Murrell is Chairman of the Society's DEC Working Party. He can be contacted at <kevin@ps8.co.uk>.

CCS Web Site Information

The Society has its own World Wide Web (WWW) site: it is located at <www.bcs.org.uk/sg/ccs/>. This is in addition to the FTP site at <ftp.cs.man.ac.uk/pub/CCS-Archive> (please note that this latter URL is case-sensitive). The Web site includes information about the SSEM project as well as selected papers from *Resurrection*. Readers can download files, including issues of *Resurrection* and simulators for historic machines.

Recollections of the Monrobot

Norma Edwins

Recently, I had the opportunity to gather some information about a particularly interesting computer that I programmed, briefly, more than 30 years ago. This machine was the Monrobot Mark XI.

The Monrobot Mark XI was a small, general-purpose computer, initially produced in May 1960 by the Monroe Calculating Machine Division of Litton Industries (formerly Monroe Calculating Machine Company, Inc) in Orange, New Jersey, USA. Historically, it is listed as the 144th computer ever made[1].

The solid-state computer was built into an ordinary desk and was designed to work in general office conditions. It could be plugged into a standard wall socket and was robust enough to withstand fluctuations in line voltage or room temperature. Monroe marketed the Monrobot Mark XI as "low cost": it was priced at around $24,500 in 1961. The intended market was business, science and government as the computer, which had its own machine language, was capable of handling a wide range of applications.

For some time during the 1960s Litton Industries sold the Monrobot Mark XI in the UK. By 1969, three UK local authorities, Kettering Borough Council and Wellingborough Borough Council, both in Northamptonshire, and Stevenage Urban District Council in Hertfordshire, had each bought a machine at a group discount from Litton Industries.

My first encounter with computers was in 1968 when IBM and Rank Hovis McDougall trained me to program an IBM 360/40 machine using Cobol and then PL/1. The installation took a whole floor of an office block, had strict air conditioning and entry restrictions, and was supported by vast numbers of data preparation and data control staff.

I worked in a team of programmers collectively developing the same system. A system would have many programs and we would each code one of these at a time on programming sheets. On completion the code was sent to the Data Preparation department to be converted into trays of cards.

The coding was punched onto the cards and then punched again on a special verifying machine to eliminate conversion errors. The programmers

[1] Watson, B, (21 May 1992), 'Every Computer Ever Made', Big List: Computer history. Available from <www.cs.unr.edu/∼ han/Dclist.html> (accessed 20 November 2000).

added the Job Control Language cards before the trays were sent to be compiled. They went first to the Data Control department, where each job entering and leaving the Computer Suite was logged, and then into the computer room to be compiled.

The cards and printout of the compilation attempt were returned to the programmer with the diagnostic lists showing the compilation errors. Once the errors had been remedied the whole process began again until compilation was successful.

Test data was added and the program was ready for the first run, via Data Control. A printout of the run highlighting the execution errors came back to the programmer and changes made. When the program ran and produced results these were checked for validity and viability. This process was repeated until the program executed according to the system specification.

Eventually, when all the programs in the system were deemed independently correct they would be combined in a thorough system test before going into production. This whole process took many months for a large system and involved many people.

I was happy to take a system specification, interpret, code, test and finally successfully run a section of a huge system. The satisfaction came from solving a problem. I hardly ever thought about the machine; how it worked; how it took my code and turned it into part of a working system; about the vast numbers of people involved.

During 1970, my husband's work moved us to Northamptonshire and I started looking for a Cobol programming job. I could not drive so I needed to work close to a bus route. This was proving to be a great handicap until the Job Agency suggested a job programming in machine code. I knew nothing about this type of programming but needed to work and the Agency assured me that I had the right aptitude. In those days, 'aptitude testing' was very common for potential programmers and analysts. The results, however, never seemed to be recorded and passed on to the next employer although the tests all seemed to be very similar.

When I arrived at Kettering Borough Council offices I was amazed to find that the computer looked like a desk and was in a very ordinary looking room with radiators and blinds as the only means of controlling the temperature.

After I joined, the computer section temporarily consisted of six people: the Senior Accounting Assistant (SAA), two programmers and three other staff who punched the paper tape and entered data for existing systems. The other programmer was about to go on maternity leave, hence the new recruit.

The SAA had been on an overview and operator's course and the other programmer, who had previously worked as a typist, had been trained to use Monrobot Mark XI code. The Council sent me on a short course at Litton Computer Systems in London. Here I was taught how to write the Monrobot Mark XI code and program it into the machine. It was a completely different way of thinking, but it was also very challenging, fascinating, and powerful.

Monrobot Mark XI code has 27 commands and is written in hexadecimal (using S to X for digits 10 to 15) though data is held internally in binary. Programs and data could be stored on the 1025 location magnetic drum in 32-bit words, although paper tape was also used to keep programs and data and magnetic cards were used to store data.

Kettering Borough Council used the Monrobot Mark XI for many applications, which included Payroll for salaried and waged employees, Rent for council owned properties, Rates for all properties in the Borough, Stores for all Council depots and sites, Haulage and Vehicles for all Council purposes, Invoicing and Purchasing for all Council transactions. It was also used extensively for financial analysis.

When new systems or amendments to existing systems were needed I would have to ask all the questions to define the requirements, code and test the program. I would even enter all the code and data. Fortunately the computer had very good facilities for interrogating the system and for program checking and tracking.

Our installation had a few extra peripherals not supplied with a basic system, including an online paper tape reader and paper tape punch. These were housed in the drawer positions of the L-shaped desk. There was also an offline paper tape punch and a paper tape punch/verifier.

The Senior Accounting Assistant has reminded me of an example of how we used the online paper tape devices. A program was used to create an Expenditure Analysis of the Payroll and output directly on to paper tape. This would then be posted to the Income and Expenditure Analysis by using the paper tape information later.

We think the paper tape was Code 8 level, giving seven holes plus one for parity. This cannot be confirmed, but the Monrobot Mark XI could handle any code from 5 to 8 level.

The magnetic card reader, which was apparently non-standard, was used extensively at Kettering Borough Council. It was housed in a metal box with a card hopper at the top to input cards. These were taken into the device, read and returned to the card collection hopper at the bottom of the unit.

The cards were punched card size with a coating of magnetic material. Data was recorded along the long dimension of the card in several parallel tracks. I can find no mention of this storage method relating to the Monrobot Mark XI so can only surmise that it was a later addition to the system.

The magnetic cards were used as backing storage files for systems such as Payroll, Stores, and Rates. One card would hold details of an individual, an item of stock, or a property.

There was a typewriter that was used to print reports from the various programs and a teletypewriter was used to send and receive information directly to County Hall in Northampton. Data and programs could be entered directly using the special 16-key keyboard or could be punched onto paper tape. The Control Panel was used to operate the machine. We used an oscilloscope that displayed the contents of key registers in binary format. Using the control panel and the oscilloscope gave the programmer very good control over what was happening in every part of the computer, and both were used constantly to monitor progress.

On 15 February 1971 the UK changed to the decimal currency system. This gave an enormous amount of extra work for all computer installations nationwide. Kettering Borough Council was no exception and we were kept busy for months converting all our systems. I left Kettering Borough Council in April 1971, with the successful changeover completed, to have my long-awaited first child. This brought my short but immensely satisfying career with low level programming to an end.

Ten years later, when I returned to work it was as a mathematics and computing teacher in comprehensive schools. Here I was able to use the Monrobot Mark XI experience to illustrate some aspects of the Computing syllabus. Alas, I did not find another career opportunity to program in a low level language.

Norma Edwins is at <norma.edwins@btinternet.com>.

Digitising the *Algol Bulletin*

Brian Wichmann

For those unfamiliar with the *Algol Bulletin*, it was an informal publication, produced under the auspices of IFIP, which appeared in 52 issues from March 1959 to August 1988.

The importance of the Bulletin is that it records the ideas behind Algol 60 and Algol 68 as well as much of the motivation behind Algol W and Pascal.

When I was told by David Hill that the British Library did not have a complete set of the 52 issues, it seemed to me that action should be taken to ensure its preservation. Producing a digital version seemed the natural thing to do.

Following various leads, the majority of the later issues were obtained from the last editor, Charles Lindsey. Most of the others were borrowed from David Hill, and the sole source for the earliest issues was Brian Randell.

It was clear that just scanning the material would not provide a convenient access and hence the process has been to produce an HTML index to all the individual articles, while the main material is just the scanned images. At the time of writing, this process is about 70% complete.

The IFIP notice on each issue states that the copyright of each article lies with the author. Initially it was feared that this would stop the digitisation entirely, but it was agreed that if all reasonable attempts were made to contact the authors, then that would be sufficient. None of the 23 authors contacted so far has refused permission, but tracing the authors is far from easy and hence it seems that the majority of authors may escape my efforts to locate them. If you did write an article but have not yet given permission, please contact me (either via the email address below or via Peta Walmisley at the BCS).

Some technical problems have arisen from the first seven issues which were produced using a spirit-based process. Some pages are barely visible in Brian Randell's copy and hence if any reader has any of these issues, I should be delighted to hear from them.

The concept behind the Algol Bulletin was for communicating ideas informally, often before a polished version was published in a refereed journal. Reading the issues myself while scanning them, I have found the earlier material of particular interest, mainly since I was involved with Algol 60. Through an accident of history, I never had a direct involvement with Algol 68 and hence the later material I have not found so interesting. In any case, virtually all modern programming languages can trace some ideas derived from Algol 60. My own path has been Algol 60 to Pascal to Ada, while perhaps others have been Algol 60 to Simula to C++ to Java.

When this work was first started, it was thought that the Science Museum would act as the repository of the authoritative version and would place it on its Web site. It has decided not to do this. Hence such a site is needed. In practical terms, a CD version is also needed, since the whole material will be around 200 Mbytes, and even downloading a single article is not easy with only a dialed telephone line. The Computer History Museum in California is interested and hence is likely to act as a repository.

I currently envisage completing the work later this year. However, it is possible to add many items to the basic material (such as a search facility) and hence if anybody wishes to undertake such work, please contact me.

Brian Wichmann is at <Brian.Wichmann@bcs.org.uk>.

What challenges have you overcome?

Ernest Morris

A few years ago I had occasion to produce a CV, and I started with what I thought were the notable bits — first with the claim to have 'made computers work in a commercial environment when it was a real challenge to do so'. That claim leads me to ask for input to *Resurrection* — what do you, the practitioners from those early days, regard as your achievements when you were faced with the unknown, or the inadequacies of technology, or the seemingly impossible demands on the technology of the time and its capabilities. If we don't tell today's generation what we faced up to and overcame, nobody will henceforward appreciate the difficulties we experienced. So please email me at <Ernest.Morris@btinternet.com> or write to me with serious or anecdotal memories of personal challenges and achievements with the first and second generations of computers.

Letters to the Editor

Dear Editor,

Resurrection issue 30 of Spring 2003 mentioned the fire which destroyed the premises of the main Artificial Intelligence Groups at the University of Edinburgh. The AI Library housed at 80 South Bridge in the central world heritage site just off the Royal Mile in Edinburgh was completely destroyed. This library was the largest of its kind worldwide and had been built up over a period of more than 40 years. It contained much irreplaceable historical material. It included the contents of the Turing Library which had been purchased by Edinburgh from the Turing Institute based in Glasgow. A worldwide appeal is taking place to recover copies of as much material as possible. See <www.inf.ed.ac.uk/resources/library> for more information.

Yours sincerely,
Professor Austin Tate
University of Edinburgh
by email from <a.tate@ed.ac.uk>
24 April 2003

Dear Editor,

In issue 30 of *Resurrection* a question was asked concerning the early operational use of timesharing in the UK.

In 1967 I was very involved with the first commercial timesharing system in the UK, namely the GE 265 which was installed and operated by De La Rue Bull Machines in their Southampton Row site.

At the time I was Senior Engineer Timesharing Systems. The machine was delivered in May 1967, commissioned and operational by the end of June. It was run for internal training during July, and presales. Any customer who signed up then for the unheard of contract of one month had free usage up to 1 September.

Regards,
Dave Lillywhite
by email from <ERNIDAVE@aol.com>
21 May 2003

Dear Editor,

Hamish Carmichael wrote about the ICL Archive going online[1], and I remembered today to look for it on the CCS site. I found a number of entries of great interest. I presume the collection is still at Blythe House, but even if accessible elsewhere what are the chances of old colonials getting a closer look at any content anytime soonish, particularly without travelling over there?

Naturally we are interested in Ace and Deuce items, because we could complete or extend our Ace/Deuce writings and move on to other systems — we are interested in pretty well most of the old British machines. I see us here (to the degree we can achieve it) as being complementary to your efforts, not competitive; we are trying to dredge up information on ICL and predecessors in Australia through our history projects. This has always been one aim, and we are producing Deuce material through Utecom and other sources.

May I broadcast a request for a real Deuce drum? We at ACMS would like to obtain one for our Deuce-Utecom display here. I suspect anyone locating one in the UK would hold on to it like grim death, but knowing one or some still exist would be a start.

In similar vein, we are wondering whether there are people (staff and users) in the UK from Ace/Deuce sites who would be willing to communicate with us to provide information and to discuss that era.

Regards,

John Webster
Australian Computer Museum Society
by email from <websters@tpg.com.au>
14 July 2003

Editorial contact details

Readers wishing to contact the Editor may do so by email to <wk@nenticknap.fsnet.co.uk>.

[1]Editor's note: In *Resurrection* issue 30 pages 28-30.

Forthcoming Events

Every Tuesday at 1200 and 1400 Demonstrations of the replica Small-Scale Experimental Machine at Manchester Museum of Science and Industry

Weekday afternoons and every weekend Guided tours and exhibition at Bletchley Park, price £6.00, or £5.00 for children and concessions

Exhibition of wartime code-breaking equipment and procedures, including the replica Colossus, plus 60 minute tours of the wartime buildings

23 September 2003 NWG Audio/Video evening

Will include footage of the SSEM Rebuild and of Pegasus

21 October 2003 NWG meeting: Computers at Jodrell Bank

Speaker Dr I Morrison

25 November 2003 NWG meeting: Other Machines at Bletchley Park

Speakers Tony Sale and Brian Oakley

27 January 2004 NWG meeting: Software and User Experience of Orion 1

Speakers to be confirmed

23-26 August 2004 IFIP World Conference on History of Computing in Education

Contact Roger Johnson for details

As we went to press, the programme for the London meetings was still being finalised. Members will find the latest details on the Notice enclosed with this issue.

The North West Group meetings will take place in the Conference room at the Manchester Museum of Science and Industry, Liverpool Road, Manchester, starting at 1730; tea is served from 1700.

Queries about Manchester meetings should be addressed to William Gunn on 01663 764997 or at <william.gunn@ntlworld.com>.

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Readers who have general queries to put to the Society should address them to the Secretary: contact details are given on the page opposite.

Members who move house should notify Hamish Carmichael of their new address to ensure that they continue to receive copies of *Resurrection*. Those who are also members of the BCS should note that the CCS membership is different from the BCS list and so needs to be maintained separately.

Resurrection is the bulletin of the Computer Conservation Society. Copies of the current issue are available from the Secretary for £5.00 each.

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