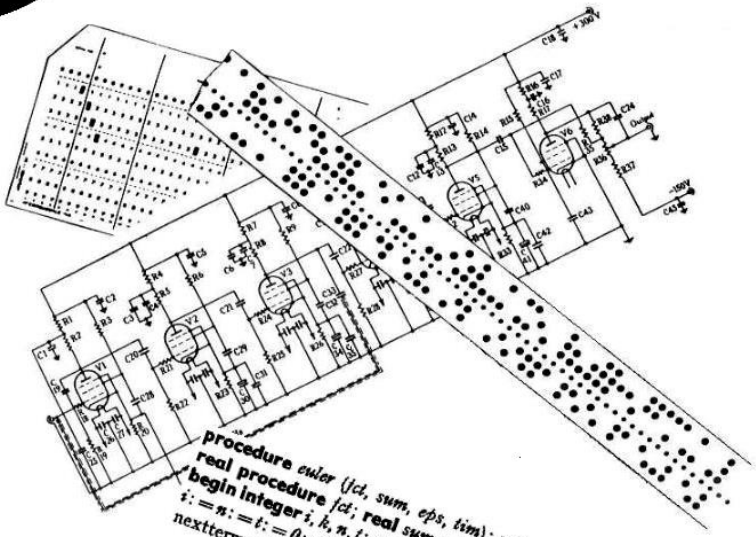
Issue Number 87 Autumn 2019

RESURRECTION

The Journal of the Computer Conservation Society



```
procedure euler (fct, sum, eps, tim); value eps, tim; integer tim;
real procedure fct; real sum, eps;
begin integer i, k, n, t; array m[0:15]; real mn, mp, ds;
    i:=n:=t:=0; m[0]:=fct(0); sum:=m[0]/2;
nextterm: i:=i+1; mn:=fct(i);
    for k:=0 step 1 until n do
        begin mp:=(mn+m[k])/2; m[k]:=mn; mn:=mp end means;
        if (abs(mn)<abs(m[n]))∧(n<15) then
            begin ds:=mn/2; n:=n+1; m[n]:=mn end accept
        else ds:=mn;
    sum:=sum+ds;
    if abs(ds)<eps then t:=t+1 else t:=0;
    if t<tim then go to nextterm
end euler
```

Computer Conservation Society
Aims and objectives

The Computer Conservation Society (CCS) is a co-operative venture between BCS, The Chartered Institute for IT; the Science Museum of London; and the Science and Industry Museum (SIM) in Manchester.

The CCS was constituted in September 1989 as a Specialist Group of the British Computer Society. It is thus covered by the Royal Charter and charitable status of 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,
- ◊ To develop awareness of the importance of historic computers,
- ◊ To develop expertise in the conservation and restoration of historic computers,
- ◊ To represent the interests of Computer Conservation Society members with other bodies,
- ◊ To promote the study of historic computers, their use and the history of the computer industry,
- ◊ To publish information of relevance to these objectives for the information of Computer Conservation Society members and the wider public.

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 BCS, fees from corporate membership, donations and by the free use of the facilities of our founding museums. Some charges may be made for publications and attendance at seminars and conferences.

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

The CCS also enjoys a close relationship with the National Museum of Computing.

Resurrection

The Journal of the Computer Conservation Society

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Society Activity

EDSAC Replica — *Andrew Herbert*

Progress on EDSAC since the re-opening of the First Generation Gallery at The National Museum of Computing has been frustratingly slow. When we mothballed the machine before the winter roof replacement it had been running very simple test programs injected into the first storage tank. We are now, finally, back at that stage once more, having apparently lost a lot of ground since the project was suspended.

A principal area of difficulty has been around the clock and digit pulse system. A lot of work has gone into improving the reliability of the clock pulse generator and reconnecting subsystems to the clock and digit pulse feeds via the clock distribution units rather than directly to the clock and digit pulse units in the hope of getting stronger and better shaped pulses. After several iterations this has been accomplished. As a project we have also learned a lot about the dangers of one group making changes to fix perceived problems in an area owned by another group in that group's absence.

On a more positive note, the pause gave us an opportunity to replace more monostables by bistables to improve circuit behaviour and tidy up a number of chassis that had been heavily modified during earlier main control commissioning.

The focus remains main control. This has been shown to be reliably fetching and decoding instructions, sending them to the arithmetic unit and moving on when receiving the required "EndPulse" signal. We have verified the correct operation of the **X** (no-op) instruction, the **E** and **G** (jump) instructions and the **Z** (stop) instruction. We have a correctly incrementing Sequence Control Tank (program counter). We are still having some issues with stability of the coincidence unit which has to stall main control until the data it wants to read or write is available in the store recirculation system. There is scope for improving these circuits with bistable replacements for monostables which will probably help. Once this is achieved we can look to add further instructions which will require testing of the second stage of main control which deals with operand fetch and store, and checking the implementation of additional arithmetic operations.

Progress has been made on the initial orders system. This has been shown to produce the desired sequence of instructions to load into store. Some further work is now needed following the updates to the clock and digit pulse system.

The delay line stores remain under test, with noise sensitivity remaining an issue, and somewhat of a moving target as more of the machine test is connected and put into operation.

Input/output remains on hold, waiting for the work on main control and arithmetic to be completed. The circuits are ready to be connected but there is no point in doing so yet.

Some minor cosmetic enhancements include the addition of -200V DC power supply chassis (as they would have been in the original) in the guise of dummy chassis containing modern -50V DC supplies.

Analytical Engine — *Doron Swade*

In a visit from the US in March Tim Robinson reviewed a collection of 'mystery' material consisting of content that had eluded listing or cataloguing in earlier programmes by the Science Museum, and by Allan Bromley who produced, in 1991, the first near-comprehensive listing of the Babbage technical archive. Logging this last cache of material is now complete and it appears that only about a third of the original material survives. This estimate is based on references in the Sketchbooks to material that should be in this cache but were not found there, or elsewhere. Findings have been shared with Science Museum archivists accompanied by suggestions of how this material might fit into the structure of the new Babbage catalogue, available now online, created by the Science Museum. There is material in the Buxton archive in Oxford that awaits attention but the primary technical archive of Babbage papers held by the Science Museum has now been viewed and relevance to the Analytical Engine design logged.

With the archive review essentially complete, a process that took over three years, Tim has shifted attention to developing a simulation environment to describe, explore and verify the mechanical designs. So far this involves 'logical' simulation which features aspects of Babbage's Mechanical Notation, the language of signs and symbols he devised to describe the machines and as a design aid, not unlike a later Hardware Description Language (HDL). Features of the Mechanical Notation that are reflected in the simulation tools include the notion of a 'piece' (an aggregation of parts that acts or is acted on as an ensemble), 'working points' (the points of influence and action between pieces), 'assemblies' and 'connections'. It is hoped that this high-level simulation will be extended in due course to solid modelling and techniques for visualisation as a design aid, a manufacturing front-end, and for education.

ICL 2966 — *Delwyn Holroyd*

The 7501 fault mentioned in my last report returned intermittently, the symptom being a blank screen after some hours. In the end this was traced to a fuse holder in the CRT heater supply!

The self-learning Noughts and Crosses demo program has been improved in a number of respects. The program works by storing board positions it has encountered before along with possible next moves — if the program loses, the last move is not tried again. It turned out that crashes observed were due to running off the end of the array storing the board positions, an early example of a buffer overflow! Consequently the array has been made much larger and a check introduced. Additionally when the program loses it will now block the winning move by the opponent.

SSEM — *Chris Burton*

The "Baby" computer continues to engender interest from visitors to the Science and Industry Museum, even appearing for a few minutes in the recent BBC4 "*Revolutions part 6 — Robots*" film as the progenitor of a brain for an intelligent robot.

Typically more than 100 visitors engage with the volunteer demonstrators on each of the demonstration days.

After 20 years since construction, the machine is beginning to show a few signs of age, with too many intermittent faults, some of which are known to be due to vibration. There is reluctance to embark on a prolonged shake-up because of the risk of preventing demonstrations. The present plan is to gather evidence and fix faults when a culprit becomes clear.

Bob Geatrell adds — It should be added that Chris Burton appeared alongside "his" Baby replica in the *Revolutions* programme recorded unfashionably early in the morning one day last year.

Baby appeared in the background during the Bank of England "£50 reveal" which was held at SIM on 15th July.

There is currently a display in front of Baby featuring all the candidates but prominently Alan Turing, which leads to even more visitors than usual asking if he designed Baby, a falsehood perpetrated by Jeremy Paxman on *University Challenge* some years ago.

IBM Museum — *Peter Short*

Current Activities

The last three months have been quite busy in the museum. Restoration work has continued on the 5496 card punch/verifier. The cover micro-switch has been replaced so the motor now stops after about 20 seconds of inactivity. The area around the main belt has been cleaned, revealing a belt in better condition than we had thought. A sticky keyboard turned out to be a paper clip hanging on one of the restore bail solenoids and sometimes jamming the restore.

We have started work on two further restoration projects. The dial recorder that came from Oslo has been cleaned up and lubricated. The clock mechanism is working fine, and runs for 7 days per wind up. The remaining recording mechanisms seem to be good too, although we are still trying to work out exactly how to set it all up. The list of patents on the serial number plate shows dates between 1911 and 1916, however the serial number suggests that the build date was 1935.

We've also started on the 2741 input/output golf ball typewriter, which was almost completely seized up from years of non-use and lack of maintenance. This item was rescued from a 2741 terminal that was going for scrap in the early 1970s. Slowly but surely we are un-seizing it a bit at a time and hoping that the adjustments, particularly tilt and rotate, have not moved over the years.

Sometimes only a hammer will do

Dial Recorder

Back Office Organisation

At long last we have installed more racking in one of our hardware stores, allowing the cluttered mess on the floor to be catalogued and neatly stored away. I guess we will start filling the floor again!

Donations & Loans

The museum donated a PC keyboard to IBM Sweden to help restore a PC-XT to full working order. The working XT is now on display in the IBM customer reception area of IBM's Kista office in Stockholm.

We have been offered 22 boxes of as yet unspecified items from the IBM 7090 by Martin Campbell-Kelly at TNMoC. We have agreed to take this and will now need to work out the best way of transporting them to Hursley.

Last year the Royal Hampshire County Hospital borrowed a number of artefacts from us for their exhibition celebrating the 70th anniversary of the NHS. This was so successful that they are repeating the exercise this year. We have now sorted out a number of artefacts for them to borrow.

Display Rooms

The Hursley Room has been reorganised, moving the Lloyds CashPoint model to a more appropriate position in the timeline of S/360 and S/370. A new item is now on display — some pieces of an experimental memory device code name MICA from 1966. The concept involved using a 10" copper plate with various thin film deposits to form memory cells. The samples we have were used in the evaporation trials.

The Hursley Room

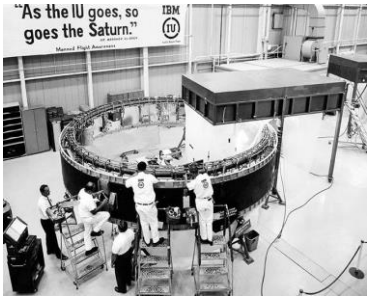
MICA

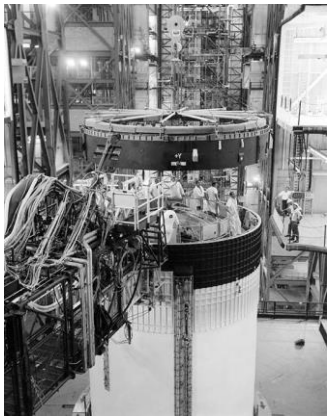
Other

We received a request from the BBC as to whether we have any equipment that demonstrates the Y2K problem. We do have a PS2, itself not affected, running a piece of software that is not compliant. We have sent screen shots and offered a copy of *Think* magazine dedicated to the subject, but that's the last we've heard.

Apollo 11

We've updated the website home page on the 50th anniversary of Apollo 11 to reflect IBM's participation in the Apollo project. July 1969 also saw the first moon landing by the crew of Apollo 11. NASA upgraded its ground-based IBM mainframes in 1968, the year before Apollo 11, to an IBM System/360 Model 50, which cost $45K per month to rent. IBM also built the Instrumentation Ring or Instrument Unit (IU) to a NASA design. This was placed on the top of the third stage of the Saturn V and contained all the guidance, control and sequencing hardware for the main launch vehicle. This was largely developed in Federal Systems Division and built in Huntsville, Alabama. The IU was the nerve centre for the launch vehicle, determining when to fire the rocket motors, when to jettison them and where to point them. Equipment included devices to sense altitude, acceleration, velocity and position, and the computer that laid out the desired course and give instructions to the engines to steer Saturn V on that course.





The IU weighed a little over two tons, with a diameter of about six metres and a height of one metre. The electronics were liquid cooled using a water/methanol mix. There were three sub-systems in the IU: Launch Vehicle Digital Computer (LVDC), Launch Vehicle Data Adapter (LVDA) and an analogue flight computer. LVDC hardware had a 2.0448 MHz clock and 32K x 28-bit RAM.

National Museum of Computing — *Kevin Murrell*

Firstly, the museum is now open seven days a week. This has been an aspiration for some time, but thanks to huge efforts by the staff and volunteers, this is now in place. Visitor numbers over the summer have not been as high as we had hoped, but the special events have attracted many new visitors.

We are pleased to announce that Rachel Burnett has joined the Trustee Board of the Museum and will also take the role of Company Secretary.

The Museum has awarded its first Honorary Fellowships to Margaret and the late Tony Sale. A small group, of a trustee, a member of staff, a volunteer and an independent person, are working to identify potential new Fellows.

The Annual Lecture series has resumed. The next lecture is entitled '*Light-years ahead — How the Apollo Guidance Computer pioneered an era of reliable software*'. This is scheduled for Saturday 26th October at 14:30.

The Home Educator day on 23rd July was well attended. The feedback was overwhelmingly positive with many families asking when the next one will be so that they can book.

The 'relaxed openings' continue and are well attended, and much appreciated by the families who visit on those days.

Education

School/College and University group bookings remain high and the education team led by Anne-Marie Sandos continues to provide an excellent experience for those visitors.

Particular Projects

Work is now complete on the 'Large Systems Gallery'. This large space houses the ICL 2966, the Marconi TAC and the Elliott 803, amongst others. The original suspended ceiling has been removed and flooring replaced. Work is continuing on the signage here to ensure it is complete and matches the signage elsewhere in the museum.

In June, veteran Bombe operator Ruth Bourne unveiled an Enigma cipher machine, the latest addition to the Turing-Welchman Bombe Gallery. Uniquely, TNMoC can now demonstrate the range of equipment used in making and breaking both the Enigma and Lorenz ciphers, the two most important enemy ciphers in the Second World War and which represent the very early stages of cyber security, a technology that is so vital to modern society.

A remarkable number of events take place at the museum including the Milton Keynes Raspberry Jam group (not that sort of jam!), overnight hackathon, electro-jumble, courses on digital electronics, valve workshops, Bytes events and coding classes.

Science Museum Group — *Rachel Boon*

Science and Industry Museum

A capacitor belonging to Geoff Tootill, donated last year around the time of the Baby anniversary, is now on display in Revolution Manchester Gallery, next to the Baby replica, and in the showcase with his lab coat —

Capacitor with two crocodile clips, assembled by Geoff Tootill in Manchester, 1948, and used for testing during the development of the 'Baby' or Manchester Small-Scale Experimental Machine. Accompanied by a handwritten note explaining that he found it in the pocket of one of his brown lab coats.

We have completed the decant of the Hidden Treasures Gallery and Store 1 in preparation for the new Special Exhibitions Gallery: *www.scienceandindustrymuseum.org.uk/aboutus/press-office/seg-update*.
A number of objects from the Computing & Data Processing Collection have moved to the National Collections Centre (Wroughton), but we have retained a very small collection for current exhibitions, research and engagement.

Science Museum

We have acquired the following for the Computing and Data Processing Collection —

WDT66N Combus Packet Line Card, developed by Ferranti Ltd., Wythenshawe, Manchester, 1973-1975, installed in an Argus 700E for the Post Office Experimental Packet Switching System (EPSS).

We are still in our loan moratorium and we are unable to lend any objects stored at Blythe House or the National Collections Centre between 2019 and 2022. We will also be unable to provide access for researchers to items in all our stores during this time.

KDF9 Directors

Bill Findlay is working on getting his emulator to run the KDF9 Director. Currently we have a known good version from a paper tape provided by Chris Burton many years ago. His system will now successfully run the Director under which he can run object programs.

We have paper copies of two other directors and the unchecked copy-typing of the NPL Director as done by Hans Pufal.

I have photographed and copy-typed the Oxford University Director, and it can be seen at: *sw.ccs.bcs.org/KDF9/FAX43CD/* We have yet to try running it. It could use some volunteer proof reading.

KDF9 Programming Languages

The offering of our four KDF9 programming language implementations has been sanitised so that the material all lives on the main server *sw.ccs.bcs.org* except for the on-line execution facility. *sw.ccs.bcs.org/KDF9/langs.htm*. We have combined the genuine input and output routines with a cut-down handling of Algol Basic Symbols and this has given a much improved rendition of the KDF9 I/O library routines. It is incorporated into the Kidsgrove Algol on-line facility.

Bill Findlay's exploration of KDF9 Director has revealed some violation of conventions in our new implementation of the I/O library routines. This remains to be fixed.

Leo III

There has been quite a bit of communication with the Leo Society. There are still hopes the Delwyn's data recovery project will yield a CLEO compiler. In the meantime, this has rekindled interest in my Leo III emulation.

It was suggested to me (by Peter Byford, I think) that the demonstration that I did at the 7th April Leo Society Reunion was far more realistic than earlier examples. It is not as easy to drive, as you have to play the role of Leo III operators, both the console operator and the mag tape operator.

I have packaged it up with some instructions and it can be downloaded as a ZIP file from: *settle.ddns.net/LeoCode/LeoIIIdemo3.zip*.

There is a readme.htm file that explains how it is supposed to work.

It runs on Windows 7, Windows 98, ubuntu 18, Debian on Raspberry-Pi, and probably lots more stuff besides. I've not had chance to try it on a Mac.

I tried it on Windows 10 just to make sure it was OK and it wasn't. Java is not installed by default, so you need the Java run-time system (or JDK).

Also the ANSI escape sequences appear not to work on the console window, which acts as the Leo III typewriter. Furthermore, the Microsoft firewall grumbles about its use of TCP/IP.

Note: The binary version of the emulator is from the Cygnus Win32 compiler, not Bill Gallagher's more modern implementation, as it says in the readme file. Bill and I are communicating over sorting out Microsoft funnies over use of sockets, and aiming for a single source text that will compile correctly on any C compiler.

Harwell Dekatron/WITCH — *Delwyn Holroyd*

Only a week after curing the power supply problem reported last time, another power supply problem appeared with -385V reading about -300V. After a false start replacing the 85V regulator which generates this supply (relative to -300V), the problem came back once again. Eventually it was found that a conductive track had appeared on the chassis underneath a capacitor causing a short circuit! The slightest movement of the chassis was sufficient to disturb this and thereby temporarily fix the problem!

Since then operation has settled down once again, with the only problems being occasional issues caused by sticky Dekatrons.

Bombe Rebuild — *John Harper*

We continue to provide demonstration every day of the week except that on some Mondays we have what we call an engineering day. This is when we close the doors and carry out major repairs.

After more than ten years of regular running, the machine is suffering from wear; this is most likely due to inadequate hardening of certain steel components when first made. This in particular applies to many of the 140 or so ratchet pawls.

Team members are replacing these a few at a time. However we can still give demonstrations because the machine can have a third of it out of action whilst leaving the rest still in operation. This technique also applies to rollers. The middle and slow mechanism progression is driven by cams. Rollers run on these cams so as to reduce any drag that might wear on the cams. However the rollers have in, some cases, worn on their mounting shafts. Along with pawl replacement these are also being replaced again with only one third of the machine's capability being affected. This exercise is expected take a few months.

After I returned the 903 to TNMoC in March, an intermittent fault appeared which we had seen in the past. The BASIC tape would load correctly and announce itself on the teletype, but would then stop without issuing the "*" prompt. After Peter Williamson swapped three A-FA bit-sliced register cards with spares, the 903 appeared to settle down over the summer. This gave me the confidence to reconnect the extra 8K store, which is now working. Having all 16K will be useful for next year's 60th anniversary celebrations for Algol 60. And if the fault reappears, we can now immediately swap the cards in the two stores, which might help us locate it. I've also upgraded an LSA-7 logic sub-assembly on the A-FQ card, to an LSA-13 with larger capacitors, as seen on newer 903s. The 903 manuals state a 6' maximum extra store cable length, this design change might be for the 10' cables often used.

Peter Onion reports that, after the TNMoC 803 ran faultlessly on a Friday and Saturday in May, something went "pop" and the 803 shut down. A large 40A fuse in the battery circuit had blown. Peter spent the following Thursday and Friday checking out the power panel and the voltage regulator boards, which were all OK, then moved his attention to the battery charger, where the main rectifier diodes were checked, and one was found to be a short circuit. These are 35A 400V PIV silicon diodes, some of the only silicon in the whole machine. They are also the less common "anode to case" packages. Getting them out proved quite a task as they are mounted on a large isolated plate in the very bottom of the charger. He and Phil Hayes had to lay the charger onto its side (not an easy task) to get easier access. Replacement (and spare) 1N1188(R) diodes were duly ordered and fitted.

At the time of writing, only half of the 803 store is working, pending investigation.

Finally, TNMoC has recently received an Elliott 920M, on loan from the Rochester Avionic Archives, comprising a CPU and memory in a "¾ short ATR" box (large shoe box). This is placarded "MCM7" and appears to be rather later than the MCM2 (with a 5µsec store) and MCM5 (with a 2µsec store) which were used on the Jaguar aircraft when I worked at Rochester.

Data Recovery — *Delwyn Holroyd*

This new project has been formed to provide a focus for data recovery efforts across CCS projects. By data recovery I mean reading data and/or software stored on obsolete media and converting it into a form where it can be accessed and manipulated by modern systems.

Data recovery is a vital underpinning of many machine restoration and emulation projects whilst not being a core activity. The creation of this project will help to enable collaboration and knowledge sharing between those members of the Society interested in the subject. It will act as a source of advice and encouragement for other groups who need to recover data from obsolete media. It will also provide a contact point when the Society is approached with requests for help in this area.

The remit includes recovery from all kinds of media — paper tapes, cards, magnetic tape or disc.

For the last six months I have been working through a large collection of over 200 magnetic tapes retrieved from the basement of the Fujitsu (formerly ICL) Reading offices just before they ended up in a skip! The contents are varied and full analysis of what they contain will take some considerable time. The majority of the tapes are in ICL 1900 format, and an early win was the discovery of a MAXIMOP issue tape as previously reported in *Resurrection*. However there are also a number of ICL 2900 format tapes.

Meanwhile we have been trying for some time to find a way to read LEO magnetic tapes. This effort was boosted by the recent discovery that fellow committee member Rod Brown possesses parts of a LEO variant Ampex TM-4 tape transport, including the all-important 8 track head!

These parts have now been delivered to TNMoC. The plan is over the coming months to transplant the head into one of the ICT 1301 TM-4 decks and construct a suitable data capture interface.

ICT/ICL 1900 — *Delwyn Holroyd, Brian Spoor, Bill Gallagher*

Katowice Link

Following Brian's visit with TNMoC to the computer museum in Katowice back in March this year, we have been giving some remote technical assistance, during spring and early summer, with software for the ODRA 1305 (ICL 1904E clone) processor that they are currently restoring back to full working order.

ICL 1904S/ICT 1905/ICL 1901A Emulation

Improvements made to the peripheral UIs, especially ED and MT — various 'funnies' found when running under Windows 10 fixed (main development/test environments 7 and 8.1).

General revision of 1904S and 1905 emulators to pass new hardware tests now available as a result of software finds. Addition of ODRA 1304 support to 1904/5/9 emulator and 1305 to the 1904S emulator. 1905 now passing the newly available FLIT tests with only the FPU's differences causing bug reports.

PF50 (1902A etc.)

Stalled awaiting completion of the scanning of the recently arrived PF50 documents.

PF56

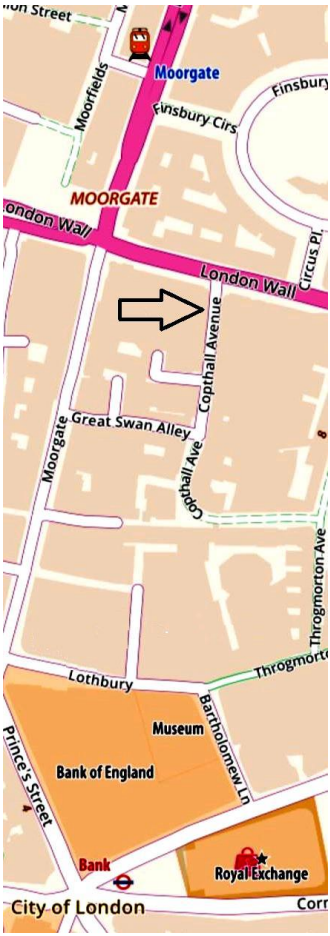
Stalled awaiting time to work on the D.D.E. interface to the 1900s and the M.C.I.U. to the 7930 scanners. Has anyone out there got a set of PF56 logics?

Diagnostic Software

Work is on-going to catalogue the newly available programs and create some operating notes for the large number of executive mode test programs, which will permit enhancement of many of our peripherals which currently only work under a customer executive. These tests performed very detailed analysis of device status at times during a transfer which normal executives simply do not do. These diagnostics cover not only the peripherals themselves but test parts of the CPU box untested by FLIT (I/O hesitations, store integrity and speed) in addition to pure peripheral-exercising actions. — Some of these could turn out to be both informative and challenging.

News Round-Up

Since early 2016 CCS London meetings have been held at the Covent Garden premises of BCS in Southampton Street. But no more. BCS's lease has come to and end and we now have a splendid new venue in the City of London near Moorgate Railway Station and not far from Bank viz. 25 Copthall Avenue, London, EC2R 7BP.



Our first meeting at the new address was appropriately by way of being a celebration of the CCS's first 30 years. Our first ever lecture was "ICL and the British Computer Industry". This September's was "The History of ICL Revisited" — both by Martin Campbell-Kelly.

A week before the event all the places had been taken! And even though Roger Johnson persuaded BCS to add an additional row of chairs, the extra places were soon snapped up. This has never happened at a CCS meeting before.

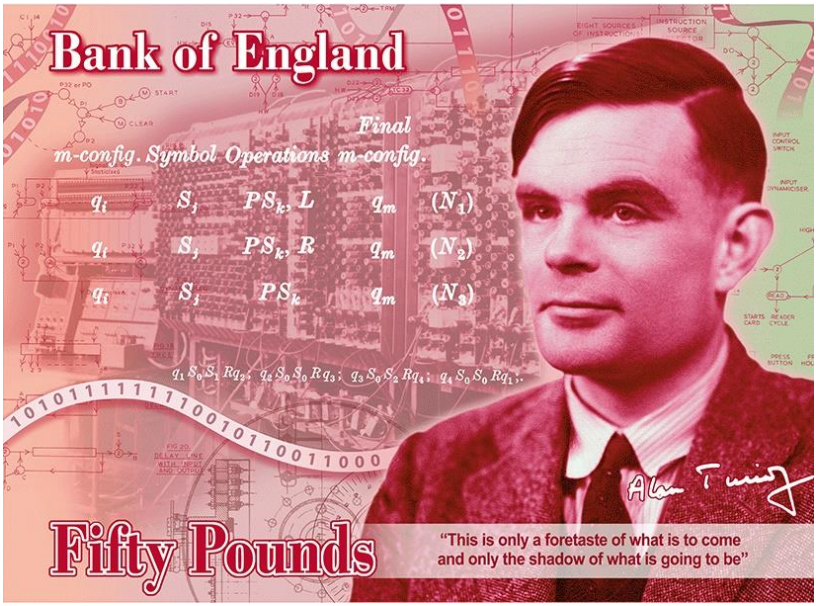
It emphasises the importance of pre-booking places for London events, not just because they may fill up, but also because the enhanced security precautions at our new home make ad hoc entry to the premises even more difficult than hitherto.

The Assembled Multitude

Our friends in the LEO Society report that they are making progress in developing a CLEO compiler. They are looking for CLEO source code in any form for testing purposes. Contact *Secretary@leo-computers.org.uk* if you have anything put by.

101010101

In *Resurrection 85* we wondered whether Alan Turing might one day appear as the face of the new £20 bank note. Such is the power and influence of this journal that Turing has NOT been chosen for the £20 note, but has been elevated to the £50! How many of us will ever get to hold one is of course, another matter.



101010101

Once again, Herbert Bruderer writes from Zurich that he has published a new paper in CACM on the origins of certain c18th automatons. *cacm.acm.org/blogs/blog-cacm/238512-who-manufactured-the-mysterious-chinese-android/fulltext* is the place to look.

101010101

We hear of the passing of Michael Edwardes, best known as the head of British Leyland in the 1970s but also briefly, the chairman of ICL until it was acquired by STC. He left with a £300K payoff — something of a record for such short service.

CCS Annual Report and Chair's Adieu

David Morriss

This is my last report as chairman of the Society as I step down at the AGM. I can hardly believe it is three years since I was appointed.

As I look back over the last enjoyable term there are many highlights. I could sum up our activities under four "P"s — Projects, Presentation, Publicity and Promulgation. The bedrock of our activity is the project work undertaken by so many of you which you can follow in the journal.

Presentations continue to draw very good attendances and cover a very large range of topics. Speakers from overseas underline the international nature of what we do. I am grateful both to the speakers and the speaker secretaries who put our programme together.

Publicity via the website and *Resurrection* both informs and connects our members and is a critical part of our activity.

Promulgation for me covers such events as the Tony Sale Award, running and participating in excellent conferences and also the overseas visits. You will know how these activities also contribute to the international aspects of our work.

The chairman is totally dependent on the committee. Without their enthusiastic support and commitment none of this would be possible. My heartfelt thanks to all who have served during my time in office.

I have already mentioned attendance at events. This reflects our growing membership who also support our work through donations enabling us to financially underpin appropriate activities. This support is most welcome. Thank you.

I must not forget the support we have had from the BCS: Mandy Bauer, the Finance Team, and the London team.

In addition to my membership of the CCS I will remain active in the area of collecting information from the people who have built our industry as I have become a trustee of the Archive IT organisation.

I hope my successor enjoys the role as much as I have and wish him and the Society every success going forward.

The Elliott 502 at Malvern

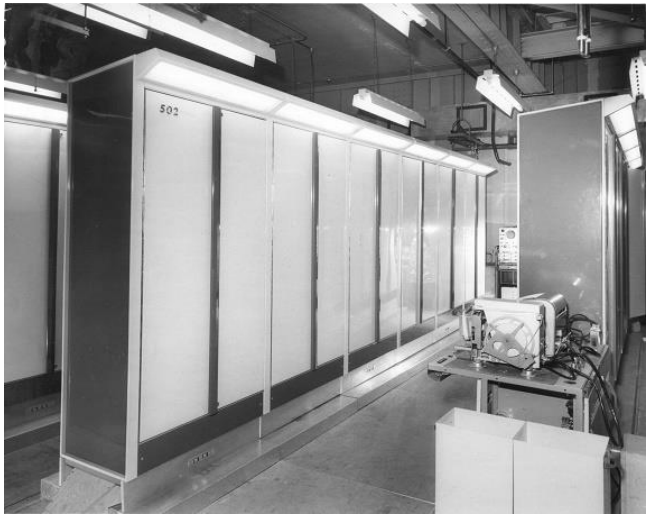
Iann Barron

Terry Frogatt's problem with fault finding on the Elliott 903 reminds me of an earlier experience with its predecessor, the 803. At the time (1962), I was on assignment at Royal Radar Establishment, Malvern and there was a major test of the UK air defence system. All the top brass from the RAF were there and were gathered around the 803. Another computer (not made by Elliott) had proved inadequate and at the last minute I had been asked to convert the incoming data on a paper tape to a different format for further processing. This was a real time situation — the aircraft were flying and the data was essential. Unfortunately the programmer who I had asked to write the conversion was far more attractive and far faster than her program, which converted about one character a second. The atmosphere in the room was dire — and then the computer stopped working. Our service engineer was called into action. He opened the doors of the 803 cabinet with a flourish and peered inside; after a minute or so, he removed one of the boards and replaced it with another; we switched on — the computer worked. There were gasps of amazement and one of the Air Commodores asked "How the hell did you do that?". The engineer looked him for a moment, then he said "It's always that bloody board".

That was the culmination of an eventful week in my life. But, to explain, I need to go back rather earlier. I learnt about computers as a vacation student at Elliott, and in my last year I designed the first version of the 803 — for which I was paid the vast sum of £60 0s 0d. After a period assisting Her Majesty's Forces, I returned to Elliott having proposed that I set up a group to do software research. This was thought to be a good idea, which was rather ironic, considering that a certain Tony Hoare was working on the floor below in the commercial software group, and had just published a program called 'quicksort'. However, when I joined, I was told that there was an emergency because Neil Wiseman, who was designing the Elliott 502 was required for another project, and I was asked to take over. The design of the 502 was almost complete and would only take a few weeks.

It was true that the design was almost complete, but unfortunately the part that needed to be done was the really innovative aspect — an automatic system for managing programs at eight priority levels and a related system of autonomous data transfers, which allowed blocks of data words to be transferred to and from the computer independently of the programs that were running. As a further problem, all but two of the 15(?) shelves in the computer were already full of circuitry, so the design had to be very economical. Then, when I was nearly done, I found out that there

were no initial orders (bootstrap) to start the computer. This was a real challenge, there was only half a logic board that was not already used. My solution involved changing the instruction set, a bootstrap of four hardwired instructions which loaded 13 instructions in reverse order from a paper tape, the last one modifying the conditional jump which terminated the hardware bootstrap, so that the new instructions could loop and install a proper binary loader from the paper tape. It was the cleverest thing I ever did, but no one ever knew about it (until now [ed]).



The 502 was designed as a high performance general purpose computer, specifically intended for real time applications. It had a 1024 word one microsecond memory with two cores per bit designed by Mullard and a larger secondary core memory. The circuitry used OC42 germanium transistors with zener reference diodes, and the logic was asynchronous — that is there was no constant clock beat, each phase of a particular instruction having an optimised timing. The design was almost identical in concept with the Atlas although, so far as I am aware, there was no contact whatsoever between the two design teams.

The first 502 was intended as part of the Linesman system. This was a highly secret project to replace the 30 odd radar stations protecting the UK with three new radar aerials located along the east coast, all facing east. Information was to be fed from the radars to a central control station which would integrate the data for presentation at 64(?) command and control consoles. There was also to be a subsidiary commercial air traffic control system, Mediator, which would be located at Heathrow. Strictly speaking, the 502 was not part of Linesman, its role was to simulate and monitor the system; as such, it had to be substantially more powerful than the computers in Linesman itself. As well as the 502 computer, Elliott

developed (at Rochester) an immensely complex special purpose system to interface into the various parts of Linesman and we also provided a raft of conventional peripherals. The whole Linesman system was conceived and planned by the Royal Radar Establishment and was initially installed and proved at Malvern.

The 502 was a great computer, but it did have three problems:

- The power supply system for the one microsecond store was a nightmare — there were 24(?) separate power voltages, and these did not have a common reference, but were balanced on one another in a complex tree structure. As a result, if one power rail failed (a common occurrence), it was highly likely that a number of the voltages would be reversed, causing untold damage to the circuitry. The power supply system was eventually redesigned.
- The computer was air cooled. There was a circulation system within each cabinet, the air being driven upwards by three fans at the bottom, and then returning down a channel at the side of the cabinet. Just above the fans there was a chiller radiator with freon coolant circulating to an external refrigerator. Freon is very good at leaking (I have a great story about the CDC6600, but not now); when it leaked the liquid would be sprayed over the circuitry by the fans — again with disastrous consequences. I don't remember the problem being solved while I was involved.
- The zener diodes had a finite possibility of failure at turn on. The Atlas team very sensibly designed out the zener diode at an early stage — foolishly, we waited for an improved version. One zener diode failing is not a great catastrophe — however, to find the fault it might be necessary to turn the computer on and off several times, which could lead to a cascade of random failures — a far more challenging problem. The workaround was to keep the computer on at all times, to use hot plugging — and to pray.

Because there was so much equipment, there was not room for it all on the computer floor at Malvern, and the user operating area had to be on the floor above — particularly difficult when it came to fault finding, which involved at least two engineers and a telephone. One night I was busy in the operating room when a security guard came in. I was preoccupied and he was very hesitant. After a while I asked him what he wanted and he said "Excuse me sir — your computer is on fire." And it was. The freon had escaped, spraying the power supply of the fast memory, and there were flames everywhere. It took many days to recover from that; the only saving grace was that the fast memory was in an end cabinet, while the

adjacent cabinet held the slower memory, so the damage was less than it might have been.

An operational test of the Linesman system was planned. This was to be a massive event. It involved the whole of the RAF. Our V bombers were to fly out over Germany and to return across the North Sea representing the attacking red force of Bear bombers (Tu95s), while the defending blue force of Lightning fighters would be scrambled and directed using the Linesman system. Because we did not have very many planes the bombers were to be tightly concentrated into a 5^0 (?) arc. The role of the Elliott system was twofold; it was to record and monitor the performance of Linesman and also to simulate the attack on the remaining 90^0 or so sector that a real raid would present.

The test was delayed repeatedly over many weeks. The problem was the Lightning fighter. The Lightning was a wonderful device. It was basically a jet engine with the pilot as a bare back rider; the Lightning could climb to 60,000ft and, with reheat, could reach Mach 2. However, it was a fuel guzzler and had a limited range; if reheat was used while it was going east it would not have enough fuel to return to base. Worse still, it was extremely unreliable. The RAF had one squadron of six planes; a minimum of five were required to be operational for the test and this proved very difficult to achieve.

Week after week went by until the September, when I was due to be married. It was made quite clear to me the needs of my Country were greater than the bonds of love. I drove home on the Friday, was married on the Saturday and returned later the same day to Malvern; it was a great time for a honeymoon. The test was go for Wednesday, then on the Monday it was decided that the computer running the Linesman system was not adequate for the task and I was asked if the Elliott system could take over its role. The answer was yes, in principle — the 502 monitored and simulated all the aspects of the system; it would be necessary to modify some of the software and to jury rig some further interfaces into the Linesman system. The work was done and by Tuesday evening at eight we were ready to try the system. It worked for a while, and then the computer locked up.

I was fairly sure that the fault lay in one of the jury rigged interfaces; the system seemed to have stopped during an autonomous data transfer. Because the system was asynchronous, and the interfaces worked on a handshake basis, all I had to do was to look at various of the interface lines, and the state of the computer to work out what had gone wrong. In any case, I dared not turn the 502 off, because one of the zener diodes

might fail. Most of the relevant signals had monitor lights and so I spent my time sitting in front of them trying to deduce what had happened from the pattern of lights. It was not long before the top brass of the RAF were jumping up and down demanding that I do something. First they asked the Linesman project manager to sort out that fool engineer who was doing nothing. I explained the situation and he attempted to reassure the RAF. Then they called my line manager, John Bunt; he, as usual, expressed himself in somewhat pithy language. The next call was to Andrew St Johnstone, my managing director. Eventually I managed to get some 20 very irate officers removed from the computer room so that I could concentrate on the problem.

It was now after 11 o'clock and I was in a poor state, I had been working extremely hard for many weeks, and I had had virtually no sleep for several days. I could not concentrate and was at severe risk of falling asleep. What I needed was a shot of energy. My solution was to ask one of my engineers (whom, by coincidence, had been in the same form as me at school) to get me some whisky. He returned, within an hour, with a bottle of whisky, which I proceeded to empty over the next hour or so. By now the officers were back, and not only was that fool engineer still not doing anything, but he had drunk a whole bottle of whisky. At two o'clock in the morning they called the chairman of Elliott — Sir Leon Bagrit. I had never met him and he knew nothing about the situation. However he was immensely courteous and supportive of me in spite of being called out of bed.

Sometime after three, I cracked the problem. On one of the jury interfaces, a control signal had been interchanged with an adjacent data bit. By some miracle the data pattern had been such that the system worked for some time before locking up. However, having identified the problem was not the same as fixing it. I still dared not turn off the computer, in case it created a hardware fault, and I could not just interchange the two wires, because this would leave the computer in a locked state, requiring the computer to be turned off and on again. A complicated procedure was devised applying external voltages to the relevant pins in a programmed sequence as the two wires were interchanged. Miracle of miracles, the system worked . . . and continued to work . . . and the aeroplanes flew.

For the next part of the story, you need to jump to the beginning. (This is not a bootstrap.)

As well as his early career at Elliott, Iann Barron is chiefly famous as the founder of Computer Technology Ltd which gave us the Modular One computer and joint founder of Inmos (the Transputer). Contact at iann@barrow-court.uk.

The Formation of ICL and the "New Range"

Virgilio Pasquali

> In August 1968, ICT and English-Electric Leo Marconi merged together to form ICL (International Computers Limited), thus completing the last step of the rationalisation of the British computer industry, under the active encouragement of the British Government (Tony Benn, aka "Golden Stick").

The two companies had incompatible products. ICT was marketing the 1900 Range of compatible systems and English Electric (EE) was marketing System 4, a range of IBM compatible systems (based on the RCA Spectra 70), both ranges marketed in direct competition to the IBM 360 (and later 370), IBM being the world dominant supplier.

The pace of competition was such that ICL, the new company, could only remain competitive on the longer term against IBM by focusing all its development resources (hardware and software) on a single compatible range, System 4 being the ICL Board's choice.

At the time, Mike Forrest was the manager of Product and Market Planning in ICT H.Q. and I was the manager of "Future Processors and Systems" in ICT Product Planning.

Mike Forrest was asked by Arthur Humphreys to form a joint working party to outline to the joint Board the future product direction of ICL. Thus Mike Forrest, Bill Talbot (the Manager of ICT West Gorton), and I got together with Colin Haley, John Aris and Reggie Allmark(?) in Kidsgrove for a week, to discuss and agree an outline product plan based on the English Electric System 4 range. I was secretary to the working party (probably because I was the most junior).

English Electric had at the top of the System 4 range an excellent system (the 4/70) designed and developed in Kidsgrove (the other systems in the System 4 range were derivatives from RCA Spectra 70 models) and we spent a long time analysing, initially that system and the System 4 architecture (John Bowthorpe, the chief designer of the 4/70, was recalled from his holidays in Cornwall to discuss the design with us).

On Friday, the last day, we moved from Kidsgrove to West Gorton (where the 1900 large and medium systems were designed and manufactured) to use their manufacturing cost estimating capabilities. It was becoming increasing clear that the System 4 systems were significantly more expensive to manufacture than the ICT 1900 systems, and, as our overall profit margins on the 1900 were already low, it was not feasible to adopt

System 4 as our main or only range, even in the short term, to replace the 1900.

The only viable Product and Market strategy we could recommend to the Board was:

1. to continue with the 1900 range on the short term
2. to market System 4 (especially the 4/70) mainly for large real-time applications e.g. "transaction processing" (the 1900 architecture was not very good for real-time applications, and the real-time interactive market (transaction processing) was the future)
3. to proceed urgently to design and develop a New Range (with initial emphasis on real-time interactive processing and large, powerful systems (another weakness of the 1900)).

I spent the weekend at home writing the report (at 3-4 pages a very difficult report to write), and, at 07:00 on Monday morning, with my manuscript (word processors had not yet been invented) I drove from Bracknell to Putney where Arthur Humphreys' secretary was waiting to type it. At 08:30 Mike, Bill and I walked into Arthur's office/conference room where some key members of the ICL Board were assembled.

Arthur offered us a sherry (at 08:30!) from his office drinks cabinet. Then Mike presented the report and all three of us explained and expanded on our conclusions.

A few weeks later Mike Forrest phoned to ask me to join New Range Organisation (NRO), that he had just been asked to set up urgently.

I joined him on secondment to NRO in Putney.

As a first step, Mike had a series of meetings with a few senior technical people to discuss and evolve the structure and "modus operandi" of NRO. John Pinkerton and David Huxtable (ex-English Electric), Ron Feathers and I (ex-ICT) (and another?) had long sessions with Mike in his office on the 8th Floor ICL House Putney, all sitting round his rather small and narrow conference table.

NRO chosen structure: a number of small teams of senior designers (each team defining and expanding on an architectural option for the New Range) plus a high power "requirements/marketing and evaluation" team (with David Caminer, John Aris and Hugh McDonald) and a bridgeware team led by Brian Hardisty.

Six options were identified i.e. "8-bit 1900", "Enhanced System 4", "Manchester University MU5", "Basic Language", "High Level Language", and "New Series Branch".

While we were discussing this list, I proposed a 7th Option, putting together, in response to the market requirements, the best features of some of the other options in a coherent architecture. Ah, John Pinkerton remarked, you mean a "Synthetic Option". The name stuck, the Synthetic Option became the 7th option, and Mike asked me to choose and lead a team to develop the proposal.

In late January 1969 the real work started. Some 50+ senior experts were seconded into NRO (full or part time) and crammed in the 8th floor of ICL House. Each option team had a single room with a conference table, lots of chairs, one or two whiteboards (and nothing else). I remember that the six of us (John Bowthorpe, John Buckle, Jack Connet, David Howarth, Colin Taylor and I) in the Synthetic Option team spent months in our single room, brainstorming, looking at and writing on our two whiteboards, where a coherent advanced design was slowly emerging. When we wanted to type something on paper I had to go and buy a typewriter (in contravention of company rules).

We hardly had room for our many helpful visitors (i.e. Derrick Morris of Manchester University, Roy Mitchell of Basic Language, etc), advising us on some aspect of their architecture that we wanted to incorporate into ours. But the excitement that Mike had induced in all of us kept us going. We were doing something extraordinary and very exciting!

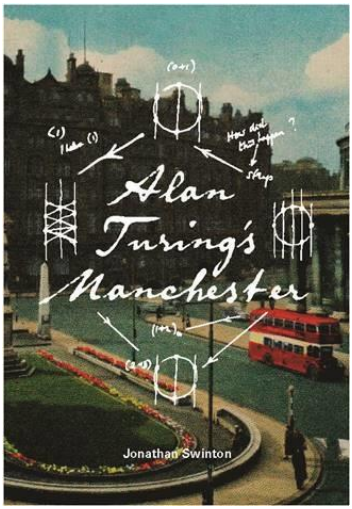
Under Mike Forrest's energetic management, NRO delivered. By October 1969, the second phase of the activity was concluded, and an independent Jury (Chairman Colin Haley, with Charlie Portman, Norman Brown, Malcolm Shermedine and eight other top technical managers) was assembled for a week in our Cookham conference centre to choose one option and advise the company about its validity and feasibility. The Synthetic Option was chosen, and New Range projects went into development.

NRO became New Range Planning Organisation, with responsibility for the Architecture, New Range Specification Documents and Planning. Many interlinked projects were launched in the development units (West Gorton, Kidsgrove, Stevenage, Bracknell and London). and the new company, ICL was unified behind its future range of products.

Virgilio Pasquali is principally known for his strategic work on the ICT 1900 Series and the ICL New Range. His history of the former can be found at www.ict1900.com. *Contact at* virgilio@pasquali.org.uk.

Book Review: Alan Turing's Manchester

Dik Leatherdale



You might be forgiven for supposing that Jonathan Swinton's book is about Manchester in the time of Alan Turing's sojourn in that city. Well yes, up to a point. But in the preface we are told that *this is a book about the people one might have met in Turing's Manchester* — an altogether more interesting story.

Most of the usual suspects are there. Turing himself of course, but also Williams, Kilburn, Newman, Strachey, Hartree, Wittgenstein (who knew? Not I.) and the Berners-Lees. The famous physicist and Nobel laureate Patrick Blackett is revealed as an important influence in the computer project, albeit not a participant. Turing's assistant and successor Tony Brooker receives only a passing mention. Surprising, as he seems to have undertaken Turing's formal duties while our hero spent his time thinking beautiful thoughts about AI and morphogenesis. Most of these people came to Manchester from Cambridge which at first glance is odd. But 70+ years ago, Cambridge represented a much higher proportion of the university establishment than is now the case.

No less a person than Andrew Hodges opines that *The narrative writing is a pleasure*. Indeed it is! The book is a joy to read, never dull, occasionally deliciously gossipy and full of fascinating asides. For example, we are introduced to Hertha Ayrton whose *nomination to the Royal Society in 1902 had caused the Society some difficulty: it was obvious to the men of the Society that it was a society only for men, but on examination their own statutes neglected to say this. Legal advice was procured that married women were not persons in the eyes of the law and so could not be members*. Shocking! But what a long way we have come since 1902!

I found myself consulting the endnotes quite often, something I rarely do, but which I here found unusually rewarding. However, the omission of an index in a work of this nature is unfortunate, particularly to a reviewer.

Resurrection readers are perhaps, the ideal audience for this book. It is a pleasure to read and to recommend.

Obituary: George Felton 1921-2019

Martin Campbell-Kelly

George Felton at the inauguration of the restored Pegasus at the Science Museum, 2001. In the background: John Crawley formerly of the NRDC, Hugh Devonald and Sir John Fairclough both ex- Ferranti. Photo Courtesy Leonard Hewitt

George Felton was one of the UK computer industry's foremost software authorities. Felton went to Cambridge University to read maths and physics in 1940, though he did not complete his degree until 1948 because he was enlisted to work on radar and electronic navigation. After graduating he became a research student in physics at the Cavendish Laboratory. This brought him into contact with the University Mathematical Laboratory where the EDSAC was close to completion. Felton became fascinated by computers, and abandoned his doctoral studies.

In 1951 he joined Elliott Brothers, where he designed the programming system for the Nicholas computer, using ideas he had picked up at

Cambridge. It was the most comprehensive system of its era. In 1954, he joined Ferranti. He was responsible for the design of the Pegasus programming system, and wrote much of it, including the Pegasus Autocode. Beyond the computer industry, he was best known for using the Pegasus to calculate π to a record-breaking 10,017 decimal places. His record lasted just six months before it was broken by a much more powerful IBM computer. In 1960 he became software manager for the Ferranti Orion, for which he designed the Orion Monitor Program, a multiprogramming operating system.

After Ferranti's computer division was acquired by ICT in 1963, Felton became manager of system software for the 1900 series, heading a team of some 200 programmers. While he was in the United States attending a conference in 1965, the operating system was named GEORGE (a contrived acronym for GEneral ORGanisational Environment).

Prior to the merger of ICT and English Electric Computers in 1968, Felton was one of a team of six that studied the feasibility of a new range of computers which needed to be compatible with the existing ranges. The team decided such a range was possible and this enabled the merger resulting in ICL to go ahead. Felton subsequently oversaw the development of the system software for the new range, announced in 1974 as the ICL 2900 series. Until his retirement in 1985, he managed ICL's university relations.

In 1983 an original Pegasus was acquired by the Science Museum and after a period in store it was restored to life by a team of enthusiasts from the Computer Conservation Society. It was inaugurated in 2001 and was maintained as a working exhibit in the Kensington Road museum for more than a decade.

Full obituaries of George Felton appeared in the Guardian (2nd July 2019) and the Times (30th July 2019)

CCS Website Information

The Society has its own website, which is located at *www.computerconservationsociety.org.* It contains news items, details of forthcoming events and also electronic copies of all past issues of *Resurrection*, in both HTML and PDF formats, which can be downloaded for printing.

At *www.computerconservationsociety.org/software/software-index.htm* can be found emulators for historic machines together with associated software and related documents all of which may be downloaded.

Letter to the Editor
Michael J. Clarke

It always fails on a Thursday!

This computer system was the control processor for a "Just in Time Delivery" manufacturer. It was required to run reliably 24×7 with some scheduled maintenance time for a few hours a month. There was heavy duplication of peripherals which allowed them to be maintained as and when required simply by switching to the alternative hardware thus allowing the equipment to be serviced. This of course did NOT include the computer, a large very expensive single processor mainframe.

The customer complaint just stated "It always Fails on a Thursday"

Hardware engineers, software experts, support staff of all sorts investigated this unhappy state of affairs. They then asked me to fly out to see if I could at least identify where the problem was.

A few days and several hours later I arrived on site, a Thursday morning! I was shown a number of paper mountains — memory dumps taken after the system crashed. I investigated and after examining just three of these paper mountains I asked a question.

"What time did you start this current run?"

"Last Friday around one a.m."

"Can you be more precise please."

The exact time from the console log of the restarted system was provided.

I consulted my pocket calculator.

"Your system will crash at about 17 minutes past two this afternoon! I will have the engineers ready with a replacement part that will resolve the problem. Where is the nearest pub?"

At 14:17 the computer crashed. The engineers changed the offending part.

The customer wanted to know how I had predicted the time it would fail and what part had I had the engineers change?

My answer "Part of the system clock! When the total number of machine 'Ticks' reached a magic binary number the clock which should just have kept counting the clock reset to an impossible number, all the bits being set indicating a negative time. Just one AND gate was broken, that AND gate was only ever active when the system clock reached that magic binary number. When is the next plane back to the UK?"

50 Years Ago ….
From the Pages of Computer Weekly
Brian Aldous – TNMoC Archivist

Digital microcircuits as learning cells in new machine: A learning machine developed at the Electronics Laboratories of Kent University, Canterbury, has been named SOPHIA. It is distinguishable from other such machines by the fact that it employs 12 digital microcircuits as learning cells, rather than large and costly analogue devices. The microcircuits, are of the SLAM, Stored Logic Adaptive Microcircuit, type. Each comprises a thin silicon wafer 2mm square which accommodates eight storage bits, three logic inputs and one output. (11/9/69 p3)

After 10 years 'tis sad, but Leo II must go: In the smother of activities in the computer world during Datafair, an item of news from the early days of commercial data processing in the UK became somewhat overlooked. It was the retirement after almost 10 years continuous service, of the Leo II computer at the DHSS at Newcastle-upon-Tyne. (11/9/69 p13)

Management Software Emphasised in Titan System: After two and a half years of operational working, Cambridge University's Titan multiple access computer system now has more than 300 online users. Although limitations of the Titan (or Atlas II) hardware only allow for 18 terminals to be simultaneously on-line, and for a total of 60 consoles, the software written to manage the system appears to be effectively allocating the resources available. Titan was one of the very first multiple access systems to operate simultaneously in batch processing and on-line modes without giving precedence to either. (18/9/69 p14)

They're on the Right Track in France: The French National Railway, SNCF, is now implementing the initial phase of an ambitious three-stage computer scheme whose broad overall purpose is to enhance profitability by tightening controls in a number of areas. Specifically, these controls are aimed at increasing the profitable mileage covered by goods wagons and passenger coaches, cutting costs and releasing tied-up capital by control over spare parts and other inventories, and speeding the flow of incoming cash by faster issue of invoices for freight carried. (25/9/69-Intl p1)

BCL display Multi-Susie at the BEE: A new office computer capable of handling complicated analyses and large volumes of data, claimed to be 10 times more powerful than anything previously produced by the manufacturer, has been announced by Business Computers Ltd. Called the Multi-Susie, it consists of up to three satellite desk units operating on-line to one main memory. All the units are capable of working together on one program or independently of each other on individual programs. (2/10/69 p1)

Mini-Computer given NRDC Support: A new all-British 16-bit word length mini-computer based on the products of the rapidly expanding integrated circuit industry is being backed by the National Research Development Corporation. Called the 18C, the computer is being developed by Arcturus Electronics Ltd. Production is to begin soon. By making use of the medium scale integrated circuits now becoming available, the 18C allows data to be manipulated between several registers without returning to the main memory with subsequent advantages in speed and ease of programming. (2/10/69 p15)

New Language for Machine Tool Control: A computer language that allows programmers to produce control tapes for numerically controlled machine tools up to eight times faster than manual methods has been developed in Britain by GEIS for its nation-wide Dial-a-Computer service. Called GEAPT, it enables users of two- and three-axis point-to-point NC machine tools to dial directly through a GPO telephone network and offers direct access to a computer system from a terminal. (2/10/69 p24)

Digital control at Wiggins Teape vindicates itself: A computer control system installed as an experimental project at a cost of £200,000 is already vindicating itself at the Dartford paper mill of Wiggins Teape Ltd. In quality control, Wiggins Teape reports that basis weight variations are now much less than half what they were before the computer — a Ferranti Argus 400 — was installed, while variations in some parts of the process have been cut to one-tenth. Equally significant, changes of grade of paper made by the machine, which used to take up to 20 minutes, are now completed in less than two minutes, and the project team is confident that change times of one minute will soon be achieved. Paper breaks have been cut by 60 per cent and the amount of unusable paper is decreasing. (9/10/69 p3)

Complete System for Shipbuilders: A suite of programs covering initial design of a vessel right through to final production has been developed by the British Ship Research Association at Wallsend. The suite — known as Britships — British Shipbuilding Integrated Production System, covers preliminary and detailed designs and lines fairing for the hull shape. It also includes the production of machine tool control tapes for cutting and bending of sheet metal for hull sections and members, data for ordering materials and information relating to scheduling and costs to assist management control. (16/10/69 p1)

Propellor Blades Machined Five Times Faster with N/C: The most technically advanced numerically-controlled machine in the world, now fully operational in AB Karlstads, machines new marine propeller blades

five times faster than with conventional methods. Called the Spheromill 'P', this new multi-purpose mill has nine machine motions controlled simultaneously by a General Electric Mark Century 105C numerical control unit. (16/10/69 p8)

1906A trebles power at Chilton Atlas Lab: The Science Research Council's annual report has formally announced the intention to have an ICL 1906A computer installed at the Atlas Computer Laboratory at Chilton. This will take place in the spring of 1971 and will treble the computing power of the laboratory. However, now that ICL has cancelled the 1908A which would have had about 10 times the power of Atlas, the question of what big machine to link with the 1906A is so far unanswered. (16/10/69 p28)

803B takes over from 802: After eight years faithful service at British Aluminium's Chalfont Park operational research centre, what is believed to be the last Elliott 802 valve/transistor computer has been replaced. Bought in 1961 for £20,000 the machine has been sold to Electronic Brokers for a reported £275. The British Aluminium operational research manager told Computer Weekly that the machine had to be sold because ICL, who did not have a servicing contract, could not provide 802 engineers. He said: 'Basically, it was a good machine but it was limited with only 1K core store, however, it did have a 33-bit word length and we used several tricks to get the best out of it.' (23/10/69 p32)

Train control net to use GEC-Elliott systems: Two computer systems, between them controlling displays indicating the whereabouts of over 200 trains, have been ordered by British Rail's Eastern Region from GEC-Elliott Automation. An Elliott 905 system will enhance the existing train monitoring system at Leeds to cope with 190 trains at a time. At Healey Mills, 20 miles away, a smaller 903 system will control 61 train displays. By October next year the two systems will cover between them 78 miles of train routes. (30/10/69 p10)

Honeywell launches modular control unit: Described as the basis of a 'building brick' system, Honeywell's H112 digital controller, announced on Tuesday, is designed for use in tailor-made control systems using standard, off-the-shelf plug-in modules. The 12-bit stored program controller is based on a special purpose controller designed for use in a photo-typesetting system. Its main selling points are flexibility — 33 instructions and plug-in construction; low cost — £2,700 for a basic unit with 4K store; and reliability — mean time between failures of a logic module is said to be over two million hours. (30/10/69 p24)

360/75 to Strengthen Multi-Access at Harwell: Any time now, AERE Harwell is to take delivery of hardware which will upgrade its existing IBM 360/65 computer to a 360/75. The new system is scheduled to be operational in January, when it will support a large-scale system of multi-access from about 200 Teletypes and also fast data links from a number of small computers. A good deal of the Atomic Energy Research Establishment's work is classified secret, but out of the expertise gained on defence and other projects it is in a position to offer advice and assistance to industry in a number of different areas of computing. One of these is in multi-access computing. The HUW system, Harwell Users' Workshop, was designed at Harwell as a fully conversational file editing and remote job entry system. IBM's own conversational RJE system has turned out to be very similar. Eight of the 200 Teletype lines now connected are linked to the GPO's Datel network, so that users working at some distance can access the computer by telephone. (6/11/69 p24)

M1 system to warn motorists of hazards: Approximately 62 miles of the M1 motorway in Yorkshire are now controlled by a signalling and communication system designed to warn motorists of hazards ahead and to impose speed limits if necessary. The system has been installed by GEC-Traffic Automation, and is similar to one which has been in use on the M4 London to Maidenhead motorway since last March. In its early days the M4 system had a bad reception from motorists who either misunderstood or ignored its messages. (13/11/69 p24)

4/70 takes over V&G real time work: The first full-scale real time insurance system in Britain is to be set up by Vehicle and General Insurance, based on one of the largest ICL System 4/70 configurations in the country. The System 4, which is already installed at V&G's computer centre in Northwood Hills, has supplanted the firm's previous IBM 360/50. Linked to the 256K System 4 will be a total of 48 Marconi-Elliott visual display units, controlled by two Elliott 905 computers. (20/11/69 p1)

£5m Russian order for 1900As: An order, worth £5 million, for five 1900A computers and associated equipment, has been placed with ICL by Mashpriborintorg, the central purchasing agency for the USSR. The order will, no doubt, be doubly welcome to ICL in that it comes at a time when their ability to maintain their pre-eminent position in the Eastern European market in the face of growing competition from US and West German firms, has been increasingly questioned. Unconfirmed reports suggest that the computers will be delivered in three stages. A 1903A with interchangeable disc units and magnetic tape storage facilities is scheduled for delivery in May, 1970. A year later, a second 1903A and a 1906A, now largest of the 1900 series, with both fixed and interchangeable disc units, will be

delivered. In December 1971 a final delivery, again of a 1903A and a 1906A, will be made. (20/11/69 p1)

Production starts on UK hybrid: The first low cost hybrid computer to be manufactured in the UK, the EAL 580 desk top machine, is now being made by Electronic Associates Ltd at Burgess Hill, Sussex. It was introduced from the US in March at a basic machine cost of £10,000. Eventually it is hoped to produce more than 20 machines a year at Burgess Hill to cope with the increasing demand for this type of machine. (27/11/69 p32)

1989 — 2019 : 30 years

Contact Details

Readers wishing to contact the editor may do so by email to *dik@leatherdale.net*, or by post to 124 Stanley Road, Teddington, TW11 8TX.

Members who move house or change email address should go to *www.computerconservationsociety.org/membership/membership_general.htm*. Those who are also members of BCS, however, need only notify their change of address to BCS, separate notification to the CCS being unnecessary.

Queries about all other CCS matters should be addressed to the Secretary, Rachel Burnett at *rb@burnett.uk.net*, or by post to 80 Broom Park, Teddington, TW11 9RR.

Forthcoming Events

London Seminar Programme

17th Oct 2019	Role of Computer Museums and Studying Computer Science	Jochen Viehof & Johannes Blobel
21st Nov 2019	Computing at Jodrell Bank	Ian Morrison
12th Dec 2019	Computer Films	Dan Hayton et al

London meetings take place at the new BCS location — 25 Copthall Avenue Moorgate EC2R 7BP starting at 14:30. The venue is on the corner of Copthall Avenue and London Wall, a three minute walk from Moorgate Station and five from Bank.

You are strongly advised to use the BCS event booking service to reserve a place at CCS London seminars in case the meeting is fully subscribed. Web links can be found at *www.computerconservationsociety.org/lecture.htm*.

For queries about London meetings please contact The CCS meetings secretary Roger Johnson at *r.johnson@bcs.org.uk* .

Manchester Seminar Programme

22nd Oct 2019	Recreating the Polish Bomba, Predecessor to the Turing-Welchman Bombe	Jerry McCarthy
19th Nov 2019	Bloodhound Missile Preservation	Peter Harry
21st Jan 2020	Rewriting History — The Past, Present and Future of Digital Archiving	David Ryan

North West Group meetings take place in the Business School of Manchester Metropolitan University, Chester Street, Manchester, M1 5GD: 17:00 for 17:30.

For queries about Manchester meetings please contact Alan Pickwick at *alan_c_pickwick@btinternet.com*.

Details are subject to change. Members wishing to attend any meeting are advised to check the events page on the Society website at *www.computerconservationsociety.org/lecture.htm*.

Museums

SIM : Demonstrations of the replica Small-Scale Experimental Machine at the Science and Industry Museum in Manchester are run every Tuesday, Wednesday and Sunday between 12:00 and 14:00. Admission is free. See *www.scienceandindustrymuseum.org.uk/* for more details.

Bletchley Park : daily. Exhibition of wartime code-breaking equipment and procedures plus tours of the wartime buildings. Go to *www.bletchleypark.org.uk* to check details of times, admission charges and special events.

The National Museum of Computing : Open daily 10:30-17.00. Situated on the Bletchley Park campus, TNMoC covers the development of computing from the "rebuilt" Turing Bombe and Colossus codebreaking machines via the Harwell Dekatron (the world's oldest working computer) to the present day. From ICL mainframes to hand-held computers.

Please note that TNMoC is independent of Bletchley Park Trust and there is a separate admission charge. Visitors do not need to visit Bletchley Park Trust to visit TNMoC. See *www.tnmoc.org* for more details.

Science Museum :

There is an excellent display of computing and mathematics machines on the second floor. The *Information Age* gallery explores "Six Networks which Changed the World" and includes a CDC 6600 computer and its Russian equivalent the BESM-6 as well as Pilot ACE, arguably the world's third oldest surviving computer.

The new Mathematics Gallery has the Elliott 401 and the Julius Totalisater, both of which were the subject of CCS projects in years past, and much else besides.

Other galleries include displays ranging from ICT card-sorters to Cray supercomputers. Admission is free. See *www.sciencemuseum.org.uk* for more details.

Other Museums :

At *www.computerconservationsociety.org/museums.htm* can be found brief descriptions of various UK computing museums which may be of interest to members.

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