Our Computer Heritage

British companies delivering digital computers in the period 1950 – 1965.
(Version 2, January 2022).

Elliott Brothers (London) Ltd. and Elliott-Automation.

The Elliott Instrument Company was founded in 1804. By the 1870s, telegraph equipment and electrical equipment were added to the company's products. Naval instrumentation became an area of increasing importance from about 1900, the company working with the Admiralty to develop *Fire Control* (ie gunnery control) electro-mechanical analogue computers. Elliott Brothers (London) Ltd. provided fire-control equipment to the Royal Navy from 1908 until shortly after the end of the Second World War.

By 1946 the company's main factory at Lewisham in south London had become a technological backwater. Although still skilled in manufacturing electro-mechanical equipment and precision electrical instrumentation, it had been bypassed by the huge war-time flow of government contracts for radar and allied electronic equipment. Compared with firms such as Ferranti Ltd., there was practically no electronic activity at Elliott's Lewisham factory. The company actually traded at a loss between 1946 and 1951.

Somewhat surprisingly, fresh discussions between the Admiralty and Elliott Brothers (London) Ltd. started in 1946, with the objective of persuading the company to host a new research team whose prime objective was to work on an advanced digital electronic Fire Control system and target-tracking radar. The Admiralty leased to the company a redundant factory at Borehamwood in Hertfordshire. This became known as Elliott's Borehamwood Research Laboratory. It was at Borehamwood that a team of specially-recruited young scientists and engineers designed and built several secret digital computers for various classified projects.

In 1950 Elliott's Borehamwood team began to look for civil applications for their digital techniques. With funding from the National Research Development Corporation the Elliott 400 series of computers was born. Between 1956 and 1967 Elliotts made an arrangement with the National Cash Register Co. Ltd. (NCR), whereby NCR became responsible for marketing Elliott computers to the commercial data-processing sector. Sometimes the Elliott 405 computer is described in contemporary pamphlets as the National Elliott 405.

Meanwhile, Elliotts realised that digital computers were becoming robust and cheap enough to be used for looking after all sorts of manufacturing processes. The word *Automation* was used to describe this trend. The company name was changed to Elliott-Automation in 1957. In 1961 Elliotts made 50 percent (by number, not by value) of all the new computers sold in the UK that year, many of these being destined for industrial

process control. The avionics market also began to blossom and Elliott airborne computers, produced at Rochester, were increasingly in demand.

Unfortunately the company's underlying finances had weakened by the mid-1960s and in the spring of 1967 a merger was arranged with the English Electric Company. By the autumn of 1968 GEC took over the merged English Electric/Elliott-Automation organisation and the mainstream computing sections were passed to International Computers Ltd. (ICL). GEC retained the military and process-control computing sections, which eventually became part of BAE Systems.

The Elliott computers featured on the Mainframe section of the *Our Computer Heritage* site are:

Group	Computers	Dates first working	Relative size	Initial target applications
E1	152	1950	Medium	Defence (naval gunnery)
	Nicholas	1952	Small	Defence (ballistics)
	153	1954	Large	Defence (direction finding)
E2	401, 402	1953	Small	General
	403	1955	Large	Defence (missiles)
	405	1956	Medium/large	Commercial data processing
E3	800 series	1957	Small	General & automation
	503	1962	Large	General
E4	502	1963	Large	Defence (radar)
E5	900 series	1963	Small	Defence & automation
E6	4100 series	1965	Medium	General

The Elliott computers not specifically covered in the *Our Computer Heritage* project are the ARCH series of process control machines of the 1960s. ARCH (the *Articulated Control Hierarchy*) was designed as a modular system of standard analogue and digital sub-units sharing a common bus. The digital sections were usually standard Elliott 800 or 900 series computers. The idea was that tailor-made ARCH on-line installations could be configured to suit the particular industrial process(es) being controlled. The Panellit 609 was an Elliott 803 computer packaged for process control applications and marketed via a licencing arrangement with the Panellit Corporation of Skokie, Chicago.

GEC took over some of Elliott-Automation's computing activities in 1968. The results, marketed as the GEC 2000 and 4000 and the Series 63, are covered in the Minicomputer section of the *Our Computer Heritage* website.

For further reading, see: *Moving Targets - Elliott-Automation and the dawn of the computer age in Britain, 1947 – 67*. S H Lavington. Published in 2011 by Springer, ISBN 978-1-84882-932-9.

Ferranti Ltd.

The Ferranti company was founded in 1882 by Sebastian Ziani de Ferranti, an inventor born in Liverpool. Ferranti soon achieved substantial success in the fields of electrical generation and supply, transformers and electricity meters. This was followed by work on electrical measuring instruments and, in due course, wireless technology.

By the end of the 1930s, Ferranti was larger than Elliott Brothers (London) Ltd. Furthermore, Ferranti was able to build on its radio and radar activity during the Second World War to become a leading UK electronics player.

The Ferranti company was based in Lancashire, with most of its factories within the Manchester area. It was therefore not surprising that, in 1948, when the government was looking for a company to produce a re-engineered production version of a pioneering digital computer produced at Manchester University, Ferranti was given the contract. This led to the Ferranti Mark I which, when it was delivered in February 1951, was the world's first production computer to have been installed at a users' site.

Throughout the 1950s and 1960s Ferranti Ltd. continued to build computers, initially aimed at the scientific and engineering sectors of the market. At the smaller machine sector of this market, Ferranti produced computers for the control of surface-to-air missiles and, in due course, for industrial process control. For the most-demanding large machine sector of the scientific market, Ferranti produced the Atlas computer. When Atlas came into full operation at the end of 1962 it was reckoned to be the most powerful in the world – a position from which, inevitably, it was soon displaced by more powerful American computers.

In terms of end-user support, a notable innovation by Ferranti was the establishment in 1955 in London of probably the UK's first Computing Centre to be based on stored-program machines. (L J Comrie had set up the world's first for-profit computing service in London in the 1930s, but based on electro-mechanical calculators). At Ferranti's Computing Centre a Pegasus was made available (from 1956) for demonstrations, programming courses, bureau services, systems development and documentation. Ferranti was at the forefront of UK companies at that time in the provision of help for end-user applications.

Ferranti remained a leading British computer manufacturer until 1963, when its mainstream computing sections were taken over by International Computers & Tabulators (ICT). Ferranti continued to manufacture smaller computers for industrial process control and for real-time military applications until the company finally lost its separate identity in 1987. Post-1963 Ferranti computers such as the later Argus machines are covered in the Minicomputer section of the *Our Computer Heritage* website.

The Ferranti computers featured on the Mainframe section of the *Our Computer Heritage* site are:

Group	Computers	Dates first working	Relative size	Initial target applications
F1	Mark I	1951	Large	General
	Mark I*	1953	Large	General
F2	Mercury	1957	Large	General
F3	Pegasus	1956	Small	General
	Perseus	1959	Large	Commercial data processing
	Sirius	1963	Small	General
F4	Orion 1 & 2	1963	Large	Commercial data processing
F5	Atlas 1 & 2	1962	Large	General
F6	Poseidon	1964	Medium	Defence (naval)
	Hermes	1964	Medium	Defence (naval)
	Apollo	1961	Medium	Air traffic control
	Argus	1958	Small	Defence (missile control)

Within the *Our Computer Heritage* time-frame of 1950 – 1965, the only Ferranti computer not specifically mentioned is the F1600 – initially designed for real-time naval applications.

For further reading, see: *Ferranti: a History. Building a family business, 1882 – 1975.* J F Wilson. Carnegie Publishing Ltd., Lancaster, 2001. ISBN: 1-85936-080-7. Volume 2: *from family firm to multinational company, 1975 - 1987*, published in 2007 by Crucible Books, Lancaster. ISBN: 978-1-905472-01-7.

Leo Computers Ltd.

The catering and bakery firm of J. Lyons & Company was founded in 1887. The firm became well known in the London area for its high street cafés, known as *tea shops*. The company was also well known as a pace-setter in office mechanisation and in 1947 two employees were sent to America to study 'the possibilities of electronic calculators in the office'. On calling at Princeton University, the two were advised to return to the UK and visit Cambridge University, where the EDSAC computer was under development. Suitably impressed by the Cambridge team, Lyons made a donation to the EDSAC project and sent a member of staff to Cambridge for six months to learn about the computer. By the spring of 1949 Lyons had started building their own computer in London, based on EDSAC but with enhanced capabilities for bulk input/output. Their computer was called LEO (Lyons Electronic Office).

By February 1951 LEO was running simple programs and the system was in full operation for business processing by the end of 1953. It attracted a great deal of attention from other commercial organisations. Accordingly, at the end of 1954 Lyons founded a subsidiary company, Leo Computers Ltd., to build and market a new computer called LEO II. Eleven of these machines were sold, starting in 1957.

Leo Computers Ltd. continued development, producing the LEO III machine in 1962, of which 94 were sold. In April 1963 English Electric's Computer Division merged with Leo Computers Ltd., to form a company called English Electric Leo Computers Ltd. The reasons why this merger made sense for both partners were two-fold. Firstly, English Electric wished to broaden its computer horizons by moving away from reliance on the

scientific field and towards participation in the rapidly-expanding commercial data-processing market. Leo Computers were well-established in the commercial data-processing area. Secondly, the management of Leo Computers realised that the tasks of enhancing their current product, LEO III, and then designing a future replacement for it, were beyond their present technical resources.

By 1968 English Electric Leo Computers had become part of International Computers Ltd. (ICL). Meanwhile, the original Lyons catering company was having financial difficulties. In 1978 Lyons was acquired by Allied Breweries, becoming part of an amalgam called Allied Lyons. By 1994 all trace of the Lyons name had vanished from public gaze.

The Leo computers featured on the *Our Computer Heritage* site are:

Group	Computers	Dates first working	Relative size	Initial target applications
L1	LEO I	1951	Large	Commercial data processing
L2	LEO II	1957	Medium	Commercial data processing
L3	LEO III	1962	Large	Commercial data processing

For further reading, see: *A computer called LEO: Lyons teashops and the world's first office computer*. Georgina Ferry. Published by Fourth Estate, 2003. ISBN 1-84115-185-8.

EMI.

Electric and Musical Industries Ltd (EMI) was formed in 1931 from a merger of two gramophone (phonograph) companies. From its beginning, EMI was involved in the manufacture of audio recording and playback equipment, in sound recording facilities at its famous Abbey Road studios in London and in the provision of records to play on its gramophones. During and after the Second World War, the EMI Laboratories in Hayes, west London, developed electronic equipment for both defence projects and, at the end of hostilities, for television.

EMI started to investigate digital computers in 1954. A one-off computer known as CP407 was delivered to the British Motor Corporation for payroll processing in 1958. By 1958 separate teams within EMI had begun working on two substantial new projects: the EMIDEC 1100 computer and the more powerful EMIDEC 2400 computer. The first EMIDEC1100 was delivered in 1960 and the first EMIDEC 2400 in late 1961 or early 1962. Work on a third project, the EMIDEC 3400, was started in 1960 but was run down after the July 1962 take-over of EMI's computer interests by ICT. After this point, the EMIDEC 1100 was re-badged as the ICT 1101. The EMIDEC 3400 was never completed.

Turning to other electronic products, EMI was noted for its provision of high-quality colour television cameras and, in the 1970s, for CAT scanners and medical imaging. Towards the end of the 1970s, EMI's manufacturing activities were run down and EMI became much more of a media organisation. In due course EMI became known to music enthusiasts as one of the world's Big Four recording companies. In 2010 EMI reported substantial pre-tax losses and at the time of writing (2011) it seems likely that the company will be broken up and sold off.

The EMI computers featured on the *Our Computer Heritage* site are:

Group	Computers	Dates first working	Relative size	Initial target applications
M1	EMIDEC 1100	1960	Large	Commercial data processing
M2	EMIDEC 2400	1962	Large	Commercial data processing

Within the *Our Computer Heritage* time-frame of 1950 – 1965, the only production EMI computer not specifically mentioned is the one-off CP407 (the BMC Payroll computer).

English Electric Co. Ltd.

Four firms joined together in 1918 to form English Electric Co. Ltd. The new company's principal factories were at Stafford, Preston, Rugby and Bradford. In 1942 English Electric acquired D Napier & Son Ltd., who manufactured automobile, marine and aero engines. Finally in 1946, English Electric acquired the Marconi group of companies. The radio pioneer Guglielmo Marconi (1874 – 1937) had founded his *Wireless Telegraph & Signal Company* in 1897. By 1946 Marconi's activities spanned electronics, communications and especially radar, with their main factories being in the Chelmsford region. Marconi brought electronics expertise to English Electric, though for the next 20 years there remained a cultural gap between English Electric and Marconi. For example, the latter designed and sold its own computers until 1964 (see below).

By the end of the Second World War English Electric was a powerful engineering organisation with a wide product range and a payroll of nearly 30,000 employees. Further expansion occurred in 1955, when two locomotive manufacturing companies joined the group. By the early 1960s, English Electric was particularly well-known for its Canberra jet bomber, Lightning supersonic fighter aircraft and the Deltic diesel-electric locomotive.

In common with most engineering firms at the time, English Electric had an internal need for better computing resources. In 1949 the company chairman Sir George Nelson, who was a member of the Executive Committee of the National Physical Laboratory (NPL), seconded a small group of engineers to help with the development of the NPL Pilot ACE computer. The company then improved the design and in 1955 produced a commercially-available version of Pilot ACE called DEUCE. 33 DEUCE computers were built, of which 12 remained in operation within English Electric.

English Electric went on to design several more computers, most of which were intended for the scientific and engineering market and, latterly, for industrial process control. In 1963 the company joined forces with Leo Computers Ltd. Then in 1964 Marconi's computer interests came on board, forming the English Electric Leo Marconi (EELM) combination. The EELM System 4, announced in September 1965, was compatible with the IBM System/360 range of computers.

In 1967 English Electric merged with Elliott-Automation. Then in 1968 the take-over of English Electric by GEC was agreed. (The General Electric Co. (GEC) had its origins in an electrical goods wholesaler established in London during the 1880s). Shortly afterwards, the mainframe computer business of English Electric Computers Ltd. was formally merged with that of International Computers & Tabulators (ICT), the result being re-named International Computers Limited (ICL). This brought the System 4 and the Elliott 4100

series computers into the ICL stables. The remaining process control and military computer activities of English Electric and Elliott-Automation were carried on by a company called Marconi-Elliott Computer Systems Ltd. (MECS), within the GEC empire. MECS was re-named GEC Computers Ltd. in 1971. In 1999 most of GEC, except for the defence-related sections known collectively as Marconi Electronic Systems, was re-named Marconi plc. At about the same time, British Aerospace purchased Marconi Electronic Systems to form BAE Systems. At this point the name GEC vanished from public gaze. In 2006 the name Marconi also effectively disappeared after massive financial losses.

The English Electric computers featured on the *Our Computer Heritage* site are:

Group	Computers	Dates first working	Relative size	Initial target applications
N1	DEUCE	1955	Medium	General
N2	KDN2, KDF6 & KDF7	1962 - 65	Small	Industrial control; SMEs
N3	KDP10 & KDF8	1962 - 64	Large	Commercial data processing
N4	KDF9	1963	Large	General

The following English Electric computers have recently (2021) been included in the current version of this website: KDN2 (1962), KDP10 (1962), KDF6 (1963), KDF8 (1964) and KDF7 (1965).   The KDN2 was a small computer developed for process control. From this design, two related small computers (the KDF6 and KDF7) were developed. The KDP10 was a version of the American RCA501 computer, intended for commercial data processing. The KDP10 was later upgraded and re-designated as the KDF8.

For further reading on the background to DEUCE, see: *Turing's legacy: a history of computing at the National Physical Laboratory, 1945 – 1995* by David Yates. Published by the Science Museum, London, in 1997. ISBN: 0-910805-94-7.

BTM, ICT and ICL.

International Computers and Tabulators (ICT) was formed from the amalgamation in 1959 of the two UK punched-card equipment manufacturers, namely the British Tabulating Machine Co. (BTM) and Powers-Samas. BTM had been founded in 1904, and re-incorporated in 1907, to exploit Herman Hollerith's invention in America of punched-card tabulating machines. Powers-Samas had grown from the Accounting and Tabulating Machine Company, established in 1915 as the British agency for the American Powers Accounting Machines. From this grew the Powers-Samas company in 1929. Thus ICT, through its two ancestor companies, had many years of experience in the provision of office machinery based on electro-mechanical punched-card equipment. Up to the late-1950s, punched-card machinery formed the overwhelming data-processing resource for business and commerce. Indeed, sales of this type of electro-mechanical equipment in the UK were increasing until 1961.

BTM became the UK's leading supplier of punch card systems. In 1951 BTM decided that they needed a small electronic digital computer to improve the calculating power and flexibility offered by their tabulators. The company saw the pioneering work of Andrew Booth's APEC (All-purpose Electronic Computer) prototype and arranged to copy the design. The resulting machine, called HEC (Hollerith Electronic Computer), was further

developed into marketable versions called HEC2M and HEC4. The HEC4, which was specifically designed for the business data-processing market, was re-named as the BTM1200 series. After BTM merged with Powers SAMAS in 1959 to form International Computers & Tabulators Ltd (ICT), it became the ICT 1200 series.

By the end of the 1950s the ICT 1200 had become the UK's best selling computer by volume and ICT seemed well-placed to lead the conversion of the UK's business community from electro-mechanical to electronic digital data processing.

In the early 1960s the increased penetration of American suppliers, particularly IBM, obliged the British manufacturers to rationalise. Between 1959 and 1968 there was a flurry of mergers and take-overs, during which ICT successively swallowed up the mainstream computer interests of GEC, EMI, Ferranti, English Electric, Leo Computers, Marconi Computers and Elliott-Automation. By 1968 this amalgam had been re-named International Computers Ltd. (ICL) and had become the UK's single major home-grown supplier of mainstream computers, with its principal offering centred on the ICL 1900 range. It is important to use the word 'mainstream' because ICL chose not to cover areas such as industrial process control and on-line real-time defence applications

ICL was gradually absorbed into Fujitsu during the period from 1981 to 2001. In June 2001 Fujitsu decided to dispense with the name ICL. At that time, ICL employed 19,200 people in Europe, the Middle East and Africa, over 10,000 of whom were in the UK. Whilst the passing of ICL could be said to mark the end of traditional British main-stream computer manufacture, the UK continues to have a distinctive home-grown presence in the real-time defence and aerospace applications of smaller computers. The current UK successor to Elliott-Automation, GEC, Marconi and Ferranti is in effect BAE Systems, a large company very much alive at the time of writing (2011) and still designing smaller computing systems.

The BTM, ICT and ICL computers featured on the Mainframe section of the *Our Computer Heritage* site are:

Group	Computers	Dates first working	Relative size	Initial target applications
T1	HEC2M HEC4/BTM1200	1955 1956	Small Small	General
T2	BTM/ICT 1300	1961	Small	Commercial data processing
T3	ICT/ICL 1900 series	1964	Small, medium & large	General and commercial data processing

Within the *Our Computer Heritage* time-frame of 1950 – 1965, the following early 1960s ICT computers have not been included in the current version of this website: 558FCC, 1500, 1600. ICT arranged to import over a hundred RCA model 301 computers during the period 1962-65. These were sold in the UK as the ICT 1500. It was classed as a small/medium computer in the price bracket £50K - £150K. Later, ICT arranged to import several RCA model 3301 computers, which were sold in the UK as the ICT 1600. It was classed as a medium-to-large computer in the price bracket £150K to £400K.

Some smaller, post-1900 Series, ICL computers such as the DRS 20 are covered in the Minicomputer section of the *Our Computer Heritage* website.

For further reading, see: *ICL – a business and technical history* by Martin Campbell-Kelly. Oxford University Press, 1989. ISBN: 0-19-853918-5.

Three British computer manufacturers not yet covered by the *Our Computer Heritage* project:

AEI.
AEI, Associated Electrical Industries Ltd., was first registered as British Westinghouse in 1899. It changed its name to Metropolitan-Vickers Electric in 1919 and then to AEI in 1928 with the merger of Metropolitan-Vickers and the British Thomson-Houston Company (BTH). In 1967 AEI was acquired by GEC. Within the time-frame 1950 – 1965 the company produced two relevant computers: the Metrovic MV950 in 1956, of which about six were built, and the AEI 1010 in 1960, of which about ten were built. The MV950 was the production version of a Manchester University prototype transistor computer that first ran a program in November 1953 – probably the world's earliest transistorized computer?

Marconi.
In 1961 the Chelmsford Division of Marconi produced the Marconi TAC (*Transistorised Automatic Computer*). This was a 20-bit word machine, of which about seven were built for process control. In 1963 came the Marconi Myriad computer, a machine aimed at specialist military and process-control applications.

STC.
Standard Telephones and Cables Ltd. (STC) started in 1883 as an agent for the American Western Electric Company. The Stantec Zebra computer (1958) used both vacuum tubes and transistors in approximately equal numbers, illustrating the chronological overlap of technologies. The Stantec Zebra's design was a collaboration between mathematicians from the Laboratory of the Netherlands Postal and Telcommunications Services at Leidschendam and engineers from STC. The machines were built in STC's Monmouth factory. STC was owned by ITT of America until the mid-1980s.

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