International History of Computing

A selective overview (1614-1961)

Edward Vanhoutte
edward@edwardvanhoutte.org

Year	Event	Country
1614	John Napier (1550-1617) published *Mirifici logarithmorum canonis descriptio* in which he discussed his logarithms.	GB
1622	William Oughtred (1574-1660) invented the slide rule which offered a quicker way to calculate logarithms	GB
1623	Wilhelm Schickard (1592-1632) devised a calculating machine that enabled Johannes Kepler (1571-1630) to calculate the orbit of the planet Mars by which he proved that the sun and not the earth was the centre of the system.	DE
1642	Blaise Pascal (1623-1662) constructed the Pascaline, an adding and subtracting machine that could automatically carry over amounts from a lower monetary unit to a higher monetary unit by applying distributed counting. The machine consisted of seven and later eight wheels, the first of which would count from 1 to 9, the second would count from 10 to 99, the third would count from 100 to 999, etc.	FR
1671	Gottfried Wilhelm von Leibniz (1646-1716) built a machine that could multiply (and divide) by repeated additions. This calculator was based on his invention of the stepped wheel, a cylinder with nine individual stepped teeth of increasing length.	DE
1680-1690	Broesel invented a weaver's programming device consisting of little wooden bars and a closed loop of a linen strip.	AT
1703	Gottfried Wilhelm von Leibniz (1646-1716) described the modern binary number system using 0 and 1 in his essay *Explication de l'arithmétique binaire, qui se sert des seuls caractères 0 et 1, avec des remarques sur son utilité, et sur ce qu'elle donne le sens des anciennes figures Chinoises de Fohy*.	DE
1725	Basile Bouchon introduced the use of a roll of punched paper for programmed weaving on his loom in Lyon in 1925.	FR
1728	Jean-Baptiste Falcon, Bouchon's assistant, improved Bouchon's idea using a set of punched cards attached to each other.	FR
1745	Jacques de Vaucanson (1709-1782) constructed an automatic tape-controlled loom.	FR

1786	J.H. Müller conceived the *Staffelwalzenmaschine* that evaluated and printed mathematical tables by adding sequentially the difference between certain polynomial values. This idea would later be rediscovered by Charles Babbage (1791-1871) for the design of his Difference Engine in 1822.	DE
1790 1801 1812	Joseph Marie Jacquard (1752-1834) conceived the idea for an automatic loom in 1790, but his involvement in the French Revolution delayed the actual building of the device that was completed in 1801. A binary system of a series of connected perforated cards and a set of needles that went through the holes activated the threading mechanism. The pattern of holes on the cards determined the weaving pattern. By 1812, approximately 11,000 automatic looms were in use.	FR
1820	Charles Xavier Thomas de Colmar (1785-1870) patented the Arithmometer on November 18, 1820 (French Patent No 1420). The machine, later referred to as the Thomas Machine, was based on Leibniz's design and performed the four operations in a simple and reliable way.	FR
1822	Charles Babbage (1791-1871) designed the Difference Engine mechanical calculator.	GB
1833- 1837	Charles Babbage (1791-1871) designed the Analytical Engine programmable mechanical calculator with a planned memory of 1,000 numbers of 50 digits.	GB
1838 1840	Thomas Fowler (1777-1843) developed a different approach towards calculating and developed a system based in tables of binary and ternary numbers to facilitate arithmetic calculations. In 1840 he presented his model of a ternary calculator to the members of the Royal Society.	GB
1842 1843	Luigi Frederico Menabrea (1809-1896) published his *Notions sur la machine analytique de Charles Babbage* which was translated into English by Ada Lovelace (1815-1852) as *A sketch of the analytical engine invented by Charles Babbage* in 1843.	CH GB
1843- 1859	Father and son Georg Scheutz (1785-1873) and Edvard Scheutz (1821-1881) built and sold the first operational Difference Engine (*differensmaskinerna*) based on Babbages plans and with Babbage's consent and support.	SE
1847 1854	George Boole (1815-1864) published *An investigation into the Laws of Thought, on Which are founded the Mathematical Theories of Logic and Probabilities* in 1847 and *An Investigation of the Laws of Thought* in 1854. In these works he discussed the foundation for the algebra of logic now called Boolean Algebra which became important for Set Theory and was essential for circuit switching and computer design.	GB
1857	Thomas Hill introduced the key driven arithmometer.	US

1875	Frank Stephen Baldwin (1838-1925) patented the pinwheel as a replacement of Leibniz' nine stepped drum.	US
1876	James Thomson (1822-1892) invented the Mechanical differential analyser, a mechanical wheel-and-disc integrator that became the foundation of analog computation.	GB
1878	Arthur Burkhardt's (1856-1918) first Arithmometer produced by his company *Erste Glashütter Rechenmaschinenfabrik*, was based on the Thomas design and started the calculating machine industry in Germany.	DE
	Independently of Baldwin, Willgodt Theophil Odhner (1845-1905), a Swede working for Ludvig Nobel in Russia, patented a pinwheel device.	RU
	Ramón Verea (°1833) patented a mechanism completely different from the Leibniz and Baldwin designs on September 10, 1878 (US Patent 207,918). He called it the Improved Calculating-Machine. It was based on a partial product multiplying mechanism able to "read" values from a notched Pythagorean table on a ten sided metal cylinder in a way similar to the Braille system. Verea was not interested in producing the machine, he just wanted to prove that a Spaniard could invent as well.	US
1880-1888	William Seward Burroughs (1857-1898) patented an adding machine with a full keyboard and printing facilities on 21 August 1888. He had developed the machine between 1880 and 1884 and applied for the patent in 1885.	US
1883	Thomas Edison (1847-1931) observed the thermionic emission effect which he promptly patented (U.S. Patent 307031).	US
1885	Dorr Eugene Felt (1862-1930) made a prototype of the Comptometer, the first practical multiple order calculator to use a keyboard. The keyboard consisted of 9 rows with keys, one for each digit (1 to 9). Zero was represented by the absence of a keystroke in the corresponding column. Felt applied for a patent in March 1887 and was granted the patent on October 11, 1887 (US Patent 371,496), so before Burroughs patent, although Burroughs had applied for a patent before Felt.	US
1889	Herman Hollerith (1860-1929) patented a whole system to process punched cards in the U.S. Patents 395781, 395782, and 395783.	US
	León Bollée (°1870) constructed a calculating machine in which the multiplication table was mechanically represented (US Patent 556,720) and which was faster than the stepped drum and pinwheel machines. The machine he built in 1892 on this principle calculated automatically the square root of an 18 digit number in about 30 seconds.	FR
	Dorr Eugene Felt (1862-1930) patented the Comptograph which was basically a Comptometer with a printing device.	US

1890	Hollerith Tabulators processed punched card data from the Austrian Census.	AT
	Hollerith Tabulators processed punched card data from the US Census.	US
1893	Otto Steiger (1858-1923) patented a multiplication machine based on Verea's approach. This machine was manufactured between 1895 and 1935 by Hans W. Egli of Switzerland and sold with the brand name The Millionaire.	CH
1895	Hollerith machines carried out the Russian national Census.	RU
	Leonardo Torres Quevedo (1852-1936) builds an algebraic machine for the mechanical calculation of the real and complex roots of an arbitrary trinomial equation.	ES
1900	Hollerith machines carried out the Austrian national Census.	AT
	Hollerith machines carried out the US national Census.	US
	Frank Stephen Baldwin (1838-1925) patented the Baldwin Computing Engine, a machine that required only one stroke per digit in order to perform multiplication or division.	US
1901	William W. Hopkins invented the Standard, a calculator that had one row of 10 digit keys which marked a significant departure from the popular full keyboard.	US
1902	The Czech Alexander Rechnitzer (d. 1922) designed the Autarith, the first motor-driven calculating machine, which was manufactured by the Autarith Company, Ltd. of Vienna. Based on the Thomas machine, this calculator also used an automatic multiplication and division mechanism patented by Rechnitzer.	AT
1904	John Ambrose Fleming (1849-1945) developed the 'oscillation valve', later known as the diode. It was also called a thermionic valve, vacuum diode, kenotron, thermionic tube, or Fleming valve.	GB
1906	Lee De Forest (1873-1961) added a third electrode to the diode, the 'triode' or 'audion' tube could both rectify and amplify; and its greater control meant that various electronic circuits would finally be commercially feasible..	US
1908 1913 1925 1927	Erwin Jahnz designed the MADAS (Multiplication, Automatic Division, Addition and Subtraction) in 1908. The calculator was manufactured by H.W. Egli A.G. in Zürich in 1913. Semiautomatic multiplication was added in the MADAS Semis in 1925. Full automatic multiplication was included in the MADAS Superautomat in 1927.	CH

1912	The Monroe Calculating Machine Company started producing calculators with full keyboards in cooperation with Frank Stephen Baldwin (1838-1925).	US
1914	Oscar J. Sundstrand introduced the modern 10-key design arranged in three rows with the sequence: [7, 8, 9] [4, 5, 6] [1, 2, 3] plus a zero key. This design was used by Remington-Rand from 1920 onwards.	US
1920	Leonardo Torres Quevedo (1852-1936) wired an electromechanical machine to a typewriter that was used as input/output device.	ES
1926 1930	Julius Edgar Lilienfeld (1881-1963) filed his first patent for the transistor principle in 1926 which was granted in 1930. Two more patents would follow.	US
1927	Vannevar Bush (1890-1974) built his first electromechanical differential analyser at MIT. The New York Times called it a 'Thinking Machine'. Further models were researched and built up to the 1942 version of the Rockefeller Differential Analyzer.	US
1933	Wallace Eckert (1902-1971) connected several IBM multiplying punched-card machines and tabulators through a calculation control switch of his own design for use in astronomical calculations. This formed the first machine to perform complex scientific computations automatically. The astronomical laboratory of Columbia University was also known as the Rutherford Laboratory or the Hollerith Computing Bureau.	US
1933 1941 1948 1965	Incorporation of the Compagnie des Machines Bull in France in 1933. From 1941 onwards, Bull developed a line of electro-mechanical punched-card equipment in the period 1941-1950 (gros relais) such as manual card punch equipment, tabulators and sorters and peripheral devices such as verifiers, translators, gang punches, collators, card readers and punches, and calculators. From 1948 till 1965, a new series, the so called petit relais, was manufactured.	FR

1936	Alan Turing (1912-1954) described his stored-program concept in *On Computable Numbers, with an Application to the Entscheidungsproblem*, published in the Proceedings of the London Mathematical Society (Series 2, 42 (1936-37): 230-265) as a by-product to show the impossibility of David Hilbert's (1862-1943) problem of decidibility. Hillbert believed that there was no such thing as an unsolvable problem because there is always a general algorithm which decides for given first-order statements whether they are universally valid or not. In his paper Turing showed that there is no solution to Hillbert's *Entscheidungsproblem* by proving that it was impossible to predict when a Turing Machine that worked on the basis of finite steps of algorithms would halt. Turing proved that such a machine would be capable of performing any conceivable mathematical problem if it were representable as an algorithm. Turing's conclusions had wrongly been misphrased by his contemporaries as the proof that all intellectual problems could be expressed as algorithms and were thus solvable by a Turing Machine. In the 1960's this general belief became the paradigm of a complete model of computation. (Wegner and Eberbach, 2004) The Turing Machine is a functional schema of an abstract mathematical machine that operates on algorithms. The Universal Turing Machine is a model which represents all possible Turing Machines or formal models of computers running one particular program each.	GB
	Nakajima Akira (1908-1970) and Hanzawa Masao of NEC published a paper on the switching theory.	JP
	Z1 — Konrad Zuse (1910-1995) built the Z1, a mechanical calculator operating on the binary system.	DE
1937	Leslie J. Comrie (1893-1950) founded Scientific Computing Service Ltd in London, a company which offered a consulting service to the scientific community with their team of human computers who used a variety of electro-mechanical hand calculators and punched-card equipment.	GB
	John Vincent Atanasoff (1903-1995) realized that the operation of a computer could be simplified by applying binary instead of decimal mode.	US
	George R. Stibitz (1904-1995) built his Model K, an electronic binary relay calculator, on his kitchen table.	US
1937 1938	In 1938 Claude Elwood Shannon (1916-2001) published the paper 'A Symbolic Analysis of Relay and Switching Circuits', which was drawn from his 1937 master's thesis, in the *Transactions of the American Institute of Electrical Engineers*. In this paper he proved that electromechanical relays could be used to do Boolean logic.	US

1937 1939 1940 1942	ABC — Atanasoff-Berry Computer. The ABC was designed and built by John Vincent Atanasoff (1903-1995) and Clifford E. Berry (1918-1963) at Iowa State University in 1942. A so called operating breadboard model was completed in December 1939. By August 1940, Atanasoff had prepared a full description of the machine. The ABC was the first machine to implement three essential innovations that are now part of every modern computer: all numbers and data were represented by binary digits, all calculations were performed fully electronically, and the use of several units for the storage and processing of data. However, it was not a stored-program computer.	US
1938	Relay binary circuit invented in Japan by Mr. Shiokawa of Fuji Electric.	JP
1939	Z2 — Konrad Zuse (1910-1995) built the Z2, an electro-mechanical calculator operating on the binary system.	DE
1941	Z3 — Konrad Zuse (1910-1995) built the Z3, an automatic and programmable calculating machine operating on the binary system.	DE
1942	Vannevar Bush' (1890-1974) Rockefeller Differential Analyzer was dedicated. Wartime security prohibited its public announcement until 1945. (Owens, 1991, p. 3)	US
1943	COLOSSUS — a series of electronic binary analytical and programmable computers constructed by Thomas Harold Flowers (1905-1998) at the Government Code and Cypher School at Bletchley Park. These machines were used in the cryptanalysis of German communications during WWII to reverse engineer the notorious Enigma code. They were programmable with switches and cables, but it did not have a memory to store the program. Information on the COLOSSUS has only been released from 1975 onwards.	GB
1944	IBM ASCC — Automatic Sequence Controlled Calculator, called the Mark I by Harvard University, devised by Howard H. Aiken (1900-1973) assisted by Grace Murray Hopper (1906-1992) and funded by IBM was completed.	US
1945	John von Neumann (1903-1957) circulated his *First Draft of a Report on the EDVAC*.	US
	IBM founded its Thomas J. Watson Scientific Computing Laboratory at Columbia University first to provide computing services to the allies, and then to advance the state of the art of scientific computing throughout the world. The Watson Laboratory was headed by Wallace Eckert (1902-1971) and within a year became the third the third most powerful computing facility in the world (after the US Army's Aberdeen Proving Ground and Harvard University).	US

	When working on the MARK II, Grace Murray Hopper (1906-1992) noted in her diary 'Relay #70 Panel F (moth) in relay. First actual case of bug being found.'[1] next to a moth taped to the diary page. This note has generally been misunderstood as the genesis of the term 'bug'. However, bug had been in use meaning a defect or fault in a machine or plan at the end of the 19th century. In the meaning of an imaginary object of terror it had even been in use since the 14th century. In her diary, Hopper played with the pun and referred to the actual moth as the literal bug.	US
1946	Konrad Zuse wrote Plankalkül, the first algorithmic programming language.	DE
	ACE — Automatic Computing Engine. Stored-program computer, designed and described by Alan Turing (1912-1954). It was a complete independent design from the EDVAC	GB
	ENIAC — Electronic Numerical Integrator And Computer. Automatic electronic digital computer built by J. Presper Eckert (1919-1995) and John Mauchly (1907-1980) of the University of Pennsylvania's Moore School of Electrical Engineering. Work on the ENIAC had started in 1942.	US
1947	Alan Turing (1912-1954) delivered the first public lecture to mention computer intelligence to the London Mathematical Society on February 20, 1947.	GB
	Sergei Alekseevich Lebedev (1902-1974) designed a stored-program architecture for the MESM (Small Electronic Calculating Machine) independently of Western efforts.	RU
	The Association for Computing Machinery (ACM) was founded on its first meeting on September 15. The ACM was originally called the Eastern Association for Computing Machinery.	US
	John Bardeen (1908-1991), Walter Houser Brattain (1902-1987), and William Bradford Shockley (1910-1989) discovered the transistor effect and developed the first device in December 1947 at Bell Laboratories. The transistor, or crystal triode, was a replacement for vacuum tubes and mechanical relays. A patent was filed in 1948 and US Patent 02569347 was issued on September 25, 1951. The inventors were awarded the Nobel Prize in physics in 1956 'for their researches on semiconductors and their discovery of the transistor effect'.	US
	The Harvard Mark II was finished under the direction of Howard H. Aiken (1900-1973).	US

[1] Picture of diary page on <http://www.history.navy.mil/photos/images/h96000/h96566k.jpg>

1948	Claude Elwood Shannon (1916-2001) identified the bit as the fundamental unit of data and, coincidentally, the basic unit of computation in his 'The Mathematical Theory of Communication' published in the *Bell System Technical Journal.* In this paper he argues that one could transmit pictures, words, sounds etc. by sending a stream of 1s and 0s down a wire.	US
	SSEM — Small-Scale Experimental Machine or the Manchester Baby. Stored-program computer designed and built by Tom Kilburn (1921-2001) and Frederic Calland Williams (1911-1977) around the Williams Tube as a storage device at the University of Manchester.	GB
	ARC — Automatic Relay Computer. Small low cost computer developed by Andrew D. Booth's (°1918) one-man-team at Birkbeck College, University of London.	GB
	Statistical Machine of Yamashita Type — first statistical relay calculator in Japan by a research group led by Yamashita Hideo (1899-1993) at Tokyo Imperial University. Instead of using punched cards or paper tape for data input, the machine accepted input by up to twenty keyboard operators in parallel. Both NEC and Fujitsu sold commercial versions in 1951.	JP
	IBM SSEC — Selective Sequence Electronic Calculator. Calculator designed and constructed by Wallace Eckert (1902-1971) and his team at Columbia University for IBM in 1946-1947. This electro-mechanical machine combined electronic computation with a stored-program and the ability to operate its own instructions as data.	US
1949	Jay Wright Forrester (°1918) invented the random-access, coincident-current magnetic storage core memory which became the standard memory device for digital computers at MIT. (US Patent 2,736,880)	US
	Z4 — Konrad Zuse (1910-1995) built the Z4, an automatic and programmable calculating machine operating on the binary system and equipped with several card readers using punched cards instead of movie tape. The Z4 survived the war and was in use at ETH in Zurich till 1955.	DE CH
	Manchester MARK I — full version of the experimental SSEM. Stored-program computer designed and built by a team led by Tom Kilburn (1921-2001) and Frederic Calland Williams (1911-1977) at the University of Manchester. Computing time was offered to industry for a fee of £50 an hour.	GB

	EDSAC — Electronic Delay Storage Automatic Calculator. Internally stored-program computer. Constructed by Maurice Vincent Wilkes (°1913) and his team at the University of Cambridge Mathematical Laboratory. Wilkes started constructing it after reading von Neumann's first draft report on the EDVAC.	GB
	Harvard MARK III — also known as ADEC (Aiken Dahlgren Electronic Calculator) finished under the supervision of Howard H. Aiken (1900-1973). The computer was partially electronic and partially electromechanical.	US
	BINAC — Binary Automatic Computer. Automatic electronic digital binary computer built by J. Presper Eckert (1919-1995) and John Mauchly (1907-1980) of the Eckert-Mauchly Computer Corporation for the Northrop Aircraft Company. The computer had two independent working CPU's.	US
1950	OME12 — Analog computer built by the Société d'électronique appliquée à l'Automatisme (SEA—founded 1948).	FR
	Pilot ACE — Automatic Computing Engine. Stored-program computer built at the National Physical Laboratory. This was the preliminary version to the full ACE designed by Alan Turing (1912-1954) in 1946 and built in 1957.	GB
	BARK — Binär Automatisk ReläKalkylator/Binary Automatic Relay Calculator. Developed by Matematikmaskinnämnden in Stockholm.	SE
	SEAC — Standards Electronic/Eastern Automatic Computer. Fully functional stored-program electronic computer. SEAC was built by the U.S. National Bureau of Standards (NBS) as an interim computer based on the EDVAC design. SEAC could also be operated by remote teletype.	US
	SWAC — Standards Western Automatic Computer. Fully functional stored-program electronic computer designed by Harold D. Huskey (°1916). SWAC was built in 1950 by the U.S. National Bureau of Standards (NBS) as an interim computer.	US
	ERA 1101 — later renamed UNIVAC 1101. Stored-program computer system designed by Engineering Research Associates (ERA) and built by the Remington Rand corporation as the commercial version of the ATLAS system which had been built for the Navy in 1950. The ERA 1102 was built in 1951 and the ERA 1103 was built in 1953.	US
1951	Maurice Vincent Wilkes (°1913) developed the concept of microprogramming from the realisation that the Central Processing Unit (CPU) of a computer could be controlled by a miniature, highly specialised computer program in high-speed ROM.	GB

	Maurice Vincent Wilkes (°1913), David John Wheeler (1927-2004), and Stanley Gill published *The preparation of programmes for an electronic digital computer: with special reference to the EDSAC and the use of a library of subroutines* (Reading, MA: Addison-Wesley) the first book on programming.	GB
	First Conference on Automatic Computing Machines in Australia, held in August 1951 at the Department of Electrical Engineering and sponsored by that Department and CSIRO.	AU
	EDVAC — Electronic Discrete Variable Automatic Calculator. Binary internally stored-program computer built by the University of Pennsylvania Moore School. Work on the EDVAC had started in 1945.	US
	CSIR Mk.1 — original name for the CSIRAC (Council for Scientific and Industrial Research Automatic Computer) electronic digital stored-program computer designed and constructed at the Council for Scientific and Industrial Research (CSIR) by a team led by Trevor Pearcey (d. 1998) and Maston Beard. CSIRAC is the only intact, though not operable, first-generation computer surviving anywhere in the world.	AU
	UNIVAC 1 — UNIVersal Automatic Computer. The first commercially available digital electronic computer which was for sale from 1951 onwards for an average cost of over $1 million. UNIVAC was designed and built by built by J. Presper Eckert (1919-1995) and John Mauchly (1907-1980) of the Eckert-Mauchly Computer Corporation. A total of 46 machines was built and sold.	US
	Ferranti Mark I — commercial and improved production version of the Manchester MARK I constructed by Ferranti Ltd. Amongst the improvements was the addition of magnetic drum stores. The machine was marketed with the promise that it could perform all the operations of arithmetic exceedingly rapidly, it could remember a great many numbers, and it could make decisions.[2] The Ferranti Mark* was an improved version of the Mark I. Ferranti Ltd. produced and sold computers well into the 1970s	GB
	LEO I — Lyons Electronic Office I. Commercial machine modelled closely on the EDSAC and constructed by J. Lyons and Co., a chain of tea rooms which founded LEO Computers Ltd. The first of its many business applications was the valuation of the weekly output of bread and cakes from Lyons. LEO computer time was also sold to other companies, e.g. for payroll calculations. Work on the LEO had started in 1949. J. Lyons and Co. produced and sold computers till the 1960s	GB

[2] A 1952 sales brochure is available on <http://www.computer50.org/kgill/mark1/sale.html>.

	МЭСМ — MESM: Malaia Elektronnaia Schetnaia Mashina/Small Electronic Calculating Machine, the first electronic digital stored-program computer in Continental Europe. MESM was a binary computer designed and constructed by Sergei Alekseevich Lebedev (1902-1974) at the Institute of Precise Mechanics and Computer Technology of the USSR Academy of Sciences. Work on the MESM had started in 1948 at the Institute of Electrical Engineering of the Ukrainian Academy of Sciences.	RU
	M-1 — Automatic Digital Computing Machine. Digital stored-program computer developed at the Laboratory of Electrosystems at the Institute of Energy of the USSR Academy of Science under the direction of I.S. Brouk.	RU
1952	G.W.A. Drummer (b. 1909) developed the theoretical concept of the integrated circuit at the UK Royal Radar Establishment.	GB
	UNIVAC predicted the presidential elections on 4 November 1952. The broadcasting of the correct prediction was postponed till late in the CBS News because newscasters Walter Cronkite and Charles Collingwood questioned the validity of the computer's forecast which was against the public opinion.	US
	Harvard Mark IV — electronic stored-program computer using magnetic drum memory and magnetic core memory was completed under the supervision of Howard H. Aiken (1900-1973).	US
	IAS Machine — Institute for Advanced Study (Princeton University). Binary electronic digital computer designed by John von Neumann to combine instructions and data in one memory which resulted in what became known as the Von Neumann Bottleneck. Plans for the IAS machine were widely distributed resulting in the construction of fifteen derivative (but incompatible) computers referred to as IAS machines.	US
	ORDVAC — ORdnance Discrete Variable Automatic Computer. General purpose binary stored-program computer constructed by the University of Illinois for the Ballistic Research Laboratory (IAS machine). ORDVAC was the first computer containing a compiler. Work on the ORDVAC had started in 1949.	US
	ILLIAC — Illinois Automatic Computer. Twin copy of the ORDVAC built and owned entirely by the University of Illinois (IAS machine). ILLIAC was used to calculate the orbit of the Sputnik 1 satellite.	US

	IBM 701 — IBM 701 Electronic Data Processing Machine, also known as the Defense Calculator. Binary stored-program vacuum tube computer with the vacuum tubes collected into pluggable units which facilitated easy maintenance. The IBM 701 was IBM's first production computer and was designed primarily for scientific calculation. The computer was part of IBM's Korean War efforts. The 701 was the first of IBM's successful 700 series that included the 702, 704, 705, and 709.	US
	APE(R)C — All-purpose Electronic (Rayon) Computers. Low-cost small computer built by Andrew D. Booth (°1918) at Birckbeck College, University of London with funding from the Rayon Research Association. The British Tabulating Machine Company derived their HEC (Hollerith Electronic Computer) from his APE(R)C project in 1956. They sold some 70 computers of this type.	GB
	NICHOLAS — In-house computer built by Elliott Bros Ltd. and available for hire by customers at £15 an hour.	GB
	CUBA — Calculateur Universel Binaire de l'Armement/Universal Binary Defence Calculator. First digital computer constructed in France, constructed by SEA.	FR
	GAMMA 3 — Electronic Calculator manufactured and commercialised by Compagnie des Machines Bull that interacted with the electromechanical punched-card equipment of the same manufacturer. Several models in the GAMMA 3 series were produced up to 1960.	FR
	ARRA — Automatische Relais Rekenmachine Amsterdam/Automatic Relay Calculator Amsterdam. Developed by Adriaan van Wijngaarden (1916-1987), Bram J. Loopstra, and Carel S. Scholten at the Mathematical Centre of Amsterdam. Work had started in 1947.	NL
	ETL-MARK I — Electrotechnical Laboratory of the Ministry of Communications relay computer pilot model in Japan.	JP
1953	WHIRLWIND — real-time computer, capable of displaying real time text and graphics on a video terminal and using core memory for RAM. Developed for the US Navy by an MIT team of 175 people led by Jay Wright Forrester (°1918). Development of the WHIRLWIND began in 1945 after a demonstration of ENIAC.	US
	ERA 1103 — later renamed UNIVAC 1103. Designed by Engineering Research Associates (ERA) and built by the Remington Rand corporation. First commercial computer to use Random Access Memory (RAM).	US
	TREAC — Telecommunications Research Establishment Automatic Calculator. Parallel electronic digital vacuum tube computer.	GB

	Manchester Transistor Computer — Small transistor research computer built by Tom Kilburn (1921-2001) and his research team at Manchester University to explore the possibilities of the transistor. The computer was completed in November 1953 and a second expanded version was completed in 1955. The transistor computer was put in production by Metropolitan Vickers as the MV950. Six machines were built, the first delivered in 1956.	GB
	PTERA — PTT Elektronische RekenAutomaat/PTT Electronic Reckoning Automat. Developed and built by Willem van der Poel for the Dutch Post, Telephone, and Telegraphy. It ran till 1958.	NL
	BESK — Binär Elektronisk SekvensKalkylator/Binary Electronic Sequence Calculator. Developed by Matematikmaskinnämnden in Stockholm (IAS Machine).	SE
	БЭСМ — BESM-1: Bystrodeistvuiushchaia Elektronnaia Schetnaia Maschina/High-Speed Electronic Calculating Machine designed and constructed by Sergei Alekseevich Lebedev (1902-1974) at the Institute of Precise Mechanics and Computer Technology of the Russian Academy of Sciences. Work on the BESM had started in 1951.	RU
	M-2 — Fast Universal Digital Computer. Developed in the Laboratory of Electrical Systems in the Institute of Energy of the USSR Academy of Science under the direction of I.S. Brouk. Stored-program digital computer based on the M-1.	RU
1954	TRADIC — TRAnsistor Digital Computer. Built by Bell Telephone Laboratories for the US Air Force. TRADIC was an all transistor device without any vacuum tube.	US
	PAC — Personal Automatic Computer. Designed between 1948 and 1954 by John Lentz at the Thomas J. Watson Scientific Computing Laboratory of Columbia University. The PAC was intended for use by one person who could interact with the computer by keyboard operation and tiny screen. The current position was indicated visually by what came to be known as a cursor. The PAC is hence the first personal computer operating with the first video terminal. The PAC was announced by IBM as the IBM 610 Auto-Point Computer in 1957.	US
	IBM 650 — IBM 650 Magnetic Drum Data Processing Machine. The IBM 650 fit into a single room and was programmable in decimal code. It was affordable for businesses at less than half a million dollars. IBM sold almost 2,000 machines worldwide, making the 650 the first significant profit-making computer for IBM.	US

	MEG — Megacycle Machine. Built at Manchester University from 1951 onwards as an update of the Manchester Mark 1 concept. It was possibly the first computing using floating point arithmetic. The production Meg is better known as the Ferranti Mercury and was available from 1957 onwards. It used a magnetic core store instead of cathode ray tubes (as in the MEG). It could be programmed using the high-level language Mercury Autocode.	GB
	MOSAIC — Ministry of Supply Automatic Integrator and Computer. A British defence stored-program computer developed between 1947 and 1954 and used for processing radar tracking data in experiments on aircraft. Parts of the project have been classified till the 1980s.	GB
	Bell Telephone Manufacturing in Antwerp (Belgium) constructed an unnamed computer from 1951 to 1956 commissioned by the Belgian government and under direction of Charles Manneback and Vitold Belevitch (1921-1999) who later became director of the Belgian computing center, the Comité d'étude et d'exploitation des calculateurs électroniques, that operated this computer in Brussels.	BE
	ARRA II — Automatische Relais Rekenmachine Amsterdam/Automatic Relay Calculator Amsterdam. Developed by Adriaan van Wijngaarden (1916-1987), Bram J. Loopstra, Carel S. Scholten, and Gerrit Blaauw at the Mathematical Centre of Amsterdam. ARRA II was a much better model than ARRA and Gerrit Blaauw, a Harvard alumnus, turned it into a fully electronic machine.	NL
1955	The term 'Artificial Intelligence' was coined by J. McCarthy (Dartmouth College), M. L. Minsky (Harvard University), N. Rochester (I.B.M. Corporation), and C.E. Shannon (Bell Telephone Laboratories) in *A Proposal for the Darthmouth Summer Research Project on Artificial Intelligence* that described the artificial intelligence problem to be that 'of making a machine behave in ways that would be called intelligent if a human were so behaving' (Minsky et. al, 1955)	GB
	The first *Journees Internationales de Calcul Analogique / International Analogy Computation Meeting* was held in Brussels from 28 September till 3 October.	BE
	DEUCE — Digital Electronic Universal Computing Engine. Commercial version of the Pilot ACE produced by English Electric Company Ltd.	GB
	ETL-MARK II — Electrotechnical Laboratory of the Ministry of Communications relay computer in Japan.	JP
	FERTA — Fokker's Eerste Rekenmachine Type ARRA/Fokker's First Calculator of the ARRA type. Built by the Amsterdam Mathematical Centre for the aeroplane builder Fokker.	NL

1956	Foundation of the AICA, Association International de Calcul Analogique — International Association for Analogue Computation.	BE
	First all-Soviet conference on high speed computing *Paths of Development of Soviet Mathematical Machine Building and Instrument Construction* chaired by Sergei Alekseevich Lebedev (1902-1974) and held in Moscow.	RU
	John McCarthy (°1927) developed the basics behind the LISP (LISt Processing) programming language during the Dartmouth Summer Research Project on Artificial Intelligence.	US
	ETL-MARK III — Electrotechnical Laboratory of the Ministry of Communications developed a fully transistorized stored-program computer.	JP
	UTECOM — University of Technology Electronic COMputer. Modified English Electric DEUCE machine at the University of New South Wales. The computer was inaugurated at 11 September 1956.	AU
	SILLIAC — Sydney ILLIAC. Developed by Brian Swires at Sydney University from 1954 onwards. (IAS machine) The computer was inaugurated at 12 September 1956.	AU
	WREDAC — Weapons Research Establishment Digital Automatic Computer. General purpose computer built on a British Elliott 403 system.	AU
	ERMETH — Elektronische Rechenmaschine der Eidgenössischen Technischen Hochschule/Electronic Calculation Machine of the Federal Institute of Technology. Designed and built between 1953 and 1956 by Eduard Stiefel (1909-1978) and his team at the Eidgenössischen Technischen Hochschule (ETH) in Zurich and used in numerical mathematics.	CH
	LGP-30 — Librascope General Precision Computer. With the Bendix G-15 the first of the desk-sized off-the-shelf vacuum tube computers offering small scale scientific computing at a relatively low cost ($40,000). Sold by Royal Precision Electronic Computer Company.	US
	Bendix G-15 — With the LGP-30 the first of the desk-sized off-the-shelf vacuum tube computers offering small scale scientific computing at a relatively low cost ($49,000-$60,000).	US
	TX-0 — Transistorized eXperimental computer zero. Fully transistorized version of the WHIRLWIND computer with a then-huge 64K core memory developed at MIT. It became the centerpiece of the MIT Artificial Intelligence Lab in 1958 and was used in the development of speech and handwriting recognition systems and wordprocessing software.	US

	PEGASUS — vacuum tube computer by Ferranti Ltd. In 1957 the PEGASUSs computer was used to calculate 7480 digits of pi, a record at the time.	GB
	FUJIC — FUJI Computer. Japan's first electronic digital automatic vacuum tube computer built by Bunji Okazaki (1914-1998) to do calculations for lens design by Fuji Photographic Film Co. Research on the FUJIC had started in 1949.	JP
	ARMAC — Automatische Rekenmachine MAthematisch Centrum/ Mathematical Centre Automatic Calculator. This successor of the ARRA II raised the interest of a couple of companies that wanted to buy a computer of the Mathematical Centre. As a result, the first Dutch computer company, Electrologica, was founded and it acquired almost all 45 staff members of the Mathematical Centre, whose pioneering computer efforts stopped instantly.	NL
	PETER — Philips Experimentele Tweetallige Elektronische Rekenmachine/Philips Experimental Binary Electronic Calculator. A small but fast computer built by Philips Computer Industry.	NL
	SMIL — Siffermaskinen i Lund/Lund Calculator. (IAS Machine)	SE
1957	A team led by John W. Backus (°1924) at IBM released FORTRAN (FORmula TRANslator), a computer programming language that enabled a computer to perform a repetitive task from a single set of instructions by using loops. Work on FORTRAN had started in 1954.	US
	Release of ALGOL (ALGOrithmic Language) authored by, amongst others, John Backus (°1924) and Peter Naur (°1928). ALGOL uses bracketed statement blocks and was the first language to use begin end pairs for delimiting them.	
	ACE — Automatic Computing Engine. Stored-program computer designed by Alan Turing (1912-1954) in 1946 and obsolete on release due to its reliance on delay-line main memory.	GB
	ERMETH — Elektronische Rechenmaschine der Eidgenössischen Technischen Hochschule/Electronic Calculator of the Swiss Federal Institute of Technology.	CH
1958	MAILÜFTERL — Dezimaler Volltransistor Rechenautomat/Decimal fully transistorised calculator built at the University of Technology in Vienna. Work on the MAILÜFTERL had begun in 1956.	AT

1958	Jack Kilby (1923-2005) invented the integrated circuit at Texas Instruments. An integrated circuit combines many transistors and resistors on a single chip of germanium or silicon, enabling computer memory, logical circuits and other components to be greatly reduced in size. In February 1959 he applied for a patent which was granted in 1964 (US Patent 3,138,743).	US
	IBM introduces the first computer to use the transistor as a switching device, the IBM 7090, hastening the demise of vacuum tube technology in computers.	US
	CDC 1604 — Control Data Corporation. Fully transistorised computer built by Seymour Cray (1925-1996) for Control Data Corporation. The CDC 1604 was essentially a much improved low-cost ERA 1103.	US
	BESM-2 — designed and constructed by Sergei Alekseevich Lebedev (1902-1974) at the Institute of Precise Mechanics and Computer Technology of the Russian Academy of Sciences. Serial production started in 1959.	RU
	M-20 — designed and constructed by Sergei Alekseevich Lebedev (1902-1974) at the Institute of Precise Mechanics and Computer Technology of the Russian Academy of Sciences. Serial Production started in 1959.	RU
	X1 — First production computer of Electrologica.	NL
	ZEBRA — Zeer Eenvoudig Binaire RekenAutomaat/Very Simple Binary Reckoning Automat. Electronic Digital Computer developed by Willem van der Poel and manufactured by Standard Telephones and Cables Limited. Research on this computer had begun in 1952.	NL
	103 — Chinese small scale digital electronic computer based on the Soviet M-3 and built by the Institute of Computing Technology of Academia Sinica and the Beijing Wire Telecommunication Factory. The 103 was put in production as the DJS-1 in 1961. An improved model, the DJS-3, went in production in 1963.	CN
1959	Robert Noyce (1927-1990) described a scheme for an integrated circuit at Fairchild Semiconductor in January 1959 and applied for a patent in July 1959, a few months after Kilby had filed a patent. Kilby was granted the patent in 1961 (US Patent 2,981,877). Years later, the court decided over the dispute and Kilby and Noyce each got a share of the credit of having invented the integrated circuit.	US
	Release of COBOL (COmmon Business Oriented Language)	US
	L.R. Johnson coins the term 'architecture' when describing the IBM 7030 Data Processing System. The project leading to the building of these supercomputers started in 1956 and the first machines were delivered in 1961 at a price of $13.5 million.	US

	TAC — Tokyo Automatic Computer. Based on the EDSAC design and built from 1952 onwards.	JP
	104 — Chinese large scale computer modelled on the Soviet BESM-2 and built by the Institute of Computing Technology of Academia Sinica and the Beijing Wire Telecommunication Factory. Renamed DJS-2.	CN
1960	PDP-1 — Programmed Data Processor. Digital parallel stored-program computer designed to operate with many types of input-output devices. Manufactured by Digital Equipment Corporation.	US
	PASCAL — Fast scientific computer developed and built by Philips Computer Industry from 1956 onwards.	NL
	STEVIN — PASCAL adapted for administrative use, built by Philips Computer Industry.	NL
1961	Sumlock Comptometer introduced the ANITA (A New Inspiration To Arithmetic), the first electronic calculator.	GB
	CAB 500 — First shipment of this single user desk small scientific computer with an internal core memory. The project was initiated in 1956 and produced the most successful system of SEA.	FR
	CAB 3900 — A business oriented machine designed in 1958 essentially for banking applications for Crédit Lyonnais. The research for the machine was focussed on the optimization of magnetic tape processing.	FR