= Manchester computers =

The Manchester computers were an innovative series of stored @-@ program electronic computers developed during the 30 @-@ year period between 1947 and 1977 by a small team at the University of Manchester , under the leadership of Tom Kilburn . They included the world 's first stored @-@ program computer , the world 's first transistorised computer , and what was the world 's fastest computer at the time of its inauguration in 1962 .

The project began with two aims : to prove the practicality of the Williams tube , an early form of computer memory based on standard cathode ray tubes (CRTs) ; and to construct a machine that could be used to investigate how computers might be able to assist in the solution of mathematical problems . The first of the series , the Small @-@ Scale Experimental Machine (SSEM) , ran its first program on 21 June 1948 . As the world 's first stored @-@ program computer , the SSEM , and the Manchester Mark 1 developed from it , quickly attracted the attention of the United Kingdom government , who contracted the electrical engineering firm of Ferranti to produce a commercial version . The resulting machine , the Ferranti Mark 1 , was the world 's first commercially available general @-@ purpose computer .

The collaboration with Ferranti eventually led to an industrial partnership with the computer company ICL , who made use of many of the ideas developed at the university , particularly in the design of their 2900 series of computers during the 1970s .

= = Small @-@ Scale Experimental Machine (SSEM) = =

The Manchester Small @-@ Scale Experimental Machine (SSEM) , also known as the Baby , was designed as a test @-@ bed for the Williams tube , an early form of computer memory , rather than as a practical computer . Work on the machine began in 1947 , and on 21 June 1948 the computer successfully ran its first program , consisting of 17 instructions written to find the highest proper factor of 218 (262 @,@ 144) by trying every integer from 218 ? 1 downwards . The program ran for 52 minutes before producing the correct answer of 131 @,@ 072 .

The SSEM was 17 feet (5 @.@ 2 m) in length , 7 feet 4 inches (2 @.@ 24 m) tall , and weighed almost 1 long ton . It contained 550 thermionic valves ? 300 diodes and 250 pentodes ? and had a power consumption of 3 @.@ 5 kilowatts . Its successful operation was reported in a letter to the journal Nature published in September 1948 , establishing it as the world 's first stored @-@ program computer . It quickly evolved into a more practical machine , the Manchester Mark 1 .

= = Manchester Mark 1 = =

Development of the Manchester Mark 1 began in August 1948 , with the initial aim of providing the university with a more realistic computing facility . In October 1948 UK Government Chief Scientist Ben Lockspeiser was given a demonstration of the prototype , and was so impressed that he immediately initiated a government contract with the local firm of Ferranti to make a commercial version of the machine , the Ferranti Mark 1 .

Two versions of the Manchester Mark 1 were produced , the first of which , the Intermediary Version , was operational by April 1949 . The Final Specification machine , which was fully working by October 1949 , contained 4 @,@ 050 valves and had a power consumption of 25 kilowatts . Perhaps the Manchester Mark 1 's most significant innovation was its incorporation of index registers , commonplace on modern computers .

= = Meg and Mercury = =

As a result of experience gained from the Mark 1 , the developers concluded that computers would be used more in scientific roles than pure maths . They therefore embarked on the design of a new machine which would include a floating point unit ; work began in 1951 . The resulting machine , which ran its first program in May 1954 , was known as Meg , or the megacycle machine . It was

smaller and simpler than the Mark 1 , as well as quicker at solving maths problems . Ferranti produced a commercial version marketed as the Ferranti Mercury , in which the Williams tubes were replaced by the more reliable core memory .

= = Transistor Computer = =

Work on building a smaller and cheaper computer began in 1952 , in parallel with Meg 's ongoing development . Two of Kilburn 's team , R. L. Grimsdale and D. C. Webb , were assigned to the task of designing and building a machine using the newly developed transistors instead of valves . Initially the only devices available were germanium point @-@ contact transistors , less reliable than the valves they replaced but which consumed far less power .

Two versions of the machine were produced . The first was the world 's first transistorised computer , and became operational in November 1953 . The second version was completed in April 1955 . The 1955 version used 200 transistors , 1 @,@ 300 solid @-@ state diodes , and had a power consumption of 150 watts . The machine did however make use of valves to generate its 125 kHz clock waveforms and in the circuitry to read and write on its magnetic drum memory , so it was not the first completely transistorised computer , a distinction that went to the Harwell CADET of 1955 .

Problems with the reliability of early batches of transistors meant that the machine 's mean time between failures was about 90 minutes , which improved once the more reliable junction transistors became available . The Transistor Computer 's design was adopted by the local engineering firm of Metropolitan @-@ Vickers in their Metrovick 950 , in which all the circuitry was modified to make use of junction transistors . Six Metrovick 950s were built , the first completed in 1956 . They were successfully deployed within various departments of the company and were in use for about five years .

= = Muse and Atlas = =

Development of MUSE ? a name derived from " microsecond engine " ? began at the university in 1956 . The aim was to build a computer that could operate at processing speeds approaching one microsecond per instruction , one million instructions per second . Mu (or µ) is a prefix in the SI and other systems of units denoting a factor of 10 ? 6 (one millionth) .

At the end of 1958 Ferranti agreed to collaborate with Manchester University on the project , and the computer was shortly afterwards renamed Atlas , with the joint venture under the control of Tom Kilburn . The first Atlas was officially commissioned on 7 December 1962 , and was considered at that time to be the most powerful computer in the world , equivalent to four IBM 7094s . It was said that whenever Atlas went offline half of the UK 's computer capacity was lost . Its fastest instructions took 1 @.@ 59 microseconds to execute , and the machine 's use of virtual storage and paging allowed each concurrent user to have up to one million words of storage space available . Atlas pioneered many hardware and software concepts still in common use today including the Atlas Supervisor , " considered by many to be the first recognisable modern operating system " .

Two other machines were built : one for a joint British Petroleum / University of London consortium , and the other for the Atlas Computer Laboratory at Chilton near Oxford . A derivative system was built by Ferranti for Cambridge University , called the Titan or Atlas 2 , which had a different memory organisation , and ran a time @-@ sharing operating system developed by Cambridge Computer Laboratory .

The University of Manchester 's Atlas was decommissioned in 1971 , but the last was in service until 1974 . Parts of the Chilton Atlas are preserved by the National Museums of Scotland in Edinburgh .

= = MU5 = =

MU5 was designed to be about 20 times faster than Atlas , and was optimised for running compiled programs rather than hand @-@ written machine code , something that contemporary computers

were unable to do efficiently . A major factor in the MU5 's much @-@ improved performance over its predecessors was its incorporation of associative memory , which greatly speeded up access to its main store . .

Work on MU5 started in 1966 . The Science Research Council (SRC) awarded Manchester University a five @-@ year grant of £ 630 @,@ 466 in 1968 (equivalent to about £ 9 @.@ 9 million as of 2016) to develop the MU5 , and ICL made its production facilities available to the university . Development began in 1969 , and by 1971 the design team had grown from its initial nucleus of six members of the university 's computer science department to 16 , supported by 25 research students and 19 ICL engineers .

MU5 was fully operational by October 1974 , coinciding with ICL 's announcement that it was working on the development of a new range of computers , the 2900 series . ICL 's 2980 in particular , first delivered in June 1975 , owed a great deal to the design of MU5 , which was in operation at the university until 1982 .

= = MU6 = =

MU5 was the last large @-@ scale machine to be designed and built at Manchester University . The development of its successor , MU6 , was funded by a grant of £ 219 @,@ 300 awarded by the SRC in 1979 (equivalent to about £ 1 @,@ 001 @,@ 000 as of 2016) . MU6 was intended to be a range of processors with MU6 @-@ V at the top end and a personal processor , MU6 @-@ P , at the bottom . Only MU6 @-@ P and a mid @-@ range processor , MU6 @-@ G , were ever produced , and ran between 1982 and 1987 . The university did not have the resources to build the remaining machines in @-@ house , and the system was never commercially developed .

= = Summary = =