

**Expert Report on Proposed Milestone
“The Manchester University “Baby” Computer and its Derivatives, 1948 – 1951”**

Thomas Haigh. University of Wisconsin—Milwaukee & Siegen University

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Version of citation being responded to:

The Manchester University “Baby” Computer and its Derivatives, 1948 - 1951

At this site on 21 June 1948 the “Baby” became the first computer to execute a program stored in addressable read-write electronic memory. “Baby” validated the widely used Williams-Kilburn Tube random-access memories and led to the 1949 Manchester Mark I which pioneered index registers. In February 1951, Ferranti Ltd's commercial Mark I became the first electronic computer marketed as a standard product ever delivered to a customer.

1: Evaluation of Citation

The final wording is the result of several rounds of back and forth exchange of proposed drafts with the proposers, mediated by Brian Berg. During this process the citation text became, from my viewpoint at least, far more precise and historically reliable.

The current version identifies several distinct contributions made by three related machines:

- the 1948 “Baby” (known officially as the Small Scale Experimental Machine or SSEM), a minimal prototype computer which ran test programs to prove the viability of the
- Manchester Mark 1, a full-scale computer completed in 1949 that was fully designed and approved only after the success of the “Baby” and in turn served as a prototype of the
- Ferranti Mark 1, a commercial refinement of the Manchester Mark 1 of which I believe 9 copies were sold. The 1951 date refers to the delivery of the first of these, to Manchester University as a replacement for its home-built Mark 1.

The citation also foregrounds the importance of the Williams Tube memory. Creating a reliable, high capacity electronic memory was the crucial stumbling block faced by computer projects in the late-1940s and the reason that almost all of them took much longer than expected to complete. Some projects failed entirely because of the difficulty. The new memory tubes were widely licensed for other computer projects, for example by IBM, before being displaced by core memory in the mid-1950s.

The relevant facts are well documented, and widely available in scholarly historical work or even on Wikipedia. The main challenge was squeezing all this down into 70 words without simplifying to the extent that the text became untrue. The result is rather dense, so let me explain why all the words are needed.

At this site on 21 June 1948 the “Baby” became the first computer to execute a program stored in addressable read-write electronic memory.

The date in question and the program executed are well documented and uncontroversial.

Sometimes the claim would be made as “first stored program computer” but like “first computer” its validity would depend on how one defines “stored program.” That led to considerable historical

wrangling around the term, since any automatic computer relies on a program stored in one form or another. As von Neumann wrote in the *First Draft of a Report on the EDVAC*: “instructions must be given in some form which the device can sense: Punched into a system of punchcards or on teletype tape, magnetically impressed on steel tape or wire, photographically impressed on motion picture film, wired into one or more fixed or exchangeable plugboards—this list being by no means necessarily complete.”

There’s a rather arbitrary historical process by which “stored program computer” emerged in the 1950s as a replacement for earlier terms such as “EDVAC-like machine” to describe computers patterned after the ideas described by von Neumann and his collaborators in Philadelphia and, later, Princeton. The problem in describing a first “stored program” computer was that the phrase could be interpreted in different ways. Machines such as the Manchester Baby and Cambridge EDSAC were clearly EDVAC-like and met any plausible definition of “stored program”, as were almost all the commercial computers of the 1950s, but several authors advanced definitions of “stored program” according to which other machines qualified as the first. In particular Allan Olley argued for IBM SSEC (Feb 1948) as the “first stored program computer” because it could potentially store and execute instructions held in a (non-addressable) electronic or relay memory, while authors such as Jean Bartik, Nick Metropolis, and Crispin Rope separately suggested that the reconfigured ENIAC (March 1948) deserved the title because it executed instructions fetched at electronic speed from an addressable read-only memory (switch panels). There’s also the question of Booth’s ARC computer, which is under documented to the extent that it is hard to be sure if or when it worked, but has sometimes been called a “stored program computer” built around a mechanical drum rather than an electronic memory. In response to issues such as these, Alan Bromley broke “stored program” into a series of staged innovations rather than a single “first.”

The adopted wording avoids all such potential challenges by being very specific about what “stored program” actually means here: executing a program stored in an addressable, writable and electronic storage medium.

For more on these points and citations to all the authors mentioned, see

- Haigh, Thomas, Mark Priestley, and Crispin Rope. *ENIAC In Action: Making and Remaking the Modern Computer*. Cambridge, MA: MIT Press, 2016 (chapters 6, 7, 8 & 11)
- Haigh, T., M. Priestley, and C. Rope. "Reconsidering the Stored-Program Concept." *IEEE Annals of the History of Computing* 36, no. 1 (Jan-Mar 2014): 4-17.
- Priestley, Mark, and Thomas Haigh. "The Media of Programming." In *Exploring the Early Digital*, 135-158. Cham, Switzerland: Springer, 2019.

“Baby” validated the widely used Williams-Kilburn Tube random-access memories and led to the 1949 Manchester Mark I which pioneered index registers.

This highlights the crucial role of the “Baby” in validating the memory units. “Led to” reflects the fact that construction of the full-scale computer was not authorized until after memory technology was “validated” by the “Baby.” The proposers prefer this phrasing to anything involving the word “prototype,” and in my view this phrasing adequately captures the relationship.

Index registers were an important innovation present on the Mark 1 but not on the prototype “Baby.” They are worth mentioning even though space does not permit a definition. Anyone who has taken a computer architecture course will be familiar with the concept.

In February 1951, Ferranti Ltd's commercial Mark I became the first electronic computer marketed as a standard product ever delivered to a customer.

The wording here may seem clumsy, but the “first” in question requires all three elements to be there:

1. Electronic computer (as opposed to mechanical computers such as https://en.wikipedia.org/wiki/Torpedo_Data_Computer) AND
2. Marketed as a standard product AND
3. Delivered to a customer.

This is because the Univac, while marketed as a standard product (and ordered by customers) as early as 1946, was not delivered for the first time to a customer until a few months after the Ferranti Mark 1. In contrast, a custom-built ERA computer and the BINAC were commercially produced and delivered prior to the Ferranti Mark 1 but were one-off machines that were never seriously marketed as standard products.

In conclusion, the proposed citation has been precisely worded to make sure that the statements made are literally true. Doing this within 70 words was quite a challenge, and I am happy to endorse the results achieved.

Dr. Thomas Haigh is a Professor of History at the University of Wisconsin-Milwaukee and a visiting Comenius Professor for the History of Computing at Universität Siegen. His PhD in the History and Sociology of Science is from the University of Pennsylvania. He is the lead author of *ENIAC In Action* (MIT, 2016) and *A New History of Modern Computing* (MIT, 2021). See also <http://www.tomandmaria.com/Tom/>