

Chapter 2

Howard Aiken

Howard Aiken made several important contributions to the early computing field. He showed that a large calculating machine could be built that would provide speedy solutions to mathematical problems. He also made important contributions to early computer science education (Fig. 2.1).

He was born in New Jersey in 1900 and grew up in Indiana. He studied electrical engineering at the University of Wisconsin and obtained a bachelor's degree in 1923. He then worked as chief engineer for several years at the Madison Gas Company before taking a position as general engineer in 1927 at the Westinghouse Electric and Manufacturing Company. He was involved in product design and in the design of power plants, and in 1931 he became a district manager at the Line Material Company.

He resigned in 1933 to return to academia to pursue graduate studies in physics. He pursued a Ph.D. degree at Harvard University, and his Ph.D. in Physics was awarded in 1939. He became associate professor of applied mathematics in 1941 and became a full professor in 1946.

It was during his graduate studies that Aiken became conscious of the need for a machine that could deal with many of the tedious calculations that arose in solving differential equations by numerical means. This led him to investigate machines to ease the calculation burden of his research.

2.1 Harvard Mark I

He did some research on what a scientific calculating machine should do and published a report. His idea was to construct an electromechanical machine that could perform mathematical operations quickly and efficiently, and the machine would need to be able to handle positive and negative numbers, scientific functions such as logarithms and be able to work with minimal human intervention.

Fig. 2.1 Howard Aiken



He discussed the idea with colleagues and IBM and was successful in obtaining IBM funding to build the machine. The machine was built at the IBM laboratories at Endicott with several IBM engineers involved in its construction.

The machine became known as the Harvard Mark I (also known as the *IBM Automatic Sequence Controlled Calculator (ASCC)*). Aiken was influenced by Babbage's ideas on the design of the Analytic Engine. The construction took 7 years and was completed in 1943. IBM presented it to Harvard University in 1944, and the machine was essentially an electromechanical calculator that could perform large computations automatically. It could perform addition, subtraction, multiplication, division and refer to previous results.

The Mark I was designed to assist in the numerical computation of differential equations and was 50 ft long, 6 ft high and weighed 5 tonnes. It performed additions in less than a second, multiplications in 6 s and division in about 12 s. It used electromechanical relays to perform the calculations (Fig. 2.2).

It could execute long computations automatically. It used 500 miles of wiring and had over 700,000 components. It was the industry's largest electromechanical calculator, and it had 60 sets of 24 switches for manual data entry. It could store 72 numbers, each 23 decimal digits long. Punched cards were used to input the data, and the results were on either punched cards or an electric typewriter.

It was used by the US Navy for ballistic calculations and remained in use until 1959. The machine cost approximately half a million dollars but was never mass-produced by IBM.

The announcement of the Harvard Mark I led to tension between Aiken and IBM, as Aiken announced himself as the sole inventor without acknowledging the important role played by IBM.

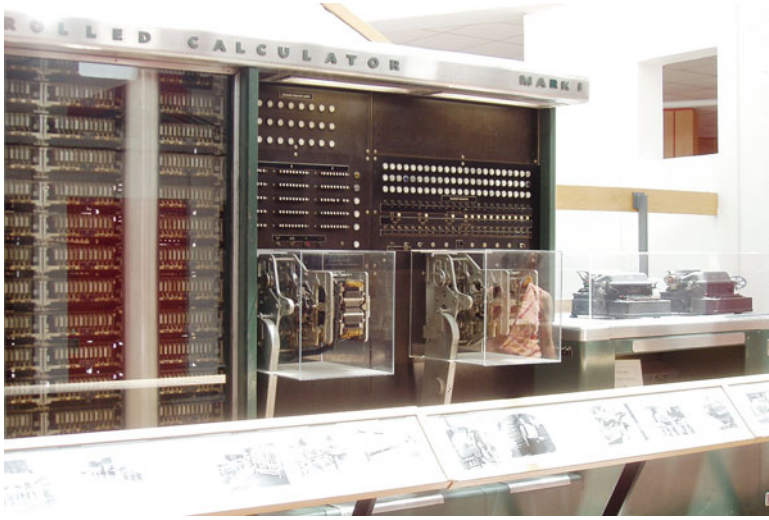


Fig. 2.2 Harvard Mark I (IBM ASCC) (Photo Public Domain)

2.2 Later Work

Aiken also designed and developed the Harvard Mark II, III and IV. The Mark II was funded by the US Navy and completed in 1947. It was faster than the Mark I and employed an electrical memory.

His Mark III (or Aiken Dahlgren Electronic Calculator (ADEC)) was built in 1949 for the Navy and was one of the earliest machines to use magnetic drums for data storage. His Mark IV was completed in 1952 with funding from the US air force.

Aiken also made important contributions to computer science education, and he started one of the earliest computer science academic programs in the world at Harvard.

He received the IEEE Edison Medal in 1970 for his pioneering contributions to the development and applications of large-scale digital computers and to important contributions to education in the computer field.

He retired from Harvard in 1961 and became a distinguished professor of Information at the University of Miami. He became an entrepreneur and founded a New York-based consulting company that focused on assisting ailing companies back to good financial health. He was a consultant to Lockheed Missiles and Monsanto. He died in Missouri in 1973.



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