

Konrad Zuse



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While von Neumann was doing his pioneering work in the USA, Zuse was achieving similar results in Germany

Inventions are often made simultaneously in different parts of the world from ideas that have been developed independently of each other. In the 1940's, while the first valve computer (ENIAC) was being developed in America, a German engineer, Konrad Zuse, was at work on a programmable calculator — arguably the world's first computer.

Zuse was born in Berlin on 22 June 1910. After attending the city's Technical University he worked as an aeronautical engineer for the Henschel Aircraft Company, developing wing design. The basic mathematical principles involved in strengthening aircraft wings to withstand the stresses of high-speed flying had been laid down in the 1920's. But the individual calculations needed for the production of each pair of wings required teams of people working with mechanical adding machines and slide rules. Zuse soon came to appreciate the need for a machine that could do this time-consuming work rapidly. Working with friends in his parents' flat in the evenings, he set about building a computer that could perform this task.

His first machine, the Z1, was a mechanical device that could perform the four elementary arithmetic operations, calculate square roots and convert decimal numbers to binary notation and vice versa. Although unaware of the achievements

of Charles Babbage (see page 220), whose Difference Engine had been created to perform the laborious calculations needed for nautical tables, he had arrived at many similar conclusions and some that were far in advance. Zuse's major breakthrough was in recognising that a lever was a switch that could be put in one of two positions — on and off — and could therefore be used either as a means of storing data or as a control device.

Zuse pursued the idea of representing both data and instructions in binary form, and in 1941 he set out to build an electromagnetic computer, which he called the Z2. Involved in the war effort, the German government at first showed little interest in his invention. However, its military potential was eventually recognised and funds were provided for him to develop the new Z3. This was to be an electrical computer, with electrical wiring in place of the mechanical linkages that he had used in the earlier machines, and which allowed for a more compact and elegant design.

Zuse built the Z3 despite major handicaps. The Allied bombing of Berlin forced him to move his workshop several times. He was called up twice, only to be returned from the eastern front to continue his work. The wartime shortage of materials forced him to improvise by scavenging components from telephone switching gear and using old cinema film, punched with codes of eight holes per frame, in place of paper tape.

The Z3 could store 64 words, each of 22 bits in length. Information was input through a keyboard and the results displayed visually on an arrangement of lamps mounted on a board. Sadly, the Z3 was destroyed, along with Zuse's earlier computers, in the saturation bombing of Berlin in 1945.

One of the computers was adapted by the Henschel Aircraft Company to help in the construction of the HS-293 flying bomb. This was an unmanned plane that was launched from an airborne bomber and guided to its target by radio control.

Zuse's last wartime computer, the Z4, had the length of its words increased to 32 bits. It was evacuated to Göttingen as the Allies approached Berlin. Eventually it ended up in Basle, Switzerland, where it operated until 1954 — one of the most important computers working in Europe at the time.

Zuse was unable to manufacture computers in post-war Germany, so he concentrated on the theory of computers. He developed a sophisticated language called Plankalkül that could deal logically with both mathematics and more general information. When he was able to manufacture computers again he formed the Zuse Company, which was Germany's major computer manufacturer until 1969, when it was absorbed into the Siemens Corporation. Professor Zuse is still working in the computer industry.

Doodle Bug

Zuse's computers were developed to replace teams of technicians working with slide rules on aeronautical calculations. In particular, they were applied to the design of the V1 and V2 (pictured) flying bombs used so heavily in the Second World War



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