George Robert Stibitz

Barn April 30, 1904, York, Pa.; Bell Telephone Laboratories inventor of several pre-World War II relay computers, and the first demonstrator of remote telecomputing.

Education: AB, mathematics and physics, Denison University, 1926; MS, physics, Union College, 1927; PhD, mathematics, Cornell University, 1930.

Professional Experience: General Electric Company, Schenectady, 1926-1927; Bell Telephone Laboratories, New York City, 1930-1941; technical aide, Division 7 (Fire Control), NDRC (later OSRD**),** 1941-1945; private consultant, 1945-1964; research associate, Department of Physiology, Dartmouth Medical School, 1964-1974; professor emeritus active, 1974-present.

Honors and Awards: AFIPS Harry Goode Award, 1965; IEEE Emmanuel Piore Award, 1977; National Academy of Engineering, 1981; IEEE Computer Pioneer Award, 1982; honorary degrees from Denison University, 1976, Keene State College, 1978, Dartmouth College, 1986.

George Stibitz grew up in Dayton, Ohio, where his father taught ancient languages at a theological seminary of the German Reform Church. He entered the seventh grade at the Moraine Park School, an experimental school newly founded by Charles Kettering and Col. Edward Deeds. Its flexible curriculum and small classes provided an excellent environment for intellectual investigation and exploration.

Stibitz developed an interest in mathematics and physics while in high school and, after graduating in 1922, he received a scholarship to Denison University. At Denison he continued his studies in mathematics and physics. He also enjoyed his English classes and out of them grew not only an appreciation for literature, but an intolerance for the abuse of language.

Upon graduation from Denison in 1927 with a major in mathematics, Stibitz enrolled in the graduate program at Union College, where he received his MS degree in physics in 1926. He then took a year off and went to work for the General Electric Company in Schenectady, N.Y. In 1928, he enrolled in the PhD program at Cornell University. Under the tutelage of Wallie Hurwitz and Kennard, he generalized his interest in the vibrations of the loudspeaker diaphragm into his dissertation study of the differential geometry of a nonplanar membrane.

In the summer of 1929 he met his future wife, Dorothea Lamson, and they were married in September 1930 after he had completed his PhD and had accepted a position as a “mathematical engineer” with Bell Telephone Laboratories on West Street, New York City.

One weekend at home in 1937, observing the similarity between two-state positions of telephone relays and the binary notation, Stibitz decided to experiment. He fastened two relays from the Bell Telephone Laboratories scrap pile to a piece of plywood, cut strips from a tobacco can, bought two dry cell batteries and some flashlight bulbs, and with some electrical work constructed a one-digit binary adder. His colleagues were amused when he showed it to them in the laboratory, but this simple exercise might have ended there, except for Stibitz' penchant for generalization. Further evenings were spent sketching circuits for other arithmetic operations. He presented his ideas to Thornton Fry, head of the mathematical section at the laboratory, who indicated a curiosity as to whether these little relay calculators could do complex arithmetic, which then involved a number of human computers (computists) in the laboratory. With this challenge, Stibitz began to design relay binary circuits for calculations with complex numbers. The designs were completed in February 1938 and Stibitz began to work in earnest with Sam Williams, a switching engineer. In 1939 the Complex Calculator was completed and put to use in the laboratory.

The machine was capable of performing all four basic arithmetic operations, and was capable of being operated by remote access from any of three Teletype machines located in different parts of the laboratory. The first public demonstration of the Complex Calculator (and coincidentally the first remote control of a computer) occurred at a meeting of the American Mathematical Society (AMS) and the Mathematical Association of America at Dartmouth College in September 1940. Stibitz presented a paper describing the machine, followed by Dr. Fry showing how a problem could be introduced to the calculator in New York through a Teletype and telephone line, the computation performed, and the answer returned to the same Teletype. Attendees, among them Norbert Wiener and John Mauchly, were then able to participate in using the complex calculator.

In 1940 Stibitz proposed that the laboratory construct a general purpose automatic computational device. He had developed circuit drawings to provide for interchangeable taped programs, an assembly language (as it would now be called), an error-detection representation code, and a design for floating-point arithmetic operations. Initially the laboratory management showed no interest in the development of a general-purpose computational device, but the onset of World War II provided the necessity for the design and construction of automatic computing machines. The first of a series of relay devices, the Relay Interpolator, was installed on West Street in September 1943. Late in the war it was moved to the Naval Research Laboratory, where it remained until 1961. The Relay Ballistic Computer, which was replicated in 1943 and 1944, was a general-purpose device as was its successor, the Model 4, or in Naval terminology, the Error Detector Mark 22. This sequence of relay calculators was later renamed Models 1, 2, 3, and 4. Models 5 (in two copies) and 6, the most ambitious of the relay devices, were completed in 1946, 1947, and 1950, respectively. Model 3 (and its successors) contained error-detection, halting-trouble diagnosis, and an assembly language. Model 5 was the first to implement floating-point arithmetic.

Each copy of the Model 5 incorporated a system of two arithmetic units and four problem positions. Problems were loaded into any positions that were idle, and upon completion of one problem the computer automatically picked up another. When the models were redesignated, Dorothea Stibitz suggested that the original one-digit binary adder should be called the Model K-for the kitchen table on which it was constructed. The kitchen table sits today in a screened-in porch in the Stibitz' home in Hanover, N.H. The Model 5 may still exist—in 1960 one was shipped to the Bihar Institute of Technology in Bihar, India. Correspondence with that institution suggests that it was never uncrated and may still be on the premises.

During World War II, Stibitz took a leave of absence from Bell Telephone Laboratories and joined Division 7 (Gun-Fire Control) of the National Defense Research Committee (NDRC), later the Office of Scientific Research and Development (OSRD), as a technical aide. The Dynamic Tester, a device developed by Division 7 to test and guide the design of newly developed antiaircraft gun control directors, made great demands on the computers. Model 2 reduced the number of fundamental calculations for the early Dynamic Testers by an order of magnitude (10), and later models of the relay series further increased the speed and reliability of the calculations, thereby making possible enormous savings in human labor.

Stibitz did not return to Bell Telephone Laboratories at the end of the war, but instead established himself as a private consultant to government and industry. One of his projects during this period grew out of his wartime association with Duncan Stewart, later president of the Barber-Coleman Company. Beginning in 1946, Stibitz began the design of a desk-size electronic digital computer for use in the business world. Two working prototypes of the Barber-Coleman computer were completed, but in 1954 the project was abandoned for financial reasons. In 1964 Stibitz was invited to join the Department of Physiology at Dartmouth Medical School as a research associate. In his new career, Stibitz did significant pioneering work in a field that is now called "biomedicine." In the next quarter of a century, Stibitz worked on a variety of biophysical problems, including the modeling of the renal exchange processes, the computer display of brain cell anatomy, and a mathematical model of capillary transport phenomena. He retired as a professor emeritus in 1974, but remained active as a consultant to the medical school.[1]

BIBLIOGRAPHY

Biographical

Daubenspeck, J. Andrew, Dartmouth Medical School Alumni Magazine, Spring 1978, pp. 12-13.

Luebbert, William F., "Commemoration of 1940 Remote Computing Demonstration by Stibitz," *Ann. Hist. Comp*., Vol. 3, No. 1, 1981, pp. 68-70.

Ritchie, David, *The Computer Pioneers*, Simon and Schuster, New York, 1986.

Stibitz, George R., "The Relay Computers at Bell Labs," *Datamation*, Apr. 1967, pp. 35-44.

Stibitz, George R., "The Relay Computers at Bell Labs," *Datamation*, May 1967, pp. 45-49.

Stibitz, George R., "Early Computers," in Metropolis, N.J. Howlett, and Gian-Carlo Rota, *A History of Computing in the Twentieth Century*, Academic Press, New York, 1980, pp. 479-483.

Stibitz, George R., *The Zeroth Generation*, private printing, 1994.

Tropp, Henry S., An Inventory of the Papers of George Robert Stibitz Concerning the Invention and Development of the Digital Computer, Dartmouth College, Hanover, N.H., 1973.

Tropp, Henry S., "New Stibitz Exhibit," *Ann. Hist. Comp.*, Vol. 13, No. 1, 1991, pp. 81-82.

Significant Publications

Stibitz, George R., "Computer," reprinted in Randell, Brian, *Origins of Digital Computers: Selected Papers*, Springer-Verlag, Berlin, 1982, pp. 247-252.

Stibitz, George R., *Relay Computers*, Appl. Math. Panel Report 171JR, National Defense Research Council, Washington, D.C., Feb. 1945.

Stibitz, George R., "A New Class of Computing Aids," *Math. Aids and Other Aids to Computation*, Vol. 3, No. 23, July 1948, pp. 217-221.

[1] Prepared by Henry S. Tropp, November 1991.

UPDATES

George Stibitz died January 31, 1995 (MRW, 2012)