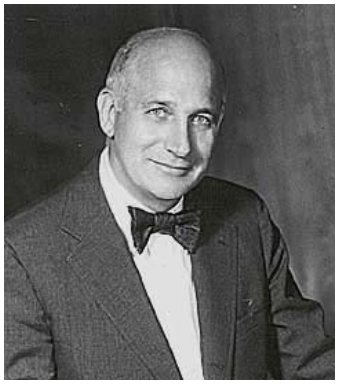
J. (John) Presper Eckert

Born April 9, 1919, Philadelphia, with John Mauchly, the inventor of the ENIAC, created the EDVAC, BINAC, and Univac computers.



Education: BS, Moore School, University of Pennsylvania, 1941; MS, Moore School, University of Pennsylvania, 1943.

Professional Experience: chief engineer, ENIAC Project, Moore School, University of Pennsylvania, 1943-1946; founder (with John Mauchly), *Electronic* Control Corporation (1947, named Eckert-Mauchly Computer Corp.), 1946-1950; director of engineering, Eckert-Mauchly Division, Remington-Rand Corp., 1950-1955; vice president and director of commercial engineering, Remington-Rand Corp., 1955-1959; vice president and executive assistant to the general manager, Remington-Rand Corp., 1959-1963; vice president and technical adviser to the president, Univac Division, Sperry-Rand Corp., 1963-1982.

Honors and Awards: IEEE Computer Society Pioneer Award, 1980; member, Information Processing Hall of Fame, Infomart, Dallas, Texas, 1985.

J. Presper Eckert was attending the University of Pennsylvania in the Moore School of Electrical Engineering when, as an undergraduate, he became interested in computing. Like so many other students, he was bothered by the fact that his statistics homework required hours of time-consuming use of a calculator to answer his professor's questions. He observed that the school had a copy of the Vannevar Bush differential analyzer and, besides desiring its use, began to think of ways to overcome its limitations. His adviser, Dr. Wygant, proposed to the governmental sponsors that these improvements be implemented, and received a grant which enabled Wygant, Eckert, and a fellow graduate student, Bill Cook, to improve the machine's accuracy and efficiency by an order of magnitude.

During this time, John Mauchly[1,'] became interested in the work but decided that there were not many improvements that could be made so long as the calculator was analog. They replaced the gears by installing electronic devices, and devised a mechanism which counted pulses, thus replacing the integrators. However, they felt that even with these improvements the system was still too limited in its applicability. The pulse counter used a monadic representation for numbers and so they decided that they needed a place value system, such as binary or decimal. About this time, the war in North Africa required that all the firing tables be recomputed as a result of the local climatic differences. From this grew their concept of a new machine and with help from John Brainerd, dean of the school, and Herman H. Goldstine, liaison to the school on behalf of the Aberdeen Proving Ground, they presented a proposal for the construction of a digital calculator.

On April 9, 1943 (Eckert's 24th birthday) the university received the authority to commence the ENIAC (Electronic Numerical Integrator and Calculator) project with an initial budget of approximately $150,000—an

[1] See Mauchly's biography for a discussion of his background and prior interests in digital computing devices.

amount which was slowly increased to approximately $400,000 as new requirements were added. World War II had created the need for improved computing power. Bell Telephone Laboratories had already developed relay-based fire control calculators for ground-to-air use,[1] but the military sought airborne systems. Further, the use of radar required sophisticated computation techniques to identify moving targets, a problem which was not being solved by analog means or by women “computers” with calculators.

There were two main criticisms of the work: mathematicians criticized the use of primitive integration methods in their calculations of the trajectories of ordnance devices, and the engineers predicted that the low reliability of the vacuum tubes would undermine the project. Eckert countered the mathematical objections by pointing out that the intervals were much less than had been used in hand calculations. In any case the flexibility of the system, as a result of the ability to “program” the calculator, permitted the use of more sophisticated methods. There was some concern regarding the cumulative effect of round-off or truncation errors, but this too was overcome. These problems were primarily solved by John Mauchly, who concentrated on the “software” and “programming” problems, while Eckert dealt with the hardware problems, including the tube reliability difficulty. The primary problem that Eckert and Mauchly encountered in this project was the need to use a large number of vacuum tubes (eventually over 18,000), which were notoriously unreliable.[2] No one had built any machine with so many tubes. Eckert went for assistance to RCA in Harrison, NJ. They provided much useful advice on this problem—mainly to keep the heaters of the tubes under power, rather than turning them on and off continually. They also received help from the International Resistance Company, of which Brainerd was a primary stockholder, for the supply of reliable, accurate resistors.

Once the first two panels of the ENIAC had been completed, Eckert was convinced of the team's ability to complete the machine. The telltale lamps, which they had installed to indicate the operation of the panels, intrigued everyone on the project; Eckert believed that this innovation was the basis for the inclusion of flashing lights in every science fiction film thereafter.

Besides the development of the first general-purpose calculator, there were two major contributions which were not part of prior conceptions of calculators—hierarchical memory and “subroutines.[3] The concept of a hierarchical storage system derived from the inability to create and afford an efficient single-level memory. Rather than a single cheap and fast memory, they developed a hierarchy of memories, some cheap and some fast. The concept of subroutines was derived from the need to repeat groups of instructions iteratively, and the need to re-use clusters of instructions. Since the ENIAC was not a stored-program machine, subprograms could be stored on cards and tapes, but the concept was extended in later machines.[4]

---

[1] See the biography of' George Stibitz.

[2] Eckert noted that Fermi heard about their problems and, based on his experiences with equipment including 2-300 tubes, estimated that the mean time to failure of their proposed machine would be 2-3 minutes. Fermi's prediction was off by two orders of magnitude.

[3] Eckert ascribes the invention of the term “hierarchical memory” to John von Neumann.

[4] The prior paragraphs are based on the interview by Christopher Evans for the Science Museum and the National Physical Laboratory. 1975.

In 1946 a dispute broke out at the university when Dean Brainerd asked the ENIAC project participants to sign documents which would assign their intellectual property rights to the university. Rather than agree to give up their rights, Eckert and Mauchly chose to found the Electronic Control Corporation, which was renamed the Eckert-Mauchly Computer Corporation in 1947. While the EDVAC (Electronic Discrete Variable Computer) was still a dream at the university, Eckert and Mauchly had the concept of a commercial system, but with limited financial backing they needed a contract in order to provide the funding for further developments. With the design of the Univac system, they sold their promises to Northrop Aircraft Company, to the US Air Force, and to the Bureau of the Census. The Northrop contract was initially fulfilled with the delivery of their first stored-program machine the BINAC. This small machine never operated effectively after delivery to Northrop, but instead of persevering, Northrop allowed it to grow dusty in a corner. The Univac machine was completed and worked successfully for several clients, although not to the profit of the company. In the meantime the corporation was bought out by Remington-Rand, and Eckert was appointed as the director of engineering, Eckert-Mauchly Division, Remington-Rand Corporation in 1950. The line of machines created by Eckert and Mauchly was continued through a sequence of reorganizations with Eckert serving successively as vice president and director of Commercial Engineering, Remington-Rand Corporation (1955-1959), vice president and executive assistant to the general manager, Remington-Rand Corporation (1959-1963), and vice president and technical adviser to the president, Univac Division, Sperry-Rand Corporation (1963-1982). Eckert retired the same year as the Univac name was finally dropped from the product line of the company.

In the 1970s, Eckert was unfortunate to find himself put on the sidelines by counterclaims to the technology which he and Mauchly developed. During the final stages of the construction of the ENIAC, John von Neumann was inserted into the environment as a consultant and mentor (and perhaps possible user). Eckert and Mauchly had already recognized (in 1944, at a time when their project was still classified) that the hierarchy of memory, in which different memories were associated with different elements of the "program "—data, constants, functions, instructions—was unnecessary. A homogeneous memory would allow for interchangeability-a conclusion which implied the insertion of instructions into a modifiable, internal memory. The design of the successor to ENIAC, named the EDVAC, was described in a report[1] which identifies only von Neumann as the author. The report is clearly entitled "Draft" and there is a belief that the final copy would have had the names of other contributors. However, this report is the primary source of the concept of the stored program, sometimes named the "von Neumann concept." Apparently, von Neumann never denied this assignation, and thus Eckert and Mauchly found it difficult to lay claim to their far-reaching, quite possibly most important invention.[2] In 1968 the patents to the invention of the computer (by then in the possession of Sperry-Rand) were challenged by Honeywell. In the process of the trial the source of John Mauchly's ideas for the electronic devices was in question. Honeywell supported the claim that Mauchly had acquired the basic concepts from John Vincent Atanasoff during a 1941 visit to the latter's home in Iowa. Judge Earl Larson found in favor of the

[1] von Neumann, John, First Draft of a Report on the EDVAC, Contract No. W-670-ORD-492, Moore School of Electrical Engineering, Univ. of Pennsylvania, Philadelphia, June 30, 1945. Reprinted in Randell, Brian, *Origins of Digital Computers: Selected Papers*, Springer-Verlag, Berlin, 1982, pp. 383-392. Corrected and reprinted in Ann. Hist. Comp., Vol. 15, No. 4, 1993, pp. 27-45.

[2] Aspray, W.F., "History of the Stored Program Concept," Meetings in Retrospect, *Ann. Hist. Comp.*, Vol. 4, No. 4, 1982, pp. 358-361.

Honeywell claim and invalidated the Eckert-Mauchly patents.[1] Eckert has never accepted this judgment, but rather than fighting it has quietly reaffirmed his own belief in the integrity of his colleague and the uniqueness of his own contributions.

BIBLIOGRAPHY

Biographical

Berkeley, Edmund *C., Giant Brains or Machines That Think,* John Wiley, New York, 1949.

Burks, A. W., and A. R. Burks, "The ENIAC: First General-Purpose Electronic Computer," *Ann. Hist. Comp.*, Vol. 3, No. 4, Oct. 1981, pp. 310-399.

Eckert, J. Presper, "The ENIAC," in Metropolis, N., J. Howlett, and Gian-Carlo Rota, *A History of Computing in the Twentieth Century,* Academic Press, New York, 1980, pp. 525-539.

Evans, Christopher, "J. Presper Eckert," *Oral History of Computing,* Science Museum London and National Physical Laboratory, Teddington, No. 3, Audiotape, 1975.

Mauchly, John W., "The ENIAC," in Metropolis, N., J. Howlett, and Gian-Carlo Rota, *A History of Computing in the Twentieth Century,* Academic Press, New York, 1980, pp. 541-550.

Maynard, M.M., "Eckert, J. Presper, " in Ralston, Anthony, and Edwin D. Reilly, Jr., *Encyclopedia of Computer Science and Engineering,* Van Nostrand Reinhold Co., New York, 1983.

Ritchie, David, *The Computer Pioneers,* Simon and Shuster, New York, 1986, Chapter 8.

Slater, Robert, *Portraits in Silicon,* MIT Press, Cambridge, Mass., 1987, Chapter 7.

Stern, Nancy, *From ENIAC to Univac: An Appraisal of the Eckert-Mauchly Computers,* Digital Press, Bedford, Mass., 1981.

Significant Publications

Eckert, J. Presper, Jr., John W. Mauchly, Herman H. Goldstine, and J. G. Brainerd, *Description of the ENIAC and Comments on Electronic Digital Computing Machinery,* Contract W/670/ORD 4926, Moore School of Electrical Engineering, Univ. of Pennsylvania, Philadelphia, Nov. 30, 1945.

UPDATES

Pres Eckert died June 3, 1995. (MRW, 2012)

[1] See biographies of John V. Atanasoff and Clifford Berry.