John Vincent Atanasoff – The Inventor of the First Electronic Digital Computing

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Abstract: *This paper describes the main points of biography of John Vincent Atanasoff and inventing of the first digital computer. The emphasis was made on the significance of his new approach to the using of digital devices for massive computations. The basic principals of operations of the first electronic digital computer are described.*

Key words: *digital computer, Atanasoff, Berry*

JOHN VINCENT ATANASOFF was born on 4 October 1903 close to Hamilton, New York. His father was a Bulgarian immigrant named Ivan Atanasov. His last name was changed to Atanasoff by immigration officials at Ellis Island when he arrived with his uncle in 1889. At that time Ivan Atanasoff was 13 years old. Later his first name was changed to John. In 1901 he graduated the University of Collgate.

His mother was Iva Lucena Purdy, a mathematics schoolteacher. The couple had nine children (one of whom died): John Vincent, Ethelyn, Margaret, Theodore, Avis, Raymond, Melva, Irving. After John Vincent's birth, his father accepted an electrical engineering position in Osteen, Florida, and subsequently, in Brewster, Florida. It was here that JV completed grade school and started understanding the concepts of electricity. The Atanasoff home in Brewster was the first house they lived in with electricity, and JV, as a 9-year-old boy found and corrected faulty electric wiring in a back-porch light.

He soon became interested in the mathematical principles behind the operation of the slide rule and the study of logarithms; this led to studies in trigonometric functions. With the help of his mother, he read A College Algebra, by J.M. Taylor. This book included a beginning study on differential calculus and also had a chapter on infinite series and how to calculate logarithms. Within a few months, the precocious 9-year-old had progressed beyond the point of needing help. During this time, he learned about number bases other than ten from his mother; this led him to study a wide range of bases, including base-two.

He completed the Mulberry High School course in two years, excelling in science and mathematics. He wanted to become a theoretic physicist. In 1921, he entered the University of Florida in Gainesville. Since the university did not offer a degree in theoretic physics, he started taking electrical engineering courses. While taking these courses, he became interested in electronics and continued onto higher mathematics. He graduated from the University of Florida in 1925 with a Bachelor of Science degree in electrical engineering. He had a straight "A" academic average. Even though he had many offers of teaching fellowships, including one from Harvard, he accepted the one from Iowa State College, because it was the first one he received and because of the institution's fine reputation in engineering and sciences.

In the summer of 1925 the 22-year-old John Vincent arrived at Ames, Iowa, home of Iowa State College. He was ready to make his mark in the world of science. From September to November he was busy working on his master's degree and teaching two undergraduate mathematics classes. Even though his social life was minimal due to his busy schedule, he was familiar with one campus organization, the Dixie Club, where he met his first wife – Lura Meeks, 25-year-old home economics major.

In June 1926, John received his master's degree in mathematics from Iowa State College, and a few days later, he married Lura. Iowa State had hired him to teach mathematics; Lura had not yet completed the work for her degree in home economics, and

she had signed a contract to teach school during the 1926-1927 school year in Montana so she could save enough money to complete the year she needed for that degree. A little over a year later, their oldest daughter Elsie, was born. When Elsie was one, the family moved to Madison, Wisconsin, where John had been accepted as a doctoral candidate. Two other children, Joanne and John, were later born to the couple. The work on his doctoral thesis, "The Dielectric Constant of Helium," gave Atanasoff his first experience in serious computing. He had always been interested in finding new ways to perform mathematical computations faster. Dr. Atanasoff examined many of the computational devices that existed at that time. These included the Monroe calculator and the International Business Machines (IBM) tabulator. Dr. Atanasoff concluded that these devices were slow and inaccurate. After receiving his Ph.D. in theoretical physics in July 1930, he returned to Iowa State College with a determination to try to create a faster, better computing machine.

In the fall of 1930 he became a member of the Iowa State College faculty as assistant professor in mathematics and physics. With his academic background, Atanasoff felt he was well equipped to try to figure out how to develop a way of doing the complicated math problems he had encounted during his doctoral thesis, in a faster, more efficient way. During the period that he was doing experiments with vacuum tubes and radio, and examining the field of electronics, he was promoted to associate professor of both mathematics and physics and moved from Beardshear Hall to the Physics Building.

After examining many mathematical devices available at the time, Atanasoff concluded that they fell into two classes--analog and digital. Since the term "digital" was not used until much later, Atanasoff contrasted the analog devices to what he called "computing machines proper." In 1936 he engaged in his last effort to construct a small analog calculator. With Glen Murphy, then an atomic physicist at Iowa State College, he built the "Laplaciometer," a small analog calculator. It was used for analyzing the geometry of surfaces. Atanasoff regarded this machine as having the same flaws as other analog devices, where accuracy was dependent upon the performance of other parts of the machine. John Vincent concluded that analog devices were too restrictive and could not get the type of accuracy he wanted. The expression “analogue computer” was used for the first time by him [5].

One night, frustrated after many discouraging events, he got into his car and started driving without destination. Two hundred miles later, he pulled onto a roadhouse in the state of Illinois. Here, he had a drink of bourbon and continued thinking about the creation of the machine. No longer nervous and tense, he realized that his thoughts were coming together clearly. The idea of building an electronic digital computer came to him. He set up four principles for his electronic digital computer.

- He would use electricity and electronics as the medium for the computer.
- In spite of custom, he would use base-two numbers (the binary system for his computer).
- He would use condensers for memory and would use a regenerative or "jogging" process to avoid lapses that might be caused by leakage of power.
- He would compute by direct logical action and not by enumeration as used in analog calculating devices. (Mollenhoff, 34)

In March 1939 he received a grant of $650 from Iowa State College.

As Dr. Atanasoff worked on his computer project, he asked a colleague to recommend a graduate student to assist him with his project. The graduate student that

was introduced to him was Clifford Berry. Berry was gifted electrical engineer and had very similar background as Dr. Atanasoff did. They both got along almost immediately.

In December 1939, the first prototype of the Atanasoff Berry Computer (ABC) was ready. The ABC showed some of the potentials of a computer and it amazed the University. So in 1939, Dr. Atanasoff and his assistant Clifford Berry built the world's first electronic digital computer. The original ABC was dismantled decades ago and later Ames Laboratory, using private funding, builds a working replica of this historically important invention. The photo of a working replica of this historical prototype is shown on Fig.1.

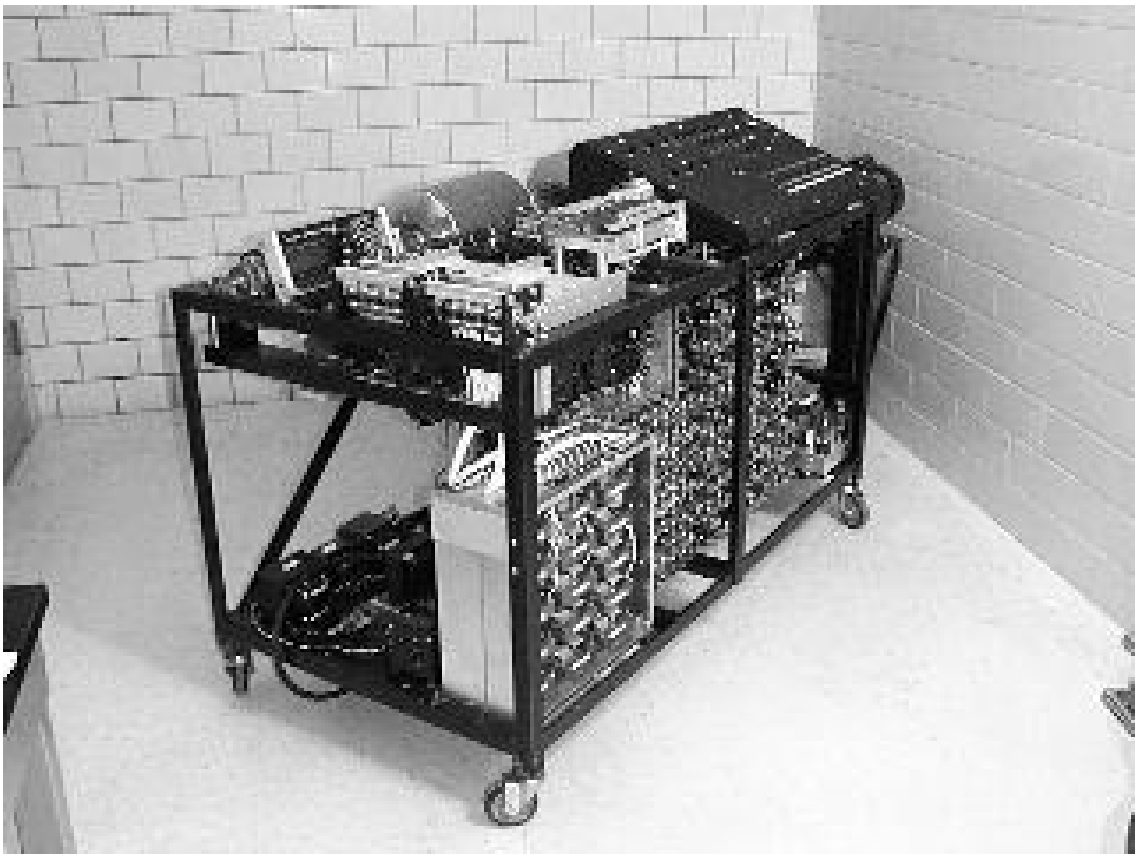

Figure 1. Photo of completed replica of Atanasoff-Berry Computer (ABC)

The block diagram of ABC is shown on Fig.2. ABC has not had stored programs as the modern computers have. All operations were assigned manually and the main point was that these operations were performed at once in parallel on 30 couples of digits by 30 Add-Subtract Modules (ACM). So the first computer was also the first realization of the SIMD (Single Instruction Multiple Data) concept. Each ACM completed the operation on two operands (two 50 bit digits) in a serial manner. The memory of the first computer was based on two drums (Drum #1 and Drum #2) for each of two operands. Each drum stores 30 numbers by 50 bits. For input and output devices are used existent punch card reader and puncher of IBM Corp. Principals of operation of ABC was very simple. The source digits from punch card reader are stored on Drum #1. The contents of Drum #1 could be transferred to Drum #2. When all operands are stored on Drum #1 and Drum #2 the ABC was ready for computations. Each computation (addition or subtraction) was completed on digits from Drum #1 and Drum #2 and the result was stored on Drum #1. When the computations was finished the contents of Drum #1 was punched on cards. The photo of one of the ABC drums, which is the only surviving fragment of the prototype built in 1939, is shown on Fig.3.

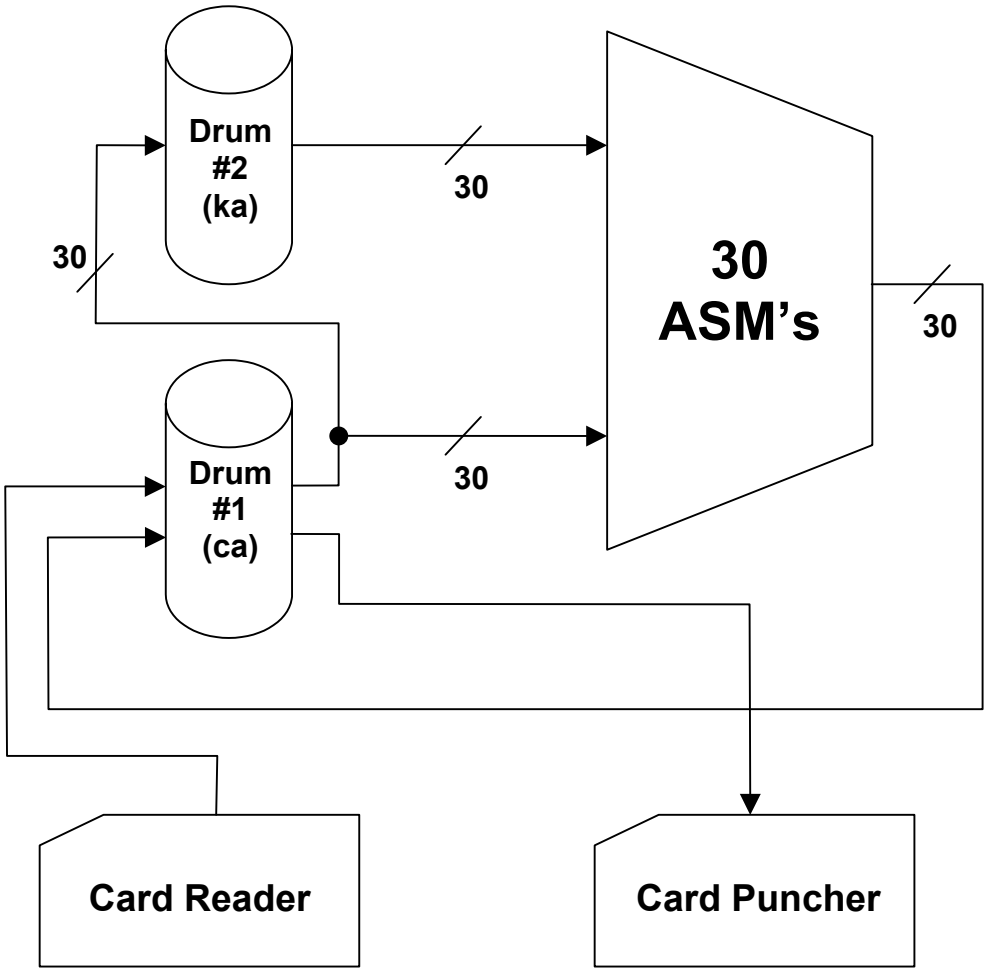

Figure 2. The Block diagram of ABC computer

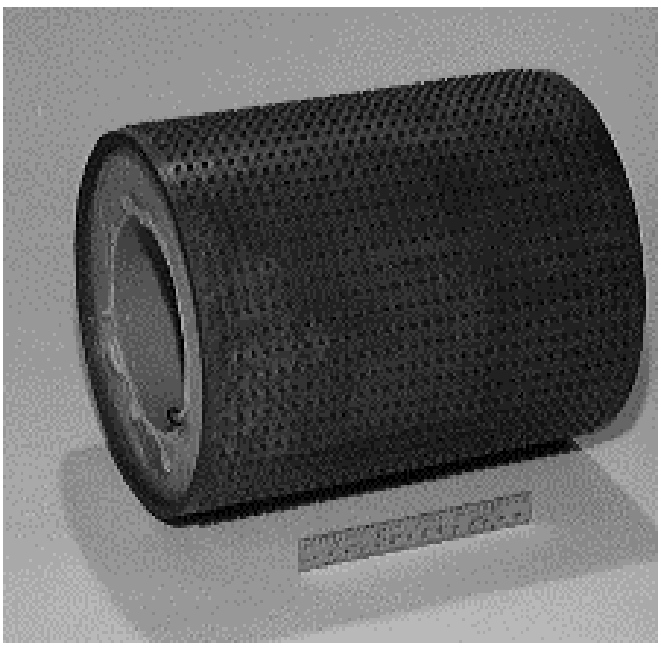

Figure 3. The only surviving fragment of the original ABC built in 1939.
This drum holds 30 numbers of 50 bits each

With the first prototype working well, Dr. Atanasoff wanted to improve on prototype as well as get patents for the Atanasoff Berry Computer. Obtaining the patents were a slow process that ultimately caused Dr. Atanasoff the recognition that he deserved. From 1939 until 1941 they worked at developing and improving the ABC. When USA entered after Purl Harbor War II on 7 December 1941, the work on the computer came to a halt. Although Iowa State College had hired a Chicago patent lawyer, Richard R. Trexler, the patenting of the ABC was never completed.

In 1940 Dr. Atanasoff attended a lecture given by Dr. John W. Mauchly. They talked for some time and Dr. Mauchly was very intrigued with Dr. Atanasoff's electronic digital computer. Dr. Mauchly wanted to see the ABC for himself and Dr. Atanasoff agreed.

In September of 1939 Atanasoff left Ames, Iowa and Iowa State on leave for a defence-related position at the Naval Ordnance Laboratory in Washington, D.C. (Clifford Berry had accepted a defence-related job in California).

He thought he would spend a few months, or at most, a few years, in government and then return to Iowa State College to, hopefully, become a department head. Lura and their three children remained in Ames, but he made frequent trips home to see his family.

He had become Chief of the Acoustics Division at the Naval Ordnance Laboratory, a position that was paying him a salary well above the $10,000 cap on government salaries at the time. He was in charge of developing a computer for the United States Navy. At the same time, he became involved in the first atomic test in the Pacific, a project that he liked very much.

In 1948, on one of his return visits to Ames, he was surprised and disappointed to learn that the Atanasoff-Berry Computer had been removed from the Physics Building and dismantled. Neither he nor Clifford Berry had been notified that the computer was going to be destroyed. Only a few parts of the computer were saved.

The long separation from his family was beginning to take its toll. He and Lura had drifted apart. In 1949 they were divorced and Lura moved with the children to Denver, Colorado. In the same year, John Atanasoff married Alice Crosby, an Iowan who had also gone to Washington to work during the war years.

In 1949 he became chief scientist for the Army Field Forces in Fort Monroe, Virginia. After one year, he returned to Washington as director of the Navy Fuse Program at the Naval Ordnance Laboratory. He stayed in that position until late 1951. In 1952 he established The Ordnance Engineering Corporation, a research and engineering company in Rockville, Maryland, with his old friend and student, David Beecher. The company was sold to Aerojet General Corporation in 1957, and he became Manager of its Atlantic Division from 1957-1959 and Vice President from 1959-1961. In 1961 he retired. In 1974, JV returned to Iowa State University (the name changed to "university" in 1959) to be guest of honour and grand marshal for the largest student-run celebration in the nation: Veisha. The acronym stands for the first letters of study at the university: Veterinary Medicine, Engineering, Industrial Science, Home Economics, and Agriculture. The festival usually attracts more than 250,000 people. He attended with his wife Alice and two of his children: Joanne and John and their respective families. Elsie was in Indonesia with her husband and was unable to attend.

In late 1966 or early 1967 patent lawyer Charles L. Call was summoned to the office of senior partner D. Dennis Allegretti and ask him if he would be interested on taking a case which might take ten years of his time. Allegretti explained that the client was the Honeywell Company of Minneapolis and the case involved a controversy with the Sperry Rand Corporation over what was called generally “The ENIAC PATENTS”.

The trial that started on 1 June 1971 consumed over 135 days or parts of days. A total of seventy-seven witnesses had given oral testimony, and an additional eighty witnesses were presented through deposition transcripts. Atanasoff's testimonies were more than 3500 pages. The first indication of Judge Larson's decision came in April 1973, after he provided lawyers for Honeywell and Sperry Rand copies of a proposed decision and asked for their comments on that decision. That tentative decision was leaked to the Minneapolis Tribune and Star and staff writer Bob Lundegaard wrote an exclusive story for the 12 April 1973 newspaper stating that Judge Larson had ruled that the basic ENIAC patents held by Sperry Rand were invalid.

When Judge Larson distributed the formal opinion on 19 October 1973, it was everything that Atanasoff had hoped it would be. It was clear and unequivocal finding that Mauchly's basic ENIAC ideas were "derived from Atanasoff, and the invention claimed in ENIAC was derived from Atanasoff." In extensive findings, Judge Larson declared: "Eckert and Mauchly did not themselves first invent the automatic electronic digital computer, but instead derived that subject matter from one Dr. John Vincent Atanasoff."

Judge Larson had ruled that John Vincent Atanasoff and Clifford Berry had constructed the first electronic digital computer at Iowa State College in the 1939 - 1942 period. He had also ruled that John Mauchly and J. Presper Eckert, who had for more than twenty-five years been feted, trumpeted, and honored as the co-inventors of the first electronic digital computer, were not entitled to the patent upon which that honor was based. Furthermore, Judge Larson had ruled that Mauchly had pirated Atanasoff's ideas, and for more than thirty years had palmed those ideas off on the world as the product of his own genius.

After retiring John Vincent continue to work actively, to give lectures, to write papers. He received several Honors and Awards: Order of Cyril and Methodius, First Class in 1970; Iowa Inventors Hall of Fame; Plaque, Iowa State University Physics Building (1974); Honorary Membership, Society for Computer Medicine (1974); Doctor of Science, University of Florida (1974); Doctor of Science, Moravian College (1981); Distinguished Achievement Citation, Iowa State University Alumni Association (1983); Governor's Science Medal (1985); Order of Bulgaria, First Class Award (1985); Computing Appreciation Award, EDUCOM (1985); Holley Medal, American Society of Mechanical Engineers (1985); Coors American Ingenuity Award (1985); Doctor of Science, Western Maryland College; National Medal of Technology given by President George Bush (1990).

The vice president and director of information and public affairs for ISU, Carl Hamilton, started the wheels moving to create a film story on the construction of the Atanasoff-Berry Computer. The film "From One John Vincent Atanasoff" was completed in 1981. On 21 October 1983 (tenth anniversary of Judge Larson's historic decision that Iowa State was the site of the construction of the first electronic digital computer and that the ENIAC had been "derived" from the ABC), the film was released and during the celebration, held at the ISU campus, JV was given a Distinguished Achievement Citation by the Iowa State University Alumni Association. Cliff Berry's widow, Jean Berry, and his mother, Mrs. Grace Berry, were recognized as relatives of the co-inventor of the ABC.

After a long illness, Atanasoff died of a stroke on 15 June 1995 at his home in Maryland.

When John Vincent Atanasoff invented the computer, he probably did not know how much of an impact it would have on people's lives. Computers will be involved in every aspect of technology, and it will continue to be a part of technologies to come. The capabilities of computers are advancing every day. Soon, a computer will become more like the human brain than an electronic machine. Computers will always be on the edge of

technology and anyone that learns to harness its power will be an important part of the future. Every aspect of our lives has changed because on the computer and its inventor, John Vincent Atanasoff.

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The paper use materials mainly from [2] and [3].

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