Clifford Edward Berry

Born 1918; died October 30, 1963, Long Island, N. Y; with John V Atanasoff developed the earliest known electronic computer for the solution of linear systems—the ABC.

Education: BS, physics, Iowa State College, *1939; MS,* physics, Iowa State College, *1941;* PhD, physics, Iowa State College, *1948.*

Professional Experience: Consolidated Engineering Corp., Pasadena, *1942-1963;* director of advanced development, Vacuum-Electronics, Huntington, Long Island, N.Y.

Introduction[1]

A remarkable team of two scientists, John V. Atanasoff and Clifford E. Berry, together invented the world's first electronic digital computer. Atanasoff came up with the concept of using the digital approach one winter night at a small tavern in Illinois."[2] The need for a fast computer had been on his mind for some time, as a way to help his graduate students at Iowa State College (now University) speed their calculations. He needed someone with a talent for inventing and a thorough knowledge of electronics to work with him on this project. Atanasoff recalls the exact spot on the campus-where the sidewalk leaving Beardshear Hall and heading toward the bookstore crossed the walk leading to Engineering-that he met the head of the Engineering Department and stopped to chat. Atanasoff said that he had managed to get some financial backing, and he asked if the dean could suggest an electrical engineering graduate with a thorough knowledge of electronics to work with him. Without a second's hesitation, the dean suggested Clifford Edward Berry, a brilliant, hard-working budding scientist with an impressive history of awards and achievements. They met, and the team of Atanasoff and Berry—two entirely different but gifted physicists—was born.

The following reminiscences by Jean Berry, wife of Clifford, include two items not included in Atanasoff's biography. One is a letter, describing the ABC, that Berry wrote to R.K. Richards, the author of *Electronic Digital Systems,* shortly before Berry died. The other item contains recollections written by Robert L. Mather who, at the time of the construction of the ABC, was an undergraduate helping Berry.

[1] Adapted from Berry 1986.

[2] See the biography of J.N. Atanasoff

Clifford Berry and the ABC

Clifford Berry graduated from Marengo (Iowa) High School in 1934 at the age of 16. He had a straight “A” average and was class valedictorian. Because he was so young, his family thought he should wait a year before starting college. He spent that year taking more science courses and working on his ham radio setup. He was an Eagle Scout and an assistant scoutmaster. He loved classical music. For financial reasons, his widowed mother moved to Ames so that all four children could attend Iowa State College. Cliff earned money for college by working for Gulliver Electric, but in spite of this outside work he maintained an extremely high grade average, and was elected to four honorary fraternities: Sigma Xi, Eta Kappa Nu, Phi Kappa Phi, and Pi Mu Epsilon. In his junior year he was given a special award for making the highest scholastic record in the Department of Electrical Engineering during his freshman and sophomore years.

Although we lived just a few blocks apart in Ames, Cliff and I did not meet until October 1941, when his laboratory mate arranged a blind date. Cliff had graduated from ISC in 1939 and begun work on his graduate degrees in physics and mathematics, and on the computer that was later named the ABC.

In a 1940 issue of *EE News,* an ISC electrical engineering newsletter, Berry wrote:

> I am still working on the calculating machine [the prototype had been completed in 1939] and we can see the end in view, though some months off. I grow more enthusiastic about it as time goes on-it is so basically new that a continual stream of ramifications emerges from the central idea.

He was awarded a master's degree in physics in 1941. His thesis was based on one of his contributions to the invention of the ABC, and was entitled, “Design of an Electrical Data Recording and Reading Mechanism.” In the thesis, Berry wrote:

> The present work was undertaken in conjunction with the development of a high-speed computing machine.... In order to realize to the fullest extent the high-speed capabilities of the computing machine proper, it is necessary to record and read numbers on cards at rates of the order of 60 holes per second. This seems plainly beyond the limits of practicability in so far as the usual mechanical methods are concerned; hence, the method to be described was developed to meet this need.

After graduating from ISC, I taught at a local school for a year. Teaching did not appeal to me, so I obtained a position at ISC as a secretary in the English Department. A few weeks after I met Berry, he told me about an opening as secretary to John V. Atanasoff, on the missile project he headed. I became JV's secretary in November 1941 and worked for him on the missile project until Cliff and I married on May 30, 1942.

Berry and Atanasoff worked well together. They were both very busy in addition to completing the computer—Atanasoff with his teaching and his supervision of the missile project, and Berry with his graduate studies and, and in early 1942, his courting of me, which took an increasingly greater amount of his spare time. Frequently Cliff worked all night on the computer and then snatched a few hours of sleep on a cot in the basement of the physics building.

I agree heartily with Atanasoff, who said in 1983 at ISU that without the ABC, computers would have been delayed by perhaps ten years. I also agree with Atanasoff's statement in the *Annals* (1984): "*I feel that the choice of Clifford E. Berry was one of the best things that could have happened to the project. After he had worked for a short time, I knew that he had the requisite mechanical and electronic skills-and that he had vision and inventive skills as well" (p.* 241).

We left Ames at the end of June 1942, one month after our wedding. Berry had a job waiting for him in Pasadena at Consolidated Engineering Corporation. He had completed most of the course work for his PhD in physics, but he did not resume work on it until World War II ended. From the beginning, he made swift progress in his career. He wrote technical publications, patents, and internal company reports, and made speeches at various societies. He was listed in *American Men of Science, Leaders in American Science,* and *Who's Who on the West Coast.*

The 30-103 Analog Computer

In 1945, just three years after we left Ames, Cliff developed an analog computer. He had been thinking about it for some time, according to Consolidated scientists with whom I have since talked. When he finally figured it out, he wasted no time, taking everybody in the research department off current projects and putting them to work building a prototype of the computer. His superior was out of town, and Cliff later said that he had needed a lot of courage to take it upon himself to put the entire department on this computer. Consolidated named it the 30-103 and formed a new company called ElectroData to manufacture it. ElectroData did not exist long as a separate entity-it soon merged with Burroughs—but it was, I believe, the beginning of the California computer industry.

The analog technique had been used during the war, but not until Cliff invented the 30-103, (and Consolidated applied for a patent and put it on the market) was a computer available for industry that could solve linear simultaneous equations. According to J.C. Pemberton, the project engineer, the 30-103 was invented for an urgent reason: Consolidated needed something to untangle simultaneous data that came out of the mass spectrometer. This same J.C. Pemberton, by the way, had contributed something to the building of the Atanasoff-Berry Computer: he made a set of dies that formed the radial brass contacts for the rotating memory drum of the ABC. It was an unpaid contribution.

The 30-103 aroused a great deal of excitement in the scientific community. Cliff presented a paper on it at the January 12, 1946 meeting of the American Physical Society; a report appeared in the January 19, 1946 issue of *Science News Letters.* On February 5, 1946, Cliff was the speaker of the evening at a dinner meeting of the California Instrument Society, where he showed and described the 30-103.

In April 1946, the 30-103 was featured on the cover of the *Journal of Applied Physics* and was described in a lengthy article (Berry et al., 1946). Although it has been nearly forgotten in the constantly changing computer world, it was an important first.

In the summer of 1946 we were visiting Sam Legvold of ISC. He had been one of the group working with Atanasoff on the missile project. He asked Cliff how near to completion of his PhD he was, and I was astounded to find out that he had completed all but his orals and thesis. Sam and I persuaded Cliff to finish the work for his PhD. Aside from two courses he took at Cal Tech, and the French and German requirements, which he did by correspondence, my husband spent the following year studying for his orals, which he took in June 1947. The second year was spent doing the research for his thesis, which was completed in time for him to receive his PhD the following summer, 1948. This thesis was based on mass spectrometry, in which he was building an international reputation. It was a busy time for me; we had a daughter when he resumed work on his PhD and a son by the time he received it, so the child care was left to me.

Cliff's career flourished. He was one of the charter members of Committee E-14 of the American Society of Testing Materials. He was a member of the American Physical Society, the American Association for the Advancement of Science, and the American Vacuum Society. He presented papers at the meetings of these societies as well as the Instrument Society of America, the American Chemical Society, the American Optical Society, the Gordon Research Conference on Instrumentation (he was the chairman in 1959), the Max Planck Institut für Kohlenforschung, the National Bureau of Standards Symposium on Mass Spectrometry, the American Institute of Electrical Engineers, and the Western Spectrometry Association. He was guest lecturer at Ohio State University during a summer session. One of his most distinguished inventions was the Isatron (derived from Ion Source Analyzer), considered the heart of the mass spectrometer. At the time of his death, only 21 years after he began his professional career, Clifford Berry had over 30 patents issued and a number still pending, a total of 47, of which 46 were in the field of mass spectrometry. The patent on the 30-103 analog computer was entitled Linear Simultaneous Equation Solver, number 2,557,070. It was issued June 19, 1951.

Clifford Edward Berry died October 30, 1963. He had been dissatisfied with this work after Consolidated merged with Bell and Howell, which occurred around 1959 or 1960. In 1963, when he heard of an opening for director of advanced development at Vacuum-Electronics in Huntington, Long Island, he applied and was hired. He spent one week of that October fixing up our house and garden for sale, and another week at a vacuum conference. He lived in Long Island for only two weeks, during which he bought a new Chevrolet and looked at a number of houses. I remained in California to sell our house. His death remains a mystery. The coroner's report called it “possible suicide.” The police kept his room locked for the three weeks while they sought clues. Sometime later, Atanasoff, having driven to Long Island in search of clues about the cause of death, told me that the landlord had torn the plastic bag off Cliff's face with no difficulty. When I told a physician what I knew, he said that Cliff could not possibly have killed himself-he was murdered: *“It's like trying to hold your breath; you can't.”* In magazine and newspaper articles, Atanasoff has referred to Berry's death as “foul *play.”* From the information I have, I believe him. Nothing can bring my husband back, however, so I hope these brief remarks will put all further speculation to rest.

Letter from Clifford E. Berry to Richard K. Richards of Iowa State University

A few weeks after Cliff's death, I came across a carbon of a letter dated July 2, 1963, that he had written to R.K. Richards (1966) who was writing a book on early computers.

> Dear Dr. Richards:
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> Thank you for your letter of April 30, 1963. It is unfortunate that Dr. Atanasoff has not responded, since he must have stored away somewhere, my notebooks, various reports, and drafts of his patent applications (I do not recall the names of the attorneys). I shall try to answer your questions as best I can from memory.
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> The machine was designed for a single purpose, namely to solve large sets of linear simultaneous algebraic equations (up to 30 x 30). It used binary arithmetic internally, with a word length of 50 bits. The basic mathematical procedure used was the successive elimination of coefficients from pairs of equations so as to eventually reduce the original square matrix to a triangular one. Since the internal memory of the computer only held the coefficients of two equations at a time, intermediate results (i.e., the single equations resulting from the linear combination of two so as to reduce by one the number of variables) were stored on special punched cards each of which held 30 fifty-place binary numbers. These cards were then read back into the machine at a later step in the process. A card could be punched or read in one second, but had to be inserted manually.
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> The maximum time required, in the worst possible case, for the machine to eliminate a variable between two equations, was about 90 seconds; the average was much less.
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> Within the machine there were two storage units, one for the coefficients of each of the equations of the pair being combined. These storage units consisted of rotating drums filled with small capacitors, each capacitor being connected to a small brass contact on the drum surface. Five-sixths of the drum periphery was occupied by these contacts (30 rows of 50 each), the other sixth being blank to provide time for other operations. The drums were driven by a geared-down synchronous motor so as to rotate at exactly 1 rps. Thus, the rate at which contacts passed a reading brush was 60 per second. The polarity of the charge on the capacitor indicated whether it represented a “one” or a “zero,” and each capacitor was recharged immediately after it was read so that it never had to hold a charge for more than one second. All words were handled in parallel, but within each word the digits were handled serially. It is interesting to note parenthetically that before designing the capacitor memory units we seriously considered using magnetic drums, but we abandoned this approach because of anticipated low signal levels.
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> There were 30 identical units which were essentially binary adders. Each consisted of a set of direct-coupled vacuum tubes (seven twin triodes) so interconnected that they performed binary addition. Each unit had three inputs, two for the digits being added (or

subtracted) and one for the carry over from the previous place, and two outputs, one for the result in that place and one for the carry over to the next place.

Initial data input to the machine was by IBM cards which were read by a special reader of our design. Each card carried five 15-place decimal numbers and was read in 15 seconds. The machine converted decimal numbers to binary numbers by means of a rotating drum (rear left corner of the machine) which carried contacts arranged to represent the binary equivalents of 1, 2, -9, 10, 20, -9 x 10^{14}. Final output of decimal numbers utilized the same apparatus in reverse and the decimal results appeared on a mechanical counter.

The above material more or less answers your questions 1 and 2. I will try to answer your remaining questions briefly.

3) Design and construction began in September, 1939, when I began my graduate work. It is amusing to recall that Prof. Atanasoff instructed me to build a framework for the machine during the first month before we had any real idea of what was going to go in the machine. As a result, the machine “grew” as work progressed, rather than being first designed and then constructed.

4) The only major element that was not completed when work stopped in the middle of 1942, was the reading circuits for the binary cards. The basic computing part of the machine had been completed and operating for more than a year, but it was of little use without means for storing the intermediate results.

5) The most important circuit developed was that of the adders. We initially tried flip-flops, but were discouraged by their unreliability and response to stray transients. The basic type of circuit which we finally evolved proved to be extremely reliable and non-critical.

The grids of the input tubes floated on small capacitors which were charged by momentary contact with a storage capacitor. A positive charge simply drained off through the grid and left the grid at ground potential so that the tube was conducting. A negative input blocked the tube so that the plate rose to the supply voltage. The output tubes were coupled: resistor R^. was selected so that tube A was blocked if either or both inputs were positive; this gave the carry over. The actual circuit with three inputs was considerably more complicated and required 14 triode elements. Changing a bias potential at one point in the circuit. All input capacitors were discharged to zero after each operation through individual neon bulbs connected to a half-wave 60 cycle source.

6) Prof. Atanasoff had thought about computing machines for several years, and had made an attempt to modify an IBM accounting machine to solve large sets of simultaneous equations. He soon recognized that the operation would be too slow and abandoned this approach. I am sure he was aware of the early work in the field and I

> recall that we were at least aware of Aiken's “relay” computer although we may not have known much about it.
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> 7) The newspaper clipping was from one of the Des Moines papers either the “Register” or the “Tribune.” Incidentally, the object I was holding was not a “memory” but rather a set of 90 triode elements used in conjunction with one of the memory drums to shift the numbers so as to divide by powers of two.
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> I am sorry to have taken so long to write this and I hope it is not too late to be of help. Incidentally, I remember that several years ago Sam Legvold had one of the memory drums under his desk! There are undoubtedly a number of parts scattered around the Physics Department somewhere.
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> Sincerely,
>
> Clifford E. Berry

I wrote to Richards to find out more about the book that led to the correspondence, and I quote part of his answer: *“Yes, I am writing a book on computers, and Cliff is to be mentioned in it in connection with Dr Atanasoff's computer inasmuch as Dr Atanasoff had told me on the telephone that many of the ideas in the machine, as well as the actual construction, should be credited to Cliff. “ The* book (Richards 1966) begins, after the introduction, with the words: *“The ancestry of all electronic digital systems appears to be traceable to a computer which will here be called the Atanasoff-Berry Computer This computer was built during the Period from about 1939-1942.”*

Mather's Recollections on the ABC at Iowa State

Over the years we had kept in touch with most of the men who had worked on the project. One was Robert L. Mather, now retired from work with the Navy, who wrote the following letter to me in 1984:

> In the 1940s a germinal entity existed at Iowa State University (then, Iowa State College, Ames, Iowa). Today known as the Atanasoff-Berry Computer (ABC), it can be said to be a predecessor of today's digital computer. Who were Atanasoff and Berry? Their names are not now found in common reference books, yet the stamp of the computer is on everyone's life.
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> I knew these men first as an upper-level undergraduate student, then as an electronic technician (1941-1942), and later as friends. One cannot describe them as they were some 40 years ago without being aware that the milieu of the day differs drastically from that of today. In 1941 JV [Atanasoff] was 37, Cliff was 24, and I was 20. I realize from the August 1940 paper of JV (see later) that I came too late on the scene to know which ideas were contributed by JV and which by Cliff—no doubt that paper had contributions by

both men. Both men were brilliant and either of them could have generated any of the key concepts.

The craftsman in the Atanasoff-Berry team was Clifford E. Berry. Cliff had graduated from ISC in 1939 as an electrical engineer and was working with JV as a graduate student when I first met him in 1940. He had a knack for electronics design which he learned as a radio amateur. When I first knew him he was also well learned in graduate physics, and I was impressed that he thoroughly knew all the aspects of the computer that he was working on.

Cliff was my admirable older brother, so to speak, while John Vincent Atanasoff (whom was always called JV) was more distant-not quite a father figure but an authority figure and also older. Cliff could make things and could make them work. He valued home, children, and a stable marriage, yet aggressively sought new insights in every direction. I valued his friendship for the rest of his life.

Together, JV and Cliff designed and built the Iowa State computer (later to be called the ABC) in a small basement alcove of the physics building. It is credited with being the first electronic digital computer-a claim that lies buried in patent litigation of the early 1970s, a claim that was established by the court but that resulted in no financial gain to them or to Iowa State, and I believe, had little financial impact on the burgeoning computer industry.

One should realize that the IBM machines of those days were extremely cumbersome for calculations of any significant complexity. Their only competition was the electrically driven Monroe or Marchant mechanical calculator combined with pencil and paper (and don't forget the eraser!).

One should perhaps mention that at that time, IBM had an arrangement with the college that allowed Snedecor's lab to use their equipment at reduced cost (a common arrangement). JV had made some overtures to IBM about some financial assistance for building his computer. He felt that IBM wanted more out of such assistance than they deserved. At any rate he chose that more difficult task of finding funds elsewhere. Probably the greatest fault with the computer project was that it was seriously underfunded. There were too many cost-cutting decisions that sacrificed component reliability. There were not funds that would have carried the project through the debugging stage and into useful application. There was too much dependency on student-wage labor who were readily drawn away when jobs developed. In fact, even JV was drawn away—faculty salaries were pretty low, also.

JV did have ready application for such a machine, if it had been usable, in the graduate research his other students were doing. Erwin Kammer was investigating the elastic constants of beta quartz, and at one point in the reduction of his data, systems of linear equations had to be solved. It was an appalling defect of the USA in the 1930s that supporting funds for advanced development of useful tools were not available—a defect we learned more about in the 1940s.

The ABC was designed to solve systems of linear equations up to systems of 30 equations in 30 unknowns. Modern computer terminology allows succinct description of the process. The numerical theory is very clearly described in Chapter 9 of the book by Anthony Ralston, *A First Course in Numerical Analysis* (New York, McGraw-Hill, 1965). The process may be known to the reader as classical Gaussian elimination. Each coefficient was represented by a fixed-point 50-bit number (15-digit precision). The number was represented electronically by 50 plus or minus charges on 50 capacitors. The charges were read by vacuum tubes once per second and either replenished or modified according to the arithmetic process being implemented. Addition and subtraction were done by an electronic AND/OR circuit. Multiplication and division were done by electronic bit-shifting.

A detailed description of the computer by Atanasoff himself is in Section 7.2 (p. 305) of *The Origins of Digital Computers—Selected Papers,* edited by Brian Randell (New York, Springer-Verlag, 1973). This is a reproduction of a paper JV prepared to justify a grant of $5,000 for the machine-written in August 1940. I remember reading it in July 1941 as one of Cliff's ways of introducing me to the machine after I started working for him. Some of the photographs were added later-in fact, I think I may have taken some of them.

I recall my hourly wage as 50 cents per hour. One of my first tasks was sorting screws and nuts in the basement student shop, and later with some coaching and supervision from Cliff I moved up to punching and wiring on the computer. The picture on page 325 of Randell's book showing the final state of the computer in May 1942 is very meaningful to me as I clearly remember cinching up those waxed-string lacings on the wire bundles over to the base-2 to base-10 conversion drum. A similar bundle shows on the thyratron chassis beneath the IBM card reader. That chassis with 30 thyratrons was my creation. Those thyratrons drove the transformers, which punched the holes in the paper cards for the intermediate memory of the coefficients. I've always wondered about the transients that would have resulted when the punching called for all 30 to fire simultaneously!

The 50 capacitors for each coefficient were mounted radially to a row of 50 pins on the surface of a phenolic bakelite drum. There were 32 such rows on each drum (giving a spare row or two). The drums revolved once per second under the stationary metal brushes leading to the electronics. All of the reading, computation, etc., was done in synchrony with the 60 Hertz power mains. The 10/60 second of dead time was used for various housekeeping chores of the computation. Each drum had the coefficients of one linear equation. A switch allowed a pair of corresponding coefficients from the two drums to be chosen for elimination. One set of coefficients was subtracted from the other (the arithmetic was done in parallel for all 30 coefficients) until the remainder turned positive. Then divided, subtracted-and so on until the coefficient had been completely eliminated. The remaining coefficients were then put into punch-card memory. The process was repeated until the last unknown was given a numerical value, which could then be substituted in the next-to-last pair of equations to evaluate a second unknown, and so on until all the unknowns were evaluated.

This process in not significantly different from modern-day computer procedure. As Ralston's book points out, there is an optimum sequence for the elimination of coefficients and there are cumulative-numerical rounding errors that can be estimated. One can estimate the total time required to solve a set of 30 linear equations with the ABC computer and it would be on the order of a day—very slow by modern standards. Still, by the standards of 1940 that would be very rapid.

World War II began, for the United States, in December 1941. I left for the Naval Ordnance Laboratory in June 1942. Cliff had married in May, and he left Iowa for mass-spectrometer work with Consolidated Engineering Corp. in Pasadena. JV and several of his graduate students left that Fall to join the Naval Ordnance Laboratory. I think we all fully expected to reassemble in Ames after a hiatus for the war.

A few bits and pieces of the ABC still remain in the Physics Department museum at Iowa State, along with some excellent photographs. In the postwar years the ABC was dismantled to make space for new academic activities required by the surge of returning veterans.

Much legal argument was made during the litigation of the 1970s about a visit of John Mauchly to Atanasoff in June 1941. I believe that Mauchly had support at that time from the Army's Aberdeen Proving Ground for computer research on computation of shell trajectories. JV also had some war research support for experimentation in a room adjacent to the computer space. Several students were employed in that research, many of us were guinea pigs part time. My impression was that the purpose of the war research was to work out and measure some of the human factors in the visual tracking of targets such as by a gunner. We spent our time as subjects chasing galvanometer spots across a screen using various types of tracking controls. It seems now that Mauchly's visit would have been natural, and there would have been an expectation that JV would be quite open about all of his work that might be useful in the war effort. I do recall a visitor to the computer in June 1941 whom I think must have been Mauchly although I was not introduced to him. It is evident in retrospect that Mauchly was much more adept at business skill, with support from his university, than JV was.

Mauchly's computing machine later became widely known under the acronym ENIAC (Electronic Numerical Integrator and Computer), and portions of it have been on display at the Smithsonian's National Museum of American History in Washington, D.C. The ENIAC involved an effort probably 1,000 times larger than the ABC, so that in comparing the two projects one needs to be careful as to what aspects are being compared. Obviously the ENIAC benefited from a professional full-time staff, better quality control of components, longer-term support, and the blessings of adequate technical administration and management. In short, money. The ENIAC was a special-purpose machine primarily funded and designed to solve the differential equations of

> shell trajectories. The technical management allowed a versatility to be incorporated, however, which permitted it to work on other problems. The ENIAC had continuing applications from 1946 to 1955. This long period of demonstration by a single machine established the productivity of the electronic digital computer to US business managers. The preceding small academic machine, the ABC had made its contribution to the history of computing.
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> I always felt Cliff had the better understanding of the arts of electronics and had more patience with imperfect performance of both machines and people. Looking back, I know I must have been irritating at times in spite of my great eagerness to please, and yet I recall no time at which Cliff expressed irritation and he was very patient to search out my foibles and go through an explanation to get me back on track. I always left with the impression that he respected and trusted me. Cliff worked well with people.
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> Since the electronic punch-card memory was Cliff's master's thesis, no doubt that was largely his work from the start. I always thought that the reduction to practice for all parts of the machine was likely to have been due to Cliff. There were other technicians besides myself who had to be supervised and instructed, and that again was a contribution of Cliff. Cliff's contribution was a major one.
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> In the legal wrangling of the 1970s, there was some emphasis on whether the computer had ever actually demonstrated its capabilities. At the time I left the project, it had not, but I knew there was no permanent reason that it should not work. I remember a later brief conversation with Cliff in which he told me that he had actually solved a small set of linear equations using the machine before he had left for California. I assumed that there were still bugs that remained to be worked out and plenty of work for all of us should we ever return to Ames.

In summing up the six-year court case, judge Earl R. Larson declared that Atanasoff's had been the first automatic electronic digital computer, and that the ENIAC patent was invalid, having derived much from the Atanasoff-Berry Computer.

Iowa State is proud of being the home of the first digital computer (though chagrined over its failure to patent the ABC). In October 1983, at a celebration of the 10-year anniversary of the completion of the ENIAC court case, ISU awarded its highest honor, the Distinguished Achievement Citation, to John V. Atanasoff. In June 1985, the same honor was awarded to Clifford Berry—the first time it had been given posthumously.

BIBLIOGRAPHY

Biographical

Atanasoff, J. V., “Computing Machine for the Solution of Large Systems of Linear Algebraic Equations,” in B. Randell, ed., *The Origins of Digital Computers, Selected Papers*, New York, Springer-Verlag, New York, 1973, Chapter 7.2.

Atanasoff, John Vincent, “Advent of Electronic Digital Computing,” *Ann. Hist. Comp., Vol. 6*, No. 3, July 1984, pp. 229-282.

Berry, Jean R., “Clifford Edward Berry, 1918-1963: His Role in Early Computers,” *Ann. Hist. Comp.*, Vol. 8, No. 4, Oct. 1986, pp. 361-369.

Ralston, Anthony, *A First Course in Numerical Analysis*, McGraw-Hill, New York, 1965.

Richards, R.K., *Electronic Digital Systems*, Wiley and Son, New York, 1966.

Significant Publications

Berry, Clifford E., Doyle E. Wilcox, Sibyl M. Rock, and H.W. Washburn, “A Computer for Solving Linear Simultaneous Equations,” J. *of Applied Physics*, Vol. 17, No. 4, April 1946, pp. 262-272.

UPDATES

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