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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | John M. Salzer |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | February 17, 1971 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 40 pp. |

**Abstract:** Salzer arrived from Budapest, Hungry in the United States in 1940 and began a career as an upholsterer. He later took courses at Case Institute of Technology and learned about radar communications and pulse communications systems in the Army. The Army provided enough training and credits to allow Salzer to return to school and obtain his B.A., M.A., and ultimately his Ph.D. at the Massachusetts Institute of Technology (MIT). Salzer started his Ph.D. work in 1948 and held a research assistant position at the Digital Computer Lab under the direction of Gordon Brown, Jay Forrester, and Bob Everett. Salzer worked with the Whirlwind Project, specifically the block diagrams. From the Whirlwind Project came Salzer's dissertation topic, control problems of digital computers. Because of this work, Salzer received a job offer in 1951 from Hughes. After leaving Hughes in 1954, Salzer joined the Magnovox Laboratory. Discusses various colleagues and where they were working and projects they were associated with. Comments on activities on the west coast opposed to those on the east coast. Frequently mentioned names include Gordon Brown, Jay Forrester, Bob Everett, Eldred Nelson,
Harold Sarkissian, and Willis Ware,

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:**

http://invention.smithsonian.org/downloads/fa_cohc_tr_salz710217.pdf

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Arthur L. Samuel |
| **Interviewer:** | Henry Tropp |
| **Date:** | March 10, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 88 pp. |

**Abstract:** Born in 1901, Emporia, Kansas, Samuel received his BS from the College of Emporia in 1922; a MS from the Massachusetts Institute of Technology (MIT), 1926; and graduate work at Columbia University. In 1922, Samuel left Kansas to go east and work for the General Electric Company. He worked for the General Electric Company intermittently until he earned his masters degree from MIT in 1926. At General Electric, Salzer worked on vacuum tubes. He comments on Vannevar Bush's work with the differential analyzer and his involvement with Bush and the problem of solving exterior ballistics using his machine. After receiving his Ph.D. and teaching for a short time as an instructor in electrical engineering at MIT, Salzer went to work for Bell Labs in 1928. At Bell Labs, Salzer continued his research on vacuum tubes, specifically a better oxide coated cathode. In 1946, Samuel joined the teaching staff in the electrical engineering department at the University of Illinois. At Illinois, Samuel was active in designing one of the first electronic computers. In 1949, Samuel left the University of Illinois to join IBM. Samuel continued to work with vacuum tubes, but also began work on transistors. He comments on projects at IBM, his colleagues, and IBM as a whole in the computing business. Discusses the development of the 701, Nat Rochester's contributions, and the conceptual design to it; the 704; and the Semi-Automatic Ground Environment (SAGE). Names mentioned are: Vannevar Bush, George Stibitz, Bill Everett, John McPherson, Wallace Eckert, T.J. Watson Sr., John Backus, and John von Neumann.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

**Interviewee:** H. H. Sarkissian
**Interviewer:** Robina Mapstone
**Date:** September 11, 1972
**Repository:** Archives Center, National Museum of American History
**Description:** Transcript, 38 pp.

**Abstract:** Sarkissian, born in 1922, graduated from the University of California in electrical engineering in 1944. He spent 2 ½ years in the Army Signal Corps, did graduate work for a time, and then started at Northrop in September 1947. He was put in the computer group and encouraged to develop the knowledge of magnetic devices he had acquired from seeing an early German tape recorder known as Magnetophone. The group was working on guidance and control of the SNARK missile and also had the Binary Automatic Computer (BINAC) on order. They originally planned to build an analog computer for guidance, but decided on a digital machine, the incremental slope computer. Sarkissian worked on wire recorders for digital circuitry and then a feedback preset counter for the incremental slope computer. Jerry Mendelson devised ways to program this computer using punched cards rather than manually. Northrop engineers then designed another machine with vacuum tube storage, the DIDA, which was partially built by Hewlett-Packard. At the same time, Glenn Hagen and Charles Williams worked on neon memories while Sarkissian and others designed a recirculating magnetic drum memory for another machine, the Magnetic Drum Digital Differential Analyzer (MADDIDA). In the course of this work, Floyd Steele developed the technique of expressing computer designs in logic equations. Although the MADDIDA was shown at a 1950 conference at Rutgers University, at military installations, and to John von Neumann, Northrop was having difficulty with other contracts and decided not to pursue the project, assigning most of the computer group to work on the BINAC. Requirements for the MADDIDA's missile guidance were extended to include takeoff and landing. In April 1950, Eckdahl and Sarkissian quit. Sprague, Steele and Irving Reed soon joined them to form Computer Research Corporation. There they developed a digital differential analyzer for North American before Steele returned to Northrop and claimed Eckdahl and Sarkissian should have none of the patent rights associated with the MADDIDA. People mentioned frequently in this interview are Donald Eckdahl, Richard Sprague; and Floyd Steele.

**Computer Oral History Collection, 1969-1973, 1977**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | H. H. Sarkissian |
| **Interviewer:** | Robina Mapstone |
| **Date:** | December 21, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 39 pp. |

**Abstract:** Sarkissian describes the formation of Computer Research Corporation (CRC), its early work on a digital differential analyzer for North American, and Floyd Steele's ability to persuade the Air Force to pay CRC to develop new computer components and logical methods. Sarkissian worked on a better magnetic drum and then on the CRC 102 (also called the Cambridge Digital Automatic Computer (CADAC) 102, a general purpose computer intended to do rapid coordinate conversion for radar data and installed at the Lincoln Laboratory of the Massachusetts Institute of Technology (MIT). CRC also developed another digital differential analyzer, the CRC 105. The CRC 107, a large general purpose computer, was sold to the Navy in 1951 and delivered in 1954. During this period CRC had serious difficulties with Steele's lack of interest in administration and with its finances. At first the founders and their relatives invested money in the company. Two outsiders provided more money and finally a merger took place. Negotiations with ElectroData were unsuccessful, but in 1952 CRC became part of National Cash Register (NCR). Although the computer group devised improvements on the magnetic drum, key-to-tape input/output equipment and a non-impact printer, NCR was conservative in its testing procedures and fell behind competitors. The CRC 107 was never widely used for commercial purposes, and both it and the CADAC 102D were outdated by the IBM 650. When Sarkissian left NCR in 1955, the National 304 was not yet on the market. Dick Dabney, Donald Eckdahl, Richard Sprague, and Floyd Steele are mentioned several times in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Roger E. Schuette |
| **Interviewer:** | Henry Tropp |
| **Date:** | June 20, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 87 pp. |

**Abstract:** Schuette began working at Barber-Colman in 1939 and soon was involved in anti-aircraft and anti-tank projects, including design of a calculating device for a rangefinder made by Eastman Kodak. During World War II, Duncan Stewart of Barber-Colman met George Stibitz while working for the National Defense Research Committee. Stewart decided his company should build a commercial computer. By 1946, Stibitz had designed a small scale serial computer with error checking circuits. The first model was completed in 1948 and a second, much superior version, the Simple Electronic Digital Computer (SEDC), in 1955. Schuette worked on the memory and an input device for the SEDC. Others introduced a compiler and improved programming. This machine was used at Barber-Colman for a few months, but the company decided not to invest in either manufacturing facilities or a national service network and did not market it. They did sell patent rights to its system for arithmetic calculations and error checking. Howard Colman, Duncan Stewart, and George Stibitz are referred to frequently in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Robert Serell |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | May 19, 1971 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 115 pp. |

**Abstract:** Born in France, Serrell is a fifth generation engineer. He attributes much of his early education and his family to his interest in engineering. He discusses his childhood and early years in France. Serrell came to the United States in 1927 and took a job at General Electric in the radio department. In 1931, Serrell had his first contact with computers. In the late thirties and early forties, RCA built a television transmitter for CBS and Serrell was invloved in its set-up. Because of the amount of time involved in setting up the transmitter, CBS offered Serrell a job to be in charge of the transmitter operations. During the war years the Radio Research Laboratory was formed at Harvard University and Serrell joined this effort too. Additionally, Serrell worked for the Radiation Lab at the Massachusetts Institute of tTechnology (MIT) while in Boston. These efforts in the labs involved radar technology, pulse technology, and projects related directly to computer weapons. Serrell eventually became head of all the theoretical aspects of the Typhoon Project at RCA. Comments on the Typhoon project in detail. Serrell also comments extensively on various colleagues and other computer projects in the United States. Discusses setting up the computing lab at RCA and the difficulties involved. Names mentioned include Robert Elbourn, Ralph Slutz, Edward Cannon, and countless others.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | SHARE XXXVII Past Presidents Meeting |
| **Interviewer:** | |
| **Date:** | August 10, 1971 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 45 pp. |

**Abstract:** This is a transcription of a meeting held in New York City at the Waldorf Astoria. The main speakers are Frank Wagner and Jack Strong.

This discussion begins with recollections of how the Society to Help Avoid Redundant Effort (SHARE) got started. SHARE was formed in response to the number of assembly programs and the amount of redundancy that was occurring in the computing field. In 1955, a meeting was called for all companies involved in computer manufacturing. Individuals participating in this discussion include: Jack Strong, Frank Engel, Francis Wagner, Ben Ferber, E. Jacks, Frank Verzuh, Harry Cantrell, Aaron Finerman, George Ryckman, James Rowe, James Babcock, Roy Dickson, James Tupac, Philip Cramer, John Noerr, Phil Dorn, and Dave [Calhuder?].

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | SHARE Meeting for Pioneers |
| **Interviewer:** | Henry Tropp |
| **Date:** | March 8, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 152 pp. |

**Abstract:** This discussion was held at the Hilton Hotel, San Francisco, California during a SHARE Meeting.

Participants in this discussion include: Engle, Paul Armer, Frank Wagner, Floyd Steele, Cuthbert Hurd, Smith, Backus, [Mort?], Ryckman, Morrison, Greenstadt, Gautney, Dolotta, Cantrell, Don Shell, and Cramer.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | SHARE-Toronto |
| **Interviewer:** | Henry Tropp |
| **Date:** | August 8, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | No transcript |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | SIAM-72 |
| **Interviewer:** | |
| **Date:** | June 14, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | No transcript |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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| **Interviewee:** | SIAM Luncheon Meeting |
| **Interviewer:** | Herman Goldstine |
| **Date:** | October 17, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 110 pp. |

**Abstract:** Remarks made by Dave Young and Bill Jameson. The Program Committee included Robert Gregory. Margaret Gregory, Lila Brahm, Nathan Keyfitz, Bill Jameson, Bert Kolvin, Joe Traub, Jane Column, Pete Stewart, and Cleve Mulla.

Herman Goldtsine delivered a speech to the Center for Numerical Analysis at the University of Texas. This luncheon was jointly sponsored by the Scoiety for Industrial and Applied Mathematics (SIAM) and SIGNUM, a special interest group in Numerical Analysis of the Association for Computing Machinery. Goldstine discusses the history of computation and comments on his book, *Computers: From Pascal to von Neumann.*

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Sherman Skillman |
| **Interviewer:** | |
| **Date:** | January 21, 1971 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | No transcript |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Harold Skramstad |
| **Interviewer:** | |
| **Date:** | February 28, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 49 pp. |
| **Abstract:** | See Bernard Howard interview. |
| **Citation:** | Computer Oral History Collection, Archives Center, National Museum of American History. |
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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Ralph Slutz |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | February 25, 1971 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 130 pp. |

**Abstract:** This transcript is incomplete, it concludes with side one and is fragmented in certain areas.

Slutz earned both his bachelor's and master's degree from Massachusetts Institute of Technology (MIT). In 1939, he went to Princeton to work on his doctorate in theoretical physics. Slutz's work at Princeton was interrupted by the war since his supervisors and thesis supervisor, H.P. Robertson, became members of the National Research Council Committee on Passive Protection Against Bombing. Because of Robertson's connection, Slutz was pulled into this work too as an assistant working on the problem of designing air raid shelters. Because of this work, Slutz practically abandoned his doctorate work. He also ran a technical library associated with the project that housed classified documents and ran a group, which was collecting data for a handbook. This handbook discussed damage to be expected to typical factory construction, residential construction, bridges, and railroads. Slutz also worked with the British in securing some of their classified data for work on his handbooks. He traveled to England for six months where he worked with the Office of Standard Reference Data (OSRD) Liaison Office. During this time, Slutz was not exposed to any computational activities. In 1944, Slutz met John von Neumann and was introduced to his ideas of calculation of hydrodynamic. Slutz joined the staff at the Institute for Advanced Study as an engineer and was responsible for the input/output of information and to build a verifying device so that one person could sit at a machine and prepare a punched paper tape of a program. He later went into controlling the recording on magnetic wire. He comments at great length on Bigelow's developments in the area of a magnetic wire recorder. Slutz mentions frequently Julian Bigelow and John von Neumann.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Joseph Smagorinsky |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | May 19, 1971 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 97 pp. |

**Abstract:** Smagorinsky, born in 1924, took an early interest in naval architecture but decided to study meteorology. After 1 ½ years at New York University (NYU), he became an aviation cadet and trained at Brown University and the Massachusetts Institute of Technology (MIT) as a weather officer. He left the Army Air Corps in 1945 and returned to NYU, completing his BS in 1947 and his MS in 1948. Smagorinsky spent two years at the Weather Bureau and became very excited about the work on numerical weather prediction of Jule Charney and Arnt Eliassen at the Institute for Advanced Study. He was assigned to the laboratories of Applied Science (LAS) for part of 1949 and went with Ragnar Fjortoft, Freeman, and Charney, to do calculations on the Electronic Numerical Integrator and Automatic Computer (ENIAC). Smagorinsky soon went to Princeton as a research meteorologist, working on his Ph.D. at NYU at the same time. When he completed his Ph.D. and ran early programs on the LAS computer, he returned to Washington to head the computer section of what became the Joint Numerical Weather Prediction Unit; his unit would be absorbed by the National Center for Atmospheric Research. He discusses numerical methods of weather forecasting, Dan Slotnick's devotion to parallel processing, and computers he used, including the IBM 701, IBM 704, STRETCH, CDC 6600 , and UNIVAC 1108. Jule Charney, Arnt Eliassen, Ragnar Fjortoft, Norman Philips, Lewis Richardson, Carl Rossby, Dan Slotnick, John von Neumann, and Harry Wexler are mentioned several times.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | C.V.L. Smith |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | March 23, 1970 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 42 pp. |

**Abstract:** Smith received a BA in mathematics and later a Ph.D. in mathematics. Smith served in the Navy during World War II working with radar, and high speed pulse circuitry. After the Navy, Smith went to work for Raytheon in 1946, on an early guided missile project. By 1948, Smith decided to leave Raytheon and join the computer affairs in the mathematics branch at the Office of Naval Research (ONR) in Washington. At ONR, Smith was Chief of the Computer Branch. He had the responsibility for overseeing Navy sponsored research projects/contracts. He comments at length on Forrester's WHIRLWIND Project at the Massachusetts Institute of Technology (MIT), specifically ONR's involvement, and Bigelow's project at the Institute for Advanced Study at Princeton. By 1956, Smith joined the Ballistics Research Laboratories (BRL). In 1959 he left BRL for NASA, Goddard Space Flight Center. At NASA, Smith did computations of orbits. In 1962, Smith began work for the Atomic Energy Commission. Colleagues mentioned frequently include John Curtiss, Mina Rees, John Gregory, Dick Bianco, Jay Forrester, Julian Bigelow, John von Neumann, and Howard Aiken.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/fa_cohc_tr_smit700323.pdf

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Samuel Snyder |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | July 16, 1970 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 53 pp. |

**Abstract:** Snyder, born in 1911, worked at temporary clerical jobs in the U.S. government from 1930 until 1936. He then was hired by the Signal Intelligence Service, a U.S. Army group of 10 people headed by William Friedman. Snyder and others used accounting equipment to compile indexes of coincidences to coded messages. Both staff and equipment greatly expanded during World War II. In 1946, Jim Pendergrass of the U.S. Navy went to a summer course on computers at the Moore School of Engineering. His report that computers might be of great use to the Navy's security agency persuaded them to order an Atlas I computer from Engineering Research Associates and also led Snyder to urge his organization, now called the Army Security Agency, to acquire a general purpose computer. They planned to buy a REEVAC [sic] from Reeves Instrument Company. When the company left the computer business, the army began building the Abner computer on the model of the Standards Eastern Automatic Computer (SEAC). The Abner, a digital computer with mercury delay line memory, started running in mid-1951, about a year after the Atlas I. A second Abner was built by Technitrol. This was supplemented by the Atlas II or the Universal Automatic Computer (UNIVAC) 1103 by 1953. Howard Campaigne, William Friedman, Sam Lubkin, and Jim Pendergrass are mentioned several times in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Richard Sprague |
| **Interviewer:** | Henry Tropp |
| **Date:** | September 13, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 152 pp. |

**Abstract:** Sprague studied electrical engineering at Purdue University, graduating in 1942. He spent the next 1 ½ years working on radar at the General Electric, and then entered the Navy for radar training and worked on radar at the Naval Research Laboratory (NRL). In 1946, he was hired by Northrop to work on the guidance system for the Snark missile. Sprague describes the influence of radar on computer circuitry, Floyd Steele's design of the DIDA for Snark guidance, and construction of parts of the computer by Hewlett-Packard. After Steele and Donald Eckdahl developed the idea of storing the output of integrators on a magnetic drum, Sprague joined them in work on the Magnetic Drum Digital Differential Analyzer (MADDIDA). Boolean algebra, used on the east coast in the design of individual circuit components, was applied to entire circuits at Northrop. The MADDIDA also made innovative use of clock rates and crystal diodes. These digital differential analyzers had a small number of logical elements compared to east coast machines, were reliable and relatively inexpensive and were not as fast as the general purpose machines. One early CRC 102A was used for oil exploration by Standard Oil. Sprague was surprised when Bob Rawlins negotiated a contract with Eckert-Mauchly for the Binary Automatic Computer (BINAC). The first computer that actually flew on a missile was the Quadratic Arc Computer (QUAC). In 1950, Sprague and several others left Northrop to form Computer Research Corporation (CRC). By 1952, they had sold 35 computers and delivered one. George Fuller and E. Gordon Turnbull funded the company, but after Turnbull died in 1953, his widow and Fuller withdrew their backing. CRC became part of NCR. Sprague stayed until 1955 and then went to Teleregister to work on an airline reservation system. He subsequently went to the accounting firm of Touche, Ross, Bailey and Smart, then to his own consulting firm, and then to Litton. Sprague describes early computer groups at Northrop, the formation and early staff of CRC, CRC's influence on Stanley Frankel and the Librascope computer, and Steele's concept of the tabula rasa as it relates to microprogramming. He recounts the reaction of von Neumann and

others to the MADDIDA and gives anecdotes about Glenn Hagen, Eric Weiss's design of the CRC 105, and Everett Emerson. Irving Reed, Chester Stone, and Herman Kahn devised a horsebetting scheme, while Sprague and others sought to profit at a roulette wheel. Sprague developed his betting schemes at Northrop and then used a CRC 102A. NCR didn't want the publicity of such activity, but in 1963 Sprague reported it at a Las Vegas meeting of the Association for Computing Machinery (ACM). Erik Ackerlind, Richard Baker, Richard Dabney, Willis Dobbins, Donald Eckdahl, Everett Emerson, Glenn Hagen, Myron J. Mendelson, Robert Rawlins, H.H. Sarkissian, Floyd Steele, Edward Thorpe, Axel Wenner-Gren, and Vernon Walker are mentioned several times.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Richard Sprague |
| **Interviewer:** | Uta C. Merzbach |
| **Date:** | June 30, 1977 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 169 pp. |

**Abstract:** This is a follow-up interview concerning the first development and technical details on Computer Research Corporation machines and related issues.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | G. Floyd Steele |
| **Interviewer:** | Robina Mapstone |
| **Date:** | January 16, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 88 pp. |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/fa_cohc_tr_steele730116.pdf

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | George Stibitz |
| **Interviewer:** | |
| **Date:** | April 30, 1969 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | No transcript |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | George Stibitz and E. G. Andrews |
| **Interviewer:** | Henry Tropp |
| **Date:** | March 2, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 24 pp. |

**Abstract:** E.G. Andrews worked on telephony from 1922 to 1941, served as a radar trainer for part of World War II, and then went to work on Bell Laboratories relay calculators. The Model l or complex number calculator had been built before the war to serve the needs of Bell Labs. The next four models were built with funds from the National Defense Research Committee. Andrews first worked on the Model 2 or Interpolator, then on ballistics computers for the Army and the Navy, and then on the Model 5, a general purpose computer of which one copy went to the Aberdeen Proving Ground and the other to Langley Field. Despite its slow speed, the Model 5 at Aberdeen did more work than the Electronic Numerical Integrator and Automatic Computer (ENIAC). It was used for calculating tables, internal ballistics, and the design of directors. The Model 5 at Langley Field did wind tunnel data reduction for design of airplane wings. The Model 6, completed in 1950, eventually was given to the Brooklyn Polytechnic Institute and then to the Bihar Institute of Technology in India. Bell Laboratories also built special purpose machines such as a degaussing machine to measure the magnetic field around ships and, after the war, a machine to calculate charges for long distance telephone calls. Andrews also mentions an electronic digital computer antedating the ENIAC that was conceived by Sam Williams, interested the National Security Administration, but was never built. He notes early attempts of Prudential Life Insurance to solve problems relating to insurance using a logic machine and a computer. Stibitz mentions people who worked on Bell Laboratories calculators and founders of the Association for Computing Machinery (ACM). Both Stibitz and Andrews comment on the Gray code and on the use of Boolean algebras in design of Bell relay calculators. Ed Berkeley and Claude Shannon are mentioned several times.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Jack P. Strong |
| **Interviewer:** | Robina Mapstone |
| **Date:** | August 29, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 31 pp. |

**Abstract:** Strong joined the tabulating department at North American in 1941. He was hired because he had a mathematical background and was familiar with IBM machines. He soon left for the Marine Corps, where he worked on radar, but rejoined North American in 1946. During the next decades, his section expanded from three people to hundreds as North American and other west coast aerospace manufacturers pioneered the use (as opposed to the building and development) of computers. Strong first worked with an IBM 601, then an IBM 604 and then a Card Programmed Calculator (CPC). The CPC had storage devices that allowed one to use the results of one calculation to operate on a later card. When North American acquired an IBM 701, Strong, Ed Law, Owen Mock, and IBM's local representative Jack Ahlean wrote an assembly program for it. Other programs for the machine came out of the Society to Help Avoid Redundant Effort (SHARE). North American used the 701 for engineering work on the B-70 and the design of rocket engines and electronic components. The company went on to acquire an IBM 704, an IBM 709 and, at about the time Strong left, an IBM 7090. But for the two or three years preceding his interview, Strong has found programmers to be in high demand. He notes methods for selecting programmers developed at RAND and IBM and also the increasing status of the occupation, due in part to the work of SHARE. Sandy Lanzarotta influenced the field as editor of *Datamation*. North American also influenced the development of computing as a participant in Guide and in the project for the Advancement of Coding techniques (PACT). In 1953 or 1954, Strong became chairman of the Data Transmission Study Group, a group that brought together users, computer manufacturers, and the telephone company. Frank Wagner, who served as a link between the engineers and the computer center at North American, is mentioned several times in the interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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**Computer Oral History Collection, 1969-1973, 1977**

**Interviewee:** Richard Tanaka
**Interviewer:** Robina Mapstone
**Date:** January 4, 1973
**Repository:** Archives Center, National Museum of American History
**Description:** Transcript, 38 pp.

**Abstract:** Tanaka received a Bachelor's degree from the University of California at Berkeley in 1950 and took a summer job working on the California Digital Computer (CALDIC). He was under the immediate supervision of Torben Meisling and David Brown and the general direction of Paul Morton. In 1951, he completed his master's thesis, designing a coded-decimal adder using the methods of Boolean algebra favored on the west coast. After graduation, he went to work under Lester Kilpatrick at North American on inertial guidance systems for the Navajo missile. He first did logic design for the North American digital differential analyzer NADAN and then worked on the logic of a transistorized descendent of this machine, the North American Digital Analyzer (NATDAN). Meanwhile, William Smith of North American was designing a general purpose computer later combined with a digital differential analyzer, made with semiconductors and used for guidance of the Minuteman missile. In 1953, Tanaka began taking courses part-time at the California Institute of Technology. In 1956, he was awarded a Hughes fellowship for full-time studies. Hughes Aircraft Corporation had just abandoned the Hughes commercial computer project, but Tanaka did design a digital differential analyzer for tool control for them. This was not built. By the next year he had completed a Ph.D. thesis under Gilbert B. McCann on the design of a general purpose microprogrammed computer. He went to work at the Lockheed Palo Alto research laboratory on ACRE, a small general purpose computer designed to check out missiles and allied electronic systems. The ACRE proved unreliable and only a few machines were built. Tanaka also organized a research group at Lockheed and wrote a book on residue arithmetic. Because of their concern for reliability, west coast computer designers favored serial machines with relatively few light components. Boolean algebra was especially suited to the design of such machines. Early input/out devices and computer memories contributed to the unreliability of some machines. Once such obstacles had been overcome, Paul Morton's emphasis on the need for skilled programming became apparent. C.L. Wanlass, Lester Kilpatrick, and William E. Smith are

mentioned several times in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Norman Taylor |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | January 27, 1970 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 53 pp. |

**Abstract:** Born in 1916, Manchester, England, Taylor's family immigrated to the United States in 1922. He attended Bates College and received a bachelor's degree in Math in 1937. Taylor attended the Massachusetts Institute of Technology (MIT) where he received his MSEE. After graduating from MIT, Taylor worked for a few months at the Lombard Governor Company doing research and development work on instrumentation of temperature problems. In 1941, Taylor left Lombard to work as an electrical engineer for the Western Electric Company. At Western he became a test equipment designer for setting up production lines of radio equipment. Taylor comments on the types of test equipment employed. In 1947, Taylor joined the WHIRLWIND project at the MIT Digital Computer Laboratory. He comments extensively on his work at MIT. In 1951, Taylor went to the Lincoln Laboratories as Associate Director of the Computer Division. At Lincoln, he was in charge of the MTC, FSQ-7, TX-2, and TX-2. Taylor would also work with the semi-Automatic Ground Environment (SAGE). From 1958 to1969, Taylor worked for Itek Corporation and later would start his own business, Corporate-Tech Planning. Names mentioned include Pat Youtz, Charles Adam, Jay Forrester, and Bob Irwin.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Norman Taylor |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | May 26, 1970 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 50 pp. |

**Abstract:** Interview discusses the state of the art in pulse technology in 1947-1948 and how it applied to the Whirlwind Project. He comments in detail on several types of tubes, FSQ-7, 787, and 7AK7, their fabrication, life span, use in computer design, and a whole host of other things concerning Whirlwind.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Gregory Toben; with James Smith, David Montgomery and Roy Harper |
| **Interviewer:** | Robina Mapstone and Henry Tropp |
| **Date:** | October 9, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 65 pp. |

**Abstract:** Toben had a background in electrical engineering and ran IBM machines used for accounting by a Los Angeles manufacturing firm. He took a course in radio from Bob Rawlins, who was then put in charge of the guided missile program at Northrop. Rawlins hired Toben to use IBM accounting equipment to compute missile guidance trajectories, reduce wind tunnel data, and solve problems of stress analysis and weight control. To handle large numbers and compute standard functions, Toben and William Woodbury cabled together an IBM 601 and an IBM 405. Smith feared that their tampering might cost him his job as an IBM service representative. However, IBM agreed to produce Toben and Woodbury's machine as the Card Programmed Calculator (CPC), linking an IBM 603 and an IBM 405 to form the Betsy. This was modified to form the CPC Model I, which linked an IBM 604 and an IBM 402 or IBM 403, and then in 6 months by the Model II. Round-the-clock maintenance of CPC's put new demands on IBM representatives accustomed to business hours. With a slow typewriter output and problems of overheating and stress, the Binary Automatic Computer (BINAC) was far less useful than the CPC. CPC's ran at Northrop on an open shop basis. In addition to computation of missile trajectories and wind tunnel data reduction, they were used for studies of supersonic drag and of nuclear energy for the propulsion of aircraft. Additions to the CPC at Northrop included a CRT output, a real-time plotter, and storage units. Eastern computers had little influence on the CPC. Woodbury and Toben went to IBM and worked with Wheelock, Amadeo, and Harper on the Wooden Wheel. This computer, the IBM 795, was used at Northrop 2 ½ years and then went to the California Institute of Technology. All later versions of the Wooden Wheel were IBM 7975, with magnetic core instead of cathode ray tube storage. Harper describes Northrop, Monsanto and McDonnell as IBM customers. Toben thinks a 1947 visit to the differential analyzer at the University of California at Los Angeles influenced those who developed the DIDA. Roy Harper, David Montgomery, James Smith, Gregory Toben, Wheelock, and

William Woodbury are mentioned frequently.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | John Todd |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | February 24, 1971 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 28 pp. |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/ fa_coch_tr_ todd710224.pdf

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | John Todd and Olga Taussky-Todd |
| **Interviewer:** | Henry Tropp |
| **Date:** | July 2, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 62 pp. |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Erwin Tomash |
| **Interviewer:** | Robina Mapstone |
| **Date:** | March 30, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 89 pp. |

**Abstract:** Tomash, born in 1921, graduated from the University of Minnesota in 1943, trained as a radar officer in the Army Signal Corps, and ran an electronic parts depot in France. He returned to the University of Minnesota briefly in 1946, worked for a few months at the Naval Ordnance Laboratory (NOL), and then went to work for the Washington office of Engineering Research Associates. Tomash wrote a chapter of a book ERA was preparing titled *High Speed Computing Devices*. He describes the origins of ERA and its early products, including magnetic drums, a selective sequence machine and the ERA 1101 computer, delivered in 1951. Tomash moved to St. Paul to work on the central control system for what became the ERA 1103. Remington Rand bought ERA in 1952, but failed to market the company's computers successfully against-IBM. Tomash moved to the vest coast in 1953 to sell both the ERA 1103 (now called the UNIVAC 1103) and the UNIVAC. After Sperry Corporation and Remington Rand merged in 1954, several staff left to form Control Data Corporation. Tomash stayed until 1955, when he went to Telemeter Magnetics as vice-president for sales. In 1962, not long after Paramount Pictures sold Telemeter Magnetics to Ampex, Tomash and others left, bought up the disc file division of Telex, and founded Data Products. Cliff Helms developed a printer planned by Telex into a marketable product. The firm eventually ceased production of disc files but took up manufacture of magnetic core memories. Arnold Cohen, Howard Engstrom, Leslie Groves, Cliff Helms, Jack Hill, Ralph Meader, Frank Mullaney, Bill Norris, John Parker, Ray Stuart-Williams and C.B. Tompkins are mentioned several times in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Erwin Tomash |
| **Interviewer:** | Robina Mapstone |
| **Date:** | April 5, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 39 pp. |

**Abstract:** When Tomash was organizing Data Products in 1962, Walter Bauer inquired about funds for a software company. This firm, Informatics, started as a subsidiary of Data Products and became independent. Government contracts and research were essential to Informatics and earlier computer projects, but became less so. Tomash discusses the early history of magnetic core memories, the first Universal Automatic Computer (UNIVAC) machines sold, the sale of the Livermore Atomic Research Computer (LARK) to Livermore Laboratory and Seymour Cray's transistorized Naval Tactical Data Systems (NTDS). He describes training provided to UNIVAC users, IBM competition and Remington Rand products. Walter Bauer, Herb Mitchell, and Bill Norris are mentioned several times.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Mark Torfeh |
| **Interviewer:** | Robina Mapstone |
| **Date:** | March 8, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 43 pp. |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/ fa_cohc_tr_ torf730308.pdf

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Irven Travis |
| **Interviewer:** | Uta C. Merzbach |
| **Date:** | May 9, 1969 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 45 pp. |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | TV Program-KQED |
| **Interviewer:** | |
| **Date:** | April 4, 1962 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | No transcript |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Keith Uncapher |
| **Interviewer:** | Robina Mapstone |
| **Date:** | February 20, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 40 pp. |

**Abstract:** After graduating from college with a dual major in mathematics and electrical engineering, Keith Uncapher went to RAND in 1950. Although hired as a programmer, he immediately was assigned to building computers. He first worked with William F. Gunning on the RAND analog Computer TRAC, earlier the Reeves Electronic Analog Computer (REAC), a reliable machine that offered users a removable patch board and an analog-digital readout. The TRAC eventually went to the U.S. Air Force Academy. RAND then turned its attention to building the digital machine JOHNNIAC, with a Selectron tube memory and an operator's console built in the institution's tradition of encouraging users. In 1959 Uncapher and others began to design an information processor, but Cliff Shaw persuaded the group to turn its attention to the Johnniac Open System (JOSS). Uncapher later worked on Tablet, an electronic input device that recognized hand-generated strokes and on the video-graphics system, with its graphical input language GRAIL. He describes Paul Baran's ideas about a back-up communications system for the military that began to be constructed in the late 1960s. In 1968, after RAND funding had been cut, Uncapher went to the University of Southern California. He describes various RAND employees, quirks in running the John von Neumann Integrator and Automatic Computer (JOHNNIAC), and the difficulties of turning innovations in computer use and design into products. Paul Baran, George Brown, Tom Ellis, William F. Gunning, and Cliff Shaw are mentioned frequently in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Arthur von Hippel |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | December 10, 1969 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 8 pp. |

**Abstract:** Born in 1898, von Hippel was the son of a professor of criminal law at the University of Goettingen in Germany. He fought in the German army in World War I, obtained his Ph.D. at Goettingen in 1924, and then became an assistant to Max Wehn at the University of Jena. After a year as a Rockefeller Fellow in the United States, he returned to teach at Goettingen in 1929. In 1933, he left Germany to teach in Turkey, then spent a year at the Niels Bohr Institute. In 1936, he went to the Massachusetts Institure for Technology (MIT) as a physicist in the electrical engineering department. Von Hippel directed MIT's Laboratory of Insulation Research from its founding in 1939 until 1958, when MIT started a materials center funded by the Advanced research Projects Agency (ARPA). Von Hippel retired around this time and transferred most of his laboratory to the Materials Center. He continued research, working with a small group on problems related to the life sciences. The Laboratory for Insulation Research investigated the electrical breakdown of materials, electron impact ionization in solids, and measurement of dielectric properties at microwave frequencies. Both its techniques of measurement and its ability to develop integrated materials with desirable dielectric properties were used by the armed forces in World War II. Nonetheless, administrators at MIT had little interest in materials research. After the war von Hippel gave a lecture course at MIT on insulators, semi-conductors, and metals that was attended by William Papian. He also knew J.W. Forrester. The Laboratory for Insulation Research could supply small quantities of materials needed for the magnetic core of the Whirlwind, but most supplies came from General Ceramics Corporation. William Papian is mentioned several times in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | John von Neumann |
| **Interviewer:** | |
| **Date:** | December 12, 1954 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | No transcript |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

**Interviewee:** Frank Wagner
**Interviewer:** Robina Mapstone
**Date:** January 3, 1973
**Repository:** Archives Center, National Museum of American History
**Description:** Transcript, 57 pp.

**Abstract:** Wagner was born in 1916. When he went to work for North American Aviation in 1942, Dr. Bower had started using tabulating equipment to reduce data from wind tunnel experiments. As project engineer, Wagner needed to have numerous calculations for aircraft design. Paul Bisch arranged to have these done on an IBM 602A and tabulator. In the late l940s North American rented CPCs for this work. The CPC could be ordered in quantity and rented for only a month. It performed operations in sequence, as an engineer would with a slide rule. Engineers trained by Everett Yowell started to do programming. When North American acquired an IBM 70l the accounting division operated the machine while the engineers did the programming. As head of engineering computing, Wagner insisted that engineers do their own programming. John Lowe of Douglas preferred to conserve machine time by hiring specialized programmers. As North American moved from producing aircraft in large numbers to building high performance machines on the frontiers of the art, computers were needed for the design of wings, ejection equipment, propulsion engines and nuclear reactors, as well as for missile guidance. RAND fostered interaction among computer people from different aircraft companies in organizations like the Digital Computers Association, the Los Angeles chapter of the ACM, and SHARE. With the IBM 702, computer input and output was stored on magnetic tape, greatly speeding operations. North American engineers started running several jobs on one input tape. In conjunction with C. Swift of Convair and Bob Patrick of General Motors, they developed an operating system for the IBM 704. Methods of duplicating tapes over telephone lines made it possible to run programs on machines at different locations, while a centralized unit handled billing. North American did not influence design of the IBM 701 but had some impact on the IBM 709 and IBM 7094. Landmarks in computing on the west coast include the modularization of programs at North American so that they could be transferred easily from one computer to the next, the development of COM (computer output on microfilm for the IBM 709 at RAND, and the language and compiler PACT, used on the

IBM 701 and 704. Wagner met Walter Bauer through the L.A. chapter of the ACM. At Bauer's urging, he started the chapter's newsletter, Data Link. In 1962 Wagner joined Bauer at Informatics. He also comments on the brief stay of Fletcher Jones at Lockheed and on the origins of the terms software and firmware. Paul Armer, Paul Bisch, and Fletcher Jones are mentioned several times in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | An Wang |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | October 29, 1970 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 42 pp. |

**Abstract:** An Wang was born on February 7, 1920, in Shanghai, China. He graduated from the University of China in 1940. In 1945, he came to Harvard University to receive a masters and Ph.D., in applied physics. Between 1940 and 1945, Wang worked for the Chinese government inside the blockaded zone, fighting Japan. In government sponsored plants, Wang designed and built military receivers and transmitters. At Harvard, Wang enrolled in communications engineering. Wang's masters degree focused on general communication engineering, while his Ph.D specialized in using nonlinear systems. During Wang's academic career, he worked on and off in the industry connected with electronic equipment. From 1948 to 1950, Wang served as a teaching fellow at Harvard's Computation Lab. At the Computation Lab, Wang worked on Aiken's MARK III computer, providing assistance with putting information into magnetic media, and getting it back without mechanical motion; with designing the control circuit for the drum; design of some speed control devices; and development of a diode matrix for conversions and logic unit diodes for logic input and output. Wang comments on the use of a magnetic material called toroid. Passing a current a certain way on toroid causes it to be magnetized one way. This magnetizing lead to the basic idea of being able to store at least one bit of information on magnetic material. He comments extensively on their research and development regarding magnetic materials. In 1950, Wang left Harvard to begin his own company, Wang Laboratories. With an initial investment of a few hundred dollars, Wang began making magnetic shift registers which led him into the digital equipment field. Wang branched out to make other components such as tape control systems, numerical control systems, calculators, and later computers. He comments briefly on patents he holds. Wang mentions Professor Chaffee, Howard Aiken, Dan Moore, William Papian, and Jay Forrester.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**



**Transcript:** http://invention.smithsonian.org/downloads/fa_cohc_tr_wang701029.pdf

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Willis H. Ware |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | February 19, 1971 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 71 pp. |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Fred Way |
| **Interviewer:** | |
| **Date:** | November 8, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 91 pp. |
| **Abstract:** | See E.L. "Ted" Glaser interview. |
| **Citation:** | Computer Oral History Collection, Archives Center, National Museum of American History. |
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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Joseph Henry Wegstein |
| **Interviewer:** | |
| **Date:** | No date |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | No transcript |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Joseph Weizenbaum |
| **Interviewer:** | Robina Mapstone |
| **Date:** | April 17, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 80 pp. |

**Abstract:** Weizenbaum, born in 1923, came to the United States when he was thirteen. He did undergraduate and graduate work at Wayne University in Detroit, completing a M.S. in mathematics in 1950. A. Jacobson had set up a Bush differential analyzer and a cinema intergraph at Wayne, acquired a United Digital ELectronic Computer (UDEC) from Burroughs, and then received a digital differential analyzer from Bendix. Weizenbaum worked with the UDEC. In 1953, he went to Computer Control Company (CCC) at Point Magu, running and repairing the Raytheon Digital Automatic Computer (RAYDAC). The machine had 4 tape units so it could read, write, and compute simultaneously. An oscilliscope display allowed users to see and alter any word in memory, offering an early example of interactive computing. Weizenbaum wrote a differential equation solver for the RAYDAC. After 2 years, changes in CCC led Weizenbaum to leave and spend a year as a consultant to Bendix. He, Harold Huskey, and an employee of Humble Oil Company developed the programming system ERCOM for the Bendix G-l5. In 1955, he went to General Electric to write software for the Electronic Recording and Machine Accounting (ERMA). Builders of that machine, GE employees in Phoenix, designed the NCR 304 and a computer intended for process control that became the GE 225. A third GE group in Schenectedy working on military contracts, developed what became the GE 235. After the ERMA was finished, Weizenbaum prepared the FORmula TRANslator System (FORTRAN) compatible list processor language SLIP. In 1963, Weizenbaum left GE to teach at the Massachusetts Institute of Technology (MIT), where he developed the interactive program ELIZA and became interested in the social impact of computers. Kenneth Colby, Dave Evans, Lou Fein, Harry Huskey, and Bob Johnson are mentioned frequently in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | R.J. Wheeler |
| **Interviewer:** | |
| **Date:** | August 14, 1969 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | No transcript |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Whirlwind Discussion |
| **Interviewer:** | |
| **Date:** | April 10, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | No transcript |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Norbert Wiener and Gordon S. Brown (MIT Club) |
| **Interviewer:** | |
| **Date:** | February 2, 1955 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 15 pp. |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Irving Wieselman |
| **Interviewer:** | Robina Mapstone |
| **Date:** | April 27, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 31 pp. |

**Abstract:** In 1946, Wieselman went to Northrop Aircraft to work on guidance systems for the Snark missile and analysis of data from flight recorders. In 1949, he and five others from Northrop went to Philadelphia to learn to program the Binary Automatic Computer (BINAC). On their return, Floyd Steele's group continued to work on the digital differential analyzer that would become the Magnetic Drum Digital Differential Analyzer (MADDIDA). Wieselman's group did other projects such as Jerry Mendelson's Quadratic Arc Computer (QUAC) and data analysis using the Card Programmed Calculator (CPC). Wieselman moved to International Telemeter in 1953. There he worked on a meter of television viewing and on a Russian-English language translator that the U.S. Air Force had requested. Within a few years Telemeter Magnetics split off from International Telemeter. The firm built core memories, both for large machines like the John von Neumann Integrator and Automatic Computer (JOHNNIAC) and the Weizmann Automatic Computer (WEIZAC) and for peripheral devices. Wieselman spent 1960-1961 at the Weizmann Institute. While he was away, Telemeter Magnetics was purchased by Ampex. He soon took a job at Data Products where he worked on disk files for the GE 225 and for the UNIVAC 1101 series of computers. He discusses the development of microprogramming and the role of IBM in standardizing computer related equipment. Jerry Mendelson and Floyd Steele are mentioned often in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | C. Robert Wieser |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | March 20, 1970 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 32 pp. |

**Abstract:** Wieser was born in New Rochelle, New York, in 1919, and took an early interest in technical subjects including model radio. In 1940, he received his B.S. and M.S. from the Massachusetts Institute of Technology (MIT) in electrical engineering. He worked with the Boston Edison Company as a student and continued there until 1942, when he went to the MIT Servomechanisms Laboratory to do research on fire control. J.W. Forrester and R. Everett planned to build a computerized aircraft simulator to evaluate aircraft design. Wieser worked on the cockpit simulator. When the Whirlwind Project received funds from the Office of Naval Research in 1947, emphasis shifted from simulation to computer building. Wieser built power supplies. In 1949, he became head of a group at MIT's Digital Computation Laboratory concerned with use of the Whirlwind for air traffic control. In 1950, interest shifted to intercepting aircraft using radar data fed into the computer. Gordon Brown, Robert Everett, and J.W. Forrester are mentioned frequently in this interview.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Arthur Wild |
| **Interviewer:** | Uta C. Merzbach |
| **Date:** | June 30, 1969 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 25 pp. |

**Abstract:** Wild was the Director of Public Information at Harvard University from 1934 to 1945, during which time he became acquainted with Howard Aiken and the work he was doing in computer development. He discusses the agreement with IBM to construct a computer of Dr. Aiken's design at their plant in Endicott, New York, and the arrangement with the U.S. Navy for further construction and testing of the machine, which had been installed at the Graduate School of Engineering.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | R.L. Wilder |
| **Interviewer:** | |
| **Date:** | August 31, 1971 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | No transcript |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Maurice Wilkes |
| **Interviewer:** | |
| **Date:** | June 12, 1969; September 28, 1972; and December 8, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | All transcripts restricted.<br>Transcript 76 pp. (June 12, 1969); Transcript 112 pp. (September 28, 1972; and Transcript 57 pp. (December 8, 1972) |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | James Wilkinson |
| **Interviewer:** | Henry Tropp |
| **Date:** | June 27, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 77 pp. |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/ fa_cohc_tr_ wilk730627.pdf

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Charles Williams |
| **Interviewer:** | Robina Mapstone |
| **Date:** | January 5, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 27 pp. |

**Abstract:** Williams completed most of his degree in electrical engineering at the California Institute of Technology by 1941. After working and military service, he finished his education in 1946 and went to work for Northrop. There, he first worked on drafting and schematics and then with Glenn Hagen on neon tubes as possible miniature, low power, bi-state devices. When Hagen took charge of the Magnetic Drum Digital Differential Analyzer (MADDIDA) project, Williams had primary responsibility for hardware. One MADDIDA sold to an eastern school had plotters designed by Bob Morton and Eugene Seid of North American. The MADDIDA was relatively reliable and designed not to accumulate error When Northrop sold its computer section to Bendix, Williams went with Hagen to Logistics Research, where he worked on the Axel Wenner-Gren Automatic Computer (ALWAC). They left in 1956 or 1957 to start Systematics, working with Lockheed and other customers on accounting systems. Williams remained with Systematics when it became part of General Transistor and when General Transistor was sold to General Instrument. Glenn Hagen is mentioned frequently.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Philip Wolfe |
| **Interviewer:** | Robina Mapstone |
| **Date:** | November 28, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 22 pp. |

**Abstract:** Philip Wolfe graduated from the University of California at Berkeley with an A.B. in Physics and Math in 1948. He received his doctorate in mathematics in 1954. While working on his doctorate, Wolfe came into contact with George Dantzig who at the time, was working at the headquarters of the U.S. Air Force Group on Mathematical Model and Planning. Wolfe worked with Dantzig and his group until he received his degree. Comments at length about Dantzig's work. Wolfe's first job was as an instructor in the Department of Mathematics at Princeton University from 1954 to 1957. At Princeton, Wolfe had contact with the Institute for Advanced Study and especially Julian Bigelow. Following his time Princeton, Wolfe returned to California to work for the Rand Corporation's Computer Science Department until 1965. At Rand Wolfe studied linear programming and did a considerable amount of personal programming on the John von Neumann Integrator and Automatic Computer (JOHNNIAC) and 704 machine. Wolfe discusses different types of languages, particularly the FORmula TRANSlator System (FORTRAN). He comments briefly on the Society to Help Avoid Redunadant Effort (SHARE). Mentions frequently George Dantzig, and Bill Orchard-Hayes.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/ fa_cohc_tr_ wolf721128.pdf

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**Computer Oral History Collection, 1969-1973, 1977**

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| **Interviewee:** | Way Dang Woo |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | October 28, 1970 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 51 pp. |

**Abstract:** During the mid-l930s Dr. Woo studied electrical engineering, with an emphasis on communications engineering, at Chao University and the Ac University in Shanghai. In 1937, after the Japanese invasion, both his home and school were moved to an international compound. After his graduation in 1938 he was able to leave for graduate study at Harvard, where he eventually became a teaching assistant. He worked for one year as a student engineer for RCA under a program for production of wartime material for the Chinese government. The rest of his professional career was spent at Harvard. He taught in the radar school during World War II, while working on his thesis on space charge effect in cylindrical diodes, a further development of Howard Aiken's thesis. In 1947, Aiken invited him to work at the Computation Laboratory on the Mark III computer. He worked on problems with input-output and drum registers, and, with An Wang, developed the magnetic shift register. Names often mentioned include Howard Aiken, Frank Innes, and Benjamin Moore.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/fa_cohc_tr_woo701028.pdf

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Ben D. Wood |
| **Interviewer:** | Henry Tropp |
| **Date:** | September 15, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 35 pp. |

**Abstract:** Wood was a psychologist at Columbia University, where he worked on the standardization of such tests as the National Intelligence Test (derived from the World War I Army Alpha Test), the Nursing Examination, and the National Law Examination. In the late 1920s, he encouraged Thomas J. Watson, Sr., to provide the machinery for scoring such examinations and to work on finding ways to speed up the printers to take advantage of the rapidity of the calculations. Wood was instrumental in bringing Reynolds Johnson to Watson's attention. It was Johnson's test-scoring machine which became the IBM 805. Wood discusses his experiences with starting the Statistical Bureau at Columbia, his work with the astronomer, Wallace Eckert, and his continuing interest in spelling and linguistics problems. Among those most often mentioned in the interview are Richard Warren, Wallace Eckert, Thomas J. Watson, Sr., Reynolds Johnson, and the dean of the astronomy department at Columbia University, Dean Pegram.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/fa_cohc_tr_wood720915.pdf

**Computer Oral History Collection, 1969-1973, 1977**

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| **Interviewee:** | William Woodbury |
| **Interviewer:** | Robina Mapstone |
| **Date:** | January 15, 1973 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 73 pp. |

**Abstract:**

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/ fa_cohc_tr_ wood730115.pdf

**Computer Oral History Collection, 1969-1973, 1977**

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| **Interviewee:** | Michael Woodger and D. W. Davies |
| **Interviewer:** | Uta C. Merzbach |
| **Date:** | No date |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 6 pp. |
| **Abstract:** | Interview is fragmented and incomplete. |
| **Citation:** | Computer Oral History Collection, Archives Center, National Museum of American History. |
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| **Transcript:** | http://invention.smithsonian.org/downloads/fa_cohc_tr_wood000000.pdf |

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | John W. Wrench |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | November 17, 1970 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 59 pp. |

**Abstract:** Wrench graduated from the University of Buffalo with a bachelor's degree in 1933 and received his master's the following year. In 1935, he entered Yale University on fellowship. Wrench's mentor, Professor Gehman, influenced him to apply for graduate school at Yale. Wrench received his doctorate in June of 1938. Comments on his course work at Yale and faculty members with whom he worked. He discusses his use of pi to compute. After graduation, Wrench took a one year faculty appointment at Wesleyan University. In 1939, he began teaching at George Washington University where he would stay until 1942. During this time, Wrench became involved with the National Defense Research Committee (NDRC) and their work on interior ballistics until the conclusion of the war in 1945. For a short period in 1945, Wrench worked on a project involving interior ballistics tables at Catholic University. Comments on Howard Aiken's address at the Harvard Congress in 1950 and his work at a laboratory that is unidentified. Mentions Horace Uhler, Oystein Ore, Carl Herzfeld, Howard Aiken, Andy Gleason, George Forsythe, and Barkley Rosser.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Pat Youtz |
| **Interviewer:** | Richard R. Mertz |
| **Date:** | January 26, 1970 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 32 pp. |

**Abstract:** Pat Youtz was born on April 4, 1907, Sunbury, Pennsylvania. He attended Bucknell University and later graduated from the University of Chicago with a master's and a doctorate in mathematics. At the onset of World War II, Youtz began his own consulting firm dealing with cathode ray tube devices. Youtz also taught evening courses at the American Television Institute, Illinois Institute, and later at the Signal Corps Schools in the Chicago area. In 1944, Youtz was hired by the Massachusetts Institute of Technology (MIT) as a lecturer in the Radar School. He conducted research in and trained personnel for work with radar equipment. In 1945, Youtz joined the Servomechanisms Laboratory at MIT. This work entailed work on the controls for radar antennae on ships. Youtz recalls his visit to the Eckert-Mauchly Group to view the electronic Numerical Integrator and Automatic Computer (ENIAC). Youtz comments at length on the development of the electrostatic tube for Forrester's WHIRLWIND Project. Frequently mentioned names include L.L. Thurstone, Jay Forrester, J. Presper Eckert, John Mauchly, John von Neumann, Donald Forbes, Frank Caswell, and Steve Dodd.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/fa_cohc_tr_yout700126.pdf

**Computer Oral History Collection, 1969-1973, 1977**

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**Computer Oral History Collection, 1969-1973, 1977**

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| **Interviewee:** | Everret C. Yowell |
| **Interviewer:** | Henry Tropp |
| **Date:** | September 25, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 87 pp. |

**Abstract:** Yowell graduated from the University of Cincinnati in 1937, where in he majored in mathematics. In 1941, Yowell went to Columbia as a graduate assistant in astronomy. He wrote his dissertation on "Period Variations in Draconis Stars," and received his Ph.D. in 1948. During the war years, Yowell worked on two major problems at Columbia, computing bombing tables and the evaluation of gun controls for the B-29. Sometime in 1946 or 1947, Yowell became interested in the insides of the machines and began examining punched card machines in detail. Comments on the need for computers in the astronomy field since astronomy was an obvious application for the computer. In 1947, Yowell spent ten weeks with Billy Lane at the Math Tables Project in New York. Yowell developed a plug board for a standard 405 tabulator that would automatically take six differences, ten digit functions. After graduating from Columbia, Yowell joined the Institute for Numerical Analysis in Los Angeles. He comments on the Standards Western Automatic Computer (SWAC), Standards Eastern Automatic Computer (SEAC), and his first introduction to the Binary Automatic Computer (BINAC) coding by Ida Rhodes.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.



**Transcript:** http://invention.smithsonian.org/downloads/ fa_cohc_tr_ yowe720925.pdf

**Computer Oral History Collection, 1969-1973, 1977**

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| **Interviewee:** | Stan Zawadzki |
| **Interviewer:** | Henry Tropp |
| **Date:** | June 21, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 83 pp. |
| **Abstract:** | See Argonne National Laboratories interview. |
| **Citation:** | Computer Oral History Collection, Archives Center, National Museum of American History. |
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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Heinz Zemenek |
| **Interviewer:** | Henry Tropp |
| **Date:** | December 12, 1972 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 28 pp. |

**Abstract:** Heinz Zemenek was born January 1, 1920, in Vienna, Austria. He studied low-voltage technology at the Technical University in Vienna and received his Dipl. Ing., in 1944. He received his doctorate in engineering from the same institution in 1959. During the World War II, Zemanek was a lecturer for the Army Communications School and Radar Research, German Army from 1939-1945 and finished his studies. Because of his association with the German Army he was sent to Greece from 1941 to 1943 to work on telephone and telex lines. After leaving Greece, Zemanek joined the German Acceleration Institute where he checked electronic equipment against accelerations which occurred in V1's, and V2's. He also joined a project on light sensitive anti-aircraft shell equipment. He ultimately left this work in search of more suitable diploma (doctorate) work. Comments on the atmosphere after the war and the British and American investigation into individuals associated with the German Acceleration Institute and German projects related to radar development. In 1947, Zemanek became an assistant professor at the Technical University, Vienna. His interests were in telegraphy and pulse technology. He would remain at the Technical University until 1961. During his time Zemenek went to France on a French Government scholarship from 1948-1949. It was in France that Zemenek had his first contact with the computer. When Zemanek returned from France he commenced research on digital communications. Comments on his research and literature reviews of the computer field, particularly articles written in English. By 1954, Zemanek announced plans to build a machine in Vienna. This machine would be a fully transistorized computer called MAILUFTERL. Zemanek discusses the design and development of the machine. This interview includes a chronological time table of the MAILUFTREL. Colleagues mentioned include Konrad Zuse and George Stibitz.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**



**Transcript:** http://invention.smithsonian.org/downloads/ fa_cohc_tr_ zema721212.pdf

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**Computer Oral History Collection, 1969-1973, 1977**

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|---|---|
| **Interviewee:** | Konrad Zuse |
| **Interviewer:** | Uta C. Merzbach |
| **Date:** | 1968 |
| **Repository:** | Archives Center, National Museum of American History |
| **Description:** | Transcript, 57 pp. |

**Abstract:** This interview was recorded in German and was translated into English. Both versions are available for research.

Zuse was born on June 22, 1910, in Berlin-Wilmersdorf, Germany. Zuse enrolled in school in 1927, at the Technical University in Berlin-Charlottenburg. He worked in the aircraft industry as a design engineer and subsequently completed his degree in electrical engineering in 1935. Discussion begins with Zuse commenting on his most important accomplishment, appliances Z1 to Z4. Z3 was to be the most striking, a relay calculating machine that was completed by 1941. After graduation, Zuse began developing and designing in his parents apartment, ,independent of funding or politics. At the outbreak of the war in 1939, Zuse was drafted as a soldier. He spent only a half a year soldiering until he could obtain a deferment because of his vocation as an aviation statistician for the Hentschel Company. By 1938, Zuse had completed the Z1. It was purely mechanical with individual parts, but it did not work. Comments on the design and development of the three subsequent Z machines. He discusses the history of the Z4 which was completed in 1945. The Z4 consisted of a punched tape control that could compute, terminate, and it had nine values and nine decimals. Because the end of the war was quickly approaching, Zuse was instructed to place the Z4 in the subterranean tunnels in the Harz Mountains. The Z4 itself and its documentation were saved from the wars destruction while the Z3 needed to be reconstructed. After the war Zuse made contact with the Remington punch card company, IBM's competitor to develop punch computers. Zuse created the Z5. These computers were delivered to Remington of Switzerland and were used in Europe. The trademark under which things were negotiated was M-9 (Mitra-9). He comments on the Z11, yet another relay computer. Zuse mentions George Stibitz, Howard Aiken, and Heinz Zemanek.

**Citation:** Computer Oral History Collection, Archives Center, National Museum of American History.

**Computer Oral History Collection, 1969-1973, 1977**