

Lecture Series Spotlights Minnesota Computing

A number of experts narrated the development of Minnesota's computer industry in CBI's 50th Anniversary lecture series.

In the opening lecture, "Where it All Started: The Legacy of ERA," former CBI Director Arthur Norberg described how Navy Commanders Howard Engstrom and William Norris combined with St. Paul glider manufacturer John Parker to develop electronic equipment for naval intelligence. ERA and its successors manufactured high performance computers for the next five decades. Norberg is completing a history of ERA and the early Minnesota computing industry.

In his talk, "Dilbert in Minnesota's Computer Industry," David Lundstrom described the difficulty of manufacturing in St. Paul the Philadelphia-designed Univac II. While Remington Rand, which acquired ERA in 1952, searched for a messiah who would save them, its spin-off CDC relied upon "midwestern engineers, the very best kind, with not a messiah in sight!" CDC faltered when its managers "began to believe their own press" regarding their social responsibility and technical innovation. Lundstrom is the author of *A Few Good Men from Univac*.

David Boslaugh's lecture "Prescription for Success: The Navy, Computers, and Minnesota" described the creation of ERA in 1946, the Atlas / ERA 1101 and the Naval Tactical Data System (NTDS). Project Lamplight developed requirements for NTDS, and Univac assigned Seymour Cray to design it. Cray developed bufferless high-speed memory-to-memory communication to link small unit computers. The NTDS 30-bit computer became a standard for generations of Navy comput-

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Seymour R. Cray 1925-1996

The computer industry lost one of its most brilliant leaders on October 5, 1996, when Seymour Cray died from injuries sustained in an automobile accident in Colorado Springs.

Cray was born in 1925, and grew up in Chippewa Falls, Wisconsin. He built an automatic telegraph machine by age 10, and an alarm on his bedroom door to prevent anyone from entering his room when he was downstairs tinkering. After serving in Europe and the Philippines in World War II, Cray went to the University of Minnesota, graduated in 1951 with a bachelor's degree in EE and a master's degree in applied mathematics, and joined Engineering Research Associates in 1951. He helped design the 1103 and the Bogart, one of the first computers to employ transistorized logic and magnetic cores. Cray's Naval Tactical Data System design set him on the path to building ever-faster



computers.

In 1957, Cray helped found Control Data Corporation, where he was the chief designer for the CDC 1604, which launched CDC into the ranks of the top

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50th Policy Conference Highlights Computer Applications

The conference "50 Years of Computing in Minnesota: Innovation, Education, and Diversity," organized by CBI, the Humphrey Institute of Public Affairs of the University of Minnesota, and the University of St. Thomas, and funded by Charles Babbage Foundation President Willis Drake, Fred Lang of Analysts International, and James Ousley of Control Data Systems, drew many distinguished participants. The conference themes, the information superhighway, international competitiveness, quality, education, and medicine, spanned a broad range of historical and policy interest.

University of Minnesota President Nils Hasselmo noted University graduates including Seymour Cray, Erwin Tomash, and Arnold Cohen led the industry from Engineering Research Associates in 1946 to the present. The Minnesota High Technology Council reported in 1993 that nearly 1000 companies created by University graduates enjoyed more than \$15 billion in annual revenues and provided 150,000 jobs.

The University pioneered academic supercomputing. It installed a Cray-1B

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CBI Welcomes New Trustees

The Charles Babbage Foundation elected six new trustees at the annual Board of Director's meeting on September 11, 1996: Lester Davis, Gerald and Thelma Estrin, George Glaser, John Sell, and Jack Shemer.

Lester Davis joined Engineering Research Associates in 1955, and Control Data in 1959, completing his bachelor's degree in EE from Minnesota in 1962. Davis followed Cray to Chippewa Falls in 1962, where he worked on the CDC 6600 and 7600 computers, and became the division general manager. Joining Cray Research in 1972, Davis orchestrated development of the Cray-1, Cray-2, X-MP and Y-MP, J916 and T3D machines, and retired from Cray Research in 1995.

Gerald Estrin received his Ph.D. in EE from Wisconsin in 1951, and joined John von Neumann's computer project at the Institute for Advanced Study at Princeton. From 1953 to 1956 he led the development of Israel's first computer, the WEIZAC. In 1956, he joined the

faculty of UCLA, where he developed restructurable computer architectures, pioneered graph models to analyze computer performance, developed computer aided design systems, and led a team to connect the National Laboratories to the ARPANET in the 1970s.

Thelma Estrin received her Ph.D. in EE from Wisconsin in 1951, and worked as a biomedical engineer in the Columbia Neurological Institute, before joining the WEIZAC development team. In 1960 she joined the UCLA Brain Research Institute and founded the Data Processing Laboratory, the first computer-based laboratory for neuroscientists. She directed the Electrical, Computer, and System Engineering Division of the National Science Foundation from 1982-1984, and served as the assistant dean of the UCLA School of Engineering from 1984 to 1989. She has taught courses on technology and society at UCLA, and takes special interest in women's careers in engineering and computer science.

George Glaser received his bachelor's degree in EE from Notre Dame in 1952 after which he worked on circuit design, testing, and systems analysis at Sandia Corporation, in management at the Naval Air Development Center, and computer peripheral planning and management at Ampex. He consulted for McKinsey & Company in Düsseldorf and San Francisco from 1961 to 1973, and independently from 1973 to 1977. Glaser was president and CEO of Centigram Corporation until 1980, and of George Glaser, Inc., after 1981. He was the president of AFIPS from 1973 to 1975, and the vice president of IFIP from 1982-1988.

John Sell received his BA degree in Psychology in 1975 from the University of Minnesota, where he served as development officer for scientific and technical computing programs, and program director for a number of high-performance computing grants in the 1980s. He co-founded the Minnesota Supercomputer Center in 1982, and is its President and CEO.

Jack Shemer joined General Electric in

Annual Meeting Awards & Challenges

The Charles Babbage Foundation held its annual meeting on September 10 and 11 in Minneapolis.

CBI Director Bob Seidel gave Director's Awards to Chairman Erwin Tomash, President Willis Drake, Walter Carlson, and Fred Lang for extraordinary service to the Charles Babbage Institute. Former CBI Director Arthur Norberg signed copies of his new book, *Transforming Computer Technology: Information Processing for the Pentagon 1962-1986*, for CBF board members.

The trustees discussed CBI's new building, which presents new opportunities to enhance CBI's national reputation, and service to the University, the state, the country, and the computer industry.

The trustees re-elected Walter Bauer, Walter Carlson, Arnold Cohen, Willis Drake, Arthur Humphreys, Douglas Ross, Clarence Spangle, and Erwin Tomash to the Board of Directors, and elected Saul Amarel, Keith Uncapher, John Sell, and Lester Davis as new Directors.



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1960, working on the 400 and 600 series computers, and the GE time-sharing system. In 1967, he moved to Scientific Data Systems, where he worked on the Sigma series mainframes. He completed his Ph.D. in EE in 1968 from Southern Methodist University. After Xerox purchased SDS, he co-founded the Advanced Development Laboratory in 1971. In 1976, Shemer became VP in Citicorp's Electronic Banking and Data Center. In 1979 he founded Teradata, which specialized in parallel-processing, relational database computers. After AT&T purchased Teradata in 1989, he retired. Shemer served IEEE as an editor and on the Governing Board in the 1970s.



50th Policy Conference

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in 1981, established the Supercomputer Institute 1984, and the Army High Performance Computing Research Center in 1989.

The Information Superhighway

John Gunyou, the Director of the Minnesota Office of Technology, reported how it aimed at "Achieving Minnesota's Vision for Information and Communications Technology." CBI Trustee Saul Amarel pointed out that strong R&D in computing and networking, like the High Performance Computing and Communications Initiative, provided the background for the Internet. He asserted that more research is needed to manage network complexity, increase bandwidth, handle security, and facilitate use through studies of human-computer interactions, agents, speech, natural language processing, and visualization. The ensuing discussion focused on the role of government in regulation, policy, and community development.

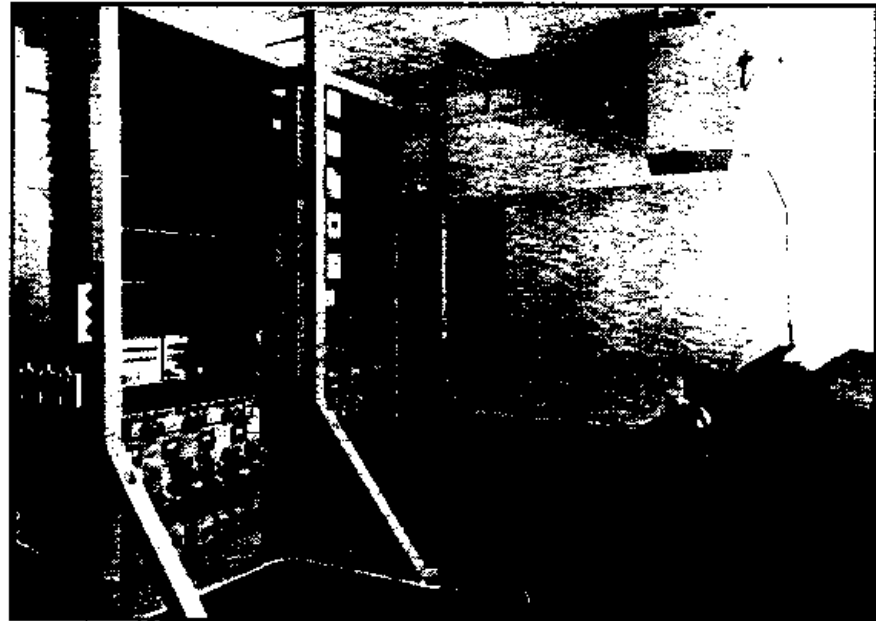
History

CBI Director Bob Seidel's speech, "The History of Computing in Minnesota," asked "who or what will replace defense markets in Minnesota's software-dominated computing industry?"

Competitiveness

Marie Anchoy of the University of Washington discussed Japanese and American industrial policy in the second session, "Computers and International Competition," noting that that Japanese policies have not changed dramatically in the 1980s and 1990s.

In the panel discussion on computers and international competition, Applied Economics Professor Vernon Ruttan of the University of Minnesota questioned whether we are moving towards maturity in information technology. If advances in science are no longer so critical for information technology, Japan is in a relatively stronger position because of its reliance on private sector R&D. Jim Ousley, the President and CEO of



A 1958 photograph of the Hitachi Parametron Automatic Computer, one of Japan's earliest computer designs. Marie Anchoy described Japanese competition with American computer manufacturers in the conference "50 Years of Computing in Minnesota" held at the University of Minnesota in September.

Control Data Systems, maintained that the United States has always been a leader in information technology from automating the "back office," to automating the "front office," and now applying technology directly to customers' needs.

Quality

Frank Soltis delivered a lively talk on the creation of the AS/400 computer that won the Malcolm Baldrige Quality Award. The Rochester spirit that led to the success of this project is unique in IBM, Soltis argued, and gave the true story behind an effort which he led to make the computer.

Education

In opening the second day of the conference, Reverend Dennis Dease, President of the University of St. Thomas said that we must not let technology be the "cutting wedge" between the "haves" and the "have-nots." Education is one route to providing technology to everyone.

ERA and CDC founder William C. Norris reviewed the history of CDC's PLATO experiment in computer education, and discussed the barriers arising from fears that computers would replace teachers. He concluded that the education system must be transformed for computer-based education to fulfill its promise. Joe Graba of the Midwestern Higher Education Commission agreed, stating that "everyone

wants our schools to be better, and almost no one wants them to be different."

Medicine

Morris Collen's keynote talk outlined the history of medical informatics. Doctors Stanley Finkelstein of the University of Minnesota and Frank Earnes of the Mayo Clinic described the use of telemedicine in patient-initiated monitoring of lung transplant outcomes and radiology services. John Haugo of Serving Software Company discussed the evolution of computer software for health applications, and Dr. Lael Gatewood of the University of Minnesota noted the barriers to the introduction of computers in medicine.

Gary Smaby of The Smaby Group compared the current trends in networking to creating the plumbing of a new infrastructure, eliminating "clogs and backups." However, soon the principal concerns will be with services flowing through the pipes.

The themes of the conference highlighted areas where Minnesota has made impressive contributions and where there is significant national and international policy interest. Audience surveys showed that that conference stimulated thought and provoked discussion on these issues. □

Recent Publications

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Goyal, Amita, "Women in Computing: Historical Roles, the Perpetual Glass Ceiling, and Current Opportunities," *IEEE Annals of the History of Computing* 18:3 (1996): 36-42.

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Sources in Electrical History 3: An

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ers. Boslaugh is completing *When Computers Went to Sea*, a book on the history of the NTDS.

Chicago journalist Chuck Murray's lecture on "The Biggest and Fastest: Minnesota's Supercomputer Industry" ascribed the success of Minnesota's computer industry to the uniqueness of its engineering culture, epitomized by Seymour Cray. Cray did not pay much attention to marketing or the "corporate team." He stubbornly pushed the state of the art, and moved to Chippewa Falls, Wisconsin, physically separating his engineering development team from the CDC corporate office. Cray Research's Boulder Laboratory and Steve Chen's Supercomputer Systems, Inc. tried and failed to replicate the Chippewa Falls model in the 1980s. CDC and Cray Research succeeded thanks to the complementary talents of Cray and Lester Davis. Murray's book *The Supermen: the Story of Seymour Cray and the Technical Wizards behind the Supercomputer* will be available from John Wiley & Sons in February 1997.

Ken Brumbaugh, the former president of the Minnesota Educational Computing Consortium (MECC), described CDC founder William Norris' persistent interest in developing educational computing in "As Ancient as PLATO: Computer-Based Education from Minnesota." MECC, a standardized, volume purchasing organization for Minnesota's schools, gave Apple its first large contract, and established the software site license contract. Former CDC and MECC employees are prominent leaders in today's educational software industry. Brumbaugh has written numerous articles and books on educational computing.

Former Tomash fellow Pat Hemmis described the metaphor of the "giant brain" in American popular culture in "The Machine is the Metaphor: The Digital Computer and Minnesota Culture." Computer companies sold their machines by claiming to save money by



Scene from "The Forbin Project," a 1960s film in which the defense computer, "Colossus" malfunctions, threatening nuclear holocaust. Pat Hemmis' lecture, "The Machine is the Metaphor" described popular portrayals of the computer. (CBI Photograph)

replacing people with a "giant brain." By the 1960s, numerous films portrayed computers as uncontrollable giant brains. Today, the metaphor of the computer is commonly used to describe human behavior.

The series was sponsored by CBI, the

Minnesota Historical Society, the Science Museum of Minnesota, and Unisys Corporation, drawing many of the participants in the history of Minnesota computing. Plans are being made to publish the lectures. □

Recent Publications...

Continued from page 4

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Seymour Cray . . .

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computer manufacturers. When CDC President William Norris asked Cray for a 5-year plan, Cray replied "Five year goal: Build the biggest computer in the world. One year goal: Achieve one-fifth of the above." He tired of business interruptions, persuading CDC to build him a new laboratory in Chippewa Falls, where he designed the CDC 6600. The 6600 was a tremendous success, prompting IBM chairman Thomas Watson to ask his staff how Cray's team of 34 people had outperformed Big Blue.

Cray's next machine, the 7600, was 4 times faster than the 6600. In 1972, Cray left CDC to start his own company focused exclusively on supercomputers, Cray Research, Inc.

The company shipped the first CRAY-1 to Los Alamos National Laboratory in 1976. After adding error correction capability, the CRAY-1 became a tremendous success. The company improved the CRAY-1 by removing performance bottlenecks and broadening its appeal by providing software support.

The CRAY-2 used a massive 256 megaword memory and liquid immersion



Seymour Cray with a Control Data Corporation 6600 computer. Cray's successful design cemented his reputation as an innovator. (CBI Photograph)

cooling. The company also produced the popular X-MP and Y-MP computers, while Cray began development of a "clean-sheet" CRAY-3.

Cray's vision for a radical new computer led to the establishment of Cray Computer in Colorado Springs in 1989. Technical problems and delays plagued the CRAY-3 project, so Cray moved on to the CRAY-4, a machine to be twice as fast at half the cost of the CRAY-3. Unable to

raise the capital necessary to finish the machine, Cray Computer filed for bankruptcy in March 1995.

Despite the disappointments of his final efforts, Seymour Cray was, and rightly remains a legend among computer designers for his innovative designs from the 1950s through the 1980s. He leaves a legacy of technical excellence that remains a hallmark of the computer industry. □

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