

History of Computing 2000: Mapping the History of Computing—Software Issues

Paderborn, Germany, April 5-8, 2000

By Arthur L. Norberg

This international conference, sponsored by the Heinz Nixdorf MuseumsForum and co-sponsored by the Charles Babbage Institute and the University of Paderborn, was convened to map out research needs in the history of software. The idea for the conference emerged from consideration of a larger concept to prepare a new handbook on the history of computing. After concluding that preparation of the handbook would encounter obstacles in some areas of computing that have not received adequate historical attention, the organizers of the conference invited a group of historians, sociologists, and computer scientists to present papers and comment on selected issues in the history of software.

The overall objective of this conference was to review present understanding of the history of software and establish an agenda for further research. The conference presenters were asked not to attempt to provide finished histories for any of the areas of software history. Instead, speakers and commentators were encouraged to address the fundamental elements that make software what it is, and explore our current understanding of software and its history. The organizers decided to address two perspectives in the conference: the perspective of computer scientists and the perspective of historians and sociologists interested in the larger context of software development. Participants

hoped to merge the two perspectives into one scheme for investigating the history of software.

The conference was designed to explore the history of software in a new way. The topics,

- Software as Science
- Software as Engineering
- Software as Dependable Artifact
- Software as Labor Process
- Software as Economic Activity,

were selected in order to provide the opportunity to define and refine a research agenda in each of the five areas, and perhaps others arising from discussions. In this sense, the conference was an opening gambit in achieving an overall history of software.

The conference topics emphasized some basic issues concerning the: (1) isolation of epistemological connections between software and larger contexts of the development of science and technology as seen through the eyes of historians and sociologists, (2) identification of fundamental starting points to address the history of software in the future, (3) introduction of the approaches of historians to the study of software rather than the approaches of the computer scientist, and (4) development of a research agenda the community can

Philip Frana to Manage CBI Software History Project



In May Dr. Philip Frana joined the staff of the Charles Babbage Institute as the manager of CBI's NSF sponsored project, "Building a Future for Software History."

Frana comes to the Institute from Iowa State University, where he completed his doctoral degree last November in the history of technology and science and has been serving as a visiting assistant professor this past semester. His dissertation, "Coordinating the Experts and the Masses: The Professions of Health and the Creation of the Modern American Health Community," is a social and intellectual history that explores the invention and institutionalization of community health in the United States.

Frana is currently preparing a manu-

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Recent Publications

Atkinson, Paul. "Computer Memories: The History of Computer Form" *History and Technology* 15 (1998) 89-120.

Baldwin, Carliss Y. *Design Rules* (Cambridge: MIT Press, 2000).

Berners-Lee, Tim. *Weaving the Web: The Original Design of the World Wide Web by Its Inventor* (New York: HarperCollins Publishers, 2000).

Copeland, Jack B. "Alan Turing's Forgotten Ideas in Computer Science" *Scientific American* 280:4 (1999) 99-103.

Estrin, Gerald. "Computer Network-Based Scientific Collaboration in the Energy Research Community, 1973-1977: A Memoir" *IEEE Annals of the History of Computing* 22:2 (April-June 2000) 42-52.

Godin, Benoit. "The Rhetoric of a Health Technology: the Microprocessor Patient Card" *Social Studies of Science* 27:6 (December 1997) 865-902.

Grier, David Alan and Mary Campbell. "A Social History of Bitnet and Listserv, 1985-1991" *IEEE Annals of the History of Computing* 22:2 (April-June 2000) 32-41.

Guice, Jon. "Controversy and the State: Lord ARPA and Intelligent Computing" *Social Studies of Science* 28:1 (February 1998) 103-138.

Hall, Eldon C. "From the Farm to Pioneering with Digital Control Comput-

CHARLES BABBAGE INSTITUTE NEWSLETTER

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ers: An Autobiography" *IEEE Annals of the History of Computing* 22:2 (April-June 2000) 22-31.

Helmreich, Stefan. "Recombination, Rationality, Reductionism and Romantic Reactions: Culture, Computers, and the Genetic Algorithm" *Social Studies of Science* 28:1 (February 1998) 39-71.

Jensen, Peter. *From the Wireless to the World Wide Web the Evolution of Telecommunications, 1901-2001* (Sydney, Lancaster: University of New South Wales Press, 2000).

Kidwell, Peggy Aldrich. "The Adding Machine Fraternity at St. Louis: Creating a Center of Invention, 1880-1920" *IEEE Annals of the History of Computing* 22:2 (April-June 2000) 4-21.

Kim, Eugene Eric. "Ada and the First Computer" *Scientific American* 280:5 (1999) 76-81.

Lomnitz, Larissa Adler and Laura Charazo. "Basic, Applied and Technological Research: Computer Science and Applied Mathematics at the National Autonomous University of Mexico" *Social Studies of Science* 29:1 (February 1999) 113-134.

Lee, John A. N. and George E. Snively. "The Rise and Sale of the General Electric Computer Department: A Further Look" *IEEE Annals of the History of Computing* 22:2 (April-June 2000) 53-60.

Pelaez, Eloina. "The Stored-Program Computer: Two Conceptions" *Social Studies of Science* 29 (1999) 359-389.

Redmond, Kent C. *From Whirlwind to MITRE: the R & D Story of the SAGE Air Defense Computer* (Cambridge: MIT Press, 2000).

Rojas, Raul, Cuneyt Goktekin, Gerald Friedland, and Mike Kruger. *Plankalkul: The First High-Level Programming Language and Its Implementation* (Berlin: Department of Mathematics, Freie University, 2000).

Rojas, Raul and Ulf Hashagen, eds., *The First Computers - Histories and Architectures* (Cambridge: MIT Press, 2000).

Tomayko, James E. *Computers Take Flight: A History of NASA's Pioneering Fly-by-Wire Project* (Washington, D.C.: NASA, 2000). □

News From the Archives

Current Projects Supported by CBI Collections

With the opening of the new CBI reading room in March, the archives welcomed a host of visitors, many of them from out of state. A description of just a few of the research projects underway demonstrates the breadth and depth of the activity that CBI's collections support.

MBA Students, Carlson School of Management, University of Minnesota

MBA candidates in Professor John Fossum's semester-long Field Project course in the Department of Human Resources and Industrial Relations made a series of trips to the CBI archives to conduct research for their class project. The students examined the Control Data Corporation's Employee Assistance Program. Formed in the late 1960s, the program was the first of its kind and served as the model for subsequent programs in corporate settings throughout the United States. Students researched the origins and development of the program using CBI's oral histories and CDC corporate records and internal publications.

Professor Bernadette Longo, Clemson University

In May, Clemson University Professor Bernadette Longo made the first of a series of research trips to the CBI archives. Her study examines computer-related documents including proposals, press releases, operating manuals, and product literature to explore links between language use and concepts of human/computer interactions. On this trip, she focused on the Edmund Berkeley Papers.

Mark Lange, History of Science, University of Wisconsin

Mark Lange, an undergraduate in the History of Science program at the University of Wisconsin, Madison, spent

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Unbundling History: The Emergence of the Software Product

A Conference of the Charles Babbage Institute

Xerox Palo Alto Research Center, September 22-23, 2000

The conference is funded by the Tomash Family Foundation. The Economic & Social Research Council and Software History Center are co-sponsors of the event.

Registration: Conference is free and open to the public. Please pre-register by mailing or emailing name, affiliation, address, email address, and phone number to CBI (address at bottom left of page 2). Lunch is available to pre-registrants only by sending a \$15 check payable to CBI. For more information visit <http://www.cbi.umn.edu> or call CBI at (612) 624-5050.

Between 1957 and 1974 software was transformed from a custom development for solving particular problems to a product that could be marketed to a sector of the economy. Through presentations on the activities of companies during the bundled software era, the consequences of unbundling, and the growth of the industry immediately after unbundling, principal actors in these developments and historians will detail the emergence of the software product. Commentators who participated in the events, or engaged in subsequent historical analysis, will offer assessments of the presentations, which will be followed by an open discussion.

Friday evening's keynote speaker, Mr. Charles Wang, Chairman and CEO of Computer Associates, Inc., will present a brief history of his firm and describe the capabilities that played a role in its success. Saturday's sessions will focus on the three areas noted above. The first session will begin by distinguishing custom software from the start of "packages" of software products designed for common applications. Speakers will comment on approaches used and critical problems encountered in developing packages by addressing issues such as development costs and financing, estimation of market size and price determination, intellectual property protection, technical difficulties, and the marketing of intangible goods.

The second session concentrates on

unbundling. Much has been said about the importance of unbundling to the growth of the computer services industry, especially the software side. While the decisions explored have been mostly those of IBM, other companies faced the same situation. Speakers will address elements of the unbundling decision and the strategies used by companies to compete with IBM during the bundled era. Unbundling offered a new business environment in which software product companies could flourish. Established programming companies such as ADR, Informatics, and MSA changed the nature of their business from custom programming to software products. In the 1970s they were joined by new companies including Oracle, Computer Associates, and Cullinane which were created to capitalize on the new conditions. This wave of specialized companies sold capital goods software to the computer industry, but the practices they established laid the foundations for the personal computer and recreational software revolutions.

Speakers in the third session will review the number and classification of firms and analyze marketing and vendor relations in the new unbundled environment. Other issues likely to be raised are strategic analysis, barriers to entry, and effects of networking among firms.

Conference Program

Friday Evening Presentation, September 22, 2000, 6 p.m.

Introduction: Arthur L. Norberg, Director, Charles Babbage Institute, University of Minnesota

Keynote Address: Charles Wang, Chairman and CEO, Computer Associates, Inc. "Computer Associates Secrets-Consolidation in the Software Products Industry" (followed by reception).

Saturday, September 23, 2000

9 am - 11 am Session I: Early Products

Chair: George Glaser, President, Charles Babbage Foundation

ADR's Autoflow - Martin Goetz, ADR, Retired

Informatics' Mark IV - John Postley, Informatics, Retired

Cincom's TOTAL - Thomas Nies, President, Cincom Systems, Inc.

Comment: Luanne Johnson, Software History Center

Lunch (provided to pre-registered individuals only)

1 pm - 3 pm Session II: Unbundling

Chair: Ulf Hashagen, Heinz Nixdorf MuseumsForum

Unbundling-An Inside View - Watts Humphrey, Software Engineering Center, Carnegie-Mellon University

Unbundling-Economic Analysis-Steve Usselman, Georgia Institute of Technology

Comment: Burton Grad, Burton Grad Associates, Inc.

3:15 pm - 5:30 pm Session III: Industry Growth

Chair: Arthur L. Norberg

Software Products-Market Analysis - Peter Cunningham, President and CEO, INPUT

Software Products-Industry and Economic Analysis - Martin Campbell-Kelly, University of Warwick

Panel (Panelists will offer reflections on the issues that emerged from the conference)

Walter Bauer, Founder, Informatics
Larry Welke, President, Info Partners International

Duane Whitlow, Syncsort

Nathan Ensemenger Awarded 2000-2001 Tomash Fellowship

Nathan Ensemenger was recently named the recipient of the 2000-2001 Adelle and Erwin Tomash Fellowship.

Ensemenger, a Ph.D. candidate in the History and Sociology of Science department at the University of Pennsylvania, is currently working on a dissertation exploring the occupational development of the computer programming profession and the emergence of technological and managerial responses to the so-called "software crisis" of the late 1960s.

As an undergraduate engineering student at Princeton University, Ensemenger cultivated an interest in the social and cultural dimensions of computer use and software development. After graduation he spent several years working as an information systems consultant. His dissertation project, tentatively titled "From 'Computer People' to Information Technology Specialist: The Software Crisis and the Management of Programmers," developed in part from this work experience.

Ensemenger's dissertation explores the history of the computer in the modern corporation as viewed from the perspective of the professional programmer. His focus is on the conflict between the craft centered practices of the early programmers and the "scientifically" oriented management techniques of their corporate managers. Ensemenger's research



seeks to situate the rich history of computer programmers and the ongoing software crisis into a larger social, political, and cultural context.

In April 2000, Ensemenger co-presented a paper with William Aspray entitled, "Software as Labour Process," at the conference, "Mapping the History of Computing-Software Issues," (see related article).

Ensemenger plans to visit CBI to conduct research for his dissertation this summer.

The Adelle and Erwin Tomash Fellowship is named in honor of the founders of the Charles Babbage Foundation and Charles Babbage Institute.

Jeffrey R. Yost □

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Paderborn Conference...

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begin to engage in without the necessity for repeated questioning about where we begin with this history of software.

Presenters all received guidelines as to what to include in their talks, in order to encourage similar treatments with the possibility to glean cross-cutting themes. Presenters were asked to:

1. Map out the subject matter in the particular software domain, i.e., in one of the five topical areas to highlight the

significant issues needing historical treatment.

2. Define the critical issues, directions, and research questions in the domain.

3. Discuss the state of historical knowledge and/or research of other kinds useful in the domain by citing the relevant secondary literature and significant primary publications.

Following an opening statement of the conference's themes and objectives by Arthur L. Norberg, Director of the Charles Babbage Institute, Frederick L. Bauer, Technical University of Munich, discussed his experiences and under-

standing of the nature of certain software developments in the conference's keynote address.

The conference's six sessions focused on software as an entity, thus avoiding the traditional emphasis on the history of software artifacts that has obscured its scientific nature.

Session one focused on Software as Science. Michael S. Mahoney of Princeton University discussed epistemological foundations of theoretical computer science to highlight this aspect of software. One of Mahoney's themes concentrated on "agendas." He offered

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as two examples descriptions of the early "agendas" of computer science and of semantics. In computer science, he focused on the perspectives of electrical engineers, mathematical logicians, and neurophysiologists, noting the principal actors in these areas. For the "agendas" of semantics, he concentrated on programming languages, mathematical logic, and artificial intelligence. In his tightly organized presentation, he related the impact of "agendas" on activities in research and training and in mathematics and software engineering.

As a complement to this first session, the second session addressed Software as Engineering. In this session, James E. Tomayko of Carnegie-Mellon University took a different tack and discussed the specific functional area in computer science known as software engineering. He began with a consideration of the history of the art of engineering to prepare for his main argument about the art of software engineering and software as applied science. Given the lack of historical work in this area, he speculated on which thematic contexts, if explored, might yield a better understanding of the history of software. He ended with a call for the collection of more primary documents to facilitate this work.

The third session, Software as Dependable Artifact, paid special attention to the specific nature of software, and to the interplay of formal methods and cooperative processes, verification, testing, validation, and standards. In many parts of the software enterprise, reliability is a high priority, for example, in areas of safety-critical systems such as medical and aircraft control systems. In other areas, such as most off-the-shelf packaged software, safety is not a factor. Donald MacKenzie, University of Edinburgh, using the concept of dependability sketched the historiography of this area, focusing on the safety of software systems. He traced the history of Hoare's paradox concerning the dangers inherent in software, which led him to a discussion of the sociology of dependability, moral entrepreneurship, and the sociology of knowledge.

Opening Events at Andersen Library



Left to Right: University of Minnesota President Mark Yudof, University of Minnesota Board of Trustees Chair Patricia Spence, Governor Elmer L. Andersen, and University Librarian Tom Shaughnessy (Photo: Dee De Van Slyke)

A series of events during the weekend of April 7th celebrated the opening of the Elmer L. Andersen Library. On Friday afternoon there was an open house for faculty and staff of the University of Minnesota, many of whom toured the state-of-the-art facilities.

This was followed by a Saturday evening gala featuring a short program and ribbon cutting ceremony in the library's atrium (see photograph). University of Minnesota President Mark Yudof, Chair of the Board of Regents Patricia Spence, and University Librarian

Thomas Shaughnessy all spoke of the importance of the new library to the university and broader community. They gave praise to the architect, construction team, and particularly, the insightful leadership, dedication, and generosity that Governor Elmer Andersen has shown to the University and state of Minnesota for many years. Governor Andersen then took center stage, communicating his long held belief that Universities have an important responsibility, beyond teaching, research,

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Session four was devoted to Software as Labor Process. In a wide-ranging analysis of labor and labor processes in software programs, Nathan Ensmenger, University of Pennsylvania, and William Aspray, Computing Research Association, discussed the perception of an acute shortage of programmers over the decades since 1950, the changing professional status of programmers, the routinization of labor as managers tried to gain more control over the process, the management of programmers, and women in software. The structure of the presentation involved the identification of issues in software and labor, discussion of the historiography of the topic,

and subjects needing further examination.

Session five attended to Software as Economic Activity. Martin Campbell-Kelly of the University of Warwick focused on an examination of the size, location, and practices of software producers. Producers have included computer users and computer manufacturers, but software firms have increasingly taken center stage. Campbell-Kelly noted that we are getting a clearer picture of the software industry through a number of studies by historians and economists, but we still need a better appreciation of what role R&D played in

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Frana...

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script surveying contemporary health and medicine for Harcourt Brace College Publishers. He is also completing work on an annotated bibliographic database of 30,000 primary and secondary sources in the history of American medicine and public health to be issued on CD-ROM. Frana's article "A Risk Perceived is a Risk Indeed: Washington Assesses the Risks of Biomedical and Public Health Research" will appear in Hamilton Cravens and Alan I. Marcus's edited volume, *The Social Sciences Go to Washington*, forthcoming from Harvard University Press.

Frana has presented his research at the American Association for the History of Medicine and at many other professional meetings. He was the recipient of numerous honors in the course of his masters and doctoral work at Iowa State and undergraduate studies at Wartburg College.

The scholarly and administrative skills that Frana brings to CBI will be a tremendous asset to the Institute and its software history project.

Jeffrey R. Yost



CBI Archives...

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several days at CBI gathering material for his senior thesis. His paper examines the phenomenon of market dominance in the U.S. mainframe computer industry in the 1950s and 1960s, in light of the recent developments in economic theory by W. Brian Arthur and others. Lange made extensive use of CBI's Market and Product Literature Collection, the Edmund Berkeley Papers, the Herbert Goldstein Papers, the Auerbach Associates reports, and the National Bureau of Standards Collection, as well as a long list of oral histories.

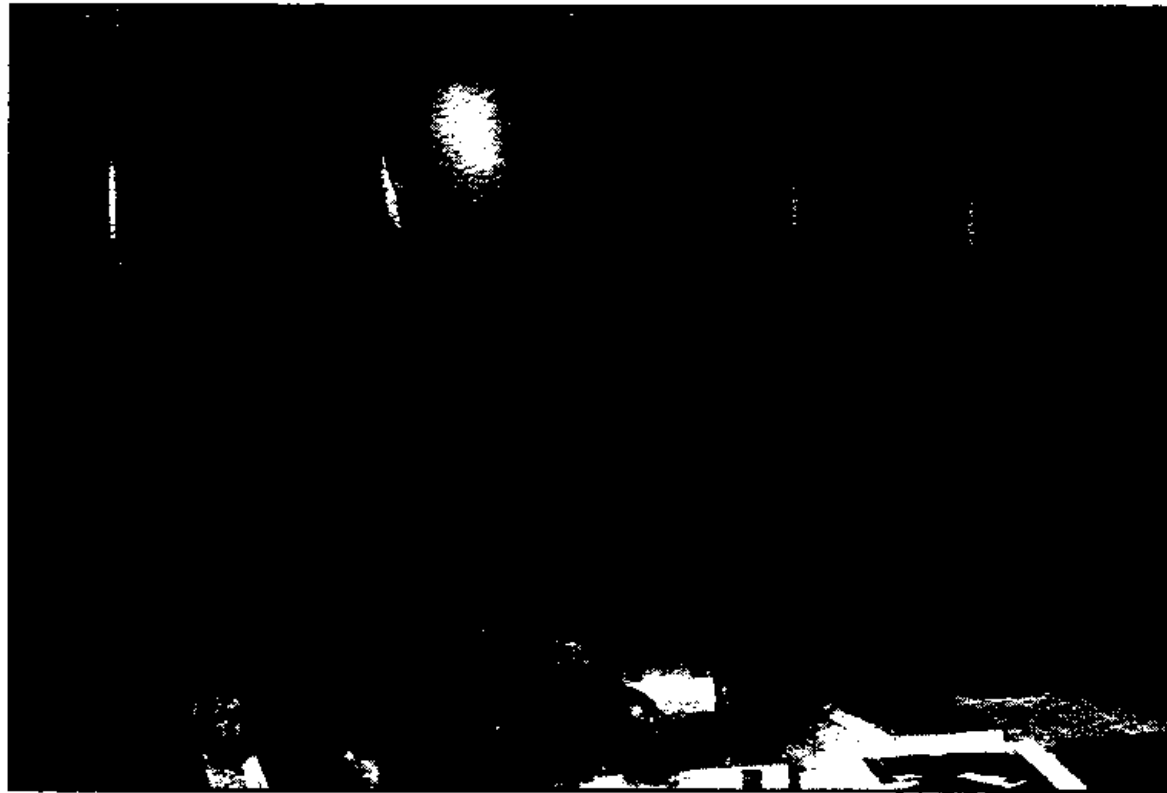
Ceridian

Ceridian, which emerged from the reshaping of the Control Data Corporation

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Opening Festivities

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CBI Exhibit Case in the Atrium of the Andersen Library

and service, to help preserve the culture of our society through collecting and making available rare books and archival materials.

On Sunday, Friends of the University of Minnesota Library sponsored a brunch, which was followed by an afternoon public open house. A front page feature in the *Minneapolis Star Tribune* and several radio spots boosted attendance, which exceeded even the most optimistic expectations: an estimated four to five thousand people

attended the open house; touring the caverns and viewing exhibit cases (see photograph), reading rooms, and office suites of the library. Many hundreds came through the Charles Babbage Institute and visited with CBI staff. Visitors included a number of longtime friends of the Institute as well as many individuals eager to learn about CBI's research and archives programs.

Jeffrey R. Yost



CBI Archives...

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in 1992, is moving to a new building across the street from the old CDC building in Bloomington, Minnesota. Designers from Ceridian's corporate communications department worked with assistant archivist Lynn Leitte to select visual materials for an exhibit and installation in the lobby of the new building.

Syntegra (USA) Inc.

Syntegra (USA) Inc., formerly Control Data Systems, Inc., sent designers from a Minneapolis production company to the CBI archives to select photographs for use in a multimedia marketing presenta-

tion depicting the history of the Control Data Corporation.

Thomas Haigh, 1999-2000 Tomash Fellow

Haigh visited the CBI archives as part of his ongoing dissertation research toward an organizational and professional history of corporate information processing. He worked with the records of the Data Processing Management Association, looking at its evolution from a group of tabulating machine supervisors and its often troubled relations with other societies such as the ACM and AFIPS. He also made extensive use of the records of Auerbach Associates, which audited the data processing

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software firms. In addition, he commented that we have no comprehensive picture of why the United States tends to dominate the software market.

He briefly explored the evolution of the different sectors within the software industry, including programming services and packaged software firms. He related the structure and strategies of firms to the ever changing technological and market environment as well as the broader economic and business context.

The organizers of the conference took the occasion to pay particular attention to the problem of exhibiting software in a session entitled, "Software in Museum Exhibits." To aid discussion, Doran Swade, Science Museum, London, David Allison, Smithsonian Institution, Friedrich Bauer, consultant to the Deutsches Museum, and Ernst Denert, CEO of sd&m, and Klaus-Peter Lohr, Free University of Berlin, presented examples of how each of their museums approach the problem of preparing a software exhibit. Some useful information emerged from the presentations for use in museum collecting and exhibiting of software.

These papers and the comments offered on them by members of a wide range of professions will be published later this year in a volume of proceedings edited by Ulf Hashagen, Heinz Nixdorf MuseumsForum; Reinhard Keil-Slawik, University of Paderborn; and Arthur L. Norberg, Charles Babbage Institute.



operations of many prominent corporations in the early 1970s. Haigh found that the collection provides a detailed snapshot of real-life conditions in these firms. The "Rand Symposium" transcripts, which record the free-ranging discussions held every year by Fred Greunberger with others such as Licklider, Weizenbaum, Grosch and Hamming also proved a valuable resource.

Elisabeth Kaplan

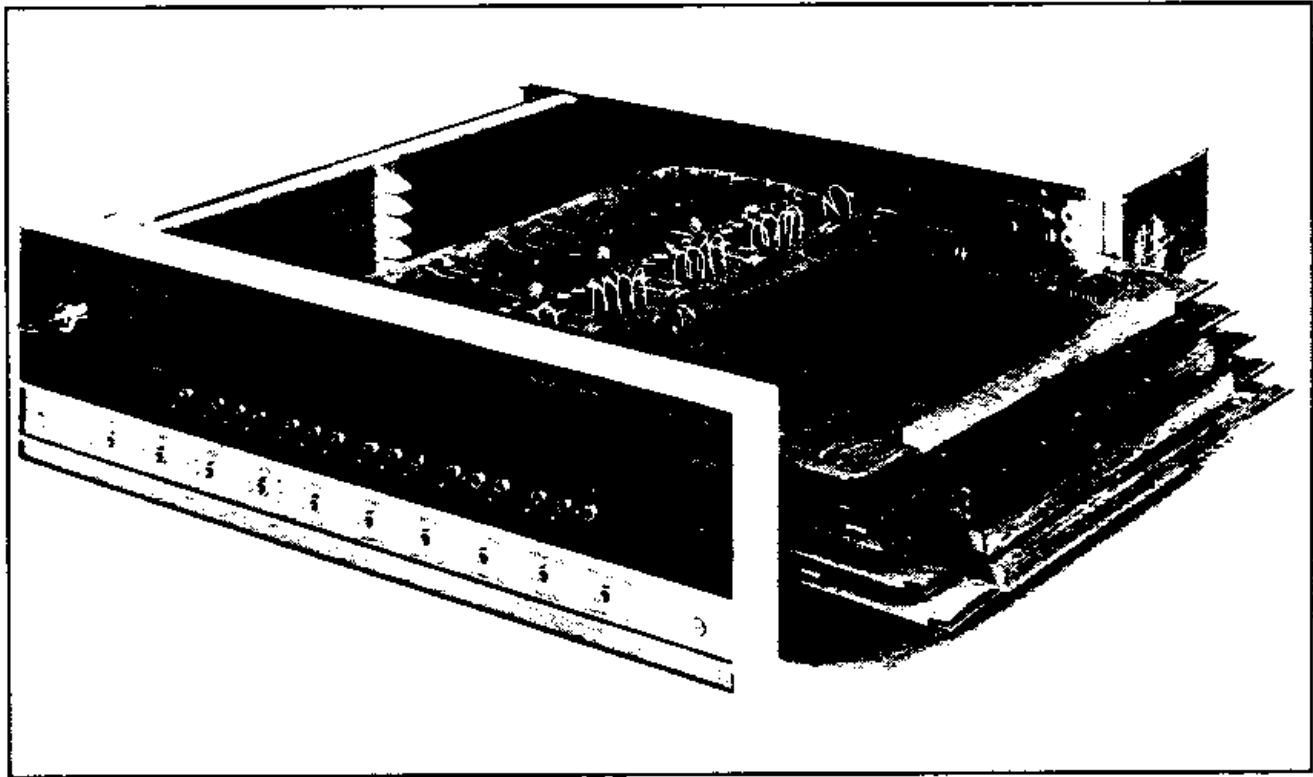


Fifty Years Ago

Grace Hopper (1906-1992) was appointed Senior Programmer at Eckert-Mauchley Computer Corporation in 1950. In 1944 she worked as a "coder" (programmer) on the Harvard Mark-I. Hopper developed the first compiler in 1952, the first compiler to handle mathematical computations, A-2 in 1953, and the first English language data processing compiler, B-0, also called FlowMatic (1957). She helped to found the Committee on Data Systems Languages (CODASYL), which developed the Common Business Oriented Language (COBOL) based on Hopper's FlowMatic. Hopper joined the U.S. Navy in 1943 and retired at the rank of Rear Admiral in 1987.

30 Years Ago

In 1970, Data General Corporation expanded its Nova line of computers with



the Nova 1200, Nova 800 and the SuperNova SC. The SuperNova SC (see photograph above) proved that use of an all semiconductor memory was viable, an innovation that failed with Illiac-IV. The non-destructive nature of semiconductor memory permits overlapping of instruc-

tion execution cycles with read cycles attaining an add time of 300 nanoseconds. The Supernova SC had 4K 16 bit-word of memory, DMA data channel, and Teletype interface.

Lynn Leitte

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NEWSLETTER

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