



The

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# Charles Babbage Institute

## The Center for the History of Information Processing

### ARCHIVES WORKSHOP AT CBI

As part of their archival missions, The Charles Babbage Institute and the Computer Museum, with the support of the National Endowment for the Humanities, convened a workshop to analyze one aspect of records of the computer industry. A group of computer scientists, historians, archivists, and records managers assembled in Minneapolis on November 29 and 30, 1984, to discuss the nature and availability of technical records in computer businesses. An emphasis on records for hardware developments kept the discussion meaningful for both the Institute and the Museum. The "problem" presented to the participants was composed of five parts. The organizers set out to learn details of the inventive process in the development of computers, the nature of the records generated in the inventive process, the similarities and differences of these records from records of earlier technological developments, historical issues in computing that are similar to historical issues involving other technological developments, and the problems with accessibility to the records. Position papers of Institute staff were submitted in advance of the workshop.

The workshop agenda was organized around five sessions. In the first session, CBI and Museum staff described the "problem" and their reasons for organizing the meeting. There followed a discussion in which the participants commented on this summary. Many of the questions raised at this time came up frequently in each subsequent session. In the second session, the computer scientists led a discussion about the nature of the development process from the conception of a system or system component to the manufacturing and sale phases. Some insights about the records' generation process came to light in this discussion. The historians took the stage for the third session and commented on the problem of resources for reconstructing the history of certain other technological developments that occurred in the last 150 years and the related problems they saw with resources for history of computing. Problems of classification schemes to set priorities for collecting artifacts and records and inherent difficulties with use of certain types of records were described and then discussed by the entire group. In the fourth session, corporate archivists described archival problems related to preserving company records. These were commented on by archivists with experience in appraising large collections of business records. The meet-

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### CBI FELLOWSHIP AWARDED



Stuart S. Shapiro

he has developed a six stage historical framework: complexity shifting (1945-1960) from machine code to assembly code to high level programming languages; vertical transportability (1960-1965) through software compatibility; imposing structure (1965-1975) through structured programming and top-down program design; modularity (1975-1980) through such languages as Pascal; horizontal transportability (1980-1985) through Ada and strict compiler validation procedures; and knowledge embodiment (since 1985).

Mr. Shapiro has a bachelor's degree in computer science from Northwestern University. His work experience includes developing educational graphics programs for personal computers and employment as an applications programmer.

### RESEARCH AT CBI ON THE EARLY COMPUTER INDUSTRY

Arthur Norberg recently received grants from the National Endowment for the Humanities (NEH) and the National Science Foundation (NSF) to study Engineering Research Associates (ERA), one of the early computer-related companies. The primary goal of this project will be to provide an account of the firm's origins in 1946 in St. Paul, Minnesota, and its influence in an industry that by 1957, as ERA faded from view, was on the threshold of major economic proportions.

A study of ERA's accomplishments and influence on developments is needed to complete our basic understanding of the origins of the industry. Major studies of Eckert-

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## RESEARCH NEWS

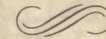
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**Donald A. MacKenzie**, University of Edinburgh, is writing a book on the origins and history of inertial guidance systems. His research for the book will investigate the nature of the inertial guidance industry, its relation to government, military, and commercial markets, and its relation to other cognate technologies. His study of the German V-2 group, Dr. Charles S. Draper's work at MIT, and John Moore and others at Autonetics will address these issues. The study of these groups and other companies that became involved in inertial guidance systems will provide insights on how the early industry matured and differentiated, how problems were overcome, why some firms invested in new technology and others preferred conventional techniques. As an historian of science and technology and as a sociologist, Dr. MacKenzie is also interested in the more general issues of why science and technology change and the effects of these changes. If you would like more information, you may write to Dr. MacKenzie at the Department of Sociology, University of Edinburgh, 18 Buccleuch Place, Edinburgh EH8 9LN, Scotland.



**The National Air and Space Museum**, part of the Smithsonian Institution in Washington, D.C., is preparing a major gallery on "The Computer in Flight." It will focus on the

variety of uses of computer technology in the field of flight from use of CAD-CAM in aircraft design and manufacturing to on-board computer flight control systems to airline reservation systems. It will also display the many innovations in real-time computing, databases, graphics, and micro-miniaturization that were driven by needs in the aerospace industry. The gallery will include both a traditional time-line of significant events in computer and aerospace history and a highly interactive hands-on experience with CAD-CAM, graphics, and flight simulation. The gallery is scheduled to open in 1987. Dr. Paul Ceruzzi, curator in the Department of Space Science and Exploration, and Dr. Howard Wolko, curator in the Aeronautics Department, are responsible for the exhibit.

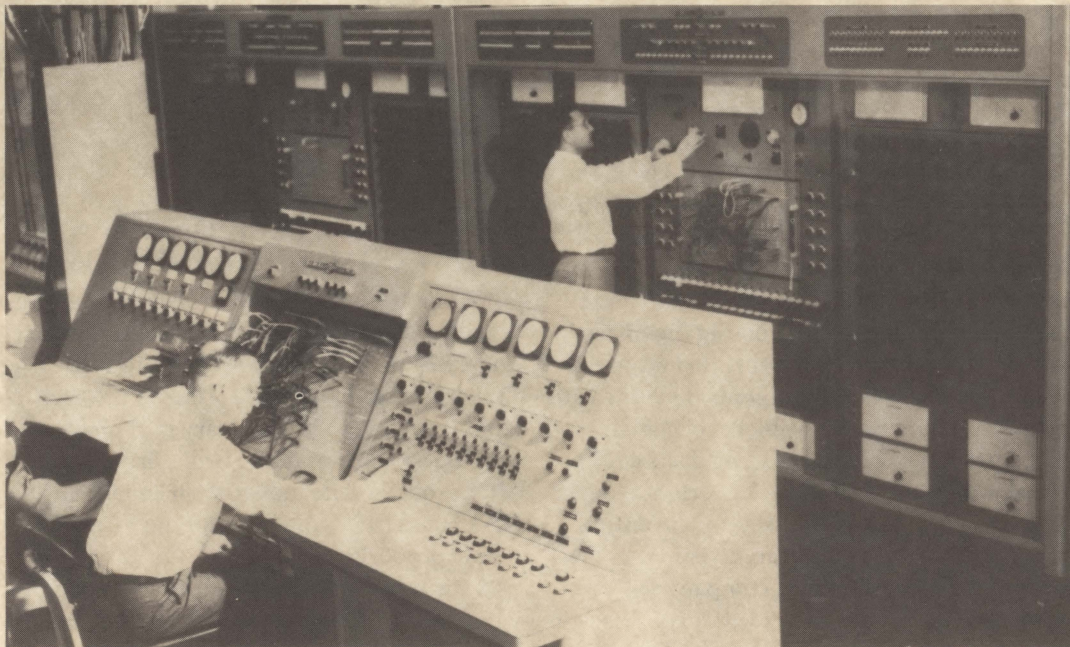


In 1984 **Bernard O. Williams** completed a doctoral dissertation in the history department of the University of Kansas on "Computing with Electricity, 1935-1945" in which he traces the development of mathematical machines, industrial mathematics and automatic control, mathematical weapons, electronic devices, and large-scale calculators in the decade preceding the first electronic, stored program computers. Dr. Williams is currently reviewing his dissertation for publication and would be pleased to hear from others who are interested in his project or who could contribute information about these developments. He can be contacted at 1618 Kentucky, Lawrence, Kansas 66044.

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## FROM CBI'S PHOTOGRAPH COLLECTION

General Electric's Power Control Simulator, an analogue computer built in 1955 to simulate the operation of a jet engine. George Jacobi, pictured standing, recently donated this photograph and other material relating to GE's early computer to CBI.



## PIONEER DAY AT NCC '85

The topic for Pioneer Day at the 1985 National Computer Conference (NCC) in Chicago is "AVIDAC, ORACLE, ORDVAC, and ILLIAC— The First Generation in Illinois." These four machines, patterned after the computer built at the Princeton Institute for Advanced Study under the direction of John von Neumann, were among the earliest computers. They were used primarily for large scientific and engineering problems associated with atomic and ballistic research.

Two sessions will be held on the afternoon of Wednesday, July 17. The first session, on "The Challenge, 1949-1953," will cover hardware and software developments at Argonne National Laboratories and the University of Illinois. The second session will focus on "The Impact, 1954-Present" on the University of Illinois and the national laboratories at Oak Ridge and Argonne.

For more information contact Margaret Butler, National Energy Software Center, Argonne National Laboratory, 9700 S., Cass Avenue, Argonne, IL 60439, (312) 972-7172.

## INTERNATIONAL TRANSFER OF TECHNOLOGY

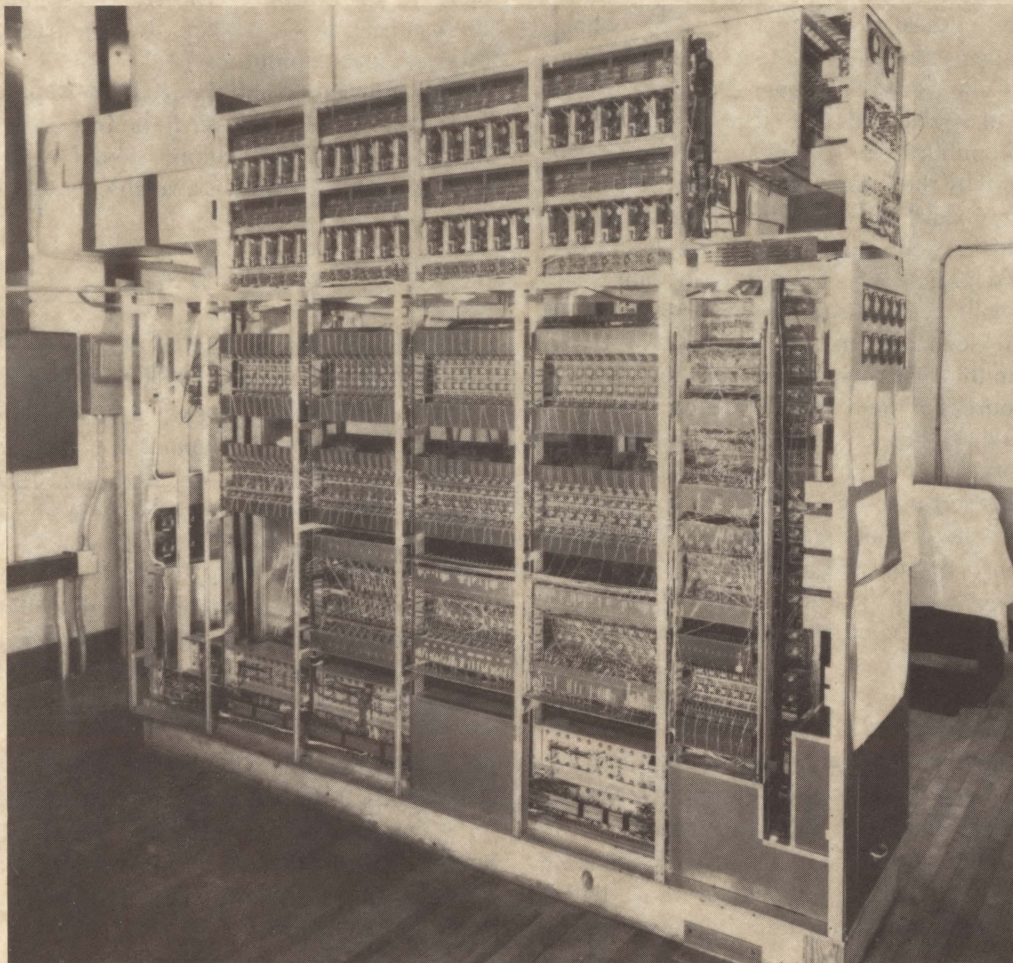
The XVII International Congress of History of Science will hold its quadrennial meeting at the University of California, Berkeley, July 31 to August 8, 1985. The general theme of the Congress is "Cross-Cultural Perspectives on Scientific Advances." One of the sessions, convened by Arthur L. Norberg, will focus on "Technology Transfer Across National Borders in the Twentieth Century." An international collection of speakers will describe modern technology transfer between at least six countries:

Jonathan Liebenau (London School of Economics), "A Case Study in the Transfer of a Medical Technology: The Production and Use of Diphtheria Antitoxin in Europe and the United States, 1890-1920."

William Aspray (CBI), "Patterns of International Diffusion of Computer Technology, 1945-1955."

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Rear view of the Ordnance Variable Automatic Computer (ORDVAC) developed at the University of Illinois for the Ballistics Research Laboratories. The photograph was taken on April 27, 1951. (From the Charles Babbage Institute collection)



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Patrick Fridenson (Université Paris X-Nanterre), "The Transfer of Automotive Technology from France to Japan in the 1950s."

Olav Wicken (Forsvarshistorisk Forskningscenter, Oslo), "Norway: The Role of Technology Transfer in the Establishment of a Local Computer Industry."

Paulo Bastos Tigre (Instituto de Economia Industrial, Rio de Janeiro), "Transfer of Computer Technology to Brazil: A Shortcut to Self-Reliance?"

For more information about the session described above, contact CBI. For information about the International Congress write the International Congress of History of Science, Office of History of Science and Technology, 470 Stephens Hall, University of California, Berkeley, California 94720.

### E. C. BULLARD PAPERS CATALOGUED

Sir Edward Crisp Bullard, FRS, (1907-1980) studied at the Cavendish Laboratory under P. M. S. Blackett and with H. S. W. Massey on electron scattering in gases. His first post in Cambridge was in the Department of Geodesy and Geophysics, where he devoted his research time to geophysical instrument design and development, gravity determinations, explosion seismology, and heat-flow in the earth. He became an internationally known expert, who later accepted posts in a number of universities including the University of California at San Diego (Scripps). His extensive collection of correspondence, diaries, research notes, journals and publications, dating from 1917 to 1980, has been catalogued by the Contemporary Scientific Archives Centre in Oxford and deposited in Churchill College Archives Centre, Cambridge.

Bullard searched for new ways to analyze the enormous quantities of data collected in his research and early became interested in mechanical means of calculation. His research papers from the 1950s contain work making use of the computer resources of the National Physical Laboratory, while he was director there, and the University Mathematical Laboratory at Cambridge. For example, one folder contains 18 descriptions of programs he wrote for use on EDSAC. He was also one of the developers of BOMM, a time-series analysis program used extensively between 1960 and 1976. These should be a good source of material on scientific applications of computers in the 1950s and 1960s.

### THE BRITISH COMPUTER INDUSTRY

There were two major early origins of the British computer industry. One is the British Tabulating Machine Company (BTM), which produced punched card tabulating and sorting equipment before the second world war. BTM moved into the computing business after the war, to serve

its punched card customers, similar to the path taken by IBM and Remington Rand in the United States. The other root is the cooperative work between the British universities, government, and industry in the period 1945-1955. Ferranti, Lyons, BTM, and English Electric all built their first electronic computing devices using the designs of early one-of-a-kind university or government laboratory computers; the companies worked respectively with Manchester, Cambridge, Birkbeck, and National Physical Laboratory. The chart on the next page depicts the genealogy of the British computer industry.

Most of the major U.S. firms have had cooperative ventures with British firms. Until 1949 BTM marketed IBM equipment in Britain. In 1956 General Electric, engaged in a joint venture with BTM to produce computers, called Computer Developments, Ltd. National Cash Register and Elliott Brothers entered into a marketing agreement in the late 1950s. In 1960 RCA entered into various marketing and development agreements with International Computers & Tabulators (ICT) and English Electric.

The British computer industry has been marked by extensive consolidation. Powers Samas and BTM merged in 1959 to form ICT. In the early 1960s GEC, EMI, and Ferranti were all consolidated into ICT. In the mid-1960s English Electric, Lyons, Marconi and Elliott Automation were merged to form English Electric Computers, Ltd. ICT and English Electric Computers, Ltd., merged in 1968 to form International Computers, Ltd. (ICL).

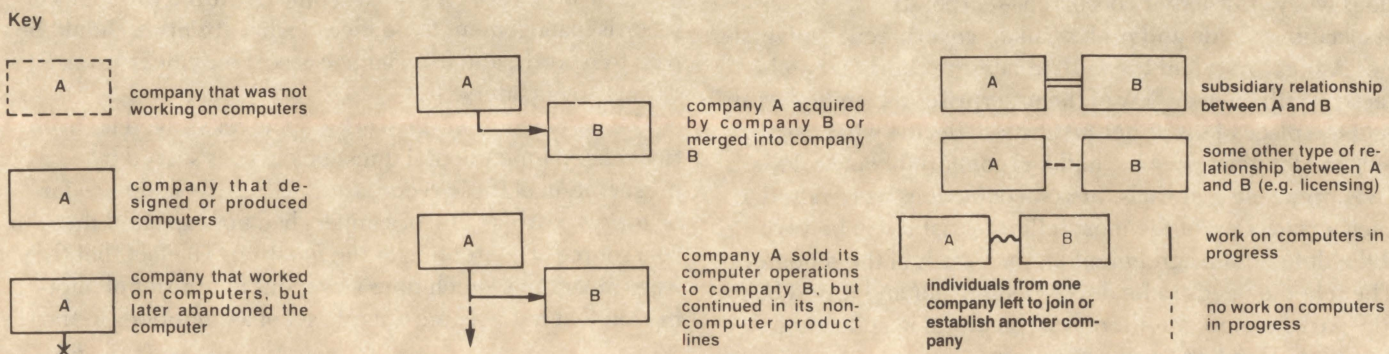
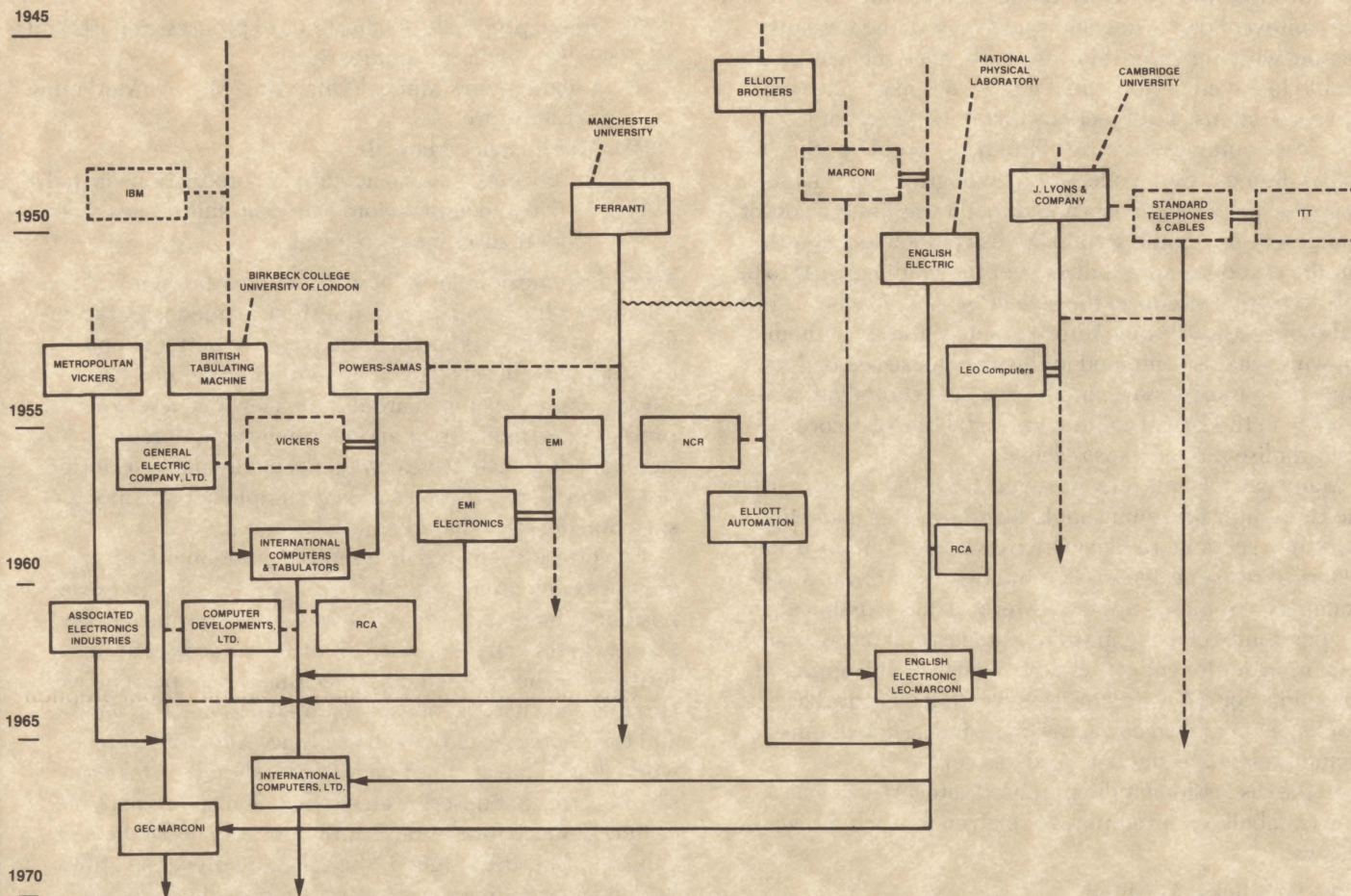
This information and the chart are adapted from Stephen C. Lutze, "The Formation of the International Computer Industry, 1945-1960," commissioned by CBI in 1979. Lutze's complete study is available for use at CBI.

### CBI RESOURCE MATERIALS ON THE BRITISH COMPUTER INDUSTRY

CBI holds a number of early British computer manuals for use by researchers. Prominent in the collection is material relating to the computers of the late 1950s and early 1960s, including Ferranti's Atlas, Mercury, Sirius, Perseus, and Pegasus; Elliott's 402E, 402F and 503; ICT's Orion and 1301; and EMI's EMIDEC 2400.

Also available are a number of early surveys describing British computer activity. The U.S. Office of Naval Research, London Branch, produced "state of the art" reports in 1959-1960, and again in 1967. Auerbach Electronic Corporation issued a broad survey in 1961 entitled *European Information Technology*. Beginning in 1959, Computer Consultants, Ltd. published the *British Commercial Computer Digest*, a survey of British computer hardware that included information about memory size, physical characteristics, price and peripherals. CBI currently holds only the 2nd edition (1960).

# GENEALOGY OF THE BRITISH COMPUTER INDUSTRY



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ing closed with a session where each participant gave a short summary of what they believed were the salient questions or issues needing attention.

However, participants did not confine their attention to the questions placed before them. Instead, they broadened the context of discussion and spent most of the time discussing whether everything available related to computing should be saved or not, and if not, who is most suited to make selections. To objections that it was impossible to save large volumes because of the space problem, the "save large volumes" group offered technological solutions such as optical discs. Archivists noted that it was not the cost of equipment that could stymie the use of such technology, but the cost of gaining control over the holdings so as to be able to retrieve items in the collection. To store boxes in a warehouse against some future group's interest without knowing what is contained in the warehouse seemed to some to be unnecessary, ineffective, and shortsighted, especially in the face of continued production of records. No compromise position was reached.

Many participants offered suggestions about what CBI or the Computer Museum should be doing. This made the workshop seem more like a discussion about archival and historical research agendas for the two organizations. Two examples of topics in appraisal were: (1) a discussion about the possibility of using machine categories as a way of setting priorities for collecting documents, and (2) appraisal guidelines for collecting business project records that would go beyond an emphasis on technical documents and include related business records as well.

In the discussion on the proposed categories of machines, labels and examples were given for each category as follows:

- A. Significant Machines  
ENIAC, Whirlwind, UNIVAC, TX-O, etc.
- B. The Classics  
CDC 6600, IBM 360/30..., PDP-8, NOVA, etc.
- C. Exceptions/Interesting  
IBM STRETCH, ERA ATLAS, HP9100, etc.
- D. All the others—may have "Corporate history" or other contextual value.

This list is not complete. Other parts of the computing enterprise that need to be added to this group are the institutions where the activity occurred—corporations, associations (trade and professional), government, universities, laboratories and the individuals (the computer architects). With an overview of the enterprise, the archivist can find the place of his or her institution, decide what to collect and for what reasons, and feel comfortable in seeking and appraising materials. Several objections were raised to such a plan. One of the most telling is that it will be very difficult to obtain agreement on the details of the scheme. The scheme needs to be developed further and tested before we can know whether it can be useful in collecting records for the history of computing.

As is evident from the above list of machines the number of companies, as well as other types of organizations, is large. This presents a twofold problem. First, we need to know the range of record types generated in a given company for the projects in the different categories. These types were listed in several groups.

- I. Initial proposal/specifications to progress reports and final technical summaries.
- II. Programmers Manual/Operating Manual/Marketing Literature.
- III. Maintenance Manuals.
- IV. All documents associated with production, installation, and application. Financial summaries. Number of machines produced.

Second, we need to know how these records types and uses vary across the companies in question. Armed with this information archivists and historians can be better prepared to evaluate materials that come to their attention.

Consensus developed around the view that a scheme for preservation of machines and for other types of records should include extensive comments justifying the priority selection scheme offered and leave ample opportunity for selection decisions based on local criteria.

Two positions existed on appraisal guidelines for large volumes of technical records. These were based on presuppositions about what should be saved. One group worried about whether anyone could predict the needs of future historians. They argued that since this cannot be done with certainty, we have an obligation to save as much as we can, and this should be close to everything. Another group worked from the assumption that care should be taken to save records that describe an organization and its activities. Materials saved for this description do not need to be large volumes. But, they argued, the selection process is still involved and requires careful attention to individual cases. No one was in favor of a rigid set of guidelines. Archivists pointed out that rigid guidelines would not work for any enterprise.

A caveat was added about corporate records. Even if a creditable plan with adequate guidelines becomes available, access to corporate records will depend on attitudes in and policies of the individual company. These attitudes range from the necessity to protect company information of all kinds to indifference to historical study and the needs of historians. The policies range from structured programs of records management to no idea of what attention should be paid to records; and from ad hoc access judgments to strict closure to outsiders.

The participants at the workshop never strayed far from two related fundamental questions: who is served by preservation of these records and who is the audience for historical writing? The organizers had not expected these to be a source of contention at the meeting. The fact that they were meant that much time was spent in transfer of information that has become a staple set of assumptions in the

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## MEMBERSHIP PROGRAM:

As many of you who are already members of the Institute's Friends program are aware, CBI receives its support from the information processing community through your membership donations, corporate sponsorship and AFIPS. Your renewed or new membership assists CBI's effort to assure the existence of an accurate record of the information processing field's evolution. If you are not currently a "Friend of CBI," please consider becoming one.

A Babbage Associate \_\_\_\_\_ \$30 donation \_\_\_\_\_ besides supporting the work of CBI you will receive:

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( ) My company has a matching gift program or might be willing to support the work of CBI.

My check for \$ \_\_\_\_\_ is enclosed payable to the Charles Babbage Foundation which is the support arm of CBI.

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I am interested in the history of information processing:

- ( ) From the standpoint of someone involved in information processing.      ( ) Both of the above.  
( ) From the standpoint of a practicing historian.                                      ( ) For other reasons (Please state reasons).

Return to the Charles Babbage Institute, University of Minnesota, 104 Walter Library, 117 Pleasant Street, S.E., Minneapolis, MN 55455.

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archival community. The discussions about these assumptions and the positions taken by many in the group informed CBI on how better to address these constituencies in its future work.

In the summary given by CBI staff at the end of the meeting, their conclusions from the discussions were listed in the form of challenges facing collection development in this field and collection strategy projects that reveal more about the nature of the records and their accessibility. Many good ideas were expressed for such projects; several of which will be initiated by CBI in the near future. Two projects with a high priority that came from the meeting are: (1) to elaborate on the machines category scheme to test its usefulness and (2) to assemble what we know about the relationships among the types of documents generated and their importance as descriptors of the computing enterprise. The two reports will then be circulated for comment. This would be a first test of their value for identification and appraisal of historically significant records of all forms in the history of computing. These reports and the comments will become the first results of the development of an overall collecting strategy for the history of computing to be implemented by archivists around the world interested in working with CBI.

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Mauchly and Whirlwind have been done, and attention has been paid to preserving the papers of significant aspects of each of these projects. IBM, several years ago, initiated a technical history program to study its contributions to the industry, and the first volume of a new history is about to appear. Little has been done on the remaining element in the industry's foundations.

It is an opportune time for a disciplined project to uncover manuscript sources and to conduct oral histories to complement the manuscript and published sources. The project will result in a focused study of ERA that will help to provide a better appreciation of how government and industry interacted to create the modern computer industry.

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The Charles Babbage Institute For the History of Information Processing is sponsored by AFIPS and the information processing community. Arthur L. Norberg, Director

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