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## *Preface*

Before 1946 digital computer activity was developmental and in a preliminary stage. After 1956, a short decade later, use of digital computers was spreading and a digital computer industry was beginning to flourish. This decade represents a critical period in the development of digital computer technology, often perceived today as unmatched by any previous technological development. Whether this perception is correct or not, the computer stimulated technical developments and modes of social behavior that made the computing enterprise into a major phenomenon. This study explores the developments in the critical first decade of the electronic digital computer industry 1946–56. The overriding objective is to illustrate what made this decade so important in the history of computing. To build an effective fully electronic stored-program digital computer required several new developments in storage components, input–output systems, and programming concepts. The study explores these developments by focusing on two new firms established in 1946, Engineering Research Associates, Inc. (ERA) in St. Paul, Minnesota, and Eckert-Mauchly Computer Company (EMCC) in Philadelphia, Pennsylvania.

The work of ERA and EMCC necessitated a major financial partner, a role assumed by the U. S. government. Hence, in analyzing this decade, the study explores the interaction between the two companies and the government. It investigates the institutional context of technological change, how innovations developed under navy and army auspices were transferred to civilian use, and how, when new technologies were introduced, people in and out of the defense establishment responded to them.

A major portion of this work presents the origins, development, contributions, and interactions with others of ERA and EMCC from 1945 to 1951. By 1950–51, both companies were having problems with financing

and had to resort to transfer of control to backers in order to survive. Remington Rand acquired both ERA and EMCC at this time. The study contains significant attention to the operations of ERA and EMCC inside Remington Rand, when the former firms acted as independent subsidiaries. During this ostensibly free period, EMCC concentrated on commercial trade and ERA continued to serve the military market, though not exclusively.

In 1955, Sperry Gyroscope and Remington Rand merged to form Sperry Rand. Sperry created the Univac Division and began a formalization of the activities of the two former divisions into civilian and military product producers. However, this did not happen smoothly within the new company. Old wounds were still raw, and infighting resulted in decisions about management personnel and reporting lines that were unsatisfactory to many. Groups formed in a less formal age felt threatened by the changes. Moreover, these men had ideas for new products that were not acceptable to the new management, and the groups began to dissolve. New companies were organized and the complexion of the computer industry began to change substantially. Indeed, the industry as we know it today began to emerge. The study closes with an account of the management history of Remington Rand, its two computing subsidiaries, and of Sperry Rand as it established the Univac Division in 1956.

### *Acknowledgments*

Over the course of twenty years, an author accumulates many debts as he talks to a large number of people and visits a significant number of archives. I accomplished the writing in three waves, during three different phases of my life at the University of Minnesota. The first wave occurred in my early years as director of the Charles Babbage Institute. I observed in the early 1980s in magazine and newspaper reporting that several areas were touted as important in the computer industry, but if Minneapolis-St. Paul came in for a line or two, it was always as a previously important setting. Conversations with citizens of this area led me to believe that the history was worth telling, even if the glory years for computing were all in the past. I conceived the idea for a study of Engineering Research Associates. Grants from the National Endowment for the Humanities (NEH RO-21098) and the National Science Foundation (NSF SES-8420418) got the project off to a good start between 1984 and 1987. A contract from the Department of Defense (DARPA/IPTO)

interrupted the research and writing while we investigated the IPTO program and wrote a book on its support-groups activities. This manuscript went to the press in mid-1995.

The second wave occurred after I stepped aside from the directorship and after a bout with cancer in the mid-1990s, while I was a faculty member only in the university's Program in the History of Science and Technology and serving as Director of Graduate Studies. The university granted me a one-term leave and I began writing again. Progress was insufficient to bring the manuscript to completion when I was recalled to the directorship of CBI in 1999. In 2001, I returned to the manuscript determined to complete it. Through all this time, CBI also contributed to the project, so it too should be considered one of the funders, along with NEH, NSF, and the university.

In the course of the two decades I worked on this project, much more became known about the early years of the industry in the United States, more documents came to light, and historical study of the industry took on increased sophistication. I owe a great debt to many authors, all of whom, I believe, are noted in the footnotes to the chapters. Perhaps more important, I realized that the story of ERA could not be told well without also recounting the history of Eckert-Mauchly Computer Company and Remington Rand during the years 1946 to 1957. These additions essentially tripled the size of the project and the resulting manuscript—and the time!

There are a number of people to whom I am indebted for more specific reasons. Several conversations with Erwin Tomash, Arnold A. Cohen, and Willis K. Drake helped me to frame the initial study about ERA and the grant proposals that followed, as well as helped with many questions throughout the course of the project. My dear friend Erwin Tomash helped me in numerous ways, too many to acknowledge here, but I offer my profound gratitude. A number of people gave freely of their time through interviews: Walter L. Anderson, Dean Babcock, William W. Butler, H. Dick Clover, Arnold A. Cohen, Hugh Duncan, Robert Herr, John L. Hill, Frank C. Mullaney, William C. Norris, John Parker, Sidney M. Rubens, Edward C. Svendsen, James Thornton, Erwin Tomash, James H. Wakelin, Joseph Walsh, and Robert L. Westbee.

My historian colleagues—William Aspray, Martin Campbell-Kelly, Jeffrey Yost, Philip Frana, and James Cortada—served as sounding boards for many ideas good and bad. They have been a constant source of help and encouragement. I want to take special note of William Aspray, who has been a dear friend over the years, and was a great and

stalwart supporter of this project and so many other things I have tried to do during our twenty-year friendship. Richard Seaberg, vice president and chief executive in Minnesota, and Jack Nichols, head of public relations in Minnesota, of the Minnesota Sperry Rand facility granted me access to the records of Sperry Rand at the Eagan, Minnesota, site. We uncovered many very useful ERA records, which were then transferred to the Hagley Museum and Library.

A debt I will never be able to repay I owe to Bruce Bruemmer, former archivist of CBI. During phase one, Bruce helped me in many ways large and small to obtain records and photographs, and offered advice on where to search for unavailable items. Later, in phase three, Carrie A. Seib, assistant archivist of CBI, helped me with Web searches, the identification and selection of photographs, and with citations for arcane sources. To these two members and others of the CBI staff I say thank you.

At the Hagley Library, depository for the Sperry Corporation Records and other collections relevant to this study, I obtained much research help from Michael Nash and Marjorie G. McNinch. Michael and I had many conversations about matters to do with Eckert-Mauchly and Remington Rand over the years, and occasionally he went out of his way to look for materials at Unisys Corporation to supplement my materials. They, too, deserve many thanks. Lee Johnson and Marjorie Ciarlante of the National Archives and Records Administration helped me examine records of the National Defense Research Committee related to the Naval Computing Laboratory at National Cash Register during World War II and relevant U. S. Navy records related to the founding of ERA.

William Aspray and James W. Cortada read the entire manuscript before I sent it to The MIT Press. In the review process, I received comments from Erwin Tomash, Jeffrey Yost, and an anonymous reviewer for The MIT Press, which, when attended to, added strength to the manuscript. I am deeply grateful to all of these colleagues.