Core

A PUBLICATION OF THE COMPUTER HISTORY MUSEUM // SPRING–SUMMER 2007

REMARKABLE PEOPLE

Focus on Robert Noyce

RESCUED TREASURES

A collection saved by SAP

EXTRAORDINARY IMAGES

Computers through the lens of Mark Richards

THE BEST WAY TO SEE THE FUTURE OF COMPUTING IS TO BROWSE ITS PAST.

T e computer. In all of human history, rarely has one invention done so much to change the world in such a short time.

T e Computer History Museum is home to the world's largest collection of computing artifacts and offers a variety of exhibits, programs, and events. It's where computing history lives.

Come visit us and see how far technology has come.

EXHIBITS

Innovation in the Valley *(now – September 2009)*
Mastering the Game: A History of Computer Chess *(now – September 2009)*
Visible Storage: 600+ Artifacts from the Museum Collection *(now – May 2009)*
Charles Babbage's Difference Engine *(September 2007 – August 2008)*
Timeline of Computing History *(opening October 2009)*
Visit these and other exhibits online at: **computerhistory.org/exhibits**

COMPUTER HISTORY MUSEUM

Open to the public:
Wednesday, Friday, and Sunday: 1–4 p.m.
Saturday: 11 a.m.–5 p.m.

1401 N. Shoreline Blvd., Mountain View, CA
+1 650 810 1010

PUBLISHER & EDITOR-IN-CHIEF
Karen M. Tucker

EXECUTIVE EDITOR
Leonard J. Shustek

MANAGING EDITOR
Robert S. Stetson

ASSOCIATE EDITOR
Kirsten Tashev

TECHNICAL EDITOR
Dag Spicer

EDITOR
Laurie Putnam

CONTRIBUTORS
Leslie Berlin
Chris Garcia
Paula Jabloner
Luanne Johnson
Len Shustek
Dag Spicer
Kirsten Tashev

DESIGN
Kerry Conboy

PRODUCTION MANAGER
Robert S. Stetson

WEBSITE MANAGER
Bob Sanguedolce

WEBSITE DESIGN
Dana Chrisler
Ton Luong

computerhistory.org/core

For reprints and permissions, contact: core@computerhistory.org. *Core* subscriptions are a member benefit; for membership information, see the inside back cover. Address changes and other written correspondence may be sent to:
Computer History Museum
Attn: *Core* Editor
1401 N. Shoreline Blvd.
Mountain View, CA 94043-1311, USA

On the cover: The eight founders of Fairchild Semiconductor in the company's production area. Back row, left to right: Victor Grinich, Gordon Moore, Julius Blank, and Eugene Kleiner. Middle: Jean Hoerni. Front: Jay Last and C. Sheldon Roberts. Facing the group: Bob Noyce. *Photo courtesy of Stanford University Libraries, Department of Special Collections.*

Core

A PUBLICATION OF THE COMPUTER HISTORY MUSEUM // SPRING–SUMMER 2007

ABOUT THE AUTHORS

Leslie Berlin is project historian for the Silicon Valley Archives at Stanford University. Her first book, *The Man Behind the Microchip: Robert Noyce and the Invention of Silicon Valley* (themanbehindthemicrochip.com), won the 2006 Book Award from the American Association for History and Computing. Leslie holds a PhD in history from Stanford.

Luanne Johnson, cochair of the Computer History Museum Software Industry Special Interest Group, served as principal investigator for CHM's Information Technology Corporate Histories Project. Luanne has more than forty years of experience in the information technology industry as a programmer, software entrepreneur, and executive with industry-related nonprofit organizations.

Leonard J. Shustek is chairman of the CHM Board of Trustees and a partner in the investment firm VenCraft. The retired cofounder of Network General Corporation (now Network Associates), Len is an occasional consulting professor at Stanford University, where he earned an MS and a PhD in computer science. He is also a trustee of Polytechnic University in Brooklyn, New York, where he earned his BS and MS in physics.

Dag Spicer is senior curator of the Computer History Museum, where he has been since 1996. A former electrical engineer, Dag also holds advanced degrees in the history of science and technology from the University of Toronto and Stanford University.

IN THIS ISSUE

When I was a child, I hated history. It was boring, the teachers made me memorize irrelevant facts, and those facts bore no detectable relationship to my life. If "there is a history in all men's lives," as Shakespeare's Warwick tells King Henry IV, then what's so special about it?

The answer is that some history has impact. It changes lives. It inspires. It teaches. That is the history we must collect, and we must find exciting ways to present it.

This issue of *Core* has multiple examples of collecting and presenting history that has impact. It starts with the remarkable story of discovering a previously unknown treasure trove of the raw material of history, in the form of hundreds of important artifacts hidden away in a warehouse in industrial Germany and destined for the scrap heap. They were rescued, thanks to the generosity of SAP AG, in a mission worthy of *Raiders of the Lost Ark*.

Then on to another form of rescuing history: gathering the stories of pioneers while they are still available to be told. The Sloan Foundation–sponsored IT Corporate Histories Project used equal measures of web-based high technology and old-fashioned human outreach to accumulate valuable materials for historians and researchers to use.

The excerpts from our oral history of Bill Atkinson and Andy Hertzfeld about their experiences at Apple give us insight into a remarkable company culture at a time when established companies were threatened by young upstarts. There is good advice here, too, from how programmers can be great to how everyone should live life.

We have many remarkable heroes in the computer industry. Here Leslie Berlin presents anecdotes about Bob Noyce from her recent biography. Leslie not only shows us various sides of the Intel cofounder's personality, but also helps us find the lessons we can learn from his successes and failures.

Finally, we pause in the center section to appreciate the visual beauty of the computer and its component parts. There are many ways that computers are used to create art, but photographer Mark Richards shows us that, when looked at through the right lens, computers are art.

We hope you enjoy this issue of *Core* and, as always, we welcome your comments.

Len Shustek
Chairman

COMPUTER HISTORY MUSEUM

MISSION
To preserve and present for posterity the artifacts and stories of the information age

VISION
To explore the computing revolution and its impact on the human experience

Computer History Museum
1401 N. Shoreline Blvd.
Mountain View, CA 94043-1311 USA
+1 650 810 1010 main
+1 650 810 1055 fax
computerhistory.org

The museum is a 501(c)3 nonprofit organization, TID #77-0507525.

ANNUAL FELLOW AWARDS DINNER & CEREMONY

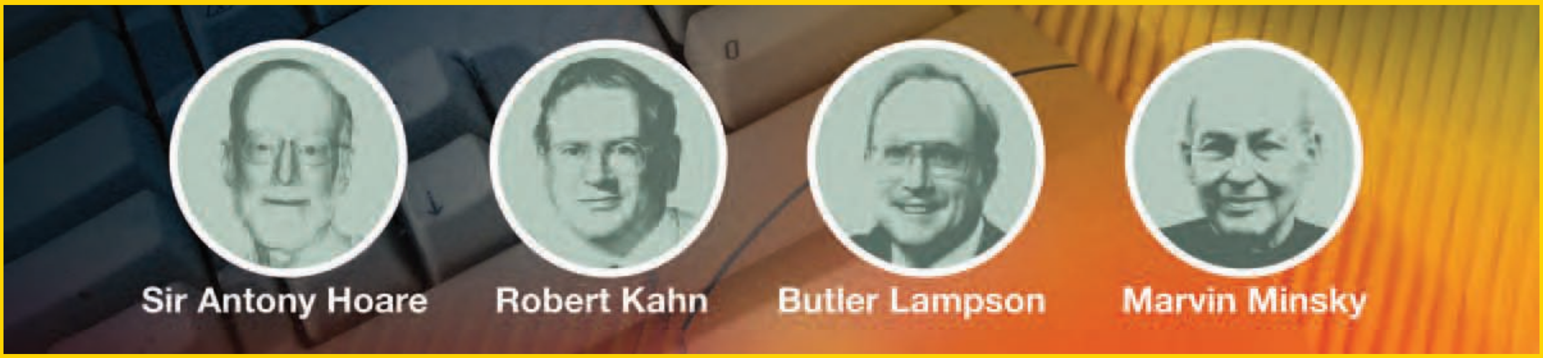
Meet the distinguished 2007 Fellows on Tuesday, October 16, 2007. This fall our event marks twenty years of celebrating the stories of the information age.

For more information, visit:
computerhistory.org/fellowawards

Thank you to our 2006 sponsors:

1185 Design
Bill and Roberta Campbell
Cisco
Carol and Chris Espinosa
Four Seasons Hotel Silicon Valley
Google
HP
Hunter Events
Madison Tyler Technology
Microsoft
SanDisk
San Jose Mercury News
SRI
SwiftPartners
Upright Marketing
Sammy Yip

LAST YEAR'S FELLOWS



Rescued treasures: A curator's personal account

On December 8, 2006, the CMA CGM Hugo, three football fields long and one of the world's largest deep ocean container ships, slipped into its berth at the sunny Port of Oakland.

Among its precious cargo of more than 8,200 forty-foot containers were six holding rare computer artifacts from a warehouse in northwestern Germany on their way to the Computer History Museum in Mountain View, their journey sponsored by software leader SAP AG. These artifacts were rescued only weeks earlier by a "rapid-response team" composed of Museum volunteer (and native German speaker) Alex Bochannek and me, the Museum's senior curator.

How did these rare objects make their multi-thousand-mile journey to the Museum and why?

ABOVE | CHM's Dag Spicer holding an IBM System/370 CPU sign.

LEFT | Phillips P 2934 dot matrix printer (ca. 1985) *in situ* in the German warehouse. That plants could grow vigorously shows the weak boundary between the inside and outside of the warehouse.

TRACES OF THE PAST

This story begins in August 2006, when Siegfried M., a computer programmer and consultant from Dortmund, Germany, notified the Museum about a collection of rare computing objects in a warehouse near him. (For privacy reasons, I use only the initial of Siegfried's surname.) The warehouse was on the outskirts of Castrop-Rauxel, a small town in an industrial area once rich in coal. The town was bombed with particular vigor by the Allies during World War II as it also had large chemical and explosives complexes—a "double score" for Allied bombers.

History is always present in Europe . . . and even during this mission, sixty or more years after the conflagration, traces of the past were all around us.

We determined that the Castrop-Rauxel warehouse was being used as an informal storage area by Gustav T., who apparently had hoped to establish a German computer museum of his own. Gustav appeared to have acquired a collection of items belonging to a professor at the University of Aachen and combined it with small computer collections from other sources. After some time, Gustav was faced with personal bankruptcy. As a creditor, it was now Siegfried's intent to have a court-appointed administrator seize the collection and dispose of Gustav's obligations to him through its sale.

It was at this point that Siegfried contacted the Museum as a possible buyer. We were certainly interested!

Being sensitive to issues of national pride, we ensured that other German museums had had a chance to look over the collection and potentially acquire items for themselves. This "ecosystem" approach is used by most museums to make optimum use of scarce resources. As long as something is preserved in a professionally managed and stable institution, CHM is agnostic about where items ultimately rest.

Siegfried and volunteer Alex Bochannek spoke on the telephone at length about the collection coming to CHM. Siegfried agreed to travel to the warehouse that weekend and take pictures of the collection *in situ*.

When we received the pictures, we were quite taken aback by the size of the warehouse and the scope of its contents. The warehouse was being shared with a construction equipment operator, and while it did have doors, they were left open all day and the warehouse contents were covered in dust . . . and, in places, bird droppings.

RIGHT | **Exterior view of the warehouse.**

FAR RIGHT | **Initial aerial view of the warehouse.**

BELOW | **Map of western Germany. The warehouse was located in the village of Castrop-Rauxel.**

It's a good thing Alex and I did not understand the scope of

A quick meeting was convened with CHM board chairman Len Shustek, CEO John Toole, and vice president of operations David Dial to discuss next steps, if any. In a letter to the Acquisitions Committee of the Museum, I expressed my optimism at the opportunity:

> Alex and I believe this to be an opportunity of enormous scale, diversity, and significance. The Museum has never had such an opportunity in its over three-decade existence to fill existing gaps in the collection, provide spares for possible restorations, obtain duplicate objects for loans or trades, and dramatically enhance the international scope of its collection.

We all agreed this collection had enormous potential and was at least worth a visit to assess it more closely. This was August 4. By noon on August 6, Alex and I were landing in Frankfurt—an airport of jaw-dropping scale—where we rented a car and then headed out onto the autobahn toward Dortmund. We arrived at our hotel in Castrop-Rauxel nearly twenty-four hours after leaving Mountain View.

THE WAREHOUSE

The next morning, Alex and I were to briefly meet Siegfried at the warehouse, which turned out to be a storage building of the German national power company, RWE. We were very excited, not knowing in what condition to expect the building or its contents. Once on site, we checked in with the locals who brought us into the building.

What met us was so overwhelming—so broad, so high, so deep—that Alex and I exchanged incredulous smiles, probably half out of fear, half out of joy. At the warehouse we briefly met Siegfried, a personable man who spoke superb English (like most Germans today), and then returned to the hotel to prepare for the first working day of the visit.

Considerable preparation had been made in advance at the Museum in Mountain View to identify as many items as possible from Siegfried's initial photographs. Once on site in Germany, Alex and I worked to a 2m-by-2m grid system in which the entire collection (more than 14,000 square feet in area) was divided. The contents of each 2m-by-2m square were recorded in a notebook and included (where possible) manufacturer, model, and any other relevant information. About 20 percent of the collection contained pallets of documents and media (magnetic and otherwise) containing historical software. Some of these documents were unique—site planning documents and sales "requests for proposals" from universities and businesses wishing to bring computers into their organizations. These are rare and offer a great deal of information about business processes and their automation at a time when many organizations were making their first foray into computing.

the collection beforehand or we may have become discouraged.

Most of the collection, however, was hardware—it took Alex and me ten days to survey it—ranging from Depression-era mechanical punch card office machines to mainframes and minicomputers.

While we worked away, after a few days Alex asked what the backhoe operator, who had been working just outside the building near us since we arrived, was doing. He was, to my chagrin but Alex's bemusement (bravado?), looking for unexploded World War II ordnance. An unexploded 500-lb. bomb had been located only a week before we arrived, about 1,000 feet away from where we were working. As I noted, history in Europe is everywhere, and even here—more than sixty years later near a warehouse in a small town—Allied bombs were still being found.

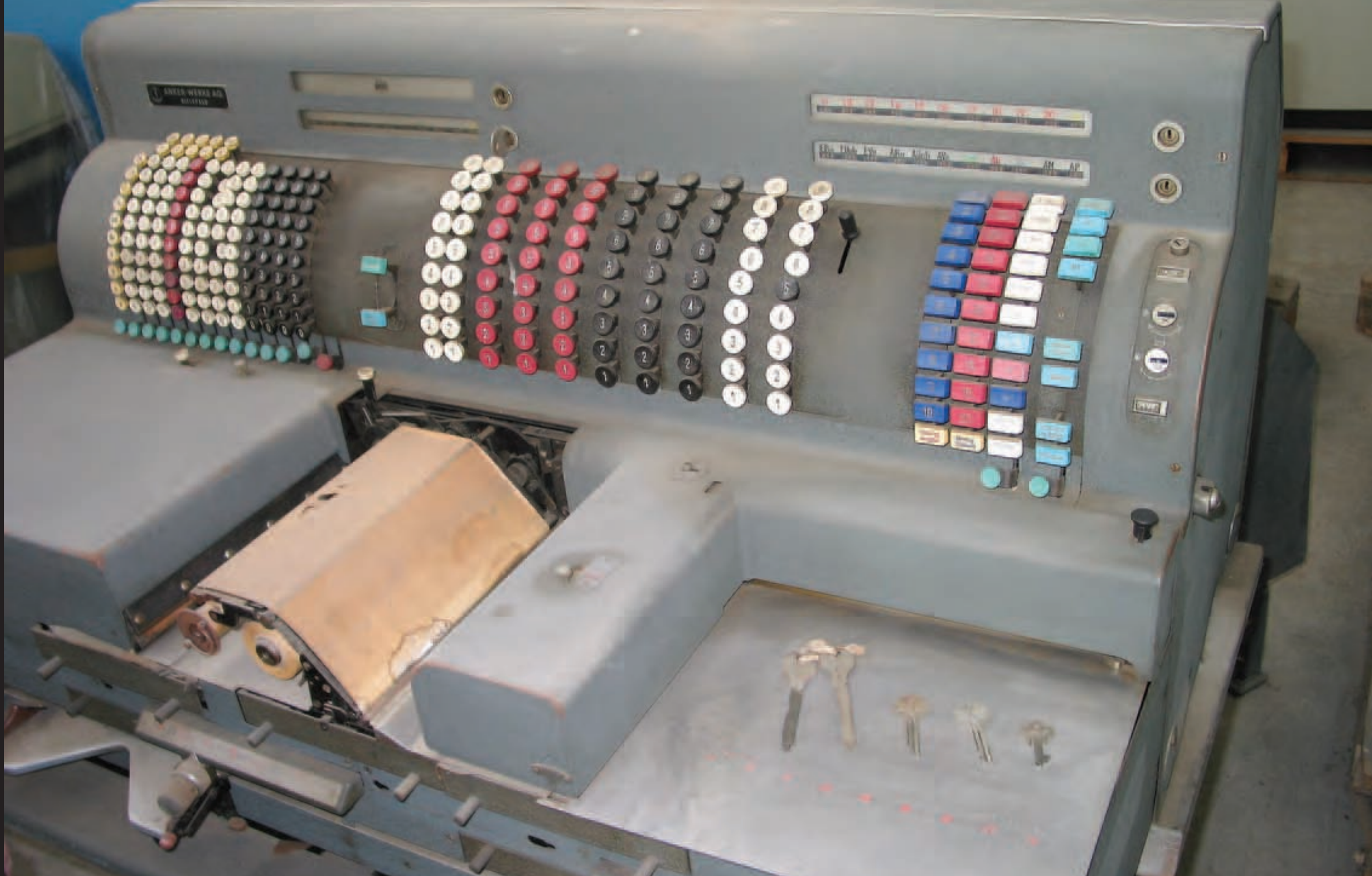
On Day 5, representatives from the German moving company Hasenkamp visited us to discuss how to ship whatever items we decided ought to be sent on to Mountain View (later indicated by a yellow sticker as Alex and I walked around the collection one final time). When they arrived, they had the same smile Alex and I had had on our first arrival: Was it fear? Disbelief? Amazement? They were to return twice more before we left.

WHAT TO SAVE, WHAT TO LEAVE

We now began the most difficult part of the adventure: deciding which items to save and which to leave behind. With a budget already stretched, we had the task of taking "only" seven ocean containers' worth of cargo. Alex and I had a great deal of support from CHM software curator Al Kossow, who put his research skills to great effect, whether it was looking up obscure German data processing equipment or commenting on the desirability of obtaining particular software. Vice president of operations David Dial was also critical in navigating the intricacies of international freight forwarding. Due to the span of computer history represented by the collection, the thousands of individual objects, the distances, and possible customs issues involved, this team approach was absolutely mandatory for success.

Alex and I displayed Marine-like discipline in not opening boxes at random and exploring their contents—much as we would have liked to! Sadly, on a project of this scale, one must make instant decisions or end up saving nothing. We *did* allow ourselves fifteen minutes of "unstructured playtime" each day, which we spent opening random boxes as fast as we could in hopes of finding some highly interesting object. We were usually not disappointed. A 1950s Anker-Werke accounting machine (shown on page 8) and a 1960s AEG-Telefunken computer system (pictured on page 9) were just two objects from the rescue mission.

I think it's a good thing Alex and I did not understand the scope of the collection beforehand or we may have become discouraged. Now, we not only had to arrange for shipping the items we wanted halfway across the world, we had to arrange for proper recycling of the electronic waste from the items we did not retain (mostly common microcomputers). Europe has very strict recycling regulations but, thanks again to Alex, we were able to navigate the shipping and recycling



Missions like this one are central to the Museum's purpose of being home to the world's

smoothly. Prior to final recycling, CHM also invited several German computer clubs to look at the items we did not take and to consider bringing them into their own collections.

As Alex and I finished tagging all the items coming to Mountain View on Day 9, we were glad to be leaving the respiratory problems, bird droppings, mold, rat poison, and occasional dead bird behind. We left early the next morning for the return flight to San Francisco.

When the Hugo finally pulled into the Port of Oakland, we were reminded of those days in the warehouse. Now we begin the multiyear process of inventorying and creating catalog records for each of the many thousands of objects in the donation. CHM also moved ahead by a year its planned purchase of off-site warehouse space to accommodate the German donation.

WORKING AGAINST TIME

Every day, year after year, the Computer History Museum works against time. Every year many thousands of tons of computer equipment are disposed of in the world's landfills—a problem unforeseen in the utopian days of early computing. Many of these items are rather uninteresting, mass-produced IBM-compatible machines of which the Museum has sufficient exemplars.

But others are truly worthy of being saved. Although we cannot know absolutely, it seems certain that extremely rare (in some cases unique) items from computing's early days are in this same waste stream. I say it "seems certain" because the few rescue missions with which CHM has been involved have had outstanding results—but have also left all involved with a feeling of "Wow, that was close!"

This incredible fragility of our world's material traces—hardware, software, the ideas behind them, the marketing materials, the people involved who can (for a while) be interviewed for an oral history—makes the window for preserving computing history especially narrow. While the delicate nature of artifact discovery and preservation is well known to archaeologists (from whom all museum curators draw some of their DNA), computers present unique challenges—first of which is a form of consciousness raising, so that old computers are not automatically considered to have no value.

Missions like this one are central to the Museum's purpose of being home to the world's largest and most important collection of computers and computing-related objects. While some may say CHM was lucky, it has always been my view that luck is merely the intersection of preparation and opportunity. As this German adventure shows, CHM remains prepared to preserve computer history at a moment's notice.

I would like to dedicate this article to Alex Bochannek, who has volunteered at CHM for ten years and without whose generosity of spirit and language skills this acquisition simply could not have taken place. Alex is also a patient and fun travel companion. The entire Museum also thanks software industry leader SAP AG of Walldorf, Germany, which made an outstandingly big-hearted gift of $250,000 to CHM for the shipping and logistical support of this collection. Thank you both. _Dag Spicer

FAR LEFT | **Anker-Werke AG accounting machine (ca. 1955). This transitional technology, between punch card and electronic accounting methods, was used by the German banking industry for decades.**

LEFT | **The "guano sorter" found in the warehouse. Wintering birds were responsible. Fortunately, this level of contamination was found only beneath warm warehouse lights, which were sparsely situated. For occupational health reasons, this item was not retained.**

BELOW LEFT | **AEG-Telefunken TR 440 computer system (1969). This now rare German mainframe formed part of Germany's national industrial strategy to develop expertise in computer design systems.**

largest and most important collection of computers and computing-related objects.

THIS COLLECTION BROUGHT TO YOU BY SAP

Opportunities to obtain a large collection of museum artifacts are rare, and the financial and preservation responsibilities that go with such initiatives are significant. A most generous gift of $250,000 from global software leader SAP AG helped to provide the required logistical support—as well as to cover shipping and storage costs—for the successful rescue of thousands of artifacts from more than 112 European and international manufacturers, including Telefunken, Siemens, Zuse, Olivetti, and Groupe Bull.

Several of the artifacts will be used to populate the Computer History Museum's 14,000-square-foot "Timeline of Computing History" exhibit, to be launched in 2009, as well as other future physical and virtual exhibits. The new collection greatly enhances the Museum's ability to undertake major exhibits, and will provide researchers access to unique technical information unavailable anywhere else.

Steve Maysonave's videotaped story describes the agreement between Digital Research, Inc., and IBM for distribution of DRI's CP/M operating system with the IBM PC.

COLLECTING THE STORIES OF **COMPANIES THAT CREATED THE INFORMATION AGE**

By Luanne Johnson

One summer Sunday in 1973, on David del Rio's first day of work at Software AG, the phone rang. A client in Los Angeles was having problems with a trial of Adabas, a database management system developed in Germany and distributed by David's new employer.

Within twenty-four hours, David was on a plane from Virginia to Los Angeles with Dick McGann, an "experienced" Adabas programmer who had been with the company two whole months. David's promised four to six weeks of training were compressed into an eight-hour flight to California, during which he frantically reviewed documentation—all in German—and asked questions of Dick—usually, "What is this in English?" That night he fell asleep over the manuals, and the next morning he was on site assisting the client.

A COLLECTION OF STORIES

If this story brings a smile to your face, it's probably because you, too, have a fly-by-the-seat-of-your-pants, scramble-to-deliver-the-goods story to tell. The information technology industry was built by people who hustled to get the job done despite ever-changing requirements, impossible deadlines, and slim lines of support all around. It was hectic; it was exhilarating; it was crazy. You either loved it or you got out.

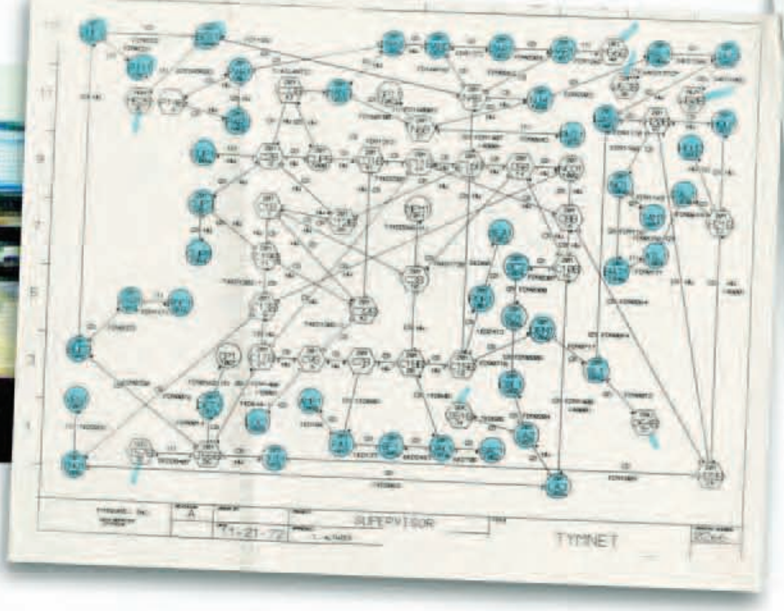
The IT Corporate Histories Collection (computerhistory.org/corphist) is a repository for these stories and many more materials that preserve the history of information technology companies. The collection was developed by a partnership of the Computer History Museum, the Charles Babbage Foundation, and the Software History Center (subsequently acquired by the Computer History Museum) and funded by a grant from the Alfred P. Sloan Foundation.

Through an initiative to use the Internet to preserve the recent history of science and technology, the Sloan Foundation encourages people to record history by telling their personal stories about working on technology projects. The IT Corporate Histories Collection focuses on stories told by people who worked for companies that developed and marketed information technology in all its permutations. The stories range from pithy anecdotes to in-depth descriptions of a company start-up or new product development. While most are memoirs written by the participants, the collection also includes a number of videotaped interviews.

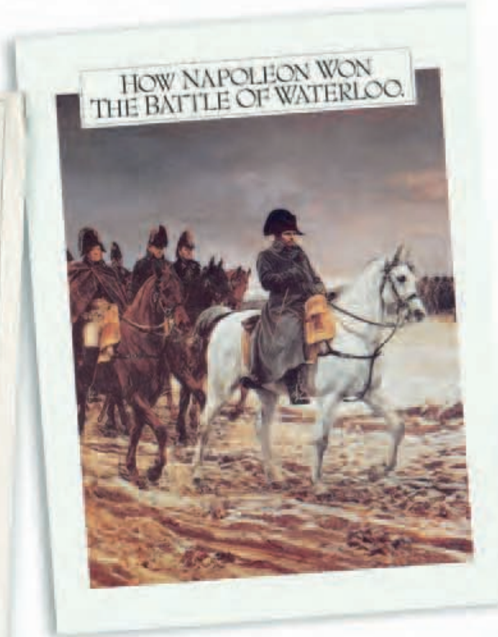
EXPLODING MYTHS

These stories provide great insights into the history of IT companies. Sometimes they serve to explode long-standing industry myths. For example, many in the IT industry have heard the story that Gary Kildall, the founder of Digital Research, Inc., blew off a meeting with "the suits" from IBM regarding licensing the CP/M operating system to go gallivanting in his private airplane. Supposedly the frustrated IBM folks turned to Microsoft's MS-DOS operating system for their PC, and DRI missed out on the greatest opportunity in the software industry.

Claims and counter-claims about this story have floated about for years. But Curt Geske was there. In his story "DRI and IBM—First Meeting," Geske tells us the meeting was a rather mundane affair between Dorothy Kildall, who ran the business end of things, and IBM lawyers over the wording of a nondisclosure agreement. IBM made it known that Microsoft already had a contract to do the work and expected DRI



A 1972 schematic of the Tymnet network. The Tymshare collection also includes schematics from 1974, 1975, and 1977, illustrating the dramatic growth of Tymnet.



From the Informix collection: A 1990s marketing brochure tells a fanciful tale of how Napoleon used the Informix On-Line database management system to manage his logistics and win the battle of Waterloo.

to supply them with the full source code for CP/M, which DRI was understandably reluctant to do. DRI and IBM did eventually reach an agreement for IBM to distribute CP/M, but as recounted in Steve Maysonave's videotaped story, the agreement was structured in a way that gave all the advantage to Microsoft. The outcome was consistent with the legend, but it hinged on the intricacies of contract negotiations rather than on Gary's preference for flying over attending meetings.

REVEALING INSIGHTS

Other stories in the collection support long-held beliefs. In the 1960s and 1970s, entrepreneurs had many war stories about how IBM—the "evil empire" of the time—was out to crush them. This was a persistent legend that was difficult to authenticate because IBM never had an official objective to crush competition. But stories from those who were there reveal how hard it could be to compete against a company that had such strong market dominance and controlled its customer accounts so effectively.

In "Day One at SAGNA," Michael Jakes recounts how a client refused to allow him to make copies of a report from a database selection committee that chose Software AG's Adabas over IBM's product. The client was so fearful of reprisals from IBM if the results of an analysis unfavorable to IBM leaked out that he allowed Michael, hidden in a conference room, only an hour to make as many handwritten notes as he could.

In another story, "MRX 1270 Terminal Control Unit," Robert DiMenna describes how IBM engineers provided incomplete interface specifications for their System 360/370 computers, and how the IBM salesmen exaggerated the risks of attaching non-IBM equipment to their computers, thereby retarding sales of the Memorex 1270. Clearly the competitive obstacles were real, whether they were the result of official IBM policies or simply the fallout of IBM's very focused marketing strategy.

REACHING OUT FOR MEMORIES

Because collecting personal stories was a key objective of the Sloan initiative, developing this collection required extensive outreach to find people who worked for these companies. The stories resulting from this effort are valuable historical source materials. Moreover, the outreach effort resulted in the collection of a large number of documents and other artifacts related to these companies—more than 1,500 documents in the online collection plus hundreds more donated to the Museum archives. The vast majority of these materials came from the personal files of individuals, not from corporate files. Because most of the companies covered by the project are defunct—long since acquired or otherwise out of business—the materials collected from the basements and attics of the participants represent historical information that was at risk of being lost forever.

More than 250 people have contributed everything from handwritten notes to organization charts to marketing brochures to network schematics—the whole hodgepodge of materials that employees of these companies saved for whatever reasons were important to them at the time. The Cincom collection includes marketing materials from the late 1960s that explain to potential customers what a database is and why you need one. Compare that to the Informix marketing brochure from the mid-1990s, which tells a fanciful tale of how Napoleon used the Informix OnLine DBMS to win the battle of Waterloo. In the intervening decades, database marketing materials had shifted from explanations of what the product was to attention-getting tactics.

The materials collected are critical to documenting the history of the industry that began to transform the world in the last half of the twentieth century. Thanks to the IT Corporate Histories Collection, they are being preserved to enlighten and inspire many generations to come.

CONVERSATIONS from the ORAL HISTORY COLLECTION

By Len Shustek

For many years the Computer History Museum has had an active program to gather videotaped histories from people who have done pioneering work in this first century of the information age. These recordings are a rich aggregation of stories that are preserved in the collection, transcribed, and made available on the web to researchers, students, and anyone curious about how invention happens.

The oral histories the Museum collects are conversations about people's lives. We want to know about their upbringing, their families, their education, and their jobs. But above all, we want to know how they came to the passion and creativity that leads to innovation.

Here, as an example, are excerpts from an interview conducted by Grady Booch on June 8, 2004, of Bill Atkinson and Andy Hertzfeld, who were major contributors to the creation of the Apple Macintosh.[1]

Bill Atkinson and Andy Hertzfeld.

1. Oral histories are not scripted, and a transcript of casual speech is very different from what one would write. I have taken the liberty of editing and reordering freely for presentation. For the original transcript, see: archive.computerhistory.org/search/oh.

The early 1980s were the Gold Rush days for the personal computer. We want to learn about the atmosphere of the time. There was, everyone says, something different about Apple.

HERTZFELD: The first computer I owned was an Apple II, serial number 1708, which I bought in January 1978. I wanted my own computer and checked out the Altairs and the IMSAIs, but I wasn't handy enough with a soldering iron. When the Apple II happened, I knew it was for me. I was a grad student at UC Berkeley, but it quickly just took over my life.

I wasn't an Apple employee then. I was one of those people who were led to Apple like a moth to the flame; the Apple II attracted me to Apple. I started at Apple in August of '79.

ATKINSON: The thing that drew me to Apple was this notion that you can do something with your life. Making a dent in the world is what Steve Jobs used to call it. You can have an impact for the positive if you are where things are being created.

I came to Apple in 1978. I was hired as the application software department, because there wasn't one. Actually, at the time I was a little better at pushing chips than software, but that's what they needed. So, okay, I can do that.

There is a famous legend that the Apple team visited Xerox PARC (Palo Alto Research Center) and carried away the user-interface ideas. What really happened?

ATKINSON: In 1979, when the Lisa team went to visit, we got to see the Alto and the Smalltalk System and I think the Bravo text editor. What people misunderstand is that we didn't just copy what we saw. It gave us great inspiration and gave us great confidence that, yes, we did want to do windowing, but then we had to go incrementally, evolutionary-wise, and develop this user interface a piece at a time by a lot of trial and error and a lot of stupid mistakes.

What really helped us was user testing. Larry Tesler was big on this. We wanted a beginning person to walk up and be able to figure it out. We'd give them tasks and say, "Here, edit this document and save it," and asked them to mutter a stream of consciousness. What are they thinking about? That was very important because *why* they do something is just as important as *what* they do. Thousands of these kinds of tests where you find that people made mistakes are what led us to the user interface.

The Mac project was run very differently from—and almost in competition with—the Lisa that had been started years earlier.

HERTZFELD: The Mac design did not flow out of the Lisa hardware. It was more like the Apple II, where you had a crazy genius coming up with very unorthodox techniques not used anywhere else. Burrell Smith, who designed the Macintosh digital board, really learned from Woz. The Apple II

Apple's Lisa II and Macintosh.

was the immediate predecessor of the Macintosh hardware, not the Lisa.

Lisa had seven different applications all developed by Apple, which was another way the Lisa team diverged from the Apple II. One of the characteristics of the Apple II was the third-party market. With Lisa the idea was that all the applications would be written by Apple. But you get a different spirit. The Mac brought it back home. It combined the Apple II spirit and a thriving third-party community. And Burrell and Woz are similar-type designers: the crazy genius instead of the conservative committee.

ATKINSON: The goals of the two were very different. We were designing the Lisa for an office worker, and since we weren't office workers ourselves, it was kind of hard to know exactly what they wanted. When the Mac was designed, I think we had a pretty clear picture of a fourteen-year-old boy using this thing, and we knew what they were like.

Every company has a unique culture for writing software. What was the Mac culture?

HERTZFELD: Freewheeling. Bill was really the center of coming up with the user interface, but he worked at home so he would come in maybe two or three times a week, usually when he had discovered something new. We would all gather around and talk about it and give him feedback.

ATKINSON: I'd get good suggestions from other people and say, "Oh, that's a good idea."

HERTZFELD: It was very loose. In the Lisa group there were a lot more philosophical arguments about what is the best way to do it in the abstract. With the Mac, it was much more, "Try it out and see how it feels," every step of the way.

PROFILE OF AN INVOLVED BOARD MEMBER

Gardner Hendrie

The founder and chair of the Oral History Committee at the Museum is Gardner Hendrie, who tackled that project like everything he does: comprehensively and in depth. He bought multiple sets of equipment, funded the necessary staff position, took a course in how to do oral histories, and for the last five years has been either videographer or interviewer (or both!) for at least a third of the more than 120 oral histories the Museum has done in locations all over the country.

Amazing as it sounds, this is only a small part of Gardner's contributions to the Museum. Gardner has been a trustee for more than twenty years, starting back when CHM was The Computer Museum in Boston. He is on the Executive and Finance Committees, for which he flies out from Boston every month. He is chairman of both the Exhibits and Investment Committees and has recently reinvigorated the Major Gifts committee. He personally gives at the highest level each year to the Annual Campaign and has made a multimillion-dollar contribution to the Museum Campaign. He funds special projects whenever he sees the need.

Gardner is a computer pioneer himself. He was the designer of several early minicomputers and was one of the founders of Stratus Computer Inc. Since 1985 he has been with Sigma Partners, a venture capital firm, and has served on many of their portfolio companies' boards.

For the last ten years Gardner has been my mentor and role model for energetic involvement. One of the great pleasures in being chairman of the Museum is the opportunity it provides to work with Gardner, and I thank him profoundly for that. _*Len Shustek*

Photo courtesy of Louis Fabian Bachrach.

But creating software is about more than writing programs that work.

ATKINSON: It's an art form. It's not just practical: "Does it do the job?" But is it clean inside? I would spend time rewriting whole sections of code just to make them more cleanly organized, more clear. I'm a firm believer that the best way to prevent bugs is to make it so that you can read the code and understand exactly what it's doing.

That was a little bit counter to what I ran into when I first came to Apple. There were a lot of people who prided themselves on how this little piece of code does something magic. I found that if I spent time going over the code, cleaning it up, making it sometimes tighter, but also making it so that it was straightforward for another person to follow in my footsteps, then I would feel proud of it.

Just as famous as the Apple visit to Xerox was Bill Gates's visit to Apple. Did Bill get it?

HERTZFELD: Well, he didn't get every detail, but definitely when he saw the Mac and the graphical user interface, he believed in it. He put a lot of resources on it, and Microsoft was really helpful in tweaking some of our rough edges. For a while they had almost as many people on the Mac as Apple did.

We always end by asking for advice for the next generation of innovators, in this case for software developers.

ATKINSON: If you want to get it smooth, you've got to rewrite it from scratch at least five times. Do a lot of user testing, because you can't see the things that you can't see. Don't try to ship that first prototype; hold off, and let it incubate in privacy. Don't tell the marketing people you're done when you've got the first fifth of it done! The thing that makes software smooth and useable is user testing, user testing, and user testing.

HERTZFELD: Pick things to work on that you really, really want to use yourself. You can close the loop with the user testing, but if you are one of the users, you can just iterate in your head.

Of all the things you can work on, work on the thing that isn't in the world that you want to make be in the world. Then you can be both user and creator. There is real power in that. To some extent, that's the secret of the Mac's success. We all wanted the Mac more than anyone else. So much so, that we had to make it.

Follow your heart. You have to do work each day that you believe in.

And that, my friends, is advice that applies to more than just writing software.

MY FIRST COMPUTER(S)

My first desktop computer (1982) was put together by San Francisco engineer and philanthropist Henry Dakin, who has helped many people in the nonprofit sector become computer functional. It consisted of a custom DOS-based computer, two eight-inch Shugart floppy drives, a big black-and-white CRT, and a dot-matrix printer. My first husband was an editor at the *San Jose Mercury News*, and the Merc outfitted its staff with TRS-80 laptops to cover the 1984 Democratic National Convention in San Francisco. I looked at his TRS-80 and said, "That's neat!" And got one for myself.

Dr. Gloria C. Duffy
President and CEO
The Commonwealth Club of California

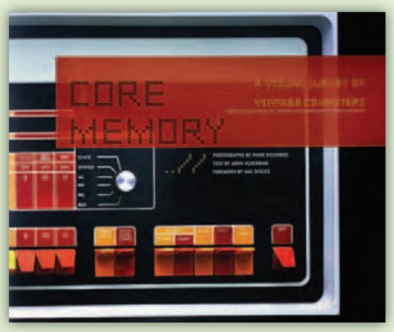
Why take pictures of computers?

Cray-3 "brick" module. Cray Computer Corporation, 1993. ***Photo © Mark Richards.***

Imagine we could be around during the time of the first printing press. What would you want to keep for civilization to see in the future? This is one of the questions I asked myself as I photographed these computers. I set out to document what I saw as the visual elements of the beginning of a new era, the age of the computer, a time as significant as the age of the early printing press.

I wanted my photography to express the kind of passion that men and women felt when they were inventing these machines. More than just taking pictures, I wanted both the layperson and the computer professional to feel what I felt. To see these machines as more than steel and wire and plastic. To see that these are ideas and dreams and lives.

As a still photographer I can use only two dimensions, color, form, context, and a few other tricks. I must use them with my enthusiasm and my imagination, while staying true to the machines. My hope is that my photographs will allow people to see these machines in a new way. _Mark Richards



Mark Richards has photographed diverse human subjects, from combat in Afghanistan for *Time* to street gangs in Los Angeles for *Newsweek*. A California native, Mark has covered Silicon Valley since the early 1990s. His images have earned numerous awards from *Communications Arts* magazine, and his work has appeared in publications such as the *New York Times Sunday Magazine*, *Fortune*, *Smithsonian*, *Life*, and *BusinessWeek*.

These pictures are from *Core Memory: A Visual Survey of Vintage Computers* (Chronicle Books, 2007), which features Mark's photographs of machines from the collection of the Computer History Museum with text by John Alderman. *Core Memory* presents "a guided tour through some of the most notable and curious devices in the history of computing." The book is available in the Museum gift shop or by contacting Jim Somers at somers@computerhistory.org. The price for Museum members is $30, including tax. The book's list price is $35.

THIS PAGE | **Univac I mercury delay line memory tank. Remington Rand, 1951**.

OPPOSITE PAGE, TOP | **Close-up of ENIAC (Electronic Numerical Integrator and Computer) Function Table. U.S. Army, 1946.**

OPPOSITE PAGE, BOTTOM | **CDC 6600. Control Data Corporation, 1964.**

All photos © Mark Richards.

“Go off and do something wonderful”

FOUR STORIES FROM THE LIFE OF ROBERT NOYCE // BY LESLIE BERLIN

Bob Noyce (left) and his older brother Gaylord proudly display the glider they built in the summer of 1945.

Image courtesy of Stanford University Libraries, Department of Special Collections.

Robert Noyce was called the Thomas Edison and the Henry Ford of Silicon Valley: Edison for his coinvention of the integrated circuit, a device that lies at the heart of modern electronics; Ford for his work as a cofounder of two companies—Fairchild Semiconductor, the first successful silicon firm in Silicon Valley, and Intel, today the largest semiconductor company in the world. Noyce also mentored dozens of entrepreneurs, an effort he loved and called "restocking the stream I fished from."

Right up until his death in 1990 at the age of sixty-two, Noyce was a daredevil. His jacket bore a patch that read, "No guts, no glory." It was a fitting motto for a man who flew his own jets and took time off every year to go helicopter skiing. It is no wonder, then, that for many his life encapsulated the high-flying, high-risk, high-reward world of high technology.

It is impossible to do justice to Noyce in a brief article. Instead, I offer four stories that provide glimpses into what made him one of the twentieth century's most important inventors and entrepreneurs. And in the spirit of Noyce's belief that the best knowledge is knowledge that can be used, each story includes a "take-away" for readers.

> For Bobby Noyce, the real test of success would be if he could, as he put it, "jump off the roof of a barn and live."

BOYHOOD ADVENTURER

When Noyce was twelve, he and his fourteen-year-old brother Gaylord decided to build a boy-sized glider. They used no blueprints, only the knowledge they had gained from years of constructing model airplanes.

Building the glider was the highlight of the summer of 1940 for many of the seventeen children Bobby Noyce convinced to help in the effort. A boy whose father's furniture store received rugs on long bamboo spindles donated the rods for the glider's frame. A girl sewed the cheesecloth that stretched over the wings. And the boy with the newly minted driver's license was charged with hitching the glider to the back of his father's car to see if the plane could be flown like a kite.

But for Bobby Noyce, the real test of success would be if he could, as he put it, "jump off the roof of a barn and live."

That's what he resolved to do. He climbed up on top of the barn near his house, had someone hand him the glider, took a deep breath, and then ran right off the edge of that roof into the unknown.

He was only aloft for a few seconds, but he landed without crushing the machine and declared the experiment a success.

TAKE-AWAY. Noyce, at age twelve, already possessed three attributes that would define his future success as a technical entrepreneur. First, his technical ability with his hands is evident. Throughout his life, Noyce was respected by engineers as well as scientists because he was not simply a thinker; he was also a builder. Second, the adolescent Noyce pulled together a diverse team, each member of which he tapped for his or her ability to contribute something unique to the project. Finally, in the boy who reached the edge of the roof and kept on running, we see the soul of the man who lived without limits, a man who believed that every idea could be taken further. These three attributes—technical credibility, the ability to assemble and motivate a diverse team, and a "no limits" mindset when it came to goal-setting—underpinned Noyce's technical and business success.

SCIENTIST TO MANAGER

In September 1957, Noyce, then thirty years old, joined a rebellion led by seven of his coworkers. Julius Blank, Vic Grinich, Jean Hoerni, Eugene Kleiner, Jay Last, Gordon Moore, and Sheldon Roberts had met more than a year earlier when they were hired by William Shockley, coinventor of the transistor, to work at his new company in Mountain View.

In short order, Shockley proved an unpredictable micromanager. Even worse, he wrenched the company's focus away from silicon transistors, the broad market for which was apparent even at that time, to four-layer diodes that were difficult to build and served a limited market. The group of seven, soon joined by Noyce, decided to leave.

It was not easy to find someone willing to fund a start-up company managed by young technologists in 1957, but with the help of two New York bankers (one of whom was Arthur Rock), the group did so. Fairchild Camera and Instrument agreed to back the fledgling operation, Fairchild Semiconductor, and soon acquired it outright.

Noyce headed research and development at Fairchild Semiconductor. He adopted a hands-off management style that encouraged outside-the-box thinking, creative freedom, and collaboration. He was an excellent supervisor of technical work.

In January 1959, Noyce became general manager of Fairchild Semiconductor. A PhD physicist with no formal business training, Noyce taught himself business skills over the next eight years. Within a decade of the company's founding, Fairchild Semiconductor had 11,000 employees and $12 million in profits. For a while, its parent company (essentially all of whose profit came from the semiconductor division) was the best-performing stock on Wall Street.

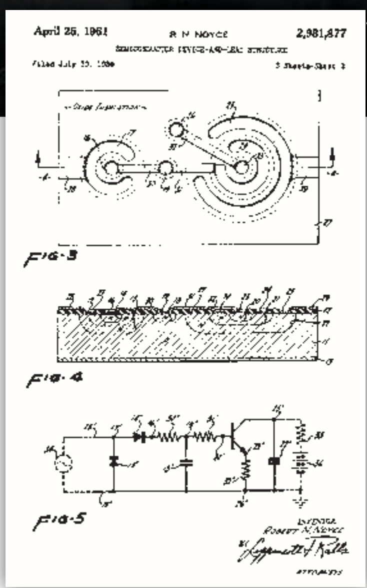
The eight founders of Fairchild Semiconductor in the company's production area.

BACK ROW, LEFT TO RIGHT: Victor Grinich, Gordon Moore, Julius Blank, and Eugene Kleiner.

MIDDLE: Jean Hoerni.

FRONT: Jay Last and C. Sheldon Roberts.

FACING THE GROUP: Bob Noyce.



At left, several key illustrations from Noyce's integrated circuit patent.

Then everything fell apart. Fairchild began missing scheduled deliveries. Products in the development stage could not be successfully transferred to manufacturing. The trickle of employees leaving Fairchild in recent years became a flood. In the third quarter of 1967, profits were 95.5 percent lower than a year before.

Fairchild Semiconductor declined for many reasons, but Noyce himself must bear some responsibility. His laissez-faire management approach—offering general directives rather than following up on specific process details—was ideal for inspiring and supervising highly creative technical work, but this management style did not translate well to large, multifaceted organizations.

TAKE-AWAY. Inspirational leadership alone is not effective management. At times, the same person can be both an excellent big-picture, rally-the-troops leader and an outstanding detail-oriented manager, but this was not the case with Noyce, who was the former but not the latter.

Noyce's experiences at Fairchild forced him to recognize his own shortcomings. "One thing I learned at Fairchild," he later admitted, "is that I don't run large organizations well. I don't have the discipline to do that, have the follow through."

When Noyce and his Fairchild cofounder Gordon Moore left the company in July of 1968 to start a small memory operation that today is called Intel, they deliberately split power evenly between them. This decision, which came directly from Noyce's having confronted his own managerial limitations at Fairchild, offers yet another take-away: Noyce was willing to act on the knowledge of his own professional limits.

INVENTOR

Of the seven patents Noyce filed in his first eighteen months at Fairchild, the best known is #2,981,877 for "Semiconductor Device-and-Lead Structure." Fairchild called the product developed on the basis of this patent—a complete electronic circuit built on a chip of silicon small enough to be carried off by an ant—a "monolithic integrated circuit." Nearly every electronic device today contains descendants of the integrated circuit in Noyce's patent application.

By the time Noyce's patent application was submitted, however, Noyce himself had left the lab—and research science—for good. As general manager of Fairchild Semiconductor, his primary contribution to integrated circuit development came through his funding relevant research and encouraging gifted researchers. It was not Noyce but a team led by his cofounder Jay Last and anchored by men such as Isy Haas, Bob Norman, Lionel Kattner, and Jim Nall that transitioned Noyce's notebook entry from good idea to real product. And in truth, Noyce's patent did not provide much guidance. It said that it ought to be possible to build integrated circuits using isolation techniques as well as the breakthrough planar process invented by Noyce's Fairchild cofounder Jean Hoerni. The patent did not, however, say how to make this possibility a reality. That was what Last's group figured out through their own remarkably innovative work, some of which earned team members patents on their own key ideas and processes.

TAKE-AWAY. Innovation is rarely the product of a single mind. Invention is best understood as a team effort, with the person ultimately called "inventor" occupying much the same space as the pitcher who has just had a perfect game. The outfielders might have caught a dozen fly balls, the first baseman might have nearly broken his neck to step on the bag an instant before the runner, the catcher might have called for pitches perfectly calibrated to each batter's weakness, but the record books note only that the pitcher threw a perfect game.

Noyce never hesitated to admit that his ideas about integrated circuits relied heavily on ideas that were "in the air" in 1958 and 1959. Without Hoerni, without Moore, without the work of Kurt Lehovec at Sprague, Noyce never would have imagined the integrated circuit in the way he did. Without Last, the microcircuits group at Fairchild, and other people around the world working in the field, Noyce's ideas would never have become marketable products.

MENTOR

After Noyce retired as Intel board chair in 1979—he remained a board member until his death—he enjoyed mentoring young entrepreneurs. Noyce worked with dozens of youthful technologists and funded many small companies. The best known of the entrepreneurs he encouraged was Steve Jobs, cofounder and CEO of Apple and cofounder of Pixar, Inc.

The two met in 1977, when Apple was a year old. Noyce's wife, Ann Bowers, headed human resources at Apple, and through her, Jobs deliberately sought out Noyce as a mentor. "Steve would regularly appear at our house on his motorcycle," Bowers recalls. "Soon he and Bob were disappearing into the basement, talking about projects."

Noyce answered Jobs's phone calls—which invariably began with, "I've been thinking about what you said" or "I have an idea"—even when they came at midnight. At some point he confided to Bowers, "If he calls late again, I'm going to kill him" . . . but still he answered the phone.

"He was very interested in—fascinated by—the personal computer, and we talked a lot about that," Jobs recalls of Noyce.

BELOW | **Bob Noyce and Steve Jobs in the mid-1980s. Jobs is one of many entrepreneurs who count Noyce among their major influences.**

For his part, Jobs believed that "you cannot understand what is happening today without understanding what came before," and Noyce gave him a way to experience what Jobs called "that second wonderful era of the valley, the semiconductor companies leading into the computer."

"Optimism is an essential ingredient for innovation."

TAKE-AWAY. There is an informal sort of generational succession in Silicon Valley that places Noyce near the top of the family tree. A few years ago, for example, the founders of Google asked Steve Jobs for advice and mentorship in the same way Jobs had come to Noyce when Apple was young.

Noyce believed that would-be entrepreneurs needed successful role models (though he never would have put it that way). His financial success directly benefited the entrepreneurs whose companies he funded as an informal angel investor, but the stories about his success indirectly inspired many more who thought, "If he can do it, I can, too." This belief is an essential aspect of any innovative culture because it encourages new ideas and risk-taking—and with it engenders a self-perpetuating cycle of entrepreneurship. "Optimism is an essential ingredient for innovation," Noyce—who often advised people to "go off and do something wonderful"—once said. "How else can the individual welcome change over security, adventure over staying in a safe place?"

All images courtesy of Stanford University Libraries, Department of Special Collections.

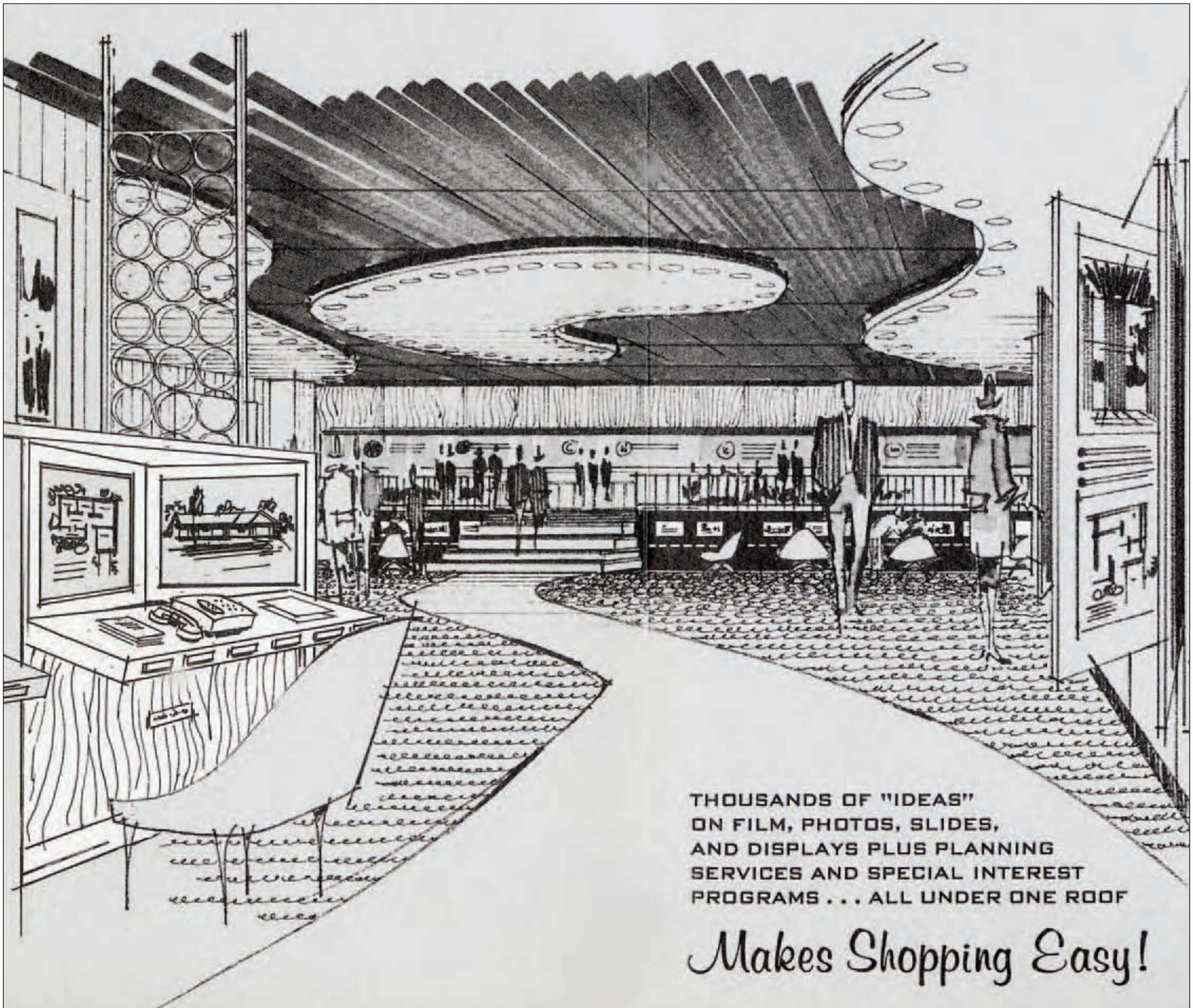
EXPLORE THE COLLECTION A sampling of objects from across the Museum's five collections

SLIDE-A-MAT RETAILING SYSTEM PROTOTYPE | CHM#: X3598.2006

DATE: 1965 | COLLECTION: OBJECTS | SOURCE: GIFT OF BRIAN KELLY CAROLAN

This 1965 prototype is early evidence of a novel concept in retailing that looks very familiar from our 2007 perspective. Want to bring your merchandise to potential ready-to-buy customers? Allow customers to compare products and services among vendors? Save them time? Allow them to shop from an armchair? Eliminate traffic congestion? These are not web-based ideas. They are just some of the advantages the Slide-a-Mat Retailing System offered—thirty years before the World Wide Web.

The Slide-a-Mat consisted of a custom desk with two rear-projection screens (with slide projectors inside), one of which showed a product or service and the other of which showed additional information such as specifications. If customers wanted to buy, they pushed one of the buttons running along the edge of the desk to specify the product, color, size, and other features.



LEFT | **Shoppers demonstrating the Slide-a-Mat.**

BOTTOM LEFT AND THIS PAGE | **Slide-a-Mat concept drawings and promotional materials.**

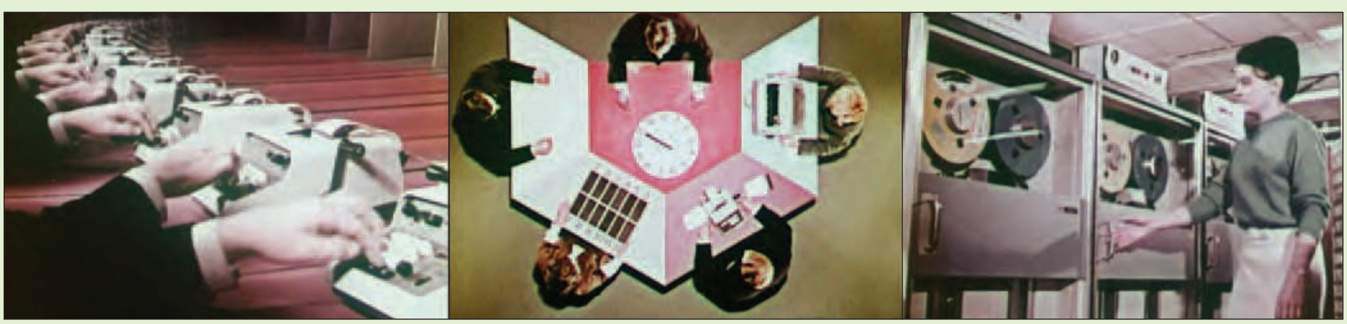
To enable customers to place orders, the Slide-a-Mat included a telephone with an optical sense card reader and a set of cards. When ready, the customer slid a vendor-specific plastic card into the telephone, which then dialed the vendor and connected the customer to a salesperson.

The Slide-a-Mat was patented, but internal problems led the company to go under. This prototype is the only physical trace of the system in existence. *_Dag Spicer*

MAN & COMPUTER, 16-MM FILM | CHM#: X3604.2006

DATE: 1965 | COLLECTION: MEDIA | SOURCE: GIFT OF HOWARD CHANG

Screenshots from *Man & Computer*.



Starting in the 1940s, IBM became a major producer of films used for training, documenting business processes, entertaining at company functions, and educating the public. Several IBM films were made by respected filmmakers and sometimes featured well-known actors such as Bob Newhart.

The film *Man & Computer*, made by IBM's UK branch in 1965, provides a basic understanding of computer operations. A large portion of the film shows the ways in which a computer can be simulated by five people using the standard office equipment of the day. The film employs a number of different techniques, including animations, and features a few brief scenes of an IBM System/360 in use—just months after the first machines were delivered.

_*Chris Garcia*

IBM SYSTEM/360 SALES MODELS | CHM#: X3749.2007

DATE: 1965 | COLLECTION: EPHEMERA | SOURCE: GIFT OF AL BURSTINER

On April 7, 1964, IBM made the most dramatic announcement in computer history. After investing nearly $5 billion in research and development, IBM had created a family of computer models that spanned a 40:1 performance range—and could all run the same software. This family of machines was known as the "System/360," an allusion to the system covering all points of the customer compass, from a small business doing payroll to a university undertaking scientific research to government agencies processing millions of checks per month.

Even though it was already the market leader in punch card equipment and "electronic data processing machines," this was a remarkable gamble by IBM.

After supporting seven mutually incompatible computer lines for years, IBM developed the System/360 as a means of simplifying their computer offerings for salespeople and customers alike. The System/360 was supremely successful. Its architecture dominated the mainframe computer industry for more than three decades and can still be seen in various IBM mainframes. IBM sold more than $100 billion worth of System/360 installations over the life of the family—a remarkable milestone, even by today's standards.

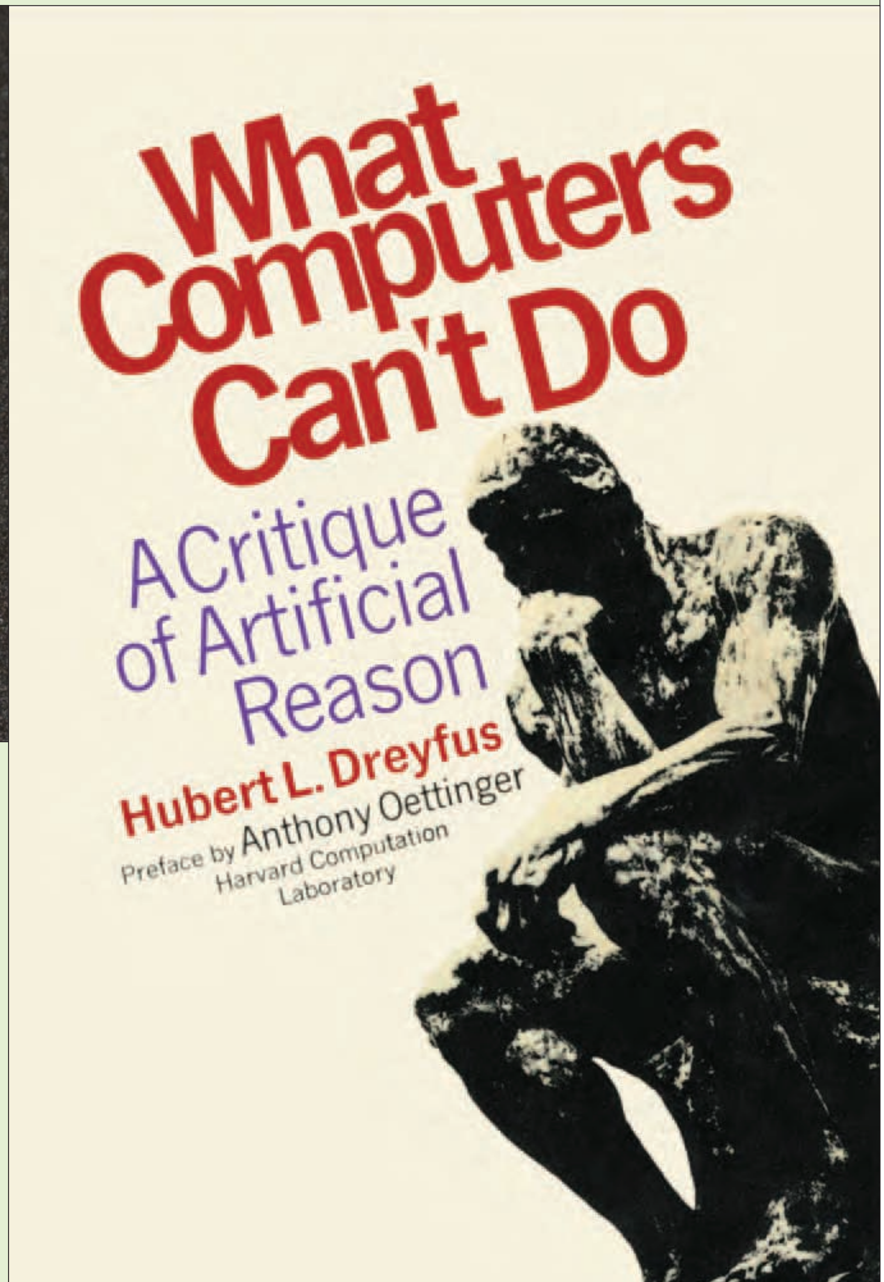
These sales models were used in two ways: first, as part of the presentation made by an IBM salesperson to potential customers; second, as a tool for planning computer installation and layout of the room where the computer would eventually reside. _*Dag Spicer*

TOP | **IBM System/360 sales models, 1965.**

BELOW | **IBM System/360 installation, 1965.**
Image courtesy of IBM Archives.

MACHACK VI VS. HUBERT DREYFUS, PAPER TAPE | CHM#: X3278.2006

DATE: 1967 | COLLECTION: SOFTWARE | SOURCE: GIFT OF BRUCE BUCHANAN



Hubert Dreyfus, a professor of philosophy at MIT in the 1960s, found that many of his students thought artificial intelligence (AI) was an already accomplished fact. This misplaced faith helped shape Dreyfus into an early critic of AI's claims, and in 1965 he was hired by the think tank the RAND Corporation to explore the issue. The result was a ninety-page paper questioning the computer's ability to serve as a model for the human brain and asserting, for example, that no computer program could defeat even a ten-year-old child at chess.

Two years later Richard Greenblatt, formerly an undergraduate at MIT, wrote a chess program using only 16K of memory for the DEC PDP-6 computer. The program, MacHack VI, played chess at a level far above its predecessors, a factor that would surprise Dreyfus (and the AI community) when demonstrated.

With some confidence, students at MIT challenged Dreyfus to play a game against MacHack VI. Dreyfus lost and the game became a milestone moment in AI—at least for AI proponents.

In fairness to Dreyfus, 1960s computers were primitive ancestors of today's machines, so to claim computers could think does indeed seem grandiose, even from today's perspective. After fifty years of research, one of the key conclusions of AI is that, for machines, simple things (e.g., tying a shoe) are difficult and difficult things (e.g., playing chess) are simple. _*Kirsten Tashev*

Can the machine, the robot, the computer replace man? Can man's behavior be formalized, his brain and body bypassed, to arrive at the essence of rationality? Is artificial intelligence possible? _*Hubert Dreyfus, 1972*

ABOVE LEFT | **Original paper tape from the chess match.**

ABOVE RIGHT | **Cover of Dreyfus's 1972 book, *What Computers Can't Do,* based on his RAND Corporation report of 1967.**

TYPED RESIGNATION LETTER FROM J. PRESPER ECKERT, JR., TO DR. PENDER | CHM#: X3278.2006

DATE: MARCH 25, 1946 | COLLECTION: DOCUMENTS | SOURCE: PURCHASE OF CHM

The transition of an invention from the laboratory to the marketplace, often difficult, is a process nearly every technology-based company must go through at some stage. In 1946, Presper ("Pres") Eckert and John Mauchly, inventors of the ENIAC computer at the University of Pennsylvania's Moore School of Engineering, wanted to form their own company but were constrained by their agreement with the university over patent rights to the EDVAC, ENIAC's successor.

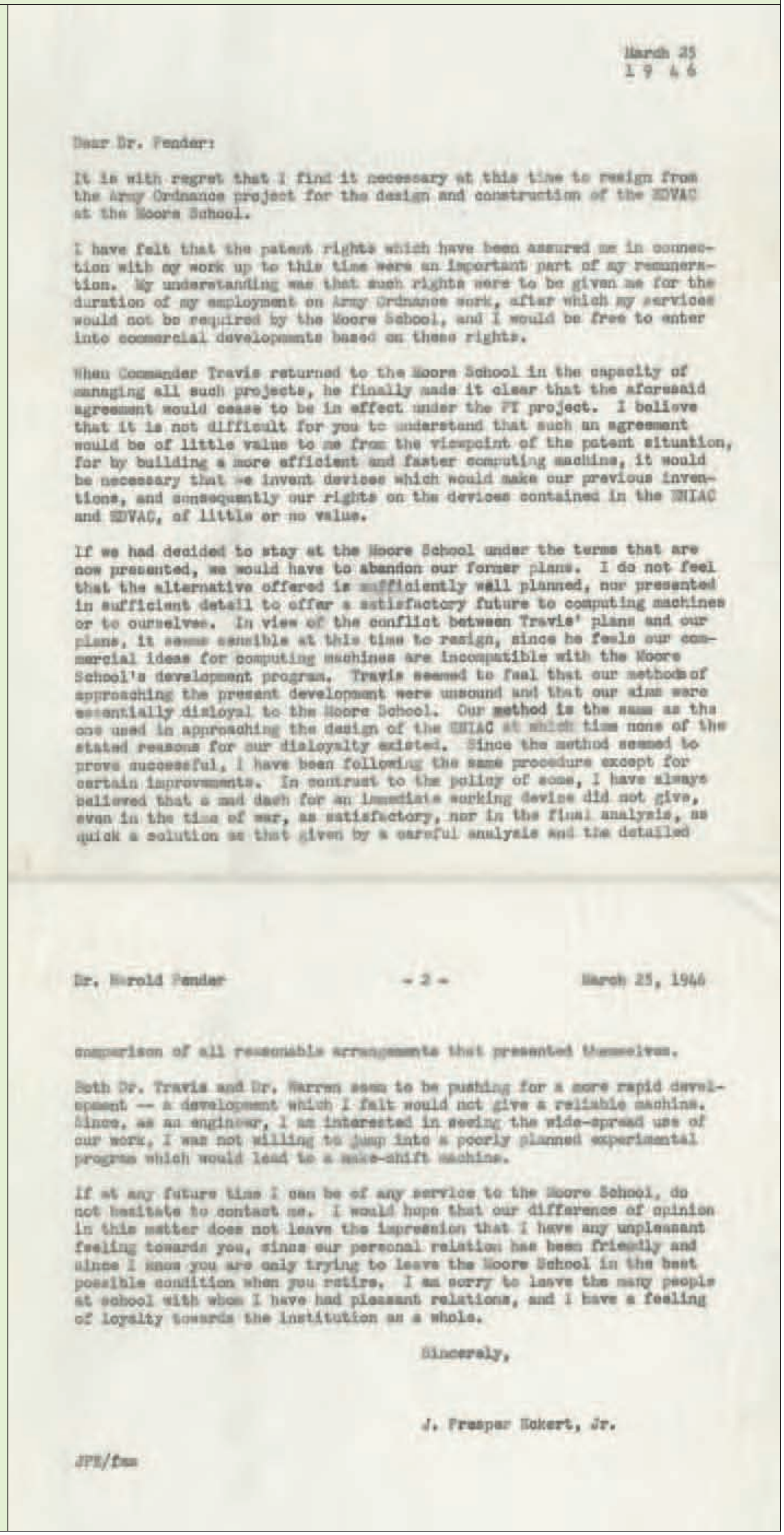
In his resignation letter, Eckert writes:

> I have felt that the patent rights which have been assured me in connection with my work up to this time were an important part of my remuneration…it seems sensible at this time to resign, since…our commercial ideas for computing machines are incompatible with the Moore School's development program.

Eckert and Mauchly founded the Electronic Control Company (ECC), which became the Eckert-Mauchly Computer Corporation (EMCC) in 1947. With the death of their main financial backer only two years later, Eckert and Mauchly sold their business to the Remington Rand Corporation. For this they received $200,000 and a guarantee of eight years of employment. Their first commercial computer, the UNIVAC I, was delivered to the United States Census Bureau on March 31, 1951.

Although their own business failed, leaving an opening for Remington Rand, Eckert and Mauchly remained pioneers in the development of large-scale electronic computing systems.
_*Paula Jabloner*

RIGHT | **Typed resignation letter from J. Presper Eckert, Jr., to the University of Pennsylvania's Dr. Pender, March 25, 1946.**



March 25
1 9 4 6

Dear Dr. Pender:

It is with regret that I find it necessary at this time to resign from the Army Ordnance project for the design and construction of the EDVAC at the Moore School.

I have felt that the patent rights which have been assured me in connection with my work up to this time were an important part of my remuneration. My understanding was that such rights were to be given me for the duration of my employment on Army Ordnance work, after which my services would not be required by the Moore School, and I would be free to enter into commercial developments based on these rights.

When Commander Travis returned to the Moore School in the capacity of managing all such projects, he finally made it clear that the aforesaid agreement would cease to be in effect under the PY project. I believe that it is not difficult for you to understand that such an agreement would be of little value to me from the viewpoint of the patent situation, for by building a more efficient and faster computing machine, it would be necessary that we invent devices which would make our previous inventions, and consequently our rights on the devices contained in the ENIAC and EDVAC, of little or no value.

If we had decided to stay at the Moore School under the terms that are now presented, we would have to abandon our former plans. I do not feel that the alternative offered is sufficiently well planned, nor presented in sufficient detail to offer a satisfactory future to computing machines or to ourselves. In view of the conflict between Travis' plans and our plans, it seems sensible at this time to resign, since he feels our commercial ideas for computing machines are incompatible with the Moore School's development program. Travis seemed to feel that our methods of approaching the present development were unsound and that our aims were essentially disloyal to the Moore School. Our method is the same as the one used in approaching the design of the ENIAC at which time none of the stated reasons for our disloyalty existed. Since the method seemed to prove successful, I have been following the same procedure except for certain improvements. In contrast to the policy of some, I have always believed that a mad dash for an immediate working device did not give, even in the time of war, as satisfactory, nor in the final analysis, as quick a solution as that given by a careful analysis and the detailed

Dr. Harold Pender - 2 - March 25, 1946

comparison of all reasonable arrangements that presented themselves.

Both Dr. Travis and Dr. Warren seem to be pushing for a more rapid development -- a development which I felt would not give a reliable machine. Since, as an engineer, I am interested in seeing the wide-spread use of our work, I was not willing to jump into a poorly planned experimental program which would lead to a make-shift machine.

If at any future time I can be of any service to the Moore School, do not hesitate to contact me. I would hope that our difference of opinion in this matter does not leave the impression that I have any unpleasant feeling towards you, since our personal relation has been friendly and since I know you are only trying to leave the Moore School in the best possible condition when you retire. I am sorry to leave the many people at school with whom I have had pleasant relations, and I have a feeling of loyalty towards the institution as a whole.

Sincerely,

J. Presper Eckert, Jr.

JPE/fmm

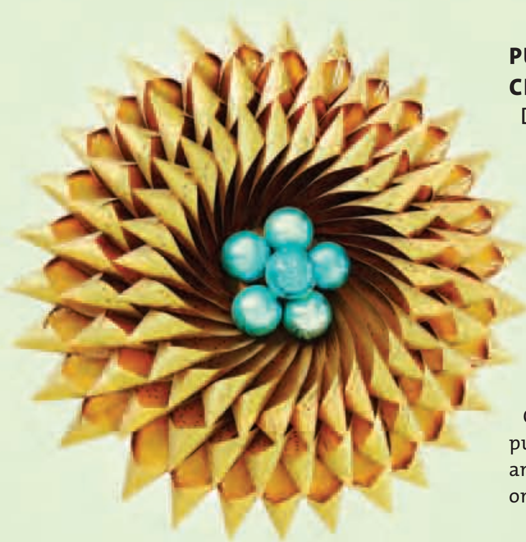
RECENT DONATIONS Objects selected for their rarity, importance, or whimsy

TELEBIT MODEM PROTOTYPE
DATE: 1980
COLLECTION: OBJECTS
SOURCE: GIFT OF ERIC SMITH
CHM#: X3570.2006

Prototypes fulfill an important part of the Museum's mission to explore the deeper forces underlying technological innovation. Often a prototype can show the genesis of an important idea or a "road not taken" before the object stabilized and came to market. This modem prototype represents the beginning of the company Telebit, which offered modems based on a new approach to data transmission over noisy lines. Telebit was founded by Paul Baran, a CHM Fellow (2005), and was later acquired by Cisco.

ITR TIME CLOCK
DATE: 1916
COLLECTION: OBJECTS
SOURCE: GIFT OF LEN SHUSTEK
CHM#: X3854.2007

International Time Recording Company (ITR) was founded in Endicott, New York, in 1889. It sold time clocks based on the 1888 patents of Willard Bundy. According to an original sticker located inside this particular unit, the time clock was shipped to R. Wallace & Sons Manufacturing Company of Wallingford, Connecticut, in 1916.

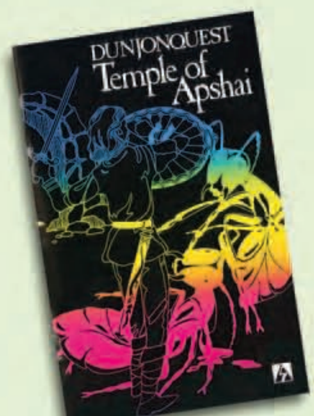


PUNCH CARD CHRISTMAS WREATH
DATE: 1962
COLLECTION: EPHEMERA
SOURCE: GIFT OF CAMILLE BOUNDS
CHM#: X3612.2007

Among the rarest things in the Museum's collection are "unofficial" objects created by computer users. This wreath, for example, was made over the Christmas holidays in 1962 using IBM punch cards. Its maker, a CalTech student, sold such wreaths to put himself through school. Due to its age and fragility, this wreath may be the only one of its kind.

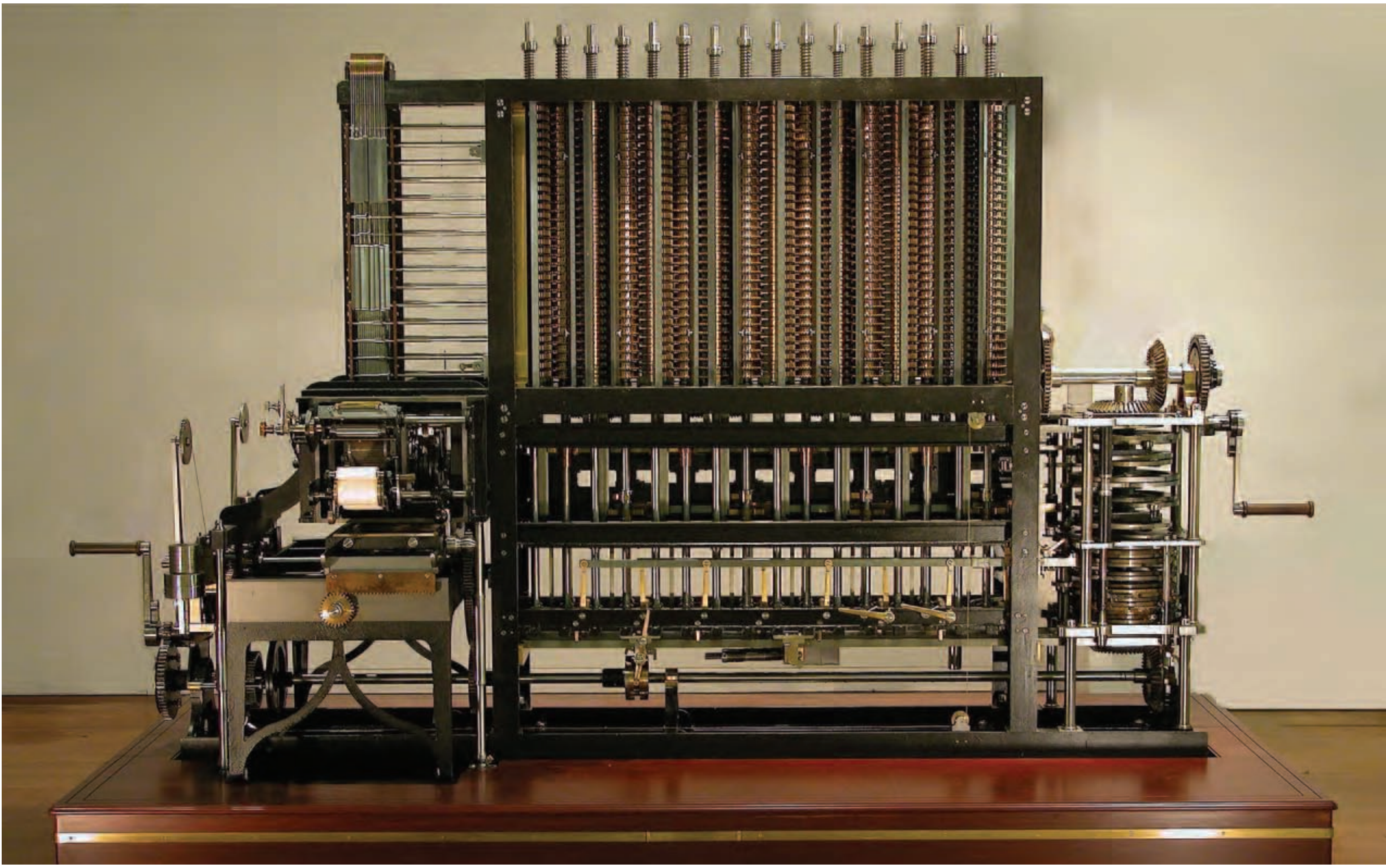
ROBOTS
DATE: 1970s–1980s
COLLECTION: OBJECTS
SOURCE: GIFT OF MONROE H. POSTMAN
CHM#: X3806.2007

By the mid-1970s, the microprocessor was inexpensive enough to place into toy and educational robots, which soon proliferated as often-whimsical links between the fearful imaginings of Shelley's Frankenstein and more sedate versions of robots as helpers. Often these robots simply integrated technologies into an android shell: many had cassette or eight-track tape players as well as home console video games built into them.



***TEMPLE OF APSHAI*, AUTOMATED SIMULATIONS, INC.**
DATE: 1981
COLLECTION: SOFTWARE
SOURCE: GIFT OF PHIL ROOT
CHM#: X3671.2007

Temple of Apshai was a computer role-playing game released for many platforms, including the IBM PC (the PC version is shown here). The game was inspired by role-playing board games of the 1970s such as Dungeons & Dragons. *Temple of Apshai* was followed by two sequels: *Gateway to Apshai* and *Hellfire Warrior*.



THE VICTORIAN COMPUTER: CHARLES BABBAGE'S DIFFERENCE ENGINE

In 1821, inventor and mathematician Charles Babbage was poring over a set of mathematical tables. Finding error after error, Babbage exclaimed, "I wish to God these calculations had been executed by steam." His frustration was not simply at the grindingly tedious labor of checking manually evaluated tables, but at the daunting unreliability of those tables. Science, engineering, construction, banking, and insurance depended on tables for calculation. Ships navigating by the stars relied on them to find their position at sea.

Babbage launched himself on a grand venture to design and build mechanical calculating engines that would eliminate errors. His bid to build infallible machines is a saga of ingenuity and will, which led beyond mechanized arithmetic into the entirely new realm of computing.

Though Babbage was not able to realize his dream of building a mechanical calculating machine, his vision was finally achieved in 2002 when the Science Museum of London completed the first full-sized Babbage Difference Engine. Over the past three years a duplicate engine, along with a printing apparatus, was built. The Babbage engine weighs five tons and consists of 8,000 parts. It is an arresting spectacle in operation.

THE BABBAGE ENGINE WEIGHS FIVE TONS AND CONSISTS OF 8,000 PARTS. IT IS AN ARRESTING SPECTACLE IN OPERATION.

This machine will be on display at the Computer History Museum for one year, beginning in September 2007. Guest curator Doron Swade, formerly of London's Science Museum, will be scheduling lectures both about Charles Babbage and about the Science Museum's task of building the Difference Engine. Throughout the year, CHM staff and volunteers will be demonstrating the machine, and an online exhibit will provide more information about Babbage and the Difference Engine.

For more information about lectures, demonstration schedules, and other events, call +1 650 810 1010 or visit: computerhistory.org.

Image courtesy of the Science Museum of London.

DONOR APPRECIATION *As of March 2007*

MUSEUM CAMPAIGN

EXA: $10M+

Elaine and Eric Hahn

Donna Dubinsky and Leonard J. Shustek

Bill & Melinda Gates Foundation

PETA: $5M–$9.99M

L. John Doerr and Ann Doerr

Jeff Hawkins and Janet Strauss

Gardner Hendrie and Karen Johansen

Dave House Family Foundation

Intuit, in honor of founder Scott Cook

TERA: $1M–$4.99M

Gwen and C. Gordon Bell

Mike and Kristina Homer

Burgess and Elizabeth Jamieson

Gloria Miner

John and Sheree Shoch

Anonymous

GIGA: $500K–$999K

Bill and Roberta Campbell

Sheldon Laube and Dr. Nancy Engel

Grant and Dorrit Saviers

Edward and Pamela Taft

Pierluigi Zappacosta and Enrica D'Ettorre

MEGA: $100K–$499K

Steve Blank and Alison Elliott

Campbell Fund

Patricia and Gene Carter

Dunlevie Family

Robert Garner and Robin Beresford

Harvey Family

Mark Horowitz and Jody Buckley

John Mashey and Angela Hey

Burton and Deedee McMurtry

Ike and Ronee Nassi

Bernard L. Peuto

The Harry and Carol Saal Family Foundation

KILO: <$100K

Sally M. Abel and Mogens Lauritzen

David and Robin Anderson

David Babcock

Peggy Burke and Dennis Boyle

Lori Kulvin Crawford

Andrea Cunningham and Rand Siegfried

David Emerson

Carol and Chris Espinosa

Samuel H. Fuller

Peter Hirshberg

Jennifer and Chuck House

Christine Hughes and Abe Ostrovsky

The Steven and Michele Kirsch Foundation

Pierre and Pam Omidyar

Stephen Squires and Ann Marmor-Squires

Karen and Mark Tucker

Peter and Cindy Ziebelman

CORPORATE SUPPORTERS

SUSTAINING: $100K+

SAP

FOUNDING: $50K+

IBM

INVESTING: $25K+

Microsoft Corporation

Mountain Winery

Palm

Rambus

Ropes & Gray

SVB Financial Group

SUPPORTING: $10K+

Broadcom Corporation

Fenwick & West LLP

Imation

Logitech, Inc.

Madison Tyler Technology

nVidia Corporation

SanDisk Corporation

Sigma Partners

CONTRIBUTING: $5K+

Fairchild Semiconductor

Liquid Computing

Mid-Peninsula Bank

Network Appliance

SDF Public Access

Six Apart

SRI International

IN-KIND CONTRIBUTIONS

1185 Design

Ardehali Consulting

Four Seasons Hotel Silicon Valley

HeartStrings Music, LLC Studio

Hunter Events

Interior Plant Design

Intuit

Krause Taylor Associates

Myers Sound Tech

San Jose Mercury News

SwiftPartners, LLC

Tekrati

Upright Marketing

Sammy Yip

THE CORE CIRCLE

CORE BENEFACTOR: 64K ($65,536+)

Paul G. Allen Family Foundation

Bell Family Trust

Campbell Fund

Donna Dubinsky and Leonard J. Shustek

Bill & Melinda Gates Foundation

Gardner Hendrie and Karen Johansen

Dave House

CORE PATRON: 32K ($32,768+)

Bill and Roberta Campbell

Ann and John Doerr

C. Lester and Audrey Hogan

Pierre and Pam Omidyar

John and Sheree Shoch

CORE SPONSOR: 16K ($16,384+)

David Bohnett Foundation

Bill Carrico and Suzan Woods Carrico

David Cheriton

Enrica D'Ettorre and Pierluigi Zappacosta

Homer Family Foundation

The Krause Foundation

Burton and Deedee McMurtry

Dr. Gregory Papadopoulos

Grant and Dorrit Saviers

David Sheraton

CORE PARTNER: 8K ($8,192+)

Paul and Evelyn Baran

Forest Baskett and Carolyn Bell

Steve Blank and Alison Elliott

Vinton and Sigrid Cerf

Ed and Lisa Colligan

David N. Cutler

Sonja and William Davidow

Elaine and Eric Hahn

Hitz Foundation

Mark Horowitz and Jody Buckley

Sheldon Laube and Nancy Engel, MD

Katherine and Robert Maxfield

Carver A. Mead and Barbara Smith

Teresa H. Meng

Gordon and Betty Moore

Gary and Eileen Morgenthaler

Ronee and Ike Nassi

Ken and Barbara Oshman

Suhas and Jayashree Patil Family Fund

Bernard L. Peuto

Frank and Denise Quattrone Foundation

Dave Rossetti and Jan Avent

Jon Rubinstein and Karen Richardson

Lawrence Schoenberg and Barbara Brizdle

The Stephen S. Smith and Paula K. Smith Family Foundation

The Vadasz Family Foundation

Steve Wozniak

THE CORE CLUB

CORE INVESTOR: 4K ($4,096+)

Association for Corporate Growth Silicon Valley

Craig and Barbara Barrett

Robin Beresford and Robert Garner

Larry Boucher

Richard and Eleanor Bravman

Peggy Burke and Dennis Boyle

Jack and Mary Carsten

Yogen and Peggy Dalal

Fusun Ertemalp

Judy Estrin

Federico and Elvia Faggin

Erik E. Fair

Edward H. Frank and Sarah Ratchye

Gideon and Sarah Gartner

Terry and Dotty Hayes

Neeru and Vinod Khosla

John Maguire

Linda and Mike Markkula

John Mashey and Angela Hey

Jami and Stephen Nachtsheim

Jim and Stephanie Nisbet

Charles L. Seitz

Heidi Henkel Sinclair

Stephen L. Squires and Ann Marmor-Squires

John and Elizabeth Toole

Bruce Wonnacott

Peter H. and Cindy Ziebelman

CORE CONTRIBUTOR: 2K ($2,048+)

Allan and Katie Alcorn

Gene and Marian Amdahl

David Anderson

Arthur and Jeanne Astrin

Carol Bartz and Bill Marr

Pam and Ron Bernal

Barry and Sharla Boehm

Jack and Cathy Bradley

June and Ned Chapin

Cogswell Polytechnical College

Simon Cooper

R. Tim Coslet

Andrea Cunningham and Rand Siegfried

Esther John and Aart de Geus

Michael Frank Deering

Reid and Peggy Dennis

Eleanor and Lloyd Dickman

Gary and Michelle Dillabough

El Dorado Ventures

David Emerson

Feigenbaum Nii Foundation

Bob Frankston

Nan and Chuck Geschke

Kathleen and Philip Gust

Jennifer and Chuck House

Christine Hughes and Abe Ostrovsky

Matthew and Connie Ives

Ted G. Johnson

Peter and Beth Karpas

Steven and Michele Kirsch Foundation

Sandra Kurtzig and Carl Brunsting

Sofia and Jan Laskowski

Laura and Gary Lauder

Catherine P. Lego

Roy Levin and Jan Thomson

Shawn and Doug Mackenzie

James and Patricia Markevitch

The McElwee Family

Debby Meredith and Curtis Cole

Howard Morgan

James N. Porter

Jeff and Tricia Raikes

Toni and Arthur Rock

Jean E. Sammet

Bob Sanguedolce

Greg Shaw

Rob Shaw

Tracey Stewart and Barry James Folsom

Rich and Cindy Tennant

Nick and Sue Tredennick

Jeanie Treichel

Guy L. Tribble

Karen and Mark Tucker

Wakerly Family Foundation

L. Curtis Widdoes, Jr.

Paul Winalski

Anonymous

CORE FRIEND: 1K ($1,024+)

Sally M. Abel and Mogens Lauritzen

Frances Allen

Connie and Charlie Bachman

John and Sheila Banning

Joe Bardwell and Anita Lenk

Allen Baum and Donya White

Brian A. Berg

Gary Boone

Jerry and Maria Brenholz

David and Arlene Brown

Richard and Virginia Case

Ed and Patti Cluss

William and Claudia Coleman

Wallace Colyer

John and Norma Crawford

Peter and Dorothy Denning

Les Earnest

Glenn T. Edens

Maria B. Evans

Peter A. Freeman

Samuel Fuller

John Galloway

Burton Grad and Carol Anne Ances

Rob and Yukari Haitani

John and Andrea Hennessy

Urs Hoelzle

Marcian and Judith Hoff

Madhulika Jain and Benjamin Chambers

George and Emily Jaquette

Doug Jefferys

Jerry Jensen

Pitch and Cathie Johnson

Anita Jones and William Wulf

Derry and Charlene Kabcenell

Robert Kahn and Patrice Lyons

Jeffrey and Marlene Kalb

Laurel and Ray Kaleda

Lee and Nancy Keet

Jerry and Judy Klein

Dr. and Mrs Leonard Kleinrock

Donald and Jill Knuth

Tom Kopec and Leah Carneiro

Bernard LaCroute

Dr. Joyce Currie Little

Karen and Walter Loewenstern

Frank McConnell

Lore Harp McGovern and Patrick McGovern

Seymour Merrin

George A. Michael

The Avram Miller Family Foundation

David and Lisa Mooring

Tom and Gillian Moran

Malachy and Jane Moynihan

John Muller and Linda Walton

Stanley and Joan Myers

Raymond G. Nasr

Randall and Julaine Neff

Donald and Helen Nielson

Max Palevsky

Joshua Parker

Paul R. Pierce

William and Rochelle Pratt

Dennis M. Ritchie

T.J. Rodgers

Alison and Kenneth Ross

Mark Roos and Catherine Rossi-Roos

The Harry and Carol Saal Family Foundation
Peter and Valerie Samson
John and Christine Sanguinetti
Jean Shuler
Roger and Elizabeth Sippl
Richard L. Sites
Alvy Ray and Zu Smith
Marcelline and William Smith
Verna and Bob Spinrad
Lee and Robert Sproull
Pamela and Edward Taft
John and Mary Ellen Toebes
Naoya and Masako Ukai
Andrew W. Verhalen and Janet L. Brownstone
Lorna and Duane Wadsworth
Willis and Floy Ware
Vern Watts
Sean Welsh and Louise Hornor
Gio and Voy Wiederhold
Warren Yogi
Anonymous

GENERAL SUPPORTERS

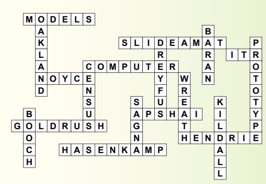
CHAMPION MEMBERS: $500+

Duane and Kathleen Adams
Dennis and Janet Austin
David and Madalyn Babcock
Ann Benett
Steve and Jane Bourne
Alison Chaiken and Wolfgang Rupprecht
Harry Chesley and Suzana Seban
Dona L. Crawford
Lori Kulvin Crawford
Steve and Beth Crocker
Kenneth Drexler
John R. Ehrman
Sarah and David Epstein
Jim and Kenna Fenton
Lance and Wendy Glasser
David and Dee Gustavson
Richard Hawes
Mary C. Henry
John Impagliazzo, PhD
David Jeschke
Randy H. Katz
Thomas E. Kurtz
David A. Laws
Susan Lesch
Donald and Alice Loughry
Gary W. Malone
Jay and Sharon McCauley
Dianne and William D. Mensch, Jr.
Dean O. Morton
Alex and Jiali Osadzinski
Debra Paget and Jeffrey Berg
Lorna and Donn Parker
Jay Perry
Arati Prabhakar and Patrick Windham
Tim and Lisa Robinson
James Sagawa and Karen Roberts
Angela Siddall
Gordon Stitt
Robert Supnik
Susan and Philip Yost

SUPPORTING: $100+

George B. Adams III
Craig J. Addison
Markus Alsleben
Eric A. Barbour
David A. Berlind
Lyle Bickley
Richard A. Blaine
Daniel G. Bobrow
Gilad Bracha
Charles W. Breckenridge
Daniel S. Bricklin
David Brock
Frederick P. Brooks, Jr.
Bathan Brookwood
Jeff Broughton
Charles D. Brown
John C. Brown
Michael A. Brown
Robert Brown
G. Edward Bryan
Jack Burness
David Burwen
Clay Busker
Chris Byrne
Paul D. Carmichael
Adam Cash
Robert H. Chaney
Peter Cirigliano
Thomas Clewe
Arthur Cohen
Danny Cohen
Edward Cohen
George E. Comstock
Michael A. Coulter
George W. Crabb
Suzanne M. Crocker
Charles Dana
Barton H. Darnell
Clive B. Dawson
Kyle Dent
David desJardins
Jim Dinkey
Michael Ditto
Michael Druke
Jane Dryden
Kenneth Duda
Duane Dunwoodie
David Ellsworth
Matthew Ettus
Debra Evans
Guy C. Fedorkow
Elizabeth Feinler
Robert Ferguson
Robert J. Ferguson
Philip H. Fleschler
Geoff Fortytwo
Joseph Fredrick
Kenneth Friedenbach
James Fruchterman
Mei Lin Fung
Rex Gardiner
Rita Gardiner
Steve Golson
Ed Gould
Andrew Grad
John C. Green, Jr.
Robert Grimm
Sharon Grimshaw
Jan Half
Rollin C. Harding
Jack Harker
Alys Hay
Dr. Martin E Hellman
Dan Henderson
Dewayne Hendricks
George Herman
Daniel S. Hill
Winston Hindle
Ron Hochsprung
Jack Holloway
Marc W. Howard
Ole J. Jacobsen
Luanne Johnson
Charles Jones
Curtis A. Jones
Jeff Kellem
Harwood G. Kolsky
Alan Kotok
Edward Kramer
Phillip Kurjan
James Kurkowski
Francesco Lacapra
Donald S. Levy
Jefferson D. Lilly
Robert J. Litwiller
Melissa Lohmann
Donald Loughry
Douglas S. Makepeace
Kunitsugu Makino
Daniel Mall
Thomas J. Malloy
Julius Marcus
Craig J. Mathias
Michael Mazour
Edward McCluskey
Michael McPherson
Anthony Mezzapelle
Kai Mildenberger
Gary Miller
Tim Mitchell
Patricia Montague
Jeffrey Moore
Mark B. Myers
Karen L. Myers-Hackem
Curt Nehring
Bill Newcomb
Dean Nichols
Ronald H. Nicholson, Jr.
Chuck R. Nile
Josh Noble
Landon Noll
David Novak
Tim R. Oren
Doug Pearson
Dr. John Peck
James L. Pelkey
George J. Perry
William Pollock
Catherine Povejsil
Vaughan Pratt
William Price
Hedley Rainnie
Rob Reis
Chris Ridder
Michael M. Roberts
David P. Rodgers
Jo Ann H. Roizen
James Rumbaugh
Jeffrey Safire
Rita Seplowitz Saltz
Ferrell Sanders
Kevin Savetz
Morey Schapira
David Schweizer
William Scull
Geoffrey Shearer
Richard Shoup
Olin Sibert
Thomas Sidle
Daniel P. Siewiorek
Stephen Skedzielewski
David Slate
Rene Sommer
Aaron T. Spink
Vladimir Steffel
Steven Stepanek
Robert S. Stetson
Philip Stillman
Oliver Strimpel
Gerald Stroffolino
Richard Taylor
Edward F. Thompson
Herbert E. Thompson
Geoffrey O. Thompson
Tommy Thorn
Eric Tilenius
Frank Tobin
Patricia Tomlinson
Frederick M. Trapnell
James B. Treleaven
Chris Tubis
Ellen Ullman
Fyodor Vaskovich
Dr. Norman W. Weinstein
Tom Weishaar
Eric J. Werme
Greg Wetzel
Donald Whittemore
Ron Wigginton
Walt Wilkins
Jan Willbanks
Vivian Wills
Duane K. Wise
Dr. Richard Wishner
Frank Yellin
William Yundt
John G. Zabolitzky

SOLUTION TO PAGE 32 CROSSWORD PUZZLE



PASSAGES

We are saddened to report on the passing of these computer pioneers since January 1, 2006.

Alan Kotok—May 26, 2006
Computer pioneer, architect, programmer

Bernard Galler—September 4, 2006
Computer pioneer, educator, founding editor, Annals of the History of Computing

Ray Noorda—October 9, 2006
Businessman, CEO of Novell (1982–1994)

Donald Wilson—November 25, 2006
LexisNexis developer

Al Shugart—December 12, 2006
Disk drive industry pioneer

Richard Newton—January 2, 2007
Electronic design automation and integrated circuit design pioneer

Jean Ichbiah—January 26, 2007
Principal designer of Ada programming language

Neil Lincoln—January 26, 2007
Supercomputing architect and pioneer

Jim Gray—January 29, 2007 (missing at sea)
Database pioneer

Doug Ross—January 31, 2007
CAD and software methodology pioneer

Ken Kennedy—February 7, 2007
High-performance computing pioneer

John Backus—March 21, 2007
FORTRAN team leader

Karen Spärck Jones—April 4, 2007
Pioneer in AI and natural language processing

CHM BY THE NUMBERS

$77,346,995 donated to the Museum Campaign. Only $47,653,005 to go!

IN THE COLLECTION

4,000 linear feet of documents (or **12 million** pages)
5,000 videos and films
5,000 software titles
20,000 photographs
20,000 objects and ephemera

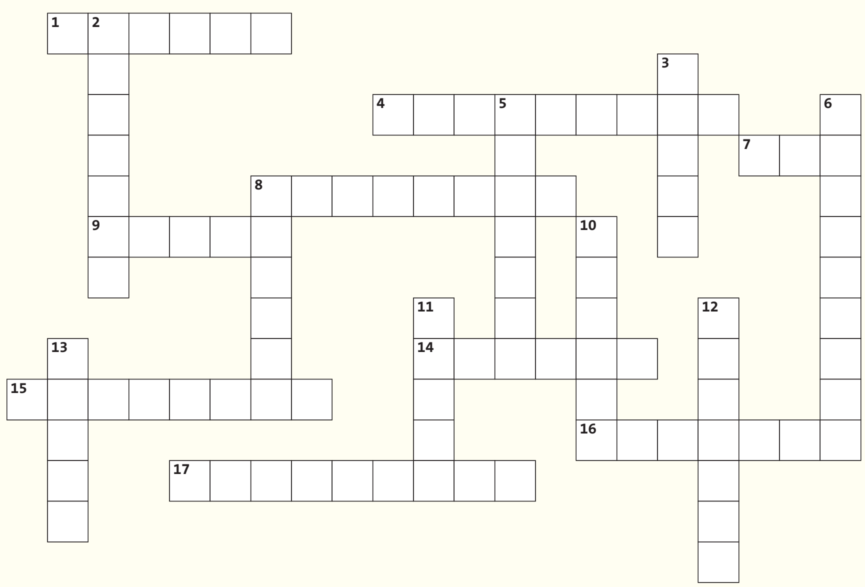
SINCE MOVING TO OUR PERMANENT BUILDING IN 2003

4 million visitors to the Museum's website
29,692 tour attendees
2,263 Museum members
671 people who have volunteered
473 events held with 69,955 attendees
123 oral histories recorded
53 lectures held with 15,038 attendees
27 staff additions
16 new Fellows

It's your museum. Customize it.

My CHM is a personalized interface that lets you track the Museum news and information that's most important to you. Through a personal login at **computerhistory.org**, you can stay informed about coming events, keep track of the gifts you've made, and more. Visit us online and sign up today!

CROSSWORD PUZZLE



ACROSS

1 IBM System/360 artifacts used as sales and planning tools.
4 Slide-based browsing system.
7 Initials of the company that made the recently donated time clock.
8 IBM UK's film "Man & _____."
9 Chairman of Intel until his retirement in 1979.
14 Temple of _____.
15 "The early 1980s were the _____ days for the personal computer" *(two words)*.
16 Board member profiled in this issue.
17 German moving company that assisted with the SAP collection.

DOWN

2 California port city where the SAP collection arrived.
3 Telebit was founded by CHM Fellow Paul _____.
5 MIT professor defeated by MacHack VI.
6 "Often a _____ can show the genesis of an important idea or a 'road not taken.'"
8 The first UNIVAC was sold to the United States _____ Bureau.
10 A CalTech student sold a punch card _____.
11 "Day One at _____."
12 Cofounder of Digital Research, Inc.
13 The Atkinson and Hertzfeld Oral History was conducted by Grady _____.

ALL ANSWERS CAN BE FOUND IN THIS ISSUE OF *CORE*. SOLUTION TO PUZZLE ON PAGE 31.

HELP US PRESERVE THE INFORMATION AGE BEFORE ANYBODY FORGETS IT.

BECOME A MEMBER

Today, people take technology as much for granted as the air they breathe. It's the mission of the Museum to preserve the remarkable history of technology and to celebrate the accomplishments of the extraordinary people who have done so much. As a member, you'll help us preserve our heritage. And you'll enjoy a number of benefits, including:

- Complimentary admission to the Museum's speaker series and speaker receptions
- Discount admission to special Museum activities
- Member email announcements
- Subscription to *Core* magazine
- Museum memento
- And more

Call **+1 650 810 1883** or join online at:
computerhistory.org

VOLUNTEER

Help us explain technology to the outside world. This is a perfect opportunity to share your knowledge and your enthusiasm for computers. As a Museum volunteer, you can help in building the collection and restoring computing artifacts. You can assist with lectures, receptions, tours, and special events, or help us with administration and operations. In the process, you'll also interact with industry leaders, expand your knowledge of computer history, and enjoy the satisfaction of helping us build a world-class museum and research institution.

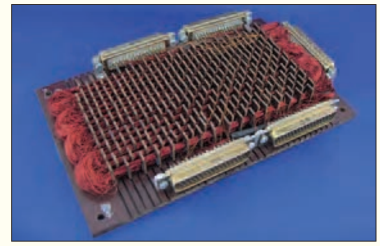
To learn more, call **+1 650 810 1027**
or visit us online at:
computerhistory.org/volunteers

Who are these people and what computer is that?


Photo courtesy of Regency Pictorials, Inc.

Take your best guess! The first three *Core* readers who submit correct answers after July 1, 2007, will receive a free copy of *Core Memory: A Visual Survey of Vintage Computers.*

The fourth and fifth correct submissions will receive Computer History Museum posters. Email your guess to: **editor@computerhistory.org.** Good luck!



Last issue's mystery item was a rope memory unit from the Apollo Guidance Computer. Congratulations to Brian Knittel, Mike Albaugh, and Randy Neff for correctly identifying it. Each of these lucky people will receive a "25th Anniversary of the Microprocessor" poster.

Rope memory is a special form of magnetic core memory ("core"). While core is useful for storing temporary or changing results, rope memory is a form of read-only memory (ROM) that will keep its contents even in the absence of power. This quality made it particularly attractive as a means of storing the various control programs for the Apollo spaceflight. It was also a very dense form of memory, though brittle and extremely difficult to manufacture. This particular unit was made by Burroughs.

COMPUTER HISTORY MUSEUM
1401 N. Shoreline Blvd.
Mountain View, CA 94043-1311
USA

Address service requested

PRSRT STD
U.S. POSTAGE
PAID
REDWOOD CITY, CA
PERMIT NO. 688