OCTOBER 2001

CORE 2.3

A PUBLICATION OF THE COMPUTER MUSEUM HISTORY CENTER

WWW.COMPUTERHISTORY.ORG

SHAPING UP FOR SUCCESS

Our vision of a computer history museum is taking shape. It includes 1) a permanent home with unique artifacts and exhibits, 2) a Cyber-Museum of virtual displays and digital information, and 3) communities of people across the world linked by a variety of Museum programs. Our goal is to build a single organization that combines these three vital resources into a lasting institution.

I am happy to report that we ended the last fiscal year in the black–a critically important accomplishment in a down economy–and our growth is almost doubling every year! Congratulations to all involved for helping to create tangible progress out of great ideas. As you can guess, we are vigilant about the economy and its financial impact on us this year, but are doing everything we can to minimize our risks.

I'd like to welcome Lori Crawford as the most recent addition to our Board of Trustees. Lori comes to us from Infinity Capital with a wealth (!) of non-profit experience and will be chairing the Finance Committee.

We have also made some significant staff changes in the last several months that are very important to our future. Mike Williams, Professor Emeritus of Computer Science at the University of Calgary, has joined us as head curator. Known worldwide as a computer historian, Mike has published extensively, served as editor of the IEEE *Annals of the History of Computing*, curated exhibits for other museums, and fallen in love with our collection and plans. I hope you have already met him and share our excitement about welcoming him to the Museum. In addition, Dag Spicer, after a leave of absence, has rejoined us for several months as exhibit curator to formulate plans for the permanent building.

David Miller came on board with great energy and experience as the vice president of development. He has taken the reigns from Eleanor Dickman, who had a wonderful year with us. Both Board and staff are working to strengthen and expand our already successful development organization to insure future growth.

Mike Walton joined us in June as the director of cyber exhibits. Some of you may know Mike from his work at ConXion, which hosts our web site, or his previous volunteer work at the Museum. The CyberMuseum team has already begun a series of experiments and explorations to help formulate our long-term technical strategies and to add real value to the current organization. This includes, among other things, experimenting with video from DECWORLD 2001 and looking at long-term "cyber exhibits."

Pam Cleveland has joined us as events manager and her expertise has been so important with the frequent, spectacular, and unique events the Museum is hosting.

Finally, we welcomed the arrival of three new NASA interns in June: Jennifer Cheng brings experience and energy to our event planning and development teams, Kathy Vo Jozefowicz is defining and implementing our e-store, and Robert Yeh provides financial and administrative support. We are very happy to have such professional and dedicated people working with us and have wondered how we would have survived our summer of growth without their help.

Our interim building is well under way. At press time, we are moving forward with a temporary steel structure–including 22.5K square feet for the warehouse, 9K square feet for exhibits/meetings, and 9.5K square feet of office space–that we expect to complete by April 2002. It will allow us to build our operation and manage a dynamic collection process for several years. In addition, we intend to keep buildings 126 and 45 until they are demolished for the proposed NASA Research Park. I think we will all see an exciting physical presence very soon.

Meanwhile, the architecture and exhibit design teams for our permanent home are moving rapidly ahead. As of August/September we are finishing the "programming" phase and will be moving into the "schematic design" phase of the project. Please review the materials on our website–we want your feedback and ideas.

Inside this issue, you'll see more about our volunteers and the great role they play in so many ways. Our Volunteer Appreciation Day in August was only a very small token of our appreciation for each and every one of them.

I can't close without acknowledging the great programs we've recently had and reminding you that the 2001 Fellow Awards Banquet is coming up on October 23rd. This year, we have put together an incredible program to honor Fred Brooks, Jean Sammet, and Maurice Wilkes. In addition to the Fellow Awards, we will update you on our exciting progress and celebrate our international outreach with a unique series of events in cooperation with the offices of the Consulate General of Switzerland. Artifact donations, a distinguished lecture panel, and a special reception will make that week very wonderful indeed.

Finally, we continue to need your support in so many ways, but hope you are also enjoying the multitude of experiences through which computing history can be preserved. The next six months are shaping up to be very important, and opportunities abound to engage in the organization–just ask! It is exciting to turn dreams into reality and to have so many people everywhere be part of it.

JOHN C TOOLE
EXECUTIVE DIRECTOR & CEO

October 2001
A publication of The Computer Museum History Center

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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

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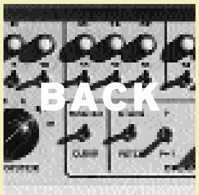
The Museum seeks technical articles from our readers. Article submission guidelines can be located at www.computerhistory.org/core, or contact Editor Karyn Wolfe at core@computerhistory.org.



IN THIS ISSUE

NEW WAYS TO EXPLORE COMPUTING HISTORY:

PROTOTYPING THE PROCESS AT DECWORLD 2001

BY KARYN WOLFE

None of these stories are the truth; these are all of our recollections after the fact.
–Gordon Bell

All the stories I'm going to tell you are true; some of the details have been revised to enhance the audience experience. –Joe DiNucci

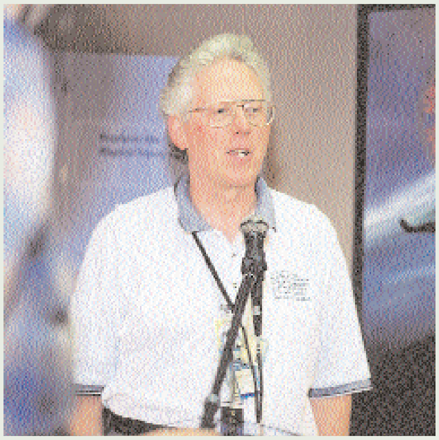
The DECWORLD 2001 experiment included videotaped interviews with many ex-DEC employees.

In June 2001, The Computer Museum History Center sponsored an unusual event: DECWORLD 2001, a retrospective conference focused on the stories and recollections of the people who helped create and develop the now-defunct Digital Equipment Corporation (DEC). Approximately 200 people attended the weekend, which included informal get-togethers, a DEC artifact exhibit, show-and-tell, panel and open mike sessions, video presentations, a speaker banquet, video interviews, and lots of time to talk and get reacquainted.

The Museum created DECWORLD 2001 in order to gather stories and information that might otherwise be widely dispersed or even lost. The event was very successful in helping the Museum to fulfill its mission "to preserve and present for posterity the artifacts and stories of the information age." We collected hundreds of quotes and comments, received donations of new DEC hardware, and captured hours of presentations, stories, and interviews. As we synthesize these new materials into our archives, we are learning how to best make them usable and available for research and display both in our physical Museum and in our CyberMuseum that is under development. Our experiences with video, digital formatting, transcribing, web posting, interviewing, etc., are an experiment that will inform upcoming collection efforts.

We thought that the best way to convey the results of our efforts was to show you just a portion of the material that we collected while documenting the unique culture and technical contributions of Digital Equipment Corporation. For a longer version of this article, for more information about the program and attendees, and for pictures and detailed reports about the event, please visit our website at www.computerhistory.org/decworld.

Gordon Bell examines an artifact at the "show and tell."



Grant Saviers sported multiple badges from his years at DEC.

DIGITAL "RULES" AND CULTURE

Attendees described the unique culture and "rules of the game" found at DEC, particularly in the early days when the company was small and literally defining much of the market. Here are some of their thoughts.

I never, in my life, spent a period of time with so many truly brilliant people as I did at DEC. –Jeff Kalb

"He Who Proposes, Does"

Everyone was encouraged to accept responsibility for programs. The expression 'He who proposes, does' was very common and the idea that someone like myself, for instance, in 1981, having been with the company only six to eight months, could take a proposal all the way to the Board of Directors was something very foreign to me. –Jeff Kalb

"Do The Right Thing" Drove the Organization

It seems that the most empowering value of the company was to 'Do the Right Thing.' That gave people a tremendous sense of personal responsibility and support for the things that they did. So many were able to get positions of responsibility much greater than they ever would have expected to. –Ted Johnson

DEC was Training Ground for Many Entrepreneurs

Probably the huge legacy of Digital was the incredible training ground that we provided. A vast number of people went on to become CEOs, to found new companies, to do things as entrepreneurs. I'm really proud to be associated with those that have gone on to do great things. Periodically somebody will say, 'Yeah, I was at DEC and started this company…' and they transported the DEC environment to create good cultures and essentially great designs. –Gordon Bell

A Company of Techies

Field sales had a test for who the customers were. If the customer couldn't program the machine and fix it from one of the handbooks, they didn't pass the test as a customer and we bypassed them. That's the kind of company it was. –Julius Marcus

Group Process Really Works

As a young consultant, one of the most unusual things about Ken Olsen's approach was that he did not set me up to make presentations or to give lectures. He said: 'Come to the meetings and see what you can do.' What I saw was people interrupting, people shouting at each other. 'What's this all about?' I thought, and began to realize it was about finding truth. No one person was smart enough. But, when we got into a group and debated the issue, we would get smart very fast. That was a very important philosophical principle for how DEC worked. The reason you don't make arbitrary decisions from a position of authority is because you're probably not that smart. –Ed Schein

A Boundary-less Organization

Digital was a place without laws. I read General Electric's annual reports and Jack Welch talks about trying to be a 'boundary-less' organization. Well, in a very natural way, that was Digital during the early days and quite far into the company's history. We were boundary-less because people were empowered to get the job done by using the resources of the company in whatever way was possible. And that meant going directly—not up through the hierarchy and down again—to the place from where you needed the help. And, by and large, that help was always given in the spirit in which it was requested. –Win Hindle

Evening speaker Win Hindle described DEC's internal culture as "merit-based, yet competitive; contentious, but fair; critical and open-minded."

Evening speaker Ed Schein asserted that DEC was "based on very strong individuals, which is the quintessential American, individualistic, competitive company."

TECHNICAL CONTRIBUTIONS

In addition to the atmosphere of working at DEC, attendees expressed admiration for the contributions they saw the company had made to the development of the computing industry… from the idea of interactive computing, to the concept of OEMs and VARs as channels of distribution for complete products, to the precocity and longevity of concepts such as VMS.

Digital's Role in Interactive Computing
Digital had a unique role in computer history. The industry was comprised of companies that took punched cards, sorted them, and did a little bit of arithmetic with them. From the very beginning we started with computers controlling things. So we built interactive computers, which was almost beyond the understanding of most people. We had this new concept—like with the SAGE system—that computers had the ability to do something, to interact with something. It was a paradigm shift.
–Stan Olsen

The Invention of the OEM and VAR Approaches
In my role in commercial OEM at DEC, we revolutionized the sale of commercial computers into the industry. We invented the VAR [Value Added Reseller] program and we really got minicomputers established in the commercial marketplace in a wide variety of applications, spurring a huge growth within the industry. Almost all the computer companies now use the VAR approach to selling those kind of systems. –Jim Willis

VMS Safe and Secure
I want to draw your attention to just how good VMS is. It's actually the 25th anniversary of the first boot up of VMS Starlet on June 14, 1976. So VMS is 25 years old, and it's still 25 years ahead of the SQLs and the NTs. And to this day, if you want to make a safe web site, you put it up on VMS with freeware, and it's so secure that no one can hack it, and the only VMS people that could hack it are too ethical to do so, thank you very much! –Max Burnet

Timesharing
Digital anticipated personal computing. Even in the early days with PDP-6 and DEC-10, timesharing made it possible for people to do computations individually, in real time, and let the pace of thought control what happened as opposed to the pace of the computer and the operations. So I think Digital's contribution, in the large, was to enable individual use of computing and then the company embodied that by allowing individuals to do their very best.
–David Rodgers

CONCLUSION

As you can hopefully see, the day resulted in wonderful reminiscences and rich contributions to the Museum's archival coffers. Thanks to all who participated. Attendee and Museum volunteer Mike Baxter made the following comments a few days after the event:

I'm still in awe at what I experienced at DECWORLD 2001. It was mind-bogglingly important, a successful experiment, and a most mature retrospective…I was very impressed to see mistakes discussed openly and without recrimination. This is really important learning, know-how that can be reused. "Museum" does not adequately describe what The Computer Museum History Center has done: The artifacts are by no means idle museum pieces, there are layers of stories hidden within them waiting to get out.

Panel Two included Grant Saviers, Dick Clayton, Julius "Mark" Marcus, Len Bosack, and Rich Lary presenting thoughts about 1970-1980, when "product lines were in full force."

By 1980, finally people knew that "Digital" didn't mean watches.
–Grant Saviers

We hope you visit **www.computerhistory.org/decworld** for a more complete picture and to discover more anecdotes and quotes, including:

Cats in the Cabinet by Marcia Russell

How VAX Got Started by Rich Lary

The Loading Dock Problem by Len Bosack

The Story of Mullen Blue by Pat Mullen

700 Pounds of Lead by Pat Mullen

UNIX for Sale – ouch! By Bob Glorioso

The Origin of "PDP" by Stan Olsen

Problem Solving for the Imp-11 by Jim Leve

The Story of the Digital Handbook Concept by Stan Olsen

Marketing Starts Writing Code by Bud Hyler

Giving Up "Frenchness" by Ed Schein

DEC Takes over Rhode Island by Marcia Russell

My Job Description (memo) by Ken Olsen

A WALK THROUGH "VISIBLE STORAGE"

BY LEN SHUSTEK

Like all serious collecting museums, The Computer Museum History Center can only display a small part of the collected artifacts at any one time. In our current temporary facilities at the NASA Ames Research Center at Moffett Field in Mountain View, California, we have configured one of the warehouses into a "Visible Storage Exhibit Area" where you can see, smell, and even (curators should stop reading here!) touch about two hundred of the thousands of items in our collection. And this is only the "iron;" we also have software, documents, photos, posters, audiotapes, videos, films, t-shirts, and coffee cups—everything you need to document the history of a revolution, which this is.

Every Museum docent gives a different tour, stopping at certain items, telling unique stories—each weaving different threads of computing history's story. Here is one virtual and very personal tour, and I ask forgiveness if I've omitted any of your favorites. Every item shown here—with the exception of the people pictured!—is currently on display at The Computer Museum History Center.

EARLY COMPUTING

Once upon a time, "computers" were people that computed, not computing machines. Mechanical devices helped make the people more reliable and faster than a reckoner who had only pencil and paper. For instance, the 1895 Swiss **"Millionaire"** was one of the first affordable mass-produced machines that could multiply and divide as well as add and subtract. About 5,000 were produced, and this, one of several in our collection, still works as well as it did the day it was made.

Photo by Jessica Huynh

The Comptometer was used, mostly by businesses, only for adding and subtracting, but trained operators could tally a column of numbers blazingly fast because all the digits of a single number could be pushed at the same time. If you don't believe this, I'll get my mother, who was a Comptometer operator in the early 1940s, to give you a demonstration. But mechanical calculators were not the genesis of modern electronic computers, they were instead one of many dead ends.

Photo by Jessica Huynh

Once upon a time, "computers" were people that computed, not computing machines.

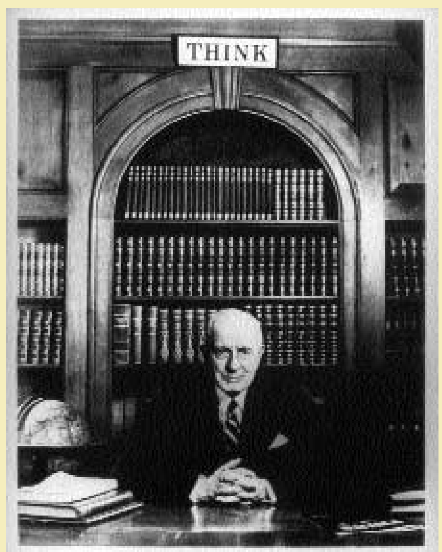
ANCESTRAL BEGINNINGS

One of the direct ancestors of the computer was the handsome **Hollerith census machine**, which was designed

to solve a new kind of problem. In 1880, the U.S. census had taken seven years to produce 21,000 pages of data. There was a real danger that the 1890 census might take more than 10 years to count, which would trigger a constitutional crisis because that document requires an “actual enumeration” every decade for allocating seats in the House of Representatives. A young New York engineer named Herman Hollerith won a three-way competition for technology to save the day by using “punched cards” to record and then tabulate the data. It was a great success, and 26,000 pages of data were compiled in only 2½ years.

But as a business, Hollerith’s “Tabulating Machine Corporation” had a less than stellar business plan: they had only one product, and one major customer that bought every 10 years. Hollerith gradually made the transition to supplying general office machines based on the same technology, and diversified the product line by merging with a computing scale company and a time clock company, calling the result CTR (“Computing-Tabulating-Recording”) Company. Hollerith’s health was failing and he retired in 1911 with about a million dollars, which was serious money in those days.

It took a consummate salesman fired from National Cash Register in 1911 to rename the company “IBM” in 1924 and create the dominant force in computers for many decades. That salesman was **T.J. Watson**, and he and



his son Tom Watson, Jr. ran the company for an astounding 60 years between them.

IBM started before the invention of the electronic computer. Its products were electro-mechanical machines designed primarily for office automation, based on Hollerith’s punched card. Here are **machines used for punching, copying, and sorting** the cards.

Photo by Michael Dubinsky

Photo by Michael Dubinsky

IBM’s business model was brilliant: instead of selling machines, they leased them and so created a recurring revenue stream. And, they sold the “razor” for your “shaver” as well: in 1930 IBM sold 3 billion of those punched paper cards, accounting for 10% of their revenue and 35% of their profit.

…as a business, Hollerith’s “Tabulating Machine Corporation” had a less than stellar business plan: they had only one product, and one major customer that bought every 10 years.

The drive toward fast electronic computers with no moving parts was natural and unstoppable, but some people still enjoyed tinkering with homebuilt computers made out of more unusual technology. Here are three examples, constructed as early as 1932, by Prof. Derrick Lehmer at the University of California at Berkeley. One is built from bicycle chains and screws, one from industrial gears and toothpicks, and one from 16mm film strips and wooden bobbins.

Lehmer's Sieves, three very different

Photo by Jessica Huynh

"computers," solve the same problem—finding prime numbers using the Sieve of Erastasthones—and dramatically demonstrate that an algorithm and the device that executes it are very different indeed.

in those days the notion of computers sharing program "software" (a term not yet invented) was not an issue—if you had a computer, you wrote programs specifically for it and no other machine used them.

ELECTRONIC BEGINNINGS

It wasn't until the 1940s that electronic devices we recognize as being similar to modern computers began to appear. Here is a small part of one of the first, the **ENIAC** ("Electronic Numerical Integrator and Calculator"), designed

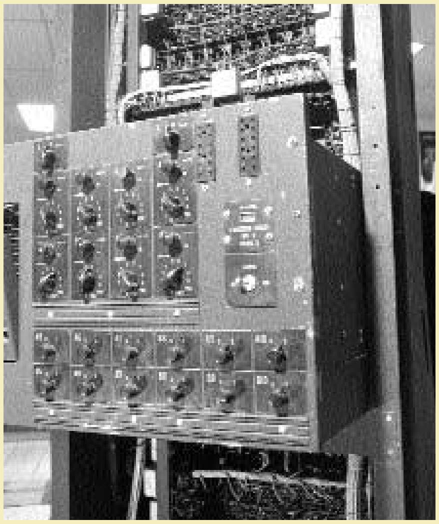


Photo by Michael Dubinsky

during WWII at the University of Pennsylvania to compute ballistics tables for the Army. Unfortunately ENIAC, a room-sized monstrosity with 18,000 vacuum tubes, was finished too late to help with the war effort. And, it wasn't really a computer in the modern sense, because it didn't have a program stored in memory that could be easily changed.

The "stored program" breakthrough occurred June 21, 1948 at the University of Manchester on a test computer called "The Baby" that at the time wasn't considered important enough to preserve so it no longer exists. But starting in 1949 and based on that idea, true computers as we know them today began to appear. **The Johnniac** was one of the first generation

Photo by Michael Dubinsky

of computers in that modern design, and the only one ever named for John Von Neumann, the brilliant Hungarian-born mathematician who played an important role in the invention of the modern "stored program" computer. The Johnniac was built by the Rand Corporation of Santa Monica, California, and was an approximate copy of the machine built under Von Neumann's supervision at Princeton's Institute for Advanced Studies. It wasn't exactly the same, but that was ok because in those days the notion of computers sharing program "software" (a term not yet invented) was not an issue—if you had a computer, you wrote programs specifically for it and no other machine used them.

These new contraptions were clearly going to be useful for many different things. But in the early 1950s if you wanted a computer for, say, calculating some physics equations for your PhD dissertation, you had a problem. Computers had been invented, but you couldn't buy one. If you were determined enough, like Gene Amdahl at the University of Wisconsin, you simply built one for yourself. This is his **WISC** from 1952, the "Wisconsin Integrally Synchronized Computer." In

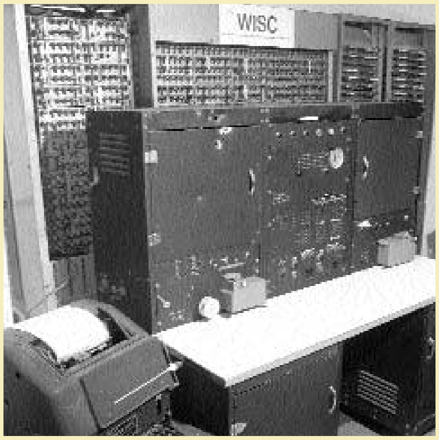


Photo by Jessica Huynh

the process Amdahl decided that building the computer was more fun than doing the physics, and he went on to design many important computers that were manufactured first by IBM and later by his own eponymous company. But this early handcrafted WISC, like many of the objects in our collection, is a one-of-a-kind item. If you look closely you can also see that it is the only object in our collection that is perforated with bullet holes, a punishment many of us have wished but not dared to inflict on our own computers. For the real story on the bullet holes, visit the Museum and ask a docent.

MEMORY MAKES IT WORK

The biggest impediment to building computers in the early 1950s was the lack of a good way to store data—which was now both numbers and programs. Early machines experimented with a wide variety of bizarre schemes, from vacuum tubes that conducted a current or not, to CRT screens with spots of light and dark, to this strange-looking **delay line from the UNIVAC I** that

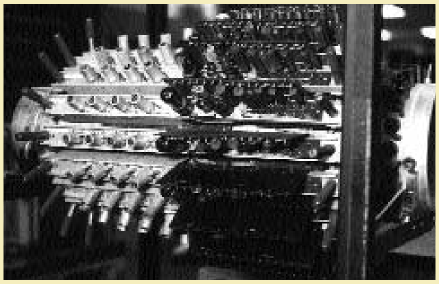
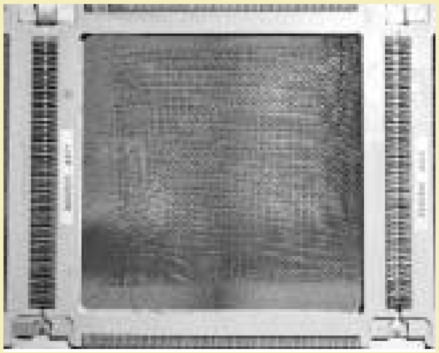


Photo by Jessica Huynh

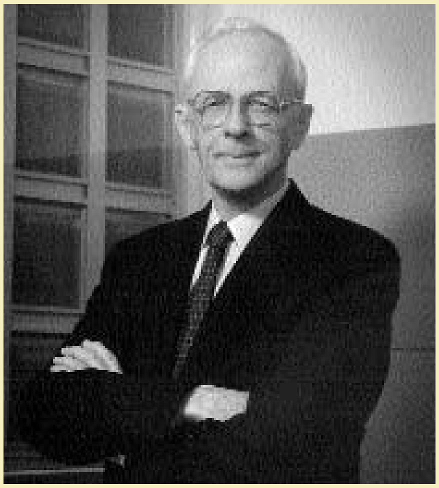
stored information as sound waves traveling through metal tubes filled with liquid mercury.

The biggest impediment to building computers in the early 1950s was the lack of a good way to store data—which was now both numbers and programs.

The 1953 breakthrough that caused computers to flourish was the **magnetic core**: a small ferrite doughnut that could



be magnetized either clockwise ("zero") or counter-clockwise ("one"). An Wang at Harvard pioneered the use of core, and **Jay Forrester** at MIT made it



practical by inventing a matrix scheme using two wires at right angles to read and write individual cores without having a separate wire for each one.

Magnetic core became the dominant computer memory for 25 years until semiconductor memories were invented. Forrester, who was inducted as a Museum Fellow in 1995, decided shortly after his invention that all the really interesting problems in computer hardware had been solved, and he moved on to other fields where he made equally brilliant and seminal contributions.

One of the first large computers that core memory made possible was a huge system for the military with the combat-speak name of "Semi-Automatic Ground Environment" or **SAGE**. This photo

Photo by Michael Dubinsky

shows only a few of SAGE's 51,000 vacuum tubes, every one of which had to be working simultaneously in order for the computer to work.

There were 46 **SAGE** computers built, one plus a second hot-standby backup

Photo by Michael Dubinsky

Photo by Michael Dubinsky

in each of 23 underground bunkers located in the northern U.S. and Canada. Their purpose was to process radar data and detect Russian piloted bombers coming over the north pole toward the U.S. Despite all the tubes, these machines were incredibly reliable and were operated until the early 1980s. The fact that by then Russia had long since developed Inter-Continental Ballistic Missiles (ICBMs) and SAGE was not fast enough to track them usefully didn't put them out of business. Perhaps the Russians didn't know SAGE's limitations.

BUILDING SUPERCOMPUTERS

Many of the artifacts in the collection demonstrate technological or commercial failures, and studying these is one of the best ways to learn from history. The **"STRETCH,"** IBM's attempt

Photo by Michael Dubinsky

in the late 1950s to build a supercomputer dramatically better than anything that had come before, was a commercial failure because it was too expensive and not fast enough. But it pioneered amazing technology that later surfaced in other computers over the next 20 years. Due to its commercial failure project engineer Red Dunwell was considered a persona non grata by T.J. Watson for many years, but later was lauded by Watson when STRETCH's numerous innovations had become apparent.

Although IBM was very successful in providing computers for the military and for ordinary businesses, from STRETCH onward, and for the next several decades, it struggled with building the very fastest scientific computers. In 1965, a small company in Minnesota introduced the **CDC 6600**, which

Photo by Jessica Huynh

tweaked IBM's nose by being the fastest computer in the world for many years. An angry T.J. Watson blasted his staff with this memo: "Last week, Control Data...announced the 6600 system. I understand that in the laboratory...there are only 34 people including the janitor. Of these, 14 are engineers and 4 are programmers.... Contrasting this modest effort with our vast development activities, I fail to understand why we have lost our industry leadership position by letting someone else offer the world's most powerful computer."

Sometimes, Mr. Watson, bigger isn't better.

Part of CDC's advantage over IBM was its smallness, but part was the remarkable genius of its principal designer, Seymour Cray. He got his start designing computers for the military, like this **Univac NTDS** computer used on

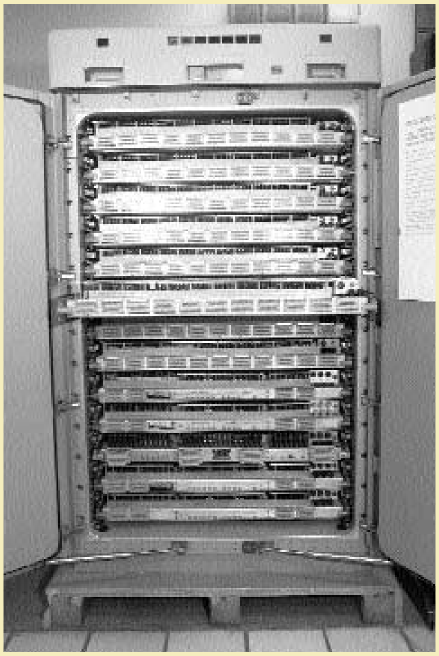
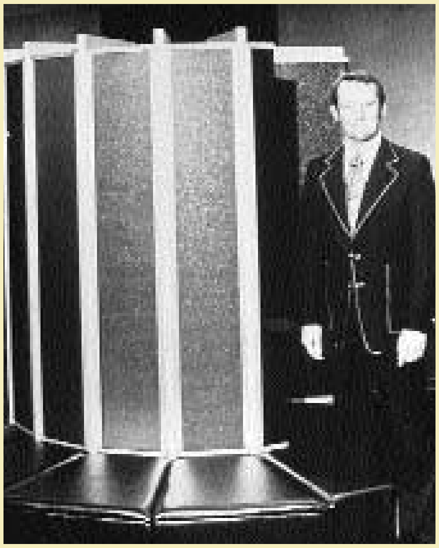


Photo by Jessica Huynh

board a battleship and built like a tank. In general, the military's influence in the early development of computers was huge and the industry would not have developed as quickly without it.

Seymour Cray had a long and



distinguished career based on repeatedly designing the world's fastest computers until his untimely death in a car accident in 1997. This **Cray-1** from

Photo by Jessica Huynh

1975, sometimes called the "world's most expensive loveseat," is perhaps the most famous example.

The physical design of fast supercomputers presents two important problems: keeping the circuitry close together so that delays caused by wiring are minimized, and getting the heat out so that circuits don't overheat. In speaking about this machine at the time, Cray was as proud of the plumbing that kept it cool as the electronics that did the computing, and would talk at length about his patents for copper tube extrusions into the aluminum cooling columns.

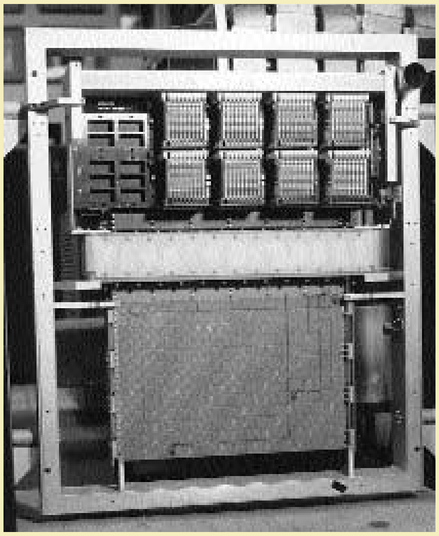
Cray's next machine, uncreatively called the **"Cray-2,"** solved the cooling/

Photo by Michael Dubinsky

plumbing problem another way: the boards themselves were swimming in a non-conducting liquid called "Fluorinert," an artificial blood plasma that just happens to have the right thermal, mechanical, and electrical properties. Changing out a defective board within the 30-minute "mean time to repair" requirement was a challenge, though, since all the Fluorinert had to first be pumped into a holding tank, the board replaced, and the liquid pumped back.

Other people solved the cooling problem for supercomputers in other ways. The **"ETA-10,"** created by engineers who,

Photo by Jessica Huynh

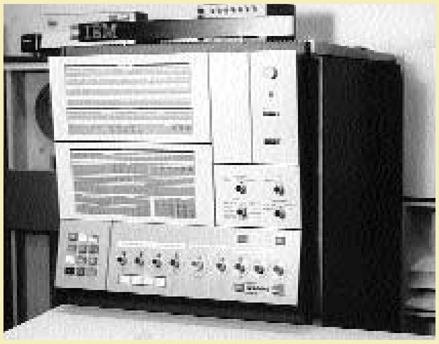


like Cray, had left CDC, contained circuit boards that were immersed in a vat of liquid nitrogen.

MAKING MAINFRAMES

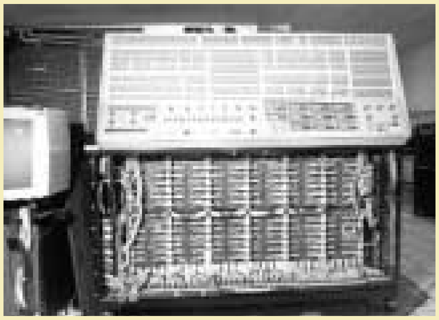
In the meantime, IBM was doing a booming business selling mid-sized computers for both business and scientific purposes. But by the early 1960s it had a looming crisis: it was building too many different kinds of computers. Each used different technology, software, engineers, salesmen, and support technicians. To consolidate behind a single uniform product line that could do both scientific and business computing at both small and large scale, Watson put a 28-year-old untested manager by the name of Fred Brooks in charge of a "you bet your company" project that would obsolete their entire product line. It was a remarkably bold move for a 60-year-old prosperous company and it could have been a colossal disaster, but the result was wild success: IBM dominated the mainframe computer industry for 20 years with the **System/360** that was introduced in 1964.

Photo by Jessica Huynh



Within the 360 family, IBM did finally manage to build a supercomputer that could compete with the CDC 6600. And this **IBM 360/91** was perhaps the

Photo by Jessica Huynh

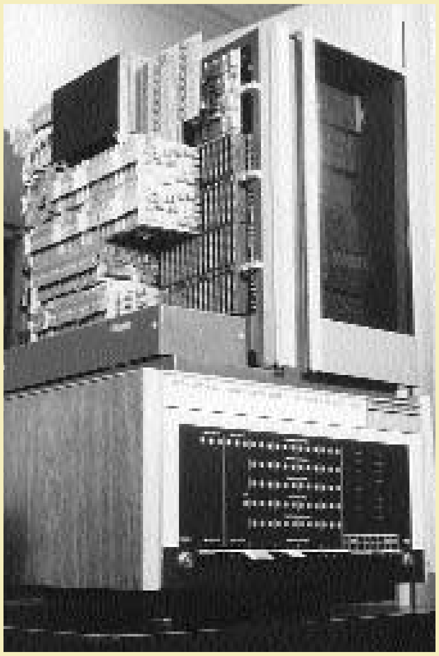


pinnacle of the "lights and switches" front console design, although even by then most of the operation and fault diagnosis of computers was being done electronically. The end of the flashing lights and whirring tape drives since then has made computers more efficient but much less photogenic.

MINI COMPUTERS FOR THE MASSES

While Seymour Cray's companies were building massive supercomputers, Digital Equipment Corporation (DEC) was a pioneer in "mini-computers" for the masses. This **PDP-8** from 1965 was a

Photo by Jessica Huynh



huge success; for about $17,000 anyone could own a serious professional computer. You could even argue that it was the first “personal” computer, if that means a computer small enough for one (strong) person to pick up and put in his car!

By that definition, DEC had started by making decidedly non-personal computers like this **PDP-1**, which had

Photo by Jessica Huynh

only 8K of memory, weighed a ton, and could fit in no one’s car. But DEC’s machines were always approachable and touchable, and this one was the inspiration for one of the first computer games, SpaceWar!, which simulated dueling rockets ships on the screen of the circular display tube.

DEC went on to make many other medium-sized computers. One that set a standard was the 1978 VAX, of which we have several in the collection. For years rumors were floating around that certain eastern European countries had built clones of U.S. computers because they could build the machine and then steal the programs; software had as much value as hardware. After the fall of the Berlin wall and the collapse of the Soviet Union we were able to get this **clone of a DEC VAX**, made from

Photo by Jessica Huynh

U.S. and British integrated circuits and Bulgarian (?) circuit boards, all running purloined DEC software.

The computer revolution has been a worldwide activity, and our collection is appropriately international in scope. This **Z-23** medium-sized computer was

Photo by Jessica Huynh

built by the German Zuse Computer Company in the early 1960s. Its designer, Konrad Zuse, a formerly under-recognized genius of computer design, independently invented many concepts before WWII that were subsequently reinvented by others in different countries. But he lost that advantage to engineers from Great Britain and the U.S. because of Germany’s war activities. His son, Horst Zuse, a computer scientist himself, has worked to restore his father’s proper place in history and facilitated the donation of this machine to us.

The end of the flashing lights and whirring tape drives since then has made computers more efficient but much less photogenic.

BUT DO THEY STILL WORK?

Many people touring the Visible Storage Exhibit Area ask how many of our machines still work. The answer, unfortunately, is “very few.” Even if we have complete hardware and documentation and the necessary software, it takes a huge effort to restore and keep the older machines running. But it can be done, and this **IBM 1620**, designed in 1959, is an example.

Photo by David Pace

A dedicated team of Museum volunteers led by the indefatigable Dave Babcock worked for over a year to get this early transistorized machine back in working condition. As part of the project, they also created an exquisitely detailed cycle-by-cycle simulator that runs on the web. They collected a huge library of 1620 software on original punched cards, which were converted to modern storage and can now run on both the real machine and on the simulator. In the long term—think 100 or 500 years—the only consistent way to keep these old machines running and to preserve the accomplishments they represent will be to do it in “virtual space” through simulations.

PERSONAL COMPUTING POWER

By the mid-1970s, computers became really personal and started showing up in homes. The do-it-yourself computer kit that started this revolution was the **Altair 8800**, which appeared on the

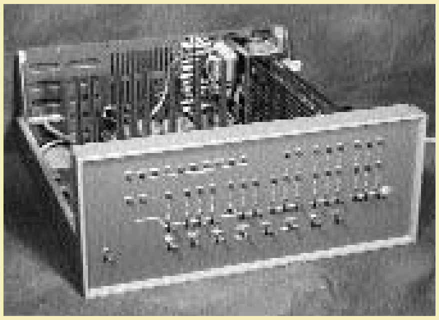


Photo by Jessica Huynh

cover of Popular Electronics in January

1975 and had thousands of propeller-head hobbyists dreaming of owning their own.

None of the companies that built "real" computers took this kind of computer seriously. But new companies started in the most unassuming ways and surprised the establishment. The two scruffy-bearded Steves (Jobs and Wozniak) who showed off this **Apple I** at a Homebrew Computer

Photo by Jessica Huynh

Club meeting in 1977 were not obvious candidates for creating Apple Computer, a hugely important computer company that would still be an major force 25 years later.

Only a few hundred of the Apple I's were built. The company's first big success was the **Apple II**, which was wildly

Photo by Jessica Huynh

popular in schools and even made a foray into businesses because of VisiCalc, the world's first interactive spreadsheet. Apple kept moving quickly: their first big failure was the **Apple III**,

Photo by Jessica Huynh

their first non-product was the **Lisa**, and

Photo by Jessica Huynh

the world's first mass-market high-resolution graphical computer was the justifiably famous **Macintosh**.

Photo by Jessica Huynh

Eventually large companies recognized that personal computers were becoming a serious force, and even IBM produced one that subsequently set the standard for 90% of the desktop computers. In retrospect, that was a most unusual turn of events: the "open standard" computer was produced by the starched shirts at "Big Blue" whereas the hippies at Apple kept their design to themselves. The interpretations and lessons of this bit of history will be debated for years.

But the 1982 IBM PC, of which we have many examples in the collection, was not IBM's first personal computer. Back in 1975 they had produced this **"IBM 5100"** to run the BASIC and APL

Photo by Michael Dubinsky

languages. The remarkable thing, besides the high price tag, was that it was actually a shrunken mainframe on a desktop running an emulation of the big 360 systems and their software. Fred Brooks' idea of "one computer for everything" had perhaps gone a bit too far.

INNOVATION AND FIRSTS

Where were the big companies when the innovative products were first coming out of the young upstarts? Well, in some cases, they were creating innovations and failing to make products out of them. Xerox, in their Palo Alto Research Center (PARC), created the **Alto**, a high-resolution

Photo by Kevin Powerx

graphic computer that was intended to be what the Macintosh became. Xerox PARC also created the world's first **prototype laser printer**, based on a

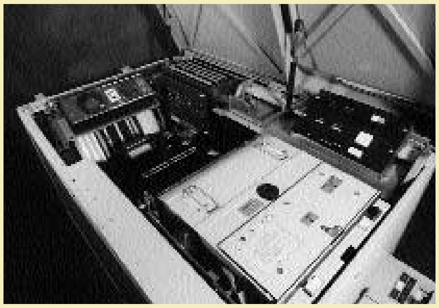


Photo by Kevin Powerx

standard office copier. But even with that head start they did not come to dominate the early laser printer market.

PARC also prototyped portable computers, like the **NoteTaker**,

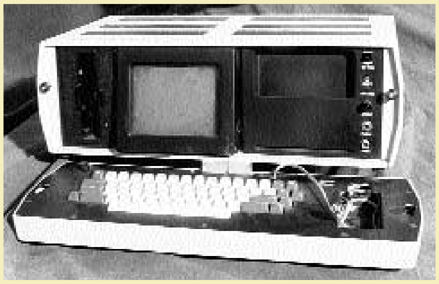


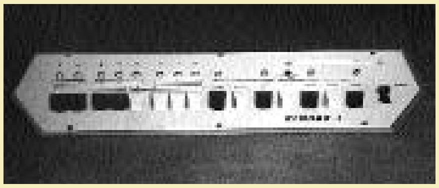
Photo by Kevin Powerx

which was never produced but looks remarkably similar to the later **Osborne 1**. How Xerox repeatedly

Photo by Kevin Powerx

managed to invent the future but failed to build it has been chronicled in several books like the aptly titled *Fumbling the Future* by Douglas Smith and Robert Alexander and the more recent *Dealers of Lightning* by Michael Hiltzik.

One of the minefields in the technological history business is the election of "firsts." It depends on pedantically precise definitions, requires meticulous and detailed records, is almost always controversial, is often historically meaningless, and engenders emotional responses that can sometimes lead to fisticuffs. But it's fun! So in that spirit, The Boston Computer Museum, our ancestor whose collection is the core of ours, ran a contest in 1985 to discover the real first personal computer. The winner, as the "first advertised commercially-available non-kit computer under $1000," was a computer you have never heard of: the **Kenbak-1**, designed



by John V. Blankenbaker and advertised in Scientific American in 1971. "Firsts," when you find them, may not be what you expect.

The Museum's award for the first microprocessor-based computer was given to an almost equally obscure French computer, the Micral, designed by Vietnamese immigrant Thi Truong around an Intel 8008 and programmed by Philippe Kahn.

The election of "firsts" depends on pedantically precise definitions, requires meticulous and detailed records, is almost always controversial, is often historically meaningless, and engenders emotional responses that can sometimes lead to fisticuffs. But it's fun!

Speaking of microprocessors and firsts, what was the first microprocessor-based device? It was this **calculator from Busicom**, a Japanese company that hired Intel in 1971 to create the world's first microprocessor, the 4004. This

Photo by Kevin Powerx

prototype, from Federico Faggin's desk, has one of the world's first working microprocessor chips plugged into it.

Stand-alone analog computers became dinosaurs that only survive in textbooks and computer history museums.

ALTERNATE ROUTES AND DEAD ENDS

Although the digital electronic computer now dominates, it wasn't always clear that binary was the best way to compute. From the 1920s to the 1960s "analog computers" represented numbers in a much more direct way than an abstract string of bits: a signal of 5.2 volts could be the number 5.2. You could add, subtract, multiply, and divide at blazingly fast electronic speeds. But the accuracy of the results and the complexity of the computational sequences was limited, so stand-alone analog computers, like these made by **EAI** and **Heathkit**, became dinosaurs that only survive in textbooks and computer history museums.

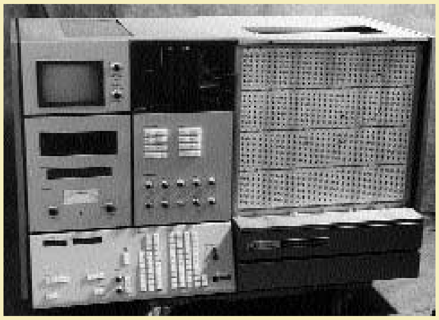


Photo by Kevin Powerx

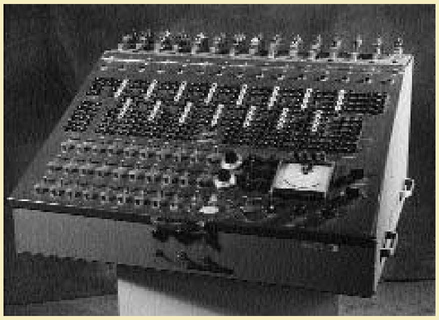


Photo by Kevin Powerx

The Museum collection contains many other instructive dead-ends, although not all of them were failures. The **Illiac IV** from 1970 was an experiment

Photo by Kevin Powerx

in making one fast computer out of a bunch of slower ones that all execute the same program in lock-step on different data. It worked, but it turns out not to be a great way to build fast computers. Note the coffee-table-sized hard disks, that hold about as much as yesterday's floppy disk.

Some computers in the collection always bring a smile to visitor's faces. This **"kitchen computer"** was the fantasy item in the Neiman-Marcus

catalog in 1965, and was an attempt to answer the persistent and puzzling question: Why would anyone want a computer in their home? The standard answer for years had been "for storing recipes," and this computer had a built-in chopping board to facilitate following its recipe instructions. Of course, the input was in binary and the output was in octal, so the user interface left something to be desired! For about $10,000, you could get the computer, an apron, a set of cookbooks, and a two-week programming course. As a measure of the social sensibility of the time, the advertising tag line for this Honeywell-built computer was "If only she could cook as well as Honeywell can compute." We have no indication that even one of these wonderful home appliances was actually sold, but many home computers still come with recipe software.

UBIQUITOUS NETWORKING

The most dramatic change in computing in the last five years has been the astounding growth of the Internet and the World Wide Web. This interconnection of millions of computers started modestly in the late 1960s by a government-funded project called ARPANET. This refrigerator-sized computer was the "Interface Message Processor" **("IMP")** manufactured by

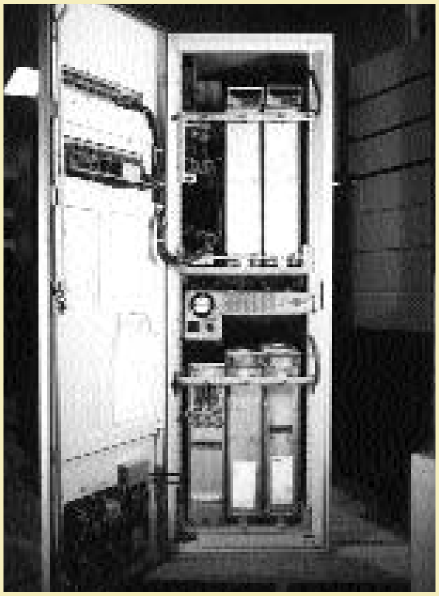


Photo by Jessica Huynh

Bolt Beranek and Newman of Cambridge, Mass., as the communications pipe for the ARPANET, which started with only four nodes: mainframe computers at Stanford, UCLA, UC Santa Barbara, and the University of Utah. Thirty years later, even cell phones can be nodes on the network.

At the dawn of the era of ubiquitous mobile computing, this virtual tour appropriately ends with an early ungainly example of mobile personal computing: Steve Roberts' computerized recumbent bicycle **BEHEMOTH** (Big Electronic Human-Energized Machine ...Only Too Heavy). In the 1980s, Steve logged

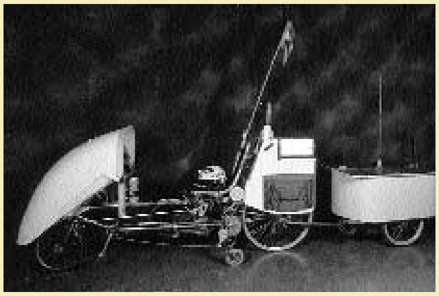


Photo by David Pace

about 17,000 pedal-powered miles while sending email from a chorded keyboard built into the handlebars and reading responses on the heads-up display attached to his helmet. If it sounds like Steve was pedaling to the beat of a different drummer, think about him in a few years when every device you own is seamlessly connected to the Internet and you do email while in the shower.

If you have enjoyed this virtual tour of our Visible Storage Exhibit Area, I encourage you to visit in person and see the other 2/3 of it, which altogether is still only 10% of our hardware collection. And if you think it is important to preserve these items and stories as a record of one of most remarkable technological achievements of our civilization, please support The Computer Museum History Center.

Leonard J. Shustek is the chairman of the Board of Trustees of The Computer Museum History Center. Len Shustek's educational background is in computer science (MS, PhD, Stanford University) by way of physics (BS, MS, Polytechnic University in Brooklyn NY). After graduation he joined the faculty at Carnegie Mellon University as an assistant professor of Computer Science.

In 1979 he co-founded Nestar Systems Inc., an early producer of networked client-server computer systems. In 1986 he was co-founder of Network General Corporation, a manufacturer of network analysis tools, notably "The Sniffer(tm)". The company became Network Associates Inc. after merging with McAfee Associates and PGP. Shustek is now semi-retired and serves on the boards of several high-tech startups and three non-profit organizations.

He teaches occasionally as a consulting professor at Stanford University, and is a partner at VenCraft, a small "angel financing" venture capital fund. He is also a trustee of Polytechnic University. Write to him at shustek@computerhistory.org.

RECENT DONATIONS

TO THE COMPUTER MUSEUM HISTORY CENTER COLLECTION

Apple IIe, Amdek data display, Daisywheel Printer, and sheet feeder (1985), X2164.2001, Gift of C. T. Kennedy

Assorted early PDAs including a Grid Pad, a Toshiba T100X, an NCR System 3130, and a GO G400 PDA with external disk drives (c. 1992), X2165.2001 - X2168.2001, Gift of Ed Devinney

IBM 1130 computer system with extensive software and documentation (1964), X2180.2001, Gift of Robert Garner

Three-and-a-half linear feet of assorted documents, many dealing with early IBM and CDC computers, X2191.2002, Gift of Douglas Albert

"The Bus Probe" Curcuit Board (1981), X2192.2002, Gift of Peter Ingerman

Cromemco System 3, LSI Information Terminal, Prism printer, disk drives, and a complete library of associated software and documentation (c. 1980s), X2217.2002, X2256.2002, X2190.2002, Gift of Peter Ingerman

Onyx C8002, Zephyr Console Terminal, and extensive documentation and operating manuals (c. 1981), X2218.2002, Gift of Douglas Broyles

Two "Cedar" circuit boards (c. 1995), X2219.2002, Gift of Dr. Allan Malony

IBM Selectric (1963), X2221.2002, Gift of Donald Knuth

Twelve books on programming and personal computing topics (c. 1982-1992), X2223.2002, Gift of Mark Possoff

Six linear feet of assorted rare publications, documents, and personal papers (c. 1950-1980s), X2224.2002, Gift of George Michael

HP65 and HP67 User's Library (c. 1975-1977), X2233.2002, Gift of George Michael

Hitachi TFT display and accessories, core memory module, and IBM data cartridges, X2235.2002, Gift of Joshua Shapiro

Olivetti PR-2300 printer (JP 101) (c. 1985), X2238.2002, Gift of Mark Possoff

Interact Model 1 Home Computer System with a complete library of software and documentation (c. 1982), X2239.2002, Gift of Lawrence Ching

Aaron Paint System (c. 1990), X2240.2002, Gift of Harold Cohen

PT-396/AS plotter (c. 1950s), X2241.2002, Gift of Douglas Brentlinger

Assorted ephemera including UNIVAC and other early flow chart templates, core memory, UNIVAC publications, and computer textbooks (c. 1966-1970s), X2242.2002, Gift of Richard and Jean Lehman

DEC baseball cap, X2243.2002, Gift of Gordon Bell

PDP-6 backplane and a group of PDP-6 system modules (c. 1963), X2244.2002, Gift of Robert Garner

PDP-10 disk (c. 1967), X2245.2002, Gift of Elizabeth Feinler

Assorted DEC t-shirts and software, X2247.2002, Gift of Pierre Hahn

"Alpha Implementations and Architecture" signed and donated by the author (1996), X2248.2002, Gift of Dileep P. Bhandarkar

AI textbook collection (c. 1980s), X2251.2002, Gift of Arthur Iadonisi

Replicas of the Genaille-Lucas Arithmetique, "Napier's Bones," Napier's Calculating Box, and Schickard's Clock, X2252.2002 - X2256.2002, Gift of Gordon Bell

VT 180 "Robin" computer system complete with disk drives and modems (1982), X2262.2002, Gift of H. Michael Boyd

RX180 AB Disk Drive (1982), X2263.2002, Gift of H. Michael Boyd

RISC II Chip (c. 1985), X2265.2002, Gift of David Patterson

Macintosh Portable Computer, Apple Desktop Bus Mouse, power adapter, and case (1989), X2266.2002, Gift of Randy Katz

TI programmable 59 calculator with a PC100C printer/docking port, including cover, full program library, complete manuals, and clippings (c. 1977), X2267.2002, Gift of Bruce Watts

HP 9810A calculator (Model 10), program library and associated documents, X2269.2002, Gift of Robert Schapp, Jr.

Osborne 1 portable computer, Trantor external hard drive, and extensive associated Osborne software and documentation (1981), X2271.2002, Gift of Ann Hyde

Millenium Information Systems Programming Panel, CPU, 2 2-Slot 8" disk drives, an Atari 1200 XL, and five boxes of associated software and documentation (c. 1978-1982), X2272.2002, Gift of Harry Stewart

Four linear feet of assorted computing documents including networking and Stanford AI Lab documents, X2273.2002, Gift of Mark Kahrs

Metaphor digital workstation unit with infrared keyboard, numeric keypad, special purpose keypad, and mouse (c. 1997), X2274.2002, Gift of Tim VanRoekel

IBM Personal System portable computer, Model 8573-401 (1991), X2276.2002, Gift of Dana Herbert

Visual Technology, Inc., Notebook portable computer with original instruction manual and two OS manuals, X2277.2002, Gift of Sylvio Demers

Extensive donation of Lotus software, ephemera, and publications as well as industry literature (1980-2000), X2278.2002, Gift of the Lotus Division of IBM

Assorted UNIVAC I and UNIVAC II equipment (c. 1953-1958), X2279.2002, Gift of Mac Maginty

REPORT ON MUSEUM ACTIVITIES

KAREN MATHEWS

Karen Mathews is Executive Vice President at The Computer Museum History Center

In July of 2001, The Computer Museum History Center celebrated its second anniversary as an independent non-profit institution, with the exciting and important mission to preserve and present early information age developments. In two short years we have tripled our staff, volunteer base, events, and annual budget. We have significantly increased our world-class collection and the number of tours we offer. All the while, we have worked behind the scenes planning a premier Museum building, complete with innovative and inspiring exhibits, scheduled to open in 2005. In short, we have made amazing progress across all areas of the Museum. Here are some highlights.

MAKE HISTORY ON OCTOBER 23: DON'T MISS THE ANNUAL FELLOW AWARDS

Each year, on one brilliant evening, hundreds of industry luminaries come together to applaud the achievements of three outstanding people in the computer technology world. This year that evening is Tuesday, October 23 at the San Jose Fairmont Hotel.

Honorees are: **Frederick P. Brooks** for his contributions to computer architecture, operating systems, and software engineering; **Jean E. Sammet**, for her contributions to the field of programming languages and its history; and **Maurice Wilkes**, for his life-long contributions to computer technology, including early machine design, microprogramming, and the Cambridge ring network.

The 2000 Fellow Awards Banquet brought together more than 300 industry luminaries and enthusiasts to celebrate three new Fellows: Fran Allen, Vint Cerf, and Tom Kilburn.

Hosts for the evening are Donna Dubinsky, Len Shustek, Suhas Patil, Jayashree Patil, Elaine Hahn, Eric Hahn, Karla House, Dave House, Angela Hey, John Mashey, and Peter Hirshberg. The master of ceremonies is Internet luminary and 2000 Fellow Vinton Cerf.

To further enhance the magical evening, a reception prior to the banquet and ceremony will feature an impressive exhibit of artifacts recently donated to the Museum by various Swiss individuals and organizations, initiated and coordinated by the Swiss Science and Technology Office in San Francisco and shipped courtesy of PRS Presence Switzerland. A number of dignitaries and pioneers from Switzerland will be in attendance.

Don't miss this marquis event! Call or visit www.computerhistory.org for details and registration.

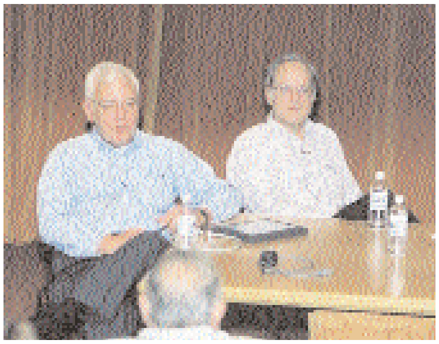
Banquet emcee Peter Hirshberg, 2000 Fellow Vint Cerf, Museum CEO John Toole, and Museum Trustee Chairman Len Shustek celebrated with Cerf at his induction as a Fellow.

DECWORLD 2001

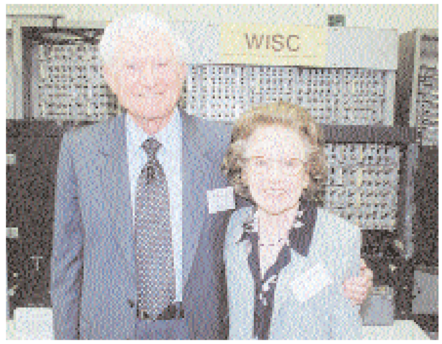
Museum-sponsored DECWORLD 2001 represented another benchmark in the Museum's quest to gather and preserve personal stories of the computing revolution. Nearly 200 people from 16 states and two countries—many who had not seen each other for years—gathered to present the inside stories of Digital Equipment Corporation, a company whose achievements notably influenced the technology boom. Twenty-seven people donated items to the Museum's collection. Over 60 DEC alumni were interviewed, recording stories for posterity, and approximately 10 hours of video recorded the entire proceedings. Museum staff is busy converting videos, transcripts, and other images of the event for posting to the web. For details, see Karyn Wolfe's article in this issue and visit http://www.computerhistory.org/decworld.

PERSONAL RETROSPECTIVES ON THE XEROX ALTO

On June 4, Butler Lampson and Chuck Thacker closed the Spring Lecture Program with an entertaining talk given to over 300 people that included personal stories from time spent at Xerox PARC developing the Xerox Alto. Attendance, by a show of hands at the lecture, included a high percentage of



Chuck Thacker and Butler Lampson discussed the Alto and other advances made during their time at Xerox PARC in the final lecture of the Spring program.



Gene and Marian Amdahl stand in front of Gene's PhD thesis—the WISC computer—after his Fall lecture that opened the 2001 lecture program.

people who had been in the development group itself. The Alto demonstrated many new concepts in computing, and the same design team invented so many, many things whose impacts are still with us: for example, LANs, Ethernet, bit-mapped displays, graphical user interfaces, laser printing, and object oriented programming. Lecturers discussed how Xerox did better capitalizing on ancillary investments at PARC (e.g. Ethernet, physics) than it did on the Alto.

GENE AMDAHL LAUNCHES FALL LECTURE LINEUP

The first of our fall lecturers, Gene Amdahl spoke on September 5 to an appreciative crowd of 200. He told the story of how, through a series of events at IBM, he was able to identify a business opportunity for a theoretical competitor to create a lower-priced machine at the high end of IBM's line. IBM would likely have had to lower the price of its own high-end machine, impacting the prices of the entire line. Thus, they could not lower prices, even at the high end, giving a theoretical competitor the edge.

After leaving IBM, Amdahl set out to deliver on this idea under the auspices of Amdahl Corporation. He relayed some of the difficulties and opportunities along the path and how eventually, through sheer tenacity, Amdahl Corp. was funded by the Heiser Corporation and later, Fujitsu, and Nixdorf, who made it possible to fulfill his vision. The company grew exponentially: it went from $50 million in sales in its first year, to $100 million, $200 million, and $400 million by the fourth year. Amdahl left the company after five years, and subsequently founded three other companies.

COLLECTION HIGHLIGHTS

Here are some of our recent acquisitions:

The IBM 1130. Purchased and donated by Robert Garner, this small computer designed for both scientific and business applications became popular with universities. Machines like this occasionally appear on Internet auction sites and with help from people like Robert, the Museum is able to acquire them for the permanent collection. Says Garner, "It's a thrill to discover and then donate workhorse computers of bygone eras to the Museum. The mid-west owners of this operational IBM 1130, selling it on eBay, were delighted that it found a suitable home. I myself have pleasant memories playing Star Trek on the 1130 late in the evenings while an undergraduate!"

RISC II Chip. Donated by UC Berkeley Professor David Patterson, the RISC II contained 40,760 transistors and ran at 3 MHz. Designed by Bob Sherburne and Manolis Katevenis, students of Professors David Patterson and Carlo Sequin, this is the second in a revolutionary line of Reduced Instruction Set Computers.

Aaron Paint System. Donated by artist and inventor Harold Cohen. Aaron, an artificial intelligence-based system for drawing, has changed over the years. The version donated used a small robotic arm with a built-in paint delivery system. The association between Cohen and the Museum dates back to the late 1970s when Cohen and an earlier system painted a mural for the Museum's original site in Marlborough.

EXHIBITING AT HOT CHIPS

Museum staff created an exhibit for the recent Hot Chips and Hot Interconnect Conferences at Stanford University. The exhibit featured highlights from various areas of the collection, including Don Lancaster's TV Typewriter Prototype, an early RISC wafer, and the "canonical teapot" used in many early computer graphics tests.

Hot Chips organizing committee member Allen Baum said, "Listening to presentations about the latest cutting edge technology is great, but it really hits home when you can see what used to be the latest and greatest, and how little time it took to advance from there. An exhibit like this gives perspective on what we can look forward to, and just how fast it is likely to come."

CYBERMUSEUM ACTIVITIES

As more physical artifacts make their way into the digital realm, we will need great ways to represent the complex relationship of ideas, people, companies, and computing machines that comprise computing history. An enthusiastic new addition to the staff, Mike Walton, has joined us as director of cyber exhibits to help tackle these problems. Backed by an impressive CyberMuseum Committee led by Gordon

Bell, the group is exploring methodologies for collecting and presenting stories and oral histories online, capturing visitor submissions about the artifacts in discussion forums, and taking in digital artifact donations such as pictures, media, or software.

As the CyberMuseum grows, you will see it start to manifest in parts of our current website. Each new experiment completed by the staff will add a new feature or exhibit to the site. As the process is refined, the CyberMuseum will extend the real-world Museum into cyberspace. In the future, it may also give depth to the exhibits in the real-world, physical Museum.

PUBLIC RELATIONS UPDATE

Media attention has stepped up in recent months. Articles about the Museum have appeared in the New York Times, International Herald, and the San Francisco Chronicle among others. Associated Press and Newhouse News Wire released articles that were picked up by several publications across the country. CNN.com taped a show in the Visible Storage Exhibit Area featuring an interview with John Toole, KICU Channel 36 ran an interview with Toole, and NPR featured an interview with Museum Board of Trustees Chairman Len Shustek.

APPRECIATION FOR OUR VOLUNTEERS

Volunteers have given their all at a number of work parties, receptions, and events over the past four months. Museum staff had the happy occasion to honor and thank these wonderful volunteers at an Appreciation Party on August 18. A picnic at Chase Park, Moffett Field, featured horseshoes, volleyball, Texas barbecue, and "Carniac the Magnificent," a computer history trivia buff wearing a turban and cape–aka John Toole!

John "Carniac" Toole illuminated and entertained volunteers and staff with some amazing facts about computing history at the annual appreciation event.

Volunteers who attended the Museum's annual appreciation event received a t-shirt, a certificate of appreciation from the staff and Trustees, a great barbeque, and heartfelt thanks from Museum staff.

VISIT THE MUSEUM'S ON-LINE STORE

We are proud to make Museum souvenirs and items from our archives available to you, including:

VIDEOS

200+ UVC videos from the Gray-Bell archive include presentations by computing legends and innovators. See and hear Seymour Cray, Danny Hillis, John Hennessy, Alan Kay, James Gosling and others talk about their work and visions.

POSTERS

Some of our most popular items. Our posters depict the stories of the Internet, microprocessor evolution, memory, and the chronology of computers. The posters are both beautiful and educational.

DECWORLD 2001 ITEMS

Tote bags and polo shirts are of very high quality and celebrate a company that impacted computing history (see article on page 2).

HATS

Our staff and volunteers wear these baseball caps proudly (yes, in the Museum) and we hope you will too. Here's an easy way to spread the word about the Museum.

POSTCARDS

These collectible postcards are printed on high-quality paper, and each one pictures and describes a one-of-a-kind artifact from our collection.

COMING SOON

We will soon be making videos available from the Museum's lecture series. Visit our website to be put on the mailing list:

www.computerhistory.org/store
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We acknowledge with deep appreciation the individuals and organizations that have given generously to the Annual Fund.

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This information is current as of September 27, 2001. Please notify us of any changes to your listing (liska@computerhistory.org). Thank you.

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CORE 2.3

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We gratefully accept direct transfers of securities to our account. Appreciated securities forwarded to our broker should be designated as follows:

FBO: The Computer Museum History Center; DWR Account # 112-014033-072; DTC #015; and sent to Matthew Ives at Morgan Stanley Dean Witter, 245 Lytton Avenue, Suite 200, Palo Alto, CA 94301-1963.

In order to be properly credited for your gift, you must notify us directly when you make the transfer. Please contact David Miller with questions or concerns at +1 650 604 2575.

UPCOMING EVENTS

Please RSVP for all events and activities by calling +1 650 604 2714 or visiting www.computerhistory.org/events. Please verify location and date 24 hours prior to attending. Thank you!

THU, OCTOBER 11, 6:30 PM
FROM SMALLTALK TO SQUEAK
Dan Ingalls
LOCATION: *Xerox PARC, Pake Auditorium*

WED, OCTOBER 17, 6PM
EARLY COMPUTER MOUSE ENCOUNTERS
Panel Presentation: Daniel Borel, Stuart Card, Bill English, Jean-Daniel Nicoud, and Niklaus Wirth
LOCATION: *Xerox PARC, Pake Auditorium*

TUE, OCTOBER 23, 6 PM
ANNUAL FELLOW AWARDS BANQUET & SWISS TECHNOLOGY RECEPTION
LOCATION: *Fairmont Hotel, San Jose, California, USA*
www.computerhistory.org/fellows

MON, OCTOBER 24, 6 PM
LECTURE TITLE TO BE ANNOUNCED
Fred Brooks, University of North Carolina Chapel Hill

THU, NOVEMBER 8, 6 PM
QUESTIONS ANSWERED
Donald Knuth, Stanford University

THU, DECEMBER 6, 6 PM
LECTURE TITLE TO BE ANNOUNCED
Eric Schmidt

POSTPONED.
DORON SWADE, AUTHOR
THE DIFFERENCE ENGINE
Please check our website for new date and time

VOLUNTEER OPPORTUNITIES
The Museum tries to match its needs with the skills and interests of its volunteers and relies on regular volunteer support for events and projects. Monthly work parties generally occur on the 2nd Saturday of each month, including:

NOVEMBER 10, DECEMBER 8, JANUARY 12

Please RSVP at least 48 hours in advance to Betsy Toole for work parties, and contact us if you are interested in lending a hand in other ways! For more information, please visit our volunteer web page at www.computerhistory.org/volunteers

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Current staff openings can be found at www.computerhistory.org/jobs.

MYSTERY ITEMS

FROM THE COLLECTION OF

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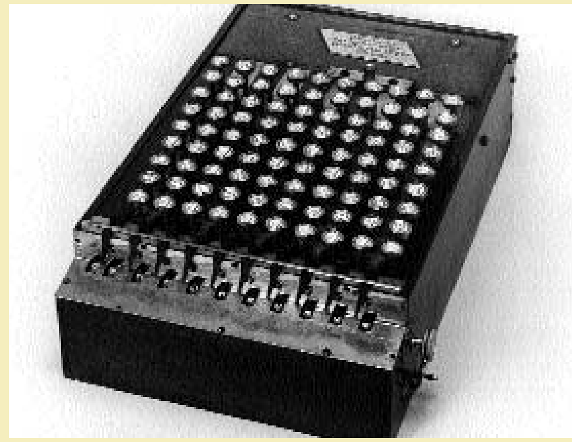


Explained from CORE 2.2

THE COMPTOMETER

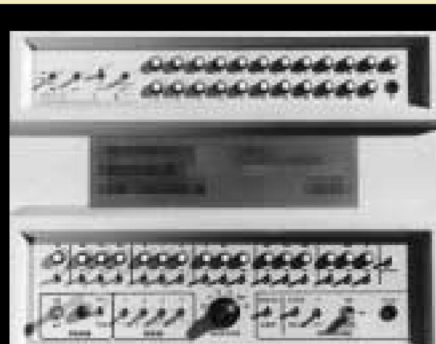
The early, wooden-cased Comptometer mechanical calculator was invented in 1886 by Dorr E Felt of Chicago, who claimed that it was the first successful key-driven adding and calculating machine. For each digit to add, a pushbutton numbered from 1 to 9 is selected, thereby rotating a Pascal-type wheel with the corresponding number of increments. The carrying of tens is accomplished by power generated by the action of the keys stored in a helical spring, which is automatically released at the proper instant to perform the carry. Numbers are subtracted by adding the complement (shown on the keys in smaller numbers).

Through effective marketing and training (at Comptometer Schools) of skilled operators versed in complement arithmetic, these machines became the workhorses of the accounting profession in the first part of the century. They never successfully advanced into the electromechanical era, but remained purely mechanical, two-function adding and subtracting machines.

For further information:
http://members.cruzio.com/~vagabond/ComptHome.html#Intro

WHAT IS THIS?

THIS ITEM WILL BE EXPLAINED IN THE NEXT ISSUE OF CORE.



Please send your best guess to mystery@computerhistory.org before 11/15/01 along with your name and shipping address. The first three correct entries will each receive a free poster: **COMPUTER CHRONOLOGY - THE EMERGENCE OF THE INFORMATION AGE**

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