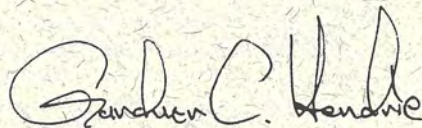


# The Computer Museum

Annual Report 1991

**Inside this year's Annual, you will find a guide to *People and Computers: Milestones of a Revolution*. The June opening of this definitive historical exhibition capped another year in which The Computer Museum successfully advanced its educational mission. Funded in part by a major grant from The National Endowment for the Humanities, the exhibit uses the Museum's unique collection to help the public better understand the evolution of computers over the last 50 years and the changes they have made in our daily lives.**

***People and Computers* and the Museum's many other national and local programs were propelled by the enthusiastic support of many individuals, corporations, and state and federal agencies. On behalf of the Museum's Board of Directors, I gratefully acknowledge all of you who helped make fiscal year 1991 such a resounding success.**



Gardner C. Hendrie  
Chairman of the Board of Directors

## FROM THE EXECUTIVE DIRECTOR

### THE COMPUTER MUSEUM, INC. BALANCE SHEET / JUNE 30, 1991

	Operating Fund	Capital Fund	Plant Fund	Totals 1991
<b>ASSETS</b>				
<b>Current assets:</b>				
• Cash and equivalents	\$120,568			\$120,568
• Receivables and other assets	113,981	\$148		114,129
• Store inventory	72,764			72,764
• Interfund receivable		<u>207,798</u>		<u>207,798</u>
<b>Total current assets</b>	<u>307,313</u>	<u>207,946</u>		<u>515,259</u>
• Net property and equipment		11,328	<u>\$2,277,160</u>	<u>2,288,488</u>
<b>Total assets</b>	<u>\$307,313</u>	<u>\$219,274</u>	<u>\$2,277,160</u>	<u>\$2,803,747</u>
<b>LIABILITIES AND FUND BALANCES</b>				
<b>Current liabilities:</b>				
• Accounts payable and other current liabilities	97,078	121,927		219,005
• Interfund payable	<u>207,798</u>			<u>207,798</u>
<b>Total current liabilities</b>	<u>304,876</u>	<u>121,927</u>		<u>426,803</u>
<b>Fund balances:</b>				
• Unrestricted	2,437	12,675	2,277,160	2,292,272
• Restricted		<u>84,672</u>		<u>84,672</u>
<b>Total fund balances</b>	<u>2,437</u>	<u>97,347</u>	<u>2,277,160</u>	<u>2,376,944</u>
<b>Total liabilities and fund balances</b>	<u>\$307,313</u>	<u>\$219,274</u>	<u>\$2,277,160</u>	<u>\$2,803,747</u>

### STATEMENT OF ACTIVITY for the year ended June 30, 1991

	Operating Fund	Capital Fund	Plant Fund	Totals
<b>Support and revenue:</b>				
• Unrestricted gifts	\$496,004	\$87,938		\$583,942
• Restricted gifts	129,643	1,065,056		1,194,699
• Memberships	256,859			256,859
• Admissions	524,090			524,090
• Store/Functions	466,368			466,368
• Investment gain	43	4,140		4,183
• Other	<u>1,814</u>	<u>13,314</u>		<u>15,128</u>
<b>Total</b>	<u>1,874,821</u>	<u>1,170,448</u>		<u>3,045,269</u>
<b>Expenses:</b>				
• Exhibits and education	453,166	134,134		587,300
• Marketing and membership	320,608			320,608
• Depreciation			\$458,246	458,246
• Supporting Services:				
Management and general	251,509	67,069		318,578
Fund-raising	192,971	185,445		378,416
Bldg opns. & mortgage debt	286,200	147,377		433,577
• Store/Functions	<u>347,656</u>			<u>347,656</u>
<b>Total</b>	<u>1,852,110</u>	<u>534,025</u>	<u>458,246</u>	<u>2,844,381</u>
Excess/(deficiency) of support and revenue over expenses	<u>22,711</u>	<u>636,423</u>	<u>(458,246)</u>	<u>200,888</u>
Fund balance, beginning of year	<u>(213,274)</u>	<u>651,683</u>	<u>1,737,647</u>	<u>2,176,056</u>
<b>Add/(deduct) transfers</b>				
• Plant		(997,759)	997,759	
• Unrestricted	<u>193,000</u>	<u>(193,000)</u>		
Fund Balance, end of year	<u>\$2,437</u>	<u>\$97,347</u>	<u>\$2,277,160</u>	<u>\$2,376,944</u>

### Museum Staff

#### Finance and Administration

Oliver Strimpel,  
Executive Director  
Brian McLaughlin  
Geraldine Rogers

#### Development and Public Relations

Janice Del Sesto,  
Director  
Elizabeth Armbruster  
Gail Jennes  
Kate Jose  
Julie Oates  
Susan Pekock  
Janet Walsh  
Peter Yamasaki

#### Education

Natalie Rusk,  
Acting Director  
Nancy Boland  
James Boyd  
Troy Fryatt  
Giselle Gonzalez  
Gerald Knight  
Robert Krikorian  
Chris McElroy  
Mary-Catherine McElroy  
Tom Mosher  
Wanda Mourant  
Marko Pankovich  
Karl Schoonover  
Noah Southall  
Earl Yavner  
Tony Walker  
Marilyn Weiss

#### Exhibits

Greg Welch,  
Director  
Wayne Cookson  
Mary Beth Dorus  
Don Greene  
David Griscler  
Dan Griscom  
Lauren O'Neal  
Stephen Snow

#### Design

Theodore Groves,  
Exhibit/Graphic Designer  
Asa Chibas

#### Marketing and Museum Store

Sue Dahling,  
Director  
Martha Ballard  
Daniel Burke  
Brian Lee  
Christina O'Sullivan  
Christa Santos  
Noah Southall

#### Collections

Gwen Bell,  
Director  
Brian Wallace

The past fiscal year has been far and away the most successful in the Museum's history. It began with the opening of *The Walk-Through Computer*, a two-story-high working model of a desktop computer. The bold nature of this project captured the imagination of the media. Since its inception, features have appeared in print, on TV, and radio in over 65 countries, generating an estimated 350 million media impressions to date. People poured into the Museum, boosting the number of visitors by 44% over the previous year. The Computer Museum became known around the world as the place with the giant computer.

During the past year, the Museum developed the major exhibit *People & Computers: Milestones of a Revolution*, addressing the question "How did computers evolve?" This was the second phase of our exhibit development plan designed to produce exhibitions that answer questions including "How do computers work?" (realized by *The Walk-Through Computer*) and "What can computers do?" The latter theme, currently realized by the existing *Smart Machines* and *The Computer and the Image* galleries, will be dramatically expanded with *Tools & Toys: The Amazing Personal Computer*, exploring the myriad uses of personal computers. Originally known as *The Computer Discovery Center*, *Tools & Toys* is a joint project with The Boston Computer Society. It will open to the public on June 13, 1992.

This year's *Annual* contains a booklet based on *People and Computers*. The exhibit was designed to make the history of technology accessible to visitors from very diverse backgrounds. Visitors' positive reactions so far are a testament to the wisdom of our advisors and the immense dedication and ingenuity of Museum staff, brilliantly led by Greg Welch. The exhibition opened 5,000 square feet (a 20% expansion) of Museum exhibit space—on time and on budget, itself a major accomplishment, occurring with just a year of lead time. With the opening of *People & Computers*, several of the collection's "crown jewels" have gone on public view for the first time. The exhibition also helped spur on the Museum's active collecting, resulting, for example, in the acquisition of a much sought-after IBM System/360.

After a national search for a Director of Exhibits, it became apparent that the Museum's own experience in building exhibits about computers was unique. Greg Welch's experience at the Museum, culminating in his leadership of the *People & Computers* project, also includes the development of *Computers in Your Pocket*, the Museum's first

traveling exhibit, which toured nationwide under the auspices of the Smithsonian Institution Traveling Exhibition Service. Greg also developed a broad international perspective during a year-long Harvard fellowship to study the museums of Europe. His background, coupled with his enormous energy and enthusiasm, made him the best qualified to lead our original, fast-paced development program, and in January I appointed him as Director of Exhibits.

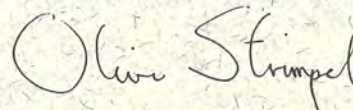
The Museum made major strides in extending its reach beyond its walls this year. Exhibit Kits, copies of our interactive exhibits, were installed in three other museums. The St. Louis Science Center installed the entire first series of nine Kits. Over 6,000 copies of our first educational video *How Computers Work: A Journey Into The Walk-Through Computer* have

been sold. Further materials, such as educator kits that meet the needs of teachers, are in the works. In all our activities, we pay special attention to reaching underserved communities.

During the last week of April, many Museum staff and friends descended on Silicon Valley for the Third Computer Bowl. The Valley's enormous enthusiasm, support, and appreciation of our mission were extremely encouraging, enabling us to make this Bowl our most successful fundraising event to date.

The success of both the exhibits and outreach activities resulted in the growth of the Museum's base of support. Our operating budget grew 27% to \$1.9 million and remained balanced. In addition, nearly a million dollars was raised for the exhibit development program.

On behalf of the staff and our many visitors, I thank the numerous individuals, corporations, and foundations who have contributed to the Museum, enabling us to deliver quality education to all who benefit from our programs. As always, we eagerly seek new friends to join us in the adventure of growing this one-of-a-kind international institution.



Dr. Oliver Strimpel  
Executive Director

***Visitors' positive reactions so far are a testament to the wisdom of our advisors and the immense dedication and ingenuity of Museum staff, brilliantly led by Greg Welch.***

## COLLECTIONS

### Computers

- Apple Computer, Inc.  
Macintosh 512, 1985  
Used to produce desktop-published school paper; on display in *People and Computers* exhibit  
Gift of Granada High School, X1074.91
- Datavue Corporation  
Spark, 1985  
Laptop computer, peripherals  
Gift of Steven B. Leeland, X1090.90
- Digital Equipment Corporation  
PDP-8e, 1971  
Used to control brain tissue testing equipment at West Haven Veterans' Administration Medical Center; on display in *People and Computers* exhibit  
Gift of Dr. Truett Allison, X1075.91
- Digital Equipment Corporation  
PDP-8a, 1975  
Embedded in lighting controller for Broadway show *A Chorus Line*; on display in *People and Computers* exhibit  
Gift of Gordon Pearlman, X1060.91
- ElectroData Division of Burroughs Corporation  
Datatron Model 205, 1954  
First general-purpose computer sold by Burroughs Corporation  
Gift of Southeastern Massachusetts University, X1055.91
- Institute für Informatik, Switzerland, and Brigham Young University  
Lilith personal computer, 1980  
Graphical user interface computer tailored to programming language Modula-2  
Gift of Tektronix Corporation, X1051.91
- Intel Corporation  
iPSC, 1985  
128 processor parallel computer; marked "First Production System"  
Gift of Robert Brams, X1076.91
- International Business Machines Corporation  
IBM System/360 Model 30, 1965  
First line of compatible computers, peripherals, programs; on display in insurance company setting in *People and Computers* exhibit  
Gift of Frost and Sullivan, X1059.91
- IXO Corporation  
IXO Telecomputer, 1978  
Briefcase-size modular computer, display, modem, printer  
Gift of Brian Randell, X1088.90
- Sun Microsystems, Inc.  
Sun 1, 1982  
First Sun graphics workstation  
Gift of Sun Microsystems, Inc., X1073.91
- Televideo Systems, Inc.  
TS 802, 1981  
Personal computer with CP/M operating system  
Gift of Don Wolman, X1089.90
- Analogue Computer**  
Northrop Aircraft, Inc.  
MADDIDA magnetic drum differential analyzer, 1947  
Engineering prototype for airborne navigational calculator  
Gift of Los Angeles County Museum of Natural History, X1050.91
- Sub-assemblies and components**  
International Business Machines Corporation  
IBM 1720 SMS mercury-wetted switches, 1959  
Standard Modular System components developed for process-control computer system  
Gift of Howard L. Funk, X1069.91
- MasPar Computer Corporation  
MP-1 components: array control unit, processor board, 1990  
Parallel computer scalable from 1,024 to 16384 processors  
Gift of MasPar Computer, X1062.91

- MIT Instrumentation Laboratory, C. S. Draper Laboratories, Raytheon Company  
Apollo Guidance Computer Block 1 components, 1962  
3 logic prototypes and 1 finished logic module from first production phase of first integrated circuit digital computer  
Gift of Eldon Hall, X1067.91
- MIT Instrumentation Laboratory, C. S. Draper Laboratories, Raytheon Company  
Apollo Guidance Computer Block 2 components, 1962  
1 sense amplifier prototype and 2 logic prototypes from second production phase of first integrated circuit digital computer  
Gift of Eldon Hall, X1068.91
- Sun Microsystems, Inc.  
Sun 2 cpu and other boards, 1983  
Networked graphics workstation  
Gift of Sun Microsystems, Inc., X1053.91
- Sun Microsystems, Inc.  
Sun 3 cpu board, 1986  
Single-board workstation  
Gift of Sun Microsystems, Inc., X1054.91
- Trilogy Corporation  
Prototype and production logic components, 1984  
First wafer-scale integration  
Gift of Gene Amdahl, X1086.91
- Union of Soviet Socialist Republics  
Minsk 32 logic module, 1973  
A copy of the Digital Equipment Corporation PDP-8, the Minsk 32 was particularly known for its reliability  
Gift of U.S.S.R. State Academy of Finance, X1084.91
- United Technologies Mostek  
Mostek chip die, wafer, chips, 1976  
Domestically-produced Dynamic Random Access Memory (DRAM) integrated circuits  
Anonymous Gift, X1087.91
- Transducers**  
Digital Equipment Corporation  
PDP-7 console, 1967  
One of a line of 12-bit computers; on display in *People and Computers* exhibit  
Gift of Digital Equipment Corporation, X1072.91
- Recognition Equipment, Inc.  
Electronic eye, 1968  
Light-sensing device consisting of array of discrete components  
Gift of Reid Dennis, X1056.91
- Recognition Equipment, Inc.  
96 element Photodiode Array, 1970  
Integrated circuit light-sensing device  
Gift of Reid Dennis, X1057.91
- Recognition Equipment, Inc.  
512 Element LSI Scanned Array, 1972  
High resolution integrated circuit light-sensing device  
Gift of Reid Dennis, X1058.91
- Tektronix Corporation  
Type 543A oscilloscope and stand  
Computer test equipment; on display in *People and Computers* exhibit  
Gift of Michael Callahan, X1061.91
- Versatron Corporation  
Foot Mouse, 1990  
Anonymous gift, X1081.91
- Memory**  
Union of Soviet Socialist Republics  
Ural 11-B core memory plane, 1969  
The Central Statistical Department of the Supreme Soviet used Ural 11-B computers from 1969 to 1977  
Gift of U.S.S.R. State Academy of Finance, X1083.91
- Digital Calculators**  
Dennert & Pape KG  
Aristo M 36 Pocket calculator, 1974  
Gift of Hermann Zapf, X1070.91

- Wang Laboratories, Inc.  
Model 360 Scientific calculator, 1967  
Four interlinked calculators with shared logic and storage registers  
Gift of Dan Freitas, X1052.91

### Slide Rules

- The Binary Slide Rule, 1940  
Gift of Herbert and Louise Spierer, X1066.91
- Cabric Limited  
Cylindrical slide rule, 1910  
Gift of Herbert and Louise Spierer, X1063.91
- Dennert & Pape  
Hohenrechscheiber cylindrical slide rule  
Gift of Herbert and Louise Spierer, X1064.91
- George W. Richardson  
Richardson's Direct Reading Slide Rule, 1912  
Gift of Herbert and Louise Spierer, X1065.91

### Ephemera

- Remington Rand UNIVAC  
UNIVAC Solid State 80 scale model, 1960  
Gift of the Family of Dr. Donald G. McBrien, X1080.91

### Other

- Dr. Donald G. McBrien  
Core memory learning aid  
Memory addressing learning aid  
Binary adder learning aid  
Professor McBrien fabricated these learning aids to communicate principles of computing to students in his classes on computing, the first offered at Boston University  
Gift of the Family of Dr. Donald G. McBrien, X1077.91 to X1079.91
- Richard O. Spencer  
Stylis's rendering of the Johnniac computer, 1950  
Rand Corporation engineers designed the Johnniac's case and framework to Institute of Advanced Studies guidelines and this drawing.  
Gift of Raymond Clewett, X1082.91
- TAB Corporation  
Punched card carrying case, 1970  
Donated by Dr. J. Paul Hartman, X1085.91
- Weston Electrical Instrument Corporation  
Model 270 tube tester, 1949  
Used on UNIVAC-1 computer in Boston  
Gift of Joseph C. Macura, X1071.91
- Donors to the Document, Film and Video, Photograph, and Library Collections**  
Anonymous  
Association for Computing Machinery  
The Charles Babbage Institute  
William J. Eccles  
Frank Friedman  
David Faultersack  
Marcia Greenberg  
Philip A. Greenberg  
Willis Griffiths  
Eldon Hall  
Dennis Bathory Kitz  
Carl C. Ledbetter  
MasPar Computer Corporation  
The MITRE Corporation  
Craig Partridge  
Paul R. Pierce  
The Rand Corporation  
Alex Randall  
Michael Rohrbach  
Joseph Royal  
Richard Russell  
Art Shifrin  
Slate Corporation  
Barrie Sosinski  
Herbert and Louise Spierer  
Sun Microsystems, Inc.  
University of Texas at Austin  
Professor Don Weinsbank  
Rod Wilmot  
Professor Hermann Zapf

# PEOPLE *and* COMPUTERS

*Milestones of a Revolution*



*A Permanent Exhibit at*

**The Computer Museum**

Major Underwriter

**The National Endowment for the Humanities**

Principal Sponsors

**Digital Equipment Corporation**

**International Business Machines Corporation**

Sponsors

**Apple Computer, Inc.**

**Lotus Development Corporation**

**Matsushita Electric Industrial Company**

**The MITRE Corporation**

**The Travelers Companies**

**Unisys Corporation**

Donors

**Charles and Constance Bachman**

**John Cocks**

**Allen Michels**

**Douglas Ross**

**Jean E. Sammet**



Photograph: Doug Baker

*This 18-screen Video Archway dramatizes 50 years of computer history in 90 seconds, and forms the entrance to the exhibit.*

*Milestones of a Revolution*

**Milestone 1**  
**Mechanizing Names and Numbers**  
 The 1930s

**Milestone 2**  
**The Electronic Computer is Born**  
 The 1940s

**Milestone 3**  
**A Big Machine for Big Business**  
 The Early 1950s

**Milestone 4**  
**Marching Orders for a Corps of Computers**  
 The Late 1950s

**Milestone 5**  
**Big Business Buys the Computer**  
 The 1960s

**Milestone 6**  
**Unleashing the Computer**  
 The Early 1970s

**Milestone 7**  
**A Small World Still Has Big Problems**  
 The Late 1970s

**Milestone 8**  
**Computing Power for People**  
 The 1980s

**Milestone 9**  
**We Are All Programmers**  
 The 1990s

The past fifty years have witnessed immense technological change. Foremost among those changes has been the explosive growth in computer technology that has been called the Computer Revolution. This booklet is a companion to the exhibition *People and Computers: Milestones of a Revolution*. Through a series of nine milestones this exhibition portrays important eras in computer history. The milestones explore the historical forces that shaped major advances in computing technology. They also investigate the effect these advances have had on our world.

When computers were invented in the 1940s, their impact was revolutionary, offering a thousand-fold improvement over hand-operated, mechanical calculators. Since that time, computers have incorporated new inventions such as integrated circuits, microprocessors, and new computer languages. Today's desktop computers are a thousand times faster than the first million-dollar mainframes that launched the Computer Age.

Each of the nine milestones depicted in this booklet typifies a new way of using and thinking about computers. Together, they create an outline of the course of the Computer Revolution, from punched paper cards through personal computers. This booklet combines photographs of the exhibition itself with vintage photographs depicting the historical context of the various milestones in the Computer Revolution.

The changes in computer technology were not linear and direct, but had false starts, dead ends, and led to unexpected applications. While each new development offered advantages, it also created and compounded problems. For example, the ability to organize data on every person electronically helped the operation of governments and corporations, but threatened the privacy of individuals. Computers created new jobs, but they also made others unnecessary.

The Computer Revolution is not over. When you finish this booklet, we hope you will ask yourself: "What have computers meant to me and my family? And how will they affect my future?"

# MECHANIZING NAMES AND NUMBERS

Governments keep records on their citizens. Before the advent of machinery for processing information, this painstaking work was done by hand. The invention of punched card equipment in 1890 changed all this. Bureaucracies came to depend on these machines which processed information using gears, switches, and paper cards. Punched card data processors were ancestors of the computers we use now.

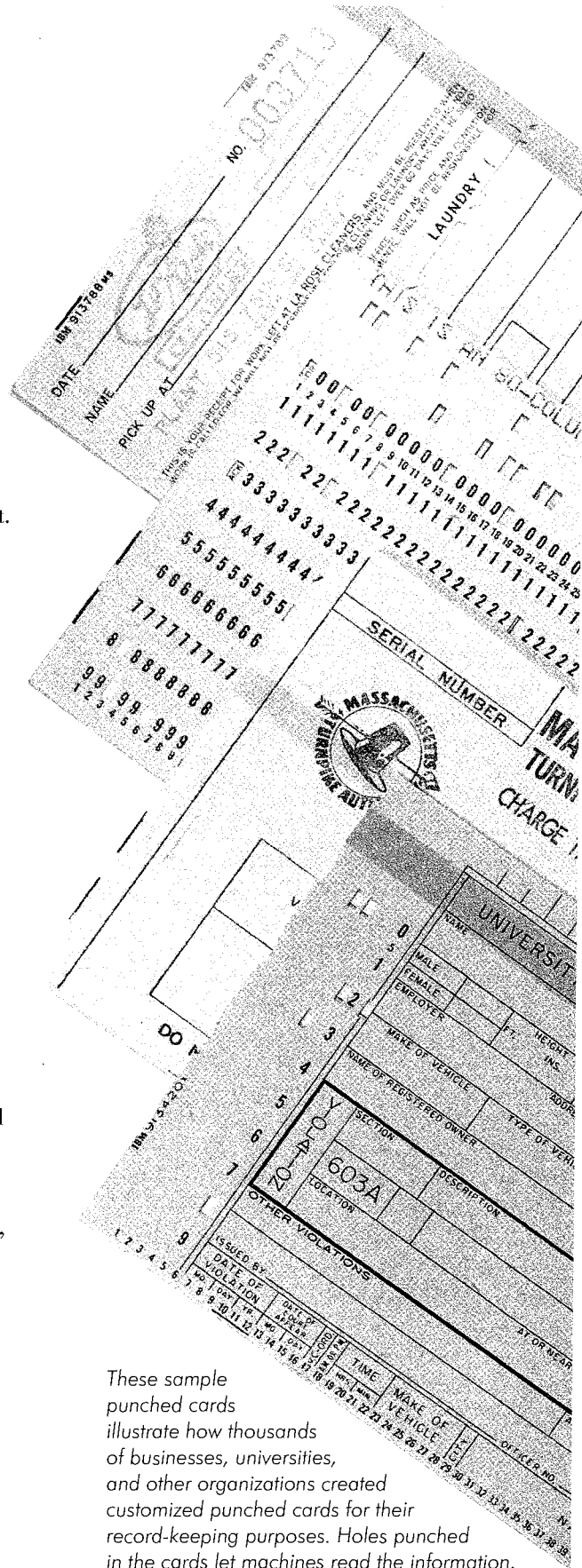
Census clerks took over seven years to tabulate and interpret the results of the 1880 Census. By the time the statistics were ready, over 10 million new immigrants had entered the United States, making the results virtually worthless. A faster process had to be found to compile the results of the next census. A Census Bureau employee named Herman Hollerith invented a better way to get the job done. He devised mechanical machinery to read a pattern of holes punched in paper cards. Each hole represented information, such as a person's country of birth, age or sex. Using this system, Census Bureau workers tabulated information on 64 million people in six weeks, at a savings of over \$5 million.

In 1896, Hollerith established the Tabulating Machine Company to sell his invention to government agencies, both in the U.S. and abroad, and to railroads and other business. This launched the punched card office machine industry. By the 1930s, police departments, schools, and many other government agencies and businesses depended on these

machines for record-keeping and accounting. Herman Hollerith's original company became part of IBM. By the end of the 1930s, many companies, such as Remington Rand in the U.S., Powers-Samas in England, and Bull in France, were producing data processing equipment.

During the Great Depression many people faced financial hardship. One of the programs created in response to this crisis in the U.S. was the Social Security Act of 1935 to ensure pensions for millions of citizens. To administer this program, the federal government turned to punched card equipment.

Starting in 1937, the U.S. Social Security Administration used IBM punched card machines to keep records on over 27 million people. The key was punched paper cards that stored records of each individual's contributions to the system. Clerks used special typing machines to punch a person's Social Security number, name, and employer onto paper cards. Mechanical machines were then used to process this information: some sorted cards, some added numbers, and others printed out reports for policy makers to study. Day after day, hundreds of clerks carried thousands of cards from one machine to the next. These machines were essential for the timely distribution of over 30,000 Social Security pension checks a month.



These sample punched cards illustrate how thousands of businesses, universities, and other organizations created customized punched cards for their record-keeping purposes. Holes punched in the cards let machines read the information. A particular pattern of holes in a column of the card corresponded to a given letter of the alphabet or digit.





Courtesy of the Dorotea Lange Collection, The City of Oakland, The Oakland Museum



Times were hard in the 1930s. Millions of people lost their jobs, homes, and hope. To get the United States back on its feet, the Congress and President Franklin D. Roosevelt set up new federal agencies that required more detailed data about human needs to deliver expanded human services.

# THE ELECTRONIC COMPUTER IS BORN

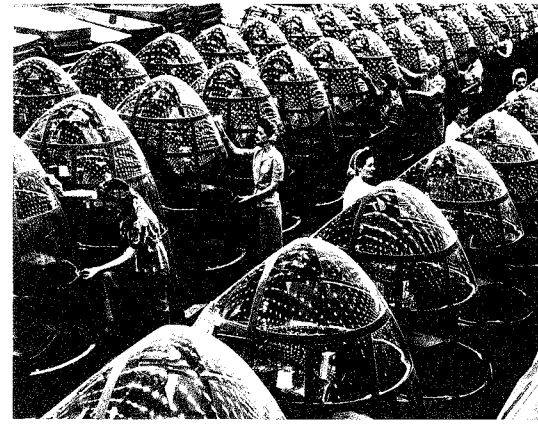
Before World War II, solving complex mathematical problems took a long time and required the coordination of dozens of people working with mechanical calculators. These workers were often called “computers.” With the War, the British and U.S. governments funded major efforts to develop automatic calculating machines. By and large, the British focused on tools for cracking coded messages, and the U.S., on tools to achieve accuracy in firing from ships and in the field. The modern electronic computer sprang from these efforts.

One such effort was Project Whirlwind at the Massachusetts Institute of Technology (MIT). Like many other early experimental computers in the U.S., Whirlwind was built with government support—close to \$4.5 million over the course of the project. Started during World War II by the U.S. Navy, Whirlwind continued to receive military support after the War and led to many important advances in computer technology.

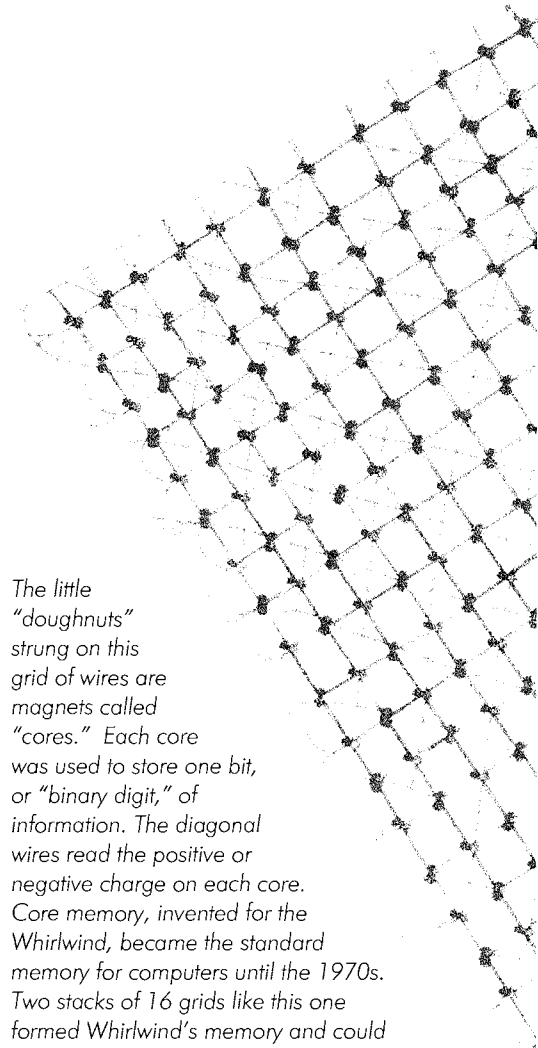
Jay W. Forrester led the team at MIT that developed the Whirlwind computer. The original goal had been to build a machine for training Navy pilots during World War II. Simulating the response of an airplane meant executing complex calculations as rapidly as the pilot moved the controls. At the time, it proved difficult to build a computer which was that fast.

The Whirlwind’s circuitry depended on over 12,500 vacuum tubes. Since vacuum tubes burned out, Forrester and his team worked to increase their reliability, designing the computer so that the vacuum tubes could be periodically checked and those in imminent danger of failure could be easily removed and replaced. In search of ever greater speed, the engineers constantly refined their designs. The development of faster, more reliable circuits and memory enabled Whirlwind to meet its original goals for speed, but by then the War was over, and the purpose of the project had changed.

After the War, the Air Force took over support of the project, and Whirlwind became a prototype for an air defense computer system that tracked every plane flying over North America. The Whirlwind also became a resource for academic research. The machine was never idle; when it was not doing work for the Air Force project, MIT professors took the opportunity to assign it calculations that would otherwise have taken hundreds of hours to solve by hand. Using the computer, they tackled such problems as designing optical lenses, controlling machinery, and studying economics, to name just a few.



World War II forced nations to build planes, tanks, ships, and guns in greater variety and number than ever before. Around the world, money and minds focused intently on developing new technologies. These efforts produced many important inventions: jet engines, rockets, radar, the atom bomb, and the computer.



The little “doughnuts” strung on this grid of wires are magnets called “cores.” Each core was used to store one bit, or “binary digit,” of information. The diagonal wires read the positive or negative charge on each core. Core memory, invented for the Whirlwind, became the standard memory for computers until the 1970s. Two stacks of 16 grids like this one formed Whirlwind’s memory and could hold 32,768 bits of information—or 4K bytes.

Courtesy of The Computer Museum



Courtesy of The Computer Museum

Joe Thompson, one of Whirlwind's full-time operators, was hired right out of high school. He is shown preparing instructions for the computer on a "Flexowriter." The racks of switches and lights along the wall of the control room allowed the operator to check that Whirlwind's circuitry was running correctly. The Whirlwind control room and computer occupied 3,100 square feet, the size of a ten-room house.

# A BIG MACHINE FOR BIG BUSINESS

In the years following World War II, factories pressed into service during the War returned to commercial use. Similarly, the computers that were developed for military use were adapted for peacetime activities in government, business and education. By the end of the 1950s, thousands of computers were in use by business and government alike.

The first machines to make the jump from government and scientific applications to practical uses in business were the UNIVAC I (short for UNIVersal Automatic Computer) in the U.S. and the LEO I (short for the Lyons Electronic Office) in England.

UNIVAC sprang directly from ENIAC, a pioneering computer developed for the U. S. Army during the War by John W. Mauchly and J. Presper Eckert, Jr. While most people still saw the computer as a tool for science and engineering, Eckert and Mauchly recognized its potential for business data processing. Inspired by their vision, they founded a company to produce the UNIVAC I, a computer specifically designed to meet the needs of business. Early customers for the million-dollar UNIVACs included General Electric, Metropolitan Life, and the U.S. Census Bureau.

G.E. purchased their UNIVAC in 1952 when they consolidated all their major appliance manufacturing into a single factory in Louisville, Kentucky. Post-war demand had increased sales of stoves, refrigerators, and washing machines. Meeting this demand meant keeping track of all the wire, plastic, steel, springs, and other materials that went into the appliances and paying a growing

workforce. In addition to the \$1 million price tag, G.E. had to provide specially climate controlled conditions and a large team of technicians and consultants to install the machine and keep it running. G.E. also retained the services of Arthur Anderson, a large accounting firm, to assist them in getting the UNIVAC up and running for the first time.

Since this was one of the first commercial applications of a computer, no off-the-shelf software, operating systems or databases were available. Only after months of work, did the team of G.E. and Arthur Anderson experts succeed in completing programs that instructed UNIVAC I to perform its giant task: keeping track of the millions of parts in the factory's inventory and calculating paychecks for the plant's 12,000 employees, with their own tax deductions, Social Security payments, wages, overtime, and health benefits.

In England, LEO I was patterned after the Cambridge University EDSAC, one of the world's first stored program computers. In this case, the Lyons Tea Company faced the daunting task of supplying hundreds of tea shops with tea, biscuits, and cakes according to ever changing demand. To assist them in processing thousands of orders every day, Lyons decided to build their own computer. After the first machine was installed and working successfully, Lyons went into the business of manufacturing computers to meet the growing need of other businesses for data processing systems.



By the mid-1950s, managers around the world saw the computer as a symbol of a thriving, modern enterprise—the latest tool for scientific business administration. Orders for computers soared to the thousands. The UNIVAC I and LEO I had broken open the market for business computers.

Using computers in business was part of a larger trend: automation. Machines that seemed to think and work tirelessly were viewed with great expectation and trepidation. Some people claimed this technology would free humans from boring, repetitive labor; others feared it would put people out of work.



Courtesy of The Computer Museum

This is a typical UNIVAC I installation of the 1950s. Here you see the computer's console and tape drives.



After World War II, economies boomed. People bought cars, refrigerators, and washing machines in unprecedented numbers. Factories churned out more and more products. To keep up with demand and to gain competitive advantages, a handful of large companies began to see the emerging computer as a tool for managing their vast operations.

# MARCHING ORDERS FOR A CORPS OF COMPUTERS

Toward the end of the 1950s, government and business invested in more and more computers produced by a growing number of companies. Each manufacturer's machines were unique and only followed their own instruction code. No common languages like BASIC or PASCAL existed. Customers complained that it took too long to get their expensive machines into operation, and no common basis existed for training the growing population of programmers. The difficulty of programming was a major obstacle to the growth of computer use.

In May 1959, at a meeting in the Pentagon, representatives from ten computer manufacturers, seven government agencies, and 11 large users formed a committee to figure out a single way to program business problems.

After six months of work and debate, members of this committee issued a report describing a language for programming business problems. They called it COBOL (short for COmmon Business-Oriented Language). COBOL offered several advantages over programming a problem in the obtuse code of individual computers: it used symbols and words familiar to business people to express instructions, and with only minor modifications, a program written in COBOL could be run on any computer that used the language.

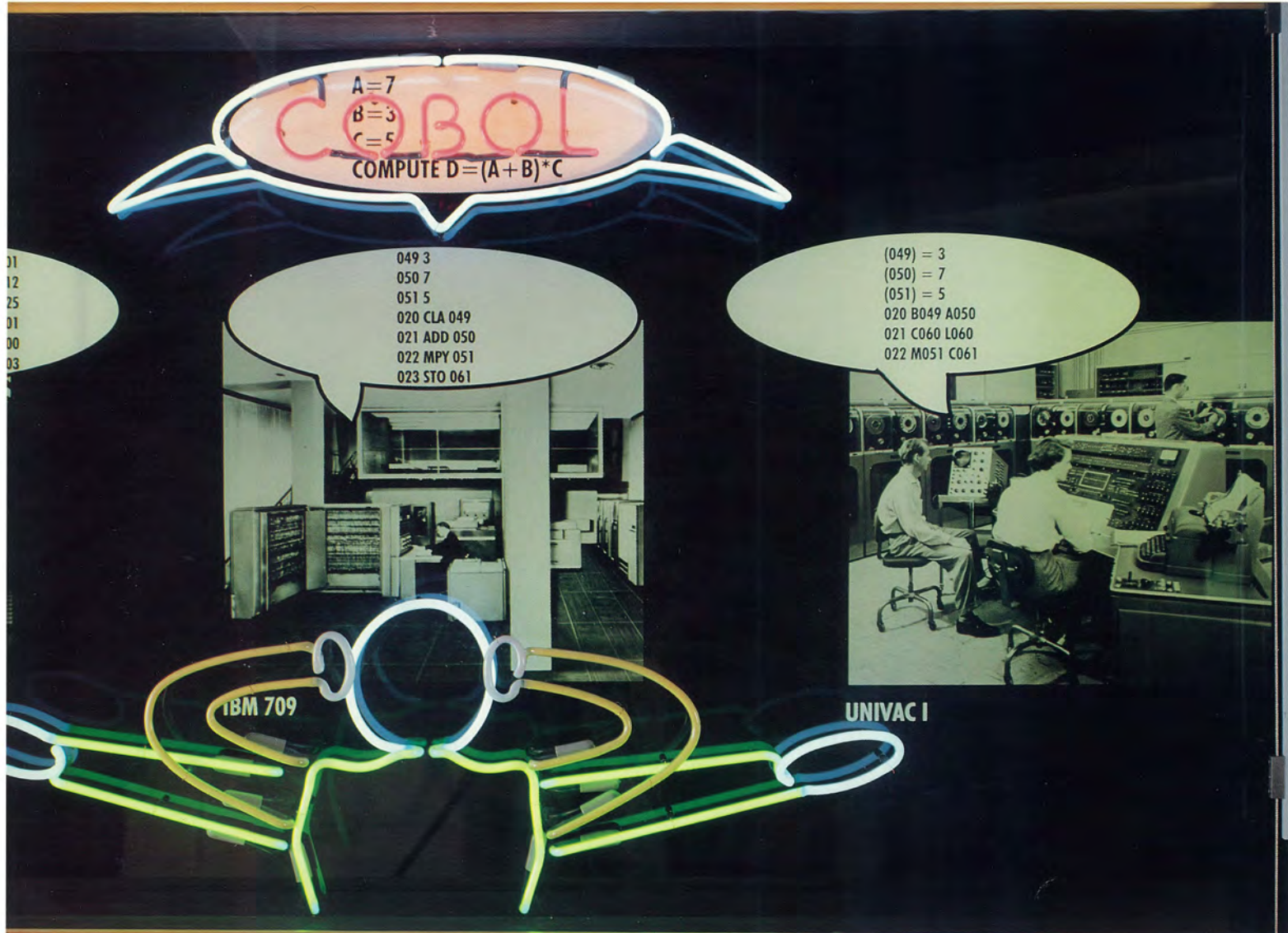
The key to COBOL and other early programming languages was a special program called a *compiler*. A compiler program took the COBOL commands written by the programmer and automatically translated them into the series of minute instructions which that particular computer actually executed. This made writing a program in COBOL much quicker and easier than having to write out the instructions the computer executed. It also permitted the same program to run on different machines.

COBOL was not the only important programming language to emerge during this period. Others included: FORTRAN (short for FORmula TRANslator and used for scientific problems), APT (Automatically Programmed Tools for controlling machinery), and LISP, the language that virtually launched the field of artificial intelligence. Programming languages allowed the development of curricula for training programmers and other users. This meant people could be trained in the use of one language and work on many different machines.

Certain languages, such as FORTRAN, enjoyed wide use and became "de facto" industry standards. In contrast, COBOL, and later ADA, a subsequent language, became standard languages by decree. The Defense Department required that all its administrative computers have COBOL compilers. But these standards were not universal; by the 1970s, hundreds of different programming languages were in use.



COBOL allowed different computers to "speak" the same language.



Courtesy of the Associated Press



Courtesy of the John F. Kennedy Library

President John F. Kennedy gives his 1961 inaugural address in Washington, DC.

In 1961, an East German soldier escapes to the West as the Berlin wall goes up.

# BIG BUSINESS BUYS

## THE COMPUTER

By the mid-1960s, computer data processing had become a crucial part of business. Designed to satisfy both business and scientific users, computers came in a range of sizes and prices, starting at \$50,000. But most were large “mainframe” computers that processed customers’ orders, issued bills, kept personnel records, and performed many other functions central to commercial enterprise. The IBM System/360 was typical of computers during this period.

The IBM System/360 was actually a family of computers that came in various sizes, all of which could use the same tape drives, printers, and other “peripherals.” As their business grew, customers could simply expand their computer system. Switching to a more powerful computer no longer meant writing new programs. This “modular” approach to building computers was one reason the System/360 sold so well.

The Travelers Insurance Companies exemplified how large corporations came to rely on computers. At its central data processing center in Hartford, Connecticut, The Travelers recorded and managed the more than 1.5 million insurance policies written by its agents nationwide, and processed over 16,000 claims every day from around the country. Enormous computer tape “libraries,” or “data banks,” stored information about the company’s customers. As The Travelers computerized more and more insurance policies, it added more computing power and memory to handle the additional information.

The Travelers used its computer primarily for electronic record keeping on a vast scale. For example, in a single day the computer might be fed 3,000 claims for fire damage to private homes. The computer’s central processing unit would then hunt down the policy record for each

customer whose house had caught fire, verify that the damage was covered by the policy, record the claim, and print a check to pay for repairs.

In the 1960s, computers could generally run only one program at a time, and were shared by dozens of users. Most people who used computers for problem-solving never actually saw or touched the machine. Full-time operators ran the programs. Users had to wait until the computer could run their job. If there were errors, they had to correct them and then start again at the end of the line.

This method of operation was called “batch processing.” For example, a programmer working on a new customer database would write a program, have it punched on cards, and then hand it over to the computer operator. The operator would run the job when its turn came and hand the results back to the programmer who had submitted it. This often took hours, sometimes days. If there were a problem, or “bug,” in their code, programmers had to find and correct it by hand and then start over at the end of the line of jobs waiting to be processed by the computer.

The large mainframe computers of the 1960s required specially made computer rooms that were heavily air conditioned and had extra space in the floors, ceilings, and walls for cables and wiring. Clattering and whirring equipment filled these rooms with a constant din. Access to computer centers was generally restricted to operators and service people, who exercised strict control over the use of the machines.

New technologies raised new dilemmas. During the 1960s, governments and big corporations began to build huge stockpiles of information using computers. Enormous databases kept medical

records, bank account records, criminal records, driver’s license records, income tax records, etc. Almost every United States citizen was affected. Some people began to joke about computers, blaming them for making mistakes on their bills. Others began to be concerned about the potential threat computers posed to their privacy. A 1965 proposal to create a nationwide, unified government database met with strenuous opposition.



The Beatles appear on Ed Sullivan's television show in 1964.



This is a computer's “library.” The reels of tape magnetically stored volumes of information in a form the computer could read.





Mainframe computers required their own special facilities. Here, a technician installs cabling for a new tape drive.

# UNLEASHING THE COMPUTER

Smaller, cheaper, more efficient components resulted in smaller cheaper computers that didn't need their own special environmental controls. Relying at first on transistors and then on more compact integrated circuits, *minicomputers* spread to many new and smaller-scale uses. From the first manned mission to the moon to operating rooms and theaters, the minicomputer went where no computer had gone before.

In 1965, Digital Equipment Corporation announced the PDP-8, one of the most popular minicomputers. This new breed of computer opened up a new universe of applications. These computers were small enough that they could be used where mainframes could never fit (including inside other pieces of equipment) and inexpensive enough that customers who could never have afforded a full-scale mainframe could buy a computer of their own.

## The Surgeon and the Computer

In the early 1970s, medical researchers and surgeons at the Yale Medical School and the West Haven VA Medical Center in Connecticut began experimenting with a PDP-8e to assist in neurosurgery. Before using the PDP-8, brain surgeons had to keep patients awake during surgery and manually prod the brain to identify the cerebral cortex. Damaging the cortex could leave the patient paralyzed. By hooking the patient up to the PDP-8, the researchers could stimulate nerves in the patient's body and electronically map the cortex while the patient slept. This method was not only faster, but also much less gruelling on both patient and surgeon.

## A Chorus Line

At the Shubert Theater in New York City, the Broadway show *A Chorus Line* played to sold-out audiences for years. Most of the audiences didn't know there was an electronic stagehand on the job to help things run smoothly.

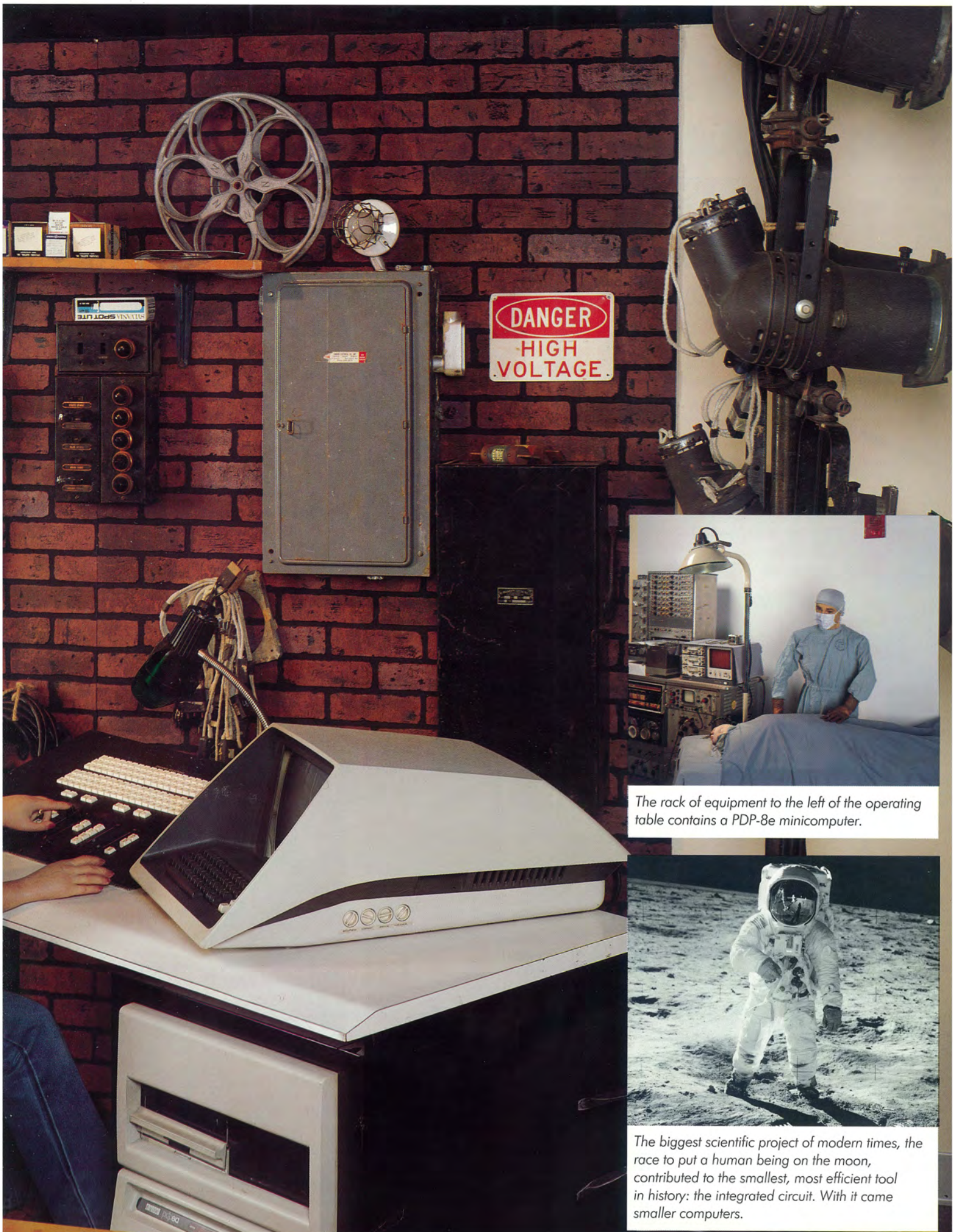
"Sam" was the nickname given to the LS-8 light controller by its operators. A lighting designer programmed Sam to remember and execute all the lighting effects for the show. Sam could flash lights faster and more precisely than any technician could by hand. That was key to running *A Chorus Line*—Sam had to keep pace with 17 whirling dancers. It would have taken eight lighting technicians to put on the show Sam and its single operator did. But computerized lighting had one drawback. If a dancer tripped or missed a cue in the middle of a special effect, Sam kept right on going.

Electronics Diversified, Inc., built the LS-8 light controller around a PDP-8a computer. The PDP-8a served as Sam's "brain" and memory. From 1975 to 1987, Sam controlled the lights for every show of *A Chorus Line* at the Shubert Theater.

Embedding a minicomputer inside another piece of equipment, be it an assembly line robot, automatic potato picker, or lighting controller, became a typical way of using computers.



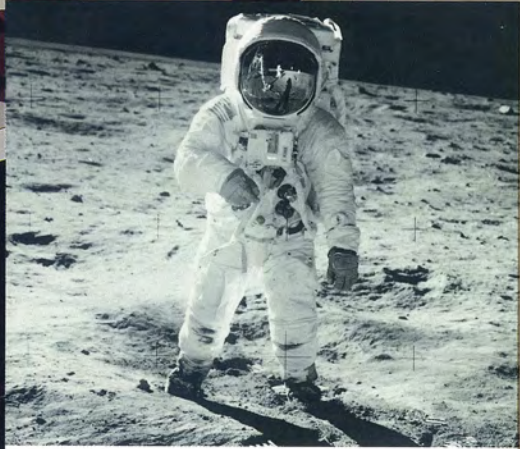
The dancers in *A Chorus Line* were not the only ones who had to make some quick changes backstage. The PDP-8a embedded inside the lighting board console stored thousands of pre-programmed lighting cues. With the touch of a button, the lighting technician could trigger a whole effect involving hundreds of lights.



**DANGER**  
**HIGH**  
**VOLTAGE**



The rack of equipment to the left of the operating table contains a PDP-8e minicomputer.



The biggest scientific project of modern times, the race to put a human being on the moon, contributed to the smallest, most efficient tool in history: the integrated circuit. With it came smaller computers.

# A SMALL WORLD STILL HAS BIG PROBLEMS

As scientists pierced the frontiers of knowledge, the problems they struggled with became ever more complex. To assist them in their research, scientists sought ever faster, more powerful computers. The fastest computers of their day came to be known as “super-computers.”

When introduced in 1976, the CRAY-1 computer was by far the fastest in the world, performing 166 million operations per second. Such calculating power helped change the way scientists used computers for research. With the CRAY-1, scientists could construct and study complex mathematical models of objects or events too dangerous, inaccessible, or big to experiment with directly.

Meteorologists at the European Centre for Medium-Range Weather Forecasts (ECMWF) in Reading, England, used the CRAY-1 super-computer to predict the world’s weather for extended ten-day forecasts. The mathematical calculations used to chart weather patterns and track major storm systems were performed by the CRAY-1 computer.

To make its weather predictions, the ECMWF built a computer center the size of a small factory and filled it with an array of computer equipment. The CRAY-1 supercomputer was its heart. “Talking” to a person would only slow down the CRAY-1, so other computers were used to feed it data and instructions rapidly.

Forecasting the weather was exactly the type of enormous arithmetic problem that demanded the use of supercomputers like the CRAY-1. The ECMWF fed the computer the temperature, humidity, barometric pressure, wind speed, and wind direction from satellites, 9,000 weather stations, 750 weather balloons, and numerous ships and

planes around the world (80 million bits of information total). From these readings, the CRAY-1 calculated the estimated conditions for every point on a grid covering the globe’s atmosphere. (With points spaced 200 km apart and 15 layers deep, there were 273,630 points in all.) Then, applying the physical laws describing the behavior of gases and fluids, the computer figured out how the weather conditions at each point of the grid would affect the points surrounding it 15 minutes later. The CRAY-1 system repeated this last step 960 times, and 500 billion calculations later the meteorologists had an approximate view of the weather around the world for the next ten days. Of course, as with all such predictions, the accuracy of the forecast was limited by the simplifying approximations made by the programmers.

It’s not hard to understand why this global weather model required a very fast and large computer. Neither a minicomputer nor a data-processing mainframe could have handled all the data and calculations fast enough. The CRAY-1 computer produced the forecast in just five hours.

Supercomputers were not cheap (the CRAY-1 computer system cost \$8,000,000 in 1976), but some jobs, both then and now, could not be done without them. For example, defense laboratories use supercomputers to simulate new weapons under design. Environmental scientists use them to study different scenarios to explain global warming. Aircraft companies use supercomputers to test the design of airplanes before they start construction. Oil companies use them to map the Earth’s interior. The weather forecast still comes to you thanks to supercomputers like the current CRAY, NEC and Fujitsu machines.

From a room in Reading, England, a meteorologist at the European Centre for Medium-Range Weather Forecasts studies the prediction of the world’s weather for the next ten days. The charts on the wall show the European forecast for June 11-21, 1979. The mathematical calculations used to produce these charts were performed by a CRAY-1 computer.



Courtesy of the Jimmy Carter Library



Egyptian President Sadat, U.S. President Carter and Israeli President Begin sign the Camp David Peace Accord in 1978.



The speed of the CRAY-1 is partly attributable to the tightly packed circuits arranged in a semi-circle to minimize the distance between the computer's parts. The CRAY-1 is so fast that if the electricity had to travel too far, the computer would have to wait for it. The "seat" houses the equipment that supplies power to the rack of circuitry above it. A pump circulates Freon (the liquid used in air conditioners) through the cast aluminum racks to keep the computer cool.

# COMPUTING POWER FOR PEOPLE

During the 1980s, technology expanded the possibilities of personal choice. With automatic teller machines (ATMs) people could do their banking whenever they chose. VCRs let people watch movies and television shows on their own schedule. The inexpensive personal computer allowed people to use computers more freely for work, play, and self-expression.

In 1971, the invention of the *micro-processor* set the stage for the personal computer. By 1974, enthusiasts designed and built their own “homebrew” computers based on this inexpensive “computer-on-a-chip,” and small companies began to sell do-it-yourself computer kits for hobbyists. In growing numbers, these *micro-computer* owners swapped programs and ideas, pioneering the use of computers by individuals.

By the late 1970s, the Apple II, TRS-80, and Commodore PET were sold as complete units in retail stores. Then, in August 1981, IBM introduced its Personal Computer. Two-and-a-half years later, in December 1984, Apple Computer responded with its Macintosh. More than any other personal computers, these two transformed the way people and organizations thought about and used computers. Low-cost systems, sold with word processors and spreadsheets, expanded the use of computers to individuals and within large organizations. By the late 1980s, resources that had been concentrated in central computing facilities during the 1950s and 1960s started to migrate to desk tops.

Ready-made, shrink-wrapped, load-and-run software programs enabled practically anyone to use these personal computers without any knowledge of programming or electronics. The software that helped make the IBM PC a success was *Lotus 1-2-3*—a *spreadsheet* program.

Businesses of all sizes bought the PC and *1-2-3* for analyzing complex charts of financial information. This combination of hardware and software helped make the personal computer a part of everyday business life.

In 1981, the IBM Personal Computer (PC) sold only 20,000 machines. In 1983, sales had grown to more than 500,000, prompting over 150 companies to try to market imitations. Compaq was the first of many “clones” with the ability to run the same software. Within a few years a whole industry of *PC clones*, *peripherals*, and software arose, all built around the basic design of the IBM PC.

One reason for this was a program made by a company called Microsoft. MS-DOS (for Microsoft Disk Operating System) administered the IBM PC’s operations. Any computer that used MS-DOS could run any software written for the PC. And conversely, any program written to run with MS-DOS would work with any *PC-compatible* computer, or “clone.” In this way, MS-DOS contributed to explosive growth in the personal computer market. By 1990, Microsoft had sold over 12 million copies of MS-DOS, two million more than the best selling record album of the year.

The Macintosh, with its own non-DOS operating system, offered an alternative form of computing more focused on graphics. Users could easily make text **LARGER**, smaller, *italicized*, or **bold** and see the result right on the screen. They could also easily create pictures, charts, and other graphics. Rather than taking their print jobs to a printer or typesetter, Macintosh users—from individuals and advertisers to schools and corporations—could produce fancy documents themselves on their own computers. Using these machines to design newsletters, catalogs, magazines, and brochures became known as *desktop publishing*.

One of the Macintosh’s most appealing features was that it was easy to use. Rather than having to memorize and type out commands, as with most PCs, Macintosh users simply pointed to an icon, or small representative picture, of the command they wanted and clicked the computer’s *mouse*. This meant new users and young children could quickly get down to useful work and play, without spending a long time learning the ropes. In this way, the Macintosh helped popularize styles of computing known as a “GUI” (Graphic User Interface) and “WYSIWYG” (What You See Is What You Get).



Photograph: David Ball

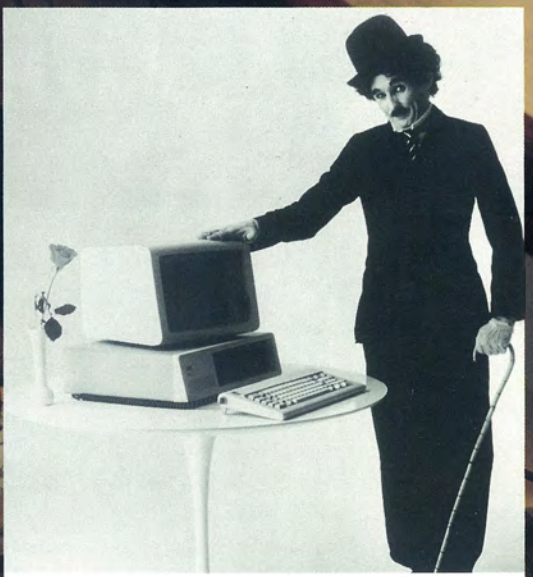
## The horses are on the track... they're at the gate... And they're off!

At over 5,000 ticket windows across Hong Kong, fans scramble to bet on their favorite horses before the race begins at Happy Valley Racetrack. The ticket windows report their sales to central offices where personal computers, running Lotus 1-2-3 spreadsheet software, create reports for the managers. The computers rapidly compile statistics showing how the volume of bets placed compares to the previous year, how many betting tickets are sold per ticket window, and the size of the average bet. Such information is critical to keeping tabs on the operation of Happy Valley and planning for the future.



**Read all about it! "Nifty Tips for a Great Homecoming Date!" "Teenagers From Around the World!"**

Starting in 1985, students at Granada High School in Livermore, California, used an Apple Macintosh computer and a program called PageMaker to publish their school newspaper, The Wall. To help pay for the computer and the software, the students also used their system to design publications for county agencies.



This print advertisement for the IBM PC was introduced in 1981.

# WE ARE ALL PROGRAMMERS

By the late 1980s, computer processors and memories were found in many, many devices—for example, CD players, telephones, thermostats, microwave ovens, cameras, and answering machines. People who programmed their VCRs were actually programming microcomputers embedded inside the VCRs. The computer itself was becoming smaller—lap-top and palm-top computers had more capability than the 20 pound IBM PC of ten years before. All these machines depended on ever more powerful, less expensive microprocessors. In 1990, world production of microprocessors totaled 1.5 billion (10 times the number of people born that year).

Today, many consumers in the developed world own and use several computers—in their cars, VCRs, telephones, calculators, watches, and electronic games—not to mention their personal computers. While this proliferation of computers has yet to occur in the developing world, the inexpensive, easily programmed, and durable microprocessor has greater potential for use by people around the globe than any of its predecessors.

Today, computers surround us, easing some age-old human problems and making others worse. They have begun to affect every person on earth in ways we can only begin to understand. Still greater changes lie ahead. Today's youth will be the first to grow up with computers. What will this mean for them and their world?



Courtesy of the Associated Press

Crowds celebrate the destruction of the Berlin Wall in 1989.



Computers surround us. Many of today's consumer electronics products rely on embedded microprocessors.





CASIO · SONY · EPSON

Panasonic  
EASA-PHONE  
KX-T2634  
Integrated Telephone System  
with Answering System  
EASA-PHONE IS  
AUTO-LOGIC  
KX-T2634 Silver  
Voice Menu/Time Day Stamp  
Auto-Answer Speakerphone

# YOU ARE THE FUTURE

Inexpensive microprocessors have made computers more widely available and the opportunities for their use more diverse than ever. It is up to us to decide what we do with these ever-evolving tools. Are they:

- Games to while away boredom or to foster learning?
- Tools to maintain the status quo or to encourage new outbursts of creativity and entrepreneurship?
- Devices to invade people's privacy or to aid democratic change and the flow of information?
- Machines to replace people's jobs or to create new opportunities?

These are a few of the choices and challenges of the continuing Computer Revolution.

## **EXHIBITION PROJECT TEAM**

### Development

**Gregory W. Welch**  
**Oliver Strimpel**  
**Gwen Bell**  
**Rachel Hellenga**  
**Mary Beth Dorus**  
**Natalie Rusk**

### Interactive Video

**Brad Larson**

### Design

**Theodore R. Groves**  
**Richard Fowler**  
**Åsa Chibas**

### Interactive Programming

**David Greschler**  
**Daniel T. Griscom**

### Technician

**Stephen Snow**

### Construction

**Don Greene**  
**Peter Somers**  
**Tyrone Peterson**  
**Wayne Cookson**  
**David Smith**

### Artifacts

**Brian Wallace**

### Advisors

**Charles W. Bachman**  
**C. Gordon Bell**  
**Daniel Bell**  
**I. Bernard Cohen**  
**Ruth Schwartz Cowan**  
**John Diebold**  
**Gardner C. Hendrie**  
**Jane A. Manzelli**  
**David Marc**  
**Christopher Morgan**  
**Douglas Ross**  
**Jonathan Rotenberg**  
**Jean E. Sammet**  
**Howard P. Segal**  
**Merritt Roe Smith**

Special thanks to *The Machine That  
Changed the World*, WGBH Boston.

© Copyright 1992 The Computer Museum

300 Congress Street  
Boston, Massachusetts 02210  
Tel 617.426.2800  
Fax 617.426.2943

A one-of-a-kind fundraising event to benefit the Museum's educational programs, The Computer Bowl® plays out the legendary East/West Coast high tech rivalry. Since 1988, the Bowl has raised more than \$1.75 million in cash, products and services. It attracts the support of hundreds of sponsors and enthusiastic volunteers, as well as media coverage from around the world. The Third Computer Bowl would not have been possible without the support of those listed below.

### **Presenter**

The Association for Computing Machinery

### **Founders**

Pat Collins Nelson and Dr. David Nelson

### **Underwriter**

Apple Computer, Inc.

### **Official Sponsors**

AT&T Computer Systems

*The Networked Computing Company*

Andersen Consulting

Bank of Boston

*The Bank*

BASF Information Systems

*The Diskette*

Digital Equipment Corporation

*The Open Systems Company*

Intel Corporation

*The Microprocessor Company*

Kubota Pacific Computer Inc.

*The Graphics Supercomputer Company*

Merrill, Pickard, Anderson & Eyre

*The Venture Capital Firm*

Metaphor Computer Systems

*The End-User Computing Company*

Price Waterhouse

*The Accounting Firm*

Robertson, Stephens & Co.

*The Investment Bankers*

Stratus Computer, Inc.

*The Transaction Processor*

Visix Software Inc.

*The High Performance Workstation Software Company*

### **Satellite Sponsors**

Borland International Inc.

Fluent Machines Inc.

Microsoft Corporation, Washington

Software Association, University of Washington/Student Chapter of WSA

### **Media Sponsors**

Business Week Magazine

BYTE Magazine

CIO Publishing, Inc.

Communications of the ACM

Compute

COMPUTERWORLD

DEC Professional

Forbes Magazine

HP Professional

Information Week

InfoWorld

LAN Computing

MacWEEK

MacWorld

MIDRANGE Systems

Network World

PC World

Software Magazine

VAR Business

VAX Professional

### **Table Sponsors**

Advanced Micro Devices

American Association for Artificial Intelligence

Apple Computer, Advanced Technology Group

Apple Computer, Eastern Research & Technology

Arthur D. Little, Inc.

Gwen and Gordon Bell

Owen and Brooks Brown

Business Week Magazine

CIO Publishing, Inc.

Cirrus Logic, Inc.

COMPUTERWORLD

Digital Equipment Corporation

Digital SCCD

Digital Systems Research Center

Digital Western Research Lab

Nancy and Pat Forster

Hal Computer Systems, Inc.

Roger Heinen/Apple Computer, Inc.

Gardner and Karen Hendrie

IBM Corporation

International Data Corporation (IDC)

International Data Group (IDG)

Robyn and Bob Metcalfe

Pat and Dave Nelson

Oracle Corporation

PC World

John William Poduska, Sr./Stardent

Computer Inc.

Sigma Partners

Larry Tesler and Colleen Barton

Weiss, Peck & Greer

Wellfleet Communications, Inc.

### **Cheerleaders**

Boston Computer Society

Object Management Group, Inc.

### **High Tech Tailgate Party Sponsor**

Business Week Magazine

### **Trade Sponsors**

American Typesetting, Inc.

Animatrix, Inc.

Apple Computer, Inc.

Arrow Composition, Inc.

Bontronics

ChipSoft, Inc.

The Composing Room of New England

Creative Gourmets, Ltd

Cunningham Communication Inc.

Cupertino Florist

H.K. Graphics

International Data Corporation (IDC)

Massachusetts Computer Software Council

Doug McLean

PARTNERS & Simons, Inc.

Pride Printers

Rand Typography

Ridge Winery

Riverview Systems Group, Inc.

Video Express

### **The 1991 Computer Bowl Committee**

Gwen Bell, National Chairperson

Mimi Macksoud, Chairperson, Major

Sponsorship

### **East Coast Committee**

S. Russell Craig

Steve Golson

Debbie and Ed Kramer

Christopher Morgan

Joyce Plotkin

Susan and Bill Poduska

Tony Rea

Byron Reimus

Dorrit and Grant Saviers

### **West Coast Committee**

Owen and Brooks Brown

Nancy and Pat Forster

Peter Hirshberg

Linda Lawrence

Claudia Mazzetti

Terrylynn Pearson

Lisa Quinones

**Capital, Exhibit & General Support****(\$250,000 or more)**

National Endowment for the Humanities

**(\$100,000 or more)**

C. Gordon and Gwen Bell  
Digital Equipment Corporation  
Gardner and Karen Hendrie  
International Business Machines Corporation

**(\$50,000 or more)**

Apple Computer, Inc.  
The Boston Computer Society  
Lotus Development Corporation  
Matsushita Electric Industrial Co.  
National Science Foundation

**(\$25,000 or more)**

The MITRE Corporation  
The Travelers Companies

**(\$10,000 or more)**

AAA  
Apollo Systems Division, Hewlett-Packard Company Foundation  
AT&T Corporation  
Massachusetts Cultural Council  
State Street Bank and Trust Co.  
Unisys Corporation

**(\$5,000 or more)**

John Cocke  
Computer Graphics Pioneers  
William Foster  
Theodore and Ruth Johnson  
Anthony D. Pell  
Jean E. Sammet  
Schrafft Charitable Trust

**(\$1,000 or more)**

Charles and Constance Bachman  
Boston Globe Foundation  
Hyams Trust  
Brian McLaughlin  
Laura Barker Morse  
Douglas Ross

**Corporate Members****Benefactor****(\$10,000 or more)**

Digital Equipment Corporation  
International Business Machines Corporation  
Xerox Corporation

**Patron****(\$5,000 or more)**

Adobe Systems Incorporated  
AT&T Computer Systems  
Bingham, Dana & Gould  
Compaq Computer Corporation  
IEEE Computer Society  
International Data Group  
Microsoft Corporation  
The MITRE Corporation  
Symantec Corporation

**Sponsor****(\$3,000 or more)**

Addison-Wesley Publishing  
Amdahl Corporation  
Automatic Data Processing  
Bank of Boston  
C. S. Draper Laboratories  
Coopers & Lybrand  
Data General Corporation  
DECUS  
Gaston & Snow  
The Gillette Company  
IPL Systems Inc.  
Liberty Mutual Insurance Company  
Lotus Development Corporation  
The Mathworks Inc.  
Marathon Mail Management  
McGraw-Hill, Inc.  
NEC Systems Laboratories  
The New England  
Prime Computer  
Ropes & Gray  
Stratus Computer, Inc.  
TASC  
The Travelers Companies  
United Technologies  
Ziff-Davis Publishing

**Contributor****(\$1,000 or more)**

Aberdeen Group Inc.  
Acer Corporation  
Alliant Computer  
Analog Devices  
Applied Technology Investors  
Arnold White & Durkee  
ASK Computer Systems  
Aspen Technology  
Avid Technology  
Banyan Systems  
Batterymarch Financial  
Bitstream, Inc.  
Bolt, Beranek & Newman Inc.  
Bull HN Information Systems  
Bull Peripherals  
Cabot Corporation  
Canadian National Railways  
Charles River Ventures  
Clearpoint Research  
Cognos  
Karen C. Cohen Associates  
CompuServe  
Corporate Software  
Data Switch  
DEC Professional  
Deloitte & Touche  
Dow Chemical, USA  
Ernst & Young  
Etra  
Fenwick Partners  
Gensym Corporation  
Greylock Management Corp.  
GTE Laboratories, Inc.  
H. K. Graphics Inc.  
Halliburton Services  
Heidrick & Struggles  
Index Group  
Innovis Interactive Technologies  
Interbase Software Corporation  
Intermetrics, Inc.  
John Hancock Mutual Life Insurance Co.  
Keane Inc.  
KPMG Peat Marwick Main

**Maintech**

MASS Microsystems  
McKinsey & Company, Inc.  
Medi-Tech  
William M. Mercer, Inc.  
Micro-Mentor  
Miller Communications  
Miller Freeman Expositions  
Milliken & Company  
The Millipore Foundation  
New Directions, Inc.  
NYNEX Corporation  
Parametric Technology  
Pell Rudman & Co. Inc.  
Price Waterhouse  
Programmed Intelligence  
The Research Board  
Schubert Associates  
Silicon Valley Bank  
Summagraphics Corp.  
TA Associates  
Ungermaun Bass  
Viewlogic Systems Inc.  
Videologic, Inc.  
Walker, Richer & Quinn  
Wellfleet Communications  
Wolfram Research  
The Wollongong Group

**Supporting Members and Annual Fund Contributors****Honorary Curator****(\$1000 or more)**

C. Gordon & Gwen Bell  
Edward Belove & Laura Roberts  
Erich Bloch  
Lynda Schubert Bodman  
Richard P. Case  
David Chapman  
Howard E. Cox  
David Cutler & Deborah Girdler  
David M. Donaldson  
Tse-Yun Feng  
R. Patrick & Nancy Forster  
Edward & Joyce Fredkin  
Steven Golson  
John Grady  
Dennis Hayes  
Gardner & Karen Hendrie  
Theodore Johnson  
David Kaplan  
James L. McKenney  
Brian McLaughlin  
David & Pat Collins Nelson  
Nicholas A. Pettinella  
Anthony D. Pell  
John William Poduska, Sr.  
Naomi Seligman  
F. Grant & Dorrit Saviers  
Edward Schwartz  
Oliver & Katherine Selfridge  
Naomi Seligman  
Paul Severino  
Robert Shafto  
Hal B. Shear  
John J. Shields  
Michael Simmons  
Ronald Smart  
Lawrence Tesler  
Hermann Zapf  
Charles A. Zraket

## Supporting Members and Annual Fund Contributors (continued)

### Donor (\$500 or more)

Lois & Harlan Anderson, Lawrence S. Brewster, Owen Brown, Bridgewater Public Library, Burlington Public Library, Deborah Coleman, Gregory & Janice Del Sesto, J. E. de Valpine, Margaret & Nick DeWolf, Ray Duncan, East Bridgewater Public Library, Roger Gourd, Richard E. Greene, Hanscom AFB, Hingham Public Library, Investors, Inc., Peter S. Kastner, Martin Kirkpatrick, Lawrence Public Library, Matrix USA, MAXIS, Anthony Medaglia, Moody Stecker Company, Lee J. Neal, Parrish Marketing Group, Edward G. Perkins, Paul R. Pierce, James A. & Noreen Pitts, Audrey R. Reith, Benjamin Robelen, David Rose, Richard Rubinstein, Irwin J. Sitkin, Joel D. Sugg, Synergetics, Leo R. Yochim

### Supporter (\$250 or more)

Richard L. Adams, Jr., Timothy Anderson, Dawn Banks & Robert Praetorius, Steve F. Barnebey, Roger M. Buoy, Mark Burrill, Michael & Adrienne Callahan, Howard Cannon, Mr. & Mrs. Arthur Carr, Mr. & Mrs. William H. Congleton, Richard Corben, James Davis, Ian Davison, Donald R. Daykin, David Dick, Lucien & Catherine Dimino, Bob O. Evans, Andrew Feit, Walter J. Gamble, Branko Gerovac, John Gilmore Jr., Robert Gilmore, William Graustein, Paul Green, Tom D. Hall, Keith Hare, Ted Hess, Hill & Knowlton, Bill Hunzeker, J. Milton Hutson, Ernest & Elizabeth Jennes, Róbert King, David Koskosz, Fritz Kunze, Bernard Lacroute, Paul J. Leach, John R. Levine, Jon & Judith Liebman, John N. Little, Joyce Currie Little, Carl Machover, Douglas Macrae, Julius L. Marcus, Barry Margolin, John R. Mashey, Andrew Mason, Tron McConnell, Medfield Public Library, Charles R. Minter, Arthur & Sandra Morley, Morrill Public Library, Robert Morrill, Ray Mustafa, Russell Naftsker, Bernard J. Nordmann, Noyce-Labombard Family, H. Edward Nyce, Octocom Systems Inc., Anthony & Marilyn Oettinger, Michael Pique, James N. Porter, Daniel Rose, Sable Technology Corporation, Howard Salwen, Richard G. Shoup, John F. Shoch, Somerville Public Library, James Starkey, Max J. Steinmann, Bruce G. Stewart, Richard Stewart, Robert E. & Diane Stewart, Oliver Strimpel, Juliet Sutherland & Jay Koven, Stephen Swerling, Warren G. Tisdale, Robert Trudel, Topsfield Public Library, Michael G. Uhler, Les Vadasz, Allan & Nadine Wallack, Waltham Public Library, Hugh M. Wilkinson, III, Mr. & Mrs. Andrew Wilson, William A. Wulf & Anita K. Jones, David Wyse

### Friend (\$100 or more)

Ken R. Adock, David Ahl, Mark Allen, Betsy Anderson, Richard Bahir, Mario R. Barbacci, Russell Barbour, Art Bardige, John C. Barstow, Leo Beranek Foundation, Alfred M. Bertocchi, Mr. & Mrs. Harvey Bingham, Joel Birnbaum, Stephen Blanchette, Corrado Bonfanti, Joshua Boger, Gary Boone, Jr., Michael Breslau, Daniel S. Bricklin, Frederick P. Brooks, Brown University, John Seely Brown, James & Diana Bouchard, Gerald Bujaucius, Richard Burnes, Peter Butler, Walter Carlson, Laurence Chait, Albert Christoph, Joel Clinkenbeard, Gary & Carole Cogswell, Daniel J. A. Cohen, Stephen Coit, Clement Cole, C. J. Considine, Steven Cooper, David Corbishley, Paul & Nancy Covell, Harvey G. Cragon, Michael Cronin, Henry J. Crouse, Bruce H. Curran, Paul Curran, David H. Dahlstrand, Charles Dana, Data Systems Associates, Gervaise G. Davis, Randall Davis, Jack Dennis, Michael L. Dertouzos, Peter DeWolf, Louise Dornenitz, Theodora Drapos, Dick Dunnington, Ian R. G. Edmonds, Tom Eggers, Arthur W. Einstein, Jr., Jon B. Eklund, William T. Elliot, Steve Emmerich, End User Systems, Lucian J. Endicott, John Esbin, Paula Evans, Evans & Sutherland, Neil Faiman, Thayer Francis, Daniel Freedman, Alan Frisbie, Stephen J. Gaal, Bruce Gilchrist, George Gilder, Lee Gillespie, Robert Glorioso, Stewart & Constance Greenfield, John Griffith, Robert Grimm, Stephen Gross, Karl Guttag, Jason Rogers Hale, Sheryl Handler, P. M. Hart, Byron Hayes, Jr., Jim Hayes, Frank E. Heart, Leslie J. Hellenack, Akiba Hermann,

Ittai Hershman, Kari Hintikka, Nancy S. Horie, Alfred H. Hopkins, Jr., Michio Horiuchi, Hans Hupperitz, John Ippalito, Horace Irvine, Brad & Dorothy Jeffries, Charles Jortberg, Mr. & Mrs. Jeffrey Kalb, Paul & Carol Karger, Richard Kenner, George Keremedjiev, Gary Kessler, J.S. Kilby, Richard H. King, Stanley Klein, David Koogler, Mark Koretz, Alan Kotok, Arnold Kraft, Thomas E. Kurtz, John W. Lacey, Faith E. Lamprey, Joel Lamstein, John Langell, Curtis LaRock, Richard Lary, Bruce Laskin, Linda C. Lawrence, Tsvi Lavi, Grace V. Leahym, Robert W. Lee, Michael Leroy, Walter J. Levinson, Joe Levy, Lawrence Levy, Tracy Licklider, Arthur D. Little, John D. C. Little, George W. Logemann, Carl D. Lowenstein, Alphonse Lucchesi, James F. Mackowiak, Michael Mahoney, Frank A. Manola, Melvin J. Mason, Paul & Kathy Mazzone, A. Maya, Richard McClusky, William & Vesta McLean, MathSoft, Pamela McCorduck, Robert McCormick, Mary McDonnell, Thomas & Elizabeth McWilliams, Todd Medlock, R. W. Meister, Dale Marie Mettrill, Sharon Merrill Associates, George Michael, Micro Net Data Systems, MOCO, Inc., Thomas H. Moog, James F. Morgan, Allen Moulton, Ellen Dana Nagler, Adeline Naiman, Isaac R. Nassi, Arthur Nelson, Cynthia L. Nelson, David Nelson, Jack Nolan, David Novak, Ocean Software Inc., Lawrence & Pauline Oliva, Robert K. Otnes, James H. Philip, Robert Probasco, Robert W. Puffer, III, David P. Reed & Jessica Kenn, Scott & Steven Reilly, Nicholas Reinhardt, Marcin Rembisz, C. Mike Riggle, Christopher Roberts, Ann Roe-Hafer, Benjamin M. Rosen, Douglas Ross, Alexander Rossolimo, Jonathan Rotenberg, Richard R. Ruopp, Stephen Russell, Michael J. Samek, Michael Sand, P.B. Schechter, Walter Schmidt, Benn L. Schreiber, Mr. & Mrs. Earl Schweppe, Aaron Seidman, W. Lee Shevel, Daniel Siewiorek, Diane J. Skiba, Casimir S. Skrzypczak, Jack Slavin, Donald Sorensen, William Steul, Jack Stevens, Linda M. Stillmack, David Strachan, Steven Szep, The Talanian Family, Robert Tannenbaum, David Tarabar, John Tartar, Teradyne, Charles Terry, Michael G. Thompson, Timothy Tolosky, Erwin Tomash, Michael G. Tomasic, Joseph Traub, Richard Van Slyke, Charles Waite, Wendell Weatherford, Ralph O. Weber, Stuart Wecker, Eric Verme, Robert Wesley, Tom Westberg, Mark & Margaret Weston, Robert M. Whelan, Jr., George Whitney, Susan & Joseph Wood, Joan Blout Wylie

### In Kind Donations

Accolade, John Adams, Allison Associates, Analog Devices, Inc., Apple Computer, Inc., Atari Games, Robert Berg, Bitstream, Inc., Boris Color Labs, Borland International, BOSE Corporation, Curtiss Butler and Associates, Inc., Cadence, Inc., The Chedd-Angier Production Company, Cigna Systems Corp., Claris Corporation, Cognex, Coopers & Lybrand, Crown Industries, Inc., Mary Daly, Data Translation, Design Communications, Inc., DGA Associates, Digital Equipment Corporation, Steve Dunleavy, Electronic Arts, Inc., Entertainment Technology, Inc., Fenwick Partners, G.W. Instruments, Inc., Gallery Theatre Lighting, Good Displays, Grass Instruments, Guarino Design Group, Inc., Terry Hanley Audio Systems, Jack Heart Sound Production, Inprint, Insignia Solutions, Intel Corporation, InterLAN, International Business Machines Corporation, Robert C. Jarvis, Kimball AV, Layout Design, Lawrence Productions, Glenn Litton, MacroMind, Inc., MASS Microsystems, Inc., Matsushita Electric Industrial Co., Ltd., Maxis, Jack McWilliams Photography, Mediagenic, Microsoft Corporation, Morse, Altman, Dacey & Benson, Multi-Core, Inc., Multivision, Inc., Museum Technology Source, Inc., Mystic Scenic Studio, Inc., NEC, New England Museum of Telephony, Nintendo, OWL International, Inc., ParaComp, Inc., Post Perfect, Preston Productions, Production Arts, The Prudential, Silicon Beach Software, Inc., Spectrum HoloByte, SPOT, Strategic Mapping, Inc., SuperMac Technology, Inc., Symantec Corp., Alan P. Symonds, Target Productions, Truevision, Inc., Video Express, Videologic, Inc., Drew Wang, WGBH Educational Foundation, Zinc Software Inc.

### We thankfully acknowledge the following corporations that supported the Museum by matching their employees' contributions:

Allied-Signal Foundation Inc.  
AT&T Foundation  
BellSouth Services  
ChemicalBank  
Digital Equipment Corporation  
The Gillette Company  
Hoecht/Celanese  
Houghton Mifflin Company  
International Business Machines Corporation  
International Data Corporation  
Pratt & Whitney  
Pitney & Bowes  
T. Rowe Price Associates Foundation, Inc.  
United Technologies Corporation  
Xerox Corporation

We apologize for any inadvertent omissions from our donor list. Please inform us of any errors so that we may correct our records.

# THE COMPUTER MUSEUM VOLUNTEERS

## Board of Directors

### Chairman

Gardner C. Hendrie  
*Sigma Partners*

Dr. Oliver Strimpel  
Executive Director  
*The Computer Museum*

Sam Albert  
*Sam Albert Associates*

C. Gordon Bell

Dr. Gwen Bell  
Founding President  
*The Computer Museum*

Edward Belove

Lynda Schubert Bodman  
*Schubert Associates*

Lawrence S. Brewster  
*Aspen Technology, Inc.*

Richard P. Case  
*International Business  
Machines Corporation*

James E. Clark  
*NCR Corporation*

Howard Cox  
*Greylock Management  
Corporation*

David M. Donaldson,  
Esquire  
*Ropes & Gray*

Dr. Jon Eklund  
*Smithsonian Institution  
National Museum of  
American History*

Edward Fredkin  
*Capital Technologies,  
Inc.*

Dr. Richard Greene  
*Data Switch Corporation*

Charles House  
*Informix, Inc.*

Theodore Johnson  
Consultant

David Kaplan  
*Price Waterhouse*

Mitchell Kapor  
*ON Technology, Inc.*

James A. Lawrence  
*LEK Consulting, Inc.*

Dr. Robert Lucky  
*AT&T Bell Laboratories*

Dr. James L. McKenney  
*Harvard Business  
School*

John A. Miller, Jr.  
*Miller Communications*

Laura Barker Morse  
*Heidrick & Struggles*

Dr. David Nelson  
*Fluent Machines, Inc.*

Dr. Seymour Papert  
*Massachusetts Institute  
of Technology*

Dr. Suhas S. Patil  
*Cirrus Logic, Inc.*

Anthony D. Pell  
*Pell, Rudman and Co.,  
Inc.*

Nicholas Pettinella  
*Intermetrics, Inc.*

Dr. John William  
Paduska, Sr.  
*AVS Inc.*

Jonathan Rotenberg  
*The Boston Computer  
Society*

Jean E. Sammet  
Programming  
Language Consultant

F. Grant Saviers  
*Digital Equipment  
Corporation*

Edward A. Schwartz,  
Esquire  
*New England Legal  
Foundation*

Naomi O. Seligman  
*The Research Board*

Paul Severino  
*Wellfleet Communica-  
tions*

Hal B. Shear  
*Research Investment  
Advisors, Ltd.*

Michael Simmons  
*Bank of Boston*

Irwin J. Sitkin, retired  
*Aetna Life & Casualty*

Casimir S. Skrzypczak  
*NYNEX Corporation*

James Sutter  
*Rockwell International  
Corporation*

Charles A. Zraket  
Trustee  
*The MITRE Corporation*

### Clerk

James Davis, Esquire  
*Bingham, Dana &  
Gould*

### Trustees

Charles Bachman  
Erich Bloch  
David L. Chapman  
Harvey Cragon

Robert Everett  
William Foster  
Max Hopper  
A. L. C. Humphreys,  
CBE  
August Klein  
Andrew C. Knowles III  
Koji Kobayashi  
John Lacey  
Patrick J. McGovern  
Carver Mead  
Robert Metcalfe  
George Michael  
William H. Millard  
Pat Collins Nelson  
Russell-Loftsker  
Brian Randell  
Kitty Selfridge-  
William Spencer  
Ronald G. Smart  
Michael Spock  
Erwin Tomash  
Paul Tsongas

### Executive Committee

Edward A. Schwartz  
(chair)  
Gwen Bell  
Lynda Schubert  
Bodman  
Lawrence S. Brewster  
Richard P. Case  
James Davis (clerk)  
Gardner Hendrie  
James L. McKenney  
Nicholas Pettinella  
Richard Ruopp

### Exhibits Committee

Gardner Hendrie  
(chair)  
C. Gordon Bell  
Edward Belove  
Richard P. Case  
Robert Lucky  
James L. McKenney  
David Nelson

### Finance Committee

James L. McKenney  
(chair)  
David Kaplan  
Nicholas Pettinella  
Richard Stewart  
Christopher Wilson

### Nominating Committee

Lynda Schubert  
Bodman (chair)  
Gwen Bell  
Irwin J. Sitkin

### Collections Committee

Gwen Bell (chair)  
Bruce Brown  
I. Bernard Cohen  
Jon Eklund  
Jaime Pearson  
Ann Russell  
Jean E. Sammet

### Corporate Membership Committee

Laura Barker Morse  
(chair)  
Randal Hujar  
Richard Karash  
Ilene Lang  
Mimi Macksoud  
Susan Parrish  
Stephen Pyka  
Cameron Read  
Lindy Recht  
Nancy Robb  
Charles Terry

### Annual Fund Committee

Hal B. Shear (chair)  
Gwen Bell  
Howard Cannon  
Steven Golson

### Education Committee

Art Bardige  
Karen Cohen  
Marilyn Gardner  
Martin Huntley  
Beth Lowd  
Jane Manzelli  
Adeline Naiman  
Dr. Seymour Papert  
Hal B. Shear  
Joyce Tobias

### Public Relations Committee

**East**  
Joann Anderson  
Joseph Codispoti  
Richard Eckel  
Maura FitzGerald  
Roxanne Frisiello  
Joan Geoghegan  
Joseph Grillo  
Reed Goodman  
Patti Kachmer  
Lewis Karabatsos  
Christopher Morgan  
Nancy Prendergast  
Heather Premru-  
Janice Rosen  
Sheryl Schultz  
Susana Thompson

### West

Kevin Compton  
Deborah Conrad  
David Kroll  
Carol Moran  
Dick O'Donnell  
Terrylynn Pearson  
Juleigh Rawlings  
Judy Roberts  
Carol Welsh

## The Computer Museum

300 Congress Street  
Boston, Massachusetts 02210  
617. 426. 2800  
fax 617. 426. 2943

NONPROFIT ORG.  
U.S. POSTAGE  
PAID  
BOSTON, MA  
PERMIT NO.55897