Silicon Valley Museum Celebrates History of Computing

Silicon Valley, the center of one of the 20th century’s most revolutionary and profitable industries, is now home to a world-class collection of historic computers. Occupying a gleaming modern structure in Mountain View, California, the Computer History Museum is a glass-and-steel testament to the innovators and innovations that have changed the fabric of modern life.

While a number of museums devoted to computers already exist, both in traditional form and as online repositories, the Computer History Museum eclipses its precursors in the depth and volume of its collection as well as the prominence and dedication of its supporters.

Said Michael Williams, Computer History Museum head curator and IEEE Computer Society vice president of publications, “The location is what drew us to the new site. We’re right in the middle of Silicon Valley, among all the major players in the industry. There’s a lot of money here, and these are the people who are interested in preserving the history of computing.”

PIECES OF THE PAST

The Computer History Museum collection is rich with notable examples of the hardware, software, and ephemera that represent milestones in computer history.

There are the plumbers’ nightmares turned out by Seymour Cray in his pursuit of adequate cooling for his high-speed supercomputers, each a nearly unfathomable tangle of pipes, wires, and ducting. There are examples of early digital games like *Pong* and *Computer Space*. There are even displays of coffee mugs and caps from long-defunct industry leaders, along with a vintage sign, THINK, that was a mandatory feature of IBM offices around the world until the 1970s.

Still, would any computer museum really be worthy of the title without holding a copy of what is arguably among the most significant machines in Silicon Valley? Installed in a vintage hand-built plywood case, the 1975 Apple 1 enshrined at the Computer History Museum bears the “Woz” autograph of Apple cofounder Steve Wozniak. Apple 1s (of which fewer than 50 still exist) are avidly sought by collectors.

The museum also boasts such seminal creations as a World War II German Enigma encryption device; an 1889 Hollerith electromechanical census tabulator; punch cards from Jacquard textile looms; an Altair 8800 microcomputer; a portion of the ENIAC; and the hulking, Jetson-esque Johnniac machine, named after famed mathematician John von Neumann, who is said to have disapproved of the honor. A curiosity that is especially beloved by museum visitors is a display of Honeywell “animals”—works of naturalistic art created from thousands of transistors, resistors, and bits of wire.
**WWII: Code breakers and bombardiers**

Besides the Enigma, the Computer History Museum is home to the largest remaining fragment of the Colossus machines that first decrypted encoded messages from Germany’s high command.

The famed Norden bombsight of World War II was a mechanical analog computer made from gyroscopes, motors, gears, mirrors, levers, and a telescope. During a bombing run, it could simultaneously pilot an aircraft and determine when to release its payload. The invention proved critical to the success of Allied high-altitude daylight bombing. Though the technology behind the Norden bombsight was a closely guarded secret for decades after the war, a surprising number of the devices survive and appear regularly in aviation restoration parts catalogs. Still, the Computer History Museum has one on display to highlight the role of analog computing technology in warfare.

**The space race and the Cold War**

Prominently displayed in the museum’s Visible Storage exhibit are artifacts that played a vital role in both the US space program and the Cold War obsession with national security.

In the early 1960s, engineers from MIT’s Instrumentation Laboratory built a compact guidance computer that fit the tight confines of the Apollo space capsule by basing it on then-emerging integrated circuit technology. At the time, the price of integrated circuits was around $1,000 each. Today, of course, integrated circuits power such prosaic items as 99-cent calculators and cereal box wristwatches.

Astronauts used a series of two-character input codes to enter commands into the computer. First used on the Apollo 7 mission, the guidance computer is on display in the Visible Storage exhibit. The museum recently acquired a computer used aboard Russia’s MIR space station.

Also during the 1960s, 54 AN/FSQ-7 semiautomatic ground environment (SAGE) machines, each powered by more than 50,000 vacuum tubes, coordinated US missile defense systems throughout North America, effectively creating the world’s first large-scale computer network. Ironically, many of the critical vacuum tubes were supplied by Soviet-bloc manufacturers.

Astonishingly, each of the 27 enormous SAGE centers housed two separate computers, the second serving as a “hot standby” in case the primary computer failed. MITRE, a public-interest nonprofit organization that has become the backbone of US government technical support services, was originally founded to maintain the extensive SAGE network.

“Computing was built on death and taxes,” quipped Williams. “If it wasn’t the military figuring out how to kill people, it was another part of the government figuring out how to count their money.”

While the Computer History Museum, possibly to its relief, does not own an entire SAGE, it does display a SAGE console (complete with circular radar scope) that sports a factory-installed cigarette lighter at the opera-

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**Figure 3. NASA’s Apollo flight computers functioned reliably on 32 Kbytes of fixed memory and less than 4 Kbytes of RAM-like erasable memory.**

**Figure 4. US Air Force specialists operated the sprawling AN/FSQ-7 SAGE air-defense network from the early 1960s through the 1980s.**

**Figure 5. Bill Pitts and Hugh Tuck first installed Galaxy in a Stanford University student union coffee shop in 1971.**
and a home arcade version of *Frogger*.

A unique artifact that the Computer History Museum now owns is the Honeywell Kitchen Computer, a sleekly designed unit that could store recipes and instructions for cooking and creating meals at home. A 1969 Neiman Marcus catalog marketed the Kitchen Computer (really an off-the-shelf Honeywell 316 minicomputer in disguise) as a $10,600 boon to homemakers. Unfortunately, since the user interface was limited to binary lights and switches, there is no evidence that anybody ever actually purchased one. By comparison, $10,600 in 1969 would also buy a top-of-the-line Cadillac limousine or two lesser Cadillacs.

**Archives and storage**

In addition to a walk-through display of more than 500 historic computers and their associated hardware, the Computer History Museum also houses more than 4,000 linear feet of cataloged documentation, uncounted gigabytes of software, 10,000 historical images in both digital and conventional form, and hundreds of video and audio recordings of speeches and presentations given by influential industry innovators.

“Several companies have donated their entire photo archive to the museum,” said museum image archivist Anel Rodriguez. “We’re digitizing large portions of the collection ... but to a certain extent, we still don’t really know what we have. There are images from companies that no longer exist or that have been bought out by other companies. In some cases, it’s not even clear who owns the copyrights.”

Thousands of artifacts are still stored in boxes and on pallets, awaiting the attention of museum curators. In fact, several pallets contain an Intel Paragon supercomputer from the early 1990s, still wrapped in its factory packaging.

**Pioneering software**

A key function of the Computer History Museum is the preservation of what can be extremely fragile historic software and storage media artifacts.

A paper tape in its care contains the first version of a Basic language interpreter for the Altair 8800 computer, written by Bill Gates and Paul Allen while both were students at Harvard University. The Altair was a computer kit that made its first appearance as a 1975 *Popular Electronics* magazine cover story. Altair Basic was the first mass-produced commercial program released by Gates’ company, known at the time as Micro-Soft.
Other media can be nearly as fragile as paper tape. Thousands of megabytes of data in the museum collection reside on everything from metal tapes to magnetic drums and plastic film cards. Lining the archives are uncounted floppy disks of every size, along with cassette tapes, data cartridges, and reams of punch cards, both new and used.

On loan from the Vintage Computer Festival, an original 1985 copy of Microsoft Windows 1.0 is currently on display. Other vintage software held by the museum includes the 1979 beta version 0.1 of the highly influential VisiCalc program and the 1982 release of Lotus 1-2-3 version 1.0.

Recognizing an important niche market, museum officials recently introduced a new (fee-based) service, punch card reading. Legacy data once thought to be irretrievable can now be processed on vintage machines that the museum has restored. Future offerings may include data retrieval services for many different types of obsolete media.

A MUSEUM IS BORN

The Computer History Museum grew out of a home collection started by computing pioneer Gordon Bell and his wife, Gwen. In 1979, the Bells installed a number of significant pieces in the lobby of a former RCA building that Digital Equipment Corporation had purchased. Gordon Bell worked for 23 years at DEC, where he led the development of the PDP-series and VAX computers.

By 1983, after a couple of moves, the growing collection ended up on Boston’s Museum Wharf, where it shared space with a children’s museum. As the Computer Museum, its focus shifted to serving a young constituency, while continuing to collect key artifacts for later display.

In 2000, the Computer History Museum collection moved to temporary quarters on the NASA base at Moffett Federal Airfield in Sunnyvale, California, where it occupied a pair of pre-World War II buildings. Soon, museum trustees began searching for a more suitable location.

A permanent home

When the Computer History Museum acquired its current building in 2002, the former Silicon Graphics marketing and sales office offered enough space for a 400-seat auditorium and still contained more than 450 office cubicles, though many have since been incorporated into exhibit installations.

Said Williams, “Being ‘blessed’ with so much surplus material is really a two-edged sword. While we regularly get donations of some truly amazing artifacts, we also find people depositing their old junkers on our doorstep. It’s a disposal problem for us. What do you do with piles of excess office equipment in a city that’s already full of it?”

The building was originally constructed to house and support office workers, not massive computer hardware displays, so detailed architectural studies were required before the museum could move in. Engineers called for a number of structural modifications. The most significant was dividing an open central atrium into three fireproofed segments before the building opened to the public.

“We had a lot of work to do to get the building ready,” said Williams, “And since we’re only about 10 miles away from the San Andreas fault, there were also earthquake codes that we had to meet. In the museum’s storage space, all the shelves have fittings on the front to keep items from shaking out and falling onto the floor. In the exhibit areas, some of the more fragile displays are bolted down or secured to the wall.”

Ironworkers also welded steel reinforcements onto the beams and columns that support the heaviest displays, while other contractors opened up large doors for bulky deliveries and added several fire exits.

Said Williams, “It’s a huge challenge to move these machines. One of our
recent acquisitions is a Cray C-90. The central unit weighs 15,000 pounds. We had to borrow special high-capacity forklifts from the NASA Ames Research Center at Moffett Field so that we could get it in inside.”

Outreach and recognition programs

Still, the museum’s mission extends beyond collecting and displaying objects. As a nonprofit educational organization under tax code 501(c)(3), the Computer History Museum offers in-house research services, a speaker series, and a Fellow awards program. The speaker series has featured talks by such luminaries as Linux developer Linus Torvalds, World Wide Web inventor Tim Berners-Lee, supercomputer architect Burton Smith, and VLSI pioneer Carver Mead.

Computer History Museum executive director and IEEE Computer Society member John Toole reflects, “In contrast to industry, we’re not pushing the ‘Next Big Thing.’ We’re celebrating the past, the pioneers, and what they created.”


Community events

The museum also hosts special events like vintage computer swap meets, industry alumni gatherings, and new product launches. Recently, hundreds of Apple Computer alumni, employees, and fans met at the museum for a celebration of Apple Computer’s historic contributions to the industry.

In past months, the Computer History Museum cooperated with the Cinequest San Jose Film Festival to present the Computers in Film cinema series, featuring such movies as Disney’s 1969 Kurt Russell vehicle, The Computer Wore Tennis Shoes, and the 1957 Spencer Tracy and Katharine Hepburn romance, Desk Set, a film that plays on the imagined perils of machine intelligence.

Museum tours

Most Saturdays, dozens of volunteers descend upon the Computer History Museum, bent on missions ranging from reconstructing classic hardware to programming vintage machines. Volunteers also make up the bulk of the museum’s docent staff. Owing to the evolving nature of the exhibit space and the complexity of the stories told there, a trained docent leads each tour of the museum. Many, if not most, of the volunteers are veterans of the Silicon Valley computer industry.

Said head curator Williams, “While our mission is most definitely educational, the target audience is an interested adult, rather than a typical school group.”

In an effort to secure the Computer History Museum’s long-term future, trustees are conducting a $100 million capital campaign, $50 million of which is earmarked for expanding exhibits. The remaining $50 million will go toward building an endowment fund. When contributions and pledges reach the $75 million mark, the museum plans to begin construction of its signature installation, a 20,000 square-foot walk-through timeline of computer history. Supporters have pledged a total of $54 million to date.

Said Williams, “We are creating a world-class museum to preserve the heritage of our industry.”

The Computer History Museum’s Visible Storage exhibit area is open Wednesdays, Fridays, and Saturdays. Free tours start at 1:00 p.m. and 2:30 p.m. Special tours are available by request. For more information, or to view the Computer History Museum’s online exhibits, visit www.computerhistory.org/.

Figures 7 and 8 courtesy of Microsoft; all other photos courtesy of the Computer History Museum.

Editor: Bob Ward, Computer; bward@computer.org

Figure 10. Museum visitors experience the 1990s tech boom modern architecture of an authentic former Silicon Graphics building.