COMPUTER UPDATE

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THE COMPUTER REVEALED

EXCERPTS FROM "THE NAKED COMPUTER"

THE RAT RACE FOR THE MIGHTIEST MOUSE

THE OPERATING SYSTEM CIRCUS

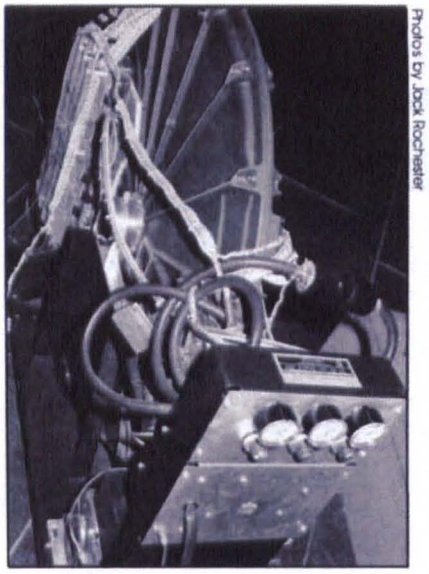
ALEX IN COMPUTERLAND

Share a wondrous peek at the bygone days of computerdom, as a looking-glass CRT whisks you away to the Computer Museum.

To the reader: The story you are about to read was told to me by a friend named Alex, a fellow oft given to flights of fancy. It's about a repository and resting ground for the great computing machines of the past, a place in time called the Computer Museum. You may find Alex's tale somewhat incredulous—many computerniks would give their eye teeth for such an adventure—but I assure you it is true. If you doubt it for even a moment, I invite you to take a spin out to One Iron Way in Marlboro, Mass., and see for yourself.

I was sitting in front of my computer one day, staring at the CRT and musing about the infinite mysteries of electrons when a most unusual thing happened. An image appeared on my screen, completely unbidden, of a beautiful building. The sun shone in rows and rows of rich copper-colored squares of glass, while the lush scene from nature that surrounded the edifice reflected over and over on its facade. It was a modern Valhalla, and I was entranced.

Almost at the same moment, I heard a squeak and looked to find an odd little mouse scurrying beside me. He was dressed in a tuxedo with tails, carried a walking stick, and wore a top hat. I heard him say, "I'm late. I'm late, for a very important date." Quite curious, I bent down closer to the mouse. As I did, he leapt into the air and disappeared into my CRT. I could see him clearly, running across the parking lot toward the beautiful building, which was still glowing in the sun. Without a moment's hesitation I stuck my foot through the screen. To my surprise, it passed right through, and in no time at all I was running after the mouse.



Photos by Jack Rochester

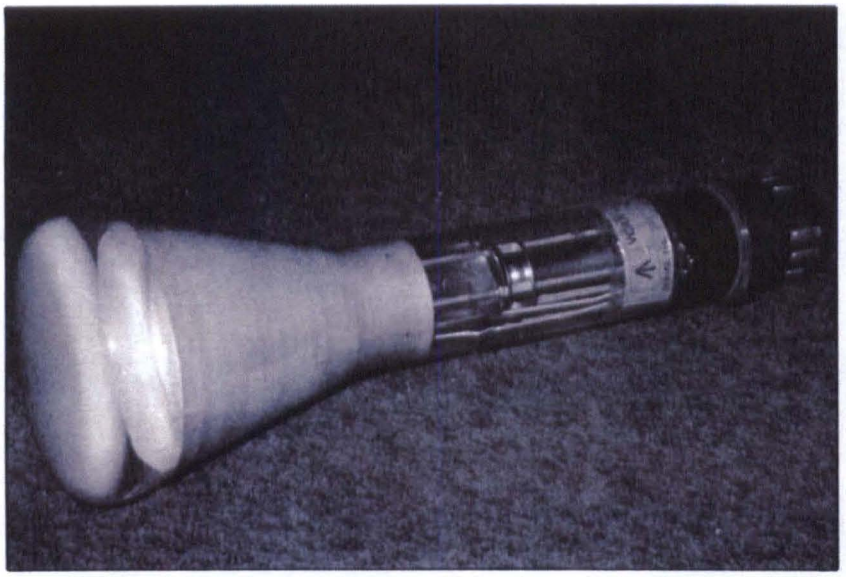
Disk drives were a lot bigger then. This fossil stretched to almost four feet in diameter.

By the time I reached the building, the mouse had slipped unseen through the entrance. I, however, was stopped by a guard. "Slow down, buddy," he said, "You got a pass to get in here?" I looked at the door, which said, "Computer Museum. Admittance by ticket only." I had to think quickly, for the mouse was clearly getting away. "Of course," I said, pointing at his hand, "I just gave it to you." He looked and, sure enough, there was an odd little punched card with "Admit 01" written on it. Leaving the guard scratching his head, I raced in; but the mouse had disappeared.

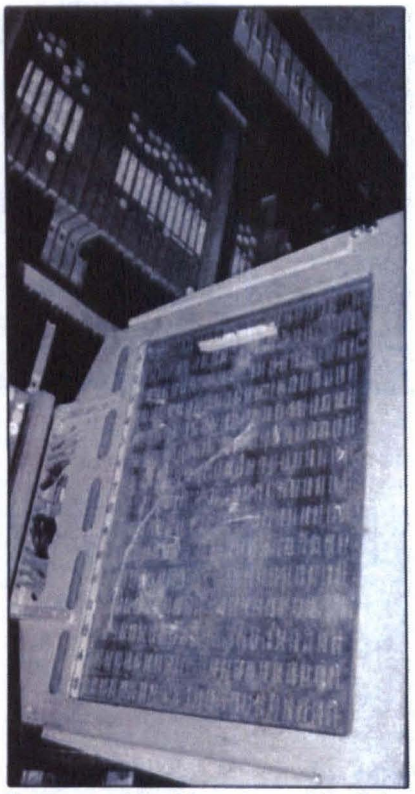
I found myself in a larger foyer filled with ancient computing machines, the likes of which I had only read of

By Jack B. Rochester

The author is a contributing editor to *Computer Update* and co-author (with John Gantz) of *The Naked Computer: A Layperson's Almanac of Computer Lore, Wizardry, Personalities, Memorabilia, World Records, Mindblowers, and Tomfoolery*, published by William Morrow & Co.



Circa 1948, the Williams storage tube showed its input visually; it verified data with little checkmarks.



The famous Illiac IV was born at the University of Illinois a quarter-century ago.

Jack Kilby, an engineer at Texas Instruments, invented the integrated circuit. The integrated circuit ushered in the third generation of computers and truly revolutionized computing. While it took ten years for the transistor to be fully implemented, it took the integrated circuit only five; IBM's System/360 was the first computer to use integrated circuits extensively.

History records that many people have simultaneously come up with the same discovery or invention, such as the radio and the telegraph. This happened with the microprocessor as well. Ted Hoff of Intel designed the first computer on a chip in 1971, at the same time Texas Instruments was introducing a similar offering. Technological infusion, by this time, was occurring much more quickly. The rooms I was passing through in the museum tell the entire story, and I was awestruck by how much has happened in the past 40 years.

Then I saw it, the machine that brought computers to the masses. Standing on a pedestal was the Altair. Its simplicity betrayed its importance; clearly it was a hobbyist's delight, and I recalled with fondness my teenage years building stereo equipment from kits.

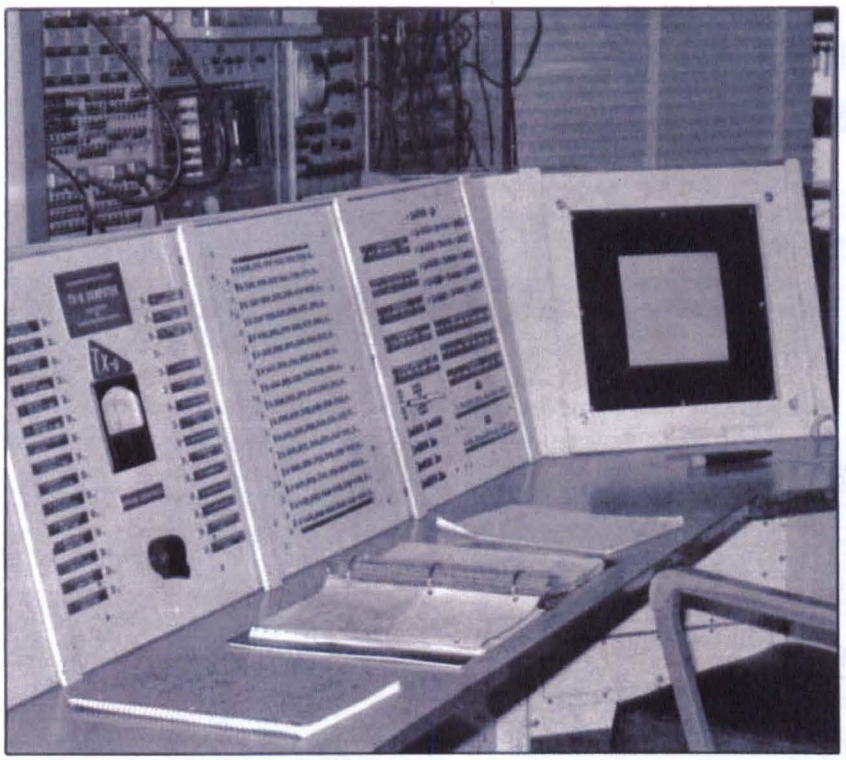
Yet all these advances in CPUs would be nothing without concomitant advances in memory. Right from the start, computer scientists realized storage was critical. Punched cards were the first medium, although John Atanasoff and Clifford Berry experimented with a drum as early as 1938. Then there were magnetic drums, magnetic cores, mercury delay lines, magnetic tape, hard disks, and floppy disks. But perhaps the most interesting storage medium was the Williams tube, devised by F. C. Williams and T. Kilburn for the University of Manchester (England) Mark I in 1948. It appears, for all intents and purposes, as the CRT for an oscilloscope; it's about two and one-half feet long with a round face about four inches in diameter. It actually showed the input visually, and when data was verified a little check mark would appear beside it.

By this time I was getting a little tired from all the excitement of the museum, so I sat down next to an odd-looking machine to rest for a minute. I couldn't help noticing the name plate, which read "International Computers, Ltd." Upon closer inspection I saw it was a British version of the punched-card machine; the cards were about 2 inches tall and 5 inches wide, with 40 columns. And then I realized these were the passes the guard used at the entrance to the museum!

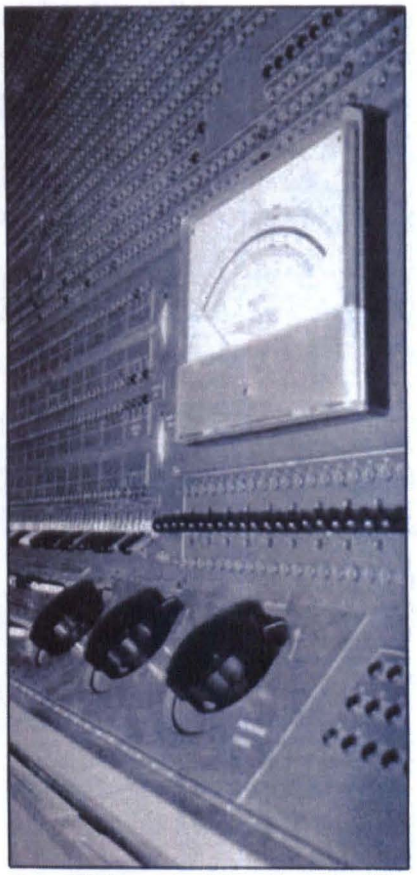
I sat back, musing on this clever ploy, when the mouse in tails came skidding around the corner and raced down the hallway. "Hey! Stop! Wait for me!" I raced off in hot pursuit, following him into a room filled with people politely listening to a lecture. The speaker, a small, frail-looking woman in a Navy officer's uniform, was introduced as Captain Grace Murray Hopper, who developed COBOL, the standard programming language in the business world today. Next came Tracy Kidder, author of *The Soul of a New Machine*, along with Tom West, who led the team that designed the Data General superminicomputer which was the subject of Kidder's book.

Then the first video game, "Spacewar," was demonstrated by the three guys who devised it at MIT. A play about the life of Charles Babbage followed, and Harold Cohen explained how he created and painted his computer graphics murals, and Grace Morton read her computer-generated poetry, and... then someone was shaking me, saying "Wake up, wake up."

I looked up and a nice lady was smiling down at me. I quickly got to my feet and introduced myself; she told me her name was Gwen Bell, and that she was more or less the curator of the Computer Museum. "I say more or less because we're really a museum without curators," she said. "We're a nonprofit, independent technology museum for people who are seriously interested in computers." I told her what I'd seen. "There are a few other things which are rather interesting," she said, and led me to the Lehmer Number Sieves, elaborate machines made of gears, chains, and pulleys that solve mathematical equations by eliminating numbers that couldn't be possible solutions. Lehmer built his first



The whopping TX-O gobbled up 9,000 square feet of space, 5,400 watts of power, and 15 tons of air conditioning. Yet it ran at one-tenth the speed of an Apple.



Before IBM decided it liked to make little computers, it felt more at home with monsters like the IBM supercomputer STRETCH.

before. To my left was the famous Illiac IV, the brainchild of Dan Slotnick and fellow engineers working at the University of Illinois in the late 1950s and early 1960s. In front of the Illiac was an early disk drive unit, its disk a good three to four feet in diameter and standing perpendicular to the floor. Nearby was the famous STRETCH computer, IBM's model 7030.

I realized I was in the presence of early supercomputers and was awed. My gaze fell next on the Control Data Corporation CDC 6600, designed by the reclusive genius Seymour Cray. I noticed this was the first 6600 ever made—serial number one. It was Cray who went on to design the world's most popular supercomputer, the Cray-1.

I reflected for a moment on how computers had grown up. In the early 1950s, computerdom's greatest scientists had predicted the world's needs would be satisfied by perhaps a dozen computers. They envisioned great computing machines, like electrical power plants, which would be used to solve long, complex, scientific equations. That was probably a fair assumption; after all, the first computers were borne of a need to solve the problem of computing ballistics trajectories for missiles. Thomas J. Watson, Jr., former president and chairman of the board of IBM, said once in an interview with *Computerworld* that no one ever thought computers would find their way into grocery-store cash registers. The first commercial UNIVAC machines were delivered to the Bureau of the Census in the early 1950s—hardly a commercial application. Using computers in business was still a gleam in IBM's eye.

The growth of computer technology is usually measured in "generations." The first generation used vacuum tubes and was characterized by the ENIAC, built by J. Presper Eckert and John W. Mauchly at the Moore School of Engineering, University of Pennsylvania. These enormous monolithic machines were the prototypes for the supercomputers; no one was thinking small at the time.

Earlier computing machines had a combination of vacuum tubes and electromechanical relays. The first was John Atanasoff's ABC computer, which he fashioned in 1939 at Iowa State College. Then came the Mark I, built by Howard Aiken with the help of IBM and Grace Hopper of the U.S. Navy, at Harvard in 1943.

The second generation used transistors, which were invented by the Schockley-Bardeen-Brattain team at Bell Labs in 1948. As I stood surrounded by the huge, imposing control panels of STRETCH and the two round goggle-eyed CRTs of the 6600, I looked up to the balcony and saw the TX-O. There it was, the first fully-transistorized computer, built at MIT in 1956, whose ancestor was the Whirlwind. It filled a 9,000-square-foot room, consumed 5,400 watts of power, needed 15 tons of air conditioning, and ran at one-tenth the speed of an Apple II. Whirlwind was the first computer that ran in real time, and it was considered the first mini—yes, mini—computer.

As I followed the time-line exhibit on the second floor of the museum, I was struck by the fact that many engineers schooled in vacuum-tube design were reluctant to adopt the transistor, even though it offered faster switching speeds and cooler operating temperatures. Somehow I had assumed that computer technology was eagerly embraced by all engineers; yet history tells a different story.

Transistorized computers were just being built (IBM followed close on the heels of MIT's machine with Gene Amdahl's first triumph, the 704) when

number sieve in 1926; his photoelectric machine, completed in 1932, could test 300,000 possible solutions per minute.

I saw other amazing machines: the "Enigma" code-breaking machine used to decipher German messages during World War II; the computer made of Tinker Toys that plays an unbeatable game of Tic-Tac-Toe; and the Friden processor, which ran on paper-tape instructions and could print out at the astonishing rate of ten characters per second.

There was more, so much more to see, but the daylight was waning, and I could see Gwen Bell had to return to her other duties. "Be sure to visit the museum shop on your way out," she said. "You'll find books, cards, computer jewelry, and quite an assortment of memorabilia—chips, disks, boards, odd parts, you know." I nodded eagerly, then paused; suddenly, I wondered how I was going to get back home, back to the other side of my computer's screen.

"There is one other thing I'd like to ask about," I said. "I came here looking for a mouse."

"That's easy," said Bell, walking over to a display. And there it was, Xerox's first professional workstation, the Alto (the "Star's" grandfather), built in 1973. And attached to it, sure enough, was a mouse.

The Computer Museum: building a database

For some reason, there isn't much documentation on the history of computers. Perhaps the scribes were too busy penning programs; perhaps the engineers were occupied rewiring breadboards. John von Neumann wrote something called "First Draft of a Report on the EDVAC" in 1945, which presented the concept of a stored-program computer. The paper was never published in a journal and did not appear in print until 1981. That's why the Computer Museum is such a good idea.

Harold Lorin of IBM's prestigious Systems Research Institute says, "Your first computer is like your first love affair; you never get over her." Apparently Kenneth Olsen and Robert Everett felt the same way; years ago, when they learned that the Whirlwind computer, which they helped build, had outlived its usefulness and was on its way to the scrap pile, they spirited it away. Olsen, president of Digital Equipment Corp., stored it in one of his firm's warehouses while he and Everett, president of Mitre Corp., pondered what to do with it for five years.

Meanwhile, Gordon Bell, a chief engineer at DEC who worked with Ken Olsen and Edson deCastro on the monumentally successful Digital PDP-8, was collecting computer artifacts and musing over the possibility of some sort of repository other than his office and home. When the three put their heads together, they came up with the idea of establishing a computer museum which, on the day it opened in 1979, would be a gift to the public from DEC to commemorate the firms's 15th anniversary.

The Computer Museum became an independent, nonprofit institution in 1982. Its board of directors includes people from every major concern in computerdom: IBM, Texas Instruments, *Computerworld*, Control Data Corporation, DEC, MIT, Harvard, the University of Newcastle-upon-Tyne, and even Massachusetts Senator Paul Tsongas.

The criterion for choosing computers for the museum is not commercial success, but rather a machine's technical aspects. "Until you get the artifacts together in one place so history isn't fragmented, and so you're not seeing just one piece at a time, you have trouble making sense of it all," says museum director Gwen Bell. "The afficionadoes find us and love it."

Indeed, even trying to put one piece of hardware together can be difficult. When the museum acquired the Iliac IV, says Bell, "There wasn't a plan, there wasn't even a picture. We had no idea how to put it together." She finally found a technician from Burroughs Corp. who had assembled, then disassembled, the computer at NASA's Ames Laboratory.

At present, the exhibits aren't interactive. "We don't let visitors play with the machines, because many of them are one-of—a-kind historical artifacts," says Bell. "But once we're better organized, we hope the museum will be used for study and scholarship."

The Los Alamos Scientific Laboratory is a contributor to the Computer Museum. "They usually get serial number 'one' of everything," says Bell, "and when they retire it, they send it to us." Other donors are Xerox, Fujitsu, the Mitre Corporation, RCA, Bell Laboratories, and, of course, Digital. Jamie Parker, who has a degree in art history, is exhibit coordinator, and spends much of her time tracking down exotic machines.

In addition to its exhibits, the Computer Museum features programs for the public. Alex's "dream" (in accompanying story) of hearing people like Grace Hopper and seeing Maurice Wilkes' play, *Pray, Mr. Babbage*, was no dream at all. There is also a film collection which includes the first movie written by a computer, and a collection of out-of-print books on computers.

The Computer Museum's biggest problem has been space; Gwen Bell and her staff can exhibit only half of the machines they currenlty possess. This problem will soon be alleviated: The Computer Museum will soon be moving from outside the city to downtown Boston. The current location will close at Thanksgiving, and the museum will reopen in the fall of 1984, right next door to the Boston Children's Museum. "The two museums are complementary," says Bell. "Young children can learn how to use computers at the Children's Museum computer exhibit, and older children can visit us to learn about the evolution of computing."

And, as everyone knows, older children interested in computers include everyone from seven-year-olds to septuagenarians. J.B.R.