LEONARD S. CUTLER

1928–2006

Elected in 1987

“For scientific and engineering contributions to the fields of atomic frequency standards and electronic instrumentation and measurement.”

BY JAMES N. HOLLENHORST
SUBMITTED BY THE NAE HOME SECRETARY

LEONARD S. CUTLER, cofounder of Hewlett-Packard Laboratories and internationally recognized inventor and scientist, died of heart failure on September 4, 2006, at the age of 78.

During his career of almost 50 years with Hewlett-Packard and Agilent Technologies, Len established a reputation as the company’s most respected scientist and innovator. His numerous innovations in time and frequency control and contributions to the world’s most accurate commercial clocks earned him the nickname “Father Time.” He was the first and still the only person to hold Agilent’s highest technical honor, Distinguished Fellow, in recognition of his long-standing and far-reaching contributions, particularly in the areas of precise measurement of time and position.

Len was born on January 10, 1928, in Los Angeles, where his parents ran small businesses such as grocery stores and a restaurant. Years later, he liked to tell the story of having to eat the spoiled food left over at his parents’ restaurant during the Great Depression, explaining that this is how he developed a lifelong hatred of fish.

He had an early interest in science and music and discovered that he had perfect pitch. He appeared briefly in the 1945 film “Anchors Aweigh” playing the piano in the Hollywood Bowl. He was 17 years old at the time.
Ultimately, he had to choose between music and science and decided he wasn’t a good enough musician to make a decent living at it. In 1945, after high school, he joined the Navy, where he trained as an electronics technician and ended up teaching some of the courses himself.

Next, Len went to work as an electronics technician for the Hoffman Radio Company in Los Angeles. Soon after, in 1947, he began his college career at Stanford University. He ran out of money after two years and headed back to Los Angeles in 1949 to work for a small company, Gertsch Products, where his starting pay was $1.50 per hour. He worked at Gertsch for eight years designing things like frequency meters, power supplies, and filters, eventually rising to the position of vice president of engineering. During this time, he married Dorothy and they had their first child, Jeffrey.

In 1957, he decided to go back to Stanford to finish his college degree. To support his growing family, he began his career at Hewlett-Packard in the same year. His employment application form reveals the true Len. When asked what work he liked, he said: “design and development.” When asked what he disliked, he said “management work.” Many years later, when I took over one of Len’s management roles, he couldn’t hide his thrill in handing over budgets and personnel matters to me, while he relished the chance to spend more time designing better atomic clocks. At management meetings that we both attended, Len could frequently be spotted solving complex but timeless equations while the rest of us debated an urgent but fleeting administrative issue.

Hewlett-Packard supported his tuition at Stanford, where he pursued a bachelor’s degree (1958) and graduate degrees (1960, 1966) in physics. He delighted in quantum mechanics, general relativity, and mathematical physics. In 1966 he earned a PhD in theoretical physics under the direction of Dirk Walecka, with whom he investigated electron scattering off nuclei and noise in lasers and masers. Concurrently at HP, he worked on precision oscillators and got very interested in atomic frequency standards, which combined his love of physics and quantum theory with HP’s practical needs.
for instrumentation. He developed the first cesium beam clock with all solid-state electronics (no vacuum tubes), which became a commercial product in 1964, and he took on management responsibilities in the process. The performance and reliability of HP's atomic clocks were much better than anything previously available, so they rapidly captured the market and became widely used throughout the world.

He also invented a new approach to distance measurement using a Zeeman-split two-frequency laser interferometer. This became an important business that today enables nanometer-scale positioning in photolithography for the semiconductor industry. It was also around this time that Barney Oliver and Len founded HP Labs. In 1967 HP decided to buy the division of Varian that was working on atomic frequency standards and Len went to Beverly, Massachusetts, to run that operation for several years. During this time, he met and worked with Norman Ramsey, Robert Vessot, and Joe Holloway. Len became a second-level manager and Director of Quantum Electronics for HP.

After the Varian operation was moved to California, Len came back to HP Labs as director of the physics research lab. He continued to work on atomic clocks but directed other activities as well. For example, he led the program on magnetic bubble memories, developing a one-megabit device, which was a very impressive accomplishment at the time. Later he became director of the instruments and photonics lab, developing photonics instrumentation and frequency standards. In 1987, shortly after the discovery of high-temperature superconductors, Len and John Moll founded the Superconductivity Lab and became its codirectors.

In 1990, Len became the first Distinguished Contributor in HP and was happy to be relieved of his lab director duties and work full time on his greatest passion, time and frequency standards. He led a small team whose innovations enabled the introduction in 1992 of HP's 5071A cesium clock, with an accuracy of one second every 1.6 million years. It soon became the most successful commercial time standard in the world.

In the 1990s, at David Packard's request, Len helped to
create the first true basic research effort in HP, at a time when most companies were stopping basic research. He hired Stan Williams to lead the effort, which subsequently became one of the preeminent nanotechnology groups in the world.

In 1999 the original measurement businesses of Hewlett-Packard spun off as a new company, Agilent Technologies. Len continued to lead his small team in the new Agilent Labs, always working on matters of importance to the business. He was soon named Agilent’s first Distinguished Fellow, the highest technical honor bestowed by the company.

Len was responsible for innovations in many areas of technology. At the time of his death, he had submitted two patent applications, which were subsequently granted, bringing his career total to 27 patents. Among his technical achievements, two stand out above all others: atomic clocks and laser interferometers. Clocks designed by Len form the cornerstone of the time standards maintained by laboratories throughout the world. They were the first to be flown in airplanes to perform the synchronization of world clocks and later to test the variations in the flow of time predicted by Albert Einstein. Like the clocks built by John Harrison in the 18th century to solve the longitude problem, the impact of Len’s work is crucial to modern commerce. Accurate timekeeping is essential to GPS navigation, computer networks, financial transactions, transportation systems, and many other things that we take for granted. His invention of the two-frequency laser interferometer is a key element in maintaining the fraction-of-a-nanometer positional accuracy in photolithography systems. This has enabled remarkable advances in integrated circuit technology, ushering in the age of nanotechnology.

Len was the recipient of many awards and honors. In addition to being named IEEE Fellow for “contributions to the design of atomic frequency standards and to the theory and measurement of frequency stability” and Fellow of the American Physical Society for work on atomic frequency standards and laser interferometers, he received the IEEE
Centennial Award, Morris E. Leeds Award, Rabi Award, the Third Millennium Medal, IRI Achievement Award, AIP Industrial Applications of Physics Award, and Precise Time and Time Interval Distinguished Service Award. In 1987 he was elected to the National Academy of Engineering for “scientific and engineering contributions to the fields of atomic frequency standards and electronic instrumentation and measurement.” He served on numerous government, professional society, industrial, and academic committees and advisory boards.

All who knew him agree that Len was among the most brilliant people they ever met. Beyond his technical accomplishments and leadership, Len had an enormous impact on HP and Agilent by setting a standard of the highest scientific and engineering excellence and by striving to hire the very best employees. Unlike most hiring managers, his vision went far beyond the project at hand. He recognized that the people he hired would contribute to the company for many years, so he was willing to make a bet on people with great drive and ability, even though their expertise might not be aligned with the immediate needs of his projects. A significant part of his legacy is the continuing impact of several generations of employees that he hired and mentored.

His son Jeff wrote:

Len Cutler was a deeply introverted man, and highly analytical. He was happy when he was designing circuitry or solving mathematical equations. He was a caring, principled father who tried to instill good values in his children. As a boy, the time I spent with him was an education in itself. He loved photography and optics. When I was around ten years old he taught me how to use a light meter to measure luminosity and then calculate a photographic exposure based on film speed. He also constructed a small refracting telescope.

He loved cats. From the time I was a little boy we always had one or two cats in the house. And on his desk at Hewlett Packard and Agilent he kept framed pictures of his cats along with his family. As an engineer he appreciated fine machinery. He admired fine automobiles, and especially liked Porsches and Ferraris. In the mid-
1970s he took all four of us sons to see the Can Am races at Laguna Seca Raceway in Monterey, California. It was a fun day for us and for him.

In spite of serious heart trouble, Len continued to work almost without interruption until his death. He passed away peacefully while doing something that gave him great joy—camping in the beautiful Santa Cruz Mountains with his extended family. At the time of his death Leonard S. Cutler was survived by his wife Dorothy; his sons Jeffrey, Gregory, Steven, and Scott; grandchildren Kim, Michelle, James, and Lindsay; and his sister Anita Roth.