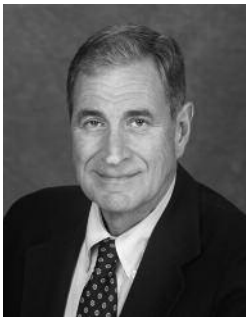
Obituaries

Ray M. Dolby 1933–2013



On September 12, 2013, the Audio Engineering Society lost one of its staunchest and most respected supporters when Ray Dolby died of leukemia in San Francisco at the age of 80.

Ray was AES president from 1980–81, a member of the Board of Governors from 1981–84, recipient of its Silver Medal in 1971 and Gold Medal in 1992, and granted a Fellowship in 1971. He and his company Dolby Laboratories have had a profound effect on the storage, transmission, and reproduction of audio and video, from the first successful professional video tape recorder in the 1950s to digital audio technologies that are widely used today in broadcast, cinema, and consumer applications.

Born in Portland, Oregon, on January 18, 1933, Ray grew up in the heart of what became known as Silicon Valley in California. He acquired from his father Earl a deep interest and abiding curiosity in how things worked, while from his mother Esther (Strand) he inherited a love of music as both listener and performer as well as a strong work ethic. As a result Ray developed at an early age the motivation of a scientist and the spirit of an artist.

In 1949 as a 16-year-old student in Redwood City, California, Ray had a chance encounter with Alex Poniatoff, founder and president of Ampex Corporation, which had recently introduced the first U.S.-made professional audio tape recorder. This led to Ray's working at Ampex for the next eight years, full-time when he could, and part-time when pursuing his education.

Most of Ray's time at Ampex was devoted to the development of the world's first practical video tape recorder. He began by building from scratch a primitive rotary-head recorder, while the last of his many seminal contributions over the next several years was a processor to interface production units with the broadcast infrastructure. Even during a 21-month stint as an electronics instructor in the U.S. Army, he continued to fire off new ideas for the VTR to Ampex. The VTR was first demonstrated in April of 1956 to the acclaim of broadcasters, who inundated Ampex with orders. Due to his having been almost fully responsible for the system's electronics, Ray shared in the Emmy later awarded to Ampex for the VTR.

In September, 1957, by which time he had graduated from Stanford with a bachelor's degree in electrical engineering, Ray undertook a new adventure: graduate study at Cambridge University in England thanks to a Marshall Scholarship. His research at the renowned Cavendish Laboratory made it possible to determine the chemical composition of light elements such as oxygen by adapting X-ray bombardment techniques that had been used previously for heavier elements like iron. Ray was elected a Fellow of Pembroke College and served as a consultant to the UK Atomic Energy Authority. He was awarded a Ph.D. in physics in 1961.

In February of 1963, Ray left academia to join a project in India sponsored by the United Nations Educational, Scientific and Cultural Organization (UNESCO). He spent the next two years in Chandigarh in the state of Punjab analyzing India's electronic scientific instruments industry and suggesting improvements. He was soon joined by a German graduate student, Dagmar Baumert, whom he had met and dated in Cambridge, and had become caught up in his sense of adventure. Theirs was to be a deeply committed and loving partnership that ended only with Ray's passing; they were married in London in 1966.

Ray had always enjoyed making live recordings, including during his years at Cambridge; in India he hired professional musicians so he could tape them. Doing something about tape noise had been in the back of his mind since his time at Ampex, but now he was sufficiently bothered by it to do something about it.

As he studied existing companders, infamous for adding more distortion than they reduced noise, Ray had a brainstorm. Tape noise is only audible on quiet passages and is electrically a very small portion of the whole signal. Why not have a separate path to process only those small signals, while letting the loud sounds pass on through undisturbed? He also opted to apply the low-level processing separately to each of four frequency bands, thereby eliminating another weakness of existing systems, noise modulation.

Upon the expiration of his UNESCO contract, Ray and Dagmar undertook a two-month overland drive back to the UK through Pakistan, Iran, Iraq, Syria, Jordan, and Turkey among other countries. While in Afghanistan, Ray wrote up his ideas for noise reduction and from Kandahar sent them off to his patent attorney in California (he was later granted the patent and was awarded over 50 more). Thus was born the invention that was to propel the name Dolby into the consciousness of the music recording industry and become the foundation on which Ray would build his own company.

Soon after arriving back in London in May of 1965 having decided to live there again, Ray opened Dolby Laboratories in the corner of a dress factory near the Thames. He first developed a monochrome video noise reduction system which the BBC evaluated, but they soon lost interest as they were then converting to color. So Ray moved on to develop his A-type audio noise reduction (NR) system and embody it in the Dolby A301 NR unit for use in music recording studios.

Decca Records tested A-type NR and found that it not only provided significant noise reduction, but unlike any previous device they had tested introduced no side

effects. Decca finally ordered nine A301s taking delivery in April 1966. The orders trickled in at first, but soon the advent of multitrack recording with yet more noise due to narrower tracks led to the universal adoption of Dolby A-type NR by recording studios worldwide.

In 1967, at the urging of U.S. stereo equipment manufacturer Henry Kloss, Ray committed to developing an NR system for consumer products that he had been contemplating. Ray also made a decision that was to profoundly affect the growth and prosperity of his company. While committed to manufacturing and selling professional products, Ray decided to license what became known as Dolby B-type NR to consumer electronics manufacturers. He established a uniquely successful licensing program that remains in force today with Dolby's digital technologies.

As he developed B-type NR, Ray considered the Philips Compact Cassette as the consumer tape format with the most potential. Introduced 1963, it was intended for dictation and casual home recording. But due to its narrow tape and slow speed, annoying tape hiss precluded the cassette from serious music recording.

Where noise in professional tape recording was distributed evenly over the entire bandwidth, with the cassette it was most objectionable as hiss at higher frequencies. This was the key to Ray's adapting the principles of A-type NR to a less costly and complicated circuit that could be mass produced, ultimately in IC form. Like A-type, Dolby B-type uses dual paths. But with B-type, low-level signals are processed within a single sliding band of higher frequencies that ably stands in for the multiple fixed bands of A-type NR specifically to reduce hiss, and without side effects.

In 1970 the first cassette recorders with Dolby B-type NR were introduced by Advent, Fisher, and Harman-Kardon to instant acclaim and popularity. Applications for licenses soon multiplied, and Ray began to encourage the release of prerecorded cassettes encoded with the Dolby B-type characteristic. Ultimately the Compact Cassette with Dolby B-type NR became a truly ubiquitous recorded music medium, with prerecorded cassettes eventually outselling LP records; nearly 765,000,000 consumer products with Dolby B-type have been sold.

In the early 1970s, Ray next turned his attention to another candidate for A-type noise reduction: the tried-and-true, but limited fidelity, optical soundtrack on 35 mm movie prints. His first step was to charge Ioan Allen, who had been in charge of marketing A-type NR, to survey film sound technology and practices from top to bottom. It turned out that simply applying Dolby A-type NR to the optical soundtrack was not enough. Almost every link in the movie sound chain from original recording to presentation in the cinema needed updating, modification, or complete rethinking. Furthermore, Ray and Ioan concluded that what was needed was multichannel surround sound in a format that would cost less, and be more durable, than the multichannel magnetic striping format that had been introduced in the 1950s, but now was used only rarely.

The result was the introduction in 1975 of the highly practical 35-mm optical release print format originally known as Dolby Stereo. The new optical track was configured to be compatible with mono playback, requiring the issuance of only one kind of release print. Dolby A-type noise reduction, a matrix system to derive four-channel surround sound from just two tracks on the film, and cinema loudspeaker equalization to a new wide-range playback standard were among the many improvements brought to bear.

Dolby Stereo profoundly changed both movie-making and movie-going. It elevated the creativity of film makers on one hand and the audience experience on the other. In 1976, the great majority of film presentations featured low-fidelity, mono sound. Less than 10 years later, thanks to Dolby, the majority of presentations were accompanied by high-quality surround sound. For fostering this revolution, Ray and Ioan were awarded Oscars in 1989.

By 1980 Dolby B-type NR had been established in cassette recording for 10 years. Anxious for something new, several important Dolby licensees got together early that year to lobby Ray for a more powerful NR system. Although not entirely convinced that more noise reduction was really needed, he went to work and introduced Dolby C-type NR eight months later.

Based on a pair of B-type processors cascaded to reduce hiss by 20 dB versus B-type's 10 dB, Dolby C-type was quickly adopted by licensees to complement B-type in their recorders. Dolby B-type nevertheless became more popular than ever and remained the standard for prerecorded cassettes; C-type would be considered as something of a luxury, and was rarely used to its full capabilities by consumers.

Developing C-type rekindled Ray's ideas for a new professional system, with further impetus from the high cost and reported unreliability of the professional digital audio recorders then coming on line. He believed he could bring to existing analog recorders signal quality at least as good as digital, but with greater reliability and at far lower cost.

To free himself for this project, Ray in May of 1983 promoted Bill Jasper, the company's financial vice president, to president. Ray retained the Chairmanship while Bill went on to run the company's day-to-day operations for 25 years, not only skillfully, but with the tact, patience, and grace required as right-hand man to a brilliant and at times willful entrepreneur.

Ray in effect locked himself in his home lab for the next four years, and with the help of two technicians at the company to breadboard his concepts, developed his ultimate analog recording process. He combined everything he had learned including both the multiple fixed bands of A-type and the sliding-band technology of B-type. As well as dramatically more noise reduction, Ray incorporated developments that also significantly improved analog's high-level signal capability. The net increase in dynamic range was so great that he named it Spectral Recording, or Dolby SR, both to hint at the way it worked and to avoid categorizing it as simply another NR system.

Ray drove himself hard to complete SR, and partly as a result suffered a mild heart attack. He would later say, not entirely in jest, that SR nearly killed him. First demonstrated in March 1986 at the AES Convention in Montreux, Switzerland, Dolby SR was gratefully received by the recording industry as a practical, economical way to bridge the gap between analog and digital. It also went on to further improve the optical movie soundtrack. While by now Dolby engineers were working on digital audio coders that would bring the company new fame and success, for Ray himself SR was his proudest technological accomplishment. It was his swan song as an inventor, as it was for professional analog audio itself.

Dolby Laboratories' involvement with digital audio began in the early days of the film sound program. The company's engineers developed an adaptive delta modulation (ADM) digital technique for introducing a delay on the surround channel of stereo optical prints to minimize the audibility of front-channel information leaking into the cinema's surround speakers.

From the beginning, Dolby's digital developments derived from a concerted effort to avoid the use of pulse-code modulation (PCM), the basis of professional digi-

tal audio recording and the Compact Disc. Ray and his engineers had developed a distaste for PCM audio for its inefficiency and not taking advantage of any psychoacoustic principles. That distaste would be parlayed by Dolby engineers into widely adopted proprietary technology taking full advantage of psychoacoustics to dramatically reduce the demands of digital audio for bandwidth. Ray followed their progress closely, and was amazed by the performance of their forays into perceptual audio coding. Their new technology accelerated the company's digital sound-on-film project, which nevertheless took six years of development before the first feature film with a Dolby Digital soundtrack could be released (*Batman Returns* in June, 1992). Dolby had revolutionized movie sound yet again.

In the 1990s Dolby Laboratories was well and truly in the digital business, facilitated by the dropping prices of components such as ICs and DSPs. Dolby engineers and staff were very busy. They first had to design and produce encoders and decoders for cinema applications. Then came Dolby Digital audio for consumer applications: Laser Disc, DVD, cable, HDTV, and other media. Digital consumer products had now become cheaper and more convenient to manufacture than analog products, a turn of events Ray and many others had not thought likely.

With Bill Jasper ably administering the company and Dolby SR now in production, Ray was finally free to pursue his many interests. Nevertheless, for many more years he regularly spent Tuesdays at the company, being debriefed about corporate matters in the morning, then in the afternoon stopping by his engineers' work stations and asking what they were up to. If an engineer was stymied by something, Ray would gently share his wisdom, often by means of an anecdote from his own vast experience to suggest a solution, or a new path to finding one.

Among the passions he could now indulge was flying both airplanes and helicopters, which he took up in his 50s. Once he had purchased his first long-range aircraft Ray would regularly fly to Europe and beyond, with Dagmar at his side, to attend AES conventions, visit her parents in Germany, and explore new lands like Africa. He never stopped acting upon the spirit of adventure that had taken him to Cambridge for graduate studies, off to India for two years, back to London to start his own company, and, in 1976, to San Francisco partly because he wanted to raise his sons in the U.S. (Today Tom lives in New York and is a novelist of growing repute, while Dave has remained in the Bay Area and sits on the Dolby Laboratories board representing the family and his father's principles and values.)

As he saw the age of 70 approaching, Ray undertook to ensure that Dolby Laboratories would continue to flourish on its own as it had under his direct control. He decided the best way was to take the company public; he announced his plans in April of 2000. That decision also enabled him to reward his longtime employees through stock options. After more than five years of hard work by Bill Jasper and his staff preparing for an initial public offering, Dolby Laboratories was listed on the New York Stock Exchange in February 2005 shortly before the company's 40th anniversary.

Arguably Ray's greatest strength as an entrepreneur was hiring the best people he could find, then providing them with the freedom, encouragement, and tools to do their best at what they liked to do best. He strove to achieve and maintain at Dolby Laboratories the collegial atmosphere in which he had flourished at the Cavendish Laboratory. He never micromanaged his employees and always treated them as colleagues, respecting their contribution regardless of position. They in turn regarded him with respect and affection, and many key executives and engineers remained with the company for most of their careers, and continue to do so. Ray's approach was particularly effective as the company transitioned from analog supremacy to digital powerhouse.

Ray never indulged in histrionics. He was not averse, however, to ruling by fiat when he was convinced he was right. In the early 1990s, for example, as Dolby's newest perceptual audio coder broke cover, it began to be known publicly by its internal project name AC-3. With an instinct for branding honed long before it became a buzzword, Ray issued one of his rare direct orders. The company would thenceforth refer to the technology only as "Dolby Digital", and the press was asked to do the same. There was some grumbling, but Ray's instinct proved correct. "Dolby Digital" stood out distinctly from all the trendy high-tech acronyms then and still extant, and the brand long synonymous with high-quality sound became irrevocably identified with 5.1-channel digital audio.

Ray spoke quietly and deliberately, thoughtfully and precisely. He communicated clearly, without a trace of verbosity. This knack also characterized his many papers, including the five he presented over the years at AES conventions. They are models of logic and clarity, though his penchant for wasting few words engenders a density that demands the reader's close attention. His English was impeccable.

In spite of great success both professional and financial, Ray remained approachable, affable, invariably courteous, and always a gentleman. While pleased by his many awards—five Emmy statuettes as well as the Oscar; honorary doctorates from Cambridge University and the University of York; the U.S. National Medal of Technology; and membership in the Order of the British Empire among others—he did not flaunt them. He was proud of his accomplishments, but never arrogant or bumptious. He kept his feet on the ground—and never lost his impish sense of humor.

After moving to San Francisco, as he and his company enjoyed increasing financial success, Ray became one of the city's leading philanthropists. He contributed generously to and served on the boards of the San Francisco Symphony and the San Francisco Opera, honoring music and all it had done for him. A firm believer in the potential rewards of stem cell research, his largest contribution was to the research program at the University of California, San Francisco (UCSF), which named its new, architecturally stunning Ray and Dagmar Dolby Regeneration Medicine Building in honor of that commitment.

Sadly, about three years before he was diagnosed with terminal leukemia in July of this year, Ray exhibited the first symptoms of what proved to be Alzheimer's disease. Alzheimer's increasingly dimmed his faculties, and he made few public appearances. His family reports, however, that he remained happy, and always able to recognize them, making it possible for him to continue to take the great pleasure in them as he always had. Dolby Laboratories may be his greatest legacy, but his family was his greatest pride and joy.

Inventor, engineer, scientist, entrepreneur, philanthropist, pilot, sailor, adventurer, devoted family man—Ray Dolby was all these things. He changed forever the ways we listen to music, watch TV, and experience movies. He is and will continue to be sorely missed.

Joseph Hull, Dolby Laboratories (retired)
San Francisco, October 2013