



*Kenneth McK. Eldred*

# KENNETH McK. ELDRED

1929–2012

Elected in 1975

*“For contributions in noise and vibration control of air, space, and transportation vehicles and in delineating acceptable noise environment for people.”*

BY ERIC W. WOOD AND GEORGE C. MALING JR.

KENNETH McKECHNIE ELDRED devoted his professional career to practical applications of a wide range of engineering noise and vibration control principles, helping to make both communities and industrialized portions of the world quieter. He received worldwide recognition for his contributions and was considered by many of his colleagues to be among the best practitioners in the nation. He was born on November 25, 1929, in Springfield, Massachusetts, to parents Robert Moseley and Jean Ashton Eldred. He married Barbara Fischer in 1957 and passed away on January 30, 2012, in his 83rd year.

Ken earned his SB (general engineering) degree with a combination of courses in naval architecture, marine transportation, and business administration from the Massachusetts Institute of Technology in 1950, where he also took graduate courses in acoustics. He supplemented his education with graduate courses in mathematics at University of California, Los Angeles.

Early in his professional career (1950–1954), he served as director of shipboard vibration, noise control for submarine machinery and propellers, and underwater sound activities at the Boston Naval Shipyard Sound and Vibration Laboratory. He also served as chief of the Physical Acoustics Section, Bioacoustics Branch, at the USAF Wright Air Development Center in Dayton, Ohio, where he worked closely with

Dr. Henning von Gierke from 1954 to 1957. At the Wright Air Development Center, he directed research in the evaluation and abatement of Air Force noise sources, including both rockets and jet aircraft. His technical projects addressed the design of fatigue-resistant structures for high-speed aircraft and aerospace vehicles considering realistic acoustic, fluctuating aerodynamic, engine vibration environments and their characteristics, including proof tests required to qualify structure and equipment. He studied how noise from aircraft propagates through the atmosphere and criteria for exposure of personnel to high-intensity jet aircraft noise. Here, with von Gierke, he developed the equal-energy hypothesis for assessing the effects of noise on people and the use of cumulative noise contours around airports. It was also here that he met his future wife Barbara, Henning von Gierke's wife's younger sister.

Ken served as vice president and consultant in acoustics and vibration while at the Western Electro-Acoustics Laboratory in Los Angeles from 1957 to 1963. The broad scope of his consulting activities included the vibration of complex vehicle structures, sonic fatigue, noise and vibration of aircraft and missiles, model-scale simulation studies, evaluation of noise and vibration in manufacturing facilities, environmental noise studies, and architectural acoustics.

In 1963 Ken was appointed director of research at Wyle Laboratories, El Segundo, California, in the newly formed research department with the directive to expand Wyle's testing facilities for the Air Force in view of the increasing technical requirements of the space program. First, at Huntsville, Alabama, he set up a staff to directly support NASA on the Apollo manned moon program, and later, at El Segundo, California, and in Washington, DC, he was responsible for drawing together a staff of talented engineers from the United States and other countries. The initial work involved predicting, and then testing in simulation at specially built test facilities, the noise and aerodynamic loading of space vehicles and the resultant vibration and stress. This work quickly

expanded into other areas of acoustics, vibration, unsteady aerodynamics, fluid dynamics, and experimental stress analysis. During his time at Wyle, Ken was a mentor to many young engineers and scientists who went on to successful careers in noise, vibration, and environmental engineering.

In 1973 Ken joined the Cambridge, Massachusetts, office of Bolt Beranek and Newman (BBN), where he served as group vice president, principal consultant, and director of many outstanding professionals. They provided consulting services in environmental, transportation, and industrial acoustics; building vibrations; architectural acoustics; surface ship and submarine noise and vibration control; underwater sound; and signal processing, as well as a wide range of special national security projects for various federal government agencies. While at BBN, Ken also provided consulting services for clients that included airport operators and the EPA's Office of Noise Abatement and Control (ONAC). One of the highlights of EPA's noise program was the 1974 publication of *Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety*. The report, usually known as the *Levels Document* is probably the most widely distributed and used EPA report on the subject of noise. Ken Eldred was a principal author.

After leaving BBN in 1982, he formed Ken Eldred Engineering, located first in Concord, Massachusetts, and later in East Boothbay, Maine. For many years he continued providing important consulting services to airport and industrial clients. His papers at this time included "Airport Noise: Solving a World Class Problem" and "Sound Exposure without Decibels." In addition to directing staff at major consulting firms, he found time to conduct his own original work in the areas of aircraft noise, including sonic booms and acoustic testing in simulation of aeroacoustic and unsteady aerodynamic loading.

One particular interest was community response studies resulting from airport noise. Ken's understanding of the nature of "community response" to environmental noise was

deeper and better developed than that of most other engineers in the field. In 1974, based on his decades of consulting and research in community noise response, he included the concept of “normalized” day-night level (DNL) in Appendix D of the EPA *Levels Document*. He believed that DNL should be tailored to individual communities, so he added adjustments to Table D7 of the *Levels Document* to account for factors such as “prior experience with the intruding noise,” the presence of pure tones, and impulsive sounds. The “normalized” DNL was a single number that accounted for acoustic factors not represented by simple A-weighted measurements and for non-acoustic factors unique to a community, such as a shared belief that good faith efforts were being made to control the noise.

Normalized DNL saw little use for many years. In 2002 an updated version of it was included in International Standard ISO 1996 Part 1 and in American National Standard ANSI S12.9 Part 4 but remained little used. Recent research on community tolerance for transportation noise exposure has confirmed that Ken’s understanding was correct. A single-valued variable—a “Community Tolerance Level” or CTL value, in modern terms—represents the sum of the nonacoustic influences on community annoyance. DNL and CTL together account for appreciably more variance in annoyance prevalence rates in communities than a simple, A-weighted measure of cumulative exposure. A CTL value, in units of DNL decibels, describes the amount by which a specific community departs from a hypothetical “average” community.

These latest research developments leave little doubt that the normalized DNL is a useful and important concept. Although it took decades to systematically confirm Ken’s understanding of community noise, it is now clear that a form of normalized DNL is essential for assessing community response to noise. Without it, the term “community response” has little meaning and it is not possible to assess response to noise in an actual community, but only in some hypothetical average community. Ken was always ahead of the rest of his colleagues.

Ken was a founding member of the Institute of Noise Control Engineering of the USA, which he served as director,

chair of the finance committee, and president. As chair of the finance committee he was responsible for turning around the INCE/USA financial situation of 1976 to make INCE/USA vigilant on cost control and income generation. For the first time the Institute was operating in the black, and his insight into investment strategies in the early 1980s helped it continue to serve the noise control engineering community for many years. He maintained his membership and affiliation with INCE/USA for 40 years.

At the INCE/USA-sponsored INTER-NOISE 72 Congress, Ken made a seminal contribution to the passage of the Noise Control Act of 1972, an act that guided American noise policy for nearly a decade. Leo Beranek has told the story in more detail; but, in summary, Ken served on the Supersonic Aircraft Neighborhood Noise Committee for the US Department of Transportation (DOT), which reported to William M. Magruder, director of DOT's Supersonic Aircraft Division. Magruder later became a special assistant to President Richard Nixon and was invited to be the keynote speaker at the INTER-NOISE 72 opening luncheon on October 4, 1972. He accepted, and his announced topic was "Technology, National Goals, and the Administration's Noise Program." Ken and others met with Magruder just before the luncheon and, after a telephone call by Magruder to the White House, were assured that President Nixon would sign a bill if passed by the Congress. The announcement was made at the luncheon and, after negotiations too numerous to mention, the Noise Control Act was passed by both houses of Congress on the last day of the 92nd Congress.

Ken made significant contributions to the world of standards as related to the noise control engineering profession. Standards development in the Acoustical Society of America (ASA) began in 1930, and Ken was involved in standards for more than half of the years since, taking his first leadership position in 1968 as chair of S1/WG 45 Sound Level Meters and Their Calibration. Few persons did as much as Ken for standards and ASA's role therein. He quickly got to the heart of a problem and was a great strategic and tactical thinker. For example, in 1977 he organized and chaired a special standards

meeting, in cooperation with the EPA, in Deerfield Beach, Florida, with the purpose of establishing what is now the S-12 Committee on Noise. The meeting also produced an ASA report on environmental acoustics. The purpose of the new committee was to deal with noise measurements, including environmental, occupational, and other special purpose noise measurements. Ken had many roles in the program and its international component, which remain important in the ASA standards to this day.

He served as ASA standards director from 1987 to 1993, chair of S12 from 1984 to 1987, and chair of ISO/TC 108 from 1994 to 1998. In addition, he chaired S1/WG 74 Guidelines for Standard Procedures for Measurement of Sound Source Emission (Joint with S3) through the mid-1970s; S1/WG 45 Sound Level Meters and their Calibration (1968–1984); S2/WG 83 Acoustic Vibration Testing (1983–1986); the ANSI Acoustical Standards Management Board and Standards Planning Panel, both in the mid-1970s; and the ANSI Panel on Noise Abatement and Control (1976), which was set up to meet the EPA's needs. He was also an individual member of S1 and S2.

Ken was a member of the DOT SST Advisory Panel for Noise, a consultant for the President's Aviation Advisory Commission, and principal consultant to the State of California Department of Aeronautics for the development of the first comprehensive regulations for airport noise. He was a registered professional engineer in the states of California and Alabama; a member of the National Academy of Engineering, to which he was elected in 1975; a fellow of the Institute of Noise Control Engineering; a director of the INCE Foundation; and a fellow of the Acoustical Society of America. In 1994 he received the Silver Medal in Noise from the ASA "for contributions to noise control and environmental acoustics, and for leadership in the development of standards."

Sailing was a passion for Ken since age 4, when he built his first boat from cereal boxes. At age 12, he built and sailed on the Niagara River a 12-foot gaff-rigged sloop. While at MIT he was co-skipper of a sailing team. He taught classes in sailing, raced Thistles on the East and West Coasts, and built his own

International 14 and raced it in California, winning many trophies including West Coast Champion (Thistle Class) in 1959. He bought his beloved 44-foot sailing sloop, Ammersee, in 1985 and, when he moved to Maine in 1992, had only one stipulation—that his home be on the coast where he could always see his boat. He loved cruising the Maine coast and faraway places such as the Windward and Leeward Islands in the Caribbean, Cuba, and the western Caribbean. He also enjoyed racing out of the Boothbay Harbor Yacht Club.

Ken is survived by his wife, Barbara, his daughter, Heidi McKechnie, and his granddaughters, Ceysa and Tess McKechnie. His family and friends wish him smooth sailing, fair winds, and love. Shared below is a poem offered by his family.

I am standing upon the seashore.  
 A ship at my side spreads his white sails  
 To the morning breeze and starts for the blue ocean.

He is an object of beauty and strength  
 I stand and watch him until at length  
 He hangs like a speck of white cloud  
 Just where the sea and sky come to mingle  
 With each other.

Then someone at my side says, "There, he is gone!"

"Gone where?"

Gone from my sight. That is all.  
 He is just as large in mast and hull and spar  
 As he was when he left my side  
 And he is just as able to bear his load of living freight  
 To his destined port. His diminished size is in me, not in him.

And just at the moment when someone at my side says,

"There, he is gone!"

There are other eyes watching him coming  
 And other voices ready to take up the glad shout,

"Here he comes!"

– adapted from Henry Van Dyke, a 19th century clergyman

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