HENNING E. VON GIERKE

1917–2007

Elected in 1976

"For pioneering in the effects of noise, sonic boom, and vibration on humans; leadership in bionics; and invention of acoustic devices."

BY KENNETH M. ELDRED AND WILLIAM W. LANG

HENNING E. VON GIERKE, an eminent acoustical engineer and scientist, died March 10, 2007, at the age of 89. He did pioneering work over more than five decades on the transmission, action, and human perception of all types of mechanical energy from infrasound, vibration, impact, and blast through the audible spectrum to ultrasound in air as well as in tissue.

Henning von Gierke was born in 1917 in Karlsruhe, Germany, the son of Edgar von Gierke, a doctor and pathologist, and Julie Braun. In the late 1930s he began studying electrical engineering and acoustics at the Technical Universities in Karlsruhe and Munich, receiving a Diplom Ingenieur in 1943 and a Doktor of Engineering (communications engineering, acoustics) in 1944 from the Technical University at Karlsruhe. For his thesis he studied pure tone sound radiation from gas jets under Professor Herman Backhaus, an important researcher on sound radiation from musical instruments and loudspeakers. He then applied his knowledge of the physical instabilities of the gas jets to understand the mechanisms that enable a human to whistle. Many years later marine acousticians studying the sounds of dolphins adapted his results to marine mammals. His combined interest in physical principles governing

mechanical processes and human responses formed the basis of his professional career in studying the interaction of acoustical, mechanical energy with the human organism.

The outstanding results that Henning achieved were due to a combination of several key qualities. He was a true teacher who, through quickly focused and deeply probing questions, stimulated his associates to think and to think logically. His scientific curiosity led to the development of several patented devices and to the answers to many scientific questions. A key to the success of many of his endeavors was his remarkable ability to quickly define the central core of a complex issue and then lead others in developing solutions, using both experiment and theory in balance. To these qualities he added the realization that one of the most important responsibilities of scientists is to see that scientific results are applied in a correct and timely manner. He had the energy, patience, and dedication to lead the development and adoption of national and international standards addressing human safety, health, and well-being with respect to noise, vibration, shock, and impact.

In 1947 Henning, together with several colleagues from the Helmholtz Institute, came to the United States as part of Operation Paperclip to work for the Army Air Corps in the Bioacoustic Section of the Biophysics Branch of the Aero Medical Laboratory at Wright Field, near Dayton, Ohio. His early years at Wright Field were dedicated to understanding the magnitude and effects of aircraft noise on humans. His research on intense aircraft noise exposures defined new data on human tolerance limits, noise-induced hearing loss, auditory pain, and hearing protection, all of which stand today. In 1957 he introduced with others the equal energy hypothesis as the time-intensity tradeoff for the Air Force hearing conservation regulation. He later chaired the International Standards Organization (ISO) working group that prepared and obtained consensus for the adoption of ISO 1999, which used the equal energy rule as the basis for determining the relationship between occupational noise exposure and an estimate of the resulting hearing impairment.

To address the noise problems of residents near air bases, he spearheaded the ten-year development of a comprehensive procedure for predicting aircraft noise exposure near airports, estimating community response, and land use planning for the Air Force, which was published in 1964. His methods provided the basis for the procedures in use today. In the early 1970s, he chaired the Environmental Protection Agency task force charged with meeting the Congressional mandate to "identify levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety." The findings in the task force's "Levels" and "Criteria" reports have provided the basis for nonoccupational noise criteria in the United States for the last 40 years.

One of Henning's first research studies at Wright Field was an investigation of the effects of high-intensity ultrasound on humans. Although the press had speculated on an "ultrasonic sickness," the research soon demonstrated that there was no significant effect of airborne ultrasound on the hearing of humans and that any annoyance was eliminated by wearing hearing protectors. The results of measurements of the acoustic absorption of the skin led to mechanical impedance measurements and fundamental studies of the physics of vibrations in human tissue. The results of these studies, understood only after analyzing the roles of transverse shear waves, compression waves, and surface waves in body tissues, enabled calculation of some of the unknown physical parameters of tissue. This whole body of information enabled Henning to develop, among other things, a lumped parameter model of the helmet-earmuff-earplug system which is still in use. Several models of other aspects of the human mechanical system were developed, which helped to explain and unify the results of vibration and impact experiments over the infrasonic and sonic frequency ranges accumulated over the years by researchers on both animals and humans.

Henning's work led to the development of human tolerance criteria for vibration and shock that were used as the basis for a comprehensive set of ISO safety and performance consensus standards for vibration exposure. His studies are documented

in over 160 publications on noise exposure and its effects on biodynamics of human exposure to impact, crash and vibration loads, vestibular effects, and protection against hazardous force environments.

Henning's laboratory grew from the bioacoustics section to a branch that he headed and expanded in 1956 to a division that would be called the Biodynamics and Bioengineering Division of the Armstrong Aerospace Medical Research Laboratory. He directed this division from 1956 to 1988, when he retired to become its technical advisor. He was an inspiring leader and teacher not only for the division's research scientists but also for top scientists from around the world who came to work in the laboratory with its unique facilities for periods of a few weeks to years.

From the 1950s on Henning provided consultations to many organizations, including the Army on impulsive noise and blast; the Navy on underwater noise exposure; NASA on radiation of rocket noise and blast and the effects of noise, acceleration, and motion on astronauts, ground personnel, and communities; the FAA on airport noise; the EPA on the full range of environmental noise issues; and the automotive industry on noise and impact. He was a clinical associate professor in the Department of Preventive Medicine at Ohio State University and a clinical professor in the Department of Community Medicine at Wright State University.

Henning was a member of the Acoustical Society of America (ASA) for 45 years, a fellow since 1956, and its president in 1979–80. He was the leader in the development of the Society's Standards Program, chairing the Committee on Bioacoustics and serving as the first ASA standards director. For many years he organized and led the US delegation to the ISO TC/43 Technical Committee on Noise, and for 30 years he chaired the ISO TC/108 Subcommittee SC4 on human exposure to mechanical shock and vibration. He was a member and chairman of the National Research Council Committee on Hearing, Bioacoustics, and Biomechanics and was actively involved with several of its working groups. He was a member and past president of the International Commission

on Biological Effects of Noise, a member and chairman of the American National Standards Institute Acoustical Standards Management Board, and a member of the Institute of Noise Control Engineering and the Aerospace Medical Association.

The honors and awards received by Henning clearly reflect his international stature and identify some of the organizations that he served so well. He was a fellow and vice president of the Aerospace Medical Association and received its Eric Liljencrantz Award in 1966, the Arnold D. Tuttle Award in 1973, and the John Paul Stapp Award in 2004. He was an elected member of the US National Academy of Engineering, the International Academy of Aviation and Space Medicine, and the International Academy of Astronautics. He received the Department of Defense Distinguished Civilian Service Award and its Meritorious Executive Presidential Rank Award for outstanding government service, and in 1981 the Distinguished Executive Award by the President on the United States. He was awarded the Commander's Cross of the Order of Merit of the Federal Republic of Germany, the Acoustical Society of America's Distinguished Service Citation, its Silver Medal in Noise and its Gold Medal Award, the H.R. Lesser Award by the American Society of Mechanical Engineers, and the Rayleigh Medal from the UK Institute of Acoustics.

In 1950 Henning married Hanlo Weil, the daughter of two noted artists. He was a devoted husband and father, and later a warmhearted grandfather. He had an avid interest in the musical, athletic, and educational activities of his children and grandchildren, and was never at a loss for advice and support. As a senior citizen he entered the computer age with great enthusiasm, maintaining lively and often stimulating email relationships with friends, family, and former colleagues. In his retirement he was committed to working for the Friends Care Community in his hometown of Yellow Springs, Ohio. He was instrumental in its founding and, as a member of the board, was involved in its expansion to include assisted living, independent living, and future apartments. He enjoyed strategic planning for the Friends Care Community and brought considerable energy to its board, even in the last year of his life.

He is survived by his daughter, Karin, and her husband, Peter Croton, and their children, Lukas Henning and Johanna Maruko. His wife passed away in 2007 and he was preceded in death by his daughter Susi, who passed away in 2002.