

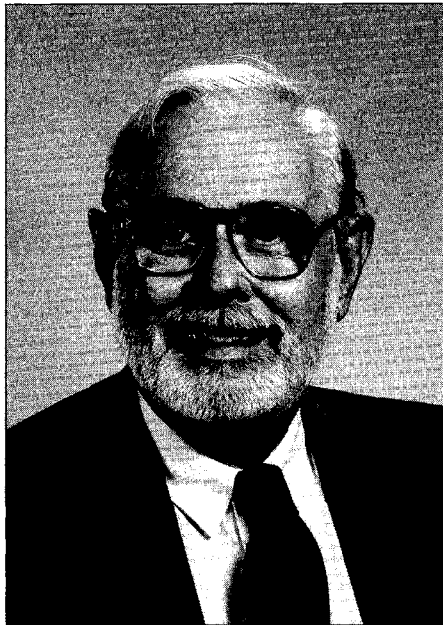
In Memoriam

Duane H. Cooper died unexpectedly at his home in Champaign, Illinois, on April 4, 1995 of an acute myocardial infarction. He was 71 years old.

Dr. Cooper was born in 1923 in Gibson City, Illinois. During World War II, he served with the United States Army in Italy as a radar specialist. He earned a Bachelor of Science and Ph.D. degree with honors in physics in 1950 and 1955 from the California Institute of Technology. His Ph.D. research involved experimental particle physics with the 500 MEV Caltech synchrotron. He maintained an intense interest in modern physics all his life, recently expressing delight at the experimental verification of the final quark.

In 1954 Dr. Cooper joined the Coordinated Sciences Laboratory at the University of Illinois where he became research associate professor. He retired in 1991 as associate professor emeritus with the electrical and computer engineering department and as an associate professor of physics. While at Illinois, he worked on statistical detection theory, noise analysis, and Monte Carlo methods. Subsequently, he contributed to developments in computer-based instruction and was a coinventor of the plasma display. He taught courses in circuits, systems, modulation, random processes, electrodynamics and acoustics. He also organized a research team for surface acoustic devices and later the University's task force on noise.

In the early 1960s, Dr. Cooper became interested in problems in audio engineering and subsequently pub-



Duane H. Cooper

lished extensively in the field. His early investigations examined the intricate geometry of the phonograph stylus-stereo record groove interface. His publications in this area introduced the audio engineering community to the research style which was his hallmark—a rigorous and appropriate application of physics and mathematics to the service of better sound. He developed a unified treatment of phonograph tracking and tracing distortion by utilizing a skew transformation. He established the optimum tracking angle, which became an industry standard, and invented and licensed the elegant skew sampling method of eliminating tracing distortion.

In 1971 Dr. Cooper built the first prototype of an echo-free acoustic delay device. It was later manufac-

tured as the Cooper Time Cube and widely used in recording studios in an era before affordable digital delays.

In the late 1960s and early 70s Dr. Cooper contributed significantly to the theory of surround-sound multichannel stereo, inventing the first working version (UMX) of the information-theoretically optimum sound-field stereo system, which led to Ambisonics and UHJ. The system, known for its rational design approach and accurate portrayal of directional information, was licensed and developed by Nippon Columbia for manufacture. Dr. Cooper was a proponent of UHJ before the National Quadraphonic Radio Committee in the United States.

In 1973 he began 3D audio calculations which included diffraction due to the listener's head as part of a loudspeaker-based playback system. This effort led to frequency-dependent system specifications as compared to the earlier frequency-independent matrix systems. By 1979 a fully specified 3D loudspeaker stereo system was developed and published. Further work throughout the 1980s and 90s led to fully realized transaural stereo (Cooper's term for loudspeaker-based 3D audio), resulting in several economical system designs capable of high-accuracy imaging of sound events. At the time of his death, he was involved in commercialization activities.

My relationship with Dr. Cooper began in 1978 as a graduate student in search of a research topic. Leaving Professor Cooper's office after my first visit, I found myself armed with a large stack of journal papers along

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with photocopies of his handwritten notes. That was the beginning of a friendship and professional collaboration in transaural stereo, which continued until his death. I fondly remember uncountable lunches, telephone calls, and trips in which the frequent topic was audio.

Dr. Cooper's service to the AES was extensive. He served as governor, vice president, and president from 1975-1976. He was on the review board of the *Journal*, a vital participant in publication policy, and was vice president of the AES Educational Foundation. He became a fellow in 1966, received the society's Emile Berliner Award (now known as the Silver Medal) in 1968, was voted a Citation in 1974, elected an honorary member in 1976, and received the Gold Medal in 1982.

A fellow of the Institute of Electrical and Electronics Engineers and a member of the American Physical Society, and the Acoustical Society of America, Dr. Cooper was listed in *American Men of Science*, *Who's Who in the Midwest*, and *Engineers of Distinction*. He served as consultant to Consumers Union, Shure Brothers, Inc., John Wiley & Sons, McGraw-Hill Book Company, Magnavox Company, and others. His audio engineering activities resulted in over 40 patents.

Dr. Cooper's interests were wide-ranging, and a venture into a new area was never done triflingly. His breadth and depth of knowledge amazed even long-time friends. He won awards for his photography, drawings, and sculpture. Friends described him in as jolly, jovial, and avuncular. He was a kind and gentle man of uncompromising principles and sublime intelligence. His robust laughter and sage advice will be missed. He is survived by his wife Phyllis, two daughters, and four grandchildren.

Jerry Bauck
Tempe, Arizona