



Donald Ross, a pioneer in underwater acoustics, died on August 24, 2015, in San Diego, California. Don made important contributions to the understanding of low-frequency ocean ambient noise and sound production by propellers.

Don Ross was born in New York City on June 9, 1922. He graduated from Harvard College in 1942 with a degree in physics and remained there as an instructor from 1942 to 1944. In 1944, Professor Edwin Kemble asked Don to oversee a project to design quiet propellers. The project, and Don, moved to Penn State after the war to the new Ordnance Research Laboratory (now the Applied Physics Laboratory). This work led to the building of the world's largest water tunnel. While working at Penn State, Don returned to Harvard to complete his PhD. The focus of his work was cavitation, the formation of vapor bubbles due to reduced static pressure in a liquid, whose collapse results in noise and can damage propellers.

After completing his PhD in 1953, Don joined AT&T Bell Laboratories to introduce acoustic LOFAR (low-frequency analysis and recording) technology to submarines as well as to evaluate the newly operational SOSUS (SOund SURveillance System) hydrophone arrays for long-range submarine detection and tracking. Don discovered that exceptionally long-range propagation of sound from a surface ship occurs by reflection from a sloping bottom into the deep-sound channel. He found that ambient noise at low frequency was significantly less than expected and he was the first to realize that it was dependent on shipping rather than on breaking ocean waves. He produced the first ocean ambient-noise spectral curves. With the development of nuclear-powered submarines, Don made the first measurements of their noise signatures and provided ways to operate them with less chance of detection. He also confirmed the existence of the first Soviet nuclear submarine based on its underwater sound signature.

Don joined the consulting firm of Bolt, Beranek, and Newman (BBN) in 1958 where he continued studies on submarine

noise, including the development of damping treatments to reduce radiated noise and an understanding of reciprocating machinery noise. From 1967 to 1971, he directed the Ship Acoustics Department at the David Taylor Naval Ship Research and Development Center (NSRDC) during a period of heavy construction of new nuclear submarines that underwent noise trials by the NSRDC. The special missions of US attack class submarines sometimes resulted in collisions with Soviet submarines (called "paint collection"). Don was tasked with finding and fixing the cause of the collisions. The problem, he found, was caused by surface reflections; the strongest signal from the Soviet submarine was often coming from the sea surface and made submarines appear to be at shallow depth. In 1971, Don received the Secretary of the Navy's Distinguished Civilian Service Award for "solution of numerous urgent and important submarine operational problems."

Don Ross wrote *The Mechanics of Underwater Noise*, which remains the seminal text on propeller-generated noise and structural vibrations in ships. In this book and a subsequent paper, he first documented that ocean ambient-noise levels had been steadily increasing on a global scale due to shipping.

Don Ross was a Fellow of the Acoustical Society of America and held numerous teaching positions. He was an outstanding mentor and remained actively engaged in training the next generation of acousticians until the end. Those of us lucky enough to collaborate with him will always remember his broad wisdom, intellect, humor, and great enthusiasm.

Articles by Donald Ross

Ross, D. (1976). *Mechanics of Underwater Noise*. Pergamon Press, New York.

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