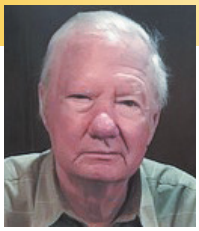
Obituary
Bryant Edward McDonald, 1944–2022



Bryant Edward (Ed) McDonald, a Fellow of the Acoustical Society of America (ASA) with a profound expertise in nonlinear physics and acoustics, passed away on August 6, 2022. Ed was born in Kentucky, grew up in Mississippi, and studied physics at Utah State University, Logan, receiving a BA in 1966. He received a MS in 1968 and a PhD in 1970 from Princeton University, Princeton, New Jersey. Starting in his undergraduate years, his signature style for approaching physics problems was his intuitive formulation with front-loaded physics to simplify the solution process.

Ed spent most of his career in Washington, DC, starting in 1970 at the Naval Research Laboratory (NRL) Plasma Physics Division; in 1980, he transferred to the Naval Ocean R&D Activity and then joined NRL's Acoustics Division in 1990, retiring in 2011. From 1997 to 2000, he was at the NATO Supreme Allied Commander Atlantic (SACLANT) anti-submarine warfare (ASW) Research Centre, La Spezia, Italy. His research trajectory intersected astrophysics, fluid dynamics, plasma physics, numerical analysis, oceanography, and ocean acoustics, including a sojourn into Jovian acoustics.

When Ed started his acoustics research, linear ocean acoustics models for *arbitrary* ocean parameters were plentiful. However, nonlinear equivalents only emerged when Ed took on the problem of ocean acoustic shock propagation. Because shocks have discontinuities, his derivation of the nonlinear progressive wave equation (NPE) was formulated as a pulse following process to eliminate, up-front, any subsequent requirement of a large, very fine grid and an irrelevant propagation timescale. Flux conservation methods to deal with the remaining numerical complexities had already been dealt with in his earlier research. The NPE became a standard tool in the Department of Energy Laboratories such as Los Alamos, Los Alamos, New Mexico. Ed continued this work, focusing on ocean boundaries, sediments, and shock propagation in the atmosphere.

Possibly motivated by his early-career work in astrophysics (his PhD thesis was on *Meridian Circulation in Rotating Stars*), he gravitated toward studying very long-range, global-scale acoustics. By including the distortion of the Earth's shape caused by rotation and the horizontal gradient in the ocean's acoustic index of refraction caused by the pole-to-equator temperature gradient, he was able to quantitatively explain the two received arrivals of a 1960 classic experiment in which sound from a 300-pound TNT explosion in the waters off Perth, Australia, reached Bermuda in about 13,000 seconds. He then applied his methods to explaining the long-range results of the Munk and colleagues' Heard Island Feasibility Test (HIFT) in 1991, the forerunner of ocean acoustic tomography to study global warming. His results agreed with the vertical structure received off California (18,000 km) and the pulse arrival structure received at Christmas Island (5,500 km). Subsequently, his acoustic research contributions included extracting signals from reverberation and nonlinearities of sediment acoustics, time-reversal acoustic-array processing, and surface and bubble acoustics.

On a personal note, Ed was an avid outdoors person, but the most rewarding part of his life was centered around his family. He is survived by his wife of 54 years, Kathleen; their two daughters, Leah and Esther; and four grandchildren.

Selected Publications of Bryant Edward McDonald

McDonald, B. E., and Ambrosiano, J. (1984). High-order upwind flux correction methods for hyperbolic conservation laws. *Journal of Computational Physics* 56(3), 448-460.

McDonald, B. E., and Baggeroer, A. B. (1993). Model eigenfunction perturbations and group speed tomography. *The Journal of the Acoustical Society of America* 94(3), 1802.

McDonald, B. E., and Kuperman, W. A. (1987). Time domain formulation for pulse propagation including nonlinear behavior at a caustic. *The Journal of the Acoustical Society of America* 81(5), 1406-1417.

McDonald, B. E., Collins, M. D., Kuperman, W. A., and Heaney, K. D. (1994). Comparison of data and model predictions for Heard Island acoustic transmissions. *The Journal of the Acoustical Society of America* 96(4), 2357-2370.

Written by:
W. A. Kuperman wkuperman@ucsd.edu
Scripps Institution of Oceanography, University of California San Diego, La Jolla