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OWEN M. PHILLIPS
1930–2010
Elected in 1996

“For analyses of multivaried ocean, atmospheric, and geological flow processes of importance in ocean and environmental engineering.”

BY MARSHALL P. TULIN

OWEN MARTIN PHILLIPS, Decker Professor of Science and Engineering at the Johns Hopkins University (JHU), chairman of the JHU Department of Earth and Planetary Sciences, widely known for his penetrating fluid dynamical studies of important ocean and geophysical problems, beloved teacher, mentor, colleague, beloved husband of Merle, and father of Lynette, Christopher, Bronwyn, and Michael, died on October 13, 2010, in Chestertown, Maryland, at age 79.

The son of an Australian veteran of both world wars, Owen was born December 30, 1930, in Parramatta, New South Wales, a small, prosperous agriculture-based town near Sydney that dates to 1788, the year of the earliest British presence in the new Australian colony. He grew up in the countryside in a family of four children and entered the University of Sydney in its engineering program in 1948, graduating in 1952 with a bachelor’s degree in applied mathematics with highest honors. Thereupon he traveled to England to undertake doctoral studies in fluid mechanics at Cambridge University.

Centered in the Cavendish Laboratory, the field was then in a constructively growing and fruitful stage under the inspiration and leadership of the Australian George Bachelor, and under the most beneficial influence of Professor (later Sir) G.I. Taylor,
then in his 70s and legendary for his innovative and physically trenchant solutions to engineering and scientific problems. Bachelor and Allen Townsend had traveled to Cambridge from Australia in 1945 to study turbulence under Taylor, who had in preceding decades initiated the statistical approach soon dominating that field. They remained in Cambridge, Bachelor carrying out elegant mathematical studies culminating in the classic “Theory of Homogeneous Turbulence” (1953), and Townsend carrying out extensive experimental studies in small wind tunnels culminating in the ground-breaking “Structure of Turbulent Shear Flows” (1956). Their research led to the inauguration of the Journal of Fluid Mechanics (JFM) in 1965 by Bachelor; it remains the most respected journal in its field 50 years later.

It was to this particularly exciting and stimulating place and to these highly gifted and original scientists that Owen Phillips came, becoming part of Bachelor’s Turbulence Group, soon receiving his doctorate (1955) and quickly initiating his own distinctive research reported in 10 papers between 1955 and 1958. In these earliest papers Phillips already displayed the exceptional characteristics that marked all his future works: a ready dedication to real and substantial physical problems needing explication; an ability to combine physical understanding and simplification with lean but elegant and cogent mathematical analysis; refined scholarship; a readiness to provide useful answers; a curiosity and ambition for extending and broadening his scientific inquiries; and a specific interest in and attraction to scientific problems of the ocean. In addition, he showed a remarkable tendency and capacity for work, all the more notable in view of his calm, sunny, and genial nature.

Scientific attention to the then unanswered question, “How does wind generate ocean waves?,” was drawn in a decisive Review (1956) by Fritz Ursell, a mathematician working with G.I. Taylor in Cambridge and later successor to Sir James Lighthill as chair of mathematics at Manchester University. The question had not been on the agenda of the Cambridge Turbulence Group, but Phillips responded immediately with
his 1957 paper “On the Generation of Waves by Turbulent Wind” (JFM) and, in 1958, went on to bring scientific order to the broader question of the nature of the newly described spectral disposition of ocean wave energy with “The Equilibrium Range in the Spectrum of Wind-Generated Waves” (JFM). In this paper, the equilibrium ocean wave energy spectrum is deduced from dimensional considerations alone after a breathtaking physical simplification, i.e., that the slope of individual waves is uniquely determined and universally limited by wave breaking. Almost immediately, and thereafter, the “Phillips Spectrum” dominated the description and understanding of the distribution of energy among ocean waves, even as the question became of greatly increased importance in the approaching age of great ocean structures and of ocean remote sensing from space.


In the forefront of his many developments and discoveries is his explication, beginning in 1960, of nonlinear multiwave interactions of surface gravity waves, and particularly the theory of four-wave resonant interactions, allowing the transfer of energy between spectral elements. This surprising discovery had an immediate and profound influence on the rational study of ocean wave dynamics, leading in subsequent decades to the development by oceanographers of computer-based and rational large-scale wave forecasting. Owen’s initial papers (1960) on nonlinear wave interaction marked the beginning of a new age of understanding of ocean wave dynamics, and his subsequent books provide even today the theoretical basis for our modern understanding of ocean and internal waves.
He was awarded the Adams Prize by the University of Cambridge for his book in 1966 and in 1968 was elected fellow of the Royal Society of London. In 1975 he received the Sverdrup Gold Medal of the American Meteorological Society. In 1996 he was elected a member of the National Academy of Engineering.

Phillips' fundamental ocean studies and discoveries continued in ensuing years, including his description of the spectral balance process. There are, indeed, few natural phenomena involving surface or internal waves arising in nature to which he did not give his attention, including internal wave generation, spectra, and propagation; circulation and mixing in estuaries; clear air turbulence; extreme and rogue waves; V-shaped ship wakes; and radar remote sensing of the ocean surface.

His interest in geological processes led to “assembling fragments of evidence” in *The Heart of the Earth* (1968; translated into Italian in 1970), and his curiosity and concern about the future of the world’s hydrocarbon supply and the question of “peak oil” resulted in *The Last Chance Energy Book* (1979; translated into Japanese in 1983). Research on the physical nature of permeable rocks and the motion of fluid elements through the medium led to the publication of *Flow and Reactions in Permeable Rocks* (Cambridge University Press, 1991) followed by *Geological Fluid Dynamics* (Cambridge University Press, 2009).

He was much sought after as an engineering consultant and provided valuable analyses on far-ranging questions about, for example, nuclear waste disposal in rock formations, the feasibility of locating a nuclear plant near the Chesapeake Bay, the prospects for the magnetohydrodynamic propulsion of ships, and detection through ocean remote sensing.

He was a faithful and diligent member of his scientific community, serving as president of the Maryland Academy of Sciences and as a longtime editor of the *Journal of Fluid Mechanics* and the *Proceedings of the Royal Society*. His balanced judgment and wisdom were widely appreciated, and he in turn contributed generously, serving on many government boards and committees throughout his career.
His widow, Merle, wrote:

Understanding his geophysical surroundings was of consuming interest to Owen, but this was tempered by a range of pursuits. When at home, Owen was present for his family. His workshop was a favorite haunt where a child’s toy was mended, items of furniture built, and the broken made to work. Growing lettuce under cold frames in February was a challenge as was detecting chemical deficiencies in plants. Frequently Owen was invited to lecture or read a paper at international meetings, and this led to world travel with me and at times with the family. For almost 40 years, Owen and I enjoyed a summer home on Cape Cod just up the road from the Woods Hole Marine Biological Labs where Owen had done some work.

This kind, gentle, brilliant man is much missed, beyond his beloved family and his university, by his admiring colleagues throughout the world, including his former students, many of whom are researchers themselves. His passion for research and rare ability to analyze and explain the complexities of the oceans and the earth will not easily be replaced.