



William H. Arnold, Jr.

WM. HOWARD ARNOLD

1931–2015

Elected in 1974

“Contributions to design of commercial pressurized water reactors for nuclear systems and to systems engineering of light water nuclear power plants.”

BY HOWARD BRUSCHI

WILLIAM HOWARD ARNOLD JR. was a pioneer in the design of early commercial pressurized water reactors and an energetic leader of the commercial nuclear industry. He passed away July 16, 2015, at the age of 84.

Howard, as he was known, was born May 13, 1931, in Jefferson Barracks, Missouri, a few miles south of St. Louis. His mother was Lib Arnold and his father was Lieutenant General William Howard (“Duke”) Arnold, commander of the 5th US Army and a division commander under General Douglas MacArthur. Howard was an Army brat, accustomed to relocating where his father’s army career took the family. His father advised him to become an engineer, which he felt better suited Howard’s temperament than the military.

A bright high school student, Howard won a four-year Pepsi-Cola Scholarship to Cornell University at age 16. He studied chemical engineering, physics, and chemistry and graduated in 1951 with an AB in a double major of physics and chemistry. While there he rowed crew, not only enjoying it as a break from studying but also undoubtedly (and perhaps unconsciously) absorbing the importance of “pulling together” as a team.

He went on to study physics at Princeton University, where he was inspired by the faculty, one of whom arranged for his

students to sit with Albert Einstein in his kitchen—reminiscing about his own student days. Howard received his master's in 1953 and PhD in 1955, both in physics.

It was at Princeton that Howard met his future wife, Josephine Inman Routheau, known to all as Jodie, to whom he was married for 63 years. She is the daughter of Colonel Edward and Josephine Routheau; Colonel Routheau was in charge of ROTC at Princeton.

After completing his degrees Howard accepted an offer to work in Princeton for Westinghouse Electric Corporation on fusion energy. But the company's endeavor in this area did not last long and decades later brought to Howard's mind a statement he had heard about fusion: "It's the energy of the future and always will be."

In the fall of 1955 Howard joined Westinghouse's newly formed commercial atomic power activity. From then until 1961, as a senior engineer and section manager, he was responsible for the reactor physics design of the first series of Westinghouse commercial reactors in the United States, Belgium, France, and Italy.

It was during this time that he made major contributions to the nuclear industry. He developed models and analytical techniques to determine such factors as control rod "worth" available for managing reactivity in a nuclear core, accounting for neutron capture in the resonance range of neutron energy, and a value for the temperature coefficient of reactivity. His work became the basis for much of the computer software for nuclear reactor core design developed over the decades that followed.

From 1961 to 1968 Howard held positions as deputy engineering manager, operations manager, and program manager for the Nuclear Engine for Rocket Vehicle Applications Project at the Westinghouse Astronuclear Laboratory. The goal of the project was to design a nuclear rocket engine to take humans to Mars. Howard was responsible for all the analytical phases of the design and testing. Years of engineering and testing demonstrated not only the proof of principle but also the viability of an engine concept. The program was eventually halted by the government as interest was lost for a mission to Mars.

Howard's next assignment took him from space to "underwater" as he became manager (1968–1970) of the Underseas Weapons Department, Westinghouse Defense Center, responsible for completing development of the Mark 48 torpedo. This project was highly successful and Westinghouse got a contract to produce 10 prototypes for operational testing. The Mark 48 basic design remains the primary underseas weapon of the US submarine fleet.

In 1970 Howard returned to the commercial nuclear energy business at Westinghouse. He was appointed engineering manager for the Pressurized Water Reactor Systems Division (PWRSD), a position he held for two years, followed by his appointment as general manager until 1979. The division was responsible for engineering, procurement, and project management for the Westinghouse systems incorporated in US and international utility nuclear generating stations.

PWRSD was a large, multidisciplinary, diverse organization with a mix of engineers and scientists from both the Navy's nuclear program and the commercial world. Howard skillfully led this organization, maintaining principles of standardization, to successfully deliver approximately 60 pressurized water reactors to utility customers around the world. His experience in approaching engineering from a systems perspective was an important element of this success.

Once asked, as a member of the Cornell crew team, what part of his body ached the most after a race, he replied, "If we all did it right, every part of our bodies ached!" Organizations pulling together and working in a team-like manner were obviously important. When tensions arose with regard to the respective roles of centralized engineering (keepers of standardization) and project managers (responsible for on-time quality delivery and customer satisfaction), Howard penned a letter to all employees defining roles, with a simile for the project manager as the conductor of a symphony.

He introduced a program of organizational development (one of the first at the time) to develop and promote more teamwork through better, open communication that was 2-way—not only from manager to employee but also managers listening

to employee issues and suggestions. Adjusting the culture was challenging as many in the organization were accustomed to a top-down directive approach. While the program had mixed results, it certainly energized people to contribute their best by removing obstacles to performance. The financial success of PWRSD spoke for itself.

From 1981 to 1986 Howard was general manager of the Westinghouse Advanced Energy Systems Division. He was responsible for the final stages of the Clinch River Breeder program and pursued numerous new business opportunities for the business unit, including the development of a small passive pressurized water reactor (10MWe), funded by the US Department of Energy, that became the seminal design innovation for the AP600 and AP1000 nuclear plant designs. Four AP1000s are being constructed in China and four in the United States—the first new nuclear power plants to be built in this country in 32 years. Another successful business opportunity was the Hanford nuclear site operations contract. Howard was appointed vice president of the Westinghouse Hanford Company responsible for engineering, development, and projects management, a position he held from 1986 to 1989, when he retired from Westinghouse.

He then became president of Louisiana Energy Services, a partnership of Urenco, Duke Power, Fluor Daniel, Northern States Power, and Louisiana Power and Light whose goal was to build the first privately owned uranium enrichment facility in the United States. After his retirement from this position in 1996, he was a consultant to the nuclear industry until 2004.

On September 10, 2004, he was appointed by President George W. Bush to the US Nuclear Waste Technical Review Board, an independent federal agency called out in the congressional Nuclear Waste Policy Act statutes. Members are presidential appointees chosen from a list provided to the White House by the National Academy of Engineering.

Howard was elected to the NAE in 1974. This was an honor he took seriously and he demonstrated such by his active involvement in the NAE and its sister institution, the National Research Council, for 40+ years. He chaired the NAE

peer committee for Section 6: Electric Power/Energy Systems Engineering. He also served on the Committee on Magnetic Fusion in Energy Policy, Panel on Cooperation with the USSR on Reactor Safety (after Chernobyl), and Committee on Improving Practices for Regulating and Managing Low-Activity Radioactive Waste, and he chaired the Committee on Improving the Scientific Basis for Managing Nuclear Materials and Spent Fuel through the Environmental Management Science Program.

In addition to the NAE, Howard was a member of the American Physical Society; fellow of the American Nuclear Society (ANS), where he chaired the Aerospace Division and served on the board of directors; and fellow of the American Association for the Advancement of Science. He received an ANS Silver Certificate in 1983 for 25 years of continuous membership and valuable contributions, and the ANS Reactor Technology Award in 2010.

He authored 18 articles and 27 papers on physics, nuclear engineering, and related subjects. He held two patents in nuclear engineering design and was a registered Professional Engineer in Pennsylvania.

Even as Howard's career involved multiple positions, geographic locations, and business trips, he was a devoted husband, father, and grandfather who cherished family reunions every summer. He had spent the summers of his youth in Michigan near the water; he won several sailing trophies on Lake Macatawa, and many years later, in 1964, he and Jodie purchased a lot on the shore of Lake Michigan. He designed and built a cottage on the lot in 1965, expanded it in 1984, and it subsequently became their permanent home, the site of enduring extended family summer reunions. Jodie still resides in the area.

He and Jodie had married while he was a graduate student at Princeton and she was a junior at Smith College. He enjoyed telling the following story: "Jodie went to the dean at Princeton to see if she could enroll there. He said to her, 'Jodie, you can sit in any class you want, but over my dead body will a woman ever graduate from Princeton.' The dean

had already rolled over in his grave a number of times before our daughter Frances graduated in 1979." Howard was especially proud that he and Frances are the only father-daughter pair elected to the NAE (Frances was elected in 2000). Howard and Jodie also have four sons—William Howard III, Edward, David, and Thomas—and 10 grandchildren.

Howard's life was replete with great accomplishments, a closeknit family, and many good friends. His obituary includes a poignant snippet that gives further insight into the nature of the man he was: "Howard was extremely active to the end, riding his bicycle around town, playing bridge, and giving lectures at Hope College on nuclear energy. Howard loved and had many good dogs, and one excellent cat."

