

# **Bill Manly of ORNL: Nationally recognized metallurgist**

(As published in The Oak Ridger's Historically Speaking column the week of 10-26-2020)

Carolyn Krause brings us another series of interesting stories of scientists from Oak Ridge National Laboratory.

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William D. (Bill) Manly made his mark on metallurgy and the Oak Ridge community. An early member of First Presbyterian Church of Oak Ridge, along with his wife Jane before they moved to Kokomo, Ind., in 1965, he later chaired the board of directors of Methodist Medical Center of Oak Ridge, and he and his wife founded the Manly House for the families of patients at MMCOR. They were a major benefactor of Roane State Community College in Oak Ridge, to which they donated their extensive collection of Oriental art. It is displayed in the Jane and Bill Manly Art Gallery on the second floor of RSCC's Coffey-McNally building.

A giant among metallurgists at Oak Ridge National Laboratory and in the United States, Manly, who held five patents, was the only ORNL employee to win the National Medal of Technology and Innovation from the U.S. Department of Commerce. He personally received this prestigious award in 1993 from President Bill Clinton at a White House ceremony.

Manly was honored "for his outstanding success in the development and processing of advanced high-temperature and high-performance materials, and the transfer of this technology to a variety of American industries." In previous years this award had been bestowed on Edwin Land, Gordon Bell, Gordon Moore, David Packard, the DuPont company and Bill Gates, among others.

As a metallurgist and manager, Manly played a major role in developing specialty nickel-based metal alloys for defense, space exploration and industrial uses. These alloys can be found in the jet engines of most commercial and military aircraft, in the re-entry heat shield of the Apollo spacecraft (to keep the astronauts safe) and in equipment used by the chemical process industry.

In 1974 Manly was elected to the National Academy of Engineering, as was Murray Rosenthal, a longtime Oak Ridger who retired as deputy director of ORNL. He wrote an informative memorial tribute to his ORNL colleague for NAE after Manly died on Nov. 22, 2003, at the age of 80. Below are excerpts from Rosenthal's tribute to Manly, who was cited by NAE "for contributions in metallurgical development for reactor applications."

"Bill was born in the village of Malta-McConnelsville, Ohio, on Jan. 13, 1923. During the summers he worked in his family's plow factory where he poured molten metal into plow molds, thereby beginning his lifelong involvement in metallurgy.

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"After high school he went part-time to Antioch College, but, with World War II underway, left and joined the Marine Corps. The Marines sent him to the University of Notre Dame for a period, then to officer training and on to the Pacific where preparations were being made for invading Japan. When the atomic bombs brought the war to an end, his unit was sent to China to disarm the Japanese troops there.

"Upon discharge from the Marines after three years of service, Bill returned to Notre Dame to study metallurgy, finishing with an M.S. degree in 1949. In graduate school he worked on the phase diagram of a nickel-cobalt-chromium system, excellent preparation for his later work on high-temperature alloys.

"Bill learned about the metallurgy program that had been established to support nuclear reactor development at Oak Ridge National Laboratory and joined ORNL after his graduation in 1949. He initially worked on the ductility of beryllium and on problems with the aluminum cladding of uranium slugs used in plutonium production reactors.

"His first involvement in a major project began with his leading the materials effort for ORNL's Aircraft Nuclear Propulsion Program, which built the Aircraft Reactor Experiment in which a molten fluoride salt containing uranium was circulated at 1580°F. This involved a multitude of materials problems, and Bill established a large research and development program that involved welding and brazing, powder metallurgy, creep and corrosion, nondestructive testing, and, ultimately, the development of a new nickel-base alloy called INOR-8. The state of the art was advanced in each of these areas, and ORNL's Metals and Ceramics Division was expanded into a materials R&D powerhouse whose output has been felt around the world.

"The advent of long-range rockets brought the need for nuclear-powered aircraft to an end, but the development of molten-salt power reactors continued at ORNL, and another reactor, the Molten Salt Reactor Experiment, was built. It was fabricated of INOR-8 (now marketed as Hastelloy N by Haynes International), which performed as designed and operated corrosion-free at 1225°F for four years.

"During this period, Bill also became involved in the fusion program, and when asked how to create a neutron-absorbing blanket around the plasma, made the enduring reply that 'if they could solve the plasma and wall problems, we could solve the blanket problem on a Sunday afternoon.'

"In directing the very successful materials program for molten-salt reactors, Bill had found his role as a leader of advanced development. With the expiration of the nuclear aircraft program, ORNL became responsible for supporting a new Atomic Energy Commission (AEC) program on gas-cooled reactors using stainless-steel-clad, uranium-oxide fuel elements.

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"To demonstrate the concept, the Experimental Gas-Cooled Reactor (EGCR) was built in Oak Ridge, and Bill again had the materials role, with the fuel elements his major responsibility. After several years, he was advanced to director of the entire gas-cooled reactor program at Oak Ridge, which included support work for the concept of a pebble-bed reactor based on the newly developed coated-particle fuel elements.

"Largely as a result of its negative commercial outlook, the AEC's gas-cooled reactor program was terminated. However, by then Bill had left ORNL and become director of materials research for Union Carbide Corporation, which at the time managed ORNL for the AEC. In 1965 he was named director of technology for Carbide's Haynes Stellite Division in Kokomo, Ind. Stellite was a world leader in the development and production of super alloys and thus was an ideal place for him. He made major changes in the division and advanced rapidly to become its general manager.

"Stellite was purchased by the Cabot Corporation in 1970, and Bill transferred with it, remaining its chief executive officer. Soon after, he became Cabot's group vice president for engineered products, which included responsibility for a number of operations in the United States and abroad. He later was made a member of the Cabot board and moved forward rapidly, eventually becoming executive vice president of the corporation.

"Bill retired from Cabot in 1986, returning to the Oak Ridge area and his hobbies of blacksmithing, collecting antique tools and fishing. And he began serving as an advisor to ORNL on technology transfer.

"Throughout his career Bill felt a strong obligation to his profession and the country, serving on many advisory committees and playing leading roles in professional organizations. He was honored as a fellow of the American Institute of Mining, Metallurgical, and Petroleum Engineers; was a fellow and recipient of a Merit Award from the American Nuclear Society, and was a fellow of the National Society of Corrosion Engineers.

"Bill served as president of the American Society for Metals and received the Medal for Advancement of Research from ASM International. He was a member of the President's Metals Properties Council for four years, served on several AEC technical committees and was a member and chairman of the important Advisory Committee on Reactor Safeguards, and was a consultant to the President's Science Advisory Committee. In addition, he served on the boards of many corporations and nonprofit organizations in Tennessee, Indiana, and Massachusetts. (He was also appointed for three years to the Army Science and Technology Board.)

"Bill maintained a close relationship with Notre Dame throughout his life and received a College of Engineering honor award. Later he was presented with an honorary doctorate of engineering by the university, which noted that 'In both the public and private sectors he has been at the forefront of

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technology transfer and cross-fertilization in American industries...and has devoted his career to improving lives the world over by making science and engineering work for people.'

"The governor of Indiana declared him a 'Sagamore of the Wabash' for his contributions to the state. And from the College of Engineering of the University of Tennessee, he received the prestigious Nathan W. Dougherty Award."

Clearly, Manly was a generous man of honor who deserved to be much honored.

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In the next installment of this three-part series, Carolyn will bring us more about Bill Manly and will include his friend and colleague, Bob Charpie: two jewels in ORNL's crown.



Bill Manly

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An artist's concept of a nuclear airplane for which Bill Manly and many others at Oak Ridge spent years researching design characteristics and high temperature materials, but which ultimately failed to be feasible. However, the research did lead to other uses for what was learned doing the project.