Hyman George Rickover

1900–1986
By John W. Simpson

Admiral Hyman George Rickover, the man responsible for the creation of the nuclear navy of the United States, died July 8, 1986, at the age of eighty-six. Rickover retired from the U.S. Navy in 1982, after sixty-three years of active duty.

Hyman Rickover was born January 27, 1900, in the village of Makow, about fifty miles north of Warsaw, in what was then a part of Czarist Russia. When he was six, he came with his mother and sister to the United States to join his father.

When Rickover started grammar school, he knew only a few words of English, but avid reading of magazines brought to him by his mother soon improved his knowledge of the language. While attending high school in Chicago, where his family settled, he held a full-time job delivering Western Union telegrams. During the period he delivered telegrams, he became acquainted with Congressman Adolph Sabath. Through the intervention of a family friend, Sabath, himself an immigrant, appointed Rickover to the U.S. Naval Academy.

Rickover entered the U.S. Naval Academy at Annapolis in 1918 and in 1922 graduated 107th in a class that started with 896 students. Upon graduation, he began his career as an officer in the navy and after routine assignments to various ships, he was sent to the Navy Postgraduate School in Annapolis in 1929. He went on to Columbia University, where he
earned an M.S. in electrical engineering. It was at Columbia that he met Ruth D. Masters, who was there pursuing a graduate degree in international law. They were married in 1931 and had one son, Robert.

In 1937 he was selected for "Engineering Duty Only" (EDO). In 1939 the navy assigned Rickover to the Electrical Section of the Bureau of Ships, with responsibility for the design and procurement of all of the major electrical equipment needed for U.S. Navy ships during World War II.

Although Hyman Rickover is better known for his nuclear-related activities, he also made a major contribution to the navy's success during World War II. It became apparent from the experiences of the British that a ship's electrical equipment often did not operate properly during or after being subjected to the explosions that were encountered in the course of battle. Our later experience in the Pacific showed that a lack of fireproofing was another major problem.

Rickover drove industry and the navy to develop a complete new line of electrical equipment that was not only markedly superior in performance to all previous equipment but that was also essentially fireproof and continued to perform under the severe shock of explosions during combat. The data obtained by the navy technical mission to Japan after the war determined that the lack of these improvements was a major factor in the outcomes of many of the naval battles that occurred in the Pacific.

As the war was ending, Rickover had a short tour of duty on Okinawa; after the war, he served as inspector general of the 19th Mothball Fleet. Although he made a success of overseeing the mothballing of ships that was occurring now that the war had ended, Rickover saw what he believed was a much more important challenge.

In 1946 a project was begun at the Clinton Laboratory (now the Oak Ridge National Laboratory) to develop a nuclear electric generating plant. The navy decided to send eight men to this project, including three civilians and one
senior and four junior naval officers. Realizing the potential that nuclear energy
held for the navy, Rickover applied. Although he was not initially selected,
through the intercession of his wartime boss Admiral Earle Mills, Rickover was
finally sent to Oak Ridge.

Before going to Oak Ridge, Rickover spent time in Washington studying all
of the available information on the possible use of atomic energy for naval
propulsion. He also talked to everyone who had anything to offer. At Oak Ridge,
he and the other naval officers had offices in the same small building with the
Daniels Pile group, but they did not take part in the actual development and
design effort.

The Pile group's objective was the construction of a high-temperature, gas-
cooled, beryllium-moderated reactor for generating central station electricity.
Rickover and his officers were busy not only monitoring what the Daniels Pile
group was doing but also assisting that group with much outside organization and
studying every aspect of the work at Oak Ridge to determine its applicability to
naval propulsion. In addition, they later visited the other facilities under the
Manhattan District.

In 1947 the Atomic Energy Commission (AEC) was formed, and all
responsibility for nuclear energy was transferred to that organization. Toward the
end of 1947, it became apparent that there was insufficient information available
for the construction of the reactor. Nevertheless, while the Daniels group was
working on a final report, Rickover unofficially persuaded them to do a
conceptual design of a water-cooled reactor for a submarine. Almost single-
ha d edly, Rickover then persuaded Admiral Nimitz and the secretary of the navy
that a nuclear submarine should be built. After enlisting the help of the Military
Liaison Committee, he persuaded AEC to formalize the naval reactor study and
succeeded in being appointed head of both the navy and AEC naval reactor
groups. The naval group was transferred bodily into AEC in 1949.

Getting the authorization to develop a nuclear submarine
was, in itself, a major accomplishment. The reputation Rickover had gained in the industry during World War II for getting things done was of great help in persuading contractors to become involved in his nuclear work, even though he had lukewarm or no support in most areas of the government. By late 1948 the research on a pressurized water reactor was centered in the Argonne National Laboratory, and Westinghouse had been given a contract to do the engineering and construction of a nuclear submarine prototype and the necessary research, development, and design for the Nautilus. At the same time, General Electric was given a contract of the same scope for a liquid metal-cooled submarine power plant. With these objectives reached, the nuclear submarine program was under way in earnest.

Because the prototype for the Nautilus propulsion plant was the world's first high-temperature nuclear reactor, a host of reactor physics problems had to be solved. Not only were the basic data that were needed for the reactor design unavailable, the reactor design methods also had to be developed. In addition, there were no available engineering data on the performance of metals in high-temperature and high-pressure water; neither had a steam propulsion plant ever been designed for operation in a modern submarine. The necessity for deep submergence compounded the problems. New design methods had to be created, and new materials such as zirconium and hafnium had to be developed.

During this same period, the parallel development of a liquid metal reactor propulsion plant was being undertaken by General Electric under Rickover's guidance. This program led to the construction of the Sea Wolf.

During the summer of 1953, just as the Nautilus prototype was being successfully tested, the navy cancelled the requirement for a nuclear carrier. But Rickover was undeterred. He was able to persuade the Atomic Energy Commission to begin a program for the development and construction of a central station electric generating plant. He saw this not only as an opportunity to transfer technology to industry but also as a way of continuing the development of larger reactors.
that might solve some of the problems of reactors of the size that would later be required for carriers.

On January 17, 1955, the signal "Underway on nuclear power" was flashed from the Nautilus, marking a dramatic moment in naval history. The invention of the steamboat had led only after many years to commercial steamships and even later to a steam-driven navy.

Prior to that time the Nautilus submarines had really only been diesel surface ships that could submerge for brief periods and travel at slow speeds. The new Nautilus revolutionized naval warfare immediately. From the day she was put to sea, she was the most important naval vessel in the world, with the capability of inflicting great damage on an entire enemy fleet. This capacity was demonstrated in maneuvers many times.

Yet many new technical problems remained to be solved. Shippingport was the first large reactor with a containment. Uranium oxide was developed as the fuel for the slightly enriched reactor, and a new zirconium alloy, Zircalloy II, was developed for the fuel cladding. A new control system had to be developed. The long life required of the nuclear core brought out many problems in the reactor physics area. Compatibility with a utility system had to be ensured.

Despite these problems, Shippingport, the first U.S. nuclear electricity generating plant, was synchronized with the Duquesne Light Company system in December 1957, just four and a half years after the start of the project. The building of Shippingport was the step that made central station nuclear power possible.

Until his retirement in 1982, Rickover was responsible for the propulsion plants of all ships in the nuclear navy. His contribution was not confined to design, however; it also included the selection and training of personnel. The people who were involved in the nuclear submarine program, both in industry and in the navy, today are spread throughout most of the important places in the nuclear industry as well as in the government.

In addition, there is little doubt that his attention to detail
and his insistence on quality, rigorous maintenance, safety, and the reduction of radiation exposure all worked together to make our nuclear ships superior. In addition, the transfer of technology that was begun with *Nautilus* and Shippingport was a major factor in the preeminence of the United States in the nuclear power field. This transfer must be regarded as another of Rickover's important contributions.

Rickover was strongly backed by many influential members of Congress. He was skilled at keeping these men knowledgeable about what he was doing by taking them on visits to the various project areas and by providing demonstrations. Yet probably the major reason he received such strong backing was that he was succeeding at a time when major successes were rare in this country. The confidence that the Joint Committee on Atomic Energy had in Rickover was a key factor in the passage of the Atomic Energy Act of 1954, a most important piece of legislation that has been little changed even now.

Rickover took great interest in high school and college education during most of his professional life. He emphasized the need for rigorous preparation in mathematics and the sciences. When the Naval Academy undertook a profound overhaul of its program, it sought his counsel, among others, and followed his advice in offering a wide diversity of fields of concentration in place of the former standard curriculum for all.

The actual research, development, and design of the nuclear plants Rickover had caused to be built were performed largely by contractors. These activities, however, were conducted under the careful eye of Rickover's staff, who approved almost every design detail. All of the major technical decisions were approved personally by the admiral. The essential element of this aspect of nuclear development was Rickover himself. The people doing the actual work could have been replaced by others, but there was only one Rickover. Without him, there might have been a nuclear navy and industry in time, but they would have been delayed many years, perhaps decades.
Rickover received many honors and awards during his career. Most notable were the Distinguished Service Medal with Gold Star (1946) and the Legion of Merit with Gold Star (1952); the Most Excellent Order of the British Empire (1946); the Egleston Medal Award of Columbia Engineering School's Alumni Association (1955); the American Society of Mechanical Engineers' George Westinghouse Gold Medal (1955); the Cristoforo Columbo Gold Medal (1957); the Michael I. Pupin 100th Anniversary Medal (1958); the Congressional Gold Medal (1959); the Institute of Electrical and Electronics Engineers' Golden Omega Award (1959); the Atomic Energy Commission's Enrico Fermi Award (1965); the National Electrical Manufacturers Association's Prometheus Award (1965); the Presidential Medal of Freedom (1980); and numerous honorary degrees. He was elected to the National Academy of Engineering in 1967. He was also the author of several books. In 1974 he married Eleanor Ann Bednowicz, a navy nurse.

It cannot be stressed too strongly that Rickover was the sine qua non of all the developments with which he was associated.