How Admiral Rickover created America's nuclear naval force

by Robert Zubrin

Today, as those Americans concerned with national defense are faced with the vital necessity of launching a crash program to develop anti-missile beam weapon defense systems, no better precedent can be brought to mind than the course of action taken by Adm. Hyman G. Rickover in creating the nuclear navy, the mainstay of America's current strategic defense capabilities. For in building the nuclear navy, not only did Rickover have to act with ruthless unorthodoxy to defeat the same anti-technology array of "fiscal conservatives" and anglophile/world federalist disarmament buffs who currently stand in the way of a beam weapon program, but he did it in such a way as to ensure that his program would also create a civilian nuclear industy in the United States, laying a foundation for future national industrial-technological strength and the prosperity through progress that would provide a reliable basis for avoiding war.

The necessity of the nuclear submarine

At the end of World War II, the United States found itself with global military and economic commitments which could only be supported by maintaining control over the seas. Yet the advent of the atomic bomb had made large fleets of aircraft carriers, battleships, cruisers, and other surface combatants vulnerable and obsolete. Submarines were a vital alternative, but the submarines of World War II were not true submarines, because they had to spend most of their time running on the surface powered by air-breathing diesel engines, and had a maximum underwater endurance of 12 to 48 hours, powered at low speed by their electric storage batteries. The Navy needed a power source that could operate indefinitely below the water, with an effectiveness and reliability comparable to that which diesel engines provided surface vessels.

Nuclear power seemed like a hopeful solution, and so in 1946, the U.S. Navy's Bureau of Ships sent a team of engineers to the Atomic Energy Commission's laboratories at Oak Ridge, Tennessee to study nuclear technology and its possible naval applications. Because of the uncooperative attitude of the AEC bureacracy, Bureau of Ships Chief Earle Mills chose his most abrasive officer to head the team, Captain H. G. Rickover. A hard-driving Polish-Jewish immigrant who had graduated from the U.S. Naval Academy at Annapolis, Rickover, as head of the Electrical section of the Bureau of Ships during World War II, had earned a reputation not only as a top engineer, but also as a man who would crush any bureacratic or procedural obstacles that stood in the way of getting a vital task done.

Deploying his Navy team at Oak Ridge like a search-and-seize task force to ferret out information, Rickover came to the conclusion, after several months' study, that the question of developing a nuclear power reactor was no longer a theoretical question but simply an engineering problem. He reported back to the Navy that the development and construction of a nuclear reactor for submarine propulsion should be made a number-one priority, and was quickly able to win over Bureau of Ships Chief Mills and, afterwards, Adm. Chester Nimitz, the Chief of Naval Operations, to his viewpoint. But the AEC opposed the project. AEC General Manager Carroll L. Wilson and J. Robert Oppenheimer, chairman of the AEC's general advisory commission, both of whom had helped draw up the State Department's Baruch Plan for containing world nuclear development, stonewalled Rickover. Wilson and Oppenheimer argued—in a manner similar to opponents of fusion energy and beam weapon engineering development today—that any move into engineering nuclear reactors was premature, and that another decade or so should be spent on research.

Wilson, who was a member of the zero-growth Club of Rome, the Trilateral Commission, and a top leader of the nuclear freeze movement, opposed Rickover's project to build a naval nuclear reactor because it would inevitably mean that civilian nuclear energy plants would follow. At the same time he was maneuvering to block Rickover, Wilson, also a member of the Order of the British Empire, was passing U.S. atomic secrets to Donald Maclean, a British national later exposed as a top-ranking KGB agent when he defected to

Moscow in 1951. As Wilson well knew, disclosing atomic secrets even to an agent of British intelligence was a violation of the MacMahon act.

The buildup of a large Soviet submarine force by 1948, followed by the detonation by the Soviets of an atomic bomb in 1949, greatly strengthened the urgency of Rickover's case. In conceding, however, Wilson demanded that the development of the naval nuclear reactor be done totally under AEC control. This Rickover would not allow, as it would have guaranteed failure, and so he deftly judoed the proposal, instead setting up the program under joint Navy-AEC auspices, with himself as project manager for both agencies.

Drawing on both the AEC and the Navy for engineering expertise and funds, Rickover's Naval Reactors Branch directed a huge research and develpment effort. A water-cooled reactor design developed by Westinghouse was selected by Rickover as the most practical, which design has since become the basis for most light water reactors in both military and civilian use today. On July 15, 1949, the contract was signed, and the project that was to lead to the *Nautilus,* the world's first nuclear submarine, was underway.

Mark I and Mark II

To maximize the rate of development of the project, Rickover decided to avoid building many scaled-down prototype reactors. Instead, only one test reactor would be built, the Mark I, which would be *identical* to the Mark II reactor that would eventually be installed in the *Nautilus,* whose hull was already under construction. The path of building the Mark I spread out over a large floor for easy access was rejected; instead, it was installed in a submarine hull built into the Mark I test site in Idaho, surrounded by a huge tank of water so that all the radiation reflection problems experienced by a submerged submarine could be simulated. And rather than cool the reactor by air, air conditioning was built into the Mark I, since that was the way the *Nautilus* would have to be cooled.

The Mark I components were placed in an old submarine and depth charged in Chesapeake Bay; those that could not take the shock were redesigned. In all respects, the operative design slogan was "Mark I equals Mark II." If Mark I functioned adequately, so would the *Nautilus*.

By the end of May 1953, the Mark I reactor was completed, and after a series of preliminary tests, reached full power on June 25. After 24 hours of smooth runnning, the officers on the site decided to end the test, but were overruled by Rickover, who ordered that charts be brought into the control room and a simulated great circle course to Ireland be plotted. No submarine had ever traveled more than 20 miles submerged at full speed before.

At the 60th hour, the nuclear instrumentation became erratic; then problems developed with the reactor cooling pumps. At the 65th hour, a condenser tube failed, and steam pressure fell off rapidly. But Rickover, who was facing at that time the threat of imminent forced retirement from the Navy, refused all requests by Navy and Westinghouse officals to terminate the test. "If the plant has a limitation so serious," he said, "now is the time to find out. I accept full responsibility for any casualty."

Repairs on the faulty equipment were undertaken with the reactor running at full power. At the end of 100 tense hours, the position marker on the chart reached Fastnet. A nuclear powered submarine had, in effect, steamed non-stop across the Atlantic without surfacing.

Six months later the *Nautilus* was launched, and within a year it was breaking all records. In April 1955, the *Nautilus* traveled submerged from New York to Puerto Rico, 10 times the distance any submarine had ever traveled under water. In war games held in August of that year, the *Nautilus* demolished (in simulation) an anti-submarine task force consisting of an aircraft carrier and several destroyers; its high speed and unlimited submerged endurance made it almost invulnerable.

Congress immediately decided to order six more nuclear submarines.

The Ecole Polytechnique tradition

Rickover quickly realized that a nuclear development program of the dimensions he envisioned could not succeed by raiding manpower from the precious few nuclear engineers and scientists available

the footsteps of Lazare Carnot, whose Ecole Polytechnique trained the technologists who gave Napoleon his victories and France its prosperity, he decided that he would take responsibility for developing such an engineering cadre. As a first step, in 1949 he deployed aides to MIT and Oak Ridge National Laboratories to persuade those institutions to set up schools of nuclear engineering, and simultaneously initiated a series of courses for his Washington staff in reactor theory, physics, mathematics, nuclear engineering, and naval architecture. Special classes were even set up for the clerks and secretaries.

Thus was only the beginning. Starting in 1951, elected groups of the most talented officers and enlisted men in the Navy were put through a grueling one-year course that included the study of mathematics, general physics, heat transfer and fluid flow, electrical engineering, reactor dynamics, chemistry, materials, radiology fundamentals, core characteristics, and reactor plant systems and operations. In addition to 700 hours of classroom instruction, trainees were given six months of experience in hands-on running of Mark I and later other landlocked test reactors. The net result was creation not of trained personnel in the ordinary sense of the term but of topnotch engineering cadre, who could not only operate a nuclear reactor, but design and build one. By 1979, 7,000 officers and 40,000 enlisted men had graduated from Rickover's curriculum. Today these men represent the core of the engineering and technical cadre of the American nuclear industry.

Indeed, 60 percent of all U.S. nuclear plant operators are

Rickover graduates, a testimony to his program.

Building a nuclear submarine was one thing, but by 1952 Rickover's activities made clear to many in the anti-progress Eastern establishment what Caroll Wilson had sensed in 1947: Rickover was interested not merely in building a nuclear navy but an entire nuclear power industry. For those individuals who hoped to maintain world political control through contolling fixed energy and mineral resources, this goal was intolerable. Alarm bells went off, and the attempt to purge Rickover began, making use of the Eastern establishment's long-time hold over the Navy brass and its personnel selection and promotion system.

The attempted purge

Thus, despite the fact that in July 1952 Secretary of the Navy Dan Kimball admitted that "Rickover has accomplished the most important piece of development in the history of the Navy," during that same month Captain Rickover was once again refused promotion to the rank of rear admiral. Rickover had been a captain since 1942 and was now 53 years old. Under the Navy system, this second refusal meant automatic forced dismissal by no later than June 30, 1953.

Knowing what was at stake, Rickover fought back furiously, first mobilizing friendly journalists, then supporters in Congress. In the end the Navy had to capitulate when Rickover had his friend Sen. Henry Jackson (D-Wash.) pass a resolution through the Armed Services Committee refusing to approve any Navy promotions until Rickover was restored and promoted. But the harassment of Rickover persisted; for example, when the submarine *Nautilus* completed its historic mission under the North Pole in 1958, Rickover was not even invited to the White House reception!

Atoms for peace

Rickover's promotion and his new alliance with Congress gave him enormous stature and political clout. Thus, when budget cutters in the Eisenhower administration, working with anti-Rickover elements in the Navy, managed to kill his program for a nuclear powered aircraft carrier, Rickover fought back by proposing that the carrier reactor program, already under preliminary development by Westinghouse, be continued under AEC sponsorship as a program to develop a civilian atomic energy plant. This idea found support within the industry and the AEC, but was adamantly opposed by Navy Secretary Robert B. Anderson. Anderson, who had just rejected Rickover's plan for a naval nuclear carrier, now said that the Navy could have nothing to do with the scheme since it was strictly a civilian enterprise. Others attempted to sabotage the project by saying that it was a fine idea, but since it was to be a civilian reactor, industry should pay for the entire cost, including R&D.

News from the Soviet Union once again strengthened Rickover's hand. In August 1953, the Soviets exploded the world's first hydrogen bomb. Rickover's ally on the AEC, Thomas Murray, took advantage of the occasion to write President Eisenhower, urging that the United States could carry out a major coup by answering the Soviet development with an announcement of a full-scale U.S. civilian nuclear energy program; atoms for peace would be the American answer to Soviet atoms for war.

While the administration was mulling over this proposal, Murray acted, delivering a historic speech in Chicago on Oct. 22, 1953. The United States must take steps to develop nuclear energy for the electric-power-hungry countries of the world, Murray said, or else the nation would not be able to count on them for the uranium ore upon which U.S. nuclear weapons and national security depended.

Finally, on Dec. 8, President Eisenhower delivered his famous "Atoms for Peace" speech to the United Nations, committing the United States to lead the way in the peaceful exploitation of nuclear power for all mankind. The development of a civilian nuclear reactor was now made a national priority, and the responsibility for getting the job done could only be given to Rickover and his team at the Naval Reactors Branch.

A group was soon assembled that consisted of Rickover's Navy team, Westinghouse, Stone and Webster, Burns and Roe, and the Duquesne Power and Light Company of Pittsburgh. Contracts were signed; and on Sept. 6, 1954, President Eisenhower used a radioactive wand to activate the bulldozer that broke ground for the construction of the nation's first nuclear power plant at Shippingport, Pennsylvania Rickover's team worked closely with Westinghouse R&D people at the company's Bettis Labs, laying down requirements, objectives, and specifications, and continually inspecting the work at the site, ordering any equipment that did not meet specifications to be torn out and replaced at once. No compromises or excuses from contractors or vendors were tolerated, as Rickover and his staff drove the pace of construction furiously.

Despite strikes and steel shortages, the plant was completed by October 1957, and by Dec. 23, it was generating power at full capacity. Thus, Rickover and his team performed the remarkable feat of constructing the world's first civilian nuclear electric power station in just over three years, a job that today takes a much more experienced nuclear power industry some 6 to 12 years to complete. As Rickover put it, "the forces of nature work best for those who work the hardest for themselves."

Although small by current standards (60 megawatts), the Shippingport plant had an enormous impact on the development of civilian nuclear technology. Because it had no military applications (unlike the slightly earlier British reactor at Calder Hall), its design was unclassified. Hundreds of engineers from around the world attended seminars on it given by the Naval Reactors Branch, Westinghouse, and Duquesne during 1954-55, and Westinghouse made available thousands of technical reports on every aspect of the project. Shippingport thus functioned as a school in reactor technology for hundreds of engineers until well into the 1960s, and the reactor's design has been the model for more than three fourths of all civilian nuclear reactors produced in the United States and many foreign countries since that time.

What Carroll Wilson had feared most back in the 1940s had come true: the nuclear genie was out of the bottle.

Rickover versus McNamara

In the 1960s, Rickover found his plans to expand the nuclear navy opposed by Defense Secretary Robert S. McNamara, today's nuclear freeze movement leader, who, together with his army of systems analysts, was using fraudulent cost-benefit studies to dismantle every advanced technology program sponsored by the military. To stop this wrecking operation, Rickover, a serving naval officer, took the unprecedented step of denouncing the Secretary of Defense in signed articles and congressional testimony. "At one time pagan gods ruled the world," Rickover told one congressional committee. "Now it is the cost accountants. The cost effectiveness studies have become a religion. . . . They are fog bombs. . . . Frankly, I have no more faith in the ability of social scientists to quantify military effectiveness than I do in numerologists to calculate the future." Instead of the systems analysts wasting their time studying the uselessness of high technology, "perhaps a study of 'Witchcraft in the Pentagon' might be more germane."

In 1967, McNamara and his deputy Paul Nitze retaliated by attempting to force Rickover's retirement. However, with support of powerful congressional allies like Sen. Henry Jackson (D-Wash.)
admiral held on to his post. Rickover also won the fight to keep all new submarines nuclear powered, but many of his planned nuclear surface vessels were either scrapped or turned into diesel-powered projects.

Towards educational reform

Perhaps nothing gives a better idea of the quality and scope of Rickover's thinking on military and scientific questions than his profound commitment to transforming American education into a rigorous curriculum capable of producing the scientists and engineers who could take America into the 21st and 22nd centuries. Rikover wrote a stream of books attacking the Deweyite deficiencies in American education which teach "adjustment to the group, personal popularity, and skill in projecting a pleasing image," and instead demanded a rigorous training in mathematics, science, history, the classics, and foreign languages that would train minds "to respect facts, reason, and logic," and be "at home in the world of ideas and abstract concepts." To those who objected that Rickover was only attacking American education because it did not produce enough graduates suitable for participation in his nuclear power development program, Rickover replied that this was precisely the point—the measure of the adquacy of a nation's education system must be determined by the degree of fitness of its graduates to participate in pushing forward the frontiers of technology of that society.

"Whenever man makes a major advance in his age-old effort to utilize the forces of nature," Rickover wrote in his book *Education and Freedom* in 1959, "he must simultaneously raise his education, his techniques, and his institutions to a higher plateau.

"From the splitting of the atom in the 1930s to the bomb of the 1940s, the the practical nuclear power plant of 1953, a vast amount of intellectual effort of a high order had to be expended. Highly trained nuclear engineers are needed to design, build, and run nuclear power plants. Still greater demands on the human mind will be made if and when we obtain energy from hydrogen fusion.

"It is obvious that the kind of American who thoroughly mastered his environment on the frontier in the muscle, wind, and water state of technology would be totally ineffective in the atomic age which is just around the corner, and the fusion age which is still a way off."

Coming at the time they did, shortly after the launching of Sputnik by the Soviet Union, Rickover's books were bombshells and played a significant role in the attempt that was made to upgrade U.S. scientific education during that period. However, the Deweyites were quick in counterattacking, denouncing Rickover's call for curriculum reform and national standards as "totalitarian" and "exceedingly destructive to our tradition of respect for the individual," to quote Lawrence Derthick, U.S. Commissioner of Education. in 1960.

Unfortunately the Deweyites won, and almost all of Rickover's attempted reforms were stopped dead or sidetracked, creating a situation where a drastic educational upgrading is even more urgent today. It is significant though that the only section of the U.S. military today that is not plagued by drug infestation is the Nuclear Navy, where the respect for the value of the human mind has allowed for the enforcement of a policy of instant dismissal for any drug use.

Rickover's mottos

Today, Rickover, perhaps somewhat cynical after being forced out of the Navy at 82, has apparently retreated somewhat from his previous Promethean outlook. Yet his accomplishments remain: a 130-ship Nuclear Navy providing America's only reliable strategic deterrent, and a well founded nuclear industry, which, if it fails, will only be for its apparent lack of ability to produce its own Rickovers. For those hesitating at the leap of scientific confidence required today to launch a program of revolutionizing America's defense through crash development of space-based beam weaponry, perhaps Rickover's best advice for the present is contained in the two mottos which for many years hung in his Washington office. The first is from Shakespeare's *Measure for Measure:* "Our doubts are traitors

And make us lose the good we oft might win,

By fearing to attempt."

The other, even more to the point, is from the Bible: "Where there is no vision, the people perish."