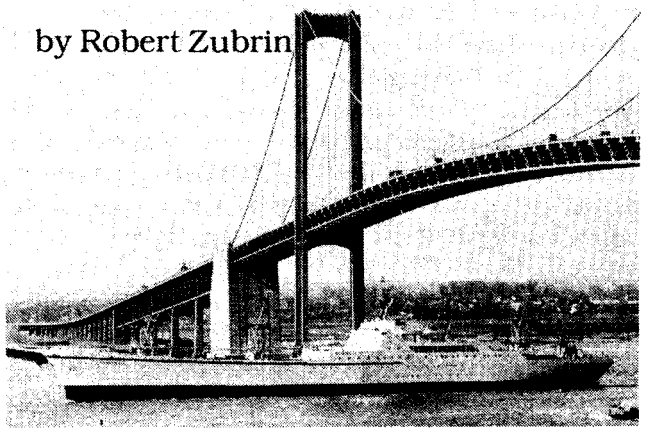
A U.S. nuclear merchant marine?

by Robert Zubrin



Today, the majority of nuclear reactors are operating not on land, but on the high seas, propelling the 250 leading warships of the world's navies. Yet in the non-communist world there exists no functioning nuclear-powered merchant ship, nor are there plans to build any. Although 90 percent of world trade moves by ship, the West has apparently decided to confine itself to a slow-moving fleets of increasingly uneconomic and wasteful oil-consuming merchant ships and tramp steamers, a low-technology approach which is allowing floating sweatshops to sweep away the once-proud U.S. Merchant Marine.

The Savannah

Because nuclear power had first been successfully developed for the submarine *Nautilus,* it was logical that when the Eisenhower administration developed its Atoms for Peace program in the mid-1950s, one of the first applications proposed was construction of a nuclear-powered merchant ship. In 1956, contracts were drawn up between Babcock & Wilcox and a Maritime Administration (MarAd)/Atomic Energy Commission project office which led to the design, construction, and, in 1962, the launching of the *N.S. Savannah,* America's first and only such nuclear-powered ship. Going into full service in 1964, the *Savannah* exceeded all of her original design specifications, and over the next seven years sailed some half million miles around the world, being visited by some 1.5 million people in 46 ports, without a single incident of either radiation leakage or reactor or fuel failure. A total technological success, the *Savannah* was not designed to be an economic success, however, being herself only a demonstration ship of some 20,000 tons, of a combined cargo and passenger type that no longer fit into the global maritime picture by the mid-1960s. Today she is moored as part of a nautical museum in Charleston, South Carolina.

Under the supervision of Dr. Zelvin Levine, the maritime reactor group at Babcock & Wilcox had developed a more advanced type of maritime nuclear reactor by 1964 known as the Consolidated Nuclear Steam Generator (CSNG). Instead of heating turbine steam with coolant piped out of the reactor vessel, the steam generators were placed inside the reactor pressure vessel itself, permitting greater efficiency and power. The first CNSG model was exported by Babcock & Wilcox to be used as the propulsion system for West Germany's nuclear ship, the *Otto Hahn.*

What was needed next was to construct some 50,000-ton or more container ships or 300,000-ton-plus oil tankers that could demonstrate the economic superiority of nuclear over conventional merchant ships. In an effort to revive the government's somewhat moribund maritime nuclear program, Dr. Levine left Babcock & Wilcox to become chief of the Office of Maritime Technology at MarAd in 1970.

Levine pushed through the design and licensing of a standardized version of an advanced CNSG of 120,000-shaft horsepower (SHP), suitable for propelling a large container ship anywhere in the world non-stop at 34 knots or a 500,000-ton tanker at 20 knots from the Persian Gulf to the United States. Studies at MarAd also indicated potentially very favorable economics for nuclear-powered liquified natural gas carriers, icebreakers, submarine oil tankers, and icebreaking petroleum-drilling ships for use in the high Artic.

By 1973, Levine could predict, "I believe the outlook for the near term is as follows: "Economic demonstration ships, probably an initial order of three Very Large Crude Carriers, may be ordered in the U.S., with government financial assistance, in the reasonably near future, probably late 1974 or early 1975. Nuclear powered vessels for Artic applications may be ordered in the period 1975-76 and will enter service in the 1980-81 period, providing further evidence of the merits of nuclear propulsion. . . .

"By the mid-1980s, nuclear propulsion will be winning multiple orders in all classes of high productivity ships: i.e. VLCC's, container ships, RO-ROs, barge carriers, Artic vessels, and perhaps LNG carriers. As a result of the rapidly rising orders backlog which will develop by 1985, new shipbuilding facilities specifically designed for nuclear ship construction and repair will be constructed. By 1990, U.S. flag operators will have at least 50 nuclear powered ships on order, under construction, or in service. . . . By the end of the century, the U.S. should have in excess of 200 nuclear

powered merchant ships."

The Globtik affair

Within a few months of his prediction, the advantages of nuclear power were quadrupled by the 1973-74 oil-price increase, and in 1975, the United States was presented a potentially huge order for nuclear merchant-ship construction from a private source, the London-based Globtik Tankers. Headed by Indian entrepreneur Ravi Tikoo, Globtik was the builder and owner of the largest ocean-going oil tankers in the world. Tikoo's offer was to build in U.S. shipyards and register under the U.S. flag three nuclear-powered Very Large Crude Carriers of 660,000 tons. Each one would be seven times the size of the largest aircraft carriers afloat. Tikoo was willing to put up $300 million per ship, but he wanted the U.S. government to provide $45 million (or 15 percent) per ship for first-of-a-kind start-up costs. He (and U.S. vendors Babcock & Wilcox and Newport News Shipyards) also needed limited liability legislation analogous to the nuclear industry's Price-Anderson Act. Given the massive job-creation potential for both steel and shipbuilding in the initial order (to say nothing of the competitive advantage U.S. shipyards would have if maritime trade went nuclear) the requested outlay was nominal, and appropriate legislation to handle the financial and the liability aspects was drawn up in the House Merchant Marine Committee. But anti-nuclear elements in both the Ford and Carter administrations not only acted to block the legislation, but ran an insulting operation on Tikoo himself, on the basis of his foreign nationality.

In 1978 Globtik presented another proposal, this time to build a fleet of twenty 300,000-ton nuclear-powered ice-breaking LNGs, in U.S. yards, which at one-sixth the cost could have fulfilled the entire function of the Alaska Gas Pipeline with much greater flexibility and security. Despite Japan's offer to provide 100 percent export financing for the port facilities the ships would need on Alaska's north slope, as well as full financing for some of the ships, the project went nowhere. Globtik lawyer John Meade explained, "We went to the DOE with the idea of applying nuclear technology to the Artic, but it was like singing them a lullaby. . . . They had their orders that nuclear was simply not something the administration was interested in. . . . It really ticks me off. Here is one field in which the U.S. had a real technological lead, and we've done

The military benefits

The following is an excerpt from a National Democratic Policy Committee discussion memorandum titled "Only Beam-Weapons Could Bring to an End the Kissingerian Age of Mutual Thermonuclear Terror."

Energy, water-management systems, and transportation infrastructure already suffice to define broadly the global civilian-economy requirements of development. These same parameters define to a large degree the combined civilian capabilities and peaceful use of military capabilities to be projected in the relevant functions of our military general staff.

For example, the world requires urgently an upgrading of the standard design of shipping containers. The handling of grain for both domestic and foreign-trade consumption is a task which illustrates the point. Grain should be cleanly poured into standard containers on the farm, and only the container itself handled as a unit thereafter until the shipment of grain reaches its final break-bulk destination. Containers for this and other uses must be shifted from one mode of transport to another probably several times during their handling in foreign commerce: among truck, rail, barge, air, ocean-vessel, and so forth. The efficiency of turnover from one mode of transport to another is of concern. The development of trucks, rail systems, inland waterway systems, air-freight systems, ocean-vessel systems, and of storage and handling among systems must be standardized world-wide.

With aid of such deliberations, the United States must develop a U.S.-flag fleet of nuclear-powered ocean vessels. Port designs and other obvious correlatives must be taken into account.

Throughout the treatment of the list of matters bearing up this area of infrastructure, what is developed to meet definable civilian needs is a definition of the potential military needs within the scope of what is both possible and required. The making of peace and development and maintenance of the capacities for war-fighting are overlapping republican enterprises, defining the corresponding participating role of the military general staff. If one reckons the ratio of combat activity to logistics in modern warfare, the greatest portion of war-fighting is using the existing arsenal of ploughshares as swords.

We won the last World War by mobilizing our potential as an exporter of industrial and agricultural goods. This was the foundation of our mobility and firepower, the heart of our war-winning capability.

nothing with it. Now the damned Russians are building nuclear-powered icebreakers."

The economics of nuclear-powered ships

The most recent study of the comparative economics of nuclear and conventional maritime propulsion was done at MarAd in 1976, when oil was selling at $11 to $12 a barrel (for bunker C fuel.) It showed that nuclear power was cheaper than conventional by 9.0 mils per SHP per hour (8 mils compared to 17.0). The nuclear advantage has soared to about 27 mils/SHP-HR today. A 1978 paper by Sam Esleeck and Al Winall published in the *Transactions of the Institute of Marine Engineers* in March 1979 states: "Consider a nuclear and fossil-fuel container ship, each at 120,000-ton SHP and 33-knot service speed operating over long routes with the equivalent of 70 percent open-sea operations at rated service speed. When at sea, the fossil-fuel ship will consume over 650 tons of fuel per day at an annual fuel cost of almost 13 million dollars. For the same situation, the nuclear ship's annual fuel bill [including investment and refueling and reprocessing costs—R.Z.] will be less than $6 million, a gross savings of some $7 million per year. . . .

"For two 600,000 DWT tankers on a Persian Gulf-to-U.S.A. or Western Europe route in one average year the fossil-fueled tanker will deliver 2.7 million tons of crude oil at an annual fuel cost of $7.3 million. In the same average year the nuclear tanker will deliver 3.64 million tons of crude oil at an annual fuel cost of $6.12 million. . . . The Required Freight Rate for each tanker is: $2.71 per ton for the fossil fueled tanker and $1.68 per ton for the nuclear-fueled tanker.

Moreover, one factor omitted from the MarAd study is the fact that if nuclear maritime propulsion became the general rule, faster ships would mean decreased shipping times and thus decreased inventory time, enhancing the rate of production and profit for industrial enterprises globally. Conversely, current fossil-fuel costs are tending to make impractical the continued operation of fast fossil-fueled containerships, causing many of the best of these ships in current operation to be laid up. Ironically, among the first victims have been the seven 34-knot SL-7 containerships built for the recently bankrupted SeaLand Corporation. The SL-7s were originally designed in the late 1960s by J.J. Henry Company to be fast nuclear-powered container ships, but the lack of liability legislation forced them to be provided with a conventional power plant instead.

The Soviet program

The only nation which today is maintaining an active program to develop a nuclear merchant marine is the Soviet Union. The U.S.S.R. began its nuclear maritime program in 1959 with the launching of the nuclear-powered icebreaker *Lenin,* and has since launched two more, the *Artika* and the *Sibir,* with a fourth, the *Rossiya,* now under construction. In 1977 the *Artika* amazed the maritime world by cutting its way through the ice all the way to the North Pole. In contrast to Western icebreakers, which have a maximum endurance of about 50 days, the Soviet nuclear icebreakers have an endurance of 400 to 700 days and unlimited sailing range. Their performance has been so outstanding that the Canadian Coast Guard in 1977 tried to get the Trudeau government to allow it to build one. The proposal was refused.

The Soviets are also building other categories of nuclear merchant ships, starting with a 60,000-ton, 40,000 SHP lighter carrier (about the size of the battleship *New Jersey*) which is expected to be completed by 1984. Powerful enough to break ice, the new ship is intended to be first of a class which will provide "a new dependable transportation system" for the Soviet north coast, according to the U.S.S.R. Merchant Marine Ministry. The U.S.S.R.'s maritime fleet has extended its activities into every corner of the globe, and the Soviet nuclear maritime plans may be far more ambitious still.

Where does the United States go from here?

The Reagan administration came to office with a promise to revive American industry in general and the nuclear industry in particular, yet it has done nothing so far to secure the nuclear maritime limited-liability legislation required for nuclear merchant ships ever to be built in U.S. shipyards. A second necessary step would be "first-of-a-kind" type federal subsidies or favorable credit terms to entrepreneurs who intend to build a nuclear merchant ship in a U.S. shipyard. If no such private interests presented themselves immediately, the administration would be well advised to spend a couple of hundred million dollars to build a sample nuclear supertanker and/or fast containership to demonstrate once and for all the economic advantages of maritime nuclear propulsion. Such ships could be sold to private industry at a profit, or assigned to the navy. The competitive advantage that would accrue to U.S. shipyards would far outweight the investment.

Finally, the administration can ratify the recently agreed-upon Intergovernmental Maritime Consultative Organization (IMCO) standards for nuclear ship construction as being standards adequate to guarantee port entry of any nuclear merchant ship into a U.S. port, and launch a diplomatic offensive to get the other principal maritime nations to do the same. (The Soviet Union has apparently ratified such regulation de facto by building its new nuclear merchant ships in accordance with IMCO rules.) Such ratification will give shipbuilders confidence in the ability of their nuclear ships to enter harbors without complications.