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NUCLEAR WARSHIPS AND THE NAVY'S FUTURE

by
Admiral H. G. Rickover, USN
before the
San Diego Press Club
San Diego, California
March 8, 1974

Congressman Wilson has asked me to give you my views on nuclear propulsion in the Navy.

Much has been said in recent months about the importance of naval power as it relates to contemporary international relations. For a country that is essentially an island nation, whose economic life is increasingly dependent on foreign resources, and the majority of whose allies are oceans away, the emergence of widespread national interest in our naval posture is long overdue.

Several important events are making clear the inescapable reality of our dependence on naval power. Among these are the national retrenchment following the long war in Southeast Asia, the development of a strong Soviet Navy, with warships particularly designed to destroy U.S. naval forces, and most recently, the Arab-Israeli conflict, with the resultant loss of oil supplies from the Mid-East.

The current lack of foreign oil has reminded us of our vulnerability to outside pressures. It has not been easy for our citizens to accept the fact that this country is

dependent on anyone or anything. Americans are proud of their self-reliance and self-sufficiency. That something as simple as heating a house or driving a car can be governed by conditions beyond national or individual control is for most of us a painful revelation. The smoothest generalizations are breaking up against the rough edges of recent events.

So far, the oil shortage has only been an inconvenience to the majority of our people. But a shortage of petroleum could have disastrous results on the ability of our oil-fired naval forces to fight in areas where fuel supplies are unavailable to us. This does not have to continue to be the case for future major U.S. naval combatants, because we can build them with nuclear propulsion, if we exercise the foresight to do so.

With existing designs of naval nuclear propulsion plants it is possible to provide enough energy for ten to 13 years of ship operation without the need to refuel. And new reactor designs now under development will last 15 years. In contrast, oil-fired naval warships must be refueled every few days. The initial nuclear fuel for a NIMITZ Class aircraft carrier contains the energy equivalent of 11 million barrels of Navy distillate fuel oil, or enough oil to fill a train of railway tank cars, stretching from San Francisco to Los Angeles.

It was the concern for fuel for naval ships in time of war that led to establishment of the Naval Oil Reserves, which are now being considered as a quick source of additional oil during the present shortage. But even if this reserve is still available during a future war it will also be necessary to have the oil at hand where it is needed, before it can be used. Of what value is an oil-fired warship if it is unable to get oil? It

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is the need for a reliable worldwide fuel distribution system that is the Achilles' heel of our oil-fired Navy. The difficulty in obtaining foreign oil supplies to support recent operations in the Mediterranean and the Indian Ocean shows this vulnerability.

But from the very beginning of the nuclear power program there has been strong opposition in the Navy. Were it not for the Congress and the Atomic Energy Commission we would not have nuclear submarines. In 1948 when the Navy opposed nuclear submarines, the Navy's systems analysts made a study. This study showed that a nuclear submarine would be worth 1.41 times as much as a conventional submarine, but would cost about twice as much. The analysts therefore concluded that nuclear power was not worthwhile. The Navy argued that if they built nuclear submarines they would only get half as many submarines each year. This argument was similar to a view held by the Navy at the end of the nineteenth century. President Theodore Roosevelt said that the Navy feared to push submarines lest Congress withhold appropriations for building battleships. Fortunately, in the case of nuclear power, Congress prevailed and the NAUTILUS was built. In fact, the Atomic Energy Commission paid for the propulsion plants of the first two nuclear submarines. The NAUTILUS ushered in a revolution in submarine and naval warfare.

Although nuclear submarines have now been recognized as among the most vital warships we have, opposition to them has nevertheless continued for over a quarter of a century. For example, the Department of Defense at one point decided to stop building any more nuclear submarines after 1970, but they were overruled by Congress.

In another case, just a few years ago, the systems analysts in the Defense Department suggested sinking ten of our Polaris submarines to save money. And more recently it had to be Congressional action that increased the number of high speed LOS ANGELES Class nuclear attack submarines in the shipbuilding program over what the Defense Department had requested. Such a reluctance to build submarines has continued even though the Soviets have surpassed us in numbers of nuclear submarines since 1971 and are outbuilding us by three to one; and even though they now possess three times our submarine building capacity and are still increasing that capacity; and even though they have introduced nine new designs in the past seven years as compared to two for us.

In nuclear powered surface warships the opposition has been even more persistent. The five nuclear surface ships in service today came into being only after much pushing and shoving by Congress. The aircraft carrier KENNEDY was built with conventional power over the strong objection of Congress. One of the two nuclear powered frigates which were authorized by Congress in fiscal year 1968 was not permitted to be built by the Defense Department, and the other was delayed for nearly two years. In 1971 the Navy scrapped a previously planned program to provide each nuclear powered carrier with its required four nuclear frigates, and suspended indefinitely the nuclear frigate construction program. Yet this was the only type of new combatant ship having a fleet air defense capability.

Central to the opposition to nuclear powered ships has been the precept that we should not go to nuclear power until we can show it is no more expensive than conventional power. But why should we expect to get all the advantages of nuclear power

at no additional cost? The cost of all other weapons has gone up as their capabilities have improved. For example, the M-16 rifle costs three times as much as the World War II M-1 cost; a modern machine gun costs nine times more than one from World War II; a C-5 transport plane is over 300 times as expensive as the World War II C-47: the airplanes the Navy flies today cost 20 to 25 times as much as World War II aircraft. Does that mean we should have only four or five planes on our carriers instead of 100?

Even so, the additional cost of nuclear powered warships is minimal when all factors are considered. First, nuclear powered ships are built to higher standards than conventional ships and have proved to be more reliable in the operation of their propulsion plants. These first line ships carry the most modern and complex weapons systems and have increased operational capabilities over their conventional counterparts--all of which naturally contribute to their higher initial cost. In addition, the construction cost of nuclear ships includes nuclear fuel for over ten to thirteen years of operation, whereas the initial cost of a conventional powered ship does not include the cost for oil.

Recently, oil costs have risen dramatically. It now costs close to $25 a barrel to buy and deliver oil to Navy ships. At that rate, it would cost almost $270 million to provide the amount of oil for a conventionally powered carrier equivalent to the nuclear fuel in the NIMITZ. That is almost three times the cost of the nuclear fuel for this ship.

Nuclear and conventional ship costs should be compared on a lifetime basis. For example, compare lifetime costs for a nuclear carrier task group with those of a

conventional task group. The nuclear carrier increases the task group cost about two percent. Each nuclear escort increases the overall task group cost one percent, so that four nuclear escorts increase the task group cost four percent. Therefore, the lifetime cost for a complete nuclear task group, consisting of a nuclear carrier and its four nuclear escorts, is six percent greater than that of a conventional carrier accompanied by four conventional escorts.

This is merely the peacetime cost. It does not take into account any of the advantages of nuclear power.

Nuclear powered task forces are far less dependent on logistic support. When logistic supply lines are attacked during a real war the decrease in the requirement for ships' fuel for the strike forces will have a compounding beneficial effect. The surviving fuel transportation and storage facilities can then all be concentrated on getting fuel for aircraft and other military vehicles to the forward areas. The escorts that would otherwise be required for the tankers which carry ships' fuel could then be assigned to assuring the safety of other supplies.

A major lesson of World War I, the first war in which fuel oil played a predominant role, was pithily expressed: "The Allies floated to victory on a sea of oil." In World War II also, the supply of oil was a controlling factor in most military operations.

Here is a statement about fuel, that points out how lack of oil was instrumental in the defeat of Japan. It is quoted from the Strategic Bombing Survey conducted after the war. This report entitled "Oil in Japan's War" states:

"In every phase of the war, oil determined Japan's strategy and governed the tactical operations of its Navy and Air Force. The collapse of the Japanese war effort was the consequence of their inability to maintain their supply routes.

"The effect of oil shortage on Japanese Naval strategy became devastatingly apparent in the campaign for the Marianas and the Philippines. Japanese fleet units had to be dispersed between the Japanese Inland Sea and Singapore, owing to limited fuel availability and failure to achieve satisfactory coordination between the fleets, contributed substantially to the Japanese defeat. Fuel shortage in the Home Islands deprived the Japanese naval forces fighting off the Philippines of the services of at least three battleships, which together with several aircraft carriers were taken out of service and assigned to duties as port and antiaircraft vessels because they consumed too much oil."

There are numerous examples where oil shortages have been a critical factor in military operations, examples that appear now to have been forgotten. Unfortunately, history has a way of taking revenge for forgetfulness.

Take the carrier task force again. In the case of a conventional carrier with four conventional escorts, one third of the fuel is used for the carrier, one third for the conventional escorts, and one third for the aircraft. By doing away with the need for fuel for the carrier and its escorts; by making them nuclear powered; only one third the amount of propulsion fuel--that used by the aircraft--is needed. Further, we design our nuclear carriers with the capacity for almost twice as much aircraft fuel and 50 percent more aircraft ammunition than the latest conventional carrier. This reduction in logistic support becomes especially important when our naval forces are operating away from home, during a real war, when they are subject to enemy attack.

When a nuclear carrier is substituted for a conventional carrier, the range of a carrier task group with four conventional escorts is doubled. When two of the four escorts with the nuclear carrier are nuclear, the range of the carrier task group is doubled again. When all the escorts are nuclear, the range of the carrier task group is essentially unlimited.

For these reasons a nuclear task force is at least 50 percent more effective than a conventional task force.

I am sure you know the maxim learned through the bitter lessons of war that: "The art of war is the art of the logistically feasible." It is the elimination of the requirement for a continuous supply of propulsion fuel that makes nuclear powered warships so valuable.

The areas I have just mentioned represent a tremendous increase in military effectiveness. In my opinion, this effectiveness far outweighs the six percent higher lifetime cost for the all-nuclear carrier task force.

There are many examples where the value of nuclear propulsion for surface warships has been demonstrated in real terms, in every day operational missions of the Fleet. I frequently receive letters from the commanding officers of our nuclear warships telling me of some of these advantages. As one of many examples, for 13 days during July 1971, the TRUXTUN--the frigate that Congress changed to nuclear propulsion in the 1962 program--provided an excellent demonstration of the capability of a nuclear powered ship to perform truly independent missions free of the fuel oil umbilical cord.

While on a special mission, the TRUXTUN steamed 8,600 miles at an average speed of advance of 28 knots, traveling from Subic Bay in the Philippines to Perth, Australia, and crossing the Indian Ocean twice en route. This is the longest period of such high speed operation ever sustained by any ship. This high speed could have been continued for an essentially indefinite period had there been a need. At the conclusion of her mission, the TRUXTUN was fully ready to undertake protracted combat operations.

In contrast, our most modern oil-fired frigate would have had to refuel at least three times during such a transit and would have arrived at her destination with close to minimum fuel reserves, unable to conduct extended combat operations. And, of course, there are no tankers normally available in the middle of the Indian

Ocean from which to refuel. From a practical standpoint, no nonnuclear ship could have performed the TRUXTUN's mission--in peace or in war--because of the fuel support needed.

Also to be considered in comparing nuclear powered to conventionally powered ships is the availability of fuel reserves during war. I mentioned that the Naval Oil Reserves are now being considered as an emergency source of fuel. These reserves are, therefore, not guaranteed.

The situation is different when we have nuclear fuel as a reserve. What limited our industrial output, and therefore our fighting capacity in World War II was the labor supply. But we can employ labor now--in peacetime--to manufacture nuclear fuel for our nuclear navy, and we can store the fuel in a small area. We would then be assured of having a nuclear fuel reserve for a long war, and we would not need labor, during the war to manufacture nuclear fuel.

There are events in a nation's history that, to use Thomas Jefferson's phrase, are like "a fire bell in the night." The recent conflict in the Mid-East was such an event. For the first time, we were in a situation where the Soviet Fleet in the Mediterranean outnumbered the United States Sixth Fleet.

Had the Soviet Mediterranean Fleet been ordered to challenge the Sixth Fleet who would have won? From the limited information available to me, I do not think the answer is entirely clear. Would such a question have been seriously asked ten years ago? Perhaps this thought will give you an inkling of the change that has taken place in the balance of naval power over the past decade.

This change underscores the urgent need we, as an island nation, have to build a Navy strong enough to protect our national interests, and our economic and political survival. To me, it is clear that the striking force ships we build for such a Navy must have nuclear power.

Yet, despite its demonstrated superiority, there is no firm long-range building program to convert our major combatant forces to nuclear power.

I suppose, that to some people, any rate of transition to nuclear power, or to any other new weapon, is unreasonable. But many have taken a stand against nuclear power for the Navy before they even investigated it. Their tendency has been to fit facts into their preconceptions. They have failed to see that the essence of all progress is a shedding of preconceived ideas and accustomed ways of doing things. In the past, this failure has prolonged military ideas beyond their time.

Changes in the Navy often come at a distressingly slow pace. It took two thirds of a century for our Navy to change from sail to steam. In 1814, Robert Fulton designed and built for our Navy the world's first warship propelled by steam. It was named DEMOLOGUS. Over the next 20 years the United States built some 700 steam merchantmen while the U.S. Navy built only one steam vessel.

It might interest you to know that in 1869, 55 years after the DEMOLOGUS, the Navy Department issued a General Order requiring all warships to carry a full set of sails. The concern over cost was so great that specific instructions were issued as to when the steam engines could be run. The order warned naval commanders that:

> "They must not be surprised, if they fail to carry out the spirit of this order, if the coal consumed is charged to their account."

After conversion to steam had become a reality we went through another period when there was great reluctance to shift from coal to oil. At the beginning of the 20th century it was generally accepted that oil-fired warships offered substantial military advantages over coal-fired warships. But since they were more expensive, there was great resistance to building them. It took Winston Churchill's command decision as First Sea Lord to give Britain's Royal Navy the position of world leadership in converting warships from coal to oil. As it later turned out, this was a significant factor in Britain's naval superiority in World War I. Churchill said:

> "Shocked at the expense, the Admiralty had reverted for two years to 27-knot coal-burning flotillas. It was too late to stop the last bevy of these inferior vessels, but I gave directions to design the new flotilla to realize 35 knots speed without giving up anything in gunpower, torpedoes or seaworthiness. Build slow destroyers? One might as well breed slow race horses!"

When one talks about the delay by the Navy in going from sail to coal, or from coal to oil, everyone today agrees that those responsible were stupid not to make the change faster. As Goethe said: "It is the truth, but not for us." With hindsight

they can easily see the traps their predecessors fell into, but they cannot recognize that a generation hence they themselves will be classed along with the other shortsighted leaders who refused to go from sail to coal, and from coal to oil.

Inertia seems to be endemic to naval development. Curiously, the lethargy is most often felt by the nation which has the greatest navy. On March 4, 1858, the French, on one day, laid the keels of three frigates. These ships were to have iron plates bolted to their sides to protect them against shot and shell--they would be far better than anything the more powerful British Navy possessed. In June of that year a high British naval official reluctantly admitted that his country had to accept the challenge. He said:

> "Although I have frequently stated it is not in the interest of Great Britain, possessing as she does so large a navy, to adopt any important change in the construction of ships of war which might have the effect of rendering necessary the introduction of a new class of very costly vessels until such a course is forced upon her by the adoption by foreign powers of formidable ships of a novel character requiring similar ships to cope with them, yet it then becomes a matter not only of expediency but of absolute necessity."

Half a century later, however, another responsible British official argued that his country was wrong to build the Dreadnought--the all big-gun battleship which made all other battleships obsolete. He said: Britain "ought never to lead in ship construction, but always to follow with something better."

For a leading navy such an attitude appears to have some merit. It coincides with all the natural instincts to preserve a familar and comfortable way of life--a way which recalls hard-won victories of the past. Also, this attitude can be defended upon economic grounds because it keeps costs down by preserving existing ships, equipment, and naval skills. But development never ends. To believe that advances can be deferred and that a nation can make up lost ground can be fatal. Such a cast of thought is what Mahan recognized when he wrote: "Finality never will be reached in anything save death...."

In each of the instances I have mentioned change was demanded of an organization; change in leadership and in training. The fault was inertia--a comfortable faith that lessons and ways of the past will hold in the trials of the future. In its broadest sense this is an undemanding mental attitude which is opposed to change. It is a vested interest.

Those outside the professional ranks, such as the press, citizens, and Congress can recognize the danger of such blindness--if they but know the facts.

You might properly ask why I, an engineer, am the spokesman for nuclear warships. The answer is that there are two roads which must be traveled to accomplish change in our military: the road of action and the road of words. I would

prefer to devote my energies entirely to engineering. But since no one in the Navy was devoting his effort to the words, I was forced to do both. This was true in 1948; it is still true today. Perhaps, by the next century, the Navy itself will finally realize the importance of nuclear power, but this is not yet the case. It should have come in the 1950's. This is a sad commentary on the lack of foresightedness of all but a few of our naval leaders over the past quarter century.

I would like to suggest that we must--from the standpoint of national safety--avoid proving again the old adage that, "history repeats itself." Congressional concern in this regard has been clearly indicated by a House Armed Services Subcommittee on the Middle East. In its December 1973 report the Subcommittee stated:

> "The Committee on Armed Services has in the past consistently urged nuclear propulsion for naval vessels because of its operational advantages--the virtually unlimited range such power gives a ship. Now nuclear propulsion has become a must because of logistic realities. In addition to the danger of a shortage of oil for ships, the rising cost of oil, when available, has made scrap paper out of past comparative cost estimates for nuclear and conventional power.
>
> "The wisdom of the committee's past position has been borne out by time, and the committee

should question carefully the construction of further oil-powered ships where the technology exists to make them nuclear powered."

What must be done? We need a permanent program to build nuclear powered ships--a program that will not be drastically changed every year or two as has happened in the past. Admiral Moorer, Chairman of the Joint Chiefs of Staff, and for many years an eloquent proponent of nuclear power for our striking forces, agrees with me that we must build these first line ships during peace.

The excuse for not building better ships is always that they are "more expensive." But all weapons of war are expensive. Cheap weapons will not win us a war. And if we cannot win a war, there is no sense in spending money on weapons at all.

Rarely in naval history have the leaders looked far enough ahead. They generally build ships that they consider to be adequate for the present. That is why, frequently, naval leadership has been replaced when war broke out.

We should be planning now for war that may erupt fifteen or more years from now. Therefore, it is time to establish a firm program for making all new major combatant ships for our striking forces nuclear powered. It is a matter of national priority.