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The Admiral Richard G. Colbert Memorial Prize is awarded each year to the Naval War College student author of the best of the professionally worthy essays submitted in competition for the prize. The 1979 winner here analyzes the consequences of the present high costs of nuclear attack submarines and suggests some steps to lessen the severity of those consequences.

PRICING OURSELVES OUT OF THE MARKET:

THE ATTACK SUBMARINE PROGRAM

by

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The U.S. Navy's nuclear attack submarine program represents a major and potent element of national power. As the Secretary of the Navy recently stated, "The qualitative edge we hold . . . in both equipment and personnel is awesome."[1] One of the many challenges the Navy faces as it enters the 1980s is that of determining the future of this exceedingly capable–and exceedingly expensive–force. In deciding where to go from here we need to face four realities: (1) We are on the verge of pricing ourselves out of the attack submarine business; (2) We should be worried about that because the attack submarine can make a major contribution under a wide variety of assumptions about the nature of a future war; (3) If we don't act soon we will face, in the late 1980s, a choice between accepting several years of degraded force levels, conducting a huge and costly crash program, or both; (4) Most of the things we can do have some drawbacks, making the selection of what course to follow more difficult but no less urgent.

The following more or less typical comments illustrate the widespread agreement on the importance of present-day nuclear attack submarines (SSNs). From a U.S. Senator: "The submarine is perhaps the best anti-submarine weapon in our current force structure, and there is no reason to think its utility in this role will lessen."[2] From a defense commentator: ". . . the life or death of our planet may be in the hands of a few hundred young submarine officers."[3] From the Soviet Navy's Commander in Chief: "[in future warfare] to an ever greater degree combat operations will move into the subsurface."[4] These and a host

of similar statements attest to the high regard in which serious students of defense hold modern attack submarines. While many are concerned over the high cost of these ships, few deny their exceptional effectiveness as fighting machines.*

Those who share such views of the importance of submarines find recent trends in submarine procurement disconcerting. Faced with increasing sophistication—and its consequent increasing cost—and ever greater fiscal constraints, the attack submarine program is being slowly but inexorably squeezed out of the market. Consider the following:

1. The final major buy of the *Sturgeon* (SSN 637) class submarine cost an average of $68.2 million in 1967 dollars. In fiscal year 1979 terms this equates to $170.5 million. In contrast the single *Los Angeles* (SSN 688) class ship in the fiscal 1979 budget was priced at $433 million.[5]

2. In fiscal year 1967, 19 percent of the total shipbuilding budget enabled us to procure five attack submarines. Buying five submarines in fiscal 1979 would have taken over 43 percent of the shipbuilding budget.[6] This disparity reflects both the increasing cost of submarines and the decreasing size of the shipbuilding budget.

3. Largely as a result of cost increases the SSN building program has been reduced steadily over the past 3 years. In March 1976 the approved 5-year program included eleven attack submarines (two per year plus a third in fiscal 1977). In January 1977 the Ford administration submitted a plan for building three SSNs every 2 years. One month later the incoming Carter administration deleted one of the two proposed fiscal year 1978 ships, in the words of the Secretary of Defense "simply because there is already a large backlog of SSN orders."[7] Although in announcing this decision in 1977 Secretary Brown stated that future procurement would be at a rate of two SSNs annually, by March 1978 the approved program had dropped to one ship a year where it remains.

These cutbacks have had a drastic effect on the Navy's ability to reach its long-held goal of a stable force level of 90 attack submarines. Maintaining such a force level requires annual procurement of an average of 3.6 ships, assuming a 25-year service life. Because of the impending mid-1990s retirement of a large number of attack submarines of the *Sturgeon* class delivered between 1967 and 1972, temporary increases above this building rate will be required in the late 1980s to maintain even the current force level of 72 SSNs, let alone to reach 90 ships. Present Defense Department thinking makes an expanded building program unlikely. Last year, for example, Secretary Brown testified that the 90 SSN force level "will be very hard to reach so long as we are spending over $400 million apiece on individual SSNs."[8] Figure 1 shows

*Dissenters do exist. For one of the most forceful see Worth H. Bagley, *Sea Power and Western Security*, Adelphi Paper 119 (London: International Institute for Strategic Studies, 1977), pp. 22-5 and 39. Bagley, a retired Vice Chief of Naval Operations, holds that the attack submarine's utility in ASW is a myth fostered by the U.S. tendency to view the Soviets as mirror images of ourselves while ignoring differences in tactics. In his view attack submarines are inferior to mines in countering transiting submarines and are ineffective against Soviet Navy joint surface/subsurface coordinated operations. U.S. SSNs should therefore be relegated to an antishipping role while halting submarine construction for "at least five years [while] evaluating technological advancements that affect submarine usefulness." While Admiral Bagley's warning against "mirror-imaging" is well taken, his conclusions are at variance with those of most other analysts. Obviously if he is correct there is little to fear from future drops in American submarine force levels. It is the contention and the underlying assumption of this paper that Admiral Bagley is in error and that the common perception that attack submarines are effective and important in war at sea is accurate.

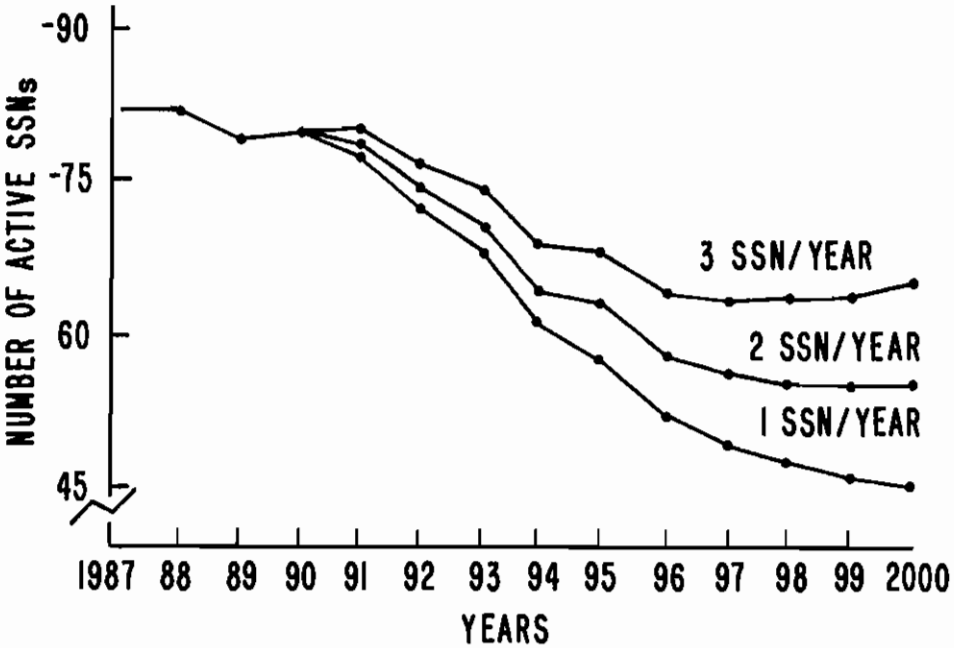

Fig. 1—Number of Attack Submarines on Active Service at Year's End as a Function of Varying Annual Construction Rates After Fiscal Year 1985[a]

[a]Assuming 25-year active lifetime and 6 years from authorization to commissioning. End-of-life based on commissioning dates given in *Jane's Fighting Ships 1978-1979* (New York: Franklin Watts, 1978).

the effect on submarine force levels of continuing the present building rate indefinitely as well as of increasing to either two or three ships per year at the end of the current five-year plan (i.e., in fiscal 1985). As can be seen, in all of these cases force levels will drop below those of today in the early 1990s. Ultimately, of course, one or two ships a year and a 25-year lifetime would lead to a stable force of 25-50 SSNs on active service.

This paper examines the effect of these projected reductions in attack submarine strength and considers some mitigating alternatives. The approach will be to examine the role of submarines in various possible wars, to consider what capabilities might be lost if force levels were to be reduced and how this loss of capability might be minimized and, finally, to suggest alternatives to simply acquiescing in this degradation of effectiveness.

Force Planning Dilemmas. The problem of planning the future submarine force is complicated by growing concern for the accelerating rate of technological development. One need only recall that at the time the *Los Angeles*-class submarine was conceived land-attack cruise missiles, if discussed at all, were relegated to "pie-in-the-sky" studies. By the time the first ship of the class was commissioned the potential employment of such missiles as *Tomahawk* in a strategic role was of sufficient importance to be a major issue in SALT II negotiations. One recent prize-winning essay suggested that the pace of technological change is becoming so rapid that the Navy should shift to "throw-away" ships, "smaller high-technology ships

designed for an extremely short (5years?) lifespan."[9] It is true that recent rapid advances in technology have done little to reduce the value of the submarine or to alter radically its method of employment. There has been no change in undersea warfare, for example, comparable to the changes wrought in surface warfare by the cruise missile. Still, in an era of serious arguments for 5-year ship lifespans it is, at a minimum, thought provoking to realize that attack submarines now take 6 years from authorization to commissioning or to see the Navy give serious consideration to extending the 25 year old U.S.S. *Nautilus* (SSN 571) on active service to help maintain adequate force levels.*

The Navy is faced with a difficult dilemma. On the one hand the imperatives of technology and of change suggest sophisticated ships with relatively short lives. On the other hand the imperatives of fiscal reality demand less expensive (and hence less sophisticated) ships with longer service lives. Before we can intelligently discuss possible solutions to this dilemma we must consider the roles of attack submarines in a future war. The utility of *any* weapons system in *any* war is a function both of the capabilities and limitations of the weapons system and of the nature of the war. The relevant capabilities of present U.S. attack submarines include: *covertness* (the ability to operate in areas where the surface of the sea is under the control of the enemy); *endurance* (the ability to operate without external support of any kind for up to 3 months, subject only to the depletion of weapons onboard); *reliability* (not inherent in submarines *per se*, but a significant strongpoint of the present U.S. submarine force); *mobility* (the ability to shift operating theaters rapidly; this too is not inherent in all submarines but only in those, either American or foreign, that are nuclear-powered); *antisubmarine warfare effectiveness* (a primary consideration in the design of U.S. submarines; specifically, existing U.S. submarines enjoy significant acoustic advantages when compared to other antisubmarine platforms); *antishipping capabilities* (overshadowed by the ASW role in recent years, but now revitalized with the advent of the *Harpoon* antiship missile); and *land attack potential* (a currently nonexistent capability that could be gained by the deployment of a long-range cruise missile such as *Tomahawk* with a nuclear warhead). Other specialized submarine capabilities such as reconnaissance, mining, and covert swimmer delivery, while useful in certain cases, are less directly applicable to modern war at sea or are of a sufficiently infrequent nature to have little affect on required force levels.

These capabilities, taken in the aggregate, relate to the sea control function and, to a lesser extent (through protection of carrier strike forces or use of land-attack missiles) to the function of power projection. At first glance attack submarines have little to contribute to strategic deterrence or peacetime presence—the remaining two of the four functions in terms of which much recent analysis of naval forces has been conducted. The unseen nature of submarines at sea, their unimpressive appearance in port, and the large number of states that do not welcome visits of nuclear-powered ships all combine to limit the usefulness of attack submarines in a peacetime presence role. The contribution of such submarines to deterrence is complex and difficult to assess. There is a growing tendency on the part of many to stress the inherent linkage between strategic and general-purpose forces in the deterrence of war.

*Submarines are, of course, not unique in facing these problems. The present service life extension program for aircraft carriers will result in extending carrier lifetimes to 45 years. This is equivalent in time, if not in technology, to having used U.S.S. *Langley* (CV 1) on *Yankee* station.

Indeed, recent posture statements by the Chief of Naval Operations have listed only sea control and power projection as roles of naval forces, tying deterrence to overall military readiness. In addition, many argue that a land-attack cruise missile would contribute to deterrence, even under its more limited strategic definition, by complicating the Soviet defense picture. But air-launched cruise missiles already provide this complication or will do so shortly. Barring radical changes in submarine operating patterns, few cruise missile equipped submarines can be maintained routinely on station year in and year out. Yet the principal value of the sea-based deterrent lies in the invulnerability that results from keeping a large fraction of the force constantly at sea. To the extent that central strategic systems (as opposed to total military capability) deter war, deterrence might be enhanced in time of crisis by rapid deployment of submarines equipped with land-attack cruise missiles. Because in the face of a serious threat of imminent war we would put all available submarines to sea in any case (both for survivability and for readiness) and because most of these submarines would be required for other missions, the potential contribution of attack submarines to classic strategic deterrence should not form a primary basis for force planning. It appears, therefore, that attack submarine capabilities for sea control and, less directly, power projection are the appropriate determinants of force levels. It is next necessary to turn to the second half of the equation, the estimation of the nature of a possible future war.

Character of Future War. Categorizing submarine capabilities is relatively straightforward; predicting the future—especially the shape of a future war—is more challenging. At the outset it must be assumed that for the foreseeable future "war" means war with the Soviet Union. No other nation has the ability to threaten seriously the dominance of the United States *at sea*. A war involving massive projection of power ashore (such as Vietnam) is possible but it is difficult to see submarines being any more relevant to this type of warfare in the future than they were in the past. Thus submarine force levels should be (and are) determined solely on the basis of a possible war with the U.S.S.R. There is substantial disagreement over the most probable form of such a war; most projections, however, fall into one of the following four general types:

1. A war that, however it starts, rapidly escalates into an all-out strategic nuclear exchange in which both nations are effectively destroyed as functioning societies. This is the type war basic countervalue deterrence is designed to prevent. In such a war, winning is seen as a meaningless term and general-purpose forces, including submarines, as irrelevant.

2. A large-scale war fought primarily in Europe away from the territory of both the United States and the Soviet Union. Such a war might follow a Soviet "land grab" in Europe or might result from escalation following some incident in time of crisis. Tactical nuclear weapons might or might not be used. The existence of strategic deterrent forces would inhibit any attacks on the home territory of the major combatants (although some argue that limited attacks against active military bases could occur, especially in coastal areas). This is the war on which present U.S. general-purpose force planning is based.

3. A limited nuclear war involving counterforce attacks on the territories of both major opponents. What distinguishes this from the previous case is not the use of nuclear weapons but the removal of most inhibitions against attacks on U.S. and Soviet territory. One version of this war involves a disarming first strike by the Soviet Union after which victory would be

determined by the relative fighting ability of the surviving forces.[10]

4. A geographically limited conventional war remote from Europe, possibly resulting from each side intervening in a war between two client states. Such a war would differ from Korea or Vietnam in that U.S. forces would be in direct conflict with the Soviets rather than fighting presumed surrogates. As a result, the danger of escalation would be greater and American mastery of the seas could not be taken for granted. The Middle East is one possible scene of such a conflict. A special case of this form of war might be the so-called "war at sea." This could involve a relatively large-scale conflict between the United States and the Soviet Union either as a result, for example, of Soviet attempts to cut off oil supplies from the Persian Gulf or of both sides attempting to prevent reinforcement of client states engaged in war. In this special case the geographic limitation would be sea vs. shore but actual hostilities might take place at widely scattered locations.

At first glance this smorgasbord of possible future wars appears to require either accurate prediction of the one most likely war or construction of forces capable of meeting any future threat. While this is generally true—and is part of the dilemma facing the Navy today in planning future forces—the situation with regard to submarines is somewhat simpler. First, if the model of an all-out, spastic nuclear war is correct, neither Soviet nor American naval forces (except ballistic missile submarines) are relevant. In either the large-scale European war or the limited nuclear war the Soviet Navy would have essentially the same missions (although the relative emphasis among these Soviet missions might vary). Such missions would include blunting U.S. power projection capabilities through anticarrier warfare, interrupting the flow of reinforcements and supplies to Europe, supporting the forward movement of the Red army, defending Soviet ballistic missile submarines, and attempting to locate and destroy American SSBNs. The chief difference between the two wars would be the number of U.S. forces destroyed in U.S. ports by a Soviet disarming strike. Such destruction would obviously be a function of warning time; if some period of tension preceded actual hostilities, a substantial fraction of the fleet might be at sea. A second difference would be the vastly increased logistics problems involved if continental U.S. ports were destroyed. These problems may well limit the amount of time that the forces at sea will be able to fight. But in either war Soviet and U.S. tasks at sea would be roughly similar, with the Soviets attempting to carry out the missions enumerated above and the United States and its allies attempting to counter these Soviet efforts, to project power ashore, and to resupply Europe. Especially if, as many believe, the large-scale European war entailed use of nuclear weapons both within Europe and at sea, even if the home territories of the two superpowers were not attacked, the two models tend to merge for the forces surviving the initial strike. This merger is particularly valid for submarines that are not directly concerned with land-based forces and that would thus have similar missions under either model. Similarly, the use or nonuse of nuclear weapons at sea has less effect on submarine warfare than on other forms of naval combat. Surface ships have some ability to absorb hits from conventional weapons attacks and still survive. Shifting to a nuclear war at sea changes the surface ship survival picture as no leakage of incoming weapons past defenses can now be tolerated. In contrast, submarines depend for survival on not being attacked or, more exactly, on attacking first. They are therefore less sensitive to the introduction of high-yield weapons as they survive primarily by not being located.

In a geographically limited war the Soviet Navy might play no role, might attempt to blunt U.S. power projection in the general area of the conflict without widening the war (for example by using cruise missile firing submarines against U.S. carriers in a hypothetical future Vietnam or *Backfire* bombers in the same role in a Persian Gulf conflict), or might attempt to interrupt the flow of supplies either to the war zone or (in the special case of oil) to the United States. In very broad terms these tasks can be viewed as subsets of the missions the Soviets would have in a conventional European war. If the United States can prevail in the one case it can prevail in the other. For example, if power can be projected ashore in Europe in the face of Soviet opposition then it can be projected ashore in areas (such as Korea) that are remote from the main sources of Soviet power in the western U.S.S.R. More specifically, U.S. submarine employment in such a geographically limited war would consist of countering any Soviet attempt to use submarines either against carriers or in attempts to sever the sealanes. But if the Soviet submarine threat can be overcome in the Atlantic, close to Soviet submarine operating bases in an all-out war, it can almost certainly be overcome in locations more remote from the U.S.S.R. in a less-than-all-out conflict. This is particularly true given the present lack of Soviet forward bases for submarine operations outside the Mediterranean. Even if the Soviets were to establish a submarine operating base in, for example, Vietnam, the United States has equal or better capabilities to provide submarine support in forward areas and would be at no more of a disadvantage from the purely submarine standpoint than in a North Atlantic conflict. Thus although geographically limited war is possible, we may set it aside in designing submarine force levels because those forces adequate for a NATO war will be capable of handling a limited war as well.*

This analysis suggests that the course of a future war at sea, at least from the standpoint of the submarine force, may be somewhat less scenario-dependent than first appears. The relevance of the struggle at sea to the ultimate outcome of the war obviously would vary with the nature of the war. So would the forces available for that struggle. But in a broad sense the missions of the two navies will be the same in any type of war (excluding the total, spastic strategic nuclear exchange). Regardless of whether the war is limited to a third country, is fought primarily in Europe, or involves attacks on each other's territory and regardless of the use or nonuse of nuclear weapons at sea, the United States will be seeking to cross the oceans to support and resupply ground forces while the

*This is not to say that such a war has no significance for U.S. planning. For example, if a major war in Europe were preceded by a war in Korea, U.S. forces would be far from the scene of the primary battle during the opening days or even weeks of the war, a period believed by many to be decisive in a short, high-intensity war. This is the reason that U.S. forces are sized for a war in Europe *and* a simultaneous contingency elsewhere. But for submarines a war in Korea would be irrelevant unless there were Soviet attempts to counter U.S. power projection. In this case *both* U.S. and Soviet forces would be remote from the Atlantic/European area. The point here is that because submarines primarily fight opposing navies (unlike surface ships, especially carriers, which can project power ashore) a third-nation war cannot tie up U.S. submarine forces without also tying up Soviet forces. Thus the degrees to which we must be able to fight simultaneously a big war in Europe and handle a minor (or not so minor) contingency elsewhere, an issue of great significance in planning force levels for carriers, the Marine Corps and tactical air forces generally, need not be considered in determining submarine force levels.

Soviet Union seeks to prevent such a crossing. If this analysis is correct we must discuss submarine requirements not in terms of the fundamental nature of a future war but in terms of Soviet missions that must be countered regardless of the type of war we find ourselves fighting.

Capabilities vs. Missions. The combination of Soviet naval missions and American submarine capabilities has the following implications for submarine employment in any type of war:

1. Soviet antipower projection (anti-carrier) missions would entail shore-based naval air attacks plus cruise missile attacks from surface ships and submarines. U.S. submarines can assist in defending carriers against both the surface and subsurface threats. Two or three submarines might be included in each battle group to provide this defense.* Because of the nature of carrier operations, the high-speed *Los Angeles* class is uniquely suited to this role.

2. The task of interrupting the flow of men and material to Europe would fall to Soviet submarines and (perhaps) naval aviation. Unless the Soviets employ a sea-based air platform, U.S. submarines can do nothing to counter the air threat. In contrast, countering the submarine threat would involve barrier operations, area sanitization, and direct support of particularly important convoys, all tasks well suited to U.S. submarines. The importance of this particular mission is directly related to the duration of the war; because a very short war probably means a U.S. defeat, it is necessary to plan on the war lasting long enough for reinforcement of Europe to be meaningful.

3. Soviet efforts to protect their own ballistic missile submarines would take the form of attacking U.S. antisubmarine warfare forces and of attempting to exclude American forces from the Barents Sea. Attack submarines' covert ability to operate in a hostile environment coupled with their ASW capabilities make them suitable for the counter-SSBN role should the United States elect to undertake such a task.* This is another way of saying that the Soviet Navy, strong on cruise missiles and weak on ASW, could less easily exclude attack submarines than other forces. Given present estimates of Soviet abilities to conduct antisubmarine warfare, no U.S. action, submarine or otherwise, is required to safeguard U.S. SSBNs; these ships will continue to depend on their inherent invulnerability from detection for their survival.

4. Soviet efforts to support the Red army would probably be limited to amphibious operations in the Baltic or the Black Sea. Because the shallow nature of the Baltic makes it ill-suited to the employment of U.S. high-speed, deep-diving submarines they could play little role in opposing such operations; opposition by allied submarines might be valuable. Submarine penetration into the Black Sea would probably be impossible.

5. If a nuclear-armed, land-attack cruise missile were deployed, U.S. submarines could supplement other forces in limited attacks on Soviet bases. This would be most valuable under conditions of limited nuclear war when carrier assets might be reduced and inhibitions against attacking Soviet territory

*Battle groups are the basic fighting units of the U.S. Fleet. Their composition varies but typically includes one carrier, four to six escorts to provide both antiair and antisubmarine defense and two or three attack submarines. Escort and submarine numbers vary with availability of forces.

*Some argue that in a war in which neither side's home territory had been attacked there would be an incentive to refrain from attacks on SSBNs for fear of sending a false signal of impending escalation. This has an aura of unreality for many professional officers. In any case if such attacks are undertaken SSNs are a suitable, even ideal, vehicle.

would have vanished. The feasibility of such employment of attack submarines obviously is dependent on the extent to which development and deployment of a submarine land-attack cruise missile is affected in future years by SALT limitations.

Three observations should be made concerning the foregoing analysis. First, the arguments reinforce the premise that from the standpoint of submarine warfare (excluding the possibility of land-attack mission) fundamental Soviet missions are more important than specific war scenarios in assessing future requirements. Second, it is the antisubmarine capability of the SSN that is most significant in most cases. Finally the reader should note the deliberate absence of any discussion of commerce destruction on the scale of World War II as an important mission for either Navy. The dependence of the United States on seaborne commerce is well known and one writer suggests a similar dependence for Asian Russia.[11] But economic strangulation takes time and a fundamental assumption in present American planning is that a future major war will be relatively short, months rather than years. If this assumption is in error it affects far more than the role of one particular weapons system; if it is correct there is insufficient time for either side to attempt such strangulation. Two possible exceptions exist: Persian Gulf oil and resupply of the Hawaiian Islands. But in a general war the Soviets would almost certainly attempt to cut off oil at the source rather than on the high seas, while supplying the Hawaiian Islands is simply the Pacific analogue on a smaller scale of the resupply of Europe. Thus the oft-cited comparison of the present Soviet submarine force with the far smaller number of German U-boats in 1939 is misleading, not because it is untrue but because it compares a force attempting long-term economic attrition in the face of overwhelming control of the surface of the sea by the Allies with a Soviet force seeking to challenge that control in a far shorter war.

How Much is Enough? The discussion to this point has suggested various roles—chiefly antisubmarine warfare ones—for U.S. attack submarines in a future war and has further suggested that these roles are more or less independent of the nature of that future war, arising instead from the interaction of Soviet naval missions and American submarine capabilities. Moving beyond the general discussion to address the specific question of how many submarines are required presents several challenges. Derivation of exact force levels is analytically difficult, requires access to a large amount of data, much of it classified, and is heavily dependent on judgment. The announced Navy goal of 90 SSNs is at least partly influenced by estimates of what is attainable; the Chief of Naval Operations recently indicated that the "real" goal was 144 attack submarines.[12] Space, data availability, and security classification preclude any attempt in this paper to derive exact force levels. It is possible, however, to examine one hypothetical way of employing 90 SSNs in order to show that such a force level is at least reasonable. The Chief of Naval Operations in his annual report to Congress estimates that 85 percent of the total fleet could deploy in time of crisis.[13] With 12 carriers and 90 attack submarines one might expect 10 carrier battle groups and about 75 submarines to be available early in the war. Allowing two to three SSNs for direct support of each carrier battle group accounts for 20-30 submarines. Five SSNs are routinely deployed to the Mediterranean and would continue to operate there after the outbreak of hostilities. Most commentators assume that other attack submarines will form barriers off such bases as the Kola Inlet (Soviet Northern Fleet) and Petropavlosk (Soviet Pacific

Fleet), as well as in such chokepoints as the two exits from the Sea of Japan, the Strait of Gibraltar and the gap between Iceland and the United Kingdom. Assuming three to five SSNs in each of these barriers would require another twenty-odd ships. But to be effective barriers must be maintained continuously. Allowing for transit and reload and resupply time it might require an average of two submarines to keep one barrier station constantly occupied (the actual number would vary with the distance from the resupply site to the barrier). Thus we account for an additional 20 SSNs. This leaves fewer than 10 ships for direct support or protection of any high-value formation other than carrier battle groups, for operations against deployed Soviet SSBNs, for land attack missions or reconnaissance, for area ASW off ports of embarkation and debarkation, for reinforcement of the Mediterranean or for replacement of losses. It should be stressed that this simplistic approach is *not* intended to describe actual U.S. planning, either in method or results. Neither is it intended to represent a rigorous derivation of submarine requirements. It *is* intended to show that a force goal of 90 attack submarines is plausible and that higher levels would not be excessive. If this approach—and the Navy's goal—is even approximately correct the anticipated mid-1990s force level of 45-65 submarines will be inadequate to carry out all of the probable submarine missions.

Alternatives. There are at least three possible approaches to this mismatch between requirements and assets. First, the Navy might drop lower priority missions or missions in theaters of secondary importance. Second, the Navy might attempt to devise more efficient employment methods so that fewer submarines could carry out the same tasks presently envisioned for 90 SSNs. Finally, of course, we could build more submarines. The first alternative is the least palatable. It is also the alternative we will be forced to adopt if we continue on our present course. It is therefore useful to consider *how* a significantly reduced submarine force might best be applied. One approach is to reexamine the present split between the Atlantic and the Pacific Fleets and shift a greater percentage of submarine assets to the Atlantic where the main Soviet Fleet is and where NATO support is most direct. This approach risks allowing Soviet Pacific submarines to close the sealanes to Hawaii and/or Japan. A second alternative might be to limit submarines to an ASW role, foregoing any opportunity for land attack and, except incidentally, for antisurface warfare. This approach simply recognizes that when assets are limited they must be employed where they are most effective. Because, as was seen above, most submarine missions are related to antisubmarine warfare, this limitation would have only a slight effect on required force levels. It might, however, have fiscal benefits as it suggests that the current fascination of many submariners with long-range cruise missiles may be misplaced, not because such weapons are ineffective but because the submarine platforms will be required for ASW. Finally the United States might be forced to choose between blunting the Soviet submarine threat to the sea lines of communication and defending the carrier power projection forces as a role for the submarine force.

Neither abandoning the Pacific nor eliminating the submarine contribution to protection of carrier battle groups are attractive responses to the problems arising from future reductions in numbers of submarines. Some combination of improved effectiveness and increased construction is therefore needed to counter the potential adverse results of smaller force levels. It would be pleasant to solve the problem by increasing production of the highly capable *Los Angeles*-class submarines. But as noted

at the outset these are expensive ships and any significant increase in construction will take money—indeed a great deal of money. It is not likely that total Navy budgets will be increased to allow such an increase in production. One need only recall the intense controversy surrounding the proposed $2.3 billion increase (in real terms) in the *entire* fiscal year 1980 defense budget in order to meet a formal commitment to NATO to evaluate the chances—or lack thereof—of finding the $1.8 billion annually needed to go from a building rate of one ship per year to a rate of five ships per year.[14] Increasing SSN construction by reallocation of funds within existing limited Navy shipbuilding budgets also appears improbable. On a sustained basis a significant increase in SSN construction would require either the virtual elimination of the construction of escort ships or the actual elimination of the *Trident* program. But escort ship levels in the Navy are already low and choosing SSNs in preference to them simply transfers the problem. Similarly, unless the nation is prepared to either (a) extend *Poseidon* lifetimes well beyond 25 years (the technical feasibility of which has not yet been demonstrated), or (b) accept an even more drastic reduction in sea-based strategic platforms and weapons than is now foreseen, some strategic submarine construction is essential in the coming decade.

If building more of the present ships is unlikely, perhaps greater operational availability can be gained from the existing force. For example, a *Sturgeon*-class SSN may spend as much as 3 years out of 10 in overhaul during which time it is unavailable for wartime service. If this could be improved to the 20 months out of 10 1/2 years now projected for *Poseidon* submarines (which have similar power plants and auxilary systems) there would be a significant increase in the number of deployable submarines.[15] Some improvements in this area are now being undertaken; they should be continued. Simple mathematics, however, will show that the 85 percent availability figure requires an improved overhaul schedule and the attainment of extended operating cycles. Another possibility would be to increase the service life of existing and future submarines from 25 to 30 years. There is technical risk in this, both in terms of cost and of obsolescence as most existing ships were designed for a 20-year lifetime. Costs for service-life extension might range up to $50-60 million per ship based on similar costs for extending the life of *Poseidon* submarines.[16] In the long run a 30-year life would reduce the required steady-state building rate to three ships annually; in the short run a 5 year extension of *Sturgeon*-class lifetimes would delay the drastic reduction in force levels from the mid to the late 1990s. It should be noted that the Navy, with no fanfare, has already extended the lifetime of existing SSNs from 20 years to 25 years (based on comparison of current and past congressional testimony).[17] The Navy also recently gave serious consideration to extending the life of U.S.S. *Nautilus* (SSN 571), the nation's oldest nuclear submarine beyond 25 years.[18]

A different approach to reducing SSN shortages through increased efficiency is to seek other ways of performing the missions now assigned to submarines. For example the addition of towed array sonars to *Knox* (FF 1052) class frigates has resulted in highly capable passive ASW platforms. Continued improvements in this technology and expanded procurement of towed sensors may allow frigates to replace, partially or totally, direct support submarines in defending carrier battle groups. Such a replacement would reduce total submarine requirements and should be pursued. Replacement of barrier submarines is less likely, at least in the early phases of the war, in that

the air and sea surface above the logical chokepoints may be contested and no other ASW platform has the submarine's ability to operate securely in such an environment.

Design to Reduce Cost and Capability. Shifting submarine missions to other platforms, increasing submarine lifetimes, and improving operational availability all serve to lessen requirements and to buy time in which to solve the problem of declining force levels. All are important in the continuing attempt to make the most effective use of scarce assets. Ultimately, however, the Navy must either accept the reduction in force levels, with at least some reduction in capability, in the 1990s or must buy more—and cheaper—submarines. It is important to recognize that less expensive means less capable; if we knew how to build existing submarines for less we would be doing so. Admiral Rickover has often observed that he was "constantly bombarded with requests to develop a small, light, cheap nuclear power plant" but that neither he nor anyone else knew how to do so.[19] The question thus becomes the manner in which submarines are to be made less capable. Broadly speaking one can reduce either platform capabilities such as depth, speed and endurance, or sensor and weapons system capabilities such as detection range or fire control sophistication. Reducing capability by simplifying sensor and fire control performance has found few advocates. The reasons are straightforward: in time of war the side making the initial detection of the enemy gains a huge advantage as it alone has the option of joining or refusing battle and, often, the advantage of the first shot at an unalerted opponent. Thus the most logical cost reduction approach is a reduction in platform capabilities.

Less capable platforms almost certainly mean slower and less mobile ones. (Costs of the platform could also be cut by reducing the efforts applied to quieting; this is equivalent to reducing sensor performance and is equally unattractive.) Reduced speed can be obtained through construction of a new class of diesel-electric submarines (which might also offer acoustic improvements during battery operations) or through construction of nuclear submarines with less powerful (and thus presumably less expensive) nuclear power plants. Many, both inside and outside the Navy, argue for the diesel alternative. For example, Senator Gary Hart alleges that diesel submarines in "missions such as barrier ASW, antisurface warfare, and mine laying . . . could be a useful alternative to nuclear powered submarines."[20] There are, unfortunately, serious flaws in this argument. As we have seen, antisurface roles for submarines are primarily associated with the defense of carrier battle groups, a role demanding high speed and thus unsuitable for diesel submarines. Mining is an appropriate submarine mission only where the surface of the sea is controlled by the enemy; otherwise other platforms can lay more mines faster. But minelaying in hostile waters implies covert penetration for long distances, a task far better performed by nuclear attack submarines. In general, the effectiveness of a diesel submarine is highest when it is serving as an intelligent mine of limited mobility but great lethality and lowest when it faces long transits in the face of ASW defenses. We are thus left with the ASW barrier role. Here a new problem arises. Many will agree that diesel submarines might equal SSNs in some barrier operations but in wartime other forms of ASW may be required, particularly if Soviet submarines have been deployed in advance of hostilities. History is sufficiently rich in detail that it can "teach" us whatever we want it to. However, history does at least suggest that wars often do not develop the way they were expected to and that single-scenario weapons

systems must therefore be viewed somewhat skeptically. As an example, in the late 1930s the Italian Army developed the L3 tank. Because their scenario assumed an invasion through the narrow mountain passes of the Alps, the tank was designed with a nonrotating turret. But when war came tank battles were fought not on narrow Alpine roads but in open Libyan desert. The point is not that a bad tank was designed; the L3 was a good mountain tank just as a diesel submarine with forward basing would be a good barrier ASW platform. The point is that weapons optimized for one narrow scenario often are at a severe disadvantage if reality fails to follow the script.

More promising than construction of single-purpose diesel submarines is procurement of a less expensive nuclear submarine, essentially similar to the existing *Sturgeon* class in cost and capabilities. This would provide basically the same sonar and fire control system as later submarines but with reduced speed (both reduced maximum speed and reduced search speed). When all attack submarines in the current 5-year shipbuilding program have been delivered the United States will have 38 high speed *Los Angeles*-class SSNs. This will provide three submarine escorts for each of the projected 12 carrier battle groups, assuming roughly the same operational availability for attack submarines and carriers. Because it is in support of high speed carrier operations that speed is most essential, the mid-1980s may be the appropriate time to shift to production of a cheaper, slower submarine. Such a shift, coupled with some reduction in escort building rates, might allow procurement of three SSNs a year. While this will not allow maintaining the desired 90-ship inventory in the 1990s, it represents a far less unsatisfactory outcome than that which will result from continuation of the current program. It is important to note that in light of the nearly 6 years from authorization to delivery experienced recently, such an expanded building program must begin in fiscal year 1985 or shortly thereafter to preclude at least temporary sharp reductions in force levels. This in turn means that design of the proposed new SSN must start soon. It is also important to note that this course is not risk free. Earlier it was alleged that the escalated cost of a *Sturgeon* was about half the cost of a *Los Angeles*. Such statements are suspect. The nuclear shipbuilding industry is in many ways unique and it is possible that much of the cost of the *Los Angeles* class represents not its increased speed and complexity but escalation within this specialized industry at a rate significantly in excess of that being experienced by the shipbuilding industry generally. We must not blind ourselves to the danger that without taking great care we may end up with less ship for the same or greater cost by attempting to introduce a new submarine design. Recently released results of a Navy study that examined the feasibility and costs associated with a variety of possible attack submarine designs show a 20 percent savings from shifting to procurement of a new, smaller submarine.[21] While details are not yet available the study appears to postulate a totally new design, resulting in a ship with capabilities somewhere between those of the existing *Sturgeon* and *Los Angeles* classes. It may yet be possible to achieve greater savings by simply reopening the *Sturgeon* production line; if, however, the 20 percent reduction in cost determined by the Navy study is the best that can be obtained, then even shifting to this less costly ship is unlikely to allow substantial increases in attack submarine construction.

A second risk involved in construction of a reduced cost SSN, especially one that is only a minimal redesign of the *Sturgeon* class, is that such a ship is a technological step backwards and flies in the face of the implications of the

accelerating tempo of technological change. There is no totally satisfactory resolution of this problem. One approach might be the application of the so-called SEAMOD concept now employed for new surface ships. In this design approach electronics and other sophisticated equipment is deliberately designed to facilitate future modular replacement with improved equipment.[22] Such a design approach is particularly worthwhile if (as it should be) a design objective of any new SSN is to increase drastically the time between overhauls, ideally to the point of requiring only a single midlife refueling overhaul. However, modular design has its limits. The greater the redesign from the existing basic *Sturgeon* platform, the more likely costs are to increase. Even if the modular concept can be fully implemented for "black boxes" at acceptable cost, it probably cannot be applied to the basic propulsion plant or auxiliary systems. Thus a redesigned submarine of the *Sturgeon* class represents a gamble that present U.S. propulsion capabilities will be adequate into the 21st century. There is a substantial risk here, but it is less than the risks involved in facing the Soviet Navy of the 1990s with a drastically smaller submarine force.

Conclusions. The fundamental argument of this paper can be stated as a series of assertions: Submarines are important under most future war scenarios. They are also expensive; as a result we will soon have fewer of them. Things aren't going to get better. There is no single solution. Nonetheless we must do something and do it soon. The exact steps we take may be less important than that we do *something*, for ships, especially submarines, take time to build and we will fight with what we have on hand when the war starts.

This analysis of alternatives suggests that there is no single answer to the problem of declining submarine force levels in the 1990s and that a combination of approaches is required. Specifically the analysis indicates that the Navy should: (1) plan on procurement of a less capable but less costly attack submarine starting in the mid-1980s, the aim to be a building rate of three per year; (2) employ the high-speed *Los Angeles*-class ships for the protection of carrier battle groups from both surface and submerged threats; (3) limit other SSNs to primarily a pure ASW role; (4) retain some *Sturgeon*-class submarines in service beyond 25 years to smooth out force levels; (5) continue efforts to improve submarine operational availability and to improve the ASW effectiveness of alternate platforms; and (6) study in detail how best to fight if we are forced to do so with a force of 50 attack submarines in the 1990s; the undesirability of this condition should not blind us to the fact that it may come to pass. One need not accept any or all of these specific alternatives, of course. But the need for some action and for decision soon cannot be escaped.

In reflecting on their lifelong study of human history, Will and Ariel Durant noted that

> War is one of the constants of history . . . . In the last 3,421 years of recorded history only

BIOGRAPHIC SUMMARY

Captain Linton Brooks, a nuclear submariner, was educated at Duke University and the University of Maryland. He has served in several nuclear submarines and in the Polaris Poseidon Plans and Programs office of OPNAV, commanded U.S.S. *Whale* (SSN 638), and was a student in the College of Naval Warfare, Naval War College in 1978-79. He is now serving in the office of the Secretary of Defense (AE).

> 268 have seen no war .... Peace is an unstable equilibrium which can be preserved only by acknowledged supremacy or equal power.[23]

The catastrophic, even apocalyptic, nature of a major war with the Soviet Union needs no elaboration. All rational men hope such a war does not take place. Yet the stark fact remains that war may come; the wise man in time of peace prepares for battle, hoping as he does so that the very act of preparation will make war itself less likely. This paper has suggested some considerations and some approaches to such preparation in the field of submarine warfare. What we must seek is not the attainment of optimum forces but the minimization of shortcomings. Distasteful as it may be, such an approach is inevitable in a world of limited resources. Regardless of our professional preference, a major building program of sophisticated and capable submarines is not likely in the near future. Some action—now—to face up to our projected shortages and soften their consequences is essential if the Navy of the 1990s is to be able to meet the challenge of deterring, or if necessary defeating, the Soviet Union.

NOTES

1. W. Graham Claytor quoted in "Navy Chief Says U.S. Has Best Submarines," *The New York Times*, 25 May 1978, p. 7:1.

2. Robert Taft, Jr., *White Paper on Defense: A Modern Military Strategy for the United States* (Washington: n.p., 1976); Naval War College undated reprint, p. G-1.

3. Drew Middleton, *Submarine, The Ultimate Naval Weapon* (Chicago: Playboy Press, 1976), p. vi.

4. Sergei G. Gorshkov, *The Sea Power of the State* (Moscow: Military Publishing House, 1976; Naval Intelligence Support Center undated abridged translation), p. 268.

5. 1967 costs from U.S. Congress, House, Committee on Appropriations, Defense Subcommittee, *Department of Defense Appropriations for 1967*, Hearings (Washington: U.S. Govt. Print. Off., 1966), p. 257. 1979 costs from James L. Holloway, *CNO Report* (1979 Posture Statement) (Washington: U.S. Govt. Print. Off., 1978), p. 93. Escalation factors from 1967 to 1979 furnished by Paul Fisher, Naval War College.

6. *Ibid.*

7. Harold Brown in testimony on 24 February 1977. U.S. Congress, Senate, Committee on Armed Services, *FY 1978 Authorization for Military Procurement, Research and Development, and Active Duty, Selected Reserve and Civilian Personnel Strength*, Hearings, pt. 1 (Washington: U.S. Govt. Print. Off., 1977), p. 605.

8. In testimony 11 April 1978, U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorization for Appropriations for Fiscal Year 1979*, Hearings (Washington: U.S. Govt. Print. Off., 1978), p. 4304.

9. W.F. Fahey, "Technology and Warship Design: Capturing the Benefits," *Naval War College Review*, Winter 1979, p. 46.

10. See for example Henry Young, "Nuclear Deterrence: The Evolving Role of Naval Forces," Unpublished Thesis, Center for Advanced Research, Naval War College, Newport, R.I.: 1978, *passim*.

11. J.H. Stevens, "Undersea Power in Maritime Strategy," Unpublished Research Paper, U.S. Naval War College, Newport, R.I.: 1964, p. 21.

12. "Future Budget Worries CNO, SECNAV," *Navy Times*, 19 February 1979, pp. 4, 20.

13. Holloway, p. 12.

14. Cost figures for "3% real growth" from Lawrence J. Korb, "Press Briefing on the FY 1978 Defense Budget and the FY 1980-84 Defense Program," Unpublished Handout, American Enterprise Institute (Naval War College Reprint): 1979, Table 3.

15. *Sturgeon*-class figures based on personal experience in U.S.S. *Whale* (SSN 638). *Poseidon* figures based on testimony of J.H. Doyle in U.S. Congress, House, Committee on Appropriations, Defense Subcommittee, *Department of Defense Appropriations for FY 1979*, Hearings, pt. 6 (Washington: U.S. Govt. Print. Off., 1978), p. 619.

16. U.S. Congress, Senate, committee on Armed Services, *FY 1978 Authorization*, Hearings, p. 3428. Data for the record provided by the CNO estimated $580 million to extend 31 *Poseidon*

SSBNs from 20-25 years and $2029 million to extend them from 20 to 30 years. Limiting components are propulsion and auxiliary systems which are similar to those in *Sturgeon*-class SSNs.

17. Compare the statements on 11 March 1977 (*ibid.*, p. 3442), which show *Sturgeon*-class retirements in 1992-2000 (a 25-year life) with J.H. Doyle testimony of 3 March 1976 showing the *Sturgeon*-class overage in 1982-1993 (20-year life). Doyle testimony in U.S. Congress, Senate, Committee on Armed Services, *Fiscal Year 1977 Authorization for Military Procurement, Research and Development and Active Duty, Selected Reserve and Civilian Personnel Strength*, Hearings (Washington: U.S. Govt. Print. Off., 1976), p. 2559.

18. "Sub's Future in Air," *New London* (Conn.) *Day*, 29 January 1979, p. 17.

19. Hyman G. Rickover testifying before Congress on 27 April 1977. U.S. Congress, House, Committee on Armed Services, Subcommittee on Intelligence and Military Application of Nuclear Energy, *Naval Nuclear Propulsion Program*, Hearings (Washington: U.S. Govt. Print. Off., 1977), p. 20.

20. Gary Hart, "The U.S. Senate and the Future of the Navy," *International Security*, Spring 1978, p. 181. See also A.R. VanSaun, "Tactical ASW: Let's Fight Fire with Fire," U.S. Naval Institute *Proceedings*, December 1976, p. 99ff.

21. Fred S. Hoffman, "Navy Study Supports Smaller Subs," *New London* (Conn.) *Day*, 5 May 1979, p. 20. See also comments by the Chief of Naval Operations on this study earlier as reported in Dan Stets, "New Submarine Design Studies," *New London* (Conn.) *Day*, 13 February 1979, p. 15.

22. See U.S. Congress, Senate, Committee on Armed Services, *Department of Defense Authorizations for Appropriations for Fiscal Year 1979*, pp. 4254, 4356.

23. Will Durant and Ariel Durant, *The Lessons of History* (New York: Simon and Schuster, 1968), p. 81