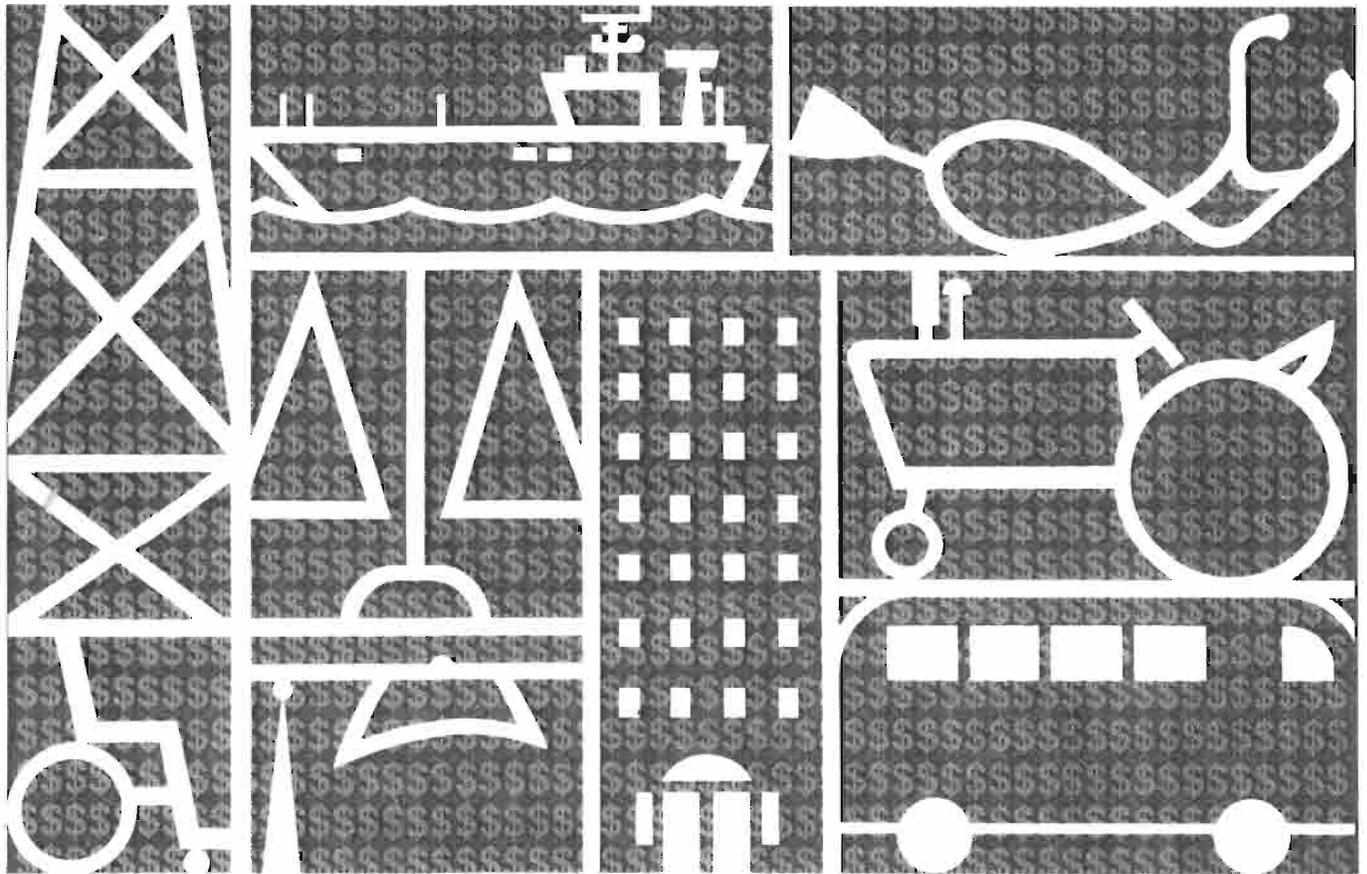


Budget Issue
Paper for
Fiscal Year 1981

Shaping the General Purpose Navy of the Eighties: Issues for Fiscal Years 1981-1985

January
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SHAPING THE GENERAL PURPOSE NAVY OF THE EIGHTIES:
ISSUES FOR FISCAL YEARS 1981-1985

The Congress of the United States
Congressional Budget Office

PREFACE

As the Congress decides upon budget targets for the defense function (050) in the First Concurrent Resolution on the Budget for Fiscal Year 1981, the appropriate size and cost of the naval shipbuilding program will be one of the most important issues. Decisions about the size of the fleet and the types of ships that might be added to current forces will be tied to assumptions about the Navy's major wartime and peacetime missions.

This budget issue paper, prepared at the request of the Senate Budget Committee, devotes primary attention to the choice between adding a smaller number of highly capable, but expensive warships or adding a large number of relatively less capable, but less expensive warships. The paper examines this trade-off between "quality" and "quantity" in terms of the alternative mission orientations that the Navy might pursue. These are offensive strike operations against Soviet forces near the Soviet homeland; defensive operations to protect convoys in a NATO/Warsaw Pact conflict, and projection and presence operations in Third World regions. In accordance with CBO's mandate to provide objective analysis, the paper makes no recommendations.

This paper was prepared by Dov S. Zakheim, who served as project leader, Andrew Hamilton, Marshall Hoyler, and Peter Tarpgaard of the National Security and International Affairs Division of the Congressional Budget Office, under the general supervision of David S.C. Chu and Robert F. Hale. The authors gratefully acknowledge the contribution of Edward Swoboda, who prepared the cost estimates. Helpful comments on earlier drafts were provided by James Capra, Donald Henry, Sue Leverone, Carol Phillips, Emery Simon, and Nancy Swope of the CBO staff, and by Robert Weinland of the Center for Naval Analyses and R. James Woolsey of Shea and Gardner, Washington, D.C. (The assistance of external reviewers implies no responsibility for the final product, which rests solely with the Congressional Budget Office.) Patricia H. Johnston edited the manuscript; Janet Stafford prepared it for publication.

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SUMMARY

After a seven-year-long debate, the Congress approved procurement of a fifth large nuclear-powered carrier; there now remain a number of unresolved major issues relating to general purpose naval force levels and budgets. Decisions on these issues will affect the composition of the fleet throughout the remainder of this century. The most outstanding issue concerns the relationship between the fleet's size and its missions. Active force levels are currently increasing, as ships authorized in the early and mid-1970s enter the fleet, but force levels are expected to drop sharply during the late 1980s and the early 1990s because of expected ship retirements. At the same time, there appear to be increasing demands for additional naval deployments, which can only be supported by higher force levels, if current deployment patterns are preserved. Thus, the U.S. Navy not only confronts a Soviet fleet with growing capabilities to threaten U.S. and other Western fleets worldwide, but also may be called upon to project power ashore against indigenous forces in Third World areas.

The Navy, stressing Soviet naval developments in the past two decades, has accorded priority to procuring large, expensive surface ships and submarines that have significantly greater firepower and range than their smaller counterparts. The Navy acknowledges that budgetary constraints will render it extremely difficult to increase force levels significantly while procuring these costly ships.

The Congress faces, therefore, a broad choice between procuring a limited number of expensive, high-quality (high-mix) warships, which could provide the greatest capabilities in major confrontations with the Soviet Union, and larger numbers of less costly, somewhat less capable, and often more specialized (low-mix) units, which would enhance U.S. capabilities for presence and projection operations worldwide.

The greatest expected declines in force levels will occur in four ship categories: surface escorts, submarines, support ships, and mine warfare ships. The issue of quality versus quantity affects Navy shipbuilding programs primarily with respect to escorts and submarines:

- o Decisions concerning surface escorts involve a choice between procuring a small number of high-cost AEGIS ships as opposed to a larger number of less costly surface units.
- o Choices among submarine types likewise stem from emphasis on either the multipurpose capabilities of large nuclear-powered attack units such as the SSN-688, or the more specialized capabilities of smaller nuclear-powered submarines or even diesel-electric ships.

The following considerations apply to decisions regarding support and mine warfare ships:

- o Decisions affecting support ship levels depend upon the degree to which budgetary priority is accorded to major surface and subsurface warship procurement.
- o Choices about the mine warfare program are also affected by the emphasis given to larger, multipurpose ships, including mine countermeasure ships, in place of less expensive and less capable alternatives.

The following pages discuss each of these decisions as they relate to assumed U.S. naval mission priorities, Soviet capabilities, and allied contributions. Alternate choices are presented as discrete budget options.

NAVAL MISSIONS AND THEIR IMPACT ON REQUIREMENTS FOR ADDITIONAL SHIPS IN THE 1980s

As the Congress debates fiscal year 1981 shipbuilding issues, it will consider the priority of various Navy missions. The Navy has three broad missions, apart from its contribution to the nation's strategic nuclear deterrent. Two of these missions apply in wartime: sea control, which seeks to ensure the safe passage of friendly shipping across selected transoceanic sea lanes; and power projection, which uses sea-based firepower against shore targets. The third mission, peacetime presence, consists of the routine deployment and operation of ships overseas.

The Navy currently attaches highest priority to the sea control mission in a worldwide NATO war with the Warsaw Pact. It states that sea control in such a war requires not only defensive operations to defend the immediate vicinity of convoys, but also

offensive naval attacks on Soviet forces near Soviet territory or bases, to which it gives especial emphasis. On the other hand, the Navy assigns a lesser priority to requirements associated with Third World contingencies.

The two Navy wartime missions and the peacetime mission actually involve four distinct types of operations:

- o Offensive operations against sea and land targets in high-threat areas;
- o Defensive operations near the sea lanes to protect transiting forces;
- o Offensive operations against land targets in medium- and low-threat areas, such as Third World regions; and
- o Presence operations.

Each of these operations generates different sets of requirements for naval forces. Offensive operations in high-threat areas call for limited numbers of highly capable escorts to support the fleet's 13 aircraft carriers. Defensive operations to protect sea lanes may call for large numbers of ships if many convoys require protection. Individual ships would not need to be highly capable, however, since they would face only those Soviet units that both had the range to reach the sea lanes and had survived attacks by land-based defensive forces operating as barriers along transit routes from the Soviet Union. Offensive operations in moderate-threat areas, such as Third World regions, would require less capability from major warships than similar operations in high-threat areas. Third World operations would require larger numbers of ships, however, if several missions were undertaken simultaneously. Similarly, presence activities would not require individual ship capability, except as needed to cope with moderate threat levels. These activities would also stress the need for large numbers of ships if several additional full-time deployments were contemplated.

The Navy will retain a significant capability to conduct each of its four types of operations well into the 1990s. Until that time, the fleet will number at least 300 ships, including 12 aircraft carriers, over 75 major surface escorts, and 60 submarines. Given this base force level, should the Navy add forces on the margin of its current capabilities primarily with a view to enhance its offensive strike capability against Soviet forces

and bases in the context of a NATO/Warsaw Pact conflict? Or should it procure forces with a view both to increase its ability to conduct defensive sea-lane protection operations and to conduct a larger number of simultaneous presence and projection missions in situations that fall short of general war? The first view leads to a demand for a relatively small number of highly capable ships. The second, while requiring ships with credible offensive and defensive capabilities, stresses the need for a larger number of units, including support ships. Which view one chooses, and how that view should be reflected in naval shipbuilding programs, depends in part upon critical assumptions about:

- o Soviet naval priorities.
- o The degree of allied contributions to the Western maritime effort, particularly with respect to sea-lane protection.

FACTORS INFLUENCING U.S. NAVAL REQUIREMENTS: SOVIET CAPABILITIES AND ALLIED CONTRIBUTIONS

Soviet Capabilities

Soviet naval capabilities have improved significantly in the past two decades. The Soviet navy now poses a serious threat to NATO's sea lanes; it has also improved its ability to sustain projection operations at great distances from the Soviet Union. U.S. Navy force planning has tended to emphasize the implications of the first of these two capabilities. On the other hand, a number of more recent Soviet developments--including the introduction of Kiev-class carriers, the Backfire bomber, large amphibious ships, and capable replenishment ships--suggest an increasing Soviet emphasis on potential Third World intervention and presence operations.

Although the introduction of new, long-range systems has enhanced the Soviet navy's capability to attack the sea lanes, the demands of this mission cannot explain all, or even most, of recent Soviet naval developments. This raises the serious question of whether the U.S. Navy should continue to assign highest priority to procuring offensive forces best suited for strikes to support a sea-control effort. Acquisition of forces capable of defensive sea-lane protection operations, added to current U.S. strike capabilities, might be a sufficient hedge against a

Soviet sea-lane attack strategy. Additional forces could be optimized for other tasks, notably operations to protect U.S. interests against both indigenous Third World forces and a Soviet fleet capable of influencing military results in Third World crises.

Allied Contributions

The NATO allies currently could contribute more than 200 ships to a NATO maritime effort. Official allied statements indicate that all but 60 to 70 of these ships are likely to be required for missions in local European waters, missions to which the United States is not expected to contribute. These 60 to 70 ships could provide sufficient protection for convoys only under the most optimistic circumstances; the actual requirement could exceed 200 ships. Thus, U.S. defensive forces--already required for protection of U.S. carrier task forces, underway replenishment groups, amphibious groups, and perhaps convoys to Asia--could also be required for transatlantic convoy escort duties.

Moreover, despite overall improvements in fleet quality, many allied ships are obsolescent, and only some NATO countries--notably Great Britain, Belgium, the Netherlands, and the Federal Republic of Germany--are committed to substantial modernization programs. The allies, particularly those in Northern Europe and Japan, could match their increased ship quality with some additional procurement. For example, Great Britain, Canada, and Denmark might increase their escort force levels. Belgium and Denmark could increase their mine countermeasure ship levels. With these efforts, the United States could more easily devote its shipbuilding resources to construction of units to support other missions, such as the aforementioned tasks of attacking Soviet forces and/or bases and projecting power in Third World areas.

MAJOR SHIPBUILDING DECISIONS FOR FISCAL YEAR 1981

Different views about U.S. mission priorities (and their relationship to assessments of Soviet and allied capabilities) interact with the quality versus quantity issues that dominate budget choices for fiscal year 1981. These choices arise both between specific classes of ships of similar type, and with respect to the shipbuilding priorities assigned to different types of ships that will require modernization in the 1980s.

Surface Ships

In fiscal year 1981, what should be the procurement mix of AEGIS air defense cruisers (CG-47), smaller guided missile ships (FFG-7), and other surface warships? An AEGIS cruiser, which is primarily an escort for aircraft carriers, costs about \$820 million. ^{1/} The Department of Defense's (DoD) fiscal year 1981 five-year shipbuilding plan seeks funds for two AEGIS ships in fiscal year 1981. It also includes procurement of four less costly (\$260 million each), but less capable, FFGs. As currently configured, these ships are intended as antisubmarine escorts for replenishment ships or convoys.

The Navy, concerned about its operations in high-threat environments, supports a larger AEGIS program, which would result in a force of 24 AEGIS cruisers. The Navy gives much lower priority to procurement of FFG-7 ships. Consistent with the Navy's preferred approach, the FFG-7 program could be terminated after procurement of three ships in fiscal year 1981.

Emphasis on declining ship numbers, however, could support arguments for an even larger FFG-7 program for fiscal 1981 and ensuing years than DoD has proposed. That program could be funded partly at the expense of AEGIS ship procurement. Three FFG-7s could be acquired for the investment cost of one CG-47. If suitably modified with systems currently in development, three FFG-7s would provide greater aggregate engagement range, fire-power, and survivability for anti-air, antisurface, and anti-submarine warfare than one CG-47. Procurement of modified FFG-7s could be coupled with procurement of small aviation ships (VSS). If modified FFG-7s served as escorts for VSS ships, the resulting task forces would have considerable offensive capabilities, suitable for missions in all but the highest-threat areas.

Submarines

How many and what types of submarines should the Congress fund in fiscal year 1981? The Navy has postulated a minimum requirement for 90 nuclear-powered attack submarines; DoD has supported that requirement. In order to maintain a 90-submarine

^{1/} All costs are in fiscal year 1981 dollars.

force level, an average of three submarines must be authorized each year. The cost of nuclear-powered submarines (SSNs) has risen dramatically, however. The largest, most capable SSN, the 688 class, currently costs about \$500 million. Although a recent Navy study examined less expensive submarine programs, it did not conclusively support any of them; the Navy continues to prefer procurement of three SSN-688s annually.

DoD's current shipbuilding program includes only one SSN for fiscal year 1981. The Secretary of Defense prefers a smaller nuclear-powered submarine, which might cost about \$350 million per unit, and includes procurement of that submarine in fiscal years 1983 and 1985 of the current five-year shipbuilding program.

Still another approach involves a combination of nuclear-powered and diesel-electric submarine construction. Diesel-electric submarines are far less expensive than nuclear variants and could permit force levels beyond 90 units for the same cost. Diesel-electric submarines cannot conduct all of the SSN's missions with equal effectiveness, however. The U.S. Navy has not added a diesel-electric submarine to the fleet since the 1950s.

Support Ships

Should the Congress fund procurement of tender and repair ships in the current five-year program? The proposed fiscal year 1981 program provides for no such procurement, although tender and repair ships are among the oldest ships in the active fleet. Possible demands for higher levels of naval operations in distant regions, where base support might not be available, would only increase the strains on this aging force. The Navy places its construction priorities on major surface escorts and submarines. The Congress might wish to consider proposals for accelerating the modernization of support ships.

Mine Warfare Ships

Should the Congress fund a new program for deep-water mine countermeasure (MCM) ships and, if so, what ships should be included in that program? The Navy plans to request \$90 million for the first of a new class of ships to counter deep-water mines. These ships would provide some defense against the large stockpile of sophisticated Soviet mines that can threaten allied surface ships and submarines. The MCM ships would replace the three

obsolete minesweepers currently in the active fleet, as well as augment the reserve force of 22 aging minesweepers. The Navy's program for nine MCM ships in the next five years might not provide enough units for the fleet, however. It also might not fully account for less costly approaches to deep-water mine warfare (such as emplacing minesweeping equipment on commercial ships) that other nations are expected to adopt. Accordingly, the Congress might wish to reexamine and adjust the Navy's program in this area.

PROGRAM IMPLICATIONS OF ALTERNATIVE NAVAL MISSION ORIENTATIONS:
OPTIONS FOR FISCAL YEARS 1981-1985

The preceding budget issues can be organized as distinct optional packages for the 1981-1985 five-year shipbuilding plan. These packages draw upon alternative approaches to U.S. mission priorities and alternative assessments of Soviet capabilities and potential contributions by U.S. allies in a NATO/Warsaw Pact conflict. Table S-1 outlines the relationships between these assumptions and the options considered here.

These options exclude major Navy research programs, such as new hull designs, which are unlikely to affect shipbuilding budgets before fiscal year 1985. Option I is the DoD shipbuilding budget of \$34.6 billion for fiscal years 1981-1985. Option II has been constructed with a higher budget level of \$39.2 billion to accommodate stated Navy priorities for fiscal years 1981-1985. Options III and IV seek to reflect the impact of alternative assumptions on naval programs and budgets. Designed to illustrate force level alternatives within DoD's five-year budget constraints, Options III and IV provide relatively smooth shipbuilding and funding profiles for fiscal years 1981-1985. The five-year funding total for each option is organized so that it does not significantly depart from proposed DoD funding levels for fiscal years 1981-1985.

Option I: Maintaining a High/Low Mix Approach for Sea-Lane Protection

This option would accept the view that U.S. naval planning priorities should emphasize protection against a Soviet attack on the sea lanes. It would, therefore, balance the demands of the two aspects of sea control--that is, both offensive strikes against Soviet forces, and possibly bases, and defensive

TABLE S-1. FOUR APPROACHES TO THE FISCAL YEARS 1981-1985 SHIPBUILDING PROGRAM

Assumptions About			
Mission-Oriented Emphasis for Fiscal Years 1981-1985 SCN Budgets	Nature of Soviet Naval Development	Allied Contributions 1981-1985	U.S. Priorities for Shipbuilding 1981-1985
I. Protect sea lanes primarily by means of defensive forces for convoys supplemented, where feasible, by offensive operations.	Soviet mission emphasis is to disrupt sea lanes to Europe in a major war; other possible missions secondary.	Allies will not expand their contribution beyond current levels of effort.	Need for high/low mix balance to protect sea lanes; limit shipbuilding costs.
II. Protect sea lanes primarily by means of offensive strikes on Soviet forces in/near Soviet bases.	Same as I.	Allies to expand their contribution to low-mix sea-lane protection areas; that is, ASW, escort, and mine warfare.	Need to emphasize high mix where United States has comparative advantage; relax budget constraints.
III. Maintain sufficient forces to conduct presence/projection in Third World areas against indigenous forces with/without Soviet support.	Critical Soviet missions may be SSBN protection and/or Third World operations; sea-lane defenses needed only in vicinity of convoys.	Allies could increase their contribution to sea-lane defenses; United States must press for larger allied shipbuilding programs for low-mix ships, such as ASW escort, and mine warfare units.	Need for improved mix to support offensive missions outside NATO area.
IV. Same as III.	Same as III.	Allies will not expand their contribution beyond current levels of effort.	Given current budget constraints, need to balance capabilities for non-sea-lane operations with requirement to deter Soviet anti-sea-lane operations.

operations to protect sea lanes in the vicinity of convoys. It assumes that U.S. allies will not expand their shipbuilding programs beyond currently planned levels, so that the U.S. Navy will have to continue to provide some forces for convoy protection. While this option would add more new ships to Navy force levels than Option II, it would place little emphasis on expanding forces for multiple Third World contingencies.

This program is similar to DoD's proposal for fiscal years 1981-1985. Table S-2 indicates that it would procure 19 ships in fiscal year 1981, at a cost of \$5.6 billion. Table S-3 shows that 101 ships would be procured between fiscal years 1981 and 1985, at a cost of \$34.6 billion. The high/low mix would call for buying two AEGIS ships (geared to a total force of 18 units) and four FFG-7s in fiscal year 1981, and 16 and 15 of these ships, respectively, in the five fiscal years 1981-1985, to provide an additional margin of carrier air defense and convoy escort protection to offset anticipated allied shortfalls in this area. It would procure only one SSN-688 annually until fiscal year 1983, at which time it would begin the transition to a class of smaller, less expensive nuclear-powered attack submarines.

Finally, this option would include a mine countermeasures program of nine ships to provide for sea-lane protection against Soviet mine warfare threats. Because of allied shortfalls, the demand for MCM ships would stem from convoy protection needs as much as from the requirements of protecting task forces on offensive missions.

Option II: A High-Mix Naval Program Emphasizing the Offensive Strike Mission in a NATO/Warsaw Pact War

The Congress could support the view that the U.S. Navy should procure those units that would most enhance its capability to conduct offensive strike operations near the Soviet homeland, even if the resulting program added fewer new ships to Navy force levels. This approach would reflect the assumptions that (1) it is more important to acquire additional resources for offensive strikes to limit Soviet attacks on the sea lanes and (2) most of the requirements for defensive sea-lane protection could be met by increased procurement programs of U.S. allies. Because this option would emphasize quality over quantity, it would place less emphasis on enhancing the Navy's ability to operate in Third World contingencies.

TABLE S-2. U.S. NAVAL FORCE OPTIONS FOR FISCAL YEAR 1981: COSTS IN MILLIONS OF FISCAL YEAR 1981 DOLLARS

	Options (Mission Priority)							
	I		II		III		IV	
	(Strike and defensive operations for sea control)		(Strike operations for sea control)		(Third World operations)		(Third World operations and defensive operations for sea control)	
	Number	Cost	Number	Cost	Number	Cost	Number	Cost
Ships Procured								
VSS	-	--	-	--	-	30 <u>a/</u>	-	30 <u>a/</u>
CG-47	2	1,630	3	2,500	1	820	1	820
FFGX	-	--	-	--	8	2,040	-	--
FFG-7	4	1,020	3	770	-	--	9	2,300
SSN-688	1	460	3	1,400	1	460	1	460
SSN(FA)	-	20 <u>a/</u>	-	--	-	--	-	--
SSX	-	--	-	--	-	--	-	--
MCM	-	--	-	--	-	--	-	--
AD	-	--	-	--	-	--	1	380
AR	-	--	-	--	1	330	1	330
DDGX	-	--	-	--	-	--	-	--
DDG-2 <u>b/</u>	-	--	-	--	3	580	-	--
Subtotal	7	3,130	9	4,670	14	4,260	13	4,320
Other Ships in Fiscal Years 1981-1985								
SCN Plan	<u>12</u>	<u>2,470</u>	<u>12</u>	<u>2,470</u>	<u>12</u>	<u>2,470</u>	<u>12</u>	<u>2,470</u>
Total SCN	19	5,600	21	7,140	26	6,730	25	6,790
Missiles Procured <u>c/</u>								
Tomahawk	-	--	-	--	-	--	-	--
Research and Development <u>c/</u>								
Shipboard air defense	-	--	-	--	-	50	-	--
Total	N/A	5,600	N/A	7,140	N/A	6,780	N/A	6,790

a/ Advance funding for fiscal year 1982 program.

b/ Conversion program.

c/ Programs in addition to those included in current fiscal years 1981-1985 defense plan.

TABLE S-3. U.S. NAVAL FORCE OPTIONS FOR FISCAL YEARS 1981-1985: COSTS IN MILLIONS OF FISCAL YEAR 1981 DOLLARS

	Options (Mission Priority)							
	I		II		III		IV	
	(Strike and defensive operations for sea control)		(Strike operations for sea control)		(Third World operations)		(Third World operations and defensive operations for sea control)	
	1981-1985 Program	1995 Level	1981-1985 Program	1995 Level	1981-1985 Program	1995 Level	1981-1985 Program	1995 Level
Ships Procured								
VSS	-	-	-	-	2	2	2	2
CG-47	16	18	19	21	5	7	5	7
FFGX	-	-	-	-	32	32	-	-
FFG-7	15	55	3	43	-	40	45	85
SSN-688	5	40	19	54	4	39	4	39
SSN(FA)	6	6	-	-	-	-	-	-
SSX	-	-	-	-	7	7	7	7
MCM	9	9	9	9	3	3	9	9
ADX	-	-	-	-	3	8	1	6
ARX	-	-	-	-	3	3	2	2
DDGX	1	1	1	1	1	1	1	1
DDG-2 a/	-	-	-	-	15	15 a/	-	-
Subtotal	52	N/A	51	N/A	75	N/A	76	N/A
Other Ships in Fiscal Years 1981-1985								
SCN Plan	49	N/A	49	N/A	49	N/A	49	N/A
Total Ships	101	N/A	100	N/A	124	N/A	125	N/A
Total Costs b/	34,600	N/A	39,210	N/A	34,380	N/A	34,000	N/A

a/ Conversion program.

b/ Includes associated missile procurement and research and development costs.

Consistent with this view, the Congress might authorize an annual procurement level of four CG-47 cruisers and four SSN-688 submarines to enhance the capabilities of carrier task forces for offensive strikes against Soviet forces. The aim of the AEGIS program would be to provide two CG-47s for each of the 12 active carriers that will operate after 1985. The submarine program would also ensure that modernization of the current 90-unit submarine fleet would continue, by replacing older SSNs with more capable substitutes. Under this option, FFG-7 procurement would terminate in 1981, since these ships would not operate with carrier forces. Finally, the option would include the Navy's proposed mine countermeasure ship program, to enhance the Navy's ability to cope with deep-water Soviet mines that could threaten forces on offensive missions.

Table S-2 indicates that this option would add 21 ships to the fleet, at a cost of \$7.1 billion in fiscal year 1981. Table S-3 shows that 100 ships--the lowest number among the four options--would be procured during fiscal years 1981-1985, at a cost of \$39.2 billion, which exceeds those of Options I, III, and IV.

Option III: Enhancing the Navy's Capability to Meet Maritime Threats Outside NATO's Operating Area

The Congress might consider that the Navy should direct its priorities to operations outside the NATO area rather than to offensive strikes near Soviet territory. This view would assume that the Soviet navy is increasingly emphasizing operations in the Third World, rather than sea-lane attack, and that U.S. allies would indeed provide the bulk of any defensive surface escorts required for sea-lane protection. These allied forces, combined with current U.S. strike and defensive capabilities, would provide NATO with a hedge against an acknowledged increasing Soviet potential to attack the sea lanes.

This approach would procure more ships than Options I or II, at the expense of fewer of the most capable units. Table S-2 indicates that this option would call for procurement of 26 ships in fiscal year 1981, with a program cost of \$6.8 billion. Table S-3 shows procurement of 124 units (including DDG-2 conversions) in fiscal years 1981-1985, at a cost of \$34.4 billion. Option III would procure fewer CG-47s, to provide limited AEGIS support for the carrier fleet. It would, however, include procurement of small carriers (VSS) for vertical/short take-off and landing

aircraft and of modified FFG-7 frigates (FFGX), carrying new air defense and offensive systems for missions in Third World areas. This option would also modernize the entire DDG-2 destroyer force to add to the fleet's overall firepower capability, and procure additional repair and tender ships to add to the fleet's sustainability in remote regions.

Emphasis on larger numbers of low-mix units would also suggest introduction of cheaper nuclear-powered as well as diesel-electric submarines for antisubmarine operations in a NATO war. U.S. diesel-electric submarines could operate with allied diesel-electric submarine forces, whose levels would be assumed to increase in keeping with an expanded allied naval contribution. The SSN-688 class submarine would be dedicated to high-endurance operations in more distant regions. This approach would aim at maintaining a submarine force of at least 90 units, at a lower cost than that associated with an all-SSN-688 force.

Finally, assumptions underlying this option would be consistent with procurement of a mix of both highly capable and somewhat less capable deep-water mine warfare ships, permitting the deployment of a larger number of units both in NATO operations and in operations outside the NATO region, such as minesweeping in the Persian Gulf.

Option IV: Enhancing Both the Navy's Sea-Lane Protection and Long-Range Operating Capabilities

The Congress might consider that the Navy should orient its procurement of additional ships toward increasing the number of units that could support long-distance operations in Third World areas. It might, however, feel that emphasis on these capabilities should be tempered by the need to provide additional resources for sea-lane protection, since this option assumes that allied programs would not expand beyond currently programmed levels. This assumption about allied contributions leads to the differences between this option and Option III.

This alternative would emphasize even more strongly than Option III the need for FFG-7 construction at the expense of a larger CG-47 force. FFG-7s could provide for convoy protection as well as for escort missions in lower-threat areas. This option, like Option III, would also call for procurement of cheaper diesel-electric submarines to create a mixed force with the SSNs already in the fleet

Emphasis on sea-lane protection would come at the expense of procuring tender and repair ships and upgrading the DDG-2-class destroyers for Third World missions. On the other hand, small aviation (VSS) ships would be procured and the mine countermeasure ship program would expand to levels suggested in Option I to account for the demands of NATO sea-lane protection (which the allies could not fully meet) and more distant operations in the Third World.

Table S-2 indicates that the fiscal year 1981 budget costs of the systems in this option would amount to \$6.8 billion for procurement of 25 ships, while the five-year cost, like that of Option III, would approach \$34.0 billion for 125 units.

PLANNING THE NAVY OF THE 1990s

Shipbuilding programs in the early 1980s will affect Navy force composition for the remainder of this century. In addition to the options outlined above, the Congress might wish to consider a variety of other new systems. Although such systems might not directly affect the fiscal years 1981-1985 shipbuilding budgets, in ensuing years they could enhance U.S. naval capabilities generally, regardless of mission orientation. Such systems could include new hull designs, such as the small waterplane area twin hull (SWATH) ship that would permit smaller ships to launch aircraft even in rough waters; new missile launcher systems, such as the vertical launch systems that would improve offensive and defensive capabilities of small missile ships; and new long-range, anti-air missile systems that could operate in cooperation with early warning vertical/short take-off and landing aircraft and also could be installed on smaller units. All of these technologies would significantly enhance the flexibility of the fleet, as well as the capabilities of smaller ships. They imply that new tactics would have to be developed for naval warfare, and that former strategies would require still more reevaluation as major warships other than carriers would take on new characteristics, freeing them from the traditionally limited roles to which they have been wedded for the past three decades.

Shipbuilding programs are the key to determining future spending levels for naval forces. Because ships operate for three decades or more, shipbuilding production profiles exert a critical influence on future manpower and training requirements, as well as on demands for maintenance and support facilities. Congressional deliberations on the fiscal year 1980 shipbuilding and conversion (SCN) budget resulted in a decision to procure a thirteenth large aircraft carrier for the Navy, at a cost of \$2.1 billion. A seven-year debate over carrier force levels was thereby resolved--at least temporarily.

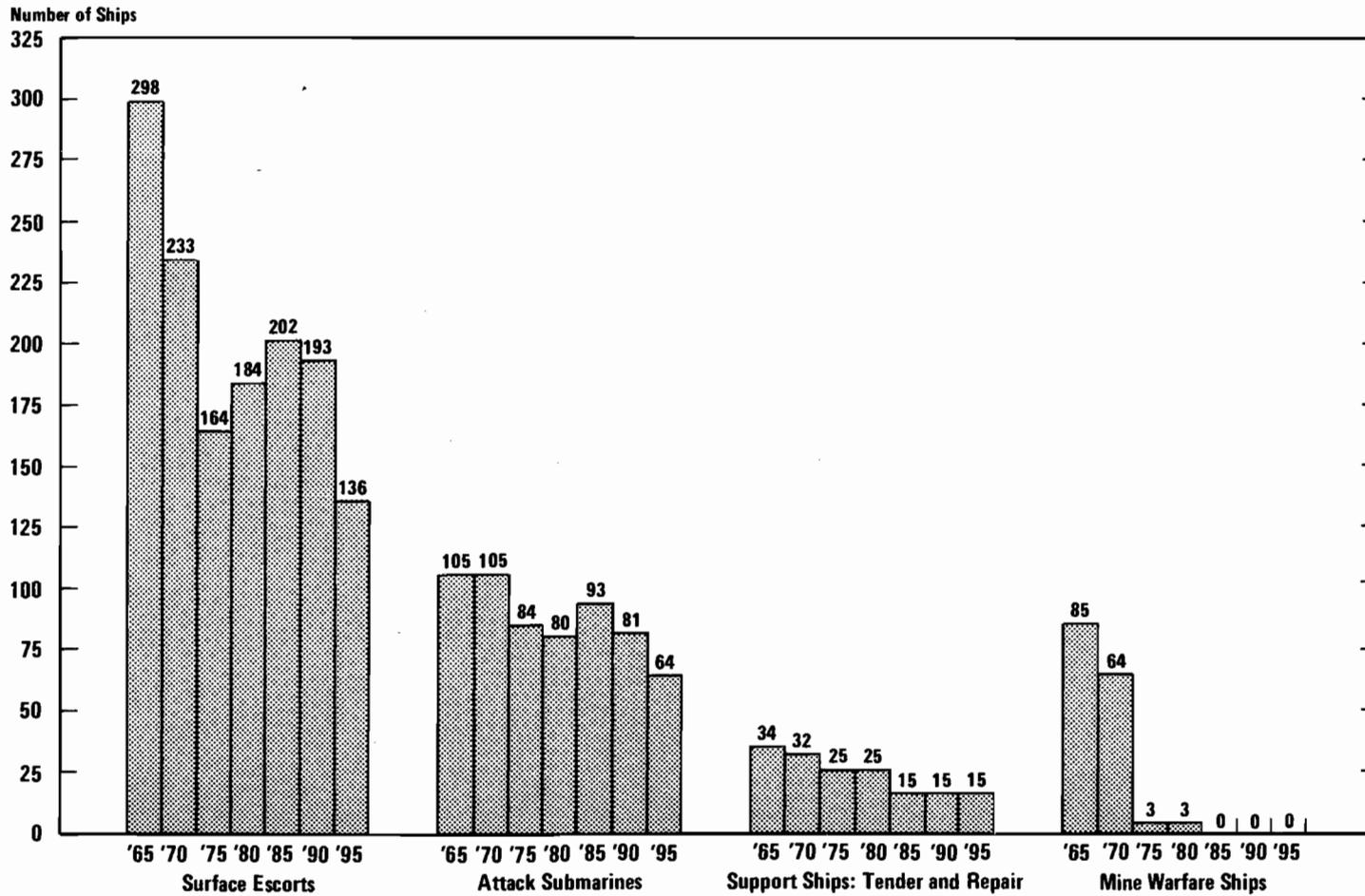
Issues relating to naval missions, force levels, and budgets, which have been overshadowed by the carrier debate in recent years, have yet to be resolved. In particular, Navy spokesmen emphasize that the size of the fleet, while currently expanding (after a protracted decline in the early 1970s), is projected to fall sharply by the end of the 1980s. At the same time, demands for additional forward naval deployments for a variety of operations in the Third World appear to be growing. These additional deployments can only be supported by higher force levels or by extending current deployment schedules, whose length already may be affecting morale negatively. 1/

This paper focuses on the mission-related requirements for four fleet categories that are likely to suffer from pronounced force level declines during the 1980s and/or the 1990s: escorts, submarines, support ships, and mine warfare ships. Figure 1, which projects future force levels exclusive of programs proposed for fiscal years 1981-1985, indicates that levels of support ships will suffer sharp declines in the mid-1980s, submarine levels will decline in the late 1980s and the 1990s, while escorts will decline sharply in the 1990s. 2/ Mine warfare levels are

1/ See Congressional Budget Office, U.S. Naval Forces: The Peacetime Presence Mission, Background Paper (December 1978), Appendix B, pp. 75-80.

2/ Force levels would increase if proposed programs were implemented. Such proposals are subject to annual reevaluation,

Figure 1.
Recent and Projected Active Force Levels, Selected Ship Types, 1965-1995



SOURCE: Based on Information provided by the U.S. Navy and estimated service lives of warships as outlined in Chapter 1, footnote 2.

presently so low that there is little room for further decline. The paper assesses the future demand for these fleet units in terms of numbers and types, on the basis of their relation to competing sets of priorities that might be assigned to various naval missions.

The issue of mission priorities was aired during last year's carrier debate, but has yet to be resolved. ^{3/} It relates directly to the choice between adding to the quality of the fleet's units or adding to the quantity of available forces. Some missions, notably those involving offensive operations in high-threat areas, such as the waters near Soviet territory, demand that individual ships be the most capable of their type. Other missions, such as the need to maintain forces on regular stations worldwide in order to reassure allies and deter potential

change, and substitution by alternative programs, such as those outlined in the body of this paper.

Estimates of the service lives of ships are subjective. Most derive from the nominal service lives for ships set by the London Treaty for the Limitation of Naval Armament in 1936 and adopted in an amendment to the 1938 Vinson-Trammell Act. The most recent service life estimates appeared in a report by the Congressional Research Service, which expanded upon updated figures presented in a 1976 CBO staff working paper. This study adopts the CRS estimates of 25 years for ballistic missile submarines, attack submarines, and frigates; 30 years for destroyers, replenishment ships, and minor support ships; and 45 years for carriers. Based on current fleet experience, however, this study assumes a 35-year service life for cruisers displacing more than 7,500 tons, as opposed to the 30-year life assumed by CRS. See Alva M. Bowen and Edmund J. Gannon, Naval Shipbuilding Costs: A Projection, Congressional Research Service (May 1979); and Congressional Budget Office, U.S. Naval Force Alternatives, Staff Working Paper (March 1976).

^{3/} See Congressional Budget Office, Navy Budget Issues for Fiscal Year 1980, Budget Issue Paper for Fiscal Year 1980 (March 1979), especially pp. 48-50; and Congressional Budget Office, Planning U.S. General Purpose Forces: The Navy, Budget Issue Paper (December 1976, reprinted July 1978), especially pp. 38-52.

adversaries (the peacetime presence mission), may place greater emphasis on numbers of units. ^{4/} In this case, actual numbers would depend on the preferred number of simultaneous operations that planners contemplate. Not all warships in the various task forces operating simultaneously worldwide are likely to require the same level of capability, however.

It should be noted that, even with the projected decline in fleet size, the Navy of the 1990s will retain more than 300 active units, including at least 12 aircraft carriers. These carriers provide the bulk of the Navy's offensive firepower and will continue to do so for the remainder of this century. Thus, the choices addressed in this paper are choices at the margin. They primarily involve roughly equal budget trade-offs between larger numbers of less costly ships and fewer numbers of more costly and capable units. This paper therefore asks: With an already capable core fleet, what ordering of mission priorities should determine the manner in which ships are added to the Navy?

EXTERNAL FACTORS AFFECTING CHOICES AMONG NAVAL PROGRAMS: SOVIET CAPABILITIES AND ALLIED CONTRIBUTIONS

To a great extent, perceptions of mission priorities and choices among shipbuilding strategies that reflect those priorities depend upon an evaluation of two key factors--Soviet maritime capabilities and intentions and potential allied contributions to U.S. naval efforts. The Soviet navy poses the greatest threat to U.S. maritime interests; it is primarily against that threat that U.S. naval planning and programming is, and must be, directed. ^{5/} Recent Soviet developments, notably introduction of Kiev-class aircraft carriers and vertical/short take-off and landing (V/STOL) sea-based aircraft, have intensified long-standing disagreements among analysts in interpreting Soviet strategy and future capabilities.

^{4/} For an example of the force implications of adding a carrier deployment, see Congressional Budget Office, U.S. Naval Forces: The Peacetime Presence Mission, pp. 79-80.

^{5/} Planning encompasses the setting of overall force requirements. Programming is the choice of a procurement strategy for immediate and future budget years.

Evaluation of recent Soviet maritime developments, particularly of their implications for naval operations in the Third World, may lead to varying interpretations of Soviet maritime objectives. These interpretations, in turn, could influence the priorities that U.S. naval planners attach to missions, as well as the degree to which shipbuilding programs for the 1980s and beyond reflect those priorities.

A second factor that could directly influence U.S. shipbuilding programs is the expected level of allied contributions to the U.S. effort, particularly in a NATO conflict with the Warsaw Pact. If judged to be sufficiently capable to meet their mission requirements, allied naval forces could supplement U.S. naval capabilities.

OUTLINE OF THE PAPER

This budget issue paper will examine the mission, programming, and budgetary implications of alternate levels of the Navy ship categories mentioned above, with special reference to varying assessments of the maritime capabilities of Soviet and other potentially hostile forces and of potential naval contributions by our NATO allies. Chapter II briefly reviews U.S. naval missions and current U.S. naval systems expected to remain in the fleet for the next 15 years. It then outlines the issues and systems that will compete for additional Navy resources in fiscal years 1981-1985. Chapter III assesses Soviet capabilities, based on the known characteristics of Soviet maritime forces, and outlines continuing uncertainties about Soviet mission priorities. Chapter IV indicates current European contributions to NATO's maritime defense, discusses ongoing European modernization programs, as well as those of other U.S. allies, and indicates what additional measures those allies might take to enhance their naval forces.

Chapter V discusses both the tactical and mission-related bases for choosing new systems for the Navy. Chapter VI examines whether current U.S. naval planning, programming, and mission priorities respond to an accurate picture of Soviet capabilities, whether they respond to other U.S. maritime needs, and whether they appear sensitive to possibilities for potential allied contributions to Western maritime goals. It suggests possible changes to U.S. programming priorities that would be sensitive to varying "threat" appraisals and to different assumptions about the nature of European contributions to NATO's maritime

defenses. Chapter VII then presents illustrative budget options for fiscal years 1981-1985, reflecting varying political/military assumptions about future Soviet naval priorities and future allied contributions to NATO that provide the context in which U.S. naval forces will operate during the remainder of this century.

CHAPTER II. U.S. NAVAL FORCES: MISSIONS, CAPABILITIES, AND CHOICES AMONG ADDITIONAL SYSTEMS

The Navy conducts three general types of nonstrategic operations:

- o Sea control is the protection of friendly shipping and forces from enemy attacks in selected ocean areas.
- o Projection is the ability to launch sea-based attacks ashore by means of aircraft, guns, or Marine forces.
- o Presence connotes a variety of activities, such as port visits and training exercises in distant waters. 1/

The first two missions are wartime activities; the last, a peacetime operation.

Depending upon strategy and circumstance, the two wartime missions could be quite distinct or, in some cases, they might be virtually inseparable. For example, in the event of a requirement to protect convoys transiting to Europe to support NATO in a conflict with the Warsaw Pact, the sea control mission could be interpreted in one of two ways. First, broadly interpreted, it would involve not merely immediate defense of convoys, but also offensive strikes against the Soviet fleet or even against Soviet bases. This view, to which the U.S. Navy adheres, stresses the importance of limiting the number of attackers before they can reach the sea lanes; it therefore subsumes power projection as an aspect of sea control. 2/

1/ A more extensive discussion of the various types of presence operations appears in Congressional Budget Office, U.S. Naval Forces: The Peacetime Presence Mission, Background Paper (December 1978), pp. 5-6.

2/ See statement of Admiral Thomas B. Hayward, in Department of Defense Appropriations, Fiscal Year 1980, Hearings before the Senate Committee on Appropriations, 96:1 (1979), Part I, pp. 885-86.

Second, a narrower interpretation of the sea control mission in a NATO/Warsaw Pact war would stress immediate defense of convoys, augmented by defensive barriers of air and sea forces operating from land bases along likely Soviet routes to the sea lanes. 3/ In this view, offensive operations--power projection--would be an entirely separate mission, undertaken for purposes other than sea-lane defense. 4/

Power projection would be viewed somewhat differently in the context of Third World operations. In this case, the absence of serious threats to naval offensive forces renders sea control a secondary, if still necessary, aspect of U.S. naval operations. Requirements for projection capability blur with those for peacetime presence, however, since it is the capability to project power that makes presence credible. 5/

It can be seen that the two Navy wartime missions and the peacetime mission actually involve at least four distinct types of operations:

- o Offensive operations against sea and land targets in high-threat areas, such as Soviet forces near or on Soviet territory;
- o Defensive operations to protect transiting friendly shipping;
- o Offensive operations against land targets in medium- and low-threat areas, such as Third World regions; and
- o Presence operations.

3/ The location of and requirements for such defensive barriers are discussed in detail in Chapters III and IV.

4/ See Congressional Budget Office, The U.S. Sea Control Mission: Forces, Capabilities, and Requirements, Background Paper (June 1977); and Congressional Budget Office, Navy Budget Issues for Fiscal Year 1980, Budget Issue Paper for Fiscal Year 1980 (March 1979).

5/ See Congressional Budget Office, U.S. Naval Forces: The Peacetime Presence Mission, p. 6.

THE IMPACT OF NAVAL MISSIONS ON REQUIREMENTS FOR ADDITIONAL SHIPS
IN THE 1980s

Just as the demands of the Navy's various missions overlap to some degree, so, too, the individual capabilities of many Navy units can be applied to more than one mission. Indeed, the Navy has emphasized procurement of general purpose ships in order to facilitate their employment in a variety of settings. In particular, the Navy's carriers, which are and for some time will remain the core of the fleet, are as flexible as the variety of aircraft that can be deployed aboard them. They can be configured for offensive operations or for primarily defensive operations such as anti-air and antisubmarine warfare. 6/ Many of the approximately 75 1970s-vintage surface ships that are in the fleet now or under construction also carry both offensive and defensive systems. 7/ These units will remain in service for at least two decades. Even the nuclear-powered submarine, traditionally viewed as primarily an antisubmarine warfare asset, now operates with carrier strike groups. The 60 nuclear-powered submarines that will remain in the force well into the 1990s (see Figure 1 on p. 2) could become a potent offensive fleet arm as well, when outfitted with new cruise missiles such as the Harpoon and Tomahawk. 8/

Mission requirements will affect future shipbuilding budgets to the extent that the current multimission core of the fleet falls short of specific mission-oriented needs. Different missions will impose different demands on those budgets, with

6/ See Congressional Budget Office, Planning U.S. General Purpose Forces: The Navy, Budget Issue Paper (December 1976; reprinted July 1978), pp. 26-29.

7/ Escorts are warships that protect ships they accompany. Protected ships may be armed (carriers, for example) or unarmed (merchant ships).

8/ Military Posture and H.R. 1872 (Department of Defense Authorization for Appropriations for Fiscal Year 1980) and H.R. 2575 (Department of Defense Supplemental Authorization for Appropriations for Fiscal Year 1979), Hearings before the House Committee on Armed Services, 96:1 (February, March, and April 1979), Part 4, p. 497.

some demands oriented primarily to improving the fleet's quality and others emphasizing the need for increasing its size.

Offensive Strikes in High-Threat Areas

An emphasis on offensive strikes in high-threat areas would generate a requirement for adding a small number of highly capable ships to current fleet assets. The current 13-carrier force, which is projected to allow an operational force of 12 carriers until the year 2000, could support at least one major strike force operating against Soviet territory in the Atlantic or Pacific, in addition to operations in the high-threat zone of the eastern Mediterranean. ^{9/} Current escort assets are sufficiently large to meet the Navy's requirement for four antisubmarine warfare (ASW) ships to accompany each carrier. These escort levels could also support the requirement for up to three anti-air warfare (AAW) escorts for major carrier strike operations. ^{10/} None of these escorts (apart from two CG-47 air-defense cruisers under construction) possesses sufficiently modern and capable anti-air missile systems to protect carrier forces against the coordinated cruise missile attacks that the Soviet Union could launch against strike forces approaching its territory. The Navy considers that two CG-47s would be required for protection of each carrier task force, as replacements for two older AAW ships. (The CG-47s would be

^{9/} See U.S. Department of the Navy, Sea Plan 2000, Unclassified Executive Summary (March 28, 1978). See also Congressional Budget Office, Navy Budget Issues for Fiscal Year 1980, pp. 23-25.

^{10/} For all carrier escort requirements noted in this section, see LCDR Bruce M. Miller, "CV/CVN Battle Group Life Cycle Cost Comparisons," Resource Analysis Group, Systems Analysis Division, U.S. Department of the Navy (1979; processed), Unclassified Executive Summary, p. 2. Suitable ASW carrier escorts commissioned after 1965 (or authorized but not yet commissioned) include 7 nuclear-powered cruisers, 31 DD-963 destroyers, 4 DDG-993 destroyers, and 7 CG-26 cruisers. The older DDG-2 class (23 ships), CG-16 class (9 ships), and two additional nuclear-powered ships will provide AAW/ASW protection for carriers beyond 1990. See Jane's Fighting Ships, 1979-80.

supplemented by a third, older AAW ship, however.) Thus, current fleet assets would fall 22 CG-47s short of maximum carrier protection requirements, assuming that all 12 carriers available until the year 2000 were committed to strike operations in the highest-threat areas.

Operations in high-threat areas also affect the nature of requirements for submarine force levels. The current Navy requirement for 90 nuclear-powered submarines accounts not only for those used in traditional submarine barrier and open-ocean search missions, but also for those assigned to the new "direct support" mission in which submarines escort carriers. While some uncertainty exists as to whether the older missions clearly led to a requirement for 90 submarines, the addition of an escort mission could generate an even higher requirement. ^{11/} Operations in high-threat areas, especially for carrier escort duty, would, however, call for the most capable submarines, whether the force is held to 90 units or expanded beyond that level.

Similar observations would apply to the less glamorous, but important, mission of mine warfare. Operations in high-threat areas would call for the most capable mine warfare units available to counter Soviet mine warfare capabilities, regardless of the level required for the force as a whole. (Figure 1 indicates that the level of active mine warfare ships is extremely low.)

Defensive Approaches to Sea-Lane Protection

Unlike requirements for offensive operations, which principally derive from carrier force levels, requirements for defensive operations to protect the sea lanes between the United States and its allies would vary with the number of protected units. The more convoys contemplated for simultaneous transit across the Atlantic (and/or Pacific) Ocean, the more forces--surface ships, submarines, and patrol aircraft--that would be required to defend them. In the Atlantic alone, such requirements could

^{11/} For a discussion of submarine requirements, see Congressional Budget Office, The U.S. Sea Control Mission: Forces, Capabilities, and Requirements, pp. 40-48.

range from 59 to 273 escorts. 12/ In general, assumptions about convoy escort requirements are likely to generate demands for more ships than would escort requirements for 12 carrier strike groups.

On the other hand, convoy escorts could be considerably less capable, and therefore less costly per unit, than strike group escorts. They could be slower, since the protected convoys would move more slowly than carriers. In addition, they would only require defenses to cope with the residual air and submarine threats that had sufficient range to reach the open ocean from the Soviet Union and had survived forward air and ASW barriers placed along key Soviet access routes to the sea lanes. 13/

A defensive approach to sea-lane protection might also permit the use of less capable submarines for barrier ASW operations. The key to defensive barrier ASW is the quietness and detection capability of submarines, rather than their speed. Thus, slower nuclear-powered submarines, or even diesel-electric submarines, might be used as less expensive replacements for the more capable nuclear-powered submarines that the United States currently would place on the barriers. This could either reduce the current Navy requirement for 90 nuclear-powered submarines or free more of them to provide direct support for carriers.

Presence and Projection Operations in Third World Areas

Offensive and presence operations in Third World areas would also require higher force levels than offensive operations in high-threat areas, which rely primarily on carrier-centered groups.

12/ The level of the U.S. contribution to meet this requirement will depend upon levels of allied contributions (see Chapter IV). The adequacy of planned force levels to fulfill the U.S. contribution will depend not only on the task force requirements discussed above, but also on a variety of other factors (see Chapter VII).

13/ A discussion of "forward" defensive barriers appears in Congressional Budget Office, Navy Budget Issues for Fiscal Year 1980, pp. 28-34.

Current escort forces support not only forward-deployed carrier task groups and amphibious groups in the western Pacific and Mediterranean Sea, but also the five-ship Middle East Force 14/ and underway replenishment and support groups that service the forward-deployed strike forces. If task forces were organized for full-time forward deployment to other regions as well, the demand for escort forces would exceed current capabilities. For example, creation of a "fifth fleet" in the Indian or South Atlantic Oceans, with a task force centered around two capital ships (such as small aviation ships), would create a need for at least 30 additional escorts (as well as six additional capital ships to support on-station units). 15/ The 30-ship escort level would permit permanent deployment of two five-ship escort groups, thus providing each aviation ship with AAW and ASW protection, as well as supplementary offensive capabilities.

Although presence or projection operations in Third World areas could demand large numbers of additional ships, they are less likely to require ships with the same high level of capability required in high-threat areas. There is no evidence that Third World forces' levels of training (particularly for open-ocean operations by land-based aircraft or missile boats), command, control, and communications, or proficiency within an electronic warfare environment have improved commensurately (or even at all) with the increases in firepower resulting from their acquisition of precision-guided munitions. While Third World operations clearly would require adequate defenses against missile attacks, such attacks are unlikely to match the sophistication, coordination, or numbers of operations in high-threat areas (that is, mounted by the Soviet Union near its borders).

Third World operations would also require more support ships than would operations linked to a major conflict with the Soviet Union. The more remote U.S. deployments are, and the less likely

14/ This force, formerly consisting of three ships (a command ship and two destroyers), has operated in the Persian Gulf since 1948. Two surface escorts were added to the force in 1979.

15/ Approximately three ships are required to support one permanently deployed unit overseas. See Congressional Budget Office, U.S. Naval Forces: The Peacetime Presence Mission, p. 11.

that nearby bases would be available to support them, the greater would be the need for support ships such as repair and tender units. As shown in Figure 1, the current force includes 25 ships to provide tender and repair capability for 184 escorts (apart from carriers), a ratio of one support ship for more than seven escorts. That ratio will deteriorate to 1 to 13 in 1985. An emphasis on additional Third World operations would clearly call for additional support ships to sustain at least the current support ship-to-escort ratio.

Third World operations would also impose additional requirements for mine warfare ships. As Figure 1 indicates, only a few mine warfare ships remain in the active fleet. These ships would be required to support amphibious operations as well as to clear critical straits along important transit routes in remote Third World areas. The Strait of Hormuz between Oman and Iran is but one example of a critical sea area that U.S. forces might have to clear of mines in a crisis.

It can be seen that differing emphases on mission priorities for the Navy of the 1980s and 1990s could lead to differing requirements for warship capabilities and numbers. Table 1 summarizes the foregoing discussion of missions and the requirements arising from them.

CHOICES FOR ENHANCING NAVAL CAPABILITIES TO CONDUCT MARITIME OPERATIONS

Systems and budget choices for the fiscal years 1981-1985 shipbuilding budgets could respond to the demands of one or more of the missions outlined above. One approach would reflect the Department of Defense (DoD) procurement strategy throughout the 1970s, which emphasized the importance of acquiring ships that could conduct both offensive and defensive operations to forestall a Soviet threat to the sea lanes, especially those linking the United States and Europe. The ships currently in the fleet or soon to enter it result from that emphasis.

An alternative emphasis would address the demands upon the fleet to protect U.S. maritime interests worldwide, while continuing to provide sufficient capability for immediate defense of the sea lanes in the North Atlantic. Such demands might differ from those for countering Soviet fleet operations in a NATO/Warsaw Pact conflict that involve carrying the war to the attacker's homeland.

TABLE 1. CAPABILITIES REQUIRED FROM INDIVIDUAL SHIPS UNDER DIFFERENT MISSIONS

Mission: Operations/ Threat	Individual Ship Capability	Emphasis on Number of Ships for Fleet as a Whole
Offensive/ High Threat	High Offensive/ High Defensive	Low
Offensive/ Medium or Low Threat	High Offensive/ Medium Defensive	Varies with Number of Deployments/Commitments
Defensive	Low Offensive/ Medium Defensive	Probably High
Presence	Varies with Locale	Varies with Number of Simultaneous Deployments/ Commitments

The specific systems choices facing the Congress thus arise from mission-related potential additions to the Navy's current primarily multimission core. The fundamental framework that governs these choices is one of "quality versus quantity," particularly with respect to the four ship categories with the greatest expected declines in force levels: surface escorts, submarines, support ships, and mine warfare ships.

- o Decisions about surface escorts will involve a choice between procuring a small number of high-cost AEGIS ships 16/ as opposed to a larger number of less costly surface units.

16/ AEGIS is an integrated, computer-controlled air defense system, comprising a network of radars (for tracking and targeting enemy projectiles) and associated missiles and missile launchers.

- o Choices among submarine types likewise will stem from emphasis on either the multipurpose capabilities of large nuclear-powered attack units such as the SSN-688, or the more specialized capabilities of smaller nuclear-powered submarines or even diesel-electric ships.
- o Decisions affecting support ship levels will depend upon the degree to which budgetary priority is accorded to major surface and subsurface warship procurement.
- o Choices affecting the mine warfare program will also be affected by the emphasis given to larger, multipurpose ships, including mine countermeasure ships, in place of smaller and/or cheaper alternatives.

The Chief of Naval Operations (CNO) appears to prefer quality to quantity, if forced to choose between the two approaches. 17/ He has emphasized that his highest priority is continued procurement of the two most expensive multipurpose units in the fleet, apart from aircraft carriers. These are the CG-47 guided missile cruiser, which carries the AEGIS air defense system, and the large, 688-class nuclear-powered attack submarine (SSN). 18/ Both ships would significantly enhance the Navy's capability to operate in high-threat environments. But a Navy program that accorded priority to procurement of up to four ships of each type in the next five fiscal years would provide for very limited procurement of other ship types in that period, even under a regime of moderately relaxed budgetary constraints. 19/ Thus, the long-term result of such a program could be a more capable, but smaller, fleet in the 1990s.

17/ Military Posture and H.R. 1872 and H.R. 2575, Hearings, Part 4, p. 42. The CNO would, of course, prefer quality and quantity.

18/ See *Ibid.*, pp. 47, 60-61.

19/ The annual cost of four SSN-688s and four CG-47s amounts to \$5.3 billion. The fiscal year 1980 shipbuilding and construction program, as put forward by DoD and excluding Trident and costs arising out of previously authorized construction, totaled \$5.5 billion (in fiscal year 1981 dollars). All costs in this paper are in fiscal year 1981 dollars unless otherwise specified.

A second approach, reflecting reports of recent positions of the Office of the Secretary of Defense (OSD), would emphasize major defensive missions to protect the sea lanes in a war, and would be consistent not only with acquisition of fewer CG-47s (for some improvement in carrier escort capability), but also with procurement of less capable surface escorts, such as the FFG-7. The OSD position would also be as consistent with procurement of less expensive submarine types as with acquisition of SSN-688s.

Emphasis on the need to maintain naval forces for simultaneous peacetime presence and projection operations in many ocean areas worldwide--none of which would be high-threat areas--could lead in a similar direction and could militate in favor of large numbers of less costly ships for task forces with some strike capability. Such ships could include small aviation units carrying vertical/short take-off and landing (V/STOL) aircraft, FFG-7 ships modified to carry cruise missiles, and tender and repair ships to sustain lengthy operations in remote areas.

Finally, the currently low mine warfare ship force level renders requirements for these ships independent of mission priority: they are needed for defense of convoys against mines; for offensive operations in high-threat areas; and for crisis operations in Third World areas, such as the mineclearing operations at Suez, Haiphong, and Chittagong harbors.

WHICH MISSION AND PROGRAM PRIORITIES FOR THE 1980s?

Procurement decisions regarding additional naval forces hinge, therefore, on the question of whether the Navy, and DoD, should alter their current emphasis on sea-lane protection to encompass the special demands of other U.S. maritime interests. One approach that could aid in answering that question is an assessment of Soviet capabilities and intentions, especially the relative emphasis that the Soviet Union accords to the sea-lane attack mission (although such an assessment of intentions should not obscure Soviet capabilities to attack the sea lanes).

Analysis of postwar Soviet naval developments indicates that the Soviet Union now appears to have optimized its fleet for defense of its nuclear-powered ballistic missile submarine (SSBN) force and for Third World intervention and presence, although it also has gradually increased its fleet's ability to attack the sea lanes. This assessment may influence the Congress' choice between

relatively few highly capable ships and a larger number of individually less capable ships. On the one hand, a case for procuring relatively few highly capable ships could be based on the Soviet Union's concern about SSBN defense. It could be argued that a Soviet navy optimized for SSBN defense would have less capability to attack the sea lanes, and that highly capable U.S. ships would induce the Soviet Union to allocate a higher proportion of its forces to protecting its SSBNs. Such a procurement strategy would also enhance U.S. capability to destroy potential sea-lane attackers near the Soviet Union.

On the other hand, the growing Soviet capabilities for intervention and naval presence overseas might support procurement of a larger number of individually less capable ships. This would permit the Navy to respond to crises (possibly induced by a Soviet presence) without disrupting its long-standing deployments elsewhere. In addition, such procurement might provide the Navy with enough escorts to protect allied shipping in a major war through defensive operations near the sea lanes, while avoiding the risk of nuclear war that could result from offensive operations near Soviet territory.

The distribution and capabilities of allied naval forces also help to frame choices on U.S. Navy shipbuilding plans. Allied naval missions are largely defensive in nature. The allies must defend key straits, ports, and national waters from submarine, surface, or air attacks, and they could offer some protection to convoys plying the sea lanes between North America and Europe or Asia, or following petroleum routes from the Persian Gulf.

A review of allied naval forces and shipbuilding plans suggests that allied navies can make major contributions to sea control in a NATO/Warsaw Pact war. Nevertheless, their escort ships, which include many obsolescent units, could not meet the full requirement for Atlantic convoy protection in a major, prolonged contest. And they may have too few mine countermeasure ships for defense of North Sea and English Channel waters and ports. Outside the NATO area, the relatively small allied naval forces would be largely limited to local operations. Clearly, the greater the availability of allied forces, which augmented shipbuilding programs might facilitate (particularly for protection of sea lanes), the greater the flexibility with which U.S. shipbuilding programs can address the demands of other missions.

Chapter III examines Soviet mission priorities in more detail; Chapter IV addresses allied capabilities. Chapters V, VI, and VII then return to a consideration of the shipbuilding choices facing the Congress.

CHAPTER III. AN ASSESSMENT OF SOVIET NAVAL FORCES

The Soviet navy poses the primary maritime challenge to the U.S. fleet. The capabilities of the Soviet fleet are, therefore, relevant to Congressional decisions about the U.S. Navy budget.

OVERVIEW AND FINDINGS

Navy planners have long considered the Soviet navy's major wartime threat to be attacks on the sea lanes between the United States and its allies. ^{1/} Recently, they have also noted a growing Soviet capability for naval presence and/or overseas intervention in peacetime. ^{2/} The analysis presented in this chapter confirms that the Soviet fleet's capability for naval presence and intervention operations has grown, although it is still markedly inferior to that of the U.S. Navy. This analysis indicates, however, that the Soviet Union has never accorded top priority to ships and aircraft most effective for attacking the sea lanes, although many of its forces could be employed for this mission. The analysis suggests that, instead, the Soviet Union might well use its fleet to defend its nuclear-powered ballistic missile submarine (SSBN) force, as well as to

^{1/} "Geopolitical considerations have led to basic differences between the strategies of the U.S. and Soviet navies. The United States will continue to be dependent upon the free use of the seas to . . . provide wartime support for its allies, while the Soviet Union will continue to plan to deny the United States that use." Admiral Thomas Hayward, Chief of Naval Operations, Military Posture and H.R. 1872 (Department of Defense Authorization for Appropriations for Fiscal Year 1980) and H.R. 2575 (Department of Defense Supplemental Authorization for Appropriations for Fiscal Year 1979), Hearings before the House Committee on Armed Services, 96:1 (1979), Part 1, p. 859, Part 4, p. 40.

^{2/} Ibid., Part 4, p. 41. See also testimony of Rear Admiral Sumner Shapiro in Ibid., Part 4, p. 2.

conduct presence and projection operations to promote Soviet interests in the Third World.

This assessment has several implications for the naval budget choices before the Congress in fiscal year 1981 and ensuing years. On the one hand, as the preceding chapter indicated, the U.S. Navy already possesses a significant capability to mount offensive strikes against highly defended onshore bases as well as against forces at sea, including Soviet ships and planes capable of attacking the sea lanes, as well as the Soviet SSBN force. If the Congress wished to enhance the U.S. Navy's ability to threaten the Soviet fleet (including SSBNs) near or in Soviet bases, it might emphasize procurement of a few relatively expensive ships designed to operate in high-threat environments. Such a program might encourage the Soviet Union to allocate more of its forces to SSBN defense and, concomitantly, to reduce further the Soviet inclination and ability to attack NATO's sea lanes to Europe.

On the other hand, the Congress could emphasize procurement of larger numbers of less expensive ships, thus enhancing the U.S. Navy's capability for presence operations in peacetime and defensive sea control operations in time of war. The Congress might also prefer such an orientation not only to offset the Soviet navy's growing capability for naval presence and projection operations overseas, but also to enable the U.S. Navy to conduct offensive operations against potential Third World adversaries while maintaining its other long-standing deployments elsewhere and its regular fleet maintenance cycle. ^{3/} It might also prefer this procurement strategy in view of the Soviet navy's evident sensitivity about SSBN defense. Such a strategy would give U.S. leaders a means of protecting the sea lanes without having to conduct offensive operations that threaten Soviet SSBNs and, therefore, risk crossing the "firebreak" between conventional and nuclear war.

^{3/} It is extremely difficult to deploy carriers to the Indian Ocean/Arabian Sea for sustained operations, while maintaining regular Pacific deployments and scheduled maintenance activities. Recent deployments of three carriers to the Arabian Sea forced the early release of carriers from maintenance to conduct routine deployments in the Northwest Pacific. See Charles W. Corddry, "Iranian Crisis Spotlights Thinness of U.S. Naval Forces," Baltimore Sun, November 29, 1979, p. 4.

These assessments are based on a review of post-World War II Soviet naval construction programs and an analysis of current Soviet deployments, both summarized in the sections that follow. Construction programs and deployments provide indicators of the Soviet navy's mission priorities and, therefore, intentions, in addition to evidence of its capabilities. 4/

A SURVEY OF POSTWAR SOVIET NAVAL CONSTRUCTION PROGRAMS

This section examines Soviet naval construction programs since World War II and provides an overview of the capabilities of the major ships currently in the Soviet fleet. It also suggests the missions the Soviet Union envisioned for its fleet as it was built. First, this discussion divides the period from 1945 until the late 1960s into three phases, by distinguishing changes in the characteristics of the ships and aircraft with which the Soviet Union equipped its fleet during this period. It then describes in greater detail the most recent, fourth phase of Soviet naval construction. The discussion notes that in none of these four phases of postwar naval construction did the Soviet Union optimize its fleet for attacks on the sea lanes.

Phase I: "Conventional" Construction

Soviet shipbuilding activity between 1945 and 1953 gave the Soviet navy a distinctly limited capability to attack Western sea lanes. 5/ Although the Soviet Union did build some 200 diesel-electric submarines, only a small percentage of them had sufficient range to conduct serious anticonvoy operations. 6/

4/ Intentions should not be confused with capabilities. Intentions reflect a preference for using systems a particular way; capabilities reflect the varieties of ways those systems might be used. Soviet intentions are extremely difficult to discern, and tend to be perceived subjectively. Soviet capabilities more easily lend themselves to objective analysis, although even capabilities are the subject of disputes among technical experts.

5/ Western includes Pacific allies, such as Japan and Australia, as well as European allies.

6/ During this period, the Soviet Union built mostly Whiskey-class boats, which would not have been useful in attacking

Moreover, the Soviet Union apparently did not base its submarine force appropriately for an anticonvoy mission. 7/ Instead of initially basing all of its longer-range submarines on the Kola Peninsula, so as to have less restricted access to the Atlantic, it allocated many of these boats to its other fleets, whose open-ocean access has been--and is--restricted by key straits whose adjacent territories are controlled by U.S. allies. 8/

Soviet surface ships built during this period would have proved almost useless in attacking Western transatlantic shipping. Soviet destroyers did not have the range needed to attack Western sea lanes. Soviet cruisers had that range but, like all Soviet surface ships, would probably have proved extremely vulnerable to Western sea-based and land-based aircraft.

If the Soviet navy could not bring most of its strength to bear in attacking the sea lanes effectively, its ships might nevertheless have adequately performed other missions. Some naval specialists believe that the Soviet Union built these ships to counter seaborne amphibious invasion of the Soviet Union by Western navies. 9/ Others suggest that these ships may have been part of Stalin's reported plans to build an ocean-going fleet. 10/

Whatever the purpose behind the naval construction program just described, the capabilities of the resulting fleet seem

the sea lanes. During the same period, the Soviet Union began building a much smaller number of longer-ranged Zulu-class submarines. See Siegfried Breyer, "Warship Construction," in Breyer and Polmar, Guide to the Soviet Navy (Annapolis, Md.: Naval Institute Press, 1970), p. 33.

7/ See Eric Morris, The Russian Navy (London: Hamish Hamilton, 1977), p. 31.

8/ Chapter IV presents a full discussion of these "geographic choke points."

9/ See, for example, Siegfried Breyer, "Warship Construction," p. 30.

10/ See, for example, Kenneth McGruther, The Evolving Soviet Navy (Newport, R.I.: Naval War College Press, 1978), p. 10.

reasonably clear. It could operate in the seas immediately outside its main operating bases. It presented a distinctly limited threat in areas beyond that range, however, for three reasons. First, the Soviet navy lacked the network of bases available to Western navies that operated in distant oceans. Second, the Soviet navy could not carry tactical aircraft to sea, and had to rely on short-range, land-based planes for air cover. (The inventory of Soviet Naval Aviation during this period consisted entirely of fighter and light bomber aircraft that had originally been developed for use in land campaigns.) Finally, the Soviet navy had limited replenishment capability, and most of its warships had relatively short cruising ranges. As a result, Soviet warships could not sustain operations more than a thousand miles from their home ports.

Phase II: Missile Armament and Nuclear-Powered Submarines

From the mid-1950s until the early 1960s, Soviet naval shipbuilding showed dramatic changes. These changes resulted in a fleet that could pose a serious threat to Western sea lanes. The thrust of the overall program, however, has convinced most analysts that the Soviet Union primarily sought improved defenses against Western aircraft carriers during this period. Western navies had drastically reduced their active amphibious ship forces, so that seaborne invasion seemed less plausible. The U.S. Navy, however, had resumed carrier construction and planned to operate nuclear-armed aircraft from these ships. Consequently, many observers believe, the Soviet navy shifted from an anti-amphibious to an anticarrier stance. 11/

The types of surface ships, submarines, and planes that the Soviet Union acquired during this period enhanced its anti-carrier capabilities more than its anti-sea-lane capabilities. In the submarine area, for example, the Soviet Union equipped both nuclear-powered and short-range diesel-electric boats with cruise missiles. The nuclear-powered submarines' virtually unlimited endurance suited them equally for operations against carriers and sea lanes. The diesel-electric cruise missile boats had relatively short ranges, however, and thus were more appropriate for defensive operations against carriers that approached the Soviet homeland. Similarly, new Soviet naval aircraft,

11/ See Siegfried Breyer, "Warship Construction," p. 35.

particularly Badger bombers acquired by 1959, did not have the extremely long operating ranges needed to attack Western sea lanes but could threaten carriers approaching the Soviet Union. Finally, both the cruise missile submarines and rocket cruisers built in this era could launch surface-to-surface missiles at maximum effective range only if land-based aircraft provided the missiles with mid-course guidance. The ships also needed air cover from attacks by NATO aircraft based on carriers and along key routes to the sea lanes, particularly on Iceland and Britain. Because of relatively limited aircraft ranges, therefore, the Soviet Union could not use these ships optimally for sea-lane attacks.

Phase III: Antisubmarine Ships and Planes

In the late 1960s, the Soviet Union began deploying new types of surface ships and naval aircraft, and followed earlier missile and torpedo submarines with more advanced types. The Soviet Union apparently designed these surface ships and aircraft for antisubmarine warfare (ASW) roles. ^{12/} The submarines included both nuclear-powered ballistic missile (SSBN) types and cruise missile and torpedo types for attacking other ships. Obviously, the latter group of advanced submarines enhanced Soviet capabilities to conduct anti-sea-lane operations. The Soviet Union appears to have emphasized other missions, however. The Soviet navy may have intended to use these ships, both surface and submarine, as anti-SSBN units, or at least justified them politically for anti-SSBN missions. ^{13/} The United States

^{12/} The ships included two Moskva-class helicopter carriers (equipped with sonars, anti-aircraft and antisubmarine missiles, and ASW helicopters) and several Kresta II and Kara guided missile cruisers, which the Soviet Union apparently gave the same general categories of equipment. Most Western observers believe that the Soviet Union intended to use the SS-N-14 weapon aboard the Kara and Kresta II cruisers in ASW roles, and that therefore these ships' weapons are analogous to the ASW armament of the Moskva. A few analysts, however, contend that the Soviet Union designed this missile for use against surface ships. The aircraft included the Hormone-A ASW helicopter and the land-based Il-28 May maritime reconnaissance/ASW aircraft.

^{13/} This possibility is suggested by Kenneth McGruther in The Evolving Soviet Navy, p. 29.

concurrently developed longer-range submarine-launched ballistic missiles (SLBMs) that rendered the Soviet vessels incapable of successful anti-SSBN operations, however. 14/

After noting their obsolescence for the anti-SSBN mission, one analyst argues that the Soviet Union might now employ its surface ASW ships to protect its other ships and submarines from enemy attack submarines. 15/ For example, the Soviet Union might use surface ASW ships to "break" ASW barriers established by NATO attack submarines in the the Greenland-Iceland-United Kingdom (G-I-UK) gap (see Figure 2 on pp. 34-35). If successful, such an operation would permit Soviet cruise missile and torpedo submarines to attack the sea lanes, and SSBNs to move within ballistic missile range of targets in the United States.

Phase IV: SSBN Protection, Small War, and Naval Presence Missions

Recent developments suggest Soviet interest in new missions, and a fourth phase in postwar Soviet naval history. Like the other phases, this one does not reflect Soviet preoccupation with attacks on Western sea lanes. Rather, it appears geared to improving Soviet capability both to protect SSBNs and to conduct sustained operations in remote Third World areas (including attacks on U.S. forces). Evidence of this fourth phase is provided by new Soviet ships under construction, two recently introduced Soviet weapons systems (the Kiev-class aircraft carrier and the Backfire bomber), as well as Soviet initiatives in amphibious and resupply shipping.

New Soviet Construction. The Western press has reported that the Soviet Union is building a nuclear-powered, medium-sized aircraft carrier and at least two very heavy gun-armed

14/ The virtual invulnerability of U.S. SSBNs armed with longer-range SLBMs did not result solely from the greatly increased area in which they could hide. It also followed from the fact that Soviet surface ships would themselves be vulnerable to Western air attacks once they moved such long distances from Soviet territory.

15/ See William S. Lind, "The Soviet Aircraft Carrier," United States Naval Institute Proceedings (February 1977), p. 79.

nuclear-powered cruisers. 16/ This development suggests heightened Soviet interest in capabilities for naval presence and intervention. 17/ In particular, cruisers with 7.3-inch guns seem best suited for the naval presence/intervention mission.

Kiev-Class Ships. These vessels, the most recent and most impressive of what the Soviet Union terms "antisubmarine cruisers," carry both helicopters and vertical take-off and landing (VTOL) jets. Some of the Kiev's characteristics suggest that the Soviet Union designed it for use against U.S. SSBNs. It has both greater endurance and more capable air defenses than older Soviet ships. These features could represent a Soviet response to the increasing range of U.S. submarine-launched ballistic missiles (SLBMs). (Increased SLBM ranges mean that Soviet anti-SSBN units have to operate farther from Soviet bases and closer to Western air threats.) Were these the sole new features on the Kiev, the ship would represent simply an improved means of performing the anti-SSBN mission for which the Soviet Union may have built the other ASW surface ships mentioned above. Other features of the Kiev, however, suggest that it may be part of the fourth phase, in that the Soviet Union may intend to use it for different missions--in particular, to support Soviet SSBN operations.

The Soviet SSBN force consists of 34 Yankee submarines (carrying 12 to 16 missiles with a range of 1,300 to 1,600 nautical miles) and 24 Delta submarines (carrying 12 to 16 missiles with a range of 4,800 nautical miles). Because of their missiles' range, Deltas in both oceans can reach U.S. targets while virtually in home port. Unless the United States sends its carriers and escorts near Soviet waters, therefore, only U.S. attack submarines and long-range ASW planes operating near Soviet bases can threaten the Delta force. By contrast, Atlantic-based Yankees

16/ See Clarence Robinson, "Soviet Carrier Policies Shifting," Aviation Week and Space Technology (August 20, 1979), p. 14; and Drew Middleton, "Russian Navy: A New Interest in Third World," The New York Times, December 10, 1979, p. 19.

17/ Of course, the nuclear-powered carrier would probably prove very versatile. It might support naval presence and intervention, defend Soviet SSBNs from long-range Western ASW planes, or even aid Soviet attacks against critical sea lanes.

must pass through Western-controlled choke points to reach launch positions. This circumstance poses a threat to the Yankee force since the Soviet Union must either move all Yankees through these choke points before Western navies can establish ASW barriers astride them, or risk heavy losses before this force comes within range of U.S. targets.

The Kiev's primary missions could include helping Yankee submarines to break through Western ASW barriers or, alternatively, fighting Western ASW submarines and planes that threatened Delta submarines near Soviet waters. The Kiev's armament equips it to support SSBN operations better than any other Soviet ship. Endurance and anti-air armament suit the Kiev for distant operations. Hormone-A helicopters and ship-based sonars equip it for ASW against Western barrier submarines, as well as against hostile submarines that might approach the Delta's operating area. Its Forger vertical take-off and landing (VTOL) jets can shoot down long-range Western ASW aircraft that also might threaten the Delta force. Long-range antiship cruise missiles, with Hormone-B helicopters to guide them "over the horizon," give the Kiev some self-defense capability against surface ship threats.

Other capabilities of the Kiev suggest the possibility that the Soviet Union may also intend to use these ships for small wars, or for impressively "showing the flag" through its overseas presence in peacetime. For example, even though its Forger VTOL jets do not improve the Kiev's air defenses enough to defeat a determined attack by Western aircraft, they might well successfully engage the air forces of minor powers. Similarly, Forgers could perform some air-to-ground missions against African or Asian targets, possibly in support of landings by Soviet troops. Finally, carriers and their aircraft can symbolize Soviet military might both to clients and to potential adversaries.

The Backfire Bomber. This aircraft augments Soviet capabilities to perform the SSBN support and small war/naval presence missions that might be associated with a fourth phase in postwar Soviet naval history. It can also attack convoys, although Western forces can substantially reduce the threat it poses in this respect. 18/

18/ Some experts have noted the potential threat the Backfire poses to the sea lanes; others have noted that NATO can reduce this threat markedly by taking appropriate measures

The Backfire represents a significant improvement in Soviet Naval Aviation. It can attack surface ships more than 1,000 miles beyond the operating radius of the Badger bomber it replaces. 19/ Thus, the Backfire could help a campaign to support SSBNs by threatening to sink Western carriers and other surface ships, which could otherwise easily threaten Soviet ASW surface ships and Soviet land-based ASW aircraft. 20/

The Backfire might also enhance the credibility of Soviet surface ships in future Third World crises. For example, the very presence of Soviet ships, supported by Backfires within range, might serve to "neutralize" a U.S. carrier task force. 21/ In

to respond. For further discussion of these issues, see William O'Neil, "Backfire: Long Shadow on the Sea Lanes," United States Naval Institute Proceedings (March 1977); Congressional Budget Office, The U.S. Sea Control Mission: Forces, Capabilities, and Requirements, Background Paper (June 1977); and Congressional Budget Office, Navy Budget Issues for Fiscal Year 1980, Budget Issue Paper for Fiscal Year 1980 (March 1979).

- 19/ Problems involved in guiding its air-to-surface missiles (ASMs) suggest that the Backfire might not always succeed in these attacks. Soviet satellites may not be able to provide Soviet Naval Aviation (SNA) location information sufficiently precise for Backfires to launch ASMs at the approximately 150-nautical-mile maximum operational range of these missiles. As a result, the Backfire must either risk its own survival and launch its ASMs relatively close to its target, or rely on a Bear reconnaissance plane to provide such mid-course guidance for the ASMs. Either alternative considerably reduces the difficulty of defeating Backfire attacks.
- 20/ Protection of these systems might prove critical to an SSBN support campaign because Soviet SSBNs would otherwise be substantially defenseless against Western ASW attack submarines and would not have surface AAW systems to engage Western long-range ASW planes.
- 21/ U.S. carrier units, if they survived an initial "shoot-out," could eventually prevail over Soviet surface ships, since their aircraft have engagement ranges superior to those of Soviet cruise missiles. U.S. leaders might nevertheless

the Indian Ocean, for example, the Backfire might help Soviet surface forces deter Western actions, particularly if it were deployed from overseas bases. As a result, the naval Backfires may indicate growing Soviet interest--as well as growing Soviet capability--in using its navy for small war and naval presence missions.

Soviet Amphibious Forces. The reach of the Soviet amphibious fleet has steadily increased since World War II. This progression parallels that of the ships, aircraft, and ballistic missiles of the rest of the Soviet navy. The various missions associated with the first three phases of postwar Soviet naval history cannot account for the development of these ships. Long-range amphibious ships do not justify their cost if used for coastal defense, anticarrier, or ASW operations. Thus, introduction of dramatically more capable amphibious ships (like the Ivan Rogov, which appeared in 1978) supports the view that the Soviet navy has entered a fourth phase, and that one of its primary missions involves possible intervention overseas.

The growth of Soviet amphibious capabilities should not be exaggerated. The Soviet Union remains unable to conduct large-scale amphibious landings at long distances. It is, however, apparently seeking to narrow the gap between U.S. capabilities and its own, at least with respect to transporting its current naval infantry force. 22/

Replenishment Capabilities. One constraint on the capabilities of the Soviet amphibious fleet requires special attention, because it affects those of the rest of the Soviet surface

prove reluctant to use carriers against Soviet clients in a crisis, fearing Soviet naval responses. Presumably, the fact that Backfires increase the Soviet Union's chances of success in the initial engagements would increase this reluctance.

22/ That gap is currently quite wide. The 17,000-man Soviet Naval Infantry (SNI) cannot compare with the 180,000-man U.S. Marine Corps. In addition, SNI has to rely on other services for helicopter and tactical air support, materiel support, and reinforcements; the U.S. Marines do not. With respect to ships, the Soviet navy has only two amphibious ships comparable in size and capability to the U.S. Navy's. Moreover, its entire oceangoing amphibious fleet is much less capable than our own.

fleet as well. To sustain operations at long distances from their home ports, warships require either base facilities in other countries or a large and capable fleet of ships to perform repairs and to replenish fuel and other supplies. In many areas, the Soviet Union lacks such bases; relative to the U.S. Navy, it lacks such a replenishment and repair fleet.

The foregoing assessment deserves qualification in two respects. First, the tankers of the Soviet Merchant Marine represent a substantial reserve for the Soviet navy. In fact, the Soviet Union routinely charters such tankers for distant replenishment. These ships can replenish with only limited effectiveness in combat conditions, however. More important, therefore, is the fact that over the past ten years the Soviet Union has begun to build large oceangoing ships, such as the new Berezina-class fleet support ships, especially for replenishment missions. These ships can conduct high-speed replenishment operations similar to those of the U.S. Navy. If it maintains this construction program as expected, the Soviet Union's capability for supporting distant ocean operations will increase dramatically. 23/

Postwar Naval Construction: A Recapitulation

The foregoing account suggests that the Soviet Union built its naval forces for missions other than attacks on the sea lanes. A fleet structured primarily for sea-lane attacks would look very different from the fleet the Soviet Union actually built. Its submarine force would consist almost entirely of long-range boats, with armament designed for use against merchant ships thousands of miles from Soviet bases. Virtually all of these submarines would join the Northern fleet, based on the Kola Peninsula, so that they would not have to risk destruction by Western ASW forces in narrow straits before attacking Western sea lanes. Because the Soviet fleet did not have aircraft carriers, it would not have included surface ships for use against convoys. Without carriers, surface ships would be too vulnerable to Western air attack. Finally, it would not include many of the ships and

23/ Siegfried Breyer and Norman Polmar, Guide to the Soviet Navy; and Jane's Fighting Ships, 1979-80. See also testimony of Rear Admiral Sumner Shapiro in Military Posture and H.R. 1872 and H.R. 2575, Hearings, Part 1, p. 2.

aircraft that it now possesses, which appear most effective for other missions.

SOVIET NAVAL DEPLOYMENT

Consequences of Divided Fleets 24/

Geography forces the Soviet Union to divide its navy into four distinct fleets (see Figure 2). The Northern fleet operates from the Kola Peninsula, in the Barents and Norwegian Seas and in the Atlantic Ocean. Ships of the Baltic Sea fleet can also deploy to the Atlantic; those of the Black Sea fleet operate in the Mediterranean. The Pacific fleet routinely operates in the Seas of Japan and Okhotsk, but also deploys to the Bering Sea and North Pacific. In addition, it provides most of the units that operate elsewhere in the Pacific, as well as those that deploy to the Indian Ocean.

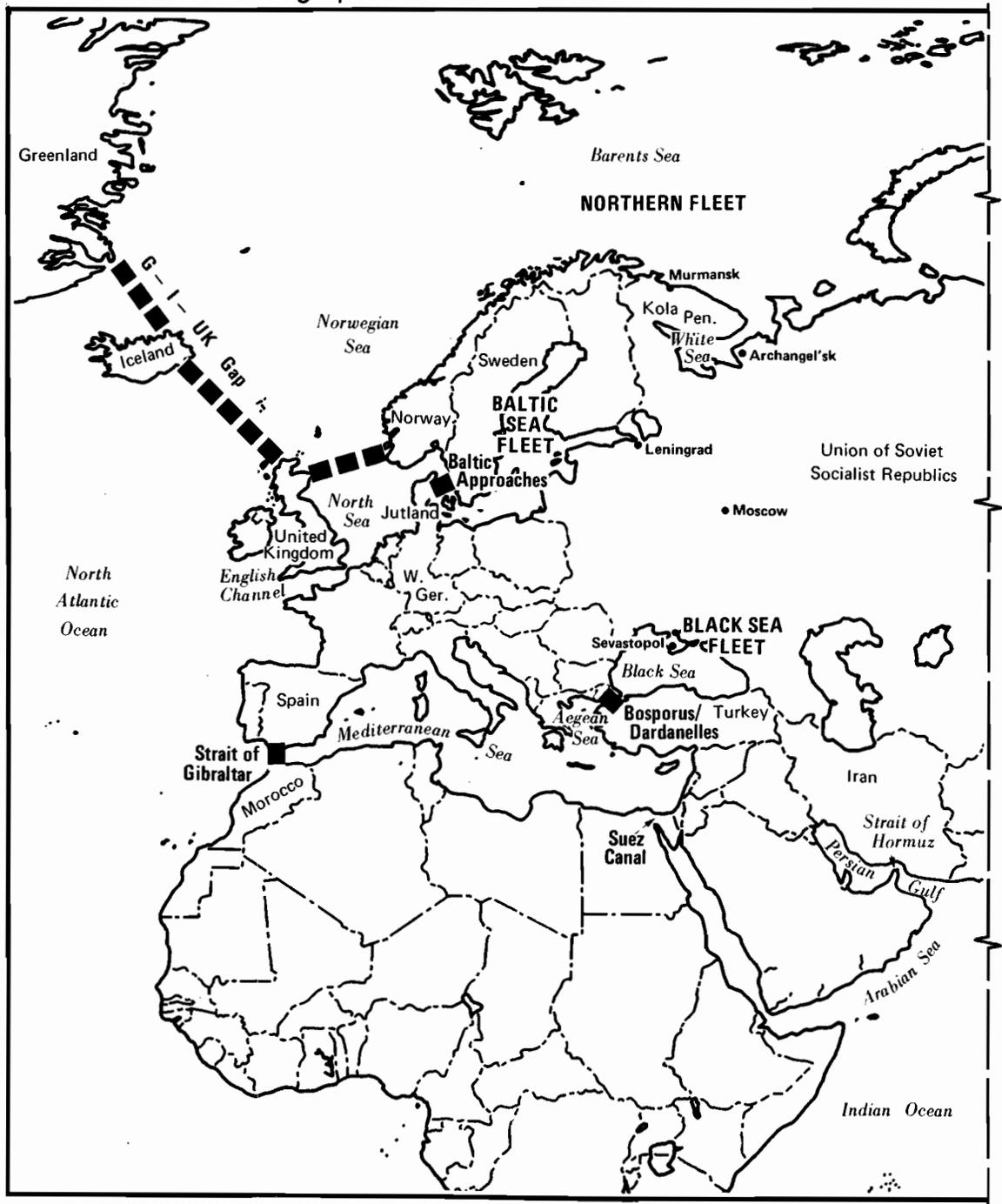
The Soviet Union can mass its separate fleets only with great difficulty. 25/ In addition, geographic choke points restrict access to the open ocean from all but one of the major Soviet operating bases (Petropavlovsk). 26/ Moreover, U.S. allies

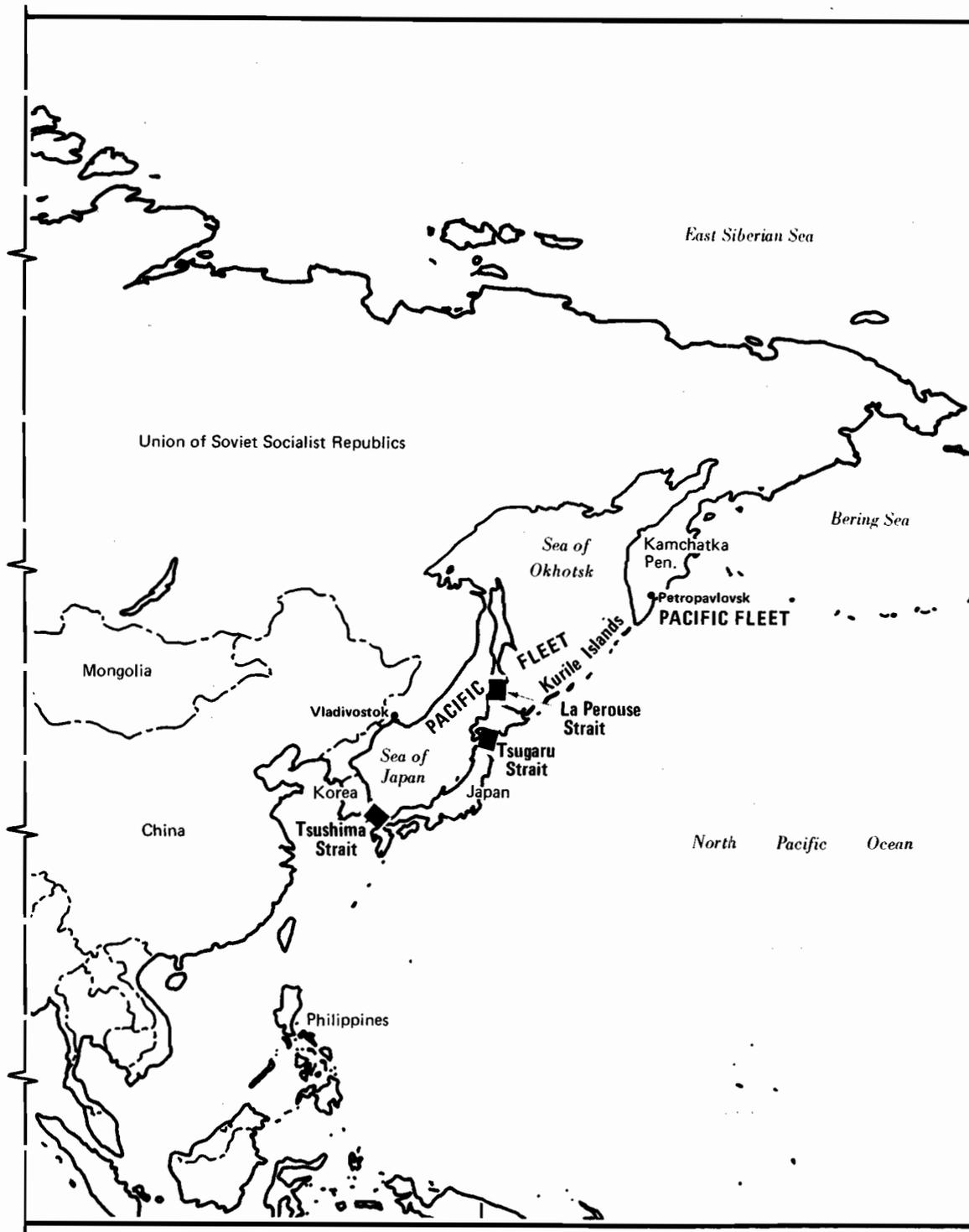
24/ The following discussion describes Soviet naval deployments in terms of Western ship types, which do not always correspond to Soviet categories. For example, the Western category "guided missile cruiser" includes some ships the Soviet Union terms "large antisubmarine ships" and some it calls "rocket cruisers." Similarly, the Soviet "large antisubmarine ship" category contains not only what Western usage terms cruisers, but destroyers as well.

25/ Two factors permit the Soviet Union to overcome some of these constraints. First, small Soviet ships can move through an extensive internal canal network that links the Black, Baltic, and White Seas. Second, and more importantly, Soviet Naval Aviation's long-range bombers can rapidly shift from any fleet operating area to another.

26/ Petropavlovsk, on the Kamchatka Peninsula, is icebound several months each year and can only be resupplied by sea or air, since few roads connect it to the rest of the Soviet Union. These circumstances sharply restrict its utility to the Soviet fleet.

Figure 2.
Soviet Fleets and Geographic Choke Points





control the territories that bound these choke points; these are discussed in Chapter IV. Thus, in the event of a worldwide war, Soviet naval forces could well meet serious challenges from mine, ship, and aircraft barriers erected by the United States and its allies. 27/

Assessing Soviet Naval Deployments

The Soviet Union's allocation of ships among its four fleets supports some Western theories about Soviet missions, and raises questions about others.

Submarine Deployment. The Soviet Union bases most of its SSBNs with the Northern fleet, and the remainder with the Pacific fleet at Petropavlovsk. 28/ These dispositions support the argument that the Soviet Union has assigned the mission of strategic strikes against the United States to most of its ballistic missile submarine force, since the SSBN force can fulfill this mission most flexibly and capably from these bases. 29/ The Northern and Pacific fleets also have most nuclear-powered cruise missile (SSGN) and torpedo (SSN) submarines. This deployment accords with the view that the Soviet navy has prepared chiefly to perform SSBN support operations. The same deployment enables the Soviet Union to attack Atlantic and Pacific sea lanes, however. 30/

27/ For a more complete discussion of this point, see Chapter IV.

28/ See Jane's Fighting Ships, 1979-80, p. 500; and Norman Polmar, "The Soviet SLBM Force," Air Force Magazine (March 1978), p. 45.

29/ Western forces might prove able to "bottle up" SSBNs in the Black and Baltic Seas, so that submarines based there could attack European targets but would be unable to threaten U.S. targets.

30/ Deployment of Yankee submarines in the Northern fleet requires crashing ASW barriers to engage U.S. targets. This deployment seems puzzling, in light of the fact that some Delta submarines are based with the Pacific fleet. Yankees could operate more freely from the Pacific, while Deltas need not crash Atlantic barriers for their longer-range SLBMs to reach U.S. targets.

Aircraft and Helicopter Carrier Deployment. Soviet deployment of Kiev-class carriers supports the thesis that current Soviet priorities focus on SSBN defense and Third World operations. Basing the Kievs with the Northern and Pacific fleets collocates them with the Soviet SSBN forces. In addition, these ships can readily deploy to West Africa from the former base, and to the Indian Ocean littoral from the latter.

Deployment of the two Moskva-class helicopter carriers to the Black Sea, however, does not directly support either the hypothesis of an SSBN protection mission or arguments about a neutralizing naval presence role for the Soviet fleet. Moskvass in the Black Sea cannot protect SSBNs, since the Soviet Union has not deployed SSBNs in that region. Moreover, Moskva-class ships cannot capably perform small war and crisis response operations. Since, as currently configured, their helicopters perform ASW tasks, not troop lift, they would not help in fighting small wars. Moskva ships have no surface-to-surface missiles with which to threaten, and thereby neutralize, Western warships, so they could offer little help in times of crisis. 31/

Deployment of Modern Guided Missile Cruisers. The Soviet Union's allocation of guided missile cruisers does not offer conclusive weight to any of the competing mission hypotheses considered in this chapter. The fact that the Soviet Union has deployed seven of its sixteen large antisubmarine ships with the Northern fleet is consistent with missions to protect Soviet SSBNs and attack American SSBNs. Neither of these missions can explain why only two of these ships are based in the Pacific, however, where the Soviet Union has located its other SSBNs and where a substantial number of U.S. SSBNs also deploy.

CONCLUSION: SOVIET CAPABILITIES AND U.S. NAVAL FORCE REQUIREMENTS

Soviet and U.S. Capabilities in a Major War

The foregoing account suggests that the Soviet Union has not built its navy primarily for sea-lane attack operations, and that it may intend to use it for SSBN protection missions instead. Nevertheless, while the Soviet navy appears not to

31/ The Soviet Union may intend to use Moskvass as training ships for ASW and SSBN-protection operations.

be optimized for an anti-sea-lane strategy, its forces have significant capabilities to pursue such a strategy. Indeed, that capability has improved in each of the navy's four phases, as newer units have significantly exceeded the range of older Soviet warships of similar type. Furthermore, deployments appropriate to SSBN protection operations are also appropriate for sea-lane attacks.

It, therefore, appears prudent for Western forces to plan to defend the sea lanes against a Soviet navy whose ability to attack those lanes is growing even while it may be optimally suited for other missions. The foregoing assessment is consistent with two approaches to the problem of sea-lane defense.

On the one hand, this chapter's assessment of the Soviet navy's potential in a major war might be used to argue for acquisition of ships appropriate to a strategy for protecting sea lanes that includes offensive strikes on Soviet forces in or near their bases. Such an argument would posit that, because of its concern with SSBN protection, the Soviet Union would be less likely to allocate a large part of its forces to sea-lane attack if the United States could threaten offensive operations in the Norwegian and Barents Seas. This argument would also posit that the United States could present such a threat more credibly if it procured additional highly capable ships that are particularly effective for this mission. Given these premises, it follows that a shipbuilding program tailored to offensive operations in high-threat areas near Soviet bases would prove an effective means of protecting the sea lanes.

On the other hand, this chapter's assessment of the Soviet navy is consistent with the conclusion that the Congress should provide the Navy with additional numbers of less capable ships appropriate to a defensive strategy for protecting the sea lanes. In this view, the risk of losses to forces conducting offensive operations against the Soviet fleet could outweigh the potential benefits, since sea lanes to Europe could be protected by other means, such as convoy escorts and land-based forces operating as advanced barriers along attackers' routes.

Supporting this conclusion is the thought that the United States should retain the option to protect the sea lanes without offensive operations because of the Soviet Union's apparent concern with SSBN defense. An offensive strategy carries the risk that the Soviet Union might initiate use of nuclear weapons

if the United States elected to attack its SSBN bases. In anticipation of these prospects, this argument would conclude that the President should be given alternative means of defending the sea lanes. Furthermore, as Chapter II indicated, the United States possesses a credible capability for offensive operations, and, therefore, threats to the Soviet SSBN force, even if it does not give high priority to acquiring additional highly capable escorts in the coming five-year shipbuilding program.

Soviet and U.S. Capabilities for Naval Presence and Overseas Intervention

In discussing lesser contingencies, the foregoing analysis suggested that the Soviet Union has increased capability for naval presence, and possibly intervention, overseas. In this regard, this assessment of Soviet capabilities conforms to that of the U.S. Navy.

Soviet naval units have freer access to the open ocean and to distant seas in peacetime. Nevertheless, the sheer distances involved substantially reduce the capability of the Soviet fleet to challenge U.S. fleet units at great distances from Soviet territory. A comparison of the Soviet Union's aggregate potential for launching antiship missiles in the northern Pacific and Indian Oceans graphically demonstrates this fact. The Soviet Pacific fleet can bring some 522 antiship missile launchers to bear against U.S. units in the northern Pacific. ^{32/} In the Indian Ocean, however, the Soviet Union can only commit a total of 374 such launchers--204 by stripping the Pacific fleet of all major warships and 170 by devoting all Black Sea long-range units to that region. ^{33/} Furthermore, as previously noted,

^{32/} See Congressional Budget Office, Navy Budget Issues for Fiscal Year 1980, Table 2, p. 36.

^{33/} The Pacific fleet figure was derived from the table cited in footnote 32, by subtracting antiship missile launchers of the Osa-class patrol boats and Badger bombers from the total. The Black Sea fleet figure was obtained by applying the same methodology to Soviet naval units assigned there, as reported in Paul Nitze, Leonard Sullivan, Jr., and others, Securing the Seas: The Soviet Naval Challenge and Western Alliance Options (Boulder, Colo.: Westview, 1979), pp. 97, 102, 108, 455-58.

Soviet at-sea replenishment and repair capabilities remain relatively limited. The Soviet navy clearly has significant capabilities for Indian Ocean operations; nevertheless, it poses a much more limited challenge there than it does closer to Soviet territory.

The foregoing assessment of Soviet capabilities for naval presence might justify a shipbuilding program substantially different from the U.S. Navy's. If forced to choose, the Navy would acquire a relatively small number of highly capable ships optimized for offensive strikes in high-threat areas. Since the Soviet fleet presents a sharply diminished challenge in distant regions like the Indian Ocean, however, increasing the U.S. Navy's capabilities for presence operations in such places would imply acquisition of different kinds of ships, and larger numbers of them. Furthermore, such a program would not only account for the need to offset growing Soviet capabilities to project naval force to remote regions, but would also enhance the U.S. Navy's ability to counter indigenous threats to U.S. interests that might arise in Third World locales.

Finally, such an approach could be compatible with the need to provide additional defenses for shipping in the immediate vicinity of the sea lanes, since, as Chapter II noted, such defenses are likely to require large numbers of ships. The degree to which the United States itself would have to provide for those sea-lane defenses is directly dependent on allied efforts in this area. The following chapter discusses that effort in detail, while Chapters V and VI outline the systems that the U.S. Navy currently possesses to meet the demands of the missions discussed above and the link between mission-related demands and systems competing for funding in shipbuilding budgets for fiscal years 1981-1985.

CHAPTER IV. THE ALLIED CONTRIBUTION TO SEA CONTROL

An assessment of the quality and availability of allied naval forces underlies any choice among alternative U.S. shipbuilding programs. This condition arises because the U.S. government explicitly relies upon allied naval forces to supplement or replace U.S. naval forces in many circumstances of a major NATO/Warsaw Pact war. 1/ In particular, the United States relies on its allies to:

- o Contribute to barrier defenses that restrict the Soviet fleet's access to major sea lanes;
- o Provide escorts to protect convoys transiting the sea lanes; and
- o Ensure the safe passage of convoys in restricted waters and entrances to major ports.

The purpose of this chapter, therefore, is to describe allied naval forces--and their anticipated construction programs--and consider the degree to which they could supplement those of the U.S. Navy. The chapter concludes that existing allied surface forces might be inadequate to meet escort requirements during a worldwide naval war involving heavy use of the North Atlantic sea lanes. It also concludes that allied mine countermeasure forces might be too small for the mission they would have to fulfill. And future allied submarine, escort, and mine countermeasure forces may be even smaller than today's force levels in some geographical areas, as obsolescent and retired ships outnumber their replacements under current and projected procurement programs.

1/ See, for example, the statement of Admiral Thomas B. Hayward, Chief of Naval Operations, in Department of Defense Appropriations for 1980, Hearings before the Subcommittee on Defense, House Committee on Appropriations, 96:1 (1979), Part 2, p. 23.

AGGREGATE NAVAL CAPABILITIES OF U.S. ALLIES

U.S. allies that might reasonably be expected to contribute naval forces to all NATO sea control activities include not only those countries whose forces would come under NATO command in a war, but also France and Spain. 2/ In addition, several South American allies might be expected to contribute naval forces in the South Atlantic. 3/ In the Indian Ocean and the Pacific, allies with naval forces include Australia, New Zealand, Japan, and South Korea. 4/ In the aggregate, allied naval forces compare favorably with the U.S. and Soviet navies (see Table 2). The allies also have about 1,600 naval aircraft comparable to those in the U.S. inventory, including fighter-bombers, maritime patrol aircraft, and naval helicopters. 5/

This summary may create a misleading picture of the potential allied contribution to sea control, however. As Table 2 suggests, these naval assets are widely scattered. They might not all be available when and where they would be most needed in a worldwide naval campaign.

Moreover, aggregates obscure a wide range of qualitative differences. Forty percent of the allied escorts in the Atlantic and Mediterranean areas, for example, carry only anti-aircraft

2/ Those contributing naval forces to the NATO commands are Belgium, Canada, Denmark, the Federal Republic of Germany, Great Britain, Greece, Italy, the Netherlands, Norway, Portugal, and Turkey. France is a member of the North Atlantic Council but not of NATO's integrated military command. Spain is not a member of either.

3/ Those with significant naval forces include Argentina, Brazil, and Venezuela.

4/ The status of Taiwan and Pakistan as allies is uncertain; consequently, their largely obsolescent fleets are not counted. The Philippines is an ally but has negligible naval forces.

5/ International Institute for Strategic Studies (IISS), The Military Balance, 1979-1980 (London: IISS, 1979). Includes all aircraft with naval missions in allied navies and air forces.

TABLE 2. ALLIED, U.S., AND SOVIET NAVAL COMBATANT FORCES AS OF MID-1979

Region	Submarines <u>a/</u>	Aviation Ships <u>b/</u>	Escorts <u>c/</u>	Other <u>d/</u>
Allied Navies <u>e/</u>				
Atlantic and Mediterranean <u>f/</u>	160	9	335	900
Pacific <u>g/</u>	<u>19</u>	<u>1</u>	<u>97</u>	<u>200</u>
Total, Allies	179	10	432	1,100
United States	80	24	226 <u>h/</u>	123
Soviet Union	268	4	321	1,000

SOURCES: Paul Nitze, Leonard Sullivan, Jr., and others, Securing the Seas: The Soviet Naval Challenge and Western Alliance Options (Boulder, Colo.: Westview, 1979), pp. 201, 219; and Jane's Fighting Ships, 1979-80.

- a/ Submarines exclude ballistic missile submarines but include 11 British nuclear-powered attack submarines.
- b/ Aviation ships include aircraft carriers (CVs) and helicopter carriers (CHs), as follows: Britain, three; France, two; and Italy, Spain, Argentina, Brazil, and Australia, one each.
- c/ Escorts include surface warships with approximately 1,000 or more tons full-load displacement, including helicopter cruisers.
- d/ Includes mine warfare, coastal patrol, fast attack craft, and amphibious ships, rounded to the nearest hundred.
- e/ For a definition of allied forces, see f/ and g/ below. Allies with naval forces in regions, such as the west coast of South America, unlikely to be involved in a major East-West war are not included, but in any event have few long-range, modern naval units.
- f/ Atlantic and Mediterranean forces include Argentina, Belgium, Brazil, Britain, Canada, Denmark, France, Germany, Greece, Italy, the Netherlands, Norway, Portugal, Spain, Turkey, and Venezuela.
- g/ Pacific forces include Australia, Canada, Japan, Korea, and New Zealand. Note that Canadian ships are divided between the Atlantic and Pacific Oceans.
- h/ Includes Coast Guard cutters.

guns and short-range antisubmarine warfare systems, and could provide only the most perfunctory protection for convoys threatened by modern submarines or aircraft armed with modern, terminally guided torpedoes or missiles.

In addition, the overall trend among the allies is toward smaller oceangoing navies. Table 3 compares allied shipbuilding programs with U.S. and Soviet efforts. While the current allied building effort compares favorably with that of the two leading naval powers, if continued into the future, it will sustain a fleet of only 320 major surface combatants as older ships are retired, substantially fewer than the roughly 440 ships active today (including aviation ships). 6/

TABLE 3. COMPARABLE COMMISSIONING RATES, 1960-1979

	<u>Submarines</u>		<u>Surface Combatants</u>	
	Diesel- electric	Nuclear- powered	Number	Tonnage
Allies	132	14	257	1,000,000
United States <u>a/</u>	0	69	196	1,800,000
Soviet Union <u>a/ b/</u>	88	85	197	600,000

SOURCE: Jane's Fighting Ships, 1979-80.

a/ Includes guided missile submarines, but not ballistic missile submarines.

b/ Totals for Soviet submarines are approximations. Construction of some types began in the late 1950s and continued into the 1960s. Totals in the table assume that equal numbers of these types were built in each year of the construction cycle.

6/ This assumes an average useful life for surface combatants of 25 years. Some allies calculate a 30-year useful life, assuming a major refit after 15 years; others use 20 years; and still others use 25. Information supplied to CBO by the Embassies of Great Britain and the Netherlands, December 1979.

The average displacement of allied surface warships, at just under 3,500 tons, is smaller than the average for similar U.S. and Soviet warships built during the same period. 7/ This smaller average displacement generally results in ships with smaller weapons loads and shorter ranges than those built by the U.S. and Soviet navies. 8/

Finally, a comparison of aggregates can be misleading without a discussion of particular missions and requirements. For example, the number of NATO submarines required to establish an antisubmarine barrier in the gaps between Greenland, Iceland, the United Kingdom, and Norway depends not only on the number and characteristics of Soviet submarines, but also on the width of the barriers, the radius of action of each submarine in the barrier force, and probable losses by each side in the barrier battle. The number of antisubmarine escort ships required on the North Atlantic varies with the number, speed, and route length of convoys, the engagement ranges of the escorts, and the number of attacking submarines and aircraft. This requirement has little relationship to the number of Soviet surface ships.

The following section opens with a brief consideration of allied roles in restricting Soviet fleet access to the open ocean in the Baltic, Turkish, and Japanese straits, and then reviews sea-lane and port defenses in the North Sea and English Channel. The remainder of the chapter highlights allied forces for sea control in the North Atlantic and the Mediterranean, assesses allied navy procurement plans affecting these regions, and discusses sea-lane protection in the Pacific and Indian Oceans.

STRAITS AND BORDER SEAS

In order to reach the high seas, three of the four Soviet fleets--the Baltic, Black, and Pacific--must emerge through narrow straits controlled by U.S. allies: the Baltic approaches, the

7/ Excluding carriers and ships of 1,200 tons or less, the average U.S. surface combatant built in the 1970s displaced 6,900 tons, while the average Soviet ship displaced 5,400 tons.

8/ Displacement is a crude, but not infallible, guide to relative weapons load and endurance.

Dardanelles and Bosphorus, and the Japanese straits (see Figure 2 on pp. 34-35). They must return through some of these straits in order to replenish and repair at home bases. A corresponding danger for U.S. and allied shipping may be the Soviet ability to conduct air strikes and mining in the congested waters of the English Channel and North Sea.

The Baltic and Baltic Approaches

The Baltic Sea empties into the North Sea through a series of narrow straits known as The Sound (passing between the major Danish island, Sjaelland, and Sweden) and The Belts (passing among the Danish islands and skirting Jutland). In order to use the Baltic fleet against North Sea and Atlantic sea lanes, the Soviet Union would have to seize the Danish islands and the Jutland Peninsula if it wished to:

- o Deploy the Baltic fleet and Soviet air forces;
- o Provide access for its forces to its major repair and replenishment facilities, which are located in the Baltic; or
- o Open the northern coast of West Germany to attacks and invasion.

The naval balance in the Baltic appears to favor the Warsaw Pact, with its larger numbers of submarines, major surface combatants, and amphibious warfare ships. Allied naval forces in the Baltic area include 61 missile and torpedo craft, 30 small submarines, and about 200 aircraft. If these forces were deployed in echelons toward the eastern Baltic and backed by adequate air defenses, by sufficient defenses against overland invasion, and by well-maintained minefields in the Danish straits, they could constitute an effective barrier against the Soviet fleet's access to the open ocean. 9/

Air defense and maritime air patrol in the Baltic would be performed by the Danish air force, with 90 to 100 fighter-bombers

9/ A further discussion of allied ground forces on the NATO northern flank will be provided in forthcoming Congressional Budget Office studies on ground forces alternatives and Marine Corps force options.

and interceptors, and by the German naval air force, with about 110 fighter/attack aircraft. Both air forces are being modernized, the Danish with F-16s and the German with Tornados. ^{10/} They could be reinforced, if needed, by NATO Central Region air forces.

Control of naval traffic in the straits would depend critically upon the ability of the allies to lay and maintain minefields. They plan to do so largely with surface craft, most of which have minelaying as only one of their possible missions. The Danish navy has seven minelayers, which could be augmented, if needed, by West German destroyers, frigates, and minesweepers, and by German and Danish fast patrol boats. If the allies were unable to achieve air superiority over the Baltic, this minelaying force could expect heavy losses from Warsaw Pact aircraft. These losses could be minimized if the minefields were laid at night. But the need for timeliness, speed, and frequent maintenance of the minefields, together with the vulnerability of minelaying ships and the competing demands for West German surface combatants and minesweepers (discussed below), suggest the need for an additional, perhaps airborne, mining capability in the Danish straits.

The Bosphorus and Dardanelles

The Soviet Black Sea fleet supports the Soviet Mediterranean squadron, whose ships must pass through the Turkish straits in order to carry out their missions. Even if passage through the straits were assured either through political pressure or military operations against Turkey, the fleet--apart from elements of Soviet Naval Aviation (SNA) that might support it--still would require secure passage through the various straits of the Aegean before it could embark upon Mediterranean operations, and before its Mediterranean squadron could return to base.

The outcome of any battle for control of the straits would depend in part upon the establishment of air superiority over Turkey. NATO air forces in the region would probably be reinforced from the United States and from the U.S. Sixth Fleet, stationed in the Mediterranean.

^{10/} IISS, The Military Balance, 1979-1980, pp. 24, 26.

Even if the Turkish straits should be opened to the Soviet Union, the Soviet Black Sea fleet, seeking to enter the Mediterranean, might still have to confront opposition as it transited the narrow exits from the Aegean Sea. Thus, the main body of the Black Sea fleet, apart from aviation, might not be able to operate in the Mediterranean in the early months of a war, and Soviet naval forces in the Mediterranean could not count on access to their Black Sea bases once war broke out.

The Japanese Straits

Although the Soviet Pacific fleet (see Figure 2 and Chapter III) enjoys a substantial numerical superiority over the forces of U.S. allies in the Northwest Pacific, that part of the fleet which is based in the Sea of Japan cannot anticipate unopposed passage through the Japanese straits. These straits--Tsushima (also known as Korea) Strait in the south, Tsugaru Strait between Honshu and Hokkaido islands, and La Perouse (or Soya) Strait between Hokkaido and Sakhalin Island--could be closed by mining from ships, aircraft, or submarines in a short period of time. ^{11/} In addition, aircraft sorties from Japanese and South Korean bases or from U.S. carriers could both discourage minesweeping efforts and re-lay mines in the shipping channels, as well as intercept raids by long-range Soviet bombers.

Allied Forces in the North Sea and English Channel

In a major war in Europe, the most important transatlantic military and economic shipping would converge on the English Channel and pass through to the North Sea ports of Belgium, the Netherlands, and Germany. Given the opportunity, the Warsaw Pact could be expected to concentrate both submarine and air attacks on shipping in those waters. The Channel sea lanes and North Sea

^{11/} In two days, May 3 and 5, 1945, the U.S. 21st Air Force dropped 1,400 mines in 195 sorties to close shipping lanes in Japan's Inland Sea, the ports of Kobe, Osaka, Tokyo, and Nagoya, and the Shimonoseki Strait. A somewhat larger effort could establish an initial mine barrier in the Japanese straits. Frederick M. Sallagar, Lessons From An Aerial Mining Campaign, R-1322-PR (Santa Monica: The Rand Corporation, April 1974), pp. 35-37.

ports would be excellent sites for Soviet minefields that could be laid by submarines or aircraft.

Despite NATO ASW barriers and air defenses in the Central Region and North Sea, it would be necessary to provide escorts to shipping plying the North Sea, either crossing from British ports to Germany and Norway or sailing into the North Sea from the English Channel. In addition to the escort forces allocated to NATO's Channel and Eastern Atlantic Commands, which are discussed in the next section of this chapter, NATO's Allied Forces North would command all West German, Norwegian, and Danish surface combatants. Although these number some 34 escort ships, only 12 (7 Norwegian, 2 Danish, and 3 German) have either modern anti-aircraft missiles or ASW weapons that can operate at a distance, such as missiles or helicopters. ^{12/} The rest could provide only limited protection to convoys.

Port Defense in the North Sea. Attacks on North Sea ports would inhibit delivery of reinforcements from the United States. Similarly, concentrated Warsaw Pact air attacks against important convoys (for instance, those carrying military equipment) as they approached Europe could inflict costly losses on NATO, especially during an early and probably critical phase of operations in NATO's Central Region.

One hedge against these contingencies lies in the large number of North Sea ports that could accept convoys, thus increasing the number of areas the Soviet Union would have to target. A second hedge would be to improve land-based air defenses near the major North Sea ports. Yet another hedge would be to assign a number of modern anti-air warfare ships to the convoys as they approached the English Channel and the North Sea. Doing so, however, would reduce the availability of these escorts for other convoy duties.

Mine Countermeasures in the North Sea. Mining by Soviet forces would be minimized if the allies succeeded in establishing ASW barriers at the entrances to the English Channel and North Sea, and if allied air forces could exact high losses on Soviet aircraft on mining missions. Nevertheless, it is probable that

^{12/} Excluded are five Danish fishing protection ships with helicopters. Their slow cruising speed (13 knots) precludes their general use as convoy escorts.

some minefields would be sown and might be reestablished by subsequent submarine or aircraft missions.

The NATO allies bordering the North Sea have 125 coastal and oceangoing minesweepers and 48 minehunters. Some of the 61 German and 8 Danish units would be employed in the Baltic, however. Construction of an additional 12 minesweepers and 29 to 34 minehunters is planned by Britain, Belgium, and the Netherlands. But the 15 new Dutch minehunters will replace 18 older mine countermeasure ships. The West Germans will replace 22 older units with six existing sweepers, each converted to conduct three remote minesweeps. The net gain from planned construction will therefore be small. The resulting force of fewer than 200 units may be inadequate for the demands of North Sea and Channel mineclearing operations. 13/

In sum, although the North Sea allies are gradually modernizing their escort and mine countermeasure ships, they may not have enough of either type to meet the requirements of a NATO/Warsaw Pact war. These forces may be too few to cope with a serious effort by the Warsaw Pact to mine the English Channel or major ports. The deficiency, moreover, could be increased if West German minesweepers and destroyers were detailed to mine-laying roles in the Baltic, as currently appears to be the plan. Finally, only Britain devotes any effort to the problems of clearing deep-water mines. But it is outfitting only 12 new trawlers for this mission, and the technology of deep-water mineclearing is largely unproved. 14/

THE DEFENSE OF SEA LANES IN THE NATO AREA

In the event of a war with the Warsaw Pact in Europe, the first priority for NATO naval forces would be to establish

13/ U.S. experience in World War II was that 125 minesweepers were needed to clear East Coast ports after 338 German mines were laid. Similarly, by the end of World War I, Britain had employed more than 700 minesweepers to clear her ports and coastal waters. The Soviet mine inventory numbers in the tens, perhaps hundreds, of thousands. See RADM Roy E. Hoffmann, USN, "Offensive Mine Warfare: A Forgotten Strategy?" United States Naval Institute Proceedings, Naval Review Issue (May 1977), pp. 146, 148.

14/ See Jane's Fighting Ships, 1979-80, p. 609.

protected sea lanes across the North Atlantic. These would extend not only from North America to the British Isles and the North Sea ports, but also from all of these places to Iceland, Norway, and the Mediterranean.

Chapter III showed that the number of Soviet submarines and antishipping bombers that might be allocated against NATO shipping would depend upon Soviet decisions concerning the forces required for defense of Soviet ballistic missile submarines (SSBNs), for shadowing and attacking U.S. carrier task forces, and for searching out U.S. SSBNs. The number of successful attacks on allied shipping would also depend on the number of Soviet submarines that deployed before allied ASW barriers were in place.

Regardless of Soviet priorities, the NATO allies would nevertheless have to conduct defensive sea control missions in the North Atlantic to deter or defeat any Soviet attacks on the sea lanes and to hedge against shifts in Soviet plans. These defensive missions would call for intercepting Soviet submarines and aircraft before they could attack allied shipping and as they returned to base for replenishment. NATO's military forces would use three tactics to carry out this mission: barriers, area defenses, and escorted convoys.

The major air defense and antisubmarine barriers would be established across the North Atlantic on a line running from Greenland to Iceland to Britain to the Faeroe Islands to Norway (see Figure 2 on pp. 34-35). Another antisubmarine barrier could be established at Gibraltar to attack Soviet submarines seeking to enter or leave the Mediterranean. A third ASW barrier could be established in the southern approaches to the English Channel to reduce the likelihood of submarine attacks and mine-laying in the Channel bottleneck.

Area defenses could be established between the barriers and the North Atlantic convoy routes. They would likely consist of land-based aircraft and surface ASW groups assigned to particular geographic areas. If Soviet Backfire aircraft constituted a threat to these areas, the ASW groups might be supported by interceptors operating from aircraft carriers. To reduce the risk of air attack, convoys might be routed south of the Backfire's radius. ^{15/} The principal defensive problem for such convoys

^{15/} See Congressional Budget Office, Navy Budget Issues for Fiscal Year 1980, Budget Issue Paper for Fiscal Year 1980 (March 1979), pp. 21, 30.

would be protection against submarines that were not sunk at the barriers or by area ASW forces. This would be provided by warships equipped to defeat submarine attacks. Some of these escorts would also have limited air defense capabilities.

The following pages review current allied forces, including French and Spanish forces, in the Atlantic and Mediterranean. They also compare allied force levels to a range of requirements for escorts in a major war and examine the likely trends in allied forces under known shipbuilding plans.

Allied Forces in the North Atlantic

NATO Forces. Forces that report to NATO's Eastern Atlantic Command and that might contribute to the various phases of North Atlantic sea-lane defense include units from the Belgian, British, Canadian, Dutch, and Portuguese navies. ^{16/} Units from the Norwegian, West German, and Danish navies might also be available for Atlantic operations, but they report to NATO's Northern Command and are likely to be required for other duties.

Table 4 displays the allied naval forces that might be available for barrier and convoy operations in the North Atlantic. If Norway's force of 15 coastal submarines also is counted as available for duty on the North Atlantic-Norwegian Sea ASW barriers, then the NATO allies can contribute 11 nuclear-powered (SSN) and 43 diesel-electric (SS) submarines to North Atlantic sea control. In addition, they can deploy three carriers for ASW, air defense, or mixed duties.

Other Allied European Fleets. Two other European navies--the French and Spanish--would probably play a role in any major war involving the NATO alliance. Both fleets have bases on the Atlantic and in the Mediterranean; both might work with NATO's North Atlantic, Channel, and Mediterranean forces. Neither fleet would automatically come under NATO command, and the precise roles they would play in a major conflict are not clear. Part of the French naval force undoubtedly would

^{16/} The commanding officer of NATO's Eastern Atlantic Command (CINCEASTLANT) also has responsibilities (as CINCHAN) for naval operations in the English Channel and in the southern parts of the North Sea.

TABLE 4. PRINCIPAL ALLIED SEA CONTROL FORCES IN THE NORTH ATLANTIC

	Belgium		Britain		Canada a/		Netherlands		Portugal		Total	
	Current	Obsolete	Current	Obsolete	Current	Obsolete	Current	Obsolete	Current	Obsolete	Current	Obsolete
Submarine Forces												
SSNs	--	--	11	--	--	--	--	--	--	--	11	--
SS (long-range)	--	--	15	1	3	--	6	--	3	--	27	1
Maritime patrol aircraft	--	--	28	--	--	37	7	13	--	--	35	50
Air Platforms	--	--	3	--	--	--	--	--	--	--	3	--
Embarked helicopters b/	--	--	39	--	--	--	--	--	--	--	39	--
Embarked interceptors b/	--	--	17	--	--	--	--	--	--	--	17	--
Escorts												
Multipurpose	4	--	66	--	4	--	10	--	--	--	84	--
ASW only	--	--	--	4	8	--	--	14	--	17	8	35
Helicopters Aboard Escorts	--	--	72	--	16	--	10	--	--	--	98	--

SOURCES: Jane's Fighting Ships, 1979-80; and International Institute for Strategic Studies, The Military Balance, 1979-1980 (London: IISS, 1979).

NOTE: Obsolete ships are defined as those ships that lack modern anti-aircraft missiles, antisubmarine helicopters, or ASW missiles. Many of them are also more than 25 years old and, consequently, at the ends of their useful lives. Obsolete maritime patrol aircraft are all models prior to the Lockheed P-3 Orion, British Aerospace Nimrod, and Breguet Atlantique.

a/ Assumes 12 of 23 Canadian surface combatants are in the Atlantic, with the remainder in the Pacific.

b/ "Embarked" helicopters and interceptors connote those aircraft that actually deploy aboard a ship at sea.

be assigned to protect France's six planned nuclear-powered ballistic missile submarines during their transits to and from French Atlantic ports. Others, including one or both of France's aircraft carriers, might be assigned to protect French interests and commerce in the Mediterranean and Red Seas and in the Indian Ocean. Nevertheless, it is possible that some French ships--which also include 23 submarines, 48 escorts, 38 patrol aircraft, and numerous smaller units--would be available for North Atlantic sea control duty with NATO under cooperative agreements, although at least 16 of France's escort ships appear to be obsolete. 17/

Similarly, although the Spanish fleet includes eight submarines, one small V/STOL aviation ship, 27 escorts, 12 patrol boats, and numerous lesser units, about half the fleet may be considered obsolete. But with the existing modern ships and major planned improvements outlined below, the Spanish navy appears likely to have a growing capability to control the Strait of Gibraltar and to support Atlantic and Mediterranean sea control missions in the next decade. Neither NATO nor the United States has a clear arrangement with Spain regarding cooperation in the event of conflict.

Allied Forces in the Mediterranean

In addition to protecting the North Atlantic sea lanes in a major war, NATO forces could be required to escort military and economic shipping in the Mediterranean. Convoys would be required to supply allied naval forces deployed in the Mediterranean, as well as Greek and Turkish ground and tactical air forces and any allied reinforcements on the southern flank.

The Soviet Union might use its naval forces in the Mediterranean to attempt to sink U.S. or allied Mediterranean fleets, probably with little warning. Any Soviet forces that survived such a "D-Day Shootout"--most probably submarines--could try to interdict military and economic shipping bound for the eastern Mediterranean.

17/ See Jane's Fighting Ships 1979-80; and IISS, The Military Balance, 1979-1980. Obsolete ships are defined as those ships that lack modern anti-aircraft missiles, antisubmarine helicopters, or ASW missiles. Many of them are also more than 25 years old and, consequently, at the ends of their useful lives.

Allied forces in the Mediterranean that would come under NATO command include the navies of Italy, Greece, and Turkey. These forces would supplement the U.S. Sixth Fleet. (In addition, as mentioned above, some French and Spanish ships probably would operate in the Mediterranean.)

The Italian, Greek, and Turkish navies include one aviation ship, 31 submarines, 62 escorts, 32 patrol aircraft, 58 missile and torpedo boats, and a variety of smaller units. However, 34 escort ships, 12 submarines, and 14 maritime patrol aircraft are obsolete. Of the 28 effective allied ASW escorts in the Greek, Turkish, and Italian navies, more than half are either converted World War II destroyers nearing the ends of their useful lives or small ships of limited endurance. Thus, no more than about 13 Mediterranean ships, all Italian, appear to be useful for North Atlantic convoy duty, in the unlikely event they were not required in the Mediterranean.

NATO Escort Requirements and Allied Capabilities

Requirements. Estimates of the number of escorts required by NATO in a major war at sea vary widely. The most important variables in these estimates are the number of convoys sailed per week, the number of days at sea per convoy, the number of escort ships required per convoy, convoy and escort turnaround time, length of war, and attrition of submarines and escorts. Other major influences on these requirements include the size and timing of Central Region and flank operations. If simultaneous protection were required for movement of forces to the flanks early in a war and for the peak movement of supply convoys to the Central Region, escort requirements would be greater than if such movements were conducted at different times.

Using a set of highly optimistic estimates (two convoys per week, seven escorts per convoy, rapid attrition of Soviet submarines, low attrition of escorts, and a short war), one recent study established a lower bound of 59 escort ships as a minimum requirement for NATO forces operating in the Atlantic. ^{18/} The requirement is likely to be considerably higher, however. For

^{18/} Paul Nitze, Leonard Sullivan, Jr., and others, Securing the Seas: The Soviet Naval Challenge and Western Alliance Options (Boulder, Colo.: Westview, 1979), p. 371.

example, one recent estimate put the number of merchant ships required to support a war in Europe at 3,000 to 6,000, each making one round trip a month. 19/ Given that estimate, a ratio of one escort ship for every 10 merchants at sea would produce a requirement for 300 to 600 escorts. With a ratio of one escort to every 25 merchants at sea, the range would drop to 130 to 240 escorts, excluding both losses and escorts that would be needed for underway replenishment groups supporting naval strike forces. One recent attempt to set an upper bound for the Atlantic convoy escort requirement estimated it to be 273 ships. 20/ Thus, a plausible range for this requirement may lie between 59 and 273 ships. The lower end reflects a short war with relatively little use of the sea lanes; the higher end reflects heavy fighting, a longer war, a high escort-to-merchant ship ratio, and significant support for forces on the flanks. 21/

Allied Escort Capabilities. The preceding sections of this chapter identified approximately 172 allied escort ships with modern sonars and ASW weapons--missiles and helicopters--capable of providing adequate protection to convoys against Soviet submarines. These include ships in the forces of all NATO allies plus France and Spain (see Table 5). A large number of these ships normally would have assignments other than escorting convoys across the North Atlantic, however, especially if the war were not confined to Central Europe. For example, 12 escorts in the forces of Norway, Denmark, and West Germany would probably be assigned to duties in the North and Norwegian Seas. The 28 Italian, Greek, and Turkish ships included in the foregoing total probably would be employed primarily in the Mediterranean. At least 18 British ships--and possibly more--could be assigned to work with British aviation ships in support of ASW barriers along the Greenland-Iceland-Britain-Norway line. Of the remaining modern ships, 48 are under French or Spanish command. These would probably be divided among a number of tasks, although a few might be available for escort duty. Excluding French and Spanish ships leaves approximately 66 modern ASW escorts available for convoy

19/ Rear Admiral Sayre A. Swarztrauber, "The Potential Battle of the Atlantic," United States Naval Institute Proceedings, Naval Review Issue (May 1979), p. 116.

20/ Nitze and Sullivan, Securing the Seas, p. 371.

21/ Ibid.

TABLE 5. NATO ESCORT REQUIREMENTS AND ALLIED ESCORT CAPABILITIES
IN THE NORTH ATLANTIC a/

Requirements and Available Forces	Number of Ships
Estimated North Atlantic Escorts Required	59-273
Estimated Allied Escorts Available	
Maximum force available	172
Less	
Aviation ship escorts	-18
Baltic, North Sea, and Norwegian coastal escorts	-12
French, Spanish, and Mediterranean escorts	-76
Forces most likely to be available	66
Less 15 percent overhaul/maintenance allowance	-10
Operational forces available	56
Range of Estimated Surplus (+) or Shortfall (-) in Available Escorts	
Maximum force available	+113/-101
Most likely operational force available	-3/-217

a/ Modern multipurpose and ASW escorts. The allies also have 128 obsolete escort ships, which could provide only marginal protection of convoys.

duty, of which as many as 15 percent may be undergoing maintenance at any given time. 22/

22/ Fifteen percent, the standard maintenance factor assumed for U.S. ships, is here assumed to be applicable to allied ships as well. With sufficient warning before a war, this number would probably be lower, since maintenance

Thus, as Table 5 shows, allied escort forces fall short of meeting the most demanding set of escort requirements by as many as 217 or as few as 101 ships. The probability that the maximum number of allied ships would be available declines as the probability of the high escort requirement rises, however, since the high requirement implies a large-scale war, which may also create other demands for these forces. The allies appear to be able to meet only the lowest and most optimistic end of the range of requirements.

The implication of these figures is clear. Unless the allies significantly increase their modern escort forces, they, by themselves, would be able to provide a force hedged against only the lowest end of the range of possible escort requirements in the Atlantic.

Trends in Force Levels of NATO-Area Allies. Whether the conclusions regarding allied contributions to sea control will continue to hold true over the coming years depends on current and projected shipbuilding programs. A number of NATO-area allies have active procurement programs for naval forces. These are summarized in Table 6. 23/

The table shows that 52 allied escort ships are overage at present and that a further 125 allied escort ships will exceed 25 years of service by 1989. Currently authorized construction will replace roughly one-third of these. If the allies were to build as many new ships between 1984 and 1989 as they will build by 1984, then nearly two-thirds of the overage ships would be replaced. Allied shipbuilding plans for the latter half of the

schedules could be accelerated. In addition, the allies would have 128 obsolete escort ships, which could provide only marginal protection of convoys and would be useful mainly for administrative tasks.

23/ In addition to the construction programs summarized in Table 6, Great Britain is constructing two new medium-sized aviation ships to replace older ships; Spain and Italy are each building one small aviation ship; and France is building a nuclear-powered helicopter carrier. When probable retirements are deducted, the net result could be the addition of three medium and small aviation ships to the seven now operated by these allies.

TABLE 6. TRENDS IN NATO-AREA ALLIED NAVAL FORCES

Country	Older Submarines <u>a/</u> (Commissioning Dates)			Submarines Under Construction or Authorized as of May 1979	Older Escort Ships <u>b/</u>			Escorts Under Construction or Authorized as of May 1979
	Pre-1960	1960-1964	1965-1969		Pre-1955	1955-1959	1960-1964	
Atlantic and Northern Command Forces								
Great Britain	1	14	4 <u>c/</u>	4 <u>d/</u>	--	4	27	13
Canada	--	--	3	--	--	13	6	--
Federal Republic of Germany	1	2	4	--	4	--	9	6
The Netherlands	--	2	2	2	6	8	--	10
Others <u>e/</u>	<u>2</u>	<u>6</u>	<u>14</u>	<u>--</u>	<u>1</u>	<u>2</u>	<u>4</u>	<u>3</u>
Subtotal	4	24	27 <u>c/</u>	6 <u>d/</u>	11	27	46	32
France	7	8	3	6 <u>f/</u>	--	20	11	13
Spain	4	--	--	4	12	2	1	7
Italy	4	--	4	2	1	10	8	6
Other Mediterranean <u>g/</u>	12	--	--	4	28	--	--	--
Total	31	32	34 <u>c/</u>	22 <u>d/ f/</u>	52	59	66	58

SOURCE: Jane's Fighting Ships, 1979-80.

a/ Submarines are diesel-electric unless otherwise noted. Their useful service lives are about 20 years.

b/ Escort ship useful lives average 25 years.

c/ Three nuclear powered.

d/ Four nuclear powered.

e/ Denmark, Norway, and Portugal.

f/ Six nuclear powered.

g/ Greece and Turkey.

1980s are not yet known, however. Britain, Canada, France, and Italy, in particular, face the impending obsolescence of 100 escorts during the 1980s. None has yet authorized a building program that would achieve a one-for-one replacement of its older escorts. Unless allied shipbuilding rates are increased, there could be a decline both in the overall level of allied escorts in the 1990s and in the critical contribution of the NATO allies to sea-lane defense in the North Atlantic.

A similar decline is possible in allied submarine forces. By 1989, more than 90 allied diesel-electric submarines will be at least 20 years old, but only 12 diesel-electric submarines and 10 nuclear-powered submarines are currently under construction. Britain and the Netherlands, however, plan additional new construction to maintain their current diesel-electric submarine force levels; Denmark, Norway, and West Germany are also planning to build new submarines during the 1980s. ^{24/} Thus, the continued aging, and possible decline in numbers, of active allied submarines is most likely to occur among Mediterranean forces.

SEA CONTROL FORCES IN OTHER AREAS

South Atlantic and Indian Ocean

In a major Warsaw Pact/NATO war, NATO shipping might become vulnerable to attack on the sea lanes in the South Atlantic and Indian Oceans. Also, the Soviet Pacific fleet might seek to interdict sea lanes to Japan from the Persian Gulf and United States.

Several South American nations that are linked to the United States through the Organization of American States and the Rio Pact maintain South Atlantic and Caribbean navies. The most important are Argentina, Brazil, and Venezuela. These three navies have an aggregate total of 16 submarines, 2 aircraft carriers, 35 escorts, 15 carrier-based attack aircraft, 23 carrier-based ASW aircraft, 31 maritime patrol aircraft, and 89 naval helicopters.

^{24/} Jane's Fighting Ships, 1979-80. Most of these programs have not been authorized, so are not included in Table 6.

While most of the submarines and escorts in these navies are obsolete, five new submarines and ten new escort ships have been commissioned in the past five years. Over the next five years, another six submarines and 13 escorts will be delivered. In the event of a major war, some of these assets might become available for sea control activities in the South Atlantic, in cooperation with NATO forces.

Allied naval forces operating in the southern Indian Ocean and Arabian Sea include French escort and replenishment forces (and, at times, an aircraft carrier) and Australian and New Zealand ships. The latter two countries have six modern diesel-electric submarines, an aircraft carrier, and 15 escort ships. They are allied to the United States through the ANZUS Treaty.

Pacific Area Sea Control Forces

U.S. allies in the Pacific have relatively small modern naval forces. Most are used for local defense and have either relatively low long-range endurance or obsolete weapons and sensors, or both. The major exception is Japan.

In the case of attacks on Japan or on Japanese commerce, the Japanese fleet of 47 modern antisubmarine escorts and 14 diesel-electric submarines could become available for sea control duties. While wide-ranging Soviet submarine and air attacks might require convoy protection over long distances, the more serious problem facing Japan's forces would probably be a concerted Soviet effort to interdict shipping in or near the Japanese waters with mines, submarines, and air attacks. If Japanese forces were dedicated to this mission, most units would probably not be available for escorting convoys that might have to transit the Pacific.

In a geographically concentrated battle near the Japanese islands, the relatively small size of the Japanese escort ships (36 of these escorts displace less than 2,500 tons each) would not be a disadvantage. Also, the capabilities of Japan's two oceangoing and 38 coastal minesweepers, its 143 aging maritime patrol aircraft, and the Japanese air defense forces would have an important bearing on the outcome. Japan will build four submarines, eleven escorts, and six minesweepers in the next five years. The new ships probably will replace nine aging escort

ships and one submarine. 25/ Japan also plans to purchase 45 P-3C maritime patrol aircraft over the next decade as the first phase of a program to replace its existing fleet with up to 90 modern ASW aircraft. Other than Japan and Canada, with 13 escorts in the Pacific Ocean, the contribution of other U.S. allies in the Pacific would be minimal. 26/

CONCLUSIONS

This chapter has reviewed the potential allied contribution to sea control in a major war between NATO and the Warsaw Pact. It concludes that the allies could make the following important contributions:

- o By controlling key straits, they would help bottle up the Soviet fleet or deny Soviet ships at sea easy access to their bases.
- o They could contribute submarines, maritime patrol aircraft, interceptors, and anti-aircraft forces for barrier operations in the North Atlantic and for sea control in the Atlantic and Pacific Oceans and the Mediterranean Sea.
- o By providing convoy escorts, they could substitute for some U.S. forces.

From the perspective of the choices facing the Congress concerning U.S. naval procurement, a question of the first importance emerges from the foregoing survey. What are the implications of current allied capabilities and procurement programs for their future sea control contributions and for U.S. shipbuilding requirements?

25/ Jane's Fighting Ships, 1979-80; and Japan Defense Agency, Defense of Japan, 1978, p. 289ff.

26/ A large proportion of the naval forces of Korea and the Philippines are more than 30 years old (see Jane's Fighting Ships, 1979-80). Taiwan's defense relationship with the United States is in doubt, as is (at this writing) Pakistan's.

The implications of current allied capabilities and planned programs for U.S. shipbuilding requirements vary:

- o Allied diesel-electric submarine capabilities could be integrated into barrier operations conducted with U.S. nuclear-powered submarines.
- o European allied mine warfare forces, currently somewhat more modern than those of the United States, still probably fall short of force level requirements for defense of ports and local waters. The United States would likely have to bear much of the burden of deep-water mine warfare, unless European allies in addition to the British initiate deep-water mine countermeasure programs. 27/
- o The European allies currently are expected to conduct all ASW, escort, and local naval operations in the seas bordering Western Europe. As a result, they probably could provide fewer than 100 modern escorts for trans-atlantic convoy duty, a level that might be insufficient except in the most optimistic circumstances. If demands for convoy protection exceeded the available allied ships, U.S. forces would have to be assigned to this mission as well. Planned modernization of escort forces will improve European capabilities but is not likely to increase force levels in the foreseeable future by enough to cover the more demanding level of escort requirements.
- o Allied forces in the Mediterranean could contribute to convoy escort requirements in that region. On the other hand, only the Italian navy currently has a modern fleet; even if Greek and Turkish fleets are modernized, U.S. forces might also be needed to escort convoys to the southern flank.
- o Allied forces in other regions could contribute to sea control and crisis response missions, as well as to

27/ The Royal Navy is developing the Hunt-class, medium-depth, mine countermeasure ship and is also planning to build a deep-water minesweeping trawler, at a lower unit cost than the Hunt class. (Information provided to CBO by the Embassy of Great Britain, September 1979.) See also Jane's Fighting Ships, 1979-80 and Chapter VI.

protection of their local waters. Japanese forces, in particular, could be sufficient for convoy operations in the vicinity of Japan, but might not be available for convoy escort duty in distant Pacific regions. The United States might have to dedicate a number of escorts for this mission.

In summary, it is apparent that U.S. forces might have to assist in the protection of convoys in more than one of the world's oceans and seas. As the following chapters will indicate, these demands for support would compete with other demands for escort forces, such as those for carrier task forces and underway replenishment and amphibious groups. It is possible that the demands of these other missions alone could use the entire U.S. active escort force. ^{28/} Although U.S. allies, particularly in the North Atlantic and Japan, are modernizing their forces, unless these allies also increase their current force levels, there will be pressure on U.S. shipbuilding budgets to augment convoy escort capabilities, in addition to mine warfare force levels.

^{28/} Escort force levels have continually fallen far below stated Department of Defense requirements, as discussed in Chapter II.

CHAPTER V. U.S. GENERAL PURPOSE NAVAL FORCES: RECENT
DEVELOPMENTS AND CURRENT CAPABILITIES

Since the early 1960s, the U.S. Navy has viewed its non-strategic missions of sea control, power projection, and peacetime presence as worldwide in nature, with sea control considered its primary mission. 1/ As Chapter II indicated, the Navy has emphasized offensive operations against Soviet forces to protect the sea lanes to U.S. allies in a worldwide war between NATO and the Warsaw Pact. This emphasis is consistent with its view that the Soviet navy accords highest priority to attacks on the sea lanes. The U.S. Navy's mission priorities have led to a clear preference by Navy decisionmakers for larger, more complex and capable, and, consequently, relatively more costly ships. These preferences, coupled with inflation and a constrained shipbuilding budget (essentially level in real terms since 1970), have led to a decrease in the number of ships added to the Navy in recent years (see Figure 3). 2/

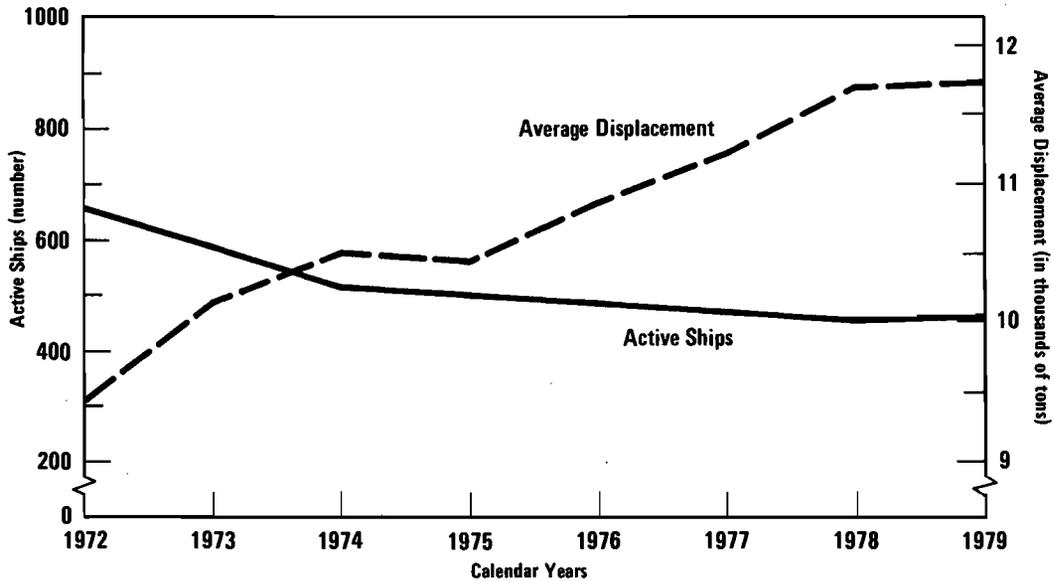
The decrease in force levels has led observers to question whether the Navy can continue to carry out all of its missions worldwide. Indeed, statements by the former Chief of Naval Operations, Admiral Holloway, 3/ implied that, unless force levels

1/ See statement of Admiral James L. Holloway III, in Military Posture and H.R. 10929 (Department of Defense Authorization for Appropriations for Fiscal Year 1979), Hearings before the House Committee on Armed Services, 95:2 (February, March, and April 1978), Part 1, pp. 659-60.

2/ Statement of Vice Admiral M.S. Holcomb, Director, Navy Program Planning, before the Subcommittee on Seapower, House Committee on Armed Services (December 3, 1979; processed).

3/ See statement of Admiral James L. Holloway III, in Military Posture and H.R. 11500 (Department of Defense Authorization for Appropriations for Fiscal Year 1977), Hearings before the House Committee on Armed Services, 94:2 (January and February 1976), Part 1, p. 822.

Figure 3.
 Number of U.S. Navy Active Ships and Average
 Displacement, 1972-1979



SOURCE: U.S. Navy

were increased, the United States could only fulfill the sea control mission in the North Atlantic, leaving unprotected the sea lanes to its allies in other parts of the world. If the trends noted above continue and more complex and costly ships are bought, the inescapable result will be continued contraction of the number of ships in the Navy.

This chapter reviews current naval programs, focusing first on specific areas of weapons development and then on individual types and classes of ships. The following chapter highlights some of the major issues that arise from a reevaluation of Navy needs based in part on different assessments of Soviet mission priorities and capabilities and on the potential contributions of U.S. allies. Readers already familiar with current naval forces may wish to proceed directly to Chapter VI.

SOME FUNDAMENTAL CONSIDERATIONS

In assessing current U.S. general purpose naval force posture, it is helpful to review briefly some of the fundamental warship capabilities that are important in almost any realistic combat scenario. Among the most important of these attributes are:

- o Engagement Range. The range at which a ship can first bring enemy units under fire.
- o Firepower/Saturation Threshold. The level of fire a ship can maintain and, more importantly in many situations, the number of targets it can engage simultaneously.
- o Endurance. Usually quantified as the distance a ship can travel without refueling, endurance is also a function of a ship's ammunition and stores capacity, the reliability of its machinery and equipment, and its ability to operate in high sea states.
- o Resilience/Survivability. The ability of a ship to survive in combat.

These same qualities, which are discussed more fully in Appendix A, are also pertinent to some degree to other naval systems, such as aircraft, and to aggregates of ships and aircraft.

The ideal warship, from a capability standpoint, would have all of these attributes to the maximum extent permitted by existing technology. Such a ship would be very expensive, however. To reduce unit cost, and thereby permit more ships to be built within a given construction budget, some compromises in capabilities might be warranted, depending on the specific missions for which these forces might be employed.

The first two attributes--engagement range and saturation threshold--relate primarily to weapon system capabilities; the last two attributes--endurance and resilience/survivability--are primarily ship characteristics. The capabilities of a warship are a synergistic combination of all of these factors. A ship's effectiveness depends not only upon its own capabilities, however, but also upon the capabilities of other units in the force, including other ships, aircraft, and even land-based systems, and how these units are used together. In addition, effectiveness depends critically on the command, control, and communications

capabilities of the force as a whole and upon the tactical skill with which the force is employed. It is inherently hazardous, therefore, to focus solely on the capabilities of individual ships and weapons when discussing naval forces. Individual units are, however, the building blocks upon which naval forces must be based, and they are the subject of the decisions required in the budget process. The following discussion will, therefore, focus on specific areas of weapons development and on individual types and classes of ships, after a brief discussion of the effect of the above factors on combat capability.

TRENDS IN NAVAL COMBAT SYSTEMS

In carrying out its missions, particularly offensive operations to disrupt Soviet attacks on the sea lanes, the U.S. Navy faces a formidable Soviet navy incorporating modern anti-air, antiship, and antisubmarine systems. While the U.S. Navy continues to rely on aircraft launched from carriers as its major source of anti-air and antiship firepower, it also has developed a series of new shipboard systems (mounted on ships other than carriers) designed to complement aircraft in this role. Like carriers, these systems also can support offensive operations in the highest-threat areas. A discussion of these systems may help to clarify the nature of some of the ship platform choices that the Congress is likely to confront in fiscal year 1981.

Antisurface (ASuW) Systems

Since the mid-1960s, cruise missiles have gained prominence as a supplement to and, ultimately, a possible substitute for aircraft in attacking surface ships. This is widely regarded as one of the most important developments in naval warfare since World War II. A cruise missile is essentially a pilotless aircraft, carrying either a nuclear or conventional explosive charge, that flies into its target under the guidance of a "seeker," or homing, mechanism. ^{4/} Cruise missiles offer long range, high

^{4/} The seeker may be one of several types, such as a small radar set carried in the missile, a missile-borne television camera, or a seeker that homes on infrared or radio frequency energy emanated by the target.

accuracy, and great destructive power in a weapon that can be launched from even the smallest warships.

The United States has developed the Harpoon antiship cruise missile, with a range of about 60 nautical miles, and is now developing the Tomahawk missile, which will have a range of about 300 nautical miles. Both are "smart" weapons with active radar seekers 5/ that will home on a target, and both can be launched from aircraft, surface ships, or submarines. Surface ships and submarines cannot employ the full range of Harpoon (to say nothing of Tomahawk) without external targeting assistance, however, since a ship more than 25 to 30 nautical miles away is beneath the visual and radar horizon because of the curvature of the earth. An aircraft or some other unit, such as the LAMPS III helicopter currently in development, must therefore be available to provide to the missile-launching ship fairly precise data on the target's location. To the extent that over-the-horizon targeting is successful, Harpoon and Tomahawk will provide a substantial and important improvement in engagement range against surface targets; and at whatever range they are used, they will offer greatly enhanced antiship firepower. It is noteworthy that vigorous exploitation of cruise missiles has been one of the most significant factors in the expansion of Soviet naval capabilities.

Anti-Air Warfare (AAW) Systems

For the past decade, naval surface AAW development has been intensely focused on the Soviet cruise missile threat. 6/ By far the largest and most expensive new AAW development is the AEGIS system, which has a powerful radar, a sophisticated high-capacity

5/ An active radar seeker is one that contains both a transmitter to generate electromagnetic energy pulses and a receiver to detect reflections of this energy from the target.

6/ Surface ships are not the only Navy AAW systems. Interceptor aircraft also provide an outer perimeter of AAW protection for carrier task forces or for other forces--such as amphibious units--operating near carriers. In turn, other aircraft support the interceptor mission. For a complete discussion, see Congressional Budget Office, Navy Budget Issues for Fiscal Year 1980, Budget Issue Paper for Fiscal Year 1980 (March 1979), pp. 58-61.

target-tracking capability, and will fire the newly developed Standard Missile SM-2. The Navy considers this to be an "area" defense system designed to defend other ships in the area, as well as that on which it is mounted. A shorter-range system designed for defense of a single ship (point defense) against cruise missiles is the NATO Sea Sparrow. This system will use a radar system that is specially designed for this purpose. 7/ The shortest-range, and perhaps most specialized, antiship missile defense (ASMD) system is the Phalanx Close-In Weapon System (CIWS). This system is designed to detect, track, and destroy incoming missiles automatically. It tracks both the incoming missile and the outgoing bullets of its rapid-fire Vulcan gun in order to achieve high accuracy. As a result of all of this effort, the Navy will soon have available a substantially improved barrier against cruise missiles.

No discussion of AAW, however brief, would be complete without mentioning the subject of Electronic Countermeasures (ECM), which critically affects modern combat capabilities. Perhaps the most significant feature of the technically esoteric subject of ECM is that it is highly fluid. A system that is today said to be highly resistant to countermeasures may be severely degraded tomorrow by some new ECM technique. The Soviet Union has been very active in this field and has reportedly developed sophisticated ECM techniques often superior to those of Western forces. 8/ ECM is pertinent to every sensor, communication, and weapon system that employs electronics and is, therefore, part of the fundamental fabric of modern warships.

Antisubmarine Warfare (ASW) Systems

The greatly increased ranges of modern submarine weapons have made it necessary for escorting forces to be able to detect and engage enemy submarines at much greater distances than in the past. Improved acoustic sensors--including long linear hydrophone

7/ The Mk-23 Target Acquisition System (TAS) detects and tracks incoming missiles and engages them with a ship-launched version of the Sparrow missile.

8/ For comment, see John M. Collins, American and Soviet Military Trends Since the Cuban Missile Crisis (Washington, D.C.: Georgetown University, 1978), p. 357.

arrays, often called "towed arrays"--have been developed over the past decade, both as components of ocean surveillance systems and as tactical sensors towed by ASW ships. These sensors, along with improved processing of the acoustic data obtained, are expected to make longer-range passive detection possible. ^{9/} If towed arrays live up to current expectations, they would offer the surface ship, for the first time, the opportunity to achieve parity with the submarine in passive listening capability. To be useful, long-range detections would require an ability to attack targets at substantially longer ranges than hull-mounted weapons permit. Helicopters and other airborne ASW systems, if available, could fulfill this function. In particular, the LAMPS III helicopter currently under development is expected to provide an improved aerial ASW weapons-delivery capability to complement surface systems.

COMPOSITION AND ORIENTATION OF GENERAL PURPOSE NAVAL FORCES

Aircraft Carriers

The aircraft carrier is perhaps the classic example of a ship that embodies the four attributes outlined earlier (engagement range, firepower, endurance, and resilience) which facilitate the conduct of the Navy's missions. As a result, carriers have been, and remain, the centerpiece of U.S. general purpose naval forces and are particularly critical to the conduct of offensive operations in high-threat areas to support sea control as well as projection missions. Carriers conduct other missions, however, which call for different tempos of operations. These include providing surveillance and air cover to smaller combat groups, underway replenishment groups, and convoys; intercepting small to

^{9/} Passive sonar uses hydrophones to listen for noises emanating from the target, whereas active sonar puts a pulse of acoustic energy, or "ping," into the water and listens for an echo off the target. Passive sonar is dependent upon target noise for detection but has the advantage of one-way attenuation of sound (from target to own ship) as opposed to two-way attenuation of active sonar emissions. It also does not reveal the presence of the searching ship. Towed arrays are expected to operate at increased depths where listening conditions may be better and, being towed, they are separated from the self-generated noise of the ship.

moderate enemy air strikes; conducting airborne ASW operations; and mounting smaller-scale strikes against enemy naval forces. ^{10/} In World War II, this divergence in mission was recognized, and the U.S. Navy built small escort carriers (CVEs) and light carriers (CVLs) to perform these lower-tempo missions.

Surface Combatants

Oceangoing surface combatants are usually designated as cruisers, destroyers, or frigates, depending upon their general size. Although cruisers of the World War II era were distinctly different in design from destroyers (since cruisers carried extensive armor and significantly heavier armament), present surface combatants are lineal descendants of the destroyer type, of greater or lesser displacement to suit the weapons suite (aggregate collection of weapons and sensor systems) and performance required. These ships have been designed primarily as escorts to provide protection to carriers and other high-value units, such as amphibious groups, replenishment ships, or merchant marine convoys.

Among older surface combatant classes that can be expected to remain in the fleet for a decade or more are a large group (62 ships) of ocean escort frigates of the FF-1052 class, FF-1040 class, and the FFG-1 class. These ships were designed primarily for ASW using echo-ranging sonar and short-range anti-submarine rockets (ASROC). The six ships of the FFG-1 class were also fitted with a single-channel Tartar AAW missile system. All of these ships were delivered between the mid-1960s and mid-1970s.

The destroyers of the DDG-2 class form a somewhat older (commissioned during 1960-1964) but more formidable group of surface combatants. Having a speed of 30-plus knots and a well-balanced multipurpose weapons suite including the Tartar AAW missile system, the 22 ships of this class often serve as carrier group escorts. Australia and the Federal Republic of Germany have each purchased three ships of this design for their navies. The U.S. Navy has proposed a program to modernize its DDG-2s.

^{10/} These missions can also be carried out by smaller ships, however. See Chapter VI, pp. 92-93.

The DD-963 destroyer program is now approaching completion with 31 ships already purchased. Despite its size, cost, and general purpose ("DD") designation, this class has been criticized as being deficient in overall combat capability. The combat suite emphasizes ASW based on the SQS-53 sonar/ASROC sensor-weapon combination, which may not have sufficient range to deal with submarines equipped with long-range weapons. The ship, as initially outfitted, has only a short-range, self-defense AAW system, and the surface engagement weapons consist of two five-inch guns. The Navy now plans to augment and improve the DD-963's ASW capability by installing a towed array sonar system and the LAMPS III helicopter. Harpoon missiles (and eventually Tomahawk) with LAMPS targeting would greatly extend the ship's surface engagement capabilities.

The FFG-7 class frigates are now in serial production, with a total purchase of about 60 ships contemplated. At 3,600-tons displacement, they are less than half the size of the 7,800-ton DD-963 destroyers. They were designed as a "low mix" ^{11/} general purpose escort and offer a balanced but relatively modest combat capability. They are equipped with a two-channel (capable of engaging two targets simultaneously) AAW missile system based on the Mk-92 weapon control system which fires Standard-MR (SM-1) missiles. They will be equipped with two LAMPS helicopters, the SQR-19 TACTAS towed-array sonar, and Harpoon missiles to provide long-range ASW and antisurface capability. Their single-shaft, gas turbine propulsion plant provides a maximum sustained speed of 28 knots, slightly below the 30 knots which is often stipulated as necessary for aircraft carrier escorts. These ships are designated for other missions, however, including escort of amphibious groups, underway replenishment groups, and patrol and presence operations in high-tension situations around the world.

The most recent class of surface combatant to be authorized is the CG-47 AEGIS cruiser (formerly called the DDG-47 destroyer). This ship will use the same basic hull and machinery

^{11/} The terms "high mix" and "low mix" were coined by Admiral Elmo Zumwalt, a former Chief of Naval Operations, to help describe his concept that the Navy should contain a "mix" of ships, some (high mix) with capabilities governed by the maximum anticipated threat and others (low mix) with a more modest capability whose lower cost would allow more ships to be procured within a given budget level.

as the DD-963 and will be equipped with the AEGIS weapons system and SM-2 missile, which will provide it with a formidable AAW capability. It will also be equipped with Harpoon cruise missiles, LAMPS III helicopters, and the ASW capability of the DD-963.

The Navy has initiated design studies for a new surface combatant, designated "DDX," whose construction would begin in the mid-1980s. The Secretary of Defense has recently directed the Navy to design a smaller ship than the DDX design it had initially proposed. The new design (now referred to as the "DDGX") is to be in the 4,000- to 6,000-ton displacement range, and the Navy has also been directed to develop a new AAW system suitable for such a ship. ^{12/} The question of what kind of ship this new surface combatant should be can be characterized as whether the new warship should be a follow-on to the CG-47 or FFG-7 class, or (as the proposed displacement range would indicate) a compromise between the two. It will likely approach CG-47 size, since a smaller "FFX" also is planned for the Naval Reserve. ^{13/} This ship design issue cannot be divorced from the competing policy and program alternatives outlined in this paper, that is, the choice between emphasis on individual ship capability geared to operation in the highest-threat areas or a stress on obtaining a larger number of less capable ships. Decisions regarding these alternatives, therefore, should affect the choice of the new "DDGX" design as well.

Attack Submarines

In this century, submarines have become the classic weapon of the interdictor at sea. As Chapter III indicated, the Soviet Union has placed a heavy emphasis on submarines in its navy. Since the 1950s, the U.S. Navy, faced with this threat, has emphasized ASW as the primary mission of U.S. attack submarines. The key to ASW is detection and tracking. Submarines are well equipped to hunt down and destroy other submarines, since their

^{12/} Clarence A. Robinson, Jr., "Five-Year Budget Curbs Aircraft Ship Buys," Aviation Week and Space Technology (August 27, 1979), p. 14.

^{13/} The Budget of the United States Government, Fiscal Year 1981, p. 96.

ability to maneuver to optimum listening depth for the best detection range makes them excellent sonar platforms.

In wartime, submarines would probably be deployed in barriers across enemy transit routes to allied sea lanes. Submarines could also operate more aggressively and penetrate to attack Soviet submarines in their own home waters as part of offensive operations.

More recently, expansion of the Soviet oceangoing surface fleet and merchant marine has brought about renewed emphasis on the antisurface capabilities of submarines. This emphasis has primarily manifested itself in new submarine weapons, such as the encapsulated Harpoon and the Tomahawk missiles, and in new operational concepts rather than in any basic submarine design changes.

Submarines underwent an explosive design evolution during the 1950s, when the combination of nuclear power and improved hydrodynamic hull form drastically increased the capabilities of submersible ships. Since that time, there has been a more gradual but, nevertheless, steady increase in the capability of successive classes of submarines.

The last conventionally powered combatant submarines built for the U.S. Navy were authorized in fiscal year 1956. Since that time, all new U.S. combatant submarine construction has been exclusively nuclear. Starting with the SSN-594 design in the early 1960s, relatively large serial production to a single design has been the rule. The resulting standardization has been very beneficial in the logistic support and maintenance of the submarine force. The attack submarine force today consists of three basic types plus a miscellaneous group of mostly earlier nuclear-powered submarines and a few remaining diesel-electric boats.

U.S. submarines now appear to enjoy a significant qualitative advantage over their Soviet counterparts in the very important area of quietness. The ability to operate quietly not only makes detection difficult for enemy sonar operators, but also greatly enhances the capabilities of the submarine's own sonars. Since sonar is by far the most important sensor for underwater operations, the quieter submarine has a crucial advantage.

The engagement range of U.S. submarines has been steadily expanding with the introduction of new weapons (the Mk-48 torpedo and Harpoon missile) and with sensor improvement achieved through

new hardware, better data processing, and ship quieting. With nuclear power, the steaming range of submarines is, for practical purposes, unlimited. 14/

The U.S. Navy has a stated force level goal of 90 attack submarines. With 73 nuclear-powered attack submarines and seven conventionally powered submarines currently in the active fleet and 25 nuclear-powered attack submarines under construction, this goal can be realized in the near term. In the longer term, however, the 90-ship level will not be maintained by the one-ship-per-year building rate that has prevailed in the past few years and is projected to continue for at least the next two years. (In order to maintain a 90-ship force level, a building rate of at least three to four ships a year would be required to replace older ships being retired.) At the same time, submarines have been assigned new escort missions, notably with carrier task groups. Thus, force level requirements may actually be increasing. 15/ The force level issue will be discussed further in Chapter VI, along with proposals for new submarine designs.

Auxiliary Ships

In general, the auxiliary ship group 16/ in the U.S. Navy has been substantially reduced in number over the past ten years. In the most important area, however, that of underway replenishment (UNREP) ships, this reduction has been commensurate with the overall reduction in combatant ships, and the remaining

14/ The firepower and combat endurance of these ships may be constrained, however, by their weapon load capacity. It is possible that additional weapon capacity could be more militarily significant for U.S. submarines than other uses of additional hull volume, such as providing more propulsive horsepower.

15/ Congressional Budget Office, The U.S. Sea Control Mission: Forces, Capabilities, and Requirements, Background Paper (June 1977), p. 46.

16/ U.S. auxiliary ships are divided into four basic categories: underway replenishment, material support, fleet support, and other auxiliaries. Underway replenishment ships provide for the underway replenishment of fuel, stores, and ammunition in

UNREP ships are, on average, younger than those of ten years ago. 17/

During the wide-ranging fleet operations of World War II, the U.S. Navy developed the art of underway replenishment to previously unknown levels of efficiency. As Chapter III indicated, the Soviet Union has recently improved its capabilities in this area as its navy has expanded from its earlier coastal orientation. An underway replenishment capability is absolutely essential if a navy is to be capable of sustained operations away from base.

Also important for sustained operations away from home bases are mobile maintenance facilities. For this role, the Navy has traditionally relied on maintenance ships, consisting of submarine tenders (AS), destroyer tenders (AD), and repair ships (AR). Shipboard support facilities can be rapidly moved from one place to another, which gives the Navy a fundamental basing flexibility it could not otherwise enjoy. Examples of areas in which this capability has proven useful include the establishment of advance SSBN operating bases at Holy Loch, Scotland, Rota, Spain, and Guam and the continuing support of naval forces in the Mediterranean and western Pacific. Maintenance ships are an important, but easily overlooked, component for a navy which seeks to be capable of sustained operations anywhere in the world.

support of naval forces at sea. Material support ships are repair ships and tenders, which are mobile ship maintenance facilities. Fleet support ships are basically ocean tugs and salvage ships, and other auxiliaries are (as the name implies) everything else.

17/ The shrinkage in the number of ships in the active fleet has been paralleled by a reduction of ships in the UNREP category. In the decade from fiscal year 1969 to fiscal year 1979, UNREP ships declined by 39 percent, while combatant force levels declined by 35 percent. The average age of the ships in the UNREP group has decreased over the same period from 19.2 years to 14.5 years, a favorable trend. The average of 14.5 years will decline further as a new class of oilers under construction, the AO-177 class, replaces some of the fleet's older oilers.

MINE WARFARE

Mine warfare is a subject which deserves special consideration, regardless of mission priorities and high or low mix. Indeed, modern mines can affect almost any mission scenario.

Mines and mine countermeasures are among the least glamorous areas of naval activities. At the same time, mines are among the most potent threats in the entire arsenal of naval weapons. Not only can mines destroy enemy merchant and naval ships at low cost in men and money to the nation deploying them, but the very threat of mines can paralyze large numbers of enemy ships and effectively redraw the contours of the ocean. Mines can be used by an inferior naval power to deny the dominant power the free and effective use of the oceans that its superior forces might otherwise secure. Mines can also be used by the dominant naval power to assist in maintaining its control over key areas of the ocean. Mine warfare, therefore, deserves careful consideration in developing naval plans and programs.

Technological advances in recent years have made it possible to give mines significant new capabilities. Among the most important areas of improvement have been:

- o Influence firing mechanisms. Recent electronics developments, including microcircuits and microprocessors, make it possible to build very sophisticated mine firing mechanisms which can be made sensitive, selective as to target, and difficult to sweep.
- o Deep-water capability. It is now possible to build mines that can be deployed in deep water as opposed to the relatively shallow areas around ports and the continental shelf. The Captor is an example of such a mine.
- o Effective radius against targets. Mines can be made that launch a vehicle to carry the charge to the target. This permits a much larger circle of effectiveness than earlier mines, which required the ship actually to touch or pass directly over the mine. Again, Captor is an example.

These improvements will also have the effect of greatly complicating the already difficult problem of mine countermeasures. The United States currently has programs for building

much more sophisticated and capable mines, but the same technology can be used by potential opponents in their mines, and this creates a more formidable mine countermeasures problem. 18/

One of the most interesting results of advances in mine warfare technology is the emergence of the mine as a significant factor in antisubmarine warfare. Although earlier types of mines could threaten submarines (in the same way they threatened other ships in shallow waters), a sophisticated deep-water mine can pose a threat to submarines over broad areas of the ocean. Such a mine, when deployed in numbers athwart likely submarine transit routes, can essentially perform one of the functions of an attack submarine in an ASW barrier patrol. 19/ In this regard, such mines must also be considered as a potential threat to SSBNs.

The area of mine countermeasures may perhaps be of even more importance than minelaying in the context of U.S. naval interests. The geopolitical position of the United States and its allies requires control and use of the seas and ports, and this must realistically require the ability to clear or neutralize mines of all varieties. The large stockpile of mines the Soviets are known to have makes the need for this capability particularly clear.

Mines in the water can be neutralized by minesweeping or minehunting techniques. Minesweeping involves removing a mine by cutting its mooring and/or causing it to detonate itself. Minehunting involves detecting a mine by high-resolution sonar or other means and then destroying it with an explosive charge or simply marking its location so that it can be avoided. Minehunting is a way of dealing with mines that are particularly difficult to sweep, such as pressure mines, 20/ or that have sophisticated sweep-resistant influence mechanisms.

18/ These programs include the Captor deep-water mine, the Quickstrike shallow-water mines, the Intermediate Water Depth (IWD) mine, and the self-propelled Submarine-Launched Mobile Mine (SLMM).

19/ It is not meant to assert here that a mine is the equal of an attack submarine, however.

20/ Pressure mines are set off by the pressure fluctuations in the water that are caused by a passing ship.

Today's active fleet contains only three mine warfare ships, compared with 85 fifteen years ago. In addition to the three active ocean minesweepers (MSOs), 22 MSOs are assigned to the Naval Reserve and could quickly be manned to full complement and used in an emergency. There are also 21 RH-53D minesweeping helicopters and seven small minesweeping boats (MSBs) in the active fleet. There is some doubt that present U.S. mine countermeasures forces can adequately cope with a serious challenge from an enemy using modern mines.

Helicopters offer certain advantages over ships in minesweeping, including speed (although not to the degree one might think) and deployment flexibility. Ship minesweepers, on the other hand, have better endurance and bad-weather capability, as well as greater sweep-depths. Presently, MSOs alone have a minehunting capability. There appears to be a complementary role for both helicopters and ships in minesweeping in the future.

CONCLUSIONS

The U.S. Navy is seeking to maintain its accustomed predominance at sea both in fact and in stature. It is struggling with pressures brought about by rapidly advancing technology, the effects of block obsolescence in the 1970s of large numbers of ships inherited from the vast U.S. fleet that emerged from World War II, and a vigorous challenge at sea from a Soviet navy growing in strength and confidence.

In addressing this challenge, Navy planners are faced with reconciling a perceived need for complex and expensive ships to counter the maximum threat with a need for sufficient numbers of ships to fulfill current and expanding worldwide naval commitments, all within the constraints of available budgets. Recent trends suggest that the former need is being given preference.

The indispensable ingredient of all naval force improvements in the modern era is technology. Improvements in engagement range, firepower, endurance, and ship resilience are heavily and, in some cases, totally dependent upon improvements in technology. Nevertheless, one ship can only be in one place at one time. Technology can do little to change this. Emphasis on adequate numbers of ships and on development of better capabilities for ships at the lower end of the cost spectrum might offer a more promising prospect of meeting the demands of a

variety of missions that address the overall maritime challenge to U.S. interests. Chapter VI discusses some issues pertaining to alternative mission orientations that could influence resource allocation for naval force improvement.

CHAPTER VI. CURRENT ISSUES IN NAVAL SHIPBUILDING

Today's Navy, as outlined in Chapter V, is the result of planning and programming priorities that have dominated over the past quarter century. The Navy of a quarter of a century in the future will have been shaped in part by decisions made today. These decisions will not be easy. Hard choices must be made, based on assessments of alternative mission priorities and on requirements for additional forces that reflect those priorities. The factors involved in weighing mission and program alternatives are complex and often contentious. This chapter outlines some major issues bearing on current naval shipbuilding decisions.

MISSION PRIORITIES

The mission that has tended to dominate U.S. naval planning in recent years is sea-lane protection in a NATO/Warsaw Pact war. Within this context, many of the governing ship performance requirements derive from an assumed battle at sea between U.S. and Soviet naval and land-based forces. In such a scenario, a U.S. carrier strike force would be subjected to an intensive, simultaneous attack by massed Soviet air, surface, and submarine forces such as might occur when the strike force approached Soviet home waters. The ability to prevail in such major fleet actions, and to destroy Soviet forces in or near their bases, would enhance NATO's ability to prosecute successfully a new "Battle of the Atlantic" against a Soviet submarine fleet vastly more capable than that of the Germans in World War II.

Consideration of these demanding scenarios has contributed to a perceived requirement within the Navy for highly capable but expensive ships. There are, however, other--and perhaps more likely--mission scenarios to be considered in deciding upon future naval shipbuilding programs. These include sustained patrol, projection, and antisubmarine operations in distant areas to counter Soviet actions in the Third World, as well as escort requirements for naval support groups that would sustain such Third World operations. In addition, it is possible that the ultimate goal of the more demanding though less likely scenario--protection of the sea lanes to Europe in a major war--could be met by more defensive postures involving forward air defenses on land

bases along enemy routes to the sea lanes and defensive protection for convoys. 1/ The number of ships available would probably be more important for any of these missions than highly sophisticated weapons on a relatively small number of ships.

Chapter III indicated that recent trends in Soviet ship-building point to a greater Soviet concern with projection operations. Soviet behavior in recent Third World crises underscores this trend. 2/ At the same time, the United States has become acutely aware of the need to deploy forces to Third World regions to demonstrate concern for its interests or those of its allies when such interests are threatened by states other than the Soviet Union. While these forces need not be naval forces, the logistical and political problems arising from the recent deployment of F-15 aircraft to Saudi Arabia underscore the contention that the flexibility of naval forces is particularly valuable in Third World environments. 3/ Indeed, in a recent study, the Brookings Institution examined the actual use of force in promoting U.S. political objectives in the period 1946-1975 and found that naval forces were involved in at least 177 of 215 incidents between 1946 and 1975 that involved the use of force to promote U.S. political objectives. These naval activities ranged from presence (to underscore U.S. policy) to blockade and actual use of firepower. 4/ Finally, the demands for maintaining current carrier deployments have not abated.

The aggregate of all of these long-standing and potential peacetime and crisis demands suggests contingencies in which the need to provide an adequate number of ships for the fleet as a

1/ See Chapter IV, and Congressional Budget Office, The U.S. Sea Control Mission: Forces, Capabilities, and Requirements, Background Paper (June 1977).

2/ See Stephen S. Kaplan and others, Mailed Fist, Velvet Glove: Soviet Armed Forces As a Political Instrument (Washington, D.C.: The Brookings Institution, 1979), especially Chapters 14 and 15. See also Bradford Dismukes and James McConnell, eds., "Soviet Naval Diplomacy," in From the June War to Angola (Arlington, Va.: Center for Naval Analyses, 1978), pp. 8-24 to 8-30.

3/ Kaplan and others, Mailed Fist, Velvet Glove, pp. 15-17.

4/ Barry M. Blechman and Stephen S. Kaplan, Force Without War (Washington, D.C.: The Brookings Institution, 1978), p. 38.

whole may be more important than the need to maximize the individual capabilities of each of its ships. The general group of crisis contingencies in Third World regions shares the common characteristic that the ability to present appropriate force in a timely and/or continuing manner may be no less important than the upper limits of a ship's capabilities when it arrives. It is these contingencies that, particularly in the context of mutual nuclear deterrence, may be the most likely, if not the most tactically demanding, of possible future naval missions.

OVERALL FORCE LEVELS

Despite much discussion within the Navy of sacrificing quality for quantity in shipbuilding and several diligent attempts to design inexpensive new warships, the actual pattern in recent years has been toward procurement of smaller numbers of very expensive new ships to replace larger numbers of old ships being retired. For this reason, the Chief of Naval Operations (CNO) has called for annual procurement of approximately 20 general purpose force ships if the fleet is not to drop below its current level of 532 active, military sealift command, and reserve ships. 5/ Nevertheless, even the CNO prefers that the Navy assign priority to annual procurement of two highly capable ship types--CG-47 air defense cruisers (at \$820 million each) and SSN-688 nuclear-powered attack submarines (at \$500 million each). 6/ The \$26.5 billion five-year cost of these two programs alone would add only 40 new ships to the fleet force levels of the 1990s. It would also probably consume at least two-thirds of the general purpose shipbuilding budget. 7/

5/ The Navy formerly included only active ships in its force level calculations. If only active ships were counted, the current level would drop to 456 units.

6/ Two CG-47 cruisers have already been authorized; the Navy's proposed program seeks 22 more. The SSN-688 construction program seeks to maintain a force level of 90 submarines that will be attained before 1985. This program assumes procurement of four CG-47s and four SSN-688s in each year of the fiscal years 1981-1985 program.

7/ Shipbuilding budgets for general purpose forces have not exceeded \$5.8 billion (in fiscal year 1980 dollars) since 1965. The fiscal year 1980 general purpose force shipbuilding program, as approved by the Congress, amounted to \$5.2 million.

The question of how large the Navy should be is very difficult to assess and is inherently sensitive to assumed mission scenarios. Despite many studies and much discussion, a firm and rationally supportable number has not emerged. Some have argued the Navy is larger than necessary, 8/ but the prevailing judgment seems to be that the number of ships in the fleet has become uncomfortably low. This view is shared both by Secretary of Defense Harold Brown and by his Republican predecessor, Donald Rumsfeld. 9/

Nevertheless, in recent years, authorizations for new ship construction have not shown a trend toward larger numbers. In the last four fiscal years, the actual numbers of new ships authorized were 15, 18, 13, and 12 ships, respectively. Therefore, despite a clearly perceived and publicly stated need for more new ships by the highest level within the Department of Defense over a period of years, there has been no corresponding trend in new ship production.

It might be argued, on the other hand, that the ships being built in the quantities authorized represent a balanced and adequate force that fulfills actual defense needs. It is certainly true that simply counting numbers of ships is an inadequate measure of real naval capability. The new ships being built do have capabilities that exceed those of the older ships being retired. The issue is whether the Navy's ability to distribute its forces flexibly, which is a strong function of numerical size, is unduly compromised by this trend toward concentrating at the margin on fewer and fewer more capable ships. Resolution of this issue hinges as much on fundamental policy decisions regarding mission and budgetary priorities as on technical capabilities and tactical employment options relating to specific ship types. Indeed, these policy decisions affect not merely competing ship types in one naval warfare area, but overall approaches to naval shipbuilding and utilization as well. Chapter VII presents several such illustrative approaches, together with their

8/ The Boston Study Group, The Price of Defense: A New Strategy for Military Spending (New York: New York Times Books, 1979).

9/ U.S. Department of Defense, Annual Report, Fiscal Year 1980, p. 167; Donald H. Rumsfeld, "Which Five-Year Shipbuilding Program," United States Naval Institute Proceedings (February 1977), pp. 18-25.

consequences for choices among individual ship alternatives. The remainder of this chapter reviews the specific choices available to the Congress.

MAJOR SYSTEMS CHOICES FACING THE CONGRESS

Surface Combatants

A current example of high- and low-mix alternatives is the CG-47 AEGIS cruiser and the FFG-7-class frigate. The comparison here is, perhaps, less than ideal since the CG-47 is actually a scaled-down version of the true high-mix alternative, which was a nuclear cruiser. Furthermore, the FFG's AAW system is based on somewhat dated technology, whereas the AEGIS is a new development incorporating more recent technology. 10/ This case

10/ Surface AAW missile systems have undergone a substantial technical evolution over the past 25 years. The early systems, such as Terrier, were beam-rider missiles, in which the missile simply rode out a beam of electromagnetic energy until it intercepted its target. The problem with beam-rider systems, however, was that the beam tended to diverge and weaken with increasing range, whereas exactly the opposite was needed as the missile approached intercept. To overcome this, semi-active guidance was developed. In newer semi-active guidance systems, such as the Mk-92 system currently used on FFG-7-class frigates, the target is "illuminated" by an electromagnetic beam from the ship's fire control radar, and the missile homes on the energy reflected from this illumination. This works reasonably well except for the problem of saturation during high-density attacks, since an illuminating radar must be devoted exclusively to a single target until the target is destroyed by the missile. One way to overcome this difficulty is to use intermittent semi-active illumination in combination with a "Track-While-Scan" (TWS) Weapon Control System (WCS). Another technique uses a WCS-to-missile command link to provide the missile with midcourse guidance commands. With these two sample data midcourse techniques, guidance is not continuous, and several targets may be tracked and illuminated by the same radar. Only in the final phase of intercept is continuous, precise guidance necessary. This represents, however, a significant jump in technological sophistication, involving the use of high-speed computers.

does, however, serve to illustrate some of the high-low mix trade-off issues, particularly with respect to AAW. It is, furthermore, a particularly apt example of how a choice between emphasis on high- or low-mix ships should be influenced by the context in which they are expected to be used: extremely high-threat environments, such as those implied by strikes against the Soviet Union, or relatively lower-threat contexts, such as patrol and presence operations in the Third World.

AEGIS shows great promise of being a very capable system with its large phased-array radar that will track hundreds of targets throughout a hemisphere in space around the ship. The initial AEGIS missile, known as the Standard SM-2, will be guided by sample-data command until the final phase of its intercept, when it will receive continuous semi-active illumination. AEGIS, however, is a very large system suitable only for rather large ships, like the CG-47. It will also be much more expensive than any other tactical missile system ever deployed at sea.

The Navy has not developed a modern, multiple-target AAW system, technically contemporary with AEGIS, but suitable for smaller, relatively inexpensive escorts. The Mk-92 weapon control system developed for the FFG-7 class of escorts is an "Americanized" variant of the successful Dutch M-20 series and is a basic semi-active system using what may now be considered somewhat obsolescent technology. By adding a separate tracking and illuminating radar (STIR), this system was given the capacity to engage two targets simultaneously, but further growth will require a new "front end," that is, a modern TWS missile-guidance radar that can track and engage multiple targets simultaneously. 11/

This is an example of the kind of trade-off issue that arises in high/low-mix force alternative decisions. Clearly, in an environment in which coordinated simultaneous attacks could be expected, a system such as AEGIS, which gives continuous coverage to long ranges and is resistant to electronic countermeasures, is preferable. Therefore, in a ship-versus-ship comparison, the CG-47 surpasses the FFG-7. If cost is factored in, however, an equal-investment comparison would balance about three FFG-7s to one CG-47 on an initial-investment basis, or about a range of 2.1

11/ See below, pp. 91-92.

to 2.8 to one in life-cycle costs. In an equal-cost comparison, the low-mix FFG-7 might compare much more favorably. 12/

Operational Comparisons of the CG-47 and FFG-7. It is instructive to examine this trade-off as it pertains to engagements with aircraft (AAW), surface ships (ASuW), and submarines (ASW), using engagement range, firepower, endurance, and resilience as rough indexes for performance.

In AAW, the CG-47 with the new Standard SM-2 missile is far superior to the FFG-7 in both engagement range and target engagement capacity. In defending against a highly intensive, coordinated cruise missile attack supported by significant electronic countermeasures--such as that which the Soviet Union could organize most readily near its territory--the CG-47 would probably outperform even three FFGs as presently configured. Three FFGs, however, could be distributed over a large section of the ocean to provide AAW coverage over at least an equivalent area to that of a single CG-47. The smaller ships might be preferred in situations in which a widely distributed or moderately intensive threat would have to be countered. Such situations could include operations against Soviet or other forces in Third World areas either during a NATO/Warsaw Pact conflict or in a lesser contingency. 13/

In ASuW, the maximum range capability is that of the cruise missile carried by the ship. Both the CG and the FFG will carry Harpoon missiles and, when the still longer-range Tomahawk

12/ The 3:1 ratio is based on the 1981 investment costs of the CG-47 and FFG-7, which amount to \$820 million and \$260 million, respectively. On a discounted 30-year life-cycle basis (assuming a 30-year life for the CG-47 and a 25-year life for the FFG-7, with an add-on to equalize notional operational life), the ratio falls to 2.8:1. On an undiscounted 30-year life-cycle basis, the ratio drops to 2.1:1.

13/ The AAW capability of the FFG could be substantially improved, however, in both engagement range and firepower if it were equipped to fire the new Standard SM-2 missile. The SM-2 is compatible with the FFG launcher, but the FFG's weapons control system would require modification, as discussed below, for it to use the SM-2's capabilities.

antiship missiles become available, both ships could readily accommodate them. Thus, the maximum surface engagement range would be the same for the CG and FFG, but several FFGs could be distributed to cover more area than one CG. The actual engagement range of ships firing cruise missiles is strongly dependent upon an over-the-horizon targeting capability, and both ship types would often depend upon other units for this. The indigenous ASuW over-the-horizon targeting capability for both the CG and the FFG will be the LAMPS helicopter. The CG will carry two of these units, whereas the two to three FFGs that could be procured for the same life-cycle cost would carry a total of four to six helicopters. ^{14/} In long-range ASuW, therefore, two to three FFGs would be substantially more effective than one CG. In patrol operations (such as the Vietnam "Marketime" patrols) in which short-range ASuW using gunfire might occur, two to three FFGs would also probably be preferred over one CG simply because they could cover more area.

In ASW, two categories must be considered: (1) long-range, broad-area ASW search and prosecution; and (2) shorter-range, active search and attack as used in traditional screening tactics. For long-range ASW, both the CG and FFG are programmed to use the same basic equipment, that is, the SLQ-19 TACTAS towed-array sonar and the LAMPS helicopter. Two to three FFGs, therefore, could be expected to cover about two to three times as much area as one CG. For close-in active sonar search and attack, the CG is equipped with a more powerful sonar and with the ASROC ASW weapon, which would give it more range and firepower than the FFG in ASW screening operations. Under most circumstances, however, two to three FFGs could be expected to provide better screen protection than a single CG, simply from weight of numbers, despite the CG's superior individual capability. In ASW, therefore, two to three FFGs should provide better capability than one CG in both long- and short-range operations, although a single CG would be superior to a single FFG.

In the attributes of endurance and survivability, the CG-47 again excels over the FFG-7 on a ship-to-ship basis. Both are gas turbine propelled ships; but the FFG can transit only 4,500 nautical miles at 20 knots, whereas the larger CG has a range of 6,000 nautical miles at 20 knots. Both are built to essentially

^{14/} The range of four to six reflects the range of life-cycle cost ratios (2.1 to 2.8) outlined above, pp. 88-89.

equivalent design and construction quality standards, but the CG enjoys the additional resilience inherent in a larger ship. The FFG, on the other hand, offers the advantage of numbers. If a CG is sunk or incapacitated, its capabilities are lost to the fleet; but, for equal cost, two to three FFGs would have to be lost to incur a similar degradation.

In summary, a comparison of the equal life-cycle cost alternatives of one CG-47 and two to three FFG-7s would indicate that the CG is more effective in the specific scenario of an intensive, coordinated attack with aircraft and cruise missiles against U.S. surface units. In other scenarios, however--including more moderate AAW situations, antisurface engagements, and antisubmarine warfare--the advantages of having a larger number of ships might outweigh individual ship features and favor the FFG as the more cost-effective alternative.

In addition, the FFG's AAW capability could be improved substantially, both in range and firepower, if its weapon control system were upgraded to accommodate the new Standard SM-2 missile. Given the large number of these ships already in the fleet and under construction, this could greatly improve overall fleet AAW capability.

This upgrade could be accomplished in conjunction with a significant improvement in the ship's missile fire control system through the use of later technology. An example of the power that more recent technology can provide in even a very small and lightweight system is afforded by the FLEXAR (Flexible Adaptive Radar) system, soon to be demonstrated under the Navy Prototyping Program. 15/ FLEXAR is designed to track automatically 16/ at least 20 air targets simultaneously and control multiple engagements with four missiles in flight at the same time. With a total weight of about two to three tons, the system would be light

15/ The Navy Prototyping Program, established in the early 1970s, involves a procedure whereby the Navy invites proposals from industry for innovative solutions to generally defined problem areas.

16/ The term "track" means that the system will automatically follow the contact and will compute and continuously update all of the parameters--such as bearing, range, speed, course, and altitude--necessary to attack it.

enough to be installed on even the smallest warships. An alternative concept, proposed by the Sperry Corporation, the manufacturer of the Mk-92 system, would use a small, four-face, phased-array radar to provide a similar capability. The Sperry proposal, if implemented, would provide the basis for a significant improvement in the Mk-92 system's engagement range and multiple target engagement capacity. These are only two examples of the kind of system upgrade that could transform tactical anti-air warfare at sea. When used to control a long-range missile, such as the Standard SM-2, launched either from existing launchers or from newly installed vertical launchers, either approach might provide an affordable high-quality AAW system for low-mix escort ships. If demonstrated to be effective, such systems could serve either as a backfit replacement for existing fire-control radars on the FFG-7 and on earlier classes such as the DDG-2, or they could be installed on newly constructed combatants.

Finally, there is a promising opportunity for a dramatic increase in fleet AAW effectiveness through a synergistic combination of AEGIS, lower-capability AAW ships such as the FFG-7 class, and older AAW missile ships. The AEGIS radar (AN/SPY-1) has detection and track capabilities beyond those which can be fully exploited by its own weapons. If appropriate data links could be established between the AEGIS ship and other ships capable of launching AAW missiles, the capabilities of the powerful AEGIS radar could be utilized not only by the AEGIS ship but also by all other missile ships in the vicinity. This arrangement would greatly enlarge the engagement range of AEGIS and increase the firepower of low-mix AAW ships. This idea has been an AEGIS planning option for many years but has never been implemented. With this capability, combinations of CG-47s and FFG-7s might be the best investment for a variety of environments. Such combinations could, for example, hedge against the potential for antiship attacks if the Soviet Union gained access to forward Indian Ocean bases. Combinations of one CG-47 and two to three FFG-7s, as trade-offs for either two CG-47s or four to six FFGs, would be especially useful as escorts for noncarrier task forces.

A New Role for FFG-7 Combatants. The promise of new AAW systems, as well as Harpoon and Tomahawk, is that they can transform the FFG-7 from a ship designed primarily as an escort in low-threat areas to a ship that could form part of task forces designed for offensive operations. In particular, FFG-7 ships armed with the systems discussed above would provide useful escorts for small aviation ships, whose V/STOL aircraft could provide over-the-horizon firepower for antiship and onshore

projection operations and possibly electronic countermeasures in medium-threat areas. ^{17/} The FFG-7's speed would be sufficient to escort ships such as the LPH or LHA general purpose amphibious assault platforms, whose maximum speed is below 25 knots. The FFG-7's AAW capabilities, especially if upgraded, would provide area coverage to supplement air-to-air capabilities of V/STOL aircraft, while its cruise missiles would supplement the offensive firepower of V/STOL aircraft.

Thus, as an ASW convoy escort geared to defense of the sea lanes, the FFG-7 could operate with its current AAW capability; its important ASW systems would be LAMPS helicopters and towed-array sonars. As a ship geared to operating with aviation ships on presence/projection missions, it could be equipped with the newer AAW and ASuW systems outlined above.

Attack Submarines

As with other types of warships, submarine force level requirements--and the ship capability mix within that force--depend upon assumed missions and the relative priorities accorded them. Assumed contributions by allied navies for various missions are also a factor in assessing requirements. Within this framework, the U.S. Navy now has a stated goal of 90 nuclear-powered attack submarines (SSNs). ^{18/} If the current construction rate of one ship per year is continued, however, it is clear that this goal will not be achieved. This leaves three basic alternatives: (1) increase investment in nuclear-powered submarines, (2) build more individually less expensive submarines, or (3) reassess the need for a 90-ship force level.

Alternatives (1) and (2) again evoke the quality-versus-quantity issue analogous to that in surface combatants. Indeed,

^{17/} For further discussion of this point, see Congressional Budget Office, U.S. Naval Forces: The Peacetime Presence Mission, pp. 54-58. V/STOL aircraft could also be employed to provide targeting assistance to very long-range anti-aircraft missiles.

^{18/} For a discussion of SSN force level requirements, see Congressional Budget Office, The U.S. Sea Control Mission: Forces, Capabilities, and Requirements, pp. 40-48.

this issue was the subject of a major review, called the Navy Submarine Alternatives Study, recently conducted by the Navy. That study concluded that less expensive attack submarines could indeed be built, but that such submarines would--not surprisingly--require certain compromises in operational capabilities. By accepting such compromises, an SSN costing about one-third less than current SSN-688-class submarines might be built. Even this price, however, would only increase production by one more submarine every other year at current funding levels, still well below the level required to maintain a force of 90 ships. The required average replacement rate to maintain a 90-ship force level is 3.6 ships per year for a 25-year service life, and 3 ships per year for a 30-year service life. 19/

It would appear, therefore, that if the United States continues its policy of building only nuclear-powered submarines, only alternatives (1) and (3) above are actually feasible. Even with a reduction in individual ship capability, at least a doubling of the current annual investment in SSNs would be required to maintain a 90-ship force. If the recent (fiscal years 1978-1980) annual investment levels are maintained, the SSN force will eventually shrink to 25 to 40 ships (depending on assumed operating life) for SSN-688-quality submarines or to 30 to 55 ships (again depending on assumed operating life) for an austere SSN-class, such as that hypothesized in the Submarine Alternatives Study and included in the current DoD five-year shipbuilding plan.

To pursue alternative (2), that is, to maintain a 90-ship attack submarine force without substantially increasing current annual investment in new ships, more drastic cost reductions will clearly be needed. One area that might be considered is the long neglected subject of conventional (diesel-electric) submarines. Nuclear-powered submarines are inherently preferred over conventional submarines on a one-for-one basis because of their overwhelming mobility advantage. In terms of an equal-investment comparison, however, a larger number of conventional submarines might be advantageous for certain missions.

Missions that conventional submarines could be expected to perform satisfactorily include ASW barrier patrol, antishipping patrol, mining, surveillance, and support of clandestine operations. In these and almost any other missions a conventional

19/ SSNs are expected to operate between 25 and 30 years.

submarine might undertake, however, it could seldom, if ever, be considered as effective as a nuclear-powered submarine in performing the mission. ^{20/} The question is one of sufficiency. Are there missions that could be performed adequately by conventional submarines, thus freeing nuclear-powered submarines for more hazardous missions? Are there missions that could be performed more effectively by the several conventional submarines that could be procured for the same cost as a single nuclear-powered submarine?

The Submarine Alternatives Study analyzed the combat effectiveness of various design alternatives against a common set of mission scenarios. Another approach, however, would be to allocate mission assignments selectively in accordance with relative capabilities. The most demanding missions would be performed by the most capable units; less capable units would be assigned to missions in which the highest capabilities are less important. This second approach should be taken when examining conventional submarine options. There are some missions, such as fast carrier task group escort, for which conventional submarines would clearly be unsuited. For other missions, however, such as the barrier mission examined in Appendix B, the conventional submarine might be attractive on a cost-effectiveness basis. The case for conventional submarines should be examined in the context of a mixed force assigned to missions for which its capabilities are most relevant.

Appendix B contains an analysis of conventional and nuclear-powered submarine cost effectiveness in one of the more important submarine mission areas, that of ASW barrier patrol in the ocean area between Greenland and Iceland and between Iceland and the United Kingdom (the G-I-UK gap), the route that Soviet submarines would have to use in transiting between their bases and the North Atlantic sea lanes. Because NATO forces are expected to provide air cover for ASW units, conventional submarines should be able to survive while operating on barriers. Indeed, allied submarines participating in these barrier operations would almost certainly include diesel-electric units. Thus, the question is whether conventional submarines can perform the barrier submarine mission and at what cost vis-a-vis nuclear-powered submarines.

^{20/} The diesel-electric submarine is probably as effective in some shallow-water barrier operations, because of the larger SSN's requirement for greater depths to exploit its maneuverability.

Since it has been nearly 25 years since the United States last designed and built a conventional submarine, it is not easy to model the performance characteristics of a conventional submarine built in the 1980s. Appendix B, therefore, uses both a conservative model, based on factors derived from the characteristics of older U.S. diesel-electric submarines, and a more optimistic model, based on much more recent German experience in building conventional submarines. This analysis concludes that, even under the more conservative model, the conventional submarine is superior in terms of cost effectiveness for the barrier mission examined. Indeed, the analysis indicates that from \$1.5 billion (conservative model) to \$8.4 billion (more optimistic model) in life-cycle cost might be saved through using diesel-electric submarines for the G-I-UK gap barrier mission.

The barrier scenario discussed above is relevant to a wide spectrum of contingencies, including a full NATO/Warsaw Pact war. Conventional propulsion in such situations might also be expedient in the event of denial of port facilities to nuclear-powered ships resulting from local concern about reactor safety. Any significant accident with a naval reactor anywhere in the world in any navy would make this an issue overnight. A force including conventional submarines would hedge against this. Conventional submarines, therefore, may bear closer examination as an attractive and prudent shipbuilding option.

Considering the continuing dichotomy between stated force goals and the probable force levels that current budgets will support, perhaps the best solution lies in a combination of the three alternatives discussed above. The Navy might consider increasing the annual investment level in attack submarines, seek ways to achieve significant reductions in unit ship costs, and reevaluate ultimate force level needs. At the same time, it may be worthwhile to reconsider the conventional wisdom that conventional submarines have no place in the modern Navy.

Auxiliary Ships

As discussed in Chapter V, the support of auxiliary ships is vital to an ability for sustained naval operations at sea. Largely as a result of a vigorous auxiliary shipbuilding program in the 1960s, the Navy now has a fairly new and efficient force of underway replenishment ships. Their services are vital to naval forces in almost any realistic wartime scenario and underpin the peacetime deployment posture of the Navy today. Their importance

becomes even more pronounced as priority is accorded to missions in distant areas, such as the Middle East and Indian Ocean.

Maintenance ships are a category of support forces particularly useful for maintaining a flexible deployment capability. Twenty-six ships of this type are currently in active service, including nine destroyer tenders (AD), thirteen submarine tenders (AS), and four repair ships (AR). Of these, sixteen are very old ships, dating from World War II. Five maintenance ships (four ADs and one AS) now under construction will replace some of these older units, but no further maintenance ship procurement is scheduled in the current five-year defense plan. By the mid-1980s, therefore, the Navy will have 15 tenders constructed in the postwar period, plus, perhaps, some maintenance ships of World War II vintage. Replacing these ships will not be a trivial budget item. The last submarine tender was authorized in fiscal year 1977, at a cost of \$260 million; the last destroyer tender, authorized in fiscal year 1979, is expected to cost \$318 million.

Mobile maintenance facilities, such as tenders, not only provide essential support for sustained operations away from home bases, but are also a necessary component of manpower reduction efforts for warship crews. With the high cost of manpower, significant savings could be realized if warship crews could be reduced. A mobile maintenance support group, at perhaps a squadron level and based on a tender, is one way to make significant crew reductions feasible. ^{21/} However provided for, adequate mobile support facilities must be available to sustain fleet operations wherever such operations are required.

MINE WARFARE

As discussed in Chapter V, naval mines are being significantly improved. These improved mines will have a larger destruction radius and deep-water capability, and will be much more difficult to sweep. As a result, mines constitute not only a

^{21/} Another way of basing such mobile maintenance support might be in onshore "containerized" facilities that could rapidly be packed up and moved from one place to another. Somewhat closer to a tender but less expensive would be a barge-based facility that could be moved from place to place by ocean-going tugs.

more dangerous threat, but also a threat in a wider range of situations than was the case with earlier generations. Improvement of mine countermeasures, therefore, is a potentially more urgent and certainly a more difficult problem than in the past.

In order to upgrade its mine countermeasures capability, the Navy proposes to build a new class of mine countermeasure (MCM) ships. These ships will be equipped with new hardware, including improved minehunting sonar and precision navigation equipment, which should fundamentally improve U.S. mine countermeasure capability. Accurate navigation is absolutely fundamental to efficient minesweeping and minehunting. One must know the precise location of channels and identified mines in order to perform these functions efficiently. Present technology permits significant improvement in this field, with commensurate increases in effectiveness. ^{22/} Improvements in minehunting sonar, likewise, will pay substantial dividends. As mines become more sophisticated and sweep resistant, minehunting (as opposed to minesweeping) will become more important. The best possible mine detection equipment will be the key to success in this activity.

Allied capabilities in the field of mine warfare are significant but vary from country to country, depending upon individual national priorities. In general, allied mine warfare capabilities are limited to relatively shallow waters both for minelaying and mine countermeasures. Several allies are building new mine countermeasure ships that will upgrade existing capabilities. These include the British "Hunt" class (five units); the Belgian/Dutch/French "Tripartite" ships (as many as 45 units), all built with a novel glass reinforced plastic (GRP) hull material; and the West German "Troika" MCM system. In addition, the British are developing minesweeping equipment, called EDATS (Extra Deep Armed Team Sweep), for use on commercial fishing trawler-type ships. Allied nations can, in general, now clear their own ports and coastal waters of relatively unsophisticated mine threats and can deploy defensive minefields in their own waters. As newer systems, such as those mentioned above, become operational, these capabilities will be improved. The Soviet deep-water mine threat noted in Chapter IV, however, is still an open challenge for allied mine countermeasures (as it is for the

^{22/} Improved navigational accuracy for mine countermeasures is one of the benefits that could result from deployment of the proposed Global Positioning System (GPS).

United States). The British have been, perhaps, the most active of the allies in addressing this problem. The area of mine countermeasures is one in which interallied cooperation in research and development, equipment procurement, and operational planning could be particularly profitable. An integrated allied mine countermeasure force would be most efficient for mine neutralization in Europe during a NATO/Warsaw Pact war. Clearance of U.S. home waters, mine clearance contingencies outside of the NATO context, and probably much of the deep-water mine neutralization task will remain U.S. responsibilities.

Given the small and aging U.S. fleet of existing mine countermeasure ships, it seems clear that new, better-equipped ships of this type are needed. It is not clear, however, that the few new MCM ships proposed by DoD (nine through fiscal year 1985) will maintain, let alone increase, the minimal mine countermeasures capability that now exists. Similarly, it can be argued that the current force of 21 minesweeping helicopters is small when compared to the potential threat. Obviously, the item of mine countermeasures will have to compete with other priorities in the defense budget, but equally obvious is the need to expand present U.S. capabilities rapidly to meet the demands which could, and probably would, be imposed in wartime. Perhaps suites of modular mine countermeasures equipment (for example, precision navigation, minehunting variable-depth sonar, and sweep gear) could be developed. These units, similar to the British system, could be rapidly fitted on a variety of selected hulls to provide for a rapid force expansion in emergencies. ^{23/} Given the length of time needed to build ships, the Navy must either be content with the existing minimal mine countermeasures force, bear the cost of maintaining a higher force level, or provide for some realistic capability to expand forces rapidly in an emergency. Perhaps the last alternative is the most palatable of the three.

CONCLUSION

New ship procurement (as measured by budget portion) in recent years has given priority to high-mix construction. With the exception of some FFG-7 procurement, U.S. shipbuilding budgets in the last half of the 1970s have emphasized Trident

^{23/} For a discussion, see "MCM Proposals: A Multitude of Options," International Defense Review (September 1979), p. 1561.

nuclear-powered ballistic missile submarines (SSBNs), SSN-688s, major surface escorts, and a nuclear-powered carrier (CVN). ^{24/} In the next five years, according to the current five-year defense plan, the Navy will buy more Tridents and SSN-688s and will shift from low-mix FFG-7s to high-mix CG-47s in surface combatant procurement. The tendency for high-mix ship purchases to dominate the shipbuilding budget appears likely to continue and, indeed, will become still more pronounced in the next few years if the current five-year defense plan is carried out.

This trend would be consistent with an assessment that the Soviet navy has become so formidable that only the most capable warships can survive and be effective in a head-to-head confrontation with them. Since it results in the acquisition of small numbers of ships, this strategy seems to depend implicitly upon allies to provide ships in the low-mix end of the spectrum. In the context of a NATO/Warsaw Pact war, the active support of allied naval forces would undoubtedly be available, and the weight of those forces would be substantial. In other conflict scenarios (such as in the Third World), however, the contribution, especially from NATO allies, is much less clear. While the present trend may represent an efficient allocation of resources when viewed in the context of a NATO war, in the context of a more general view of possible naval contingencies, it might be assessed as too narrow a focusing of resources.

^{24/} In the last half of the 1970s (fiscal years 1976 through 1980), 59 percent of ship construction (SCN) funds authorized went to build 18 high-mix combatants; 30 percent of SCN funds purchased 39 low-mix combatants. Of the 18 high-mix combatants, most (14) were nuclear-powered submarines, Trident SSBNs, and SSN-688s, with the remainder a CVN and three surface combatants. Excluding the cost of Trident SSBNs, the portion of the budget given to high-mix ships is still greater than that for low-mix, with 13 high-mix ships having cost about 22 percent more than 39 low-mix ships.

CHAPTER VII. BUDGET OPTIONS FOR FISCAL YEARS 1981-1985

As the Congress examines naval shipbuilding programs, it faces a broad choice between augmenting current naval forces with more expensive, high-quality warships or with less expensive, less capable, and often more specialized units. This choice between "quality" and "quantity" is not unique to decisions about any particular ship type at the margin. Rather, it affects the Congress' overall approach to shipbuilding and conversion (SCN).

Naval requirements are not only manifold, but are also extremely sensitive to assumptions about the contingency for which they are defined, particularly to assumptions about likely opposing forces and their strategies and to estimates of contributions on the part of key allies. Preceding chapters indicated that current U.S. naval shipbuilding priorities attach greatest importance to preventing the Soviet Union from mounting successful attacks against the sea lanes in a NATO/Warsaw Pact conflict. The Navy prefers procurement of a relatively small number of large, complex, and extremely expensive multipurpose surface and submarine units. This preference is consistent with a series of mission priorities that stress the importance of protecting the sea lanes against Soviet attacks as much, if not more, by offensive strikes in or near Soviet waters as by defenses organized to reduce the number of attackers as they approach the convoys.

As Chapter III noted, however, many newer Soviet naval systems--particularly those introduced during the third and, especially, during the current (fourth) stage of Soviet naval development--embody capabilities that appear to be more relevant to protection of the Soviet strategic submarine fleet and to projection operations in distant regions. To be sure, the Soviet Union's ability to disrupt the sea lanes cannot be discounted, particularly as the Soviet navy has introduced many systems that would be more suitable for this mission than the systems they replaced. Nevertheless, the demands of a sea-lane attack mission cannot fully explain the thrust of recent Soviet naval developments. For this reason, there is some question as to whether the Navy's emphasis on procuring a small number of systems, capable of withstanding highly coordinated massed Soviet attacks that are most likely to take place near the Soviet homeland, appropriately addresses the range of Soviet maritime

capabilities and sufficiently accounts for the requirements that other U.S. naval missions might engender.

These other missions, including presence and projection operations in Third World regions against indigenous and/or Soviet forces, appear to permit the use of somewhat less capable individual ships, since there is less risk that they will face coordinated air, surface, and submarine missile attacks in these locales. On the other hand, pursuit of a Third World-oriented naval strategy would call for large numbers of ships to conduct sustained operations in the many regions in which the United States has significant political and economic interests. Current force levels could not sustain such operations without a reduction or alteration in the Navy's long-standing deployment patterns. 1/

Even if this alternative assessment of U.S. naval priorities is correct, there is still a requirement for protection of the immediate vicinity of the sea lanes in any major war with the Warsaw Pact. Deficiencies in sea-lane protection capabilities would only increase the attractiveness of sea-lane attacks to Soviet naval planners. Unless alleviated by expanded allied shipbuilding programs, such requirements create additional strains on U.S. shipbuilding budgets.

Only in the most optimistic circumstances could current European allied escort forces meet convoy escort demands in a NATO/Warsaw Pact conflict. Japanese forces would likely be committed to operations in defense of their homeland. Mediterranean allied forces include a large number of obsolescent units. Thus, U.S. escort forces, already required for carrier, underway replenishment, and amphibious escort groups, might also be needed to escort convoys in one or more of these theaters. In addition, allied mine warfare resources remain limited in number and capability. No U.S. ally currently has any deep-water minehunting

1/ For a discussion of the effect of additional deployments on naval force levels, particularly on carrier levels, see Congressional Budget Office, U.S. Naval Forces: The Peacetime Presence Mission, Background Paper (December 1978), pp. 79-80. It should be noted that alternate arrangements that might reduce carrier force requirements or permit current levels to carry out additional deployments may still not ease the strain upon escort and support forces, especially if additional task forces are created around smaller aviation ships.

capability to counter the sophisticated Soviet mine threat. Again, U.S. resources might have to fill allied shortfalls.

Chapter IV indicated that NATO countries are undertaking modernization programs whose completion is still some years away. Unless they are expanded, these programs at best will result in a replacement of current forces with equal, but newer, systems. Only if the momentum of modernization is increased can allied contributions significantly ease the strain upon U.S. shipbuilding programs imposed by the requirements for defensive sea-lane protection.

This chapter presents the program and budgetary implications of four shipbuilding strategies for Congressional consideration. These alternatives are illustrative; they should be construed not as rigid options, but as indicators of a range of choices available to the Congress as it addresses the Administration's shipbuilding proposals. They are intended to present the degree to which variations in expenditures, force levels, and force mixes are sensitive to estimates of the intentions of non-U.S. actors--both friendly and unfriendly--with respect to their own future maritime priorities. Table 7 illustrates these relationships. These options exclude major Navy research programs, such as new hull designs, which are unlikely to affect shipbuilding budgets before fiscal year 1985. Option I represents the DoD shipbuilding budget for fiscal years 1981-1985. Option II has been constructed to reflect stated Navy priorities. Options III and IV reflect the impact of alternative assumptions on naval programs and budgets. The last three options have been designed to provide relatively smooth shipbuilding and budget profiles for fiscal years 1981-1985, with five-year cost totals that do not depart significantly from proposed DoD funding levels for that period.

OPTION I: MAINTAINING A HIGH/LOW MIX APPROACH FOR SEA-LANE PROTECTION

The Congress could take the view that current U.S. naval capabilities are insufficient for adequate defense of the sea lanes in a NATO/Warsaw Pact war. Furthermore, the Congress might assume that, because of current defense budget constraints, European allies will not expand their current force levels, and indeed may not even equal them in the future. It would then fall to U.S. forces to provide the bulk of protection for the immediate vicinity of convoys transiting to Europe during a

TABLE 7. FOUR APPROACHES TO THE FISCAL YEARS 1981-1985 SHIPBUILDING PROGRAM

Assumptions About			
Mission-Oriented Emphasis for Fiscal Years 1981-1985 SCN Budgets	Nature of Soviet Naval Development	Allied Contributions 1981-1985	U.S. Priorities for Shipbuilding 1981-1985
I. Protect sea lanes primarily by means of defensive forces for convoys supplemented, where feasible, by offensive operations.	Soviet mission emphasis is to disrupt sea lanes to Europe in a major war; other possible missions secondary.	Allies will not expand their contribution beyond current levels of effort.	Need for high/low mix balance to protect sea lanes; limit shipbuilding costs.
II. Protect sea lanes primarily by means of offensive strikes on Soviet forces in/near Soviet bases.	Same as I.	Allies to expand their contribution to low-mix sea-lane protection areas; that is, ASW, escort, and mine warfare.	Need to emphasize high mix where United States has comparative advantage; relax budget constraints.
III. Maintain sufficient forces to conduct presence/projection in Third World areas against indigenous forces with/without Soviet support.	Critical Soviet missions may be SSBN protection and/or Third World operations; sea-lane defenses needed only in vicinity of convoys.	Allies could increase their contribution to sea-lane defenses; United States must press for larger allied shipbuilding programs for low-mix ships, such as ASW escort, and mine warfare units.	Need for improved mix to support offensive missions outside NATO area.
IV. Same as III.	Same as III.	Allies will not expand their contribution beyond current levels of effort.	Given current budget constraints, need to balance capabilities for non-sea-lane operations with requirement to deter Soviet anti-sea-lane operations.

NATO/Warsaw Pact conflict. The Congress might therefore elect to support a program for a high/low mix of ships such as that which DoD is proposing for fiscal years 1981-1985. This program would reflect one approach to the trade-off between meeting the demands of offensive strikes and defensive operations for sea-lane protection that is imposed by current budget constraints. Under this program, the procurement of CG-47 cruisers would fall short of the Navy's preference for 24 AEGIS ships. It would, however, require the purchase of more FFG-7s than that reportedly favored by the Navy. 2/ These smaller ships would provide an additional margin of convoy escort protection to offset potential allied shortfalls in this area. This option would not, however, provide the fleet size and capabilities the United States might require to expand its Third World deployments beyond current levels.

In the absence of greater allied mine warfare initiatives, the United States would probably have to expand its mine counter-measures program. This option provides for ships that could conduct deep-water, open-ocean operations along key areas of the sea lanes, such as the western approaches to the English Channel.

Given the need for sustaining or expanding these low-mix programs, it would be extremely difficult, even with an expanding defense budget, to meet preferred Navy force levels that would require construction of up to four AEGIS ships and four SSN-688s annually. 3/ Many of the objectives to which such a high-mix program would be directed could be met by a more limited AEGIS cruiser program. For example, 18 AEGIS ships would permit at least six carriers to conduct operations, each with the support of two AEGIS cruisers. While such support would fall below the

2/ Charles W. Corddry, "Iranian Crisis Spotlights Thinness of U.S. Naval Forces," Baltimore Sun, November 29, 1979, p. 4.

3/ On preferred Navy SSN-688 construction levels, see remarks of Vice Admiral C.R. Bryan in Military Posture and H.R. 1872 (Department of Defense Authorization for Appropriations for Fiscal Year 1980) and H.R. 2575 (Department of Defense Supplemental Authorization for Appropriations for Fiscal Year 1979), Hearings before the House Committee on Armed Services, 96:1 (February, March, and April 1979), Part 4, pp. 492-93. His preference for efficient SSN production at two shipyards implies a minimum of two submarines at each yard.

highest levels that the Navy considers desirable for demanding carrier task force missions, it nevertheless appears to provide what Navy spokesmen have considered to be acceptable levels of AEGIS defenses in high-threat areas. This is particularly true since CG-47s would be expected to operate with carrier task forces whose interceptor aircraft would contribute significantly to the AAW battle. 4/ Similarly, this option would terminate SSN-688 production by 1985. In its place, the Navy could procure a slower nuclear-powered fleet attack submarine, called the SSN(FA), beginning in fiscal year 1983. This submarine would be suitable for all operations except high-speed escort of carrier strike forces.

Table 8 indicates the total unit buy and cost of this option. The number of units constructed exceeds that of Option II, which would cost \$4.6 billion more. The five-year cost of Option I (about \$35 billion) would approximate those of Options III and IV, but would provide 23 fewer ships than Option III and 24 fewer than Option IV. 5/

OPTION II: A HIGH-MIX NAVAL PROGRAM EMPHASIZING THE OFFENSIVE STRIKE MISSION IN A NATO/WARSAW PACT WAR

The Congress could adopt the official U.S. Navy view that resource priorities should emphasize procurement of high-mix units, which could most enhance its capability to conduct offensive strikes against Soviet bases and/or forces so as to limit the number of attackers that could threaten the sea lanes to U.S. allies. This approach would be consistent with the assumptions that planning defenses against Soviet attacks on the sea lanes remains the highest U.S. naval priority but that U.S. allies can be expected to meet the requirements for defensive convoy escort in the North Atlantic.

The Navy acknowledges that convoy protection would be important, even in a strategy emphasizing strikes against Soviet forces in or near their bases. There is no certainty that numerous

4/ The carrier's F-14 interceptor can launch its Phoenix missiles at six targets simultaneously. Each carrier normally deploys 24 F-14s.

5/ See below, pp. 110-16.

TABLE 8. OPTION I: MAINTAINING A HIGH/LOW MIX APPROACH FOR SEA-LANE PROTECTION: BY FISCAL YEAR, IN MILLIONS OF 1981 DOLLARS

Program	1981		1982		1983		1984		1985		Total	
	Number	Cost	Number	Cost	Number	Cost	Number	Cost	Number	Cost	Number	Cost
FFG-7	4	1,020	4	1,030	3	780	4	1,030	-	--	15	3,860
CG-47	2	1,630	3	2,500	3	2,500	4	3,330	4	3,330	16	13,290
SSN-688	1	460	1	500	1	450	2	800	-	--	5	2,210
SSN(FA)	-	20 <u>a/</u>	-	80 <u>a/</u>	1	400	1	320	4	1,200	6	2,020
MCM	-	--	1	90	-	--	4	300	4	300	9	690
DDGX <u>b/</u>	-	--	-	--	-	--	-	--	<u>1</u>	<u>570</u>	<u>1</u>	<u>570</u>
Subtotal	7	3,130	9	4,200	8	4,130	15	5,780	13	5,400	52	22,640
Other Ships in Fiscal Years 1981-1985												
SCN Plan <u>c/</u>	<u>12</u>	<u>2,470</u>	<u>10</u>	<u>1,950</u>	<u>10</u>	<u>2,650</u>	<u>6</u>	<u>1,620</u>	<u>11</u>	<u>3,270</u>	<u>49</u>	<u>11,960</u>
Total	19	5,600	19	6,150	18	6,780	21	7,400	24	8,670	101	34,600

a/ Advance procurement funding.

b/ Proposed new guided missile destroyer; for discussion, see Chapter V.

c/ Includes conversion programs.

Soviet forces would remain at their bases at the onset of a conflict. Should they deploy to the open ocean during the buildup to a war, offensive strikes might have little effect, while convoy protection would be critical. It was, among other things, to hedge against such an eventuality that the Navy supported the FFG-7 program. Nevertheless, the Navy's current emphasis on high-mix systems implies that additional forces for convoy protection should be provided by U.S. allies.

In the Navy's view, therefore, U.S. shipbuilding priorities could be geared to production of more complex multipurpose units, such as the CG-47 AEGIS cruiser and the SSN-688 submarine, that are optimized for missions both in high-threat areas and on the open ocean. In this view, the NATO allies must be relied upon to augment their maritime programs to fulfill their traditional defensively oriented missions. Only if its allies produced more of the lower-mix units that are vitally important to the success of sea control could the United States emphasize only high-mix construction.

As Chapter IV indicated, several European allies are now modernizing their naval and maritime patrol aircraft forces. With the possible exception of Britain, few are likely to replace their forces on more than a one-for-one basis, however. Current European naval programs, which represent a quality-for-quantity trade-off, will do little to improve the absolute level of allied contributions. Having committed themselves to 3 percent real growth in their defense budgets, however, other allies besides Britain could devote greater effort to augmenting their naval forces. For example, Belgium might expand upon its current Tripartite mine countermeasure ship program and procure the 15 units originally planned for, rather than the currently funded ten ships. Canada, Denmark, and the Netherlands might increase the size of their planned surface escort construction programs. Finally, Denmark, Norway, and the Federal Republic of Germany could also expand their diesel-electric submarine capabilities beyond currently funded levels.

A Navy program geared to production of primarily high-mix units earmarked for operation in high-threat areas would be extremely costly even if low-mix units were dropped from the current SCN five-year plan. If current budget constraints are not relaxed, the Navy's emphasis on high-mix ships would result in procurement of very few ships of any other type, except ballistic missile submarines required for the strategic nuclear deterrent

and the carrier life-extension program. 6/ This option presents one example of the effects of relaxing those constraints upon preferred Navy shipbuilding priorities.

This option would embody a major step toward achieving an AEGIS force of 24 ships. The 24 AEGIS ship level, in conjunction with modified and upgraded Tartar AAW systems currently being installed aboard major cruisers, would ensure adequate air defense for all carriers in all environments in which they are likely to operate. 7/ If the allies expanded their own escort production programs, the need for more FFGs than the 40 already authorized also would diminish, and the program could be ended in fiscal year 1981.

A high-mix Navy also would require continued production of nuclear-powered submarines (SSNs). With the allies providing local submarine barrier ASW capabilities, additional U.S. ASW resources could more usefully be devoted to those missions supporting carrier strikes and/or longer transits, notably open-ocean ASW searches. Procurement of four SSNs annually not only would easily maintain a 90-SSN force, but also would replace older units more quickly with more capable substitutes.

The high-mix Navy would not preclude production of the new mine countermeasure ship (MCM). To the contrary, the MCM would continue to be needed to limit deep-water mine threats to U.S. forces, threats for which the allies have no counter either currently in force or in production. The MCM level probably could be stabilized at 10 ships, the level originally contemplated in fiscal year 1977. 8/ This option would procure

6/ For example, the cost of four CG-47s and four SSN-688s, as outlined in this option, when added to the cost of a Trident ballistic missile submarine and a carrier life extension, amounts to \$7.1 billion in fiscal year 1981 dollars. The fiscal year 1980 SCN budget as proposed by the Department of Defense totaled about \$6.4 billion (in fiscal year 1981 dollars) for warship construction or conversion.

7/ As noted above, AEGIS is intended to act as a targeting mechanism for Tartar ships, thereby significantly enhancing the older system's response time to incoming targets. AEGIS does not yet have that capability, however.

8/ U.S. Department of Defense, Annual Report, Fiscal Year 1977, p. 176.

nine such ships by fiscal year 1985. The small U.S. force would be needed to ensure clear pathways in the open ocean for major task forces. More traditional forms of mine warfare, such as clearing paths for convoys entering the North Sea, would be conducted by the Belgian and Dutch navies, while British forces would be expected to operate in the deep approaches to the English Channel.

Table 9 outlines the cost of a high-mix force for fiscal years 1981-1985. The costs of Option II exceed those of Option I by \$1.5 billion and those of Options III and IV by about \$350 million for fiscal year 1981. The five-year costs of Option II exceed those of the other options by approximately \$5 billion. On the other hand, this option would result in the addition of 23 fewer ships to the fleet than Option III and 24 fewer than Option IV. Option II is, in effect, a program that emphasizes quality over quantity; as such, it meets the demands and preferences of current Navy planners.

OPTION III: ENHANCING THE NAVY'S CAPABILITY TO MEET MARITIME THREATS OUTSIDE NATO'S OPERATING AREA

The Congress might decide that the Navy should direct its priorities for additional shipbuilding to support Third World operations outside the NATO area, rather than enhancing its ability to conduct offensive strikes to protect the sea lanes. This view would stem from the assumption that there is a pressing need to counter indigenous and Soviet threats to U.S. interests in the Third World, particularly given the Soviet Union's recent emphasis on improving its naval projection capability. This option would also assume that U.S. allies would provide the bulk of defensive surface escort capabilities for sea-lane protection. It would, therefore, stress procurement of large numbers of low-mix ships with offensive capabilities to support more far-flung operations, at the expense of even less procurement of high-mix units than the DoD budget contemplates.

Although the United States currently has 13 carriers and nine nuclear-powered escort ships, current force levels cannot meet growing demands for additional U.S. naval forces permanently stationed in the Indian Ocean and Caribbean Sea, while maintaining current deployments in the Mediterranean and western Pacific. 9/

9/ See Congressional Budget Office, U.S. Naval Forces: The Peacetime Presence Mission, especially pp. 79-81.

TABLE 9. OPTION II: A HIGH-MIX NAVAL PROGRAM EMPHASIZING THE OFFENSIVE STRIKE MISSION IN A NATO/WARSAW PACT WAR: BY FISCAL YEAR, IN MILLIONS OF 1981 DOLLARS

Program	1981		1982		1983		1984		1985		Total	
	Number	Cost	Number	Cost	Number	Cost	Number	Cost	Number	Cost	Number	Cost
FFG-7	3	770	-	--	-	--	-	--	-	--	3	770
CG-47	3	2,500	4	3,330	4	3,330	4	3,330	4	3,330	19	15,820
SSN-688	3	1,400	4	2,000	4	2,000	4	2,000	4	2,000	19	9,400
MCM	-	--	1	90	-	--	4	300	4	300	9	690
DDGX <u>a/</u>	-	--	-	--	-	--	-	--	<u>1</u>	<u>570</u>	<u>1</u>	<u>570</u>
Subtotal	9	4,670	9	5,420	8	5,330	12	5,630	13	6,200	51	27,250
Other Ships in Fiscal Years 1981-1985												
SCN Plan <u>b/</u>	<u>12</u>	<u>2,470</u>	<u>10</u>	<u>1,950</u>	<u>10</u>	<u>2,650</u>	<u>6</u>	<u>1,620</u>	<u>11</u>	<u>3,270</u>	<u>49</u>	<u>11,960</u>
Total	21	7,140	19	7,370	18	7,980	18	7,250	24	9,470	100	39,210

a/ Proposed new guided missile destroyer; for discussion, see Chapter V.

b/ Includes conversion programs.

In addition, as Chapter I indicated, support ship and mine warfare units, which would be important to sustained operations (including amphibious operations) in Third World areas, are already significantly below the force levels of a decade ago. In view of declining submarine force levels at current SSN production rates, and given continuing demands for submarines on key ASW barrier missions, there could also be an inadequate number of submarines available for long-range task force escort. Thus, under Option III, eliminating the shortfalls in these three areas would be the SCN priority for the next few years.

Emphasis on U.S. naval missions outside NATO's operating area would call for increased FFG production and for continued production of one CG-47 a year. The FFG-7 would, however, be outfitted as a new guided missile frigate (FFGX) with new offensive systems, such as the Tomahawk missile, as well as improved AAW systems. This option would also call for the introduction of five new programs: an amphibious ship modified specifically to support V/STOL aircraft (VSS), a conventional submarine (SS), repair ships (ARX), tenders (ADX), and mine countermeasure ships (MCM). This option could only be realized within the budget levels proposed by DoD, however, if U.S. allies increased their own naval production efforts beyond currently planned one-for-one replacement of forces. The European allies could then meet the demands for sea-lane protection in the Atlantic that will remain essential, if only to ensure that sea-lane attack remains a low Soviet priority.

This option also provides a steady program leading to a force of up to 12 AEGIS ships that could permit deployment of one of these capable systems with most, if not all, carriers. These could be supplemented by major fleet escorts already constructed, including the newly acquired DDG-993 class, which carries the Tartar-D air defense system. Additional Tartar-D escorts could be obtained by converting the entire DDG-2 class. Indeed, some of the DDG-2 ships converted after 1985 could be fitted with still more modern air defense systems currently under development.

Procurement of new V/STOL ships and FFGXs, armed with Harpoon and Tomahawk missiles and new AAW systems, would permit creation of additional aviation task forces for operations in Third World regions. These task forces would pose a formidable counter to indigenous and/or Soviet units whose potential air threats could not match the firepower that the Soviet Union could aggregate nearer the Soviet homeland. The VSS could be funded with advance increments along the lines suggested by the fiscal

year 1980 report of the Senate Committee on Armed Services. 10/ Procurement of 32 additional FFG-7s, reconfigured as FFGXs, would provide 17 more units than DoD has programmed, a number sufficient to support at least one additional permanently deployed task force. 11/

Emphasis on sustained operations in the Third World calls for using the SSN-688 class, the fastest nuclear-powered submarine units, to support task forces operating beyond the NATO maritime theater. Open-ocean ASW could be conducted by the current force of somewhat slower, smaller SSN-637s, which are virtually as quiet as the 688 class. Barrier operations where friendly air cover is available could be conducted by new diesel-electric submarines (SS). Diesel-electric submarines could well prove to be cost effective for that mission, particularly if barriers such as the G-I-UK gap and the Sea of Japan were partly covered by modern allied diesel-electric submarines.

Construction of less costly diesel-electric submarines would help to sustain a fleet of at least 90 submarines, although it would not consist entirely of nuclear-powered ships as currently programmed. A new SSN program could be undertaken in the late 1980s, to ensure a larger force than the currently authorized 35 SSN-688s, to support both carrier escort and open-ocean ASW search operations.

10/ See Authorizing Appropriations for Fiscal Year 1980 for Military Procurement, Research and Development, Active Duty, Selected Reserve, and Civilian Personnel Strengths, Civil Defense, and for Other Purposes, S.Rept. 96-197 (May 1979), p. 53.

11/ This statement is based on the assumption that the rough calculation of three units to support one on permanent forward deployment applies to escorts as well as carriers. It also assumes that five escorts are required for each aviation unit. A force of 17 ships could probably support both a distant full-time deployment and a part of a permanent task force near the United States (in the Caribbean, for example). For a detailed discussion of carrier deployment cycles, which tend to demand more forces than cycles for escorts, see Congressional Budget Office, U.S. Naval Forces: The Peacetime Presence Mission, pp. 75-80.

Increased emphasis on long-distance deployments of U.S. naval forces would call for a growth in tender and repair ship capabilities to match the surface escort-to-tender/repair ship ratios of the early 1970s. Accordingly, additional tender and repair ships are included in Option III, so that these ratios could be approximated by the late 1980s.

Finally, the MCM program could be modified to procure only three of the currently proposed units to replace the current active MCM ships. Meanwhile, the Navy could examine less expensive MCM alternatives, including the possibility of procuring deep-water MCM equipment from an allied country as part of the "NATO two-way street."

Table 10 indicates the size and cost of a program that emphasizes the low-mix end of naval requirements. This program would add 26 ships, at a cost of \$6.8 billion in fiscal year 1981; over five years, it would add 124 ships, at a cost that would reach \$34 billion in fiscal year 1981 dollars.

OPTION IV: ENHANCING BOTH THE NAVY'S SEA-LANE PROTECTION AND LONG-RANGE OPERATING CAPABILITIES

As in the case of Option III, the Congress might incline to the theory that the Soviet navy attaches considerable importance not only to protecting its SSBNs, but also to developing the capability to operate effectively and forcefully in regions remote from the Soviet Union. Furthermore, the Congress might well appreciate the potential contribution that U.S. allies could make to sea-lane protection. Nevertheless, even if it accepts current U.S. budget constraints, the Congress might not wish to risk supporting a U.S. shipbuilding program that assumed expanded allied maritime activities given their current level of shipbuilding effort. It is in this dimension that Option IV differs from Option III.

The case against assuming expanded efforts by the allies appears quite strong. There are few, if any, indications that any major U.S. maritime ally plans greater than one-for-one replacement of its surface ships, submarines, or other maritime units. Shipbuilding programs in some countries, such as Canada, are behind schedule. Other nations, like Belgium, have completed small shipbuilding programs which they do not currently plan to expand. Of the NATO allies, only Britain may be attempting greater than one-for-one replacement of current levels, although

TABLE 10. OPTION III: ENHANCING THE NAVY'S CAPABILITIES TO MEET MARITIME THREATS OUTSIDE NATO'S OPERATING AREA: BY FISCAL YEAR, IN MILLIONS OF 1981 DOLLARS

Program	1981		1982		1983		1984		1985		Total	
	Number	Cost										
VSS	-	30 <u>a/</u>	1	730	-	30 <u>a/</u>	1	590	-	30 <u>a/</u>	2	1,410
CG-47	1	820	1	820	1	820	1	820	1	820	5	4,100
FFG-7	8	2,040	7	1,790	6	1,530	6	1,530	5	1,280	32	8,170
SSN-688	1	460	1	500	1	450	1	450	-	-	4	1,860
SSX	-	-	-	-	1	150	2	240	4	480	7	870
MCM	-	-	1	90	-	-	1	80	1	80	3	250
ADX	-	-	1	380	1	380	1	380	-	-	3	1,140
ARX	1	330	-	-	1	330	1	330	-	-	3	990
DDGX <u>b/</u>	-	-	-	-	-	-	-	-	1	570	1	570
DDG-2 <u>c/</u>	<u>3</u>	<u>580</u>	<u>3</u>	<u>540</u>	<u>3</u>	<u>630</u>	<u>3</u>	<u>480</u>	<u>3</u>	<u>470</u>	<u>15</u>	<u>2,700</u>
Subtotal	14	4,260	15	4,850	14	4,320	17	4,900	15	3,730	75	22,060
Other Ships in Fiscal Years 1981-1985												
SCN Plan	<u>12</u>	<u>2,470</u>	<u>10</u>	<u>1,950</u>	<u>10</u>	<u>2,650</u>	<u>6</u>	<u>1,620</u>	<u>11</u>	<u>3,270</u>	<u>49</u>	<u>11,960</u>
Total Ships	26	6,730	25	6,800	24	6,970	23	6,520	26	7,000	124	34,030
R&D Funds for New AAW Development	-	50	-	50	-	50	-	50	-	50	-	250
Tomahawk missiles <u>d/</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>32</u>	<u>60</u>	<u>28</u>	<u>50</u>	<u>60</u>	<u>110</u>
Total Program <u>e/</u>	26	6,780	25	6,850	24	7,020	23	6,630	26	7,100	124	34,390

a/ Advance procurement funding.

b/ Proposed new guided missile destroyer; for discussion, see Chapter V.

c/ Conversion.

d/ Program in addition to DoD five-year defense plan; numbers of missiles not added in totals.

e/ Numbers for ships only; costs for entire program.

current levels already are significantly below Royal Navy force levels of the 1960s.

A decision not to assume expanded allied shipbuilding efforts has significant implications for U.S. shipbuilding programs. Under relatively constant budget levels, more emphasis would have to be placed on sea-lane protection at the expense of wider-ranging operational capability. The FFG-7 program could be justified on the basis of sea-lane protection requirements as well as on extended-range presence and crisis response operations, and, indeed, could be expanded beyond the levels assumed for FFGX in Option III. There would be less urgency to improve the ship's AAW and ASuW capabilities, since its primary task as a convoy escort would be ASW. A mixed force consisting of SSN-688s and SSN-637s currently in the fleet and less expensive diesel-electric submarines might meet the primary demands of sea-lane protection as well as allow some capability for operations with carrier forces in distant areas. Since the U.S. Navy already includes more than 35 SSN 688s, SCN programs in the next several years could also be devoted to procurement of lower-cost SSs.

Three other casualties of Option IV would be the tender, repair ship, and DDG-2 conversion programs. The emphasis on sea-lane protection would render these programs less urgent. Tenders and repair ships could be procured, but at somewhat lower numbers than Option III assumes. On the other hand, the MCM program would have to expand beyond the levels in Option III, since it would fall to the United States to provide the bulk of allied medium- and deep-water minehunting capabilities in a NATO/Warsaw Pact war.

Table 11 indicates the costs and levels of a shipbuilding program that seeks to emphasize both sea-lane defense and some additional capability to operate in Third World regions. The fiscal year 1981 cost of the systems in this option would amount to \$6.8 billion for procurement of 25 ships, while the five-year cost would, like Option III, reach \$34 billion, for procurement of 125 units.

CONCLUSION: THE NAVY OF THE 1980s AND 1990s--NEW ORIENTATIONS,
NEW SYSTEMS

This paper has sought to demonstrate that growing demands for naval forces present the Congress with some fundamental choices. Should budget constraints be relaxed to enable the Navy to procure

TABLE 11. OPTION IV: ENHANCING BOTH THE NAVY'S SEA-LANE PROTECTION AND LONG-RANGE OPERATING CAPABILITIES: BY FISCAL YEAR, IN MILLIONS OF 1981 DOLLARS

Program	1981		1982		1983		1984		1985		Total	
	Number	Cost	Number	Cost	Number	Cost	Number	Cost	Number	Cost	Number	Cost
VSS	-	30 <u>a/</u>	1	730	-	30 <u>a/</u>	1	590	-	30 <u>a/</u>	2	1,410
CG-47	1	820	1	820	1	820	1	820	1	820	5	4,100
FFG-7	9	2,300	9	2,300	9	2,300	9	2,300	9	2,300	45	11,500
SSN-688	1	460	1	500	1	450	1	450	-	--	4	1,860
SSX	-	--	-	--	1	150	2	240	4	480	7	870
MCM	-	--	1	90	-	--	4	300	4	300	9	690
ADX	1	380	-	--	-	--	-	--	-	--	1	380
ARX	1	330	-	--	1	330	-	--	-	--	2	660
DDGX <u>b/</u>	-	--	-	--	-	--	-	--	1	570	1	570
Subtotal	13	4,320	13	4,440	13	4,080	18	4,700	19	4,500	76	22,040
Other Ships in Fiscal Years 1981-1985												
SCN Plan	<u>12</u>	<u>2,470</u>	<u>10</u>	<u>1,950</u>	<u>10</u>	<u>2,650</u>	<u>6</u>	<u>1,620</u>	<u>11</u>	<u>3,270</u>	<u>49</u>	<u>11,960</u>
Total	25	6,790	23	6,390	23	6,730	24	6,320	30	7,770	125	34,000

a/ Advance procurement funding.

b/ Proposed new guided missile destroyer; for discussion, see Chapter V.

what it considers to be sufficient systems for the high-threat mission? Should the Navy of the future augment its offensive firepower in a small number of ships to support operations in high-threat areas, or seek a larger number of units capable of operations in all but the most threatening areas? To a great extent, this choice may be influenced by perceptions of Soviet maritime capabilities as they relate to distant operations, in contrast to those near the Soviet Union related to a Soviet campaign against the sea lanes. It will also be influenced by the levels of allied contributions to the Western sea-lane protection mission. The greater those contributions, the lower will be the demand on U.S. shipbuilding budgets for capabilities primarily suitable for that mission.

The options outlined in this paper and summarized in Table 12 are merely illustrative of the ways in which shipbuilding and conversion budgets might be constructed to meet the requirements of one or more of the above considerations. Some elements of these options, such as AEGIS ships, are common to all of them, with the critical issue being force levels. Other systems, such as diesel-electric submarines, might ultimately prove useful regardless of associated decisions about the future of the SSN-688 as opposed to a smaller SSN(FA).

Finally, there are some new systems that are not yet ready for incorporation in the current SCN five-year plan, but could further enhance the Navy's capabilities, regardless of mission priority, beginning in fiscal year 1986. The changing naval environment--particularly the advent of cruise missiles, which suggests greater vulnerability for current ship types--also provides the promise for new offensive and defensive capabilities that would enhance the operations of U.S. ships other than carriers.

Chapter VI noted that new vertical launcher systems would enable smaller ships to launch more missiles more quickly than in the past. It also indicated that V/STOL aircraft could provide targeting and electronic warfare support to long-range, ship-launched anti-aircraft missiles. Both capabilities would be most valuable for area and point defense of task groups. Still another development noted in Chapter VI, a viable small air defense tracking radar, would improve the survivability of task forces in all environments, regardless of the opponents' capabilities. Finally, new hull designs, such as the small waterplane area twin-hull (SWATH), could add to the stability of smaller ships in rougher water, thereby enabling groups of fixed-wing aircraft to

TABLE 12. U.S. NAVAL FORCE OPTIONS FOR FISCAL YEARS 1981-1985: COSTS IN MILLIONS OF FISCAL YEAR 1981 DOLLARS

	Options (Mission Priority)							
	I		II		III		IV	
	(Strike and defensive operations for sea control)		(Strike operations for sea control)		(Third World operations)		(Third World operations and defensive operations for sea control)	
	1981-1985 Program	1995 Level	1981-1985 Program	1995 Level	1981-1985 Program	1995 Level	1981-1985 Program	1995 Level
Ships Procured								
VSS	-	-	-	-	2	2	2	2
CG-47	16	18	19	21	5	7	5	7
FFGX	-	-	-	-	32	32	-	-
FFG-7	15	55	3	43	-	40	45	85
SSN-688	5	40	19	54	4	39	4	39
SSN(FA)	6	6	-	-	-	-	-	-
SSX	-	-	-	-	7	7	7	7
MCM	9	9	9	9	3	3	9	9
ADX	-	-	-	-	3	8	1	6
ARX	-	-	-	-	3	3	2	2
DDGX	1	1	1	1	1	1	1	1
DDG-2 <u>a/</u>	-	-	-	-	<u>15</u>	<u>15</u> <u>a/</u>	-	-
Subtotal	52	N/A	51	N/A	75	N/A	76	N/A
Other Ships in Fiscal Years 1981-1985								
SCN Plan	<u>49</u>	<u>N/A</u>	<u>49</u>	<u>N/A</u>	<u>49</u>	<u>N/A</u>	<u>49</u>	<u>N/A</u>
Total Ships	101	N/A	100	N/A	124	N/A	125	N/A
Total Costs <u>b/</u>	34,600	N/A	39,210	N/A	34,380	N/A	34,000	N/A

a/ Conversion program.

b/ Includes associated missile procurement and research and development costs.

be deployed on units less than one-tenth the size of an aircraft carrier. 12/ All of these systems imply that new tactics will have to be developed for naval warfare, and that former strategies will require still more reevaluation as submarines take on new capabilities while surface ships are provided with systems that will free them of the escort role to which they have been wedded for the past three decades.

12/ At the other extreme of warship size, the SWATH concept could be used as a mine warfare ship, providing stability and speed when required.

APPENDIXES

APPENDIX A. WARSHIP DESIGN: FACTORS AFFECTING PERFORMANCE AND CAPABILITIES

Among the many factors that collectively determine a warship's capabilities, some assume greater or lesser importance depending upon the nature of the specific mission and scenario being considered. Some general categories of warship attributes are important in almost any realistic combat scenario, however. These include:

- o Engagement range;
- o Firepower/saturation threshold;
- o Endurance; and
- o Resilience/survivability.

These factors have proved to be important in the past and can be expected to remain significant in the future over a wide spectrum of possible contingencies.

Engagement Range

Engagement range, which is the distance at which a ship can first bring enemy units under fire, has long been a key factor in naval warfare. It was, in fact, the basis for the dominance of big-gun ships in the battleship era. Not only did larger guns fire larger shells, but they also had longer range. Thus, the battleship, with its larger guns, could destroy a cruiser before the cruiser could even close to engagement range. Aircraft, in turn, outranged the big guns and, as a consequence, battleships have passed into history. Range continues to be an important, and dynamic, factor in the development of systems for surface, anti-submarine, and anti-air warfare.

Range involves much more than the distance a missile will fly or a shell can be fired because that alone will not guarantee a successful engagement. Engagement requires the means to detect a target initially, classify it as enemy or not, track it with sufficient accuracy for weapon launch and delivery, and control

and coordinate the entire process. A deficiency in any of these areas can seriously degrade effective range, and the side that can engage first clearly enjoys a fundamental advantage.

Firepower/Saturation Threshold

Firepower is the level of fire a ship can maintain and, more importantly in many situations, the number of targets it can engage simultaneously. In the sailing-ship era, firepower was the chief factor in determining the relative strength of warships. The number of guns mounted on a ship provided a good index of its capability in battle.

While the combat situation is much more complex today, the underlying fundamental has not changed. A ship that can sustain a high volume of fire against enemy forces enjoys an important advantage. Of particular significance with current technology is the ability to engage multiple targets simultaneously. This is so because modern weapons and command and control capabilities can make it possible for an enemy to orchestrate coordinated attacks that seek to overwhelm a ship's defenses. Observation of Soviet fleet exercises clearly indicates that this is one of their tactics. Such attacks are more difficult to accomplish successfully as the saturation threshold of ships (or of aggregates of ships) is raised.

Endurance

Endurance is usually quantified as the distance a ship can travel without refueling. It is also a function of a ship's ammunition and stores capacity, the reliability of its machinery and equipment, and its ability to operate in high sea states. Endurance is a quality of very clear importance to the ships of an oceangoing navy with far-flung deployments, such as that of the United States. The development of nuclear power has made possible the achievement of the ultimate in one aspect of endurance--essentially unlimited steaming range at any speed achievable by the ship. Over the past 25 years, the Navy has made a substantial investment in nuclear-powered ships, but they have been very expensive ships. The high standards of engineering and craftsmanship and the elaborate management control procedures required in the fabrication, operation, and maintenance of nuclear reactors have made these ships substantially more expensive than conventionally powered ships. Even in conventionally powered

ships, however, required endurance is a significant factor in their ultimate costs. In general, longer range requires more space and weight for fuel, which necessitates a larger ship. A larger ship requires more power to maintain a given speed, which means more fuel to maintain a given endurance. Thus, endurance, although important, can be a costly feature in warships.

Resilience and Survivability

Resilience and survivability in combat are important attributes of a well-designed, high-quality warship. The resilience of a ship is a product of many factors, such as redundant systems and shock hardening, as well as a myriad of construction details that have been found by experience to enhance resilience. Collectively, all of these items are one of the factors that make warship construction more costly, in general, than merchant ship construction.

Other Factors

The items discussed above are, of course, only a few of the many factors that together determine the capabilities of a warship. Qualities such as speed, maneuverability, quietness, and other more esoteric technical attributes may assume equal or even greater importance in some operational scenarios and for some types of ships. In such cases, these factors must be recognized and given appropriate weight. The factors discussed above, however, will prove particularly important for almost any warship over a broad spectrum of missions.

APPENDIX B. COST-EFFECTIVENESS ANALYSIS OF CONVENTIONALLY
POWERED AND NUCLEAR-POWERED SUBMARINES IN AN
ASW BARRIER MISSION

This analysis investigates the cost-effectiveness of conventionally powered and nuclear-powered submarines in maintaining an antisubmarine warfare (ASW) barrier in the Greenland-Iceland-United Kingdom (G-I-UK) gap. The G-I-UK gap includes the Denmark Strait between Greenland and Iceland and the area of the Norwegian Sea between Iceland and the tip of Scotland. It is a choke point through which Soviet Northern fleet units would have to pass in transiting to and from their bases and the North Atlantic sea lanes. In this area, NATO forces should be able to maintain air superiority. U.S. and allied submarines therefore should not have to contend with Soviet airborne ASW and could have the support of friendly ASW aircraft in maintaining the barrier.

THE ANALYSIS

The analysis determines the number of submarines of each type examined that would be required to maintain the hypothesized barrier indefinitely. The cost is the life-cycle cost per submarine times the number of submarines required. The most cost-effective alternative is that which involves the lowest total cost to maintain the barrier.

THE SUBMARINES

Three types of submarines will be examined:

- o SSN-688. A high performance nuclear-powered attack submarine currently being procured by the U.S. Navy;
- o Conventionally powered submarine (conservative case) [SS(C)]. A hypothetical, conventionally powered submarine based on relatively conservative assumptions as to performance, maintenance, and cost; and
- o Conventionally powered submarine (current technology case) [SS(X)]. A hypothetical, conventionally powered

submarine based on performance, maintenance, and cost assumptions largely extrapolated from recent European experience with diesel-electric submarines (particularly the German models 1200 and 2000).

Because the last U.S. diesel-powered attack submarines were designed more than 25 years ago, it would be unrealistic to use them directly as models in this analysis.

EFFECTIVENESS

Key Relationships

To calculate submarine requirements, it is necessary to find:

- o Base Loss Factor. The number of submarines needed to fill a single barrier station, taking into consideration factors such as transit distance, speed, days on patrol, and days in refit.
- o Inventory Backup Factor. The number of submarines required to support each unit in the operational cycle, taking into account overhaul duration, time between overhauls, and duration of post-overhaul training (shake-down time).
- o Number on Barrier. The number of submarines required for a barrier of a given width.

Base Loss Factor (BLF)

With the parameters shown in Table B-1, base loss factor can be computed from the relation:

$$BLF = \frac{T_p + T_r}{T_p - 2T_t}$$

where

$$T_t = \frac{D}{SOA \times 24}$$

and

- T_P = Patrol duration (days on patrol), including transit time to and from station
- T_r = Refit duration (days per patrol)
- D = Transit distance (nautical miles)
- SOA = Speed of advance (knots)

The resulting values are shown in Table B-1.

Inventory Backup Factor (N_i)

The parameters shown in Table B-2 for computing the inventory backup factor are representative of recent peacetime experience and have been adopted as the index for this analysis. Some compression of overhaul duration and post-overhaul shakedown would undoubtedly occur under the stress of war, but the amount is uncertain.

The required inventory can be calculated from the relation:

$$N_i = \frac{T_{bo}}{T_{bo} - T_o - T_s}$$

where

- T_{bo} = Time between overhauls (months)
- T_o = Overhaul duration (months)
- T_s = Shakedown time (months)

The resulting values are shown in the Table.B-2.

TABLE B-1. BASE LOSS FACTOR PARAMETERS

Parameter	SSN-688	SS(C)	SS(X)
Patrol Duration (T_p), (in days)	80 <u>a/</u>	60 <u>a/</u>	60 <u>b/</u>
Refit Duration (T_r), (in days)	40 <u>a/</u>	30 <u>a/</u>	15 <u>b/</u>
Transit Speed of Advance (SOA), (in knots)	25 <u>a/</u>	9 <u>c/</u>	10 <u>c/</u>
Transit Distance (D) (in nautical miles)	2,500 <u>d/</u>	2,500 <u>d/</u>	2,500 <u>d/</u>
Base Loss Factor (BLF)	1.67	2.44	1.91

a/ K.G. Schacht and others, Non-Nuclear Powered Submarine Alternatives (McLean, Va.: Analytic Advisory Group, Inc., April 1979; processed).

b/ LCDR Hans Saeger, FRGN(R), "Comment and Discussion," United States Naval Institute Proceedings (August 1979), pp. 92-94.

c/ CDR A. Von Saun, USN, "Tactical ASW: A Case for a Non-Nuclear Submarine," United States Naval Institute Proceedings (November 1978), pp. 147-51. Von Saun suggests 10 knots as a realistic transit SOA for modern diesel-electric submarines; Schacht lists snorkel speeds of 11 and 12 knots for recent diesel-electric submarine types. An SOA of 10 knots is therefore assumed for SS(X) and 9 knots for SS(C).

d/ The approximate transit distance from New London, Connecticut, to the Denmark Strait is 2,500 nautical miles.

TABLE B-2. INVENTORY BACKUP FACTORS

Parameter	SSN-688	SS(C)	SS(X)
Time Between Overhauls (T_{bo}), (in months)	60 <u>a/</u>	48 <u>b/</u>	60 <u>c/</u>
Overhaul Duration (T_o), (in months)	16 <u>a/</u>	9.5 <u>a/</u>	8 <u>c/</u>
Post-Overhaul Shakedown (T_s), (in months)	12 <u>a/</u>	4 <u>a/</u>	4 <u>a/</u>
Inventory Backup (N_i)	1.88	1.39	1.25

a/ CDR A. Von Saun, USN, "Tactical ASW: A Case for a Non-Nuclear Submarine," United States Naval Institute Proceedings (November 1978), pp. 147-51.

b/ Four years has been the prevailing interval during the 1970s for the newest U.S. diesel-electric submarines, the SS-580 class, now 20 years old.

c/ LCDR Hans Saeger, FRGN(R), "Comment and Discussion," United States Naval Institute Proceedings (August 1979), pp. 92-94.

On-Station Submarines Required for Barrier (N_b)

Key capabilities for a submarine on a barrier mission are its ability to detect transiting enemy units and to attack the enemy units detected.

Detection Capability. A new-construction conventionally powered submarine and nuclear-powered submarine should be approximately equal in detection capability. When on the battery (by far the dominant condition in barrier operations), a diesel-electric submarine is an even quieter sonar platform than a nuclear-powered submarine. Further, it can be expected that the first detection of transitors would be with a towed-array sonar, trailed well behind the barrier submarine. The development of towed-array sonars reduces the effect of periodic snorkeling (to

charge batteries) on the detection capability of the diesel-electric submarine. The noise of the diesel engines when snorkeling would effectively deafen the hull-mounted sonar, but the effect of snorkel noise on a towed array should be relatively small. In barrier operations, a modern diesel-electric submarine might snorkel about 10 percent of the time to maintain its battery charge. Despite the fact that the diesel-electric submarine would not necessarily be ineffective during this time, as a rough adjustment this analysis increases the number of submarines required on a barrier (N_b) by 10 percent to account for the disadvantage of snorkeling.^{1/} For high-speed transitors (assumed here to test barrier submarine ability to close and attack), a convergence zone detection, at about 55 nautical miles, is assumed. 1/

Attacking Transitors. In the other key aspect of barrier operations, ability to close transiting enemy submarines, nuclear-powered submarines are clearly superior. Recent technical improvements, however, including efficient hydrodynamic hull design and high-capacity batteries, can provide new conventionally powered submarines with much better performance in this area than earlier classes. Figure B-1 shows the submerged speed versus endurance on the battery for a recent German conventionally powered submarine design. A submarine with these characteristics could sustain relatively high speeds long enough to cover a fairly large barrier patrol area. Based on these data, it is assumed that SS(C) and SS(X) can close at 15 and 18 knots, respectively.

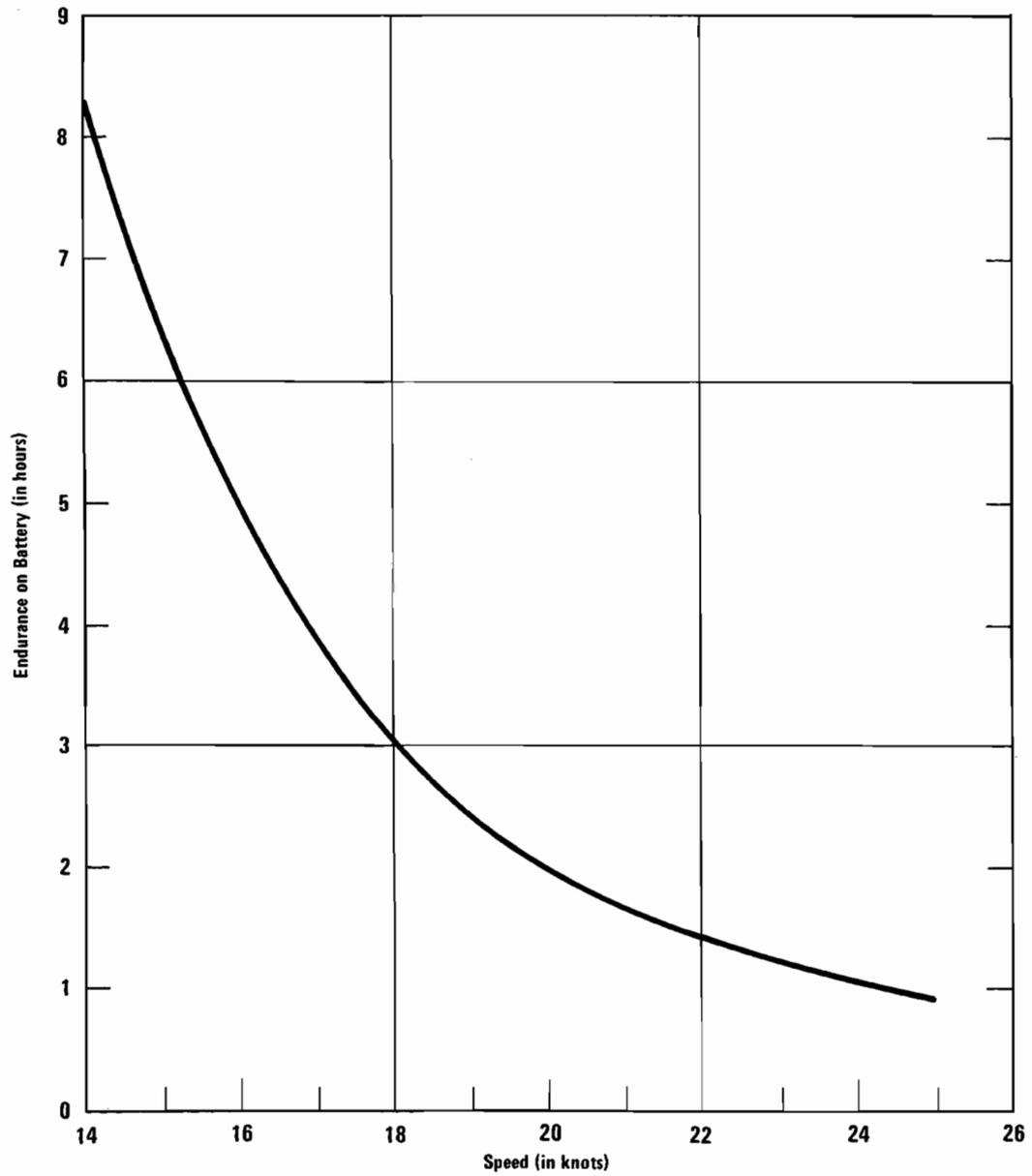
Barrier patrol zone width can be calculated from a simple Pythagorean theorem relationship based on the geometry shown in Figure B-2. This yields the equation:

$$D_d^2 = (TS_i)^2 + (TS_t)^2$$

1/ The term convergence zone refers to a phenomenon in the propagation of sound in deep water, in which sound waves, initially deflected to the ocean depths, are periodically redeflected back toward the surface due to the propagation characteristics of the water. This is a basically stable and predictable effect that results in annular zones (convergence zones) around a noise source where it can be detected at very long ranges by sensitive sonar equipment.

Figure B-1.

Submerged Speed versus Endurance of German HDW
Type 2000 Submarine



SOURCE: Derived from K. G. Schacht, E. T. Reich, J. S. C. Gabbert, P. St. Hilaire, *Non-Nuclear Powered Submarine Alternatives* (McLean, Va.: Analytic Advisory Group, Inc.; Processed, April 1979).

where

D_d = Detection distance (nautical miles)

S_i = Barrier submarine intercept speed (knots)

S_t = Transiting submarine speed (knots)

T = Time to intercept (hours)

Patrol zone width (W_p) can then be determined from:

$$W_p = 2(S_i \times T)$$

The number of barrier submarines required is simply the length of the barrier (L_B) divided by W_p :

$$N_B = \frac{L_B}{W_p}$$

Figure B-2.
Barrier Intercept Geometry

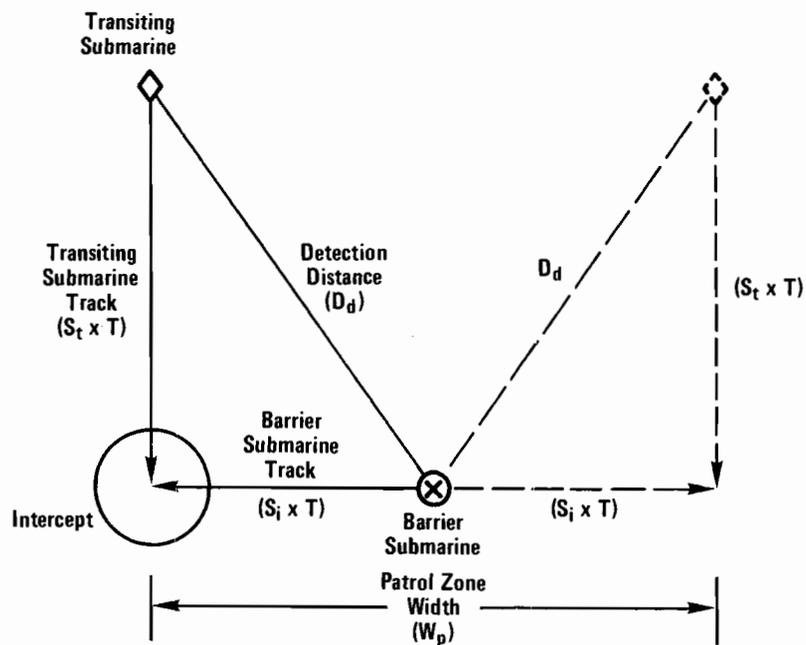


Table B-3 shows the result of these calculations for the three cases considered. 2/

TABLE B-3. BARRIER SUBMARINE REQUIREMENTS

Parameter	SSN-688	SS(C)	SS(X)
Detection Distance (D_d)(in nautical miles)	55	55	55
Intercept Speed (S_i)(in knots)	30 <u>a/</u>	15 <u>a/</u>	18 <u>a/</u>
Transitor Speed (S_t)(in knots)	33	33	33
Barrier Width (L_B)(in nautical miles)	450	450	450
Patrol Zone Width (W_p)(in nautical miles)	75	45	50
Barrier Submarines Required	6	10	9
Barrier Submarines Required, Including 10 Percent Snorkel Factor	6	11	10

a/ The intercept speed assumed is not the maximum submerged speed, but rather a net speed of advance that might result as a submarine maneuvered to intercept the transitor. The intercept speeds for SS(C) and SS(X) fall well within the envelope shown in Figure B-1.

2/ A more conservative approach in establishing patrol zone width would require that the barrier submarine be able to close any transitor from any position in his zone. This, at its extreme, would result in a patrol zone half the width

Total Submarine Inventory Required (N)

The total inventory of submarines required to support the hypothesized barrier--including those actually on station, those transiting to and from the barrier, and those in refit, overhaul, or post-overhaul shakedown--can be calculated from the relation:

$$N = BLF \times N_i \times N_B$$

Table B-4 provides the results of this calculation for each type of submarine considered. The SSN-688 accomplishes the mission with the smallest number of units.

TABLE B-4. REQUIRED INVENTORY OF SUBMARINES

Parameter	SSN-688	SS(C)	SS(X)
Inventory (N)	19	37	22
Effectiveness Ratio (SSN/SS)	-	2.0	1.1

COST

Procurement and operating costs for the SSN-688 class, which is still in production, are well established. Similar estimates for conventionally powered submarines are more difficult to establish in view of the long period of time that has elapsed since such submarines were last built in the United States.

assumed here. The effect would be simply to double the number of submarines of each type required. This would not affect this analysis, since the relative effectiveness and cost ratios would remain the same. The absolute value of the cost difference between competing ship programs would be doubled, however.

LDCR Hans Saeger, of the Project Department of Howaldtswerke-Deutsche-Werft (HDW), estimated the price of the HDW model 2000 submarine to be \$70 million to \$80 million in 1978 dollars. ^{3/} If these figures are increased to account for inflation, growth, U.S. versus German construction, and other uncertainties, the cost would rise to between \$130 million and \$145 million in 1981 dollars. The upper end of this range is assumed for SS(C) and the lower end for SS(X).

When accumulated over an assumed life of 25 years and combined with procurement cost, annual operating costs give the assumed life-cycle costs shown in Table B-5. ^{4/}

TABLE B-5. ASSUMED COSTS FOR SUBMARINE ALTERNATIVES: IN MILLIONS OF FISCAL YEAR 1981 DOLLARS

Cost Category	SSN-688	SS(C)	SS(X)
Procurement	500.0	145.0	130.0
Annual Operating Cost	15.4	10.7	10.0
25-Year Operating Cost	385.0	267.5	250.0
Life-Cycle Cost	885.0	412.5	380.0
Cost Ratio SSN:SS	--	2.1	2.3

^{3/} LCDR Hans Saeger, FRGN(R), "Comment and Discussion," United States Naval Institute Proceedings (April 1979), p. 92.

^{4/} Based on Navy Program Factors Manual, OPNAV-90P-02C, Vol. 1 (October 31, 1979). Diesel-electric submarine operating costs were based on those of the SS-580 class; personnel and maintenance costs were adjusted to be consistent with assumed SS(C) and SS(X) characteristics.

COST EFFECTIVENESS

By combining the required inventory of submarines (N) determined earlier with the life-cycle costs above, it is possible to calculate the cost of maintaining a barrier capability over the assumed 25-year operating life for each of the alternatives (Table B-6). It can be seen that the conventionally powered submarine would be somewhat more cost effective in the conservative case, SS(C), and dramatically more cost effective in the current technology, SS(X), case.

TABLE B-6. COST EFFECTIVENESS OF SUBMARINE ALTERNATIVES IN THE BARRIER MISSION

	SSN-688	SS(C)	SS(X)
25-Year Cost of Barrier Capability <u>a/</u>	16.8	15.3	8.4
Cost-Effectiveness Ratio	1.0	1.1	2.0

a/ In billions of fiscal year 1980 dollars.

SOME FURTHER CONSIDERATIONS

The life-cycle costs shown in Table B-5 are undiscounted--that is, the annual operating costs are simply added together in terms of constant dollars to yield the life-cycle operating costs. Discounting the annual operating costs at a 10 percent rate yields the life-cycle costs and resulting cost ratios in Table B-7. 5/ The effect is to make the conventional

5/ Department of Defense Instruction 7041.3 (December 19, 1966) and Office of Management and Budget Circular A-94 (March 27, 1972) both recommend a 10 percent discount rate. For a discussion of this issue, see Robert Shishko, Choosing the Discount Rate for Defense Decisionmaking, R-1953-RC (Santa Monica: The Rand Corporation, July 1976).

TABLE B-7. LIFE-CYCLE COST ESTIMATES AND COST-EFFECTIVENESS COMPARISONS OF SUBMARINE ALTERNATIVES ASSUMING DISCOUNTING

	SSN-688	SS(C)	SS(X)
Procurement Cost <u>a/</u>	500	145	130
25-Year Operating Cost Discounted at 10 Percent <u>a/</u>	140	97	91
Discounted Life-Cycle Cost <u>a/</u>	640	242	221
25-Year Barrier Cost with Discounting <u>b/</u>	12.2	9.0	4.9
Cost Effectiveness	1.0	1.4	2.5

a/ In millions of fiscal year 1981 dollars.

b/ In billions of fiscal year 1981 dollars.

submarines compare somewhat more favorably than in the undiscounted case.

In the previous analysis it was assumed that the barrier submarines operated from a port in the United States. Actually, submarines with this mission could be more efficiently employed if based in the United Kingdom. This would reduce the transit distance to about 1,000 nautical miles or less. If a 1,000-mile transit is assumed (either as a result of permanent basing or an advanced based established to support barrier operations), then the resulting BLFs yield the effectiveness ratios shown in Table B-8, again assuming discounting at a rate of 10 percent.

TABLE B-8. LIFE-CYCLE COST ESTIMATES AND COST-EFFECTIVENESS COMPARISONS OF SUBMARINE ALTERNATIVES ASSUMING ADVANCED BASING

	SSN-688	SS(C)	SS(X)
Required Inventory (N) <u>a/</u>	17	27	18
25-Year Barrier Cost <u>b/</u>	10.9	6.5	4.0
Cost-Effectiveness Ratio	1.0	1.4	2.7

a/ With advanced basing at 1,000 nautical miles.

b/ Billions of fiscal year 1981 dollars and 10 percent discounting of outyear costs.

GLOSSARY

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AAW: Anti-air warfare.

AEGIS: An integrated, computer-controlled air defense system, comprising a network of radars for tracking and targeting enemy projectiles, and associated missiles and missile launchers.

ASMD: Antiship missile defense.

ASW: Antisubmarine warfare.

ASuW: Antisurface warfare.

Backfire: New, long-range Soviet bomber that can carry air-to-surface missiles for antiship operations.

Badger: Older, medium-range Soviet bomber that can carry air-to-surface missiles for antiship operations.

Carrier Task Force: A group of warships, including an aircraft carrier and supporting warships, organized as an operational combat unit.

CH: Helicopter carrier.

Choke Point: A geographic bottleneck (for example, a strait) through which ships must pass to reach the open ocean.

CIWS: Close-in weapon system.

Cruise Missile: A pilotless aircraft, propelled by an air-breathing engine, that operates within the earth's atmosphere.

CV: Conventionally powered multipurpose aircraft carrier.

CVN: Nuclear-powered multipurpose large aircraft carrier.

DD-963: Antisubmarine warfare destroyer intended for escort of aircraft carriers, underway replenishment groups, and amphibious lift forces.

ECM: Electronic countermeasures. Actions taken to degrade or exploit enemy electronic systems.

Escorts: Naval vessels employed in the protection of ships they accompany. The protected ships may themselves be armed (for example, carriers) or unarmed (merchant ships).

FFG-7: A class of multipurpose frigates of relatively modest cost.

FLEXAR: Flexible adaptive radar; a lightweight, surface warship multiple-engagement weapon control system currently in development.

Harpoon: A U.S. antiship cruise missile that can be launched by aircraft, surface ships, and submarines.

Kiev: A class of 37,000-ton Soviet antisubmarine cruisers carrying helicopters and VTOL jets; capable of AAW, ASW, ASuW, and limited strikes against targets ashore.

LAMPS: Light airborne multipurpose system; helicopter designed to operate from surface warships, primarily destroyers and frigates. Extends the ship's engagement range against surface and subsurface targets. The latest version is known as LAMPS III.

LHA: General purpose amphibious assault ship.

LPH: Amphibious assault ship.

MCM: Mine countermeasures; also mine countermeasure ship proposed by the U.S. Navy.

Mk-92: Gun and missile weapon control system. The FFG-7 version is the Mk-92 Mod 2.

Moskva: A class of 17,000-ton Soviet antisubmarine cruisers, carrying helicopters and armed for AAW and ASW.

Naval Presence: Deployment of naval forces to demonstrate commitment to friends and adversaries.

Phalanx: A type of antiship missile defense system, sometimes termed Close-In Weapon System.

Power Projection: In naval terms, the launching of sea-based attacks against targets on shore.

Sea Control: Naval operations to achieve the relatively unimpeded transit of friendly shipping across selected sea lanes and denial of the enemy's ability to use those ocean areas.

Sea Sparrow: A relatively short-range, shipborne air defense missile system in service in the U.S. and some allied navies.

SLBM: Submarine-launched ballistic missile.

SS: Diesel-electric submarine.

SSBN: Nuclear-powered ballistic missile submarine.

SSGN: Nuclear-powered attack submarine armed primarily with cruise missiles.

SSN: Nuclear-powered attack submarine armed primarily with torpedoes.

SSN-688: A class of high-performance nuclear attack submarines.

Standard Missile: A relatively long-range, surface-to-air guided missile now widely deployed by the U.S. Navy. Its initial version is SM-1. A later version, designated SM-2, will have longer range as well as other improvements to make it compatible with multi-target weapon control systems.

STIR: Separate tracking and illuminating radar; used with some weapon control systems, notably the Mk-92 Mod 2 on FFG-7 frigates, to improve AAW capability.

TACTAS: Tactical towed-array sonar; see towed arrays.

Tomahawk: A long-range cruise missile. Three versions are being developed, a long-range strategic nuclear version and two tactical versions for antiship and land-attack operations. Tomahawk missiles will be capable of being air, surface, or submarine launched.

Towed Arrays: A name commonly applied to sonar systems using long linear hydrophone arrays towed behind a ship.

V/STOL: Vertical/short take-off and landing; a type of aircraft.

VTOL: Vertical take-off and landing; a type of aircraft.

