CBO STAFF MEMORANDUM

SELECTED OPTIONS FOR ENHANCING NAVAL CAPABILITY IN REGIONAL CONFLICTS

June 1993

NOTICE

This memorandum is not available for public release until it is submitted at a hearing of the Subcommittee on Regional Defense and Contingency Forces of the Senate Armed Services Committee at 10:00 a.m. (EDT), Tuesday, June 29, 1993.

CONGRESSIONAL BUDGET OFFICE
SECOND AND D STREETS, S.W.
WASHINGTON, D.C. 20515

NOTES

Numbers in the text and tables may not add to totals because of rounding.

All costs in this memorandum are expressed in constant 1994 dollars of budget authority.

This memorandum, prepared at the request of the Subcommittee on Regional Defense and Contingency Forces of the Senate Armed Services Committee, identifies options for additional investment designed to enhance the U.S. Navy's capabilities in six mission areas associated with its ability to fight regional wars. These mission areas are mine countermeasures, naval fire support, defense against antiship cruise missiles, antisubmarine warfare in shallow water, amphibious lift, and sealift. In some cases the options represent new programs; in other cases, they involve increased investment in ongoing efforts. The options are intended to illustrate possible increases in funding and do not constitute a CBO recommendation for added spending.

Some of the options involve approaches that have been defined by Navy officials but, presumably because of funding limits or other limitations, have not yet become part of any official plan. Other options were developed by outside analysts or CBO. This memorandum also identifies, but does not recommend, illustrative reductions in other naval programs that could be used to finance added investments in the six mission areas.

Ivan Eland of CBO's National Security Division prepared this memorandum under the general supervision of Robert F. Hale and R. William Thomas. Lane Pierrot and Michael Berger provided a substantial contribution to the initial phases of the analysis. Bill Myers and Raymond J. Hall of CBO's Budget Analysis Division performed a portion of the cost analysis. Ellen Breslin Davidson thoroughly reviewed the memorandum.

Paul L. Houts edited the text. Sherwood D. Kohn provided editorial assistance. Cindy Cleveland prepared the manuscript for publication.

SUMMARY AND INTRODUCTION

With the end of the Cold War, and the accompanying demise of the Soviet naval threat, the Navy and Marine Corps have made fighting regional conflicts their chief priority. In their white paper, published in September 1992 and entitled *From the Sea*, the two naval services emphasize the "enabling role" they will play in future regional conflicts. For example, the Navy and Marine Corps could seize and defend an enemy port or airfield to allow the introduction of Air Force and Army forces, substantial portions of which would be transported to the war on Navy ships. The Navy is also increasing its emphasis on supporting Marine Corps operations, including amphibious assault.

Compared with conflicts that were likely during the Cold War, more of these regional conflicts are expected to take place in littoral areas--that is, waters near to shore. The threat facing U.S. naval forces in littoral areas is quite different from the threat they faced in operations against the forces of the former Soviet Union. That nation possessed a substantial air force that could mount long-range attacks on Navy ships deployed on the open ocean. The former Soviet Union also had a large fleet of attack submarines that threatened the Navy and commercial shipping.

By contrast, regional powers have much smaller navies and few long-range aircraft. Overall, therefore, the threats to U.S. naval forces are much reduced. But littoral areas pose new problems. These areas are confined and crowded and may be populated with a mix of friendly, enemy, and neutral forces. This situation shortens warning times and makes identification of potential adversaries difficult. In addition, threats exist from mines, coastal batteries, patrol boats firing sea-skimming cruise missiles and torpedoes, and diesel submarines.

NEW NAVY PLANS APPARENTLY RESPOND TO CHANGED THREATS

The Navy appears to be responding to the major changes in threat with substantial shifts in the size of its planned forces. The Clinton Administration has not yet announced detailed plans for naval or other military forces beyond 1994. According to press reports and statements by senior Navy officials, however, the service plans to have about 340 battle force-capable ships in its fleet by the end of this decade. By comparison, under the plans of the Bush Administration, the Navy expected to have a fleet of 450 ships. The smaller fleet would be substantially cheaper, significantly improving the chances that long-term budgets would be sufficient to sustain it.

The composition of this smaller fleet would also be altered under this possible new Navy plan. For example, there would be many fewer attack submarines (about 55 compared with 80 under the Bush plan), reflecting a smaller need for these vessels in the absence of a Soviet submarine threat. The fleet of surface combatants would also be reduced (about 130, including frigates in the naval reserve force, would be maintained compared with 150 under the Bush plan).

Other categories of ships will remain relatively the same under the possible plan. For example, the Navy apparently desires to maintain a total of 12 aircraft carriers--deleting only the training carrier from the Bush Administration's plan--in order to retain all of its ability to project military power ashore. For amphibious vessels that transport Marine Corps troops and equipment, no reductions will occur from the Bush Administration's plan.

The Navy's reported plan for its air forces also reflects the changed threats. The service apparently will not buy any new aircraft to modernize its fleets of P-3 and S-3 aircraft, which are intended to hunt attack submarines. But the Navy does plan to upgrade the capability of its carrier-based F/A-18 aircraft, which is designed in part to attack targets on shore. Eventually, the Navy may also purchase a new type of carrier-based aircraft that would have greater ability to attack targets located at long distances from the carrier.

FURTHER SHIFTS MAY BE APPROPRIATE

These changes in major U.S. naval forces reflect the decline of the Soviet Navy and increased emphasis on regional threats in littoral areas and on the enabling role of naval forces. It is not as clear, however, that the Navy has made far-reaching changes in some of the less visible portions of its investment budget (investment is defined in this paper as funds for procurement and for research and development). The Congress may therefore wish to direct the Navy to consider additional investments designed to enhance the service's ability to prosecute regional wars. These additional changes could complement the expected changes in major forces. In this period of tight budgets, the Congress would also have to approve further cuts in other programs to offset the increases.

To illustrate the nature of these additional changes, the Congressional Budget Office (CBO) analyzed six mission areas in which increased investment might enhance the Navy's ability to fight regional conflicts:

- Mine countermeasures,

- o Naval fire support,
- o Defense for ships against antiship cruise missiles,
- o Antisubmarine warfare in shallow water,
- o Amphibious lift, and
- o Sealift.

CBO also illustrates program reductions that might be imposed to pay for increases in investments in these mission areas.

Estimates of the costs and savings associated with these various approaches are made for the 1994-1998 period. In 1994, costs and savings are estimated relative to the plan submitted by the Clinton Administration. Beyond 1994, the Clinton Administration has not yet submitted a detailed plan. In 1995-1998, therefore, estimates are relative to the Navy's preliminary plan for forces and programs, which could change during the review that is currently taking place within the Department of Defense. The hybrid plan used in this paper--the Clinton Administration's budget request for 1994 and the Navy's preliminary plan thereafter--is referred to as the base case.

KEY FINDINGS

The importance of added investment, and the nature of that investment, differ among the six mission categories.

Mine Countermeasures

Added investment to help counter mines may be particularly important. Mines are cheap and easy to lay, which means that even minor military powers can afford them. Clearing mines is difficult and consumes valuable time, which can delay critical naval missions such as amphibious assault.

The Navy is working to improve its ability to clear mines, but additional investment might be considered. For example, the Navy could buy additional mine-clearing ships and helicopters. The service could also purchase rather than charter the heavy lift ships that are needed to transport mine-clearing vessels over long distances. If it owns the ships, they would be available quickly in the event of a crisis. In addition to its plans for converting one retiring amphibious assault ship to serve as a command ship for mine-clearing vessels, the Navy could convert another ship and possibly more to serve a greater portion of the mine-clearing fleet. Finally, the Navy could increase the portion of its research budget devoted to mine countermeasures in littoral

areas. In 1993, only about 2 percent of Navy funds for research and development are being devoted to this mission area.

Under the base case, programs devoted to mine countermeasures identified in this memorandum would receive funding of $1.1 billion in the 1994-1998 period. Adopting all the options noted above would add between $2.5 billion and $3.1 billion to that total (see Summary Table). The range depends on the amount of change that is approved (for example, the number of ships that are converted to serve command vessels for the mine countermeasures mission).

SUMMARY TABLE. COSTS OF IMPROVEMENTS IN EACH MISSION AREA
(In billions of 1994 dollars)

Mission Area	Cost in the 1994-1998 Period: Base-Case Plan	Cost in the 1994-1998 Period: Additional Cost of Option
Mine Countermeasures	1.1	2.5-3.1[a]
Naval Fire Support	0[b]	0.9
Defenses Against Antiship Cruise Missiles	2.6	0.9-2.0
Antisubmarine Warfare in Shallow Water	n.a.	n.a.
Amphibious Lift	3	2.0-2.2
Sealift Improvements	3.3	3.6-3.9[c]
Total	10.0	9.9-12.1

SOURCE: Congressional Budget Office based on data from the U.S. Navy.

NOTE: n.a. = not applicable.

a. Of this total, between $140 million to $320 million would be used to buy existing heavy-lift ships to transport mine-clearing vessels. These purchases would be financed through added funding for the National Defense Sealift Fund.

b. The Navy has allocated $20 million for developing an advanced short take-off and vertical landing aircraft (ASTOVL) and $40 million for general research and development in naval surface fire support.

c. This option would be financed through added funding for the National Defense Sealift Fund.

Naval Fire Support

Naval surface fire support--the use of ship-based weapons to attack targets on shore--is one form of naval fire support and is another area where added investment may be appropriate. In past wars, bombardment from ships was a primary means used to support amphibious assaults. Since the Navy retired its four battleships with sixteen-inch guns, the five-inch guns deployed on cruisers and destroyers have insufficient range and lethality to support such assaults.

In some less demanding circumstances, attack aircraft and artillery that is lifted to the beach can fill the gap in fire support. But these assets represent an imperfect substitute for the mobile firepower based on ships. Reactivating battleships may be the only option that could be carried out during the next few years to improve naval fire support. Over the longer term, other options are available, such as developing new gun or missile systems for existing ships. Together the options would add about $900 million to costs in the 1994-1998 period. In contrast, the base case contains little investment in this mission.

Defense Against Antiship Cruise Missiles

Ships can be attacked by cruise missiles, which may fly low to avoid detection by radar. According to one analyst, the most significant naval weapons of modern times are these sea-skimming antiship cruise missiles, with offensive capabilities that have outstripped the defenses against them.

If aircraft carriers are present, their planes can help defend against cruise missiles by attacking their launchers. Also, if a surface ship equipped with the Aegis area air-defense system can detect an attack sufficiently early, its long-range surface-to-air missiles can detect and defend against cruise missiles by attacking the aircraft carrying the missiles or the missiles themselves after they have been fired.

The Navy is experimenting with deploying groups of ships that would operate without an aircraft carrier or Aegis ships. Moreover, cruise missiles are a serious threat in regional conflicts that are fought in littoral areas. In such areas, the warning time that precedes a cruise missile attack may be less than what would have been available in a fight with the Soviet Navy on the open ocean. Thus, non-Aegis ships and even Aegis vessels may need added shorter-range defenses for conflicts in littoral areas. For all these reasons,

added investment in systems to defend against cruise missiles may be appropriate.

Plans have already been developed to improve defenses against cruise missiles, and those planned programs identified in this memorandum would receive funding of about $2.6 billion in the 1994-1998 period. But more might be done. For example, the Navy could further improve the Sea Sparrow anti-air missile, the Phalanx gun system, and the Rolling Airframe Missile; the Navy could also attempt to develop a laser weapon to destroy cruise missiles. Options such as these could add anywhere between $900 million and $2 billion to base-case funding over the 1994-1998 period.

Other Mission Areas

The Navy might consider some other missions areas for additional investment, though these may be of lower priority than the first three discussed in this paper.

Antisubmarine Warfare in Shallow Water. Countering the diesel submarines that are operated by regional powers in littoral areas requires different capabilities than hunting nuclear-powered Soviet submarines in the deep water of the open ocean. The Navy has a number of programs under way to improve its antisubmarine capability in shallow water. With additional funding, it could accelerate these programs. But the small number of diesel submarines in the fleets of potentially hostile regional powers, and the possibility that those fleets could decline further in size, argues against significant acceleration. Moreover, in 1993 the Navy will reportedly spend a total of $3.4 billion for research, development, and procurement for all types of antisubmarine warfare. Any necessary acceleration in developing shallow-water programs might be financed by shifting money from antisubmarine warfare programs that are no longer as important because of the declining threat from Russian submarines.

Amphibious Lift. The Navy is now emphasizing the roles of the Marine Corps, including amphibious assault. This emphasis might argue for an increase in the amphibious fleet. Options that would accomplish such an increase could add between $2 billion and $2.2 billion to funding in the 1994-1998 period. Substantial funding for amphibious lift is already planned ($3 billion), however, and the carrying capacity of the fleet is substantial as it is. Moreover, some analysts argue that because of the growing presence in regional militaries of mines, precision-guided munitions, and satellite

reconnaissance, the United States is unlikely to undertake a large-scale amphibious assault.

Sealift Improvements. Under the base case, $3.3 billion would be spent in the 1994-1998 period to provide enough sealift assets to handle one major contingency, such as the Persian Gulf War. If the United States were willing to spend an additional $3.6 billion to $3.9 billion, it could procure enough sealift ships to speed supplies more quickly to that first contingency or begin supplying a second contingency that occurs simultaneously.

The Clinton Administration, however, may elect not to maintain enough military forces to handle two simultaneous contingencies, which might argue against any added investment in sealift ships. Moreover, if additional lift capacity is needed for two contingencies, the Navy could lease foreign commercial vessels, as it did during the Persian Gulf war.

Paying for Increased Investments

In this period of tight budgets, cuts in other programs would have to finance any added investments in these six mission areas. If the Navy adopted all of the options in this paper, added costs in the 1994-1998 period would be from $10 billion to $12 billion (see Summary Table).[1] The Navy, however, would probably not adopt all of the options; indeed, there are good arguments against adding investments in some mission areas. Thus, any increase would probably be smaller than $12 billion.

Finding the additional program cuts needed to pay for any added spending would not be easy. Navy budgets are declining. The Navy is apparently planning substantial cuts in its ship forces, and in some of its weapon programs, just to accommodate the expected budgetary reductions.

Even added costs of $12 billion, however, would represent about 3 percent of the total funding that the Navy might receive in the 1994-1998 period. This relatively modest increase in funding could be offset by further reductions in programs that are of lower priority in the post-Cold War period. Examples of potential cuts include reductions in the operating tempo of ballistic missile

1. If CBO's options to buy added Sealift and heavy-lift ships to transport mine-clearing vessels were adopted, between $3.7 billion to $4.3 billion in funding would need to be added to the National Defense Sealift Fund, a new account that the Congress created in 1993. CBO assumes in this study that the Navy's budget would need to be cut by the same amount to pay for the added spending by the fund. Thus, the $3.4 billion to $4.3 billion is counted in the $10 billion to $12 billion in cuts that the Navy would need to make if it adopted all of the options.

submarines and cuts in the procurement of weapon programs such as the D5 missile and the DDG-51 destroyer.

The Navy could also consider depending more on the other military services to accomplish certain missions and reducing the size or modernization of its forces for those missions. For example, if the Air Force were to assume more responsibility for attacking distant bombing targets, the Navy might be able to cancel plans to develop a new aircraft. Such a shift in missions might also permit the Navy to retain fewer than the 12 aircraft carriers that it hopes to maintain under its preliminary plan.

MINE COUNTERMEASURES

The mission area of mine countermeasures includes ships and helicopters that are designed to detect and destroy enemy mines. It also includes research on ways to counter mines.

Arguments for and Against Added Investment

Increased investment in mine countermeasures arguably offers a substantial payoff. Some analysts believe that the Navy neglected efforts to counter mine threats for many years.[2] In part, the Navy's lack of interest reflected a division of effort between this country and its NATO allies. The major threat was presumed to be directed against European ports and coastal approaches to them. In a major European war, the NATO allies were expected to provide the ships needed for mine countermeasures.

In regional conflicts, however, the interests of the United States and its NATO allies may not always coincide. Therefore, whether allied assets would be made available on a timely basis is not clear.

Moreover, mines are a potent threat to naval forces during regional wars. They are inexpensive and easy to manufacture and lay, which means that even poorer nations can include them in their defense arsenals. Excluding the nations of the former Soviet Union, about 45 countries can lay mines, making their use in a regional conflict likely.

In contrast to the ease with which mines can be laid, clearing them is hazardous, difficult, and slow. Mine clearing can set back other naval operations for weeks, which might eliminate the element of surprise for an amphibious attack. Indeed, Iraqi mines may have prevented the Marines from carrying out an amphibious assault against the Kuwaiti coast during the Persian Gulf War in 1991. The presence of mines can also restrict the use of ports needed for unloading equipment and supplies.

Mines also limit operating areas of ships and cause damage to them. In 1988, while protecting Kuwaiti tankers in the Persian Gulf, the U.S.S. Samuel B. Roberts was severely damaged by an antiquated mine. In 1991, during the Persian Gulf War, mines planted by Iraq damaged two U.S. ships.

Furthermore, a regional deployment requires transporting mine-clearing ships to the theater of operations--something not anticipated for the European war scenario. If made under their own power, such a voyage would severely

---

2. James L. George, *The U.S. Navy in the 1990s: Alternatives for Action* (Annapolis, Maryland: Naval Institute Press, 1992), p. 175, and Lieutenant Ernest Fortin "Those Damn Mines," *Proceedings* (July 1992).

tax these small ships and their crews. Once in theater, mine-clearing ships need local maintenance facilities. Today, these facilities may not be available.

Options for Added Investment

For all these reasons, several options might be considered that would increase investment in mine countermeasures. The options described below would add between $2.5 billion and $3.1 billion to funding for mine countermeasures in the 1994-1998 period (see Table 1). This added funding would represent a substantial increase above the $1.1 billion of funding planned under this memorandum's base case.

Buy More Ships and Helicopters. Buying more ships and helicopters is the most direct way to increase U.S. capability to clear mines. In the future, the Navy will have 44 helicopters and 26 ships in its mine-clearing fleet. The helicopters can tow devices for "sweeping" larger areas of water to free them from mines. The devices simulate the magnetic or acoustic characteristics of ships to detonate mines or sweep mechanically by cutting cables that attach moored mines to the bottom. Helicopters can also tow mine-hunting sonar to detect and locate mines. Because helicopters can be flown quickly to a theater of regional conflict, they are the rapid response arm of U.S. mine-clearing forces. Similarly, ships can clear mines by sweeping, using acoustic, magnetic, and mechanical means, or by hunting individual mines and neutralizing them. Ships, however, will not arrive as quickly as helicopters in the theater of operations.

This option assumes the purchase of 8 additional MHC-51 mine-hunting ships and 11 more MH-53 mine-hunting helicopters. Such an increase might be needed to permit the United States to conduct extensive mine-clearing operations during a large regional war in which allied assistance was not available. During the Persian Gulf War, the allies used 34 mine-clearing vessels. If the United States had to clear mines without allied help, it would be able to field a maximum of only 26 ships. Because of overhaul schedules and other maintenance, even fewer might be available quickly.

New mine-hunting ships would cost $130 million per ship; helicopters cost $25 million each. This option would therefore add a total of $1.3 billion to investment costs in 1994 through 1998 if all the ships and helicopters are authorized in this period. If new ships and helicopters are to be bought, it may make sense to buy them soon. MHC-51s would not be available for four years after procurement is authorized, while MH-53s would not be available for two years after authorization.

Enable the MH-53 Helicopter to Operate at Night. Currently, the MH-53 helicopter cannot tow devices for sweeping or hunting mines at night. Its ability to perform this mission could be enhanced by purchasing equipment that would allow helicopter pilots to operate the aircraft after dark, including night vision equipment and a forward-looking infrared radar (FLIR). The Navy could not provide an estimate of the cost of this option.

TABLE 1. OPTIONS FOR ENHANCING MINE COUNTERMEASURES
(In millions of 1994 dollars)

Option	Cost in the 1994-1998 Period: Base-Case Plan	Cost in the 1994-1998 Period: Additional Cost of Option
Buy More Mine-Clearing Ships (MHC-51s) and Helicopters (MH-53s)	0	1,320
Improve the MH-53 Helicopter to Operate at Night	0	a
Convert Amphibious Assault Ships (LPHs) to Mine Command Ships (MCS)	130	130-520
Lease Two (Planned) or Buy Two to Four Heavy Lift Ships to Transport Mine-Clearing Vessels	5	135-315[b]
Double Yearly Funding for Research and Development for Mine Countermeasures to $300 Million	950	950
Modify or Convert Vessels to Give Them a Secondary Mine-Clearing Capability	0	c
Total	1,100	2,500-3,100

SOURCE: Congressional Budget Office based on data from officials of the U.S. Navy.

a. The Navy was unable to provide an estimate of the cost for this option.

b. Buying existing heavy-lift ships to transport mine-clearing vessels would be financed through added funding for the National Defense Sealift Fund.

c. CBO was unable to estimate the costs for this option.

Convert More Vessels for Use as Mine Command Ships. Another way to improve capability to counter mines is to retire large, helicopter-capable assault ships (LPHs) from service as amphibious vessels and convert them to mine countermeasures command ships (MCS). Under the base-case plan, the Navy will convert one ship at a cost of $130 million.

The Persian Gulf War demonstrated the need for a command ship that has adequate command and control systems and can provide a source of in-theater maintenance. The single ship that would be converted under the base-case plan can support eight mine-clearing ships and eight helicopters. Yet, the U.S. mine-clearing force has 26 ships and 29 MH-53E helicopters, and the option noted above would purchase 8 new ships and 11 new helicopters. To provide command and control and in-theater maintenance for more of the mine countermeasures force--which might be needed in a major regional conflict--additional command ships might be required.

Under this option, the Navy would convert between one and four additional LPHs to mine command vessels. Converting one more command ship would allow a substantial fleet of mine-clearing vessels to be deployed effectively during a major regional conflict. Converting four more ships (for a total of five) would provide enough mine-command vessels to accommodate the entire fleet of mine-clearing ships, even if that fleet is expanded as suggested above. Depending on the number of conversions, the costs to convert these additional ships would range from $130 million to $520 million.

Constructing new ships could also meet the need for more command ships and allow a longer useful life for the vessels than that achieved by converting existing amphibious ships. But under this approach, increasing the fleet by one to four new vessels would cost at least from $900 million to $3.6 billion, which might be prohibitively expensive.

Buy Heavy-Lift Ships. Mine-clearing ships are small vessels that are not well suited to making long voyages on the open ocean. To transport them to and from a theater of operations, the Navy plans to charter commercial heavy-lift ships, as it did before and after the Persian Gulf War. (The mine-clearing vessels sail into and out of the heavy-lift ships.) In this way, mine-clearing vessels can be transported over long distances without being damaged. Chartering two commercial ships when they are needed to transport the mine-clearing vessels to and from one theater of operations would cost about $ 5 million.

For the Persian Gulf War, the United States chartered foreign commercial ships to transport U.S. mine-clearing vessels. But the Assistant

Chief of Naval Operations for Surface Warfare stated that the United States could not depend on foreign-owned ships when U.S. national interests are at stake.[3] In addition, chartered commercial ships may not be immediately available for transporting mine-clearing ships. Depending on where in the world they are sailing when needed, it would take between 15 and 45 days (30 days on average) before they became available for use and another five to seven days to prepare them for transporting the vessels. The time lag occurs because there are few large heavy-lift ships in the world that are suitable for transporting mine-clearing vessels.

Yet, mine-clearing ships are often needed first in a war theater before other naval operations can take place. To reduce response time, the Navy could buy existing commercial ships and maintain them in a reduced operating status. In this status, the ships could be available for use in three days and prepared for loading in two to four more days. The Navy already plans to buy existing commercial ships to help meet the requirements for sealift, a mission where response time is important but probably less so than for mine countermeasures.

During the 1994-1998 period, buying two existing heavy-lift ships and operating and maintaining them could cost $140 million to $160 million. Two heavy-lift ships will transport six to eight mine-clearing vessels. If the Navy wanted the ability to transport 12 to 16 mine-clearing vessels--or roughly one-half of its fleet of 26 vessels--in one trip, then more than two heavy-lift ships would have to be purchased. Buying, operating, and maintaining four existing heavy-lift ships would cost $280 million to $320 million from 1994 through 1998.

If the heavy-lift ships were purchased for this price, they could be used for multiple voyages and multiple tasks. During peacetime, or during wartime when they were not transporting mine-clearing vessels, the heavy-lift ships could be used to transport other items, such as Army ships, drydocks, cranes, and sections of submarines that are being decommissioned.

Building new vessels could also meet the need for government-owned ships to transport mine-clearing ships. But this approach would cost considerably more than buying existing ships. After the lead ship was constructed, each new ship--built to military specifications--could cost $260 million to $310 million. A commercial design might cost less.

---

3. See statement of Vice Admiral Robert K. U. Kihune, U.S. Navy Assistant Chief of Naval Operations (Surface Warfare) before the Subcommittee on Seapower of the House Armed Services Committee, March 17, 1992.

Increase Research and Development. Although funding has increased in recent years, the Navy still does not spend much on research and development to find better ways to counter mines. In 1993, the Navy plans to devote $190 million (1994 dollars) to research and development for mine countermeasures in littoral areas, which amounts to only about 2 percent of its total R&D budget.

This option would double the funding for research and development in mine countermeasures in littoral areas over the 1994-1998 period. Annual funding would amount to $380 million a year; added costs would total $950 million. The Congressional Budget Office has not sought to identify particular new projects that would be undertaken with this added funding. Instead, the rationale for the option rests on the small fraction of R&D resources now devoted to this key area.

Detecting and locating mines clandestinely, however, is an example of an effort that might benefit from increased funding for research and development. This capability is important if mines are to be identified and avoided during an amphibious assault without giving away the specific location of the planned assault. For this mission, the Navy is developing unmanned underwater vehicles and unmanned aerial vehicles, which are difficult to detect by radar. Added funding could result in earlier improvement in the Navy's ability to detect mines clandestinely.

Create Secondary Capability in Some Vessels. This option would modify or convert existing vessels so that they would have a secondary mine-clearing capability. Technologically advanced vessels, such as Coast Guard ships or oceanographic vessels of the National Oceanographic and Atmospheric Administration (NOAA), might be altered so that mine-clearing equipment could be installed.[4] In addition, modern air-cushioned landing craft for amphibious assaults (LCACs) might make excellent mine-clearing vessels because they ride above the water on a cushion of air. Some of the landing craft might be assigned this task as a secondary mission or a specialized mine-clearing version (designated an MCAC) might be produced. The Navy is actively considering the secondary use of LCACs to clear mines. Alternatively, a Norwegian company already produces an air-cushioned, mine-clearing ship, which the Navy could purchase.[5]

4. James L. George, *The U.S. Navy in the 1990s: Alternatives for Action* (Annapolis: Naval Institute Press, 1992), pp. 177-178.

5. See "Norway Buys Air-Cushioned Mine-Clearing Ships," *Defense News* (January 27, 1992), p. 20.

The option of using LCACs for mine clearing might involve little added cost because mine clearing would only be a secondary mission for these landing craft. CBO could not estimate the costs of modifying Coast Guard or NOAA ships to give them a secondary mine-clearing capability or buying more LCACs and converting some of them for mine clearing. The Norwegian company sells its air-cushioned, mine-clearing ships for about $44 million per ship.

NAVAL FIRE SUPPORT

During an amphibious assault, guns, missiles, or rockets fired from ships could be used to suppress shore defenses and hit targets inland. Aircraft and artillery lifted to the beach can also support the assault. This mission is called naval fire support.

Arguments for and Against Added Investment

Because the Navy is emphasizing its role as an "enabling force" for the other services during the post-Cold War era, naval surface fire support may now be more important. Since the Navy retired the last of its four battleships in 1992, however, it can generate little gunfire from ships to support ground troops. The five-inch guns on most remaining surface ships have insufficient range and lethality to meet the requirements for the mission. Tomahawk cruise missiles fired from ships and submarines can only hit fixed targets, leaving large numbers of mobile targets untouched. Initially, then, attack aircraft must provide fire support for ground forces. Once artillery has been transported ashore, it can assume a role of providing fire support.

Using aircraft and artillery to generate fire support may be adequate in less demanding circumstances, such as amphibious assaults that occur during daytime and assaults against foes with limited defensive capability. Even if these forms of fire support are not fully adequate, there are few ways to improve them in the near-term except by reactivating some or all of the battleships. Higher-technology solutions that are available in the longer term would cost more.

Moreover, the Marine Corps has undertaken no large amphibious assaults since the landing at Inchon, which occurred 40 years ago during the Korean War. Some analysts have argued that no large assaults have occurred because they have been made risky by the access of regional powers to mines,

precision-guided munitions, and satellite reconnaissance. If large assaults are a thing of the past, there may be less need for improved fire support.

The Marines, however, are carrying out changes that may reduce the risks associated with large-scale amphibious assaults--for example, changing their doctrine from head-on assaults on the beach to maneuver warfare from the sea, which uses more indirect attacks. Or they may launch smaller assaults that require fire support, as they have done in recent decades.

During such assaults, use of aircraft and artillery to provide fire support would have limitations. For example, artillery on the ground is less mobile than ships at sea and cannot be used during the initial assault on the beach or to protect helicopter landing zones further inland. Aircraft have problems sustaining their attacks at night and in bad weather. Their response time for redirection to new targets may be slower and they may have less ordnance at their disposal to sustain their fire than ship-based guns.

Presumably because of those limitations, the 1993 Navy Posture Statement concluded that fire support from aircraft is insufficient to meet all naval needs.[6] The document concluded that a sea-based system is required when intense, concentrated, all-weather fire support is required to suppress opposition during an amphibious assault.

Options for Added Investment

If more fire support is judged to be appropriate, this memorandum identifies several illustrative options, and still others are being considered within the Navy.[7] Together, the added cost of a package of such options could total about $900 million in 1994 through 1998 (see Table 2). Carrying out only a few of these options would represent a marked increase in the Navy's investment in fire support compared with that under the base case. During the 1994-1998 period, the Navy plans to spend only about $60 million in research and development for two fire-support projects. The first is to develop an Advanced Take Off and Landing (ASTOVL) aircraft and the second is general research and development for naval surface fire support.

Reactivate Two Battleships. If a near-term increase in the capability to provide naval fire support is desired, reactivating battleships may be the only

6. See U.S. Navy, *Department of the Navy 1993 Posture Statement* (March 1993), p. 32.

7. Studies of naval fire support are nearing completion, including a Navy Cost and Operational Effectiveness Analysis (COEA) that may provide a more comprehensive list of options.

solution. Battleships have 16-inch guns that can provide substantial firepower in support of shore-based operations. The battleships might suffice to provide fire support in the short term until systems with longer ranges can be developed and produced.

This option assumes that two of the four existing battleships are reactivated. Reactivating two ships would allow the Navy to provide some sea-based fire support in the near term without incurring the cost of

TABLE 2. OPTIONS FOR AUGMENTING NAVAL FIRE SUPPORT
(In millions of 1994 dollars)

Option	Cost in the 1994-1998 Period: Base-Case Plan	Cost in the 1994-1998 Period: Additional Cost of Option
Reactivate Two Battleships	0	400
Develop and Procure the Assault Hawk (Variation of Tomahawk)	0	120[a]
Develop and Procure the Army Tactical Advanced Cruise Missile System (ATACMS) Fired from a Ship's Vertical Launch Tubes	0	90[a]
Develop and Procure the Sea SLAM Fired from Vertical Launch Tubes	0	80[a]
Develop an Advanced Major Caliber Light Gun and Precision-Guided Munitions for the Twenty-First Century Destroyer	0	210
Accelerate Research and Development on the Advanced Short Take-Off and Vertical Landing (ASTOVL) Aircraft	20	40
Provide General Research and Development for Naval Surface Fire Support	40	0
Total (Assumes ATACMS is chosen)	60	900

SOURCE: Congressional Budget Office based on data from officials of the U.S. Navy.

a. Only one of these options would probably be chosen.

reactivating all four ships. It would entail about $50 million to recommission each ship, assuming that there is no need to upgrade further the capability of the vessels while they are being recommissioned. Annual operating costs amount to about $40 million per ship. If both ships return to service by the end of 1995, then the added cost of this option in the 1994-1998 period would total $340 million. For an additional $60 million, the 16-inch guns of the battleships could be upgraded to increase their range, bringing the added cost to $400 million during the period.

Although reactivating battleships is one of the least expensive options for improving naval fire support considered in this paper (the other options have substantial procurement costs after the 1994-1998 period), the Navy originally decommissioned the battleships because the costs to operate and maintain them and to pay the salaries of personnel to staff them were high in comparison to those for many other types of ships. Nevertheless, if the Navy deems a near-term, sea-based naval fire support capability to be important, it may want to consider paying the cost to recommission two battleships.

Those costs could be reduced somewhat by maintaining less than full staffing or by recommissioning the ships into the reserves, where personnel costs are lower. These approaches, however, might leave the ships less readily available in an emergency. Battleships are also labor-intensive ships that might be difficult to maintain in peacetime if part-time reserves provide a large share of the staffing.

Develop Systems with Longer Range. Reactivating battleships would at most provide a few platforms capable of providing substantial fire support. Other options would take longer to bear fruit but would permit ship-based fire support assets to be dispersed more widely. In addition, the gunfire support systems on the battleships, without an upgrade, would only meet the Navy's minimum requirements for range in a fire support system. Such systems would primarily be useful in bombarding areas adjacent to the coastline. The new Marine Corps doctrine of maneuver warfare, however, assumes that troops are lifted further inland by air. This doctrine may require fire support at longer ranges.

Developing and procuring the Assault Hawk is one option for sea-based fire support at longer ranges. The system consists of a modified Tomahawk missile that is fired from a ship's vertical launch cells. The system has much more range than that of the battleship's guns, and it can be fired from all of the Navy's ships with vertical launch cells--the Ticonderoga class cruisers (CG-47s), the Arleigh Burke class destroyers (DDG-51s), and the Spruance class

destroyers (DD-963s). The Assault Hawk also costs less than the existing Tomahawk missile because it requires a less sophisticated guidance system.

Research and development on the missile during the 1994-1998 period would cost an additional $120 million more than the base case. In the longer term (the 1999-2008 period), the missile would cost an additional $1.2 billion to produce, assuming that 2,000 missiles were purchased. The system could be initially fielded between the years 2000 and 2010.

The Navy could buy the Army Tactical Missile System (ATACMS), a missile the Army uses for fire support, for use on ships. ATACMS could be fired from a ship's vertical launch cells. It would have a range of 100 nautical miles. The missile would need to be modified so that it can be fired from a vertical launch cell and accurately from the rolling deck of a ship. In 1994, the Navy will conduct an Advanced Technology Demonstration to evaluate whether a sea-based ATACMS can successfully hit a target on land. If the option is feasible, the added cost to research and develop it would be about $90 million during the 1994-1998 period. Assuming the Navy buys 2,000 ATACMS missiles, the missile would cost an additional $1.4 billion to modify and produce during the 1999-2008 period.

The Navy could also develop and procure the Sea-Launched Standoff Land Attack Missile (Sea SLAM). This weapon would be a variation of the Harpoon antiship missile. Although Harpoon is designed to attack ships, the SLAM variation has been modified to attack targets on land. The added cost to research and develop the option is $80 million during the 1994-1998 period. The cost to produce the missile is an additional $1.8 billion during the 1999-2008 period, assuming 2,000 missiles are purchased at $900,000 per copy.

The Navy could also initiate a program to produce an advanced major caliber light gun (five- to eight-inch gun) and retrofit it on some of the DDG-51 destroyers or design them into its successor, the 21st century destroyer. For example, an advanced eight-inch gun, shooting extended-range ammunition that is guided by the Global Positioning System (GPS) satellite, would have a range of more than 70 nautical miles. During the 1994-1998 period, the added costs to design an advanced gun system would be about $210 million for research and development, with $110 million allocated to designing the gun for the 21st century destroyer and another $100 million for developing precision-guided munitions to fire from it. From 1999 to 2008, production costs are estimated to be and additional $1.3 billion, assuming 6,000 precision-guided munitions were purchased.

Hasten Development of a New Aircraft. Development efforts are beginning on the Advanced Short Take Off and Vertical Landing (ASTOVL) aircraft. This aircraft is expected to replace eventually the AV-8B aircraft and the F/A-18 fighter/attack aircraft. When it is available, the ASTOVL is expected to be able to take off and land in small areas. It could also carry substantial amounts of ordnance. It may therefore be a potent asset for supporting ground forces.

Under the base-case plan, the ASTOVL is slated to receive $20 million in Navy funds for research and development from 1994 through 1998. In addition, the Advanced Research Projects Agency, a part of the Department of Defense, plans to invest another $40 million during that period. The plane, however, is in the early stages of development and is not scheduled for initial deployment until after the year 2010.

This option would add another $40 million in Navy funding to accelerate the program. Nevertheless, even with additional funding, the ASTOVL would not be available for many years.

DEFENSE FOR SHIPS AGAINST ANTISHIP CRUISE MISSILES

During regional conflicts, Navy ships could be attacked by cruise missiles. Antiship cruise missiles are pilotless vehicles that can fly low over the sea in order to evade detection by radar. In addition to being launched from aircraft, the missiles can be fired from shore batteries or naval vessels, including patrol boats. When Navy ships are operating in close-in littoral areas, they will probably have little warning of an attack because the missiles are hard to detect until they are very close to their targets.

Arguments for and Against Added Investment

The Navy already plans to spend considerable amounts to defend its ships against cruise missiles. In addition to surface ships that can fire Tomahawk missiles, the aircraft from aircraft carriers could attempt to destroy the missile launchers at long ranges. If newer cruisers and destroyers, equipped with the sophisticated Aegis area air-defense system, can detect an attack sufficiently early, their long-range surface-to-air missiles might be able to shoot down enemy aircraft carrying cruise missiles or attack the missiles themselves after they are fired. There may therefore be little need for further investment in defenses against these missiles.

The Navy, however, is experimenting with task forces that do not include an aircraft carrier or Aegis ships. In addition, when operating in littoral areas with shorter warning time of an attack, non-Aegis and even Aegis ships may need shorter-range defense systems to counter incoming cruise missiles coming from patrol boats, shore batteries, and mobile launchers on land, such as trucks.

Cruise missiles are becoming potent weapons in the arsenals of regional powers. The U.S. frigate Stark was almost sunk by Exocet missiles fired from an Iraqi aircraft during the Iran-Iraq war in 1987, and the HMS Sheffield was sunk by an Argentine air-launched Exocet during the Falklands war in 1982. According to one analyst, the most significant naval weapons of modern times are these antiship cruise missiles, with offensive capabilities that have outstripped those of the defenses against them. Like mines, these affordable missiles are a weapon of choice for use against modern navies by potentially hostile regional powers, which usually cannot afford large fleets. More than 90 countries currently have the missiles in their inventories.

Options for Added Investment

A number of approaches could be pursued to improve the ability of naval ships to defend themselves against cruise missiles. Some of the approaches involve improving existing systems or buying new ones. Another option would permit better integration of data from various sources about the nature and location of the attacking missiles, thereby increasing the chance of rapidly destroying them.

The options discussed in this section could add as much as $900 million to $2 billion to the $2.6 billion planned for this memorandum's base case from 1994 through 1998 (see Table 3). This latter estimate does not include money for highly classified programs the Navy is apparently pursuing. Insufficient official information is available about all these programs to permit their inclusion here, but the programs may nevertheless involve substantial resources.

An example of such a program is "Link Iron." A press report suggests that the program is designed to establish secure electronic data links that would be needed if ships are to exchange information about enemy attacks.[8] The press article also notes that the program will absorb 40 percent of the

8. See "Navy Installing 'Outlaw Bandit' Signature Reduction Materials to Ships," *Inside the Pentagon* (April 22, 1993).

funds spent on research and development for ship defense between now and the end of the decade. According to the article, the Defense Department has stated that the Navy intends to provide funding of $750 million for Link Iron during the 1994-1998 period, which suggests that these classified programs would add substantially to the total of $2.6 billion noted above.

TABLE 3. OPTIONS FOR IMPROVING THE DEFENSE OF SHIPS AGAINST CRUISE MISSILES (In millions of 1994 dollars)

Option	Cost in the 1994-1998 Period	
	Base-Case Plan	Additional Cost of Option
Add Armed Helicopters to Surface Ships	0	80
Improve Electronic Warfare Systems (Including decoys and reducing the radar signature of ships)	670	50-140
Improve Phalanx Gun System to Counter More Advanced Antiship Missiles	380	100-130
Develop Precision-Guided Munitions to Be Fired from Five-Inch and Future Guns	0	50
Improve the Sea Sparrow Missile with Infrared or Vertical Launch Capabilities	570	100-670
Improve Rolling Airframe Missile (RAM) by Adding an Infrared Capability or Buying More Launchers and Missiles	720	170-350
Develop a Laser Weapon to Destroy Antiship Cruise Missiles	0	300-500
Improve Integration of Sensors and Weapons	260	80
Total	2,600	900-2,000

SOURCE: Congressional Budget Office based on data from officials of the U.S. Navy.

NOTE: Highly classified programs are not included in this table.

Add Armed Helicopters to Surface Ships. In regional conflicts against less developed nations with small navies, a major threat may be patrol boats carrying antiship missiles. Helicopters operating from surface ships are often the first to detect such small craft and might be able to destroy them before they are close enough to fire their antiship missiles at the ship. Yet, in the Persian Gulf War, Navy helicopters did not have the ability to strike Iraqi patrol craft after they detected them. Instead, Army OH-58D scout helicopters were flown onto ships and, along with British helicopters, were used to attack enemy patrol boats.

For $80 million, the Navy could modify SH-60B antisubmarine helicopters to carry missiles for antisurface attack. Modifying Navy helicopters for attack would allow this capability to be fully integrated into the operations, doctrine, and training of the fleet, which could significantly enhance wartime effectiveness. Currently, the Navy has no plans to arm these helicopters.

Improve Electronic Warfare Systems. The Navy has electronic warfare devices that consist of electronic support measures (ESM) that detect and classify the radar signals of incoming cruise missiles and jamming devices that interfere with their electronic systems so that they miss their targets. Under its base-case plan, the Navy expects to improve the capabilities of the existing SLQ-32 electronic warfare system used on ships by increasing its power and cutting the time needed to respond to a threat; the base case plan would also carry out measures to reduce the radar signatures of U.S. ships. These improvements would cost $670 million over the 1994-1998 period.

The Navy could accelerate these improvements. It addition, it could devote additional funds for research and development of a successor system, the SLQ-54, which could be deployed by the year 2002. Among other things, the SLQ-54 would integrate data from all-source intelligence systems, be even faster than the SLQ-32 in its response to threats, and be more precise in detecting and classifying targets. The SLQ-54 would, therefore, provide more precise information about the source and location of cruise missile attacks, increasing the chance of intercepting the missiles before they damage U.S. forces. The additional costs of these added capabilities in the 1994-1998 period ranges from $50 million to accelerate the improvements to the SLQ-32 to $140 million, which includes accelerating these improvements as well as research and development for the SLQ-54.

Improve the Phalanx Gun System. The Phalanx gun is a Gatling gun that is based on many ships and is designed shoot down cruise missiles at short ranges, providing protection against missiles that have penetrated other defenses. Under the base case, the Navy plans to spend $380 million from

1994 through 1998 to improve the Phalanx gun by enhancing the weapon's rate of fire, magazine capacity, and ability to detect and hit small and high-flying targets.

The Navy could further enhance the Phalanx system. Estimates of the additional cost of such improvements range from $100 million to accelerate the fielding of planned improvements to $130 million to accelerate the improvements and enhance the system further to make it more effective against more advanced cruise missiles that can maneuver to avoid the gun's fire.

Develop Precision-Guided Munitions for Existing and Future Guns. The Navy recently began to explore the capabilities and cost-effectiveness of precision-guided munitions (PGMs) shot from guns to use against sea-skimming cruise missiles and patrol boats that fire them. The munitions might be fired from existing five-inch guns or future gun systems on surface ships. From 1994 to 1998, no funding is available for research and development for this option under the base case. If research and development were fully funded for the program, additional costs for the option would total about $ 50 million during the same period.

Improve the Sea Sparrow Missile. The Navy plans to improve the Sea Sparrow, a short-range missile that can defend a ship against cruise missiles, at a cost of $570 million. These efforts are designed to produce a version of the missile that has more capability to engage sea-skimming antiship missiles and a more advanced version that could home in on heat from the exhaust of an incoming cruise missile or its radar signature. Additional improvements, which could initially be available by the late 1990s, would cost from $100 million to $670 million in the 1994-1998 period. For $100 million, procurement of the two improved versions could be accelerated. For $670 million, the Navy could accelerate the two improved versions and develop and procure an even more sophisticated Sea Sparrow that has greater speed and agility to defeat supersonic, maneuvering cruise missiles and can be fired from a ship's vertical launch cells.

Improve the Rolling Airframe Missile. The Rolling Airframe Missile (RAM) is a light-weight, shipboard missile system. It provides defense against cruise missiles but uses a passive radar/infrared seeker and is less expensive per unit than the Sea Sparrow. During the 1994-1998 period, the Navy plans to procure RAM launchers and missiles and develop an improved missile seeker at a cost of $720 million. Added options in the 1994-1998 period could range from $170 million if the Navy bought 30 additional RAM launchers to $350

million if the Navy bought the extra RAM launchers plus 600 additional missiles with an improved infrared capability.

Develop a Laser Weapon. Among the options that improve systems or buy new ones to defend ships against missiles, one of the more expensive approaches is a high-energy laser weapon. If deployed on ships, a laser might be effective in destroying an incoming cruise missile by burning out sensitive optics and electronic parts that guide it to its target. A prototype laser weapon has been developed, but it would require significant additional research to allow it to be integrated onto ships.

The Navy currently has no plans to fund development of this weapon during the 1994-1998 period. Estimated funding requirements to develop the system range from $300 million to $500 million in the 1994-1998 period, with initial fielding projected sometime during the period from 2001 to 2003.

Improve Integration of Sensors and Weapons. The Combat Direction System (CDS) aids the commanding officer by integrating and displaying data from several sensors, including air surveillance radars, an infrared search and track system, the SLQ-32 electronic support measures system, and radars associated with the Phalanx gun. Key data include features such as the incoming missile's range and trajectory. The CDS also coordinates the ship's defensive systems as they respond to the threat. Using multiple sources of information and automating control of sensors and weapons would allow faster reaction to antiship missiles--an important improvement if missiles are fired from shore-based batteries, helicopters, or patrol boats that are close to the ship.

Under the base case, the Navy plans to spend $260 million to begin integrating existing sensors and weapons under the Quick Reaction Combat Capability (QRCC) program.

Further integration would allow an additional weapon to take advantage of data from several different existing sensors. The Sea Sparrow missile could use information from radars, electro-optic sensors, and the SLQ-32 electronic support measures system. Completing this added capability would cost $80 million more than the base case.

ANTISUBMARINE WARFARE IN SHALLOW WATER

Most U.S. systems for detecting and tracking submarines were designed for combat in the open ocean against Soviet nuclear-powered submarines. With most of the Russian nuclear submarine fleet tied up in port, the U.S. Navy

faces a much diminished threat from nuclear submarines. Today, diesel submarines operating in the shallow waters of littoral areas represent the major threat to U.S. forces.

Arguments for and Against Added Investment

The new submarine threat is certainly different than the Cold War problem. While submerged, diesel submarines are powered by batteries. A submerged diesel vessel is actually quieter than a nuclear-powered submarine and so may be harder to detect.

Detecting submarines is also inherently more difficult in coastal waters than it is in the open ocean. Coastal waters often have heavier ship traffic, generating noise that masks that of a submarine. Also, sound propagation patterns are more complex and are affected by such factors as temperature variation at different depths and increased reverberation off the shallow bottom.

The threat posed by diesel submarines operating in littoral areas should not be overstated, however. These submarines are quiet underwater, but they are relatively easy to detect when they are running on or near the surface (snorkeling), which they must do periodically in order to operate their diesel engines to recharge their batteries. In addition, unlike Russian submarine crews, those from regional powers have limited training. The submarines from these nations must therefore be near their targets before firing a weapon, which makes them easier to detect and destroy.

Regional powers have small fleets of submarines. Moreover, according to a press report, the Director of Naval Intelligence stated that few developing countries other than Iran would begin operating submarines over the next decade. Indeed, he reportedly estimated that the number of diesel submarines in the inventories of potentially hostile regional powers will actually decline by 10 percent during the 1990s.[9]

Options for Added Investment

The Navy has a number of programs under way to improve its antisubmarine warfare (ASW) capabilities in shallow waters. If more funds are to be

9. See "Submarine Threat to Decline Among Third World Nations During the 1990s," *Inside the Pentagon* (February 13, 1992).

invested in this mission area, these programs could be accelerated. The U.S. Navy did not provide the added costs associated with accelerating the programs.

Improve Sonar Systems. Submarines can use active sensor systems, which send out a signal that bounces off a target and then returns to a receiver, or passive sensors that listen for submarines without radiating sound waves. The Navy preferred passive sensors as the primary means of detecting advanced Soviet nuclear-powered submarines because they avoided giving away the position of the U.S. submarine and detected submarines at greater range than active sensors.

Active sonar, however, may be increasingly effective in detecting submarines in littoral waters because of the greater reverberation of sound off the bottom in shallow water and the use of quieter diesel submarines by regional powers. As a consequence, the Navy is developing improved active sonar systems. With added funds, development of these systems could be accelerated.

Some of the systems being developed can be installed on ships or towed behind them; others are operated offboard from the ship. Offboard systems offer an advantage: they do not divulge the location of hunting ships to the enemy submarine. The Active Low Frequency System (ALFS) sonar, which is lowered into the water from an SH-60B or SH-60F helicopter, is an example of an offboard system.

Make Underwater Sonar Arrays More Mobile. When Soviet submarines were the major threat, fixed arrays deployed on the ocean floor were useful in detecting them. The fixed arrays could be deployed in areas the Soviet submarines had to traverse, such as the egress points from the northern waters of the former Soviet Union.

Now there is greater uncertainty about which countries' submarines would pose a threat to U.S. forces and where these submarines would operate. Fixed arrays are therefore less useful. As a result, the Navy is developing mobile arrays that could be rapidly deployed in various areas. Some of these arrays can be recovered for reuse in other theaters. With added funds, development of mobile arrays could be accelerated.

Accelerate Development of Nonacoustic Systems. Nonacoustic systems rely on something other than sound waves to detect submarines. For example, radar systems can detect the periscopes of diesel submarines; infrared systems can pinpoint their exhaust when they are snorkeling to recharge their

batteries. These systems could be useful against diesel submarines and could be accelerated with added funds. In contrast, Soviet nuclear-powered submarines spent little time at periscope depth and had no exhaust.

Improve Torpedoes for Use in Shallow Water. The systems that guide torpedoes can be reprogrammed or modified to operate better in the shallow water environment of littoral areas. Upgrade programs for the Mark 48 submarine-launched torpedo and for the Mark 46 and the Mark 50 lightweight torpedoes will improve their performance in these waters.

Paying for Improvements. If the Navy decided to accelerate these improvements to its shallow water ASW capabilities, it might be possible to shift funds from other ASW programs that are not as important now that the threat from Russian submarines has declined. The Navy would not provide CBO with the amount of money it spends on ASW or the percentage of its ASW budget currently spent on shallow water efforts. According to a press report, however, the Navy will spend $3.4 billion on ASW in 1993, of which $1.6 billion will be used for research and development and $1.8 billion for procurement.[10]

AMPHIBIOUS LIFT

The Navy is now emphasizing the roles that the Marine Corps could play in regional conflicts. In particular, the Marines could be used more extensively to conduct assaults during regional wars.

Also, the Navy is experimenting with formations of ships centered around amphibious ships (such as the LHD, LHA, or LPH) rather than aircraft carriers. Although amphibious ships cannot accommodate the fixed-wing aircraft that operate off carriers, they can be used to operate helicopters and aircraft capable of vertical or short take off and landing.

These new formations could substitute for aircraft carrier battle groups in certain situations that do not demand the range and weapons capacity of fixed-wing aircraft. They could, for example, maintain a U.S. presence overseas in peacetime, aid in humanitarian relief efforts such as the one in Somalia, or evacuate personnel from countries in crisis (such as the evacuation of U.S. personnel from Liberia that was carried out in 1991 by

10. See "Antisub Warfare Moving to the Fore," *Navy Times*, January 11, 1993.

helicopters operating from an amphibious ship). In addition, the Navy is now integrating smaller amphibious ships into carrier battle groups.

Arguments for and Against Added Investment

Such emphasis on the role of the Marines and the amphibious ships that carry them could argue for increasing the carrying capacity of the amphibious fleet. The capacity could, for example, be increased from the current level--which is sufficient to transport the troops and equipment needed to support 2.5 amphibious Marine Expeditionary Brigades (MEBs)--to a level necessary to support three such brigades.[11] (A MEB typically consists of about 13,000 Marine troops and their associated equipment.) Such an increase would be consistent with Department of the Navy studies that show that at least 3 MEBs are needed, despite the financially constrained goal of 2.5 MEBs.

Whether such an added investment would be appropriate is another matter. The current capacity to transport 2.5 amphibious MEBs permits one MEB to be available for deployment on each U.S. coast. Moreover, the Marines have not launched an amphibious assault that would warrant a capacity of three MEBs since the attack on Inchon during the Korean War 40 years ago. The absence of a large amphibious assault during the past four decades may reflect the many risks associated with such an operation. These risks include mines in the water and on the beach, precision-guided munitions fired from land, and access by adversaries to reconnaissance from satellites that might eliminate the element of surprise.

Options for Added Investment

If a decision is made to increase amphibious lift, several options are available that, when combined, would add between $2 billion and $2.2 billion to base-case costs during the 1994-1998 period (see Table 4). To maintain the capacity to lift 2.5 MEBs, the Navy already plans a substantial building program for amphibious ships at a cost of $3 billion from 1994 through 1998.

Procure an Additional Amphibious Helicopter Carrier. In 1993, the Congress authorized the purchase of a sixth new amphibious helicopter carrier (designated as an LHD), but provided only $300 million of the total cost of about $1.2 billion. The Clinton Administration's budget proposal for 1994

11. See "Momentum Building to Increase Marine Corps' Amphibious Forces by 20 Percent," *Inside the Pentagon* (August 13, 1992).

provides the extra $890 million to fund the ship fully. An LHD is a large vessel that displaces about 40,000 tons, about half the size of an aircraft carrier of the Nimitz class. It can carry about 30 helicopters, six to eight AV-8B Harrier jets that can take off and land vertically, and three air-cushioned landing craft.

A seventh LHD could be purchased at a cost of $1.4 billion to $1.6 billion. Another LHD would provide an additional vessel to serve as a nucleus for a group of ships that could perform some of the missions of an aircraft carrier battle group. The ship would require five years to build and deploy after being authorized.

Buy One More New Amphibious Ship (LX). If the lift goal were raised from 2.5 MEBs to 3 MEBs, the Navy would need to buy one more LX ship in addition to the three the Navy plans to purchase during the 1994-1998 period. LX ships are smaller than LHDs (displacing about 25,000 tons compared with about 40,000 tons for the LHD). However, they can still accommodate about 800 troops, as well as helicopters and landing craft.

Buying one more LX ship during the period would add $640 million to the almost $2 billion in funding already planned. The ships require four years to build and deploy after they are authorized.

TABLE 4. OPTIONS FOR AUGMENTING AMPHIBIOUS LIFT
(In millions of 1994 dollars)

Option	Cost in the 1994-1998 Period	
	Base-Case Plan	Additional Cost of Option
Procure a Seventh Amphibious Helicopter Carrier (LHD) After Completing the Funding of the Sixth in the Clinton Budget for 1994	890	1,400-1,600
Buy One More LX in Addition to the Three Planned	2,140	640
Total	3,000	2,000-2,200

SOURCE: Congressional Budget Office based on data from officials of the U.S. Navy.

NOTE: LX = new amphibious assault ship.

SEALIFT

Regional conflicts often occur in places with little U.S. military equipment or infrastructure. Therefore, cargo and equipment to support U.S. forces must be moved by ships and transport aircraft. Although aircraft can transport high-priority items quickly, they cannot move large volumes of materiel. The bulk of all war materiel must move by sea. Indeed, during many past conflicts, including the Persian Gulf war, more than 90 percent of all supplies were shipped by sea.

Arguments for and Against Added Investment

According to the Department of Defense, the United States currently has a shortage of assets for sealift. The Mobility Requirements Study, an analysis of required capacity that was conducted by the Joint Chiefs of Staff, recommended the purchase of 11 fast sealift vessels and 9 ships designed to preposition equipment at sea but near potential theaters of operation. By buying ships designed for transporting military equipment, rather than leasing commercial vessels, the military would have a more capable fleet that would be immediately available in time of crisis.

The National Defense Sealift Fund has $2.5 billion that the Congress appropriated toward fulfilling the requirements of the Mobility Requirements Study. The Navy's preliminary plan--the base case for this paper--would spend $3.3 billion more during the 1994-1998 period. The planned purchase is based on the "medium-confidence/medium-cost" option in the study. That option is designed to provide enough sealift assets to transport the U.S. forces needed to fight one demanding regional contingency--such as the Persian Gulf War.

The Bush Administration, however, argued that its proposed force had enough military units to fight two regional conflicts that started sequentially but overlapped. One scenario would involve a major war in the Middle East; the second envisioned U.S. assistance to South Korea after a North Korean attack. More sealift than would be provided by the study's medium option would be needed to support U.S. forces involved in two simultaneous wars. A large number of sealift ships could be needed for the Korean scenario. U.S. military intervention in South Korea would benefit from reinforcement by heavy forces early in the conflict, according to the Mobility Requirements Study.

The "high-confidence/high-cost" option in the Mobility Requirements Study assumed simultaneous contingencies and recommended the purchase of a total of 17 fast sealift ships and 15 prepositioning ships. This additional sealift could move supplies to the first major regional conflict more quickly or could be used to transport some of the supplies needed for a second concurrent contingency.

The high-option levels of sealift assets may not be needed, however. The current Administration may not recommend defense budgets sufficient to buy and operate the military forces necessary to contest two regional wars at the same time. Moreover, in the unlikely event of two concurrent contingencies, sealift needs could be met by leasing commercial ships. Although less well-suited to moving some types of military equipment, commercial ships were leased by the Navy to move U.S. forces during the Persian Gulf war.

Options for Added Investment

If a decision is made to purchase more sealift assets than are now planned, they could add between $3.6 billion and $3.9 billion to the funding of $3.3 billion already planned for the 1994-1998 period (see Table 5).

Buy High-Option Recommendation. This option would buy the assets recommended under the high option in the Mobility Requirements Study. Specifically, it would buy an additional six prepositioning and six fast sealift ships beyond those called for under the medium option of that study. This approach would permit some ships to be used to move forces to a second regional contingency that occurs concurrently. If only one contingency

TABLE 5. OPTIONS FOR AUGMENTING SEALIFT (In millions of 1994 dollars)

Option	Cost in the 1994-1998 Period: Base-Case Plan	Cost in the 1994-1998 Period: Additional Cost of Option
Buy High Option, Mobility Requirements Study (17 Fast Sealift and 15 Prepositioning Ships)	3,300	3,600-3,900[a]

SOURCE: Congressional Budget Office based on data from officials of the U.S. Navy.

a. This option would be financed through added funding for the National Defense Sealift Fund.

occurs, the added ships would allow the Navy to transport heavy forces to that war more quickly. The additional 12 ships would add between $3.6 billion and $3.9 billion to planned funding during the 1994-1998 period, assuming that new ships cost between $300 million and $324 million apiece.

PAYING FOR INCREASED INVESTMENTS

If the Navy put into place all options for added capability identified in this paper for the six mission areas, excluding only those options that are clearly redundant, the added cost would range between $10 billion and $12 billion during the 1994-1998 period (see Summary Table). These added costs would be above those planned under the base case, which reflects the Clinton Administration's plans in 1994 and the Navy's preliminary plan for the 1995-1998 period.[12] The range of added costs reflects the degree of improvement selected within each option and, in some cases, uncertainties about costs.

In a period of fiscal tightness, the Navy is unlikely to adopt all of these options. Indeed, in some cases, there are good reasons to reject the added funding. For example, as has been noted, existing plans provide substantial funding for sealift and amphibious lift; added funding may not be necessary. Therefore, the total cost of any added investments in the six mission areas would probably amount to less than $12 billion.

Finding Offsetting Cuts Within an Already Shrinking Navy Budget

In times of tight defense budgets, offsetting reductions will have to be identified to pay for any increases in funding. Finding those offsetting cuts will not be easy.

In the 1994-1998 period, the added funding for these mission areas would have to come out of a Navy budget that will decline sharply below its 1993 level. If the Clinton Administration's budget request for fiscal year 1994 is approved, the Navy's budget, expressed in 1994 dollars, would decline from $84 billion in 1993 to $77 billion in 1994. The new Administration's plans for Navy funding in the years beyond 1994 are not yet available. But the total defense budget is projected to decline in real terms in each year through 1997, which suggests that the cuts in Navy funding will not end in 1994. Indeed, if

12. The Navy's preliminary plan could be changed after the Department of Defense's "bottom-up" review later this year.

the Navy continues to garner its current share of the national defense budget (about 30 percent), the service's budget would fall to $70 billion by 1998.

The long-term funding outlook is also tight. The Navy is now apparently planning substantial cuts in its forces and in some of its weapon programs. By the end of this decade, the U.S. Navy's fleet may number only about 340 ships compared with about 443 ships in 1993. Under one version of this possible Navy plan, CBO estimates that the Navy would require funding of about $70 billion a year during the first half of the next decade.[13] That is roughly the amount of funds that would be available, providing the Clinton Administration's planned funding for defense in 1998 stays constant in future years and assuming that the Navy retains its current budgetary share.

Under CBO's assumptions, therefore, no extra money would be available to finance the added initiatives outlined in this paper. Moreover, during the second half of the next decade, Navy funding requirements could rise to more than $80 billion a year, creating an even tighter budgetary outlook.

Initiatives Could Be Funded

Conversely, the added funding of as much as $12 billion represents only a small fraction of possible Navy budgets for 1994 through 1998.[14] If the Navy retains its current share, its total funding during the period would amount to almost $370 billion. The extra funding would represent about 3 percent of that total.

In order to fund these initiatives, which are designed to improve capability to fight regional contingencies, the Navy could make further reductions in programs that are arguably designed primarily for larger wars against a foe like the former Soviet Union. The Navy could also depend more heavily on other services for some missions and reduce its forces designed for those missions.

---

13. See Congressional Budget Office, "The Long-Term Costs of Naval Forces," CBO Staff Memorandum (May 1993).

14. If CBO's options to buy added Sealift and heavy-lift ships to transport mine-clearing vessels were adopted, between $3.7 billion to $4.3 billion in funding would need to be added to the National Defense Sealift Fund, a new account that Congress created in 1993. CBO assumes in this study that the Navy's budget would need to be cut by the same amount to pay for the added spending by the fund. Thus, the $3.4 billion to $4.3 billion is counted in the $10 billion to $12 billion in cuts that the Navy would need to make if it adopted all of the options.

The specific examples discussed below are intended not as recommendations of specific cuts, but rather as illustrations of the types of reductions that might be made. Although the pros and cons of each option are mentioned briefly, a detailed discussion is beyond the scope of this paper. Savings associated with these examples are estimated relative to the base case, which reflects the Navy's preliminary plan from 1995 to 1998. When the Clinton Administration submits its formal plan for this period, the savings associated with some of these options could possibly be reduced or eliminated.

Shifts in Priorities. Some programs that may have a lower priority in the post-Cold War era could be reduced below levels in the base case. One such approach would reduce the number of ballistic missile submarines (SSBNs) on patrol in the open ocean at any one time. This reduction would be consistent with the overall reduction in tensions between Russia and the United States, arms control treaties that will reduce the number of potential targets in Russia, and the decline of the Russian submarine force that previously threatened--although not severely--U.S. SSBNs. Reducing the percentage of the total SSBN force that is deployed from the current level of about two-thirds of the total force to one-third would save about $1 billion in operation and support costs in the period from 1994 through 1998.

Some weapons programs might also be curtailed in order to fund initiatives aimed at improving capability to fight regional wars. The Navy could, for example, terminate production of the new D5 strategic missile after 1994. That missile was designed to attack Soviet targets hardened against nuclear attack, a high priority during the Cold War but perhaps of lower priority now. Compared with the base case in this paper, canceling the D5 program after 1994 would save $2.7 billion in the 1994-1998 period. The Navy could also scale back production of DDG-51 destroyers to two a year. That approach, which may be consistent with the smaller fleet of surface combatants the Navy apparently plans to maintain, would reduce costs by $5.5 billion from 1994 through 1998.

These illustrative reductions are not without significant disadvantages. For example, lowering SSBN operating tempo would reduce the number of submarines available to retaliate in the event of a nuclear war that occurred with little notice. Terminating production of D5 missiles would require substantial changes in the submarine-based leg of the triad, while reducing the

buy of DDG-51 destroyers might raise questions about the adequacy of the shipbuilding industrial base.[15]

Consolidate Missions. The Navy could also depend more heavily on the other services to carry out some missions, thereby eliminating the need for some naval forces and weapons. For example, if the Air Force assumed more responsibility for the medium-range bombing mission, a change that the Chairman of the Senate Armed Services Committee suggested for consideration last year, then the new aircraft that the Navy is developing for that mission might be canceled.[16] The Navy could continue to buy the F/A-18E/F aircraft to perform shorter-range air defense and attack missions, primarily to support amphibious assaults by the Marine Corps. It is not clear how much this approach would save compared with the Navy's preliminary plan. Savings in the 1994-1998 period might amount to about $5 billion--which is the funding during the period that was planned for developing the A/FX aircraft as of last year. Savings could differ from this amount, however, depending on the specific proposals that are eventually approved by the Administration and Congress.[17]

If the Air Force is the service primarily responsible for medium attack, then the Navy might be able to reduce the size of its carrier force from the level of 12 carriers--called for in the Navy's preliminary plan--to 10 carriers or fewer. A fleet of 10 carriers was proposed by President Clinton during the campaign and was the minimum number recommended in 1990 by the Chairman of the Senate Armed Services Committee. If the number of deployed carriers were gradually reduced to 10 and the associated escorts were eliminated (12 surface ships and 4 submarines), and if the new carrier planned for procurement in 1995 is not bought, then about $13.6 billion could be saved during the 1994-1998 period.

Cutting the number of aircraft carriers would reduce the Navy's ability to maintain a presence overseas during peacetime and conduct other naval missions, though the reduction might be offset through heavier reliance on other assets, perhaps including amphibious vessels. Consolidating missions

---

15. See Congressional Budget Office, *Reducing the Deficit: Spending and Revenue Options* (February 1993). To calculate the cost savings used in this paper, cost savings from this volume were revised to reflect the proposals of the Clinton Administration for 1994 and the Navy's preliminary plan for the years 1995 to 1998. The Navy's preliminary plan could change after the Department of Defense's "bottom-up" review later this year.

16. Speech on the Senate floor by Senator Sam Nunn, Chairman of the Senate Armed Services Committee, *Congressional Record* (July 2, 1992), pp. S9,561-9,562.

17. For more on possible options for tactical aircraft, see Congressional Budget Office, "Options for Fighter and Attack Aircraft: Costs and Capabilities," CBO Staff Memorandum (May 1993).

reduces the redundancy in U.S. forces, which in some circumstances could be an important disadvantage. Depending on the circumstances of any conflict that arises, having both Navy and Air Force aircraft that can accomplish the medium-range strike mission could give the United States more flexibility in prosecuting the war. These disadvantages must be weighed against the potential for cost savings that could finance some or all of the added investments in the six mission areas assessed in this memorandum.