

Executive Summary

NAVAL MINE WARFARE FOR U.S. NAVAL FORCES¹

At the request of the Chief of Naval Operations,² the National Research Council, under the auspices of the Naval Studies Board, established a committee to assess the Department of the Navy's capabilities for conducting naval mining and countermine sea operations. The Committee for Mine Warfare Assessment first convened in August 2000 and met approximately 2 days a month for 9 months. This report is based on the information presented to the committee during that period and on the committee members' accumulated experience and expertise in military operations, systems, and technologies.

Sea mines have been important in naval warfare throughout history and continue to be so today. They have caused major damage to naval forces, slowed or stopped naval actions and commercial shipping, and forced the alteration of strategic and tactical plans.³ The threat posed by sea mines continues, and is increasing, in today's world of inexpensive advanced electronics, nanotechnology, and multiple potential enemies, some of which are difficult to identify. The

¹The term "mine warfare" is used in this report to include both naval mining and countermine warfare (CMW). CMW includes not only local measures to detect and clear mines, but also the intelligence and other support activities important to countering the threat of mines at sea and in the approaches to shore. In this report countermine warfare in inshore waters (<40 ft deep) is addressed separately from CMW in offshore waters.

²In a letter dated December 11, 2000, to the president of the National Academy of Sciences, the Commandant of the Marine Corps endorsed the study's terms of reference.

³Salient mine warfare historical highlights are noted in the main body of the report and in the appendixes.

largely unregulated sale of sea mines by friends and third parties (e.g., Italy, Sweden, Russia) is contributing directly to this growing threat.

During the Cold War, U.S. naval forces concentrated on guarding against the sophisticated Soviet blue-water, air, and undersea threats. Yet since World War II, U.S. naval forces have suffered significantly more physical damage and operational interference from sea mines than from air, missile, and submarine attacks: 14 U.S. Navy ships have been sunk or damaged by mines, whereas only 2 have been damaged by missile or air attack (see Chapter 1). Because of the low cost and wide availability of modern sea mines, their importance as a threat to shipping and naval force operations is growing rapidly. The threat of air, missile, and submarine attack, while also important, is posed by a much smaller number of countries and nonstate forces than is the threat of mines.

The need for U.S. naval forces to maneuver and project power in the world's littorals is also increasing. Yet U.S. naval forces are not now likely to be able to adequately handle the plausible near-term threat of mines either offshore or inshore. Looking ahead, the Navy's planned mine warfare improvement programs have major shortcomings that need to be addressed now if current risks are to be reduced rather than permitted to continue to grow. In addition, modern sea mines could provide the United States with critically important capabilities that will not be available under current plans.

This report is the latest in a long series of reports by the Naval Studies Board of the National Research Council and by other organizations pointing out that the Navy has assigned inordinately low importance to mine warfare. Based on the committee's review of previous reports and the knowledge and experience of many of its members, it seems clear that the Navy's relative inattention to mine warfare is a natural legacy of its historical focus on blue-water operations, from the battleship Navy prior to World War II through the postwar deep-water carrier/nuclear-powered attack submarine Navy—a focus that was diverted toward near-shore operations only sporadically during the 20th century (except during World War II).

The committee notes that the official Navy focus has been shifting landward since the demise of the Soviet threat. Experience in the Persian Gulf, Red Sea, Taiwan Strait, Sea of Japan, and elsewhere has coalesced under the general organizing principle of "Forward . . . From the Sea."⁴ One natural outcome of this decade-long shift of focus has been the beginning of work on the organic mine countermeasures systems described in Chapter 4. Another desired outcome would be the assignment of higher priority to improving the nation's ability to conduct naval mine warfare operations. It is for this reason that the committee

⁴Department of the Navy. 1994. "Forward . . . From the Sea, Continuing the Preparation of the Naval Services for the 21st Century," U.S. Government Printing Office, Washington, D.C., September 19.

believes that the analysis and recommendations contained in this report may be of greater use to the Navy's leadership now than may previously have been the case.

This committee's recommendations are designed to ensure that the deficiencies referred to above receive prompt attention in the Department of the Navy's force, personnel, and equipment management processes. The following recommendations are presented in the order of priority agreed to by the committee. Implementation of the first recommendation would greatly facilitate implementation of the others. The committee emphasizes its belief that all of these recommendations are important, and that implementation of some of them should not preclude implementation of the others.

RECOMMENDATIONS FOR IMPROVING THE OPERATIONAL EFFECTIVENESS OF MINE WARFARE FORCES

Establish Mine Warfare as a Major Naval Warfare Area

The Navy is responsible for protecting all maritime forces, including logistics transport and Marine Corps units, against the mine threat wherever it may be encountered, from the sea lanes, to logistics unloading areas, to the high-water mark on the landing beaches. It is also responsible for providing the inventory of sea mines that may be needed to implement U.S. national security strategy. But these responsibilities were not aggressively pursued until well after the Gulf War.

In its recent efforts to "mainstream"⁵ mine warfare, the Department of the Navy has concentrated its efforts on mine countermeasures (MCM) in the offshore regions, including shipping lanes and operating areas. In this offshore region the Navy has focused on two goals: (1) to give carrier battle groups an organic capability (within the multimission, general-purpose forces) to locate minefields and to hunt, sweep, and neutralize mines in offshore operations along the littoral and (2) to maintain a dedicated MCM force, based primarily in the United States, that can deploy when ordered to undertake mine hunting and clearing operations that are beyond the expected organic MCM capability and capacity of the battle groups. Some progress has been made toward these goals by initiating the development of new MCM equipment and through the establishment of the Fleet Engagement Strategy. However, the cost-effective military capability that is potentially available to the United States through the use of modern sea mines is being neglected.

In addition, progress toward mainstreaming mine warfare is being retarded in part because the readiness to conduct mine warfare operations is not now

⁵The term "mainstreaming" as used in this report refers in general to the Navy's efforts at the present time to bring existing mine countermeasures operational knowledge and understanding into the mainstream of naval force planning and, in particular, to help prepare for the introduction of new countermine warfare systems into the carrier battle groups.

highly valued as a component in assessing the readiness of battle groups for deployed operations. In the fleet, mine warfare is practiced only in selected special exercises, and facilities for such practice are minimal. Furthermore, in Navy and Marine Corps school curricula, mine warfare receives little emphasis, and assignments are not ordinarily considered beneficial for naval officers' career advancement.

The Navy budget for mine warfare in total is small compared with that for the other major naval warfare areas, and the Navy budget for mines is negligible compared with the budget for other strike munitions. Within a very few years the current budget plan will essentially remove the option of naval mining from the capabilities the Navy could provide to the theater commanders.

Although significant funding has been allocated for countermine warfare in recent years, about two-thirds of this budget is devoted to (1) operations and maintenance of the dedicated/legacy MCM force and (2) the acquisition of the seven new systems intended for offshore organic MCM. The remainder of the mine warfare budget, approximately \$215 million per year, on average, leaves many important elements underfunded. These include improvements to the dedicated MCM force, maintenance of ship signature control, acquisition of modern U.S. mines, and other essential force improvements. The committee estimates that an increase of approximately 30 percent in the mine warfare budget could meet these unfunded needs while also providing for the needed modernization of the current dedicated mine warfare command and support force, as discussed below. The committee could not identify a significant amount of money being inappropriately spent within the mine warfare budget, and, therefore, if the committee's first recommendation is accepted, the Navy will have to allocate additional funds to mine warfare from other warfare areas that have comparable or lesser priority.⁶

In conclusion, several actions will be needed beyond those currently reflected in the Navy program of record in order for mine warfare to be accorded its proper position in the mainstream of naval force planning and operations. Those actions are detailed in Chapters 2 through 5 and are summarized below, in priority order.

Recommendation 1. The Secretary of the Navy, the Chief of Naval Operations, and the Commandant of the Marine Corps should take the steps needed to establish mine warfare as a major naval warfare area. Such an elevation in warfare status will require that the Department of the Navy (a) coordinate and improve the focus of its "mainstreaming" initiatives; (b) upgrade mine warfare-related readiness reporting, certification, training and education, and officer career planning; and (c) program, budget, and execute accord-

⁶Other warfare areas, such as air and submarine warfare, have traditionally enjoyed much higher levels of support than has mine warfare.

ingly. Continual follow-up by these officials will be necessary to ensure implementation. Specifically,

- The Chief of Naval Operations (CNO) and the senior Navy leadership should expeditiously establish an implementation plan that assigns responsibility and accountability to the appropriate officials to bring to fruition the mainstreaming of mine warfare, in particular the introduction of organic mine countermeasures capabilities. Such a plan should include the seven key elements—doctrine, organization, training, materiel, leadership and education, people, and facilities—detailed in Chapter 2.

- The Department of the Navy should establish broad first-order force-protection requirements for naval units that will ensure adequate levels of counter-mine warfare capability, both active and passive.

- Naval component and other operational commanders should enhance realism in predeployment training, fleet maneuvers, and amphibious warfare exercises by routinely including mine threats, in addition to air and submarine threats, in such exercises and by assigning realistic consequences to poorly planned and executed counter-mine warfare operations.

- The CNO and the Commandant of the Marine Corps (CMC) should ensure that the routine interdeployment training cycle for fleet battle groups and amphibious ready groups entails the same level of rigor in certifying capabilities for mine warfare and in reporting readiness, in both the ship's operational readiness training status (SORTS) report and the mission capability assessment system (MCAS),⁷ as is now the practice for the other major warfare areas. Readiness should include the routine measurement of the acoustic and magnetic signatures of applicable ships.

- The Secretary of the Navy, the CNO, and the CMC should ensure that the growing importance of mine warfare is emphasized in all appropriate Navy and Marine Corps formal education curricula and in officer career development practices. These curricula and career development criteria should place mine warfare expertise on a par with the emphasis given to air warfare, surface warfare, and submarine warfare.

- The Secretary of the Navy, the CNO, and the CMC should increase the priority of funding for mine warfare relative to other warfare areas. The Secretary of the Navy and the CNO should review the allocation of funds by warfare area in the future year defense program (FYDP), with a view to finding ways to increase funding in the mine warfare area to meet the urgent mining and counter-mine warfare program needs identified in this report.

⁷SORTS is the Joint Chiefs of Staff (JCS)-managed system of reporting the readiness of ships and squadrons to conduct assigned missions. MCAS is a new system that would report the readiness of battle group commanders to conduct their assigned missions.

Place Greater Emphasis on Intelligence, Surveillance, and Reconnaissance

Intelligence, surveillance, and reconnaissance (ISR) is at the heart of mine warfare. It ascertains the technical characteristics of threat mines, identifies where minefields and mines are laid, and helps determine how they can best be countered in the context of the extant environmental constraints. More broadly, ISR helps ascertain the potential mining and countermine warfare capabilities of hostile forces and provides near-real-time indications and warning of mine threats to enable tracking and potential interdiction, as well as to optimize mine avoidance or clearance operations, and it shows where minefields should be placed by friendly forces should that be indicated.

Notwithstanding its importance, ISR for maritime mining and countermine warfare is not in good order, either in the fleet or elsewhere in the joint warfighting and intelligence tasking establishments. The most critical problems are insufficient attention to mine warfare ISR in operational planning; failure to task the ISR agencies for needed information, including analysis and dissemination; a paucity of the environmental data needed to find mines expeditiously; and failure to use the best available modern sensors and signal processing technology to help find mines, including buried mines, and separate them from nonmine, minelike bottom objects to facilitate mine hunting and neutralization.

Recommendation 2. The Department of the Navy should place greater emphasis on the intelligence, surveillance, and reconnaissance needed for mine warfare operations. Increased priority should be given to (a) technical exploitation of threat mines; (b) mine warfare indications and warning (I&W) tasking and dissemination at all command levels; (c) rules of engagement (ROE) to counter hostile miners; and (d) relevant environmental databases, such as the mine warfare environmental decision aids library (MEDAL) and the INTELINK contingency planning tool. Specifically,

- The CNO and the CMC, through their senior planning staffs, the fleet and fleet Marine force commands, and in joint forums, should take steps to ensure that the ISR needed for mining and countermine warfare is planned and integrated into all naval warfare activities as part of a total system that starts with ISR and ends with successful mine interdiction, mine countermeasures (including avoidance), and U.S. mining activities in critical areas along the littoral.

- The CNO and the CMC should also take steps to ensure that theater Navy and Marine Corps operational commanders are trained in the tasking of the collection and analysis agencies so as to obtain and update mine information and mine warfare-related data and analysis, including the observation of potential opponents' relevant activities, as a routine part of theater warfare planning and operations.

- The CNO should ensure that the Oceanographer of the Navy places increased emphasis on mine warfare-related environmental data collection and

the entry of all existing data into the MEDAL system. Provision also should be made for the collection and automated transmittal of key environmental data from the applicable dedicated and organic MCM sensors as well as from national sensors. Up-to-date MEDAL databases should be “pushed” to ships en route to contingency operations.

Reestablish a Naval Mining Capability

As amply demonstrated in World War II and the Vietnam War, U.S. sea mines can be force multipliers, used both to provide protection against hostile ships and submarines and to extend maritime power in strategic areas that the fleet cannot always guard. The United States is in the process of giving up this potentially critical capability as U.S. sea mining capability is being allowed to rapidly atrophy. With some additional effort focused toward the development of modern sensor and communication technology, sea mines and minefields could be remotely monitored and controlled, thereby enabling their use for coercive purposes in situations short of war, in full compliance with international conventions.

The current U.S. capability to use mines for strategic or tactical military purposes is characterized by small inventories of old and obsolescent mines, no plans for future mine acquisition, declining Navy and Air Force mine delivery capability, and a lack of robust minefield planning capability in the fleet battle groups.

Recommendation 3. The United States should reestablish a naval mining capability that is both credible and joint. Such a capability will require overt, covert, and remotely controllable mining. Specifically,

- The CNO should establish and sponsor for joint approval a prioritized set of joint mining system requirements, giving full consideration to the advanced capabilities outlined in Chapter 3 of this report, and should plan an adequately funded program for acquiring them. These plans should extend from individual weapons to minefields designed to accomplish specific purposes. Ultimately, the plans should include overt and covert (submarine) delivery and be applicable to a broad range of water depths. The plans should reflect the results of a systematic cost-effectiveness study of potential future mines, including mines for water deeper than that suitable for Quickstrike mines. The recommended study should consider joint warfighting needs with jointly agreed concepts of operation and recommended rules of engagement for promulgation by the National Command Authority. The funded program should include explicit plans for retaining a U.S. naval capability, and an associated industrial base, for mine and valid minefield system design, and for acquiring mines deliverable by naval and Air Force aircraft as well as by *Virginia*-class nuclear-powered attack submarines and current attack submarines.

- The CNO should establish a fast-track program to improve the current Quickstrike shallow water mining capability by developing and acquiring joint direct attack munition, extended range (JDAM-ER) delivery and mine fuzing kits that can target modern, small, surface craft and submarines, in addition to traditional surface ship targets, and that can accommodate remote-control features.
- The CNO should ensure that sea mine and valid mining planning tools, including provision for joint mining and minefield control operations, are added to battle group warfare planning capability, and that battle group individual and unit training includes realistic exercises that use mining as an extension of battle group capability.
- The CNO should ensure that the readiness of naval battle group commanders to conduct mining operations is routinely reported in the new MCAS, and that mine delivery is designated a primary mission area requirement reported in GSORTS by appropriate tactical aircraft squadrons.
- In view of the potential importance of maritime mining as a coercive option quite independent of expeditionary warfare operations, the CNO should consider transferring resource sponsorship of naval mining programs to a resource manager with broad policy and cross-platform responsibilities.

Modernize the Dedicated Mine Countermeasures Force

Mine warfare threats may vary from a few mines having mainly nuisance value to major concentrations of sophisticated mines blocking naval force maneuver areas. The opportunities and occasions for encountering such threats are growing.

At some point in the possible spectrum of mine threats, the need for timely clearance of mines and obstacles from both offshore and inshore areas could become essential to providing assured access. In some highly plausible circumstances, such operations could become very demanding, well beyond planned battle group organic MCM capabilities, particularly if it became necessary to divert the battle group's multimission ships away from their other duties.

For these reasons the committee concluded that the specialized capability of a dedicated MCM force will be needed into the indefinite future. Many improvements and upgrades to the current force, detailed in the main body of this report, are needed. The following paragraphs summarize the committee's assessment for each element of the dedicated MCM force.

- *Dedicated MCM support ship(s).* Currently only one dedicated MCM support ship is assigned the responsibility for supporting the surface dedicated MCM ships, airborne MCM helicopters, and undersea MCM detachments—the USS *Inchon* (MCS-12). The *Inchon* cannot deploy with fleet battle groups at their speeds, and for this and reliability reasons would not be readily available for expeditious MCM operations in a large-scale contingency when battle group

organic capabilities might well need to be augmented. An aging reserve ship due to be retired within 10 years, the *Inchon* is very expensive to operate, even with its reduced manning. And without a well deck, its ability to support current airborne MCM operations is hampered and to support inshore MCM operations is minimal.

- *Dedicated surface MCM ships.* The Navy has a relatively modern force of 26 dedicated MCM surface ships, stationed mostly in Texas. These ships, both MCM and MHC classes, are not being funded adequately to ensure timely accomplishment of approved combat system upgrades. In addition, they do not have the installed self-protection systems or equipment they need to be fully effective.

- *Dedicated airborne MCM aircraft.* MH-53E MCM helicopters constitute the current dedicated airborne MCM force. These heavy-lift aircraft are uniquely capable of towing the types of heavy minesweeping equipment needed in some threat situations. The minesweeping gear planned for the smaller MH-60S helicopter that will constitute the organic airborne MCM force when fielded will be considerably less capable per sortie than the MH-53E. Despite the advantages of the larger MH-53E helicopters for such sweep missions, the Navy has not allocated funds for their retention or modernization, nor is airborne MCM a visible consideration in Navy planning for meeting its long-term heavy-lift logistics aircraft requirements.

- *Dedicated undersea MCM detachments.* Currently, explosive ordnance disposal (EOD) diver systems and marine mammal systems play key undersea MCM roles in countermine warfare operations. These teams, with the equipment described in Chapter 4, currently constitute the only means for hunting and clearing mines from shallow inshore waters. Small unmanned undersea vehicle (UUV) systems are under development as part of the undersea MCM toolkit and may eventually augment or replace the divers and marine mammals. The major issue with the undersea MCM force is the very small number of existing and planned units, when compared with the potential demands for rapid clearance of an amphibious landing zone. Unless (or until) the Navy fields an alternative system such as UUVs that can find and clear mines more rapidly, reliance on the planned small EOD/very shallow water force structure will either limit the size of future assaults against potentially mined littorals, or add to the time required to support large assaults.

Recommendation 4. The U.S. Navy should modernize its dedicated mine countermeasures (MCM) force. Elements of this modernization should include (a) sustaining and upgrading the current (legacy) elements of the dedicated MCM force; (b) replacing the aging *Inchon* (MCS-12) as soon as one or more suitable replacement(s) can be readied; and (c) planning and programming for follow-on dedicated MCM command and support capability and for follow-on dedicated surface, airborne, and undersea MCM capabilities. Specifically,

- The Secretary of the Navy, the CNO, and the CMC should plan to retain and continually evolve the dedicated MCM force based on an integrated plan that is prepared, updated, and optimized as lessons from the combined dedicated and organic force operations are learned.
- In the short term, the CNO should address the obsolescence issues related to the USS *Inchon* (MCS-12) by planning (and programming) to replace it with one or more ships to ensure a continuing MCM support capability. The near-term replacement ship should have a well deck, for mine countermeasures craft and sweep gear, as well as a flight deck, to provide increased flexibility and efficiency of operation, and to provide optimized support for MH-53E minesweeping operations and increased support for inshore MCM. Meeting this short-term need will most likely require the conversion of an existing hull suitable for this purpose.
- The CNO should consider providing more than a single replacement ship, to permit faster assured crisis response by the dedicated MCM force in both oceans.
- The CNO should plan to retain and modernize a capable, dedicated MCM warfare force that would be available for those situations in which the MCM requirements exceed the available organic MCM capabilities of the deployed battle groups. Such a dedicated force should include:
 - Upgraded surface MCM ships and their potential future replacements as discussed in Chapter 4;
 - Dedicated MCM helicopters, including retention of the MH-53E helicopter in the dedicated airborne MCM force until it can be replaced by equipment that provides comparable capability, perhaps as a variant of the Navy's next-generation heavy-lift logistic aircraft;⁸
 - Augmented EOD/VSW teams and systems designed to help or replace them;
 - Continued provision of support for deployed dedicated surface, airborne, and undersea MCM craft that is similar in concept to that provided by the *Inchon* (MCS-12), enhanced by the future evolution of the command and support capability embodied in the *Inchon*. Such support should be extended to inshore MCM.
 - Additional capabilities such as a mine-hunting craft like the MHS-1, as discussed in Chapter 5, and hull forms facilitating the rapid deployment of ships and their operation with battle and amphibious ready groups.

⁸The decision between retiring the MH-53E force, extending its service life, or acquiring a follow-on dedicated helicopter may need to be made before all the new mine warfare components of the MH-60S host aircraft have been fielded and their overall capability fully measured, depending on the pace of any new heavy-lift helicopter program. In the interim, selected upgrades should be made to the MH-53E aircraft suite (such as adding the AQS-20 mine-hunting sonar, the airborne laser mine detection system (ALMDS), and the airborne mine neutralization system (AMNS) capability, and a greater degree of self-protection).

Improve the Overall Integration of the Seven Organic Offshore Mine Countermeasures Systems

The Navy's plans for making MCM organic to the fleet are embodied in seven systems (described in Chapter 4) currently in development and intended to become operational by 2005.⁹ They are intended mainly for operation outside the 40-ft-depth regime, but some of them will also have a limited ability to operate in somewhat shallower water. There are numerous problems with some of these systems, many recognized by the Navy. *The greatest problem, however, is the lack of a systems concept and approach toward integrating these systems into the fleet and using them operationally.* As an example, the MH-60S helicopter is the host vehicle for several of these systems. It is the committee's understanding that the Navy intends to base the MH-60S only on nuclear-powered aircraft carriers (CVNs) and to operate them only in a temporary "lily pad" fashion from some cruisers, destroyers, and amphibious ships. But the DDG-51s are not funded to be qualified to operate the MH-60S helicopter. As an additional example of the lack of an overall mine warfare systems concept, the design of the new LPD-17 amphibious assault ship incorporates anti-aircraft defense but only limited passive and no active MCM defenses, such as the remote mine-hunting system (RMS) or the MH-60S, even though it is likely that it will operate in potentially mined waters.

Recommendation 5. The U.S. Navy should improve the overall integration of its seven organic offshore mine countermeasures (MCM) systems that are currently in development. Improvements should include (a) developing and promulgating an integrated countermine warfare concept of operations and a total system architecture, (b) testing and evaluating the resulting integrated capabilities at sea, and (c) extending the application of the new systems to the amphibious force. Specifically,

- The CNO should develop and promulgate a countermine warfare concept of operations and a total system technical architecture that includes all the legacy dedicated MCM systems and the new organic MCM systems and other upgrades that will be fielded. As part of this effort, the planned integration of organic MCM systems into the fleet should be extended to include amphibious ships as well as battle group combatants.

- The CNO should designate a single official to design a detailed program plan for integrating the seven MCM systems that are in development, and others that may follow, into battle groups and amphibious ready groups. The plan should include manpower and training, interaction with other combatant systems, logistics support plans, provision for accommodating MH-60S contingents on CVNs and aviation-capable amphibious ships as appropriate, and qualification of

⁹Some slippage to 2007 is likely.

all combatants that will have a latent capability to operate the MH-60S to actually do so.

Improve the Capabilities and Clarify the Services' Responsibilities for Inshore Countermine Warfare Operations

The terms of reference for this study direct placing special emphasis on inshore countermine warfare—within the very shallow water (VSW) zone from 40 to 10 ft deep,¹⁰ through the surf zone (SZ) and the craft landing zone (CLZ), to the exit from the beach. The primary goal in the inshore region is to provide an effective method for the assured and rapid detection of both minefields and mine-free areas in order to permit initial entry forces to avoid minefields, or to breach the minefields if necessary. The threat of mines in the inshore region has received considerably less attention by the Navy than has the mine threat offshore. This leaves a potentially significant near- and mid-term deficiency that sharply limits the nation's ability to quickly clear mined approaches to shores that may be important for landing either maneuver forces or logistics support, or both.

A two-Marine expeditionary brigade (MEB)-size landing to protect a major U.S. interest, carried out in accordance with the Marine Corps "Operational Maneuver From the Sea" (OMFSTS)¹¹ and "Ship to Objective Maneuver" (STOM)¹² concepts, could be needed into the indefinite future. (This was roughly the size of the amphibious operation planned in the Persian Gulf during Operation Desert Storm.) Planned amphibious shipping will not permit a larger landing, even in the event that one might be desired. Opposition to a U.S. landing can come in many forms, from opposing forces massed behind a heavily mined and obstructed potential landing beach (which would be bypassed under the new maneuver concepts) to waters and landing zones that are lightly mined and that may or may not be overwatched by protective forces ashore.

Essentially all of the nation's inshore/surf zone countermine warfare capability currently resides in a single Navy VSW detachment, with its divers, mammals, and expectations for UUVs. The force structure and posturing of this unit are not consistent with current operational plans for amphibious warfare in major theater wars. As a result, any actual operations against a mined and defended shore will be dangerous, slow, and subject to enemy detection and attack.

¹⁰This report uses English units of measure as a matter of convenience, since these are the units used by the Navy in its mine warfare work.

¹¹Headquarters, U.S. Marine Corps. 1996. "Operational Maneuver From the Sea," U.S. Government Printing Office, Washington, D.C., January 4. Available online at <<http://www.192.156.75.102/omfts.htm>>.

¹²Van Ripper, LtGen Paul K., USMC. 1997. "Ship to Objective Maneuver," Marine Corps Combat Development Command, Quantico, Va., July 25. Available online at <<http://www.192.156.75.102/stom.htm>>.

The Navy and Marine Corps have not worked out future joint concepts of operation (including STOM, OMFTS, and Navy organic MCM) for opposed amphibious landings at any force level, nor developed methods to support subsequent over-the-shore logistic operations in the face of enemy sea mines. And the Navy and Marine Corps have not harmonized the lane clearance width requirements or the navigational accuracy requirements of their respective landing craft in a way that establishes the number and minimum width of landing lanes that would have to be cleared of mines.

The committee recognizes the complex considerations that have recently stopped the Shallow Water Assault Breaching/Distributed Explosive Technology (SABRE/DET) program after 12 years of development aimed at providing a capability for the Navy to rapidly breach from seaward a mined and obstructed beach. The committee reviewed another technical approach, known a decade ago as Harvest Hammer, that may offer a reasonably near-term prospect for the rapid “brute-force” clearance of smooth landing channels through the SZ and CLZ: a line charge analogue that uses large, precisely placed and simultaneously exploded air-delivered explosive charges. This approach, recommended in several studies over the past 10 years, has been opposed by the Navy for various technical reasons, all of which appear subject to resolution in an affordable R&D program. The approach could have the advantage of involving the U.S. Air Force in the delivery of such ordnance in some types of joint operations, thereby saving naval aviation sorties for tactical air support at critical times. Other potential brute-force approaches being pursued by the Office of Naval Research (ONR) appear to be considerably further from fruition than is the Harvest Hammer approach.

In addition, the U.S. Marine Corps has proposed that the Navy take over the Marine Corps responsibility of clearing land mines above the high-water mark (through the CLZ) at some time in the future. In view of the general need for Marine Corps counter-land-mine capability in inland areas, the committee believes that it is appropriate for the Marines to retain responsibility for dealing with such mines on the beach above the high-water mark.

Potentially viable but unbudgeted approaches (described in Chapter 5) have also been previously identified for the mission of clearing the beach above the surf line where landing craft and troops have to operate more efficiently than by using heavy tanks with plows and rollers.

The shallow water environment threatened by mines encompasses more than just amphibious operating areas. In addition to the vulnerability of U.S. military ships and MCM aircraft operating in potentially hostile overseas locations, U.S. ports and waterways are susceptible to mining by terrorists or other hostile forces. A U.S. Navy response to such an attack on the homeland could take up to several weeks, depending on the initial conditions and MCM force dispositions.

The U.S. Transportation Command (TRANSCOM) does not appear to plan realistically for the possibility that its logistics support ships may have to transit mined waters when either leaving or entering ports. More generally, force con-

centration areas crucial to a rapid response to contingencies are quite vulnerable to mining, and the committee sees little evidence of serious planning for such eventualities.

Recommendation 6. The U.S. Navy and U.S. Marine Corps countermine warfare capabilities for the inshore region should be improved and harmonized, and responsibilities among the Services should be clarified. In general, efforts are needed to (a) improve the utilization of inshore intelligence, surveillance, and reconnaissance (ISR) information in order to better assemble a common operational picture so that maneuver units can avoid mined and obstructed areas, thereby limiting the need to conduct breaching operations; (b) improve U.S. capabilities for rapid breaching operations (when they are needed); (c) expand the focus of inshore countermine warfare to more fully reflect the need to provide assured, timely access for logistics support; and (d) agree that responsibility for countering land mines above the high-water mark should be retained by the U.S. Marine Corps. Specifically,

- The Marine Corps Combat Development Command for the Marine Corps and the Navy Warfare Development Command for the Navy, under CNO and CMC direction, should jointly define and approve preferred concepts of operation (CONOPS) for opposed amphibious operations, the size and operational character of which should form the basis for future landing force size and equipage requirements (including MCM requirements). The CONOPS should be consistent with the available amphibious lift and fire support resources, approved threat scenarios, and the requirements for logistics flows to and across the shore.
- The CNO and the CMC should agree on, and the CNO should ensure that the Navy funds, the programs needed to fulfill the Navy's responsibility to clear minefields from the VSW zone through the SZ that the Marines may have to traverse to make amphibious landings of up to two Marine expeditionary brigades in size against levels of opposition and on the time lines that have been jointly determined and agreed to be reasonable. These programs should include:
 - Expansion of the MCM capability supported by the dedicated MCM support ship(s) to include inshore waters;
 - Harmonization and funding of the automated navigation systems for Navy and Marine Corps landing craft as needed to minimize the width of the lanes that have to be cleared of mines;
 - A joint research, development, testing, and evaluation (RDT&E) program with the U.S. Air Force to develop and refine the Harvest Hammer approach to clearing channels through the SZ, perhaps as a variant of the JDAM weapon system, including expansion of the existing memorandum of understanding with the Air Force to reflect how the technique will be designed and proved, and how the service will be provided when needed; and

—An aggressive program to reevaluate SABRE/DET and other line charge systems concepts.

In addition, the Marine Corps should retain responsibility for clearing the beach above the high-water mark of land mines and obstacles and should aggressively pursue a program to evaluate innovative techniques (such as water cannon) for use in fulfilling this responsibility.

- The CNO should work with the Commander in Chief, Transportation Command to more clearly define the likely requirements for joint countermine warfare activities in support of the planned early arrival in the combat theater of maritime prepositioning ships and others that plan to put unit equipment and logistics supplies ashore, either through ports or over the beach—both of which are subject to inshore mining.

Reduce the Vulnerability to Sea Mine Threats

The vulnerability of all classes of Navy ships to mine warfare is a neglected area of naval force planning. There are many areas where Navy ships, MCM forces, and even U.S. harbors are more vulnerable to mine warfare than they need to be.

The acoustic, magnetic, and electric signatures of many naval ships are designed to minimize susceptibility to influence mine fuzing, but periodic signature monitoring and maintenance are frequently neglected. Some portable signature-monitoring equipment acquired at congressional direction and earmarked for use by MCM ships reportedly remains in storage. Appropriate information on speed and depth vulnerability specific to particular ships, which is needed to operate safely in mined waters, is not kept up to date on the ships, nor is there software available for rapidly establishing the optimal operating parameters for specific waters. In addition, likely countermeasures against U.S. MCM systems are not accounted for in MCM system design. Most MCM ships and helicopters do not have even rudimentary and inexpensive protective measures that could be made available using off-the-shelf technology.

More generally, there is a pervasive lack of attention to mine threats throughout the Navy. This exacerbates the risk inherent in the lack of specific vulnerability-reducing features summarized above.

Sophisticated, hard-to-detect and hard-to-sweep mines can be and are purchased by potential opponents from U.S. friends and allies as well as from nations that might be adversaries. The United States does not aggressively seek to acquire and exploit these modern mines to improve its own defenses, nor does it pursue arms control measures that might limit the proliferation of such weapons.

Recommendation 7. As part of its force protection planning, the Department of the Navy should take further measures to reduce its (and the nation's) vulnerability to sea mine threats. Specifically,

- The CNO should ensure increased attention to the regular measurement and maintenance of the designed acoustic, magnetic, and underwater electric potential signatures of all ships. Continually updated data, charts, and decision aids showing optimum operating conditions to protect against influence mines should also be available on all naval ships.
- The CNO should ensure that MCM ships and helicopters that may have to operate in areas where they are threatened by attack from sea- or shore-based forces are provided with appropriate self-protection.
- The CNO should ensure that the fleet commanders-in-chief and theater naval component commanders extend countermine warfare contingency planning to include transit and operating areas, homeland defense, and critical base defense.
- The Secretary of the Navy should take the lead in urging the Defense and State Departments to initiate international discussions among U.S. allies and other nonhostile nations to institute a mine technology control regime, analogous to the Missile Technology Control Regime instituted in 1987, to help slow the spread of increasingly sophisticated and threatening sea mines.