Countering the Asymmetric Threat from Sea Mines

Executive Summary

Sea mines have long posed a threat to the operations of U.S. sea-based forces. Since World War II, sea mines have damaged four times the number of U.S. naval vessels as all other means combined. The essence of U.S. national defense strategy is to protect the global commons – most obviously the world's oceans and waterways – and to project expeditionary joint power in the defense of U.S. allies, friends and interests globally. America's potential adversaries, whether they are peer competitors, rogue regimes or terrorist groups, understand this nation's dependence on open sea lines of communication. Some prospective adversaries are energetically pursuing the ability to combine the delivery of advanced sea mines with employment of ballistic and cruise anti-shipping missiles and the use of both small boats and submarines to create an anti-access force. The ability of adversaries to interfere with the movement of U.S. forces or global commerce must be judged to be a serious danger.

There are two challenges facing the U.S. Navy with respect to addressing the sea mine threat. One is to modernize the existing mine countermeasures force that will reach the end of its useful life beginning in the next decade. This modernization effort must take place in an environment marked by the growing technical sophistication and proliferation of sea mines. The other challenge is to both revitalize the U.S. mine warfare capability and provide additional capabilities that can be deployed rapidly to meet new threats. This rests principally with the deployment of the Littoral Combat Ship (LCS) and, specifically, the Mine Countermeasures Mission Package.

The capability to perform a given mission will reside in so-called mission packages. These consist of mission modules, trained crews and support aircraft. The mission modules consist of mission systems plus associated support equipment. The incremental acquisition of the mission package will ultimately consist of nine distinct but integrated mission systems. The Navy is employing an incremental acquisition strategy for the mission modules. A basic Mine Countermeasures Mission Package was delivered in 2007. The program of record is to incrementally expand on this basic mission capability with the introduction of additional elements as they become available, deploying the complete mission package in 2017 if adequate funding is available.

The delay experienced in the LCS program should not be allowed to set back development and fielding of the Mine Countermeasures Mission Packages. It is particularly important to get the initial packages to sea so that the sailors can begin training in a real world environment. This could guide further development of the component systems. Sending the existing Mine Countermeasures Mission Packages to sea on another platform makes tremendous sense. In addition to sending mission packages to sea for testing and further development, the Navy needs to consider how it might deploy elements of the Mine Countermeasures Mission Package on other platforms if the need arose.

This report was written by Dr. Daniel Goure and was reviewed by participants in the Mine Warfare Working Group.

The Sea Mine Challenge

At the outset of the invasion of Iraq, the United States military entered a new world, one marked by strategic uncertainty and the proliferation of asymmetric threats. The political, fiscal and human effects of unanticipated or misjudged threats such as that of improvised explosive devices (IEDs) stand as a stark warning of things to come. Our adversaries will seek out ways to limit U.S. military advantages and exploit areas of weakness.

What is the next asymmetric threat that may challenge areas of U.S. conventional military superiority and technology much in the way the IED did for land forces? Could it be sea mines?

Sea mines have long posed a threat to the operations of U.S. sea-based forces. Since World War II, sea mines have damaged four times the number of U.S. naval vessels as all other means combined. Fundamentally, the role of sea mines in warfare is not to destroy or even damage vessels; it is to deny access. The essence of U.S. national defense strategy is to protect the global commons – most obviously the world's oceans and waterways – and to project expeditionary joint power in the defense of U.S. allies, friends and interests globally. The ability of adversaries to interfere with the movement of U.S. forces or global commerce must be judged to be a serious danger.

> Assured access is a linchpin of both our naval and national security strategies. Our first priority must be improving our near-term capabilities, but it is also important to keep an eye on our long-term vision of mine warfare…. Given the growing threat to our fleet and the current state of technology, we are fools if we don't. [1]

America's potential adversaries, whether they are peer competitors, rogue regimes or terrorist groups, understand this nation's dependence on open sea lines of communication. It makes sense for them to invest in capabilities for the purpose of interfering with the movement of commercial and military vessels. Some prospective adversaries are energetically pursuing the ability to combine the delivery of advanced sea mines with employment of ballistic and cruise anti-shipping missiles and the use of both small boats and submarines to create an anti-access force.

There is also the additional and relatively new threat posed by terrorists employing sea-based IEDs. Even a single such device in a major shipping channel could play havoc with U.S. maritime and global commerce or the deployment of U.S. forces overseas.

Countering the growing sea mine threat will require both the quantitative expansion and qualitative improvement of U.S. mine countermeasure capabilities. The U.S. Navy is in the process of moving from a dedicated mine warfare capability to one based on organic assets that, in theory, could be deployed on a number of platforms but are primarily intended for use on the new Littoral Combat Ship. [2] The development of this modular capability to conduct demining operations is absolutely critical to the ability of the U.S. Navy to ensure its command of the seas and free transit of critical waterways and ports.

U.S. Navy inventory of MK 6 Training Mines.

Sea Mines: A Growing Asymmetric Challenge

By all reasonable measures, the potential threat from sea mines of all types is growing. More than 50 nations around the world hold inventories believed to total more than 250,000 mines of over 300 types. More than 30 countries produce and more than 20 countries export mines. During the first Gulf War Iraqi minefields prevented U.S. naval forces from operating in the northern Persian Gulf. In Operation Iraqi Freedom the ability to access the port of Um Qasr was seriously compromised by the presence of underwater debris and fears regarding the presence of sea mines and unexploded ordnance. [3]

The popular impression of the sea mine threat focuses on older technology, the globular floating or tethered mine with multiple spikes or horns. There have been dramatic and dangerous advances in sea mine technology over the past several decades. A number of nations have invested and continue to invest heavily in a wide array of advanced sea mines. Russia and China are developing and deploying an array of sea mines including several different types of propelled mines and sea mines deployed on underwater vehicles. Beijing has acquired a large quantity of mines, including some very advanced ones from Russia. In addition, Russia has pursued advances in sensors, guidance systems and stealthy coatings and components which make these advanced mines both more dangerous and more difficult to detect. These mines can be deployed in a variety of ways including clandestinely by surface vessels, aircraft, submarines and underwater platforms. There is even evidence of the development of sea mines designed to attack helicopters and low-flying air vehicles. [4]

China has been almost equally aggressive in developing its sea mine capabilities. Not only is it acquiring advanced sea mine technologies, it is improving its tactics and techniques for deploying them.

> By studying U.S. minesweeping in Operation Desert Storm, People's Liberation Army (PLA) analysts realized potential U.S. strengths and vulnerabilities. They saw how difficult it was for U.S. and allied forces to conduct minesweeping, and they saw shortcomings in the Iraqi mining campaign. They likewise observed during Operation Iraqi Freedom that it was difficult to sweep the few mines that Iraq laid. China has thus decided to develop sufficient mining capabilities to challenge U.S. forces if they intervene in a Taiwan Strait scenario.[5]

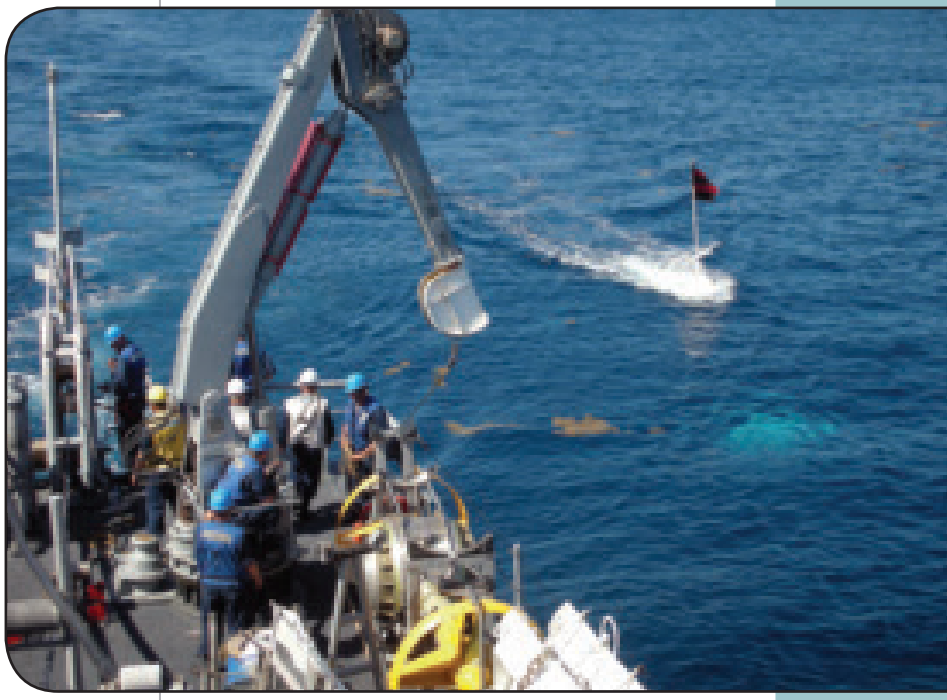
The mine countermeasure ship USS Gladiator conducts underway operations in the Persian Gulf.

Many nations make advanced sea mines available on the open market. For example, Italy sold sea mines to Iraq, one of which, a MANTA, damaged a U.S. surface combatant during the 1991 Persian Gulf War. The MANTA is a multi-influence shallow water sea mine, designed to be effective against landing crafts and small-mid tonnage vessels. The mine can be laid by surface vessels, helicopters and aircraft. It uses acoustic, magnetic and pressure sensors, which makes it resistant to countermeasures. The unique shape and low magnetic signature make the MANTA very difficult to detect.

Since the Iran-Iraq war more than 20 years ago, Iran has demonstrated a keen interest in employing mines as a means of contesting control of the Persian Gulf. [6] Today, Iran has a very large arsenal of mines, some of which are quite sophisticated, as well as a wide variety of platforms, including its diesel-electric Kilo submarines and converted commercial vessels and fishing trawlers, with which to deliver sea mines. [7] Although there are doubts that Iran could employ mines to close the deep waters at the entrance to the Persian Gulf (the Shatt al Arab), the shipping channels that provide access to the oil terminals of the northern Persian Gulf are extremely vulnerable to the mine threat. [8] Iran's supreme leader, Ayatollah Ali Khamenei, has said that if the U.S. or Israel attacked Iran then "definitely the shipment of energy from this region will be seriously jeopardized." [9]

Historically, the focus of U.S. demining efforts has been on overseas threats. However, in the age of global terrorism, there is also a need to give attention to the possibility of improvised sea mines in domestic waters.[10] Such weapons could be used by terrorists or even a state adversary seeking to impose asymmetric cost on the United States or interfere with the flow of forces overseas during a confrontation. One of the most disturbing scenarios would involve simultaneous mine threats against the homeland and overseas waterways in the context of a military confrontation with a hostile power. In such a scenario, relatively scarce mine countermeasure assets would be severely stressed.

The U.S. Navy, which would be responsible for answering the threat of sea-borne IEDs in American ports, considers the threat to be credible. Recent war games have demonstrated that even a single sea-borne IED in the sea channel for the port of Houston, Texas, would shut down that entire port. "Underwater improvised explosive devices are a credible threat. We consider it an unlikely event, but if it did happen, it would have huge consequences that would be very expensive and difficult to recover from." [11]



A mine countermeasure ship using advanced mine sweeping gear with a rigging that enables larger lanes in the ocean to be cleared.

The Emerging Chinese Sea Mine Threat

China reportedly possesses between 50,000 and 100,000 mines, consisting of "over 30 varieties of contact, magnetic, acoustic, water pressure and mixed reaction sea mines, remote control sea mines, rocket-rising and mobile mines…." People's Liberation Army Navy (PLAN) submarines are said to use the Chen-1, -2, -3, and -6 type influence mines, "appropriate for use in the sea area immediately outside of harbor mouths;" the T-5 mobile mine, "appropriate for port channels and sea areas immediately outside a port;" and the Soviet-produced PMK-1 and the Chinese-developed Mao-5 rocket rising mines, "appropriate for waters up to 15 kilometers outside a port."

China's remotely controlled mines, such as the EM53 bottom-influence mine, are thought to be deactivated by coded acoustic signals to allow the safe passage of friendly vessels, and again activated to prevent the transit of those of an enemy. Remotely controlled mines are well suited to defensive mining purposes, but could be useful in offensive operations as well.

China likely also possesses an inventory of submarine-launched mobile mines (SLMMs). Called "self-navigating mines" (zihang shuilei) in Chinese, these mines are simply torpedo bodies that carry a mine payload to waters inaccessible by other means. Apparently derived from Yu-class torpedoes, China's SLMMs would travel along a user-determined course for a set period of time. When SLMMs arrived at their programmed destination (e.g. in the middle of a harbor), the torpedo's engine would shut off, and the weapon would sink to the bottom where the warhead would be controlled by a fuse similar to that of any other bottom mine.

Significantly, China began to develop rocket rising mines in 1981 and produced its first prototype in 1989. Thus, Beijing has been working on this technology for well over two decades. Today, China reportedly offers two types of rising mines for export. Rising mine systems are moored, but have as their floating payload a torpedo or explosive-tipped rocket that is released when the mine system detects a suitable passing vessel. The torpedo or rocket rises from deep depth to home in on and destroy its intended target, typically a submarine. As one source notes, "The so-called 'directional rocket rising sea mine' is a type of high-technology sea mine with accurate control and guidance and initiative attack capacity.… Attack speed [e.g., against a target submarine] can reach approximately 80 meters per second." China's EM52, a guided rocket-propelled destructive charge, reportedly has an operating depth of at least 200 meters. Russian rising torpedo mines such as the PMK-2 are said to be capable of being laid in waters as deep as 2,000 meters.

Recent focus on rocket rising mine development indicates for China "a new understanding of the art of sea mine warfare [whereby] it is essential to implement effective sea mine warfare over a vast range of deep sea areas [and to] develop and equip rocket sea mines capable of … mobile attack." The PLA Navy is therefore augmenting its existing inventory of 1970s-80s mines designed to defend littoral areas, most of which "can only be deployed in shallow seas," and only a fraction of which can be deployed in medium depths. In particular, China's navy has "started to outfit vertical rocket rising sea mines, and is energetically developing directional rocket sea mines, rocket rising guided-missile sea mines and rocket-assisted propulsion sea mines."

(Erickson, Andrew, Goldstein, Lyle, and Murray, William (Winter 2007). "China's Undersea Sentries." *Undersea Warfare,* Volume 9, No 2.)

Current U.S. Mine Countermeasure Capabilities

Neutralizing the sea mine threat is the job of the U.S. Navy's mine countermeasure (MCM) force. Currently, the U.S. Navy deploys three sets of capabilities to counter sea mines. The first of these consists of the 14 Avenger-class MCM ships. The second of these capability sets consists of helicopter-borne mine warfare systems carried by the two dedicated MH-53E Sea Dragon helicopter squadrons. The third set of capabilities is associated with the Navy's Explosive Ordnance Disposal (EOD) MCM detachments.

The problem is that many of these assets are aging and will soon reach the end of their useful life. The last of the Osprey MHC minesweepers was decommissioned in 2008. Until recently, the Navy's plan was to begin retiring the Avenger MCM vessels beginning in 2016 with the final vessel decommissioned in 2023. Similarly under current plans, the MH-53 will start to be retired in 2017. The U.S. Navy is considering extending the life of the MH-53 to forestall a potential gap in MCM capabilities that might otherwise exist between the time the older systems are retired and new ones become available. However, this would probably require the diversion of funds for the fielding of organic MCM capabilities.

Thus, for the next few years, at least, the U.S. Navy faces the twin challenges of a MCM force that is relatively few in numbers and beginning to obsolesce. The Navy has already taken some measures to improve the capabilities of the systems aboard the Avenger MCMs. There is little more that can be done to enhance the capabilities of the MH-53 which lack, for example, an airborne mine neutralization capability. According to one report, the state of U.S. MCM capabilities in the Persian Gulf is less than adequate. [12]

Perhaps more significant is the overall small size of the mine countermeasures force. In addition, the Avenger MCM ships can only be redeployed slowly. This is one reason why four have been forward deployed to the Persian Gulf in anticipation of a conflict there. Two additional Avengers are deployed in Japan while the remainder are based in San Diego. While the MH-53 can be deployed anywhere around the globe in as little as 72 hours there are only some 22 of these aircraft. Today it may take as long as a month to deploy a mine-clearing capability to a distant part of the globe. This is an absolutely unacceptable delay in a world of just-in-time delivery and rapid power projection.

The Navy and the Coast Guard share responsibility for securing America's ports and waterways against maritime threats. The Coast Guard, through the Department of Homeland Security, is responsible for defining the requirement for port security. This includes what counter-mine capabilities will be required in the event of a terrorist event. But it is the Navy that will have to do the hard work of actually finding and clearing obstacles. To this end, the two services have conducted a limited number of exercises. The Navy has also performed a few surveys of the subsurface environment around American ports of military significance, but commercial ports such as Long Beach and New York have invested in commercial surveys.

It is not only that the number of dedicated MCM platforms will be declining. Another problem is that sea mines are becoming more sophisticated and, in many cases, difficult to detect and neutralize. Therefore, the Navy needs to deploy advanced technologies. Equally important, the Navy requires a mine warfare technology plan that allows future capabilities to be refreshed at a steady and predictable pace in keeping with advances in the threat.

The Rapid Airborne Mine Clearance System (RAMICS) will be included in LCS Mine Countermeasures Mission Package and deploy on the MH-60S helicopter.

The Littoral Combat Ship Independence (LCS 2) has a deployable Mission Package focused on mine countermeasures.

There are two challenges facing the U.S. Navy with respect to addressing the sea mine threat. One is to modernize a MCM force that will reach the end of its useful life beginning in this decade. This modernization effort must take place in an environment marked by the growing technical sophistication and proliferation of sea mines. There is also the potential that terrorists and insurgents may turn to improvised sea mines as a means of complicating U.S. expeditionary operations and even threatening critical infrastructure in the homeland.

The other challenge is to increase the resources available with which to respond to the threat. The U.S. Navy does not possess the luxury of being able to concentrate its existing mine warfare assets in one location or to meet a single, known threat. It must balance deployments in one region or at one location against the risk of a threat emerging in another part of the world. Nor is the problem restricted to overseas sea mine threats. The Navy must be capable of meeting its responsibilities to protect domestic waters against threats from hostile states or from terrorist groups.

It was with an eye towards addressing these two challenges and also to reducing the vulnerability of naval personnel and marine mammals that the U.S. Navy adopted a radically new approach to countering the sea mine threat. It decided to go from dedicated mine warfare assets to an array of organic capabilities that could be deployed on a range of platforms. The Navy's new approach was described in one article at the time thusly:

> The future of MCM, as in other warfare areas, is about developing technologies – sensors, weapons and vehicles – that will provide leap-ahead capability. The Navy's vision is to field a common set of unmanned, modular MCM systems employable from a variety of host platforms or shore sites that can quickly counter the spectrum of mines to enable assured access on a timeline that supports Sea Power 21's Sea Basing concept.
>
> Realizing the vision will accelerate the timeline of MCM operations – from days or weeks down to hours or minutes – decreasing the "detect-to-neutralize" kill chain, and keeping sailors and marine mammals out of harm's way in minefields. Additionally, the technologies now being developed will bring new performance in shared situational awareness and combat power across the full spectrum of operations. [13]

The key to both revitalizing the U.S. mine warfare capability, thereby addressing the potential asymmetric threat, and providing additional capabilities that can be deployed rapidly to meet new threats rests principally with the deployment of the Littoral Combat Ship (LCS) and, specifically,

the Mine Countermeasures Mission Package. One of the key features of the LCS is its ability to deploy modular mission packages that address specific threats. To date, three mission packages are in development: mine countermeasures, antisubmarine warfare and surface warfare.

The capability to perform a given mission will reside in so-called mission packages. These consist of mission modules, trained crews and support aircraft. The mission modules consist of mission systems plus associated support equipment. The incremental acquisition of the Mine Countermeasures Mission Package will ultimately consist of nine distinct but integrated mission systems. These are:

- *The Remote Multi-Mission Vehicle (RMMV);*
- *The Unmanned Surface Vehicle (USV);*
- *The Airborne Laser Mine Detection System (ALMDS);*
- *The Airborne Mine Neutralization System (AMNS);*
- *The Airborne Minehunting Sensor AN/AQS-20A;*
- *The Unmanned Undersea Vehicle (UUV);*
- *The Rapid Airborne Mine Clearance System (RAMICS);*
- *The Coastal Battlefield Reconnaissance and Analysis system (COBRA), and;*
- *The Organic Airborne & Surface Influence Sweep (OASIS).*

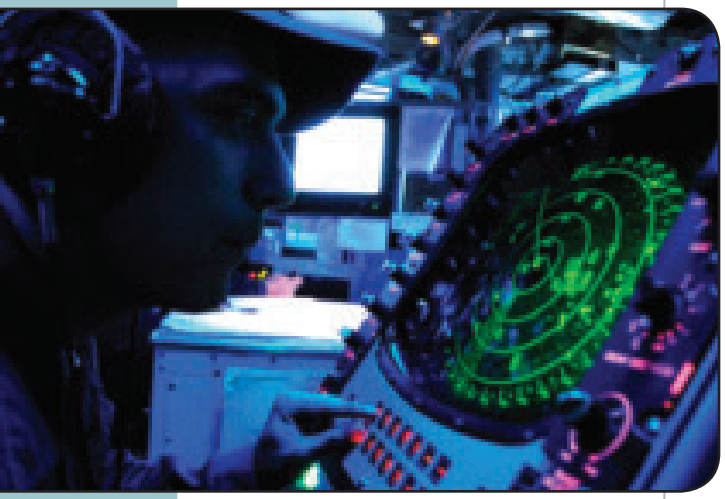
Traditionally, mine hunting and neutralization has been a difficult, tedious and dangerous task. One key aspect of the design for the Mine Countermeasures Mission Package is to exploit the opportunities presented by unmanned vehicles and standoff systems to reduce the burden and dangers associated with the mission. The concept undergirding the Navy's approach to the use of mission modules envisions deploying key mine hunting and neutralizing systems aboard aerial, surface and subsurface platforms as adjunct to the LCS. The RMMV and the USV will extend the range of the LCS on and beneath the surface of the seas. Unmanned vehicles can bring both sensors and weapons to bear over long periods of time, thereby reducing the risks to manned platforms and the wear and fatigue that comes with long and repetitive missions.

A key feature of the Navy plan is to invest in new helicopter-borne mine countermeasure capabilities. The platform for these will be the MH-60S multi-mission helicopter. Many of the systems included in the LCS Mine Countermeasures Mission Package (e.g., the ALMDS, AMNS, AQS-20A, RAMICS and OASIS) will be deployed on the MH-60S. In addition, an unmanned aerial system, the MQ-8B Fire Scout, will also be integrated into the total mine countermeasure system utilizing COBRA.

The array of new and more capable sensors that will deploy as part of the Mine Countermeasures Mission Package holds out the promise to dramatically improve the Navy's ability to detect, characterize and localize sea mines. When combined with the RAMICS and AMNS for airborne platforms, the potential will exist for extremely rapid mine clearance over relatively large areas.

The Airborne Laser Mine Detection System (ALMDS) will deploy on the MH-60S mine hunting helicopter.

It is also possible to design specially tailored mine countermeasure mission packages that provide a suitable match for the extent and sophistication of the threat. For example, where it is possible to avoid known and characterized minefields, the U.S. Navy may choose to deploy only those mission systems needed for threat detection and characterization. In cases where time is not critical, it may be possible to deploy mine detection systems in support of EOD detachments. Where time is critical and the threat is extensive, the entire mission package will probably be required. [14]



Radar station in the command information center of the mine countermeasures ship USS Defender.

The Navy is employing an incremental acquisition strategy for the mission modules. The first Mine Countermeasures Mission Package consisting of the USV, RMMV, AMNS, ALMDS, and AQS-20 was delivered in 2007. The program of record is to incrementally expand on this basic mission capability with the introduction of additional elements as they become available. The current plan is to deploy the complete mission package with all nine integrated systems in 2017. However, this presumes adequate funding and attention. Additional mission systems will be added to the mission packages as they reach a level of maturity necessary for fielding. Key to the ability to provide continuing technology refresh for the mission packages is the Navy's policy of modularity, an open business model, and open system architectures. [15]

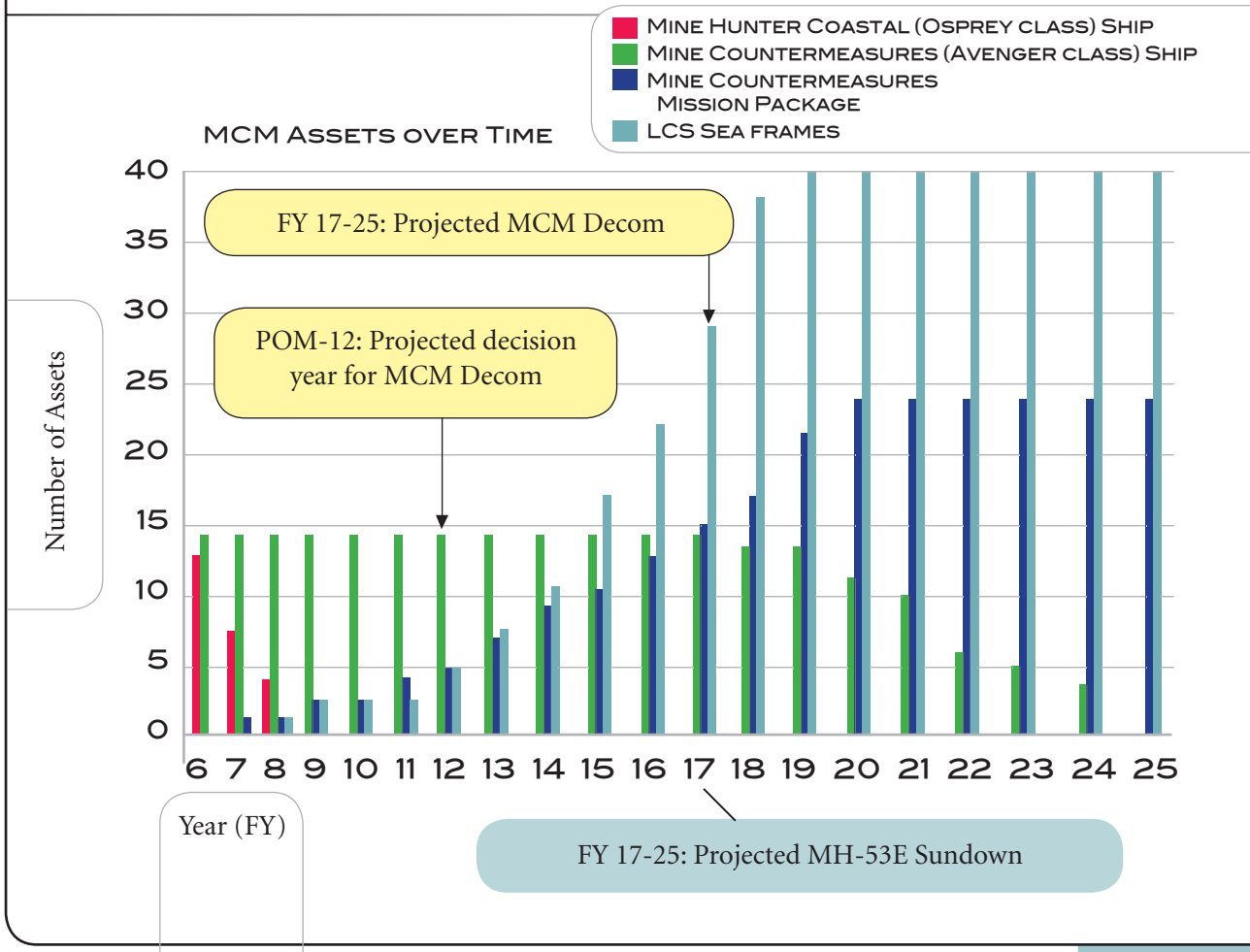
The mine countermeasures package faces a number of challenges in meeting the original goal of a fully functional capability by 2017. The Government Accountability Office (GAO) noted that several of the proposed systems are not yet mature and at least two have had to undergo redesign and retesting. None of these problems are insurmountable. They require time and resources to address. For each of the systems still not in low-rate production, the Program Office has a strategy to reduce existing risks and correct problems.

The future of U.S. mine warfare is critically dependent on the evolution of the LCS program and, in particular, the ability of the Navy to achieve a stable program that permits the deployment of sufficient ships in a time frame that will allow for the assumption of the mine countermeasure mission as current systems are retired. In addition to progress on the LCS, the Navy needs to ensure that it can meet the timelines for deployment of initial mission modules and for continuing progress in spinning out the required advanced technologies.

One of the challenges facing those involved in developing the overall Mine Countermeasures Mission Package is that the delay in fielding the LCS makes it more difficult to deploy and test the elements of the mission package. Similarly, without taking the systems to sea, it is difficult to develop the appropriate concept of operations or the training requirements for the crews. Consequently, waiting until there are sufficient LCSs deployed to permit fielding of the three classes of mission packages means tolerating unwarranted and unnecessary delays in testing the new systems, in designing the appropriate means of conducting mine warfare and in training the crews.

The technologies that allow removing the sailor from the minefield are also needed by allied navies. The United States has historically counted heavily on the minesweeping/hunting capabilities of its allies. Their capabilities are now obsolescing, as are ours. At the same time, our allies are increasingly reluctant to support U.S., North Atlantic Treaty Organization and United Nations combat operations with boots on the ground. It is notable that they don't seem to hesitate to support littoral operations at sea – witness their recent willingness to join anti-piracy operations in the Horn of Africa area. Once these new technologies become widely available (thus at reduced cost) and assuming security agreements can be arranged for technology transfer, allies may be willing to increase deployment to potential or realized mine threat areas. This allows our allies to participate while potentially putting fewer lives at risk. Interest among allied navies is already growing and the sooner these programs are appropriately funded to permit timely testing and fine tuning, the sooner a greater MCM capability can be achieved to counter this ubiquitous and increasingly sophisticated threat. As coalition operations gain in importance, partner capability will potentially increase in significance. Since countermine operations usually occur early in a campaign, distributed capability for quick reaction among allied navies may be important to future U.S. Navy operations.

The Organic Transition Challenge



Source: Commander Dave Hebert. "U.S. Navy Mine Countermeasures," National Defense Industrial Association 13th Expeditionary Warfare Conference (October 2008)

What still needs to be done?

The remote-controlled mine neutralization vehicle of the mine countermeasures ship USS Defender deploys into the Yellow Sea.

It is important that national decisionmakers appreciate the fact that sea mines in contested waters or in and around U.S. ports could constitute a "show stopper." Not only could such a threat block the movement of naval and amphibious forces or even damage or destroy major surface combatants, it also could pose a major threat to this nation's and even the world's economy.

Whatever delays there have been in the LCS program or in the fielding of mission packages, one thing is clear: the threat is not taking a holiday. Nations of concern to the United States continue to develop and stockpile sea mines. Given the fact that the threat is increasing in both quantity and sophistication while the existing U.S. mine countermeasure capability is aging, the Navy and the nation have no alternative but to press forward with the current plan to develop an organic mine-warfare capability.

The development of new military capabilities is often a difficult and even painful process, one marked by setbacks. But there are no scientific obstacles to perfecting the remaining systems that will constitute the Mine Countermeasures Mission Package. The problems being confronted are at the level of detailed engineering. In fact, several of the systems still in development have already undergone significant engineering changes and are about to be field-tested again. It is important to ensure that adequate funding is provided for all the systems being developed.

The delay in fielding LCS coupled with the continuing planned decommissioning of mine warfare platforms has created a potential gap in the deployment of organic mine countermeasure capabilities that needs to be filled. The Navy has made the wise decision of committing to extending the life of the existing dedicated mine-warfare force until the new organic capability can be deployed. This is a necessary step but one that should not come at the expense of developing new organic mine warfare capabilities. Taking money from the programs of the future to extend the life span of today's capabilities risks a situation in which the future never arrives and the present must be extended indefinitely.

The delay in the LCS program should not be allowed to set back development and fielding of the Mine Countermeasures Mission Packages. It is particularly important to get the initial packages to sea so that the sailors can begin training in a real-world environment. This could guide further development of the component systems. The initial intent behind the development of an organic mine warfare capability was to free the Navy from its dependence on relatively scarce, slow and vulnerable capabilities at a time when speed and agility, both tactical and operational, were becoming more important. Sending the existing Mine Countermeasures Mission Packages to sea on another platform makes tremendous sense.

In addition to sending mission packages to sea for testing and further development, the Navy needs

to consider how it might deploy modules of the Mine Countermeasures Mission Package on other platforms if the need arose. It should also begin developing the concept of operations needed in order to employ both organic and dedicated MCM assets. In 2007, the GAO proposed that in light of the delay in the LCS program that the Navy consider and evaluate the possibility of deploying mine warfare systems on platforms other than the LCS.[16] Fielding of mission modules in advance of LCS deployment also could assist in risk reduction and the development of the necessary concept of operations to support an evolving mine warfare strategy. Congress made a similar point in 2009, adding money in the defense appropriations bill for a study of complementary deployment options for the mine warfare package.

Identifying the right alternative platforms for deployment of mine countermeasure mission modules will not be easy. Such platforms have to be able to support not only the mission modules themselves, which includes launching and recovering multiple unmanned vehicles, but the associated communications, command, control and intelligence (C3I), aerial systems and crew. Nonetheless, there is research to suggest that suitable supplementary platforms exist. The Navy should examine the potential to deploy the Mine Countermeasures Mission Package on alternative platforms both as a hedge against further delays in the LCS program but also to provide for a rapid expansion of mine countermeasure capabilities in response to changes in the threat.

The GAO also noted a decline in the Navy's investment in intelligence preparation capabilities – the ability to locate and map minefields. The Navy should consider increasing its investment in this area. Intelligence preparation of the environment is critical to the ability to rapidly detect and neutralize sea mines. In addition, the Navy and the Coast Guard need to expand their work to survey the critical waterways, particularly in the continental United States, to enable improved detection of mines and improvised explosive devices.

The Navy needs to press the Department of Homeland Security to define a requirement for mine countermeasure support in the event of a terrorist incident at home. Without a clear requirement, the Navy will be unable to properly size its mine-warfare force. As a consequence, in the event of simultaneous international and domestic demands for mine countermeasure assets, the Navy, Department of Defense or ultimately the President may have to decide whether to take risk at home or in the deployment of U.S. forces abroad.

Finally, the Navy Oceanographic Office in conjunction with the Coast Guard also needs to be given the resources to conduct basic bottom surveys of the major ports and waterways. Collecting baseline environmental intelligence would significantly decrease the challenge of detecting and locating maritime IEDs. Currently, harbor mapping is accomplished utilizing side-scan sonar – a long, laborious and expensive undertaking that may have to be repeated periodically. New laser technology exhibited in systems like ALMDS will permit rapid mapping for baseline and change detection.

The USS Freedom (LCS 1) is a fast, agile, ship designed to defeat mines, quiet diesel submarines and fast surface craft.

End Notes

[1] Natter, Admiral Robert, cited in, Program Executive Office Littoral and Mine Warfare (2009). *21st Century U.S. Navy Mine Warfare: Ensuring Global Access and Commerce.* U.S. Navy, p. 7.

[2] At present, only the Littoral Combat Ship is planned to have the necessary interfaces to support the various warfare modules.

[3] Program Executive Office Littoral and Mine Warfare (2009). *21st Century U.S. Navy Mine Warfare: Ensuring Global Access and Commerce,* U.S. Navy, pp. 8-9.

[4] Mason, Wayne (May 19, 2009). *Naval Mine Technologies.* Briefing presented at the Farragut Technical Analysis Center.

[5] Erickson, Andrew (May 8, 2006). *China's Undersea Warfare: Strategy and Capabilities.* Presentation at the American Enterprise Institute. Available at www.aei.org/EMStaticPage/1332?page=Summary.

[6] Haghshenass, Fariborz (September 2008). *Iran's Asymmetric Naval Warfare,* Policy Focus Number 87, The Washington Institute of Near East Studies.

[7] The Robert S. Strauss Center for International Security and Law (2008). *The Straits of Hormuz: Assessing Threats to Energy Security in the Persian Gulf,* The University of Texas at Austin. Available at hormuz.robertstrausscenter.org/mines.

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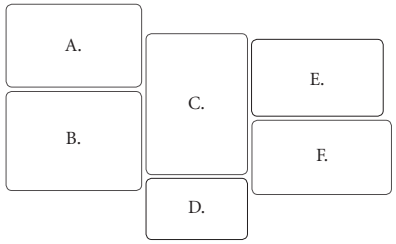

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