COMMENTARY

WANTED U.S. NAVY MINE WARFARE CHAMPION

Scott C. Truver

Successfully implementing innovation within a bureaucracy ultimately requires a champion to navigate the inherently political processes of securing sponsorship and resourcing. This is just as important to the very small as to the very large programs, particularly during periods of fiscal austerity. "It's fragmented," commented retired rear admiral Paul Ryan, former commander of the U.S. Navy's Mine Warfare Command, in April 2014. "There is no single champion for mine warfare."[1]

This lack of support presents challenges for the U.S. Navy and the nation, as the service struggles to articulate, and to muster the necessary backing for, mine warfare (MIW) strategies, programs, capabilities, and capacities. The task of confronting these challenges is complicated by the fact that MIW comprises not only mine-countermeasures (MCM—that is, minesweeping and mine hunting) systems and platforms but also mines that can be employed to defeat our adversaries' naval strategies and forces. In recent decades, the counters to our adversaries' mines have received increasing attention, leading to the advanced MCM mission package fitted on the littoral combat ship (LCS). Yet at the same time, our mines and offensive and defensive mining capabilities have languished to the point of irrelevance. If MCM is the neglected program of "Big Navy," then mines are the misbegotten offspring of the MIW community. However, that might be changing, albeit ever so slightly.

The post–World War II political history of U.S. Navy mine warfare (defining "politics" as who gets

Dr. Truver is director of Gryphon Technologies' Team Blue National Security Programs group. He has forty years of experience in research, analysis, program advocacy, and publishing and has supported U.S. Navy mine warfare since 1979, when he prepared a law-of-war assessment of an advanced mine concept. He has also investigated the potential for use of mines and underwater improvised explosive devices by terrorists, as well as Chinese / Chinese navy mine warfare. He is a member of the editorial board of the Naval War College Review.

what, when, where, and how) is fraught with insufficiently sustained and stable commitment, relatively long periods of benign neglect, indifference, uncertainty, and inadequate funding, punctuated by relatively short bursts of grave concern and avid support, usually directly related to some recently experienced MIW embarrassment. Political scientist Harvey Sapolski at the Massachusetts Institute of Technology explains in his book *The Polaris System Development* the inherently and necessarily political process by which a government program can achieve high priorities and guarantee resources for research-and-development (R&D), programmatic, and operational success. "The success of the [Polaris fleet-ballistic-missile, or FBM, submarine] program was dependent upon the great skill of its proponents in bureaucratic politics," he writes. "Without their quick recognition of the political nature of decisions determining the procurement of weapons, I do not believe that sufficient resources could have been assembled to create the . . . FBM Fleet."[2]

There is perhaps only one other U.S. Navy program that has had R&D, bureaucratic, programmatic, and operational success similar to that of the Polaris FBM project, and that is the Aegis antiair warfare system, deployed in the *Ticonderoga* and *Arleigh Burke* surface warships. Looking at Polaris and Aegis, some secrets of naval-warfare bureaucratic-political success can be gleaned for the future U.S. MIW community, despite the great differences in size, cost, and scope of the programs.

SAPOLSKI'S SECRETS OF SUCCESS

First, Polaris and Aegis had a set of well-defined goals that stayed constant.[3] The Special Projects Office focused on building a solid-fuel, submarine-launched ballistic missile and a fleet of nuclear-powered, ballistic-missile-launching submarines to enhance U.S. strategic deterrence. The Aegis Shipbuilding Program (PMS 400) had the goal of building a fleet of antiair-warfare surface warships armed with advanced phased-array radars and surface-to-air (and space) missiles capable of defeating massed Soviet naval aviation raids. Therefore, since 2002 Aegis ballistic missile defense (BMD) has pushed the envelope, achieving twenty-eight intercepts in thirty-four flight-test attempts through 2013, a rate unprecedented in any element of the nation's BMD systems.

Second, both Polaris and Aegis were born and sustained in favorable environments. For Polaris, it was the demand pull for a survivable nuclear deterrent within a strategic context of mutually assured destruction and bitter U.S.-Soviet rivalry, as well as a budgetary context of resources that were virtually unlimited (particularly by today's standards), often reallocated from less well protected programs. Aegis was conceived when the Soviet navy began to break out of its historical boundaries, challenging the U.S. Navy everywhere and holding at risk aircraft

carrier battle groups with increasingly capable antiship cruise missiles launched from aircraft, surface ships, and submarines. "Aegis . . . don't leave home port without it" was the program office's unique selling point—and it worked! This has continued with Aegis BMD, extending the shield well beyond forces at sea.

Third, both the Polaris and Aegis programs also depended for success on their proponents' ability to promote and protect them. Competitors had to be eliminated; reviewing agencies had to be outmaneuvered; defense and Navy officials, admirals, congressmen, defense industry, the media, and academicians had to be co-opted. Every opportunity to promote and protect Polaris and Aegis had to be seized and won, whether the challenge came from the Office of the Secretary of Defense, another service, Congress, or the Navy.

Finally, both had to have long-term champions skilled in bureaucratic politics and possessed of great managerial strength in dealing with technological complexity. Both Polaris and Aegis were "rocket science," and both needed leaders with broad and deep technical, engineering, and program-management expertise. Admirals Levering Smith, William F. Raborn, and the man who is widely regarded as the "Father of Aegis," Admiral Wayne E. Meyer, were all masters in these areas. Also, Admiral H. G. Rickover was instrumental in the development of nuclear power, and it did not hurt that Admiral Arleigh Burke, Chief of Naval Operations (CNO), personally established the Polaris Special Projects Office.

U.S. Navy MIW Challenges

Compare the Polaris/Aegis political-culture experience with MIW since 1945. Instead of a single set of well-defined goals that stay constant, MIW goals and program elements often compete among themselves for priorities and resources, and they are far from stable, particularly in terms of funding for research and development, acquisition, and sustainment.

- Should we emphasize mine countermeasures at the expense of offensive or defensive mines and mining?
- Within the MCM arena, what is the best way to allocate scarce resources between mine hunting and minesweeping, and what element of the MCM "triad"—airborne, surface, and explosive ordnance disposal (EOD)—needs to be supported most urgently?
- How can Big Navy be convinced to acquire and sustain a modern offensive and defensive mining capability?

This situation is made more complex by the fact that, except in rare cases, the MIW community does not procure its own major platforms and so can be held hostage by the competing goals, priorities, and dynamics of other warfare sponsors. Witness the challenges of keeping the heavy-lift Sea Dragon MH-53E

airborne MCM helicopters ready for tasking, as they continue to be "sundowned," replaced by the medium-lift MH-60S helicopter, particularly as the naval aviation enterprise focuses on next-generation aircraft carriers and aircraft. Likewise, challenges to the littoral combat ship could jeopardize mine-countermeasures modernization as the *Avenger* surface MCM vessels are stricken from the Navy list. Indeed, the Navy surface MCM community is "betting the farm" on the research-and-development, bureaucratic, programmatic, and operational success of the LCS program, however modified as a result of the recommendations of the CNO's Small Surface Combatant Task Force in 2014.

When the Navy reorganized the LCS Program Executive Office out of the previous Program Executive Officer (PEO) Littoral and Mine Warfare in 2011, the programs of the MIW manager (known with the Naval Sea Systems Command as PMS 495) and other MIW-related legacy "cats and dogs" were included in the new PEO's "portfolio." This reorganization has taken some time to sort out.

Moreover, when U.S. Navy MIW receives emphasis, it tends to be in nonfavorable environments and in knee-jerk reaction to embarrassment and to an urgent, ultimately ephemeral, perception of need. Two quotes illustrate this:[4]

- "When you can't go where you want to, when you want to, you haven't got command of the sea. And command of the sea is the rock-bottom foundation for all our war plans. We've been plenty submarine and air conscious. Now we're going to start getting mine conscious—beginning last week."
- "I believe there are some fundamentals about MIW that we should not forget. Once mines are laid, they are quite difficult to get rid of. That is not likely to change. It is probably going to get worse, because mines are going to become more sophisticated."

The first quote belongs to Admiral Forrest Sherman, speaking as CNO in late October 1950. He is lamenting the fact that in a four-hundred-square-mile area off Wonsan, North Korea, an extensive minefield, a mix of some three thousand Soviet 1904- and 1908-vintage moored mines and more modern magnetic-influence bottom mines, had been keeping a 250-ship amphibious task force at bay. The operational plan had allocated only ten days and insufficient MCM vessels to clear several channels, intelligence on the mine threat was all but absent, and maps and charts of the area were inadequate. Ultimately, only 225 of the three thousand mines were swept, and the North Koreans (and Russians) had another thousand mines in reserve.

In the second quote, Admiral Frank B. Kelso, CNO, is reacting in October 1991 (quoted in the Navy's 1992 Mine Warfare Plan) to the more than 1,300 mines that had frustrated planned Marine assaults against Iraqi forces in Operation Desert Storm. A few of the mines were of a 1908 vintage and a crude Iraqi design, but

others were modern Soviet and Italian multiple-influence weapons, including at least two hundred of a multiple-acoustic type that had never been seen before in the West. The operational plans had allocated only a few days to clear assault lanes, and intelligence on the mine threat was all but absent. Maps and charts of the northern Arabian Gulf were inadequate. Our intelligence about the Iraqi mine threat was so incomplete that two U.S. warships suffered mine strikes in areas that analysts had assessed to be mine-free. The helicopter assault ship *Tripoli* and the Aegis guided-missile cruiser *Princeton* were damaged severely; *Princeton* was taken out of the war by a single fifteen-thousand-dollar weapon.

Our adversaries' mines and mining superiority revealed by Wonsan and DESERT STORM had the near-instantaneous effect of revitalizing our MCM—though not our mines. There was not only an infusion of much-needed funding but also a new understanding that somehow MCM was still important to the Navy during a period of great change.

But the threat of global strategic-nuclear war in the 1950s and the uncertainty of the post–Cold War era in the 1990s, respectively, were short-lived, and by the early 1960s and late 1990s "business as usual" was the unofficial MIW motto, as resources became increasingly tight and attention turned to other needs. Since the last new-design mines reached the U.S. operating forces in 1983, and despite interest in "littoral sea mines" since then, only an upgraded target detection device (TDD) has seen the light of day.

Two Other Factors

The two additional factors of success that Polaris and Aegis enjoyed were the ability of their proponents, long-term champions skilled in bureaucratic politics, to promote and protect their programs against all others inside and outside the Navy. This has been absent in the MIW community. Rarely has a CNO put MIW on the line and protected the program of record from those who had different priorities. Recently two CNOs, Admirals Vern Clark and Jonathan Greenert, "talked the talk" *and* "walked the walk" for MIW, earning them the title of "Mine Warfare CNO." However, the reality is that only one CNO since 1945, Admiral Mike Boorda, who had been commanding officer of the minesweeper *Parrott* (1966–68), has had an actual tour in MIW. Others might point to Admiral Robert Carney, who had at least one MIW experience, as commanding officer of the light cruiser *Denver*.

During his stint as Secretary of Defense William Cohen's senior military adviser in the late 1990s, General James Jones, USMC, asked me, "What do we have to do, to keep the Navy's attention focused on mine warfare?" I replied, "Ships got to sink and people have to die, or it will be business as usual." He replied, "Sadly, I agree."

In a way, Big Navy's indifference, if not hostility, to investment in MCM is not without merit. Looking objectively at mine-hunting technology versus advanced mine technology, the Navy cannot have any real confidence that a quick and effective in-stride mine-clearing capability in a nonbenign environment will ever be achieved. Post–DESERT STORM, the world's best MCM capabilities were for the most part pitted against relatively ancient mines. The clearance rate was painstakingly slow and could be achieved only in a totally benign environment. Following the end of DESERT STORM hostilities, an international MCM force needed some two years to declare Persian Gulf sea-lanes and ten mine-danger areas to be mine-free.

More important is the reality that if we cannot effectively and quickly detect, classify, localize, identify, and neutralize mines, neither can our adversaries. If their mines will have major antiaccess/area-denial (A2/AD) impacts on U.S. naval strategies and operations, the U.S. Navy's offensive mines should have the same effect on their strategies and operations. Thus, the Navy should be investing heavily in a state-of-the-art mining capability for use against potential adversaries that rely in a major way on the sea.

A CASE STUDY: MINES AND MINING

Although mine hunting/sweeping and offensive/defensive minelaying are two sides of the same naval warfare coin, they are indeed very different functions, with very different prospects for success. The seemingly enduring offense/defense imbalance in this warfare area, an imbalance that so heavily favors the mine, should stimulate U.S. Navy investment in the "winning" side: offensive mining. While in 2014 there are indications that Navy "weapons that wait" are receiving greater attention among the operating forces and Navy leaders, particularly as a result of the "Pacific pivot" and the need to address potential adversaries' capabilities, since the mid-1980s Navy mines and mining have represented an even more dismal story than MCM.[5]

During the Cold War, the U.S. Navy maintained a large stock of mines for both offense and defense. Several types of bottom and moored antisubmarine mines (Mark 52/55/56/57) deployed by submarines and aircraft entered service in the 1950s and 1960s. Mine inventories included general-purpose bombs fitted with mines, known as Destructors, which saw widespread employment at sea and on land during the Vietnam War. But with the end of the Cold War, the U.S. Navy's mine capabilities began to atrophy. No conventional mines remain, and at one point the Navy had programmed the remaining obsolescent submarine-launched mobile mines (SLMMs) to be phased out in 2012. Had that been carried out, U.S. attack submarines would have had no mining capability at all; as it was, only direct intercession by the CNO, Admiral Greenert, saved a handful of SLMMs.

The only other mines in service are the Quickstrike series of aircraft-deployed weapons (essentially upgrades of the 1960s Destructor mines); the dedicated, thin-wall Mark 65 two-thousand-three-hundred-pound bottom mine (in service since 1983); and the Mark 62 five-hundred-pound and Mark 63 one-thousand-pound bottom mines (1980). Like the Destructor series, these last two are general-purpose bomb-conversion weapons, using screw-in multiple-influence (magnetic, pressure, and seismic sensors) TDDs in place of the bombs' conventional fuses.

There are no surface minelaying capabilities in the U.S. Navy.[6] While packages for mission sets beyond the baseline of MCM, surface warfare, and antisubmarine warfare (ASW) have been suggested for the littoral combat ship, there is no apparent interest in configuring LCS variants as minelayers. Likewise, in early winter 2014 there is little indication that the results of the 2014 Small Surface Combatant Task Force will include minelaying for a next-generation, "frigate-like," small warship.

With the eventual demise of the Mark 67 SLMM, the nation's sole minelaying capabilities will reside in naval aviation and the U.S. Air Force. The U.S. Navy's P-3C Orion maritime patrol aircraft and F/A-18 Hornet / Super Hornet can drop Quickstrike mines, but the P-3Cs are leaving service. They are to be replaced by the P-8 Poseidon Multi-Mission Maritime Aircraft, which will also have a mining capability, but its ability to lay mines in meaningful numbers is years away.

The Air Force B-52H Stratofortress, B-1B Lancer, and B-2A Spirit strategic bombers constitute the nation's only high-volume mining capability. B-1s can carry more Quickstrike mines than the seemingly ageless B-52s (expected to remain active through 2040, the first B-52H having entered service in 1961), and B-52s and B-1s (but not B-2s) regularly train for and practice this mission. The seventy-seven active B-52Hs can each carry about forty-five Mark 62 Quickstrike or eighteen Mark 63 mines or ten Mark 65s; the sixty-six B-1s can carry eighty-four Mark 62, or twenty-four Mark 63 (although the Mark 63s are not yet certified), or eight Mark 65 mines; and the twenty B-2s could carry eighty Mark 62s each. However, the availability of bombers, airborne tankers, and defensive escorts for mining campaigns is uncertain. There will certainly be intense competition for these scarce resources in future crises and conflicts.

In short, at the time of writing the United States lacks modern mines and the means to deliver them. The Navy has no surface-deployed mines. A handful of obsolescent SLMMs—with perhaps less-than-optimum reliability, accuracy, and standoff characteristics—constitute the Navy's only clandestine mining capability. The air-launched Quickstrikes have less-than-optimal accuracy and are best deployed in less-than-contested environments. The 1991 Gulf War was the last time that the Navy deployed mines in combat. (On that occasion, four A-6

Intruder bombers planted a tactical minefield of Quickstrikes at the mouth of the Khawr az-Zubayr River to deny Iraqi access to the northern Gulf; one aircraft was lost to ground fire. Although there was little evidence that the minefield was successful, the Navy used the Quickstrikes also against bridges and airport runways, to better effect.)[7] Thus the nation's only offensive mining capability is resident in a small number of SLMMs and our only defensive mines are the shallow-water Quickstrikes.

Of greater long-term concern, there are only a few uniformed and civilian mine specialists, and a dwindling mine technological/industrial base has already presented challenges. For example, the U.S. Navy has been developing the next-generation, multiple-influence, programmable Mark 71 Quickstrike TDD since 1991. Only since 2012 has the system been acquired, and work is already under way to develop "smarter" algorithms for a broader target set. The Navy's mines/mining community has long wanted the ability to command and control deployed mines remotely but has not received the R&D funding to support it.

At the direction of Admiral Greenert, in 2012, the Navy conducted an "analysis of alternatives" (AoA) for near- and far-term mining capabilities that would address shortfalls and gaps. This included assessments of foreign mines, as well as American weapons. As of 2014, the AoA has yet to be released, and its potential impact on the mine warfare program of record is unclear. Nevertheless, low-level research and development for "advanced undersea weapon systems" has continued at the Office of Naval Research and the Naval Surface Warfare Command, in Panama City, Florida.[8] With today's unmanned-precision-vehicle and underwater communication technologies, the mining vision has significantly been expanded to make it more tactically responsive to changing situations, to provide much greater reach and utility in all phases of operations, including A2/AD missions.

IRONY AND PARADOX

The great irony and paradox for the Navy lie in the fact that mines do work and that mines/mining and MCM will almost certainly be needed in a future crisis or conflict. The post–World War II operational history underscores this fact of naval life. Of the twenty U.S. Navy ships that have been severely damaged or sunk by adversary action since September 1945, fifteen were mine victims. When the Navy employed mines in Haiphong in 1972, they were effective operationally and politically. More to the point of mines and mining in Navy strategies and operations is that in various fleet exercises during the past decade, senior flag officers have been increasingly concerned that they could not carry out operation plans because of a lack of modern mines and platforms. During international MCM exercises in the Persian Gulf in 2012 through 2014 stimulated by Iran's "mine

rattling" threats to close the Strait of Hormuz, numerous U.S. and foreign navy surface and airborne MCM and EOD forces tested capabilities against threats, a process that helped identify both weaknesses and strengths.

Yet during the Cold War and post–Cold War periods the MIW community has been subjected to a near-constant roller coaster of long periods of neglect alternating with short but intense "get well" efforts. Only since 2003 or so has this sinusoidal pattern been short-circuited, generating a "minirenaissance" in MIW—primarily MCM, but there is also a growing optimism for mines and mining. Unlike the history of the previous fifty years, there was no apparent mine embarrassment in the early 2000s that generated sufficient support to get MIW funding up to levels where it started to make a difference. When asked, during an interview with me, to explain this relatively robust support, Admiral Clark replied succinctly, "Because it's the right thing to do."

Captain Glenn R. Allen, then the CNO's MIW resource sponsor (N952), offered this insight during an April 2014 conversation: "The program of record requirements when written were visionary, but the technology has yet to advance to the required level to achieve them even twenty years later, largely due to funding uncertainties. Unfortunately, the acquisition process and limited budget do not allow the MIW programs to seize on those technologies that almost meet the requirements and get them in the fleet along the way to full operational capability."

While that might be the case for MCM, the Navy's mining programs have also severely atrophied. In 1993, during the first of several post–Cold War reorganizations, the Navy established the office of the Director, Expeditionary Warfare (N85/N75/N95), headed by a Marine Corps major general with a Navy one-star deputy. The intent was to focus expeditionary warfare resource sponsor attention on several crucial ". . . from the sea" warfare areas. The reality has been "director churn," with average tenures less than twenty-three months (separated at times by gaps), too short to have impacts that survive the next rounds of cuts once new people are on board. To be fair, this seems to be business as usual throughout Navy headquarters. But given a succession of non-MIW-experienced commanders and deputies at the Naval Mine and Anti-Submarine Warfare Command (NMAWC) in San Diego, California, the demise of the Navy one-star deputy billet, and a chronically small share of budget, it may be difficult to establish mine-warfare focus, traction, and consistency, let alone sustain them.

POSSIBLE FRUSTRATIONS

This situation cries out for a high-level champion who is willing to drive research and development, acquisition, the development of employment concepts, incorporation into operational plans, and fleet training and exercises. Several impediments conspire to frustrate this process.[9]

First, champions cannot be lone voices in the wilderness. Rather, they must be catalysts who mobilize the believing masses who are looking for a leader. In other words, there must be bodies of believers out there who agree with the champions and are ready to follow and take positive action.

There does not appear to be any process or forum that exposes the vast body of naval officers today to the high-end challenges of mine war fighting, to produce either the body of true believers or the champion. There is no requirement that naval officers know much if anything about mine warfare. At the Naval Academy and in the Naval Reserve Officers Training Corps, the handbook introducing midshipmen to the Navy's warfare communities has only a page on mine warfare; an informal and unscientific survey of Naval Academy midshipmen (classes 2008–14) could not identify a summer cruise anyone had taken on an MCM vessel. At the Naval War College, mine warfare is covered in a single class session at the junior level, but there is not even that at the senior level. (That said, in recent years considerable attention has been given to mine warfare by the Halsey groups, at a classified level, perhaps responding to Admiral Greenert's interest in mines as well as MCM.) Thus, the bulk of the Navy's officer corps not only is not exposed to the demands of mining and countermining but is given the clear message that in preparation for war, knowledge of mining is not important.

There is a single exception to the lack of mine-warfare Joint Professional Military Education. As an element of its response to the DESERT STORM MCM debacle, the Navy in 1996 stood up the Chair of Expeditionary and Mine Warfare and an assistant directorship of the Undersea Warfare Research Center at the Naval Postgraduate School (NPS), in Monterey, California. The goal was to enhance the academic and research content and establish the NPS as a major center of excellence for mine and undersea warfare research, analysis, and education. There have been some successes in these areas. During the past eighteen years about a thousand young officers have attended a quarter-long course on Navy MIW history, completed MIW projects, submitted theses, attended related symposia, and visited laboratories and uniformed and civilian leaders. While not all have subsequently gone on to MIW assignments, their solid understanding of the subject stands in stark contrast to the usual approach to MIW education.

SAPOLSKI'S LESSONS TO BE (RE)LEARNED

Although U.S. Navy MIW does not benefit from being either large, or, sadly, adequately funded, there is a short list of Polaris and Aegis lessons learned for MIW. Mine countermeasures are among them, to be sure, but also greater interest in mines and offensive mining.

- Articulate clearly the Navy's mining and MCM visions and establish a set of well-defined requirements, goals, and programs that stay constant for more than a couple of budget cycles.
- Take advantage of defense strategic reviews and the resurrection and refreshment of the triservice cooperative maritime strategy (and the "strategy after next," after Admiral Greenert leaves office) to shape and sustain a joint environment that appropriately incorporates MIW contributions to joint operations. As Admiral Greenert has acknowledged, "It's all about assured access." Assured access is a joint concern. In that regard, the Navy's offensive A2/AD mines and mining should be embraced to make adversaries think twice about transiting areas that might have been mined.
- Take every opportunity to promote and protect the programs of record. Work to eliminate competitors; outmaneuver reviewing agencies; and educate, inform, or co-opt influential officials, admirals, congressmen, defense industry, the media, and academicians.

We must reorganize MIW so it can do all these things and more. Someone, or some organization, must be responsible for providing trained and ready MCM forces and advanced mines to the combatant commanders. However, as Rear Admiral Ryan recognized, the MIW enterprise is fragmented. Perhaps this responsibility should be a function of the U.S. Fleet Forces Command. Unfortunately, there is no MIW "czar." For now, responsibilities are split among NMAWC, the Naval Expeditionary Combat Command (for EOD, in Little Creek, Virginia), N95 (and other CNO warfare/platforms resource sponsors) in the Pentagon, and numerous program offices in the Office of Naval Research and in Navy systems commands, laboratories, and on the staffs of warfare commanders.

In the early winter of 2014, rumor had it that the Navy was poised to disestablish NMAWC and dole out MIW and ASW responsibilities to the type commanders (i.e., for surface, subsurface, and aviation), perhaps further diluting the focus on MIW. Others have suggested that MIW's mines/mining and MCM areas be split asunder, with MCM remaining within the N95 Expeditionary Warfare arena and mines/mining responsibility subsumed within the N97 Undersea Warfare community. Such a "divide and counter" plan is just the opposite of what needs to be done and can result only in the further decline of U.S. Navy MIW.

The MIW community must develop its own senior leadership. As things stand in 2015, in all but a few exceptional cases, leaders with no or very little background in mines/mining and MCM requirements, capabilities, or operations are making decisions that will affect the program's future. Even if they are strong

leaders with excellent skills in the bureaucratic process, they might not have the background needed to make the right decisions for mine warfare.

Finally, we must find and nurture long-term MIW champions who are skilled in bureaucratic politics and who possess the managerial strengths to manage technological and operational complexity. After all, mines and MCM systems are sophisticated and complex weapons that wait—too often in vain.

NOTES

1. Mike Hixenbaugh, "Silent Threat: Are Sea Mines the Navy's Achilles Heel?," *PilotOnline .com,* hamptonroads.com/.
2. Harvey Sapolski, *The Polaris System Development: Bureaucratic and Programmatic Success in Government* (Cambridge, Mass.: Harvard Univ. Press, 1972), p. 15.
3. Ibid., pp. 41–60.
4. U.S. Navy Dept., *U.S. Navy Mine Warfare Plan: Meeting the Challenges of an Uncertain World* (Washington, D.C.: Office of the Deputy Chief of Naval Operations for Surface Warfare, OP-03, Mine Warfare / EOD Branch, OP-363, January 1992), p. ii. See also U.S. Navy Dept., *21st Century U.S. Navy Mine Warfare: Ensuring Global Access and Commerce* (Washington, D.C.: Program Executive Office for Littoral and Mine Warfare, and Expeditionary Warfare Directorate N85, April 2009), pp. 4–7.
5. Scott D. Burleson, David E. Everheart, Ronald E. Swart, and Scott C. Truver, "The Advanced Undersea Weapon System: On the Cusp of a Naval Warfare Transformation," *Naval Engineers Journal* (March 2012), pp. 59–60; Joshua J. Edwards and Dennis M. Gallagher, "Mine and Undersea Warfare for the Future," U.S. Naval Institute *Proceedings* (August 2014), pp. 72–73.
6. That said, any ship could be a minelayer, often more than once. During the late summer of 1984, Libya used the commercial ferry *Ghat* to deploy at least nineteen weapons—Soviet / East German "export" mines of a type never seen before in the West—in the Red Sea and Gulf of Suez. Reports indicate that the North Korean navy would deploy some of its fifty thousand mines from thousands of fishing boats and junks.
7. U.S. Navy Dept., *21st Century U.S. Navy Mine Warfare;* Edwards and Gallagher, "Mine and Undersea Warfare for the Future."
8. Burleson, Everheart, Swart, and Truver, "Advanced Undersea Weapon System."
9. These impediments were suggested by peer reviewers of the *Naval War College Review,* who remain anonymous. Elsewhere, I have identified similar concerns.