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**NAVAL WAR COLLEGE
Newport, R.I.**

**AMPHIBIOUS ASSAULT IN THE 21ST CENTURY: ARE THE COSTS AND RISKS
TOO HIGH?**

by

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Major, USMC

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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ABSTRACT

The rise in cost of developing and maintaining an amphibious force in readiness and the risk associated with amphibious operations, in terms of lives, ships, and equipment that could potentially be lost, have raised concerns specifically over the utility of conducting amphibious assaults in the 21st century. Furthermore, the proliferation and development of sea denial weapon systems combined with a reduced naval capability to counter anti-access, area-denial threats have forced military leaders to reconsider the use of amphibious assaults to achieve operational objectives. The following paper will analyze the primary threats of anti-ship missiles and naval mines, identify shortfalls with respect to the U.S. Navy's ability to conduct naval fire support and mine countermeasure operations, and offer a counterargument and rebuttal that will address the concept of "Sea Power 21" as an enabler for the future implementation of amphibious assaults. Finally, conclusions regarding the future of amphibious operations and recommendations towards making amphibious assaults a viable option will be addressed.

INTRODUCTION

Because of the development and proliferation of sea denial weapon systems and the U.S. Navy's reduced capability to conduct naval surface fire support (NSFS) and mine counter measure (MCM) operations, amphibious assault by means of forcible entry will no longer be utilized in the 21st century to achieve U.S. operational objectives. Despite the success of amphibious assaults by American forces during World War II and Korea, both civilian and Department of Defense officials have since raised concerns over the threats posed to amphibious forces and the financial costs associated with funding the capability to conduct amphibious operations. Moreover, military leaders have become reluctant to recommend amphibious assaults as a viable means, which is a result of the costs and risks outweighing the benefits or the existence of alternative course of action to achieve the desired endstate. Ultimately, the anti-access, area-denial capabilities of potential U.S. adversaries must be realized, while deficiencies that would impact amphibious operations must be addressed. The following paper will focus on factors affecting the U.S. ability to conduct amphibious assaults of the future by analyzing current threats of anti-ship missiles and naval mines as well as identifying deficiencies associated with the Navy's ability to conduct NSFS and MCM operations.

COUNTERARGUMENT

In order to conduct amphibious operations in the 21st century, the Navy and Marine Corps have adopted a conceptual framework known as Sea Power 21, which seeks to project

firepower, assure access, and project defense in a range of military operations that would include amphibious assault by means of forcible entry. Based on the concepts of sea strike, sea shield, and sea basing, Sea Power 21 provides for movement and maneuver of forces from ship to objective vice ship to shore and then to objective.¹ Primarily through the concept of sea basing, amphibious forces would be provided with an over the horizon assembly area from which to project forces and sanctuary from threats that include: anti-ship missiles, mines, aircraft, ships, submarines, and small craft. Not only does this concept minimize vulnerability to the amphibious force but it also eliminates dependency on host-nation support and the need for a lodgment from which to project power inland.²

Sea Power 21 also relies on the following assumptions: (1) amphibious assets can be defended from attack, (2) mines can be detected, identified, neutralized, and cleared to allow for follow on surface assaults, (3) movement and maneuver can be conducted by vertical insertion of forces, and (4) availability and access to seaports of debarkation (SPODs) and aerial ports of debarkation (APODs) may be limited during the initial phases of an operation.³ In light of this conceptual framework Under Secretary of the Navy Robert O. Work has noted “the future Marine Corps, closely supported by the U.S. Navy and the joint team, is going to be capable of conducting amphibious assault and conducting joint forcible entry operations ... amphibious assault means nothing more than putting a force ashore on a hostile, or potentially hostile, shore ... If you think Tarawa, that’s old think.”⁴

¹ U.S. Navy and U.S. Marine Corps, *Seabasing*, Navy Warfare Publication (NWP) 3-62M/Marine Corps Warfare Publication (MCWP) 3-31.7 (Washington, DC: Department of the Navy, August 2006), 1-2.

² *Ibid.*, 1-2.

³ *Ibid.*, 1-4.

⁴ Otto Kreisher, “Soldiers from the Sea,” *Seapower* 53, no. 9 (September 2010): 20.

However, this framework has been tied to the development of new ships, aircraft, and vehicles that are multi-mission capable, provide for missile defense, incorporate stealth technology, and have an increased range for deployment from over the horizon. With the exception of the MV-22 Osprey, fiscal constraints have limited or all together canceled the development of such assets that included the DD (X), the CC (X), and the expeditionary fighting vehicle (EFV). In addition, the Marine Corps Operating Concepts for 2010 stated that since 1990, “amphibious lift has been reduced from over 60 ships to just over 30 amphibious ships,” thereby impacting the number of response platforms available for use in amphibious operations.⁵

Further compounding the problem have been the wars in Iraq and Afghanistan that have degraded the Marine Corps’ training in amphibious operations and transformed the Marine Corps into a heavier fighting force. The development of the Mine Resistant Ambush Protected (MRAP) vehicle and the increased armor of the High Mobility Multipurpose Wheeled Vehicle (HMMWV) pose a significant issue to the carrying capacity of amphibious ships and the related ability to rapidly employ the force during amphibious operations. Furthermore, the concept of sea basing could quickly become irrelevant in the face of anti-ship ballistic missiles, which would force naval ships to position themselves at distances that would prove too great for the insertion of Marine forces. Despite a new way of thinking that seeks to avoid the inherent risks faced by Marines during amphibious operations of World War II and Korea, the limitations associated with Sea Power 21 may become a continued source of resistance with respect to utilizing amphibious assault in the future.

⁵ U.S. Marine Corps, *Marine Corps Operating Concepts – Third Edition* (Quantico, VA: Marine Corps Combat Development Command, June 2010), 79.

AMPHIBIOUS ASSAULT

Joint Doctrine states that an amphibious assault by means of forcible entry “involves the establishment of an LF [landing force] on a hostile or potentially hostile shore”⁶ by “seizing and holding of a military lodgment in the face of armed opposition.”⁷ Conducted in three phases, forces must gain and maintain access, open entry points, and transition to follow on operations while overcoming an adversary’s employment of air defense weapons, mines, and anti-ship missiles.⁸ Thus, the success of an amphibious assault is dependent on the ability to achieve maritime and air superiority, clear or breach seaward mines or minefields, and destroy or neutralize an adversary’s coastal defenses and installations through the use of naval fire support.⁹ Although Title 10 stipulates that “the Marine Corps has the primary responsibility for developing LF doctrine, tactics, techniques, procedures, and equipment that are of common interest to the Army and Marine Corps,”¹⁰ the ability to conduct amphibious operations, and more specifically amphibious assault, has come into question. Having spent more than a decade operating primarily as a second land army in both Iraq and Afghanistan and in light of recent budget constraints, the Marine Corps is once again seeking to define both its size and purpose within the Department of Defense. During

⁶ Chairman, U.S. Joint Chiefs of Staff, *Joint Doctrine for Amphibious Operations*, Joint Publication (JP) 3-02 (Washington, DC: CJCS, 19 September 2001), 1-2.

⁷ Chairman, U.S. Joint Chiefs of Staff, *Joint Doctrine for Forcible Entry Operations*, Joint Publication (JP) 3-18 (Washington, DC: CJCS, July 2001), vii and I-1.

⁸ U.S. Marine Corps, *Marine Corps Operating Concepts for a Changing Security Environment* (Quantico, VA: Marine Corps Combat Development Command, March 2006), 35-36.

⁹ Chairman, U.S. Joint Chiefs of Staff, *Joint Doctrine for Amphibious Operations*, Joint Publication (JP) 3-02 (Washington, DC: CJCS, 19 September 2001), I-4 and XIII-3.

¹⁰ U.S. Marine Corps, *Marine Corps Operations*, Marine Corps Doctrine Publication (MCDP) 1-0 (Washington, DC: Headquarters U.S. Marine Corps, 21 September 2001), 2-6.

his remarks to the Navy League's Sea-Air-Space Exposition, Secretary of Defense Robert Gates was quoted as saying, "We have to take a hard look at where it would be necessary or sensible to launch another major amphibious landing again – especially as advances in antiship systems keep pushing the potential launch point further from shore. On a more basic level, in the 21st century, what kind of amphibious capability do we really need to deal with the most likely scenarios, and how much?"¹¹

Proponents of amphibious operations point to the strategic benefits such as deterring aggression, intervening on an allies' behalf, compelling compliance, and exploiting access at the place and time of our choosing.¹² Moreover, seizing a lodgment, airfield, or port in order to introduce follow-on forces will require a continued investment in precision fires, naval surface fire support, maritime pre-positioning, and mine clearing systems.¹³ While military leaders recognize the inherent risk of amphibious forces to anti-access threats and the corresponding need to suppress enemy defenses in the form of guided rockets, artillery, mortars, and missiles (G-RAMM),¹⁴ they have yet to address the growing disparity between sea denial systems, in the form of anti-ship missiles and sea mines, and the U.S. Navy's growing inability to conduct MCM operations or provide landing forces with NSFS.

¹¹ Robert M. Gates, U.S. Secretary of Defense (address, Navy League Sea-Air-Space Exposition, Gaylord Convention Center, National Harbor, Maryland, 3 May 2010. <http://www.defense.gov/speeches/speech.aspx?speechid=1460> (accessed 18 April 2011).

¹² Robert O. Work and Frank G. Hoffman, "Hitting the Beach in the 21st Century," *Proceedings* 136, no. 11 (November 2010): 51.

¹³ Frank G. Hoffman, "Forcible Entry is a Strategic Necessity," *Proceedings* 130, no. 11 (November 2004): 2.

¹⁴ Robert O. Work and Frank G. Hoffman, "Hitting the Beach in the 21st Century," *Proceedings* 136, no. 11 (November 2010): 54.

ANTI-SHIP MISSILES

The French made Exocet, Chinese made Silkworm, and American made Harpoon are just several examples of combat proven anti-ship missiles that have become prevalent in the arms inventory of nation states throughout the globe. The continued development and advances in such anti-access, area-denial weapon systems have not only raised concern over the potential sacrifice of lives, ships, and equipment that could be lost, but also increased the cost of developing future weapon systems and capabilities that would be required to counter this threat. Moreover, the possession or mere threat of having the capability to employ anti-ship missiles can serve the purpose of thwarting an amphibious assault. While much has been said concerning the threat posed by sea mines during Desert Shield/Desert Storm, batteries of Silkworm missiles located along the Kuwaiti coast appear to have created similar consternation over a proposed amphibious assault, leading to an amphibious feint that was successful in fixing six Iraqi divisions along the Kuwaiti shoreline. In effect, “the amphibious feint said as much about the allies’ limitations as it did about their ingenuity. With their poor mine-clearing ability and the failure to destroy Iraq’s Silkworm missiles, an amphibious landing was out of the question.”¹⁵

In response to the Taiwan Strait crisis of 1996 in which President Clinton deployed two carrier strike groups to the region, Chinese military planners have pursued the development of anti-ship missile technology in order to both prevent U.S. interference in the event of a future Taiwan crisis and also increase China’s influence within its maritime

¹⁵ Michael R. Gordon and Bernard E. Trainor, *The Generals’ War* (New York, NY: Little Brown and Company, 1995), 417.

periphery.¹⁶ Specifically, the PLA's approach in developing an anti-access, area-denial capability seeks to destroy or threaten to destroy what they perceive to be a primary threat, in the form of the aircraft carrier. Chinese officials have claimed the Dong Feng 21-D (DF-21D) has a range of between 1800 to 2800 kilometers, can strike a slow moving ship,¹⁷ and can carry a variety of warheads to include a conventional, sub-munitions, or electro-magnetic pulse payload.¹⁸ Targeting for the missile is based on a radar system that selects the largest target reflection, which would typically be indicated by an aircraft carrier.¹⁹ As a mobile, ground delivered weapons system, the DF-21D will likely be deployed with coastal defense units; however, Chinese officials claim that air, surface, and subsurface variants will be developed in the future.²⁰

While anti-ship missiles have been employed for over 30 years, the recent Chinese development of an anti-ship ballistic missile is cause for concern in the future execution of amphibious operations. Despite still being under development and costing an estimated 10 million dollars per missile,²¹ the future proliferation of the DF-21D will be a game changer for military planners. The loss of an aircraft carrier or amphibious ship would have serious implications on the success of an amphibious assault. Officials must now consider the cost and benefit associated with risking the loss of what would likely be both a strategic and operational center of gravity. In addition, determining when and under what circumstances

¹⁶ Andrew S. Erickson, "China's Evolving Anti-Access Approach: Where's the Nearest (U.S.) Carrier?" *China Brief* 10, no. 18 (10 September 2010): 5.

¹⁷ Andrew S. Erickson, "Chinese Sources Discuss the Anti-Ship Ballistic Missile (ASBM) Threat to the U.S. Navy" (lecture. U.S. Naval War College, Newport, RI, 21 March 2011).

¹⁸ Andrew S. Erickson, "China's Evolving Anti-Access Approach: Where's the Nearest (U.S.) Carrier?" *China Brief* 10, no. 18 (10 September 2010): 6.

¹⁹ *Ibid.*, 6.

²⁰ *Ibid.*, 5.

²¹ Andrew S. Erickson, "Chinese Sources Discuss the Anti-Ship Ballistic Missile (ASBM) Threat to the U.S. Navy" (lecture. U.S. Naval War College, Newport, RI, 21 March 2011).

such a missile would be employed will have a significant impact on employment of amphibious forces. In effect, U.S. limitations associated with defending against an anti-ship missile attack or saturation attack must be addressed if amphibious assaults are to remain relevant in the 21st century.

NAVAL MINES

In contrast to the development of high technology anti-access, area-denial weapon systems like the anti-ship missile, naval mines continue to be one of the most effective naval weapons that can have a major effect on the conduct of amphibious operations. Used to “hinder, disrupt, and deny adversary sea operations,” naval mines can be combined with other anti-access, area-denial assets to reduce surface and subsurface threats.²² Characterized as simple, reliable, highly destructive, and cheap to produce and procure, the U.S. must consider that both state and non-state actors not only have the capability to acquire naval mines but also the willingness to use them in the defense against an amphibious assault.²³ Be it by ship or aircraft, naval mines can be laid through both high and low technological means. Unlike other weapon systems that can quickly become outdated, older mines remain lethal and can be upgraded as a result of technological advancements. Moreover, the development and manufacture of new models has created a naval mine with twice the power of its predecessor and a range of lethality that exceeds a half-mile.²⁴ In 2003, an estimated

²² Chairman, U.S. Joint Chiefs of Staff, *Barriers, Obstacles, and Mine Warfare for Joint Operations*, Joint Publication (JP) 3-15 (Washington, DC: CJCS, 2007), IV-3.

²³ Milan Vego, *Mine Warfare* (Newport, RI: U.S. Naval War College, 2008), 9.

²⁴ *Ibid.*, 6.

275,000+ naval mines could be found throughout the world;²⁵ when combined with the fact that over 50 of the world's navies have a mine laying capability, it is clear mine warfare will continue to pose a threat to amphibious assaults of the 21st century.²⁶

Historical analysis suggests naval mine operations significantly effect amphibious assaults. Having procured approximately 4,000 mines from the Soviet Union, North Korean forces were successful in laying over 3,000 mines in the port of Wonsan during the Korean War. This led to the sinking of a ROK mine sweeper and additional strikes against naval vessels, which ultimately resulted in a delay of the U.S. Navy's amphibious assault.²⁷ Moreover, total losses during the Korean conflict included four minesweepers, one tug, and included significant damage to five destroyers.²⁸ The effect was so profound that senior naval leaders like Rear Admiral Smith, the amphibious task force commander at Wonsan, would later comment "we have lost command of the sea to a nation without a navy, using weapons that were obsolete in World War I laid by vessels that were used at the time of the birth of Jesus Christ."²⁹

The use of naval mines during Desert Shield/Desert Storm offers a more recent example of how the threat of mines thwarted an amphibious assault. Employing a combination of pre-World War I Russian contact mines and high-technology magnetic and acoustic mines purchased from the Soviet Union and Italy, Iraq was able to secure the sea lines of communication to Kuwait and prevent the U.S. from pursuing its plans to conduct an

²⁵ Ibid., 2.

²⁶ Chairman, U.S. Joint Chiefs of Staff, *Barriers, Obstacles, and Mine Warfare for Joint Operations*, Joint Publication (JP) 3-15 (Washington, DC: CJCS, 2007), IV-1.

²⁷ Milan Vego, *Mine Warfare* (Newport, RI: U.S. Naval War College, 2008), 3.

²⁸ Ibid., 3.

²⁹ Ocean Studies Board, National Research Council, *Oceanography and Mine Warfare* (Washington, DC: National Academy Press, 2000), 12, <http://books.nap.edu/openbook.php?isbn=0309067987&page=12> (accessed 18 April 2011).

amphibious assault.³⁰ Furthermore, post-conflict estimates indicate approximately 1,167 mines were laid using both high and low technology means of delivery, which included the use of minesweepers, landing craft, auxiliary ships, Hip helicopters, B-6 bombers, and even row boats.³¹ Although only two U.S. warships were damaged during the conflict, the potential loss of ships and amphibious assault vehicles played a primary role in contributing to the opposition of an amphibious assault.

In light of the proliferation of naval mines in today's operating environment and the historical trends of mine warfare, the presence of naval mines will continue to be an obstruction to forcible entry operations of the future. For military decision makers, suspected minefields or simply the threat of employing naval mines could be just as effective as a surface combatant striking a mine or identifying the presence of mines prior to an amphibious operation. Moreover, the psychological impediment to conducting an amphibious assault will be driven by human nature, in which senior leaders think in terms of the most serious consequences.³² The presence or threat of mines will have both a tactical and operational impact, in which an analysis of costs and benefits of an assault are concerned not only with the loss of lives and equipment but also with the strategic influence corresponding to media coverage and its effect on the public's support for a military operation.

³⁰ U.S. Department of Defense, *Conduct of the Persian Gulf War: Final Report to Congress* (Washington, DC: U.S. Department of Defense, April 1992), 200-201.

³¹ *Ibid.*, 200.

³² Milan Vego, *Mine Warfare* (Newport, RI: U.S. Naval War College, 2008), 9.

MINE COUNTERMEASURE OPERATIONS

MCM operations have played a significant role in almost every U.S. maritime conflict by seeking to counter enemy-laid mines in order to permit friendly maneuver or the use of selected land and sea areas during amphibious operations.³³ Based on the proliferation and threat of naval mines, MCM operations will play a critical role in amphibious operations of the 21st century. However, mine hunting and mine sweeping are costly and time consuming processes that continue to be inadequate against the most advanced mines or those placed in the very shallow waters (VSW) from depths of 40 feet through the surf zone.³⁴ Moreover, the U.S. Navy's focus on mine clearance of the deep water, from depths of 600 to 40 feet, and lack of investment in those capabilities designed to clear the VSW have created a critical vulnerability to landing craft and assault vehicles required to conduct an amphibious assault.³⁵ The current U.S. inventory includes 14 Avenger class ships, with no ships currently scheduled for construction. Based on the challenge of moving these ships into theater and subsequently providing for the delivery of critical repair parts for their maintenance, it would appear the investment in MCM capabilities is not a current priority of the Navy.

In addition, the need to conduct MCM operations has often relied on allied or coalition assistance, further indicating the inherent lack of capability on the part of the U.S. Navy to provide a critical requirement in the conduct of amphibious assaults. The clearance

³³ Chairman, U.S. Joint Chiefs of Staff, *Barriers, Obstacles, and Mine Warfare for Joint Operations*, Joint Publication (JP) 3-15 (Washington, DC: CJCS, 2007), IV-1.

³⁴ Milan Vego, *Mine Warfare* (Newport, RI: U.S. Naval War College, 2008), 2.

³⁵ Michael O'Neal, "The Mine Threat to Amphibious Warfare (2003)," in *Amphibious Operations*, Course Book and Readings 8907, AY 2009, 4-29 to 4-35 (Quantico, VA: Marine Corps University, 2009), 4-31.

of Wonsan Harbor in 1950 saw the employment of both ROK and Japanese civilian sweepers;³⁶ forty years later, the U.S. was relying on British MCM assets, under the tactical control of the U.S. MCM Group (USMCMG), to clear mines for the potential amphibious assault against Iraqi forces entrenched along the Kuwaiti coast.³⁷ Following the liberation of Kuwait and the establishment of a ceasefire, Belgian, French, German, Italian, Japanese, and Dutch MCM assets were utilized to clear the Iraqi naval minefields.³⁸ Had the plans to conduct an amphibious assault gone forward, it is estimated that 10 days of dedicated mine clearing would have been required to clear a path through the minefield.³⁹ Based on the events of the USS Tripoli and USS Princeton during Operation Desert Shield/Desert Storm, in which both ships were struck by naval mines during the conduct of MCM operations in the Persian Gulf, the continuation of MCM operations and the execution of the planned amphibious assault of the Kuwaiti coast would likely have resulted in additional casualties and damage to U.S. naval forces.

Because of the proliferation of mines, MCM operations are a critical capability required to conduct amphibious assaults or other types of amphibious operations. The risk posed to ships operating in deep water, as well as the threat to amphibious vehicles and landing craft conducting an assault, must be calculated against the benefits of achieving the desired military objectives. The reliance on coalition or allied assistance to conduct MCM, the limited numbers of U.S. Navy MCM assets, and the failure to develop VSW MCM capabilities have created a critical vulnerability that future adversaries will attempt to exploit.

³⁶ James A. Meacham, "Four Mining Campaigns: An Historical Analysis of the Decisions of the Commanders," *Naval War College Review* 19, no. 10 (June 1967): 105.

³⁷ U.S. Department of Defense, *Conduct of the Persian Gulf War: Final Report to Congress* (Washington, DC: U.S. Department of Defense, April 1992), 202.

³⁸ *Ibid.*, 207.

³⁹ *Ibid.*, 216.

These factors will play an important role in the decision making process as to when and where an amphibious assault will be conducted in the future.

NAVAL SURFACE FIRE SUPPORT

NSFS provides an all-weather, sea-based capability that can be used to destroy or neutralize enemy installations and defenses that oppose ships, aircraft, landing forces, and advancement of post-landing forces employed in an amphibious assault. The mobility, high rate of fire, and variety of ordnance affords amphibious forces prolonged support during the assault, establishment of a lodgment, and the execution of follow-on operations both ashore and inland. Moreover, historical examples of amphibious assaults in the 20th century, to include Normandy, the island hopping campaigns of the Pacific, and Inchon, were successful in large measure because of the use of NSFS. Although technology has changed many aspects of the battlefield, NSFS will continue to be an essential element to forcible entry from the sea. While lacking the precision of ship launched cruise missiles, NSFS provides a comparatively cheap source of firepower that can be massed against enemy targets and delivered under circumstances that would prohibit the use of aviation assets.

In March 2006, former Commandant of the Marine Corps General Michael Hagee reported, “firepower, including responsive, lethal, and persistent fires from U.S. Navy surface ships, is essential in expeditionary operations against irregular and conventional forces.”⁴⁰ He went on to indicate that suppressive fires are necessary to facilitate maneuver

⁴⁰ General Michael W. Hagee, Commandant, United States Marine Corps, to The Honorable Donald C. Winter, U.S. Secretary of the Navy, “Marine Corps Views and Recommendations for Naval Surface Fire Support,” Memorandum, March 2006.

during the critical transition from ship to shore by vertical and surface assault elements of the amphibious force.⁴¹ Furthermore, “the 2000 Johns Hopkins University Applied Physics Laboratory study found 12 DD-21 ships (with magazines for 1,500 rounds on each ship, as well as a rapid resupply capability) were required for a Marine expeditionary force-level, high-intensity operation over a 17-hour period.”⁴² In effect, a degradation of the U.S. Navy’s capability to provide NSFS would negatively impact the ability to conduct an amphibious assault in the future.

Since the retirement of the Iowa-class battleships, the U.S. Navy has relied on its cruisers and destroyers to provide NSFS, specifically with the use of the Mk 45 Mod 2 5-inch/54 caliber gun. Shooting a ballistic round that has a limited range of up to 13 nautical miles, the U.S. Navy began development of the Mk 45 Mod 4 5-inch/62 caliber gun weapon systems (GWS) for installation on both its destroyers and cruisers, thereby providing an improved capability by firing both conventional and extended range munitions (ERM) capable of striking targets at ranges up to 63 nautical miles.⁴³ In addition, the Navy began designs for the 155mm advanced gun system (AGS) for installation on the newly designed DD(X) warships, which would provide rapid and effective NSFS at distances of up to 100 nautical miles.⁴⁴

However, operational, procurement, and budget constraints have left these upgrades unfulfilled. The Mk 45 Mod 4 was introduced on the DDG 81 class of ships, but the upgrade

⁴¹ Ibid., 1.

⁴² James W. Hammond III, “NSFS Shortfalls,” *Marine Corps Gazette* 90, no. 3 (March 2006) 32.

⁴³ Curtis Marsh, ed., *Naval Fires in Support of Expeditionary Maneuver Warfare Concept of Employment (2008-2018)* (Arlington, VA: EDO Professional Services, 2005), B-28.

⁴⁴ Ibid., B-50.

has yet to be installed on the DDG-51 class and has been cancelled for the Navy's cruisers.⁴⁵ While the Mk 45 Mod 4 will eventually be installed on the DDG-51 class by a mandate from Congress, they will not be equipped with the magazine or shell handling equipment to fire the ERM.⁴⁶ The ERM has also met with disappointment with only two of seven successful test fires being conducted in 2005, and proposed procurement costing upwards of \$50,000 per round, depending on the number purchased.⁴⁷ Moreover, implementation of the AGS was delayed and the DD(X) and CC(X) class of ships were summarily canceled. Even more disconcerting, since 1999 the Department of the Navy has only procured non-explosive ammunition for training purposes and cancelled purchases for illumination and smoke variants, indicating to some officials that expenditure rates and a lack of procurement will limit the number of rounds per surface combatant to the point of leaving the Navy incapable of providing timely volume of fires vital to an amphibious assault.⁴⁸ Similarly, the NSFS plan has failed to address issues of target acquisition, which would improve force protection of assault elements during early stages of forcible entry operations.⁴⁹ Ultimately, the Navy and Marine Corps must come to terms with these deficiencies and recognize issues relating to development and procurement of NSFS weapon systems will have significant consequences to amphibious operations of the 21st century.

⁴⁵ James W. Hammond III, "NSFS Shortfalls," *Marine Corps Gazette*, March 2006, 31-32.

⁴⁶ *Ibid.*, 31-32.

⁴⁷ *Ibid.*, 31.

⁴⁸ Curtis Marsh, ed., *Naval Fires in Support of Expeditionary Maneuver Warfare Concept of Employment (2008-2018)* (Arlington, VA: EDO Professional Services, 2005), B-27.

⁴⁹ James W. Hammond III, "NSFS Shortfalls," *Marine Corps Gazette* 90, no. 3 (March 2006) 32.

CONCLUSION & RECOMMENDATIONS

Proponents of amphibious operations emphasize that “retaining the ability to project power and conduct landing operations into hostile territory remains strategically important to American global interests.”⁵⁰ In addition, the Navy and Marine Corps will continue to assert they have the ability to conduct amphibious assaults by means of forcible entry. However, concern over the potential loss of an aircraft carrier, amphibious ship, or American resolve, due to high casualty rates, will severely limit the use of amphibious assault as a primary means to achieve future military objectives because of an unwillingness to risk an operational or strategic center of gravity. Ultimately, the U.S. will continue to secure its diplomatic, economic, and military objectives by projecting its influence in the international community through the use of sea power. This power projection will be achieved through the continued execution of amphibious operations, in the form of humanitarian assistance, disaster relief, noncombatant evacuations, demonstrations, and raids. Moreover, enhancing passive and active defenses against anti-ship ballistic missiles, reducing dependence on coalition partners, and increasing standoff capability of amphibious forces may serve to bolster the probability of employing the Navy and Marine Corps in an amphibious assault of the 21st century. While proliferation and advancement of sea denial weapon systems will inevitably continue, benefits of conducting an amphibious assault may yet be realized if deficiencies associated with NSFS and MCM are rectified and prioritization is given to developing and improving upon current tactics, techniques, and procedures (TTPs) and future conceptual models.

⁵⁰ Robert O. Work and Frank G. Hoffman, “Hitting the Beach in the 21st Century,” *Proceedings* 136, no. 11 (November 2010): 56.

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