

# The Problems Facing United States Marine Corps Amphibious Assaults

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**Abstract:** There are calls by some experts to accept that an amphibious assault of coastline is simply too risky to attempt due to current threats. So, what are the challenges facing amphibious assaults? Is the amphibious assault still a viable type of military operation in the current threat environment? These questions are at the heart of the mission and role of the United States Marine Corps. This analysis delves deep into the problems facing amphibious assaults, and it serves as a primer for future discussions pertaining to improving amphibious assault capabilities.

**Keywords:** amphibious operations, amphibious assault, antiaccess/area-denial, A2/AD, near-peer competitors, threats, vulnerability

This analysis highlights areas of concern for modern United States Marine Corps amphibious assaults. The goal of this analysis is to show that current amphibious assault capabilities carry enormous risk against major powers and potentially all powers possessing near-peer weaponry, unless a landing is unopposed. This analysis will explore numerous reasons for this, and it will bring greater attention to key issues that affect capabilities. This analysis is meant to be actionable information on current limitations and vulnerabilities of U.S. amphibious forces, in order to chart a way forward for a robust forcible entry capability from the sea.

First, it is necessary to define the terminology concerning amphibious op-

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erations. An *amphibious operation* is a military operation launched from the sea by an amphibious force to conduct landing force operations within the littorals. The littorals include any land areas (and their adjacent sea and associated air space) that are primarily susceptible to engagement and influence from the sea and may reach far inland.<sup>1</sup> Additionally, “amphibious operations require the unique ability to operate across air, land, and sea. Amphibious operations, also, require integrated command and control to achieve unity of effort, increased speed of action, and coordinated application of sea control and power projection capabilities.”<sup>2</sup>

There are a few types of amphibious operations. This analysis concentrates on the amphibious assault. The following excerpt explains this type of amphibious operation:

An amphibious assault is launched from the sea by an [amphibious force], embarked in ships or crafts, to land the [landing force] and establish it on a hostile or potentially hostile shore. The salient requirement of an amphibious assault is the necessity for rapid build-up of combat power ashore to full coordinated striking power as the attack progresses toward [amphibious force] objectives. The organic capabilities of [amphibious forces], including air and fire support, logistics, and mobility, enable them to gain access to an area by forcible entry.<sup>3</sup>

Additionally, amphibious assaults are some of the most difficult operations due to their complexity, and they are the most difficult type of amphibious operation.<sup>4</sup> An amphibious assault has the following phases:

1. Forces arrive in the operational area.
2. Preparation of the landing area by supporting arms.
3. Ship-to-shore movement of the landing force.
4. Air and surface assault landings.
5. Linkup operations between surface and air landed forces.
6. Provision of supporting arms and logistics and/or combat service support.
7. Landing of remaining required landing force elements.
8. Mission accomplishment.<sup>5</sup>

American history will remember the first half of the twenty-first century as a perilous era for U.S. national security. The threats of nonstate actors, rogue regimes, and near-peer powers create a pool of potential enemies that may seek a military confrontation with the United States and its allies to accomplish their strategic objectives. These threats include islands in the Western Pacific

contested by China, a potential Russian invasion of Eastern or Northern Europe, the ever-present threat of North Korea, the threat of a Chinese invasion of Taiwan, Iran's operations in the Persian Gulf, and nonstate actors across the world. There are several potential theaters of action that may demand the use of U.S. military forces against major powers, rogue regimes, or nonstate actors. The Marine Corps should not expect any single potential enemy to go to war with the United States and its allies. This means the Marine Corps must be able to win in a variety of wars against a multitude of actors that will contest all domains and use increasingly potent antiaccess/area-denial (A2/AD) weaponry. In such a threat environment, the amphibious assaulter must be able to win in a variety of operations, including a variety of tactical situations against potential enemy militaries or irregular forces. Because of the breadth of this security situation, this analysis will concentrate on general threats facing amphibious assaults, rather than concentrating on any one geopolitical situation.

This article will address several limitations and vulnerabilities one phase of an amphibious assault at a time, with specific concerns in each of these phases. This analysis gives special attention to the advanced military forces currently employed by major powers, since they represent the greatest threat to Marines.

## **Problems with Movement to the Area of Operations Limited Protection for Amphibious Warfare Ships against Near-Peer Attempts at Sea Denial**

Amphibious task forces (ATFs) transiting from U.S. bases to the theater of operations will face grave risk due to enemy sea-denial capabilities able to project power into open ocean. These capabilities are possessed primarily by China and Russia, such as sophisticated surveillance systems hunting for the ATF, attack submarines armed with torpedoes and antiship missiles, long-range bombers able to launch antiship missiles, carrier-based aircraft, land-based long-range precision fires, or surface combatants. These assets can threaten the ATF in the open ocean while it transits to the battle zone.<sup>6</sup>

An amphibious Ready Group (ARG) consists of a Marine Expeditionary Unit (MEU) and at least three amphibs, allowing for a flexible and a capable force able to accomplish a variety of amphibious operations. Currently, an ARG consists of an amphibious assault ship, an amphibious transport dock, and a dock landing ship.<sup>7</sup> Amphibious assault ships are effectively small aircraft carriers, often with well deck capability for the deployment of surface connectors. Amphibious transport docks are another hybrid-style vessel with a well deck for surface connectors and a much smaller flight deck that supports only vertical aircraft. Dock landing ships have extensive well deck space for more surface connectors or more room for cargo. The trade-off for a dock landing ship versus amphibious transport dock is the loss of a hangar for aircraft maintenance,

which reduces the ability to support aircraft compared to the amphibious transport dock.

In relation to the threat of enemy naval assets while transiting in open ocean, amphibis lack the antisubmarine warfare, antisurface warfare, and antiair warfare capabilities of surface combatants, aircraft carriers, and attack submarines. This means an ATF will need to be composited with escorts to protect it in open ocean, especially against a blue-water naval power like the People's Republic of China. A carrier strike group (CSG) escort will likely be a key part of giving amphibis the most protection from a panoply of surface, aerial, and subsurface threats in blue-water environments and the littorals. A CSG is an obvious choice given its offensive and defensive capabilities, coupled with the command and control necessary to integrate a multimission fleet.

Such a command and control capability is needed to support a Marine Expeditionary Brigade (MEB) of multiple ARGs, because amphibis do not currently possess the ability to integrate with multimission ships like destroyers or cruisers. This capability is in development with the up-gunned Expeditionary Strike Group (ESG) concept. The up-gunned ESG is a concept that aims to defend against adversarial threats in the undersea, surface, and air domains as well as provide offensive firepower to strike from the sea to a traditional ARG. This is done by adding surface combatants to the ESG and incorporating the Lockheed Martin F-35B Lightning II joint strike fighter aircraft.<sup>8</sup>

Additionally, potential enemies can detect an ATF over-the-horizon (OTH) from their shoreline and deploy tactical aircraft against the ATF and launch many antiship missiles over-the-horizon from aircraft, submarines, and ships operating in the littorals or from land-based launchers as the ATF comes closer to contested shoreline. While an ATF has several options for missile defense, including point defense on amphibis, escorts providing area missile defense, and F-35B aircraft, the closer the ships of the ATF come to shore, the less effective these defenses become. This is because it is easier to detect a task force the closer it is to shore, because the reaction time of an ATF to aircraft and missiles decreases the closer to shore it is and the number of weapons an enemy may use increases the closer to shore an ATF comes. These same issues are also true of ships performing fire support for the task force, since they must come within range of using naval guns.<sup>9</sup>

Furthermore, a key aspect of modern attempts at sea denial by near-peer adversaries, such as Russia and China, is the concept of A2/AD military capabilities. These are the "family of military capabilities used to prevent or constrain the deployment of opposing forces into a given theater of operations and reduce . . . [the opposing force's] freedom of maneuver once in a theater."<sup>10</sup> These capabilities limit the projection of power by the United States and its allies, and this includes naval power projection such as amphibious operations.<sup>11</sup>

These defenses encompass threats from enemy aircraft, submarines, ships, and missiles.<sup>12</sup> The threat of antiship missiles constrain the deployment of an ATF or CSG into a theater, such as the Western Pacific, and makes them vulnerable to attack.<sup>13</sup> Another threat to amphibians are antiship missiles, since such missiles pose a threat to CSG escorts.

Currently, there are three broad types of antiship missiles. These types of missiles include antiship cruise missiles, hypersonic weapons, and antiship ballistic missiles. First, there are cruise missiles, which are unmanned, self-propelled, self-guided missiles that use aerodynamic lift during most of their flight path and which are designed to deliver a payload to a target. Antiship cruise missiles (ASCMs) are designed to strike ships and can be launched from submarines, ships, aircraft, or land-based launchers.<sup>14</sup> ASCMs traveling at supersonic speeds and launched from a coastline will allow around 47 seconds to reach an ATF 30 nautical miles (nm) away; 30 nm is over-the-horizon from a shoreline. Slower ASCMs may stay at low altitude and skim the ocean's surface to avoid radar detection, resulting in the ability to detect them 18 nms from a ship, reaching an ATF in two minutes.<sup>16</sup>

New hypersonic weapons, which could be deployed by both China and Russia by 2020, pose a major threat to amphibians.<sup>17</sup> Hypersonic weapons can be maneuverable, travel at speeds in excess of 5,000–25,000 km per hour, can fly at unusual altitudes—between a few tens of kilometers and 100 km—and hypersonic weapons are difficult to detect with radar until late in the weapon's flight. The combination of high speed, maneuverability, and unusual altitudes make hypersonic weapons difficult to counter using current missile-defense technologies, and it makes them unpredictable as to their targets until the last minutes of flight.<sup>18</sup> The delay in detection for hypersonic weapons means decision makers will have less time to respond and may allow only one intercept attempt.<sup>19</sup>

Another emerging threat to amphibians is the development of antiship ballistic missiles (ASBMs), which are ballistic missiles designed to strike a warship at sea. Ballistic missiles are a rocket-propelled, self-guided weapon system that follows a ballistic trajectory to deliver a payload from its launch site to a predetermined target.<sup>20</sup> ASBMs include the Chinese Dong Feng-21D and Dong Feng-26, the Russian Kh-47M2 Kinzhal, and the Iranian Khalij Fars ballistic missiles.<sup>21</sup> Chinese and Russian ASBMs possess enormous range and can strike targets hundreds of nautical miles away.<sup>22</sup> Additionally, ASBMs require ballistic-missile defenses to counter, which amphibians, and even many large surface combatants, lack.

How dangerous this antiship missile environment is becoming is clearer given the lengths the U.S. Navy has gone to defend its aircraft carriers. Due to the long ranges of ASBMs, the U.S. Navy has proposed a drone aerial refueler

called the Boeing MQ-25 Stingray to almost double the ranges of an aircraft carrier's current aircraft. The goal of the program is to allow aircraft carriers to strike targets 700 or more nautical miles away.<sup>24</sup>

The enormous threat of antiship missiles to amphibians has influenced the doctrine and tactics of the Marine Corps as well. The Marine Corps developed a new military concept proposed to protect amphibians from antiship missiles. This concept calls for OTH amphibious operations beyond radar and visual range of shore. The decision to conduct OTH operations may principally be a force protection decision to mitigate threats such as antiship missiles.<sup>25</sup> As for amphibious operations that take place within radar and visual range of shore, this article will refer to them as conventional amphibious operations.

Conventional amphibious operations are not a feasible option against a defended shoreline, because of the need to put amphibians within 3,000–4,000 yards of shore. Thus, a broad range of weapons can target amphibians, including, potentially, small arms and enemy vehicles armed with large caliber guns or antitank guided missiles (ATGMs). The reason for coming so close to shore is that a realistic distance for the amphibious assault vehicle (AAV) to swim to shore is only 3,000–4,000 yards. This necessitates OTH amphibious operations in the current threat environment.

However, a technological solution to enemy A2/AD precision-guided fires is elusive. Even the planned replacement for the AAV, the proposed BAE Systems Amphibious Combat Vehicle (ACV), will be incapable of swimming to shore over-the-horizon in the early phases of the program. The proposed 1.2 phase of the ACV program will only have a realistic distance to swim to shore of 12 nm and have 250 statute miles to work with on land. Even disembarking landing craft at a distance of 12 nm from shore, precision-guided fires, such as ASCMs, will allow little time to react. Thus, for a conventional amphibious operation to succeed, with little risk of incurring losses of amphibians, it will need to be unopposed. This analysis will later revisit a lack of surface forcible entry capability concerning OTH amphibious operations. The vulnerability of amphibians to near-peer fires is perhaps the most pressing problem there is to the amphibious assault.

Furthermore, the proliferation of antiship missiles to nonstate actors is an enormous threat to open sea lanes, commercial vessels, U.S. ships, and allied ships all over the world. The threat of antiship missile proliferation is underscored by a recent event in which Iranian-backed Houthi rebels in Yemen launched two cruise missiles at targets in the Red Sea. The guided-missile destroyer USS *Mason* (DDG 87) launched three interceptors and neither cruise missile hit their targets, but while unsuccessful, this event shows that a nonstate actor can acquire weapons that may threaten U.S. surface vessels, including amphibians. This creates an environment where nonstate actors could possess weap-

ons able to inflict significant losses against a U.S. or allied amphibious assault.

### **The Threat of Naval Mines Laid in Approaches, in Shallow Water, or in the Surf Zone**

Naval mines are easy to emplace by ship, aircraft, or submarine, and they present a valid threat to a commander, who must rely on naval support or on sea-borne reinforcement and resupply. During amphibious operations, assault and assault follow-on shipping must transit narrows and operate in shallow waters. This allows an enemy to place these forces at risk, with little cost to its own forces, by emplacing only a few mines.<sup>29</sup> Naval mines can threaten amphibious shipping, surface connectors carrying the larger and heavier elements of the assault force, and the landing force equipment and personnel as they move ashore. Naval mines are also a relatively low-cost way to stop an amphibious assault.<sup>30</sup> Naval mines also represent a way for less advanced forces to limit the amphibious capabilities of more advanced navies. This is evident by the failure to prosecute an amphibious assault in the Korean War at Wonsan (1950) and by the decision not to carry out an amphibious assault in the Persian Gulf during the First Gulf War (1990–91).<sup>31</sup>

Naval mine warfare consists of the strategic, operational, and tactical employment of sea mines and mine countermeasures (MCM). Mine warfare divides into two categories: the emplacement of mines by friendly forces to degrade the enemy's capabilities to wage land, air, and maritime warfare, and the countering of enemy mining capability or emplaced mines in order to permit friendly maneuver. Naval mine warfare played a significant role in every major armed conflict involving the United States since the Revolutionary War. Mines can be inexpensive, easy to procure, reliable, effective, and difficult for intelligence agencies to track. More than 50 of the world's navies have mine-emplacing capability, and a considerable number of countries, many of which are known mine exporters, actively engage in the development and manufacture of new models. While relatively old, mine stockpiles remain lethal and often upgradable.<sup>32</sup>

Current Chinese- and Soviet-era mines include a variety of mines detonated by contact, such as magnetic signature of a ship or submarine, acoustic signature, water pressure, and multiple-influence (e.g., acoustic or magnetic sensor). These mines include remote-controlled mines that can be deactivated when friendly ships or submarines are nearby and then reactivated, rocket-propelled mines that rise from deep underwater and can be emplaced in choke points and open ocean, and mobile mines that possess the ability to maneuver along a predetermined path for a set period of time before reaching a destination, shutting off its engine, and sinking to the bottom.<sup>33</sup>

MCM includes all actions to prevent enemy mines from altering friendly

forces' maritime plans, operations, or maneuver. MCM reduces the threat of mines and the effects they have on friendly naval force and seaborne logistics force by granting access to and transit of selected waterways. MCM divides into offensive MCM and defensive MCM. The best method to ensure mobility and counter naval mines is offensive MCM, which is the destruction or deterrent of enemy assets and capabilities responsible for the production and employment of sea mines early in a conflict. Offensive MCM deters or destroys enemy mining capability before the mines are emplaced, with capabilities that include enemy mine layer, mine storage, and, ultimately, mine production facilities and assets.<sup>35</sup>

Defensive MCM, on the contrary, is countering naval mines after they are emplaced.<sup>36</sup> Defensive MCM further divides into passive and active. Passive MCM reduces the threat from emplaced sea mines without physically attacking the mines by reducing the ship susceptibility to mine actuation. There are three methods to passive MCM. These methods include localization of the threat by establishing a system of transit routes to minimize exposure to potentially mined waters, detection and avoidance of mine fields using intelligence that allows friendly shipping to route around the mined area, and risk reduction by limiting contact with mine sensors. Risk reduction can be accomplished by reducing the magnetic signature of a ship, reducing a ship's radiated noise, reducing a ship's emissions, avoiding contact mines through more lookouts and shallower draft, reducing a ship's speed to avoid triggering pressure sensors, and enhancing a ship's survivability if a mine detonates.<sup>37</sup>

Active MCM, on the other hand, includes minesweeping and minehunting. Minesweeping entails either the towing of specially equipped mechanical cables to sever moored mines so that they float to the surface or towing devices that emulate the signatures of target ships to trigger explosive mines. This is conducted by either surface craft or helicopters with explosive ordnance disposal divers destroying mines that float to the surface. Minehunting is the use of sensors and neutralization systems, whether surface, aerial, or subsurface, to dispose of individual mines. When mines are located, they are disposed of by remote-controlled vehicles, explosive ordnance disposal divers, or marine mammals. Minehunting occurs to verify the presence or absence of mines in a given area, or it is used to eliminate mines in a known field when minesweeping is not desirable or feasible. Minehunting poses less risk to MCM forces, covers an area more thoroughly, and provides a higher probability of mine detection than minesweeping.<sup>38</sup>

However, breaching operations against enemy minefields with MCM assets providing minesweeping or minehunting are a poor option for an amphibious assault because they require air superiority and littoral sea control and can last for days, giving enemy forces time to mass.<sup>39</sup> Additionally, once detected, the



MCM force could compromise the location of the landing. Therefore, breaching operations may void the possibility of a landing or force a landing to occur against a well-defended shoreline.

This highlights the reality that the prevention of minefields is of the utmost importance to secure friendly maneuver from the sea for amphibious operations. An enemy's mine warfare assets and capabilities must be high-value targets and thus eliminated early in a war. Otherwise, the alternatives to breaching operations will be a combination of using transit routes for the amphibious force that avoid potential minefields, likely found in predictable approaches from the sea and reconnaissance and intelligence gathered by MCM assets on where mines are located, so the landing force can avoid mines while swiftly making their way to shore from over-the-horizon. Additionally, ships of the ATF and surface connectors will need reduced signatures against sensors on sea mines. However, outmaneuvering enemy naval mines may not always be possible, due to geography or political considerations in neighboring nations' waters. This only adds emphasis to the mission of offensive MCM.

If a large minefield separates Marines from an objective, as would happen in a geological choke point like the Strait of Hormuz, one option may be to rely more on the aviation combat element to transport Marines to their objectives for an amphibious assault or amphibious raid. This could occur while mine-breaching operations open the way for surface connectors, armor, and heavy logistic support to eventually reach Marines assaulting key positions.

The problem of naval mine warfare may get even worse as the mine warfare capabilities of the Russian Federation and China modernize and client states like Iran, Syria, and North Korea procure more advanced naval mines. Some advancements in mine technology include the development of smart mines that can distinguish between the signatures of friendly and nonfriendly ships and submarines. These mines will not activate in the presence of a friendly ship or submarine. Another advancement in development is a universal mine that can be emplaced from a wide variety of ships, submarines, and aircraft. This advancement could be a game changer by allowing a plethora of enemy assets to lay minefields of advanced mines rapidly in place of more specially built minelayers.<sup>41</sup>

In response, the U.S. Navy is developing a variety of new MCM technologies and methods to allow the massing of MCM assets in a war. This involves a current effort of using a variety of friendly ships to house MCM assets, such as explosive ordnance disposal divers, and the commissioning of littoral combat ships with the MCM mission module.<sup>42</sup> Littoral combat ships will need to replace aging *Avenger*-class MCM ships, some of which are already decommissioned.<sup>43</sup> However, there are still significant issues with breaching operations during a war, even with the best that technology can so far provide. These MCM

assets will still need air superiority and littoral sea control to carry out breaching operations safely. There is also the potential for the littoral combat ships with the MCM mission module to not be any faster at breaching minefields than the *Avenger*-class MCM ships and will require their unmanned vehicles to have line-of-sight communications to the littoral combat ship.<sup>44</sup>

## **Problems with Preparation of the Landing Area by Supporting Arms Difficulty Securing Air Superiority**

According to Joint doctrine, air superiority is control of the air by a military force that permits that force to conduct its military operations at a time and place without prohibitive interference from air and missile threats. These missile threats include enemy cruise missiles, ballistic missiles, and hypersonic weapons. Air threats include helicopters, tiltrotors, and fixed-wing aircraft, including unmanned aircraft systems (UAS), fighters, attack aircraft, gunships, bombers, electronic warfare aircraft, airborne early warning aircraft, transport aircraft, air refueling aircraft, and intelligence, surveillance, and reconnaissance aircraft. Historically, air superiority is essential to the success of an operation or campaign because it prevents enemy air and missile threats from interfering with friendly air, land, maritime, space, and special operations forces. This gives these friendly forces both freedom of movement and freedom of action in the operational area.<sup>45</sup> Air superiority is vital to amphibious assaults in modern times, since only 14 percent of modern amphibious operations have been successful with a lack of air superiority.<sup>46</sup>

Additionally, the lethality of air and missile threats, such as enemy cruise missiles, ballistic missiles, hypersonic weapons, fixed-wing aircraft, and rotary-wing aircraft makes it imperative to keep them from targeting the ATF and its surface connectors. This is because the loss of a few critical ships can hamper or doom a landing. An example of this is the Falklands War where a British amphibious force lost much of its rotary-wing aviation when an Exocet missile sank a British ship carrying Boeing CH-47 Chinook helicopters. However, this did not doom an eventual landing, but it did force the British troops to march dozens of kilometers to their ultimate objective after an amphibious landing.<sup>47</sup> However, if the Argentines had targeted more valuable ships such as British aircraft carriers, then the Argentines may have contested British air superiority and prevented a landing and ultimate victory.

At the theater level, integrated air and missile defense consists of defensive counterair (DCA) supported by offensive counterair (OCA) attack operations.<sup>49</sup> *Countering Air and Missile Threats*, Joint Publication (JP) 3-01 describes these concepts. The counterair mission is an inherently Joint and interdependent endeavor. This is because the capabilities and force structure of each of

the armed Services reflects an increasing reliance on all components across all Services to leverage complementary and reinforcing effects while minimizing relative vulnerabilities.<sup>50</sup>

Next, the counterair framework is based on the integration of offensive counterair and defensive counterair operations by all capable Joint force components, against both air and missile threats. Generally, OCA operations seek to dominate enemy airspace and prevent the launch of threats, while DCA operations defeat or reduce the effectiveness of enemy air and missile threats attempting to penetrate or attack through friendly airspace.<sup>51</sup>

OCA operations destroy or neutralize enemy aircraft, missiles, launch platforms, and their supporting structures and systems both before and after launch and as close to their source as possible. Assets and capabilities used to support OCA include aircraft (e.g., manned and unmanned, fixed wing, tiltrotor, and rotary wing), air-to-air missiles, air-to-surface missiles, cruise missiles, Special Operations Forces, surface-to-surface fires, ground maneuver forces, electronic warfare, cyber operations, and intelligence collection systems. OCA operations also include targeting assets that enable enemy air and missile capabilities, such as petroleum, oils, and lubricant facilities; airfield facilities; missile reload and storage facilities; aircraft repair structures; and command and control (C2) facilities.

OCA includes four types of operations:

1. Attack operations. OCA attack operations include offensive action by any part of the Joint force against targets that contribute to the enemy's air and missile capabilities.
2. Suppression of enemy air defenses (SEAD). These types of operations neutralize, destroy, or degrade surface-based enemy air defenses by destructive and/or disruptive means.
3. Fighter escort. Fighter escort provides dedicated protection sorties by air-to-air capable fighters in support of other offensive air and air support operations over enemy territory. Fighter escort can contribute to DCA by protecting aircraft such as high-value airborne assets.
4. Fighter sweep. Fighter sweep is an offensive mission by fighter aircraft to seek out and destroy enemy aircraft or targets of opportunity in a designated area.

DCA includes all defensive measures within the theater of operations designed to neutralize or destroy enemy forces attempting to penetrate or attack through friendly airspace. The goal of DCA operations, in concert with OCA operations, is to provide an area from which friendly forces can operate while protected from air and missile threats.

DCAs include active air and missile defense, which are direct defensive actions taken to destroy, nullify, or reduce the effectiveness of hostile air and ballistic missile threats against friendly forces and assets. Active air and missile defense includes both air defense and ballistic missile defense (BMD). First, air defenses are defensive measures designed to destroy attacking aircraft and aerodynamic missiles, or to nullify or reduce the effectiveness of such attacks. It includes the use of aircraft, surface-to-air missiles, anti-aircraft artillery, cyber operations, electronic warfare (including directed energy), multiple sensors, and other available weapons/capabilities. Air defense also includes defense against cruise missiles and UAS. Second, BMDs are defensive measures designed to destroy attacking enemy ballistic missiles, or to nullify or reduce the effectiveness of such attack.

Passive air and missile defenses are all measures, other than active air and missile defense, taken to minimize the effectiveness of hostile air and ballistic missile threats against friendly forces and assets. These measures include detection, warning, camouflage, concealment, deception, dispersion, hardening, and the use of protective construction.<sup>52</sup>

It is vital to restate how complex and Joint the endeavor of acquiring air superiority is. A Western Pacific theater under attack or threat from thousands of Chinese ballistic missiles and cruise missiles and Japanese possessions in the Pacific and a European theater facing the same threat from Russian ballistic and cruise missiles will complicate achieving air superiority by delaying, disrupting, or destroying Joint forces needed to achieve air superiority.<sup>53</sup>

In addition, in such a threat environment CSGs may not venture within 700 nms of shore due to the threat of ASBMs. This will greatly affect the availability of aircraft at any given time due to the distances involved for aircraft to travel. This begs the question: Why risk highly valuable amphibians in a way that aircraft carriers will not be risked?

Another factor is that amphibious assault ships lack the ability to accommodate aircraft that do not possess vertical/short take-off and landing (V/STOL), short take-off vertical landing (STOVL), or vertical take-off and landing (VTOL) capabilities.<sup>54</sup> As a result, ATFs will need to rely on CSGs or nearby airfields for airborne early warning and airborne electronic warfare through Northrop Grumman E-2 Hawkeye and Boeing EA-18G Growler aircraft, respectively. These two aircraft require catapult assisted take-off but arrested recovery systems to function from naval ships, which is a capability provided by aircraft carriers.<sup>55</sup>

The MAGTF Unmanned Aircraft System Expeditionary or MUX drone may provide a solution to the problem of Marine amphibious units lacking both organic airborne early warning and airborne electronic warfare capabilities. It is also being assessed whether F-35Bs could be adapted for electronic

warfare. However, even if the programs for the MUX and an electronic warfare F-35B go as planned, then an MEB will still be dependent on the Joint force to achieve air superiority.

Another issue with achieving air superiority during an amphibious assault is the breadth of the threats to the landing force. This includes enemy assets such as aircraft, ships, land-based launchers employing precision-guided weapons, bombs dropped by aircraft, artillery projectiles, rocket artillery, cruise missiles, ATGMs, ballistic missiles, hypersonic weapons, and armed drones.

Compounding these threats is that a landing force with low altitude air defense (LAAD) units possesses the ground-based air defense system providing short range air defense capabilities to shoot down threats using FIM-92 Stinger missiles and direct-fire machine guns. This capability is augmented by the Air Combat Element's and Ground Combat Element's Ground/Air Task-Oriented Radar (G/ATOR) to detect threats, including cruise missiles, UAS, aircraft, rockets, artillery, and mortars.<sup>58</sup> However, given the panoply of aerial threats to the landing force in a near-peer fight, there is added emphasis on the need for counter rocket, artillery, and mortar capabilities; counter unmanned aircraft systems capabilities; and high to medium air defense capabilities, including cruise missile defense, for Marine ground units. This is especially true of static forces such as those stationed in forward military bases or airfields. These threats are all on top of the need for passive air and missile defense and for Joint assets to provide ballistic missile defense and offensive counterair to protect the landing force.

The threat of armed drones is worthy of special mention, since it was the most daunting problem to special operators in 2016, according to the head of U.S. Special Operations Command.<sup>59</sup> Swarms of armed drones are especially difficult to counter. Since conventional air defenses are unlikely to successfully defeat hundreds of drones, dedicated counter-UAS weapon systems are in development.<sup>60</sup> Additionally, the Marine Corps faces a capability gap with detecting the threat of small UAS. To fill this gap in capabilities, the Marine Corps is purchasing more G/ATORs to detect these threats and is also acquisitioning air defense joint light tactical vehicles (JLTV) variants to modernize LAAD units. These JLTVs of the Marine Air Defense Integrated Future Weapons System program will have Stinger missiles, electronic warfare capability, advanced optics, and direct-fire weapons, including the potential for a high-energy laser. A second C-UAS variant will sport a 360-degree radar, direct-fire weapon, advanced optics, and a command and control communications suite.<sup>61</sup>

### **The Potential of Insufficient Fire Support for Amphibious Assaults**

One aspect of fire support for amphibious assaults is naval surface fire support (NSFS), which is fire support by naval surface guns, missiles, and electronic

warfare systems in support of a unit or units tasked with achieving the commander of the amphibious operation's objectives. In general, the mission of NSFS units in an amphibious assault is to support the assault by destroying or neutralizing shore installations that oppose the approach of ships and aircraft and to deliver fires against enemy forces that may oppose the landing force, including its post-landing advance.<sup>62</sup> The most common naval surface guns on U.S. Navy vessels are 5-inch/54-caliber (Mk 45) lightweight guns on current *Ticonderoga*-class cruisers and *Arleigh Burke*-class destroyers. These 5-inch guns have a maximum range of 13 nms.<sup>63</sup> The only land-attack missiles used by the Navy are the Tomahawk cruise missiles, an extremely expensive theater-level weapon that needs significant launch preparation time.<sup>64</sup>

In addition to NSFS, amphibious assault fire support includes both Joint surface-to-surface fires assets, originating within range of the amphibious objective area, and aircraft, whether fixed-wing, helicopters, tiltrotors, or unmanned. Surface-to-surface fires include ballistic missiles like the Army Tactical Missile System (ATACMS), guided rockets such as those used by the M142 High Mobility Artillery Rocket System, and cannon artillery such as the M777A2 155mm towed howitzer.

Fire support from Joint fires is so important because the initial landing, one of the most dangerous parts of an amphibious assault, leaves Marines without the ability to employ field artillery, such as mortars and howitzers.<sup>65</sup> Without field artillery or Joint fires, an entire arm of the combined arms team is missing, giving the enemy a distinct advantage. Additionally, due to the possibility that close air support alone will be insufficient fire support for an amphibious assault and the enormous expense of cruise missiles, it is of great importance to possess cost-effective NSFS or sufficiently long-range, surface-based fires.

Currently, General David H. Berger is moving the Marine Corps to drastically reduce its number of artillery battalions using the M777A2 to triple its number of rocket-artillery units.<sup>66</sup> An increase of rocket-artillery units will offer the opportunity to deploy the in-development precision strike missile (PrSM) in support of future amphibious assaults. PrSM has a range of 500 km, which may be enough to support amphibious assaults. The end of the Intermediate-range Nuclear Forces Treaty now allows for longer-ranged, land-based missiles, such as an even longer-ranged PrSM.<sup>67</sup>

Additionally, the U.S. Army is developing surface-launched hypersonic cruise missiles for deployment in 2023.<sup>68</sup> These missiles will travel at more than five times the speed of sound and will be able to strike targets hundreds of kilometers away.<sup>69</sup> There is also a strategic long-range cannon in development by the Army that will have a range of more than 1,610 km.<sup>70</sup> With their impressive ranges, the Army's strategic long-range cannon and land-based hypersonic

weapons could be extraordinarily useful for landing forces, since they can target enemy units from distant islands or land masses.

U.S. Navy ships will have difficulty providing the necessary fire support using deck guns unless ships with naval guns are very close to defended shoreline, due to the limited range of the Mk 45. This makes ships providing NSFS extremely vulnerable to a multitude of threats in the littorals, which puts large surface combatants at risk. Large surface combatants also excel at multiple missions, and the *Arleigh Burke*-class destroyers are expensive ships at \$1,918.5 million on average as of fiscal year 2020.<sup>71</sup> The costs, along with the risks involved, mean that the risks of involving a destroyer or cruiser on NSFS exceed the benefits.

That said, electromagnetic rail guns, if fielded, will have a range of 100 nms or more.<sup>72</sup> The distance of 100 nms from shore will lend more protection to large surface combatants. However, the electromagnetic railgun is years away from implementation on naval ships.<sup>73</sup> In addition, only the *Zumwalt*-class ships currently provide the power generation capability to use the weapon.<sup>74</sup> It is hoped that battery packs may allow the weapon to function on naval vessels other than the *Zumwalt*-class such as the *Arleigh Burke*-class of guided missile destroyers.<sup>75</sup> However, this is speculation on deploying a new technology, and it is unlikely that the electromagnetic railgun will revolutionize NSFS in the next 10–15 years.

Finally, within the next 10–15 years, this means the use of either Excalibur N5 projectiles or hypervelocity projectiles (HVPs) by Mk 45 guns represent the obvious ways forward. Excalibur N5 projectiles are a precision-guided artillery projectile designed to shoot from naval 5-inch guns that more than doubles the range of conventional 5-inch munitions.<sup>76</sup> The HVPs are another precision-guided munition designed for use from naval 5-inch guns. HVPs will be able to fire up to 40 nm at a cost of \$85,000 per projectile. However, even at these increased ranges, this still requires that a fleet composed of several large surface combatants capable of missile defense will be relatively close to shore to provide NSFS. Such ships would exclusively use Excalibur N5 projectiles or HVPs.

Still, these surface-based and NSFS solutions have significant problems. Even a large surface combatant using HVP rounds 40 nms from shore will have little time to react to aerial threats originating from the coastline. Large surface combatants are still expensive, strategically important, and are not risk-worthy vessels. The HVP ammunition is expensive, and given the cost of HVP ammunition, it is logical to extrapolate precision-guided artillery projectiles from a larger strategic cannon will not cost less. Additionally, the PrSM is likely to be very expensive, given the unit cost of ATACMS at \$1,252,500 as of fiscal year 2020.

For instance, if 5-inch guns must use HVP ammunition exclusively, let alone more expensive ordnance, this means that the NSFS will add considerable expense to amphibious assaults. Assuming the fleet providing NSFS fires an estimate of 24,000 projectiles, which is the same number used during the amphibious assault against Tarawa in World War II, then the cost of the projectiles alone would be around \$2 billion.<sup>79</sup>

Still, for the next several years, NSFS will likely rely on close-air support heavily for its fire support, unless large surface combatants venture perilously close to shore.

## **Problems with Ship-to-Shore Movement of the Landing Force**

### **A Shortage of Amphibs**

There are two types of modern amphib in production for the U.S. Navy: amphibious assault ships and amphibious transport docks. The classes of amphib currently constructed are the newer *America*-class amphibious assault ships and the *San Antonio*-class amphibious transport docks. The other classes in service are the older *Wasp*-class amphibious assault ships, *Whidbey Island*-class dock landing ships, and *Harpers Ferry*-class dock landing ships.

Previously, the goal for amphib shipbuilding was 38 amphib, enough to support two MEBs, training and readiness for amphibious operations, and the ability to provide MEUs and Special Purpose MAGTF with enduring forward presence and capable crisis response. This force of 38 amphib would eventually include 12 amphibious assault ships and 26 amphibious transport docks.

However, this model for amphib shipbuilding ended recently. Berger has issued a *Commandant's Planning Guidance* that emphasizes the need for the U.S. Navy and Marine Corps to integrate their operations jointly to enable sea-control and sea-denial operations in the presence of long-range, precision-guided fires. This contrasts with the current emphasis on naval power projection.<sup>83</sup>

General Berger anticipates that this will require a new type of amphib that is more numerous, less expensive, more lethal, and more risk worthy. Larger vessels will need mission agility to contribute to sea control, littoral operations, and amphibious operations. The reason for this change is that Marines must now distribute forces ashore for safety from precision-guided strike capability. This means that possessing only a few large ships to deploy from is illogical, since it will convince an enemy to strike while forces concentrate on their ships.<sup>84</sup> Given the issues already explored on the lack of protection for amphib against near-peer threats, this is especially salient. There is an Integrated Naval Force Structure Assessment currently underway to understand what options will be best going forward.<sup>85</sup>

For now, amphib consist of large, exquisite vessels. As stated in an earlier



section, this means that such ships are of strategic value, are high cost, and difficult to replace. There are other key issues facing the current amphib force due to a lack of ships. Amphibs currently have an absence of adequate specialized training for MEB amphibious assaults due to a lack of amphibians to train an MEB or Marine Expeditionary Force (MEF) landing.<sup>86</sup> This makes it difficult to train for high-intensity warfare with a near-peer competitor.

Second, the attrition of amphibians presents another problem. From the time the USS *America* (LHA 6), an *America*-class amphibious assault ship, had its keel laid down until its launch, it took around 39 months.<sup>87</sup> In the case of the *San Antonio*-class amphibious transport dock USS *Somerset* (LPD 25), it took about 28 months to construct the vessel from laying its keel down to launch.<sup>88</sup> However, these estimates of 39 months and 28 months are still too short. It took almost two years to commission the *America* after sea trials concluded, and it took the *Somerset* almost 23 months to commission after sea trials concluded.<sup>89</sup> This means that the *America* took 63 months from the time its keel was laid down until it was commissioned, and the *Somerset* took 51 months to do the same. However, there is a final problem to consider. These estimates of 63 months and 51 months, respectively, assume that shipyards and suppliers can accommodate extra construction, which is a reality that may not be possible with the current industrial base. In a war with a major power like Russia or China, it will take multiple years before new amphibians will be ready for service.

Third, in testimony before Congress in 2015, Marine Corps Lieutenant General Kenneth J. Glueck Jr. testified that the demand set by the combatant commanders was for around 54 amphibians of current design.<sup>90</sup> How to better meet combatant commander demands with new types of vessels without spending far more than currently on amphib shipbuilding will be an important issue.

However, new shipbuilding funds to build more amphibians may be difficult to materialize with so many pressing shipbuilding needs for a 355-ship U.S. Navy. Competitors for acquisition dollars include the *Columbia*-class ballistic missile submarines that must replace the aging *Ohio*-class submarines, the new FFG(X) frigates, nuclear attack submarines that face a critical shortage, and the upcoming large surface combatant destroyers.

### **A Lack of Protection for Surface Connectors against Littoral Defenses**

The *Marine Corps Operating Concept* states that the future of warfare will exhibit a “battle of signatures”:

Tomorrow’s fights will involve conditions in which “to be detected is to be targeted is to be killed.” Adversaries will routinely net together sensors, spies, UAS, and space imagery to form sophisticated “[Intelligence, Surveillance, and Recon-

naissance] (ISR)-strike systems” that are able to locate, track, target, and attack an opposing force. In complex terrain, adversaries will collect targeting information through eyes and ears and spread it through social media. No matter the means of detection, unmanaged signatures will increasingly become a critical vulnerability.

This means that a decisive factor for land and amphibious warfare is to stay undetected, because detected forces face swift destruction by enemy fires.

A battle of signatures affects landing craft, and a key issue is that surface connectors are vulnerable to enemy attack when away from their amphibious ships and possess little ability to defend themselves against a wide range of precision-guided threats. This threat can come from enemy coastal defenses, armed drones, diesel submarines, tactical aircraft, and littoral vessels, including fast-attack craft. These enemy assets will be hunting surface connectors, which lack air defenses against enemy precision-guided rockets, artillery shells, mortars, antitank guided missiles, antiship cruise missiles, bombs, and armed drones. Surface connectors are also vulnerable against enemy torpedoes and naval mines. Although hovercraft are less susceptible to them, naval mines will hold some threat even for them.<sup>92</sup>

Additionally, hovercraft such as the landing craft, air cushion (LCAC) and the ship-to-shore connector (SSC) are fragile, having complex and vulnerable engines small-arms fire can disable.<sup>93</sup> Massed area fires by enemy field artillery may also prove effective against surface connectors approaching shore or that have just arrived on a beach.

Surface connectors are currently armed with two gun mounts able to support a heavy machine gun, machine gun, or automatic grenade launcher.<sup>94</sup> These weapons lack the ability to engage subsurface targets such as submarines; are shorter ranged than medium and large caliber naval guns, making them more useful against smaller boats; and they can be useful against low-altitude aircraft, but these threats may have stand-off weapons like medium caliber guns, rockets, or missiles. The detection of surface connectors in transit to the amphibious objective area carries great risk.

The lack of defenses for surface connectors is a far greater problem in OTH amphibious operations for two reasons. First, there is the extended length of time for ship-to-shore movement, which means longer vulnerability.<sup>95</sup> Second, LCACs and new SSCs are the only surface connectors that can carry heavy equipment with high water speed. This is problematic since hovercraft produce enormous noise, which is apparent from kilometers away. Hovercraft also create a plume of water behind them. Both the noise and plume of water make hovercraft easier to detect than slower surface connectors.

All these points emphasize the need for greater protection for surface connectors as they transit from an ATF to shore and back. This is especially true as surface connectors become more vulnerable by having to transit farther from shore in OTH amphibious operations. An alternative is to design ships, such as a new class of medium amphibious ships, that are able to disembark Marines directly onto a beach.<sup>97</sup> These will need low observability and adequate defenses to survive a battle of signatures.

### **Attrition of Surface Connectors during an Amphibious Assault**

Currently, a MEB composited for high-intensity operations with a maximum number of LCAC hovercrafts can support 34–45 LCACs. The reason for this variance, per MEB, is because older ship classes have more well deck space than newer classes.

A *Wasp*-class amphibious assault ship can support three hovercraft, a *San Antonio*-class Flight I ship can support two hovercraft, and a dock landing ship can support three or five hovercraft, depending on class. Additionally, according to the fiscal year 2020 30-year shipbuilding plan, *San Antonio*-class Flight II vessels, which can support up to two hovercrafts, will replace all dock landing ships. The last purchase of a *San Antonio*-class Flight II vessel will occur in 2034. Using the math associated with the acquisition of the *Somerset* earlier in this analysis, which was 51 months from laying the keel down to commissioning, these new amphibious transport docks will join the Navy's fleet by the end of 2039. It is also important to note that, according to the fiscal year 2020 30-year shipbuilding plan, *America*-class amphibious assault ships will eventually replace *Wasp*-class amphibious assault ships at some point after 2050. The first two vessels of the *America* class, called Flight 0, lack a well deck entirely. However, future vessels, called Flight I, will be capable of supporting two hovercraft.<sup>98</sup>

That said, as older ships retire, especially the dock landing ships, the maximum number of hovercrafts per MEB composited for high-intensity operations could drop from 34–45 of the in production SSC hovercraft to 26–30 hovercraft. This assumes 10 *San Antonio*-class Flight I or II amphibious transport docks and five *America*-class Flight 0 or Flight I amphibious assault ships.

This is the inverse of what to expect if OTH amphibious operations are to become standard for amphibious assaults and amphibious raids. This is because AAVs and ACVs cannot swim to shore from ships in an OTH amphibious operation. Instead, large surface connectors with high water speed, such as hovercraft, will be relied on more, not less, in an amphibious assault to deliver heavy equipment as well as light armored vehicles (LAVs), JLTVs, AAVs, and ACVs to shore.

This creates a simple problem. An enemy can attrite surface connectors to

potentially significantly reduce the amount of equipment and supplies that can be delivered to shore in a given time period. With a future maximum of 30 connectors for an entire MEB, and far fewer connectors if using the larger but slower landing craft utility (LCU), it may become all too easy for an enemy to hunt and destroy enough surface connectors to significantly affect the MEB's amphibious operations. That said, new medium amphibians will help alleviate this problem, depending on the number available for use by an MEB assault amphibious task force.

## **Problems with Air and Surface Assault Landings Enemy Armor and Other Land Forces in the Amphibious Objective Area**

Even if there is relatively light opposition to movement ashore, adversary land forces can pose significant opposition to the landing force once it arrives.<sup>99</sup> This is not just enemy forces on the shoreline waiting for landing vehicles. There is the real threat of rapidly deployed forces that can mass against the landing force before the seizure of a lodgment.

Marines are an infantry-centric force and lack the focus on heavy armored vehicles of a U.S. Army armored brigade combat team. This leaves Marines at a disadvantage compared to a heavier armored formation against enemy armor, due to Marines possessing reduced mobility, firepower, and protection than a heavier force. Additionally, LCACs and LCUs lack the capability for forcible entry of defended beaches, which is the domain of AAVs and, in time, ACVs.

Furthermore, AAVs are not armed with antitank weapons and are not to be treated as infantry fighting vehicles. This is because "it lacks the armor protection, stabilized weapons station, low silhouette, and means for the infantry to fight from the vehicle without exposing themselves to direct fire," as compared to infantry fighting vehicles. As noted earlier, some ACVs will have 30mm autocannons, which should be lethal against enemy armored personnel carriers and infantry fighting vehicles. However, 30mm rounds will not be effective against most main battle tanks or similarly heavy armored vehicles, if their performance is like the 25mm rounds used by M2 and M3 Bradley Fighting Vehicles.<sup>103</sup>

Massed enemy forces with the mobility to rapidly respond to a landing in the amphibious objective area, especially massed armored vehicles, are a significant threat to the landing force. Should an enemy have well-armed forces in the amphibious objective area, then there may be little chance for a landing to succeed. Near-peer competitors have numerous battle tanks and infantry fighting vehicles at their disposal. Additionally, even if an amphibious landing has succeeded, it may not be able to defend a lodgment against massing reinforcements, to include enemy armor.

Such could be the case if the Russian Federation invaded Norway's northern coastline to seize strategic territory in the Arctic. The lightest Russian combined arms formations are entirely mechanized.<sup>104</sup> As a result, Marines can expect to find themselves opposed by numerous infantry fighting vehicles supported by Russian main battle tanks.

Another key problem facing Marines storming a defended beach is a need for Marines to operate in waves. Each wave of connectors can only transport a fraction of a MAGTF's forces. This is due to the current inventory of surface connectors and aircraft per ship and the limited number of ships to place them on.

It is also difficult to transport an effective combined arms force to shore, because the only connectors with forcible entry capability are aircraft with armed escorts, AAVs, and the new ACV. This immediately creates a deployment of assets starting with, primarily, infantry. Thus, aircraft, AAVs, and ACVs will need to clear the way for vulnerable surface connectors carrying JLTVs, medium tactical vehicle replacements, LAVs, artillery, and other equipment. Aircraft will also lack armor and will be vulnerable to small-arms fire.

A target such as a small island in the South China Sea or the Arctic Ocean may require not only a capability to assault a defended beach but also a diverse combined-arms team. Unless any action the enemy takes to avoid one threat makes them more vulnerable to another, an amphibious assault may fail to achieve overmatch and suffer defeat. Additionally, an amphibious assault should take advantage of the element of surprise as much and as early as possible by employing a diverse combined-arms force from the start.

A last looming threat to the landing force worth mentioning is the surging size of the Chinese amphibious fleet. By 2025, China will possess 3 amphibious assault ships, 4 aircraft carriers, at least 8 amphibious transport docks, and around 60 landing ship, tanks.<sup>105</sup> Such a force will be able to threaten an amphibious assault against Marines that seized a lodgment in the South China Sea, the East China Sea, or on islands around Taiwan. However, to not overstate matters, an intelligence estimate by the Defense Intelligence Agency indicates that the Chinese People's Liberation Army-Navy Marine Corps are not currently able to defeat U.S. Marines or Army soldiers in amphibious or ground operations.<sup>106</sup> However, as China reforms its military, this situation may change with significant effect on the ability of Marines to hold a lodgment against a Chinese amphibious assault.

### **Massed Enemy Fires against the Landing Force**

The earlier concept of a battle of signatures affects Marine Corps ground forces. Again, a decisive factor for land and amphibious warfare is to stay undetected, because detected forces face swift destruction by enemy fires.

The Russian Federation has begun to use a tactic of massing area-effect fires in Ukraine, as evidenced by the Zelenopillya, Ukraine, rocket attack. The increased availability of overhead surveillance combined with fires able to affect a large area, such as through the use of cluster munitions, have produced a new level of intensity in modern conventional combat.<sup>108</sup> Data from the Ukraine conflict show that artillery is producing approximately 80 percent of all casualties, and because of high troop losses Ukrainian soldiers prefer to ride on top of armored vehicles and assault while dismounted.

The superior range for Russian and Chinese artillery, combined with massed-area fires and aided by overhead surveillance, mean present or future amphibious assaults or land battles against China or the Russian Federation will have to contend with a battle of signatures immediately. The superior ranges of Chinese and Russian artillery mean that Marines may lack the capability to wage a deep fight against Russian and Chinese assets and counterbattery fires against Russian and Chinese artillery with their own shorter-range artillery assets. Weapons in development to meet or beat Russian or Chinese artillery ranges, such as the PrSM, the Tail Controlled Guided Multiple Launch Rocket System, and the Extended Range Cannon Artillery programs hold the promise to defeat Chinese and Russian capabilities. The programs to acquire these weapon systems are a high priority for amphibious assaults.

Russia's intelligence, surveillance, and reconnaissance (ISR)-strike model leads to a few key conclusions concerning future battlefields with near-peer powers. First, opposing ISR units, including aircraft and surface units, now present an enormous and immediate threat from both the information they gather for fires units and from their ability to directly engage Marines. Aerial assets can provide close-air support or close-combat attacks and include helicopters, fixed-wing aircraft, tiltrotors, UAS, and small UAS. Surface assets include enemy ships operating in the littorals, unmanned surface vehicles, unmanned ground vehicles, both mounted and dismounted scouts, special operators, intelligence collectors, and paramilitary forces. The detection and destruction of opposing reconnaissance units has become vital to the survival and success of Marines in an era of proliferating area-effect munitions and precision-guided munitions.

This increases the need to locate and destroy enemy ground-reconnaissance units, especially those disguising the fact they are opposing military forces. It also necessitates a robust air-defense capability for Marines that can tackle all aerial threats economically, especially proliferating drones such as quadcopters.

A second consequence of this ISR-strike model, which combines massed-area fires with overhead surveillance, is that there is further emphasis on efforts to actively counter enemy rockets, artillery, mortars, cruise missiles, and UAS on near-peer battlefields. To survive detection by an enemy, Marine ground

units may have to become reliant on a Marine version of the U.S. Army's indirect fire protection capabilities (IFPC). The Army's IFPC rely on interceptors or directed energy to destroy enemy rockets, artillery, mortars, cruise missiles, and UAS.<sup>112</sup> This will potentially protect detected Marines from an artillery barrage as they attempt to disrupt an enemy's ability to target them.

Third, the increasing ranges of field artillery may limit a rapid response to an enemy artillery attack on U.S. ground forces to friendly counterbattery fires, fixed-wing aircraft, helicopters, and tiltrotors. This is due to the extremely slow speeds of maneuver that ground vehicles have in relation to the increasing ranges of fires. Simply put, enemy fires originating dozens of kilometers away will only face destruction by platforms or weapons with enough speed or reach to threaten enemy artillery. The speed of aircraft mitigates this effect. The suppression or destruction of opposing air defense artillery assets is of high importance, so that friendly aircraft have the freedom of maneuver to destroy enemy fire units that have revealed themselves by firing on friendly forces.

Fourth, current and future armored vehicles and armored units will need to change in response to these emerging threats. To remain effective, ground vehicles will likely require active protection systems to protect them from top-attack mines and antitank submunitions. Active protection systems employ kinetic means of intercepting incoming antitank threats, such as ATGMs, or nonkinetic methods of neutralizing incoming antitank threats, such as through jamming infrared, radar, or laser sensors.<sup>113</sup> Ground vehicles will likely have to rely far more on low observable technologies than they currently do for their survival, since detection may lead to swift destruction. Armored vehicles will likely need laser-detection capabilities that warn the crew when an enemy laser targets them. Ground vehicles may need increased speed of maneuver to close with enemy forces more quickly and reduce their vulnerability to artillery attacks. That is, if such mobility does not sacrifice low observability. This is because increased mobility will give an enemy a shorter window of opportunity to detect and orchestrate fires against U.S. forces before an engagement. These considerations will need to impact the purchase of future ACV variants, future JLTVs, and the in-development advanced reconnaissance vehicles meant to replace the LAVs.<sup>114</sup>

Fifth, against a near-peer competitor, a greatly reduced sensor-to-shooter time cycle will present challenges to a slow or immobile force. This includes command posts and command, control, communications, computers, and intelligence (C4I) infrastructure. This demonstrates the need for all military assets to be mobile within a few minutes. In addition, towed artillery faces a severe threat due to their slow or immobile nature. Through radar tracking of projectiles back to their source; the use of advanced command, control, communications, and intelligence (C3I) assets; drones; and counterbattery fires, an enemy could force the need for artillery units to almost constantly maneuver.

Consequently, fires units will need to keep mobile by using “shoot and scoot” maneuvers before counterbattery fires destroy them, particularly counterbattery fires using massed area effect munitions. This will present enormous challenges to towed artillery, which may have to rely on actively countering rockets, artillery, mortars, and cruise missiles to survive.

### **A Lack of Surface Forcible Entry Capability for OTH Amphibious Operations**

Conventional amphibious operations need to be unopposed because of the proliferation of weapons able to destroy amphibians to even nonstate actors. However, for now, even an OTH amphibious operation lacks surface connectors that can assault a defended beach. This is because the only forcible entry surface connectors are the AAV and its successor—the ACV. LCUs and LCACs are incapable of assaulting defended beaches. The reason for this is that the LCAC has complex and vulnerable engines, and both the LCAC and LCU lack the mobile protection for Marines given by the AAV or ACV. The new SSC hovercraft has the same problems assaulting a beach as the LCAC, because like the LCAC, it has complex and vulnerable engines. Additionally, the Ultra Heavy-lift Amphibious Connector (UHAC) in development will not solve this lack of surface forcible entry capability, because it is not meant to assault defended beaches. This leaves the Marine Corps dependent on vertical aircraft with armed escorts as its primary OTH forcible entry capability.

The Corps is assessing whether to upgrade LCACs with ramps that will allow AAVs and ACVs to deploy from them within swimming range of shore. Additionally, the UHAC should have the ability to deploy AAVs and ACVs from a ramp into the ocean. This will allow forcible entry to occur using AAVs and ACVs to swim to shore from LCACs, SSCs, and UHACs. AAVs and/or ACVs combined with vertical aircraft with armed escorts could transport Marines in a first wave.

Therefore, high water speed surface connectors with the protection and firepower to assault a defended beach, such as a small island held by Chinese forces in the South China Sea, are of prime importance for forcible entry in OTH amphibious operations. This also means that the cancellation of the expeditionary fighting vehicle without a clear alternative was a major blow to OTH amphibious operations until an alternative materializes.

The Center for Strategic and Budgetary Assessments proposed turning current *Spearhead*-class vessels into surface connectors able to transport AAVs and ACVs within sight of shore, so that they can deploy from a reinforced ramp and then swim to shore. However, this may be impractical for a few reasons. The *Spearhead*-class is incompatible with Marine Corps assault aircraft like the Bell Boeing V-22 Osprey, and its ramp will need to be replaced to launch AAVs or



ACVs into the ocean outside of an enclosed harbor. Such a ramp may become a reality if the interface ramp technology, being developed for the *Spearhead*-class, possesses this capability.<sup>121</sup> The littoral combat ship (LCS) is not an alternative to amphibians because of limited flight deck space, limited command and control capabilities, and limited room for embarked Marines.

## **Problems with Sustainment and the Introduction of Follow-on Forces**

### **Lack of Protection for Maritime Prepositioning Force Ships and Connectors Delivering Logistic Supplies**

An amphibious assault is beholden to a logistic line of supply from the ATF to shore through surface connectors and aircraft delivering logistic supplies and vehicles. This means that surface connectors and aircraft will play a vital role throughout the entire process of an amphibious operation, including in daylight and when an enemy has discovered an ATF is near contested coastline. The adversary will begin amassing air, naval, and land forces to counter any forcible entry operation and destroy a lodgment. These massing forces will represent a significant threat to an ATF, its surface connectors, and aircraft. Particular threats include an adversary's low-observable assets such as attack submarines and stealth aircraft as well as long-range precision-guided weapons that can target vessels, surface connectors, and aircraft many nautical miles distant.

The threat of long-range precision-guided fires, submarines, and stealth aircraft are also enormous threats to ships in the Maritime Prepositioning Force (MPF), which are cargo ships designed for military use, crewed primarily by civilians, and lacking both weapon systems countermeasures.<sup>123</sup>

Current methods to enhance protection against these surface, submersible, aerial, and land-based threats include a combination of seizing air superiority, gaining sea control in the littoral environment, eliminating enemy strike platforms on land, and providing area air defense, including ballistic missile defense. However, hypersonic weapons and stealth aircraft can defeat current air defenses. To counter these threats, an amphibious assault will require OCA aimed at destroying hypersonic weapons and stealth aircraft before their use.

## **Conclusions and Key Findings**

This analysis looked at key problems and issues facing modern amphibious assault capabilities one phase of operations at a time and then one issue at a time, especially during major combat operations against near-peer powers. These problems include issues with movement to the area of operations, such as limited protection for amphibious ships against near-peer threats and the threat of naval mines laid in approaches, in shallow water, or in the surf zone.

Second, there are problems with preparation of the landing area by supporting arms (e.g., difficulties securing air superiority and the potential for insufficient fire support for amphibious landings). Third, there are problems with ship-to-shore movement of the landing force: a shortage of amphibians, a lack of protection for surface connectors against littoral threats, and the attrition of surface connectors during an amphibious assault. Fourth, there are difficulties with air and surface assault landings, including enemy armor and other land forces in the amphibious objective area, the threat of massed enemy fires against the landing force, and a lack of surface means of forcible entry for OTH amphibious operations. Fifth, and lastly, there are problems with sustainment and the introduction of follow-on forces. This includes a lack of protection for MPF ships and connectors.

There are a few common aspects shared by many vulnerabilities found in this analysis. Common vulnerabilities include a rapid growth in lethality for potential enemies, combined with a lack of protection for amphibious forces and landing forces, a lack of investment in amphibious equipment, and a lack of multimission capabilities for amphibians. Finally, the military needs to outmaneuver any adversaries due to fragile surface connectors.

The first of these commonalities is the rapid growth in the lethality possessed by potential enemies. Increasingly common assets that are proliferating are giving developing nations and even nonstate actors powerful military capabilities, such as A2/AD weapons. These proliferating technologies are changing the face of nation-state warfare and even wars with nonstate actors. These technologies include naval mines, landmines, improvised explosive devices; chemical, biological, and radiological weapons; cluster munitions; precision-guided munitions; information operations including internet propaganda, cyberattacks, drones (quadcopters and kamikaze aircraft); integrated air defenses; diesel submarines; tactical fixed-wing and rotary-wing aircraft; swarms of coastal patrol vessels and fast attack craft; and ASCMs.

Furthermore, near-peer competitors possess new and potentially warfare-changing weapons, such as ASBMs and hypersonic weapons. This is on top of advanced military technologies, such as stealth aircraft, nuclear attack submarines, and ballistic missile submarines possessed by near-peer competitors. These weapons lag behind U.S. counterparts but represent significant threats from rival militaries.

As a result, U.S. amphibious forces will need to mitigate the threat of enemy weapon systems using means such as superior protection, including active defenses; dispersion; superior lethality at increasingly long ranges; superior training; reduced signatures; information dominance; adaptation, especially when technology fails due to enemy action; suppression or destruction of enemy defensive capabilities, including the destruction of the most dangerous en-

emy assets before they are employed; and effective military deception. Another consequence of increasing enemy lethality is that ATFs face a reliance on naval escorts, including aircraft carriers, for most of their antisubmarine warfare, mine countermeasures, antisurface warfare, and antiair warfare capabilities.

A second commonality of the vulnerabilities in this analysis is a lack of necessary investment in amphibious equipment. Apart from the need for more and different amphibs, four key amphibious equipment issues face the Marine Corps in the next 10 years. First, the need for high water speed forcible entry surface connectors, without which amphibious assaults using surface means of deployment lack the means for forcible entry. Second, the need for effective surface fire support for the initial wave of landing forces, without which amphibious assaults must depend on close-air support for a large part of their fire support. Third, the need for ATFs and landing forces to better counter proliferating technologies and new technologies that could inflict grave losses in an amphibious assault. Without giving amphibs, surface connectors, and landing forces effective counters to proliferating technologies, the continuing risk of high casualties could put the amphibious assault enterprise at risk. Fourth, the need to fill gaps in Marine aviation capabilities such as airborne early warning, long-range, and persistent surveillance and airborne electronic warfare so that ATFs are not so dependent on CSGs.

A third commonality to the vulnerabilities presented in this analysis is the current nature of amphibs, which have little utility to sea control, sea denial, and land attack except for using their embarked Marines, aircraft, and ground vehicles. This reality calls into question the design of current amphibs because expensive, large, and exquisite vessels should be capable of contributing more to sea control, sea denial, and land-attack capabilities.

There is advocacy and experimentation on upgrading the lethality, defenses, and flexibility of current amphibs to increase their utility. This could include giving amphibious transport docks missile cells.<sup>124</sup> Previously mentioned medium amphibious ships are themselves a novel idea in the current environment of large, expensive vessels.

In the current fiscal environment, the future of amphibs may rest on more economical means of improving capabilities than building more amphibs. Such economical means may include new concepts, better training, and novel tactics and strategies for existing or soon to be acquisitioned equipment. The expeditionary advanced base operations (EABO) concept is in part a way to use current Marine Corps forces in a novel way that enhances their capabilities.

A fourth common aspect to the vulnerabilities listed in this analysis is a reliance on outmaneuvering an enemy due to the fragility of surface connectors. If Marines do not outmaneuver an enemy from the sea, then a landing is most likely not an option. A lack of surface OTH forcible entry capability and the

fragility of current amphibs against modern threats underscores this problem.

This analysis casts doubt on the effectiveness of Marine amphibious assaults against a defended coastline with a modern military. Because of the need to outmaneuver an enemy so that Marines do not assault a defended beach, any amphibious assault carries significant risk—intelligence can be wrong, enemies can fool commanders with military deception, and not all coastlines are lengthy enough to have significant cracks in their defenses.

Likely crises envision limited wars for islands in the Western Pacific, stretches of coastline in the Strait of Hormuz and the Gulf of Oman, a war covering roughly half of the Korean Peninsula, and limited stretches of coastline in the Baltic, Black, and Barents Seas. The reality is that an aggressor may not need to secure vast amounts of shoreline should they take territory and then fortify their position. It may therefore be necessary to penetrate defended coastline at an adversary's weakest points, but with current amphibious forces this is a risky operation.

Currently, in any operation against an enemy that cannot be outmaneuvered, it may be necessary to suppress coastal air and surface defenses in the amphibious objective area, gain sea control around the amphibious objective area in a contested littoral environment, perform MCM breaching operations against naval mines over an extended time, gain air superiority over the amphibious objective area for an extended time, and eliminate an enemy's use of long-range weapons. Otherwise, an amphibious assault may carry great risk due to a chance of high casualties. It becomes imperative to engage enemy forces in what may be a series of battles to prepare for an amphibious assault.

As for where to go from here, it is imperative to have a broad and deep discussion on the future of the amphibious assault that continues well into the future. This is a discussion that must include a wide range of active and retired military personnel, scholars, civilian Marines, and other experts. There is a strategic need to nurture innovation with respect to amphibious assaults. This innovation must be more than merely technological—it must address issues facing the amphibious assault with respect to doctrine, organization, training, materiel, leadership, personnel, facilities, or policy (DOTMLPF-P).

Additionally, the role of Marine Corps University Press in advancing these discussions—as well as other scholarly publishers like them—will be important. It is the Marine Corps' premier open access asset to vet ideas and marshal expert opinion regarding the DOTMLPF-P pertaining to amphibious assaults. Therefore, there should be a continuous discussion within the Marine Corps on how these presses can best foster innovation in the DOTMLPF-P, tactics, campaigning, and strategy for amphibious assaults.

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