

Resurrecting The Monitor: A Littoral Imperative

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RESURRECTING THE MONITOR:

A LITTORAL IMPERATIVE

by

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## ABSTRACT

The United States Marine Corps is experimenting with an operational concept titled "Operational Maneuver from the Sea" (OMFTS) as a way to maintain the capability to project power ashore against all forces of resistance. One recurring tenet of OMFTS is sea-basing logistics. Sea-basing logistics obviates a traditional buildup ashore phase and much of the force structure required ashore to protect the supply depot and the supply routes or convoys to the supported ground units. This paper explores the implied mission that OMFTS has for the United States Navy: security of sea lines of communications between the forward edge of the sea echelon area and the beach against (all forms of) future resistance. That is a critical mission because the landing craft required for over-the-horizon assaults are a critical vulnerability of the OMFTS force.

While the United States Navy has the most powerful blue-water fleet in the world, that fleet may not have the correct tools and operational concepts to perform that security mission without sacrificing operational flexibility. This paper proposes that the United States Navy build a class of ship specifically designed to operate close to hostile shores where it can directly influence the security of the sea lines of communication without constraining the more powerful assets of the blue-water fleet. The "monitors" that served with distinction in World War I and II were great examples of affordable, low-profile, armored vessels that possessed substantial firepower and were specifically designed to operate in the dangerous littorals.

## Resurrecting the Monitor: A Littoral Imperative

The Navy remains fixated on the synergistic effects of the aircraft carrier battle groups (CVBGs -- comprising aircraft carriers and their associated multi-mission airwings, and high-technology, high-cost, multi-mission surface combatants and submarines) operating in concert with national and joint assets to solve force protection and power projection missions. That force dominates in the "blue water" region; it was never designed to dominate in the littorals. The Navy requires a lower-cost, survivable platform capable of maintaining a visible and potent presence in the littoral operating area (between the beach and the sea echelon area) to protect the MV-22s, CH-53Es, LCACs (henceforth "landing craft"), and other vulnerable assets that are required to operate close to shore, such as mine sweepers and potentially Advanced Assault Amphibian Vehicles (AAAVs): attack aircraft are not adequate (e.g., Iraqi Styx missiles fired at United States battleships during the Gulf War even though coalition forces had air superiority) and submarines are not capable of suppressing or defeating sophisticated coastal defenses due to their ordnance limitations both quantity and capability against land targets, and the potential cost of losing one of those high-cost surface combatants in the high-threat, low-reaction time operating area close to shore is prohibitive.

Projecting military power ashore -- from the sea -- is a cornerstone capability for the United States Naval Service, the Navy and Marine Corps.<sup>1</sup> The Naval Service recognizes the current and future challenges posed by myriad, low-cost, mobile coastal defenses (e.g., robust enemy surveillance systems combined with small, mobile, increasingly lethal and low-observable weapons systems). From a potential adversary's point of view, those systems combined with naval mines and other maritime defenses (e.g., surface combatants, submarines, and aircraft with a maritime surveillance or attack capability) are intended to minimize the ability of a foreign naval force to project maritime power against their own national interests.

The United States Marine Corps is taking the lead for the naval service in developing the doctrine, equipment, and organizations required to "...maintain the capability to project power ashore against all forces of resistance...."<sup>2</sup> Using their operational concept titled "Operational Maneuver from the Sea" (OMFTS), the Marine Corps is experimenting with ways to capitalize on technological advances in mobility, long-range precision firepower, and command, control, communications, computers, and intelligence (C4I) in order to overcome the challenges to traditional methods of amphibious operations, specifically the ship-to-shore movement and build-up phases.

For most of the 20th century the usefulness of sea-based logistics was limited by the voracious appetite of modern landing forces for such items as fuel, large caliber ammunition, and aviation ordnance. As a result, the options available to landing forces were greatly reduced by the need to establish, protect, and make use of supply

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<sup>1</sup> Joint Chiefs of Staff, *National Military Strategy of the United States of America 1995*, (Washington D.C.: GPO, 1995), p. 14.

<sup>2</sup> MCCDC, *Operational Maneuver from the Sea*, (Quantico: MCCDC, 1996), p. A-1.

dumps. Concerted efforts were delayed and opportunities for decisive action missed while the necessary supplies accumulated on shore.

In the near future, improvements in the precision of long-range weapons, greater reliance on sea-based fire support, and, quite possibly, a decrease in the fuel requirements of military vehicles promise to eliminate, or at least greatly reduce, the need to establish supply facilities ashore. As a result, the logistics tail of landing forces will be smaller, ship-to-shore movement will take less time, and what were previously known as "subsequent operations ashore" will be able to start without the traditional "buildup phase."<sup>3</sup>

One recurring tenet of OMFTS is sea-basing logistics. Sea-basing logistics has the potential to provide a significant battlefield advantage for an amphibious commander: in theory it allows the amphibious commander to strike directly at operational objectives by obviating the buildup ashore phase and much of the force structure required ashore to protect the supply depot and the supply routes or convoys to the supported ground units. Conversely, sea-based logistics burdens the navy commander that is responsible for defense of the force: it shifts the rear area security problem from the Marine Expeditionary Force Commander (MEF) to the navy commander. Rear area security is defined as providing "...for the defense of all forces operating within the...rear area so that those functions associated with rear area operations may continue in an uninterrupted manner with minimum degradation to combat operations."<sup>4</sup>

There are significant implications from this shift of rear area security responsibilities. Many questions must be addressed, such as: How critical is that responsibility; what threats exist; and what assets and tactics can deal with those threats? The Navy needs to take the lead role in developing the doctrine, equipment, and organizations needed to deal

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<sup>3</sup> MCCDC, *Operational Maneuver from the Sea*, (Quantico: MCCDC, 1996), p. 3.

<sup>4</sup> MCCDC, *FMFM2-6 MAGTF Rear Area Security*, (Washington, D.C.: Department of the Navy, 1991), p.1-1.

with this issue or else it may overlook a critical vulnerability to the maritime component of a Joint or Combined Force.

The concept of over-the-horizon amphibious assaults came about in part because of the increased threat to the amphibious task force from modern coastal defenses. "In the restricted waters off a defended shore, naval forces face particularly challenging threats, all of which point to the advantages of deeper and more open waters farther from shore."<sup>5</sup> Yet as naval doctrine responds to those threats by having the amphibious and aircraft carrier task forces operate farther out to sea -- in an effort to provide greater protection and enhance the ability to achieve tactical and operational surprise -- the assets required to deliver the ground combat forces ashore must, nevertheless, traverse the same dangerous littoral area between the sea echelon area and the shore. The lines of communication between the close (where the ground forces ashore are operating) and rear (where all of the logistical support is located) battle areas become elongated in an OMFTS or Ship to Objective Maneuver (STOM) scenario; that in turn puts a premium on security of the lines of communications (LOCs), especially in light of the vulnerability -- a critical vulnerability to OMFTS -- of platforms capable of transporting logistics ashore from over the horizon (i.e., MV-22 (Osprey), Landing Craft Air Cushioned (LCAC), and CH-53E).

Because of the speed and operational reach of those platforms the force, if employed with the correct degree of audacity and calculation, will in all likelihood achieve operational and tactical surprise. The key issue is: what requirements will it take to

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<sup>5</sup> Beddoes, Mark W, LT, USN, "Logistical Implications of Operational Maneuver from the Sea," *Naval War College Review*, Autumn 1997, p. 34.

allow follow-on missions (e.g., resupply and medevac) to maintain effective combat forces ashore? It should not be the ability to achieve surprise again, rather the requirement should be met with well thought out and tested doctrine, equipment, and organizations.

## The Dangerous Littoral

"Since the beginning of modern amphibious warfare at Gallipoli, defenders have searched for a way to defeat a landing.... [In the main] the defenders have been unsuccessful."<sup>6</sup> The future, however, may hold new hope for the defenders, especially in light of technological developments in command and control, surveillance, and weapons systems, and a clear look at the operational and strategic impact of littoral events during Operations Desert Shield and Desert Storm.<sup>7</sup> "Top leaders believe that any enemy the United States might face in the future will have learned from the mistakes made by Iraq during the Gulf War.... "<sup>8</sup>They will also learn from Iraq's successes such as the effects of naval mines and strong coastal defenses to increase the risk for amphibious assaults. The United States Navy must prepare to fight an innovative opponent and not rely on the successes of the past to win that future fight.<sup>9</sup>

"The defenders...have generally found themselves in positions that were never anticipated. Amphibious planners today should be aware that future opponents might not be as remiss in this respect as many past defenders."<sup>10</sup> Therefore, it is important to consider the major characteristics of a successful anti-landing defense as postulated by

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<sup>6</sup> Gatchel, Theodore L., *At the Water's Edge*, (Annapolis: Naval Institute Press, 1996), p. 203.

<sup>7</sup> Jorgensen, Tim S., CDR, Royal Danish Navy, "U.S. Navy Operations in Littoral Waters 2000 and Beyond," *Naval War College Press*, 1997, p. 1-8.

<sup>8</sup> Anderson, Jon R., "Pushing Toward a Brave New World," *Navy Times*, 5 January 1998, p. 10.

<sup>9</sup> Reason, J. Paul, ADM, USN, with Freyman, David G., "Sailing New Seas," *Newport Paper Number Thirteen*, (Newport: Naval War College Press, 1998), p. preface.

<sup>10</sup> Gatchel, Theodore L., *At the Water's Edge*, (Annapolis: Naval Institute Press, 1996), p. 208.

one author. They are: 1) extensive use of minefields; 2) a fleet battle; 3) coordinated attack with small or independent naval forces such as submarines, fast attack boats, assault swimmers, and other special units; 4) all out aerial assault with smart weapons; 5) integrated defense at the water's edge by land forces; 6) counterattack by heavy armored forces; 7) a counter landing; and 8) integrating all defensive measures under a single forward commander.<sup>11</sup> A consideration of each characteristic follows so that proper treatment is given to the pertinent threats to OMFTS and STOM vulnerabilities.

**MINE THREAT:** Naval mines are clearly low-cost and highly capable weapons that are able to complicate the planning and execution of an amphibious operation that has a surface assault or resupply requirement. For the Marine Corps to bring a significant level of combat power ashore, a force substantially larger than a Marine Expeditionary Unit (MEU), and to provide that force with long-term staying power an efficient system of ship-to-shore offload is required. The efficient offload of heavy equipment and supplies from amphibious shipping and maritime preposition ships will require extensive mine sweeping close to shore. Desert Storm demonstrated the significant amount of time that it takes to clear minefields to an acceptable level of risk.

Minefields are more effective when they are covered by some weapon system capable of defeating the mine clearance units or taking advantage of the slowness at which the attacker is able to proceed through existing or created gaps in mine fields. That puts a premium on protecting the generally defenseless, slow, and visible mine

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<sup>11</sup> Gatchel, Theodore L., *At the Water's Edge*, (Annapolis: Naval Institute Press, 1996), p. 203-204.

countermeasure vessels that are critical to ensuring the ability to efficiently offload large quantities of logistics.

**FLEET THREAT:** The United States Navy enjoys a significant advantage over the rest of the world when it comes to fleet engagements. It is likely to maintain that advantage for a long time because of the prohibitively high-cost of building a modern fleet capable of challenging the United States Navy's "blue water" dominance. More than likely, the defender will opt for more affordable coastal defense craft with a potent yet limited blue water reach. Never the less, should an adversary possess a fleet capable of projecting combat power with significant open ocean reach, some of the combat power of the United State's fleet will likely be on call to engage and defeat the adversary's fleet.

**SMALL or INDEPENDENT NAVAL FORCES:** The more realistic threat to an amphibious operation is submarines, small attack craft, and special units. The proliferation of very capable diesel submarines does not directly effect the OMFTS assault or resupply assets because submarines do not have the weapons systems capable of effectively attacking "landing craft." Submarines do, however, have a great impact on the amphibious force's undersea warfare capable assets; the same assets that traditionally provide direct firepower support during ship-to-shore movement. Submarines, if not capable of penetrating USW (undersea warfare) defenses, also have the ability to provide covert surveillance of SLOC to provide a defender tipper information concerning where and when other critical assets to the amphibious force are operating.

Small fast attack craft armed with lightweight, advanced weapons, like Exocet Surface-to-Surface Missiles (SSMs), Stinger Surface-to-Air Missiles (SAs), or

multi-purpose guns, may not have to overly expose themselves from the cover of the coastal waterways and inlets to achieve a firing position against inbound "landing craft." The advent of low-observable, day and night, active and passive surveillance systems and the ability to link surveillance data allows fast attack craft to remain hidden or operate in a non-threatening profile until the last possible moment before maneuvering and launching their attacks. It cannot be guaranteed that fast moving attack aircraft will be able to identify and engage these fast craft prior to their attacks.

Assault swimmers do not pose a serious threat to the operations of "landing craft" because their ability to stay on station and their tactical reach is generally extremely limited. Other special units may pose a far greater threat to amphibious forces: much of the coastal regions of the world are populated with civilian vessels such as tankers, freighters, fishing boats, and aircraft going about their daily business.<sup>12</sup> These vessels have the capability to perform surveillance missions as well as carrying lightweight advanced weapons. The operations of civilian craft may cause channelizing of assault and resupply routes to minimize the exposure of "landing craft" to the aforementioned threats.

AERIAL ASSAULT: The proliferation of advanced anti-ship cruise missile technology is not going to subside; nor is the advantage that the developers of SSMs have over the developers of shipboard hard and soft-kill defensive systems.

The Exocet Block II, for instance, is almost immune to current soft-kill means and poses a highly challenging interception and destruction problem. The Russian

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<sup>12</sup> Ya'ari, Yedidia, RADM, Israel Navy, "The Littoral Arena: A Word of Caution," *Naval War College Review*, Spring 1995, p. 9.

SS-N-22 "Muskit" (or "Sunburn," as Nato knows it) is an operational Mach 2-plus sea-skimmer with a Quirky (and at present incompletely known) maneuver in its terminal phase that can probably penetrate any existing defense system, hard or soft-kill, especially when launched in salvos. Optical guidance and laser beam-riding missiles require a whole new family of defenses for soft kill, which are only now emerging as prototypes, some ten years behind the threat they are designed to counter.<sup>13</sup>

The use of those highly capable missiles directly against "landing craft," specifically LCACs, is not very likely -although possible if an adversary truly believes that a critical vulnerability of an OMFTS configured amphibious force is "landing Craft." Rather, an enemy will employ those systems against larger surface combatants, perhaps on escort missions, that are detected within the SSM's engagement envelope. LCACs are highly vulnerable to much less sophisticated weapons because of their size and lack of armor protection. Less costly SSMs, shoulder-fired missiles or gun systems are the weapons of choice to engage LCACs and potentially AAVs.

Air-to-surface launched attacks are, likewise, not going to be focused on LCACs and AAVs unless they have been designated as critical vulnerabilities and the fleets' air defenses prove invulnerable. Air attacks are also not likely to focus on MV-22s and CH-53Es because the Joint Force Air Component Commander (JFACC), using all of the doctrine and assets at his or her disposal, has experience in the daunting task of bringing all joint and combined air attack and defense assets to synergistic optimization to gain local air superiority both around the fleet and throughout the reach of the MV-22s and CH-53Es. The challenges that the JFACC face are beyond the scope of this paper.

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<sup>13</sup> Ya'ari, Yedidia, RADM, Israel Navy, "The Littoral Arena: A Word of Caution," *Naval War College Review*, Spring 1995, p. 11-12.

The Falkland's War demonstrated the capacity of a tenacious air force and SSM batteries to inflict damage on an amphibious fleet. The capabilities of the defender's airpower, if not strung out at extreme range, and the SSM batteries, if not blinded by being without an over-the-horizon surveillance capability, could have made the Royal Navy's challenges greater. That fact may not directly translate into increased losses for the Royal Navy, but clearly the Royal Navy's risk assessment may have adversely impacted fleet operations until an acceptable level of risk was achieved.

**DEFENSE AT THE WATER'S EDGE:** Traditionally, a defense at the water's edge is considered the most dangerous defensive measure against an amphibious assault.

The enemy's great difficulty is to land; we should not, therefore, trust to defeat him once he has got on shore, but should meet him as he quits the transports, and prevent his landing. The defenders should not renounce the predominance which they possess in a contest on the beach...The ease with which it is practicable to defeat a landing should not be undervalued, and all the principles of tactics clearly point to a vigorous and determined resistance on the beach as the correct course to pursue.<sup>14</sup>

A defense at the water's edge does, however, have some inherent weaknesses, such as the cost of defending everywhere along one's coast or the gaps that exist where one's force is stretched too thin or chooses not to defend. With 70 percent of the world's coastline accessible to modern amphibious vehicles, and the advent of vertical assaults, the task of defending at the water's edge seems overly daunting.<sup>15</sup>

At a closer look though, the transition period from ship-to-shore is still where the amphibious force is most vulnerable. "Landing craft" have significant vulnerabilities

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<sup>14</sup> Furse, *Military Expeditions*, 1897, p. 359. Copied from Gatchel, Theodore L., COL, USMC (Ret), *At the Water's Edge*, (Annapolis: Naval Institute Press, 1996)

<sup>15</sup> Gatchel, Theodore L., COL, USMC (Ret), *At the Water's Edge*, (Annapolis: Naval Institute Press, 1996), p. 4.

based on their radar cross section and heat signatures, inherent lack of protection (e.g., hard-kill and armor), maneuvering ability (speed and agility) verses advanced weapons systems, and lack of terrain cover. The advent of small, mobile, and passive surveillance systems coupled with the smart weapons that are mobile, easy to conceal and, and have adequate range to provide overlapping fields of fire may in fact offset the cost of defending almost everywhere.

Reinforced concrete coastal fortifications, such as the ones constructed during World War II that required repeated direct hits from the largest caliber battleship guns, could pose a significant obstacle for an amphibious force.<sup>16</sup> In view of the paucity of heavy penetrating naval ordnance and the inability to account through battle damage assessment (BDA) for the destruction or neutralization of all defensive weapons, some investment in coastal fortifications armed with highly capable smart weapons, and other systems capable of dealing with "landing craft" may cause the amphibious assault to channelize its ingress and egress routes into other more stealthy threat envelopes.

In the viewpoint of the commander of the Amphibious Task Force for the amphibious landings at Inchon and Wonsan, during the Korean War, "...the most serious threat was a defense at the water's edge combined with naval mines."<sup>17</sup> The Japanese Commander of the Gilbert Islands defenses recognized the vulnerability of the landing force and issued an order that stated, in part: "If the enemy starts a landing, knock out the landing boats...then concentrate all fires on the enemy's landing points and destroy him

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<sup>16</sup> Gatchel, Theodore L., COL, USMC (Ret), *At the Water's Edge*, (Annapolis: Naval Institute Press, 1996), p.214

<sup>17</sup> Ibid., p. 180.

at the water's edge."<sup>18</sup> Although various factors contributed to the success of American amphibious assaults against Japanese defenses set up around a defense at the water's edge doctrine, the Japanese came to realize that it was the overwhelming firepower of the American warships and aircraft that made defenses designed to prevent the landings unsuccessful.<sup>19</sup>

The assessment of the best form of defense against amphibious assaults was also argued by the Germans. German commanders recognized that the ship-to-shore movement phase was the most vulnerable phase of an amphibious assault. "Everything must be directed towards destroying the enemy landing force while it is still on the water, or at the latest during the landing itself."<sup>20</sup> They too eventually concluded that, "...the Allies' aircraft and naval gunfire would overpower a defense at the water's edge..."<sup>21</sup>

**MOBILE DEFENSE:** The mobile defense is predicated on a defense in depth and throwing the amphibious attacker back into the sea through the use of a mobile reserve force, usually consisting of some armored forces, to launch a counterattack at the landing beaches. The conclusions of Field Marshall Erwin Rommel, drawn from first-hand experience maneuvering armored units without control of the air and from personal studies of the Allies' Italian campaign, indicated that he discounted the possibility of massing and moving armored forces in a reserve position away from the coast into a counterattack.<sup>22</sup> The conclusion stems from the vulnerability of armored forces to enemy

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<sup>18</sup> Gatchel, Theodore L., COL, USMC (Ret), *At the Water's Edge*, (Annapolis: Naval Institute Press, 1996), p. 123.

<sup>19</sup> Ibid., p. 134.

<sup>20</sup> Ibid., p. 59.

<sup>21</sup> Ibid., p. 50.

<sup>22</sup> Ibid., p. 65.

air power; a conclusion re-validated during the Gulf War and apparently still valid in the future with the proposed development of smart, long-range anti-armor ordnance.

A potential adversary needs to have a robust defensive doctrine, especially one that considers defense in depth, geography, and the tenets of their offensive doctrine; however, the mobile defense does not pose the threat to the "landing craft" that is being considered in this paper. The mobile defense, by virtue of applying the principles of defense in depth, does contribute to attrition of "landing craft" and the increased demand for follow-on cycles of "landing craft."

COUNTER LANDINGS: A counter landing by an adversary is envisioned to inject a new force into the battle area in order to wrest the initiative away from the amphibious operation. Like the mobile defense, this counter landing has little direct impact on "landing craft" except for the increase sortie response that it is likely to illicit as the ground forces cycle-up to deal with the new threat.

UNITY OF COMMAND: Arguably the most significant aspect of the defense against an amphibious attack is having unity of command and a well thoughtout coastal defense doctrine. History is replete with examples of the conflicts, inefficiencies, and missed opportunities that have plagued unclear command relationships between naval, land, and air force commanders responsible for some facet of defensive operation against amphibious assaults.

The very nature of an amphibious operation requires ground and naval commanders to acknowledge one another's participation in the enterprise and demands a minimum level of cooperation...The basic nature of a defense against a landing, on

the other hand, exerts no corresponding pressure on commanders from different services to cooperate or consider the requirements of the other services.<sup>23</sup>

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<sup>23</sup> Gatchel, Theodore L., COL, USMC (Ret), *At the Water's Edge*, (Annapolis: Naval Institute Press, 1996), p. 205-206.

## Ship-to-Objective Maneuver

STOM doctrine currently under development envisions projecting, by sea and air assaults, a combined-arms force, sufficiently strong enough, to win battles for inland operational objectives. By taking advantage of modern mobility and integrated C4I systems, assault assets and for that matter follow-on sorties, will maximize their ability to out-maneuver the enemy on their way to the objectives.<sup>24</sup> That ability coupled with robust, remote fire support, such as Navel Surface Fire Support (NSFS), carrier aviation, and other joint assets, obviates the necessity to buildup logistics support ashore.

STOM assumes that "...the ATF's mobility and firepower, in concert with joint and combined forces, will dominate the littoral battlefield."<sup>25</sup> However, if it is truly possible to dominate the littoral battlefield, then why have ATFs been forced to operate from over-the-horizon? Again, in follow-on phases, it should not be assumed that the maneuverability of modern "landing craft" coupled with integrated C4I and supporting fires will enable the "landing craft" to move unscathed over or on the littoral SLOCs.

Given that operational and tactical surprise is achieved during the initial assault, surprise should not be counted on to provide any security for follow-on missions, both over and on the littoral SLOCs and over the ground. It is wise to consider other methods of protecting the vulnerable "landing craft," such as escorting and suppression or destruction of enemy defenses.

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<sup>24</sup> MCCDC, *Tentative Landing Force Manual 2014*, (Quantico: MCCDC, 1997), p.1-2 – 1-5.

<sup>25</sup> *Ibid.*, p. 1-2.

When considering the possible options for defending the "landing craft," it is first necessary to have a better appreciation of how STOM effects various assets available to the joint force commander -- a significant tradeoff exists in the competition for assets. A basic premise of STOM is that the amphibious force will greatly increase its operating area over traditional amphibious operating areas. *"By requiring the enemy to defend a vast area against our seaborne mobility and depth of power projection, we will render most of his force irrelevant [emphasis in the original]."*<sup>26</sup> The implication of that philosophy is -- there is a corresponding increase in demand on force assets, especially the ones capable of protecting "landing craft."

**AIR ESCORTS:** The ability of the Navy to conduct widely dispersed operations and still mass and coordinate its firepower is not at issue; what is at issue is the realistic drain on air assets that, based on the navy commander's assessment of the risk to dispersed ships, will occur. For the fleet, the concept of defense in depth is still the doctrine. The Mahanian principals of concentrating the fleet are still applicable against the increasingly more capable multi-dimensional threat facing the fleet in the littorals. Without discounting the ability of an adversary to employ diesel submarines, small surface combatants, and armed civilian vessels, the navy, if in fact operating in a dispersed manner, will severely tax the limited number of multi-mission undersea and surface warfare (USW/SUW) capable aircraft (currently LAMPS III and S-3) of the force, and possibly draw fixed wing attack sorties for surface combat air patrol (SUCAP) missions, in an effort to keep up surveillance, identification, targeting, and, if necessary, attack

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<sup>26</sup> *MCCDC, Tentative Landing Force Manual 2014*, (Quantico: MCCDC, 1997), p. 1-4.

missions on enemy craft before they can get within effective weapons release range of a high-cost surface combatant with 350 plus crewmembers.

A similar drain on air assets comes from the need to provide air support to the forward ground units engaged in battles for operational objectives. The distance of the objectives from the possible fire support asset locations is likely to require a significant amount of close-air support sorties, to mitigate time of flight and air coordination problems caused by long-range NSFS ordnance. Furthermore, strategic suppression missions, such as SCUD Hunting, and maintaining local air superiority over inland objective areas from airbases over the horizon will in all likelihood require a large number of air patrol sorties.

Finally, other joint targeting priorities, aircraft attrition and myriad other operational limitations (friction), such as deck cycle, weather, and aircrew availability to name a few, will further strain the available number of aircraft. The reality is that the call for logistics and other follow-on "landing craft" missions to support the attainment of operational objectives will continue for the relatively defenseless transports. It may be wishful thinking to plan on having attack aircraft escort "landing craft" over the entire route; even if they do, they are severely limited in their ability to defeat the incoming threats.

Sophisticated electronic countermeasure aircraft are also heavily taxed by the increased scope of the battlefield. Furthermore, their effectiveness against future advanced weapons will be a constant technological race that they may never be able to keep up with.

The Air Command Element (ACE) has at its disposal a number of attack helicopters that are capable of escorting some of the "landing craft," especially over the SLOCs. Their availability for escort missions is dependent on other battlefield requirements with respect to close air support missions. Based on STOM doctrine's tendency to push for deep objectives and to keep ground logistics support minimal, attack helicopters may find themselves available for escort missions over SLOCs. A significant limitation is their inability to provide hard-kill defenses against in-flight missiles.

**SURFACE ESCORTS:** Surface ships provide another asset capable of escorting "landing craft." Certain realities are likely to limit their use for "landing craft" escort missions. First, the cost of U.S. surface combatants operating by the second decade of the 21st century are \$1.2 billion (Aegis Cruiser), \$900 million (Aegis Destroyer), and \$750 million (Land Attack Destroyer). The cost of those ships, coupled with their crews 400+, 350+, and 95<sup>27</sup> and valuable ordnance 120, 90, and 250 vertical launch cells (cells that are not underway reloadable), is prohibitively high to risk them in operations close to shore.<sup>28</sup>

Secondly, even though those ships are multi-mission capable, there is a trade-off in performance of the various mission areas (e.g., Air Warfare (AW), Surface Warfare (SUW), and Undersea Warfare (USW) based on system configurations, ship stationing, and other factors. During high-tempo operations, whether dispersed or concentrated, there are multitudes of tasks required of surface combatants. In view of the limited

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<sup>27</sup> Wilson, George C., "Becoming a More Lethal Weapon," *Navy Times*, 5 January 1998, p. <sup>14</sup>.

<sup>28</sup> Jorgensen, Tim S., CDR, Royal Danish Navy, "U.S. Navy Operations in Littoral Waters 2000 and Beyond," *Navy War College Press*, 1997, p. 6.

number of surface combatants based on the projected purchases, escorting follow-on "landing craft" missions may not be achievable based on the risk and the defenders maritime response, such as aggressive submarine, air, and fast attack boat attacks.

Thirdly, based on the maneuverability characteristics of conventional surface combatants, they are unable to keep up with the "landing craft" operating under STOM doctrine which stresses flexibility in maneuvering to achieve safe routing to objectives. In other words, they are unable to provide effective escort duties (i.e., direct fire support coverage) to the "landing craft."

OPERATIONS IN LIEU OF ESCORTS: The STOM doctrine does recognize the need to deal with enemy defenses and strong points on the coast. "While the landing forces will attempt to bypass the enemy's defensive strengths, it may be necessary to neutralize or destroy critical positions in the defensive array...."<sup>29</sup> Two options are mentioned regarding possible ways to counter strong enemy coastal defenses: battlefield shaping conducted by aviation, NSFS, or special operations; and surface assaults designed to exploit gaps and then take the defenses in the flank or rear.

The Navy is actively pursuing a strategy to fix its lack of NSFS assets and destructive power. It is funding a variety of NSFS acquisition, and research and development projects, such as the Vertical Gun Advanced System (VGAS), Extended Range Guided Munitions (ERGMs), Navy Tactical Missile System (NTACMS), Sea SLAM, and Land Attack Standard Missile. The accuracy and capacity of those systems may achieve the same suppression, neutralization, and destructive power provided by the

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<sup>29</sup> *MCCDC, Tentative Landing Force Manual 2014*, (Quantico: MCCDC, 1997), p.1-6.

large caliber gunships of the 20th century when supporting amphibious operations. Unfortunately, the ordnance for those new systems tends to be very expensive, for example: the cheapest of the aforementioned systems, a VGAS round is estimated at \$25,000 per round with hopes that it eventually can be reduced to \$5,000 per round.<sup>30</sup> Other limitations of the new family of NSFS weapons are: their reliance on intelligence, surveillance, and target acquisition systems which were inadequate for SCUD Hunting in a desert environment (the GULF WAR), an environment that is much less complex and challenging from a target acquisition point of view than the littorals; and their responsiveness in light of airspace deconfliction and time-of-flight issues.

Surface assaults through gaps or at penetration points away from coastal defenses may provide this assault force with the ability to rapidly turn the flank of the coastal defenses.<sup>31</sup> The vital question is -how large an area will the surface assault force have to neutralize in order to reduce the defender's reach across the vulnerable littoral SLOC? That of course is very dependent on terrain, and surveillance and weapons reach.

DOCTRINAL SOLUTIONS IN LIEU OF ESCORTS: The Marine Corps does recognize the need to coordinate the support effort with the navy commander. "The supporting effort demands detailed planning and coordination among landing force and supporting naval forces."<sup>32</sup> Flexibility is a key characteristic of the assets tasked with supporting the movement from ship-to-shore because the navy, as envisioned in the

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<sup>30</sup> Peniston, Bradley, "Taking Aim from 100 Miles Out? VGAS Makes It Possible," *Navy Times*, 20 April 1998, p. 14.

<sup>31</sup> *MCCDC, Tentative Landing Force Manual 2014*, (Quantico: MCCDC, 1997), p.5-1.

<sup>32</sup> *Ibid.*, p.1-5.

doctrine, is responsible for getting the "assault craft" to their attack positions which are seaward of the line of departure. At that point, a landing force maneuver element takes control of the "landing craft" and may adjust their attack formations, axes, and other tactical directions. Any supporting elements (e.g., escorts), working off of a common tactical picture, must be capable of adjusting plans and action to continue to provide the required support.<sup>33</sup>

HISTORICAL REALITIES FOR ESCORT: STOM doctrine recognizes the need to have a surface assault capability. The doctrine presents one concept of how a force might be configured to perform that mission. In that example it identifies a need and a hope which should draw considerable attention.

Touchdown of LCACs and AAVs depends on the degree of combat...MCAC (mine countermeasures) detachments clear mines and obstacles. AAVs must go off plane, provide covering fire, touch down, and fight enemy defenses. LCACs must land in as tight and rapid an order as possible, offloading tanks, and so on directly into battle, if necessary. LCACs may be exposed to loss or damage in the initial assault, as are the equally vulnerable heavy lift helicopters in the vertical envelopment. Hopefully, the actions of AAVs, their infantry and engineers, and supporting arms will reduce the threat to acceptable levels.<sup>34</sup>

As amphibious operation progressed during World War II, one consistent lesson learned was that there could never be enough fire support at the beach as the assault was going ashore. Vessels of virtually every class of World War II landing craft were converted, by adding guns, rockets, or mortars, to fire support ships. It was commonly recognized that those vessels were less valuable than cruisers or destroyers.<sup>35</sup> That fact

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<sup>33</sup> *MCCDC, Tentative Landing Force Manual 2014*, (Quantico: MCCDC, 1997), p.1-7.

<sup>34</sup> *Ibid.*, p.5-11.

<sup>35</sup> Gardner, Robert, *The Eclipse of the Big Gun: The Warship 1906-45*, (London: Conway Maritime Press Ltd., 1992), p. 146-147.

was recognized even in light of operating with the largest NSFS and aviation armada ever assembled. The firepower of 25mm Bushmaster armed AAVs plus their associated infantry pales in comparison to firepower requirements that were commonly used to support the battle for the beach in World War II.

Another solution to close-to-shore fire support was the concept of "...well-protected shallow draft vessels...."<sup>36</sup> Some of those World War I vessels, "monitors" as they were called because they were designed to support one 14 inch or larger gun turret, remained in operation through the end of World War II. They were armored and designed to provided good protection against mines, torpedoes, and artillery at the sacrifice of maneuverability. "Essential requirements of coastal offense vessels were that they should carry the heaviest guns available on the smallest hulls, and to be "riskable" in a way that battleships could not be for secondary purposes."<sup>37</sup>

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<sup>36</sup> Gardner, Robert, *The Eclipse of the Big Gun: The Warship 1906-45*, (London: Conway Maritime Press Ltd., 1992), p. 71.

<sup>37</sup> *Ibid.*,p. 71.

## Solution for the Navy's Littoral Dominance Deficiency

The Quadrennial Defense Review (QDR) has recommended a Navy structured around twelve aircraft carrier battle groups and twelve amphibious ready groups but with a reduced number of surface combatants. To offset the reduction of the surface fleet, the QDR recommends that the Navy rely on newer and more capable systems.<sup>38</sup> A recent Navy war game series produced a valuable insight concerning the limitations of new and projected naval capabilities: "It was quickly apparent to players that while stealth, precision, and information technologies afforded U.S. forces a unique wartime ability to engage at great distance while hidden from a foe, it was close-in, *visible* presence that was critical to preventing war by deterring or containing a crisis in the first place...Avoiding enemy weapons and surveillance by stealth or submergence makes sense in wartime, but it does not obviate the need for surface forces to go in harm's way in situations short of war...In each of the war games there arose requirements to perform traditional military functions -- mine clearance, escort operations...and so on."<sup>39</sup> Surface ships have the unique ability to provide visible, long-term presence and multi-mission capabilities to implement national policy over a broad spectrum of operation from peace through war.

John Paul Jones had part of the solution when he said, "I wish to have no connection with any ship that does not sail fast for I intend to go in harm's way." If he were alive

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<sup>38</sup> Cohen, William S., "Report of the Quadrennial Defense Review," *Joint Force Quarterly*, Summer 1997, p. 12.

<sup>39</sup> Smith, Edward A., Jr., CAPT, USN, "The Navy RMA War Game Series," *Naval War College Review*, Autumn 1997, p. 27-28.

today, he may alter those words to, "I wish to have no connection with any ship that does not sail fast or is too valuable to be risked for I intend to go in harm's way." The Navy requires fast and affordable ships to operate close to the beach.

Affordability cannot be overlooked in this post-right sizing age marked by stagnant or reduced military budgets. The affordability analysis for the next generation surface combatant came out in favor of the land attack destroyer over the arsenal ship. The condensed version of the decision as presented by Admiral Donald Pilling was that about 35 land attack destroyers, at \$750 million a ship with a crew of 95 sailors, could be purchased to replace the fleet of non-Aegis surface combatants that are scheduled for decommissioning and fill the fire support gap that the six proposed arsenal ships were being designed to fill.<sup>40</sup> The total purchase cost of the DD 21 program is over \$26 billion dollars with 8,750 vertical launch cells. Past estimates on the Arsenal Ship program had a purchase price of \$6 billion (including ordnance) with 3,000 vertical launch cells.<sup>41</sup> Many skeptics challenged the notion of being able to afford filling the 3,000 vertical launch cells.<sup>42</sup> It may be too early yet to hear their reaction to 8,750 cells. The bottom line is that by reverting to the plan to build six arsenal ships, \$20 billion is available for purchasing a sizable number (perhaps 50) less costly ships. Those ships would also take advantage of technology to keep crew size down.

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<sup>40</sup> Wilson, George C., "Becoming a More Lethal Weapon," *Navy Times*, 5 January 1998, p. 14.

<sup>41</sup> Department of the Navy, "Arsenal Ship Capabilities Document," 1996.

<sup>42</sup> Stearnman, William L., "The Navy's Proposed Arsenal Ship - Con," *The Retired Officer Magazine*, November 1996, p. 37.

The trade-off from that approach would entail a loss of advanced technology multi-mission capabilities. Perhaps called a "coastal fighting" version of SC 21, it would need to be capable of: mine detection; point and small area (25 miles) air defense using SA missiles; providing NSFS (mostly short range (<20 miles) rapid delivery weapons); lightweight and low observable naval gun system (76mm or less); aviation facilities for a helicopter or unmanned aerial vehicle (UAV); robust C4I suite with cooperative engagement capability (CEC); underway refueling; robust survivability; and advanced passive self defense.

**MINE DETECTION:** Mines pose a significant threat to any ship operating close to shore. The Navy has a long-range plan for upgrading ships with organic mine detection systems. A coastal fighting version of SC 21 would require a highly capable mine detection system to allow it to avoid detectable mines.

Noticeably, there is no mention of submarine detection. The belief is that an enemy submarine would likely choose not to engage a small platform like a coastal fighting SC 21: by attacking, a submarine would give away its position and likely become the subject of a well focused search by USW assets. With an aviation facility, the ship could contribute to USW search and attack, if a submarine was detected close by.

**AIR DEFENSE (primary mission):** Vertical launched surface-to-air missile technology exists for self defense and limited area defense (< 5 miles). The range of the area defense envelope needs to be increased to allow for interception of threats to "landing craft," 25 miles should be sufficient. Those vertical launched missiles need to have CEC, too.

Integrated command and control systems exists for hard and soft-kill point defense weapons systems, such as the close-in weapons system (CIWS), rolling airframe missile (RAM), and super rapid blooming off-board chaff (SRBOC). That technology may be needed to maximize self defense capabilities, defense in depth, and redundancy.

NSFS (primary mission): Only short range NSFS ordnance is required for the coastal fighting SC 21. This ship will be designed to operate close to shore and effect the land battles taking place close to shore. The arsenal ship, aircraft carriers, cruisers, destroyers, and submarines can provide the maritime punch for long-range NSFS. The goal is to minimize the expensive multi-mission trend and focus on providing rapid and volumous coastal fire support.

GUN SYSTEM: In the coastal region, the coastal fighting SC 21 will be challenged by many small craft, both armed and unarmed civilian craft and fast attack craft. Virtually, every warship needs a gun system to deal with those craft. Cheap ordnance fired across the bow of a civilian vessel is a proven and effective way to ward them off. The gun system also allows for the conservation of high performance ordnance for NSFS and air defense. Furthermore, having cruisers conduct maritime interdiction operations or operate in an exercise with a third world country is often wasteful and awkward. A coastal attack ship operating in the cruising mode would be well suited for both frequently called upon missions.

AVIATION FACILITIES: The one significant void that will occur upon the decommissioning of the non-Aegis ships is the lack of ships capable of embarking helicopters. Helicopters greatly extend the range of sensors, weapons, and the ability to

positively identify contact. Positive identification is vital in this age of restrictive rules of engagement. In the littoral, the value of helicopters, especially armed ones, in direct support of a ship cannot be overstated: when embarked, helicopters act as an extension of the ship.

C4I: The Navy is on the right track with its C4I architecture that links information throughout the entire force. Some of that information is already real-time fire control data using CEC. That minimizes the need to have a wide array of topside fire control antennas on a ship that is operating close to the beach: the benefit is a reduction in radar cross-section. Fire control and search antennas for terminal engagement or self protection could be of the pop-up variety.

The ship must be capable of coordinating its operations with the multitude of aircraft searching, transiting, escorting, and fighting over the water close to the beach. This is another area where C4I architectures and joint doctrine are already heading.

SURVIVABILITY: During John Paul Jones' day, one thing that speed attributed to was the defense, controlling the amount of time that the enemy had for engaging you. Today, stealth technologies can be equated to speed. A stealthy design and lightweight armor are significant factors in making a ship survivable. In the environment close to the shore where visual detection is a threat, low observability is a critical subset of stealth. Low observability translates into semi-submersible or submersible vice traditional stealth technologies such as faceted design and absorptive material use.

Submersibles have some significant disadvantages. First, the United States has recognized for years the benefits of nuclear power to long-range power projection for

submarines. Nuclear propulsion requires an extensive cost in infrastructure and personnel; both areas where the Navy is likely not going to accept increases. Secondly, submarines would have to surface in the littoral to effectively deliver the volume of fire envisioned. Finally, any damage incurred by a submarine while on the surface may preclude their ability to submerge and would definitely result in significant repair costs.

Semi-submersible surface ships offer many of the benefits of stealth. They are able to operate in two modes, cruising and "lurking." By "lurking" the ship would ballast down and have only the minimal topside exposure. They would also maintain their C4I data link with the force.<sup>43</sup>

Armoring surfaces that are exposed to air breathing weapons provides additional passive protection. By using six inch thick armor inclined 60 degrees from vertical to connect the deck and the hull, horizontally flying sea-skimming missiles would impact on the equivalent of 16 inches of armored belts. Theoretically, that would withstand hits by supersonic cruise missiles.<sup>44</sup> Additionally, using reactive armor to reinforce vital areas could make the ship less vulnerable to ordnance with shape charges, such as those typically employed in anti-armor weapons. Reactive armor can help mitigate the effects of those type weapons and wide-area bomblette type weapons.

A water shield system could be incorporated into the coastal attack ship. That unsophisticated technology would further hide the ship from infra-red and radar observation. The shield is created by spraying water out from the gunwale area, both to

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<sup>43</sup> Ya'ari, Yedidia, RADM Israel Navy, "A Case for Maneuverability," *Naval War College Review*, Autumn 1997, p. 129-130.

<sup>44</sup> Loire, Rene, *The Striker - A Warship for the 21st Century*, (Houston: A. Ghosh), 1996, p. 402-405.

hide the freeboard and superstructure, and douse the deck of the ship. To sensors, the ship, in the "lurking mode" with water shield activated, would appear to be a wave. The heat dissipating property of the sea water would mask the ships heat signature. In theory, weapons would fly over the ship as if it was a wave.<sup>45</sup>

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<sup>45</sup> Loire, Rene, *The Striker – A Warship for the 21<sup>st</sup> Century*, (Houston: A Ghosh), 1996, p. 421-425.

## Summary

"Hostile combined-arms forces supported by integrated air and coastal defense systems remain the greatest threat to landing forces. From mobile or fixed positions, defending forces attempt to deny landing sites and to counter our maneuvers ashore. Landing forces may face any combination of obstacles, mines, artillery, aircraft, submarines, small boats, air defense artillery, and mobile reaction forces. The enemy may attempt to defeat or disrupt the amphibious force by contesting our control of the air, surface, and subsurface battlespace. He may attack the amphibious task force (ATF) at sea, attempt to repel the landing during the assault, counterattack on land to eject the landing force, or any combination of the above."<sup>46</sup>

That survey of the threat does not address the one aspect that is critical to STOM -- the ability of an adversary to respond after the initial assault by awakening a robust coastal defense system with pre-prioritized targets focused on a critical vulnerability of STOM, namely "landing craft" on follow-on missions. Given that operational and tactical surprise is achieved and the assault forces are ashore, Marine Combat Service Support kicks in to perform its six basic functions: supply, maintenance, transportation, general engineering, health services, and other services. Much of that support must pass through the dangerous region between the sea echelon, where the sea based logistics is located, and the beach.

Operating in the region between the beach and the sea echelon area is what the United States Navy needs to think hard about and experiment in -- now -- so that the doctrine, equipment, and organizations exist in the future, when STOM doctrine is implementable. The Navy has swung to the opposite end of the NSFS spectrum by going from a paucity of NSFS assets to purchasing nearly 9,000 vertical launch weapons cells,

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<sup>46</sup> MCCDC, *Tentative Landing Force Manual 2014*, (Quantico: MCCDC, 1997), p. 1-2.

not including the existing vertical launch cells on existing destroyers and cruisers. The area close to the coast, under the domination of an unsinkable, survivable, and concealed coastal defense system needs a specialized warship, the likes of which have hardly ever been seen before. The Navy definitely does not need another \$750 million multi-purpose ship armed with a mixture of ordnance, some of which can "...blow up a power grid 1,000 miles away...." or take down a theater ballistic missile.<sup>47</sup> With that price-tag, it hardly passes the acceptability test for operating close to shore.

The threat and its defeat are not 1,000 miles away, or streaking down from space -- leave that to capital ships. All OMFTS operational designs and innovations will be for naught, if the troops ashore cannot be supported by CSS afloat. The tactical battle discussed in this paper -- for true littoral maritime superiority -- will be fought up close to the beach against a tenacious foe responding to the amphibious assault. If the United States Navy is unable to get follow-on missions across that tactical zone which falls in large measure under the responsibility of the Navy, then STOM will die on the vine.

Further investigation into the realities of how much attrition can be accepted and still have enough reach to support the battle for the operational objectives. Wargaming may prove beneficial in providing data in this area. With that data, the requirement for validating the significance of close-to-shore escort operations can be achieved.

The Navy needs a specialized class of ship that is: capable of operating close to the shore; designed with realistic cost constraints; and produced in sufficient quantities to be effective. With those broad requirements, that ship passes the acceptable and suitable

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<sup>47</sup> Wilson, George C., "Becoming a More Lethal Weapon," *Navy Times*, 5 January 1998, p. 14.

requirements. Feasible may be in the realm of wishful thinking, but at some time every revolution in military affairs (RMA) was there. C4I capabilities hold a key to opening the door to reality because surface ships and air craft, coupled with surveillance and C4I integration, and all operating under a common maneuver doctrine will go a long way to achieving success in the future littoral fight.

If the naval service is going to strive for an over the horizon forced entry capability, then it cannot assume that the SLOC between the sea echelon area and the shore are safe to operate the highly vulnerable MV-22, CH-53E and LCAC. Resupply is critical. It would be foolhardy to assume that against a determined and resourceful enemy that a "Blitzkrieg-like" STOM would be overwhelmingly, rapidly successful as to obviate the resupply requirements of the ground forces attacking their objectives. The Marine Corps is excited about being able to achieve operational and tactical surprise made possible by OMFTS concepts. They also relish the advantages of keeping the initiative and maintaining a high-tempo on the battlefield. However, they certainly understand the principles of fog and friction on the battlefield and that using the military instrument of national power to bring a determined, capable, and resourceful enemy to our will is going to be a hard fight that is likely to not be accomplished in one fell swoop, ergo the requirement to keep the ground units in the close battle adequately supplied.

## BIBLIOGRAPHY

- Anderson, Gary W. "Implementing OMFTS: Infestation and Investation." *Marine Corps Gazette*, April 1995.
- Anderson, Jon R. "Pushing Toward a Brave New World." *Navy Times*, 5 January 1998.
- Annati, Massimo, "Coastal Defence: Issues and Solutions." *Military Technology*, February 1995.
- Bally, Jacques J., CAPT, (Ret.). "The Shape of Ships to Come." *Armada International*, January 1994.
- Bally, Jacques J., CAPT, (Ret.). "The Shape of Ships to Come II." *Armada International*, January 1996.
- Beddoes, Mark W., LT, USN. "Logistical Implications of Operational Maneuver from the Sea." *Naval War College Review*, Autumn 1997.
- Bender, Bryan. "Arsenal Ship Could Face at Least One-year Delay." *Defense Daily*, 16 October 1997.
- Bender, Bryan. "DoD Views Predator's All-weather Capability as Crucial." *Defense Daily*, 20 August 1997.
- Blazar, Ernest. "Future Shock/Arsenal Ship Will Have Small Crew & Big Punch." *Navy Times*, 29 July 1996.
- Blazar, Ernest. "How the Arsenal Ship Will Fight." *Navy Times*, 29 July 1996.
- Blazar, Ernest. "Inside the Ring: 300-Ship Navy." *Washington Times*, 6 October 1997.
- Blazar, Ernest. "Navy's Future: Is it Boorda's of Owens'?" *Navy Times*, 26 December 1994.
- Blazar, Ernest. "Ships With 2 Points of View." *Navy Times*, 4 September 1995.
- Blosser, O. Kelly. "Naval Surface Fires and the Land Battle," *Field Artillery*, September-October 1996.

- Bradshaw, Bruce, CAPT, USN. "Fleet Readiness: Right Sailor, Right Training, Right Ship." *Surface Warfare*, January/February 1997.
- Brooks, Donovan. "Admiral: China no 'Blue-water Threat'." *Pacific Stars and Stripes*, 28 February 1997.
- Buckley, Patrick E., LCDR, USN. *The Submarine Threat to Naval Operations... From the Sea*. Joint Military Operations Department Paper. Newport, RI: Naval War College, 1995.
- Bush, Tom, CAPT, USN. "SC-21 Roadshow." 2 September 1997.  
<[http://sc21.crane.navy.mil/sec-1 .pdf](http://sc21.crane.navy.mil/sec-1.pdf)>
- Cavas, C. P. "Is Arsenal Ship's Mission Adrift?" *Navy Times*, 17 March 1997.
- Cayce, David M., LT, USN. "Composite Maneuver Warfare Commander." *Marine Corps Gazette*, March 1995.
- Center for Naval Analysis. *Amphibious Ready Group Ship-to-Shore Capabilities*. July 1993.
- Center for Naval Analysis. *Efficient Use of LCAC at Varying Standoff Distances*. June 1992.
- Center for Naval Analysis. *Forces for Forcible Entry: An Analytical Overview of Amphibious Programs in POM-96*. August 1994.
- Center for Naval Analysis. *LCAC Data Summary and Analysis*. June 1992.
- Center for Naval Analysis. *LCU Operations During Amphibious Assaults*. December 1990.
- Center for Naval Analysis. *Project Culebra. MCM Follow-on Wargame*. June 1995.
- Center for Naval Analysis. *Project Culebra: Sea-based Combat Service Support for Ship-to-Objective Maneuver (Supply and Transportation Analysis)*. September 1995.
- Center for Naval Analysis. *Project Culebra: Summary Report*. August 1995.
- Close, Bradley C. "Electronic Warfare: The Critical Vulnerability of OMFTS." *Marine Corps Gazette*. August 1996.

- Cohen, William S., "Report of the Quadrennial Defense Review." *Joint Force Quarterly*, Summer 1997.
- Crawley, James W. "The U.S. Fleet's Silent Partners." *San Diego Union-Tribune*, 4 August 1997.
- Department of the Navy, "Arsenal Ship Capabilities Document," 1996.
- Department of the Navy, "Arsenal Ship Concept of Operations," 1996.
- Department of the Navy, *Forward...From the Sea*, Washington, DC: Department of the Navy, 1995.
- Dorsey, Jack, "Now's Time to Take Risks for New Navy, Admiral Says," *Virginian-Pilot*, 26 October 1997.
- Dziminowicz, John W., LCDR, USN. *Maritime Action Groups: The Expeditionary Building Block of the Future*. Department of Operations Essay. Newport, RI: Naval War College, 1993.
- Fleet Marine Force Manual (FMFM) 1. *Warfighting*. Washington, DC: Department of the Navy, 1989.
- Fleet Marine Force Manual (FMFM) 1-1, *Campaigning*, Washington, DC: Department of the Navy, 1990.
- Foxwell, David. "Beyond the Horizon But Not Out of Sight: Long-range Radars Assume Wider Roles." *Jane's International Defense Review*, August 1997.
- Foxwell, David. "Sub Proliferation Sends Navies Diving For Cover: The Multiple Menace of Diesel-Electric Submarines." *Jane's International Defense Review*, August 1997.
- Frank, Harry. *Marine Corps Midrange Threat Estimate -- 1997-2007: Finding Order in Chaos (U)*. Quantico, VA: Marine Corps Intelligence Activity, 1997.
- Gardner, Robert. *The Eclipse of the Big Gun. The Warship 1906-45*. London, UK: Conway Maritime Press, Ltd, 1992.
- Gatchel, Theodore L., COL, USMC (Ret). *At the Water's Edge. Defending Against the Modern Amphibious Assault*. Annapolis, MD: Naval Institute Press, 1996.

Goodman, Glenn W., Jr. "Accelerated Schedule for New Aegis Ships." *Sea Power*, October 1997.

Goodman, Glenn W., Jr. "Sea-Based Firepower: US Navy Plans a Measured Revolution at Sea for its Surface Warships." *Armed Forces Journal International*, November 1997.

Gourley, Scott. "Arsenal Ship." *Popular Mechanics*, June 1996.

Gourley, Scott. "Naval Surface Fire Support in Forcible Entry Operations." *Naval Forces*, January 1995.

Gourley, Scott. "U.S. Naval Surface Fire Support: The Gun Factor." *Military Technology*, August 1992.

Gresham, William F.P. "OMFTS and the Single Battle Concept." *Marine Corps Gazette*, April 1996.

Grimes, Vincent. Scott, Richard, and Wells, Mike. "Amphibious Advancement." *Jane's Navy International*, September 1997.

Hamilton, Charles R., CAPT, USN. an Interview by Bersia, John C. "Navy Technology Revolution Awaits Ships, Firepower." *The Orlando Sentinel*, 17 August 1997.

Hanlon, Edward J., Jr., MGEN, USMC. "In the Littoral, We Are All Mine Warriors." *Sea Power*, May 1997.

Hannon, Brent. "On the Defensive: The Threat from Mainland China is taken Seriously by Taiwan's Air Force." *Flight International*, 13-19 August 1997.

Hessmen, James D. "Evolution of a Revolution -- the PCs (Patrol Coastal Ships): Custom Built for Littoral Warfare." *Sea Power*, October 1997.

Hewish, Mark. "Strengthening the Weakest Link: Integrated Ship Self-defense in the Age of Littoral Warfare." *International Defense Review*, November 1995.

Holzer, Robert. "DD-21 Program May Be Delayed." *Navy Times*, 27 April 1998.

Holzer, Robert. "Doubling the Sortie Rate." *Navy Times*, 10 March 1997.

Holzer, Robert. "Sharing Arsenal Ship Assets." *Navy Times*, 1 July 1996.

Holzer, Robert. "Revolutionary Concept Goes to Navy Chief." *Defense News*, 11-17 August 1997.

Holzer, Robert. "The Future of Naval Gunfire Support." *Navy Times*, 22 April 1996.

Ingersoll, Alvah E., III, MAJ, USMC. *A Naval Expeditionary task Group in Operations Other Than War*. Department of Joint Military Operations Paper. Newport, RI: Naval War College, 1996.

Jane's Staff Writer. "Four Frigates will Cost \$1.61b, Says Dutch MoD." *Jane's Defense Weekly*, 23 July 1997.

Jane's Staff Writer. "Sea-skimmer Missile Prepares for Critical Component Test." *Jane's Defense Weekly*, 23 July 1997.

JJL. "Advanced MEKO Vessels Cut Down to Size." *Jane's International Defense Review*, October 1997.

JJL. "Kongsberg and Aerospatiale Join Forces on Anti-ship Missile." *Jane's International Defense Review*, October 1997.

Johnson, Gary W. MAJ, USMC, and Chang, Shujie. "The Combat Service Support Challenge." *Marine Corps Gazette*, March 1996.

Johnson, Jay L., ADM, USN. "The Navy Operational Concept: Forward...From the Sea." *Sea Power*, May 1997.

Joint Chiefs of Staff, Joint Publication 3-0, *Doctrine for Joint Operations*, Washington, DC: Office of the Chairman of the Joint Chiefs of Staff, 1995.

Joint Chiefs of Staff, "Joint Vision 2010: America's Military - Preparing for Tomorrow." *Joint Force Quarterly*, Summer 1996.

Joint Chiefs of Staff, *National Military Strategy of the United States of America*, 1995, Washington, DC: GPO, 1995.

Jones, Davy, JO2, USN. "Retired Surface Warrior Details New Arsenal." *Campus News: The Navy -University*, Public Affairs Office, Naval Postgraduate School Monterey, California, 21 October 1996.

Jorgensen, Tim S., CDR, Royal Danish Navy. "U.S. Navy Operations in Littoral Waters 2000 and Beyond." *Navy War College Press*, 1997.

- Kelly, Patrick M., ENS, USN. "The U.S. Navy Must Re-Evaluate Its Doctrine." *USNI Proceedings*, July 1996.
- Kojukharov, Asen N., LCDR, Bulgarian Navy. "In Retrospect: The Employment of Antiship Missiles." *Naval War College Review*, Autumn 1997.
- Kreisher, Otto. "Admiral Warns 300-Ship Goal is Periled: He Says Cheaper, Arsenal-type Vessels are a Crucial Need." *San Diego Union-Tribune*, 16 October 1997.
- Krulak, Charles C., GEN, USMC. "The Commandant's Planning Guidance." July 1995.
- Krulak, Charles C., GEN, USMC. "The Commandant's Planning Guidance: Frag Order." August 1997.
- Lane, Lawrence B., MAJ, USMC. "The Future of Fire Support -- The Future of the Marine Corps." *Marine Corps Gazette*, September 1994.
- LaPlante, J.B., VADM, USN. "The Future of Amphibious Warfare Takes Shape." *USNI Proceedings*, May 1994.
- Lasswell, James A., COL, USMC. "Why the Arsenal Ship Concept is Gaining Momentum." *Marine Corps Gazette*. January 1996.
- Loire, Rene. *The Striker - A Warship for the 21st Century*. Houston, TX: A. Ghosh, 1996.
- Looney, John P., LCDR, USN. *A Proposed Littoral Dominant Battle Group Centered Around the Arsenal Ship*. Quantico, VA: Marine Corps Command and Staff College, 1997.
- Mackin, Jere G. "Navy Warfighting Formula Needs Fire Support Boost," *National Defense*, May/June 1995.
- Marine Corps Combat Development Command, *FMFRP 1-18 Amphibious Ships and Landing Craft Data Book*, Department of the Navy, 1991.
- Marine Corps Combat Development Command, *FMFM 2-6 MAGTF Rear Area Security*, Department of the Navy, 1991.
- Marine Corps Combat Development Command, *FMFM 4-1 Combat Service Support Operations*, Department of the Navy, 1993.

- Marine Corps Combat Development Command, *FMFM 5-70 MAGTF Aviation Planning*, Department of the Navy, 1995.
- Marine Corps Combat Development Command, *FMFM 5-41 Close Air Support and Close-in Fire Support*, Department of the Navy, 1992.
- Marine Corps Combat Development Command, *Tentative Landing Operations Manual 2014*. 1997.
- Martin, John R., LTC, USA and Gunzinger, Mark, LTC, USAF. "Fight Fast First," *USNI Proceedings*, July 1996.
- Metcalf III, Joseph, VADM, USN (Ret.). "Revolution at Sea Initiative," *USNI Proceedings*, January 1988.
- MH. "Airborne FUR Adds Mid-wave Operations." *Jane's International Defense Review*, October 1997.
- Moore, R. Scott. "Maneuver From the Sea...Maybe." *Marine Corps Gazette*, April 1996.
- Morison, Samuel L. "For Now, Iowa Battleships Still Have a Vital Role." *Navy Times*, 11 May 1988.
- Morrison, Archibald, IV, MAJ, USMC. *Sea Dragon at the Operational Level*. Department of Operations Paper. Newport, RI: Naval War College, 1996.
- Murray, Williamson. "Innovation: Past and Future." *Joint Force Quarterly*, Summer 1996.
- Naval Doctrine Publication (NDP) 1, *Naval Warfare*, Washington, DC: Department of the Navy, 1994.
- Naval Doctrine Command. *Naval Fires: A Concept for Seabased Warfighting in the 21st Century* (Working Copy). September 1997
- Naval Doctrine Command. *Sea-base Logistics: A Naval Concept* (Coordinating Draft). 31 October 1997.
- Office of the Chief of Naval Operations, *NWP 22-3 (REV A)/FMFM 1-8 Ship-to-Shore Movement*, Department of the Navy, 1988.

- Paloczi-Horvath, George. *From Monitor to Missile Boat: Coastal Defense Ships and Coastal Defense Since 1860*. Annapolis, MD: Naval Institute Press, 1996.
- Patton, Jim, CAPT, USN (Ret). "Keeping Up With the Revolution." *USNI Proceedings*, July 1996.
- Peniston, Bradley. "Taking Aim from 100 Miles Out? VGAS Makes It Possible." *Navy Times*, 20 April 1998.
- Peniston, Bradley. "The Next Destroyer: Reinventing Surface Warfare." *Navy Times*, 20 April 1998.
- Perry, Tony. "Hunting Beyond Red October." *Los Angeles Times*, 21 October 1997.
- Perry, Tony. "Military Poised for Era of Super Surveillance." *Los Angeles Times*, 17 March 1997.
- Philpott, Tom. "Meeting Today's Challenges." *The Retired Officer's Magazine*, November 1997.
- PMS 500. "5C21 Mission Needs Statement." 22 June 1995.  
<<http://sc21.crane.navy.mil/mns.htm>>
- Polmar, Norman. "The Navy's Proposed Arsenal Ship .Pro." *The Retired Officer Magazine*, November 1996.
- President of the United States, *A National Security Strategy of Engagement and Enlargement*, Washington, DC: GPO, February 1995.
- Quist, Burton C., COL, USMC. "Operationalizing the NEF Concept." *Marine Corps Gazette*, June 1995.
- Rashba, Gary L. "With Only 12 Carriers, Will America be Ready Next Time?" *Wings of Gold*, Summer 1997.
- Reason, J. Paul, ADM, USN, with Freyman, David C. "Sailing New Seas." *Newport Paper Number Thirteen*. Newport: Navy War College Press, 1998.
- Roos, John G. "All Aboard: Joint US Navy-Industry Effort Moves Surface Ship Self-defense System Training Out to Sea." *Armed Forces Journal International*, December 1997.

- Serter, Erbil. "The Naval Need for Speed: Fitter and Faster Ships." *Jane's International Defense Review*, October 1997.
- Sewell, Kelly. "Telesurveillance Systems to Transmit Sensor Imagery." *Defense Security Electronics*, August 1995.
- Shirfrin, Carole. "TI Sees Rapid Growth in International Sales." *Aviation Week & Space Technology*, 28 June 1993.
- Shlyakhtenko, Alexander. "Amphibious Air-cushion Craft: The Stages of Creation and Prospects for Their Development in Russia." *Military Parade*, October 1997.
- Smith, Carole J., LCDR, USN. *Small Fleet -- Big Risk*. Department of Operations Paper. Newport, RI: Naval War College, 1995.
- Snyder, Jim, CAPT, USN. "Undersea Warfare: The Battle Below." *Surface Warfare*, January/February 1997.
- Spassky, Igor. "Submarines of the 21st Century." *Military Parade*, October 1997.
- Stearman, William L. "A Look At.. .The Pentagon's Misguided Priorities: A Misguided Missile Ship." *The Washington Post*, 7 July 1996.
- Stearman, William L. "The Navy's Proposed Arsenal Ship - Con." *The Retired Officer Magazine*, November 1996.
- Stover, Dawn. "Floating Arsenal." *Military Technology*, February 1996.
- Townes, John W. III, CAPT, USN. "Navy Surface Fire Support: On Target." *Surface Warfare*, January/February 1997.
- Townes, John W. III, CAPT, USN. "Surface Strike: The Powerful Punch of Deterrence." *Surface Warfare*, January/February 1997.
- Trachtenberg, Stephen J. "The Role of Navy's Aircraft Carriers." *San Diego Union-Tribune*, 5 October 1997.
- Truver, Scott C. "A Call for Fire: Launching the NSFS Projectile." *Jane's Naval International*, September 1997.
- Truver, Scott C. "The Fleet of the Future: An Eclectic View." *Sea Power*, October 1997.

Truver, Scott C. "Tomorrow's Fleet - Part I," USNI Proceedings, July 1996.

Truver, Scott C. "Tomorrow's Fleet - Part II," USNI Proceedings, August 1996.

USN Seeks 24-Hour 200-Strike Carrier." *Jane's Defense Weekly*, 23 July 1997.

Valinejad, Afshin. "Iran Says it Employs Stealth Drone Plane to Watch U.S. Navy." *Washington Times*, 16 October 1997.

Van Buskirk, James H. "Synchronizing Fire Support and Joint SOF Operations." *Field Artillery*, February 1993.

Walsh, Ray, RADM, USN (Ret), and Buzzell, Brian V, CAPT, USN (Ret).  
"Helicopters Meet Surface Littoral Warfare Challenge." *USNI Proceedings*,  
September 1996.

Weible, Jack. "Upgrading the Tactical Picture." *Navy Times*, 11 November 1996.

Wilson, David C. "Training CSS Professionals for the 21st Century." *Marine Corps Gazette*, April 1996.

Wilson, George C. "Becoming a More Lethal Weapon." *Navy Times*, 5 January 1998.

Woeltjen, Donald A. CAPT, USMC. "Operational Maneuver from the Sea and the Marine FIST." *Marine Corps Gazette*, April 1996.

Worthington, George R., RADM, USN (Ret). "Combatant Craft Have a Role in Littoral Warfare." *USNI Proceedings*, August 1994.

Wright, Richard, CAPT, USN. "Arsenal Ship: Potent and Punishing," *Surface Warfare*, January/February 1997.

Wright, Richard, CAPT, USN. "Coastal Defense: Suppressing the Enemy." *Surface Warfare*, January/February 1997.

Wright, Richard, CAPT, USN. "Information Superiority: Increasing the Warfighter's Advantage." *Surface Warfare*, January/February 1997.

Wright, Richard, CAPT, USN. "Killing Machines in the 19th Century: Wooden Warships and Surface Fires." *Surface Warfare*, January/February 1997.

Wright, Richard, CAPT, USN. "The 21st Century Surface Navy." *Surface Warfare*, January/February 1997.

Wright, Richard, CAPT, USN. "War of Attrition: Kamikaze Attacks at Okinawa." *Surface Warfare*, January/February 1997.

Ya'ari, Yedidia "Didi", RADM, Israel. "A Case for Maneuverability." *Naval War College Review*, Autumn 1997.

Ya'ari, Yedidia "Didi", RADM, Israel. "The Littoral Arena: A Word of Caution." *Naval War College Review*, Spring 1995.

Yukhnin, Vladimir. "Major Trends in the Development of Frigates at the Start of the 21st Century." *Military Parade*, October 1997.

"A Different Look for Affordable Platforms: The Need for Lower Cost Will be a Major Factor Shaping the Design of Aircraft Carriers in the Future." *Jane's Defense Weekly*, 23 July 1997.