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The current U.S. Navy vessels lack the necessary tools to conduct shore bombardment against peer and near peer forces that have developed technology that can match or succeed our own. Facing these threats will require new technology that can operate within current enemy weapon zones without fear of losing personnel or expensive aircraft and ships. One solution would be to develop a relatively fast vessel that has a primary role of Maritime Fire Support (MFS). Furthermore, if the United States wants to stay competitive in a littoral fight, it must design a MFS vessel that can provide offensive and defensive fire support to shore based forces, operate in the shallow and deep waters, have a reduced signature, provide forward surveillance, have a cost that will not break the U.S. Defense budget and be an expendable asset since it is unmanned or lightly crewed. As the Department of Defense shifts priorities to preparing for the future fight in the littoral environment, the Joint Forces will need this technology to allow them to get an edge over a peer competitor that steps up to challenge the United States.

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Naval Surface Fire Support vessel for the future fight

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EXECUTIVE SUMMARY

Title: Naval Surface Fire Support vessel for the future fight

Author: Major Kirk R. Steinhorst USMC

Discussion:

The guided missile cruisers and destroyers entered the United States Navy's fleets with the ability to perform a multitude of missions. However, through the proliferation and advancement of anti-ship weaponry, and low-tech swarm tactics, the U.S. Navy's fleets are moving further away from providing support to Marines conducting Amphibious Assaults/Raids on a contested beach. With a renewed interest deterring peer competitors in a littoral environment spelled out in the Commandant's Planning Guidance in 2019 and the National Defense Strategy of 2018, having ships move further away from contested areas creates a gap in the U.S. Military's ability to operate anywhere in the world. With the U.S. Navy's approach to decommission some of her cruisers over the coming years, the gap in providing Naval Gunfire is growing larger. Without a change of course, the Marine Corps will be forced to perform over the horizon air assaults to secure Maritime Objectives. Which given the current peer and near peer competitors capabilities in anti-air defense, this option is also not viable.

Changes in Naval Fire Support tactics, use of modern technology, and training will allow the Marine Corps and Joint Forces to overcome this gap and restore confidence in their ability to conduct Maritime Operations. One solution would be to develop a relatively fast vessel that has a primary role of Maritime Fire Support (MFS). The MFS vessel should be able to conduct both offensive and defensive maritime operations sea and ashore to include sea denial, operate in both deep and shallow water. In addition, this vessel should be affordable to the American Taxpayers. So that if the risk of losing one vessel to enemy attack does not cripple the surface fleet. Furthermore, a bonus that fits the theme of future technological initiatives spelled out by the Commandant and Chief of Naval Operations, the future MFS vessel could also be lightly crewed, or unmanned.

Conclusion: The current U.S. Navy vessels lack the necessary tools to conduct shore bombardment against peer and near peer forces that have developed technology that can match or succeed our own. Facing these threats will require new technology that can operate within current enemy weapon zones without fear of losing personnel or expensive aircraft and ships. In addition, if the United States wants to stay competitive in a littoral fight, it must design a vessel that can provide offensive and defensive fire support to shore based forces, operate in the shallow and deep waters, have a reduced signature, provide forward surveillance, have a cost that will not break the U.S. Defense budget and be an expendable asset since it is unmanned or lightly crewed. As the Department of Defense shifts priorities to preparing for the future fight in the littoral environment, the Joint Forces will need this technology to allow them to get an edge over a peer competitor that steps up to challenge the United States.

PREFACE

The decision to write this research paper was based on the observations and interactions I had during my time at Expeditionary Warfare Training Group-Pacific (EWTGPAC) from 2016-2019. During this time, I had the pleasure of working with some of the greatest servicemembers and civilian I have ever encountered in my career. Through our extensive time in the field or on-board the various warships the amount of professionalism and dedication to the profession of Naval Surface Fire Support was invaluable. The decision to pursue this research paper came from those professionals from the Naval Surface Fire Support community that recognized the shortfalls within the mission set and wanted to share their ideas. I want to personally thank U.S. Navy Fire Control Chief Petty Officer Clay Lewis, and U.S. Navy Fire Control Chief Petty Officer Ed Webb, their patience, leadership, dedication, and passion for their trade I enabled substantial research for this project. I would also like to thank my wife for the love and support through the 875 days away at sea or on San Clemente Island during my time at EWTGPAC.

PART 1: THE PRESENT PROBLEM

The Battleship is gone. Either scrapped or turned into museum ships for the public to view. What was one of the most feared ship in the U.S. Navy, is no longer around to provide the support that the Marine Corps relied on during critical battles for 70 years of Amphibious Operations. What replaced the Battleship, were aircraft carriers, Ticonderoga-class guided-missile cruisers, and Arleigh Burke-class of guided missile destroyers. The aircraft carrier with its vast array of tactical aircraft, became the sole capital ship within the fleets, and heavily relied on to provide Close Air Support during Amphibious Operations. On the other hand, the guided missile cruisers and destroyers became the primary Naval Surface Fire Support vessels to provide shore bombardment. Currently, the U.S. Navy's main weapon of choice to support beach landings and bombardment missions is the 5-inch Naval Gun aboard cruisers and destroyers. A multi-purpose weapon that can provide timely conventional fires. As opposed to the old Battleship 16-inch guns that could fire a 2,700lbs amor piercing round over 20 nautical miles[1], the conventional rounds that the current 5-inch Naval Gun fires require the ships to be within a few miles (5-6) of land in order to provide support to forces ashore. Presently, U.S. adversaries and allies across the world have invested in conventional anti-ship artillery/rocket/missiles systems that out range, out maneuver, and provide more destructive capability than current U.S. Navy assets can handle. The only guidance spelled out in the National Defense Strategy 2018 and Commandant's Planning Guidance regarding fire support, came in the form a few short paragraphs on updating the U.S. missile programs (Anti-ship

[1] USS Wisconsin BB-64 Association of Former Crewmembers, "Armament", (website) https://www.usswisconsin.org/wp/general-information/armament/, accessed on Jan 25 2020.

missiles in the CPG).[2] When given that the U.S. has perfected the way to conduct Amphibious Operations using Naval Surface Fire Support as a part of Combined Arms in an Amphibious Operation; the lack of guidance and initiative to defeat future threats and peer competitors with Naval Surface Fire Support along coast lines is troublesome. Therefore, the Joint Force needs to take a renewed interest in future ship design, naval strategy, and amphibious tactics to overcome growing threats.

Current Joint Amphibious Doctrine (JP-3-02) calls for the use of Naval Surface Fire Support to support the close and deep fight during an Amphibious Landing.[3] However, through the proliferation and advancement of anti-ship weaponry (ie Dong-Feng 21/DF21[4]), low-tech swarm tactics[5], modern day mines, and long range advanced bombers (ie China's H-6 Bomber[6], Russia's TU-22M/TU-160/PAK DA)[7] by peer and near peer competitors, the U.S. Navy's fleets are moving further away from these threats in an effort to protect their expensive ships from anti-ship missiles. This in turn, moves the U.S. Navy away from supporting the Joint Force conducting Amphibious Assaults/Raids on contested amphibious objectives. As the Commandant stated in his planning guidance, "We must acknowledge that different approaches are required given the proliferation of anti-access/area denial (A2AD) threat capabilities in

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[2] General Berger, David H., Commandant of the Marine Corps, *Commandant's Planning Guidance*, July 16, 2019, pg3.https://www.hqmc.marines.mil/Portals/142/Docs/%2038th%20Commandant's%20Planning%20Guidance_2019.pdf?ver=2019-07-16-200152-700 (accessed on August 13, 2019)

[3] Joint Forces Command, Amphibious Operations, JP-3-02, Norfolk-Suffolk Virginia: Joint Forces Command, 04 January 2019. https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_02.pdf (accessed on Dec 22, 2019)

[4] Missile Defense Project, "DF-21 (Dong Feng-21 / CSS-5)," Missile Threat, Center for Strategic and International Studies, April 13, 2016, last modified January 2, 2020, https://missilethreat.csis.org/missile/df-21/. (accessed on Jan 15, 2020)

[5] H.I. Sutton, 10 Ways Iran Could Attack Oil Tankers In Response To U.S. Killing Of Top Commander, Forbes website, Jan 3, 2020 https://www.forbes.com/sites/hisutton/2020/01/03/10-ways-iran-could-attack-oil-tankers/#280920eb2c54 (accessed on Jan 15, 2020)

[6] Asia Maritime Transparency Initiative, "China Lands First Bomber on South China Sea Island", 18 May 2018. https://amti.csis.org/china-lands-first-bomber-south-china-sea-island/ (accessed on Dec 15 2019)

[7] Caleb Larson, "These Four Bombers are the crown jewels Russia's air force", National Interest. 28 October 2019. https://nationalinterest.org/blog/buzz/these-four-bombers-are-crown-jewels-russias-air-force-90876 (accessed on Dec 15 2019)

mutually contested spaces. Visions of a massed naval armada nine nautical miles off-shore in the South China Sea preparing to launch the landing force in swarms of ACVs, LCUs, and LCACs are impractical and unreasonable."[8] This is expanding the gap in the U.S. Military's ability to operate anywhere in the world. Coupled with the Navy's approach to decommission some of her cruisers over the coming years, and competitors around the world developing long range anti-ship missiles, the U.S. Navy's ability to support Amphibious Operations ashore is becoming fleeting. Without a change of course, the Joint Force will be forced to perform over the horizon aircraft/helicopter-assaults and heavily rely on attack aircraft to secure Maritime Objectives. Which given the current peer competitors capabilities in anti-air defense and air interdiction aircraft, this option is also not viable due to the amount of risk of placing large amounts of aircraft in a non-air superiority situation. This in turn leaves doubt in the United States' ability to conduct Combined Arms in a maritime environment in the near future.

PART 2: A SOLUTION

Through the development of future naval operational concepts (Distributed Maritime Operations, Expeditionary Advance Base Operations), gaps have been formed where the current strategies and technology fall short in addressing the need for Naval Gun Fire Support to support future Amphibious Operations in a potential peer conflict. For instance, the U.S. Navy and Marine Corps are in the process of dedicating significant tax dollars towards the development and procurement of the Naval Strike Missile (NSM)[9]. The NSM is an advanced anti-ship missile

[8] General David H. Berger, Commandant of the Marine Corps, *Commandant's Planning Guidance*, July 16, 2019, https://www.hqmc.marines.mil/Portals/142/Docs/%2038th%20Commandant's%20Planning%20Guidance_2019.pdf?ver=2019-07-16-200152-700 pg. 5(accessed on 02 Jan 2020).

[9] Hope Hodge Seck, "Marine Corps Gets Long-Range Missile to Take Out Enemy Ships", Military.com, website accessed on 12 December 2019. https://www.military.com/daily-news/2019/05/09/marine-corps-gets-long-range-missile-take-out-enemy-ships.html

that is meant to be employed both on land and at sea, in support of Sea Denial and Sea Control Operations. However, the NSM is not intended to be used on land targets or for shore bombardment. Therefore, the NSM may prevent enemy combatants' ships from getting to close to friendly positions, but it will nothing to help the Joint Force eliminate enemy forces that are already ashore. In order to address the need in future Amphibious Operations ashore where the current "Grey Hulls" are not able to support, a solution is to develop a vessel that its primary role is Strike and Maritime Fire Support (MFS). This future vessel should possess five distinct qualities that the Joint Force should demand for: 1. Conduct offensive and defensive maritime operations at sea and ashore to include sea denial. 2. Be able to operate in both deep and shallow water. 3. Be affordable to the American Taxpayers. 4. The risk of losing the vessel to enemy attack does not cripple the surface fleet. 5. Be as fast or faster than the current destroyers. As a bonus that fits the theme of future technology initiatives spelled out by the Commandant of the Marine Corps and Chief of Naval Operations, the future Strike/MFS vessel could also be unmanned or lightly manned if needed. With a vessel capable of conducting these mission sets and possess the qualities that the Joint Force requires in the future, the U.S. Navy can fill the void that the Battleships left behind in the early 90's. Furthermore, in order to best fill the gaps in naval fire support that the current U.S. Navy has come short of fulfilling, the U.S. Navy needs a ship that is dedicated to supporting the Joint Force within close proximity to the beach without fear of anti-ship missiles. According to NASA's website there are over 372,000 miles of coastline, and over one third of the world's populace live within 60 miles of a coast.[10] With that in mind the chance of the U.S. Navy supporting an Amphibious Operations ashore grows every year, and the U.S. Navy becoming ill equipped to handle a maritime operation that will require

[10] NASA, "Living Ocean", NASA website https://science.nasa.gov/earth-science/oceanography/living-ocean (accessed on Jan 04 2020)

providing offensive and defensive fires in support of a beach landings, sea denial in a littoral environment, or support for maritime raids, without being susceptible to incoming anti-ship weapons/swarm tactics. A vessel that is relatively fast, can conduct offensive fire support for an amphibious force with over the horizon cannon and missile fires, operate in both littoral and deep waters, have a low signature or advance maritime stealth technology, and unmanned, could make the difference between the Joint Force being able to achieve its maritime objectives or risking valuable warships and their crew by getting too close to beaches with the current assets.

PART 3: CURRENT IDEAS

From 1892 with the commission of the USS Texas, the Battleship was viewed as the flagship of the U.S. fleet. It provided not only protection from enemy combatant vessels, but also the main fire support vessel for troops going ashore. These behemoth sized ships arguably became obsolete when the invention of the ship to ship missiles were distributed amongst all U.S. warships, and the cost of maintaining such large vessels became too cumbersome. In addition, the choice to use Land Attack Missiles attacking targets inland vice using 16-inch cannons, sealed the fate of the Battleship with every technological advance in missiles. However, what made the island-hopping campaign in the Pacific and the storming of the beaches in Normandy successful, was the U.S. Navy's ability to bombard the beaches and coastal regions in preparation for beach landings.

Since 1992 when the last Battleship was finally released from active duty, naval strategist and military reformist have discussed what would/should replace the Battleship in the future. Three common themes have resonated within these discussions. First, these new ships must have massive amounts of weapons. Second, these ships must be large enough to carry all

the weapons that they would hope to be employing. Lastly, these ships premier weapon of choice is missiles.

What is missing from all these proposed ship designs is the ability to conduct sustained bombardment from sea in support of an Amphibious Raid or Assault. Without including weapon designs to support troops ashore other than missiles, these proposals are nothing better than the current destroyers and cruisers of the U.S. Navy.

One proposal of a replacement to the Battleship that has generated plenty of buzz over the last year is developing a missile container that could be employed on a merchant ship or converting a container ship that could be fitted with nothing but missiles. In an article for the U.S. Naval Institute, Captain R. Robinson Harris (Ret.), Andrew Kerr; Kenneth Adams, Christopher Abt, Michael Venn, and Colonel T. X. Hammes (Ret.), wrote, "The Navy should acquire and arm merchant ships, outfitting them with modular weapons and systems to take advantage of improving technology and shipping market conditions while providing capability more rapidly and less expensively than traditional acquisition efforts"[11]. The authors' goal was to improve the U.S. Navy's lethality by having merchant ships being converted to missile ships. They highlighted three proposals, by designing "missile merchant" ships it would get the U.S. Navy to the 355-ship goal that President Trump made a national policy for the U.S. Navy in 2018[12]. Secondly, Captain Harris et al. claim that missile merchant ships would add more missiles at the disposal of the Combatant Commanders, because the U.S. Navy's offensive and defensive capabilities are measured in the number of missiles. Lastly, the authors argue that by

[11] Harris, Kerr, Adams, Abt, Venn, Hammes,"Converting Merchant Ships to Missile Ships for the Win", U. S. Naval Institute Proceedings Vol. 145/1/1,391. Jan 2019 https://www.usni.org/magazines/proceedings/2019/january/converting-merchant-ships-missile-ships-win (accessed on Jan 15 2020)

[12] Congressional Budget Office, "Cost of building 355 ship Navy", US Congress, Washington DC, April 2017. https://www.cbo.gov/system/files/115th-congress-2017-2018/reports/52632-355shipnavy.pdf

employing merchant ships would save the Department of Defense millions, since double hull container ships are relatively cheap compared to a modern-day destroyer or cruiser.

The advocates for converting merchant ships to missile vessels to improve the U.S. Navy lethality are well intentioned but miss the mark in fulfilling the gap left by the Battleships of yesteryear. The first problem with recruiting and employing merchant vessels is that they come at a price to operate and maintain. The authors assume that employing a missile merchant ship would be cheaper than operating a modern-day destroyer or cruiser, and in their article *Converting Merchant Ships to Missile Ships for the Win*, surmise that the U.S. Navy would partially make up the crew aboard these ships and only take over when the mission demands it. At other times, the merchant crew would be in control to go about their daily routine and act as a merchant container vessel. What the authors failed to mention is what it would cost the U.S. Navy to enter in a contract with a merchant company to operate in hostile waters, or potentially have to pay exorbitant amount of money to repair or replace a merchant vessel after it was conducting offensive strikes. Let alone the amount of money and insurance costs that the merchant crewmen aboard would have to be covered to be in harm's way, or insurance costs the merchant company would have to accept for a vessel that has the potential of being destroyed after some of its cargo launches missiles from the deck. With the authors of the article also stating that the U.S. Navy's Offensive and Defensive capabilities are measured in how many missiles that the U.S. Navy can bring to bear justifies employing merchant vessels, is rather callous towards the capabilities of the rest of the U.S. Navy's Fleet. With 70+ active duty destroyers funded (to include DDG 1000 class) in the U.S. Navy in the FY20 budget[13], and

[13] NAVSEA Shipbuilding Support Office, "Naval Vessel Register", website, Norfolk Naval Shipyard, Portsmouth VA, https://www.nvr.navy.mil/ (accessed Feb 14 2020)

building more, the question becomes how many missiles is enough? Current Flight IIA and Flight III Arleigh Burke-class Destroyer's carry upwards towards 96 Vertical Launch Tubes (VLS) to employ a whole host of missiles for land attack, anti-air, and anti-ship missions. The authors of the 2019 article argue that the Department of Defense (DOD) would not want to place too many missiles aboard a merchant vessel so that it becomes a lucrative target, like an aircraft carrier. However, arm the merchant vessels with just enough missiles so that the U.S. Navy increases it number of ships it has at its disposal, and ultimately reaching its goal of 355 ships. "Arming them with too-few weapons does not add much punch and does little to complicate adversary planning. A detailed campaign analysis is warranted, but our rough estimate of the "just right" number is 30–50."[14] By arming missile merchant ships with a minimal number of missiles to attack targets, is not just asking for enemy combatants to hunt down any U.S. or her Allies merchant ships, but also creating a paper tiger navy with merchant missile ships trying to get to a 355 fleet Navy.

Lastly, the article addressed the cost of a merchant container ship being relatively cheap compared to a modern destroyer. While true, the cost of each U.S. destroyer is 1.8 Billion [15](estimate) U.S. Dollars, but that dollar figure includes all the offensive and defensive capabilities that a modern-day warship brings to bear. The authors argue that, "Trade publications such as *Tradewinds*, *Lloyds List*, *Marine Log*, etc., show that the nominal cost to acquire container or double-hulled tanker ships could be between $25 and $50 million per hull depending on size and where they were constructed. (Any major conflict in the Pacific will

[14] Harris, Kerr, Adams, Abt, Venn, Hammes,"Converting Merchant Ships to Missile Ships for the Win", U. S. Naval Institute Proceedings Vol. 145/1/1,391. Jan 2019 https://www.usni.org/magazines/proceedings/2019/january/converting-merchant-ships-missile-ships-win (accessed on Jan 15 2020)

[15] Congressional Budget Office, "Cost of building 355 ship Navy", US Congress, Washington DC, April 2017. https://www.cbo.gov/system/files/115th-congress-2017-2018/reports/52632-355shipnavy.pdf

significantly reduce international trade, which could make a large number of commercial vessels suddenly available at a fraction of the cost of building a new warship.)"[16] The authors did not mention anywhere in the article that the merchant vessels would have any defensive capability, nor the ability to have a sensor suite that current Arleigh Burke-class Destroyers have on board. In addition, it is agreed that a purchasing a merchant vessel would be cheap compared to a U.S. Navy destroyer, however, they would be a single purpose vessel that present little offensive capability for a large-scale war against a peer competitor. Let alone the unknown cost of insuring and paying civilian contractors to operate a vessel that may or may not be a lucrative target to enemy forces.

Another proposed concept to replace the Battleship has been to develop a vessel similar to the Merchant Missile Ships, but instead of a large vessel with limited offensive capability, naval strategists and enthusiasts propose the opposite; an active duty Naval vessel with large amounts of missiles, the Arsenal Ship. The Arsenal Ship concept is not new. Ever since Battleships fell out of favor and moved into floating museums, people have conceptualized a modern vessel as big and as powerful as the Battleships of old. Instead of powerful 16-inch guns on board, many have envisioned large batteries of missiles on board that could do the same job as the 14-16-inch guns of the past. In 2015 Captain Sam J. Tangredi, U.S. Navy (Retired) wrote an elegant piece for the U.S. Naval Institute on why the Arsenal Ship concept should be incorporated into the U.S. Navy's plans for future ship procurement, "There are too few missile tubes/launchers in the Fleet, and many of them must be filled with theater ballistic-missile defense, anti-satellite, anti-ship ballistic and cruise missiles, and anti-aircraft weapons to provide

[16] Harris, Kerr, Adams, Abt, Venn, Hammes,"Converting Merchant Ships to Missile Ships for the Win", U. S. Naval Institute Proceedings Vol. 145/1/1,391. Jan 2019 https://www.usni.org/magazines/proceedings/2019/january/converting-merchant-ships-missile-ships-win (accessed on Jan 15 2020)

the needed layered defense. In this scenario, the Navy requires launchers with strike weapons in abundance. This should drive us back to reconsidering the once-heralded but quietly discarded concept of the arsenal ship".[17]

Captain Tangredi's deductions are not wrong. The current destroyer and cruiser squadrons are made up of multipurpose vessels that conduct a multitude of surface warfare missions: anti-surface, anti-air, ballistic-missile defense, and anti-submarine warfare. Each of the destroyers and cruiser squadrons could be tasked with any of these missions at any given time. Consequently, in order to be able to perform each of these missions that each ship could be assigned to conduct for the Combatant Commander, the destroyers and cruisers must carry multiple types of munitions in the VLS tubes aboard. Unless otherwise tasked to carry more of one type of munition, each of these vessels are limited in the number of missile strike capabilities for a mission set. Therefore, in order to successfully deter against a peer competitor a new ship would need to be employed to conduct strikes large enough to make an impact on the battlefield. As author Captain Tangredi proposed, as well as, Think Tank JB Associates author Dr James Bosbotinis states, "…the Arsenal Ship would be a one-ship surface action group capable of providing a substantial land attack capability and contributing to the Anti-Air Warfare (AAW) and ballistic missile defense (BMD) roles; this would be achieved via the ship being equipped with a 512-cell VLS."[18]

Both CAPT Tangredi and Dr. Bosbotinis logic with the proposal for the U.S. Navy to adopt the Arsenal Ship concept for ship building is not out of line for finding a replacement

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[17] Tangredi, Sam J. U.S. Navy (Retired), "Breaking the Anti-Access Wall", U. S. Naval Institute Proceedings, Vol. 141/5/1,347. May 2015 https://www.usni.org/magazines/proceedings/2015/may/breaking-anti-access-wall (accessed on Jan 15 2020)

[18] Bosbotinis, Dr. James, "Chinese Power Projection; A Role for Arsenal Ships?", Wavell Room Contemporary British Military Thought website, June 2018, 2019. https://wavellroom.com/2019/06/18/chinese-power-projection-arsenal-ships/ (accessed on Jan 04 2020)

strike vessel in the wake the Battleships left behind. However, two things that stand out in both of their proposals are cause for concern: The first concern is cost of the Arsenal Ship, and second is the lack of flexibility in mission sets for the Arsenal Ship. The Arsenal ship cost vary between both authors between 450-800 million per vessel starting out. The average cost of a single modernized Tomahawk Land Attack Missile (TLAM) is estimated at 1.4+ Million U.S. Dollars. By adding between 96-500 of each of these missiles to the Arsenal Ship the cost of the ship creeps up on current costs of a modern-day destroyer. That price is hard to swallow for a single purpose vessel in today's U.S. Navy Fleets. The second concern with regards to single mission set vessels is, what happens if current peer or near peer competitors that these ships are designed to deter never materialize? The answer is the U.S. Navy will be stuck with a single purpose ship with an expensive array of weapons on board that may or may not be used in the future. Given the price and the large hull design to carry 500 VLS cells of these potential vessels, the authors of the Arsenal Ship articles lack the necessary justifications for the Navy design of a new vessel.

PART 4: RESEARCH DESIGN

The origin of this research was derived from many different sources to include personal experience within Naval Fire Support, strategic literature on future ship design for the U.S. Navy, and Marine Corps wargames with an emphasis on the future littoral fight. With the shift of focus towards developing a force that could fight against peer competitors, there is a need to explore options that could solve some the critical gaps in operations.

The research to identify a potential solution to gaps in the future littoral fight, started with personal experience serving as the Naval Fire Support Branch head at Expeditionary

Warfare Training Group-Pacific (EWTGPAC) from 2016-2018. During this time the NSFS branch oversaw and evaluated 31 cruisers and destroyers from 3rd and 7th Fleets on naval gunfire, three test firing of Block IV Tomahawk Land Attack Missile (TLAM) exercises, one experimental live fire exercise of a HIMARS shot off of a Landing Platform Dock (LPD), six Carrier Strike Group Composite Training Unit Exercises (COMPTUEX), and five Pacific MEU pre-deployment training exercises. Over the course of three years the NSFS Branch conducted many experiments to improve training and recommend advances in the Naval Gunfire mission set to Surface Forces-Pacific (SURFPAC). These experiments consisted of changes to the U.S. Navy Naval Surface Fire Support curriculum to enhance individual sailor performance, team proficiency, and overall readiness. Other experiments consisted of new live fire testing and future training concepts for cruisers and destroyers. These experiments helped drive this thesis due to in part to witnessing the U.S. Navy's true ability to provide support to troops ashore, and realizing that the U.S. Navy will be ill prepared to support land forces with Naval Gunfire in a peer fight in the future based on current technology.

The secondary source of information for this research comes from published works. Most of the information that was used to form a thesis on this subject is written by Naval experts. The U.S. Naval Institute continually publishes works on Naval Gunfire and new ship design, and those works helped form a basis of what the future Naval Surface Fire Support ship should look like for this thesis.

The last source of information for this research came in the form of a pair of wargames hosted by the Marine Corps Warfighting lab and 12th Marine Regiment. In each of the wargames the focus of the fight was in a littoral environment using current and future weapon programs. The Warfighting Lab wargame is currently Classified Secret, and the information found during

that wargame will not be used for this thesis. The 12th Marine wargame was Unclassified, and the scenario was based in a littoral environment using Fire Support Expeditionary Advanced Base Operations (EABO). During which High Mobility Artillery Rocket Systems (HIMARS) were used to conduct sea denial missions. During each wargame there were gaps identified that were not mitigated with the current and proposed weapon systems. These gaps in the wargames has underscored the basis for this proposed new vessel.

PART 5: CURRENT STATE OF NAVAL FIRE SUPPORT

The genesis of this research started in 2016 with the Naval Gunfire Evaluations of 3rd and 7th Fleet Ships in the Pacific by EWTGPAC located in Coronado California and San Clemente Island California. These evaluations are part of the readiness training in preparation for ship deployments. During these evaluations' ships are required to fire six separate fire missions with the purpose of testing accuracy, timeliness, and the ship's crew ability to apply proper procedures and techniques that the crew has learned during their pier side training on Naval Gunfire. Through evaluations in the fall of 2016 and lasting through 2018 EWTGPAC evaluated over 30 ships with current techniques and technology that was not applied in years prior. Shore Fire Control Teams/Spotter Teams used Defense Advanced Global Positioning Receiver (DAGR) coupled with Laser Range Finder Vector 21B's and Common Laser Range Finder-Integrated Capability (CLRF-IC). Which are handheld target location systems that are used to determine a target's location. During this implementation of equipment that are used expansively throughout the Department of Defense, the Spotter teams started failing ships for: accuracy, failure to properly employ Basic Gunnery Procedures, excessive time on fire missions,

error in entering target altitudes, poor Gun Safety oversight, and failing to properly conduct internal training in preparation for the evaluation.[19] See attachment 1.

The more serious reason for the push to improve Naval Gunfire came from a Naval Gunfire firing incident on San Clemente Island Shore Bombardment Area (SHOBA) 2016. In the incident an Arleigh Burke Destroyer (Ship name and Hull Number redacted for this paper) was conducting its pre-deployment Naval Gunfire Qualification and shot outside the designated range boundaries with its rounds landing within 91 meters of friendly observers from EWTGPAC. The resulting investigation found that the crew failed to follow proper procedures when firing, and transposed numbers on the Gun weapon system resulting in the ship missing the target by almost 6,100 meters. The investigation also identified that the crew lacked experienced in Naval Gunfire from not shooting their Mk-41 system ashore in over 16 months, and the ship was tasked to conduct multiple training events during that day so the crew was not entirely focused on the evaluation. Due to the safety of personnel, EWTGPAC and the Navy Safety Center started to conduct in depth research to get to the root of the problem amongst the Pacific Fleet.

In addition, due to the rather sharp increase of ship failures in early 2017 that continued through the summer as a result of spotter measuring rounds accurately using modern-day technology, nine destroyers out of 11 had failed their live fire evaluation. Thus, forcing EWTGPAC, Surface Forces Pacific, and outside training consultants from Expeditionary Training Group-Atlantic to conduct a working group to identify the problem and find solutions in Sept 2017. This led to EWTGPAC Naval Gunfire Branch to conduct multiple experiments and audits of instruction to the Pacific Fleet from the fall 2017 and into 2018 to get to the root of the

[19] EWTGPAC Naval Surface Fire Support Branch, *End of the Year rollup CY2018*. (EWTGPAC, Coronado California Dec 2018), PowerPoint Presentation.

problem. After two years of research the NSFS Branch at EWTGPAC deducted nine main points[20]:

1. NSFS ship teams did not have the required foundational knowledge in Gunnery Basics. In a deep dive through sailors in the Pacific Personnel Qualification Standards (PQS) records by the staff at EWTGPAC/LANT and Surface Forces Pacific, that the lack of knowledge came from generations of sailors not having the experience outside of pre-deployment training, of firing the 5" inch weapon system. Ships currently are required every 14 months to go through Naval Gunfire training (10-day course). It was recorded during 2016-2018, that a few vessels in the Pacific fleet exceeded the 14-month mark (two vessels recorded 18-22 months lapse), therefore did have the requisite knowledge of fundamental gunnery.

2. Minimal preparation and material readiness were performed on ship to meet pre-deployment requirements to go through Naval Gunfire training.

3. Gun Liaison Officer training in preparation for NSFS duties was non-existent. After many failures in the NSFS mission set the NSFS Working Group stood up a pilot course that being taught at EWTG-LANT for GLO's. Before 2019 there was not a school for GLO's to attend, all the education on NSFS for young Ensigns and Lieutenants was conducted through "On-the-job-training".

4. Knowledge of navigation, target plotting, and gunnery procedures were almost non-existent in Naval Gunfire Fire teams as a result of recent departure of paper charts.

5. The optimal range from the beach while firing the Mk-41 5" Naval Gun is 10-12,000 yards for accuracy. (This becomes problematic when the Mk-41 5" max range is 30,000 yards, and almost 1/3 of its range is over ocean. Thus, not being able to hit targets further inland.) At

[20] EWTGPAC Naval Surface Fire Support Branch, *End of the Year rollup CY2018*. (EWTGPAC, Coronado California Dec 2018), PowerPoint Presentation.

distances greater than 12,000 yards, the range dispersion would greatly increase. Therefore, decrease accuracy.

6. The Mk-41 5" Naval Gun tends to breakdown or pause in firing for mechanical issues. Since destroyers have only one Mk-41 5" Naval Gun, this causes gaps in delivering conventional rounds ashore until the weapon is repaired, leaving troops and targets idle during suppression missions.

7. The U.S. Navy only has High Explosive and Illumination rounds in the Navy's inventory. Consequently, Naval Gunfire with the Mk-41 lacks the ability to conduct true counter-mech/anti-armor missions.

8. There is a lack of land based naval gunfire ranges. Currently only one live fire Naval Gunfire range in the United States, San Clemente Island.

9. Gunnery teams have lack of experience firing the Mk-41 5" Naval Gun other than training scenarios, resulting in treating the NGF mission set as a low priority compared to other mission sets aboard ships.

Figure 1 below is the graphical representation of the onboard ship training and the live fire evaluations that took place from 2011-2018. The graph depicts the Mobile Team Training (MTT) and the Live Fire Shooting for 3rd and 7th Fleet ships. The graph shows a steady tread of failures for Live Fire Shooting, versus the steady decrease of failures with pier side training. What the data points out is the curriculum became easier for crews starting in 2014 when the Surface Force Training and Readiness Manual (SFTRM) was updated. This update prepared the crews less for Live Fire Evaluations. For instance, before 2014 ships were required to be evaluated in 12 fire missions. Due to a shortage of ammo,

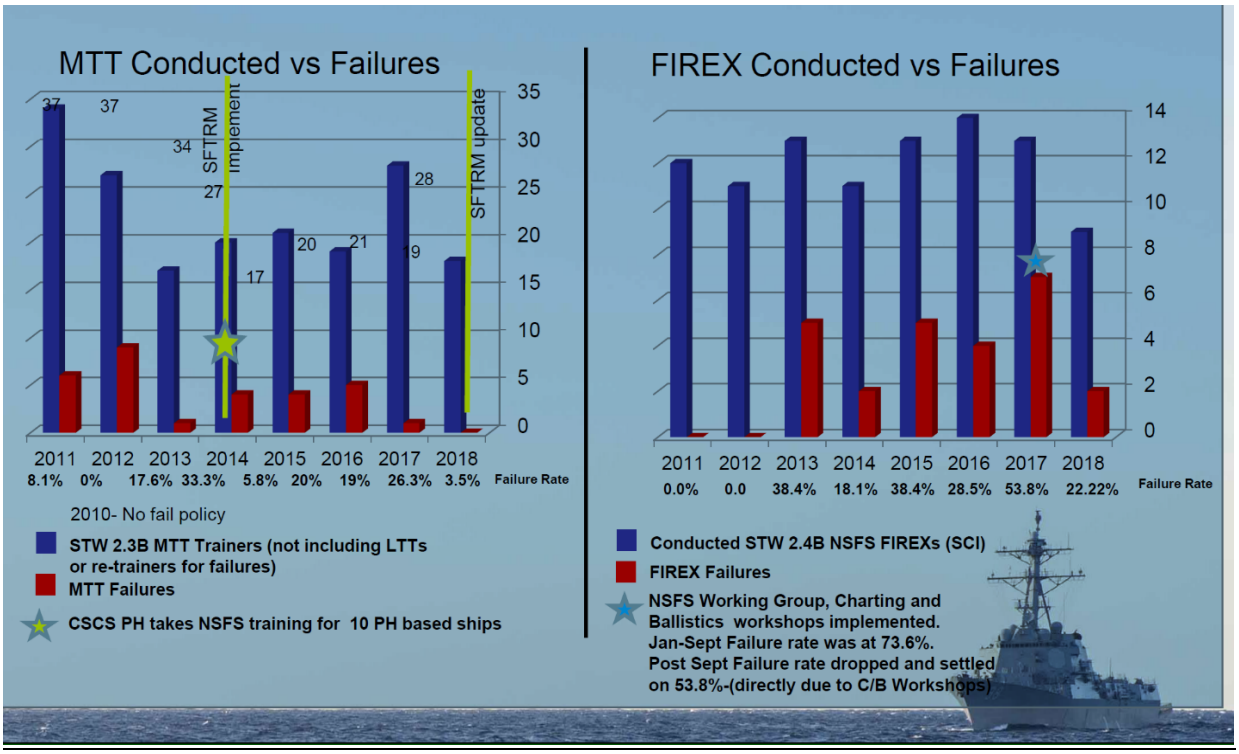

*Figure 1: This is a graphical representation of the fire support exercises for 3rd and 7th fleet ships. The left-hand column depicts the pier side training and lecture a ship must undertake before conducting live fire exercises. The right side depicts the evaluations of ships on San Clemente Island.

lack of need for 5" Naval Gunfire due to wars in the Middle East, and higher priorities in the Navy, the updated SFTRM drop the number of missions the gun crews were evaluated on to just six. In addition, some ships were given waivers to skip training based on certain criteria, and therefore went many months even years past their recertification date.

After a year of "plugging holes in the dam" per say, there was sharp decrease in failures in 2018 and 2019. Which was the result of an extensive overhaul in the lecture, practical application, and live fire practice missions. Professionals also within the Naval Surface Fire Support community have implemented new guidance on training, with an emphasis on live fire shooting regardless of their current mission (Ballistic Missile Defense, Air Defense etc.). However, due to the natural deployment, training, and maintenance cycles the problem with accuracy and knowledge could take years to fix.

In addition, with the implementation and the increasing development of missiles, the naval gun has taken a back seat in development priorities in favor for missiles. Thus, priorities have shifted from close in fights with naval guns to over the horizon missions utilizing long range missiles. Though not entirely the U.S. Navy's problem, the Department of Defense lacks the necessary three-dimensional land live fire ranges needed for the U.S. Navy to practice and evaluate their Naval Gunfire skills and mission sets. Currently there is only one live Naval Gunfire Range that is on land in in the United States, San Clemente Island. The remaining ranges are buoy and sonic ranges. With only one realistic range for the U.S. Navy in the United States, the U.S. Navy skills in shore bombardment and fire support have deteriorated.

It was apparent to the instructors and evaluators within EWTGPAC over those two years that the U.S. Navy has accepted that Naval Surface Fire Support is not a top priority. However, the future fight within a littoral is now on the horizon, and the Department of Defense must re-prioritize what the future of the U.S. Navy can accomplish. If current trends continue, the U.S. Navy will be ill suited to support an Amphibious Landing or Assault given the current weapon systems, and relative lack of knowledge on board.

PART 5A: HUNTER VS THE HUNTED

Sometime in the late 80's and early 90's, the U.S. Navy's ship planners shifted to missiles as the U.S. Navy's primary weapon of choice. How the U.S. Navy came to an over reliance on missiles could be a result of the Cold War and the lessons learned from it. As retired Navy Commander T.J. McKearney wrote in the July 1998 issue of *Proceedings*, "Our overall

strategic consciousness regarding the post-Cold War world has led to a belief that the next battle will be in some far-off corner just beyond the reach of U.S. land-based forces."[21]

The U.S. Navy's offensive firepower resting on its array of missiles continues today with employing Standard Missile 2, Standard Missile 6, Tomahawk Land Attack Missiles, etc. These are highly capable munitions capable of attacking single point targets. Each U.S. destroyer or cruiser can be Armed with 94-120 different types of missiles depending on the mission set and type of vessel to carry them. These vessels prove to be invaluable when it comes to air defense and strike missions.

A problem arises when there is a need of maritime suppression, amphibious bombardment for a duration of time, or attacking land based moving targets. The U.S. Navy attempted to remedy these problems with the use of a single 5" naval gun on destroyers and two 5" naval guns on cruisers. The Mk 45 was designed to give the cruisers and destroyers (CRUDES) defense against enemy surface ships, shore bombardment capability, and an alternative weapon against enemy aircraft. However, given the restrictions of limited range (effective range 10-12k yard), flat trajectory, and limited number of guns on U.S. CRUDES, the Mk-45 is more of a defensive weapon for the ship than an offensive weapon.

Due to advances in anti-ship weaponry and the MK-45 not able to shoot over the horizon, the Mk-45 is becoming less of an effective means to conduct shore bombardment without placing the CRUDES asset in a critical position along a shore in order to support amphibious operations with bombardment and suppression. In a littoral fight, this becomes even

[21] Mark Thompson, "The U.S. Navy's Titanium "Tin Can", Project of Government Oversite website, Jan 10, 2019 https://www.pogo.org/analysis/2019/01/the-u-s-navys-titanium-tin-can/. (accessed on Jan 04 (2020)

more problematic because the U.S. Navy will be needed to conduct both sea and land attack missions in tight confined spaces of water.

Aside from Submarines, the current CRUDES assets of the U.S. Navy become the hunted not the hunters that the Joint Forces need in a littoral fight. Having a dedicated vessel that can conduct both offensive and defensive missions is key to winning the fight in a contested environment like the South China Sea, Baltics Sea, Barents Sea, as well as the Persian Gulf. As Lt. Col. Frank Hoffman (ret.) and Col. Garrett (ret.) wrote in April 2019 for the U.S. Naval Institute, "A changing world always mandates fresh thinking and constant adaptation to threats both new and old. But the capability to project ground combat power ashore from the sea and forward-deployed locations is both necessary and consistent with the Joint Force called for in the National Defense Strategy. Divesting this capability would mean, in effect, abdicating assurances made to allies, ceding the initiative to competitors, and requiring "permission slips" from regional powers to provide ports and airspace access in every region."[22]

In a littoral environment, having a vessel that is fast attack, low profile, can conduct shore bombardment, strike, and anti-ship attacks, all without worrying if the vessel is lost or damaged makes the U.S. Navy the hunter vice the hunted. By doing so can mitigate the disparities within the current and future planning of maritime operations and restore confidence in the U.S. Navy's ability to support Naval Fires ashore.

PART 5B: WHERE AN UNMANNED MARITIME FIRE SUPPORT VESSEL FITS

[22] Hoffman, Garrett, "Amphibious Assault Will Remain a 'Corps' Competency", U. S. Naval Institute Proceedings, Vol. 145/4/1,394, April 2019. https://www.usni.org/magazines/proceedings/2019/april/amphibious-assault-will-remain-corps-competency (accessed on Dec 14 2020)

With the shift of priorities to the Western Pacific by the Joint Force to deter potential threats of the future, updated strategy and technological advances are the only way to prepare for the upcoming conflict. Through the development of the Expeditionary Advance Base Operations (EABO) and Distributed Maritime Operational (DMO) concepts, gaps have been formed where the current and proposed future strategies and technology fall short. The gaps in those models fail to address the fires needed to support the operational designs of those concepts. By developing an MFS vessel, the disparities within the current concepts of EABO and DMO are mitigated.

The biggest issue or gap that needs to be addressed within DMO and EABO concepts is surveillance over a wide area. Under normal circumstances, a drone or aircraft can be tasked to watch over areas that need to be surveyed. However, given the large spaces of places like the Western Pacific, there is not enough drones and aircraft that can cover such a wide area for 24 hours a day. Without full time coverage over the Maritime Area of Operations (AO), enemy forces could slip in and out of the zone without detection and end up in a place where the United States is most at risk. With a few MFS vessels forward deployed in the littorals that are equipped with detection assets on board serves two purposes: first it provides coverage over gaps in surveillance where it is too dangerous for a CRUDES asset to maneuver. Second, it provides flexibility to commanders and frees up aviation assets to maintain normal flight requirements without surging. MFS vessels could add depth to intelligence, surveillance, and reconnaissance (ISR) gathering within the AO, that current assets cannot provide without significant surge operations or putting potential aircraft and current CRUDES at risk in areas where the U.S. has not established air/naval superiority.

Next foreseeable gap is the use of current fire support assets within DMO and EABO. The existing arsenal of weapons within the Joint Force are ill equipped to fight in such a vast AO such as the Western Pacific. The problem with relying on aviation is that they have either a limited range or limited amount of ordinance. Even with drone aircraft there is a risk of limited munitions on-board. With artillery assets there is other risks: First, they are land based and the Joint Force will need to get them ashore. Second, USMC and U.S. Army artillery, to include HIMARS, have a limited ability to hit a moving target. Lastly, all these assets require heavy re-supply logistical trains. If following the Commandant's Planning Guidance of developing an anti-ship missile for HIMARS in order to hit a moving target, there is another risk that needs to be factored in; the amount of munitions a HIMARS launcher can carry. With developing and implementing an MFS asset(s) to augment artillery unit(s) in a Maritime Domain, the risk become very manageable. Developing an MFS vessel that could patrol, guard, screen, and cover areas with enough offensive and defensive munitions, minimizes the risk that current artillery assets in a Maritime AO can bring to the fight as well as the number of logistical requirements needed.

The last item that needs to be discussed regarding EABO and DMO, is being able to carry out effective raids and strikes. Having distributed forward presence of troops within striking distance of potential adversaries allows distance between the enemy and the bulk of friendly forces. However, by having small groups of troops spread out over hundreds if not thousands of miles limit's the Joint Force's ability to conduct timely raids and strikes due to finite resources available in these small troop formations. This is in large part due to the logistical train that is associated with having troops spread out over long distances. The logistics alone to pick up and fly a raid force to and from the objective, or re-supply a unit that has just

returned from a raid, is a complete nightmare for any unit spread out over hundreds of miles. By developing and implementing an MFS vessel, it can move into striking range of an enemy force and conduct offensive fire support to the raid force. The burden becomes less on the Joint Force planners to plan for withdraws, re-supplying units, as well as mitigates risk of putting troops and aircraft in harm's way. An MFS vessel adds flexibility to raids and strikes, where the DMO and EABO fall short.

EABO and DMO provide a roadmap to which the Joint Force can operate from. However, there is a need for significant upgrades to the current plans before these concepts are implemented in a peer conflict. The AO's for the Western Pacific, Baltic Sea, and Barents Sea are too vast to maintain constant surveillance and re-supply with the current technology that the United States owns. One way to overcome these discrepancies is to develop an MFS vessel that can conduct offensive and defensive fires, have the ability and technology to maintain constant surveillance, and alleviate the need to re-supply units due to the MFS vessel taking the place of many EABO sites. EABO and DMO is the direction the U.S. Navy and Marine Corps are intending to use during a future conflict in the Western Pacific, an MFS vessel fills in the gaps in the conceptual planning and commanders gain flexibility and speed to their operations while mitigating significant risk.

PART 6: A WAY TO WIN

A future Naval vessel that is going to be able to fight and win within a littoral environment and have the legs to operate in blue water, must be a combination of what is currently in the U.S. Navy inventory and some of the proposed future assets that has already been discussed in this research. Since the author of this research is not a ship engineer or

designer, this paper will focus on requirements for the future MFS vessel rather than detailed ship building designs. Therefore, the requirements set forth in this research are what current vessels are lacking for the future littoral fight: weapons, signature, defensive capabilities, and cost. The MFS vessel must be able to make up the ground in all those endeavors. If not, then the MFS vessel will be a large overpriced, light armored, vessel that will have a huge signature and lack the necessary weapons to be relevant in a littoral fight.

The first requirement in designing a relevant ship for the future fight, is whether to make it manned or un-manned. There are advantages in both, however, going with current trends the next generation ship for the littoral fight should be un-manned. By designing it to be un-manned allows extra space aboard due to lack of crew quarters, deck house, crew amenities, and personal storage and workspaces. Removing all these items allows for more weapons, fuel, and reduces the signature by not having tall structures above the water line. The drawback to having an un-manned vessel is that it will be required to have a digital link to a base station for control. The base station or Command and Control (C2) center for the MSF vessel will manage navigation, surveillance, weapons, and control over the vessel. Therefore, the link between the base station or C2 center and the vessel must be secure and able to operate in a GPS denied environment in order to be relevant against a peer competitor of the future. The C2 center could also be placed anywhere in the world if the MSF vessel is equipped with long range communications and controls like the current RQ-4 Global Hawk's[23]. Which are based in the central part of the United States but operate the drones all over the world. The same could be used for the MSF vessel using long range digital command and control systems to connect the MSF vessel to the C2 center out of Hawaii for missions in the Pacific, or out of a European country for missions in

[23] United States Air Force, "Fact sheets", United States Air Force, 27 Oct 2019. https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104516/rq-4-global-hawk/

the Mediterranean and Middle East. If possible equipping aircraft carriers or Amphibious ships with a mobile C2 center where the MSF vessel could use both long/short-range command and control in the areas where it is assigned to support. The best quality for an un-manned vessel is that it doesn't put personnel in harm's way. This reduces the risk of putting the vessel in situations where the current U.S. Navy is hesitant to go. Therefore, the leaders that would employ the MFS vessel in all types of operational environments.

Next requirement is the weight and hull design. The future MSF ship should be lighter than the current destroyers within the U.S. Navy, but large enough to carry the necessary weapons to be applicable for the future fight. Current weight of an Arleigh Burke class destroyers can weigh over 9,000 tons and measure over 500 feet long[24]. In order to be able to operate in both open ocean and in shallow water within the littorals the MFS should have the measurements closer to that of the old Oliver Hazard Perry-class frigate or the British Type 31 Frigate. Somewhere between 400-450 feet long, and a draft large enough to fit the Vertical Launch Cells that are fielded currently. As well as, weigh somewhere between 5000-7000 tons. The design of the vessel should also consider some of the technological advances that the DDG-1000 USS Zumwalt has aboard with regards to the tumblehome hull and inverted bow[25]. Both are added to cut through large waves and reduce radar cross-section. All these structural requirements would help the MFS vessel maneuver through the littorals and open ocean, have a smaller radar cross section, reduce cost in materials, and be large enough to carry a vast assortment of weapons.

[24] United States Navy, "Fact File-Destroyers", United States Navy website, 21 August 2019. https://www.navy.mil/navydata/fact_display.asp?cid=4200&tid=900&ct=4 (accessed on Dec 14 2019)
[25]United States Navy, "Fact File-Destroyers", United States Navy website, 21 August 2019. https://www.navy.mil/navydata/fact_display.asp?cid=4200&tid=900&ct=4 (accessed on Dec 14 2019)

The pivotal piece to the MFS vessel is the weapon requirements. The MFS vessel must be able to carry an assortment of offensive and defensive weapons to be relevant for the future fight. Being un-manned would potentially allow for the vessel to carry more weapons than the current U.S. Navy ships. Therefore, the MFS vessel should have a compliment of weapons that combine both the Arsenal ship and Missile Merchant vessels proposals. After researching both U.S. Navy and Allied warships, the number of Vertical Launch Tubes should be double what the current Arleigh Burke class destroyers house (96)[26]. The justification of putting this many tubes aboard the future vessel is that it can do the work of two U.S. Navy destroyers. Consequently, reducing the number of ships the U.S. Navy needs to build and maintain, as well as reducing the number of ships in harm's way against a potential peer Navy.

Other weapons that need to be incorporated on the MFS vessel are multiple 155mm indirect fire Naval Guns, and 30mm anti-ship weapons. The 155mm Naval Guns like the USS Zumwalt Advanced Gun System, will allow the MFS vessel to support ground forces with bombardment and destruction missions. Armed with over the horizon munitions, the 155mm could saturate a beach with constant bombardment or destroy individual targets when conducting Offensive Amphibious operations. Something that current CRUDES assets are struggling with when anti-ship missiles are present. In addition, having a 30mm defensive guns for anti-ship missions allows the MFS vessel some protection against enemy small boat tactics. Lastly arming the MFS vessel with weapons that can be interchanged with emerging technology (Rail Gun, Lasers, Hypersonic munitions, etc.) will allow the MFS vessel to stay relevant throughout its life cycle.

[26] United States Navy, "Fact File-Destroyers", United States Navy website, 21 August 2019. https://www.navy.mil/navydata/fact_display.asp?cid=4200&tid=900&ct=4 (accessed on Dec 14 2019)

The last requirement that is needed in order for the MFS vessel to be successful is the cost of building and maintaining a ship of this caliber. Again, without being a ship designer or engineer the total cost for project is above this research. Focusing on the requirements of the MFS vessel being a ship that its cost is moderate to the taxpayer. Cost is a driving factor for future ship design given the U.S. Navy's expensive ships like the USS Zumwalt class destroyers ($13,031 million for three vessels[27]), the Littoral Combat Ships (approx. $18,329 million for 35 vessels by FY19[28]), USS Ford Class Carriers (approx. $13.1 billion per vessel[29]), etc. If the program is too expensive or the cost outweighs the benefits of having a dedicated vessel that is different from the general-purpose ships currently in the U.S. Navy, then the program will be dead on arrival in the U.S. Congress.

PART 7: THE ASSESMENT

From the start of this research project the need for an MFS vessel is growing larger than initially thought. Through the Commandant's Planning Guidance, Chief of Naval Operation's 2018 Design for Maintaining Maritime Superiority version 2.0, National Defense Strategy 2018, DMO concept, and EABO concept, the push to prepare for a fight within the littorals is becoming a priority. Throughout wargames conducted at the end 2019 Marine Corps Warfighting Lab, Krulak Center, and 12th Marine Regiment research concluded that the U.S. Navy/Marine Corps lacks the overwhelming offensive fire support to support troops ashore

[27] Congressional Research Service, "Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress", US Congress, Washington DC. 17 Dec 2019. https://fas.org/sgp/crs/weapons/RL32109.pdf (accessed on Dec 23 2019)
[28] Congressional Research Service, "Navy Littoral Combat Ship (LCS) Program: Background and Issues for Congress", US Congress, Washington DC. 17 Dec 2019 https://fas.org/sgp/crs/weapons/RL33741.pdf (accessed on Dec 23 2019)
[29] Congressional Research Service, "Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress", US Congress, Washington DC. 04 Feb 2020. https://fas.org/sgp/crs/weapons/RS20643.pdf (accessed on 15 Feb 2020)

based on current forces and technology in a littoral environment against a peer competitor. Secondly, the current U.S. Navy assets are at high risk for anti-ship missiles due to large signatures of U.S. Warships and the enemy's ability to out range current CRUDES assets. Lastly, the Marie Corps will lack the necessary number of munitions using the proposed missile systems (HIMARS Marine Anti-ship missile[30]) to take on a large naval force of near peer/peer competitors.

Part 7a: The 12th Marine Wargame

In the fall of 2019 students and faculty from Expeditionary Warfare School, Command and Staff College, School for Advance Warfighting, the Krulak Center, and inputs from the staff of 12th Marine Regiment, conducted a wargame at the Marine Corps University based on the Commandants proposed EABO concept to deter a peer competitor utilizing the HIMARS to support the U.S. Navy in sea denial and control. (For details see Appendix).

Though the proposed MFS vessel for this research was not introduced during the 12th Marines wargame, it was apparent that if the U.S. Navy had employed a few of the proposed MFS vessels in the scenario the gaps that were identified during the wargame would be fulfilled. For instance, during the wargame it was identified that if the Marine Corps employed a Fires EABO site in a littoral environment the current and the proposed systems of anti-ship weapons and HIMARS launchers lacked the necessary range against a peer competitor force that utilizes modern day anti-ship technology. The launchers lacked the ability to engage targets due to limited range of the actual systems, as well as restricted to terrain within the littorals. By using a proposed MFS vessel in concert with the Fires EABO site, it could be assumed that an MFS

[30]Sam LaGrone, "Raytheon to Arm Marine Corps with Anti-Ship Missiles in $47M Deal", US Naval Institute News, US Naval Institute website, 18 May 2019. https://news.usni.org/2019/05/08/raytheon-to-arm-marine-corps-with-anti-ship-missiles-in-47m-deal (accessed 15 Dec 2019)

vessel would be able to maneuver to engage targets that were out of range of the Fires EABO site. In addition, with the MFS vessel not restricted to small pieces of terrain in a littoral environment (only certain depths of water), it could also be assumed that the MFS vessel could move to positions where it could reinforce the anti-ship umbrella that the Fires site set up. Furthermore, it was noted that once the Fires EABO sites executed a strike on an enemy formation, the launchers would have to shut down to reload, or displace to another location in an effort to prevent the enemy from targeting the launchers after they had fired. During this period the launchers are extremely vulnerable, and the launchers will not be able to support the mission for a significant period of time. By having the addition of an MFS vessel in the mix of Fires EABO sites, it could be tasked to cover the withdraw or "down time" for launcher reloads. Thus, reducing the amount of time of broken anti-ship coverage.

Another gap identified in the war game was in the use of multiple sections of Joint tactical aircraft to augment the Fires EABO sites. Due to the large quantity of enemy vessels and aircraft, coupled with their long-range weaponry, EABO sites needed a significant amount of tactical aircraft to achieve air superiority. This becomes unsustainable due to the amount of sortie generation needed to successfully deter or defeat a peer adversary navy and maintain air superiority. With the "blue water" Navy maintaining its distance out of the weapon engagement zone (WEZ) to avoid anti-ship missiles, MFS vessels employed with anti-air capabilities would lessen the burden of needing an abundance of Joint aircraft. If MFS vessels were applied in this scenario with anti-air capabilities, it could be assumed that the Joint Force would be able to achieve air superiority much quicker, utilizing less aircraft, and not have to surge sortie generation to accomplish the mission.

Lastly, at the beginning of the wargame the Allied forces already occupied their positions within the littoral operations area. The wargame never dealt with the scenario of enemy forces already occupying the positions where friendly EABO sites would be established. As well as, the scenario where enemy forces land troops on the island occupied by Fires EABO Marines, and attack by land. Again, with the U.S. Navy staying out of the WEZ of anti-ship missiles, an MFS vessel would largely be the only asset to support the Marines in the area.

The 12th Marines wargame based its game design on Commandant's Planning Guidance to fight a littoral battle. This invaluable wargame proved that the Marine could fight a small adversary in a littoral battle. However, to fight and win in the littorals against a large force the Marine Corps and U.S. Navy will need significant help. With the proposed MFS vessel in this research, the Joint Force will significantly decrease the risk of mission failure against a peer adversary. Coupled with the Fires EABO concepts, the MFS vessel could provide the necessary support to fight and win anywhere in the world. Without the MFS vessel, the Joint Force is out matched if the enemy throws more assets into the fight based on the conclusions within the 12th Marines wargame.

PART 8: CONCLUSION

The research conducted for this project concludes that there still is a requirement for Naval Gunfire and Shore Bombardment within the Joint Force. However, since 1992 when the last of the U.S. Battleships were released from active duty, there has been a steady decline in the U.S. Navy's ability to conduct effective Naval Surface Fire Support. Whether from dismissed programs due to cost, design, weight of the systems, or general lack of interest due to the long land wars fought in the Middle East, the deterioration of the NSFS mission within the U.S. Navy

is in jeopardy. Furthermore, this problem is exacerbated by the advancements and proliferation of anti-ship weapons by near/peer adversaries, which pushes the fleets further away from operations ashore. Given these shortfalls and the guidance spelled out by the top echelons of the U.S. Military (NDS 2018, CPG 2019 etc.), the U.S. Navy needs to modernize its Fleet and design a vessel that can support the Joint Force in Combined Arms from the sea. By designing a new Fire Support vessel that is unmanned or lightly crewed and providing both offensive and defensive fire support to shore based forces, the U.S. Navy will be able to maintain the edge over peer adversaries in a future littoral fight. By not addressing the need for a future Naval Fire Support vessel, will create gaps in the U.S. Military's ability to support forces ashore during an Amphibious Operation or EABO; as well as its ability to operate anywhere in the world.

Bibliography

1. Asia Maritime Transparency Initiative, "China Lands First Bomber on South China Sea Island", 18 May 2018. https://amti.csis.org/china-lands-first-bomber-south-china-sea-island/ (accessed on Dec 15 2019)
2. Caleb Larson, "These Four Bombers are the crown jewels Russia's air force", National Interest. 28 October 2019. https://nationalinterest.org/blog/buzz/these-four-bombers-are-crown-jewels-russias-air-force-90876 (accessed on Dec 15 2019)
3. Captain R. Robinson Harris, U.S. Navy (Ret.); Andrew Kerr; Kenneth Adams; Christopher Abt; Michael Venn; and Colonel T. X. Hammes, U.S. Marine Corps (Ret.), "Converting Merchant Ships to Missile Ships for the Win", U. S. Naval Institute Proceedings Vol. 145/1/1,391. Jan 2019 https://www.usni.org/magazines/proceedings/2019/january/converting-merchant-ships-missile-ships-win (accessed on Jan 15 2020)
4. Captain Sam J. Tangredi, U.S. Navy (Retired), "Breaking the Anti-Access Wall", U. S. Naval Institute Proceedings, Vol. 141/5/1,347. May 2015 https://www.usni.org/magazines/proceedings/2015/may/breaking-anti-access-wall (accessed on Jan 15 2020)
5. Congressional Budget Office, "Cost of building 355 ship Navy", US Congress, Washington DC, April 2017. https://www.cbo.gov/system/files/115th-congress-2017-2018/reports/52632-355shipnavy.pdf (accessed on 23 Dec 2019)
6. Congressional Research Service, "Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress", US Congress, Washington DC. 17 Dec 2019. https://fas.org/sgp/crs/weapons/RL32109.pdf (accessed on 23 Dec 2019)
7. Congressional Research Service, "Navy Littoral Combat Ship (LCS) Program: Background and Issues for Congress", US Congress, Washington DC. 17 Dec 2019 https://fas.org/sgp/crs/weapons/RL33741.pdf (accessed on 23 Dec 2019)
8. Congressional Research Service, "Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress", US Congress, Washington DC. 04 Feb 2020. https://fas.org/sgp/crs/weapons/RS20643.pdf (accessed on 15 Feb 2020)
9. Dr James Bosbotinis, "Chinese Power Projection; A Role for Arsenal Ships?", Wavell Room Contemporary British Military Thought website, June 2018, 2019. https://wavellroom.com/2019/06/18/chinese-power-projection-arsenal-ships/ (accessed on Jan 04 2020)
10. EWTGPAC Naval Surface Fire Support Branch, *End of the Year rollup CY2018*. PowerPoint Presentation. EWTGPAC, Coronado, California Dec 2018.
11. General Berger, David H., Commandant of the Marine Corps, *Commandant's Planning Guidance*, July 16, 2019, https://www.hqmc.marines.mil/Portals/142/Docs/%2038th%20Commandant's%20Planning%20Guidance_2019.pdf?ver=2019-07-16-200152-700 (accessed on August 13, 2019)
12. Gina Harkins, "A Navy Ship Sailed to Hawaii and Back With No One on Board", Defense Tech, Military.com website, 15 Feb 2019. https://www.military.com/defensetech/2019/02/15/navy-ship-sailed-hawaii-and-back-no-one-board.html (accessed on 10 Jan 2020)

13. H.I. Sutton, 10 Ways Iran Could Attack Oil Tankers In Response To U.S. Killing Of Top Commander, Forbes website, Jan 3, 2020 https://www.forbes.com/sites/hisutton/2020/01/03/10-ways-iran-could-attack-oil-tankers/#280920eb2c54 (accessed on Jan 15, 2020)
14. Joint Forces Command, *Amphibious Operations*, JP-3-02, Norfolk-Suffolk Virginia: Joint Forces Command, 04 January 2019. https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_02.pdf (accessed on Dec 22, 2019)
15. Lieutenant Colonel Frank G. Hoffman, U.S. Marine Corps Reserve (Retired) and Colonel George P. Garrett, U.S. Marine Corps (Retired), "Amphibious Assault Will Remain a 'Corps' Competency", U. S. Naval Institute Proceedings, Vol. 145/4/1,394, April 2019. https://www.usni.org/magazines/proceedings/2019/april/amphibious-assault-will-remain-corps-competency (accessed on Dec 14 2020)
16. Marine Corps Systems Command, "Advanced Technology Investment Plan", Marine Corps Systems Command, Quantico Va Vol. X, 2019. https://www.marcorsyscom.marines.mil/Portals/105/PELandSystem/ATIP/2019_ATIP.pdf (accessed on 05 Jan 2020)
17. Mark Thompson, "The U.S. Navy's Titanium "Tin Can", Project of Government Oversite website, Jan 10, 2019 https://www.pogo.org/analysis/2019/01/the-u-s-navys-titanium-tin-can/. (accessed on Jan 04 (2020)
18. Missile Defense Project, "DF-21 (Dong Feng-21 / CSS-5)," *Missile Threat*, Center for Strategic and International Studies, April 13, 2016, last modified January 2, 2020, https://missilethreat.csis.org/missile/df-21/. (accessed on Jan 15, 2020)
19. NAVSEA Shipbuilding Support Office, "Naval Vessel Register", website, Norfolk Naval Shipyard, Portsmouth VA, https://www.nvr.navy.mil/ (accessed Feb 14 2020)
20. NASA, "Living Ocean", NASA website https://science.nasa.gov/earth-science/oceanography/living-ocean (accessed on Jan 04 2020)
21. Sam LaGrone, "Raytheon to Arm Marine Corps with Anti-Ship Missiles in $47M Deal", US Naval Institute News, US Naval Institute website, 18 May 2019. https://news.usni.org/2019/05/08/raytheon-to-arm-marine-corps-with-anti-ship-missiles-in-47m-deal (accessed 15 Dec 2019)
22. United States Navy, "Fact File-Destroyers", United States Navy website, 21 August 2019. https://www.navy.mil/navydata/fact_display.asp?cid=4200&tid=900&ct=4 (accessed on Dec 14 2019)