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Get Small or Get Shot

Increasing survivability for maritime operations

by Maj Leo Spaeder

At Modern Day Marine 2017, then-Commandant of the Marine Corps Gen Robert B. Neller outlined the primary challenge of future maritime operations in a contested environment where the Navy-Marine Corps Team will have "to fight to get to the fight."[1] Recent articles in the *Gazette* and the defense press highlight the threat of anti-access/area denial weapons, especially the Chinese Df-21 and Df-26 anti-ship ballistic missiles (ASBM).[2] These concerns are well-founded but do not auger a final verdict on Marine Corps operations or the offense-defense balance in the 21st century. *Appropriate to this new threat, the Marine Corps should apply a well-understood maxim of ground combat to the maritime domain: get small or get shot.* No warfighter in a gun fight makes themselves a larger or easier target for their opponent to shoot. This article outlines why getting small while afloat is essential, how the Marine Corps could implement this concept, and the implications on both Navy and Marine Corps force structure and fleet architecture, budget, and force generation.

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There are three key assumptions that underline this analysis. First, until there is a significant breakthrough in directed energy weapons, America's peer and near-peer enemies—such as China, Russia, and Iran—will possess larger anti-ship missile inventories than the Joint Force (particularly U.S. Navy warships) can counter. The second assumption is the Df-21 and Df-26 are true "carrier killers." This implies a single strike results in at least a mission kill and the circular error probability radius (CEP) matches the target radius of a *Gerald R. Ford*-class (CVN-78) aircraft carrier.[3] This means a single missile has a 50 percent probability of scoring a hit—exclusive of any defensive countermeasures, (see Figure 1). Lastly, the analysis below does not include any defensive countermeasures as enemy magazines have enough depth, consistent with the first assumption, to eventually place U.S. warships in this defenseless tactical situation.

Beginning the analysis of enemy salvo requirements, the *Ford*-class carriers are 337 meters in length, 78 meters abeam at the flight deck, and cost approximately $12 to $13 billion based on the adjusted dollars for fiscal year 2019 (FY19$). This is before considering the cost of 2,600 Sailors and dozens of F-35Cs in the carrier air wing.[4] Setting the CEP radius as half the carrier's length (169 meters), the Chinese would have to fire five ASBMs to have a 95 percent assurance of achieving a hit. For the currently planned amphibious fleet, *America*-class (LHA-6) and *San Antonio*-class (LPD-17/-30) ships would require missile salvos of eight and twelve, based on their respective lengths, to assure a successful strike.[5] While these numbers are better compared to the CVN-78, these salvos would only cost the Chinese $140 million and $210 million, respectively, assuming the average ASBM costs $17.5 million.[6] With each LHA-6 priced at $3.48 billion (FY19$), LPD-17 at $1.72 billion (FY19$), and LPD-30 at $1.8 billion (FY19$), the cost curves are not in the United States' favor.

Missile Salvo Size to Generate 95% Probability of Hit (PH)				
PH Methodology	CVN-78	LHA-6	LPD-17	San Giorgio
CEP = ½ CVN-78 Length (169m)	5	8	12	24
CEP = ½ CVN-78 Flight Deck Beam (39m)	5	26	26	55
CEP CVN-78 Area (92m)	5	14	18	36

Figure 1. Probability of Hit. *(Figure provided by author.)*

This is where smaller amphibious ships, particularly the more numerous amphibious transport docks (LPD), are essential for successful operations in contested maritime environments. At 143 meters long by 22 meters abeam, the Italian *San Giorgio*-class amphibious ship is significantly smaller and offers a helpful model for analysis. Returning back to our salvo calculations, 24 carrier killer ASBMs would achieve a 95 percent probability of a direct hit against this sized platform.[7] That salvo would cost approximately $420 million. The cost of the *San Giorgio*-class: $298 million (FY19$).[8] That is the cost curve inversion—or, at the very least, cost curve parity—that the United States requires to thrive in the A2/AD age.

An Italian Navy design with four hulls in service, three with the Marina Militare and one with the Algerian Navy, is a reliable base platform that has proven adaptable to various mission sets. For example, the class namesake was originally outfitted with a 76mm gun and two 25mm machine guns (which were later removed to accommodate more helicopters), while the Algerian hull is armed with an additional 16 vertically launched Aster-15 surface-to-air missiles. For landing operations, these vessels can hold three LCM-8 watercraft, fifteen tracked vehicles, or a combination of the two from a floodable well deck. It currently has four spots for light and medium helicopters to support vertical lift operations. With a crew of approximately 180 sailors, it can transport 450 Marines (including the aviation detachment). The ship's company requires significantly fewer sailors than the LPD-17/-30, which is crewed by 360 personnel. Fully loaded, it only displaces 8,800 tons compared to the LPD-17's 25,300 tons, which does indicate more susceptibility to both direct hits and non-direct, proximate warhead detonations. Lastly, it is designed and built by Fincantieri, which has an American subsidiary that already builds Littoral Combat Ships for the Navy as well as Coast Guard cutters, so the platform can be quickly adapted and produced with minimal regulatory overhead.

The smaller LPD design offers a number of opportunities for legacy Marine Corps missions as well as expansion into new aspects of naval warfare. First and most traditional, because of its smaller signature and more numerous quantity which makes the force more survivable than its larger LHA/D and LPD-17/-30 counterparts, the *San Giorgio*-class can be the main platform for launching Marine landing forces during a joint forcible entry operation. These Marines could launch from the organic surface connectors or assault vertically from these "lilly pads" via MV-22s operating from the LHA/Ds.

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Next, the latest *San Giorgio* LPD—built for the Algerians—is outfitted with sixteen surface-to-air missiles.[9] If this Aster-15 capability is adapted to the Navy standard vertical launch system (VLS), then these ships could provide surface-to-air fires, anti-ship fires, or surface-to-ground fires. This follows the Navy's distributed lethality strategy and makes more sense than retrofitting missiles onto multi-billion dollar platforms. The smaller LPDs could deliver munitions in support of its own Marines landing on hostile beaches during conventional landing operations. It could provide additional firepower while adding expeditionary force capabilities to legacy surface action or carrier strike groups, transforming them into littoral combat groups as outlined in the Navy-Marine Corps *Littoral Operations in a Contested Environment* (LOCE) concept. Armed with its 76mm and two 25mm guns, anti-air or anti-ship VLS missiles, and embarking a Navy coastal riverine detachment or Navy/Marine unmanned surface vessels, this smaller platform will be ideal to defend a naval task force transiting key maritime choke points and operating in closed and confined seas against adversaries such as the Iranian Revolutionary Guard Corps Navy in the Strait of Hormuz and Arabian Gulf. Below the level of traditional armed conflict, this platform with a similar unit configuration could

The Italian Marine Militare amphibious transport dock* San Marco *(L9893). ***(Photo by Mass Communication Specialist 1 Rafael Martie.)***

compete against malign forces afloat, such as the Chinese Maritime Militia, and conduct extended freedom of navigation operations in complex maritime terrain, including the Paracel or Spratly Islands chains. With its 60-bed medical facility, 210-ton daily water production capability, and ability to operate light and medium helicopters as well as smaller watercraft, the *San Giorgio*-class is an ideal economy of force platform for humanitarian assistance/disaster relief missions—such as the seemingly annual hurricane relief missions in the Caribbean—to allow the larger, more capable platforms to continue their great power deterrence operations elsewhere around the world.

Most importantly, the Navy and Marine Corps could use this platform as the connecting tissue to a number of concepts—specifically LOCE, *Distributed Maritime Operations* (DMO), and *Expeditionary Advanced Base Operations* (EABO)—to achieve desired naval integration, increase forward presence in the contact and blunt layer, and compete (and potentially fight) for sea control.[10] The *San Giorgio*-class platform is ideal to employ a sea control MAGTF and fulfill these ends. First, a HIMARS battery task force with anti-ship missiles can be landed via the LCM-8s to operate from expeditionary advanced bases and is capable of striking far out to sea while remaining harder for peer adversaries to detect or target. Operating independently or from the ship, teams (both manned or unmanned) of Navy or Marine patrol craft, unmanned undersea vehicles, and unmanned surface vessels outfitted with low cost, loitering, swarm-enabled, ship-launched multimission unmanned aerial vehicles that are capable of electronic warfare, lethal strikes, and intelligence, surveillance, reconnaissance, and targeting could cue shooters throughout the naval network. These shooters include the new, smaller LPD with sixteen VLS anti-ship missiles. Finally, a light attack helicopter detachment operating from the ship or EABs ashore can target both land-based and afloat adversaries, enable the maneuver of forces ashore, and sustain them. This balanced concept revolves around a low-cost, risk-worthy platform that can operate independently, embark key capabilities from both the Navy and Marine Corps inventory, and fight those capabilities in a contested environment. While the potential mission sets for this platform are many, this final concept answers the requirements set forth in the naval concepts of LOCE, EABO, and DMO as well as the overall approach outlined in the *National Defense Strategy*.

The Presidential Budget Request 2020 contains two LPD-30s to be built in FY21 and FY23.[11] These ships should be replaced with four *San Giorgio*-class amphibious ships, which will repurpose the 760 Sailors that would have crewed those two LPD-30s.[12] With the original budget of $3.5 billion (FY19$), this four-ship proposal only accounts for $1.2 billion.[13] The remaining $2.3 billion (FY19$) can purchase an additional six ships (with $500 million returned to the Shipbuilding and Conversion account); three aging *Whidbey Island*-class (LSD-41) or *Harpers Ferry*-class (LSD-49) ships can be decommissioned to source the 1,080 crewman required (with approximately 150 billets returned to the Navy).[14] Under this plan, a total of five ships can transform into ten vessels that are more survivable for the future A2/AD challenge. If maintained beyond this current Future Years Defense Plan covering FY20 to FY24, two *San Giorgio*-class vessels could replace every other new LPD-30 hull, whose cost savings could enable the early decommissioning of the LSD-41/-49 ships or be returned to the Navy Shipbuilding and Conversion account.

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If the *San Giorgio*-class is accepted as is, the Navy and Marine Corps will have to re-assess the underway LCU-1600 and LCAC recapitalization program as the current ship design only supports LCM-8s in the well deck. This allows for two options. Fincantieri could modify the ship to accommodate an LCU-1600; however, this would incur engineering costs that obviate the cost savings of using an existing design and most likely create a larger ship that will cost more to build and be more targetable. Instead, the Navy could acquire LCM-8s at the expense of the more expensive LCAC, whose overall requirement would shrink as there would not be well-deck space available to house these platforms. This makes economic sense as the LCM-8 replacement is more fiscally judicious than the larger, more complex, and personnel intensive LCAC, which costs $65.6 million per unit (FY19$).[15] The money saved could be routed toward acquiring other much needed connectors or high priority naval programs.

In terms of force generation, the addition of ten amphibious ships into the fleet instead of the planned five hulls during the FY20 to FY24 FYDP offers exciting opportunities for Marine Corps and naval operations. The first force generation concept is to conduct a one-for-one replacement of the two LPD-30s and three LSD-41/-49 into the amphibious ready groups. Instead of deployments with an LHA/D, LPD-17/-30, and LSD configuration, these ARG/MEUs would incorporate a *San Giorgio*-class vessel into the mix. This new ship mix will require a new MEU design as the smaller ship class offers less space for landing force equipment. This re-thinking of the MEU is not fatal as the future operating environment will require adaptive capabilities; new tables of organization and equipment are a natural process and a key message of the *Commandant's Planning Guidance*. Another concept supported by the continued procurement of two *San Giorgio*-class ships for every other LPD-30 in FY25 onward could even allow for a four ship ARG where most of the landing force embark space has been replaced. This will offer a more distributable unit of employment where the MEU's effects could be magnified across a larger geographic area.

If a one-for-one replacement into the current ARG force generation model is adopted, this leaves five smaller LPDs available for tasking. The naval force could leverage these ships to add a new constant, heel-to-toe special purpose

MAGTF presence in potential hotspots around the world; furthermore, they can concurrently deploy embarked Marine and Navy forces for episodic or surge presence as well as potentially in humanitarian assistance/disaster relief response during storm season. Regarding China's global ambitions under the Belt and Road Initiative, the opportunity to deploy single or two ship special purpose MAGTFs in previous economy of force sectors offers welcome flexibility to affect the Middle Kingdom's and other peer or near-peer competitors' strategic calculus.

In conclusion, the current amphibious platforms are not survivable and cannot achieve a competitive cost framework in the contested maritime environment populated by A2/AD systems, particularly Chinese ASBMs. Choosing a smaller amphibious transport dock platform such as the Italian Navy *San Giorgio*-class ship provides a survivable, risk-worthy platform that creates redundancies, supports distributed maritime operations and lethality, enables amphibious operations while expanding potential maritime mission sets, and flattens or potentially inverts the cost curve. In addition to ship survivability, it also accounts for fiscal realities and returns, funding to the Shipbuilding and Conversion account, and Sailors to Navy Personnel Command. This concept facilitates opportunities for different MEU configurations, new afloat units of employment, and integration with Navy units. Employing this concept, the naval force of the future will get small and avoid the enemy's fire to successfully operate in the maritime domain.

Notes

1. Megan Ekstein, "Neller: Marines Must Prepare to 'Fight to Get to the Fight' In High-End Littoral Warfare," *USNI News,* (Newport, RI: September 2017), available at: https://news.usni.org.

2. The Dong Feng-21 (Df-21) is a single warhead, two-stage solid fuel rocket, medium range ballistic missile loaded on a ground-mobile transporter erector launcher. The Df-26 has similar characteristics but is a longer-range weapon that can carry both conventional and nuclear payloads.

3. This analysis uses circular error probability—50 percent of rounds fired will land within this radius—for an illustration of the effect of platform size on survivability in an unclassified publication. The author recognizes there are underlying problems with this approach as precision guided munitions (PGM) have more "close misses" than conventional munitions, which comply with a normal distribution, whereas PGMs have skewed probability distributions. However, PGM's "close misses" do not account for electronic warfare defenses, such as GPS spoofing, which may return targeting results back towards a traditional, normal probability distribution. Probability of hit (P_H) is defined as warhead-to-target contact and therefore does not include the effect of the warhead's lethal radius; however, ship defense systems are part of this analysis which would off-set some of the warhead effect on kill probability.

4. All costs are normalized into FY19 dollars based on the Joint Inflation Calculator for Navy Shipbuilding and Conversion factors. Information available at https://www.ncca.navy.mil/tools/inflation.cfm.

5. There are three potential methodologies to analyze the direct hit probability for a target such as an aircraft carrier. The CEP radius can be set according to ½ of the length of the ship, which makes the target larger than it is as the radius only accurately accounts for the length fore and aft, whereas that same distance port to starboard makes ship wider than reality (in the CVN-78's case, 260 meters wider). The second is ½ of the flight deck beam, which penalizes the missile as it does not account for the entire targetable area of the ship in an inverse of the first methodology. The last methodology calculates the rectangular area of each platform and converts it into a circular area to determine a synthetic target radius for analysis. The article uses the results from the ½ length method as its salvos are the most conservative. Each individual missile's P_H is calculated by the formula "$=1 - \text{Exp}(-0.6931*(R^2/CEP^2))$" where R is the ½ ship length and CEP is ½ CVN-78 length. Salvo size was determined by the formula "$=1 - (1 - P_H)^N$" where N is the number of missiles to achieve a 95 percent probability of hit. The results are depicted in the table on page 30.

6. The Df-16, a short-range, single-stage solid-fuel rocket, ballistic missile is estimated to cost $6 million each. The low end Df-21 cost estimate of $12 million each is based on the fact that the DF-21 has approximately twice the range of the Df-16. Hypersonic boost-glide weapons are estimated to cost $23 million each by CSBA. Therefore, this analysis averages the cost per ASBM as $17.5 million. Information available at https://breakingdefense.com.

7. See footnote 5.

8. Ryan Hilger, "Cost and Survivability: Acquiring the Gator Navy," Center for International Maritime Security, (Online: April 2019); available at https://www.cimsec.org.

9. The Algerian vessel is referred to as the Enhanced San Giusto-class by Fincantieri as it is a longer version of the San Giusto, launched in 1994. Information available at https://www.fincantieri.com.

10. Chief of Naval Operations, *Distributed Maritime Operations,* (Washington, DC: 2019); Chief of Naval Operations and Commandant of the Marine Corps *Littoral Operations in a Contested Environment*, (Washington, DC: 2017); and Chief of Naval Operations and Commandant of the Marine Corps, *Expeditionary Advanced Base Operations,* (Washington, DC: 2019).

11. Navy budget materials for Presidential Budget Request 2020 are available at https://www.secnav.navy.mil. See the PB20 Battle Force Inventory for the shipbuilding plan and P-40 exhibits for system procurement costs.

12. Surface ship fact files available at https://www.navy.mil.

13. *Distributed Maritime Operations; Littoral Operations in a Contested Environment*; and *Expeditionary Advanced Base Operations.*

14. See footnote 11.

15. *Distributed Maritime Operations; Littoral Operations in a Contested Environment*; and *Expeditionary Advanced Base Operations.*