

# ADVANTAGES OF SINGLE-PURPOSE THE WARSHIPS FOR LITTORAL COMBAT

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*The world today truly is different. Our enemies are different and we need to resist the temptation to be smug about our past successes. The future is not going to be the past on fast forward.*

General Michael Williams, Assistant Commandant of the Marine Corps

*Marine Corps Gazette, April 2002<sup>1</sup>*

## WHAT HAS HAPPENED

Writing a dozen years ago, the retiring Assistant Commandant perceived that the Marine Corps must adapt to a changing world. The same is true for the U. S. Navy. There is a plethora of published essays and DoD white papers that discuss policy and strategy. I add nothing new to the ends of national and naval strategies. I concentrate on the ways and means to execute the imputed strategies for the 21<sup>st</sup> Century. My special emphasis is on the need to reintroduce small and numerous surface ships that can operate and fight in deadly littoral waters because “the world today is truly different.”

For 25 years our large, multipurpose surface warships—CVNs, DDGs, and Amphibious ships—have enjoyed the luxury of delivering combat power to the land efficiently from a safe sanctuary at sea. Multipurpose warships made sense, and wherever the future threat of attack is small they will continue to be best. Big expensive, multi-mission warships and transports will and should comprise the greater part of our fleet, when measured in displacement, delivery capacity, and cost because they deliver large quantities of ordnance and troops efficiently. But the open sea is no longer everywhere a safe sanctuary, and the more constricted littoral waters have become downright dangerous for ships in many important coastal regions.

From 1950 to 1990 and until the collapse of the Soviet Union, our Navy was designed first and foremost for a NATO war that entailed maintaining a safe Atlantic sea link between the U. S. and Western Europe. We had a “transoceanic navy,” in Samuel P. Huntington’s felicitous term.<sup>2</sup> But Huntington expected and we pursued more than safe seas from our transoceanic fleet. Sea control having been achieved, the U. S. Navy exploited its sea control by threatening attacks from the sea at many places around the world, not least against the Soviet Union itself.

In the middle of this period, around 1970, our large fleet of relatively small ships that had fought in World War II was 25 years old and needed replacement. The numbers of replacement aircraft carriers, submarines, amphibious ships, and other surface combatants shrank by a third, but the

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<sup>1</sup> Quoted in “A2AD: The Death Knell for Amphibious Operations?” *Naval Institute Proceedings*, February 2014 by Cooper and Jernigan, who are describing future Marine Corps roles for the 21<sup>st</sup> Century.

<sup>2</sup> Huntington, “National Policy and the Transoceanic Navy,” *Naval Institute Proceedings*, May 1954, pp 483-493

new, postwar generation of warships were three and four times bigger in size for sustained deployments, peacetime presence forward, and large-volume attacks.

## **A TRANSITION TO THE MISSILE ERA AND ITS CONSEQUENCES**

Conducting attacks against the Soviet mainland was always chancy. But the threat was a high-reward endeavor, because the Soviets feared our Navy and invested heavily in the means to prevent attacks from the sea at great cost to them in aircraft, submarines, command and control systems, and to a lesser extent a surface fleet.

The weapons the Red navy planned to deliver were missiles. The Soviets developed a robust array of anti-ship missiles that over the years grew in variety, reach, warhead size, numbers, and homing accuracy. As a consequence, the U. S. Navy's way of surviving missile attacks had to shift away from the armor and sturdy hulls of the battleship era. (We called the capacity to take hits and keep fighting "staying power.") Anti-ship missiles with large warheads were capable of putting large, armored warships out of action with one or two hits, so in the new missile era active defenses had to be developed. They consisted of defending aircraft, surface-to-air missiles, close-in weapons, jamming, decoys, and deception.<sup>3</sup> The new defenses had to be virtually impenetrable. Twenty-five years later defending against the ever-more-capable missile threat is even more demanding.

In blue water both perspectives still abide. We employ large, multipurpose surface combatants to maintain wide area sea control and project power efficiently either (1) when an opponent dares not attack us, or (2) when we have confidence we can fend off his attack with very high probability. Implicitly Secretary of Defense Charles Hagel by curtailing the LCS program has reemphasized such a blue water combat capability: more offensive missile power to destroy an enemy at long range, and defensive power to survive his attack—not by taking hits and fighting on, but by attacking first, or preventing the enemy's hits.

## **RESPONDING TO SURPRISE**

A separate but equally important issue is whether our long-lived ships will stay relevant in a changing world. To amortize the considerable costs of their multiple capabilities, our warships are programmed to last as long as thirty and forty years. To see the hazard of this, compare the inaccuracy of our projections of the operating environment as the world existed in 1975, geopolitically, economically, and technologically. This was well before the collapse of the Soviet Union, the rise of the People's Republic of China, the onset of severe budget deficits, the widespread influence of cyber links and operations, and the development of robotic weapons, to name a few of the bigger changes.

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<sup>3</sup> I have skipped the carrier era of warfare at sea, essentially World War II, in which carriers were vulnerable and many were sunk or put out of action by bombs and torpedoes. Armor was of limited value to protect a flight deck, so active defense with CAP and many, many anti-aircraft guns created, by 1944, a virtually impervious defense, leading to kamikazes, which were *de facto* missiles guided by human beings.

Here is an elegant description of the consequences of depending on large, costly, long-lived warships. It is in a study seeking better ways to prepare for capability surprise:

“In a cost-constrained environment, when envisioning a low-threat situation or scenarios where there is little risk of loss of life or ships being damaged, building fewer but more expensive weapon systems and multipurpose ships is economically rational. More capability can be provided at sea with fewer hulls, crews, logistics, and total life-cycle costs. When, however, there is a risk of that ship being damaged or sunk because there is a high probability of a tactical surprise attack, the reverse is true—that is, cost-effectiveness becomes ‘too many eggs in one basket.’ A damaging hit on a guided missile destroyer (DDG) hull is degradation not just of the fleet’s air and missile defense capacity but also of ASW, antisurface, maritime interdiction operations, support for Marines ashore, and helicopter-related missions as well. Building more but less-expensive, single-mission ships may increase fleet resilience to absorb the impact of an unanticipated threat at sea, and provide more options for response through geographic dispersion as well as greater ship availability for quick modifications . . . Resiliency to surprise [tactical or technological] is the determining factor.”<sup>4</sup>

Perhaps Rear Admiral Benyamin Telem of the Israeli Defense Force described best the downside of multi-mission warships: “Under no circumstances should ships become big or expensive in equipment to the extent that their defense becomes a first priority requirement in itself. This would inevitably negate their offensive value.”<sup>5</sup>

## **THE DEADLY LITTORAL WATERS**

Thus far I have been speaking of combat without regard for the dimensions of the ocean battlefield. When we enter “the narrow seas,” early warning and constant alertness are harder to achieve. Depth of fire is lost for lack of sea room. The clutter of inlets, differing coastlines and islands, coastal shipping, fishing boats, and oil rigs all complicate both offensive and defensive tactics. Foreign littoral waters have become an unsafe place to operate on the sea surface. Do you challenge this? Read Admiral “Didi” Ya’ari’s description of the hazards he learned at first hand while fighting in the relatively uncomplicated waters of the eastern Mediterranean and upper Red Sea. In 1995 he published an essay in the *Naval War College Review* describing in detail why offshore surface warship operations are deadly, even more so in 1995 than in the Arab-Israeli 1973 War.<sup>6</sup> Twenty years after Ya’ari’s article the environment he described is still dangerous.

The larger purpose of this essay is to show why a single-purpose ship is far superior to an open-ocean multipurpose ship when it must sail in harm’s way. My specific purpose is to demonstrate the advantage quantitatively, first when measured by lost capabilities, next when measured in

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<sup>4</sup> National Research Council, *Responding to Capability Surprise: A Strategy for U. S. Naval Forces*, National Academies Press, 2013, p.73

<sup>5</sup> Telem, *Naval Lessons of the Yom Kippur War*, Tel Aviv, University Publishing Projects, 1975. One reviewer said “negate” is too strong and “offset” is a better word. I think Telem meant what he said.

<sup>6</sup> Ya’ari, “The Littoral Arena: A Word of Caution,” *Naval War College Review*, Spring 1995, pp. 7-21

battle outcomes, and lastly when measured in the dollar-cost of replacing a lost ship. I illustrate the quantitative advantages for missile warfare. I do not explore ASW, undersea warfare, NGFS, mine countermeasures, and land attack in the littorals, but the same rationale will probably apply: single-purpose ships are best in many settings that are rising in importance.

## A QUANTITATIVE DEMONSTRATION

An easily understood way to show the advantage of the single-purpose ship is by using *lost combat capabilities* as the basis of comparison. Assume a notional multipurpose ship has four combat capabilities. These might be surface missile warfare, antisubmarine warfare, mine clearance, and the employment of helicopters or unmanned aerial vehicles. Since there is a high probability that one modern anti-ship cruise missile will put either ship out of action, the advantage in missile combat is 4:1 in favor of the single-purpose ship, because when the multipurpose ship is put out of action in a missile battle, the fleet also loses all its other capabilities.

This is a *tactical* measure of combat advantage. From an *operational* or campaign perspective we must take account of design efficiency and ship endurance. The notional multipurpose ship has the advantage of performing four different missions when the chance of it being lost is small. Another advantage is that one propulsion plant moves all four combat capabilities. This operational advantage can be shown by using a new metric of *lost mobile combat capabilities*. We should now divide both ships into mobility and combat components. Assume the space, manning, and cost of the mobility and combat components in a single-purpose ship are the same and the value is one each. We give a multipurpose ship its same four combat capabilities and assert its propulsion capability requires only two units to move its four combat capabilities. Then the advantage of the single-purpose ship is reduced from 4:1 to 3:1.<sup>7</sup>

We should make one more comparison of lost value. A much-admired peacetime advantage of a large American multi-mission warship is that it carries the logistical support to stay at sea unreplenished for several weeks. We don't want our small missile ship to carry sustainment for more than a short time because we expect it to fight in dangerous waters. Moreover, since the ship carries only a small missile load, it must return to base to rearm after a battle. Thus, the missile combatant should be supported from a base or tender that is close to the operating area. For different reasons, the LCS will also be forward based, at places like Singapore and Rota, Spain.

If the ship carries substantial self-sustainment, then it loses that non-combat capability when it is put out of action. To take the loss into account quantitatively, a third comparison might be the following, using the metric of *lost sustainable, mobile combat capabilities*. When sustainment—valued at two units of stores, fuel, food, and additional personnel—is added to the total loss of

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<sup>7</sup> The lost value of the single-purpose, mobile missile ship is two. The lost value of the mobile multi-purpose ship in combat capabilities is four but the mobility loss is only two. The ratio of losses is therefore now 6:2 or 3:1.

value, then the new metric favors the single purpose ship over the multi-purpose ship in the ratio of 4:1 again. This is a simple reminder that sustainment built into a warship is no advantage if the ship is lost in action.

## **SALVO EQUATIONS ALSO ARGUE FOR SINGLE-PURPOSE MISSILE SHIPS**

I can properly be accused of comparing apples and oranges by summing unlike quantities. Later I will add apples to apples by making dollar comparisons, but first I must answer the question, “Why are the ships exposing themselves to loss?” The answer is of course because they are fighting to defeat an enemy. To give the ships a combat purpose we must shift to a different method of quantitative comparison by using salvo equations to measure the performance of two opposing surface forces fighting in the missile era. I have no space to explain these well-vetted equations, simple though they are.<sup>8</sup> What is pertinent is that the salvo equations reinforce the conclusions above but in a different, orthogonal way. For our purposes, one broad and general conclusion tells the story.

It is a mathematical truth from the equations that if you have three times as many ships as I have, then for parity in fractional losses each of my ships must have three times the offense power, three times the defensive power, and three times the staying power of your ships. It is easy to understand operationally what the equations show mathematically. If you put one of my ships out of action, I have simultaneously lost its offensive power, its defensive power, and also its staying power value, since my crippled ship is no longer a threat to draw your fire. Thus, the number of ships in your battle force is the single most important combat property you can have.

The salvo equations explore how a more numerous and distributed force can exploit freedom of choice, for example, either to conduct a swarm attack to saturate the enemy defenses, or to approach by stealth, or to conduct a coordinated attack from several directions simultaneously. As the attackers, a flotilla of small, lethal ships get to choose the times and places to hunt and strike. The burden of achieving an ever-alert defense becomes the enemy’s problem.<sup>9</sup>

## **BRITTLENESS<sup>10</sup>**

The salvo equations also show quantitatively that an unstable situation results when the staying power of a combat *formation* is small. Staying power of the formation is the product of the number of ships in it and the number of missile hits to put one ship out of action. We are going to have fewer and fewer ships in our blue water fleet, and only a small capacity in each one to take

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<sup>8</sup> A concise introduction to the salvo equations with examples is in Wayne P. Hughes, Jr., *Fleet Tactics and Coastal Combat*, Annapolis, USNI Press, 1999, pp. 268-290. The root document is Hughes, “A Salvo Model of Warships in Missile Combat Used to Evaluate Their Staying Power,” in J. Bracken, M. Kress, R. E. Rosenthal, *Warfare Modeling*, Danvers, MA, John Wiley, 1995, pp. 121-144. A Wikipedia web site that shows the equations and lists a small number of the many references and applications is *Salvo Combat Model*

<sup>9</sup> See Hughes, Op cit., Figure 11, p. 271

<sup>10</sup> A term I first saw applied to the U. S. Navy by Commander Phil Pournelle in an unpublished but insightful presentation, “The Future of Sea Control,”

missile hits and keep fighting. The consequence is a brittle, unstable situation. A small change in the offense, the defense, or the number of ships on either side will change a result from total victory (no losses) to total defeat (all ships out of action) after only a small change in the inputs.<sup>11</sup> It is evident that for missile warfare a more numerous, more distributable force that is well trained for littoral combat will reduce our brittleness when fighting in dangerous waters.

I should justify my quantitative argument that the same weight of ordnance can put out of action the bigger multi-purpose ship as the small missile ship. An historic example is torpedoes in World War II. One torpedo hit would cripple anything up to a 12,000 ton cruiser and sometimes sink it. In the missile era of naval warfare, the *Sheffield*, *Stark*, and *Atlantic Conveyor* were ships of significant size that were rendered ineffective after one *Exocet* missile hit. We have no combat data for a warship of 10,000 tons hit by a missile, but there is a large body of data from World War II and more recent experimental data from which to infer that one missile will usually put a DDG out of action.<sup>12</sup>

What is your advantage in dollar terms if you buy many small, single-purpose missile ships and I build and deploy only large multipurpose warships? We now must talk about real warships with real characteristics. What is meant by a “single-purpose warship” becomes an issue. Let us look at some history to clarify the term.

### **WHAT IS A SINGLE-PURPOSE WARSHIP?**

The meaning of multi-mission, multi-capability, multi-task, multi-function, or multipurpose ship is clear. “Single-purpose” is not. No definition of single-purpose is entirely satisfactory. One way to see this is to observe that every warship’s employment will change, depending on whether current American policy toward another state like China is at the moment one of cooperation, competition, confrontation, or conflict. But a better way to assimilate “single-purpose” is with an extended example.

My first destroyer, USS *Cushing* (DD-797), was a 2,500 ton multi-capability ship that was assigned many tasks, yet it was built for one purpose, which was to escort bigger, more valuable ships. A member of the large *Fletcher* class of destroyers, DD-797 was commissioned in World War II when destroyer flexibility was already well established. Even though the *Fletchers* were designed to protect aircraft carriers or amphibious ships, they were exploited as singularly effective in night battles, most famously in the Solomon Islands under leadership of Rear Admirals “Pug” Ainsworth and “Tip” Merrill, and Commanders Arleigh Burke and Fred

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<sup>11</sup> This is a mathematical artifact of the equations, but I think most naval officers would agree that a numerically small force of big warships with little staying power is undesirable and probably is an unstable fighting unit.

<sup>12</sup> See Hughes, *Op. Cit.*, pp. 156-163. Instability arose when U. S. and Japanese aircraft carrier task forces fought in World War II. Staying power in the battleship era was substantial— the brittle Royal Navy battle cruisers being an exception. A respected contemporary authority, Bradley A. Fiske, illustrated the advantage of numbers in a Naval Institute prize winning 1905 *Proceedings* essay, “American Naval Policy.” He asserted it would take about ten major caliber gun *salvoes* from a battleship to eliminate the firepower of an enemy battleship.

Moosbrugger. After six months of mediocre U. S. Navy battle performance in 1942, when Burke arrived in early 1943 he pointed out that our radar gave us the potentially decisive tactical advantage; that the torpedo, not the fast-firing 5-inch gun, was the decisive weapon; and that fighting in a column formation was a foolhardy carry-over from prewar daytime tactics. When our navy adopted Burke's new tactics, our destroyers started winning clear-cut victories over IJN warships in the littoral waters of the central and upper Solomons. It is no small irony that my ship was named for USS *Cushing* (DD-376), a 1,500 ton prewar destroyer that had been sunk fighting 30,000 ton Japanese battleships in the First Night Battle of Guadalcanal before we learned how to attack with cruisers and destroyers.

During most of my service, destroyers and cruisers were categorized as “major fleet escorts” well after they had become multimission and with an independent missile attack capability. A modern DDG epitomizes the multi-purpose ship. Nevertheless, destroyers originated as single-purpose ships, starting with the first USS *Cushing*, (TB-1): a torpedo boat of 150 tons commissioned in 1890. She was designed to join in swarm attacks in coastal waters against enemy battleships. Nevertheless, in 1898 she was sent to patrol the Cuban coast during the Spanish-American War.

Today single-purpose ships like the first *Cushing* (TB-1) are exemplified by our American PHM and the contemporary Chinese Type 022 *Houbei* designs, but in which torpedoes are replaced by surface-to-surface missiles. Both classes displace 250 tons and were designed for a single deadly purpose.

All big navies saw that something had to defend battleships against torpedo boats. “Torpedo boat destroyers” were soon invented, and well before World War I they subsumed the TB's purpose. Destroyers practiced fighting each other, not for their own sakes but to attack or defend against attacks on battleships and transports. The second USS *Cushing* (DD-55) of 1,200 tons was typical of destroyers commissioned before and during World War I. In short order the destroyer role was expanded to protect warships and commercial vessels from submarine attacks. By the time I reported to DD-797 in 1952, destroyers did air defense and radar picket duty as well.

Thus, it is no simple matter to say what one means by a single-purpose ship. In the 21<sup>st</sup> Century doubtless the ship will be adapted for ancillary employments—if and when we build and deploy these small ships: shall we call them corvettes? But ancillary tasks must not distract from their utility as low-cost, high lethality missile combatants that can be put at risk in dangerous waters.

## **THE LOGIC OF THE CASE WITH REAL SHIPS**

A new DDG will cost about \$2 billion. For that price it has many valuable capabilities, more than the four in our notional multimission ship. A DDG has efficient *propulsion* and *sustainment* to move it and maintain its combat capabilities on long and distant peacetime deployments.

Our two LCS designs both cost on the order of \$600 million dollars each, if we prorate the cost of the modules that support their multimission combat capabilities. Both designs are speedy, but neither has a propulsion system designed for long endurance. An LCS is not intended to stay at sea unreplenished for very long, and so the best way to operate a squadron is from a forward base at places like Singapore, Sasebo, Darwin, Bahrein, Rota, or Naples.

A blue water frigate epitomizes the ship Secretary Hagel described to replace the LCS. His imagined frigate will cost as much as an LCS--\$400 to \$500 million. It will have about the same number of billets and must be multi-purpose. Its design can be adapted from many existing foreign frigates, some of which are being built now in U. S. shipyards. The new frigate must serve as a blue water combatant to replace numerically our lost DD-963s and FFG-7s. The number of CGs and DDGs is also likely to shrink in the near future. We can buy four or five new-design frigates for the cost of one new DDG. Frigates will help keep our blue water fleet numbers up for operations in CVBGs, ESGs, and SAGs.

*But the new frigates are not suitable for fighting in the littorals.* A smaller missile corvette must be a low cost, small-crewed, single-purpose warship designed exclusively for missile combat in dangerous waters. The environments are the China Seas, the Yellow Sea, the eastern Mediterranean, the Persian Gulf, the Arabian Sea, and perhaps very soon the Baltic, Black, Red, and Aegean Seas, and the Sea of Japan. A flotilla of, say, eight to sixteen will be forward based in the critical area, hosted by the friends or allies we are supporting. They should have simple, affordable hulls and unremarkable propulsion plants. Operational stay time will be at most a few weeks of peacetime steaming, or a few days for each sequential wartime strike mission. Affordability and a small combat crew are dominant considerations, because one missile hit is certain to render the vessel useless. After a hit the tactical aim should be to abandon the ship and save the crew.

No existing corvette is quite the correct design, because small navies have to load their limited number of surface ships with multiple missions, including search, patrol, coast guard duties, and many others. A suitable goal for an austere, single-purpose, uniquely American missile design is a 500 ton ship costing \$100 million. If the goal is unachievable within our procurement system, then that does not diminish the need for a littoral combatant that is better suited than the LCS which was, after all, our first attempt to produce such a ship in many years. Pessimistically a missile corvette may take two or more designs in tandem to achieve my minimalist goal, so for comparison I will assume our first such ship displaces 1,000 tons and costs \$200 million. If so, for \$200 million we can still have 10 for one DDG, and three instead of one LCS. With the \$10 billion budget wedge from the 20 canceled LCS, we can buy ten fleet frigates for sustained open ocean operations, and 25 first-generation missile corvettes for littoral combat in waters where more costly ships ought not to be put at risk.

Eventually the Navy may also decide to buy single purpose ASW, MCM, and Naval Gunfire Support ships. Meanwhile the 32 LCS we are building can play their intended roles for inshore ASW, MCM, and countering swarm attacks.

## **TRAINING, NEW TACTICS, AND NEW METHODS OF C2**

A more general discussion of the littoral environment would include the logistical vulnerabilities of land bases and the mobile combat logistics force. These vulnerabilities are specific to enemies and geography. The discussion would also have to include the intimate connection between an air campaign above and an undersea campaign beneath the surface. An interesting relationship between the air and surface battles is a reverse of what is true of valuable multimission ships that are severely disadvantaged vis-à-vis aircraft attacks. Small, single-purpose ships can pose a threat to enemy ships at sea that an enemy can ignore only at his peril. If his aircraft undertake a difficult search and attack effort against them, this will consume air resources that will be lost from his battle for air superiority.

The details of every littoral operation are different, but it is obvious that each requires new and flexible fleet doctrine and tactics. An important part of our naval tactics will be new methods of command and control. CVBGs and ESGs cannot function and fight without detectable electromagnetic radiations within the ideal of “network centric warfare” (NCW). But command and control of flotilla operations can exploit new ways of fighting under what might be called “network optional warfare” (NOW).<sup>13</sup> We can become adept at infrequent, hard-to-detect emissions to conduct sudden attack in the littorals. Achieving proficiency and cooperative action will take tactical development and training, most usefully if done in the waters where fighting may ensue, and in collaboration with the countries with prior experience who we are there to support with a combined “1,000-ship navy.”

In the *Naval War College Review*, Summer 1995, I wrote “The U. S. Navy does not have current tactical doctrine for fighting a fleet on the littoral, nor does it have substantial joint, campaign-level doctrine . . . This contrarian tactician’s point of view is that a new “play book” is needed for winning battles along a hostile shore.”<sup>14</sup> That nothing has changed since 1995 was demonstrated by recent discussions at NPS with Swedish Navy and Marine officers who *have* trained and are proficient in the Baltic. They described the differences in coastal environments of Swedish, Norwegian, Finnish, and Danish waters and called them the “extreme littorals.” The Swedish officers pointed out the many advantages they train to exploit. They regard their coastal waters as a defenders’ advantage. Rather than seeing fishing boats, coastal trade and other coastal clutter as liabilities, they suggest that for *defense* a nation may take a proactive approach to clear or augment the clutter to its advantage.

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<sup>13</sup> The inspiration of Network Optional Warfare is NPS Professor Don Brutzman, who is pursuing a variety of technologies to enhance semi-silent and undetectable operations. Online at <https://wiki.nps.edu/display/NOW/Network+Optional+Warfare>

<sup>14</sup> Hughes, “The Power in Doctrine,” *Naval War College Review*, Summer 1995, p. 29

My message and theirs are identical: Know your tactics, know your enemy, know the territory, and know how to fight with friends in ways quite different from our blue water fleet experience.

## **SUMMARY**

“The world today is truly different.”

First, with one hit, an anti-ship cruise missile will usually put out of action a small combatant, a pretty big warship, or a large commercial vessel.

Second, the precision tracking, targeting, and homing capabilities of modern missiles have enhanced the value of small combatants, because offensive power can be distributed more widely than in a DDG or even an aircraft carrier that must be big to launch and recover modern combat aircraft, including big UAVs.

Third, although littoral waters have almost always been where the U. S. Navy’s action has been since 1950, their significance has been promoted by the rise of China, the continuing threat from Iran, and recent ventures of other states including Russia.

Fourth, ships for fighting in the littorals are a niche capability to fill a void. They should be numerous, yet take only a small budget fraction. The expensive part of the Navy will continue to ensure safe sea lines of communications for all peaceful nations and to project and sustain large quantities of combat power onto to land at select locations.

You have read three basic forms of quantitative analysis that demonstrate the marked advantage of single-purpose missile ships for littoral combat:

--measured in lost value after being put out of action, the advantage of a single-purpose ships is roughly proportional to the number of capabilities carried in a multi-mission ship.

--the salvo equations show parametrically that the number of ships in a fighting force is its most valuable property for missile combat.

--when procurement cost is explicitly measured, the equal-cost numerical advantage of single-purpose missile ships stands out. This is significant in combat and in a time of budget austerity and diminishing fleet numbers.

Throughout the essay Navy affordability was a prominent consideration. Although not analyzed specifically here, other studies have demonstrated that many ships in a U. S. Navy component for littoral operations need cost only a small fraction of the procurement and operating costs of the whole fleet, on the order of five percent of SCN, MPN, and O&MN.<sup>15</sup>

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<sup>15</sup> See Jeffrey Kline and Wayne Hughes, *A Flotilla to Support a Strategy of Offshore Control*, Technical Report NPS-OR-13-0001R, FOUO, January 2013

Despite its small budget share, the littoral fleet will increase total fleet numbers and availability for worldwide presence. Missile corvettes are ideal for cooperative operations and joint training with friendly coastal navies around the world.

A flotilla of missile corvettes is designed for fighting a war but not for making war. The flotilla's special value is to help *keep the peace* by visibly affirming our support for our allies and deterring an enemy, by overtly confronting the prospective enemy at a critical point in littoral waters.

One conclusion seems irrefutable: when our warships are intended to fight in the littorals, an affordable flotilla of relatively inexpensive single-purpose ships is preferable to expensive multimission warships.

**5,200 words (3/21/14)**