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Small Combat Ships and the Future of the Navy

The Navy is wisely preparing to introduce a new ship design, but it should evaluate the prototypes comprehensively before moving into production.

In November 2001, the U.S. Navy announced a new family of 21st century surface warships that includes a small, focused-mission combatant called the Littoral Combat Ship, or LCS. The LCS would be a fast, stealthy warship designed specifically for operations in shallow coastal waters. It would have a modular mission payload, allowing it to take on three naval threats—diesel submarines, mines, and small "swarming" boats—but only one at a time.

Inclusion of the LCS in the Navy's future plans caught many by surprise. Just one year earlier, the Navy's 30-year shipbuilding plan pointedly excluded any mention of small, modular, focused-mission combatants. And throughout the 2001 defense program review, an effort conducted at the start of every new administration, the Navy had panned the idea of small warships. It had instead supported a future fleet comprising multimission warships, the smallest of which had a displacement of 9,000 tons. Small warships are those having a displacement of less than 3,000 tons; the LCS would displace about 2,700 to 2,900 tons.

The Navy's leadership spent little time preparing either its own officer corps or Congress for this abrupt reversal of its long-stated preference for large warships, and then it botched the explanation of its rationale. As a result, the analytical basis for the ship was immediately attacked by naval officers, defense analysts, and members of Congress. The Navy spent more than two years trying to explain its decision and make a solid case for the ship.

Supporters of the ship took heart when in May 2004 the Navy awarded two contracts for the next phase of the LCS. One, valued at $423 million, went to a team led by Lockheed Martin. This award was for a seven-month systems-design effort, with an option to construct two prototype vessels. The second award, for $536 million, was for a 16-month systems-design effort by a General Dynamics-led team. It, too, had an option to build two prototypes, but of a different design. These competing designs will vie for a production run that could number as many as 56 ships.

On the surface, it appeared as though the Navy had finally prevailed over the LCS's many skeptics.

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But the debate is not finished. Support for the LCS remains uncertain, especially in the House, which tried to pull money from the current defense program to delay construction. In essence, House members agreed in conference only to a "sail-off" between two designs; it is not yet clear that they have endorsed either the LCS concept or a subsequent production run. Meanwhile, within the Navy itself, the ship continues to be attacked by submariners and aviators, who see it taking resources away from their programs. Even within the surface warfare community, officers whisper that the ship will survive only so long as the current chief of naval operations, Admiral Vern Clark, remains in charge. Thus, although supporters of the program are currently riding high, its detractors may yet succeed in sinking the program before it has a chance to prove itself.

That would be as big a mistake as pursuing the program blindly. There are sound reasons why the LCS should be pursued. On the other hand, much about the ship's concept of operations remains to be proven or explored. The present plan, modified to allow for thorough operational testing of the LCS concept and design, is the proper one.

Is the carrier era ending?

The Navy consists of aircraft carriers, surface warships, submarines, amphibious ships, mine warfare ships, and support ships, plus the men and women who use them as an instrument of national power. Its combat power has traditionally been measured by counting the number of ships in its total ship battle force.

Any major change to the character of the battle force is an issue of almost religious importance to the Navy and its many supporters. Whether to include the LCS in its future plans was thus a question that would have sparked spirited debate regardless of the circumstances. However, the timing and character of the LCS debate ensured that it would be even more contentious than most.

For more than 60 years, the Navy's battle force has been built around the aircraft carrier. In 1940–41, air attacks against Pearl Harbor and Italian and British battleships made it clear that the airplane had supplanted the gun as the arbiter of fleet-on-fleet battle. The aircraft carrier quickly supplanted the battleship as the most important ship in the U.S. fleet, and it was the aircraft carrier that led the U.S. Navy's hard-fought charge across the Pacific against the Imperial Japanese Navy. Indeed, the shift to the carrier era and the ascendance of the U.S. Navy as the world's number one naval power were inextricably linked. That helps explain the enduring and powerful hold the aircraft carrier has had on U.S. naval thought and battle force design since World War II.

During the carrier era, the surface combatant fleet was redesigned primarily to protect the aircraft carrier from attack. Large battleships and heavy cruisers, with their powerful gun batteries, gradually disappeared. In their place, guided missile cruisers and destroyers, armed primarily with surface-to-air missiles, guarded carriers from air and missile attack, and general-purpose destroyers, armed primarily with helicopters, antisubmarine rockets, and torpedoes, shielded them from submarines. Smaller, less capable frigates and guided-missile frigates were assigned the less demanding task of escorting convoys, logistics ships, and amphibious ships. However, even these ships had to contend with air and missile attack and fast submarines. Thus, over time, all carrier-era surface combatants evolved into intermediate-size multimission warships, carrying a mix of anti-air, anti-submarine, and anti-surface ship capabilities. Guided missile cruisers and destroyers and general purpose destroyers all boasted displacements between 8,000 and 10,000 tons; guided missile frigates came in at 4,000 tons.

With the collapse of the Soviet Union, the Navy found itself without a global challenger for the first time in a century. The fundamental business of the Navy shifted from sinking an opposing navy to supporting joint power projection operations from shallow coastal waters. This triggered a decade-long bout of institutional soul-searching as naval planners struggled to answer several key questions: Was the carrier era ending? How much should the future battle force be reconfigured? What new types of surface combatants should be built? Not surprisingly, the initial answers were: no; not much; and the bigger, the better.

From the Navy's perspective, the carrier era appeared to be enduring. Although the Cold War Navy fretted about maintaining global sea control in the face of a Soviet threat, the aircraft carrier routinely operated along seacoasts, supporting combat operations ashore. Navy planners believed that the only substantive change in the future would be that the

open-ocean threat of the past would be replaced by numerous navies protecting approaches to their coasts. In these circumstances, carrier battle forces would first work to establish shoreline sea control and then support forces operating ashore with air, missile, and gun fire—just as they had done in every war since Korea.

Threats from small coastal navies were deemed manageable, well within the capabilities of existing ships. Indeed, the requirement to provide sustained fire support for forces ashore argued for the high payload volume offered in roomy, multimission guided missile cruisers and destroyers. These intermediate-size ships would remain the preferred carrier escort, although long-range land attack missiles would increasingly fill their magazines. And with no open-ocean submarine or aircraft threat to convoys, frigates could disappear entirely, to be replaced by new classes of large combatants designed to support forces ashore with new precision land-attack weapons.

There are many roles for which small, handy warships have proven better-suited and cheaper than larger, multimission ships.

The Office of the Secretary of Defense (OSD) accepted the Navy's judgment. In 1997, it approved a future surface combatant fleet of 116 warships. In 1998, it approved the Navy's new "DD-21" (for 21st century destroyer) program for 32 large, more than 15,000-ton, multimission ships that were the size of World War II heavy cruisers. The practical result of these two decisions was that the Navy's future battle force would consist of 116 intermediate and large combatants. The 4,000-ton guided missile frigate, the smallest combatant in the Navy, would gradually disappear from fleet service.

Status quo challenged

In 1998, however, a vocal group of naval officers, led by then-Vice Admiral Arthur Cebrowski, president of the Naval War College and commander of the new Naval Warfare Development Command, challenged the notion that the Navy's future was a simple extension of its past. This group made two arguments. The first was that the corporate Navy was drastically underestimating the threat to future fleets operating in near-shore waters. Future enemies would likely move their own battle lines ashore, purchasing over-the-horizon targeting sensors, long-range anti-ship cruise missiles, and maritime strike aircraft. They would also likely develop special-purpose coastal screening forces consisting of quiet diesel submarines, advanced moored and bottom mines, and small, high-speed attack craft that would either be armed with missiles or employed in massed suicide attacks. Together, shore-based battle lines and coastal screening forces would form increasingly capable networks that would threaten all surface ships and force them to operate at some distance from the shore. Under these circumstances, the future Navy would have to fight hard for access to coastal waters.

The second argument derived from the first. This emerging "access competition" called for dramatically new naval operational architectures and ship designs. Although they did not couch the arguments in such terms, the reformers essentially declared that the Navy was entering a new battle-force era, and that old ways of doing business thus had to change, just as they had changed in the past.

The reform school believed that future architectures and designs needed to account for the new competitive dynamics of the information age. Accordingly, they argued that the key organizing construct for future naval forces should shift from naval task groups optimized for independent operations to fleet battle networks consisting of interlocking sensor, command-and-control, and engagement grids. These battle networks would first fight for information superiority and then, exploiting this advantage, pry apart enemy anti-access networks. Once access to close-in waters was assured, they would bolster joint forces ashore with precision fire, sea-based maneuvers, and logistical support.

Since the power of any network is best measured by the number of its nodes and the connections between them, the reform school argued that the fleet's sensing and offensive and defensive fighting power should be distributed across as many nodes as possible.

The carriers would remain among the most powerful nodes in the battle force. However, they would increasingly operate alongside more numerous manned and unmanned platforms and systems of varying size and power that would create a multinodal naval battle network. In other words, the power of the 21st century fleet would be measured less by the number of carrier battle groups and surface combatants in the total ship battle force, and more by the combined sensing and combat power of the total force battle network.

Therefore, the reformers argued, building a combatant fleet of 116 large, multimission surface combatants unnecessarily limited the ultimate combat potential of the total force battle network. Indeed, putting too many eggs in such a small number of baskets made the network tactically unstable—overly sensitive to combat losses and prone to catastrophic failure. Fleet operations closer to shore had historically proven dangerous and costly in terms of ship losses, so future risk to the fleet could be mitigated only by spreading its sensors, systems, and weapons among an ever-larger number of nodes.

Given relatively flat budgets, the only way to increase the size of the surface combatant fleet and battle network flexibility was to build smaller, cheaper combatants that could be reconfigured for any task at hand. These multipurpose, focused-mission combatants, designed with open combat system architectures and modular payloads, were dubbed Streetfighters. They would rely on high speed and reduced signature to survive. Because of the large number of these relatively inexpensive warships, individual ship losses would have less network-wide impact, thus making the network more resilient.

Although the reformers were making a broader argument that the competitive dynamics of the carrier era were no longer valid, it was their advocacy of the Streetfighter that sparked the greatest response from the corporate Navy. The result was an intense and sometimes vitriolic counterattack by proponents of larger multimission combatants. Some critics interpreted the Streetfighter concept as one that was based on expendable ships. Others doubted the tactical value of small combatants in a Navy intent on projecting its power globally. Still others doubted that technology could deliver the small ships that the reformers envisioned. The skeptics were many.

The debates over the Streetfighter raged for three years. Throughout the debates the institutional Navy hung tough in its view that the operational architecture and design precepts of the carrier era remained valid. Navy officials blasted the idea of small Streetfighter combatants and vigorously defended the large, multimission DD-21. The Navy gave every indication that it believed small combatants had no place in its future battle force.

Transforming the Navy

Thus it was a surprise when, in November 2001, the chief of naval operations announced that the DD-21 program was being renamed and restructured as a new family of surface combatants, including a large multimission DD(X) destroyer, a large multimission CG(X) guided missile cruiser, and a new small ship designed for focused missions, the LCS.

Although Navy officials took pains to distinguish the LCS from the Streetfighter, its kinship to that earlier concept was evident. Indeed, many observers believed the Navy's senior leadership included the ship in their plans only because they were ordered to do so by OSD and its new Office of Force Transformation, led by none other than retired Vice Admiral Arthur Cebrowski, the outspoken proponent of Streetfighter. Had the LCS been approved without any other changes in the Navy, such a view might hold more weight. However, given some of the other changes that have occurred since the LCS was unveiled, it appears that the Navy's decision to reconsider the role of small combatants was the result of a well-reasoned acceptance of the broader argument made by the reformers. Consider some of the changes that accompanied the decision to expand the 21st century surface-combatant family of ships:

The Navy has embraced a future that is about guaranteeing delivery of goods and services in support of joint campaigns ashore, with the key operational requirement of assuring joint force access into and from coastal waters. In this regard, the Navy has teamed with the Marine Corps—the second service within the Navy—to explore new ways in which the fleet can support Marine maneuver operations from sea bases established in close-in waters.

The Navy's senior leaders have now unquestionably endorsed a new 21st century battle force that will assemble and operate distributed fleet battle networks. These networks will consist of carriers, surface

combatants, submarines, amphibious ships, support craft, and unmanned systems, all connected through dense webs of machine-to-machine and man-to-machine links. These battle networks will be characterized by high degrees of collaborative planning and shared awareness. This, in turn, will allow future naval forces to sense and respond to their environment much faster than any non-networked opponent, giving them a decided combat advantage.

In essence, the Littoral Combat Ship aims to be the Swiss army knife of future naval battle networks.

The Navy is pursuing a new, more distributed fleet architecture to fit its new vision of scalable battle networks. In the final stages of the Cold War, the fleet operated 12 independent strike groups. In the 1990s—as precision weapons increased individual carrier and surface combatant strike power—the fleet could muster 19 strike groups. Now, by leveraging information, precision, and networking, the Navy plans to operate a total of 37 smaller strike groups, nearly doubling the maximum number of strike forces in the carrier era. These smaller task groupings will form the building blocks for flexibly assembled battle networks that can be scaled for the mission at hand.

These changes, among others, indicate the broader transformation occurring within the Navy. In essence, after carefully considering the arguments made during the vibrant institutional debate between 1998 and 2001, naval leaders accepted the position of the Cebrowski-led reformers that the carrier era was giving way to a new distributed, networked battle force era that demanded new thinking, organizations, and ships. This helps to explain, in part, the Navy's abrupt reversal on including small combatants in the future fleet. Small combatants are arguably not compatible with an enduring carrier era, but they are perfectly compatible with the idea of an emerging distributed naval battle network.

Assuring access to coastal waters

The new three-ship DD(X) program essentially rejects the homogenous force of intermediate-size multimission surface combatants that characterized the carrier era and instead seeks to build a heterogeneous group of small, intermediate, and large battle network combatants designed to provide assured access to coastal waters. Whenever a fleet battle network or sea base closes in on an enemy coastline that is being defended, its intermediate and large combatants will focus on the enemy battle line located to the landward side of the littoral. They will rely on smaller combatants to protect them from mines and enemy attacks. As in the past, when performing these roles, small network combatants will themselves rely on the larger combatants for protection. In vigorously contested coastal waters, naval planners also count on small combatants employing unmanned systems from standoff ranges in support of battle operations.

However, the Navy will often operate in situations where an adversary either has no navy or only a small coast guard. Under these conditions, small combatants can operate independently and conduct a wide range of missions, ranging from sanctions enforcement, to drug, piracy, and terrorism patrols, to support of humanitarian assistance and disaster relief operations, among others. These are roles for which small, handy warships have proven better-suited and cheaper than larger, multimission warships.

Moreover, because small combatants are less expensive, the Navy can buy more of them. As a result, even if defense budgets remain flat, the Navy can either expand its global battle network coverage or free up its fewer, more expensive and more capable combatants for more pressing duties without appreciably increasing risk. Of course, for this to work, the small combatants must be capable of sensing over-matching threats and carry a capable self-defense suite.

Envisioning the LCS as a component of a larger fleet battle network helps to explain the ship's design goals as well as the missions it will initially perform. In essence, the new ship aims to be the Swiss army knife of future naval battle networks. Its design is being shaped by six principles:

Get fast. Both LCS designs boast top speeds of 45 to 46 knots and sustained speeds sufficient to keep

pace with fleet battle networks surging forward from U.S. home waters. They will be the first small combatant capable of operating with high-speed naval task forces since the famous World War II Fletcher-class destroyer. The LCS will reintroduce many small combatant roles that disappeared from fleet service during the carrier era, such as high-speed mine sweepers and sea-base support ships capable of keeping up with fast amphibious forces.

Get connected. The LCS will consist of a basic sea frame (hull, machinery, and living spaces) with an austere, high-bandwidth command-and-control system that connects the ship's combat suite to the wider battle network sensor net. What the LCS sea frame will lack in onboard sensors will more than be made up for by its robust connectivity to the future battle network; it will be able to "see" whatever the battle network sensor net sees.

Get modular. The LCS mission payload volume will be divided among a minimum of 20 different mission-module stations. These stations will have standard open-architecture connections designed to accommodate assorted onboard weapons and sensors, manned or unmanned off-board systems, or supply containers. By mixing the types of mission modules, an LCS can be reconfigured to carry entirely different mission packages. For example, the two initial LCS prototype designs will carry three different mission packages: one for shallow water anti-submarine warfare, one for mine warfare, and one for antiboat warfare. In other words, the LCS's initial mission focus is on the three most prevalent coastal naval threats to intermediate and large surface combatants, aircraft carriers, and the sea base. Taking on the enemy battle line ashore will remain the job of the big boys.

Get off-board. To accomplish its three missions, the LCS will serve as a mother ship for off-board systems and sensors. Two of its mission modules are sized to carry off-board surface craft or undersea vehicles up to 11 meters in length; another two are sized to carry systems up to seven meters long. Two aviation stations are designed to carry either a medium helicopter or three vertically launched unmanned aerial vehicles. Still another carries sensor arrays that can be dropped off-board. Relying on off-board systems expands the sensing and engagement envelope around the LCS itself as well as the battle network in general. Moreover, although the LCS will be armed with only an austere self-defense suite, its off-board systems will allow the ship to contribute to battle network operations even in high-threat environments, because the ship itself will be able to operate from safe, standoff ranges.

Get unmanned. People are the most expensive component of a ship's life cycle. To minimize these costs, the LCS will be highly automated and carry a permanent core crew of fewer than 40 officers and sailors to operate and maintain the basic sea frame. The core crew will be augmented by a mission crew that comes aboard with a mission-tailored package. However, no mission-configured LCS will have a crew of more than 75. In comparison, the crew of an intermediate carrier-era combatant could be more than 350. Moreover, the LCS ships are designed to operate a wide array of unmanned aerial, surface, and underwater vehicles, all designed for autonomous or semi-autonomous operation.

Get reconfigured. By designing the ship around modular mission stations, separating the ship's mission capability from its hull form, and dividing the ship's crew into core and mission crews, the Navy is designing the LCS so that an entire mission reconfiguration process—including operational testing of its combat systems and crew readiness for missions—will take no more than four days. The Navy hopes such a rapid reconfiguration process will allow a single hull to be used for a variety of different missions during the course of a single joint campaign. Initial LCS designs require pier-side reconfigurations. Future LCSs might be reconfigured at sea.

The LCS's unique design criteria means that it is more a completely new type of battle network component system than it is a traditional warship. The LCS's high degree of modularity would be without naval precedent. It would give the Navy's 21st century total force battle network a unique ability to adapt itself to any access challenge and to reconfigure itself to meet local threats and conditions.

Next steps

Critics of the LCS program advocate slowing or canceling the program entirely until alternatives can be explored. Others believe that the process of learning more about small combatants and their potential contributions is more important than selecting a single

design; they advocate a series of operational prototypes.

Meanwhile, proponents of the LCS generally accept the concept of a reconfigurable combatant and the basic design characteristics developed by the Navy. In their view, the recent award of two competing designs is merely the prelude to a production run of 40 to 60 ships; the sooner the choice is made between the Lockheed Martin and General Dynamics designs, the better. This is the current position of the Navy. After building the four prototypes from Fiscal Year (FY) 2005 through FY 2007, it plans to ramp up LCS production, building 18 of the ships between FY 2008 and FY 2011.

Despite its intuitive attractiveness, there remain some real questions about the LCS concept itself and certain of its design characteristics.

Neither of these positions can withstand scrutiny. Despite lack of a formal analysis of alternatives before the program was announced, the ship's conceptual underpinning is developed well enough to explore it with operational prototypes. Moreover, despite the potential attractiveness of building a long series of prototypes, the practical pressures of recapitalizing the Navy's battle force demand movement toward some type of series production.

On the other hand, there remain some real questions about the LCS concept itself and certain of its design characteristics. These questions argue for a more thorough exploration of the concept before committing to a large ship production run. Two examples help to illustrate.

First, despite the intuitive attractiveness of being able to reconfigure a ship for a new mission in less than four days, will a battle network really be able to take advantage of this while engaged in combat? Will campaigns unfold in such precise phases as to allow an LCS to be pulled off the line and reconfigured for a single new mission? Is the requirement that LCS be able to be reconfigured in one to four days imposing other undesirable design or tactical tradeoffs? Would a relaxed requirement save costs while still providing important battle network benefits? Should the ship be bigger so that it can carry two or three mission packages simultaneously, creating a reconfigurable multimission ship?

Second, there is abundant historical evidence to suggest that high speed in surface combatants is rarely worth the tradeoffs in ship payload and endurance necessary to get it. Despite this, the LCS design requirement calls for a ship capable of speeds of 40 to 50 knots, and both designs have sprint speeds in the range of 45 to 46 knots. However, at this speed, they carry a payload of only 210 to 215 metric tons and have extremely limited operational ranges: the General Dynamics design runs out of fuel after 1,942 miles, the Lockheed Martin design after only 1,150 miles. The ships' cruising ranges appear adequate, ranging from 3,550 to 4,300 miles at speeds of 18 to 20 knots. But frequent sprints will mean the ships will require numerous refuelings in most operational settings. Is this wise? Shouldn't the design tradeoffs among speed, range, and payload be determined by its ultimate operational use? If the ship operates most of the time in unimpeded and guarded access scenarios, might payload and endurance be more important? What is the value of high speed when operating off-board systems?

Because of such lingering questions, the best next step would be to conduct a series of operational squadron tests using the already contracted prototypes. These tests would aim to determine the best way to employ the LCS and to exploit its modular, multipurpose design. Based on test results, next-generation ships could then be either modified versions of the prototypes, a different design altogether, or even a family of small combatants.

This would mean delaying the planned production run for a year before finally deciding whether either, both, or neither of the current designs meet the needs of the fleet. However, such a measured approach would improve the likelihood that the Navy's new 21st century small network combatant would be the best one for future naval battle network operations. The Navy should build the four prototypes, and Congress should insist on a well-constructed and executed fleet operational test before committing to a large production run.