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BACKGROUNDER

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KNOW WHEN TO HOLD 'EM, KNOW WHEN TO FOLD 'EM: THINKING ABOUT NAVY PLANS FOR THE FUTURE SURFACE BATTLE LINE[1]

By Robert Work

When hearing the term "ships-of-the-line"—warships that take their place in a navy's line of battle—most think of old two- or three-deck sailing ships carrying large cannon batteries, or perhaps steam-powered, armored battleships. Since entering the age of jet aircraft, guided missiles, and nuclear-powered submarines, however, the US Navy's surface battle line consists of *battle force capable* (BFC) surface combatants—large, multi-mission and focused-mission warships designed first to operate as part of a fast Carrier Strike Group. These include guided-missile cruisers (CGs), guided-missile destroyers (DDGs), and general-purpose destroyers (DDs). Battle force capable combatants are separate and distinct from *protection of shipping* combatants (now known as frigates and guided missile frigates) and littoral combat ships, both of which are smaller, and less capable, focused-mission warships.

Today, the Navy's surface battle line consists of a mix of 22 *Ticonderoga*-class CGs and 50 *Arleigh Burke*-class guided-missile destroyers. If not the finest warships of their types in the world, they are among the very best. All 72 vessels are equipped with the superb SPY-1 phased array radar and Aegis anti-air warfare combat system, which together are often described as being "the most advanced anti-air system in existence, land-based or naval." Their main batteries consist of the Mk-41 Vertical Launch System (VLS), a flexible, modular guided missile system consisting of groups of *missile cells* nestled in the hull, each capable of storing and launching one of the following types of *battle force missiles*: a land-attack cruise missile; a ballistic missile interceptor; a surface-to-air missile; an anti-submarine rocket; or, with proper modifications, any other type of guided missile that can physically fit inside the 25-inch by 25-inch cell. Alternatively, a single cell can be configured to carry four smaller short-range surface-to-air missiles in a so-called "quad-pack" arrangement. The Mk-41's modular weapons flexibility allows the Navy to tailor the battle line's missile load to account for the most likely threats, and allows it to meet emerging threats with newly-designed missiles rather than brand new ships.

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[1] This Backgrounder is the Executive Summary from the upcoming CSBA report: Robert. O. Work, *Know When to Hold 'Em, Know When to Fold 'Em: Thinking about Navy Plans for the Future Surface Battle Line* (Washington, DC: Center for Strategic and Budgetary Assessments, forthcoming).

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An additional 12 *Burke* DDGs are either authorized or under construction. When the last of these ships is commissioned in 2011, the Navy's surface battle line will consist of 84 state-of-the-art Aegis/VLS ships-of-the-line, with 84 common air defense radars and a distributed main battery consisting of no less than 8,468 VLS cells—an aggregate missile capacity greater than that found on all of the major warships in the world's next 17 largest navies. The battle line's secondary battery will be equally impressive: 106 5-inch naval guns; up to 672 *Harpoon* anti-ship cruise missiles or its land attack variant; 168 *Phalanx* close-in weapons systems for terminal missile and anti-surface defense; and 504 ready-to-fire short-range anti-submarine homing torpedoes (with more in onboard magazines). The force will also be able to hanger up to 112 MH-60R *Strike Hawk* helicopters. No other line of battle in the world will be come close to matching the firepower and multi-mission capabilities associated with this impressive assemblage of ships.

The Navy is now in the early stages of a general transition to a next-generation battle line. The first step in the transition began in Fiscal Year 2007 with the authorization of the first two of seven planned *Zumwalt*-class DDG-1000s, very large multi-mission BFC combatants with an advanced stealth design, a new anti-air warfare combat system, a new integrated electric power and propulsion system, and a host of other technological advances. These seven ships are to be quickly followed by 19 CG(X)s, multi-mission guided-missile cruisers (supposedly with the same hull as the DDG-1000) optimized for fleet air and missile defense. These 26 ships will be followed, in turn, by an entirely new DDG(X), which will replace the 62 *Burke*-class DDGs soon to be in service. Depending on the final building rate of the DDG(X)s (two or three per year), the last of the DDG(X)s will be commissioned sometime between 2046 and 2056. Assuming a 35-year service life, the last Aegis/VLS combatant, DDG-111, will leave the fleet in 2046.

This approach represents the third major transformation plan for the Navy's future surface battle line developed in the last ten years:

- During the 1997 Quadrennial Defense Review (QDR), the Navy planned to do away with small combatants entirely, opting instead for 116 large BFC combatants, divided into a "high-end" group composed of 84 legacy multi-mission guided-missile cruisers and destroyers (27 *Ticonderoga* CGs and 57 *Burke* DDGs) and a "low-end" group composed of 32 new *focused-mission* DD-21 land-attack destroyers. This represented a 72/28 "high-low" capability split among US Navy surface combatants.

- With the DD-21's costs steadily climbing, after the 2001 QDR the Navy reclassified the ship as a *multi-mission* destroyer (DD(X)). The planned new 375-ship Global Concept of Operations Navy included a battle line consisting of 88 Aegis/VLS ships and 24 DD(X)s. These 112 multi-mission ships would be augmented by 56 small, focused-mission Littoral Combat Ships (LCSs). The combined 168-ship surface combatant fleet had a 67/33 "high-low" surface combatant capability split.

- With the DD(X)'s costs still escalating, the Navy reclassified the ship yet again, this time as a *multi-mission* guided-missile destroyer (DDG-

1000). However, the high cost of the ship required the Navy to dramatically reduce its planned production run. The recently announced 313-ship Navy includes a surface combatant fleet of 143 ships, split between a multi-mission battle line of seven DDG-1000s, 19 CG(X)s, and 62 DDGs or follow-on DDG(X)s, augmented by 55 of the new small, multi-purpose, focused-mission LCSs. This new plan now shoots for a 61/39 "high-low" capability split.

If nothing else, the tortured lineage of the DD-21/DD(X)/DDG-1000 clearly demonstrates the declining usefulness of classic ship designators such as "destroyer," "guided-missile destroyer," and "guided-missile cruiser." Such terms are now essentially decoupled from ship size and displacement. They are used instead to separate ships in terms of the overall capabilities of their combat systems. By using both size and capabilities to classify ships, however, one sheds light on the Navy's most recent transformation plan. With apologies to the Navy's current ship titles, under current plans the future surface battle line will have three distinct tiers. The top tier will consist of 26 large and expensive multi-mission "CG-21s" (21st century "cruisers") based on the "DDG-1000" hull: seven will carry two 155mm (6-inch) advance gun systems (ships now known as the DDG-1000) and 19 will replace one or both gun systems with additional missile cells filled with new long-range SAMs and anti-tactical ballistic missile interceptors (ships now known as CG(X)). The middle tier will be defined by 62 multi-mission *Arleigh Burke* DDGs or futuristic DDG(X)s. Finally, the bottom tier will consist of 55 focused-mission LCSs.

The evolution of the DD-21/DD(X)/DDG-1000 also helps to illuminate how the Navy's early failure to balance the ship's requirements with cost considerations has found it making repeated adjustments to its future surface combatant plans. Even now, after the DDG-1000's displacement has been reduced by around 4,000 tons, as a result of design and requirement assumptions made over a decade ago, the ship remains very expensive. Just how expensive is a subject of healthy debate. The Navy projects that the first DDG-1000 will come in at $3.3 billion (in FY 2007 dollars). In contrast, the Cost Analysis Improvement Group within the Office of the Secretary of Defense pegs the cost of the first ship at $4.1 billion, while the Congressional Budget Office estimates a first-ship price of $4.7 billion. Moreover, estimates for follow-on ships keep climbing. The original Department of the Navy (DoN) cost projections for the fifth new DD-21 (based on a much higher production run) were between $1.06 and $1.23 billion in FY 2007 dollars. In 2004, the DoN estimates for the fifth DD(X) jumped to $1.4 billion; in 2005, they jumped again to $2.1 billion. Based on a seven ship production run—down from the 32 ships called for in the 1997 QDR fleet and the 24 ships called for in the 375-ship Global ConOps Navy—the Navy believes the average cost per ship will be $2.7 billion; the CBO projects the average cost of seven ships to be $3.7 billion. No matter who turns out to be right in the long run, the ship's steady cost growth helps to explain the sharp turns in the long and winding road that defines the Navy's post-Cold War plans for its future surface combatant fleet.

Indeed, whether the Navy's optimistic ship cost estimates prove to be true or not, it seems certain that the 26 new CG-21s will continue to have inevitable, disproportionate impacts on plans for the future surface battle line

and the larger 313-ship battle fleet. One impact among many discussed in the upcoming report is readily seen in the planned split between the fleet's "high-end" multi-mission combatants and "low-end" focused-mission ships. The planned percentage split for current 143-ship surface combatant fleet is now 61/39, a rather significant reduction from the 70/30 mix long pursued by naval planners. In other words, because of the unexpectedly high costs for future multi-mission warship, lower-cost, focused-mission ships will necessarily comprise a greater proportion of the future fleet.

Given the unwelcome impact that the CG-21s have had and will continue to have on the Navy's post-Cold War transformation plans, even the staunchest proponents of the ship have to question whether pursuing the ship continues to make sense. The arguments to go forward still have a definite appeal: the ship will mark a major advance in US surface combatant capability, especially in terms of stealth; the Navy needs to step toward improved automation to reduce the size of ship crews in order to reduce future operations and maintenance costs; the move to an integrated power system will result in quieter, more survivable ships and open the way toward exotic new weapon systems such as electromagnetic rail guns; and building the ships will help to recover the Navy's considerable sunk research and development costs, and help maintain the US national shipbuilding industrial base. Indeed, in a bow to the Navy's "Requirements School"—officers who believe ships should be built to requirements regardless of their cost impact—it is impossible to resist their claim that the DDG-1000s (and, presumably, the follow-on CG(X)s) will be among the most survivable and powerful surface combatants ever built.

However, these arguments and claims are not as relevant as they might appear to be. The Navy is in the midst of a grand transformation from a fighting organization that focuses first and foremost on the number of ships in its *Total Ship Battle Force* (TSBF) to one that focuses on the aggregate capabilities found in its *Total Force Battle Network* (TFBN). In this new construct, the individual power of any single ship is subordinate to the combined power of the TFBN. When shifting to a new "FORCEnet," one thus has to ask a simple question: do the disproportionate costs and impacts associated with the Navy's plans for its future surface battle line unduly threaten the Navy's broader goal of building an affordable, balanced, and effective TFBN? Analysis suggests the answer to this question may likely be "yes." The question that immediately follows is: What should the Navy do about it?

In contemplating this important question, a gaming analogy might help. With apologies to naval purists, the US Navy finds itself in the very early stages of a high-stakes post-Cold War naval transformation game, patterned after Texas Hold 'Em. The objective of this game is to emerge with the largest stack of naval capability "chips," representing fiscal resources, platforms, and battle fleet capabilities. In other words, the Navy seeks a future battle force more capable than any other naval competitor at the table. Its current stack of "chips" is quite high, including among them 22 *Ticonderoga*-class CGs, 62 programmed *Arleigh Burke* DDGs, 30 frigates, and 26 mine warfare ships. The Navy recently decided to replace 56 legacy frigates and mine warfare ships

with 55 new LCSs in return—a trade that will hopefully add to the size of the fleet's capabilities "stack." Now, the Navy has just been dealt two DDG-1000s in the FY 2007 budget and it is considering going "all in," risking all of its remaining "chips" with the hope that the DDG-1000 (and the follow-on CG(X)) will add significantly to the Navy's overall capabilities "chip stack."

Is this a smart move? Is now really a good time for the Navy to push "all in" on a highly capable, but perhaps ruinously expensive, surface combatant? As any poker player will tell you, in games of chance, every decision—even those made with an apparently dominating hand—entails some risk. Given the high stakes involved, should the Navy risk both its plans for the future surface battle line and the larger battle fleet so early in the post-Cold War transformation game on the apparent strength of one ship, or "hand"?

This report concludes the answer to this question is "no." Based on the major changes to the strategic, operational, and tactical assumptions that drove the design of the DD-21/DD(X)/DDG-1000, and upon review of all the arguments for and against the new ship, it is easy to conclude that Navy's next best move is to walk away from its previous "bets" on the DDG-1000 and CG(X). "Folding" on the new ships will in no way threaten the Navy's current position as the number one player at the naval transformation table. In fact, by doing so, the Navy will have a rare opportunity to change its current game strategy and actually improve its long-term prospects for retaining the naval capabilities "chip lead."

In line with this thinking, then, the Navy should do five things:

- *First, "fold" the CG-21 hand: cancel all planned new CG-21s beyond the two DDG-1000s already authorized.* A variation of this plan would be to build just one ship. By building two (or one) operational test beds/technology demonstrators, the Navy can recoup most of the previous "bets" made on the CG-21s. Having one or two test ships would allow further testing and refinement of the SPY-3 multi-function radar, which is to be installed on future aircraft carriers regardless of what happens with the DDG-1000, and perhaps on other ships. Over time, the ships could be modified to test other future surface combatant combat systems such as underwater combat systems or electronic warfare systems. Regardless of configuration, the ships would provide the battle fleet with a test article for new integrated power system components as well as electrically-powered weapons. In this role, the less capable advanced induction motor to be installed on the first two DDG-1000s ships will be as effective as the permanent magnet motor—the Navy's desired electric motor. The ships' larger VLS cells would allow the Navy to test larger diameter guided missiles. In fleet exercises, the ships would help to identify the true operational payoffs of ship stealth within the context of distributed naval battle networks. Finally, these large ships with small crews would help the Navy to refine the maintenance concepts for future optimally manned fleet combatants (i.e., warships with reduced crews).

- *Second, "hold" the Aegis/VLS fleet: design a comprehensive, Aegis/VLS Battle Network Reliability and Maintenance (BNRAM) program, with the goal of producing the maximum number of interchangeable, Interim Large Battle Network Combatants. (I-LBNCs).* The Navy's ultimate goal is to shift to a new *Large Battle Network Combatant,* or LBNC—a far better description of future Total Force Battle Network ships-of-the-line than the multi-mission guided-missile "cruisers" and "destroyers" or general-purpose "destroyers" associated with today's legacy Total Ship Battle Force. Until they can be designed, betting an additional $10-15 billion on five or six additional DDG-1000s would appear to provide far less of a TFBN payoff than making a similar sized or even smaller bet on a well-thought-out and executed BNRAM program to convert the 84 programmed Aegis/VLS warships into more powerful I-LBNCs. This conversion program would be patterned after earlier modernization and conversion efforts, like the Fleet Reliability and Maintenance (FRAM) program, which converted many of the large legacy fleet of World War II destroyers into effective Cold War ASW escorts. The BNRAM would include a thorough mid-life upgrade to the ships' hull, machinery and electrical (HM&E) systems; a combat systems upgrade to allow the ships to counter emerging threats; and a battle network upgrade to allow the ships to operate as part of a coherent naval battle network. Consistent with battle network precepts, the intent of the BNRAM would be to bring as many ships as possible to a common I-LBNC combat system baseline. The BNRAM would also aim to lower substantially the operations and maintenance costs (O&M) costs necessary to operate the legacy Aegis/VLS fleet, in order to save money in the near term, and to offset to some degree the added costs necessary to keep older ships in service over the longer term. A key part of this effort centers on reducing the crew size needed to operate, maintain, and fight the ships. Importantly, because this effort can justifiably be seen as converting legacy Aegis/VLS ships into more capable I-LBNCs, the BNRAM should be funded out of more stable Ship Construction Navy (SCN) funds rather than the more volatile O&M accounts.

- *Third, immediately kick-start a clean-sheet competition to develop and design a family of next-generation Large Battle Network Combatants, with close oversight by the newly reconstituted Ship Characteristics Improvement Board (SCIB).* For nearly a century, the Navy's SCIB—a group of high-ranking DoN officials—worked to balance desired warship warfighting requirements against their impact on a ship's final design and production costs. The primary reason why the Navy lost cost control over the DD-21/DD(X)/DDG-1000 was that just as the ship entered its design definition phase, the power of the Navy's SCIB was waning, replaced by a Joint requirements definition process with no fiscal checks and balances. One of the first things Admiral Mike Mullen, the current Chief of Naval Operations, did upon assuming his office was to reconstitute the Navy's SCIB. With a chance to start from a clean sheet of paper, naval design architects could leverage an additional decade of experience in the post-Cold War era to design an entirely new family of next-generation LBNCs,

under the close oversight of the newly reconstituted SCIB. These new warships would have a common gas turbine or perhaps even a nuclear power plant that supplies enormous shipboard electrical generating capacity; common electric propulsion motors; common integrated power systems that distribute electric power to the ships' electric motors, combat systems, and weapons, as needed; and advanced automation to enable them to operate with relatively small crews. Their single common hulls, or network frames, should be large and easily produced, based on the best ideas of naval engineers, with an affordable degree of stealth. The network frames would be able to accept a range of open architecture battle network mission modules consisting of sensors and onboard and offboard weapons designed explicitly to support a battle network rapid capability improvement strategy. The cost-constrained goal for the combination of network frames and network mission modules would be to build new LBNCs at a rate of five every two years, allowing the complete transition from 84 Aegis/VLS I-LBNCs to 88 next-generation LBNCs in 35 years. The ships would be built under a profits-related-to-offer arrangement. While each of the two remaining surface combatant shipyards could count on building one LBNC per year, they would compete for an extra ship every other year. The yard with the lowest bid would be able to claim higher profit margins on the two LBNCs it would build until the next bi-annual competition. In this way, in addition to the natural cost savings due to learning curve efficiencies, the Navy would be able to spark continuous competition between the two building yards.

- *Starting in FY 2008, build a minimum of seven additional Burke-class DDGs to help sustain the industrial base until the new LBNC is ready for production.* In effect, building one modified *Burke* each year between FYs 2008 and 2014 would replace the seven DDG-1000s in the current plan. For reasons that are detailed in the forthcoming report, the first four modified *Burkes* would be configured with the same Area Air Defense Command Capability System (AADCCS) found on the *Ticonderoga*-class CGs. In addition, all seven ships would serve as active test beds for DDG improvements identified as possible candidates for further BNRAM backfits, or to test next-generation LBNC technologies. As such, the ships would serve much the same purpose as both the *Forrest Sherman*-class destroyers—which helped to bridge the shipbuilding gap between World War II combatants and Cold War combatants designed to battle jets, missiles, and high-speed submarines—and modified legacy combatants like the *USS Gyatt*, DDG-1, which helped to illuminate the way forward toward a new generation of BFC combatants. Provided all went as planned, Congress would authorize two of the next-generation LBNCs in FY 2015, split funded as in the current arrangement for the DDG-1000, giving each of the two remaining surface combatant construction yards one ship. The general fleet-wide transition from Aegis/VLS I-LBNCs to the new LBNC design would then begin in FY 2017, with three ships authorized after a bidding competition. Of course, if the design was not ready for production, additional *Burkes* could be built until it was.

- *Task each of the planning yards for CG and DDG modernization to design and implement a comprehensive follow-on maintenance regime to ensure all Aegis/VLS combatants are able to serve out the remainder of their 35-year service lives effectively*. The Navy's plan counts on every one of the 84 programmed Aegis/VLS combatants of completing 35 years of commissioned service. Yet, since the end of World War II, few surface combatants remain in commission beyond 25-30 years of service—even after receiving mid-life upgrades. Unless the BNRAM program includes a sustained maintenance regime beyond its mid-life HM&E, combat systems, and battle network upgrades and crew reduction measures, it is unlikely the ships will see their 35th year. The building shipyards might be the logical organizations to implement this new maintenance regime on the Navy's behalf. By establishing financial incentives that provide the yards with bonuses for every year a ship stays in service beyond 25 years, the Navy will maximize the probability that the ships will remain in service. As part of their efforts, the yards and the Navy should also solicit ideas for further ship improvements from vendors, and complete the trade studies for an expanded service life extension program (SLEP) of the existing ships, with a goal of extending their expected service lives to 40 years. This would provide a hedge should design work on the next-generation LBNC be delayed for any reason, or if a future maritime challenge spurs the need to rapidly expand the number of large combatants beyond the 88 included in the 313-ship Navy.

No plan is perfect, and this one is no exception. Indeed, rather than prescription, one should view these recommendations primarily as a point-of-departure to guide efforts to develop a new transformation approach for the Navy's future battle line. While different, the approach is wholly consistent with the Navy's broader transition from a Total Ship Battle Force to a Total Force Battle Network. It results in a more formidable near-term surface battle line; ensures the viability of both the design and industrial base for large, complex surface combatants, maximizes near-term O&M savings; provides a smoother, more easily manageable transition to the next generation of Large Battle Network Combatants; and better positions the Navy to respond to any future maritime challenge. Better yet, it is less fiscally risky than the current plan, with ample built-in flexibility to adjust to unexpected changes in future shipbuilding budgets.

Regardless of whether or not the Navy and Congress agrees with this approach and "folds" the DDG-1000 and CG(X), the requirement to design and execute a comprehensive Aegis/VLS Battle Network Reliability and Maintenance program remains. These ships represent a $100 billion taxpayer investment. Moreover, keeping them in service for 35 years is absolutely critical if the Navy has any chance of building to, and maintaining, a 313-ship TFBN fleet. Said another way, making sure the Navy can count on over 2000 years of future fleet ship life for the Aegis/VLS fleet is far more important to the Navy's immediate future than building seven DDG-1000s which promise only 245 years of future fleet ship life.

The FY 2008 budget will be the first complete new budget since the Chief of Naval Operation's announcement that fleet O&M dollars are to be maintained at current levels and that research and development (R&D) money must be reduced to build a TFBN fleet of 313 ships. As discussed in this report, the former ensures that *any* fleet-wide sustainment program for the Aegis/VLS ships will be difficult to execute, while the latter may make it hard for the ships to keep up with pacing threats over the next two decades. It is therefore important that Congress be an early and interested observer when the Navy's FY 2008 budget is presented, and that it asks penetrating questions about the full extent of Navy's plans to modernize and sustain its Aegis/VLS fleet.

Among the most critical questions to be asked are:

- What are the Navy's plans for a balanced Aegis/VLS modernization and sustainment program? Do plans for their fleet-wide HM&E upgrades guarantee all 84 Aegis/VLS combatants will remain in service for a full 35 years? If not, why not?

- What are the most likely operational threats to naval battle forces over the next 25-35 years? Are the Navy's plans for Aegis/VLS combat system upgrades consistent with the evolution of likely future threats? Does the Navy have a robust R&D line to make sure the Aegis/VLS fleet can meet these projected threats?

- Are planned battle network upgrades sufficient to allow all 84 Aegis/VLS ships to seamlessly operate in improved future naval battle networks? If not, why not?

- Are planned crew reduction efforts taking full advantage of all technological options? If not, why not?

- What HM&E, combat system, and battle network upgrades are being cut to stay within established O&M caps? What will the effect of these cuts be on fleet combat capability?

- Should Aegis/VLS modernization programs be funded out of SCN accounts instead of O&M accounts?

- Are studies for possible expanded SLEPs for these ships adequately funded? What desirable HM&E, combat system, and battle network upgrades are not being pursued due to lack of funds? How would these upgrades improve fleet combat capability? How much would these additional improvements cost?

Getting the answers to these questions will help ensure the US Navy doesn't inadvertently "fold" a winning hand. The 84 Aegis/VLS ships soon to be in commissioned service will represent perhaps the most powerful surface battle line in naval history. With the proper plans, they will only get better. However, as the report will suggest, keeping the ships combat effective for a full 35 years of commissioned service, as is now planned, is by no means a sure

bet. Scrimping on any of the five components of a Battle Network Reliability of Maintenance program—a thorough mid-life upgrade to the ships' HM&E systems; an equally through combat systems upgrade; battle network upgrades to make sure the ships can operate in future naval battle networks; additional crew reduction efforts; and a sustained follow-on maintenance regime—will sink the Navy's plans for both its future surface battle line as well as its larger plans for TFBN fleet of 313 ships.

In the words of a famous Kenny Rogers song, the Navy has "got to know when to hold 'em, know when to fold 'em." Cancelling further CG-21s beyond the two now authorized; planning, budgeting, and executing a balanced Aegis/VLS BNRAM program with a sustained follow-on maintenance regime; starting a clean-sheet design for the next 21st century LBNC; and sustaining the industrial base with further *Burke* DDGs until the LBNC is ready for production is an affordable, executable, and effective transformation strategy which will help to ensure continued US naval superiority for the foreseeable future.

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