[H.A.S.C. No. 110–76]

SURFACE COMBATANT CONSTRUCTION UPDATE

HEARING

BEFORE THE

SEAPOWER AND EXPEDITIONARY FORCES SUBCOMMITTEE

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

HEARING HELD
JULY 24, 2007

U.S. GOVERNMENT PRINTING OFFICE

37–891 WASHINGTON : 2008

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
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SURFACE COMBATANT CONSTRUCTION UPDATE

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SEAPOWER AND EXPEDITIONARY FORCES SUBCOMMITTEE,
Washington, DC, Tuesday, July 24, 2007.

The subcommittee met, pursuant to call, at 2:06 p.m., in room 2212, Rayburn House Office Building, Hon. Gene Taylor (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. GENE TAYLOR, A REPRESENTATIVE FROM MISSISSIPPI, CHAIRMAN, SEAPOWER AND EXPEDITIONARY FORCES SUBCOMMITTEE

Mr. TAYLOR. The committee will come to order.

I want to apologize to all of our witnesses. It is not that what you are doing is not important. They have, unfortunately, called a caucus meeting of the Democrat Party, and so that explains these guys. Now, Roscoe will have to tell you where those guys are.

But anyway, the committee will come to order.

The purpose of this afternoon's hearing is to receive testimony on the progress of the construction of the Navy's surface combatant fleet. Testifying today are representatives of the Department of the Navy, along with independent experts from the Congressional Research Service (CRS), Congressional Budget Office (CBO), and the Government Accountability Office (GAO).

On behalf of the entire subcommittee, I welcome the witnesses and look forward to their testimony.

Today's first panel is composed of our independent experts in ship operation and construction. They are Mr. Ronald O'Rourke, a Specialist in National Defense from the Congressional Research Service; Mr. Michael Gilmore, Assistant Director for National Security Research; Dr. Eric Labs, Naval Analysis, Congressional Budget Office; and Mr. Paul Francis from the Government Accountability Office.

The second panel is composed of representatives from the Department of the Navy: Vice Admiral Paul Sullivan, Commander, Naval Sea Systems Command; Mrs. Allison Stiller, Deputy Assistant Secretary of the Navy for Ships; Rear Admiral Barry McCullough, Director of Warfare Integration on the staff of the Chief of Naval Operations; and Mr. Dub Summerall, Executive Director for Surface Combatants Office and the Program Executive Officer (PEO).

Again, I thank the witnesses and welcome them here today.

The subcommittee has asked the witnesses to give an update on the construction status of four of our major shipbuilding programs for the Littoral Combat Ship (LCS), the *San Antonio* class amphib-

ious assault ship, the *Arleigh Burke* class destroyer, and the *Gerald Ford* class aircraft carrier.

This subcommittee, and I believe this Congress, is committed to restoring the nation's fleet and preserving the strike and expeditionary warfare capability of the Navy and Marine Corps. This is vitally important for the long-term security of our nation. Decisions we make concerning the status of the fleet will have effects for decades to come. We need to get this right, and we need to do it now.

Only the Navy and the Marine Corps embarked with the expeditionary strike groups have the ability to respond to crises anywhere in the world on short notice with overwhelming force in the face of an enemy or significant humanitarian aide in the event of a natural disaster. Our nation must maintain this capability.

However, cost and schedule overruns on virtually every Navy shipbuilding program threaten to sabotage the goal of a 313-ship Navy envisioned by the chief of naval operations.

This year we have seen a total restructuring of the Littoral Combat Ship program caused by over-optimistic predictions of cost and scheduling. The Marine Corps Expeditionary Fighting Vehicle (EFV) has likewise suffered optimistic cost and schedule performance. The Coast Guard Deepwater program has been beset by technical and performance issues.

Everywhere this Congress turns, there is another major program suffering from either poor management, technical challenges or both. There is not an unlimited supply of funding for these programs, and right now the Mine Resistant Ambush Protected (MRAP) vehicle program must have Congress's and the Department's top priority, because these vehicles can save lives today.

This hearing is important. We need to understand all the challenges facing the ship construction program so that we can make informed decisions for the future force.

I again thank our witnesses and look forward to your insights on these important matters.

I now recognize my partner and former chairman of this committee, the Honorable Roscoe Bartlett of Maryland.

STATEMENT OF HON. ROSCOE G. BARTLETT, A REPRESENTATIVE FROM MARYLAND, RANKING MEMBER, SEAPOWER AND EXPEDITIONARY FORCES SUBCOMMITTEE

Mr. BARTLETT. Thank you, Mr. Chairman. Mr. Taylor, I want to thank both panels of witnesses for being with us today. I understand that many of my colleagues have a hard stop at 4 p.m. this afternoon, so I will keep my remarks brief in the interest of getting to our witnesses' statements.

I would really like to thank the chairman, as well as the witnesses from the Navy, for today's format. So often we have non-DOD witnesses testifying in the second panel. These witnesses often have very perceptive insights, but when they testify last, it does not allow the members to follow up with questions for the DOD. Today we have a chance to hear from these witnesses and then immediately discuss some of the oversight issues they have raised with the subject matter experts from the Navy.

Although I expect that much of today's hearing will focus on the persistent challenges at LCS and LPD–17 programs, I am glad we

will be getting an update on DDG–1000 and CVN–21. I understand that, as these programs come closer to completion design and the start of construction, they, too, are facing serious schedule costs and weight challenges.

I am especially interested in how the Navy is applying lessons learned from LCS and LPD–17 to these shipbuilding programs to avoid similar pitfalls as detailed design concludes and construction begins.

With respect to LCS, I was dismayed to learn of additional schedule slippage on LCS–1 and the further potential impact of workforce challenges at Marinette Marine. I would like the Navy to provide us with a detailed update on the construction phase to both LCS–1 and LCS–2.

I would also like the Navy to address the status of LCS–4. What are the cost trends for this platform? What actions is the Navy taking to ensure equitable treatment between the two contractors?

As well, we have heard a number of disturbing stories in the press recently regarding LPD–17. I would like to understand what risks remain in the completion of construction and performance of LPD–17, 18, and 19 in particular.

What lessons has the Navy learned about accepting delivery of ships prior to the completion of construction? Has the Navy ever done this before? Does the Navy believe it may have to do it again? What types of contractual remedies could have prevented such a situation?

Finally, I am concerned about the impact that a potential shortage of steel may have on our shipbuilding programs. It is my understanding that the Defense Contract Management Agency (DCMA) recently conducted an industrial capabilities assessment for the MRAP program. According to this assessment, the limiting factor for producing large quantities of MRAP vehicles is material constraint, and not the production capacity of the prime contractors.

Tires and specialty mil-spec thin-gauge armor plate are the two primary material constraints limiting production. It is imperative we understand how the consumption of these materials for MRAP will impact other DOD programs, particularly the shipbuilding programs this subcommittee oversees.

There is no reason why we should learn six months from now that another critical platform cannot be delivered or has experienced excessive cost growth because all the steel has gone to MRAP. It is incumbent upon the Department to do a thorough evaluation of these impacts now and for members to fully understand the hard choices that will have to be made.

All of our witnesses, DOD and non-DOD, are performing an important job for our warfighting. Again, thank you for being here, and I look forward to your testimony.

Thank you, Mr. Chairman.

Mr. TAYLOR. I thank the gentleman.

Sheriff Ellsworth, do you have an opening statement?

Mr. ELLSWORTH. No, sir.

Mr. TAYLOR. Okay.

With that, the chair would now recognize, I would hope, in this order. We will start with Mr. O'Rourke.

STATEMENT OF RONALD O'ROURKE, NATIONAL DEFENSE SPECIALIST, CONGRESSIONAL RESEARCH SERVICE

Mr. O'ROURKE. Chairman Taylor, Ranking Member Bartlett, distinguished members of the subcommittee, thank you for the opportunity to testify today on these programs.

With your permission, I would like to submit my statement for the record and summarize it for you briefly.

Mr. TAYLOR. Without objection.

Mr. O'ROURKE. Concurrency between design and construction was a significant cause of cost growth on the LCS. Avoiding such concurrency is an old lesson in defense acquisition. In this sense, the LCS program is not so much an instance of new lessons learned as of old lessons that were forgotten.

Over the last several months, the Navy has maintained its support for procuring 55 LCSs. Continued stability in plan numbers can help control costs. At the same time, however, there is a risk of industry receiving an implicit message from the Navy that for the LCS substantial cost growth does not pose a significant threat to planned numbers. Such a message might not be conducive to rigorous cost control.

As the cost of the LCS increases, it puts added pressure on the shipbuilding budget. But the more pressure there is on the shipbuilding budget, the more Navy officials might believe they need to keep the relatively inexpensive LCS in the mix of ships being procured. Such a paradoxical situation might not be helpful to rigorous cost control in the program.

The Navy testified that it was overly optimistic on the LCS program. It also testified that compared to CBO, the Navy budgets do a much more aggressive number on its shipbuilding programs. This raises a question regarding what the difference is between "overly optimistic" and "much more aggressive."

A potential issue for the subcommittee is whether the Navy's requested figure of $460 million would be too high to use in amending the LCS cost cap. If $460 million is more than what these ships are expected to cost, then amending the cost cap to that figure might encourage someone to believe that additional growth up to $460 million would be acceptable, which again would not be conducive to rigorous cost control.

Of the $160 million implicit delivery work performed on LPD–17, a substantial part was for construction work that was remaining to be done on the ship when the Navy took delivery. This post-delivery work was funded through a line item that is not included in ship-end cost, so the ship's reported end cost will understate its actual construction cost.

The Navy acquisition executive is now planning quarterly reviews of Northrop Grumman ship systems and the ships under contract there. A potential question for the subcommittee is why such reviews are only now being planned, given the history of the LPD program, and why they aren't being planned for all shipyards and all shipbuilding programs, given cost growth on other ships?

Despite putting an additional LPD at the top of its fiscal year 2008 unfunded priorities list, the Navy has expressed caution about this option, in part, because it believes the shipyard would not be able to start work on an additional LPD right away. Al-

though that might be the case, Congress could still decide to procure the ship in fiscal year 2008, particularly if it decides that it has the funding this year, but perhaps not in a future year, to do so.

Funding two LPDs in fiscal year 2008, with the knowledge that the second one might not be started right away, could be viewed as somewhat analogous to Congress's decisions in fiscal year 1983 and fiscal year 1988 to fund the procurement of two aircraft carriers in a single year, with the knowledge each time that the second ship would be started sometime after the first.

As DDG–1000 technologies mature, technical risk in the program will shift to the task of system integration. Since the Navy is acting as the program system integrator, the program will be an early test of DOD's ability to perform the system integration function following the downsizing of DOD's technical and acquisition workforce.

On DDG–1000 work-share agreement, the Navy might have the option of having the two yards compete for the role of final-assembly yard for the third and subsequent ships. A potential question for the subcommittee is whether such a competition, particularly if done on a one-time basis, would be consistent with the intent of vital legislation prohibiting the Navy from a winner-take-all acquisition strategy for the program.

The Navy might find it difficult to fund both the fifth DDG and the lead CGX in fiscal year 2011. One option for addressing this would be to accelerate the procurement of that DDG to fiscal year 2009 or fiscal year 2010. Another possible option for the program would be to authorize the Navy to use a block buy for procuring several of the DDGs. This could reduce the cost by a few percent—enough, for example, to procure an additional LCS.

Information provided by the Navy suggests that the Navy's estimate for CVN–78 may be optimistic. The Navy interprets the cost cap on the CVN program as being expressed in fiscal year 2006 then-year dollars. A potential question for the subcommittee is whether this interpretation is correct. If it is, then CVN–78 and 79 could each experience millions of dollars of cost growth without exceeding their caps. This situation might not be conducive to rigorous cost control.

A potential option for the Congress would be to authorize a block buy for CVN–78 and 79 or for CVN–79 and 80. The potential savings from such a block buy could be enough, for example, to procure an additional Navy auxiliary ship or two LCSs.

Mr. Chairman, this concludes my statement, and I will be happy to respond to any questions the subcommittee may have.

[The prepared statement of Mr. O'Rourke can be found in the Appendix on page 51.]

Mr. TAYLOR. Thank you, Mr. O'Rourke.

The chair now recognizes Dr. Gilmore.

STATEMENT OF DR. J. MICHAEL GILMORE, ASSISTANT DIRECTOR FOR NATIONAL SECURITY, CONGRESSIONAL BUDGET OFFICE

Dr. GILMORE. Mr. Chairman, Congressman Bartlett and members of the subcommittee, my colleague Eric Labs and I appreciate

the opportunity to appear here today to discuss the Navy's shipbuilding program.

CBO's analysis indicates a couple of things. First of all, executing the Navy's most recent 30-year shipbuilding plan will cost an average of about $23 billion a year in 2008 dollars, or about 30 percent more than the Navy has projected.

And historical experience, including very recent experience that Ron has discussed, suggests that a number of the Navy's shipbuilding programs, particularly the DDG–1000 guided missile destroyer and the CGX future cruiser, continue to face considerable risk of cost growth relative to the Navy's current projections for the cost of those ships.

Eric will discuss some of the details underpinning those conclusions, but before he does that, I would like to provide the subcommittee a little bit of context that I hope it will find useful as it considers the Navy's current shipbuilding program and plans.

Regarding the Navy's past and planned shipbuilding purchases, assuming that the notional service life of a fleet is 35 years, the Navy would need to buy an average of 8.9 or about nine ships per year to sustain a 313-ship fleet. During the 16 years of the Clinton and Bush Administrations, however, the Navy has acquired ships at a rate of about seven per year. Thus, above average purchases will be necessary over the next 30 years to meet the Navy's goal for fleet size.

During the 8 years of the Reagan Administration, the Navy spent $138 billion—all these costs are in 2008 dollars—to buy 147 ships at an average cost of about $.9 billion apiece—$900 million apiece—and, of course, that was to support a much larger fleet, almost twice the size of the one we have today.

In the 8 years of the Clinton Administration, the Navy spent $62 billion to buy 54 ships at an average cost of $1.2 billion a ship. In the 8 years of the Bush Administration, the Navy will spend, according to most recent plans, about $98 billion to purchase 53 ships at an average cost of $1.9 billion per ship—so 54 ships during the Clinton Administration, 53 ships during the Bush Administration, and an increase in cost per ship of about 50 percent.

During the 8-year period spanning 2009 to 2016, the Navy plans to spend $158 billion to purchase 91 ships at an average cost of $1.7 billion per ship, CBO estimates. Thus, notwithstanding large purchase of what are called inexpensive Littoral Combat Ships during the next 8 years, the Navy plans for 2009 through 2016 indicate it will spend about 15 percent more than during the Reagan years, in total, while purchasing about 40 percent fewer ships.

Now, these ships will be more capable, perhaps, than the ships that were purchased during the Reagan Administration, but numbers also matter, and the numbers are going to be smaller, while the costs will be higher.

Regarding CBO's estimates for the costs of the Navy ships, CBO considers the relationship between cost and weight, specifically the cost-per-thousand-tons of light ship displacement, as one of the key factors determining its projections for the prices of future naval vessels. That method assumes, broadly speaking, that what has happened in the past will happen again.

CBO takes account of changes in productivity improvements in shipbuilding practices and procedures, but such changes are frequently offset by, for example, cost increases for labor and materials, unexpected production problems, increased requirements, or new technologies.

In testimony before this subcommittee, some Navy officials have characterized our methodology for estimating costs as worst-case analysis or extremely conservative estimating techniques that seek to include all possible sources of cost risk. In that regard I note that our method would have understated the actual cost of Littoral Combat Ship, the LPD–17 amphibious warfare ship, and the CVN–76 and CVN–77 aircraft carriers, and it would have closely approximated the cost of a lead *Virginia* class attack submarine.

Now, I will turn to Eric for some additional details.

Mr. TAYLOR. The chair recognizes Dr. Labs.

STATEMENT OF DR. ERIC J. LABS, SENIOR ANALYST, CONGRESSIONAL BUDGET OFFICE

Dr. LABS. Mr. Chairman, Congressman Bartlett, members of the subcommittee, I want to thank you for the opportunity to be here today to discuss the Navy's ship programs. I will focus my remarks on the DDG–1000, CVN–78, and the LCS programs.

In CBO's view the Navy's cost estimate for the DDG–1000 is optimistic. Using the DDG–51 destroyer and the CG–47 class cruiser as analogies, CBO estimates the two lead DDG–1000 will cost about $4.8 billion each, while the Navy's estimate is about $3 billion each.

The Navy has argued that comparing the DDG–1000 with the DDG–51 may not be valid, because the design of the DDG–51 was disrupted and incomplete when construction began. In comparison, the design of the DDG–1000 is going more smoothly, and the Navy expects to have the design largely settled when construction begins.

Also, the Navy says the DDG–51 was a smaller, more densely built ship, and thus on a ton-for-ton basis was more difficult and more expensive to construct than the DDG–1000 cost will be.

Several factors offset those arguments. First, as Navy officials will state, lead ships are difficult to build and encounter unexpected problems during construction. The first two Littoral Combat Ships and the LPD–17, both of which are much less complex technologically than the DDG–1000, illustrate that point. The lead DDG–1000 may not have the same difficulties as the DDG–51, but it will have problems of its own.

Second, the DDG–1000 program is incorporating 10 new technologies that are not found in current destroyers. In the past the Navy has typically introduced just three or four technologies in new class of service combatants. Integrating them may prove more challenging than the Navy anticipates.

Finally, a comparison of the Navy's cost estimates for two more DDG–51s and for the seventh DDG–1000 to be purchased in 2013, illustrates the risk for cost growth. The Navy stated to this subcommittee that two additional DDG–51s authorized in 2008 would cost $1.5 billion to $1.6 billion each. At the same time, the Navy expects the seventh DDG–1000 purchased in 2013 to cost about $2.1 billion in 2013 dollars.

Deflated to 2008 dollars, using the Navy's inflation index, that equals $1.6 billion, or the same as an additional DDG–51 that benefits from efficiencies and learning of 62 prior ships. The light ship displacement of the DDG–1000 is 5,000 tons more than the DDG–51. In effect, the Navy's numbers imply that those 5,000 extra tons and the 10 new technologies will be free.

CBO also believes that the Navy's cost estimate for the CVN–78 is optimistic. The Navy estimates that the ship will cost $10 billion in 2008 dollars, including $2.2 billion for non-recurring engineering and design. The Navy argues that construction time and cost for the CVN–78 will be less than for the CVN–77.

In contrast, CBO estimates that CVN–78 will cost about $11 billion, including cost growth that has affected past shipbuilding programs at the same stage of construction. And if the CVN–78 experience has cost growth similar to other lead ships, then the cost could even be higher.

The LCS was supposed to be simple to design and build and cost about $250 million in 2008 dollars per sea frame. The reported cost growth, especially the Navy's need to raise the cost caps for the fifth and sixth ships to $460 million, implies that the Navy's estimate for the total acquisition cost for the first two LCSs will be around $600 million each.

Historical experience had suggested that cost growth would occur in the LCS program. Historical cost-weight relationships using the lead ship of the FFG–7 class of frigates as an analogy indicated that the Navy's original cost target for the LCS was highly optimistic.

The first FFG–7, including its combat systems, cost a total of about $650 million in 2008 dollars. That suggests that the lead LCSs would cost about $575 million to $600 million apiece. In short, cost-to-weight relationships produced an estimate less than the cost of the first LCSs, but substantially greater than the Navy's original estimate.

Incorporating the most recent cost growth, CBO estimates that the first two LCSs would cost about $630 million each as a total acquisition cost. As the program advances with a settled design and high rates of production, the average cost-per-ship is likely to decline to about $450 million each, excluding mission modules.

A quick note on the LPD–17—on a per-time basis, the LPD–17 is the most expensive amphibious war ship ever built, and while the Navy's cost of follow-on ships has come down, they are still far above the Navy's original estimates.

In closing, Mr.Chairman, I would like to add that CBO uses what I would call a realistic approach to estimating the cost of ships. In my ten years as a naval analyst, CBO has yet to overprice a ship.

Thank you, Mr.Chairman, and I would be happy to answer any questions that you might have.

[The joint prepared statement of Dr. Gilmore and Dr. Labs can be found in the Appendix on page 67.]

Mr. TAYLOR. Thank you, sir.

The chair now recognizes Mr. Francis.

STATEMENT OF PAUL L. FRANCIS, DIRECTOR, ACQUISITION AND SOURCING MANAGEMENT TEAM, GOVERNMENT ACCOUNTABILITY OFFICE

Mr. FRANCIS. Thank you, Mr. Chairman, Mr. Bartlett, Mr. Ellsworth, for involving me in a discussion of shipbuilding issues today.

I will echo what Mr. O'Rourke said. The problems in shipbuilding today I do not think are new to shipbuilding, nor are they unique to shipbuilding. As, Mr. Chairman, you noticed, the Expeditionary Fighting Vehicles have those problems. We see those across the board in weapons systems. I think what is different today is it is our turn to wrestle with the problem and make headway on it, and I really think we can.

The first thing I would like to talk about is cost growth in shipbuilding. And suffice it to say that the patient does have a fever. In the over 40 ships that are in construction today, they have overrun by a total of about $5 billion, so far. Most of that you have paid for, but some is coming.

If you look at cost growth, you will see that lead ships are the long pole in the tent. They typically overrun by about 30 percent. That is going to be a real challenge for us, because in the Navy shipbuilding plan there are about nine classes of new ships. So we really have to get those right.

One of the things that you realize when you look at cost growth is in construction you have to get about 60 percent into the construction of the ship before you actually start to recognize real cost. That means there is a time lag of several years between when you authorize money for construction and when you get real data on what it is really costing, and then you get the overruns.

And that is what we have seen, I think, recently on the LPD and the LCS. And for that reason, you need to put the DDG–1000 and the CVN–78 on your watch list, because they are just going into that phase. And in particular, we have to watch the margins for error on these programs, because even with LCS, a 100 percent overrun is $200 million. A 10 percent overrun on DDG is $300 million. Ten percent on the carrier will be a billion. So margins for error will be much smaller there, I hope.

That puts a lot of pressure, I think, on the committee and what it does in the 2008 and 2009 budget deliberations, because the moneys that you authorize there are going to be a factor in whether and how large the overruns will be in 2010, 2011, 2012, and 2013.

So you ask yourself what can we do about this structural problem? And I think what we really need is a new paradigm for establishing programs and overseeing them. And I would say that would consist of three things. One is a better business case, a real solid business case up front for programs, a good plan for making business arrangements and contracting on programs, and a good plan for execution.

And I think to curb the optimism of what we have seen in programs today, we really do need that solid business case up front, which I would describe as firm requirements, mature technologies, a knowledge-based lay down of all the key events in design and construction, coupled with metrics for goodness. It is one thing to

lay the events down; it is another to have a set of metrics or criteria to know whether they make sense or not.

Now, with that you would have to put good resources: time, money, and people. I think time, schedule, will be derived from a good knowledge-based lay-down of a program. And I think cost will come from that as well, but I think there are other things we could do with cost estimating, such as confidence levels.

In terms of business arrangements, it just means what we are doing with competition and what we are doing with contracting strategies. And on contracting strategies, it is the type of contract, how we are going to scope work on the contract, and the government's roles there.

And there are a couple of lessons learned in contracting. One is it makes sense to separate detailed design from construction, as the committee has stated this year, and it makes sense to separate lead ships from follow-on ships.

And finally, in the area of execution, basically we are talking about two things there. One is the shipyard's ability to design and construct the ship that they have at hand, and the government's ability to provide what I would call agile oversight—that is, the ability to detect and react to variances before they become big problems.

And if you took a lens like that and applied it to a couple of programs, like LCSs, I think that is one where you would say, "Gee, the cost estimate was no good. The schedule estimate was no good. The requirements were in flux."

We tried to do detail design, system design, and construction at the same time. When we signed up for construction, we did not understand the design. We went with the shipyard that was not very experienced with designing naval surface combatants, and the government was, I think, too focused on schedule, and not the whole program.

Take the same lens and put it on CVN–78, which, for what it is worth, I happen to think is a pretty well-laid-out program, pretty well-managed, but nonetheless you see risks. You see very demanding requirements, high technical content with, I think, several breakthrough technologies that are not mature yet, a schedule that is bounded by the retirement of the *Enterprise*, and a cost estimate that is optimistic. And the budget is set at the target right now, and we have never delivered a lead ship in target.

So that is a very pressurized business case for the CVN. In the business arrangements, I think they are doing pretty well. We gave them an extra year, and that construction preparation contract allowed them to really pursue a robust process, and I think we will have 75 percent of their design before they go into construction. They separated detail design from construction, so that is good.

We have seen some risks in execution, which I would describe as the technologies. There are three really key technologies that have had problems. Their schedules have slipped to the right. They have used up all their margin. If they have more problems, they are going to interrupt the ship's construction schedule.

So if you are just using that lens, you would come back and say, "Well, why can't we do that more on other programs?" And I would say, I think there is a language barrier. When we look at programs,

it seems like each program uses a different language to describe its key events, the criteria it is using for judging the completeness of those events, and the programs are scheduling milestone decisions at a different point relative to those at hand.

So it is hard to get a common language, and I will just use LCS as an example. I think everyone would agree that the launch of the first ship was premature, with only 63 percent of construction done. I can see that.

Well, what should it have been? What are the standards for launch? What are the things that should have happened beforehand, and can't we see that in a proposal for a ship? And if it is true for launch, isn't it true for keel way? Isn't it true for fabrication, detail, design systems, and so on?

Those are the types of things I think are not knowable when a program is presented for approval. So, again, I would just sum up by saying we really need a knowledge-based foundation for solid, executable business cases on these programs that does provide transparency for oversight.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Francis can be found in the Appendix on page 90.]

Mr. TAYLOR. Thank you, sir.

The chair now recognizes the gentleman from Maryland, Mr. Bartlett.

Mr. BARTLETT. Thank you very much.

Mr. O'Rourke, you testified about the Navy's proposed change to the cost cap for LCS. Do you or any of the other witnesses have any thoughts about how Congress might more effectively implement cost caps? For example, would it be feasible to establish caps on labor hours or material cost by imposing a cost reduction or laborsaving scale similar to a learning curve?

Mr. O'ROURKE. That is a possibility. My own sense is that there might be an advantage in keeping the cost cap as legislated simpler, rather than more complex, so as to preserve the Navy's ability to manage the program under that cap in the best way that it can find how.

In terms of options for amending the cost cap, I mentioned in my opening remarks one issue about the $460 million figure possibly being a little too high. Now, if it is actually higher than what the Navy might expect those ships to cost, then you are actually providing some room for extra cost growth on those ships. And so one potential issue for the subcommittee to explore would be whether the $460 million figure is perhaps too high, and if so, what a lower figure should be.

The second thing in terms of how else you might think about amending the cost cap would be to apply the cost cap not to simply ships five and six in the program, but to some or all of the follow ships in the program. Some of the other cost caps that the subcommittee has implemented on Navy shipbuilding programs have applied to a larger number of ships in the program in question, and the subcommittee can look to those examples as potential models for how they might want to go about amending the cost cap on the LCS program.

Mr. BARTLETT. Thank you.

Dr. Gilmore, you mentioned that recent ship procurements are costing us roughly 50 percent more than the prior generation. I assume that those are in constant dollars, so that we can compare dollar to dollar?

Dr. GILMORE. Yes, the numbers I cited were in 2008 dollars.

Mr. BARTLETT. Okay.

Dr. GILMORE. They were averages over all the ships that were bought during certain periods.

Mr. BARTLETT. Clearly, these newer ships have more capabilities, but in the commercial world, each new generation of sophisticated, complex equipment has increased capabilities over the last generation, and they are costing less. Why are our ships costing more?

Dr. GILMORE. I do not have an answer for you that would satisfy you. I like to base my answers on the results of analysis. We have not done any analysis that would shed light on that. I can only observe that this is the trend not just for shipbuilding, as Mr. Francis mentioned and Mr. O'Rourke mentioned.

This is the trend not just for shipbuilding, but it has been a long-established trend for all DOD weapons systems, which are built only for the government, for which the government assumes all the risks of development. It pays all the costs of development. Those are not recouped later on.

And so there are just a lot of unique aspects to these programs in terms of requirements, which are usually aggressive in terms of what the new capabilities are that are wanted, in terms of who bears the risk—which is the government—and who the prime customer is—which is the government—and it is a customer for a relatively small number of items, although they are obviously very expensive items, that are at variance with what happens in the commercial world.

And so, not having done the analysis, I cannot tell you exactly which of those factors are most important or quantify how they are important. I can just observe that there are all these differences, and that is probably a large part of the story.

Mr. BARTLETT. Clearly, there is an apparent disconnect. The newer generations of similar kinds of complex integrated systems in the commercial world are actually decreasing in price, so it is not a given that because you have more capability, the cost has to go up. And it would be very interesting for us to see what the differences are between our world and the commercial world. The commercial world costs are going down with increased complexity. Our costs are going up.

Mr. Francis, your written testimony references challenges integrating mission packages with LCS. Would you please elaborate on the weight and personnel issues that may impact the mission package integration? To your knowledge, what steps is the Navy taking to manage these issues?

Mr. FRANCIS. Mr. Bartlett, as you know, the mission packages are not included in the ship itself, and I think a rough order of magnitude to get the mission packages on the LCS is going to add about $100 million to the cost per ship. So the costs we have been talking about have been sea frame so far. So we add the mission packages—that is a separate development effort, as you know, and separately funded.

What we are seeing on that so far is the Navy has allotted about 180 tons on the ship for the mission packages. Right now, it looks like they are overrunning about 13 tons right now in development. And similarly, I think there are about 35 people allotted to man those mission packages, and we understand right now that they are roughly about seven people over that that were currently in development.

Some of the challenges associated with that is the number of the mission packages have been reduced in size so that the redundancy you might have, or if one component goes out, you would have another one there—that is gone. And a lot of the organic maintenance that would be on the ship right now is gone. So I think the Navy is working very hard to try to manage the weight and the people, but they are having to make trade-offs in potential capability.

Mr. BARTLETT. Thank you. The cost growth on LCS–1 was really quite perplexing, because, as you mentioned, it was essentially a sea frame, and one would have suspected that the major uncertainties would have been in the packages.

Mr. O'Rourke, I am sorry that I didn't get your gesture. You had a comment on a prior question?

Mr. O'ROURKE. Just a quick addendum, which is the question you asked about why the cost of ships is going up the way that it has is a question that the previous CNO asked during his time in office, and he went off and asked the RAND Corporation to study that question. RAND did look into it in a formal analysis. They reported out the results last year, and I will make a copy of that analysis available to your office.

Mr. BARTLETT. Thank you.

And one last quick question for any of the witnesses. Have you seen any changes in the Navy's program management, ship construction supervision, contracting or cost estimation procedures since the stop work and termination of LCS–3, which would indicate a change to best practices incorporating lessons learned?

Mr. O'ROURKE. Just to start, I have seen things that I can point to. One is a beefing up of the oversight staff for the program, both on the private sector and on the Navy side. And just to cite one other example, there has been a change in the cost-estimating standard that is being applied to the program.

Mr. BARTLETT. So you would anticipate from that that we would not have this spread in the next——

Mr. O'ROURKE. I think both of these things are helpful, but in terms of lessons, as I said earlier, I think this is not so much a case of new lessons to learn as it is to apply old lessons that were learned long ago.

Mr. FRANCIS. Mr. Bartlett, we have seen, I think, the Navy is moving more toward putting confidence levels in their estimates. There is a debate as to what level that should be. The Defense Acquisition Performance Assessment (DAPA) panel says 80 percent. I think the CAIG would say it needs to be less than that. But the fact that they are starting to do that is a step in the right direction.

By the same token, we do see some, I would say, shortfalls in the ability of SUPSHIP to oversee some of the construction contracts and to get the kind of cost data they need to react quickly to problems. So I think the picture is mixed.

If I could offer a comment, Mr. Bartlett, on cost caps. I just wanted to say I think once we get to the point where we are considering cost caps, I think the battle may be lost already.

Really, your point of leverage is early when you are setting requirements and doing design, and I think one of the things we would have to do up front better is to identify what trade space we are going to have maybe within the ship or other ships, so that if cost becomes a problem, you can make trades, because once the design is set and the strategy is set, I think the cost cap, really, is going to be a victim of what happens on the program. So it is, I think, a measure that probably comes too late.

Dr. LABS. Mr. Bartlett, I guess the only thing I would add to that—because I would echo some of the things Mr. O'Rourke said—is that a lot of these issues come up because I am not convinced the Navy has realistic cost estimates for their ship programs to start with.

If the Navy had come to the Hill, for example, and said they thought the LCS was going to cost $450 million, it would not have come as a shock as much to see some cost growth with that type of a number as opposed to $220 million to start with. So a lot of it is sort of in the setting of expectations and what your baseline is to start with.

Dr. GILMORE. I would say that looking at the issue of cost growth and realistic costing from the perspective of the overall shipbuilding program, we will have to wait to see whether the improvements that Mr. O'Rourke mentioned and Mr. Francis mentioned translate into the Navy's programming process, because right now, the Navy is basing its future-year ship program under unrealistic estimates. They are top-down-driven estimates.

When they derive the costs of several of the classes of new ships, they have done that by allocating budget shares and dividing the number of ships that they want to buy into a budget share. That is what they have done in generating their 30-year shipbuilding plan. So those do not generate realistic estimates, and I do not think they generate for either the department or the Congress a realistic appraisal of the number of ships that are going to be bought.

So if these improvements in pricing-out the individual ships and pricing them at something a little bit higher than the 50th percentile level of confidence translates into more realism in the shipbuilding program, that would be a good thing. But we have not seen the next 30-year shipbuilding program yet, so we will have to wait.

Mr. BARTLETT. Mr. Chairman, one quick last comment which may or may not need some observations by the panel. Clearly, we want our new ships to be as good and capable as they can be, but very frequently, getting that very last five percent improvement in capability may double the cost.

Is there somebody sitting at the table that is challenging these requirements as the contractor gets them, and they would say, "Do you really need that? That will cost you twice as much as if you only asked for 95 percent of that capability." Do we have those discussions?

Dr. GILMORE. Well, they are supposed to occur. When I worked in the department, I worked for the Office of Program Analysis and Evaluation, which provides the guidance and oversees the conduct

of what are now called analyses of alternatives which, if done correctly, are done before a program's requirements are set and explore exactly the issues that you described.

What do you have to pay realistically to get a certain level of requirements? And if you are willing to back-off that level of requirements, how much might that cost be, and would that still produce an article that was useful, that could do what people think needs to be done—perhaps not as much as people would like, but still make a useful contribution to the missions the Navy is pursuing?

And those kinds of analyses are supposed to be done, but my experience is that often they are done in a way that adopts assumptions that drive the analysis to support conclusions on what the capabilities should be that have already been reached before the analysis explores those issues.

Mr. BARTLETT. Mr. O'Rourke.

Mr. O'ROURKE. Just as, again, a quick adjunct, there used to be an organization at one time in the Navy for many, many years that performed the function of being the "requirements police," if you will, to add some discipline into the requirement-setting process, and that was the Ship Characteristics Board or the Ship Characteristics Improvement Board.

Now, that board was disestablished some number of years ago, and we went through a period of time when the Navy was looking at some ship designs when that board was not in place. Now, the Navy has now reestablished this organization under a new name, and so they do now once again have in place an organization that can act as the "requirements police," if you will, to help separate requirements from desirements.

And the proof will be in the pudding. We will have to wait and see just how tough this board acts in terms of actually policing requirements and making sure that the Navy does not let its requirements get away from them. But the Navy has once again reestablished that organization.

Mr. BARTLETT. Thank you very much.

Thank you, Mr. Chairman.

Mr. TAYLOR. The chair thanks the gentleman from Maryland.

The chair now recognizes the gentleman from Indiana, Mr. Ellsworth.

Mr. ELLSWORTH. Thank you, Mr. Chairman.

Gentlemen, I have to admit that my past dealings with government contracts have been more in the tens of millions and not these numbers that you have been talking about today.

And I am even more proud now, Mr. Chairman, that the last jail that I built, we came in half-a-million dollars under budget. And that makes me more proud now when I hear about these government projects.

There are a few things we have talked about today that concern me. My first question is that on the change orders that you all see, who is more responsible? When we are in this shipbuilding project, is it the Navy comes in and says—the hull is there; they start putting the guts in this thing and they say—"No, we would like this switched over here. We want to do this with our left hand instead of our right." Or, "We would like this window to be here, or this" whatever it might be?

Who does more of that? The shipbuilder saying, "Oh, here we have our schematic design on the table, but now it is like we have got steel hung. We cannot do that; we have got to change it." Is there a feel for that? Who has more of that—the Navy or the shipbuilder themselves—that would naturally add to that cost when we switch this over here? Does that make any sense at all?

Dr. LABS. CBO does not have any data as to who is the initiator of a lot of those changes, whether it is the contractor or the Navy. But I can say at sort of a general level that a lot of times those change orders are at the instigation of either the contractor or the Navy, because maybe they just want something different than what was originally there.

But in many instances, when you translate a design that is on paper into actual construction, things do not necessarily—through no fault of anyone, really—work out in reality the way they seem on paper. So it looks like a certain pipe can be hung in a certain way, and when you actually start building the thing, "Oh, that isn't going to work," for whatever reason, and so that becomes a change and a change order under that category.

But we do not have data that can break out as to levels of responsibility or attribution.

Mr. O'ROURKE. You can take those change orders and divide them, if you will, into two basic groups. One is those that arise as a function of the construction process of the ship—the errors you just talked about. And the others are those that have to do with the fact that the Navy has reconsidered what it wants the ship to be or what it wants the ship to do.

Ultimately, final responsibility for those change orders happening and being put into place resides with the Navy. And it is especially that second category that I think people are concerned about, because those are the ones that are more likely to be initiated by the Navy and might be initiated by the Navy in part because the Navy had not completely thought through ahead of time what they wanted that ship to be and what they wanted that ship to do.

I think the Navy recognizes that, and they are trying to move back to a greater sense of self-discipline on requirements so that they do not come back later with this second group of change orders that gets added to the first that are going to arise as a result of the construction process.

Mr. FRANCIS. Mr. Ellsworth, I will say change orders are expected, and they build in a number in all the cost estimates and the contracts for change orders. So I do not know the answer to this question, but it is a good one to see how are we doing that? Are those budgets anywhere close to reality? Because there is an expectation of a fairly significant level of change order traffic.

Mr. ELLSWORTH. And they are certainly not making up the kind of dollars we are talking about—the increase to the total price of the ship I would hope they are changing.

Mr. FRANCIS. Right.

Mr. ELLSWORTH. Or the person who draws the ship needs to go back to Drafting 101, I would say. That kind of leads me to the next question.

It sounds like at the very end of y'all's presentation and Mr. Bartlett's questioning that maybe Congress and the Navy—prior

past Congresses—haven't really demanded very accurate figures. Is that fair to say, that we are talking about so many dollars that the old saying about "a billion here or a few hundred million here," we kind of expect that?

Maybe we have not had that construction manager in there, that person that is watching that cost, and as it gets away from us, it is like "Well, it is going to be $100 million here." Has Congress been doing our job to watch and really put the thumb down, saying this needs to come in maybe not on budget or under budget, but at least some kind of reasonable figure?

Mr. FRANCIS. I think that is an astute observation, Mr. Ellsworth, and I think it transcends the acquisition role—not just shipbuilding. There are those who would say the acquisition process is broken, and it needs to be fixed. I would offer a different explanation.

I think the acquisition process is in equilibrium, and part of the rules of the game is, as we were talking earlier, performance sells. So higher requirements are going to allow your alternative—whether it is a ship, an aircraft, a missile, a tank—to defeat any other alternative. So you have that high performance, but you also have to have low cost. Your cost has to fit in the budget.

And I am not trying to be glib about this, but that is sort of the rules of the game to get a program into the budget where you can actually start to attract funds to do something. There are conventions that you build around that, and we kind of all participate in that.

So if the Navy, for example, were to come here and say, "The cost of the LCS is actually going to be $500 million, not $200 million," then the budget would accommodate maybe 20 ships, and not 55. So you might say, "No," and nobody wants to get a "no" answer. So it is easy for you if the budget proposal when it first comes in is low, because then you don't have to make trade-offs. And our system kind of works that way.

Mr. ELLSWORTH. It is just like it is heading that way, I know, with the MRAPs. We have been having a lot of discussion about that. We went from—was it $6 million to $16 million apiece—because that was my recollection on the cost of the—oh, I am sorry. No, I am thinking about the——

Mr. FRANCIS. EFV?

Mr. ELLSWORTH. The other boat.

Mr. O'ROURKE. I have got a couple of things to that. In addition to the sort of the sociology of the situation that can drive people to price things to sell and price things to get programs started, there are a couple of other things, which is Congress can demand realistic estimates, but once it gets estimates, it may not always have enough information to evaluate independently whether in fact that estimate is realistic.

I remember a hearing that Chairman Taylor held a year or 2 ago where the DDG–1000 was discussed, and as I recall, he asked Admiral Hamilton, "Will you wager 1 or 2 months of your pay to make sure that the DDG–1000 is going to come in at cost?" And Admiral Hamilton said, "Yes."

And so we have that commitment there, but once the Navy says that, what position is Congress in to evaluate that number and say,

"Well, okay, he said it was." But now how do you parse that number apart and say, "Was Admiral Hamilton right about that or not?"

The other issue that the evidence for these numbers being wrong, as was mentioned earlier, always comes years later, so by the time it comes in, it is a different cast of characters, and the people who talked to you at the time about whether a number was supposedly realistic or not—they are gone by that time. And I have seen this. I think we have all witnessed this on a number of systems over the years.

So there is the issue of consequences and accountability in a system where people only have limited tenures in office. By the time some of the different numbers start to become available to Congress, we are dealing not with the people who originally spoke to those numbers, but with their successors or even their successors' successors.

Mr. ELLSWORTH. Thank you, Mr. O'Rourke.

Mr. Chairman, if I could have one more question.

Mr. TAYLOR. Certainly.

Mr. ELLSWORTH. One of you—and I cannot remember which one—were talking about the 60 percent point of construction where we really start projecting those costs. I don not remember which one of you was talking about that.

Mr. FRANCIS. I did.

Mr. ELLSWORTH. Mr. Francis, could you just go and kind of elaborate on that just a little bit, why that is that we get to 60 and then we start knowing the price of steel, the price of technology; we think we have all those bugs worked out, those change orders—is that when we——

Mr. FRANCIS. Yes. The 60 percent is a number that we have observed in looking at actual construction of ships. I would not say it has scientific precision, but back of the envelope precision.

But basically, the main thing we see is that when labor hours really start to come in, and you can start then measuring how many labor hours we are associating with work packages, because once you get into construction, your packages of work are pretty discreet. And you know whether or not you are starting to construct in a certain sequence, because you plan to do things in a certain order.

When you get past the halfway mark, around 60 percent, you start to realize, one, what actual labor is taking and, two, the things that did not get delivered to the yard in time are starting now to disrupt the construction sequence.

And that is the point maybe of reckoning where you have to admit, "Gee, the schedule is not going to go the way we want it." And we either have to add more calendar time, which is labor and overhead, or we have to put more labor on it and drive the cost up.

In some cases, too—and ships are unique in this respect—because of the long construction time, the cost of materials does change, even though we put in economic adjust clauses. Price of steel in a number of the ships that we have looked at has gone up when they are in that stage of construction.

Mr. ELLSWORTH. Thank you.

Thank you, gentlemen, for your testimony.

I yield back.

Mr. TAYLOR. The chair thanks the gentleman.

Gentlemen, I want to thank all of you for being here.

And given our desire to not be surprised with an LCS-type scenario again or a Deepwater-type scenario, both of which are regrettable—they happened, and we hope they are being fixed, and what we do not want to see is this become a reoccurring problem—I am curious to hear your thoughts if there is an institutional problem within the Navy to where there is no one person who is responsible for our shipbuilding programs for a long enough period of time—given how long it takes to go from development to R&D to actual construction to delivery—where there is one person who, in effect, is not going to let this happen on their watch.

Is this something this committee ought to be looking into?

It is strange that you should mention Admiral Hamilton. Heck of a nice guy. Bottom line is, I am told he is going to retire in September. So he is not going to be around in position to make good on that bet, one way or the other. And that would be an example of this.

But I would like to hear your thoughts on it. Again, the Navy guys are going to be—I have great respect for them—kind of restrained by the uniform they wear to actually what they can say. So what are your thoughts?

Mr. O'ROURKE. Just one thought to start the answer, which is that within the Navy there already is a model of a person who has a much longer tenure in office, and that tenure was designed specifically because it was felt that it would be beneficial for someone to be around long enough to live through the consequences of actions or decisions that were made earlier in that person's tenure, and that is the director of Naval Reactors.

Mr. TAYLOR. Admiral Donald.

Mr. O'ROURKE. Currently, Admiral Donald—that is right—who is the fifth person to hold that office in about 50 years. Now, that term of office is 8 years, and there are very few other parallels in the Federal Government for that.

That long term of office reflected a sense many years ago when Naval Reactors was being set up that this was a very special, very important technology, and therefore, a person of that tenure would be beneficial in helping to bring to come to pass and to make sure that it was done right.

But if we decide now that shipbuilding—because of the very long time spans, because of the large amount of dollars involved and because of consistent congressional concern over the issue over the years—has now become an issue like that, or sort of like that, then one possible model would be to look to what we have with Naval Reactors and not necessarily copy it verbatim, but look at it as a rough model for doing something within the shipbuilding arena that is maybe a little bit like that.

Mr. TAYLOR. Is there value to that, in your opinion?

Mr. O'ROURKE. I think that there is merit enough that it may be worth investigating. There are always downsides to these options as well, and there are differences between shipbuilding in general and the responsibilities of Naval Reactors in particular, but what I want to get across is that we do have this model over here which

does seem to have worked well for this one function of bringing nuclear power to the Navy.

And so if we have that model, and if it is a model also that Sean O'Keefe, after leaving the Navy, felt that NASA could benefit from, then maybe it can be something that a part of the Navy elsewhere can also benefit from.

Again, I cannot make a recommendation on the issue one way or the other, but I do think it is a model that there has been enough evidence accumulating on for at least people to look at that and come to a decision about whether they think that would make sense or not.

Mr. TAYLOR. Would any of the other gentlemen like to weigh in?

And I very much appreciate your answer, Mr. O'Rourke.

Dr. GILMORE. If you do not have a realistic cost estimate to begin with, it does not matter how long the person is there. They are not going to be able to manage the program to achieve an unrealistic target.

Now, to the extent that longer tenure would mean that might translate into the person being responsible at the initial stages of the program where the first cost estimates are generated generating more realistic ones, that might help.

But there are still all these incentives in the system to generate estimates that are optimistic. And estimates that are a little bit low are probably good, because they help you manage the program and control costs, as Mr. O'Rourke has mentioned.

But estimates like the ones that existed for LCS and that exist for DDG–1000 probably are not helpful, because they are too low initially. The initial estimates for DDG–1000 for the fifth ship were about $1.1 billion, and the Navy is now admitting that in its estimates the cost will be maybe two or three times that, and our estimates would be a little bit higher.

So the initial estimates for that program were extremely optimistic, and I disagree a little bit with my colleague, Mr. O'Rourke. There were plenty of people inside the Pentagon at the time those estimates were generated that knew there was no way in the world that those ships were going to be built for that cost. Sometimes that is known very early on, and if you try to manage the program to those targets, you just cannot do it.

Mr. O'ROURKE. Just one quick additional comment, and not to disagree with what was just said, but we have had a number of hearings this year, as you are aware, on the Deepwater program, and at one of those hearings—it was one of those on the House side—the commandant was asked, "Well, who is responsible for this situation?"

And I thought his answer to that question was fairly powerful. He said, in essence—and I am paraphrasing here a little bit—"Well, the program manager and the chief engineer of the Coast Guard and the vice commandant of the Coast Guard and the commandant of the Coast Guard at the time are all no longer here." And I think that gets to the crux of your question.

Mr. FRANCIS. Mr. Chairman, my boss, David Walker, has recommended that type of position for the Department of Defense, a chief management officer who would have a tenure long enough that they could, let us say, last through the ups and downs of indi-

vidual decisions. So I think conceptually something like that in the Navy is something worth considering.

I would have to add that that person would have to be empowered to make decisions, and he would have to be supported by the kind of systems like Dr. Gilmore just said—cost estimating, good trade-offs. In other words, they need a support system to generate business cases that they could make good decisions about.

And one of the things I worry about is what is going on in the program offices and the PEOs, because I think there are really exceptional people there. But I think when they get unexecutable programs, we are grinding them up. So we have to find some way to allow the PM to weigh in and be able to say when something is not doable or unexecutable. And that type of information would have to get to that level.

Mr. O'ROURKE. One more quick comment?

Mr. TAYLOR. Sure.

Mr. O'ROURKE. Which is that, although I have mentioned the fact that there are a lot of old lessons that can be brought back in and reinforced, there are, I think, some new ideas out there.

And one of those that I think has particular promise is the concept that Admiral Sullivan has promoted for reducing the Navy over the longer run to a smaller number of common hull designs so as to recover some of the lost economies of scale that were suffered by the Navy when the shipbuilding rates went down.

That idea, I think, has a lot of promise for being a powerful engine for reducing ship costs and for allowing the country to support a larger Navy for a given amount of dollars.

But it is also a vision that would take a long time to implement over time, and if you have an idea like that that requires somebody to be behind it consistently over time, then having someone in the Navy who has a long tenure in office to pursue that idea and to make the decisions at the critical points along time to help make that vision come about can be potentially beneficial for doing that.

So if you have an idea for reducing ship costs, that is inherently one that would take a long time to implement—which strikes me that is what you have, in the case of what Admiral Sullivan is proposing—then that might lead you to think, "Well, maybe the person in charge of implementing it should have a longer term of office."

Mr. TAYLOR. We will see.

Gentlemen, it seems like within days of the change with last November's elections, we had the secretary of Navy come see me and say, "We have got a big problem with LCS." The commandant of the Coast Guard shows up: "We have a big problem with home porting."

Let us just say both of them kind of took me by surprise and—water under the bridge—my point being, do you see anything we are missing, any problems that we can prevent by actions this summer or this fall that are coming down the line anywhere near those problems that probably could have been avoided or certainly mitigated?

In the case of the Coast Guard, apparently the deputy commandant had raised concerns about premature failure of the hull. In the case of LCS, someone had to see that there was a problem

last summer and would not tell. So is there anything that you see that we should be addressing now?

Mr. FRANCIS. Mr. Chairman, if I can start, I would say you really need to be looking at the DDG–1000 and the CVN–78, because again, the moneys that you are going to authorize in 2008 and 2009 are going to form part of their business case.

Mr. TAYLOR. And your specific concerns with those two hulls are what?

Mr. FRANCIS. On the DDG–1000, when we convened here last year, I think the cost estimate at the time was $3.3 billion per ship, and the Navy then went through a cost reduction on the ship and got it down to $3 billion, and the idea was to keep the $.3 billion in there as a hedge against future cost growth. My understanding is that money has been scrubbed out of the program, so we have, I think, a very tight cost estimate on that program.

And the other things we need to be looking at are what is happening with the key technologies on that, and are we holding schedule? So that is my concern there. On the CVN–78——

Mr. TAYLOR. Do you know of any specific instances that you can name as a for-instance?

Mr. FRANCIS. Two for-instances. One is the dual band radar, which affects both the CVN and the DDG–1000. They have had trouble generating the power out of the transmit-receive units that they need for that radar, and it does not look like they are going to be able to generate that power until they get that system into production.

If the dual band radar does slip, the current construction sequence is to install the radar into the composite deckhouse and deliver that as a unit. That is going to be the construction sequence. If the dual band radar gets delayed much further, they are going to have to install the deckhouse first and then put the radar in afterwards. That is going to be a cost issue.

The other thing on the DDG–1000 is the software—the total ship computing environment. That was to be released in six stages. The first three went okay, but a lot of work now in the last three has been deferred, basically reflecting late delivery of information like vendor-furnished information where the software has to wait. So there is going to be more software work on the tail of the program on that.

Mr. TAYLOR. Mr. Francis, I very much appreciate that. If you have that or any other concerns, I know this committee would welcome hearing them up-front, so, hopefully, we can address them before the Nation has a needless delay or a needless expenditure of funds.

Mr. O'ROURKE. Mr. Chairman, just to add two quick things, things that the committee might consider doing this summer as it looks forward into the shipbuilding program.

One would be to look for instances of where a cost-plus type contract is being combined with a schedule driven program, because that was one of the other lessons that were forgotten that came out of LCS. That has been commented by others as a recipe for cost growth, and so you would look to see if there were other instances in the Navy shipbuilding program that combined those two things together.

And the second thing I think that——

Mr. TAYLOR. Again, do you have any specific examples of where you see a——

Mr. O'ROURKE. I would have to go actually survey the programs to see which programs would meet both of those conditions, but that definitely is something the committee may want to consider doing on its own and then arrive at their own judgments about which programs may satisfy both of those conditions.

And the other thing that the subcommittee, I think, may wish to do this summer is gain a better understanding of the risk balance of the cost estimates that are the cost estimating standards that were used to estimate the cost for each of the Navy's shipbuilding programs so that you at least have that baseline data to then evaluate what the Navy is really telling you when they give you an estimate for each of these programs.

Mr. TAYLOR. Anyone else?

If not, the chair is going to recognize—I am trying to remember who got here first. Admiral Sestak?

Mr. SESTAK. I think it was Mr. Courtney.

Mr. COURTNEY. I pass. I pass.

Mr. TAYLOR. Okay. Mr. Courtney was here first but has no questions.

Admiral Sestak.

Mr. SESTAK. Thanks, Mr. Chairman.

If I could follow up on the question, Mr. Francis, that you asked. When the funding went from $3.3 billion to $3 billion, did requirements fall out?

Mr. FRANCIS. Some ship content was taken out. So I think a magazine was taken out and some of, I think, the content of the advanced gun systems. So some specific things were taken off. I would not describe them as a complete capability like, "Gee, we lost the gun; we lost the radar," but a less capacity, if you will.

Mr. SESTAK. Then the tail, all that—whatever is going to happen to that, none of that—the consequence of trying to squeeze down to $3 billion is just the ship's contents?

Mr. FRANCIS. To my knowledge, yes, sir.

Mr. O'ROURKE. Some of it was content. Some of it was things like documentation for the program that was judged to be no longer necessary.

If I remember right, at the time the Navy testified that the actions it took—we are talking about things that were in the spring and summer of last year; at least that is when we talked about it—had the effect of reducing the lead ship cost by $250-something million and having the effect of reducing the follow-on ships' cost on a recurring basis by $215 million, something like that.

So there was content taken out of the design, but there were other things as well in terms of documentation.

Mr. SESTAK. Mr. O'Rourke, your question on Admiral Sullivan's proposals for three or four common hulls. If one of those hulls—the cruiser, let's say—that idea you have of DDG–1000 becoming a CG, if it is to be nuclear-powered, does that have implications for that?

Mr. O'ROURKE. It does, because for one thing the nuclear power plant that the Navy is considering might not be easily fittable into the DDG–1000 hull, in which case that might tend to argue in

favor of going to a different hull design for a nuclear-powered version of the ship.

That is not clear at this point, but what I do want to emphasize is that Admiral Sullivan is talking along these lines, and if you had one person in office over a longer span of time to make decisions about implementing that, then you could maintain that momentum of vision to help bring it about.

But yes, the nuclear power issue is one that could become a hard choice for the Navy in terms of whether to stick with hull commonality or not within the DDG–1000 and CGX efforts.

Mr. SESTAK. Just one last one. You had mentioned—I think it was you, Mr. Francis—I am trying to read my notes that I wrote as you were talking—even though you did not say it, this is really a software-controlled ship. Even the engineering software is all automatic, and it fits into—and I forgot what you call it—a tactical ship control system.

Mr. FRANCIS. Total ship computing environment.

Mr. SESTAK. Computing system.

So your comment about vendors—there was a delay because of vendors—I assume these vendors are probably software vendors that did not potentially have the engineering code done so that the combat systems over all ships could be done.

My question is how we fund these ships. I cannot remember the terms—partial funding, incremental funding. There have been some reports that that has an impact upon the sub-prime contractors, that way down at the tail, these vendors are not able to get the money to start the engineering code which impacts the overall thing on such a ship that is built upon software.

Is that part of the reason for some of the delays—how we do the process of funding?

Mr. FRANCIS. Well, on the vendor furnished information, what I was referring to is not so much the software vendors, but for the people doing the software for the ship, they need specific information coming from the detailed design of specific subsystems that a vendor may be supplying. That could be a fire control system. It could be a missile, and so forth, but they need the specific specifications from that system to build that into the code for the entire ship. So it may not necessarily be software vendors in this case.

Mr. SESTAK. The over-arching question of the process—is the way we fund an issue in this?

Mr. FRANCIS. In this case I do not see—and I would be interested in what my colleagues have to say—where split funding or incremental funding would have a direct impact on the ability to get money to the key vendors when they need it. It is a way to fit in the Navy's budget, but for the DDG–1000, for example, we do have roughly $2.7 billion in each year's budget. It would seem to be that that would be enough money to get the front-end-loaded work done to the vendors.

Dr. LABS. I would agree with that, Congressman, because the way the Navy sort of handles when they do split funding—at least, the way it should be done—is that when they do get priority to do split funding or incremental funding, they are funding the things that they need to have done to support their vendors to get the

ship constructed on time. And that is the way they sort of allocate the funding.

So if there is a problem there that is a result that money is not getting to the vendors that need to get the money in the proper amount of time, I would suggest that that is probably more of a management issue than it is a funding issue.

Mr. O'ROURKE. It is not technically funding, but one difference in an acquisition arrangement that can affect the lives of the vendors is whether or not you use something like multi-year procurement. That is a contracting arrangement, not a difference in how you fund the program.

But if you were to go to multi-year procurement on a shipbuilding program, then both the shipyards and the vendors would have confidence in the future business that would come from the procurement of those downstream end-items, and they could therefore take steps to optimize their workforce in their production plant to build what they build at the lowest possible cost.

In my earlier testimony, I talked about the option not of an official multi-year, but of the alternative of a block buy. And I raised that alternative, because in the case of the two programs I mentioned, which were the destroyer and the aircraft carrier, we will not be able to use a multi-year for some number of years until that lead ship is delivered.

But in the meantime, you could use a block buy. That would at least allow the shipyards to optimize their workforce and their productive plan and get some savings.

But one difference between a block buy and a multi-year is that it does not include the authority to bring long lead items forward and fund them all at once. So the vendors would not benefit from that. They would, however, still benefit from the confidence in future business that you would get from the block buy.

Mr. SESTAK. A very last question, if I might, just one last one?

Mr. TAYLOR. Sure.

Mr. SESTAK. Did you all read the article by Secretary Winters in proceedings last month?

Mr. O'ROURKE. The one based on his speech.

Mr. SESTAK. I do not know if you addressed—it laid out his new approach. It was titled, "Tough Love."

Mr. O'ROURKE. The "Tough Love" speech.

Mr. SESTAK. Did you all talk about that and the value, if you saw, of his seven or eight points? Have you talked on that?

Mr. O'ROURKE. I think Eric and I probably have talked about it together at the time that it came out.

Mr. SESTAK. Is there value in those various points he brought out?

Mr. O'ROURKE. I think there is potential value in some of the things he talked about, at least, if not all of them. There are probably points in there that would need to be debated. I think it reflected a recognition on the part of the Secretary of the Navy that shipbuilding is central to the future of the Navy, and that it therefore deserves oversight attention at the highest levels.

Dr. LABS. I would agree with Mr. O'Rourke on that. There are certainly things in there that are worth exploring and doing. Other things you are going to have to sort of think about and explore in

a little bit more detail, but he has got his eyes apparently focused on the problem, and I think that certainly deserves some recognition.

Mr. SESTAK. I thought the most salient point he made, though, was this charity of optimism that you probably spoke of, meaning that the service can lose, and is losing, credibility by this effort to try to fit—to use your words—the split-funding things in, and over the longer term that can stand us not in good stead.

Would you agree with that, Dr. Gilmore?

Dr. GILMORE. Yes. Well, as I said before, though, these problems are not unique to shipbuilding. When you look at what has happened with the F–22 program, for example—and of course, that got caught up in the end of the Cold War, but nonetheless, there were plenty of problems that occurred with the program after that.

And the Air Force spent $5 billion or $6 billion a year developing that program for 10 or 15 years, and it is now going to get about 180 planes out of it, which is, what, 10 percent or less of the overall inventory of planes that they would like to maintain right now?

Now, this situation with shipbuilding is not nearly as dire, but the reason that I provided some of the numbers at the outset of my testimony on what we spent during the Cold War and the number of ships we bought and how the price per ship has escalated quite a bit—along with the capabilities of the ships, no doubt—was to point out that the shipbuilding program is facing a similar situation, not as stark in terms of numbers and budgets, but still, a similar situation to the situation that the Air Force is facing in terms of modernizing its fleets of tactical aircraft and, for example, the situation that the Army is facing with the Future Combat System.

So, as you know, these problems have existed for a long time. Some of them are now becoming more apparent in terms of what is actually happening versus what the predictions were of some people several years ago.

And I would say whatever actions you take, if you do not have realistic estimates at the beginning of the program of what the program will cost, you will run into trouble.

And to say that we should manage these programs to cost really is not addressing the problem, because if the initial cost estimates are very unrealistic, no manager, no matter how intelligent or how heroic, is going to be able to manage a program to hit a cost estimate that is completely unrealistic.

Mr. SESTAK. Thank you.

Mr. FRANCIS. Mr. Sestak, I have Dr. Winters' points right here, and I know when I went through them, I think the first one he makes about who is going to be the integrator—that is a sophisticated discussion I think that needs to be had.

And I think Mr. Taylor brought up the issue of Deepwater. We have had issues with the contractors' integrator there. We have it on Future Combat Systems. So I think that is a rich debate that needs to be had—not an easy one.

But the other points are in principle hard to argue with. The Navy must define design constraints to optimize the capability of the fleet. Contractors must design for production and sustainment. The Navy needs to use independent cost estimates for trade-offs.

Detailed design constructions must be supported by mature specifications. And the Navy needs to provide knowledgeable program oversight. These seem like almost unarguable principles, I would say.

Dr. GILMORE. Let me just comment with regard to independent cost estimating. The Navy eliminated its capability to do independent cost estimating. Its only independent cost-estimating office was essentially eliminated. Now it has been rebuilt a little bit, but it is nothing like it was in terms of capability previously.

Again, as Mr. Francis pointed out, I cannot argue and would not argue with the need for independent cost estimating, but the Navy does not have much capability there now.

Mr. SESTAK. That was 1996?

Dr. GILMORE. Yes, well, I was thinking of—what was it?—well, it was the Navy independent cost-estimating office. That was not its exact title, but I cannot remember what it was. But it was eliminated at one point.

Mr. TAYLOR. Thank you, Admiral.

The chair wants very much to thank our panel. I think you have done a great job of enlightening us, and we appreciate you being here. The chair is going to dismiss you all and ask for the second panel.

The subcommittee will come to order.

The second panel that we are very fortunate to have with us this afternoon is composed of representatives of the Department of the Navy: Vice Admiral Paul Sullivan, Ms. Allison Stiller, Rear Admiral Barry McCullough, and Mr. Dub Summerall.

Thank you all for being here.

Again, given the depth of knowledge that you bring to the table, we do not want to unnecessarily limit you to the five-minute rule. I would remind you that I have got to leave at about ten till to visit with the speaker on something, so do what you can to stay near the five-minute rule, and then Mr. Ellsworth will take over.

Ms. STILLER. Yes, sir. Chairman Taylor——

Mr. TAYLOR. Particular order?

Ms. Stiller.

STATEMENT OF ALLISON STILLER, DEPUTY ASSISTANT SECRETARY OF THE NAVY FOR SHIPBUILDING; VICE ADM. PAUL SULLIVAN, COMMANDER, NAVAL SEA SYSTEMS COMMAND, U.S. NAVY; REAR ADM. BARRY MCCULLOUGH, DIRECTOR, WARFARE INTEGRATION; DUB SUMMERALL, EXECUTIVE DIRECTOR FOR SURFACE COMBATANTS, PROGRAM EXECUTIVE OFFICER, SHIPS

Ms. STILLER. I am going to give an opening statement for the four of us.

Chairman Taylor, Mr. Bartlett and members of the subcommittee, thank you for the opportunity to appear before you to discuss the topic of Navy surface ship construction.

On behalf of Admiral Sullivan, Admiral McCullough, Mr. Summerall and myself, I would like to submit our written testimony for the record.

Mr. TAYLOR. Without objection.

Ms. STILLER. I would like to begin by thanking the committee for its keen interest in shipbuilding. I will try to condense my remarks. They were a bit lengthy.

The Navy is committed to building an affordable 313-ship fleet by 2020.

Mr. TAYLOR. Ms. Stiller.

Ms. STILLER. Yes, sir?

Mr. TAYLOR. Take your time.

Ms. STILLER. Okay.

Mr. TAYLOR. Again, we are happy to have you here. We want to hear what you have to say.

Ms. STILLER. Yes, sir.

The department continues to utilize a long-range plan for construction of naval vessels which reinforces the 313-ship plan, and is designed to stabilize workload and funding requirements. A stable plan will enable the shipbuilding industry to maintain critical skills and to make business decisions that increase efficiency and productivity.

We still face challenges. Recent setbacks with the Littoral Combat Ship have underscored the need for closer scrutiny of our acquisition process from contracting practices to ship production monitoring.

Additionally, as a result of Hurricane Katrina and the recent strike at Northrop Grumman ship systems Ingalls operations, the Navy is working within GSS to review the baselines for current NGSS contracts with the Navy and understand how to best execute the future shipbuilding efforts. The review effort will help both the Navy and NGSS to closely monitor and best utilize manning resources and facilities.

At your request, I am pleased today to provide you an update on our current surface ship shipbuilding programs. LPD–17 and LPD–18 have been delivered to the Navy and are now commissioned. LPD–19 is scheduled to be delivered this fall.

LPD–17 was accepted with incomplete work as a result of higher than planned ship construction costs and to mitigate potential schedule or cost impacts to follow-on ships in the shipyard. The Navy decided to complete portions of the ship in the home port area after delivery to both improve the sailors' quality of life and to allow the remaining work to be completed more affordably by local ship repair companies using competitively bid contracts.

LPD–17 recently completed her Post Shakedown Availability this month. All compartments and mission critical systems are now complete. The remaining items, mainly routine maintenance work, are scheduled to be completed in the upcoming maintenance availabilities. Lessons learned and improvements identified on LPD–17 during production and since delivery have been incorporated on follow ships.

In light of competing priorities for resources, the President's budget for fiscal year 2008 represents the best balances of resources to requirements. However, an additional LPD–17 class ship was identified by CNO as the number-one item in this year's unfunded program requirements letter. If Congress were to provide sufficient additional funds, they could be used for procurement of a tenth LPD–17 class ship in mid–2008.

General Dynamics NASCO has been performing well on the T–AKE class, with three ships delivered, a successful operational evaluation, a fourth ship to be delivered later this year, and a fifth, sixth and seventh ship under construction. The Navy and NASCO are in the process of restructuring the T–AKE contract to address the procurement of the next five ships—two more than the original 12 planned.

This approach will benefit both the Navy and the shipbuilder and results in the lowest overall cost per hull over the entire class. Two additional T–AKEs were identified by the CNO in his letter as well, and the Navy would support procurement of additional ships, if sufficiently funded.

The CVN–21 acquisition program is designed to improve operational capability while simultaneously driving down manpower and total ownership cost. Since Milestone B in April 2004, the program has made significant progress. The Navy plans to award detail design and construction contracts for the lead ship of the class in 2008 with planned delivery in fiscal year 2015.

The program is fully funded to the current cost estimate, which was independently validated by Office of the Secretary of Defense (OSD) CAIG at Milestone B, and is within the congressional cost cap. All critical technology elements are fully on track to support the planned construction schedule.

The President's budget request for CVN–21 program includes funding for the CVN–78 Ship Self Defense System, or SSDS. Full funding of this budget request is critical. All 62 ships of the DDG–51 class have been authorized and appropriated. The final ship, DDG–112, is scheduled for delivery in 2011.

The President's budget included a request for funding primarily for production shutdown requirements expected with the shipbuilders and the government furnished manufacturers. Congressional reductions to this requested budget may prevent the Navy from meeting our contract obligations in 2008.

The Navy is continuing its dual lead ship strategy for the DDG–1000 program, with lead ships to be constructed concurrently at NGSS and General Dynamics Bath Iron Works. Contracts for detail design were awarded to the shipbuilders in August 2006. Both contractors were also awarded contracts for long lead material and pre-production planning to support detail design and construction in June of 2007. Construction contracts for the dual lead ships are planned to be awarded later this year.

The Navy, Northrop Grumman Ingalls Ops go in different options on the specifics of the construction schedules, based on the future workload of both shipyards. The DDG–1000 program continues to execute on cost and schedule.

CGX is envisioned to be a highly capable surface combatant tailored for joint air and missile defense and joint air control operations. The analysis of alternatives is ongoing, and it started in June and is scheduled to complete this year. The AOA is examining both fuel-efficient conventional power plants and nuclear power plant alternatives for CGX.

The Navy takes seriously the House's desire that we carefully consider nuclear power for CGX and other future platforms. However, the Navy does not support legislation that would effectively

require nuclear power for major combatant vessels. The Navy supports a process that includes a rigorous technical analysis of alternatives and matches requirements with operational demands of the warfighter for the projected threat.

The President's budget in 2008 also requests outfitting and post delivery funding that ensures our ships will receive their full allowance of spare parts and operating space items. It allows for post delivery correction of deficient government responsible items and ensures the ability to perform essential tests and trials.

Our 2008 request is fully adjusted for delivery delays resulting from Hurricane Katrina and other factors. Any reduction in this area would severely jeopardize our ability to deliver fully operational capable, and safe ships.

After an extensive LCS program assessment, the Navy has developed an executable program that adjusts the acquisition profile, ship cost estimates, budgets and schedules. It also provides resources for effective management of costs, production and technical risk to deliver the ships to the fleet to support the urgent and revalidated warfighting requirement.

Progress on the LCS program continues. LCS–1 is reported by Lockheed Martin to be approximately 84 percent complete. The Navy currently projects LCS–1 will conduct underway trials next spring with delivery in summer of 2008. LCS–2 is under contract with General Dynamics. The contractor estimates the ship is approximately 53 percent complete in construction at Austal in Mobile, Alabama. The Navy projects LCS–2 to launch in early 2008, and deliver in late summer 2008.

LCS–4 has not yet begun fabrication. The Navy will continue to monitor GD's performance on LCS–2 and 4 and assess the need for further action if GD experiences cost growth comparable to LCS–1.

The Navy appreciates Congress's support at a recent reprogram request for the portion of the 2007 LCS funds and looks forward to working with Congress on the remaining funding required to execute the revised plan.

The restructured LCS plan also includes reduced procurement of the Flight 0 sea frames in fiscal year 2008 and fiscal year 2009 to address critical warfighting gaps. The President's budget request for 2008 is $911 million, and that is required to procure two LCSs in fiscal year 2008.

Additionally, the Navy is requesting a change in the current statutory cost cap to $460 million per ship for the two proposed fiscal year 2008 procurements. This estimate includes basic construction costs, and represents a 55 percent increase in the sea frame cost, and reflects the restructured program in the revised ship end-cost estimates. Without an adjustment to the cost cap, the Navy will not be able to procure any new LCSs in fiscal year 2008.

The two existing sea frame designs will undergo operational performance testing in fiscal year 2009, and the results will be considered as part of the Navy's evaluation for a single sea frame design selection. Flight 1 ships will be based on the selected design and will incorporate lessons learned from tests and trials.

The Navy also intends to implement a government furnished open architecture common combat systems and C4I suite as part

of Flight 1 to optimize lifecycle cost and capability across the family of surface combatants. Subject to OSD approval, the Navy intends to hold a full and open competition for the procurement of the Navy's Flight 1 design in fiscal year 2010 and beyond. The proposed acquisition strategy does not preclude continuing with those sea frames, if the operational evaluation concludes the need for both.

The Navy has taken swift action to ensure the lessons learned from the LCS program cost growth do not reoccur for other Navy programs. As an initial response to the findings of the LCS program assessment, ASN(RDA) directed a series of specific actions to reduce risk and improve management of Navy acquisition programs.

These actions have included a review of design build concurrency risk in Navy programs, reviews of acquisition program performance conducted by portfolios such as air or ship programs, and a review of staffing levels, organization and qualifications in both our PEOs and our onsite contractor oversight.

As a longer-term effort, ASN(RDA) is leading the Navy acquisition reengineering to better control cost and requirements growth, more accurately estimate the cost risk in Navy programs, and match contracting models and incentives to the cost and risk of each program. The efforts will focus resources where they are most needed and ensure our higher-risk and most critical programs are resourced properly.

In closing, Mr. Chairman, I would like to thank you for this opportunity to discuss Navy shipbuilding. I think we have a strong plan to ensure the way ahead for the Navy to meet the fleet requirements in an affordable matter. I continue to look forward to working with you in the future.

Admiral Sullivan, Admiral McCullough, Mr. Summerall and I will be happy to answer any questions.

[The joint prepared statement of Ms. Stiller, Admiral Sullivan, Admiral McCullough, and Mr. Summerall can be found in the Appendix on page 116.]

Mr. TAYLOR. Thank you very much, Ms. Stiller. And other than your remarks on the nuclear cruiser, I thought it was well-said. [Laughter.]

Ms. STILLER. I am pretty good at it.

Mr. TAYLOR. For the record I would like you, just for the fun of it—no, not for the fun of it—for the record, I would like your estimate as to fuel costs for that cruiser 20 years from today—cost and availability. Because if it is nuclear, I can tell you what the cost and availability of the fuel is. For a conventionally powered platform, I would like your projection.

Ms. STILLER. Sir, I do not have a projection on that.

Do you want to—on the affordable——

Mr. TAYLOR. Conventionally powered—for the record, I would like the Navy's estimate of fuel cost and availability for 20 years from now for a conventionally powered cruiser.

Ms. STILLER. I would have to take that for the record, sir, because I cannot predict the price, and I think that is your point.

Mr. TAYLOR. Or the availability.

Ms. STILLER. Or the availability.

Mr. TAYLOR. That is what the point is, as the gentleman from Maryland has done, I think, an excellent job of making our nation aware of.

The gentleman from Maryland is recognized.

Mr. BARTLETT. Thank you very much. Thank you, Mr. Chairman, for that question. I would suggest that the cost would be very much higher and the availability limited 20 years from now.

I have some questions that I would like, because of constraints of time, some brisk answers to. If, upon reflection, you would like to add more material, would you please do that for the record?

The first question, I think, is especially important because the decision, I understand, to start construction of LCS–4 is happening this week.

In the March 29th brief provided to members, the Navy stated that, as a part of the LCS program restructuring, the path ahead would rely on the use of internal Navy cost estimates, as though the Navy has established specific cost thresholds that would trigger a stop work on LCS–4 and possibly a renegotiation of the LCS–2 and 4 contract.

Understanding that the cost estimated at completion, the EAC, is competition-sensitive, has the Navy's internal EAC for LCS–4 met or exceeded the cost threshold established by the Navy?

Ms. STILLER. No, sir. The cost threshold was actually established for LCS–2. And no, sir, they have not reached that threshold that you are speaking about.

Mr. BARTLETT. Okay. My second question, a really important one. The MRAP program has been given a DX priority level, the highest priority for procurement of steel. Given the importance of the MRAP program, how will this DX priority level affect shipbuilding in the near and far term?

Ms. STILLER. We have not yet evaluated in great detail, because we have not been told exactly. You have to look at how material is procured when you are in a shipbuilding environment. They will buy the steel as they are getting ready to build those particular modules, so it might have an impact on shipbuilding, but right now we have not seen any impact on that.

Mr. BARTLETT. In the process of establishing this priority——

Mr. TAYLOR. Would the gentleman yield?

Mr. BARTLETT [continuing]. Did anyone talk to you about the possible effects on your programs, if they gave this kind of priority to the MRAP program?

Ms. STILLER. Yes, sir. There has been a data call to look at impacts on all programs across the department. What has not been decided is where will the resources be deviated from, whether that will come from shipbuilding or not.

Mr. SUMMERALL. Mr. Bartlett, we are providing data, as Ms. Stiller has said, on all our shipbuilding programs to RDA so they can start to formulate a sense of what our requirements are going forward. So we are starting to put the data in place and anticipate that.

If I could, just to supplement Ms. Stiller's response to a prior question, we had a production readiness review on LCS–4 on June 28th. Coming out of that, we reached agreement—actually, the company proposed this, and we concurred with it—to consider start

fabrication in the September timeframe. As far as I know, that is still the plan going forward.

Mr. TAYLOR. Will the gentleman yield?

And this is a follow-up. The Army was nice enough to take me to Aberdeen yesterday and show me the nine potential MRAPs that they are taking a look at. And one in particular caught my eye. It was under license from the Israelis. And they said, "Well, you know, if we order this one, we are going to have to order the top half from the Israelis, and we could domestically produce the bottom half."

As I am looking at those fairly flat steel panels on the top half that have obviously been cut probably with a laser, given how pretty the cut was, because we are talking now—I had an opportunity to visit with the secretary of the Army this morning for perspective—you know, you are looking at 19,000 potential panels—each one of those panels.

And one of the things that the shipyards are telling us is, "Well, we can't invest in this laser cutting because there isn't the volume," which leads to the question to what extent is the right hand of the DOD speaking to the left hand? To what extent are you going to places like the shipyards and saying, "Hey, if we are in a position to work with the vendor to have this steel cut at your facility and then shipped to a manufacturing plant, would you then look at getting a more efficient high volume machinery than you have now—making those investments?"

I am not convinced there is a lot of integration going on as far as that kind of thought, but if there is, I would like to know about it.

Ms. STILLER. There is certainly an opportunity that would present itself. In the past the shipyards have done work on non-ship programs, so certainly that is an opportunity.

Mr. TAYLOR. Again, Ms. Stiller, you are a very good person. We are lucky to have you serving our country, okay?

So, with that said, this is a high-priority program. And my apologies to my friend Peter Geren for a temporary lapse in remembering his name, but Secretary Geren actually threw the number out of 17,700 this morning. That is on top of the approximately 4,000 that have already been ordered.

So we are talking about a mass production of something that the military needs on one hand with the MRAPs. We are talking about something that our shipyards need to be going to, as far as laser cutting, laser welding. And they have had a reluctance to do so, because they don't see the need for volume.

And this really is an opportunity to get the mass production, high-order quantity, short delivery time that the Nation needs, and serve the long-term best interests of the shipyards. And I really do think it is important that there be a greater cooperation between the MRAP program and what you are trying to accomplish.

And I don't say that to scold you. I say that as knowing that you are a capable person, to encourage you to try to make that happen—and knowing Secretary Winters' desire to modernize the yards to the greatest extent possible, knowing at the end of the day the taxpayer is going to pay for all of this.

Ms. STILLER. Mr. Chairman.

Mr. TAYLOR. The six Navy shipyards have only one customer. We are their one customer. But this really is an opportunity to do some short-term good in the case of the MRAP and some long-term good. It is something the Nation needs.

Ms. STILLER. Sir, I will be happy to take that back and work with the MRAP program.

Mr. TAYLOR. With that, again, I very much appreciate you being here. I have a meeting concerning the Gulf Coast recovery with the speaker, so I hope you will excuse me, and I am going to turn the chair over to Mr. Ellsworth.

Mr. BARTLETT. Thank you.

I have several more questions, but I will ask just one more here and submit the others to you for the record, if that would be okay.

My understanding is that this last week there was a cure notice given by Lockheed Martin to Marinette Marine. What is the Navy's assessment of this contractual action taken by Lockheed Martin on LCS–1? Does the Navy believe Lockheed Martin and its subcontractor Marinette Marine will be able to achieve propulsion trials by December of 2007?

Ms. STILLER. I will start this, and then I will defer to Mr. Summerall on the propulsion trials.

As you know, the Navy's contract on LCS–1 is with Lockheed Martin, so our contractual relationship is with Lockheed Martin. The Navy does not have privity of contract with Marinette. There is a contractual letter. We are aware of a contractual letter between Lockheed Martin and their subcontractor, and they are working to try to resolve some issues so that they can move forward on the program.

And I will defer to Mr. Summerall on the propulsion trials and where we see that now.

Mr. SUMMERALL. It is true as a priority we would like to see that ship go to propulsion trials in December as a risk mitigation effort. If we did trials in December, we would be able to address whatever needs were identified during those trials during the ice period up there.

We have asked the Lockheed Martin team to give us an integrated master schedule and a resource plan to support that schedule that would get us to propulsion trials in the December timeframe. To date we have not yet received that.

I believe that to try to expedite that effort was one of the reasons Lockheed made the contractual request that they did to their subcontractor. We hope to get the initial submittal of that integrated master schedule in the next few weeks.

Ms. STILLER. Presumably, Lockheed Martin selected Marinette Marine because they had a long history of delivering on time on budget. And as was emphasized in the first panel, what Marinette Marine is building under contract to Lockheed Martin is essentially a sea frame—that the major uncertainties and sophistication will be in the modules that are procured separately.

Mr. BARTLETT. When will we learn what went wrong—that this company that was selected because they have a long history of delivering on time on budget now has failed to deliver either on time or on budget? When will you be able to tell us what happened?

Mr. SUMMERALL. Sir, as we outlined on our February hearing, what we think went wrong is the schedule pressure on what is basically a good contractor driven by requirements of schedule and a design that was far more complex in the end than they bid on the ship.

And the sophistication of that design, driven by the change in what I would call the builder's codes—not the military requirement, but the building specs—caused them to do a lot of rework, caused them to not be able to follow the cardinal rule of large projects, which is make sure you have the design and the drawings complete before you start construction.

A lot of rework was done, a lot of out of sequence construction was done, and that is what got us off track.

Mr. BARTLETT. Thank you very much.

Thank you, Mr. Chairman. I will submit my remaining questions for the record, if that is okay.

Mr. ELLSWORTH [presiding]. Thank you, Mr. Bartlett.

The chair recognizes Mr. Courtney from Connecticut.

Mr. COURTNEY. Mr. Ellsworth, a follow-up on the last question.

Secretary Stiller, given all the problems and the sort of scrambling that has been going on to try and figure out what went wrong and how to fix it, does it make any sense for us to still be procuring two ships a year in 2008 and 2009? Is it possible for us to even accomplish that, given what we already know about what went wrong? And it still seems like up until just the last few weeks ago that there are still problems.

Ms. STILLER. Yes, sir. From a capacity perspective, from the acquisition perspective, we have capacity. We could execute additional ships. We looked very carefully at that as we restructured the entire program.

The real driver behind why we want to continue in 2008 and 2009 is the warfighting requirement, and I will turn to Admiral McCullough to address that.

Admiral MCCULLOUGH. Yes, sir. There is a critical warfighting gap in the area of swarm surface combatants carrying in our ship cruise missiles as well as the rapid clearance of sea mines—in specific areas of the world, sea lines of communication.

We have this gap today. We need those ships to meet the warfighting gaps that have been identified, and so the Flight 0 ships in 2008 and 2009 are very necessary from a warfighting requirement standpoint.

Mr. COURTNEY. Okay. Again, just looking at the memo that was prepared by the staff which described a fire that took place a couple of months ago and again, the cure notice.

Again, I think what the admiral just testified to was obviously a strategic rationale for us moving forward, but it just seems that we also have to budget and authorize based on what is feasible, and even the Navy itself has been self-critical about being over-optimistic.

Are we really there now where we really feel like it is okay for Congress to proceed with that type of procurement schedule?

Ms. STILLER. Yes, sir. As I said, we laid out in great detail. We looked at the program holistically and said, "What makes sense?" And that is why the quantities are less than what we had proposed

in the President's budget 2008 omission. We said, "Okay, what are the right quantities from loading in the shipyards, et cetera."

So, yes, we can accommodate it, and as I said in my statement, the ships will both deliver in 2008, and the plan is in fiscal year 2009 for both sea frame designs to go through the operational evaluation.

So certainly procurement can continue in the 2008 and 2009 timeframe even while that evaluation is ongoing so that we meet the warfighter need.

Mr. COURTNEY. Thank you, Mr. Ellsworth.

Mr. ELLSWORTH. Thank you, Mr. Courtney.

The chair would recognize Mr. Sestak from Pennsylvania.

Mr. SESTAK. Thank you very much. I had one question, I think, on the power issue, now that he has left. [Laughter.]

Admiral Sullivan, as I kind of remember your study—haven't looked at it for a while—but it had something like $73 per barrel, and then it went up to what is called, I think—and I have forgotten these words—fully burdened costs, which is like $153 or something. That fully burdened cost takes into account all the storage facilities, the acquisition of oilers and things like that.

Could you get back? We have had some discussion on this, if you remember, a few months ago, and I was supposed to get together with you, but I would like to know that when they did their cost-benefit analysis and the curves crossed, did you include in that the fully burdened cost? It seems to me that at least some elements of the burdened cost are a sump cost.

If this nuclear power capability is to be CGs—I think that is what it is supposed to be—cruisers—we are still going to have such an enormous amount of other ships. Is it 316?

Ms. STILLER. Thirteen.

Mr. SESTAK. Three-hundred-thirteen. It has changed. That 313 is to come about—only a relatively small amount will be nuclear-powered. So that is kind of a sump cost. Should that have been considered into your overall nuclear power study of when it became cost-effective?

Admiral SULLIVAN. I apologize for not following through on that.

Mr. SESTAK. No, we were supposed to—we are good classmates.

Admiral SULLIVAN. We had a miscommunication. And I believe that the cost of those fuel farms was included in the fully burdened cost. What I would like to do is take for the record the analysis both with that and without that.

Mr. SESTAK. If they included all of those fully burdened costs, it is kind of an unfair metric, I think, because we are going to have those facilities anyway for all the other ships. And when I read the study, it looked to me as though they included them all, I thought. I am probably wrong.

Admiral SULLIVAN. We will get you that for the record, sir—both ways.

Mr. SESTAK. DBR—I have to go to a hearing on habeas corpus. But let me ask you maybe instead about CGX. Do you still expect it? Is it 2015, ma'am, you said you expect it? When is CGX supposed to come along? 2019?

Ms. STILLER. The lead ship procurement is in fiscal year 2011 with delivery in 2019.

Mr. SESTAK. 2019.

Ms. STILLER. IOC in 2019. Delivery in 2017.

Mr. SESTAK. All right. I was just curious on that one. And DBR is probably, as they said in the previous panel, the key long pole in the tent, correct?

Admiral MCCULLOUGH. Not for the CGX, Congressman. The DBR is——

Mr. SESTAK. I am sorry. The——

Ms. STILLER. DDG–1000.

Mr. SESTAK. What is the radar called?

Admiral MCCULLOUGH. On the CGX?

Mr. SESTAK. Yes.

Admiral MCCULLOUGH. We are currently going through an analysis of alternatives based on the potential threat set in 2024, and the initial indication is that it will be a two-frequency spectrum radar BNS band in the 3.5-gigahertz range.

Mr. SESTAK. This is the one that would be embedded?

Admiral MCCULLOUGH. Yes, sir. Well, there is an embedded radar that Northrop Grumman Electronic Systems and Integrated Systems has shown the Navy. I don't know whether that is specifically the one that we would choose, but Northrop Grumman has at least shown that capability and concept embedded in the deckhouse.

Mr. SESTAK. All right. There were some studies that were being done in other worlds that had held some propensity. Are we still going down this path? Do we still think this radar is going to be able to do what we want on the size that we want on the ship?

Admiral MCCULLOUGH. Yes, sir. I believe that is within projected technology that would support that radar coming online potentially to support. In 2019 I would see that ship.

Mr. SESTAK. All right. I asked a question of the other panel. Do you expect—I didn't ask this one, but it was leading to—DDG–1000 to split to the right again? Is there any expectation right now that software or engineering designs or anything with the vendors that you expect it to slip to the right?

Mr. SUMMERALL. No, sir. We are at the point where we are getting ready to hopefully release the RFP for the two lead ships construction. Detail is on track. Based on current schedule, we project we will be 85 percent complete with detail design when we go to start fabrication on the two lead ships.

Mr. SESTAK. So the software configuration is coming along.

Mr. SUMMERALL. Yes, sir, it is. And during the transition to production phase three phase of the program, as you know, sir, we actually completed two million lines of code, 10 EDMs on cost on schedule, a $2.9 billion effort to mitigate a lot of risk of this program.

We are still on track. We are reporting metrics quarterly to OSD—CPR analysis and other metrics in a package to OSD—so this is all available to the CAIGs. They can look at it during milestone——

Mr. SESTAK. So we won't hear two or three months from now that engineering control system code has caused any perturbations in the overall tactical combat systems code and delayed this down the line?

Mr. SUMMERALL. No indication of that at this time, sir.

Mr. SESTAK. All right. Thank you.

One other thing on LCS. I was taken with LCS. It seems to me that in DDG–1000 you kind of had PEO ships kind of in single belly button with IWS supporting and others. LCS—it seems as though there is quite a diverse group of PEOs involved. And I jotted some down. There are IWS ships. These begin to get into modules.

Ms. STILLER. Sure.

Mr. SESTAK. We have submarines. People get involved with SPAWAR with the communications. We have warfare centers that are involved as we get into Littoral-type stuff.

Has there ever been any thought that we need to take some of the people out of the decision loop in a sense and go to a more of a single button type of approach as we do in DDG–1000 as we look back upon any lessons learned with LCS?

Ms. STILLER. On the ship side——

Mr. SESTAK. Particularly the interface of the module, since that is the real combat system and all—that you have these people that kind of don't work for one another, but they are really responsible for very important parts.

Ms. STILLER. Yes, sir. On the ship side, as you said, PEO Ships has the responsibility for the sea frame. On the mission module side, PEO LMW, Littoral and Mine Warfare, has responsibility for the mission modules. And so they go and integrate with SPAWAR, the laboratories and others to pull together the mission packages. They are the belly button.

As for the interface, there is a very detailed interface specification that was part of the delay in the program way back when, as we stopped and we said we need this interface described for both sea frames so that the mission modules would work on either sea frame seamlessly.

And so that interface document is developed. It is a living, breathing document that both PEOs work to. And ultimately, if there are issues, ASN(RDA) has responsibility over both of those PEOs. So on the mission module side, there is a single belly button to deliver the mission modules.

Admiral SULLIVAN. We have added an extra level of oversight to at least the mine warfare mission in that PEO Ships has the ship. PEO LMW has the module. Two program managers in PEO LMW—one for the module, one for the mine countermeasures sweep, and PEO–A in NAVAIR has the responsibility for the mine sweeping helicopter.

So there are four program managers, three PEOs, two SYSCOMS. Admiral Venlet and myself and his predecessor, Admiral Massenburg, have periodic discussions with the program managers and all the PEOs in the room to synchronize scheduling.

Mr. SESTAK. The last question I had is, as I have to go next-door, the requirements for DDG–1000. Have there been any changes in requirements through time contracted——

Admiral MCCULLOUGH. Congressman, there has been no change to the warfighting requirements for that ship. One of the things we have done is lay out cost drivers from a capability standpoint, and when we look at potential cost trades that drive the cost of the ship

down, the PEO and I, when I was in 1986 at the record surface warfare, would sit and figure out what we could do to get at cost.

And it enabled us to reduce cost a couple of hundred million dollars by taking non-key performance parameters and non-key system attributes out of the ship to find those cost savings. And we laid it out for the leadership in a chart that showed where you could go get those type trades, as opposed to where you would get trades that affected KPPs, and then where you would get trades that affected both the KPPs, key performance parameters, and the schedule of delivery. So the warfighting requirements——

Mr. SESTAK. Which EW system are you going with?

Admiral MCCULLOUGH. I am sorry, sir?

Mr. SESTAK. Which electronic warfare system are you going with?

Admiral MCCULLOUGH. We looked initially at MFWS, and we found that that probably was not the right system—Multi-Frequency W System—and so, because of the way that system was developing, we did a fall-back to a very needed Surface Ship Electronic Warfare Improvement Program.

Mr. SESTAK. Is it as capable?

Admiral MCCULLOUGH. Yes, sir, it is.

Mr. SESTAK. Why did we fall back to it?

Admiral MCCULLOUGH. It has to do with the antenna arrays and how much capability you can put into various antennae array.

Mr. SESTAK. Would the other one, if it had borne out, been more capable?

Admiral MCCULLOUGH. No, sir, not from a warfighting perspective. From an antenna co-site capability, probably. But we don't envision that antenna technology.

Mr. SESTAK. So Nulka will be there?

Admiral MCCULLOUGH. Sir?

Mr. SESTAK. Nulka would be there?

Admiral MCCULLOUGH. Yes, sir.

Mr. SESTAK. You are sure?

Admiral MCCULLOUGH. Yes, sir.

Mr. SESTAK. Okay. And Tomahawk is still there.

Admiral MCCULLOUGH. Yes, sir. You can put Tomahawks in the launchers.

Mr. SESTAK. And could VLA?

Admiral MCCULLOUGH. Yes, sir. It will fit in the launchers.

Mr. SESTAK. In the tail?

Admiral MCCULLOUGH. I have to get back to you on that, Congressman. I don't remember off the top of my head.

Mr. SESTAK. I was just curious. There had been some talk that as we came down in cost—it appears it is wrong—is that we kept the same capabilities.

Admiral MCCULLOUGH. Yes, sir. We have kept the same key performance parameters in the ship and the same warfighting capability in the ship.

Mr. SESTAK. Thank you very much.

Admiral MCCULLOUGH. Yes, sir.

Mr. ELLSWORTH. Thank you, Mr. Sestak.

We have got big shoes to fill here for Chairman Taylor. We will give it a try.

Thank you all for being here.

Going back to some of the prior group's testimony, we talked about the construction manager theory, and I would like your analysis on the continuity of naval employees that oversee these projects.

A, do we have that person on scene that his focus is keep this thing going, an on-scene person that watches it day to day as these changes come on, but he has that authority? And their length of stay—the turnover that is watching out for our side—I would like your analysis on that continuity employee and how we might improve that.

Ms. STILLER. Yes, sir. There are tenure agreements for the PEOs, the program executive officers, and their executive directors—four years—as well as the major program manager. It is a four-year tenure agreement or until you get to a major milestone. That is the standard for all large programs, so pretty much any shipbuilding program will fall under that requirement.

As for the on-site support, we have the supervisor of shipbuilding that falls under Admiral Sullivan's expertise, and I will let him talk to you about program managers' representatives that are actually physically in the shipyard.

Admiral SULLIVAN. Okay. So the waterfront is supervised by a Navy captain engineering duty officer who has been in the business probably for at least 15, probably 18, years, rotating through various jobs. His or her tenure on the waterfront in the command job is approximately 3 years.

And working for that organization are a variety of disciplines from quality assurance specialists to engineering processing folks to progressing folks who oversee the ship. And in our previous testimony, particularly on LCS, we went through the lack of numbers as far as depth charge of the folks in the supervisor's office.

The ship was being built in Marinette, Wisconsin. The supervisor herself was on the waterfront at Gulf Coast in Ingalls. And so we had a detachment team up at Marinette. And we had far fewer people doing that oversight than were required, and the reason for that was a variety of reasons—one, the hurricane; two, the four supervisor offices that supervised construction on our new construction shipyards had been cut 50 percent in staff since 1992.

That doesn't relieve us of the responsibility of having to make sure we have sufficient folks onsite for a high-risk program. We just didn't ramp up the staff fast enough, so when this all went down in January-February of this year, we had about eight people onsite. We are now up to 18, headed for 20, which is our steady state onsite. So we are in the process of correcting the problem, but certainly we undermanned that at the start.

Ms. Stiller mentioned a thing called the program manager's rep. That is a naval officer of the lieutenant commander or commander rank, typically has been in the business anywhere from three to eight years, and that person has a dual reporting responsibility.

They report to their waterfront supervisor of shipbuilding, and they also report to the Washington, D.C., program manager who has that four-year tenure agreement. So that is a pretty good arrangement. It is very powerful, because that person has the autonomy of having to report to both bosses.

That said, earlier the previous panel talked about lack of cost reporting in the Navy. We have two problems with cost reporting. First, in those cuts of the personnel on the waterfront to go watch the ships, earned value management was one of the disciplines that fell by the wayside, because we just couldn't sustain the staff to do meaningful, independent cost verification. That is the first thing that we have started to work on as we stood those back up.

Second, there is a backup at headquarters there where our cost estimating shop would have normally done that earned value management independent from the Washington, D.C., viewpoint, looking at all the numbers coming in from the waterfront. Headquarters staff has been cut, between the program officers and my supporting infrastructure, 51 percent since 1992, and again, earned value management is one of the disciplines that went by the wayside.

I have asked for an increase in the staff in that office so we can re-grow, but that is tough to re-grow overnight, because that is a specific discipline that has to be generated. Fortunately, my counterpart in the Naval Air Systems Command stuck with the earned value management system, and they have folks who may be able to help us in that process.

Mr. ELLSWORTH. What you have asked for, is that the magic wand, in your best estimate, that says, "This is exactly what I need"? Have you asked for exactly what you need, or have you fallen below that on the scale, would you say? If you had total control—the budget, the manpower, and you could wave the wand?

Admiral SULLIVAN. Well, everyone would like margin in their numbers. I have asked for program office people. I have asked for technical people. And I have asked for onsite supervisors of shipbuilding people, and I have asked for what I consider to be the minimum.

Mr. ELLSWORTH. Can you explain? You know, CBO was in here an hour ago, and it appears that their cost estimates were more accurate than the Navy's. Is that due to the fact that you were understaffed and didn't have those people on there? Again, do we go back to that turnover? Can you give me some analysis on that?

Admiral SULLIVAN. I would tell you we tend to not like the first cost estimate that comes out when we go first cost a ship. And so we go sharpen our pencils.

Our initial cost estimate for LCS was $400 million. That was based on a mil spec model—pretty crude—at the very, very inception of the program, based on only a set of characteristics.

Subsequently, in dealing with the information coming in from the competing teams, our cost estimators came down to be within I would say $30 million of the contractors' cost estimates. And that is probably for a variety of reasons, one of which is pressure and another which is a lack of good cost estimating tools for this particular type of ship, where it comes to LCS.

And I think there was a lot of pressure from the Navy to control that program cost, and it turns out that when you set a very aggressive cost target, people will lean very far forward to try to produce that cost. So the over-optimism that you discussed on the previous panel was definitely there for LCS.

Mr. ELLSWORTH. Admiral, when you said that the cardinal rule of shipbuilding was violated, that they started building before they had the finished—wouldn't there be a point where, when you had the construction documents, that somebody would say, "Ooh, the last hundred pages, the last thousand pages are gone here; let's not start this"? Should that not have been caught when we said, "Somebody is violating a cardinal rule; we are not going to start construction here," during the project review? Can you elaborate?

Admiral SULLIVAN. Again, we went forward with full knowledge of that state of the design, and again, the pressure for cost and schedule were pervasive, and everybody leaned far forward, and you have seen the result.

Mr. ELLSWORTH. When we have changes—this thing starts coming up; the hull is built; and I asked this in the last panel also—certainly, there are going to be changes. And I have been involved in projects where, along the way, we have said, "This just isn't going to work. We need to change that."

Who do you see having more changes: the shipbuilders themselves that say, when they get it up, "This pipe won't go through here; engineering-wise we can't do this"? Versus when you guys go in and say, "Look, my sailor needs this; I need more of this," whatever?

Who has more of those changes that obviously are going to add to that cost when we have got to re-engineer or you want something? Where does more of that come from, the engineer or from the Navy?

Ms. STILLER. The Navy program manager is limited in what changes he can approve, and there are five areas: safety, unavailable contractor furnished equipment, test and trial deficiencies, contractual defects, and statutory and regulatory changes that are passed down. So a program manager is very limited on the amount of change he can approve.

In the case of LCS when—we have also testified before—the naval vessel rules, which are your building codes, were also in development during the design of the ship and—well, not into construction, but they were going on at the same time. You had the building specs being developed at the same time, so that caused a lot of change and a lot of churn in the case of LCS.

But certainly on a lead ship, you are going to see challenges as you go into production that the contractor is going to find as he starts to produce. And in most of our combatant vessels, we used a design tool that is very mature so you can see interferences and know ahead of time, but in some cases you don't catch everything.

Mr. ELLSWORTH. On the changes on the LCS–1, my note shows 58 proposed change orders. Given the current issues and the estimated costs, are these—the things that we list are 58; I don't have them in front of me—we would like to have, nice to have, or we have to have—these are "need these" changes.

Admiral SULLIVAN. If you start the clock back to when they first started, when they were first awarded the contract, there were certainly more changes than that. The majority of the changes were generated by the shipbuilder going back and looking at the naval vessel rules—again, the building codes.

The military requirement for the ship has not changed at all, but that is at the top level. There are tiered requirements that go all the way down to how you will assemble pipes together. The shipbuilder looked at the naval vessel rules as they were finally published and had to go back and do a lot of changes to his own diagram. And some of those didn't come before the Navy; they went before the shipbuilder's own change control board.

But then the Navy was also looking at and approving drawings and looking at and approving a ship specification that the shipbuilder derived from naval vessel rules and the military requirements. And we would, on a safety or military performance basis, tell them that "Well, this doesn't meet the naval vessel rules."

The current round—we are trying to close that out right now; if it is 58, that is approximately the number—were actually instituted by my chief engineer basically going up to resolve issues that we had been arguing about—well, not arguing—discussing with the shipbuilder, because it is a pretty robust discussion.

And he actually crawled through the engine room, and they are all safety to the sailor-related deficiencies, such as you can't access a circuit breaker because there is a pipe running in front of it or a sailor running across the deck plate and there are three pipes right in his walking path that he would trip over or you have a shaft coupling that is four to five feet in diameter rotating at several hundred rpm with no guards over it that could kill a person walking past it.

So they are small changes, but they are significant in that they are all safety related. Anything in that screening, anything that was not absolute safety or operability related was tossed. There were about 20 to 25 changes tossed in that process.

Mr. SUMMERALL. Admiral, if I could just follow on what you just said. I think in large part due to Admiral McCoy's personal visit up there on I believe it was the 13th of July, we were able to come to agreement on the technical baseline, and the changes moving forward are just as the admiral said.

There are some changes in the machinery spaces for clearance safety issues to enable us to get underway on trials, but any additional changes will be deferred to post delivery. So we are minimizing changes going forward to absolutely bare minimum.

Admiral SULLIVAN. I would characterize it as a punch list.

Mr. ELLSWORTH. This kind of goes back to one of my previous questions and one for the former panel. Congress changes a certain amount of seats every two years. The chairmen change. You all are career, and we certainly appreciate that. We are kind of the visiting dignitaries for a certain amount of years.

What would you say to the folks that might think that because of that reason, because we change—we have new freshmen on Seapower—that the contractors, even though they are great contractors—they have built us great products—know that coming in and that by the time these ships get built, there is not going to be the oversight. And what this Congress approves for ships down the road could be totally different than that, and that we don't have that continuity just becomes the regular part of doing Federal business as expected.

And I said this on the last panel. I built a jail two years ago, and I was so proud that we came in half-a-million dollars under budget. Everybody was shocked in my county that a government project came in under budget. That was just almost unheard of. And so we have almost come to expect that Federal budgets can't be on time and under budget or even at budget.

I know we have overruns, and certainly a ship with its complexities is not the same, but that we are not putting enough pressure and enforcing the importance with the taxpayers' dollars of saying this thing really needs to be more in line with what you are estimating, even though it is going to be three years out. You have got to be better at estimating what the cost is than what you are doing.

We had a boat that has been estimated from $6 million when at the first step. Now it is up to $16 million. I don't think the American public minds so much a little bit here and there, but $6 million to $16 million is pretty substantial. And I guess I would like someone to answer that we are going to do our best, and we are improving.

How do we assure the American public and our vendors that we have got to do a better job of keeping these costs closer to the estimates of what they are? That is the only way we can budget—if we know what it is. And we couldn't buy a car like we are buying these ships.

Admiral SULLIVAN. Sir?

Ms. STILLER. Yes, sir.

Admiral SULLIVAN. Do you want to take it?

Ms. STILLER. I will start.

Admiral SULLIVAN. Okay.

Ms. STILLER. One of the keys that I mentioned, too, in my statement is stability. Over time we have not given the shipbuilders the ability to look ahead and say, "This is what the Navy plans to buy."

And with our 313-ship Navy and where we want to go, we have laid out that roadmap, and we are attempting to stick to that roadmap so that we show them we are serious and where we are headed. Giving them that stability allows them to estimate what a ship is going to cost, knowing what the future is looking like. It is harder if you are not certain what is coming.

So that has been, I think, a critical factor. It had to start with the Navy, and we are committed to that. And I think that is an important first step in getting our arms around the cost.

Admiral SULLIVAN. And a second element—and I know the previous panel discussed this some—is the fidelity of the cost estimating tools and the training of the independent cost estimators.

We have been embarked for a couple of years on working on cost estimating tools and training our cost estimating. That is a cyclic business, and I would say ten years ago we had a real problem in the cost estimating discipline where we weren't hiring any new folks, and we had to train up a whole new set. We talked about cuts in personnel. Cuts in ship design and ship cost estimating tools followed the same pattern of reductions that the people followed.

And so, the last couple of years we have been standing up some of the new estimating tools. I know you talked on the last panel about—I will call it—probabilistic cost estimating, where you don't

just come up with a point estimate based on the displacement of the ship and a couple of military characteristics.

We have actually worked pretty hard over the last five to eight years coming up with hundreds of cost estimating relationships, because the pipes cost something, engines cost something, valves cost something, the steel costs something. Each labor pool that assembles those things has a different labor cost structure and a different amount of money that you would pay that sort of an artisan.

But probably the biggest thing is coming up with what is the probability that the cost will not exceed that cost number that you have come up with, and now instead of arguing who is right, we argue over where do we want to be on the probability curve, and where do you want to budget? Do you want to budget to an 80 percent probability of success, or 60 or 4 or 99?

And a lot of the difference in the numbers that you see between us and the CBO or the GAO is based on how much risk are you willing to take.

Mr. ELLSWORTH. I have only one more question, unless somebody slips me a note, or—oh, as they just did.

I did want to ask you if the Navy is keeping up on the situation in Wisconsin on some labor issues that could affect the shipbuilding there and the follow-up ship. I am not sure if it is the boilermakers or which labor organization, but apparently, there are some contract problems that are causing some problems.

Do they update on that? Or is that any concern that the follow-up ship may be in jeopardy?

Ms. STILLER. We are aware of it. The shipyard is in negotiations with the union. I don't have an update today. Our supervisor of shipbuilding in the yard watches that very closely for us. But certainly we are aware. Whether that would jeopardize future procurements—that is usually not a factor in the Navy's decision-making.

Mr. SUMMERALL. To date, there has been no work stoppage. I don't see why going forward with the plan that we have in place to deliver the ships in 2008, to do the fly-off in 2009, and then to deploy the ships in fiscal year 2010—if we get additional ships in 2008 and 2009, I don't see why the current negotiations and labor discussions would have any impact on that company being able to compete going forward.

Mr. ELLSWORTH. Thank you.

And unless I get slipped another note, I will ask you this question.

Mr. O'Rourke from the last panel stated that we should re-think the $460 million cost cap—and this would be in conference; that is why I am asking—that the Navy proposes, because it might be too high. And I just want to know if you agree or disagree and why.

Admiral MCCULLOUGH. We think that the $460 million cost cap is the right number. We have worked that through our cost estimating and budget process, and we have had that approved by the CNO and the secretary that we believe that is what these ships are going to cost to produce in fiscal year 2008 dollars as an end-cost.

Mr. ELLSWORTH. Mr. Bartlett, any other questions?

Mr. BARTLETT. I just want to thank both panels.

Thank you very much for your testimony. Thank you.

Mr. ELLSWORTH. And I would also like to thank the four of you in both panels for that exchange, and I appreciate your time you spent with us today.

Admiral SULLIVAN. Thank you, sir.

Ms. STILLER. Thank you.

Admiral MCCULLOUGH. Thank you, sir.

Mr. SUMMERALL. Thank you very much.

[Whereupon, at 4:33 p.m., the subcommittee was adjourned.]

A P P E N D I X

JULY 24, 2007

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

JULY 24, 2007

NOT FOR PUBLICATION
UNTIL RELEASED BY
HOUSE ARMED SERVICES COMMITTEE

STATEMENT OF

RONALD O'ROURKE

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CONGRESSIONAL RESEARCH SERVICE

BEFORE THE

HOUSE ARMED SERVICES COMMITTEE

SUBCOMMITTEE ON SEAPOWER AND EXPEDITIONARY FORCES

HEARING ON

SURFACE COMBATANT CONSTRUCTION PROGRAMS

JULY 24, 2007

NOT FOR PUBLICATION
UNTIL RELEASED BY
HOUSE ARMED SERVICES COMMITTEE

Chairman Taylor, Ranking Member Bartlett, distinguished members of the subcommittee, thank you for the opportunity to appear before you today. As requested, this statement provides observations and analysis on cost, schedule, performance, and associated risk regarding the following surface combatant construction programs:

- the Littoral Combat Ship (LCS) program (pages 1-6);
- the LPD-17 program (pages 6-10);
- the DDG-1000 program (pages 10-13); and
- the CVN-78 (CVN-21) program (pages 13-15).

LCS Program

Cost Growth

Estimated procurement costs for follow-on LCSs (defined here as seaframes to be procured in FY2009-FY2011) have grown substantially over the last two years, from an average of $223 million per ship in the FY2006 budget, to an average of $298 million ship in the FY2007 budget, to a current figure of somewhere between $350 million and $460 million per ship.[1] This cost growth has added hundreds of millions of dollars to the amount of funding the Navy will need each year between now and about FY2016 to execute its shipbuilding plan. LCS cost growth reported since January 2007 is one of three developments in recent months that have increased the risks associated with implementing the Navy's 30-year shipbuilding plan.[2]

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[1]For the calculation of the FY2006 and FY2007 figures of $223 million and $298 million, respectively, see Table 3 in CRS Report RL33741, *Navy Littoral Combat Ship (LCS) Program: Oversight Issues and Options for Congress*, by Ronald O'Rourke. The figure of $350 million is based on Navy statements earlier this year that LCS-1 might cost $350 million to $375 million; the figure of $460 million is based on the Navy's reported desire to have Congress amend the procurement cost cap on the fifth and sixth LCSs to $460 million per ship.

[2]The other two developments were the Administration's decision to increase Army end strength, and the Navy's addition of several ships to its 30-year shipbuilding plan. In a situation of finite defense budgets, funding to pay for additional Army personnel and equipment may come from the Navy and/or Air Force budgets, which could make it more difficult for the Navy to achieve the budget top line that it has assumed as part of its strategy for implementing the 30-year shipbuilding plan. In moving from the FY2007 version of its 30-year shipbuilding plan to the FY2008 version, the Navy decided to include several additional ships, but to not change its estimate of the average annual amount of funding needed to implement the plan. The resulting implicit assumption in the FY2008 plan is that Navy ships will cost slightly less, on average, than was assumed in the FY2007 plan. The Navy made this decision at about the same time that it was learning that one of its ships — the LCS — will cost substantially more, not less, to procure than the Navy had earlier

(continued...)

Navy and industry officials testified to this subcommittee on February 8, 2007, that concurrency between design and construction was a significant contributor to the recent cost growth in the LCS program. Avoidance of concurrency in design and construction is an old lesson in shipbuilding and defense acquisition in general. In this sense, the LCS program is not so much an instance of new lessons learned as old lessons that were forgotten.

Navy and industry officials also testified at that hearing that design-construction concurrency resulted in part from the LCS program's rapid (compressed) acquisition schedule. In earlier years, the LCS program's rapid acquisition strategy was held up as an example of acquisition reform — specifically, of reducing acquisition cycle time. In retrospect, it might now be viewed as a case study in support of the old adage that haste makes waste.

Over the last several months, as information on LCS cost growth has come to light, the Navy has maintained its support for procuring 55 LCSs. Maintaining stability in planned numbers of ships to be procured can be conducive to cost control. At the same time, however, there is a risk, in expressing continued support for procuring 55 LCSs in spite of substantial cost growth in the program, of industry receiving an implicit message from the Navy that, at least in the case of the LCS, cost growth does not pose a significant risk of prompting a reduction in the number of ships to be procured. Such an implicit message might not be conducive to cost control in the LCS program.

Cost growth in the LCS program could, paradoxically, cause Navy officials to view the LCS as increasingly necessary. As the cost of the LCS increases, it puts added pressure on the shipbuilding budget and on the affordability of the Navy's shipbuilding plan. But the more pressure there is on the shipbuilding budget and on the affordability of the Navy's shipbuilding plan, the more Navy officials might believe they need to retain in the mix of ships to be procured at least one relatively inexpensive type of combat ship — and in spite of its cost growth, the LCS is the only such ship. In other words, from the Navy's potential perspective, you don't solve a problem in Navy shipbuilding affordability by eliminating the one relatively inexpensive type of ship you are planning to procure. If LCS costs continue to grow, they might eventually reach a point at which Navy officials might reconsider their support for the program. But recent Navy statements do not suggest that we are at that point. This paradoxical dynamic, to the extent that it exists, might not be conducive to cost control in the LCS program.

The Navy testified earlier this year that it was "overly optimistic" regarding what could be accomplished in the LCS program.[3] The Navy also testified earlier this year that, compared to CBO cost estimates for Navy ships, the Navy "budgets to a much more aggressive number." When asked whether "aggressive" meant optimistic, the Navy said it simply meant more aggressive.[4] The Navy

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[2](...continued)
estimated. See also the section entitled "Affordability and Executibility of Shipbuilding Plans" in CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[3]Transcript of spoken testimony of Secretary of the Navy Donald Winter before the Senate Armed Services Committee on March 29, 2007.

[4]Transcript of spoken testimony of Vice Admiral Paul Sullivan before the Seapower and Expeditionary (continued...)

more recently has stated that in regard to the LCS program, "We have to be more honest about doing proper analyses about what these ships... cost."[5] This raises two potential questions:

- What is the difference between "overly optimistic" cost estimating and "much more aggressive" cost estimating?
- How does the Navy's current "much more aggressive" cost estimating — and the Navy's recently stated desire to "be more honest about doing proper analyses" for ships costs — compare with the policy articulated by DOD in 2002 and reaffirmed by DOD in 2003 to rely in its budgeting on "realistic costing," which DOD defined at the time as using either "the CAIG's estimates or with those estimates that are a product of agreement between the CAIG and the services that in fact might even be better than the CAIG estimates"?[6]

Amending The Cost Cap

On May 10, 2007 — a week after this subcommittee marked up its portion of H.R. 1585, the FY2008 defense authorization bill — it was reported that the Navy would ask Congress to amend the procurement cost cap on the fifth and sixth LCSs (Section 124 of the FY2006 defense authorization act [H.R. 1815/P.L. 109-163 of January 6, 2006]) from the current per-ship figure of $220 million to $460 million.[7]

One potential issue for the subcommittee is whether $460 million would be an excessive figure to use in amending the LCS cost cap. Prior to the May 10 news report, Navy testimony and other public statements had suggested that LCSs might cost upwards of $400 million each, or perhaps a bit more than $400 million each, to procure. The Chief of Naval Operations testified in February that he was "embarrassed" by cost growth on the LCS program.[8] In light of this, one question is

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[4](...continued)
Forces subcommittee of the House Armed Services Committee on March 20, 2007.

[5]Secretary of the Navy Donald Winter, as quoted in Zachary M. Peterson, "Winter Seeks More Control Over Industry," *Navy Times*, July 9, 2007: 13. (Ellipsis as in the article.)

[6]See, for example, the news transcripts of comments by the "senior defense official" on February 1, 2002, and January 31, 2003, available online at:
[http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=2596] and
[http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=1384]. The CAIG is the Cost Analysis Improvement Group within OSD.

[7]Geoff Fein, "Navy Seeks New LCS Cost Cap of $460 Million Each For Ships Five And Six," *Defense Daily*, May 10, 2007. The Navy stated in 2006 that it would treat the $220-million figure as a cap on basic construction cost (BCC) rather than on the more inclusive measure of end cost, even though the cost cap (Section 124 of the FY2006 defense authorization act [H.R. 1815/P.L. 109-163 of January 6, 2006]) refers to "the total amount obligated or expended for procurement of the fifth and sixth vessels...." Cost caps that have been legislated for other Navy ships using similar wording have been interpreted as applying to end cost. The Navy reportedly would treat the $460-million figure as a cap on end cost.

[8]Transcript of spoken testimony of Admiral Michael Mullen before the Defense subcommittee of the House Appropriations Committee on February 12, 2007. See also Megan Scully, "Navy Chief Is "Embarrassed'
(continued...)

whether Navy settled on the $460-million figure in part because it would permit the LCS program to experience some additional (albeit unanticipated or unwanted) cost growth without causing the Navy the additional embarrassment of exceeding a cost cap that Congress had amended at the Navy's request. From the Navy's perspective at least, there would be value in avoiding such additional embarrassment. At the same time, however, if the $460-million figure is somewhat higher than what the Navy currently expects the fifth and sixth ships to cost, then amending the cost cap to the $460-million level could create a situation in which additional cost growth to the $460-million figure might be viewed by some as acceptable. Such a view might not be conducive to rigorous cost control on the program.

Another potential issue for the subcommittee is whether the LCS cost cap should be amended to apply not just to the fifth and sixth ships in the program, but to subsequent ships in the class as well. The cost cap on the CVN-78 aircraft carrier program (Section 122 of the FY2007 defense authorization act [H.R. 5122/P.L. 109-364 of October 17, 2006]) includes caps for both the lead ship (CVN-78) and for any follow-on ships in the class. The cost cap on the LHA-6 (LHA[R]) amphibious ship program (Section 125 of the FY2007 defense authorization act) applies to any ship constructed under the program. The cost cap for the LPD-17 program (Section 126 of the FY2007 defense authorization act) includes individual caps for ships six through nine in the program — the final four ships that the Navy plans to procure.

Planned FY2010 Downselect

Lockheed Concern About Bias Resulting From LCS-3 Termination. Lockheed is concerned that the Navy's decision to terminate construction of LCS-3 will create a bias against the Lockheed LCS design in the Navy's planned FY2010 LCS design downselect, and also a bias against the Lockheed-led industry team in the planned follow-on competition to determine which firm or firms should build the winning LCS design.

Lockheed is concerned about a potential bias against its design in the LCS design downselect for two reasons. The first is that LCS-3 would have incorporated one modification of the design used for LCS-1. Lockheed is concerned that, without LCS-3 in built form, the Navy will not be able to confirm through real-world tests the improvement in ship performance resulting from this or other potential design modifications that LCS-3 would have incorporated. The second is that without building LCS-3, the Navy at the time of the downselect will lack a data point showing improvement in production costs for the Lockheed design in moving down the learning curve from LCS-1 to LCS-3. Lockheed believes this second data point would increase Navy confidence in the potential production costs of follow-on LCSs built to the Lockheed design.

Lockheed is concerned about a potential bias against the Lockheed-led industry team in the follow-on competition to determine which firm or firms should build the winning LCS design because, without LCS-3, the Lockheed-led team's LCS design staff, shipyards, and suppliers will

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[8](...continued)
By Overruns But Vows Vigilance," *National Journal's CongressDailyAM*, February 14, 2007 (also published as "Navy Official 'Embarrassed' By Cost Overruns On Combat Ship," *GovExec.com*, February 14, 2007).

go "cold," compared to the General Dynamics-led industry team's design staff, shipyard, and suppliers, who will build LCS-4 after LCS-2, and will consequently remain "hot."[9]

The Navy's position is that since the LCS design downselect — an operational "flyoff" conducted by the fleet — will be determined by fundamental differences between the two LCS designs, the additional performance resulting from design modifications planned for LCS-3 will not be a critical factor. The Navy says that since the fleet will make the flyoff decision based on the operational performance of the two designs, and not on acquisition-related factors such as potential construction cost, the absence of a second data point on the Lockheed LCS production cost learning curve will not be a factor in the decision.

The Navy's position on the follow-on competition to determine which firm or firms will build the winning design is that the Lockheed-led industry team would be brought back into a "hot" status in time for the competition if Congress funds the LCSs that the Navy wants to procure in FY2008 and FY2009 and some of those ships are then awarded to the Lockheed-led team.[10]

Treatment of LCSs Built To Losing Design. Under the Navy's restructured plan for the LCS program, a total of eight LCSs are to be procured through FY2009. Depending on how LCSs procured in FY2008 and FY2009 are awarded between the two competing industry teams, three to five of these nine LCSs might be built to the design that is not chosen by the Navy in the FY2010 design downselect. Compared to the LCSs built to the winning design, these three to five LCSs will likely have some unique operation and support (O&S) costs. The Navy could choose to operate these ships with their unique O&S costs, or sell them to foreign buyers, or modify their combat systems or other features so as to make them more like the Navy's other LCSs in terms of their O&S requirements. One potential oversight question for the subcommittee is when the Navy anticipates being able to report to Congress on its strategy for these three to five ships.

Total Acquisition Cost

Five years into the LCS program,[11] the total acquisition cost of the LCS program (including mission packages) remains unclear. Based on available data, and assuming that follow-on LCSs cost $350 million to $460 million each to procure, CRS estimates the total acquisition cost of a 55-ship LCS program (plus mission packages) at roughly $27 billion to $33 billion.[12] This is, however, a CRS estimate, not a Navy estimate, and there is considerable uncertainty about the program's total acquisition cost due to uncertainty about LCS seaframe procurement costs and the number and average cost of LCS mission packages.

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[9]The paragraphs summarizing Lockheed's position are based on consultations with Lockheed officials on July 17, 2007, and previous dates, and are presented here with Lockheed's permission.

[10]The paragraphs summarizing the Navy's position are based on consultations with Navy officials on July 16, 2007, and are presented here with the Navy's permission.

[11] Congress approved the initial increment of research and development funding for the LCS program in 2002, as part of the FY2003 defense budget.

[12]See CRS Report RL33741, Navy Littoral Combat Ship (LCS) Program: Oversight Issues and Options for Congress, by Ronald O'Rourke.

Refueling And Replenishment Requirements

A recent RAND analysis of the number and type of mission packages that might need to be procured for the LCS fleet identified the refueling and replenishment needs of the LCS fleet as an "emerging issue." The report stated:

> We did not evaluate means of refueling or replenishing LCSs at sea during our study; it was beyond our charter. However, our study highlights the large demand that the LCS fleet may place upon assets to provide refueling and replenishment and highlights the need to align fleet logistics with LCS CONOPS [concepts of operations]. We feel that this issue warrants careful consideration....[13]

RAND states that for purposes of its study, LCSs were assumed to have an unrefueled cruising range of 1,250 nautical miles at a "sprint speed" of 45 knots and an unrefueled cruising range of 3,900 nautical miles at an "economical speed" of 19 knots. These figures, RAND stated, are averages of the threshold and objective levels specified in the LCS Capabilities Development Document (CDD) for Flight 0, as reflected in two NAVSEA documents dating to 2003 and 2004.[14] If LCSs turn out to have unrefueled cruising ranges that are lower than those assumed in the RAND report, this could underscore the emerging issue identified by the RAND report.

LPD-17 Program

Execution Problems And Cost Growth

The LPD-17 program has encountered a number of execution problems since the program entered procurement. The first LPD-17, which was procured in FY1996, encountered a roughly two-year delay in design and construction. It was presented to the Navy for acceptance in late June 2005. A Navy inspection of the ship conducted June 27-July 1, 2005, found numerous construction deficiencies.[15] The ship was commissioned into service on January 14, 2006. In April 2007, it was reported that the first LPD-17 had thousands of construction deficiencies.[16]

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[13]Brien Alkire, et al, *Littoral Combat Ships: Relating Performance to Mission Package Inventories, Homeports, and Installation Sites*, RAND, Santa Monica (CA), 2007, pp. 80-81. (National Defense Research Institute, MG-528-Navy)

[14]Ibid, p. 99.

[15]Associated Press, "Shipbuilder: Navy Will Accept New Vessel," *NavyTimes.com*, July 21, 2005; Christopher J. Castelli, "Naval Inspection Report Finds Numerous Problems With LPD-17," *Inside the Navy*, July 18, 2005; Dale Eisman and Jack Dorsey, "Problems On New Ship A Bad Sign, Analyst Warns," *Norfolk Virginian-Pilot*, July 14, 2005; Nathan Hodge, "Navy Inspectors Flag 'Poor Construction' On LPD-17," *Defense Daily*, July 14, 2005. A copy of the Navy's inspection report, dated July 5, 2005, is posted online at [www.coltoncompany.com/newsandcomment/comment/lpd17insurv.htm]

[16]See, for example, Louis Hansen, "New Navy Ship San Antonio Found To Be Rife With Flaws," *Norfolk Virginian-Pilot*, April 14, 2007; Christopher P. Cavas, "Thousands of Problems Found On New Amphibious Ship," *DefenseNews.com*, April 23, 2007.

At various points over the years, Navy or industry officials have stated that the LPD-17 program was turning a corner, or getting back on track, or words to that effect. Some of these statements, at least, appear in retrospect to have been premature.

The LPD-17 program has experienced considerable cost growth. When LPD-17 procurement began, follow-on ships in the class were estimated to cost roughly $750 million each. Estimated procurement costs for the follow-on ships subsequently grew to figures between about $1,200 million and about $1,500 million. The Navy estimates the procurement cost of the ninth ship at $1,798.3 million. A relatively small portion of the cost growth in the program since its inception is attributable to the decision to reduce the program's sustaining procurement rate from two ships per year to one ship per year. Most of the program's cost growth is attributable to other causes.[17]

Navy Acceptance Of Incomplete Ships

The Navy accepted delivery of LPD-17 with about 1.1 million hours of construction work remaining to be done on the ship. This equates to about 8.7% of the total hours needed to build the ship, and (with material costs included) about 7% of the total cost to build the ship.

The Navy accepted delivery of LPD-18 with about 400,000 hours of construction work remaining to be done on the ship. This equates to about 3.3% of the total hours needed to build the ship.

The Navy projects that it will accept delivery of LPD-19 with about 100,000 hours of construction work remaining to be done on the ship. This would equate to about 0.8% of the total hours needed to build the ship.

The Navy states that it accepted LPD-17 in incomplete condition for four reasons:

- It permitted the fleet to begin sooner the process of evaluating LPD-17 through operational use so as to identify problems with the LPD-17 class design that need to be fixed in follow-on LPD-17s.

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[17]RAND estimates that halving a shipbuilding program's annual procurement rate typically increases unit procurement cost by about 10%. (Mark V Arena, et al, *Why Has the Cost of Navy Ships Risen? A Macroscopic Examination of the Trends in U.S. Naval Ship Costs Over the Past Several Decades*. RAND, Santa Monica (CA), 2006. p. 45. (National Defense Research Institute, MG-484-NAVY). The December 2006 Selected Acquisition Report (SAR) summary table, available online at [http://www.acq.osd.mil/ara/am/sar/2006-DEC-SST.pdf], states that in then-year dollars, changes in the LPD-17 program's production schedule (including the reduction in annual procurement rate) account for $768.1million in increased costs for the program, or about 11.2% of the increased costs caused by all factors. The other factors leading to increased costs were economic errors (meaning errors in projected rates of inflation), which account for $361.7 million; estimating errors, which account for $4,648.8 million; and "other," which accounts for $1,093.4 million. The LPD-17 program's total cost was also reduced by $4,037.8 million due to the reduction in program quantity from an originally planned total of 12 ships to the currently planned total of 9 ships. The resulting net change in the program's estimated cost is an increase of $2,832.2 million.

- It avoided further delays in giving the LPD-17's crew an opportunity to conduct post-delivery tests and trial events that are intended to identify construction (as opposed to class design) problems with LPD-17 itself.

- It permitted LPD-17 to leave the shipyard sooner and thereby mitigated schedule and cost impacts on other ships being built at the shipyard (other LPD-17s, LHD-8, and DDG-51s) that would have resulted from having LPD-17 remain in the shipyard longer.

- It reduced the cost of the remaining construction work to be done on LPD-17 because the work in question could be performed by repair shipyards that charge lower rates for their work than the construction shipyard.

Of the approximately $160 million in post-delivery work performed on LPD-17, a substantial fraction was for the 1.1 million hours of construction work remaining to complete the ship. (The rest was for post-shakedown and other work that normally occurs after a ship is completed and delivered to the Navy.)[18] This $160 million in work was funded through the post-delivery part of the outfitting/post-delivery (OF/PD) line item in the Shipbuilding and Conversion, Navy (SCN) account. Since OF/DP costs are not included in ship end cost, the reported end cost of LPD-17 will understate the ship's actual construction cost.

The Navy plans to fund post-delivery construction work on LPD-18 and LPD-19 through the completion of prior-year shipbuilding line item in the SCN account — a line item that is included in ship end cost.

Potential oversight questions for the subcommittee include the following:

- To what extent are cost growth and construction problems in the LPD-17 program due to poor performance by NGSS, poor performance by other contractors, inadequate program management and oversight by the Navy, Hurricane Katrina, and other factors?

- What specific actions have NGSS, other contractors, and the Navy taken, and what additional actions do they plan to take, to avoid further cost growth and construction problems in the LPD-17 program?

- Although the Navy in the past has accepted delivery of ships that were not complete, has the Navy previously accepted delivery of a ship with one million or more hours of shipyard construction work remaining to be done, and if so, when?

Secretary of the Navy Donald Winter's June 22, 2007, letter to the chairman and chief executive officer of Northrop Grumman, Ronald Sugar, states in part: "It is imperative that NGSS [Northrop Grumman Ship Systems] deliver future ships devoid of significant quality problems and that it meet its cost and schedule obligations." The letter does not list any specific negative consequences that

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[18]On July 16, 2007, CRS and CBO asked the Navy to break down the $160 million figure into ship-construction work and other work. The Navy's response was not provided to CRS in time to be incorporated into this statement.

might result for Northrop if Northrop does not meet this goal.[19] As such, this part of the letter might be viewed as essentially an exhortation on the Navy's part. It is possible that Secretary Winter simply did not wish to list any potential negative consequences in the letter. It is also possible, however, that the Navy may have few effective potential negative consequences that it could list. Perhaps the most significant potential negative consequence would be to take future work away from NGSS by either terminating shipbuilding programs, reducing planned numbers of ships to be procured, or transferring ships to other shipyards. The Navy, however, has limited ability to threaten NGSS with this outcome: The Navy has a stated requirement for its shipbuilding programs, has already reduced planned numbers of ships to be procured to relatively low or minimum-sustaining levels, and has limited flexibility to transfer the ships in question to other yards.

Secretary Winter's June 22 letter also states that the Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN RDA) is planning quarterly reviews of NGSS and all of the ships under contract there. A potential question for the subcommittee is why the ASN RDA office is only now planning such quarterly reviews, and why such reviews are not being planned for all shipyards that build Navy ships, and all Navy shipbuilding programs. The ASN RDA has many responsibilities, including at present the critically important responsibility of ensuring that urgent acquisition needs related to operations in Iraq and Afghanistan are met without delay. But on the list of priorities that come after this urgent wartime responsibility, shipbuilding arguably would rank fairly high: Ships are central to the Navy; they are expensive, high-visibility items; the Navy's shipbuilding effort currently encompasses several new or recent designs; shipbuilding has experienced significant cost growth and other execution problems in recent years; and shipbuilding has been a strong concern of Congress for several years. The Navy periodically reviews its shipbuilding programs at levels below that of the ASN RDA, but as the Navy is now implicitly acknowledging, there is a difference between reviews conducted at lower levels and reviews conducted at the ASN RDA level.

Procuring An Additional LPD-17 In FY2008

The procurement of an additional LPD-17 at a cost of about $1,700 million is the top item on the Navy's FY2008 unfunded priorities list (UPL). This additional LPD-17would be the tenth ship in the class. Although the Navy currently plans to end LPD-17 procurement at nine ships, a tenth LPD-17 would be needed to achieve the Navy's goal, under its desired 313-ship force structure, of a 31-ship amphibious force that includes 10 LPD-17s.

Despite placing an additional LPD-17 at the top of its FY2008 UPL, the Navy in its testimony this year has expressed caution or even ambivalence about the idea of procuring an additional LPD-17 in FY2008, in part because the Navy believes that NGSS, on account of Katrina-related damage, would not be able to start construction work on an additional LPD-17 right away. Funding an additional LPD-17 in FY2008, the Navy has testified, could "result in, essentially, booking a ship, not really being able to build it."[20]

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[19]A copy of the letter was posted on the subscribers-only part of the *InsideDefense.com* website on July 9, 2007.

[20]At a March 28, 2007, hearing before the Defense subcommittee of the Senate Appropriations Committee, for example, Admiral Michael Mullen, the Chief of Naval Operations, when asked about the potential for

(continued...)

Although NGSS might not be able to start construction right away on an additional LPD-17 funded in FY2008, Congress could nevertheless decide to procure the ship in FY2008. Congress might come to such a decision, for example, if it decides that is has the funding available this year, but perhaps not in a future year, to procure an additional LPD-17. A decision by Congress to fund two LPD-17s in FY2008 — the one that is in the Navy's FY2008 budget, plus the additional one that is in the Navy's FY2008 UPL — with the knowledge that the second ship might not be started right away could be viewed as somewhat analogous to Congress' decisions in FY1983 and FY1988 to fund the procurement of two aircraft carriers in a single year (CVNs 72 and 73 in FY1988; CVNs 74 and 75 in FY1988) with the knowledge in each instance that the second ship would be started some time after the first. (The keels for CVNs 72 and 73 were laid down on November 3, 1984 and August 25, 1986, respectively. The keels for CVNs 74 and 75 were laid down on March 13, 1991 and November 29, 1993, respectively.)

If Congress decides that there is insufficient funding in FY2008 to fully fund the procurement of an additional LPD-17, another option would be to split-fund the ship in FY2008 and FY2009. If the Navy, in next year's budget submission, were to exercise the authority granted by Congress in Section 121 of the FY2007 defense authorization act to use four-year incremental funding (as opposed to the current split funding) for the procurement of CVN-78, the FY2009 funding requirements for CVN-78 would be reduced, which could make it easier in FY2009 to accommodate a second increment of funding for the additional LPD-17.

DDG-1000 Program

Technical Risk And Navy As System Integrator

Over the past few years, GAO has reported on the technical risks involved in developing the several significant new technologies that are to be incorporated into the DDG-1000. The Navy over the years has worked to retire these risks. As these individual technologies mature, technical risk in the DDG-1000 program will shift more to the follow-on task of system integration — of getting

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[20](...continued)
funding additional ships in FY2008, began his response by stating:

> I think it would be, we — in responding to this, we look at the possibilities of being able to actually build ships.
>
> One of the — and it's on my unfunded priority list, the number one ship is an LPD — LPD-17, which would be the tenth one. And it's a required LPD, but it's not been affordable.
>
> But the ability to actually do that, I think — and, in fact, because of the challenges we've had as a result of Katrina with the shipyard in that area, would — it would be very challenging. And it could well just, if it were added, result in, essentially, booking a ship, not really being able to build it.
>
> That said, it clearly would relieve some financial pressure that I've got in the SCN [account] on the — in the — in the program in later years.
>
> (Source: transcript of hearing. Mullen continued his response by commenting on the potential for funding additional ships of other types in FY2008.)

all ship's technologies to work together smoothly in a single platform. In past defense acquisition programs, system integration has often proven to be as least as challenging as the task of developing individual new technologies.

Since September 30, 2005, the Navy has managed the DDG-1000 program through a series of separate contracts with major DDG-1000 contractors, including NGSS, General Dynamics' Bath Iron Works (GD/BIW), Raytheon, and BAE Systems. Under this arrangement, the Navy is acting as the overall system integrator for the program.

Problems in the execution of the Coast Guard Deepwater program[21] and the LCS program have led to a reexamination in Congress this year of the concept of the private-sector lead system integrator (LSI), and to a desire among some Members to shift certain acquisition functions, including system design and integration, from the private sector, to where they had migrated starting in the 1990s, back to the federal government. The Navy's decision in 2005 to begin acting as the system integrator for the DDG-1000 program will make the program an early test of DOD's ability to once again perform the system-integration function following the downsizing of DOD's technical and acquisition workforce that occurred when acquisition functions were earlier transferred to the private sector. The DDG-1000 program, in addition to being an early test of DOD's abilities in this area, may represent a fairly challenging test, given the number of significant new technologies that are to be integrated into the ship.

Shared-Production Arrangement

NGSS and GD/BIW have agreed on a shared-production arrangement for building DDG-1000s. Under this arrangement, certain parts of each ship will be built by NGSS, certain other parts of each ship will be built by GD/BIW, and the remaining parts of each ship would be built by the yard that does final-assembly work on that ship. The arrangement can be viewed as somewhat analogous to the joint-production process for Virginia-class submarines that was proposed by industry and the Navy, and then approved by Congress in Section 121 of the FY1998 defense authorization act (H.R. 1119/P.L. 105-85 of November 18, 1997).

NGSS will be the final-assembly yard for one of the two lead DDG-1000s, and GD/BIW will be the final-assembly yard for the other. The difference in the two ships' construction schedules — about 6 months — is driven in large part by the production capacities of vendors making certain government-furnished equipment for the two ships. Until recently, it was expected that NGSS would be the final-assembly yard for the first ship and that GD/BIW would be the final-assembly yard for the second. On July 17 and 18, 2007, it was reported that the Navy is considering the option of instead assigning the first ship to GD/BIW and the second to NGSS. The potential switch reportedly is being considered by the Navy in part because the Navy believes it could provide some additional help in maintaining GD/BIW's work force as its DDG-51-related work begins to wind down, and because it could also provide some additional time for NGSS to recover from Katrina-related

[21]For additional discussion of the Deepwater program, see CRS Report RL33753, *Coast Guard Deepwater Program: Background, Oversight Issues, and Options for Congress*, by Ronald O'Rourke.

damage. The July 17 article reporting the potential switch stated that "a decision [from the Navy] is not expected before July 23," the day before this hearing.[22]

It is possible that the Navy might wish to have the two yards compete for the role of final-assembly yard for the third and subsequent ships in the class. Such a competition could be done on a one-time basis for all the ships in question, or serially, for each ship. One potential question for the subcommittee is whether competing the role of final-assembly yard for the third and subsequent ships, particularly if done on a one-time basis, would be consistent with the intent of Section 1019 of the Emergency Supplemental Appropriations Act for 2005 (H.R. 1268/P.L. 109-13 of May 11, 2005) and Section 125 of the FY2006 defense authorization act (H.R. 1815/P.L. 109-163 of January 6, 2006). Both of these provisions prohibit the Navy from using a winner-take-all acquisition strategy for the DDG-1000 program. The provisions require the participation of a second shipyard in the program, but they do not specify the share of the program that is to go to second yard.

Another potential question for the subcommittee is what implications, if any, the shared-production arrangement for the DDG-1000 program might have for the CG(X) cruiser program.[23] The Navy has testified that it would like to use the DDG-1000 design as the basis for the CG(X) design. If the CG(X) design is derived from the DDG-1000 design, supporters of the DDG-1000 shared-production arrangement might argue that it would make sense to extend the arrangement into the CG(X) program. Navy plans call for procuring DDG-1000s at a rate of essentially one ship per year, and for procuring CG(X)s at an eventual steady rate of two ships per year. Particularly given this difference in planned procurement rates, one potential question is whether a shared-production arrangement that makes sense for the DDG-1000 program would also make sense for the CG(X) program.

Procuring The DDG-1000 Currently Planned For FY2011

The Navy currently plans to procure the fifth DDG-1000 in FY2011, along with the first CG(X). The Navy might find it difficult to fund both a follow-on DDG-1000 and the lead CG(X) in a single year, particularly if the design for the CG(X) that emerges from the CG(X) Analysis of Alternatives (AOA) turns out to be more expensive than the "placeholder" cost for the lead CG(X) that appears in the FY2008-FY2013 Future Years Defense Plan (FYDP). One option for avoiding a potential funding tension in FY2011between the fifth DDG-1000 and the lead CG(X) would be to accelerate the procurement of the fifth DDG-1000 to FY2009 or FY2010. The resulting combined cost of the two DDG-1000s procured in FY2009 or FY2010, both of which would be follow-on ships, could be less than the combined cost of a fifth DDG-1000 and a lead CG(X) in FY2011. If funding is insufficient to fully fund the procurement of two DDG-1000s in either FY2009 or FY2010, another option would be to procure the accelerated DDG-1000 in FY2009 with split funding in FY2009 and FY2010, or in FY2010 using split funding in FY2011 and FY2011. An additional option would be to retain the fifth DDG-1000 in FY2011 and split fund either that ship, the lead CG(X), or both, across FY2011 and FY2012.

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[22]Christopher P. Cavas, "First DDG 1000 Could Shift To Bath," *Defense News*, July 17, 2007.

[23]For more on the CG(X) program, see CRS Report RL32109, *Navy DDG-1000 (DD(X)) and CG(X) Ship Acquisition Programs: Oversight Issues and Options for Congress*, by Ronald O'Rourke, and CRS Report RS22559, *Navy CG(X) Cruiser Design Options: Background and Oversight Issues for Congress*, by Ronald O'Rourke, and CRS Report RL33946, *Navy Nuclear-Powered Surface Ships: Background, Issues, and Options for Congress*, by Ronald O'Rourke.

Block Buy

Another possible option for Congress to consider would be to authorize the Navy to use a block-buy arrangement for procuring several DDG-1000s, particularly if Congress decides that there is a high likelihood those DDG-1000s will be procured. A block-buy arrangement, for example, could be used to procure the five DDG-1000s that are currently planned for procurement over the five-year period FY2009-FY2013.

The block-buy authority, which Congress created for procuring the first four Virginia-class submarines over the five-year period FY1998-FY2002, is similar to a multiyear procurement (MYP) authority in that it permits the Navy to use a single contract to procure several ships that are planned for procurement over a period of several years. A block-buy arrangement, like an MYP arrangement, can reduce the cost of the ships being procured by a few percent by giving the shipyards the confidence about future work that they need to support investments in workforce retention and development, and in new production equipment, that can better optimize the yards for producing the ships. The savings that would result from reducing the cost of a group of DDG-1000s by a few percent might be enough to procure, for example, another LCS.

Unlike an MYP arrangement, a block-buy arrangement does not include authority for making up-front economic order quantity (EOQ) purchases of long-lead items (which is how MYP arrangements can save an additional few percent on the cost of the ships being procured). Also unlike an MYP arrangement, a block-buy arrangement does not require the Navy to first demonstrate design stability in the program — a requirement that, in a shipbuilding program, is usually not considered met until the lead ship is delivered. This difference between a block buy and an MYP is significant, because under Navy plans, all seven ships in the DDG-1000 program are to be procured by the time the first ship is delivered, making it, from a practical standpoint, impossible to use MYP arrangement to reduce the cost of the DDG-1000 program.

Using a block-buy arrangement might be incompatible with the idea of having the two yards compete for the role of final-assembly yard for the third and subsequent ships in the program. If so, however, the potential savings of a block-buy arrangement might be comparable to the savings that might result from competing the final-assembly role. A block-buy arrangement could also make it difficult or expensive for the Navy or Congress to later change its mind about procuring the DDG-1000s covered under the arrangement, which is why having a high confidence in the procurement of these DDG-1000s would be beneficial.

When CRS raised the option of using a block-buy arrangement on the DDG-1000 program at a July 16, 2007, meeting with the Navy on the DDG-1000 and other shipbuilding programs, officials from the DDG-1000 program office appeared unfamiliar with the option. This may be because the option previously has been used for procuring submarines but not surface ships.

CVN-78 Program

Technical And Cost Risk

Technical and cost risks for CVN-78 were reduced by the Navy's decision in May 1998 to base the ship on the Nimitz (CVN-68) class hull design rather than on a new hull design, and by later

decisions to defer the procurement of the ship from FY2006 to FY2007, and from FY2007 to FY2008. GAO has identified remaining technical risks for the ship, particularly regarding the electromagnetic aircraft launch system (EMALS), the dual-band radar, and the advanced arresting gear. Information about the CVN-78 program provided by the Navy to CRS and CBO at a June 21, 2007, briefing suggests that the Navy's cost estimate for CVN-78 may be optimistic. In light of this, as well as cost growth in other recent Navy shipbuilding programs (including CVN-77) and recent Navy statements regarding the challenges involved in building lead ships (including LPD-17 and LCS-1), there appears to be a substantial possibility of cost growth on CVN-78.

Cost Cap

Section 122 of the FY2007 defense authorization act [H.R. 5122/P.L. 109-364 of October 17, 2006]) established a procurement cost cap for CVN-78 of $10.5 billion, plus adjustments for inflation and other factors, and a procurement cost cap for subsequent ships in the class of $8.1 billion each, plus adjustments for inflation and other factors. The Navy interprets these caps as being expressed in "FY2006 then-year dollars," meaning the cost of the ship in then-year dollars if the ship were procured in FY2006 rather than in FY2008 (for CVN-78) or in FY2012 (for CVN-79). The Navy states that the estimated then-year-dollar costs for CVN-78 and CVN-79 of about $10.5 billion and $9.2 billion, respectively, de-escalate into *FY2006* then-year dollar figures of about $10.0 billion and $7.4 billion, respectively.

One potential question for the subcommittee is whether the Navy is correct in interpreting the cost cap figures in Section 122 as being expressed in "FY2006 then-year dollars." If the Navy is correct in this interpretation, then CVN-78 could experience about $500 million in cost growth for reasons outside those permitted in Section 122 without exceeding its cost cap, and CVN-79 could experience about $700 million in cost growth for reasons outside those permitted in Section 122 without exceeding its cost cap. Other things held equal, this would reduce the chance that these ships will exceed their respective cost caps. At the same time, however, the existence of a cost cap that is higher than a ship's currently estimated cost might not be viewed as conducive to rigorous cost control on the ship, as it might encourage some to believe that cost increases up to the cap would be acceptable.

Four-Year Incremental Funding

Section 121 of the FY2007 defense authorization act authorized the Navy to use four-year incremental funding to procure CVN-78, CVN-79, and CVN-80. In its FY2008-FY2013 budget submission, the Navy did not use this authority and continued to budget for CVN-78 and CVN-79 using split funding (i.e., two-year incremental funding). The Navy has the option of using the authority when it submits its FY2009-FY2013 budget plan next year. As mentioned earlier, using the authority for CVN-78 would permit a reduction in the amount of funding required for the ship in FY2009. Other things held equal, that might permit additional things to be funded that year. It would also, however, increase funding requirements for CVN-78 in FY2010 and FY2011, which could, other things held equal, make it more difficult at the margin to fund other things in those years.

Option For Block Buy

One possible option for Congress to consider for the CVN-78 program, as for the DDG-1000 program (see earlier discussion), would be to authorize the Navy to use a block-buy arrangement, particularly if Congress decides that there is a high likelihood procuring CVN-79 and CVN-80. One option for a block-buy arrangement would encompass CVN-78 and CVN-79. If that option is not used, another option would be a block-buy arrangement encompassing CVN-79 and CVN-80. As with a block-buy arrangement in the DDG-1000 program, a block-buy arrangement in the CVN-78 program could reduce the cost of the ships covered by a few percent — perhaps enough, in the case of the CVN-78 program, to fund the procurement, for example, of an additional Navy auxiliary ship or two additional LCSs. As with the DDG-1000 program, the alternative strategy of a multiyear procurement (MYP) would likely not be available for CVN-78 and CVN-79 because the Navy won't be able to demonstrate design stability in the CVN-78 program — a requirement to qualify for MYP — until CVN-78 is delivered in FY2015, which is three years after the planned procurement year for CVN-79.

Mr. Chairman, distinguished members of the subcommittee, this concludes my testimony. Thank you again for the opportunity to appear before you to discuss these issues. I will be pleased to respond to any questions you might have.

CBO TESTIMONY

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The Navy's 2008 Shipbuilding Plan and Key Ship Programs

before the
Subcommittee on Seapower and Expeditionary Forces
Committee on Armed Services
U.S. House of Representatives

July 24, 2007

This document is embargoed until it is delivered at 2:00 p.m. (EDT) on Tuesday, July 24, 2007. The contents may not be published, transmitted, or otherwise communicated by any print, broadcast, or electronic media before that time.

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Mr. Chairman, Congressman Bartlett, and Members of the Subcommittee, we appreciate the opportunity to appear before you today to discuss the Navy's shipbuilding programs. Our ongoing analysis of those programs, of the Navy's fiscal year 2008 shipbuilding plan, and of available information from the Navy about specific ship programs indicates the following:

- Executing the Navy's most recent 30-year shipbuilding plan will cost an average of about $22.7 billion a year (in 2008 dollars), or about 30 percent more than the Navy has projected.[1]

- Historical experience (including very recent experience) suggests that a number of the Navy's shipbuilding programs—particularly the DDG-1000 guided missile destroyer and the CG(X) future cruiser—continue to face considerable risk of cost growth.

Overview

In response to a Congressional mandate, the Department of the Navy recently began issuing annual reports that describe its 30-year plans for ship construction. In the report released last year, the Navy presented a plan to expand its battle force fleet from 285 ships in 2006 to 313 ships over the long run.[2] That plan, which was consistent with the Navy's proposed budget for fiscal year 2007, reflected the department's view of its future naval requirements and the types of ships needed to meet those requirements. In May 2006, the Congressional Budget Office (CBO) issued a study analyzing that plan and estimating its potential costs.[3]

The Navy has since updated its long-term shipbuilding plan for fiscal year 2008.[4] The current plan resembles the previous one in that it envisions a 313-ship fleet, but the timing and size of purchases have changed for several categories of ships. The most important difference is that the total number of ships that the Navy hopes to buy over 30 years has grown from 280 to 293 (see Table 1). That 13-ship increase mainly reflects two factors:

- An acceleration in the building of certain ships, such as the DDG(X), which is intended to replace today's Arleigh Burke class guided missile destroyers; and

1. Unless otherwise indicated, the cost figures in this testimony are in billions of 2008 dollars of budget authority.

2. Department of the Navy, *Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY2007* (February 2006).

3. Congressional Budget Office, *Options for the Navy's Future Fleet* (May 2006).

4. Department of the Navy, *Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY2008* (February 2007).

Table 1.

Comparison of the Navy's 2007 and 2008 Long-Term Shipbuilding Plans

	2007 Plan (2007 to 2036)	2008 Plan (2008 to 2037)
	Number of Ships Purchased Over 30 Years	
Aircraft Carriers	7	7
Large Surface Combatants	53	66
Littoral Combat Ships	78	85 [a]
Attack Submarines	51	51
Ballistic Missile Submarines	14	14
Amphibious Ships	22	20
MPF(F) Ships	11	11
Support Ships	44	39
Total	**280**	**293**
	Total 30-Year Costs for New-Ship Construction (Billions of 2008 dollars)	
Navy's Estimate	462	462
CBO's Estimate	585	618

Source: Congressional Budget Office based on data from the Navy.

Note: MPF(F) = Maritime Prepositioning Force (Future).

a. CBO assumed that the two littoral combat ships canceled in 2007 (as well as the ones that the Navy is now planning to forgo in 2008 and 2009) would be purchased in 2017, at the end of that ship program.

- A shift in the time period under consideration (the Navy intends to buy more ships in 2037 than in 2007, so moving from a 2007–2036 planning window to a 2008–2037 window increases the number of vessels bought over 30 years).

Despite the rise in the number of ships to be purchased, the Navy estimates that the average annual spending needed to carry out its 2008 plan will be the same as for the 2007 plan.

This past March, CBO provided the Subcommittee with its analysis of the Navy's 2008 plan.[5] Unlike the Navy, CBO concluded that the 2008 plan would require greater average annual spending over 30 years for new ships than the 2007 plan would. The increase stems primarily from the growth in ship purchases (because of the acceleration in construction and the shift in the planning period). However,

5. Congressional Budget Office, *Resource Implications of the Navy's Fiscal Year 2008 Shipbuilding Plan* (March 23, 2007). Some of the cost figures in this testimony have been updated since that report to account for recent cost growth in the littoral combat ship program.

higher projected costs for some types of ships, such as the littoral combat ship (LCS), also play a role in raising the costs of the current plan.

The difference between CBO's and the Navy's estimates for the 2008 plan are attributable to two factors. First (as noted in previous CBO reports), CBO generally estimates that new ships will cost more to build than the Navy anticipates. Second, in updating its analysis for the 2008 plan, CBO revisited its cost-per-ship estimates and, in several cases, raised them because of new information. In updating its plan, by contrast, the Navy adopted a largely top-down approach to estimating ship costs—it assumed that average annual spending for ship construction would be the same as in last year's plan. Since the number of ships in the plan has increased, that approach implicitly assumes that future costs per ship will be lower than the Navy has stated previously. As a result, the difference between CBO's and the Navy's estimates of the costs of the 30-year plan has widened since last year.

The Navy's 2008 Shipbuilding Plan

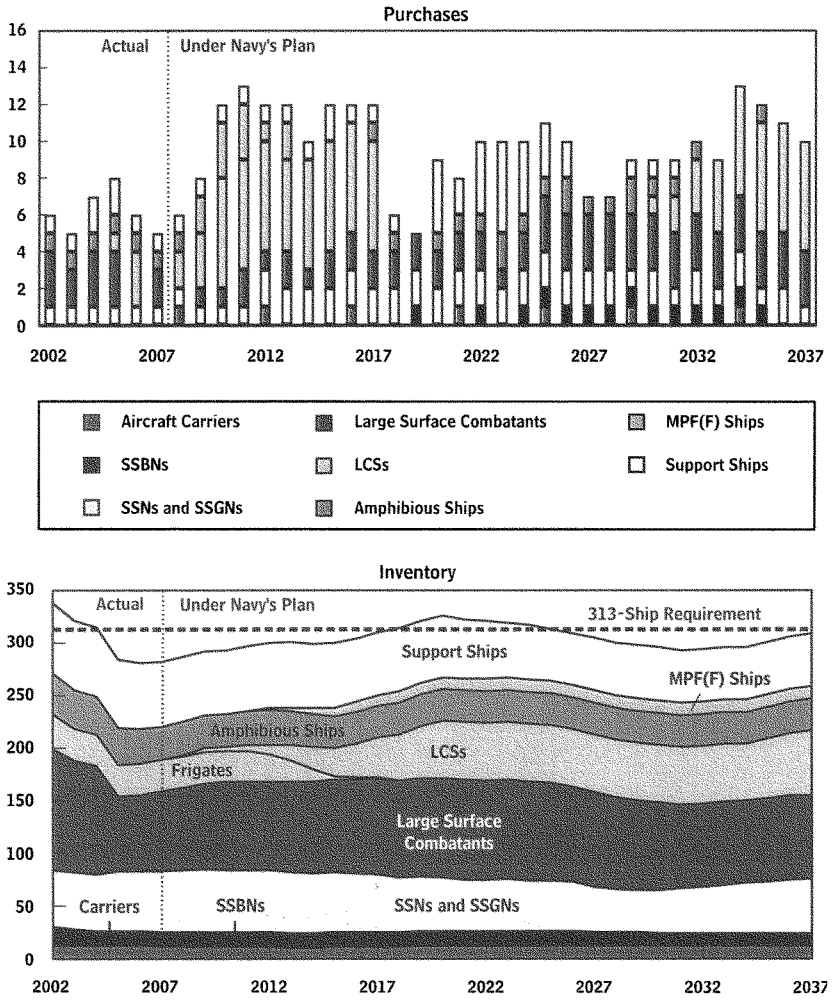
On February 2, 2007, the Secretary of the Navy submitted a report to the Congress on the Navy's fiscal year 2008 goals for ship construction over the next three decades. The report maintains the requirement for a fleet of 313 ships that was first outlined in the Navy's 2007 report. That fleet is intended to comprise the following battle force ships:

- 11 aircraft carriers;
- 69 guided missile destroyers;
- 19 guided missile cruisers;
- 55 littoral combat ships;
- 48 attack submarines;
- 4 guided missile submarines;
- 14 ballistic missile submarines;
- 31 amphibious ships;
- 12 future maritime prepositioning force, or MPF(F), ships, constituting one MPF(F) squadron; and
- 50 logistics and support ships.

Under the current plan, the Navy would purchase 6 ships in 2008 (see Figure 1) and a total of 63 ships between 2008 and 2013 (the period covered by the

Figure 1.

Annual Ship Purchases and Inventory Implied by the Navy's 2008 Shipbuilding Plan



Source: Congressional Budget Office based on data from the Navy.

Notes: SSBNs = ballistic missile submarines; SSNs = attack submarines; SSGNs = guided missile submarines; LCSs = littoral combat ships; MPF(F) = Maritime Prepositioning Force (Future).

CBO adjusted the number of ships purchased under the Navy's plan to reflect the recent decision to forgo buying two LCSs in 2007, to purchase two LCSs in 2008 instead of three, and to buy three LCSs in 2009 rather than six. CBO assumed that the six ships removed from procurement plans for those years would be bought in 2017, at the end of the LCS program.

Department of Defense's 2008 Future Years Defense Program). From 2014 to 2037, the Navy would buy another 230 vessels under its long-term plan—for a total of 293 ships, or an average of 9.8 per year, over 30 years.[6]

CBO adjusted the pattern of ship purchases in the Navy's plan to reflect the service's recent decision to alter the procurement schedule for littoral combat ships. The Navy now intends to forgo buying two LCSs in 2007 (to pay for cost overruns on the first four LCSs), purchase two LCSs in 2008 instead of the planned three, and buy three LCSs in 2009 rather than the six in the current shipbuilding plan. CBO assumed that the six ships removed from the Navy's near-term procurement plans would be bought in 2017, at the end of the LCS program.

If implemented as described, however, the Navy's current plan would not keep the fleet at or above the 313-ship goal over the long term. The number of battle force ships would rise initially, from today's level of about 276 to a peak of 326 in 2020 (see Figure 1). By 2031, however, the fleet would decline to 293 ships, before increasing at the end of the 30-year period to 309 ships.

In particular, relative to the goals for various components of the 313-ship fleet, the Navy would experience shortfalls in attack submarines (40 in 2028 and 2029 versus a stated requirement of 48), guided missile submarines (none after 2028 compared with a stated requirement of 4), and guided missile destroyers (60 in 2037 versus a stated requirement of 69). The shortfalls would result from not buying enough ships at the right times to replace Los Angeles class attack submarines and Arleigh Burke class destroyers as they were retired in the 2020s and 2030s. The Navy's plan is also short one LPD-17 amphibious transport dock.

In addition, the number of ballistic missile submarines (SSBNs) in the Navy's inventory would fall below the stated requirement of 14 beginning in 2027. That shortfall stems from a procurement schedule that would not be fast enough to deliver new submarines to the fleet before the old ones were retired. By 2041, however, the Navy would again have 14 SSBNs in its inventory. Recently, though, the Chief of Naval Operations, Admiral Mike Mullen, stated that because future SSBNs will have nuclear reactors that will last for the life of the ship (rather than having to be refueled midway through their service life), those submarines will spend less time in dry dock and more time at sea. Therefore, the Navy's requirement for SSBNs could drop to 12.

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6. Assuming that the notional service life of the fleet is 35 years, the Navy would need to buy an average of 8.9 ships per year to sustain a 313-ship fleet. During the Clinton and Bush Administrations, however, the Navy has acquired ships at a rate of 6.7 per year. Thus, above-average purchases would be necessary over the next 30 years to meet the Navy's goal for fleet size. By comparison, in the eight years of the Reagan Administration, the Navy bought 147 ships at an average cost of $0.9 billion apiece. In the eight years of the Clinton Administration, the Navy purchased 54 ships at an average cost of $1.2 billion per ship. In the eight years of the Bush Administration, the Navy's purchases will total 53 ships at an average cost of $1.9 billion each.

Finally, the 2008 shipbuilding plan would not replace the Navy's four current guided missile submarines (SSGNs). Those ships—former Ohio class ballistic missile submarines that were converted to a guided missile configuration—are scheduled to be retired in the 2020s. The Navy notes the absence of planned replacements, stating in its report that "plans for the recapitalization of the OHIO Class submarines that have been converted to SSGN have been deferred until the ships are fully operational and their war fighting utility has been tested."[7] That statement leaves open the possibility that either the 30-year plan will need to incorporate replacements for those submarines in the future or the Navy will conclude that the SSGNs are not useful enough to be worth replacing, in which case they would presumably be dropped from the official fleet requirements.

Differences Between the 2008 and 2007 Plans

On the whole, the long-term shipbuilding plan that the Navy submitted this year is similar to the one submitted in February 2006. The procurement schedules and quantities for aircraft carriers, attack submarines, ballistic missile submarines, guided missile cruisers, and future maritime prepositioning ships remain virtually unchanged. For other categories of ships, however, the Navy has made significant changes from the previous plan.

- The procurement quantity for the new guided missile destroyer, the DDG(X), has been increased from two per year to three per year starting in the mid-2020s. That increase reduces the Navy's pending shortfall of guided missile destroyers to 10 ships in 2034 (and to 12 ships in 2042, if the procurement rate of three per year continues beyond 2037).[8]

- Although the total number of amphibious assault ships (LHAs and LHDs) to be purchased over 30 years has not changed, the Navy has made the procurement schedule more regular at one ship every three years (except for a single instance in which the gap between ships would be four years). By comparison, the 2007 plan had an 11-year gap—from 2013 to 2024—when no LHAs or LHDs would have been built. The new plan provides a more stable construction schedule for the private shipyard that builds amphibious assault ships.

- Four large combat logistics ships that would have been purchased in the late 2020s have been eliminated in the 2008 plan. Those ships were intended to replace four AOE-6 class logistics ships that, in the 2007 plan, would have been

7. Department of the Navy, *Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY2008*, p. 6.

8. Under the 2007 plan, the Navy would have fallen 15 ships short of its requirement for guided missile destroyers in 2036, and the shortfall would have grown to 27 by 2045 if guided missile destroyers were bought at the then-planned rate of two per year beyond the period of that plan. See Congressional Budget Office, *Options for the Navy's Future Fleet*, pp. 26–28.

retired as their replacements were commissioned. The current plan does not envision retiring the AOE-6 class any time before 2037, meaning that those ships would be more than 40 years old—the notional life span for the class—at the end of the current planning period.

- Overall, the difference of 13 ships between the 2008 and 2007 plans can be accounted for by larger planned ship purchases as well as by the shift in the time period that the two plans cover. For the 29 years that are common to both plans (2008 to 2036), the Navy added 12 destroyers and removed 4 large combat logistics ships. In addition, the 2008 plan dropped the year 2007, when the Navy had planned to buy 7 ships, and added the year 2037, when it intends to purchase 10 ships. Finally, CBO included in the 2008 plan the two LCSs that were canceled in 2007.

The Navy's Planned Spending for Ship Construction

Despite the changes outlined above, the Navy's estimate of the costs of constructing the ships in the 2008 plan is the same as its estimate for the 2007 plan: an average of about $15.4 billion per year in 2008 dollars, or $13.4 billion per year in 2005 dollars (see Table 2).[9] Those costs, known as new-ship construction costs, exclude the expense of refueling reactors on nuclear-powered aircraft carriers and submarines. In addition, the Navy's estimate omits costs for modernizing large surface combatants (cruisers and destroyers) and purchasing mission modules for littoral combat ships, both of which the Navy intends to fund from other procurement accounts. With those related costs included, the Navy's estimate of the average annual funding needed to implement the current plan would rise to $17.3 billion in 2008 dollars—45 percent more than the Navy received for those categories of spending in its 2007 appropriation and about 20 percent more than it requested in its budget for 2008.[10]

In developing its shipbuilding plan, the Navy assumed that its total obligational authority—the budgetary top line—would increase at the same rate of inflation as Department of Defense (DoD) programs overall, about 2 percent a year. In other words, the Navy assumed no real (above-inflation) growth in its budget for the next 30 years.

Since 1990, the Navy has allocated about 8.5 percent of its total budget to ship construction. Under the 2008 plan, it would devote more than 12 percent of its

9. Although most cost figures in this testimony are in 2008 dollars, because the Navy's cost estimates for its original 313-ship plan were presented in 2005 dollars, CBO sometimes also provides 2005 figures for comparison.

10. The Navy intends to fund 40 percent of the construction of its newest aircraft carrier in 2008 and 60 percent in 2009. Historically, funding for ship construction has been much higher than average in years in which carriers have been purchased.

Table 2.

Average Annual Shipbuilding Costs

(Billions of 2008 dollars)

	New-Ship Construction	New-Ship Construction and Nuclear Refuelings	New-Ship Construction, Nuclear Refuelings, LCS Mission Modules, and Surface Combatant Modernization
Navy's Actual Spending, 2002 to 2007	9.6	11.4	11.5
Costs Under the Navy's 2008 Long-Term Shipbuilding Plan			
Navy's estimate	15.4	16.5 [a]	17.3 [a]
CBO's estimate	20.8	21.9	22.7
Costs to Meet the Navy's 313-Ship Requirement over the Long Term (CBO's estimate)	22.0	23.1	23.9
Memorandum:			
Navy's Estimate of Costs Under the 2008 Plan in 2005 Dollars[b]	13.4	14.3 [a]	15.0 [a]

Source: Congressional Budget Office based on data from the Navy.

Note: LCS = littoral combat ship.

a. The Navy's estimate for new-ship construction plus CBO's estimate for the additional costs.

b. The Navy originally presented the costs of its long-term shipbuilding plan in 2005 dollars.

budget to shipbuilding, on average, over the next 30 years. To accommodate the larger budgetary share for ship construction, the Navy made four assumptions:

- That spending on operations and maintenance in the service's accounts would not grow faster than the overall rate of inflation;
- That spending on research and development—which hit a historical high of about $20 billion in 2006—would fall by $4 billion or $5 billion and remain at that annual level through the next 30 years;
- That any increase in pay and benefits for Navy personnel beyond the general rate of inflation would be offset by reductions in the number of personnel (the Navy's end strength); and
- That ship programs would experience no cost growth in the short run and would meet strict cost goals in the long run.

Most of the near-term costs for ship programs shown in the Navy's plan are based on estimates for existing ship designs, but the cost targets for ships to be bought after 2013 generally do not reflect either existing or notional designs.[11] To develop cost targets for future ships, the Navy used a top-down approach. It allocated the total amount of money it plans to devote to new-ship construction over 30 years among different types of ships—surface combatants, amphibious ships, attack submarines, ballistic missile submarines, and aircraft carriers—according to their historical shares of Navy spending. The historical share for a particular category was then divided by the number of ships the Navy wants to buy in that category to calculate the cost goal for each future ship.

In some cases, meeting those goals would require the Navy to reduce the costs of major classes of ships already in production (such as the Virginia class attack submarine and the LHA-6 amphibious assault ship). In other cases, those targets would allow little or no growth in the costs of new classes of ships relative to the costs of the ships they would replace. The Navy realizes that its plan may be inconsistent with its cost goals. The plan report states: "As more accurate cost estimates are determined in future ship development (for ships such as CG(X), SSBN(X), etc.), the Navy may need to adjust the average annual investment objective or revisit warfighting requirements as appropriate."[12]

Inflation in Shipbuilding

An important component of the Navy's and CBO's cost analyses is the role of inflation in the construction of naval vessels. The Navy has examined the inflationary component of past cost increases in shipbuilding programs and concluded that the overall figure ("inflator") that DoD uses to project cost increases for its procurement programs has underestimated the inflation that has actually occurred in the naval shipbuilding industry over the past decade by about 1.8 percentage points per year, on average. The Navy provided CBO with a composite inflator that reflects the growth in labor and materials costs that the industry has experienced in the past and that the Navy expects it to experience through at least 2013. That inflator is an average of about 1.4 percentage points higher per year—from 2008 through at least 2015—than the price increases expected for DoD procurement programs overall: about 3.5 percent for shipbuilding versus 2.1 percent for defense procurement programs as a whole. The Navy incorporated that higher level of inflation into its budget request for 2008 and the associated Future Years Defense Program. In both the Navy's and CBO's analyses, the higher level of

11. Exceptions to that generalization include the CG(X) future cruiser, which would begin to be bought in 2011 but has not yet been designed, and the Virginia class attack submarine and LHA-6 amphibious assault ship, which are under construction now and would be purchased in the long term as well.

12. Department of the Navy, *Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY2008*, p. 8.

inflation produces real growth in the future costs of ships. For example, a ship that costs $2.5 billion to build in 2008 will cost $2.9 billion (in 2008 dollars) to build in 2020.

In its analysis of the Navy's previous long-term plan, CBO assumed that cost growth in the shipbuilding industry would continue to be higher than average for many years and then would gradually revert to the level of general inflation for DoD procurement programs by 2025. CBO made the same assumption in analyzing the Navy's current plan.

CBO's Estimate of the Costs of the 2008 Shipbuilding Plan

Buying a total of 293 ships over the 2008–2037 period—or an average of about 9.8 ships per year—would require an average annual shipbuilding budget of $20.8 billion for new construction alone, CBO estimates (see Table 2 on page 8). That amount is about one-third more than the Navy's $15.4 billion target (see Figure 2) and more than double the $9.6 billion per year that the Navy spent on new-ship construction between 2002 and 2007. Including the costs of refueling nuclear-powered aircraft carriers and submarines would raise CBO's estimate to $21.9 billion a year, on average, over the next 30 years.

Those figures exclude costs to modernize existing cruisers and destroyers and to buy the mission modules that are intended to provide much of the combat capability of littoral combat ships. As noted above, the Navy plans to fund those items from accounts other than the ones normally associated with ship construction. However, such modernization programs have been funded from shipbuilding accounts in the past; and in other new-ship programs (such as for the DDG-1000 Zumwalt class destroyer), combat capability is included in a ship's cost and funded as part of the ship's construction. Paying all of the expenses of new-ship construction, nuclear refuelings, modernization of surface combatants, and mission modules for LCSs would require average funding of $22.7 billion annually, CBO estimates.[13]

According to CBO's calculations, the Navy's 2008 shipbuilding plan would cost about $1.3 billion more per year to carry out than the 2007 plan. Of that amount, $0.4 million results from the difference between 2007 dollars and 2008 dollars.[14] The remainder of the increase is attributable to higher ship prices (such as for the LCS) and the overall growth in the number of ships envisioned in the 2008 plan—

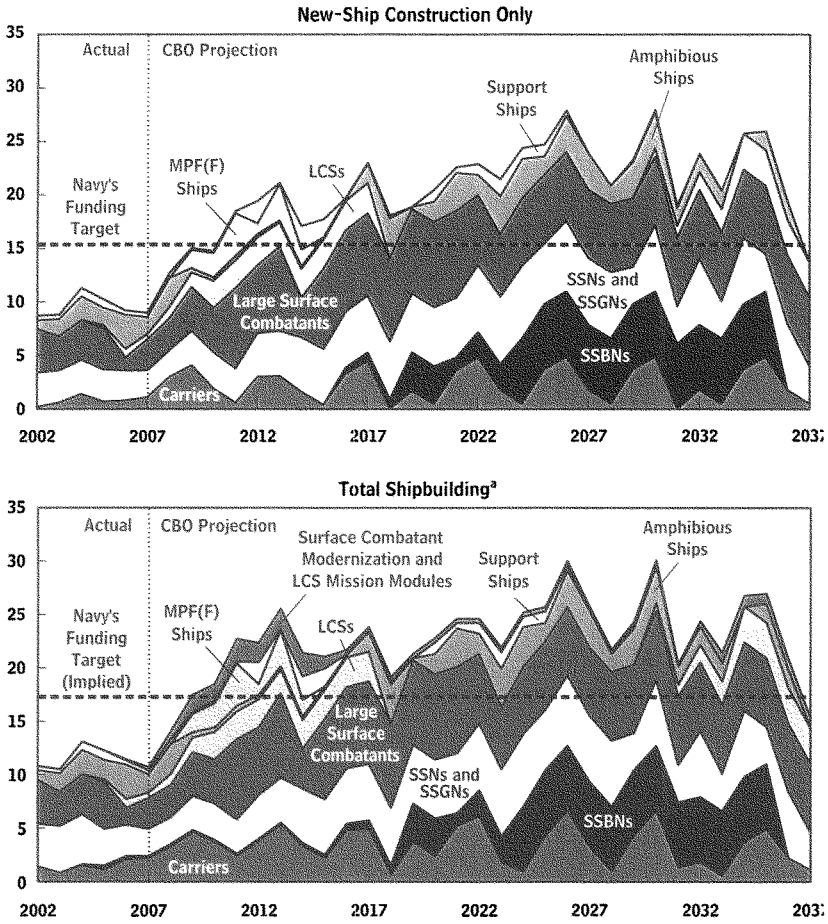
13. The Navy has not stated how many mission modules it plans to buy for each littoral combat ship; CBO assumed that those purchases would average two per ship.

14. CBO estimated that new-ship construction under the 2007 plan would require average annual funding of $19.5 billion in 2007 dollars, which is $19.9 billion in 2008 dollars.

Figure 2.

Annual Costs Implied by the Navy's 2008 Shipbuilding Plan

(Billions of 2008 dollars)



Source: Congressional Budget Office based on data from the Navy.

Notes: SSBNs = ballistic missile submarines; SSNs = attack submarines; SSGNs = guided missile submarines; LCSs = littoral combat ships; MPF(F) = Maritime Prepositioning Force (Future).

Amounts for 2006 exclude supplemental funding related to Hurricane Katrina.

a. Includes costs for new-ship construction, refuelings of nuclear-powered ships, programs to modernize existing large surface combatants, and mission modules for littoral combat ships. The modernization of surface combatants and the mission modules for LCSs are expected to be funded from Navy accounts other than those traditionally associated with shipbuilding.

notably, 12 additional DDG(X) replacements for Arleigh Burke class destroyers over the 2025–2036 period.

Individual Ship Programs

To estimate the costs of the 2008 shipbuilding plan, CBO used Navy data on actual costs for ships now under construction and historical relationships between the cost and weight of ships (as discussed in more detail below). To apply those relationships to ships for which the Navy has yet to develop even a notional design—such as the prospective replacements for the Arleigh Burke class destroyers and the Ohio class ballistic missile submarines—CBO had to make assumptions about the size and capabilities of future ships.

Aircraft Carriers

Under the Navy's plan for a 313-ship fleet, the number of aircraft carriers (CVNs) would decline from 12 to 11. That reduction comes from retiring the *John F. Kennedy* in 2007. To maintain that size force, the Navy's plan would buy seven CVN-78 Gerald R. Ford class aircraft carriers over the 2008–2037 period at a target cost of about $10.1 billion apiece (see Table 3).[15]

To estimate the cost of those new aircraft carriers, CBO relied on the cost of the Navy's most recent carrier, the CVN-77, and adjusted that amount to account for past levels of cost growth and for the higher inflation expected in the shipbuilding industry. The first two ships of the new CVN-78 class would require substantial funding for nonrecurring detail design, but subsequent ships would not need any money for that purpose. CBO estimates that the seven carriers in the Navy's 2008 shipbuilding plan would have an average cost of about $10.1 billion each, the same as the Navy's target.

However, CBO believes that the Navy's cost estimate for the first ship of the class, the *Gerald R. Ford* (CVN-78), is optimistic. In its budget submission to the Congress, the Navy estimates that the CVN-78 will cost about $10 billion in 2008 dollars, including about $2.2 billion for nonrecurring engineering and design.[16] The Navy argues that actual construction time and cost for the CVN-78 will be less than for its predecessor ship, the *George H.W. Bush* (CVN-77). CBO, by contrast, estimates that the CVN-78 will cost about $11 billion, allowing for the cost growth that has affected past shipbuilding programs at the CVN-78's stage of construction. If the CVN-78 experiences cost grow similar to that of other lead ships the

15. The program to build that new class of nuclear-powered aircraft carriers was formerly called the CVN-21 (for 21st century) program.

16. That amount is about $10.5 billion measured in the dollars of the years in which the money has been or will be appropriated.

Table 3.

Comparison of the Navy's Goals and CBO's Estimates of the Costs of Major New Ships

(Billions of 2008 dollars)

	Average per-Ship Cost over the 2008-2037 Period[a]	
	Navy's Cost Target[b]	CBO's Estimate[c]
CVN-78 Gerald R. Ford Class Aircraft Carriers	10.1	10.1
DDG-1000 Zumwalt Class Destroyers	2.3	3.9
CG(X) Cruisers	2.9	4.0
DDG(X) Destroyers (Replacement for Arleigh Burke class)	1.6 [d]	2.2
Virginia Class Attack Submarines	2.3	2.7
SSBN(X) Ballistic Missile Submarines (Replacement for Ohio class)	3.3	6.3
Amphibious Ships	1.5	2.3

Source: Congressional Budget Office.

a. The total amount of money spent on a ship program from 2008 to 2037 divided by the total number of ships bought in that program—except in the case of the DDG-1000 program, for which the average cost per ship reflects the costs of all seven ships in that program.

b. Based on a briefing by the Navy for CBO and the Congressional Research Service, February 10, 2006.

c. CBO's estimates are generally based on historical relationships between cost and weight for individual types of ships; they also incorporate the higher inflation that the naval shipbuilding industry has experienced (compared with that in other defense procurement programs).

d. The Navy's 2008 plan added 12 DDG(X)s and removed 4 large logistics ships compared with the 2007 plan, but it indicated that overall shipbuilding costs would not change. Thus, CBO assumed that the Navy's per-ship cost target for the DDG(X) was lowered to reflect those changes. (CBO also assumed that the funding not allocated to the logistics ships would be spent on the new destroyers.)

Navy has purchased in the past 10 years, costs could be higher still.[17] Moreover, Navy officials have told CBO that the confidence level associated with their estimate is below a 50 percent probability of meeting the cost target, which also suggests that costs could increase. In addition, a number of critical technologies for the CVN-78 are still under development, and difficulties could still arise in integrating the various new technologies associated with that class.

17. For example, the LPD-17, the SSN-774, and the LCS-1 have experienced cost increases of about 70 percent, 11 percent, and 80 percent, respectively.

Surface Combatants

Overall, some of the largest differences between the Navy's and CBO's cost estimates involve the planned family of new surface combatants. Over the next 30 years, those ships include the DDG-1000 guided missile destroyer, the CG(X) future cruiser, the DDG(X) destroyer (a notional replacement for the Arleigh Burke class guided missile destroyer), and the littoral combat ship.

DDG-1000 Guided Missile Destroyer. The Navy's current plan would buy one DDG-1000 Zumwalt class destroyer each year from 2009 to 2013, in addition to the two authorized in 2007. The service's 2008 budget suggests that the Navy expects the first two ships to cost $3.0 billion each and the following five to cost an average of $2.0 billion apiece—meaning that the entire class would have an average cost of $2.3 billion per ship.[18] CBO, by contrast, estimates that the first two DDG-1000s would cost $4.8 billion apiece and the next five would cost an average of $3.5 billion each. The average per-ship cost of the class would be $3.9 billion (see Table 3 on page 13).

The Navy's estimate for the two lead ships of the DDG-1000 class is equivalent to about $230 million (in 2008 dollars) per thousand tons of lightship displacement (the weight of the ship without its fuel, payload, or crew). That figure is smaller than the cost of the lead DDG-51 class destroyer or the lead Ticonderoga class cruiser (see Figure 3). CBO's estimate for the first two DDG-1000s—which equals $380 million per thousand tons—is based on the cost of the lead DDG-51, adjusted for differences in the size of the two types of ships.

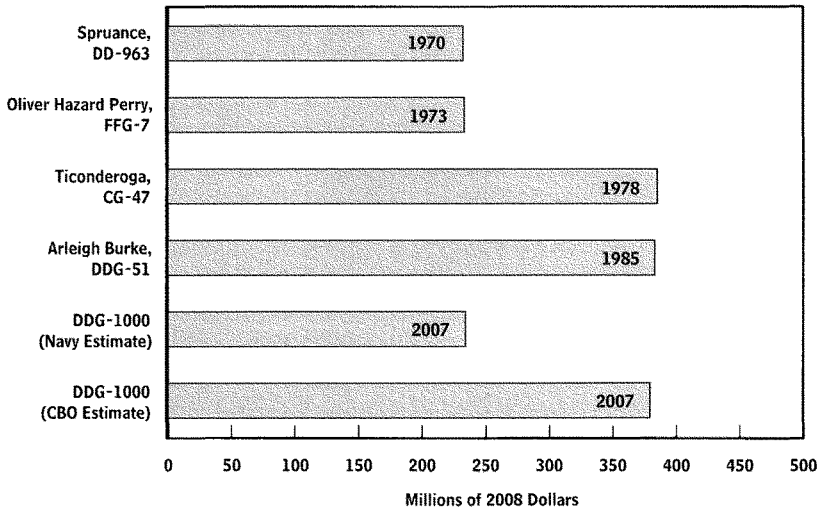
The Navy has argued that comparing the new DDG-1000 with the DDG-51 may not be valid because the older destroyer had various problems in the early stages of construction that increased its cost. In particular, the design of the ship was disrupted and delayed because a new design tool being used at the time was incomplete and not well understood. The design tool had to be abandoned and the design restarted using more-traditional methods. In comparison, the design process for the DDG-1000 is going far more smoothly, and the Navy expects to have the design largely settled when construction begins. In addition, the Navy says, the DDG-51 was a smaller, more densely built ship and thus, on a ton-for-ton basis, was more difficult to construct than the DDG-1000 class will be.

In CBO's view, however, several factors offset those arguments. First, as Navy officials often state, lead ships are generally very difficult to build and typically encounter many problems during construction. The problems with the first few littoral combat ships and with the lead ship of the LPD-17 class of amphibious transport docks—both of which are much less complex technologically than the DDG-1000—illustrate those difficulties. A survey of lead-ship programs shows that although many experience problems in design or construction, those problems

18. The first two DDG-1000s were partially funded in 2007 and earlier years; the rest of the Navy's estimated costs for those two ships (about half) would be funded in 2008.

Figure 3.

Cost per Thousand Tons for the Lead Ship of Various Classes of Surface Combatants



Source: Congressional Budget Office based on data from the Navy.

Notes: The years shown here indicate the year in which each lead ship was authorized.

Costs are per thousand tons of lightship displacement (the weight of the ship itself without its crew, materiel, weapons, or fuel).

vary from program to program. In other words, the lead DDG-1000 may not face the same difficulties as the lead DDG-51, but it will have problems of its own that will increase costs and delay construction.

Second, the DDG-1000 program is incorporating 10 new technologies into the class that are not found on the current generation of destroyers. Those technologies include an electric drive and a distributed-power system, a tumblehome hull (which slopes inward above the waterline to make the ship less visible to radar), the Advanced Gun System, and new radars, as well as composite materials and stealth coatings for the deckhouse. In the past, the Navy has typically introduced just three or four new technologies in a new class of surface combatants.

Finally, a comparison of the Navy's cost estimates for two more DDG-51s and for the seventh DDG-1000 (to be purchased in 2013) illustrates the risk for cost growth in the new destroyer program. The Navy has stated that if the Congress authorized and bought two additional DDG-51s in 2008—which would be the 63rd and 64th ships of their class—those destroyers would cost a total of $3.0 bil-

lion to $3.1 billion, or $1.5 billion to $1.6 billion apiece (in 2008 dollars). At the same time, the Navy's 2008 budget submission to the Congress estimates the cost of building the seventh DDG-1000 in 2013 at about $2.1 billion (in 2013 dollars). Deflated to 2008 dollars (using the inflation index for shipbuilding that the Navy provided to CBO), that estimate equals about $1.6 billion—or the same as for an additional DDG-51, which would have the benefit of substantial efficiencies and lessons learned from the 62 models built previously. The lightship displacement of the DDG-1000 is about 5,000 tons greater than that of the DDG-51s under construction today. In effect, the Navy's estimates imply that those 5,000 extra tons, as well as the 10 new technologies to be incorporated into the DDG-1000 class, will be free.

CG(X) Future Cruiser. The Navy intends to begin buying a new air- and missile-defense surface combatant, the CG(X) cruiser, in 2011, with a second ship to follow in 2013. CBO assumed that a CG(X) would use the same hull, and cost about the same, as a DDG-1000. The Navy's estimates for the 2011 and 2013 cruisers are based on the same assumption; thus, it expects those ships to cost $2.6 billion and $2.4 billion, respectively. However, the Navy is currently conducting an analysis of alternatives to determine what capabilities the CG(X) will have. A version using the DDG-1000's hull and technology is only one option being considered; the Navy says it is also studying versions of the ship that would be larger and more capable, including using nuclear propulsion. (There does not appear to be a design smaller than the DDG-1000 under consideration.) Any design larger than the DDG-1000 is likely to be substantially more expensive than that ship. Using the same method as for its estimate of DDG-1000 costs, CBO estimated that the lead CG(X) would cost $4.9 billion and that the class would average about $4.0 billion per ship (see Table 3 on page 13).

CBO's estimate for the cost of the CG(X) may be optimistic, however. The last time the Navy reused a hull design for a new class of surface combatants was in the 1970s, when it built Spruance class destroyers and Ticonderoga class cruisers, which had the same hull but were designed for different missions. The Spruance class consisted of general-purpose destroyers intended to escort other Navy ships in wartime and designed particularly for antisubmarine warfare. The Ticonderoga class cruisers incorporated the Aegis antiair combat system, the SPY-1 radar, and surface-to-air missiles to counter threats to carrier battle groups from Soviet naval aviation. Reflecting its more complex combat systems, the lead Ticonderoga cost 60 percent more per thousand tons than the lead Spruance, notwithstanding their many common hull and mechanical systems.

DDG(X) Future Guided Missile Destroyer. Besides building the new DDG-1000 Zumwalt class of destroyers, the Navy's 313-ship plan would also maintain a fleet of 62 DDG-51 Arleigh Burke class destroyers. CBO assumed that those ships would be modernized and would serve for about 35 years. That assumption is consistent with the Navy's plan, which would purchase the first replacement for those

ships—a DDG(X)—in 2022.[19] For its analysis of costs and capabilities, CBO assumed that a fully loaded DDG(X) would be somewhat larger and heavier than the DDG-51 (which displaces about 9,200 tons at full load) but smaller than the DDG-1000 (which is intended to displace about 14,500 tons at full load). Specifically, CBO assumed that the new DDG(X) would have a full-load displacement of about 11,000 tons and would not be able to carry both of the Advanced Gun Systems of the DDG-1000. In CBO's projection, those replacement destroyers would have the same cost per thousand tons as today's Arleigh Burke destroyers—or an average cost of about $2.2 billion apiece if bought at a rate of three per year.[20] The Navy's implicit cost target for the DDG(X) is lower: $1.6 billion each (see Table 3 on page 13).[21]

Littoral Combat Ship. The current shipbuilding plan envisions building 55 LCSs between 2005 and 2017. Because those ships are assumed to have a service life of 25 years, the Navy would need to begin procuring their replacements in 2030. The LCS differs from the Navy's usual warships in that the program is divided into two components: the sea frame and mission modules. The sea frame (the ship itself) will be built with the ability to switch mission modules (combat systems) depending on which mission the ship is intended to carry out at a given time. Currently, the Navy expects to use three types of mission modules: for countermine warfare, antisubmarine warfare, and anti-surface-craft warfare. However, it has not yet determined how many mission modules it plans to buy for each sea frame.

The Navy intends for the LCS to be an affordable ship that will be relatively simple to design and build. Originally, the LCS was expected to cost about $250 million per sea frame in 2008 dollars (or $220 million in 2005 dollars). Then, the Navy's 2008 budget envisioned buying 32 LCSs during the 2008–2013 period at an average cost of a little less than $300 million each (excluding mission modules).[22] Shortly after that budget was submitted, however, the Navy stated that the program was suffering from cost growth that was much greater than had already been reported. In early 2007, the Navy testified that the sea frame for the first littoral combat ship (LCS-1) would cost between $350 million and $375 million.

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19. Generally, the Navy retires large surface combatants after no more than 30 years even if their notional service lives are longer. If the DDG-51s lasted only 30 years, replacements would need to start being purchased earlier than 2022.

20. Buying more ships of a given type in the same year reduces their cost because it allows a shipyard's fixed overhead expenses to be spread among more ships.

21. The cost target for DDG(X)s in the Navy's 2007 plan was $2.1 billion. However, the Navy added 12 DDG(X)s to the 2008 plan and removed only 4 logistics ships, while stating that the overall costs of the plan were unchanged. CBO therefore assumed that the cost target for the DDG(X) had declined, reflecting the larger number of ships to be purchased. CBO also assumed that the money saved from removing the logistics ships would be allocated to the DDG(X) program.

22. The Navy says that a mission module will cost about $50 million to $70 million.

Several months ago, press reports indicated that the cost could well exceed $400 million each for the first two LCS sea frames. Recently, the Navy requested that the cost cap for the fifth and sixth sea frames be raised to $460 million, which suggests that the Navy's estimate of the acquisition cost for the first two LCSs would be around $600 million apiece.

Experience had suggested that cost growth was likely to occur in the LCS program. In particular, historical cost-weight relationships—using the lead ship of the Oliver Hazard Perry class of frigates (FFG-7) as an analogy—indicated that the Navy's original cost target for the LCS was optimistic. The first FFG-7, including its combat systems, cost a total of about $650 million (in 2008 dollars) to build, or about $235 million per thousand tons. Applying that per-ton estimate to the LCS program suggests that the lead ships would cost about $575 million apiece, including the cost of one mission module (to make them comparable to the FFG-7). In this case, looking at cost-weight relationships produced an estimate less than the apparent cost of the first two LCSs but substantially greater than the Navy's original estimate.

As of this writing, the Navy has not publicly released an estimate for the LCS program that incorporates the most recent cost growth, other than its request to raise the cost caps for the fifth and sixth ships. CBO estimates that with that growth included, the first two LCSs would cost about $630 million each, excluding mission modules but including outfitting, postdelivery, and various nonrecurring costs associated with the first ships of the class. As the program advances, with a settled design and higher annual rates of production, the average cost per ship is likely to decline. Excluding mission modules, the 55 LCSs in the Navy's plan would cost an average of $450 million each, CBO estimates.

The relatively simple design of the LCS and the large cost increases that have occurred in the program suggest that the Navy may also have trouble meeting its cost targets for the larger, much more complex surface combatants in its shipbuilding plan, such as the DDG-1000 and the CG(X).

Submarines

The attack submarine force continues to be a major source of demand for the Navy's resources. Under the current plan, the Navy would buy two attack submarines a year beginning in 2012 (including Improved Virginia class submarines starting in about 2024). That procurement rate would continue through 2028 and then alternate between one and two submarines a year. The Navy's plan does not envision continuing to use guided missile submarines beyond the 2020s, when the existing Ohio class SSGNs are likely to be retired from service.

Senior Navy leaders have stated—and the 2008 shipbuilding plan assumes—that the cost of Virginia class submarines would have to be reduced by about 15 percent, to less than $2.3 billion each, before the Navy would be able to buy two per

year.[23] However, the Navy's 2008 budget requests an appropriation of about $2.7 billion for the next Virginia class submarine. Approximately 30 percent of that amount (or about $800 million) is for equipment furnished by the government, with the remainder to be spent by the shipyard building the submarine. If the necessary savings are intended to come from the shipyard, its expenses will have to be reduced by more than 20 percent to meet the Navy's cost goal for Virginia class submarines.

CBO estimates that the Virginias built during the 2008–2037 period would have an average cost of $2.7 billion apiece, on the basis of the prices that the Navy is currently paying for Virginia class submarines, the effects of producing two subs per year starting in 2012, and the real cost growth affecting naval shipbuilding. CBO also assumes that the Improved Virginia class would cost about 20 percent more to build than the original Virginia class did, largely because of past cost growth in the shipbuilding industry.

In addition to the attack submarine force, the 2008 plan calls for a force of 14 ballistic missile submarines through 2037. Consequently, the Navy intends to buy its first replacement SSBN in 2019 and purchase one per year starting in 2024 (three years earlier than under the 2007 plan). The design, cost, and capabilities of that replacement submarine are some of the most significant uncertainties in the Navy's and CBO's analyses. The Navy's plan assumes that the first ship of a new class of ballistic missile submarines—an SSBN(X)—would cost $4.1 billion and that subsequent ships would cost about $3.2 billion each. The average cost for 14 SSBN(X)s would be about $3.3 billion (see Table 3 on page 13).

Some senior Navy officials who oversee submarine programs have stated that the most cost-effective strategy for designing a new ballistic missile submarine would be to rely heavily on the Virginia class design. Much of the bow and stern of a Virginia, as well as the nuclear reactor, could be incorporated into the SSBN(X). However, new missile-compartment sections would have to be developed and integrated into the submarine's design. The practicality of using the Virginia class as a model has not yet been explored, and the Navy is only beginning to think about how to design an SSBN(X). No notional design or displacement estimate exists. Most participants in the process and outside observers agree that the new ballistic missile submarine would probably be substantially smaller than existing Ohio class submarines.

Adopting an approach consistent with that thinking, CBO assumed that the Navy would buy 14 SSBN(X)s that would be smaller than Ohio class submarines. CBO assumed that the SSBN(X) would be designed to carry 16 missile tubes (instead of the 24 on existing submarines) and would displace about 15,000 tons submerged—making it roughly twice the size of a Virginia but nearly 4,000 tons

23. The Navy's position is that to purchase two submarines per year in 2012, their cost would have to fall to $2.0 billion each in 2005 dollars, which equals about $2.3 billion in 2008 dollars.

smaller than an Ohio. On the basis of what the Navy is currently paying for a Virginia class submarine, CBO estimated that the average cost of the SSBN(X) would be about $6.3 billion. A smaller design with only 12 or 8 missile tubes could cost $700 million or $1.4 billion less, respectively.

Amphibious Ships

The Navy's 313-ship plan calls for a force of 31 amphibious ships organized around nine expeditionary strike groups. Each group would include one large amphibious assault ship (LHA or LHD class), one amphibious transport dock (LPD), and one dock landing ship (LSD). The 2008 plan would end the LPD-17 class at nine ships—one short of the Navy's stated goal of 10—and would maintain nine LHAs or LHDs by buying replacements for them about every three years.[24]

Specifically, the Navy's plan would purchase an LHA-6 in 2017—in addition to the one being bought in 2007 and the MPF(F) versions of that ship to be purchased in 2010 and 2013—as well as six replacements for the Wasp class LHDs in the 2020s and 2030s. In addition, 12 replacements for today's LSD-41 and LSD-49 class ships, which will start to reach the end of their service lives in about 15 years, would be purchased in the long term.[25] The Navy's cost target for an amphibious ship is $1.5 billion. That target averages the costs of the large LHAs and LHDs (which displace about 40,000 to 45,000 tons) and the smaller LSD replacements (which would probably displace 20,000 to 25,000 tons).

CBO assumed that no future amphibious assault ship would be substantially larger than the lead LHA-6 (a variant of the existing LHD design), which is being bought this year. According to the Navy, the current shipbuilding plan assumes that future large-deck amphibious ships will look much like the first LHA-6. Under that assumption, CBO estimated that the average cost of an amphibious ship—that is, the average for the LHA-6s, LHD replacements, and LSD(X)s—would be $2.3 billion (see Table 3 on page 13).

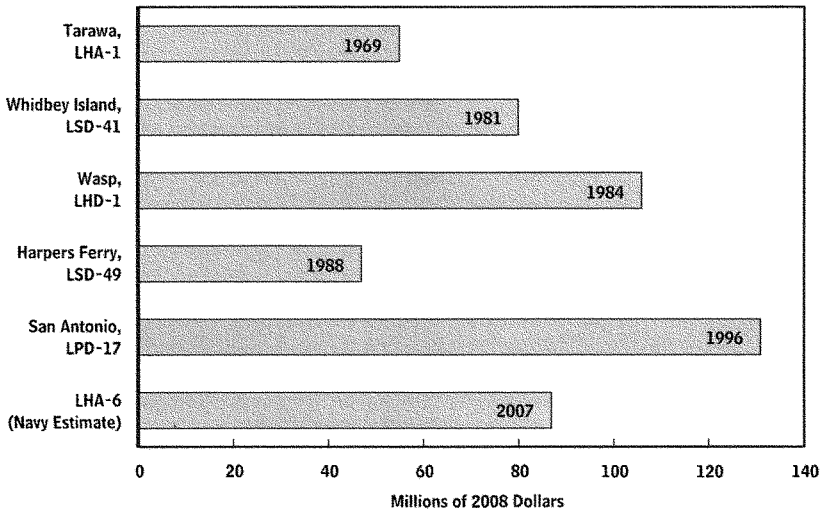
The Navy's experience with the San Antonio (LPD-17) class of amphibious ships serves as a useful illustration of how ship costs rise from one generation to the next on a per-ton basis. It also illustrates the difficulty of reducing those costs to levels that might meet the Navy's targets. On a per-ton basis, the lead LPD-17 was the most expensive amphibious ship ever built, at more than $130 million per thousand tons (see Figure 4). Using the historical cost-weight relationship of either the LSD-41 or LHD-1 amphibious ship as an analogy would have substantially understated the actual costs of the LPD-17. Subsequent ships in the LPD-17 class cost

24. In the Navy's stated requirements, the 10th LPD-17 would be part of the forward-based expeditionary strike group in Japan, which normally is composed of four amphibious ships.

25. According to the Navy, the three LSDs beyond the nine needed for expeditionary strike groups would be used for antiterrorism missions.

Figure 4.

Cost per Thousand Tons for the Lead Ship of Various Classes of Amphibious Ships



Source: Congressional Budget Office based on data from the Navy.

Notes: The years shown here indicate the year in which each lead ship was authorized.

Costs are per thousand tons of lightship displacement (the weight of the ship itself without its crew, materiel, weapons, or fuel).

The LSD-49 is a variant of the LSD-41, and the LHA-6 is a variant of the LHD-8, the last ship of the LHD-1 class. The principal differences between the LHA-6 and the LHD-8 are that the LHA-6 will not have a docking well but will have enhanced aviation capabilities.

between $1.4 billion and a little less than $1.7 billion, or an average of about $90 million per thousand tons. To meet the $1.5 billion cost target in the current shipbuilding plan, the Navy would have to build all future amphibious ships for about $70 million per thousand tons. However, the Navy estimates that the lead LHA-6 will cost about $90 million per thousand tons.

Maritime Prepositioning Ships

In a June 2005 report to the Congress, the Navy outlined the future of the Maritime Prepositioning Force. It described an MPF(F) squadron consisting of 12 ships, most of which would be based on designs of existing amphibious or support ships. The squadron would include two LHA-6s; an LHD; three modified large, medium-speed roll-on/roll-off ships; three modified-design T-AKE support ships; three mobile landing platforms (large flow-on/flow-off ships to carry the squadron's landing craft); and two ships from existing maritime prepositioning squadrons.

However, the Navy's current shipbuilding plan appears to forgo a modified T-AKE design. Instead, the Navy would build the same versions that are now under construction, thus reducing their cost by about $200 million per ship relative to the June 2005 estimates. The Navy also intends to use an existing LHD in the MPF(F) squadron. With those changes, the Navy plans to buy one such squadron at a total estimated cost of about $12 billion. However, CBO estimates that such a squadron would cost about $14 billion, reflecting its higher cost estimates for various ships in the squadron, such as the LHA-6s and current-design T-AKEs.

The Value of Historical Cost-Weight Relationships in Estimating the Prices of Future Ships

As noted above, CBO looks at the relationship between cost and weight (specifically, the cost per thousand tons of lightship displacement) of analogous past or present ships to estimate the prices of future naval vessels. That method assumes, broadly speaking, that what has happened in the past will be repeated in the future. CBO takes into account changes or productivity improvements in shipbuilding practices and procedures; but such changes are frequently offset by, for example, cost increases for labor and materials, unexpected production problems, increased requirements, or new technologies.

In testimony before the Congress, some Navy officials have characterized CBO's methodology as "worst-case analysis" or an "extremely conservative" estimating technique that seeks to include all possible sources of cost risk. Despite its purported conservatism, however, that method would have understated the actual costs of the littoral combat ship, the LPD-17 amphibious warfare ship, and the CVN-76 and CVN-77 aircraft carriers, and it would have closely approximated the cost of the lead Virginia class attack submarine.

United States Government Accountability Office

GAO

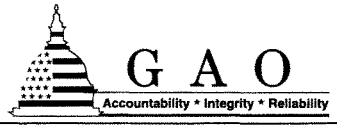
Testimony
Before the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, House of Representatives

For Release on Delivery
Expected at 2:00 p.m. EDT
Tuesday, July 24, 2007

DEFENSE ACQUISITIONS

Realistic Business Cases Needed to Execute Navy Shipbuilding Programs

Statement of Paul L. Francis, Director
Acquisition and Sourcing Management Team



GAO-07-943T

July 2007

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Highlights

Highlights of GAO-07-943T, a testimony before the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, House of Representatives

DEFENSE ACQUISITIONS

Realistic Business Cases Needed to Execute Navy Shipbuilding Programs

Why GAO Did This Study

The Navy is beset with long-standing problems that affect its ability to accomplish ambitious goals for its shipbuilding portfolio. Significant cost growth and long schedule delays are persistent problems. Making headway on these problems is essential in light of the serious budget pressures facing the nation.

This testimony focuses on (1) cost growth in shipbuilding, (2) acquisition approaches in the LPD 17, Littoral Combat Ship, DDG 1000 and CVN 78 programs and (3) steps the Navy can take to improve its acquisition decision-making, particularly the adoption of a knowledge-based framework.

What GAO Recommends

While GAO is making no new recommendations in this testimony, GAO has made numerous recommendations through the years to improve business cases for Navy acquisitions as well as other Department of Defense weapon acquisitions. The Department's acquisition policies largely incorporate these recommendations, but they have not been implemented on actual programs.

www.gao.gov/cgi-bin/getrpt?GAO-07-943T.

To view the full product, including the scope and methodology, click on the link above. For more information, contact Paul L. Francis at (202) 512-4841 or franciep@gao.gov.

What GAO Found

The Navy has exceeded its original budget by more than $4 billion for the 41 ships under construction at the beginning of this fiscal year. And more cost growth is coming. Cost growth is not just a problem for lead ships of a new class but also for follow-on ships. For example, costs for the first two Littoral Combat Ships have more than doubled. Similarly, costs for the first two San Antonio class (LPD 17 and LPD 18) amphibious ships have increased by over $1.3 billion—almost a 77 percent increase above the initial budgets. Cost growth of this magnitude leads to lost opportunities for tomorrow's needs.

These types of problems point to the wisdom of using solid, executable business cases to design and build ships. A business case requires a balance between the concept selected to satisfy warfighter needs and the resources—technologies, design knowledge, funding, time, and management capacity—needed to transform the concept into a product, in this case a ship. Neither LPD 17 nor the Littoral Combat Ship programs was framed around an executable business case; rather, the programs pushed ahead without a stable design and without realistic cost estimates, resulting in higher costs, schedule delays, and quality problems. The Navy has a more thoughtful business case for its next generation aircraft carrier and destroyer programs (CVN 78 and DDG 1000, respectively) before construction, but the programs remain at risk for cost growth partly because of continuing efforts to mature technologies. GAO's work on best practices highlights the need for a disciplined, knowledge-based approach to help shipbuilding, and other defense acquisition programs achieve more successful outcomes. This approach is predicated on certain essentials, including:

- ensuring that technology maturity is proven before a design is considered stable and understanding that production outcomes cannot be guaranteed until a stable design is demonstrated;
- improving cost estimating to develop initial shipbuilding budgets that are realistically achievable; and
- improving cost management through increased use of fixed-price contracting and comprehensive cost surveillance.

A significant challenge to adapting a knowledge-based approach is the lack of a common understanding across programs regarding the definition, timing, and criteria for key knowledge junctures. For example, each shipbuilding program seems to have a different measure as to how much of the design needs to be complete before beginning ship construction. Similarly, there appears to be little criteria across programs regarding how much knowledge—such as the percent of ship units built—is needed at different decision points, including keel lay, fabrication start, and ship launch.

Mr. Chairman and Members of the Subcommittee,

I am pleased to be here today to discuss the Department of the Navy's shipbuilding programs, including its surface combatant programs. The Navy has ambitious goals for its shipbuilding programs. The Navy expects to build more—and often increasingly complex ships—and deliver them to meet warfighter needs, while still achieving reduced acquisition and/or life cycle costs. These are admirable goals, representing the Navy's desire to provide the fleet with the most advanced ships to meet national defense and military strategies. However, there is often tension among the Navy's cost, schedule, industrial base, and capability goals. While this tension is embedded at the beginning of shipbuilding programs, its effects are realized later, during ship construction. Budgets set prior to beginning construction are not realistically achievable and often include optimistic dates for delivery to the fleet. The consequence is often that costs increase after construction has begun, schedule targets slip, and contract scope is reduced. The LPD 17—the lead ship of the San Antonio class amphibious ships—is a case in point. The cost to construct the ship has more than doubled, delivery was delayed by over 3 years, and ship quality ultimately compromised.

Today, I would like to discuss (1) cost growth in shipbuilding programs, (2) acquisition approaches in the LPD 17, Littoral Combat Ship (LCS), the next-generation destroyer and aircraft carrier programs (DDG 1000 and CVN 78, respectively), and (3) steps the Navy can take to improve its acquisition decision making, particularly the adoption of a knowledge-based management framework.

Summary

Cost growth in shipbuilding programs remains a problem. Ships under construction at the beginning of the fiscal year have experienced cumulative cost growth almost $5 billion above their original budgets. Cost growth displaces other ships contemplated in the Navy's 30-year shipbuilding plan and reduces the buying power of the shipbuilding budget.

This cost growth illustrates the problems that arise when programs proceed without a solid business case. A business case requires a balance between the concept selected to satisfy warfighter needs and the resources—technologies, design knowledge, funding, time, and management capacity—needed to transform the concept into a product, in this case a ship. Both the LPD 17 and the LCS programs illustrate the perils of proceeding without a solid, executable business case. Both programs

pushed ahead without stable designs or realistic cost and schedule estimates, resulting in higher costs, schedule delays, and quality problems.

A paradigm shift is needed for shipbuilding programs. Technology maturity must be proved before a design can be considered stable, and production outcomes cannot be guaranteed until a stable design is demonstrated. The Navy also needs to

- define and align knowledge points more consistently across programs to optimize resource allocation and improve performance;
- ensure initial shipbuilding budgets are realistic by improving cost estimating, and
- improve cost management through increased use of fixed-price contracting and comprehensive cost surveillance.

Cost Growth Remains a Problem in Navy Shipbuilding Programs—and May Threaten Future Success

Cost growth is a persistent problem for shipbuilding programs as it is for other weapon systems. Over 40 ships were under construction at the beginning of this fiscal year. If the performance of future shipbuilding programs continues at the same rate as current programs, the Navy will be forced to fund cost growth in future budget years at the expense of other ships in the Navy's shipbuilding plan.

Funding for the 41 ships under construction is over $56 billion, almost $4.6 billion above initial budget requests.[a] Congress has already appropriated additional funds to cover most of these cost increases (see table 1).

[a]Based on the fiscal year 2008 President's budget request and over $513 million in fiscal year 2007 funding transfers from other Navy programs.

Table 1: Cost Growth in Program Budgets for Ships under Construction in Fiscal Year 2007

Dollars in millions

Ship	Initial budget	Fiscal year 2008 or latest President's budget	Total cost growth	Cost growth as a percent of initial budget
CVN 77	$4,975	$5,822	$847	17%
DDG 100–112	14,309	14,679	370	3
LCS 1-LCS 2[a]	472	1,075	603	128
LHD 8	1,893	2,196	303	16
LPD 18-23[b]	6,194	7,742	1,548	25
SSN 775-783[c]	20,744	21,678	934	5
T-AKE 1-9	3,354	3,386	32	1
Total: 41 ships	**$51,941**	**$56,578**	**$4,637**	

Source GAO analysis of Navy data

[a]Includes about $484 million in reprogrammed funding requested by the Navy through June 2007. A small amount of these funds may be designated for certain LCS research and development activities.

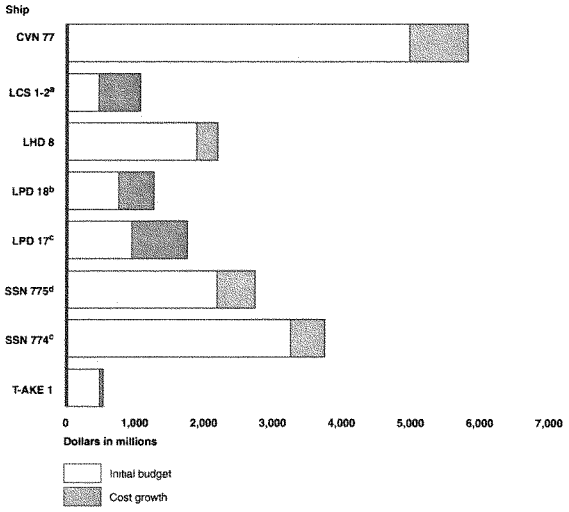
[b]Includes $29.3 million in reprogrammed funding requested by the Navy in 2007 to complete LPD 18 and LPD 20.

[c]The Navy has transferred $25.5 million in funding from SSN 776 to cover the costs of completing SSN 775 after delivery—and believes that additional unfunded shortfalls may still exist.

Note: For ships constructed on the Gulf Coast, cost growth can be attributed in part to the effects of Hurricanes Katrina and Rita. The Navy has already received over $1.1 billion in funding, and an additional $1.3 billion has also been appropnated for hurricane-related damages, but it has not yet been allocated to individual programs.

Breaking these costs down further reveals the dynamics of shipbuilding cost growth and the challenges it presents for the 30 year shipbuilding plan. For example, cost growth in mature programs, like the Arleigh Burke class destroyers (DDG 100-112) is low because most cost growth has already been captured in earlier ships. Cost growth in the Virginia class submarines (SSN 775-783) and the Lewis and Clark class auxiliary ships (T-AKE 1-9) is also low because they include several ships early in construction—before cost growth tends to occur. On the other hand, cost growth is particularly high on lead ships of a new class (see fig. 1).

Figure 1: Cost Growth in Lead Ships and Significant Follow-ons (Dollars in Millions)



Source: GAO analysis of Navy data

[a]LCS 1 and 2 include about $484 million in reprogrammed funding requested by the Navy through June 2007. A small amount of these funds may be designated for certain LCS research and development activities.

[b]Includes $20.6 million in reprogrammed funding requested by the Navy in 2007 to complete LPD 18.

[c]SSN 774 and LPD 17 were delivered in October 2004 and January 2005, respectively.

[d]The Navy has transferred $25.5 million in funding from SSN 776 to cover the costs of completing SSN 775 after delivery—and believes that additional unfunded shortfalls may still exist.

Cost growth for recent lead ships has been on the order of 27 percent.[b] The Navy is developing two lead ships in the LCS program—each with a unique

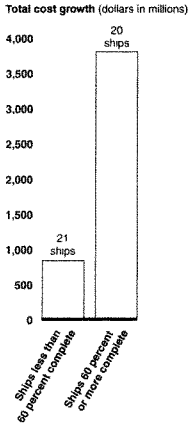
[b]Based on the initial and most recent President's budget request for all lead ships authorized between fiscal year 1996 and fiscal year 2006, including the second ship when the hull is constructed at a different shipyard than the first ship of the class.

design. These ships have already experienced a 128 percent cost growth. Cost increases are also significant if the second ship is assembled at a different shipyard than the first ship. This is the case with SSN 775, which has had cost growth of well over $500 million. Although the ship has been delivered, the Navy continues to incur costs for unfinished work.

Follow-on ships in many cases are also experiencing significant cost increases in construction. Although LPD 18 is the second ship of the class, construction costs grew by over $500 million—a more than 90 percent increase over its initial budget for construction. LPD 18 has recently been delivered, but the Navy requested an additional $20.6 million in reprogrammed funding in 2007 to complete the ship. Cost growth is particularly prevalent where major changes were made to an existing ship design. For example, CVN 77 is the final aircraft carrier of the Nimitz class and is based on the design of previous carriers, but it included over 3,500 design changes. CVN 77 has experienced cost growth in construction of over $847 million—a 17 percent increase over the initial budget.

Besides lead and mature ships, a number of ships under construction may not have realized the full extent of cost growth—which tends to lag behind the initial budget request by several years. In fact, the magnitude of cost growth occurs in later phases of construction—after ships are 60 percent or more complete (see fig. 2).

Figure 2 Cost Growth in Ships by Percent of Construction Completed



Source GAO analysis of Navy data

The current budgets for many ships have already proven inadequate to cover the likely costs to complete construction. Funding has been transferred from other Navy programs, obtained through prior year completion requests or shifted away from future build plans. The most prominent example is the LCS program. The Navy has already reprogrammed almost $485 million to fund cost increases for the first two LCS and deleted three Flight 0 ships from its budgets. The Navy transferred about $62 million in funding from future T-AKE ships to cover cost increases on the first two ships under construction. In the Virginia-class program, the Navy estimates about $130 million shortfall and plans to cover the shortfall from transfers from within the program. In December 2006, the Navy believed that about $67 million would be needed to complete LPD 20 and LPD 21. However, Navy officials stated that these estimates are too conservative because they represent cost growth against the current contract baseline for LPD ships under construction. The Navy anticipates increasing the baseline for the LPD 17 ships—resulting in even higher completion costs.

If current patterns of performance continue in the future, the Navy's shipbuilding plan will be in jeopardy. The Navy outlined its strategy for achieving a 313-ship force in its updated long-range shipbuilding plan. Over the next 5 years, the Navy plans to significantly increase the rate of construction and introduce nine new classes of ships, including the Ford-class aircraft carrier (CVN 78) and the Zumwalt-class destroyer (DDG 1000). To support the plan, the Navy will require shipbuilding funding significantly above current levels—on the order of $5 billion more by fiscal year 2013. The Navy recognizes that the success of the plan will depend on its ability to realistically estimate and control shipbuilding costs. Over the next year the Navy will begin construction of CVN 78, DDG 1000, and LHA 6 amphibious assault ship. The Navy estimates that these ships alone will require nearly $20 billion in construction funding, representing the Navy's most costly lead ships. Even a small percentage of cost growth on the big ships could lead to the need for hundreds of millions of dollars in additional funding.

Shipbuilding Programs Often Have Unexecutable Business Cases

Navy shipbuilding programs are often framed around an unexecutable business case, whereby ship designs seek to accommodate immature technologies, design stability is not achieved until late in production, and both cost and schedule estimates are unrealistically low. This situation has recently been evidenced in the LPD 17 and LCS programs, which have required costly out-of-sequence work during construction. The DDG 1000 and CVN 78 programs are at risk because of lingering technology immaturity, coupled with cost and schedule estimates with little margin for error.

Elements of a Business Case

We have frequently reported on the wisdom of using a solid, executable business case before committing resources to a new product development effort. In its simplest form, a business case requires a balance between the concept selected to satisfy warfighter needs and the resources—technologies, design knowledge, funding, time, and management capacity—needed to transform the concept into a product, in this case a ship. At the heart of a business case is a knowledge-based approach that requires that managers demonstrate high levels of knowledge as the program proceeds from technology development to system development and, finally, production. Adapting this approach to shipbuilding is a challenge, as I will discuss later. Ideally, in such an approach, key technologies are demonstrated before development begins. The design is stabilized before the building of prototypes or, in the case of ships, construction begins. At each decision point, the balance among time,

money, and capacity is validated. In essence, knowledge supplants risk over time.

A sound business case would establish and resource a knowledge-based approach at the outset of a program. We would define such a business case as firm requirements, mature technologies, and an acquisition strategy that provides sufficient time and money for design activities before construction start. The business case is the essential first step in any acquisition program that sets the stage for the remaining stages of a program, namely the business or contracting arrangements and actual execution or performance. If the business case is not sound, the contract will not correct the problem and execution will be subpar. This does not mean that all potential problems can be eliminated and perfection achieved, but rather that sound business cases can get the Navy better shipbuilding outcomes and better return on investment. If any one element of the business case is weak, problems can be expected in construction. The need to meet schedule is one of the main reasons why programs cannot execute their business cases. This pattern was clearly evident in both the LPD 17 and LCS programs. In both cases, the program pushed ahead with production even when design problems arose or key equipment was not available when needed. Short cuts, such as doing technology development concurrently with design and construction, are taken to meet schedule. In the end, problems occur that cannot be resolved within compressed, optimistic schedules. Ultimately, when a schedule is set that cannot accommodate program scope, delivering an initial capability is delayed and higher costs are incurred.

In shipbuilding programs, the consequences of moving forward with immature technologies or an unstable design become clear once ship construction begins. Ships are designed and constructed with an optimal sequence—that is, the most cost-efficient sequence to construct the ship. This includes designing and building the ship from the bottom up and maximizing the units completed in shipyard shops and installed in the dry dock while minimizing tasks performed when the ship is already in the water, which tend to be costlier than tasks on land. Once units are installed access to lower decks of the ship becomes more difficult. If equipment is not ready in time for installation, the shipbuilder will have to work around the missing equipment. Additional labor hours may be needed because spaces will be less accessible and equipment may require more time for installation.

Business Cases Deteriorated with Construction of LPD 17 and Littoral Combat Ships

What happens when the elements of a solid business case are not present? Unfortunately, the results have been all too visible in the LPD 17 and the LCS. Ship construction in these programs has been hampered throughout by design instability and program management challenges that can be traced back to flawed business cases. The Navy moved forward with ambitious schedules for constructing LPD 17 and LCS despite significant challenges in stabilizing the designs for these ships. As a result, construction work has been performed out of sequence and significant rework has been required, disrupting the optimal construction sequence and application of lessons learned for follow-on vessels in these programs.

In the LPD 17 program, the Navy's reliance on an immature design tool led to problems that affected all aspects of the lead ship's design. Without a stable design, work was often delayed from early in the building cycle to later, during integration of the hull. Shipbuilders stated that doing the work at this stage could cost up to five times the original cost. The lead ship in the LPD class was delivered to the warfighter incomplete and with numerous mechanical failures, resulting in a lower than promised level of capability. These problems continue today—2 years after the Navy accepted delivery of LPD 17. Recent sea trials of the ship revealed problems with LPD 17's steering system, reverse osmosis units, shipwide area computing network, and electrical system, among other deficiencies. Navy inspectors noted that 138 of 943 ship spaces remained unfinished and identified a number of safety concerns related to personnel, equipment, ammunition, navigation, and flight activities. To date, the Navy has invested over $1.75 billion constructing LPD 17.

In the LCS program, design instability resulted from a flawed business case as well as changes to Navy requirements. From the outset, the Navy sought to concurrently design and construct two lead ships in the LCS program in an effort to rapidly meet pressing needs in the mine countermeasures, antisubmarine warfare, and surface warfare mission areas. The Navy believed it could manage this approach, even with little margin for error, because it considered each LCS to be an adaptation of an existing high-speed ferry design. It has since been realized that transforming a high-speed ferry into a capable, networked, survivable warship was quite a complex venture. Implementation of new Naval Vessel Rules (design guidelines) further complicated the Navy's concurrent design-build strategy for LCS. These rules required program officials to redesign major elements of each LCS design to meet enhanced survivability requirements, even after construction had begun on the first ship. While these requirements changes improved the robustness of LCS designs, they contributed to out of sequence work and rework on the lead

ships. The Navy failed to fully account for these changes when establishing its $220 million cost target and 2-year construction cycle for the lead ships.

Complicating LCS construction was a compressed and aggressive schedule. When design standards were clarified with the issuance of Naval Vessel Rules and major equipment deliveries were delayed (e.g., main reduction gears), adjustments to the schedule were not made. Instead, with the first LCS, the Navy and shipbuilder continued to focus on achieving the planned schedule, accepting the higher costs associated with out of sequence work and rework. This approach enabled the Navy to achieve its planned launch date for the first Littoral Combat Ship, but required it to sacrifice its desired level of outfitting. Program officials report that schedule pressures also drove low outfitting levels on the second Littoral Combat Ship design as well, although rework requirements have been less intensive to date. However, because remaining work on the first two ships will now have to be completed out-of-sequence, the initial schedule gains most likely will be offset by increased labor hours to finish these ships.

The difficulties and costs discussed above relate to the LCS seaframe only. This program is unique in that the ship's mission equipment is being developed and funded separately from the seaframe. The Navy faces additional challenges integrating mission packages with the ships, which could further increase costs and delay delivery of new antisubmarine warfare, mine countermeasures, and surface warfare capabilities to the fleet. These mission packages are required to meet a weight requirement of 180 metric tons or less and require 35 personnel or less to operate them.[c] However, the Navy estimates that the mine countermeasures mission package may require an additional 13 metric tons of weight and 7 more operator personnel in order to deploy the full level of promised capability. Because neither of the competing ship designs can accommodate these increases, the Navy may be forced to reevaluate its planned capabilities for LCS.

[c]LCS mission packages include combat systems, support equipment, computing environment, and mission crew. The mission package weight requirement of 180 metric tons or less also includes aviation fuel, and the manning requirement of 35 or less includes personnel comprising an aviation detachment.

DDG 1000 and CVN 78 Have More Thoughtful Business Cases, but Significant Technical Risks Remain

Elements of a successful business case are present in the Navy's next-generation shipbuilding programs—CVN 78 and DDG 1000. The Navy's plans for these programs call for a better understanding of the designs of these ships prior to beginning construction, thereby reducing the risk of costly design changes after steel has been bent and bulkheads built. Yet some elements of their business cases put execution within budgeted resources at risk. While the Navy has recognized the need to mature each ship's design before beginning construction, CVN 78 and DDG 1000 remain at risk of cost growth due to continuing efforts to mature technologies. Success in these programs depends on on-time delivery and installation of fully mature and operational technologies in order to manage construction costs. Budgets and schedules for each ship leave little if any margin for error.

DDG 1000

The DDG 1000 development has been framed by challenging multi-mission requirements, resultant numerous technologies and a tight construction schedule driven by industrial base needs. In the DDG 1000 program, the Navy estimates that approximately 75 percent of detail design will be completed prior to the start of lead ship construction in July 2008. Successfully meeting this target, however, depends on maturing 12 technologies as planned. Currently, three of these technologies are fully mature. Two DDG 1000 technologies—the volume search radar and total ship computing environment—have only completed component-level demonstrations and subsequently remain at lower levels of maturity. Schedule constraints have also forced the Navy to modify its test plans for the integrated power system and external communication systems.

The volume search radar, one of two radars in the dual band radar system, will not have demonstrated the power output needed to meet requirements even after integrated land-based testing of the prototype radar system is completed in 2009. Production of the radars, however, is scheduled to begin in 2008, introducing additional risk if problems are discovered during testing. According to Navy officials, in the event the volume search radar experiences delay in testing, it will not be integrated as part of the dual band radar into the DDG 1000 deckhouse units that will be delivered to the shipbuilders. Instead, the Navy will have to task the shipbuilder with installing the volume search radar into the deckhouse, which program officials report will require more labor hours than currently allocated. The DDG 1000 program's experience with the dual band radar has added significance as the same radar will be used on CVN 78.

In the case of the DDG 1000 total ship computing environment, the Navy is developing hardware infrastructure and writing and releasing six blocks of software code. Although development of the first three software blocks progressed in line with cost and schedule estimates, the Navy has been forced to defer some of the functionalities planned in software release four to software blocks five and six due to changes in availability of key subsystems developed external to the program, introduction of non development items, and changes in program integration and test needs. The Navy now plans to fully mature the integrated system following ship construction start—an approach that increases program exposure to cost and schedule risk in production.

The DDG 1000 program also faces challenges completing testing for its integrated power system and external communications systems. Currently, shipbuilder-required equipment delivery dates for these systems do not permit time for system-level land-based integration testing prior to delivery. As a result, the Navy has requested funds in fiscal year 2008 for the third shipset of this equipment so that testing can be completed without interrupting the planned construction schedules of the first two ships. However, in the event problems are discovered, DDG 1000 construction plans and costs could be at risk.

CVN 78

The Navy has completed the basic design of CVN 78, and the shipbuilder is currently developing the carrier's more detailed design. According to the shipbuilder, about 70 percent of CVN 78's design is complete, with almost all of the very low decks of the ship completely designed. Progress in designing CVN 78 is partially the result of a longer preparation period that has enabled the shipbuilder to design more of the ship prior to construction than was the case on previous carriers. However, the Navy may face challenges in maintaining its design schedule because of delays in the development of the ship's critical technologies. Such delays could impede the completion of the ship's design and interfere with the construction of the ship.

CVN 78 will feature an array of advanced technologies such as a new nuclear propulsion and electric plant, an electromagnetic aircraft launch system (EMALS) and an improved aircraft arresting system. These technologies, along with an expanded and improved flight deck, are designed to significantly improve performance that the Navy believes will simultaneously reduce acquisition and life cycle costs compared to previous carriers. The Navy has focused much attention on developing technologies and has retired much risk. Yet risk remains. The schedule for installing CVN 78's technologies takes advantage of construction

efficiencies. The shipbuilder has identified key dates when technologies need to be delivered to the yard in order to meet its optimal construction schedule. A number of CVN 78's technologies have an increased potential to affect this schedule because they are (1) located low in the ship and needed early in construction or (2) highly integrated or embedded in the ship's design. The dual band radar is integrated into the design of the carrier's island and is critical to the smaller island design. EMALS crosses 48 of the ship's 423 zones (or separate units that make up the ship's design). For example, problems with EMALS could have a cascading effect on other areas of the ship.

While the Navy has mitigated the risk posed by some technologies, like the nuclear propulsion and electric plant, key systems, in particular, EMALS, the advanced arresting gear, and the dual band radar have encountered difficulties during development that will likely prevent timely delivery to the shipyard. Challenges include the following:

- **EMALS** encountered technical difficulties developing the prototype generator and meeting detailed Navy requirements, which led to increased program costs and an over 15-month schedule delay. To meet shipyard dates for delivering equipment, the contractor eliminated all schedule margin, normally reserved for addressing unknown issues. Yet, significant challenges lay ahead—the Navy will begin testing a production representative system in 2008, and the shipboard system will be manufactured in a new facility inexperienced with production. If problems occur in testing or production, the contractor will not be able to meet its delivery date to the shipyard, causing work to be done out of sequence.
- The **advanced arresting gear** program faced difficulties delivering drawings to the Navy, leading to program delays. Schedule delays have slipped the production decision and delivery to CVN 78 by 6 months. In an effort to maintain shipyard delivery dates, the Navy has consolidated upcoming test events—increasing test cycles and eliminating schedule margin. However, by compressing test events, the Navy will have little time to address any problems prior to production start. Late delivery of the advanced arresting gear will require installation after the flight deck has been laid. The shipbuilder will expend additional labor to lower the system into place through a hole cut in the flight deck.
- The **dual band radar** presents the most immediate risk to the DDG 1000 program, but delays in production could cascade down to CVN 78—affecting delivery to the shipyard. Moreover, upcoming land-based testing will not include certain demonstrations of carrier-specific performance. In particular, the Navy has not yet scheduled tests to

verify the radar's air traffic control capability, but expects such demonstrations will occur by the end of fiscal year 2012. This leaves little to no time to make any necessary changes before the radar's 2012 in-yard date.

The CVN 78 business case also faces risks in the area of cost because the estimate that underpins the budget is optimistic. For example, the Navy estimates that fewer labor hours will be needed to construct CVN 78 than the previous two carriers—even though it is a lead ship that includes cutting edge technologies and a new design. Although the Navy is working with the shipbuilder now to reduce costs prior to the award of a construction contract (scheduled for early next year) through such measures as subsidizing capital expenditures to gain greater shipyard efficiency, costs will likely exceed budget if technologies or other materials are delivered late or labor hour efficiencies are not realized.

A Disciplined, Knowledge-Based Process Is Key to Better Outcomes

How can the Navy achieve better outcomes in its shipbuilding programs? Our work on best practices highlights the need for a disciplined, knowledge-based approach so that programs proceed with a high probability of success. This means technology maturity must be proven before a design can be considered stable, and production outcomes cannot be guaranteed until a stable design is demonstrated. The challenge in adapting such an approach to shipbuilding is determining when these levels of knowledge should be reached in shipbuilding programs and what standards should serve as criteria for demonstrating this knowledge. It seems that no two shipbuilding programs are run the same way. For example, it can be agreed that key aspects of a ship's detail design must be completed before construction begins. However, what those aspects are or how they should be measured is not defined. What may be acceptable in one shipbuilding program is not acceptable in another. In our reviews of ship programs, the definition of phases, strategies, and decision points varies from program to program. In addition to defining key junctures of knowledge, standards, and corresponding decision points for shipbuilding programs, there are other steps the Navy could take that would better inform its acquisition decision making in shipbuilding programs. These include:

- ensuring that initial shipbuilding budgets are realistically achievable by improving cost estimating, and
- improving cost management through increased use of fixed-price contracting and comprehensive cost surveillance.

Aligning Knowledge and Decision Points Consistently across Shipbuilding Programs

Each shipbuilding program seems to embody its own strategy for making decisions. In programs other than shipbuilding, the Milestone B decision represents the commitment to design and develop a system, at which time requirements should be firm and critical technologies mature. Milestone B means different things in different shipbuilding programs. The CVN 21 program held its Milestone B review shortly before a preliminary design review, and 3 years before the planned approval for the construction contract. The Milestone B review for DDG 1000—called DD(X) at the time--occurred over 1 year after the preliminary design review and shortly after the critical design review—it was used to authorize negotiation of a construction contract. The LCS program has received authorization for construction of six ships—it has yet to hold a Milestone B review.

The need for a common understanding of what Milestone B represents is all the more important given the requirements for certification at Milestone B enacted by Congress in 2006.[d] These provisions require the decision authority to certify that, among other things,

- the technology has been demonstrated in a relevant environment,
- requirements have been approved by the Joint Requirements Oversight Council,
- the program is affordable, and
- the program demonstrates a high likelihood of accomplishing its intended mission.

We believe that the certification for all shipbuilding programs should take place at the same point. The uniqueness of individual program strategies leads to similar challenges in trying to establish what level of knowledge is needed at subsequent critical junctures in shipbuilding programs. Each shipbuilding program seems to have a different measure as to how much of the design needs to be complete—and what constitutes design readiness—prior to beginning ship construction. It seems to us that there should be clear metrics for what the Navy expects at key junctures across all shipbuilding programs. Further, there appears to be few criteria across shipbuilding programs regarding how much knowledge—such as the percentage of ship units built—is needed at different decision points, including keel lay, fabrication start, and ship launch. A clearer understanding of the key knowledge junctures and corresponding criteria

[d]National Defense Authorization Act for Fiscal Year 2006, Pub. L. No. 109-163, § 801; 10 U.S.C. § 2366a.

across shipbuilding programs would help establish a better basis for cost and schedule estimates.

Establishing Executable Program Budgets through Improved Cost Estimating

As we have seen, the Navy's track record for achieving its initial budgets for shipbuilding programs has not been good. If we expect programs to be executed within budget, programs need to begin with realistic budgets. Since ship construction is generally budgeted in 1 fiscal year—or in the case of CVN 78 and DDG 1000—over 2 years, it is essential that the Navy understand and plan for the likely costs of the ship when construction is authorized. A ship's initial budget will, in large part, determine whether and how much cost growth will occur and require funding in later years.

The foundation of an executable budget is a realistic cost estimate that takes into account the true risk and uncertainty in a program. Realistic cost estimates are important not only because they are used to establish program budgets, but also because they help enable the Navy to determine priorities, including whether to proceed with a program. Our past work has shown that the Navy tends to underestimate the costs needed to construct ships—resulting in unrealistic budgets and large cost increases after ship construction has begun. Initial estimates of LPD 17 and LCS 1 assumed significant savings based on efficiencies that did not materialize as expected. Future ships like CVN 78 make similar assumptions.

One way to improve the cost-estimating process is to present a confidence level for each estimate, based on risk and uncertainty analyses. By conducting an uncertainty analysis that measures the probability of cost growth, the Navy can identify a level of confidence for its estimates and determine whether program costs are realistically achievable. Navy cost analysts told us that they used quantitative risk analyses to test the validity of cost estimates of CVN 78 and DDG 1000. We believe that the Navy and the Department of Defense (DOD) should take this a step further—requiring a high confidence level threshold when making program commitments and budget requests. The Defense Acquisition Performance Assessment Panel recommended an 80 percent confidence level, meaning that a program has an 80 percent chance of achieving its estimated costs.[6] Whether this is the right level warrants thoughtful discussion, but it is worth noting that analyses for CVN 78 and DDG 1000 were well below an

[6]Defense Acquisition Performance Assessment Panel, *Defense Acquisition Performance Assessment Report* (Washington, D.C., January 2006).

80 percent confidence level (in the case of DDG 1000 at around 45 percent)—increasing the likelihood that costs will grow above budget.

Timing is also an important element for achieving realism in budgets. In the past, the Navy has generally requested approval for detail design and construction of the lead ship at the same time. As a result, construction budgets did not benefit from the knowledge gained in system design or early stages of detail design. An alternative approach is to separate the decision to fund detail design from the decision to fund construction. The benefits of this approach are evident in the funding of DDG 1000. The Navy first requested funding for detail design and construction of the lead ship in its fiscal year 2005 budget request, estimating these costs to total $2.7 billion. Congress did not fund construction of the lead ship, but instead funded detail design and purchase of some materials in the fiscal years 2005 and 2006 budgets. In March 2005, the Navy completed a life-cycle cost estimate for the ship that placed the cost of DDG 1000 at $3.3 billion. DOD independent cost analysts estimated even higher costs. The budget request for fiscal years 2007 and 2008 included $3.3 billion for each of the two lead ships, reflecting an improved understanding of budget requirements compared to the initial fiscal year 2005 request.

Better Management of Costs through Fixed-Price Contracting and Comprehensive Cost Surveillance

The Navy can take other steps to improve the outcomes of its shipbuilding programs by strengthening its cost management capability, including

- greater use of fixed-price contracting and
- enhanced and comprehensive cost surveillance

Fixed-priced Contracting for Construction

In an effort to improve cost management, the Navy is promoting fixed-priced contracts for ship construction. In a fixed-price incentive contract, costs above a target are shared with the contractor, up to a ceiling price. Both the target cost and price ceiling are negotiated at the outset. The contractor is responsible for costs above the ceiling price, limiting the government's cost risk. In shipbuilding, lead ships are commonly done under cost-plus-incentive-fee contracts as are some follow-on ships. Under these contracts, the government is responsible for paying allowable costs incurred and the fee will be adjusted according to a negotiated formula. The first five LPD 17 ships use cost-plus-incentive-fee contracts and the first two LCS are being built under cost-type contracts. The Navy typically uses fixed-priced incentive contracts for ships that are later in the class, including DDG 51 class destroyers and CVN 77, and for all ships in the T-AKE class of auxiliary ships, a less complex ship.

We are encouraged by the Navy's efforts to move to fixed-price contracts. Fixed-price contracts limit the government's risk of cost growth while encouraging realism in negotiating contract prices and careful cost management. However, the move to fixed-price contracting is feasible only if risks can be understood and managed. If the Navy is to use fixed-price contracts for the second or third ship in the class—or even the lead ship—it must supplant risk with knowledge. We are convinced that a move to fixed-price contracting will only succeed if the Navy adopts a more disciplined process, one that ensures that the elements of an executable business case exist as the development effort begins. If technologies are still being demonstrated, the delivery of critical systems when needed cannot be assured. Nor can designs be finalized. Increased used of fixed-price contracting requires that technologies be demonstrated early, the design stabilized before construction begins, and realistic estimates for cost and schedule made.

Cost Surveillance

Given the risk of cost growth in shipbuilding, it is equally important that the Navy strengthen its oversight of shipyard cost performance. Our work has shown that the Navy may not have adequate management tools necessary to identify and react to early signs of cost growth. In particular, in the CVN 78 program the Navy has not effectively used earned value management data captured in cost performance reports submitted by the contractor. Earned value management is a tool that provides the government and contractors with insight into technical, cost, and schedule progress on their contracts. Although the shipbuilder is designing much of CVN 78 prior to the award of the construction contract, we found that contractor cost performance reports do not provide an objective measure of program schedule and costs incurred. While the Navy expects that future cost performance reports will better reflect shipyard performance after the construction contract is awarded and significant construction work is under way, it has missed an opportunity to gain insight into current costs—and gauge future shipyard performance. Moreover, the Navy may not require the shipbuilder to submit monthly cost performance reports that include variance analyses, which describe the reasons for cost and schedule variances. Without monthly contractor performance reports that include variance analyses, the Navy will miss timely information regarding root causes for cost and schedule problems and mitigation efforts—making it more difficult to identify risk and take corrective action.

But timely and complete cost performance reports are not enough. The Navy must leverage this information to better manage shipbuilder performance. In particular, the Navy's Supervisor of Shipbuilding

(SUPSHIP) is not engaged in evaluating shipbuilder cost performance for all shipbuilding programs. SUPSHIP provides the Navy with unique insight into program performance because it is located at the shipyard, providing on-site program surveillance, including independent analysis of shipbuilder cost and schedule performance. However, SUPSHIP does not currently have the capability to conduct independent cost surveillance of the CVN 78 program. We believe that this capability is necessary to effectively analyze shipbuilder cost data and verify that the data depict actual conditions and trends.

Cost surveillance at the shipyard is just one element of the management capacity needed to plan and execute shipbuilding programs. There has also been considerable discussion of the need to have a workforce with the right skills in the right numbers. It has been more difficult to arrive at a firm definition of the size and composition of the workforce needed, and the appropriate balance between government and contractor personnel. Sharp declines in the size of the acquisition workforce have occurred over the last several years. The Navy's numbers are a case in point. The Navy reports that staffing at Naval Sea Systems Command headquarters has decreased by almost 50 percent since 1991, from 4,871 to 2,331 personnel.

Mr. Chairman, that concludes my statement. I would be pleased to answer any questions.

Objectives, Scope, and Methodology

To develop information on the status of Navy shipbuilding programs and practices that can improve the process for acquiring ships, we relied largely on our prior reporting on shipbuilding programs and updates to this work, as well as work under way for the committee on the CVN 78 program. In the course of this work, we analyzed program documents, including program baselines, contractor performance reports, cost estimates, budget documents and other program assessments, as well as policy guidance. We also interviewed government, shipbuilding, and other contractor officials associated with a number of shipbuilding programs, including CVN 77 and 78, LPD 17, DDG 1000, LCS, and Virginia-class Submarines.

Contact and Staff Acknowledgments

For future questions about this statement, please contact me at (202) 512-4841. Individuals making key contributions to this statement include Lisa L. Berardi, Noah B. Bleicher, Gwyneth M. Blevins, Lily J. Chin,

Todd Dice, Christopher R. Durbin, Jennifer Echard, Diana Moldafsky, Moshe Schwartz, and Karen Zuckerstein.

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Appendix I: Cost Growth for Individual Ships

Table 2: Cost Growth in Program Budgets

Dollars in millions (figures may not add due to rounding)

Ship	Initial Budget	Fiscal year 2008 President's budget[a]	Total cost growth	Cost growth due to construction	Cost growth due to Navy-furnished equipment	Cost growth as a percent of initial budget
CVN 77	$4,975	$5,822	$847	$771	$76	17%
DDG 100	938	1,066	128	142	(13)	14
DDG 101	935	984	49	62	(13)	5
DDG 102	1,016	1,097	80	126	(46)	8
DDG 103	1,107	1,117	10	56	(46)	1
DDG 104	1,062	1,113	51	97	(46)	5
DDG 105	1,184	1,207	23	42	(20)	2
DDG 106	1,233	1,240	7	27	(20)	1
DDG 107	1,089	1,093	4	21	(17)	0
DDG 108	1,102	1,103	1	18	(17)	0
DDG 109	1,138	1,142	4	21	(17)	0
DDG 110-112	3,505	3,517	12	29	(17)	0
LCS 1-2	472	1,075[b]	603	NA	NA	128
LHD 8	1,893	2,196	303	320	(17)	16
LPD 18	762	1,272	510	531	(22)	67
LPD 19	1,064	1,286	222	228	(6)	21
LPD 20	890	1,137	247	311	(64)	28
LPD 21	1,113	1,287	173	283	(110)	16
LPD 22	1,256	1,403	147	287	(140)	12
LPD 23	1,108	1,357	249	337	(88)	22
SSN 775	2,192	2,740	548	546	1	25
SSN 776	2,020	2,183	164	154	9	8
SSN 777	2,276	2,332	56	65	(9)	2
SSN 778	2,192	2,242	50	246	(196)	2
SSN 779	2,152	2,255	102	283	(180)	5
SSN 780	2,245	2,289	44	41	3	2
SSN 781	2,402	2,378	(24)	(24)	(0)	-1
SSN 782	2,612	2,604	(7)	(7)	0	0
SSN 783	2,654	2,654	-	-	-	0
T-AKE 1	489	538	49	44	6	10
T-AKE 2	358	370	12	9	3	3
T-AKE 3	361	335	(26)	(25)	(1)	-7

Ship	Initial Budget	Fiscal year 2008 President's budget[a]	Total cost growth	Cost growth due to construction	Cost growth due to Navy-furnished equipment	Cost growth as a percent of initial budget
T-AKE 4	370	342	(28)	(32)	4	-8
T-AKE 5/6	683	702	19	20	(1)	3
T-AKE 7/8	713	712	(1)	4	(4)	0
T-AKE 9	380	386	6	9	(3)	2
Total	**$ 51,941**	**$ 56,578**	**$ 4,637**			

Source GAO analysis of Navy data

[a]Includes reprogramming actions and requests through June 2007

[b]A small amount of these funds may be designated for certain LCS research and development activities.

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THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON SEAPOWER AND
EXPEDITIONARY FORCES

STATEMENT OF

VADM PAUL SULLIVAN
COMMANDER, NAVAL SEA SYSTEMS COMMAND

AND

MS. ALLISON STILLER
DEPUTY ASSISTANT SECRETARY OF THE NAVY FOR
SHIPBUILDING

AND

RADM BARRY McCULLOUGH
DIRECTOR, WARFARE INTEGRATION

AND

MR. DUB SUMMERALL
EXECUTIVE DIRECTOR FOR SURFACE COMBATANTS,
PROGRAM EXECUTIVE OFFICER, SHIPS

BEFORE THE

SUBCOMMITTEE ON SEAPOWER AND EXPEDITIONARY FORCES

OF THE

HOUSE ARMED SERVICES COMMITTEE ON

SURFACE COMBATANT CONSTRUCTION UPDATE

JULY 24, 2007

NOT FOR PUBLICATION UNTIL RELEASED
BY THE HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON SEAPOWER AND
EXPEDITIONARY FORCES

United States Navy Biography

Vice Admiral Paul E. Sullivan
Commander Naval Sea Systems Command

A native of Chatham, N.J., Vice Admiral Sullivan graduated from the U.S. Naval Academy in 1974 with a Bachelor of Science degree in Mathematics.

Vice Adm. Sullivan served in *USS Detector* (MSO 429) where he earned his Surface Warfare Qualification. After transferring to the Engineering Duty Officer Community, he served at the Norfolk Naval Shipyard, Naval Sea Systems Command, Supervisor of Shipbuilding in Groton, Conn. and on the staff of the Assistant Secretary of the Navy (Research, Development and Acquisition). During his engineering duty assignments Adm. Sullivan earned his Submarine Engineering Duty Officer Qualification.

Vice Adm. Sullivan holds dual degrees of Master of Science (Naval Architecture and Marine Engineering) and Ocean Engineer from Massachusetts Institute of Technology.

Vice Adm. Sullivan served as program manager of the *Seawolf*-class Submarine Program (PMS 350) and the *Virginia*-class Submarine Program (PMS 450).

Upon selection to flag rank, Vice Adm. Sullivan served as Deputy Commander for Ship Design Integration and Engineering, Naval Sea Systems Command from 2001 to 2005.

Vice Adm. Sullivan became the 41st Commander, Naval Sea Systems Command in July 2005.

ALLISON F. STILLER

Since January 2004, Ms. Stiller has been the Deputy Assistant Secretary of the Navy for Ship Programs, responsible for executive oversight of all naval shipbuilding programs, major ship conversions and nuclear refueling, and the maintenance, modernization and disposal of in-service ships.

Prior to her current assignment, Ms. Stiller served as the Deputy Program Manager in the Amphibious Warfare Program Office (PMS 377), responsible for design, development, acquisition, and fleet introduction of amphibious ships and landing craft. Previously, she was the Director for Naval and Commercial Construction in the Office of the Assistant Secretary of the Navy for Ship Programs, responsible for oversight of amphibious and auxiliary ship construction and conversion programs, as well as shipbuilding industrial base matters.

Ms. Stiller is an alumnus of the Commander's Development Program. She completed short-term rotational assignments from 1994 to 1997 in various offices, including the Office of the Assistant Secretary of the Navy for Ship Programs, Office of the Secretary of Defense (Acquisition and Technology), Capitol Hill, Supervisor of Shipbuilding (Pascagoula, MS), and the Maritime Administration.

Ms. Stiller's previous assignments have included Acquisition Manager for the New Attack Submarine Program; SEAWOLF Combat Systems Mechanical Branch Head; and private industry supervisor supporting TRIDENT submarine engineering and logistics efforts.

Ms. Stiller holds a BS in Systems Engineering from the University of Virginia and a MS in Engineering Management from Virginia Tech. She is also a graduate of the JFK School of Government's Senior Executive Fellows Program at Harvard University.

United States Navy Biography

Rear Admiral Bernard J. "Barry" McCullough
Director, Warfare Integration/Senior National Representative (N8F)

From Weirton, W.Va., Rear Admiral Bernard J. "Barry" McCullough graduated from the United States Naval Academy with a Bachelor of Science Degree in Naval Architecture and was commissioned on June 4, 1975. Additionally, Rear Adm. McCullough completed Naval Nuclear Power training and received a Master of Science degree in Strategic Resource Management from the Industrial College of the Armed Forces at National Defense University.

Rear Adm. McCullough's sea tours include serving as Commander, Carrier Strike Group 6/Commander *USS John F. Kennedy* Strike Group. He also served as Commander Carrier Strike Group 14/Commander *USS Enterprise* Strike Group. Rear Adm. McCullough's major command was aboard *USS Normandy* (CG 60) from February 1999 until February 2001.

Prior to commanding *Normandy*, he served as Commanding Officer aboard *USS Scott* (DDG 995) and *USS Gemini* (PHM 6). Other sea assignments were: Operations Officer for Commander 2nd Fleet/Striking Fleet Atlantic, Engineer Officer aboard *USS Enterprise* (CVN 65), Engineer Officer aboard *USS Virginia* (CGN 38), and Main Propulsion Assistant aboard *USS Texas* (CGN 39).

Rear Adm. McCullough's shore tours include serving as Director, Surface Warfare, (N86), Commander, Navy Region Hawaii and Naval Surface Group Middle Pacific, the Director for Strategy and Analysis, J5, at U.S. Joint Forces Command, 1st Battalion Officer at the United States Naval Academy and as the Department Head for the D1G Prototype Nuclear Power Plant at Nuclear Power Training Unit, Ballston Spa, N.Y. Rear Adm. McCullough assumed his current responsibilities as Director, Warfare Integration/Senior National Representative (N8F) in April, 2007.

His decorations and awards include: Defense Superior Service Medal, Legion of Merit, Defense Meritorious Service Medal, Meritorious Service Medal, Navy Commendation Medal, and Navy Achievement Medal. Additionally, he is authorized to wear numerous unit and campaign awards.

Updated: 11 April 2007

Wilmot N. (Dub) Summerall, III
Executive Director
Combatants
PEO SHIPS

Mr. Summerall entered the Senior Executive Service in December 2004 and is currently serving as the Executive Director for Combatants within PEO Ships. His responsibilities span five major Program Offices: PMS 500 (DD(X)), PMS 501 (Littoral Combat Ship), PMS 400D (DDG-51), PMS 400C (Cruiser Modernization), and SHIPS-AM (Acquisition Management).

From July 2001 to December 2004, Mr. Summerall was the Head of the Ship Construction/Modernization and Sealift Branch in the Office of the Assistant Secretary of the Navy, Financial Management and Comptroller. In this capacity, Mr. Summerall managed budget preparation and financing for the Department of the Navy's shipbuilding program valued at over $10 billion per year.

From Sept 1983 to July 2001, Mr. Summerall served in numerous positions within the Cost Engineering and Industrial Analysis Division of the Naval Sea Systems Command (SEA 017), primarily as the Group Director, Surface Combatants. From August 1998 to June 1999, Mr. Summerall served as the Acting Division Director of SEA 017.

Mr. Summerall received his BS from Columbia University in New York, NY in 1978, and a BA degree from Jacksonville University in Jacksonville, FL. Mr. Summerall has received numerous honors and awards, including the Navy Meritorious Civilian Service Award, the Department of Defense Value Engineering Award, and the Department of the Navy Competition and Procurement Excellence Award.

Chairman Taylor, Mr. Bartlett, distinguished members of the Subcommittee, thank you for the opportunity to appear before you today and discuss the current status of surface ship construction programs, and particularly the Navy's Littoral Combat Ship (LCS) program.

The Department is committed to the effort to build an affordable 313-ship fleet by 2020 tailored to support the National Defense Strategy and the 2006 Quadrennial Defense Review. The Department continues to utilize a Long Range Strategic Shipbuilding Plan with an eye on further stabilizing workload and funding requirements. A stable plan will enable the shipbuilding industry to maintain critical skills and to make business decisions that increase efficiency and productivity in order to meet the Navy's projected shipbuilding requirements.

We still face challenges. Recent setbacks with the LCS have underscored the need for an evaluation of our acquisition process from contracting practices to ship production monitoring. As a result of Hurricane Katrina and the recent strike at Northrop Grumman Ship Systems (NGSS) Ingalls Operations, the Navy is working along with NGSS to review the baselines for current NGSS contracts with the Navy, and to also understand how best to execute future shipbuilding efforts. The review effort will help both the Navy and NGSS to closely monitor and best utilize NGSS manning resources and facilities. We thank the Committee for its support of split funding for dual lead ships of the ZUMWALT Class to maximize competitive efficiencies and focus design efforts.

At the Subcommittee's request, the Department is pleased today to discuss the status of our current surface ship shipbuilding programs, including recovery efforts from Katrina. We will also discuss the Navy's revised plan for the LCS program, and will describe how the lessons learned from LCS are being applied to Navy acquisition.

LPD 17 Program

The LPD 17 Class of amphibious warfare ships represents the Department of the Navy's commitment to a modern expeditionary power projection fleet that will enable our naval force to operate across the spectrum of warfare. The LPD 17 Class provides personnel, vehicle, and cargo movement and staging areas to support both vertical and surface assault operations in support of Marine Expeditionary Brigade (MEB) or a smaller Marine Expeditionary Unit (MEU). LPD 17 (SAN ANTONIO) was accepted with incomplete work as a result of higher than planned ship construction costs, and to mitigate potential schedule or cost impacts to follow-on LPDs and other shipbuilding programs at NGSS. When the Navy took delivery of the LPD 17 in July 2005, the ship was 93% complete and the estimates to complete exceeded the available funding. Given the ship's crew was in place, and the ship was functionally complete and able to safely transit to its homeport, the Navy decided to complete portions of the ship in the ship's homeport area after delivery. This improved the Sailors' quality of life and allowed the remaining work to be completed more affordably by local ship repair/maintenance companies using competitively bid contracts. Additionally, this approach permitted the identification of any technical and operational problems with the class design as early as possible, allowing time to efficiently roll corrections into follow ships of the class. Over the past year LPD 17 has spent a great deal of time at sea. In fact, it was underway for over 200 days in 2006, more than the standard six-month deployment, demonstrating her combat systems, aviation, replenishment and landing craft capabilities.

LPD 17 recently completed a Post Shakedown Availability at BAE Systems Ship Repair, Norfolk, VA, on July 11, 2007. The work package included the planned installation of new systems, planned system upgrades, maintenance work and the remaining ship completion work. All compartments and mission critical systems are now complete. The remaining items, mainly routine maintenance work, are scheduled to be completed in the upcoming maintenance availabilities.

The NAVSEA Logistics Center has been tasked to lead and conduct the LPD 17 Program's Logistics Readiness Assessment (LRA) for Initial Operational Capability (IOC). The LRA is an independent review to advise the program manager on the readiness of the logistics program for Fleet introduction and Initial Operational Capability (FOC). The LRA will also assess logistics readiness in conjunction with the Fleet. The LPD 17 LRA is scheduled to complete this fiscal year.

Lessons learned and improvements identified on LPD 17 have been incorporated on follow ships. LPD 18 (NEW ORLEANS) was 97% complete at delivery to the Navy and has now been commissioned, and LPD 19 (MESA VERDE) is scheduled to be delivered this fall. LPD's 20-24 are under construction and will be delivered in the next few years.

In light of competing priorities for resources, the President's Budget for FY 2008 represents the best balance of resources to requirements. However, an additional LPD 17 Class ship was identified by the Chief of Naval Operations in his February 13, 2007, Unfunded Program Requirements letter. The LPD 17 ship was the number one item on the list with an approximate price of $1.7 billion. If sufficient additional funds were provided, they could be used for the procurement of a tenth LPD 17 Class ship in mid-2008, which would start construction about one year after LPD 25. If Congress intends to add funds for an additional LPD in FY 2008, the Navy requests that full funding be included. A significant disruption to the current shipbuilding plan will be created by including additional ships in the procurement plan without accompanying full funding from outside Navy's accounts.

T-AKE Program

The T-AKE 1 Class was designed to replace our aging combat stores (T-AFS) and ammunition (T-AE) shuttle ships. Working in concert with an oiler (T-AO), it can perform a station ship mission which will allow the retirement of four fast combat support ships (AOE 1 Class). Nine T-AKE hulls are under a Fixed Price Incentive contract with General Dynamics National Steel and Shipbuilding Company (NASSCO). T-AKE 1 (LEWIS AND CLARK) was delivered in June 2006, T-AKE 2 (SACAGAWEA) delivered February 2007 and T-AKE 3 (ALAN SHEPARD) was recently delivered to the Navy on June 26, 2007.

NASSCO was awarded a contract in FY 2002 for the construction of up to 12 Dry Cargo and Ammunition Ships (T-AKEs) for the Combat Logistics Force. The T-AKE contract required that options for each vessel be exercised within the specified option window in order to maintain the price in the contract. When the Navy chose not to exercise contract options in FY 2006, it necessitated a price negotiation for all ships procured after that decision.

The Navy and NASSCO have restructured the contract to procure T-AKE ships to address the procurement of the next five ships (two more than the original 12-ship contract). This approach

will benefit both the Navy and the shipbuilder. By restructuring the contract to include the existing nine and the additional five ships, the Navy will procure the entire class at the lowest overall cost per hull. The restructuring also includes a release from the company's Request for Equitable Adjustment (REA). An offer agreement that defines the revised pricing, terms and conditions and release from the REA was signed on July 13, 2007 with contract modifications forthcoming. The contractor has been performing well with three ships delivered, a successful operational evaluation, a fourth ship to be delivered later this year, the fifth and sixth ship production well underway, and the seventh ship in the early construction phase.

The Department would support congressional increases in T-AKE ship procurements. Two additional T-AKE's were identified by the Chief of Naval Operations in his February 13, 2007 Unfunded Program Requirements letter. The T-AKE was the number two item on the list with an approximate price of $600 million per ship. The current contract structure could accommodate earlier T-AKE procurements and the increased backlog would enhance stability and could yield benefits to both industry and the Navy in execution. If Congress intends to add funds for an additional T-AKE in FY 2008, the Navy requests that full funding be included. A significant disruption to the current shipbuilding plan will be created by including additional ships in the procurement plan without accompanying full funding from outside Navy's accounts.

CVN 21 Program

The CVN 21 Acquisition Program will replace the USS ENTERPRISE and the NIMITZ Class with the CVN 78 (GERALD R. FORD) Class, designed to improve operational capability while simultaneously driving down manpower and total ownership costs. CVN 78 Class warfighting capability improvements include a 25% increase in Sortie Generation Rate, increased operational availability, nearly three-fold increase in electrical generating capacity, restoration of Service Life Allowances, and an enhanced Integrated Warfare System. These capability improvements will ensure that the CVN, the centerpiece of the Navy's Carrier Strike Group, continues to pace projected threats.

Since Milestone B in April 2004, the CVN 21 Program has made significant progress. The ship specification has been certified and the product model is 70% completed, reflecting a rapidly maturing design. The Navy plans to award the Detail Design and Construction Contract for the lead ship of the Class, CVN 78 (GERALD R. FORD), in FY 2008 with delivery planned for FY 2015. The program is fully funded to the current cost estimate, which was independently validated by OSD's Cost Analysis Improvement Group at Milestone B and is within the Congressional cost cap. With the award of the construction contract in FY 2008, the Navy plans to implement rigorous cost monitoring and control measures, including an integrated baseline review within six months of contract award, monthly cost performance reports from the shipbuilder and an independent cost analysis group within the on-site Supervisor of Shipbuilding field office.

On July 6, 2007, the Deputy Under Secretary of Defense (Science and Technology) (USD(S&T)) concurred with the Chief of Naval Research Technology Readiness Assessment for the CVN 21 Program. Fourteen Critical Technology Elements (CTEs) were assessed by an independent panel. Six CTEs rated a Technology Readiness Level (TRL) of 6 or better. Six CTEs with 5 TRL ratings have technology maturation plans that lead to TRL 6 demonstration in time for integration with the carrier construction. The Evolved Sea Sparrow Missile (ESSM) data link

improvements will mature to TRL 5 in FY 2008 and TRL 6 in 2011, well before required on the ship. The status of the ESSM program will be reported to the Office of the USD(S&T) again in March 2008.

Three new systems of particular note include the Electromagnetic Aircraft Launch System (EMALS), the Advanced Arresting Gear (AAG) and the Dual Band Radar (DBR). These systems provide vital capability to the new carrier, and a robust risk mitigation strategy is in place to prove each system before fielding on the CVN 78. The EMALS technology was demonstrated in 2004 on a full scale, half length prototype installed at Naval Air Warfare Center, Lakehurst, NJ. Full scale, shipboard representative prototypes of both EMALS and AAG will be thoroughly tested at Lakehurst before procuring the equipment for CVN 78. AAG will be backfit on a NIMITZ Class ship and tested at sea before delivery of CVN 78. DBR will be thoroughly tested at the Navy's Wallops Island facility, and radar systems will be tested at sea on DDG 1000 before delivery of CVN 78.

The CVN 78 Warfare Systems components include the self-defense systems, air traffic control capabilities and command and control systems. The Senate has expressed concern regarding the unit cost of the CVN 78 Ship Self Defense System (SSDS) relative to a similar system procured for the FY 2007 amphibious assault ship, LHA 6. CVN 78 is incorporating the Dual Band Radar into the warfare system to replace five radars along with four illuminators associated with the Evolved Sea Sparrow Missile. The cost delta between the SSDS on LHA 6 and CVN 78 is due to the integration with Dual Band Radar system, which is a significant difference from LHA 6.

DDG 51 Class Ships

The DDG 51 Class is a 62-ship class that was developed in three incremental flights, with upgraded technology and capability built into each subsequent hull. All 62 ships in the class have been authorized and appropriated. Ships are being constructed at both NGSS, Ingalls Operations and General Dynamics - Bath Iron works. The Navy accepted delivery of three ships in 2006, bringing the total to 51 ships delivered by the end of the calendar year. The final ship, DDG 112, is scheduled for delivery in 2011.

In the President's Budget request for FY 2008, the Department requested $78.1 million. The majority of the FY 2008 budget is for production shutdown requirements ($65.9 million). The DDG 51 Class Program expects to incur obligations with the shipbuilders and Government Furnished Equipment (GFE) manufacturers for production shutdown activities during FY 2008. The final DDG at Bath Iron Works (DDG 112) will start fabrication at the Hardings, East Brunswick Manufacturing Facility, and proceed into the Pre-Outfit Building number 1 during 2008. The last NGSS DDG 51 Class ship (DDG 110) will start fabrication during FY 2008. Similarly, the last AEGIS Weapon System and MK 41 Vertical Launch System will complete assembly and test by the end of FY 2008. As work moves through the production lines, the Government will incur obligations associated with production shutdown and the shipbuilders and GFE manufacturers are expected to submit invoices for costs incurred with production shutdown efforts. Congressional reductions to the requested budget may prevent the Navy from meeting contract obligations it expects to incur during FY 2008. The Department's request reflects the best balance of resources with requirements.

DDG 1000 Destroyer Program

This multi-mission surface combatant, tailored for land attack and littoral dominance, will provide independent forward presence and deterrence and operate as an integral part of joint and combined expeditionary forces. DDG 1000 (ZUMWALT) will capitalize on reduced signatures and enhanced survivability to maintain persistent presence in the littoral in future scenarios. The program provides the baseline for spiral development to support future surface ships. DDG 1000 with the Advanced Gun System (AGS) and associated Long Range Land Attack Projectile (LRLAP) will provide volume and precision fires in support of joint forces ashore. A GPS guided, 155mm round, LRLAP will provide extended range, all weather fires capability. DDG 1000's Dual Band Radar represents a significant increase in air defense capability in the cluttered littoral environment. Investment in open architecture computing infrastructure and reduced manning will provide the Navy life cycle cost savings and technology options that can be retrofitted to legacy ships allowing adaptability for an uncertain future.

Under the dual lead ship strategy, a lead ship will be constructed at both NGSS and General Dynamics Bath Iron Works (BIW). Contracts for detail design were awarded to the shipbuilders in August 2006. Both shipbuilders were also awarded contracts for long lead material and pre-production planning to support detail design and construction in June 2007. Additionally, BAE Systems was awarded a contract in June 2007 for the detail design and construction of the AGS. Construction contracts for the dual lead ships are planned to be awarded this year. The FY 2008 President's Budget request of $2.8 billion provides the second and final increment and completes full funding of the dual lead ships.

The DDG 1000 program continues to execute on cost and on schedule for both software development and detail design, and will be ready to start construction in late 2008 on both lead ships.

In preparation for Milestone B, the DDG 1000 program successfully completed an independent TRL Assessment (TRA). The TRA was conducted by the Office of Naval Research (ONR) and validated by an Independent Expert Review. The Deputy Under-Secretary of Defense (Science and Technology) concurred with the report of successful TRA on April 19, 2005. The TRA noted satisfactory progress in all key technology areas, particularly those associated with the Engineering Development Models, to demonstrate technology readiness at Milestone B. All the major technologies for DDG 1000 will achieve TRL 6 or 7 prior to ship installation.

CG(X) Program

CG(X) is envisioned to be a highly capable surface combatant tailored for Joint Air and Missile Defense and Joint Air Control Operations. CG(X) will provide airspace dominance and Sea Shield protection to joint forces. The Maritime Air and Missile Defense of Joint Forces (MAMDJF) Initial Capabilities Document (ICD) was validated by the Joint Requirements Oversight Council (JROC) in May 2006. The MAMDJF Analysis of Alternatives (AoA) started in June 2006 and is scheduled to complete this year.

The FY 2008 National Defense Authorization Bill (HR 1585) passed by the House would require that major combatant vessels, to include CG(X), be constructed with integrated nuclear power systems unless the Secretary of Defense submits a notification to Congress that the inclusion of

an integrated power system in such a vessel is not in the national interest. The Navy opposes this requirement as it presupposes the outcome of the Department's process for arriving at a decision of a new platform. The Navy supports a process that includes a rigorous technical analysis of alternatives and matches requirements with operational demands of the warfighter for the projected threats. Implementation of language without such analysis would more than likely result in unrealistic requirements for future combatant classes of ships.

The Navy's Report to Congress on Alternative Propulsion Methods for Surface Combatants and Amphibious Warfare Ships submitted in January 2007 demonstrated that the selection of a ship propulsion method is an extremely complex process with many variables, and is highly dependent on ship operational requirements. There is no optimum solution across ship classes. The Navy also must always weigh the design decision for a single ship class against wider considerations, including: total ship procurement and life cycle costs and their impact on affordability of the overall shipbuilding plan; the capabilities and capacity of the shipbuilding industrial base; technology benefits and risks; and operational support considerations.

The MAMDJF AoA, which will include recommendation of a CG(X) platform alternative, is incorporating the methods of the Navy's FY 2006 study, and is examining both fuel efficient conventional power plants and nuclear power alternatives. The Navy takes seriously the House's desire that we carefully consider nuclear power for the CG(X) and other future platforms. The Navy will examine all of the relevant factors when making future power system choices.

SCN Outfitting and Post Delivery

SCN Outfitting and Post Delivery funding ensures that US Navy hulls receive their full allowance of outfitting spare parts and operating space items and post-delivery correction of deficient government-responsible items, along with the ability to perform essential Post Delivery tests and trials. In FY 2007, the Congress assessed a $40 million mark on SCN Outfitting and Post Delivery based on delays in ship deliveries. However, the FY 2007 President's Budget request had already adjusted the outfitting and post delivery account for delivery delays resulting from Hurricane Katrina. Furthermore, any other delays that have occurred have already been accounted for in subsequent budget cycles. An additional reduction to the FY 2008 request would severely jeopardize the Department's ability to deliver fully operational, capable, and safe ships. If potential congressional marks are sustained, vertical program cuts will be applied eliminating funding essential for successful completion and delivery of hulls to the Fleet. It is critical that the Department's full request be approved, particularly in light of Congressional marks to post delivery and outfitting in FY 2006 and FY 2007.

Hurricane Katrina Impact on Shipbuilding

The impact of Hurricane Katrina on the workforce and facilities on the Gulf Coast, primarily NGSS Ingalls and Avondale Operations, continue to affect Navy shipbuilding programs, and the recovery from this disaster is taking longer than originally anticipated. Numerous factors have impacted both the workforce and the shipyard facilities restoration.

The Navy continues to work with NGSS to adjust schedules to best utilize manning resources and facilities. The company has been extremely cooperative in providing the Navy multiple metrics to monitor performance including employment vs. demand, attrition, labor resources, overtime and attendance.

At the direction of the Assistant Secretary of the Navy for Research, Development & Acquisition (ASN(RDA)), a multidisciplinary Navy team including representatives from DASN Ships, Program Executive Office Ships, and Naval Sea Systems Command (including the Supervisor of Shipbuilding) is evaluating the ability of Gulf Coast shipyards to execute current and future workload. Those efforts are ongoing. Due to the magnitude of current and projected ships under contract, the first shipyards under review were NGSS Ingalls and Avondale. The Navy is working closely with NGSS to manage its programs as a portfolio, implement revised performance management baselines, and establish a set of ship construction performance metrics for Navy and industry review.

Early this year, the Navy selected projects from six Katrina-affected shipyards eligible for funds provided by Congress under Section 2203 of Public Law 109-234, commonly referred to as Katrina Supplemental IV. This law provided that, "not less than $140,000,000 of emergency hurricane relief Shipbuilding and Conversion, Navy funds appropriated . . . shall be made available for infrastructure improvements at Gulf Coast shipyards that have existing Navy shipbuilding contracts and that were damaged by Hurricane Katrina in calendar year 2005." The purpose is to expedite recovery of shipbuilding capability in areas affected by Hurricane Katrina by repairing and / or replacing shipbuilding facilities, to make lasting improvement in shipyard facilities that would result in measurable cost reductions in current and future Navy shipbuilding contracts, and to improve the ability of shipbuilding facilities on the Gulf Coast to withstand damage from potential hurricanes or other natural disasters.

On July 12, 2007 the Navy awarded the first of these contracts to NGSS for a Panel Assembly Line at NGSS Ingalls Facility in Pascagoula, MS, a Composite Manufacturing Facility at NGSS Gulfport Facility in Gulfport, MS, and an option for the Panel Assembly Line at NGSS Avondale Facility in New Orleans, LA. The Navy is also in negotiations with five additional companies selected for projects, including: Atlantic Marine in Mobile, Ala.; Austal USA in Mobile, Ala.; Seemanns Composites in Gulfport, Miss.; Swiftships in Morgan City, La.; and Textron Marine and Land Systems in New Orleans, La. The Navy intends to award the remaining contracts by the end of FY 2007.

To date, the Congress has appropriated $2.3 billion in supplemental funds for Hurricane Katrina recovery excluding the $140 million set aside in Section 2203 for shipyard recovery. Of that total, the Navy has to date requested allocation of $1.7 billion to affected Navy shipbuilding programs and plans to fully utilize the remaining funds.

Littoral Combat Ship (LCS) Program

LCS will be a fast, agile and networked surface combatant with capabilities optimized to assure naval and joint force access into contested littoral regions. LCS will operate with focused-mission packages that deploy manned and unmanned vehicles to execute a variety of missions, including littoral anti-submarine warfare (ASW), anti-surface warfare (SUW) and mine countermeasures (MIW). Mission packages will continue to mature through spiral design. LCS will also possess inherent capabilities including homeland defense, Maritime Interception Operations (MIO) and Special Operation Forces support.

LCS is needed now to fill critical, urgent warfighting requirements gaps that exist today. The capability provided by LCS in the areas of:

- Sea mine hunting, identification and neutralization
- Detect, classify, track and successfully engage small boats
- Detection and neutralization of quiet diesel submarines in shallow-water environments.

LCS is required now to establish and maintain U.S. Navy dominance in the littorals and sea lines of communication choke points around the world.

The Navy awarded contracts for construction of the first four LCS seaframes. Lockheed Martin (LM) and General Dynamics (GD) have been awarded two ships each. LCS 1 (FREEDOM), the first LM ship was launched in September 2006. Fabrication on LCS 2 (INDEPENDENCE), the first GD ship, began in November 2005. LCS 3 and 4 options were exercised in June and December 2006, respectively.

The Navy identified significant cost growth with the lead LM ship and issued a 90-day stop work order in January 2007 for the second LM ship, LCS 3, to provide time to assess factors contributing to the cost growth and to develop an executable program plan for the way ahead. The Navy evaluated the overall performance of the program, working closely with the contractor to address cost overruns and root causes. The ASN(RD&A) established a Program Management Assist Group (PMAG) to conduct a review of cost growth associated with LCS 1, and to review projected costs for LCS 2, LCS 3 and LCS 4. The PMAG assessment was completed, and identified the following root causes of cost growth:

- Aggressive cost goal and schedule
- Pressure to build to schedule was strongly emphasized and generated cost growth.
- The ambitious schedule relied upon concurrent design and construction that was not achieved.
- For LCS 1, the timing of LM's bid to the finalization of Naval Vessel Rules resulted in underestimated efforts for design and construction by the contractor.
- The competitive environment created disincentive for the contractor to surface execution challenges to the Navy.

The PMAG made several recommendations based on the assessment of LCS root causes:

- Emphasize rigorous risk management for high risk programs, including incorporation of risk mitigation strategies directly into shipbuilding contracts.
- ASN(RD&A) issue guidance highlighting critical program management functions and emphasizing chain of command notification of unexpected results, including details surrounding changes in contract baselines.
- Conduct formal independent cost estimates before exercising future options or contracts in LCS. Incorporate appropriate risk margins in budgets for future LCS procurements.
- Implement organizational changes across supporting offices: improving timing and staffing levels of on-site government oversight (Supervisor of Shipbuilding, SUPSHIP) to better match construction schedules; providing adequate resources and manning to the acquisition program office and supporting NAVSEA offices; and improving experience and training levels of the program managers and their staffs.
- Implement contractual and acquisition policy changes to improve visibility and performance expectations.

Responses to these recommendations will be addressed in the following discussion of the revised LCS program plan, and in a later overview of changes being made to prevent reoccurrence of LCS lessons across all Navy acquisition programs.

LCS Program Plan

After the extensive program assessment, the Navy has developed an executable program plan that adjusts the acquisition profile, ship cost estimates, budgets and schedules. It also provides resources for effective management of cost, production and technical risk to deliver ships to the Fleet to support the urgent and revalidated warfighting requirement. This plan for LCS includes four core elements:

- Increased Navy oversight
- Selective contract restructuring
- Reprogramming of resources largely within the LCS program
- Execution to an achievable schedule

The Navy sought to restructure the LM contract for LCS 1 and 3 to Fixed Price Incentive terms to more equitably balance cost and risk, but could not come to terms and conditions that were acceptable to both parties. On April 12, 2007, the Navy partially terminated construction of LCS 3 for convenience under the Termination clause of the contract.

The Navy will continue to monitor GD performance on LCS 2 and LCS 4. If GD experiences cost growth comparable to LCS 1, the Navy will seek to restructure the contracts from cost plus to fixed-price incentive.

Projected cost growth on LCS 1 and LCS 2 varies between 50-75% depending on the basis of comparison, and the Navy has seen increases on LCS 4. With the approval of Congress, the Navy will forgo LCS procurements currently budgeted in FY 2007 (two ships) and use the FY 2007 Shipbuilding and Conversation, Navy (SCN) funding to cover LCS 1, 2, and 4 cost overruns. The Navy appreciates Congress's support of the recent reprogramming request for $279M of the FY 2007 SCN funds, and looks forward to working with the Congress on the remaining funding required to execute the Navy's revised program plan. The FY 2007 Omnibus reprogramming request recently submitted by the Department includes an additional $206 million of the FY 2007 SCN funds. The remainder of FY 2007 SCN, approximately $34 million, is still required due to cost growth seen on LCS 4.

The restructured LCS plan also includes procurement of Flight 0 seaframes in FY 2008 and FY 2009 to address critical warfighting gaps. The FY 2008 President's Budget request ($911 million) is required to procure two LCS in FY 2008.

The FY 2006 National Defense Authorization Act (Public Law 109-163) included a cost cap on the fifth and sixth ships of the LCS Class. Due to program cost growth, the Navy seeks a change in the cost cap to reflect the restructured program and revised ship end cost estimates. To accommodate the Navy's investigative results that determined recurring estimated ship and program costs, the Navy is requesting a change in the cost cap to $460 million per ship end cost in FY 2008 dollars, based on a two-ship procurement in FY 2008. This represents a 55% increase in seaframe cost. This adjustment would reflect updated cost estimates for ship end cost that include: incorporation of lessons learned from lead ship contract execution; a more refined

cost estimate of the required changes to the designs; and a higher allowance for program management costs to provide for the additional government oversight that was recommended as a result of the Navy's root cause analysis of the LCS 1 cost growth. This cost cap adjustment must be adopted into law in order for the Navy to procure any new LCS in FY 2008.

The Navy intends to conduct an operational evaluation of LCS 1 and LCS 2 against a variety of critical factors between the two LCS designs in FY 2009. The evaluation could be used to select a single seaframe for Flight 1 LCS in FY 2010.

Status of LCS 1 and 3

LCS 1 (FREEDOM) is reported by LM approximately 84% complete. The vessel is currently in the water at the shipbuilder's (Marinette Marine Corporation) facility undergoing post launch equipment installation, outfitting and testing. Machinery Trials are planned for December 2007. The ice period on the Great Lakes will prevent underway trials between December 2007 and April 2008. The Navy currently projects LCS 1 will conduct trials in the spring period, resulting in delivery in the summer of 2008.

LCS 3 construction was partially terminated for convenience to the Government on April 12, 2007. LM had procured long lead time material for LCS 3 primarily consisting of major propulsion and electrical power equipment and components for the ship combat system, such as radar equipment and the 57mm gun. The Navy and LM will negotiate the disposition and value of these procurements as part of the termination negotiation. The Navy is also directing LM to complete the manufacturing of certain key items, such as propulsion reduction gears, in order to provide useable end items to the Navy. The material will be assets available for continued execution of the LCS program.

Status of LCS 2 and 4

LCS 2 (INDEPENDENCE) is under construction at Austal USA, Mobile, AL, and is approximately 53% complete. The Navy projects LCS 2 to launch in early 2008 and deliver in late summer 2008. A production readiness review was performed for LCS 4 on June 28, 2007. Fabrication has not yet begun.

LCS Flight 1 Procurement in FY 2010 and Beyond

The two existing seaframe designs will undergo operational performance testing in FY 2009, and the results will be considered as part of the Navy's evaluation for a single seaframe design selection for the FY 2010 and follow Flight 1 ships of the LCS class. Flight 1 ships will be based on the selected design and will incorporate lessons learned from test and trials. The Navy also intends to implement a Government-furnished open architecture common combat system/C4I suite as part of Flight 1 to optimize lifecycle cost and capability across the family of surface combatants. Subject to OSD approval, the Navy intends to hold a full and open competition for procurement of the Navy's Flight 1 design in FY 2010 and beyond.

The LCS Flight 0 ships acquisition strategy allowed the industry teams to design and acquire the combat system/C4I suite. As a result, each team developed a combat system whose components varied greatly from those found in other Navy combat systems as well as being significantly different from each other. The lack of commonality between the two current designs and Navy components negatively impacts the expected combat systems ownership costs to support these

ship variants: i.e., materiel logistics, training programs, maintenance, system upgrades and technology refreshment. Additionally, some system components are foreign and/or proprietary designs that may not convey with Government Purpose Rights, limiting sources for obtaining component support.

To minimize impacts to the combat systems ownership costs to acquire, operate, and maintain the LCS 1 Class, the Navy is amending its acquisition strategy for acquiring the LCS combat system beginning with FY 2010 Flight 1 procurements. The Navy intends to transition from Contractor Furnished Equipment (CFE) designs to a single common combat system that will be provided as Government Furnished Equipment (GFE)/ Government Furnished Information (GFI). This strategy will incorporate, wherever possible, existing Navy programs of record combat system components. Where no Navy program of record or fleet-common component exists that meet LCS requirements, a full and open competition will be conducted. This strategy allows the Navy to establish commonality of LCS combat system components across all Flight 1 ships in the class, preserve Government Purpose Rights for the Navy, and assure that required capabilities are met with a set of combat system components that optimizes performance, acquisition and ownership costs.

The current Flight 0 combat system solutions consist of eight major elements: an open architecture combat management system, volume search radar, identification friend or foe system, electronic surveillance system, medium caliber gun, gun fire control system, electro-optical/infrared sighting system, and a close-in/self-defense weapon system. The common combat system that the Navy will provide as GFE/GFI is comprised of these same elements. The Navy is not developing a new LCS combat system or adding elements to the current solution configuration. Rather, for Flight 1 the Navy is replacing the two unique sets of Flight 0 combat system components with a single set of combat system components.

During the FY 2008-09 timeframe, ship design changes from the common combat system/C4I suite, lessons learned from LCS Flight 0 production, developmental/operational testing and at-sea testing will be incorporated into a Government-furnished design package. The Government-furnished design package provides the technical baseline for FY 2010 Flight 1 full and open competitive solicitation and subsequent Flight 1 ship production contract awards.

Methods and Procedures in Place to Correct LCS Root Causes in Navy Acquisition

As an initial response to the findings of the LCS program assessment, ASN(RD&A) directed a series of specific actions to reduce risk and improve management of Navy acquisition programs:

- A review, still in progress, of all Navy ACAT 1 programs to assess the amount of design/build concurrency to identify potential additional risks and ensure proper mitigation.
- A review, still in progress, of Program Office staffing for all ship new construction programs.
- A completed review of DAWIA qualifications required and as currently staffed for Navy ACAT I and II programs. This review did not identify problems with DAWIA qualifications as an issue in Navy programs.

- An ASN(RDA) review of each PEO's span of control to determine if changes in PEO organizational structures or portfolio alignment are required.
    - In one specific action, the span of control for PEO Ships has been reduced by establishing a Team Ships such that one flag officer is responsible for Fleet support, and one flag officer is responsible for ship acquisition.
    - Additionally, the System Commands are transitioning to a Competency Aligned Organization (CAO) to create an organization that responds to the workload "demand signal" in an agile, disciplined and cost effective manner.
- NAVSEA review of Supervisor of Shipbuilding (SUPSHIP) staffing for all ship new construction programs. This review identified the need for additional billets in the areas of Earned Value Management System (EVMS), technical authority (engineering), and on-site project management. ASN(RDA) has directed NAVSEA to work with the PEOs to develop a plan for the added capability.
- ASN(RDA) has directed a similar Navy review of Defense Contract Management Agency (DCMA) support for all of Navy acquisition.
- An increase of the frequency and scope of ASN(RDA) reviews of acquisition programs, now conducted within "portfolios" (Air, Ships, C5I, Expeditionary Warfare) to improve communication and management transparency.
- Conduct of a series of "Dialogues on Acquisition Excellence" with the leadership of the System Commands, PEOs, and Program Management offices to understand LCS Lessons Learned and new policies as a result of LCS cost overruns.

While these actions represent an immediate effort to identify and mitigate risk in current Navy acquisition programs, they have also informed a larger effort which ASN(RDA) is now leading - an Acquisition Reengineering effort within the Department of the Navy to:

- Better control cost and requirements growth,
- More accurately estimate the cost risk in Navy programs, and
- Match contracting models and incentives to the cost and risk of the program.

As part of this effort, ASN(RDA) is focusing resources where they are most needed; including ensuring that our higher risk and most critical programs are resourced properly.

The key tenets of Navy Acquisition Reengineering include:

- Aligning the organization
    - Ensuring business practices are based on accountability, transparency, and trust
    - Focusing business practices on delivering the required capabilities on time and within budget
    - Focusing organizational structure on PEOs and PMs who are responsible for delivering to the warfighter
- Aligning the resources
    - Focusing resources where they are most needed
    - Ensuring higher risk and most critical programs are resourced properly
    - Improving the timing and staffing levels of on-site government oversight (SUPSHIP/DCMA) to better match production schedules
    - Providing appropriate resources and manning the acquisition program offices and supporting SYSCOM offices
    - Improving experience and training levels of the PMs and their staffs

- Cost Risk Management
    - Understanding program cost risk
    - Exploring techniques for isolating/mitigating risk
    - Reflecting cost risk in contract terms and conditions
    - Moving to fixed price incentive contracts as soon as possible
    - Establishing shared understandings of risk across the Navy Enterprise
    - Stabilizing requirements

The Navy's greatest challenge is getting the right resources where they need to be across the Acquisition Enterprise. Like most areas of the Department, Navy Acquisition is faced with the realities of a fiscally constrained environment, and that means less people and funding than is optimum. At the same time, the nation is at war, and there is a true urgency to the programs that the Navy is working on. It is critical that the Navy execute its programs well, and in a productive partnership with the Navy's counterparts in industry. The Acquisition Reengineering effort will be a key component of the Navy's ability to affordably provide these critical capabilities.

Summary

In summary, the Navy is committed to ensuring fiscal responsibility in the shipbuilding process. We appreciate your strong support and the opportunity to testify before the Subcommittee regarding Navy surface ship construction, the LCS program in particular, and the efforts the Navy has taken to apply LCS lessons learned to Navy acquisition. We will be pleased to answer any questions you may have.

QUESTIONS AND ANSWERS SUBMITTED FOR THE RECORD

JULY 24, 2007

QUESTIONS SUBMITTED BY MR. TAYLOR

Mr. TAYLOR. I would like the Navy's estimate of fuel cost and availability for 20 years from now for a conventionally powered crusier.

Ms. STILLER. The Department of the Navy takes seriously the House of Representatives' desire that we carefully consider nuclear power for CG(X) and other platforms. The Analysis of Alternatives for the Maritime Air and Missile Defense of Joint forces capability, which includes assessment of CG(X) platform alternatives, is incorporating the methods of the Navy's Fiscal Year 2006 study on Alternative Propulsion for Surface Combatants and Amphibious Warfare Ships. The AoA is examining both fuel efficient conventional power plants and nuclear power alternatives.

Rather than assessing CG(X) alternatives against single point predictions of future fuel prices over the life of the ship, the Navy is conducting sensitivity studies as part of the AoA that vary assumptions on fuel price to further understand the influence of this variable. Projections of world oil prices and production are provided by the Department of Energy/Energy Information Administration in their International Energy Outlook 2007, Report #: DOE/EIA–0484 (2007) released May 2007, which will be considered in the Navy's analyses.

The Navy will take a comprehensive approach to the development of CG(X). This process will carefully weigh all pertinent force structure considerations including projected force and platform operational capability requirements of the new maritime strategy, total ship procurement and life cycle costs and their impact on affordability of the overall shipbuilding plan, capabilities and capacity of the shipbuilding industrial base, technology benefits and risks, and operational support considerations.

QUESTIONS SUBMITTED BY MR. BARTLETT

Mr. BARTLETT. In the March 29th brief provided to members, the Navy stated that as part of the LCS Program Restructuring the path ahead for a low risk program would rely on the use of internal Navy cost estimates. As well, the Navy has established specific cost thresholds that would trigger a stop work on LCS 4 and possibly a renegotiation of the LCS 2 and 4 contract. Understanding that the cost estimated at completion (EAC) is competition sensitive, has the Navy's internal EAC for LCS 4 met or exceeded the cost threshold established by the Navy?

Admiral MCCULLOUGH, Ms. STILLER, Admiral SULLIVAN, and Mr. SUMMERALL. The specific cost threshold that would trigger an assessment of the need for contract action with General Dynamics applies to LCS 2 vice LCS 4. There are other factors in addition to this cost threshold that the Navy continues to monitor. The Contractor's Estimate at Completion (EAC) for LCS 2 has not met or exceeded the threshold. The specific threshold criteria, contractor cost performance reports, and Navy assessments of contractor performance include proprietary and/or business sensitive data. The Navy would be pleased to brief the Committee with further detail if desired.

Mr. BARTLETT. What was the LCS construction delay at General Dynamics due to the delay in submission and approval of the reprogramming request? At Lockheed Martin? What do you estimate the cost impact will be?

Admiral MCCULLOUGH, Ms. STILLER, Admiral SULLIVAN, and Mr. SUMMERALL. The LCS 1 schedule delay associated with the Above-Threshold Reprogramming approval timing is estimated to be 2–4 weeks. A cost impact has not been estimated. There is no schedule or cost delay on LCS 2.

Mr. BARTLETT. Does the Navy believe that equity in future LCS competition is still possible? Won't General Dynamics be able to continue to refine their design on LCS 4 and be bidding on a 3rd ship cost, leading to a lower cost for its FY08 bids? Given all the construction problems on LCS, does the Navy still believe that it is prudent to procure 2 ships in FY08 and 3 in FY09? Why?

Admiral MCCULLOUGH, Ms. STILLER, Admiral SULLIVAN, and Mr. SUMMERALL. Yes, the Navy believes an equitable competition is still possible. For continued procurement of Flight 0 Littoral Combat Ships, both Lockheed Martin and General Dy-

namics have advantages and disadvantages relative to their specific detail design and construction experience. The Navy's selection criteria for future contract awards will be structured to fairly evaluate proposals in order to make awards that provide best value to the government. For Flight 1 ships, the Navy is developing an acquisition strategy to establish a level playing field to procure ships based on the selected design and will incorporate lessons learned from Flight 0 test and trials.

The FY08 and FY09 ships are needed to address a critical warfighting gap. Both Lockheed Martin and General Dynamics are resolving lead ship design and production issues and applying lessons learned so that follow-on ships do not experience similar issues.

Mr. BARTLETT. How has the Navy shared lessons learned from the LCS program with other acquisition programs and with industry to ensure that neither community repeats the same mistakes?

Admiral MCCULLOUGH, Ms. STILLER, Admiral SULLIVAN, and Mr. SUMMERALL. The Navy Senior Acquisition Executive (SAE) has taken the following actions in an effort to share these lessons learned:

1. Personally conducted Portfolio Management Reviews, both internally with all of the Program Executive Officers and externally with her Industry counterparts.
2. Personally conducted a series of Town Hall meetings at various geographic locations to share her views with the entire enterprise acquisition workforce.
3. Issued new policy guidance on specific areas of concern raised during the review of the LCS program. These Policy memos have been posted to the ASN (RDA) web site and are accessible by the entire enterprise.
4. Conducted a comprehensive review of the program management engineering and technical authority staffing and on-site waterfront government oversight requirements.

QUESTIONS SUBMITTED BY MR. SESTAK

Mr. SESTAK. I would like to know that when they did their cost-benefit analysis and the curves crossed, did you include in that the fully burdened cost?

Admiral SULLIVAN. The cost analysis included the burdened cost of fuel and these costs are appropriately considered in the study. In performing analysis of alternatives, all the affected costs or costs accruing to an option should be included when comparing the alternatives. The Alternate Propulsion Study used the following cost per barrel:

Fully Burdened Cost of Fuel (FY 07$)	**$152.95**
Direct (DESC)	**$96.60**
Crude Oil (variable)	74.15
Refinement (variable)	13.76
Transportation (fixed)	2.67
Facilities/Operations* (fixed)	5.93
Mark-Up (fixed)	0.09
Indirect (Burden)	**$56.35**
Storage & Handling	**$ 0.05**
Navy FISC* (fixed)	(Incl. with DESC)
Navy Barge* (fixed)	0.05
Delivery	$52.10
Oiler Acquisition* (fixed)	14.67
Oiler O&S/Charter Costs* (variable)	37.43
Environment (fixed)	**$4.20**

*Portion of burdened fuel cost associated with storage and delivery infrastructure.

As indicated in the table, there are two parts to the fully burdened cost, direct and indirect. Within each category, some of the costs vary with changes in the cost of refined fuel (price and volume) and some do not (or neglibly so).

The direct portion of the cost per barrel is the price charged by the Defense Energy Supply Center (DESC). Since this price is based on the DOD-wide fuel usage, changes to the cruiser fleet's fuel usage will have little to no impact on the price per barrel charged. Therefore, use of the entire DESC price is appropriate to the Alternate Propulsion study.

Fleet Oiler acquisition and operating & support (O&S) costs are indirect costs. The treatment of Oiler acquisition costs as a cost per barrel assumes Oiler acquisition is directly linked to the number of barrels delivered. For small changes in delivered fuel, this would not be the case. However, larger increases or decreases in fleet fuel usage would impact Oiler force levels (and therefore acquisition costs) at some point. This is not the case for Oiler O&S/Charter costs. The duty cycle of the oiler fleet directly impacts manning, maintenance and charter cost. If more fuel is delivered, more O&S costs would be incurred. If Oiler acquisition costs are removed from the calculation, the break-even per barrel costs would increase by $15/bbl (e.g., the medium surface combatant break-even range would be $85–$240 per bbl vice the range reported in the Alternate Propulsion study of $70–$225 per bbl).

QUESTION SUBMITTED BY MR. FORBES

Mr. FORBES. One of the ways the Congress can provide relief to monetary pressures facing Navy acquisition programs is to provide multi-year procurement for the most expensive vessels. The FY 2007 Defense Authorization bill allowed for the CVN 78 aircraft carrier to be financed over a four-year period, instead of the current two-year plan. Why did the Navy choose not to take advantage of this, and does the Navy intend to revisit this decision in the future, either on the CVN 78 or follow-on ships in the class?

Admiral MCCULLOUGH, Ms. STILLER, Admiral SULLIVAN, and Mr. SUMMERALL. The Navy was unable to take advantage of the FY 2007 Defense Authorization bill language which allowed the CVN 78 aircraft carrier to be financed over a four-year period due timing. The Navy appreciates the four-year funding authorization, and as stated in the Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY 2008, we will evaluate feasibility of four-year funding in future budgets.

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