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ACQUISITION EFFICIENCY AND THE FUTURE NAVY FORCE

HEARING

BEFORE THE

SUBCOMMITTEE ON SEAPOWER AND PROJECTION FORCES

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

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[There were no Questions submitted during the hearing.]

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[There were no Questions submitted post hearing.]

ACQUISITION EFFICIENCY AND THE FUTURE NAVY FORCE

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON SEAPOWER AND PROJECTION FORCES,
Washington, DC, Tuesday, December 1, 2015.

The subcommittee met, pursuant to call, at 2:25 p.m., in room 2212, Rayburn House Office Building, Hon. J. Randy Forbes (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. J. RANDY FORBES, A REPRESENTATIVE FROM VIRGINIA, CHAIRMAN, SUBCOMMITTEE ON SEAPOWER AND PROJECTION FORCES

Mr. FORBES. Today, the subcommittee meets to discuss Navy shipbuilding plans and to discuss opportunities to procure the platforms we need at lower costs to the Department [of Defense, DOD] and the American taxpayer. Our panel today includes two distinguished experts: Mr. Ronald O'Rourke of the Congressional Research Service [CRS]; and Dr. Eric Labs of the Congressional Budget Office [CBO].

Gentlemen, we thank you both for being here once again and all the help and advice you give to this subcommittee. We also want to thank you for the invaluable support you have provided to this subcommittee over the years. In April of 2013, the Under Secretary of Defense for Acquisition, Technology, and Logistics, Frank Kendall, wrote a memo to the Defense Acquisition Workforce about how to achieve better buying power. In this memo, he indicated that the first responsibility of the acquisition workforce is to think.

When I read this memo for the first time, I must admit that I laughed a little. I couldn't believe that the Department of Defense's senior acquisition official was reminding the workforce to think. However, reflecting on this memo now, I think he may have been on to something. And I hope that our hearing today can stimulate some fresh thinking about how we pay for our national defense.

Looking at the Armed Services acquisition reform efforts to date, it seems to me that they have been focused primarily on structural efficiencies within the Department of Defense. I believe that there is a significant amount of work to do in this area. And I applaud Chairman Thornberry for his leadership and his efforts. At the same time, I think it is equally plausible that we can achieve more efficiencies and savings if all of us in Congress work with the Department to use the legislative tools that are already available in our toolbox. Those tools include the authority to execute multiyear procurement contracts and incremental funding. These authorities

provide contract stability for the industrial base and allow the government customer to achieve economies of scale.

On the programs within the subcommittee's jurisdiction, I believe that we may be able to achieve savings of 10 percent just by changing the way we go about buying our ships. Ten percent may not sound like a lot. But if applied to something like the *Ohio* Replacement Program, which is projected to cost around $100 billion, that 10 percent would equate to savings of $10 billion over the course of the program. Looking at all the pressures and demands on the shipbuilding budget, that kind of money really matters, especially as the *Ohio* Replacement Program ramps up. That is why Mr. Courtney and I have worked to grant those authorities to the National Sea-Based Deterrence Fund. I think it is time for the Department to take Secretary Kendall's direction to heart and think hard about what acquisition vehicles will provide the most savings to the Department.

As to the broader 30-year shipbuilding plan, I still fear that the existing plan is predicated on pixie dust and highly optimistic. While the Navy's plan purports to achieve a 308-ship Navy by 2022, it assumes that there will be a significant expansion in the funding for shipbuilding beyond what we have seen in recent history. I think a more plausible alternative is to increase the overall Department of Defense top line, ensure that a credible Navy build plan is accommodated within this higher top line. I think that CBO's assessment of a 30-year shipbuilding plan seeks to provide some budget reality to the pixie dust. And I look forward to hearing your testimony on this issue. Ultimately, at the end of this hearing, I hope to have a clearer picture of both the challenges that we face in funding our Navy and of the opportunities that Congress can exploit to turn Navy requirements into a shipbuilding reality.

With that, I turn to another leading proponent of American seapower, Ranking Member Mr. Joe Courtney of Connecticut.

[The prepared statement of Mr. Forbes can be found in the Appendix on page 25.]

STATEMENT OF HON. JOE COURTNEY, A REPRESENTATIVE FROM CONNECTICUT, RANKING MEMBER, SUBCOMMITTEE ON SEAPOWER AND PROJECTION FORCES

Mr. COURTNEY. Thank you, Mr. Chairman.

And thank you for holding these series of hearings really which are I think, you know, building to this afternoon's testimony. So, in the interest of time, I am not going to read my whole statement. I will submit it for the record.

But, again, just, you know, a couple of quick points which is that, you know, I think a lot of people, when they think about defense issues and shipbuilding issues understandably focus on the Budget Control Act [BCA], sequestration. And, you know, thank goodness we came together with a 2-year agreement that lifted at least partially those caps to give some stability in terms of planning and some relief in terms of the, you know, the Defense Act that we passed this year and the budget that we passed. But I think many closer observers understand that the challenge is actually in many respects much bigger than that. And I think the two witnesses understand that intimately.

A couple days ago, Mike McCord, who is the Defense Department Comptroller, gave an interview in one of the journals. And he made the point that I think really the uncertainty is more about beyond the BCA. And, again, that is where we have a lot of concern. This is not a problem that I think, frankly, we can do much to solve in this administration of what is going to happen in the 2020s. I mean, in one sense, he acknowledged what I think we have been saying in this subcommittee for a number of years which is the challenge to shipbuilding, frankly, is longer term and bigger than even the Budget Control Act. And the solution is something that can't wait until the 2020s. It really requires people to focus on ways to stretch the dollars in an intelligent way and not a reckless way.

And, again, I think our subcommittee has distinguished itself actually with the National Sea-Based Deterrence Fund, with the tools it created, as well as the structure of funding, which has a good, solid precedent, as Mr. O'Rourke can point out, and I think he does in his testimony here today. And the time is now, that we can't sort of just sort of put this off as a 2020s issue. And, again, I think the two witnesses can help us amplify that message and create a good record so that we can continue to build on the work that we did in this year's Defense Authorization Act. So, again, I will submit my full statement and yield back the balance of my time.

[The prepared statement of Mr. Courtney can be found in the Appendix on page 27.]

Mr. FORBES. Mr. Courtney yields back the balance of his time.

With that, we are ready for our witness.

Thank you, once again, gentlemen, for all that you do for our country and for being here consistently to help us and advise us.

And, Dr. Labs, it is my understanding that you are going to go first. So, with that, we yield the floor to you and look forward to your comments.

STATEMENT OF ERIC J. LABS, SENIOR ANALYST FOR NAVAL FORCES AND WEAPONS, CONGRESSIONAL BUDGET OFFICE

Dr. LABS. Thank you. Chairman Forbes, Representative Courtney, members of the subcommittee, it is a pleasure to be here today to discuss the Navy's 2016 shipbuilding plan.

Mr. Chairman, with your permission, I would like to submit my statement for the record and summarize it here in a few brief remarks.

Mr. FORBES. Without objection, both statements will be submitted for the record.

Dr. LABS. My written testimony today focuses on the costs and force structure implications of the Navy's 2016 plan, and is based on the recently released CBO report entitled "Analysis of the Navy's Fiscal Year 2016 Shipbuilding Plan," which is required under section 1011 of the 2012 National Defense Authorization Act [NDAA]. In my remarks today, I will focus on the key points of that report and highlight a few points on acquisition efficiency.

First, if the Navy received the same amount of funding for ship construction over the next 30 years that it has over the last 30 years, which is a little less than $16 billion for all activities related to ship construction, it will not be able to afford all 264 ships in

its plan. The Navy estimates that it will cost an average of $16.5 billion per year over 30 years to implement its plan. But I want to stress that that amount is for new construction only. The Navy must fund a number of other activities from its shipbuilding accounts. CBO estimates that those other activities, such as refueling of nuclear-powered aircraft carriers and the outfitting and delivery of all new warships, would add an additional $1.9 billion per year to the Navy's estimate. Thus, the Navy's cost is actually $18.3 billion per year, or more than 15 percent higher than what the service has received historically.

In contrast, CBO's estimates of the Navy's shipbuilding plan are $1.8 billion or about 10 percent higher than the Navy's. CBO estimates that it would cost $18.4 billion per year for new ship construction and $20.2 billion for everything the Navy needs to fund in its ship accounts. That amount is about 30 percent higher than the historical average.

The Navy shipbuilding plans over the last 3 years have become progressively more frank and direct in reporting to Congress the challenge the Navy faces in implementing its plan under current fiscal conditions. The 2016 plan does not, for example, depend on achieving any heroic assumptions regarding the level of spending in other budget accounts. And while the Navy's cost estimates for new ships are, in my view, a little optimistic, they are not dramatically so. As I stated before this committee 2 years ago, the Navy's shipbuilding plan is really a statement of resources required to buy the fleet the Navy says it needs. As a result, the Budget Control Act of 2011, now amended by the Bipartisan Budget Act of 2015, did not affect the composition of the Navy's report. However, if the BCA remains in place, funding for ship construction will be well below the amounts required for the 2016 shipbuilding plan unless such funding is protected at the expense of other military activities.

Between 2016 and 2021, which are the remaining years of the Budget Control Act, the Navy's shipbuilding account would have 28 percent less funding if the service receives the same percentage of DOD's budget and devotes the same 10 percent of its budget to shipbuilding that it has historically. That represents a difference of about 15 fewer ships or $26 billion less by 2021.

In recent years, Congress has added additional money to shipbuilding, increasing the Navy's shipbuilding account by an average of 10 percent above the President's request. But even if that were to continue, it would only partially alleviate the shortfalls under the Navy's plan.

Let me turn to the subject of acquisition efficiency, which Mr. O'Rourke will discuss in more detail. Generally, one of the most effective ways to reduce the unit price of individual ships is to buy them at higher rates. However, if such a strategy is pursued for all shipbuilding programs, the budgetary resources required annually would likely be higher than those already proposed in the Navy's shipbuilding plan. If purchasing more ships as an acquisition strategy is pursued for different ships, ship types, and rotation, parts of the shipbuilding industrial base may be left barren for periods of time, which would result in higher start-up costs when the rotation favors the sector again or, alternatively, yards could exit the shipbuilding business altogether.

The cost estimates associated with the Navy's shipbuilding plan, both the Navy's and CBO's, already incorporate in most cases acquisition efficiencies that stem from multiyear and block buy contracts, as well as competition. A notable exception is the *Ohio* Replacement Program. The Navy's cost estimate for the follow-on *Ohio* replacements, boats 2 through 12, is $5.7 billion per ship. CBO's equivalent estimate is about a billion dollars higher. Using a block buy strategy or purchasing those ships through the National Sea-Based Deterrence Fund could potentially save several hundred million dollars per submarine under both Navy's and the CBO's estimates.

I would like to close with a word of caution. While there may be other acquisition efficiencies still to be had in various programs of the Navy's shipbuilding accounts, those efficiencies alone will not likely close the gap between the Navy's plan and historical funding levels.

Thank you, Mr. Chairman. I would be happy to respond to any questions you may have.

[The prepared statement of Dr. Labs can be found in the Appendix on page 29.]

Mr. FORBES. Thank you Dr. Labs.

Mr. O'Rourke.

STATEMENT OF RONALD O'ROURKE, SPECIALIST IN NAVAL AFFAIRS, CONGRESSIONAL RESEARCH SERVICE

Mr. O'ROURKE. Chairman Forbes, Ranking Member Courtney, distinguished members of the subcommittee, thank you for the opportunity to appear before you today to testify on acquisition efficiency and the future Navy force. As requested, my testimony focuses on multiyear procurement, block buy contracting, combined purchases of materials and components, and incremental funding. Now, these are topics I have been following in my CRS reports since 2002. I have eight points that I would like to make.

The first is that multiyear procurement can reduce the cost of ships by roughly 10 percent compared to costs under the standard approach of annual contracting. In recent years, savings from the use of multiyear procurement have helped Congress and the Navy to convert a 9-ship buy of DDG 51 destroyers into a 10-ship buy, and a 9-ship buy of *Virginia*-class attack submarines into a 10-ship buy.

The second point is that block buy contracting can reduce costs by comparable amounts if the authority granted for using block buy contracting explicitly includes authority for making economic order quantity, or EOQ, purchases of components. If EOQ authority is not included, then the savings from block buy contracting will be something less.

Third point is that block buy contracting can be used at the outset of a shipbuilding program starting with the lead ship in the class. Multiyear procurement, in contrast, cannot be used until the lead ship has completed construction. This is due to a provision in the law regulating multiyear procurement.

The fourth point is that shipbuilding programs that do not use multiyear procurement or block buy contracting might still be able to reduce their procurement costs by using combined purchases of

materials and components. This is possible for ships funded through the National Defense Sealift Fund or the National Sea-Based Deterrence Fund.

The fifth point is that multiyear procurement contracts and block buy contracts can be awarded competitively, that multiyear procurement contracts by law must be fixed-price contracts, and that block buy contracts can also be fixed-price contracts.

The sixth point is that incremental funding can help mitigate budget spikes associated with very expensive ships that are procured at a rate of less than one per year, such as aircraft carriers and LHA-type [Landing Helicopter Assault] amphibious assault ships. Mitigating budget spikes might reduce the need for the Navy to shift the procurement of other items to years before and after the spike. Since shifts of that kind can increase costs for those other programs, using incremental funding in a shipbuilding program might help avoid cost increases to other programs.

The seventh point is that from a congressional perspective, making greater use of multiyear procurement and block buy contracting involves certain tradeoffs, such as accepting reduced congressional control over year-to-year spending, accepting reduced flexibility for making changes in Navy shipbuilding programs in response to changes in strategic or budgetary circumstances, and accepting the risk of having to make penalty payments to shipbuilders if multiyear contracts need to be terminated due to unavailability of funds needed for the continuation of the contracts.

My eighth and final point is that several Navy shipbuilding programs can be viewed as candidates for using multiyear procurement, block buy contracting, or combined purchases of materials and components.

My prepared statement discusses these opportunities. In considering whether to grant authority for using multiyear procurement or block buy contracting, Congress may weigh the potential savings of these measures against the tradeoffs I just mentioned.

Mr. Chairman, this concludes my remarks. Thank you again for the opportunity to testify. And I look forward to the subcommittee's questions.

[The prepared statement of Mr. O'Rourke can be found in the Appendix on page 71.]

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

And I am going to save my questions for the end because I have a number of them that I want to make sure we get on the record.

So, at this time, I will recognize Mr. Courtney for any questions he may have.

Mr. COURTNEY. Thank you, Mr. Chairman.

So, Mr. O'Rourke, I mean, your work on shipbuilding goes back obviously decades at this point. And when we crafted the National Sea-Based Deterrence Fund in the last Congress, again, there was some question about just, you know, the novelty or what was perceived as the novelty of that approach in terms of removing it from the shipbuilding account. You mentioned the Sealift Fund, and I just wonder if you could sort of talk a little bit more about that in terms of how it has operated over the years and particularly in terms of whether it was able to achieve efficiencies because of the authority that Congress gave when it was created.

Mr. O'ROURKE. That is right. When the idea of having something like the Sea-Based Deterrence Fund was being considered in Congress, I included in my report on the *Ohio* Replacement Program a discussion of possible precedents for that fund, and there were two. One was the National Defense Sealift Fund, and the other was mission-oriented budgeting for missile defense programs, which was also a way of taking funding for a certain thing and segregating it to a particular part of the budget.

To get at your question about how the National Defense Sealift Fund has operated, because that fund was located outside the procurement title of the DOD Appropriation Act, the full funding policy was applied differently to the use of that fund than it would be to funds inside accounts that were underneath the procurement title of the DOD Appropriations Act. And because the full funding policy was applied differently, it gave the Navy the ability to, in effect, cash flow money across the hulls, and that in turn allowed the Navy to pursue batch orders of components for the ships in the class that they were procuring through the National Defense Sealift Fund.

So, on two occasions, more recently with the T–AKE-class [*Lewis and Clark*-class] cargo ships and, before that, for a class of DOD sealift ships called the large medium-speed roll-on/roll-off ships, the Navy used this cash-flowing strategy to pursue batch orders, combine purchases of components for ships, several ships in the class, not just for the one that happened to be funded that year, and that allowed the Navy to reduce the cost of those ships by a few percent because those components happened to be purchased in a batch fashion, which was more efficient for the component manufacturers.

Mr. COURTNEY. And, Mr. Labs, again, that experience is at least somewhat analogous if not the same as your comments regarding the *Ohio* Replacement Program. Is that right?

Dr. LABS. Yes, Mr. Courtney. What I would envision, the way I envisioned the National Sea-Based Deterrence Fund to work would be similar to the National Defense Sealift Fund and the authorities that have given to that of providing for economic order quantity purchases of components and various materials for the ships as well as then being able to cash flow that money across more than one ship of the program. The way I look at it, that should give a savings of the current estimated round numbers of $6 billion per boat. You are going to save somewhere in the neighborhood of 5 percent with those kinds of authorities and that kind of ability to cash flow an economic order of quantities of those ships.

Mr. COURTNEY. Well, thank you. That is a point we probably want to highlight in the transcript when we are done here today.

And my last question is that, you know, during the discussion about the *Ohio* Replacement Program, you know, a lot of our military witnesses have talked about the fact that the New START [Strategic Arms Reduction Treaty] Treaty is going to shift a greater burden on sea-based deterrence in terms of the, you know, the three-legged stool of nuclear deterrence. Given the fact that, again, there is that shift that is going to take some of the burden away from the Air Force and the Army, you know, in terms of trying to, you know, justify the special treatment, if you want to call it that,

of the National Sea-Based Deterrence Fund, again, it sort of aligns with the strategic policy of this country in terms of nuclear deterrence because of the way that, you know, the system is going to be designed after New START. I mean, and I guess, well, that is sort of a statement. I guess the question is, in the past, has Congress, because of those kinds of, you know, rationales, shifted greater budget dollars to one branch versus another? I mean, there is no sort of precast pie chart for how the different branches get their money. And given the fact that we may have different priorities from one year to the next, I mean, we are free to make that choice. Is that a safe statement, Mr. O'Rourke?

Mr. O'ROURKE. I would agree with that. I think both Eric and I have testified in the past and will do so again today, that the idea that the distribution of funding within the DOD top line is fixed in stone or sacrosanct is not correct. If you look at the historical record, you will see that there was a period of rather stable division of resources between 1973 and 2003. And I think it was during that 30-year period that many people got the idea that that division was fixed or set in stone. But in the years before that period, and in the years after the end of that period, in fact, there have been fairly significant swings in the division of resources among the services within the DOD top line. But to build a little bit more on what Eric was saying, and I think to get at part of what your question was about in terms of the value of the fund in relation to this program, now that the National Defense Authorization Act has been enacted, there is a new enhanced authority within the Sea-Based Deterrence Fund that is unique and goes beyond what is in the permanent statute for multiyear procurement or what by precedent you might also write into a block buy authorizing provision. And that is a new authority to pursue joint procurement of materials and components across shipbuilding classes, specifically across the nuclear-powered ships. So there is three programs there, not just *Ohio* replacement, but also *Virginia* and the *Ford* class, that can now have as an option the idea of procuring materials and components across all three programs. That authority does not exist in the statute for multiyear procurement. So in terms of making a dollars-and-cents argument for saving money and achieving efficiency during a time of constrained defense resources, there is now a mechanism within the National Sea-Based Deterrence Fund that does not exist under multiyear procurement or by extensions doing something similar under block buy contracting, and that is the ability to do these cross-class combined purchases of materials and components. That can achieve savings that would not be possible under multiyear procurement alone or under a similar provision that might be written into a block buy contract.

Mr. COURTNEY. Well, thank you both for your testimony.

Yield back, Mr. Chairman.

Mr. FORBES. Before we go to Mr. Conaway, I just want to make sure we have got a good picture of what Mr. Courtney has just said. As we are looking right now, Mr. O'Rourke, as we put in the new authorities that we have in the National Sea-Based Deterrence Fund, we have had some individuals indicate to us that we could have savings anywhere between 5 percent or as much as 10 per-

cent or so. And would you think that those estimates would be unreasonable to project?

Dr. Labs.

Dr. LABS. Mr. Chairman, yes. I agree with the 5 to 10 percent range. And the way that works and the way the CBO sort of does the estimating process sort of economic order quantity authority, which has been put into the National Sea-Based Deterrence Fund, is going to give you somewhere in the neighborhood of a 5 percent savings because of the ability to sort of, as Mr. O'Rourke said, to buy components either jointly with other programs or just within the *Ohio*-class replacement itself.

Further authorities that would allow it to sort of do a block buy contract over, you know, several ships of the class could get you another 5 percent and upwards in the 10 percent range. So if you are talking about a $6 billion submarine in round numbers, you know, you are looking at a $300 million to $600 million savings, you know, per boat.

Mr. FORBES. And if you are looking at $100 billion program and you could save 10 percent, you are talking about roughly $10 billion.

Dr. LABS. That's fair.

Mr. FORBES. So at a time when we are making enormous cuts in Army brigades, in readiness, in strike fighter shortfalls, in munition shortfalls, all taking real pain to the warfighter, this is an opportunity for us to have a substantial savings without having to take that pain to the warfighter simply by setting up this fund. Would that be a fair statement to make?

Dr. LABS. Yes, Mr. Chairman.

Mr. FORBES. And the last part on that before we go to Mr. Conaway, is one of the downsides to that normally is the fear that we may not ultimately purchase all of those boats, but in this particular case, it is also another difference because we know we are going to be acquiring and building those 12 boats. Is that a fair statement?

Dr. LABS. The Navy has stated that the *Ohio*-class replacement is their number one priority, and the assumption is, is that that will be funded before all other acquisition programs will be in the Department of the Navy.

Mr. FORBES. Okay.

Mr. Conaway is recognized for 5 minutes.

Mr. CONAWAY. Thanks, Chairman.

As I listen to both of you on multiple occasions, it seems like we are constantly stuffing square pegs in round holes. If you could be dictator or king for a week and could eliminate all of this morass that you know so well, how would a proper acquisition program look like? I mean, we have got all this multiyear block and all this other kind of stuff that you talk about. All of that has been cobbled together over a number of years in responses to struggles and everything else. Cutting through all of that, and maybe this is a waste of time, but cutting through all of that, is there a better way to build this mousetrap than the current Rubik's Cube we currently put ourselves through?

Mr. O'ROURKE. Well, as you know, Eric and I can't make policy recommendations. That is prohibited by our agencies. But your

question gets at the issues of lessons learned in shipbuilding and what are good ways of conducting shipbuilding programs and, to some degree, acquisition programs in general. It is my view that the lessons in shipbuilding have been identified quite thoroughly over the years. And the question has not been to identify those lessons; it has been to live up to them and to continue to implement them and not stray from them. And if I could give you a short list of what those lessons are, they have been mentioned over the years by many people, and I think they would be echoed to a large degree within the acquisition directorate of the Department of the Navy, it would be the following. There are eight or nine points here.

The first would be to get the operational requirements for the program right, up front, so that you don't get into a situation of changing the requirements in the midst of the program.

You would impose cost discipline up front by using realistic price estimates and consider not only development and procurement costs but lifecycle operation and support costs as well.

Third point would be to employ competition where possible in the awarding of design and construction contracts.

A fourth would be to use a contract type that is appropriate for the amount of risk involved and structure its terms to align incentives with desired outcomes.

A fifth is to minimize design/construction concurrency by developing the design to a high level of completion before starting construction and by resisting changes in requirements during construction.

Next one is to properly supervise construction work by maintaining an adequate number of properly trained Supervisor of Shipbuilding, or SUPSHIP, personnel.

And the final two are to provide stability for industry in part by using, where possible, multiyear procurement or block buy contracting.

And then, lastly, to maintain a capable government acquisition workforce that understands what it is buying, as well as the points that I have just gone through. Again, these are points that people who have worked a long time in shipbuilding have mentioned over and over again over the years. The challenge is not identifying those points. It is living up to them.

Mr. CONAWAY. Well, it is one thing to—and, by the way, I am impressed that you had that list handy like that because I just made up my question sitting here. It wasn't like you got any heads-up.

So, all right, the question about living up to it. What about the current legal structure, all the vast, you know, number of NDAAs that have been signed over the years, what about the current system that does not allow that. Does that mechanically keep you from being able to—or the system from being able to implement those best practices? Are there things that we should do differently or laws we should change to make that happen?

Mr. O'ROURKE. I think in connection with that, I will refer back to something that the Navy's own acquisition executive, Sean Stackley, I think has said, which is that the first thing is to have good people in your acquisition workforce. And if they know what they are doing and they are knowledgeable and skilled in what

they are doing, they can make the system work, even if there are imperfections in that system; whereas the opposite or the obverse is much more problematic. You can have a perfect system——

Mr. CONAWAY. Yeah, but we intend to have both——

Mr. O'ROURKE. Right, and you want to strive toward——

Mr. CONAWAY [continuing]. And a system that works for them. So to your first point, if we put great people in place, they can make any system work. Well, that may be great as an exercise, but wouldn't it be better to have both really good people in place as well as a scheme that makes the most sense? And I know you can't make policy recommendations, but we don't do—every time we go through some sort of acquisition reform process, we never let it fix and bake enough before we start on the next round. But all your conversation you guys both went through, it seems incredibly difficult to get through all of those hoops and get the ships we need. So——

Dr. LABS. The one thing I would add to Ron's answers, which were excellent, was that—and he touched on it. I am going to put a term on it, which is organizational culture. The culture of your acquisition organizations have got to be incentivized in a way that they are interested in getting things right. In other words, you don't sort of do unrealistic cost estimates which are going to create any number of problems as the program evolves. And if they are interested in sort of getting all the requirements right and the design right ahead of time, and to the extent that there is legislation—I don't know if there is; I am not a lawyer, and I am not an expert on acquisition reform—to the extent that you can sort of encourage those kinds of organizational imperatives within your acquisition directorates, I think that is all to the good.

Mr. CONAWAY. I guess the frustration I have is that there is no way to—there seems to be no upside to folks in that business to take risks. And taking risks, if it works, great. If it doesn't work, you just get punished and beat to death. And so there is no upside to do that.

And, anyway, I yield back.

Mr. FORBES. Thank you, Mr. Conaway.

Mr. Langevin is recognized for 5 minutes.

Mr. LANGEVIN. Thank you, Mr. Chairman.

I want to thank both of our witnesses for your testimony and the extraordinary work and contributions you are making to the committee in helping us to understand these challenges. I want to continue on the line of questioning Mr. Courtney had raised with the National Sea-Based Deterrence. In your statements, you both noted that the *Ohio* Replacement Program is the Nation's number one strategic priority and will have a significant impact on the Navy's 30-year shipbuilding plan if its effects aren't mitigated. So obviously to help answer this, the Congress created the National Sea-Based Deterrence Fund, and I would like to give you an opportunity to further explain how cost savings from this method of implementation would perhaps indirectly benefit other programs of interest to the Navy at risk due to the budgetary strain from recapitalizing our strategic deterrent.

Mr. O'ROURKE. In terms of the benefits of the mechanism and how they can help other programs as a result, there are two things

that I would say. The first would be to reiterate my point earlier that there is now an authority within the National Sea-Based Deterrence Fund that does not exist in the standard statute that governs multiyear procurement. And that is an authority to do—combine purchases of materials and components across classes. So that legislation, which has just been enacted into law, provides a unique mechanism of savings that would be on top of the savings that you would get from using a block buy contract with EOQ authority or a multiyear procurement contract with its automatic EOQ authority. How much more, I don't know exactly what the additional savings would be, but we are in a situation with a constrained defense top line where additional savings are, in general, a welcome thing because it can free up money for use in other programs.

The other way in which you can mitigate the impact of this program on other Navy programs or on other DOD programs generally is by mitigating the budget spikes associated with the funding of each ship in the program. That is something that can be done through incremental funding if the Congress and the executive branch agree to do that. And this is something that is already used with aircraft carriers and LHA-type amphibious assault ships, and very much for that reason: so that you don't have to push programs to either side of that budget spike. When you do that to those other programs and you move them to the years before and after the spike, you can disrupt their procurement schedules, which can drive up their costs by causing instability in their production timelines.

So if you can mitigate the spike that would otherwise force you to move those other programs to the side, you can preserve the production timelines a little better for those other programs and avoid the cost increases that would result from those disruptions.

Dr. LABS. To put the specific *Ohio*-class replacement example on that, in 2021, the Navy would currently plan to spend $7 billion in 1 year buying the bulk of the lead *Ohio* replacement ship. There is, you know, procurement funding that occurs before that period starting in 2017, but the plan is $7 billion in 2021. That is a big hunk of money to swallow in 1 year. So to the extent that the authorities, as Mr. O'Rourke said, can sort of help spread that out a little bit, it would make sort of planning and going back to the issue of stability something that helps other shipbuilding programs or certainly the avoidance of higher costs in other shipbuilding programs.

Mr. O'ROURKE. If you wanted to do that in a very forward leaning or even aggressive manner, it would be to pursue the revised procurement schedule that I laid out in notional form in my testimony for starting the procurement boats—the procurement of the 12 boats earlier and maybe stretching it out at the end a little bit later. That would put more open years into the total procurement profile, into which the incremental funding for those individual boats could be transferred and would provide more opportunities for avoiding budget spikes than you have in the current schedule for the program.

Mr. LANGEVIN. Thank you. That was helpful.

So let me look at it the other way. Conversely, if we fail to take advantage of the National Sea-Based Deterrence Fund and force

these costs on the *Ohio* Replacement Program to come out of the shipbuilding account, what would that mean for the Navy's ability to project power and remain technologically superior in the future?

Dr. LABS. Mr. Langevin, I have a section in the CBO report that discusses if the Navy is still constrained with a historical level of shipbuilding, $16 billion a year, and they must pay for the *Ohio* replacement—and I also include the aircraft carrier program in that—out of that first and there is no cuts to those programs to sort of get the Navy shipbuilding top lines down into that historical level, the result would be buying 192 ships over the 30-year period instead of 264. And that would lead you to a 237-ship Navy by 2045 instead of the 305-ship Navy that the Navy envisions in the plan. So cutting that many ships out of the shipbuilding program is going to substantially affect the amount of forward presence that the Navy can provide at any given time. It is going to substantially affect the number of ships that can be brought to bear in a conflict situation through the surge process that normally that the Navy would go through in those kinds of scenarios.

Mr. O'ROURKE. Another way of looking at it is this. We had a discussion earlier about what the savings would be just inside the *Ohio* Replacement Program if you could get a 10 percent savings. And the figure was in the billions of dollars. Another way I have of characterizing that is to say that if you get a 10 percent reduction in the cost of each ship in a 12-boat program, then you are getting a little bit more than one of the 12 boats in that program for, quote, unquote, "free." But the obverse, which is what you are asking about, is what did you have to pay for that boat? Well, that boat is like a $6 billion boat in then-year dollars when you are out in those years. And that is money that could pay for two or three other kinds of major combatants. So to get at your bottom line question, what would you lose? You could lose another two or three major combatants.

Mr. LANGEVIN. Thank you. Great. Very powerful scenario. Thank you.

And I yield back, Mr. Chairman.

Mr. FORBES. The gentleman yields back.

Mr. Hunter is recognized for 5 minutes.

Mr. HUNTER. Thanks, Mr. Chairman.

Thank you, gentlemen, for being here and answering questions. I guess my question is on testing. So you have talked about buying the stuff to build the ships, the steel, all the cable and everything you need to build the ships. What about the integration portion and the testing portion?

Mr. O'ROURKE. That is the phase in construction where a lot of the cost growth in shipbuilding programs has been experienced in trying to bring everything together during the final stages. The testing can then discover further problems, but the history of cost growth in lead ship construction is one in which quite often a lot of that cost growth has occurred in the final stages, when you are trying to integrate. And that is why the question of design stability becomes important potentially as a requirement, for example, for multiyear procurement or, more generally, for the philosophy in shipbuilding making sure that you get the design right and not trying to do too much with any one new design for a new class.

Mr. HUNTER. You wouldn't possibly have any numbers, would you, on what you think you could save if you could—have you heard of the thing called automatic test retest, ATRT? Okay. It is a way that they test Aegis ships right now, and it is very simple. It takes a day versus 6 months. But, anyway, so do you not have a number on how much savings it would be compared to the buying stuff savings? I mean, the integration savings, the not changing things midway through? I mean, if you could save 5 percent or 5 to 10 percent talking about what you are talking about now, what could you save on——

Mr. O'ROURKE. I guess what I would say is that changing the design, design/construction concurrency, finding problems with the design because you did not bring it to a high state of completion before you started building it is a significant part of—significant contributor of the overall amount of cost growth that historically has been experienced on lead ships. I don't know what the fraction is, but it is probably a substantial fraction. And Eric has actually calculated historically what that total amount of cost growth has been for lead ships in recent decades.

Dr. LABS. Yeah. What we have seen for cost growth in lead ships in recent decades is about a 45 percent growth average overall over the last 30 years or a 27 percent growth as a weighted average. But our data does not break it down to that level of detail. And I am not even sure, as I sit here thinking, contemplating your question, how I would go about doing that calculation because there is so much potential for idiosyncrasies and variability among the different shipbuilding programs, it just—there are so many potential unknowns there. But I agree with the general thrust of your point that to the—and what Mr. O'Rourke said—that to the extent that we can make the design stable and that things can be tested and avoid any changes at the last minute and so forth, you are going to have a more stable and less cost growth, if any at all.

Mr. HUNTER. Thank you.

I yield back, Mr. Chairman.

Mr. FORBES. Ms. Graham is recognized for 5 minutes.

Ms. GRAHAM. Thank you, Mr. Chairman.

Thank you, gentlemen. Listening to you all, I hear the issues associated with contracts. And the structure of contracts can diminish options, obviously, that we have with our shipbuilding plans. What other options—you mentioned extending—within the contractual language—extending the timeline for the building of the ships as one potential for driving—being able to drive down cost. What are some other options where we could put in place a more flexible contracts approach that would help with driving down some of the cost of shipbuilding, taking advantage of opportunities to help our shipbuilding program be more efficient and effective? And I have one more question. It deals with flexibility as well, but totally different subject.

Mr. O'ROURKE. In terms of contracting options, the Federal Acquisition Regulations give you two broad families of contracts that you can pursue. You can do cost-reimbursement-type contracts or you can do fixed-price contracts of one kind or another. And then there are variations that some people look at and say: Well, they fall somewhere in between those two. Cost-reimbursement con-

tracts are kinds of contracts that, for shipbuilding, we try to get away from historically and to move as much as possible toward fixed-price contracts. Within fixed-price contracts, there is firm fixed-price, and there is fixed-price incentive. And a lot of the shipbuilding programs have been done with fixed-price incentive, where there is a target cost, a ceiling cost, and a line in between the two that determines how the government and the contractor will share the costs as you run from target up toward ceiling. And above ceiling, the contractor takes responsibility for everything. I think, within that framework, there are innumerable specific combinations about what the slope of that share line looks like or what allowable adjustments might be for the target cost or the ceiling cost. And there is actually a lot of flexibility that you have for building in the specific terms of the contract within that overall framework. I think what the Navy would say, what DOD would say, is that you should use that flexibility to wind up with a contract that aligns the incentives that the contract provides with your desired outcomes so that you are not rewarding something that is not important to you but that you are rewarding something that is important to you, like making a certain cost or meeting a certain schedule or quality or capability. So aligning the incentives that are bound into the contract with what you truly have as your desired outcome becomes the goal. And then, after that, the devil is in the details. And there are innumerable permutations for what the guts of the contract can look like.

Ms. GRAHAM. So are they form contracts, or are they modified for each, or are they individually drafted for the particular project?

Mr. O'ROURKE. The contracts tend to be negotiated program by program, and if the program is being pursued through annual contracting, then you have an annual contract for each year's—or more than one annual contract for each year's worth of procurement within that program.

Dr. LABS. I am not sure I can improve upon what Mr. O'Rourke said.

Ms. GRAHAM. Yeah. I agree. He did an excellent job. Excellent. Thank you very much. My contract law is kind of coming back into my head a little bit. Scary. Long time ago. Law school was a long time ago.

Second question on flexibility issues. If you have one major piece of a ship, let's say a hull, for example, could you use that hull as the basis for a ship that performs multiple functions?

Dr. LABS. Yes. And the Navy has already been pursuing those types of strategies in the past. One of the things that the Navy has done is they have been evolving the DDG 51 program, for example, from the Flight I, IIs, to the Flight IIA, and then the Flight IIIs, with the prospect that they may pursue that in their shipbuilding program, you know, later on down the road.

In the world of amphibious shipping, the LPD 17 hull form is something that we are completing the process of building 11 of those ships with a 12th still to be started. And then we are now going to adapt that hull form for the LXR program, taking capability off that ship to reduce its cost but still the basic hull is there. And, conceivably, if the Navy chose to do so, that hull form could be used for other types of missions, whether you want to replace

hospital ships or command ships or something else. You can reuse hulls for different purposes.

Mr. O'ROURKE. Yeah. There is actually a fair amount of history behind this. The *Spruance*-class destroyer became the basis for the *Kidd*-class destroyer and also the Aegis cruiser that we have today. And the Mobile Landing Platform Ship more recently became the basis for the Afloat Forward Staging Base. The latter is essentially a modified version of the former. So there are multiple examples you can point to of hulls being reused and adapted to create specific new designs for ships that have slightly different mission orientations.

Dr. LABS. And to the extent you can do more of that is going to be—on average, should be more cost-effective than designing something new and fresh.

Ms. GRAHAM. Thank you. I am out of time, but, again, I so appreciate you coming here today and helping us to understand in a more specifically, you know, information-driven way the issues that we face with funding these incredibly huge contracts and important projects for our military. So thank you very much. Appreciate it.

I know I am way out of time. I am sorry, Mr. Chairman.

Mr. FORBES. Well, that is okay, Ms. Graham. Good questions.

And as we look at all the questions that have been asked today and we try to get an aerial view of them because each one of them are important, Mr. Conaway's question about what legally we can do to change the language we certainly want to explore because if we can do that, it is important. Mr. Hunter said about testing and those kinds of things: If we can save dollars, we want to do it.

Ms. Graham, your question is very important for us to look at. And, of course, Mr. Courtney and Mr. Langevin looked at the Sea-Based Deterrence Fund.

Let me put it in a picture maybe that we can give to our other policymakers in Congress. We have had testimony that if we reach about a level of 260 ships, we cease to be a superpower, and we become a regional power. That is what some of our admirals have testified to. How many ships—and this is not a quiz for you; like Mr. Conaway, I know we haven't given you the questions before—but how many ships do we currently have in the Navy today if we started with just a number? Best estimates you have.

Dr. LABS. 273 today, sir.

Mr. FORBES. So if we have 273 ships today and we look at our 30-year—we are basically 13 ships above that magical 260-ship line that would cause us significant problems. If we take the 30-year shipbuilding plan and we follow that plan to what the Navy would propose would be its conclusion, how many ships would we have at the end of that period of time?

Dr. LABS. 305 ships in 2045.

Mr. FORBES. So we would have 305 ships.

Now, Dr. Labs, CBO has said roughly that there is a $4 billion delta between what they looked at as the average amount that the Navy had for shipbuilding over the last 30 years and between what it would take to do the shipbuilding plan that they have given to Congress. Is that a fair——

Dr. LABS. Yes, sir.

Mr. FORBES [continuing]. Representation?

Dr. LABS. About 4.5 billion would be the CBO number.

Mr. FORBES. So to fill that $4.5 billion a year, I haven't seen any proposals being put on the table from anybody where they are going to fill that for the Navy. So if that delta remains, based on what we have done over the last 30 years, can you tell me where we would be in terms of our ship count at the end of the 30-year period of time?

Dr. LABS. There is a variety of ways that you can do that calculation.

Mr. FORBES. I understand.

Dr. LABS. The way the CBO report did it is it made two starting assumptions that the *Ohio* Replacement Program would be fully funded because that is our number one acquisition priority and that the *Ford*-class carrier program would also be fully funded because that is something that Congress has mandated in law, that they want an 11-carrier force. After that, I did sort of basically roughly proportionate reductions, and then the result is that, in 2045, you have a fleet of 237 ships, not 305.

Mr. FORBES. So then if we let things go just the way they are and with the proposals that have been put in there, we will go in 30 years from 273 ships to 237 ships. And the shortfall between what even the Navy says, which we all recognize is lower than what a lot of analysts say we need, but you would have the difference between 305 and 237 ships as the shortfall we would have in terms of ships, ship count. Fair?

Dr. LABS. Yes, sir, based on those assumptions, correct.

Mr. FORBES. Now, one of the ways we can begin to close that gap—Mr. Courtney alluded to this earlier with the Sea-Based Deterrence Fund, and, Mr. O'Rourke, you said it very properly—one of the things that we are doing with that fund is if those numbers hold, instead of paying for 12, we would get 12, but we would pay for 11, and that could save us a substantial amount of money.

The other thing, Mr. O'Rourke, you have at some time talked about the ability we could have—would be to shift a small portion of the overall budget of the Department of Defense to build some of these ships. If we did that, what percentage would we be talking about that we would need to shift to be able to build the ships that we need over that 30-year period of time?

Mr. O'ROURKE. Shifting that $4.5 billion would equate to shifting less than 1 percent of the DOD base budget.

Mr. FORBES. So if we shifted approximately 1 percent or less, then we could build all the ships that the Navy says that they need over that 30-year period of time. So the options, it seems to us, is to end up at the end of 30 years with 237 ships. One shift of about 1 percent of the current Department of Defense budget or adding additional dollars to the top line of the Navy for doing that shipbuilding if we want to build those ships. Fair argument on that?

Mr. Conaway, did you have another question?

Mr. CONAWAY. No, just the math is 30 years times 4.5, so $135 billion shortfall. And so where did this come from? You know, you were talking about the $10 billion here, the $3 billion there, $5 billion there, but 135, you know, you don't get there. You can't save your way into fixing this.

Mr. FORBES. You can't save your way into——

Mr. CONAWAY. In terms of, you know, you ought to do those things, but at the end of the day, building all these ships we plan to at less than what we thought they were going to cost still doesn't get you 135 you need to make——

Mr. FORBES. That is exactly—and that is why we have to have a combination of these things if we want to get there.

Mr. O'Rourke, the one last question I have for you, when we look at different services, they have different acquisition schemes, approaches, that they use. For example, the Navy seems to make great use of multiyear procurement contracts and block buys while the Air Force currently has no multiyear procurements. Can you give us any idea from your analysis why there is such a significant difference between the approaches of various military services and what do you believe drives those services toward different acquisition approaches?

Mr. O'ROURKE. I don't track the Air Force or the Army, so I really can't speak to detail about the other two services. But in terms of why the Navy makes extensive use of multiyear procurement and block buy contracting, I think a primary reason has to do with program stability. When you ask both the Navy and industry, what is a foundation for success in shipbuilding, they will tell you that a big part of that foundation is stability. And so I know that the idea of program stability in all dimensions, funding stability, design stability, and so on, appears to be fairly central to their thinking. It is a starting point for them in thinking about how to have success in ship acquisition. And if that is a big part of their starting point, then it seems to me that it would only be natural for them to then think about multiyear procurement and block buy contracting for two reasons. One is that if you have a stable program, then the risks of using multiyear procurement and block buy contracting are less. And, conversely, using those programs can then become a new and added dimension of stability in shipbuilding.

So if the Navy is using multiyear procurement and block buy contracting a lot, which it is—it is using it for all—currently for all three of its year-to-year shipbuilding programs, they account for almost three-quarters of all the ships in the Navy's 5-year shipbuilding plan. That is extraordinary, the amount of commitment that the Navy has to these contracting mechanisms. And I believe, as I look at the situation, that this is a reflection in both of those ways of how the Navy puts stability at the heart of its formula for how to achieve success in ship acquisition.

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

Mr. Courtney had one final question.

Mr. COURTNEY. Yeah, actually, just to follow up on that last line of thought, and certainly the Navy has embraced multiyear procurement and incremental funding, but it has done it somewhat in tandem with Congress. I mean, when we acted in 2012 in the *Virginia*-class program to, you know, create incremental funding, I mean, that 10-for-the-price-of-9 block for a contract became possible. And so I just think that it is also good to underscore the fact that, you know, we gave the Navy the tools, and they have demonstrated that it works. And I think we have done it again with the Sea-Based Deterrence Fund.

And, you know, Mr. Conaway's point is well taken that that by itself is not going to fix this problem, but certainly in terms of making the case to our colleagues and to the country that we are being smart buyers here, you know, these approaches are definitely showing real tangible results that we can point to historically and empirically, and your reports did that. I don't know if you want to comment on that. I just wanted to, again, remind people that it was partly because of the 2012 NDAA that we got to some of those savings.

Mr. O'ROURKE. To underscore that, I think it is worth reiterating that every single use of multiyear procurement, every single use of block buy contracting, was done with the approval, the positive approval, of the Congress. The Navy, the services cannot do this except with congressional approval. And it was Congress that legislated the creation of the National Defense Sealift Fund back in the early 1990s. And it was also Congress just within the recent past, within the last year or two, that did not agree with the idea of eliminating the National Defense Sealift Fund when that was a proposal that was part of the executive branch's budget submission for that year.

Mr. FORBES. Gentlemen, you have both done incredible work to do this analysis. We thank you. I would like to give you at this time an opportunity if you need it to do any kind of wrap-up to make sure you get on the record what we need to get on the record based on your work.

So why don't we start with you, Mr. O'Rourke, and we will end as we started with Dr. Labs.

Mr. O'ROURKE. I have one wrap-up point, as it were, which is that even though we have talked a lot today about the *Ohio* Replacement Program and the ability to use contracting mechanisms and incremental funding to save money in that program, that program is not the only Navy shipbuilding program where there are opportunities of this kind. My testimony goes through all of the opportunities that I can identify in one form or another. And, indeed, the list I come up with encompasses every one of the Navy's principal shipbuilding programs, either as a continuation of what you are already doing or as a new opportunity because it is a new start program. So it is important to understand what these mechanisms can do for the *Ohio* Replacement Program, but you don't want to assume that that is the only place where you can do these things. You can do block buys and eventually multiyears on things like the TAO(X) program and the LXR program. You can even think about doing a two-ship block buy on the LHA program. So I would underscore going through the list of opportunities and candidate programs that forms the back half of my testimony because it certainly includes the *Ohio* program and talks about more about that program than any other, but it talks about virtually all of the other principal Navy shipbuilding programs as well.

Mr. FORBES. And that is a good point because as Mr. Conaway said, the math is the math, and as Mr. Courtney pointed out, you are going to have to get there with a combination of means. But $10 billion here and $10 billion there starts adding up to real dollars. And also when you start shifting some of the top line of De-

partment of Defense and maybe adding a little bit more, it helps get us closer to home.

So, Dr. Labs, we are going to let you have the last word.

Dr. LABS. Well, the only thing I would add to what both Mr. O'Rourke said and what I have said earlier is that going back to this question of sort of stability under the Budget Control Act, the Budget Control Act and the Bipartisan Budget Act of 2015 has provided a fair amount of stability for the Department of Defense top line. But that is at the top line. Underneath that top line there is no stability guaranteed to the shipbuilding accounts or any other number of accounts. That is something that is a choice that is made underneath that line by the administration or ultimately by the Congress.

So to the extent that the stability that is provided by the BCA with the Bipartisan Budget Act does not ensure that shipbuilding is going to be funded to levels that maybe you might desire, that is something that is still going to have to be actively done by the policymakers.

Mr. FORBES. Okay.

Well, thank you all. If we have nothing else, then we are adjourned.

[Whereupon, at 3:23 p.m., the subcommittee was adjourned.]

A P P E N D I X

DECEMBER 1, 2015

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

DECEMBER 1, 2015

Opening Remarks of the Honorable J. Randy Forbes
for the
Seapower and Projection Forces Hearing on
Acquisition Efficiency and the Future Navy Force
December 1, 2015

Today the subcommittee meets to discuss Navy shipbuilding plans and to discuss opportunities to procure the platforms we need at lower costs to the Department and the American taxpayer.

Our panel today includes two distinguished experts:

- **Mr. Ronald O'Rourke** of the Congressional Research Services
- **Dr. Eric Labs** of the Congressional Budget Office

Distinguished guests, thank you for being with us today and thank you for the invaluable support you have provided to this subcommittee over the years.

In April 2013, the Under Secretary of Defense for Acquisition, Technology and Logistics Frank Kendall wrote a memo to the defense acquisition workforce about how to achieve "better buying power." In this memo, he indicated that "the first responsibility of the acquisition workforce is to think". When I read this memo the first time, I must admit that I laughed a little. I couldn't believe that the Department of Defense's senior acquisition official was reminding the workforce to think. However, reflecting on this memo now, I think he may have been on to something. And I hope that our hearing today can stimulate some fresh thinking about how we pay for our national defense.

Looking at the Armed Services' acquisition reform efforts to date, it seems to me that they have been focused primarily on structural efficiencies within the Department of Defense. I believe that there is a significant amount of work to do in this area and I applaud Chairman Thornberry for his leadership and his efforts.

At the same time, I think it is equally plausible that we can achieve more efficiencies and savings if all of us in Congress work with the Department to use the legislative tools that are already available in our toolbox.

Those tools include the authority to execute multiyear procurement contracts and incremental funding. These authorities provide contract stability for the industrial base and allow the government customer to achieve economies of scale. On the programs within this subcommittee's

jurisdiction I believe that we may be able to achieve savings of 10 percent just by changing the way we go about buying our ships.

10% may not sound like a lot, but if applied to something like the Ohio Replacement Program, which is projected to cost around $100 billion, that 10% would equate to savings of $10 billion dollars over the course of the program.

Looking at all the pressures and demands on the shipbuilding budget, that kind of money really matters, especially as the Ohio Replacement Program ramps up.

That is why my Mr. Courtney and I have worked to grant those authorities to the National Sea-Based Deterrent Fund.

I think it is time for Department to take Secretary Kendall's direction to heart and "think" hard about what acquisition vehicles will provide the most savings to the Department.

As to the broader, 30-year shipbuilding plan, I still fear that the existing plan is predicated on "pixie dust" and highly optimistic. While the Navy's plan purports to achieve a 308 ship Navy by 2022, it assumes that there will be a significant expansion in the funding for shipbuilding beyond what we have seen in recent history. I think a more plausible alternative is to increase the overall Department of Defense topline and ensure that a credible Navy build plan is accommodated within this higher top line. I think that CBO's assessment of the 30 year shipbuilding plan seeks to provide some budget reality to the "pixie dust" and I look forward to hearing your testimony on this issue.

Ultimately, at the end of this hearing I hope to have a clearer picture of both the challenges that we face in funding our Navy and of the opportunities that Congress can exploit to turn Navy requirements into a shipbuilding reality.

Opening Remarks for Congressman Joe Courtney
Ranking Member
Seapower and Projection Forces Subcommittee
Hearing on Acquisition Efficiency and the Future Navy Force
December 1, 2015

Thank you, Mr. Chairman, for holding this hearing today on increasing efficiency in acquisition of the future Navy force.

We are fortunate to be joined today by two distinguished experts on Navy shipbuilding, Dr. Eric Labs of the Congressional Budget Office (CBO) and Mr. Ron O'Rourke of the Congressional Research Service (CRS). Both are familiar faces here before the subcommittee, and as always we value and appreciate their input to us on these important issues.

As we know all too well on this subcommittee, we face a compounding series of challenges in achieving the fleet needed to support the needs of our nation. While the number of ships deployed globally has remained constant at about 100 for much of the last two decades, the number of ships in the fleet has shrunk by 20 percent during that same period - from 333 in 1998 to 272 today.

That means the fleet today is working harder than ever to maintain the same level of presence around the world. The result has been deferred maintenance, lengthened deployments, and further straining on our ships and people.

This did not happen overnight – a steady underinvestment in our fleet over many years lead us to where we are today. Between 1993 and 2010, for example, we annually procured ships and submarines in the single digits – often five or fewer. As you both know well, it is easy to divest or defer investment in ships but very difficult to recapitalize them. Doing so takes time and funding, which are both in short supply. That is the challenging situation we find ourselves in today.

I have seen this play out as a member of this committee since 2007. The first defense authorization bill I worked on when I arrived as a new member of the House Armed Services Committee authorized three ships. This was the lowest number of ships procured in a single year since at least 1982, according to the Congressional Research Service. We were able to break the single-digit streak in 2011 when we included 11 ships in that year's bill and have hovered around 10 since.

This is a good start, but we know we have to do more to get the fleet we know we need. That starts with, at a minimum, ensuring that we can meet the levels of shipbuilding called for in the 2016 shipbuilding plan. That plan would achieve the 308-ship Navy called for in the most 30 year shipbuilding plan by 2022.

However, even as we achieve a 308-ship force in the Navy's plan, we will not sustain the levels needed to fully support the various components of the fleet. For example we will face a shortfall in small surface combatants through 2027, experience a shortfall in attack submarines between 2025 and 2036, and a shortfall in large surface combatants like destroyers between 2036 and 2045.

At the same time, a pair of looming fiscal pressures threatens to undermine progress to the 308 ship Navy. First is the impact the Budget Control Act and sequestration will have on the ability to invest in shipbuilding. While the recently enacted two year budget agreement provides

a measure of stability for 2016 and 2017, the fact remains that the outstanding uncertainty that the Navy and Defense Department faces between 2018 and 2021, when the Budget Control Act expires, remains a downward pressure on our efforts to achieve the minimum force we've identified as necessary to meet military requirements.

In fact, the CBO has warned that of the 57 ships the Navy plans to buy between now and 2021, as many as 15 could be eliminated if the budget caps in 2018 and beyond are not addressed.

The second challenge, of course, is the bulge in shipbuilding funding needed to resource the range of ships and submarines we need to build during the period that we acquire the Ohio Replacement Submarine. Some estimates have indicated that without funding above the historic average levels of funding given to shipbuilding, up two 32 ships could be dropped from the plan in order to fund the new ballistic missile submarine.

As one expert put it best, the question is not whether we will build the Ohio Replacement Submarine – it will be built as our nation's top strategic investment priority – the question is how you support the rest of the fleet that also needs to be built at the same time.

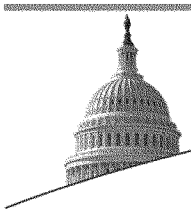
That is what makes today's hearing so important. As we look ahead to the difficult fiscal picture we face in the coming years, it is going to be more important than ever that we utilize every tool available to us to ensure that we build the fleet we need. This is no time for business as usual, and we must consider every option to provide the resources stability and support needed to make critical investments in our future fleet.

To this end, working on a bipartisan basis, our subcommittee has taken the lead in addressing this challenge. Through the creation and expansion of the National Sea-Based Deterrence Fund, we are working to find a creative and realistic way to ensure that we can build the full slate of ships and submarines that we will need in the future.

We made some important progress this year as we worked on the 2016 defense authorization, including adding to the range of authorities and tools that are available to the Navy and Defense Department to buy and build the submarine in new and cost-effective ways. As we prepare to further address this issue next year, I look forward to greater engagement from the Navy, Defense Department and our colleagues in Congress to embrace and build on what we have started.

Both our witnesses have done significant analysis of the challenges facing the Navy and our shipbuilding budget, and I am sure will have some insightful recommendations for us. I am particularly interested in their views on the potential benefits of the National Sea-Based Deterrence Fund – both have estimated significant savings in the Ohio Replacement Program from the use of the fund. I look forward to hearing their testimony on this topic.

Again, thank you to our witnesses for being here today and I look forward to the discussion ahead.



Congressional Budget Office

Testimony

An Analysis of the Navy's Fiscal Year 2016 Shipbuilding Plan

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Before the
Subcommittee on Seapower and Projection Forces
Committee on Armed Services
U.S. House of Representatives

December 1, 2015

This document is embargoed until it is delivered at 2:00 p.m. (EST) on Tuesday, December 1, 2015. The contents may not be published, transmitted, or otherwise communicated by any print, broadcast, or electronic media before that time.

Notes

Unless otherwise indicated, all dollar amounts reflect budget authority in 2015 dollars, and all years are federal fiscal years, which run from October 1 to September 30 and are designated by the calendar year in which they end.



Chairman Forbes, Ranking Member Courtney, and Members of the Subcommittee, thank you for the opportunity to testify on the Navy's 2016 shipbuilding plan and the 2014 update to the service's 2012 force structure assessment. My submitted statement today reprises the Congressional Budget Office's report entitled *An Analysis of the Navy's Fiscal Year 2016 Shipbuilding Plan,* which was released on October 29, 2015. That report was required under the 2012 National Defense Authorization Act.

The Navy is required by law to submit a report to the Congress each year that projects the service's inventory goals, procurement plans, and cost estimates for its shipbuilding program over the coming 30 years. Since 2006, CBO has been performing an independent analysis of the Navy's latest shipbuilding plan. The CBO report on which I am testifying today analyzes the implications of the Navy's 2016 plan for its ability to meet inventory goals through 2045. The report also provides independent estimates of the cost of the Navy's shipbuilding program and compares those cost estimates with the funding levels that the Navy has received historically.

According to its most recent 30-year plan, the Navy envisions buying a total of 264 ships over 30 years at an average annual cost of $16.5 billion for new construction and $18.3 billion for total shipbuilding (including new-ship construction, refueling of nuclear-powered aircraft carriers, and other costs related to shipbuilding). By comparison, CBO's estimates of the costs of the Navy's plan are about $2 billion higher—an average of $18.4 billion per year for new construction or $20.2 billion per year for total shipbuilding. Those amounts are significantly greater than the amounts the Navy has received for shipbuilding annually over the past 30 years.

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An Analysis of the Navy's Fiscal Year 2016 Shipbuilding Plan

Summary

The Department of Defense (DoD) submitted to the Congress the Navy's 2016 shipbuilding plan for fiscal years 2016 to 2045 in April 2015.[1] The total annual cost of carrying out the 2016 plan—an average of about $20 billion in 2015 dollars per year over the next 30 years, the Congressional Budget Office estimates—would be one-third more than the amount the Navy has received in Congressional appropriations for shipbuilding in recent decades. The Navy's 2016 shipbuilding plan is similar to its 2015 plan with respect to the goal for the total number of battle force ships, the number and types of ships the Navy would purchase, and the funding proposed to implement its plans.

The Navy Plans to Expand the Fleet to 308 Battle Force Ships

The Navy's 2016 shipbuilding plan states that the service's goal (in military parlance, its requirement) is to have 308 battle force ships, consisting of aircraft carriers, submarines, surface combatants, amphibious ships, combat logistics ships, and some support ships. The 2016 shipbuilding plan falls short of the goals for some types of ships in some years, although generally the shortfalls are smaller than they have been in previous years' plans. The fleet today numbers 273 ships.

Under the 2016 plan, the Navy would buy a total of 264 ships over the 2016–2045 period: 218 combat ships and 46 combat logistics and support ships (see Table 1). Given the rate at which the Navy plans to retire ships from the fleet, the 2016 plan would not meet the inventory goal of 308 ships until 2022, but it would allow the Navy to maintain its inventory at least at that level through 2031. After that, in most years through 2045, the fleet would fall below 308 ships.[2]

The size of the Navy does not depend on ship construction alone; the length of time that particular ships remain in the fleet affects the force structure as well. The Navy often shows flexibility in its approach to retiring ships: A ship may be retired before the end of its service life to save money or may be kept beyond that span to maintain a desired force level.[3] Generally, the Navy's estimates of expected service life align with historical experience. However, the Navy currently assumes a 35- or 40-year service life for its large surface combatants; in the past, few of those ships were in the fleet for longer than 30 years. (See Table 2 for the composition and the planned service life of major ship types in the fleet.)

CBO Estimates That Spending for New Ships in the Navy's Plan Would Average $18.4 Billion per Year

The Navy estimates that buying the new ships specified in the 2016 plan would cost $494 billion (in 2015 dollars) over 30 years—or an average of $16.5 billion per year—slightly less than the costs of the 2015 plan. Using its own models and assumptions, CBO estimates that the cost of new-ship construction in the Navy's 2016 plan would total $552 billion over 30 years, or an average of $18.4 billion per year.

1. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2016* (March 2015), http://tinyurl.com/ocrqtfc.

2. Most new-ship construction occurs to replace older ships as they retire, although the Navy sometimes builds ships to fulfill a new mission or to satisfy a specific need. For example, the Navy proposes buying new ballistic missile submarines in the 2020s and 2030s to replace existing submarines that provide strategic deterrence, whereas several years ago, it canceled the DDG-1000 destroyer program and restarted its DDG-51 destroyer line because it had reassessed the need for one kind of ship over the other.

3. The Navy's budget request often reflects trade-offs between buying new ships and modernizing existing ships to serve longer in the fleet. Over the past several years, the Navy has proposed retiring rather than modernizing seven Ticonderoga class cruisers and spending that money on new ships or to meet other objectives. Instead, lawmakers directed the Navy to modernize the cruisers to keep them in the fleet. The Congress appropriated funds greater than the amounts requested in the President's recent budget proposals to pay for that modernization as well as for new ships.

Table 1.

The Navy's 2015 and 2016 Shipbuilding Plans

	2015 Plan (2015–2044)	2016 Plan (2016–2045)	Change From 2015 to 2016
	Number of Ships Purchased Over 30 Years		
Combat Ships			
Aircraft carriers	6	6	0
Ballistic missile submarines	12	12	0
Attack submarines	48	45	-3
Large surface combatants	65	65	0
Littoral combat ships and fast frigates	66	67 [a]	1
Amphibious warfare ships	21	23	2
Subtotal	218	218	0
Combat Logistics and Support Ships	46	46	0
Total	264	264	0
	Costs of New-Ship Construction[b] (Billions of 2015 dollars)		
Total Cost Over 30 Years			
Navy's estimate	515	494	-21
CBO's estimate	583	552	-31
Average Annual Cost			
Navy's estimate	17.2	16.5	-0.7
CBO's estimate	19.4	18.4	-1.0
Average Cost per Ship			
Navy's estimate	2.0	1.9	-0.1
CBO's estimate	2.2	2.1	-0.1
Memorandum:			
Average Annual Costs of All Activities Typically Funded From Budget Accounts for Ship Construction			
Navy's estimate	19.2	18.3	-0.9
CBO's estimate	21.3	20.2	-1.1

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

a. Under the 2016 plan, the Navy will have 32 littoral combat ships in service after 2029. However, because each of those ships is expected to be in service for 25 years, the Navy will begin buying replacements in 2030.

b. Costs exclude funds for refueling nuclear-powered aircraft carriers and for ship conversions, construction of ships that are not part of the Navy's battle force (such as oceanographic survey ships) and training ships, outfitting and postdelivery (including the purchase of smaller tools and pieces of equipment that are needed to operate a ship but not necessarily provided by the manufacturing shipyard as part of ship construction), and smaller items. Costs for the mission packages for littoral combat ships, which are not funded in the Navy's shipbuilding accounts, also are excluded.

CBO's estimates are higher because the Navy and CBO use different estimating methods and assumptions regarding future ships' design and capabilities and treat growth in the costs of labor and materials for building ships differently. CBO's constant-dollar estimate is 8 percent higher than the Navy's for the first 10 years of the plan, 12 percent higher for the following decade, and 17 percent higher for the final 10 years (see Figure 1). The difference widens over time in part because the Navy's method of developing constant-dollar estimates (which differs from CBO's method) does not account for the faster growth in the costs of labor and materials in the shipbuilding industry than in the economy as a

Table 2.

Navy Ship Inventory and Expected Service Life by Ship Type, as of August 2015

	Inventory	Service Life (Years)
Aircraft Carriers	10	50
Ballistic Missile Submarines	14	42
Guided Missile Submarines	4	42
Attack Submarines	54	33
Large Surface Combatants	84	35–40
Small Surface Combatants and Mine Countermeasures Ships	18	25–30
Amphibious Ships	30	40
Combat Logistics and Support Ships	59	30–45
Total	273	

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

whole and thus does not reflect the anticipated increase in inflation-adjusted costs of future purchases of ships with today's capabilities.

The Navy's shipbuilding plan reports only the costs of new-ship construction. Other activities typically funded from the Navy's budget accounts for ship construction—such as refueling nuclear-powered aircraft carriers or outfitting new ships with various small pieces of equipment after the ships are built and delivered—would add $1.7 billion to the Navy's average annual shipbuilding costs under the 2016 plan, by CBO's estimate. (Between 2010 and 2015, the cost of those other activities averaged $2.1 billion per year.) Including those extra costs would increase the average annual cost of the Navy's 2016 plan to $20.2 billion per year, CBO estimates. CBO's estimate of the total cost of the Navy's plan is 10 percent above the Navy's estimate.

The Navy's Shipbuilding Plan for the Next 30 Years Would Cost Almost One-Third More Than It Has Spent Over the Past 30 Years

If the Navy received the same amount of funding (in constant dollars) for new-ship construction in each of the next 30 years that it has received, on average, over the past three decades, the service would not be able to afford its 2016 plan. CBO's estimate of $18.4 billion per year for new-ship construction in the Navy's 2016 shipbuilding plan is 32 percent above the historical average annual funding of $13.9 billion (in 2015 dollars). And CBO's estimate of $20.2 billion per year for the full cost of the plan is 28 percent higher than the $15.8 billion the Navy has spent, on average, annually over the past 30 years for all items in its shipbuilding accounts. If funding were to continue at the average for the past 30 years, under one possible approach to ship construction, the Navy would be able to build about 70 fewer battle force ships than it currently plans, CBO estimates.

Implementing the Navy's Shipbuilding Plan Might Be Difficult Under Current Law

At least for 2016 through 2020, the Navy's shipbuilding plan incorporates the assumption that total discretionary funding for DoD will comport with the President's 2016 budget submission and the associated 2016 Future Years Defense Program (FYDP; a five-year funding plan that DoD updates annually). However, the funding proposed in the 2016 FYDP exceeds the amounts available to DoD under the Budget Control Act of 2011 (BCA), which placed caps on discretionary spending through 2021. (The BCA does not address specific budgetary accounts such as the one for shipbuilding.)

Under the BCA, if the Navy receives the same percentage of DoD's budget during the coming decade and devotes the same percentage of its budget to ship construction that it has historically, the annual shipbuilding budget would be 30 percent below CBO's estimate of the amount required to execute the Navy's 2016 plan over the 2016–2021 period. If all shipbuilding programs were cut proportionately, a reduction of that magnitude would require the Navy to purchase 16 fewer ships than the 57 it plans to purchase over that period. Consequently, under current law, policymakers face a choice between implementing the Navy's 2016 shipbuilding plan and cutting costs elsewhere in the Navy's budget (or in DoD's budget more broadly), scaling back the 2016 plan, or taking some combination of those actions.

As of this writing, the Congress was considering H.R. 1314, the Bipartisan Budget Act of 2015.* That bill, if enacted, would raise the budget caps for national defense for fiscal years 2016 and 2017. That change would allow the Navy to cut 15 ships rather than 16 ships from its 2016 plan, if all shipbuilding programs were cut proportionately.

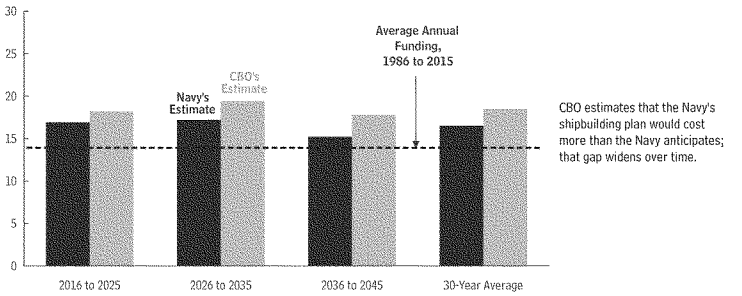
Ship Purchases and Inventories Under the 2016 Plan

The Navy's 2016 shipbuilding plan, submitted to the Congress by the Deputy Secretary of Defense on April 3, 2015, reflects the service's inventory goal of 308 battle

*The Bipartisan Budget Act of 2015 (Public Law 114-74) was enacted on November 2, 2015.

Figure 1.

Average Annual Costs of New-Ship Construction Under the Navy's 2016 Plan



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

Note: Costs exclude funds for refueling nuclear-powered aircraft carriers and for ship conversions, construction of ships that are not part of the Navy's battle force (such as oceanographic survey ships) and training ships, outfitting and postdelivery (including the purchase of smaller tools and pieces of equipment that are needed to operate a ship but not necessarily provided by the manufacturing shipyard as part of ship construction), and smaller items. Costs for the mission packages for littoral combat ships, which are not funded in the Navy's shipbuilding accounts, also are excluded.

force ships, an increase from the 306-ship goal established in the force structure assessment the Navy performed in 2012 (see Table 3).[4] For this report, CBO did not evaluate the validity of the Navy's goals or the fleet's ability to fulfill its missions in the national military strategy. Rather, this report presents CBO's assessment of the plan's costs, its effects on the force structure, and the extent to which it would satisfy the Navy's goals for major components of the U.S. fleet. (The major types of ships in the fleet and their basic missions are described in Box 1.)

Total Ship Purchases and Inventories

The Navy intends to buy 9 ships in 2016 and a total of 48 between 2016 and 2020—the period covered by DoD's 2016 FYDP (see Figure 2 on page 8 and Figure 3 on page 9). Thereafter through 2045, the Navy would buy an additional 216 ships, for a total of 264 ships over 30 years, or an average of about 9 per year. The pace of shipbuilding would be slightly faster, on average, in the near term than later on. The Navy plans to purchase an average of about 10 ships annually between 2016 and 2025, slightly fewer than 8 ships per year between 2026 and 2035, and 9 ships per year between 2036 and 2045.

With those purchases, the Navy projects that it will have 282 ships in the fleet at the end of 2016. Under the Navy's current ship-counting rules, the 2016 plan would not achieve the intended force of 308 ships until 2022. The service would meet its overall goal for 12 of the 30 years in the plan—and except in the 2016–2019 period—the shortfall would never be more than 6 ships (see the bottom panel of Figure 2). The Navy would achieve its force structure goal at about the same time under the 2016 plan that it would have under the 2015 plan, although under this year's plan, the Navy would meet its force goal for fewer years than it would have

4. Department of the Navy, *Report to Congress: Force Structure Assessment* (February 2015). A more extensive discussion of the history of the Navy's force structure goals is presented in Ronald O'Rourke, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, Report for Congress RL32665 (Congressional Research Service, September 21, 2015).

Table 3.

The Navy's Goals for Its Force Structure

	Goals for a 313-Ship Fleet in the Navy's 2005 Force Structure Assessment	Goals for a 313-Ship Fleet in the Navy's 2010 Force Structure Assessment	Goals for a 306-Ship Fleet in the Navy's 2012 Force Structure Assessment	Goals for a 308-Ship Fleet in the Navy's 2014 Update of the 2012 Force Structure Assessment[a]
Aircraft Carriers	11	11	11	11
Submarines				
Ballistic missile	14	12	12	12
Attack	48	48	48	48
Guided missile	4	4	0	0
Large Surface Combatants	88	94	88	88
Small Surface Combatants and Mine Countermeasures Ships[b]	55	55	52	52
Amphibious Warfare Ships	31	33	33	34
Maritime Prepositioning Force (Future) Ships	12	0	0	0
Combat Logistics Ships	30	30	29	29
Support Ships				
Joint high-speed vessels	3	10	10	10
Other[c]	17	16	23	24
Total	**313**	**313**	**306**	**308**

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

a. The Navy's 2016 shipbuilding plan is based in part on achieving the goal for a 308-ship fleet.

b. Includes littoral combat ships, Oliver Hazard Perry FFG-7 frigates, fast frigates, and Avenger class mine countermeasures ships.

c. Includes command ships, salvage ships, ocean tugs, ocean surveillance ships, and tenders.

under the 2015 plan.[5] All together, the 2016 plan calls for the Navy to buy the same number of ships over 30 years that it would have under the 2015 plan. The number of purchases of combat ships and logistics and support vessels is the same under the 2015 and 2016 plans, although the composition of major ship types is slightly different in the 2016 plan.

Combat Ships

Under the 2016 plan, the Navy envisions buying 218 combat ships—aircraft carriers, submarines, large and small surface combatants, and amphibious warfare ships—over the 30 years, matching the total in its 2015 plan. Those purchases would leave the Navy short of its inventory objectives for ballistic missile submarines, attack submarines, and large surface combatants—but not for amphibious warfare ships—for significant segments of the 2016–2045 period (see Figure 4 on page 10).

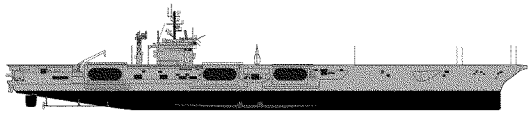
Aircraft Carriers. Under its 2016 shipbuilding plan, the Navy would purchase 6 aircraft carriers between 2016

5. Those numbers reflect the ship-counting rules specified in the Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for Fiscal Year 2015, which required the Navy to revert in 2016 to the rules it had used for the 2014 plan but permitted the Navy to add one high-speed transport vessel to the battle force. For the 2015 shipbuilding plan, the Navy had adopted new counting rules involving a small number of ship classes designated as (very) small combatants or logistics and support ships; the Congress rejected the new rules. For a discussion of the Navy's ship-counting rules in 2015, see Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2015 Shipbuilding Plan* (December 2014), p. 8, www.cbo.gov/publication/49818.

Box 1.

Major Ship Types in the Navy's Fleet

Nimitz Class Aircraft Carrier



The Navy's 10 **aircraft carriers** are the heart of the battle force. Each carries an air wing of about 60 aircraft, which can attack hundreds of targets per day for up to a month before needing to rest. Carriers are the largest ships in the fleet, with a displacement of about 100,000 tons. All 10 current carriers belong to the Nimitz class.

Ohio Class Ballistic Missile Submarine



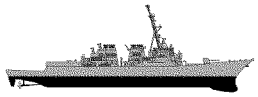
Strategic ballistic missile submarines carry one of the major parts of the U.S. nuclear deterrent, up to 24 Trident missiles with one to eight nuclear warheads apiece. The Navy has 14 Ohio class ballistic missile submarines, each of which displaces about 19,000 tons when submerged. In addition, the Navy has converted 4 submarines of that class to a conventional guided missile (SSGN) configuration. Those SSGNs carry up to 154 Tomahawk missiles as well as special-operations forces.

Los Angeles Class Attack Submarine

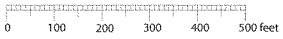


Attack submarines are the Navy's premier undersea warfare and antisubmarine weapons. Since the end of the Cold War, however, they have mainly been used for covert intelligence gathering. They also can launch Tomahawk missiles at inland targets in the early stages of a conflict. Forty-one of the Navy's 54 attack submarines belong to the Los Angeles class. At 7,000 tons, they are less than half the size of ballistic missile submarines.

Arleigh Burke Class Destroyer



Large surface combatants, which include cruisers and destroyers, are the workhorses of the fleet. They provide ballistic missile defense for the fleet and for regional areas overseas. They defend aircraft carriers and amphibious warfare ships against other surface ships, aircraft, and submarines, and they perform such day-to-day missions as patrolling sea lanes, providing an overseas presence, and conducting exercises with allies. They also can launch Tomahawk missiles to strike land targets. Most of the Navy's surface combatants displace about 9,000 to 10,000 tons.



Continued

Box 1. Continued

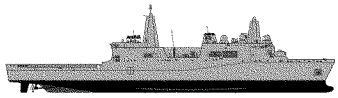
Major Ship Types in the Navy's Fleet

Freedom Class Littoral Combat Ship*



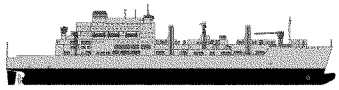
Small surface combatants include frigates and littoral combat ships. Frigates are used to perform many of the same day-to-day missions as large surface combatants. Littoral combat ships are intended to counter mines, small boats, and diesel electric submarines in the world's coastal regions. More routinely, they also patrol sea lanes, provide an overseas presence, and conduct exercises with allies. They range in size from 3,000 to 4,000 tons. The Navy retired all of its Oliver Hazard Perry frigates in 2015. [*Image corrected on October 30, 2015]

San Antonio Class Amphibious Transport Dock



The Navy has five classes of **amphibious warfare ships**. Two classes, referred to as **amphibious assault ships** (also known as large-deck amphibious ships or helicopter carriers), are the second-largest types of ships in the fleet at 40,000 to 45,000 tons. They form the centerpiece of amphibious ready groups, and each can carry about half the troops and equipment of a Marine expeditionary unit. In addition, they can carry as many as 30 helicopters and 6 fixed-wing Harrier jump jets; alternatively, they can carry up to 20 Harriers or short takeoff and landing versions of the Joint Strike Fighter. The other three classes are divided into two types: **amphibious transport docks** and **dock landing ships.** Two of those ships together provide the remaining transport capacity for a Marine expeditionary unit in an amphibious ready group. They range in size from 16,000 to 25,000 tons.

Lewis and Clark Class Dry Cargo/Ammunition Ship*



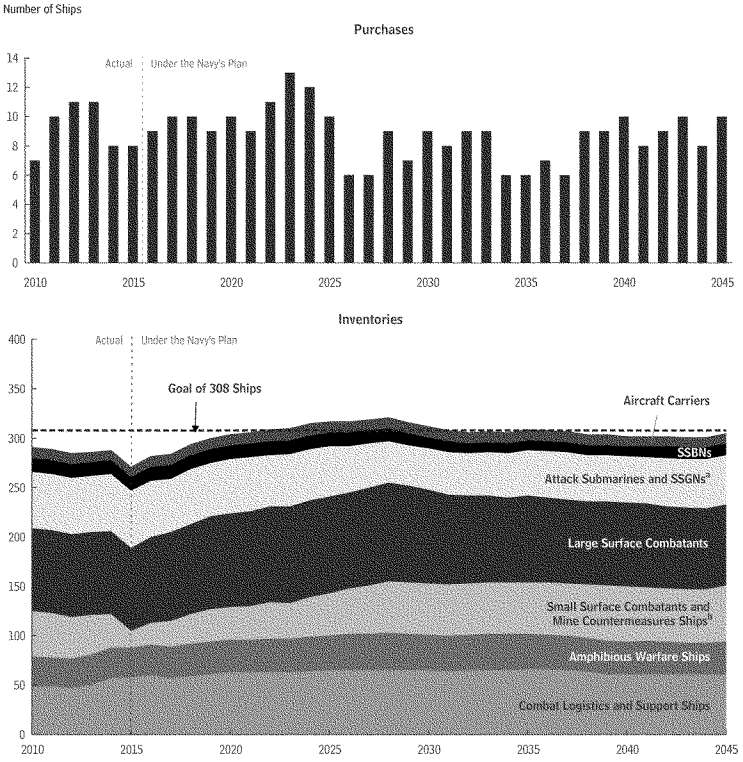
The many **combat logistics and support ships** in the Navy's fleet provide the means to resupply, repair, salvage, or tow combat ships. The most prominent of those vessels are fast combat support ships, which operate with carrier strike groups to resupply them with fuel, dry cargo (such as food), and ammunition. Logistics and support ships can be as small as 2,000 tons for an oceangoing tug or as large as 50,000 tons for a fully loaded fast combat support ship. [*Label corrected on October 30, 2015]



Source: Congressional Budget Office.

Figure 2.

Annual Ship Purchases and Inventories Under the Navy's 2016 Plan



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

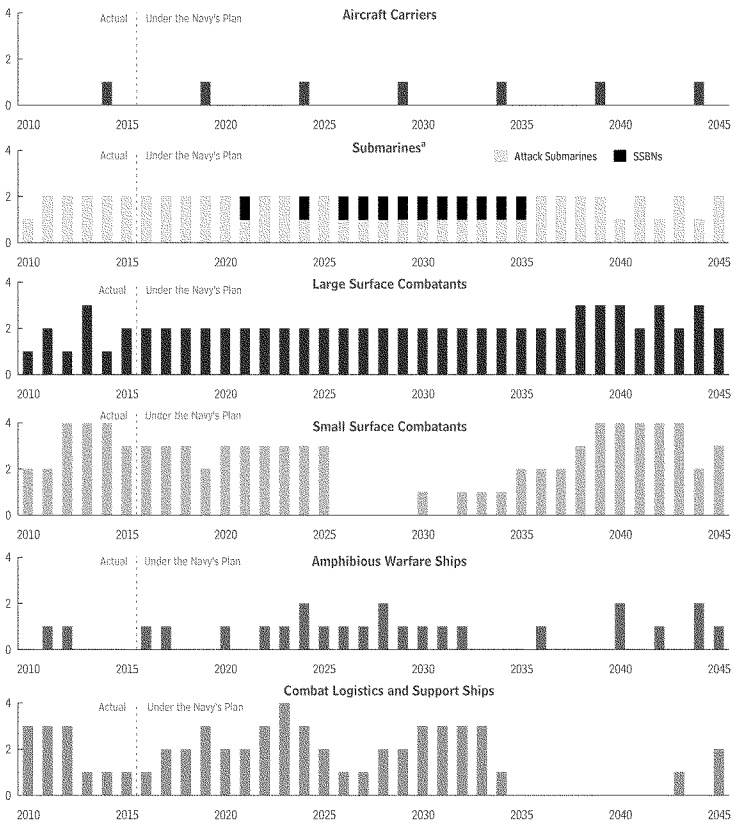
Note: SSBNs = ballistic missile submarines; SSGNs = guided missile submarines.

a. Although the Navy does not plan to build more SSGNs, 4 will be in service through the mid-2020s.

b. Includes littoral combat ships, Oliver Hazard Perry FFG-7 frigates, fast frigates, and Avenger class mine countermeasures ships.

Figure 3.

Annual Ship Purchases, by Category, Under the Navy's 2016 Plan



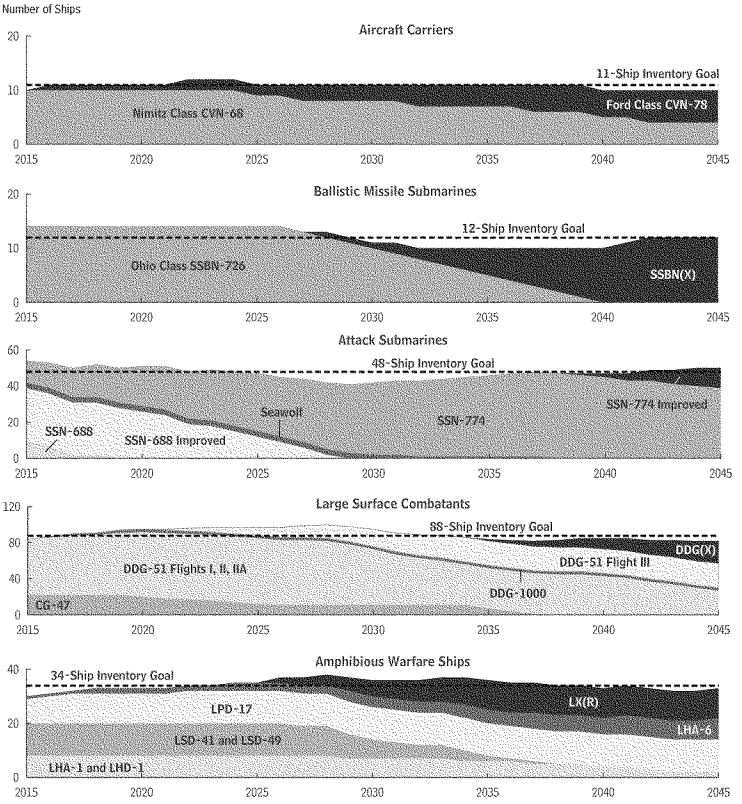
Source: Congressional Budget Office based on data from the Department of the Navy.

Note: SSBNs = ballistic missile submarines.

a. Although guided missile submarines are included in the Navy's inventory, the service does not plan to build more of them.

Figure 4.

Annual Inventories Versus Goals for Selected Categories of Ships Under the Navy's 2016 Plan



Source: Congressional Budget Office.

Note: CG = guided missile cruiser; CVN = nuclear-powered aircraft carrier; DDG and DDG(X) = guided missile destroyer; LHA and LHD = amphibious assault ship; LPD = amphibious transport dock; LSD = dock landing ship; LX(R) = dock landing ship replacement; SSBN and SSBN(X) = ballistic missile submarine; SSN = attack submarine.

and 2045, at a rate of one every five years. That plan would be sufficient to maintain a force of 11 aircraft carriers through 2039. However, with a 50-year expected service life, the force would fall to 10 carriers in 2040 and beyond.

Ballistic Missile Submarines. The 2016 shipbuilding plan calls for buying the first replacement for the Ohio class ballistic missile submarine in 2021 and for purchasing 12 such submarines, also known as SSBN(X)s, that would begin to enter the fleet in 2028. (The Navy estimates that the lead submarine will take about seven years to build and that two to three years after that will be needed for testing before it is placed into regular operation.) However, because the Ohio class submarines are retired at the end of their 42-year service life, the Navy's inventory of SSBNs would fall below the goal of 12 by 1 or 2 ships between 2030 and 2041. In particular, between 2032 and 2040, the Navy would have 10 SSBNs.

Attack Submarines. Under the 2016 plan, the Navy would purchase 45 attack submarines (SSNs) through 2045. That number is 3 fewer than under the 2015 plan, and it would not be enough to keep the force at the goal of 48 for all of the next 30 years. The number of attack submarines would decline from 48 in 2024 to a low of 41 in 2029 and then increase to 48 or more after 2042. The decline is the result of the retirement, beginning in 2014, of Los Angeles class attack submarines (SSN-688s). Those ships are reaching the end of their 33-year service life, having generally been built at a rate of 3 or 4 per year during the 1970s and 1980s. The Navy would replace those submarines with Virginia class attack submarines (SSN-774s) and their successors, at a rate of 1 or 2 per year.

Large Surface Combatants. The 2016 shipbuilding plan calls for buying 65 destroyers—the same number as in the 2015 plan—based on the existing Arleigh Burke class destroyer (DDG-51) design. Those purchases and the Navy's plan to modernize its cruiser force would allow the Navy to meet or exceed the goal of 88 large surface combatants through 2034 (with the exception of 2016) and then decline by 6 destroyers, to 82 ships, by 2044.

The Navy's assumptions about the service life of large surface combatants have not changed for several years: All 34 Arleigh Burke class destroyers commissioned after 2000 are assumed to have a service life of 40 years and the 28 destroyers commissioned earlier would remain in the fleet for 35 years. Historically, very few cruisers or destroyers have served longer than 30 years.[6] If the Navy's large surface combatants serve for 30 years instead of their longer intended life, and if the Navy's acquisition of such ships matches the pace of the 2016 plan, their number in the fleet will fall substantially short of the Navy's goal of 88 large surface combatants.[7]

Small Surface Combatants. For small surface combatants, the Navy plans to replace its retired Oliver Hazard Perry frigates and mine countermeasures ships with littoral combat ships (LCSs) and improved LCSs, which are to be designated as frigates. The service would not reach its objective of having 52 small surface combatants in the fleet until 2028, the same as under the 2015 plan.

Amphibious Warfare Ships. The Navy's current plan calls for buying 23 amphibious warfare ships through 2045—2 more than specified in the 2015 plan—and increasing the amphibious force from 30 ships today to 34 by 2022. The force would stay at that size or increase through 2039 and then fall 1 or 2 ships short of the goal in the 2040s. The Navy assumes that it will keep its LHD class amphibious assault ships in the fleet for 43 to 45 years, although their expected service life is just 40 years.

Combat Logistics and Support Ships

Under the 2016 plan, the Navy envisions buying 46 combat logistics and support ships in the next three decades—the same number included in the 2015 plan. Combat logistics ships include T-AKE dry cargo ships, T-AO oilers, and AOE fast combat support ships; they operate with or directly resupply combat ships that are on deployment. The plan includes the purchase of 17 new oilers (which provide fuel and a few other supplies to ships at sea) at a rate of 1 per year through the 2020s, concluding in 2033. The plan also includes the purchase of 3 replacement T-AKE dry cargo and ammunition ships in 2043 and 2045. Other support ship purchases in the Navy's plan include 10 joint high-speed vessels (JHSVs), 4 salvage ships, 5 surveillance ships, 2 tenders,

6. See Congressional Budget Office, *Resource Implications of the Navy's Fiscal Year 2009 Shipbuilding Plan* (attachment to a letter to the Honorable Gene Taylor, June 9, 2008), p. 25, www.cbo.gov/publication/41703.

7. See Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2014 Shipbuilding Plan* (October 2013), p. 26, www.cbo.gov/publication/44655.

4 fleet tugs, and 1 new afloat forward staging base (a variant of the Navy's mobile landing platform ship).[8]

One notable change in this category in the 2016 shipbuilding plan is the removal of the proposed purchase of 2 command ship replacements; the existing command ships are still slated to be retired in 2039.[9] Another change is a delay, from 2016 to 2017, in the slated retirement of 2 salvage ships and 2 fleet tugs. Those retirements had been moved up as a cost-saving measure by nine and four years, respectively, under the 2015 plan. That would leave the Navy with 2 fleet tugs and 2 salvage ships in its inventory until 2019 and 2023, respectively, when replacements are scheduled to enter the fleet. The decision to retire the ships early (even though they are less expensive to operate than many other ship types), and the consequent gaps in the inventory raise the question of whether the Navy needs 4 ships of each type to support fleet operations. In the 2015 plan, the Navy stated that it would use leased vessels "if [the] mission workload requires additional ships."[10]

Shipbuilding Costs Under the 2016 Plan

According to the Navy's estimates, its planned purchases of new ships would cost an average of $16.5 billion per year (in 2015 dollars) through 2045 (see Table 4)—3 percent less than the $17.2 billion average shown in its 2015 plan (see Figure 5). In making its estimates, the Navy divided the time frame of the 2016 plan into three periods: the near term (2016 to 2025), the midterm (2026 to 2035), and the far term (2036 to 2045).

CBO also estimated the costs of the Navy's 2016 plan; it used its own cost models and assumptions, which are explained in detail later in this report, to price the ships. All together, CBO's estimates for new-ship construction are nearly $2 billion per year (or 12 percent) higher than the Navy's for the 30-year period, but the differences increase over time: They are smallest for the near term and largest for the far term. If other items that the Navy would need to fund from its budget accounts for ship construction are included, the Navy's estimates and those of CBO are $1.7 billion higher per year.[11]

The Navy's Estimates

The Navy's 2016 report is a relatively brief update to the 2015 report—the 2016 version regularly refers to the language in the earlier document. The 2015 report offers a frank discussion of the difficulties in estimating the capabilities that the Navy will want ships to have—and thus the cost of those ships—over the three planning periods. For the near term, the report explains, "projections in the period are based on our most accurate understanding of required combat capabilities, future defense budget toplines, and shipbuilding costs based on actual procurements in progress. The cost estimates for this period are the most accurate of the three planning periods." For the midterm, "the accuracy of the plan cost estimates diminishes." And for the far term, "Since the strategic environment and state of technology 20–30 years hence are both sure to be much different than they are today, the precision and accuracy of the ship types required and cost projections in this period are much more speculative."[12]

New-Ship Construction Costs. According to the Navy's estimates for its 2016 plan, over the near term, new-ship construction will cost an average of $16.9 billion per year. That amount excludes about $600 million in cost overruns and cuts made as a result of the automatic spending reductions (called sequestration) in 2013 that need to be restored to complete the construction of ships funded before 2016; that sum would be paid out from 2016 through 2018. The Navy projects that about a quarter of the funding for the construction of the Ohio Replacement class ballistic missile submarines will be spent in the next 10 years—mostly between 2021 and 2025. According to the Navy's estimates, the average budget for

8. The afloat forward staging base is a ship designed to remain on station overseas for long periods to provide support to other naval forces, such as special operations units, patrol craft, or minesweepers.

9. Since the 2005 publication of the Navy's interim report on shipbuilding, command ships have been removed from or added to Navy shipbuilding plans four times.

10. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for FY2015* (June 2014), p. 13, http://go.usa.gov/FYZR (PDF, 3.4 MB).

11. The Navy has funded shipbuilding through two accounts: Shipbuilding and Conversion, Navy (commonly called the SCN account); and the National Defense Sealift Fund (NDSF), which includes funding for the procurement of some types of logistics ships. With the 2015 budget, the Navy proposed terminating the NDSF and funding all ships through the SCN account.

12. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for FY2015* (June 2014), p. 10, http://go.usa.gov/FYZR (PDF, 3.4 MB).

Table 4.

Average Annual Shipbuilding Costs Under the Navy's 2016 Plan, by Decade

	Near Term (2016–2025)	Midterm (2026–2035)	Far Term (2036–2045)	All Three Decades (2016–2045)
		Navy's Estimates (Billions of 2015 dollars)		
New-Ship Construction	16.9	17.2	15.2	16.5
New-Ship Construction and Refueling of Nuclear-Powered Aircraft Carriers[a]	18.3	18.2	15.9	17.5
New-Ship Construction, Refueling of Nuclear-Powered Aircraft Carriers, and Other Items[b]	19.5	18.8	16.5	18.3
		CBO's Estimates (Billions of 2015 dollars)		
New-Ship Construction	18.2	19.2	17.8	18.4
New-Ship Construction and Refueling of Nuclear-Powered Aircraft Carriers	19.6	20.2	18.4	19.4
New-Ship Construction, Refueling of Nuclear-Powered Aircraft Carriers, and Other Items	20.7	20.8	19.0	20.2
		Percentage Difference Between the Navy's and CBO's Estimates		
New-Ship Construction	8	12	17	12
New-Ship Construction and Refueling of Nuclear-Powered Aircraft Carriers	7	11	16	11
New-Ship Construction, Refueling of Nuclear-Powered Aircraft Carriers, and Other Items	6	11	16	10
Memorandum (Billions of 2015 dollars):				
CBO's Estimate of the Costs of New-Ship Construction Needed to Meet Nearly All Inventory Goals in Each Year	20.6	20.8	16.5	19.3
Costs of Mission Packages for Littoral Combat Ships	0.3	0.1	0.3	0.3

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

Note: Costs for other items include funds for ship conversions and for ships that are not part of the Navy's battle force (such as oceanographic survey ships) and training ships, outfitting and postdelivery (including the purchase of smaller tools and pieces of equipment that are needed to operate a ship but not necessarily provided by the manufacturing shipyard as part of ship construction), and smaller items. Actual costs for the Navy's shipbuilding accounts over the past 30 years averaged about $16 billion per year for all items.

a. These figures are the Navy's estimates for new-ship construction and CBO's estimates for the refueling of nuclear-powered aircraft carriers.

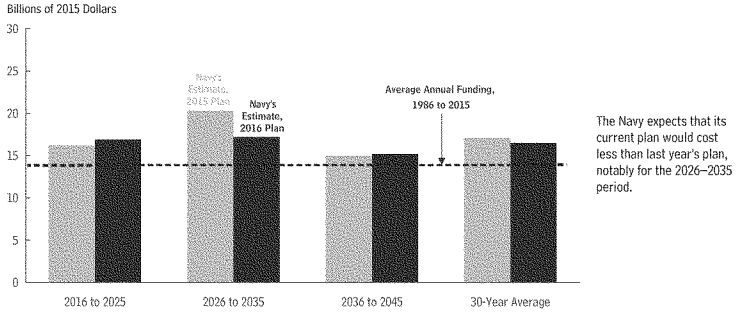
b. These figures are the Navy's estimates both for new-ship construction and for the cost to complete for ships purchased in prior years and CBO's estimates for the refueling of nuclear-powered aircraft carriers and for other items.

new-ship construction rises from $14.9 billion per year between 2016 and 2020 to $18.9 billion per year for 2021 to 2025 (see Figure 6).

The Navy's shipbuilding plan suggests that the midterm will be fiscally challenging as well: At $17.2 billion per year, the average total cost of new-ship construction is close to the average the service estimates for the first 10 years. The Navy projects that building the new submarines will cost $5.4 billion per year in the middle decade of the plan. In the far term, with Ohio Replacement submarines completed, the Navy's estimate for new-ship construction declines to an average of $15.2 billion per year.

Figure 5.

The Navy's Estimates of the Average Annual Costs of New-Ship Construction Under Its 2015 and 2016 Plans



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

Note: Costs exclude funds for refueling nuclear-powered aircraft carriers and for ship conversions, construction of ships that are not part of the Navy's battle force (such as oceanographic survey ships) and training ships, outfitting and postdelivery (including the purchase of smaller tools and pieces of equipment that are needed to operate a ship but not necessarily provided by the manufacturing shipyard as part of ship construction), and smaller items. Costs for the mission packages for littoral combat ships, which are not funded in the Navy's shipbuilding accounts, also are excluded.

Total Shipbuilding Costs. As in previous shipbuilding plans, the Navy's latest estimates exclude some costs that it would need to cover out of its budget accounts for ship construction:

- The cost of refueling nuclear-powered aircraft carriers midway through the ships' 50-year service life would increase the Navy's estimate for the 2016 shipbuilding plan by $1 billion per year, to an average of $17.5 billion a year through 2045,[13] and
- The costs of ship conversions, construction of ships that are not part of the Navy's battle force (oceanographic survey ships, for instance), moored training ships, outfitting and postdelivery (including the purchase of many smaller tools and pieces of equipment that are needed to operate a ship but that are not necessarily provided by the shipyard when the ship is built), and smaller items.

Adding those costs, plus the $600 million in cost-to-complete funding that will be spent from 2016 through 2018, to the estimated new-ship construction costs would boost the Navy's estimate for the full cost of the 2016 shipbuilding plan to $18.3 billion per year, or $1.8 billion more than its estimate for new-ship construction alone. That figure is 16 percent higher than the average funding of $15.8 billion per year that the Navy has received for total shipbuilding costs over the past three decades.

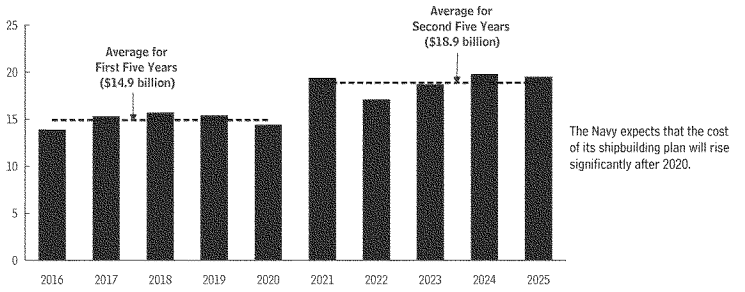
CBO's Estimates

In CBO's estimation, the full cost of the 2016 shipbuilding plan (including construction, refueling of nuclear-powered aircraft carriers, and other items) would average $20.2 billion per year over the 2016–2045 period (see Table 4 on page 13). That amount is 28 percent above the average annual funding the Navy

13. In 2010, the Navy transferred funding for refueling nuclear-powered submarines to other Navy accounts (Other Procurement, Operation and Maintenance, and Weapons Procurement) that are not used to purchase ships. Therefore, CBO did not include the refueling costs for submarines in its estimates of future shipbuilding costs.

Figure 6.

The Navy's Estimates of the Costs of New-Ship Construction, 2016 to 2025



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

Note: Costs exclude funds for refueling nuclear-powered aircraft carriers and for ship conversions, construction of ships that are not part of the Navy's battle force (such as oceanographic survey ships) and training ships, outfitting and postdelivery (including the purchase of smaller tools and pieces of equipment that are needed to operate a ship but not necessarily provided by the manufacturing shipyard as part of ship construction), and smaller items. Costs for the mission packages for littoral combat ships, which are not funded in the Navy's shipbuilding accounts, also are excluded.

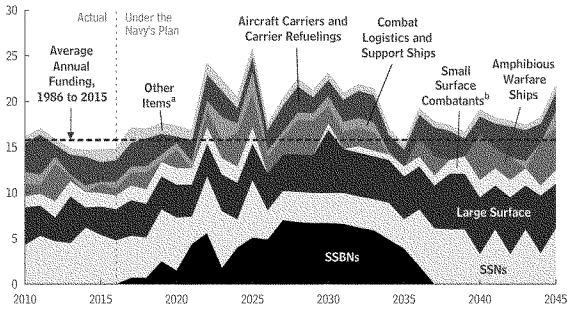
has received over the past three decades. The estimated costs have a fair amount of yearly variation but are on an upward trend for the first two decades of the plan (see Figure 7). CBO makes the following estimates for the 30-year period as a whole:

- New-ship construction would average $18.4 billion per year, 12 percent more than the Navy's figure of $16.5 billion;
- New-ship construction plus refueling of nuclear-powered aircraft carriers would cost an average of $19.4 billion per year, 11 percent more than the Navy's figure of $17.5 billion; and
- All other items would add annual costs of about $800 million, raising CBO's estimate to an average of $20.2 billion per year through 2045, 10 percent more than the Navy's figure of $18.3 billion.

CBO's estimates of the full cost of the plan are only 6 percent higher than the Navy's for the first 10 years but 16 percent higher for the final 10 years. The two sets of estimates are similar for the near term because most of the ships that the Navy plans to buy are already under construction and their costs are reasonably well known. But CBO and the Navy made different assumptions about the size and capabilities of future ships that contributed to different cost estimates for the midterm and far term. Generally, CBO estimates the cost of a future ship on the basis of the relationship between the weight and cost of analogous existing ships. The resulting amount is then adjusted for factors such as production efficiencies that occur as more ships of the same type are built simultaneously at a given shipyard and additional efficiencies that occur as more ships are built over the duration of a production run. CBO also incorporated into its estimates (which are in constant 2015 dollars) a projection that, as they have for the past several decades, labor and materials costs would probably continue to grow faster in the shipbuilding industry than in the economy as a whole. The Navy's constant-dollar estimates do not reflect that faster growth (see Box 2 on page 18). That difference in estimates is much more pronounced in the final decade of the plan, after 20 or more years of compounded cost growth, than in the early years. (For more information on CBO's methods for estimating the cost of new ships, see Appendix A.)

Figure 7.

CBO's Estimates of Annual Shipbuilding Costs Under the Navy's 2016 Plan



Over the next two decades, CBO estimates, the new SSBN program will push the Navy's annual shipbuilding costs above the historical average.

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

Note: SSBNs = ballistic missile submarines; SSNs = attack submarines.

a. Includes ship conversions, ships that are not part of the Navy's battle force (such as oceanographic survey ships) and training ships, outfitting and postdelivery (including the purchase of smaller tools and pieces of equipment that are needed to operate a ship but not necessarily provided by the manufacturing shipyard as part of ship construction), and smaller items.

b. Costs for the mission packages for littoral combat ships, which are not funded in the Navy's shipbuilding accounts, are not included.

Costs of Meeting Nearly All Inventory Goals in Each Year

Under its 2016 shipbuilding plan, the Navy would not build enough ships at the right times to meet the service's inventory goal of 308 battle force ships until 2022. In particular, the plan would lead to temporary shortfalls relative to the Navy's goals for ballistic missile submarines, attack submarines, large surface combatants, and, in the far term, for aircraft carriers as well. However, there would be only small and short-lived shortfalls for amphibious warfare ships (see Figure 4 on page 10).

The Navy does not believe that it can prevent the shortfall in ballistic missile submarines. Because of specific characteristics of the design and operations, the service of existing Ohio class submarines cannot be extended.[14] And building the new class of ballistic missile submarines faster, the Navy argues, would introduce technical risks that would outweigh the risk of having 10—rather than the preferred 12—SSBNs that are deployable for a decade.

Other shortfalls, however, could be avoided or reduced by accelerating or increasing ship purchases relative to those specified in the 2016 shipbuilding plan. To meet most of its existing goals, the Navy could make the following changes to the current shipbuilding plan:

- To prevent the force from falling below the inventory goal of 48 attack submarines, the Navy could accelerate the purchase of 7 submarines to the period from 2017 through 2023, thus increasing the production rate to 3 submarines per year for most of those years. In that case, the Navy could buy 7 fewer attack submarines between 2025 and 2034 than is called for under the 2016 plan and still maintain the

14. Among the many factors that determine the service life of a submarine are the two primary ones: the condition of its hull and the energy in its reactor. The number of times a submarine can "cycle"—submerge and surface—before it must be retired is limited, as is the reactor's capacity to produce energy. Some nuclear submarines can be refueled if their hulls have life remaining, but those with "life of the ship" reactor plants cannot be refueled.

desired inventory. However, doing so under the Navy's 2016 plan would reduce attack submarine construction to an average of 1 every other year for the 2026–2035 period.

- To prevent the carrier force from declining to 10 ships in the 2040s, 1 short of its inventory goal of 11, the Navy could accelerate purchases after 2018 to 1 every four years, rather than 1 every five years.
- To meet its goal of 88 large surface combatants in the last years of the plan, the Navy could purchase 6 additional destroyers between 2028 and 2037, increasing the production rate to 3 ships per year for six more years.
- To prevent small shortfalls in later years of the plan, the Navy could purchase 2 additional amphibious warfare ships by 2038 to meet its inventory goal of 34 ships in each year after 2022. However, the Navy cannot prevent a shortfall in amphibious warfare ships relative to its goal in the next few years because such ships take four to five years to build.

According to CBO's estimates, incorporating the changes described above into the Navy's 2016 plan would raise costs significantly in the first two decades of the plan but reduce them in the third decade. The annual cost of new-ship construction would average $20.6 billion between 2016 and 2025 (instead of the $18.2 billion in CBO's estimate of the Navy's plan), $20.8 billion between 2026 and 2035 (instead of $19.2 billion), and $16.5 billion between 2036 and 2045 (instead of $17.8 billion). Over the entire 30-year period, new-ship construction would average $19.3 billion per year, compared with CBO's estimate of $18.4 billion per year for the Navy's plan.

Other approaches to preventing the Navy from falling short of its goals could have different costs. For example, if the Navy was able to extend the service life of some existing ships, it would need fewer new ones, thus reducing procurement costs but possibly increasing operation and maintenance costs because older ships tend to be more expensive to operate than newer ships of the same class. Such an approach would not be effective in preventing a shortfall of all types of ships, however. In particular, the Navy's plan already reflects an assumption that most destroyers will be in service for 40 years, although historically very few have served longer than 30 years. Consequently, CBO does not expect that those ships could serve for an even longer period to prevent the shortfall in large surface combatants. By contrast, extending service life for amphibious warfare ships seems more plausible because those ships are already serving for 40 years and the Navy is planning to keep some beyond that length of service. Thus, the Navy could prevent the minor shortfalls in amphibious warfare ships after 2040 by not retiring existing ships and, in several cases, by extending their service life by a few years.

Shipbuilding With Historical Average Funding

CBO's estimate of $20.2 billion per year for the full cost of the Navy's 2016 shipbuilding plan is 28 percent higher than the $15.8 billion (in 2015 dollars) the Navy has spent on average per year over the past 30 years for all items in its shipbuilding accounts. If the Navy's future funding for shipbuilding is in line with the past, the Navy will need to substantially reduce its new-ship purchases relative to the number called for in its 2016 plan.[15]

To illustrate how much smaller the fleet of battle force ships might be under that scenario, CBO constructed an alternative shipbuilding plan to meet two criteria: First, the purchase of specific types of ships, with the exception of ballistic missile submarines and aircraft carriers, would be reduced in rough proportion to the 2016 plan. The Navy's most senior officials have described replacing the current Ohio class submarines as the service's top priority; CBO assumed, therefore, that the Navy would purchase all 12 submarines included in its 2016 plan. The Congress has mandated in law that the Navy maintain a fleet of 11 aircraft carriers, so in this illustrative scenario, CBO did not make cuts to that category.

With the nearly proportionate reduction in purchases of other types of ships, the composition of the fleet in 2045 would be about the same as that specified in the 2016 plan, although the number of ships of each type would be smaller.

15. For a broader discussion of historical cost trends in Navy shipbuilding, see the testimony of Eric J. Labs, Senior Analyst for Naval Forces and Weapons, Congressional Budget Office, before the Subcommittee on Seapower and Expeditionary Forces of the House Committee on Armed Services, *The Long-Term Outlook for the U.S. Navy's Fleet* (January 20, 2010), www.cbo.gov/publication/41886.

Box 2.

Inflation in the Cost of Shipbuilding

The costs of building future ships will depend not just on their size and capabilities but also on the evolution of production costs. The differences between the Navy's and the Congressional Budget Office's estimates of the cost of the Navy's shipbuilding plans arise in part from their different methods for measuring the value—in constant 2015 dollars (that is, removing the effects of inflation)—of production costs that will be incurred years or decades from now.

For the same ship with the same capabilities, the Navy reports the future cost of capabilities purchased as being the same as the cost today. By contrast, CBO projects the cost to build the same ship in the future but accounting for the rising cost of shipbuilding labor and materials relative to that for other goods and services in the economy. CBO regards that difference between shipbuilding inflation and overall inflation as growth in the constant-dollar cost of budgetary resources for building naval ships. The agency's constant-dollar estimates incorporate the increased costs of a future ship of any given size and capability relative to the average increase in costs for other goods and services that might be purchased with the same amount of discretionary funding.

The Navy provided CBO with a shipbuilding cost index that measures growth in the costs of labor and materials for the period from 1960 to 2014. To project increases for 2015 through 2019, the Navy constructed a shipbuilding cost index by extrapolating from the historical cost data and incorporating other information—derived from advance-pricing agreements, vendor surveys, and forecasts of the labor market—into its projections. For the 2015–2019 period, the Navy projects, shipbuilding costs will rise at an average annual rate of 2.9 percent.

The Navy incorporated that projection into its budget request for 2016 and into the associated Future Years Defense Program; both documents express costs in nominal dollars. In projecting the constant-dollar costs for its 2016 shipbuilding plan, the Navy converted nominal dollars to constant 2015 dollars by discounting the nominal dollar amounts, using the same shipbuilding cost index the service used to construct the future-year estimates.[1] Thus, the Navy's constant-dollar estimates are essentially a measure of the amount of ship capability purchased: If a ship costs $2.5 billion to build in 2015, the cost (in 2015 dollars) of building an identical ship in 2035 will be the same amount—$2.5 billion.

In contrast, CBO used the gross domestic product (GDP) price index, which measures the prices of all final goods and services produced in the economy, to convert shipbuilding costs from nominal to constant dollars. CBO anticipates an average annual rate of increase in that measure of 1.9 percent for the 2015–2019 period. CBO's estimates of the cost of building a given ship (as projected from the Navy's shipbuilding cost index) show a rate of increase over the period that is 1.0 percentage point faster per year, on average, than the rate of inflation it projects for the overall

1. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2016* (March 2015), http://tinyurl.com/ocrqtfc.

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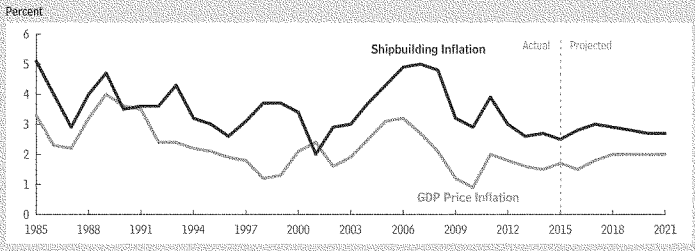
The second criterion underlying the alternative plan is to keep spending fairly similar (in inflation-adjusted, or real, dollars) during the near-term, midterm, and far-term periods. The alternative plan is not a recommendation by CBO but simply an illustration of the possible consequences of continuing funding for shipbuilding at its historical average amount rather than increasing it, as would be required under the Navy's 2016 plan.[16]

16. In a report accompanying the 2014 National Defense Authorization Act, the House Committee on Armed Services directed the Navy to provide to the Congress a similar illustration of a shipbuilding plan (starting in 2015) that conforms to historical funding levels. The Navy has not responded to that Congressional directive.

Box 2 Continued

Inflation in the Cost of Shipbuilding

Annual Rates of Shipbuilding Inflation and GDP Price Inflation



Sources: Congressional Budget Office; Department of the Navy.

Note: GDP = gross domestic product.

economy. CBO identified the same the 1.0 percentage-point real annual growth in its analysis of the Navy's 2015 plan.

Since 1985, the average difference between the rate of increase in the Navy's shipbuilding cost index and that in the GDP price index has been about 1.3 percentage points per year (see the figure). Cost growth in the shipbuilding industry has exceeded general inflation for most of the past three decades, and CBO lacks an analytical basis for determining when or to what extent the difference between the two growth rates might narrow. Therefore, CBO projects that shipbuilding inflation will outpace GDP price inflation by 1.0 percentage point per year between 2015 and 2019 and by about 1.3 percentage points per year—matching the 30-year historical average—thereafter.[1] The result is that CBO estimates that a ship that costs $2.5 billion to build in 2015 will cost $3.2 billion (in 2015 dollars) in 2035. (Shipbuilding costs cannot continue indefinitely to grow faster than the costs of goods and services in the economy as a whole. If that occurred, the price of ships eventually would outstrip the Navy's ability to pay for even a small number of them.)

1. In its report, the Navy estimates shipbuilding costs in nominal dollars for the 2016–2025 period (it does not provide estimates beyond those years) totaling between $190 billion and $201 billion. The lower figure uses inflation assumptions determined by the Office of the Secretary of Defense; the higher figure uses shipbuilding inflation. CBO's nominal-dollar estimates for the 2016–2025 period total $204 billion.

Under that illustrative 30-year plan, the Navy would purchase 192 ships (versus 264 in the Navy's 2016 plan) as follows:

- 6 aircraft carriers (the Navy's plan also has 6),
- 12 ballistic missile submarines (the Navy's plan also has 12),
- 34 attack submarines (the Navy's plan has 45),
- 46 destroyers (the Navy's plan has 65),
- 44 littoral combat ships and fast frigates (the Navy's plan has 67),
- 15 amphibious ships (the Navy's plan has 23), and
- 35 combat logistics and support ships (the Navy's plan has 46).

Under this plan, the battle force fleet in 2023 would be about the same size as in the Navy's plan but by 2045 would number 237 ships, as opposed to the 305 in the Navy's plan. The inventory in 2045 would consist of the following ships:

- 10 aircraft carriers (the Navy's plan has 10),
- 12 ballistic missile submarines (the Navy's plan has 12),
- 37 attack submarines (the Navy's plan has 50),
- 64 destroyers (the Navy's plan has 82),
- 34 littoral combat ships and fast frigates (the Navy's plan has 57),
- 27 amphibious ships (the Navy's plan has 33), and
- 53 combat logistics and support ships (the Navy's plan has 61).[17]

Other approaches to staying within historical funding would produce different results. If the Navy reduced the number of larger and more expensive ships more sharply than in the plan described above, the fleet would be larger overall. Conversely, if it preserved the programs of more expensive ships, the fleet would be smaller overall. Ultimately, decisions about which ships to build would depend on policymakers' priorities for certain naval missions relative to others.[18]

Shipbuilding Under the Budget Control Act of 2011

The Budget Control Act of 2011, as amended by the American Taxpayer Relief Act of 2012 and the Bipartisan Budget Agreement of 2013, established caps on discretionary defense funding that will continue from 2016 through 2021. Those caps apply to DoD's base budget but exclude the costs of overseas contingency operations, which consist of U.S. involvement in the war in Afghanistan, Iraq, Syria, and other nonroutine military activities elsewhere. The caps set funding, in real terms, substantially below the amount DoD received in 2010, when its base budget reached its peak.

In the first three years of the BCA, the Congress has increased funding for shipbuilding above the President's requests, which roughly aligned with the historical shares the service would have expected to receive under the law. (During the past 15 years, the Department of the Navy has received about 30 percent of DoD's base budget and has devoted about 10 percent of its funding to shipbuilding.) Between 2013 and 2015, the President's budget requests included an average of about $14.1 billion per year in nominal dollars for shipbuilding. The Congress appropriated about 10 percent more, an average of $15.5 billion per year (see Figure 8). Nevertheless, the Navy bought substantially fewer ships between 2013 and 2015 than it had planned before the BCA took effect. In all, the 2012 shipbuilding plan called for the purchase of 36 ships over those three years. In his 2013, 2014, and 2015 budgets, the President proposed to purchase a total of 25 ships, and the Congress added funding for 2 additional ships along with partial funding for several more.

In 2015, DoD's real base budget fell to about the same amount that it received in 2007, and as a result of the BCA's caps, funding (in real terms) will remain essentially at that level through 2021. Consequently, under current law, policymakers face a choice between implementing the Navy's 2016 shipbuilding plan and cutting costs elsewhere in the Navy's budget (or in DoD's budget more broadly), scaling back the 2016 shipbuilding plan, or taking some combination of those actions.

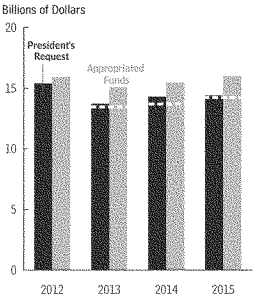
Specifically, if the Navy receives the same percentage of DoD's base budget during the coming decade and devotes the same percentage of its budget to ship construction that it has historically, the annual shipbuilding budget would be about $14 billion (in 2015 dollars) from 2016 through 2021. In comparison, the Navy's 2016 plan would require spending a little more than $19 billion per year on all shipbuilding over the same period, CBO estimates. The $14 billion amount would be about $5.5 billion per year—or 30 percent below CBO's estimate of the amount required to execute the Navy's 2016 plan over the 2016–2021 period. If all shipbuilding programs were cut proportionately, a reduction of that magnitude would require the Navy to purchase 16 fewer ships than the 57 it plans to purchase over that period, a reduction of about 30 percent.

17. The alternative plan also would fund the refueling of 1 aircraft carrier fewer than called for under the Navy's current plan.

18. For an illustration of such an analysis, see Congressional Budget Office, *Options for the Navy's Future Fleet* (May 2006), www.cbo.gov/publication/17802.

Figure 8.

Requested and Appropriated Shipbuilding Budgets Under the Budget Control Act



Source: Congressional Budget Office based on various volumes of the Department of the Navy's *Highlights of the Department of the Navy Budget.*

Notes: The dashed line indicates the estimated shipbuilding budget, calculated as the historical share of the Department of Defense's base budget under the BCA, as that act stood at the time of each year's budget submission.

BCA = Budget Control Act of 2011.

As of this writing, the Congress was considering H.R. 1314, the Bipartisan Budget Act of 2015.* That bill, if enacted, would raise the budget caps for national defense for fiscal years 2016 and 2017. That change would allow the Navy to cut 15 ships rather than 16 ships from its 2016 plan, if all shipbuilding programs were cut proportionately.

Outlook for Specific Ship Programs

To estimate the costs of implementing the Navy's 2016 shipbuilding plan, CBO calculated the cost of each of the 264 ships that the Navy intends to purchase between 2016 and 2045 (see Appendix A). For ships under construction, the estimates were based in part on data for actual costs from the Navy. For ships yet to be built, the estimates were based primarily on information about the cost per unit weight of similar ships from the past. Specifically, CBO used the cost per thousand tons of lightship displacement—which is the weight of the water the ship displaces without its crew, stores, weapons, fuel, or other liquids. CBO then adjusted its estimates to incorporate the effects of *rate* (the reduction in average overhead costs that occurs when a shipyard builds more than one of the same type of ship at a time) and *learning* (the efficiencies that shipyards gain as they produce additional units of a given type of ship). The effects of rate and learning were applied to the estimated cost of the first ship of a class (the lead ship) to determine the estimated costs for all subsequent ships of that class. Thus, CBO's estimate of the cost of the lead ship in a class drove its estimate of the costs of subsequent ships of that class. CBO had to make assumptions about the size and capabilities of ships for which the Navy has yet to develop even expected designs. All estimates exclude outfitting and postdelivery costs, which typically add at least 3 percent to a ship's cost.

Aircraft Carriers

The 2016 shipbuilding plan states that the Navy's goal is to have 11 aircraft carriers—a number also mandated by the Congress. The Navy intends to buy 6 CVN-78 Gerald R. Ford class aircraft carriers over the 2016–2045 period (see Table 5). Building 1 carrier every five years (referred to as five-year centers) would allow the Navy to have a force of at least 11 carriers through 2039, after which the force would drop to 10. (To maintain a force of 11 carriers that serve in the fleet for 50 years would require purchasing 1 ship every 4½ years rather than 1 every 5 years as is called for under the Navy's current plan.)

The Navy's current estimate of the total cost of the lead ship of the CVN-78 class is $12.9 billion in nominal dollars for the period from 2001 to 2016, an amount that is equal to the cost cap set in law.[19] CBO used the Navy's inflation index for naval shipbuilding to convert that figure to $14.7 billion in 2015 dollars, or 23 percent more than the amount requested in the President's budget proposal when the ship was first authorized in 2008. The Navy's estimate does not include $4.7 billion in research and development costs that apply to the entire class.

Because construction is nearly finished and no major problems have arisen in the test program (which is about half completed), CBO used the Navy's estimate for the lead ship to estimate the cost of successive ships in the class.

*The Bipartisan Budget Act of 2015 (Public Law 114-74) was enacted on November 2, 2015.

19. In its 2016 budget request, the Navy asked for an extra $124 million in nominal dollars in 2016 to cover cost growth and additional tooling and vendor services. That amount was anticipated in the 2014 and 2015 budget requests and it completes a total of $1.4 billion in additional funding requested in the past two budgets. The amount is included in the Navy's estimate of the total cost to complete the ship.

Table 5.

Comparison of the Navy's and CBO's Estimates for the Construction of Major New Ships Under the Navy's 2016 Plan

Billions of 2015 Dollars

	Number of New Ships Purchased Under the 2016 Plan	Total Costs per Class Over the 2016–2045 Period		Average Costs per Ship Over the 2016–2045 Period		Memorandum: Average Costs per Ship Under the 2015 Plan	
		Navy's Estimates	CBO's Estimates	Navy's Estimates	CBO's Estimates	Navy's Estimates	CBO's Estimates
CVN-78 Gerald R. Ford Class Aircraft Carriers	6	68 [a]	73 [a]	11.3 [a]	12.3 [a]	12.9	13.2
Ohio Replacement Ballistic Missile Submarines	12	75	88	6.2	7.3	6.8	7.9
Virginia Class Attack Submarines	26	74	76	2.9	3.0	2.9	3.0
Improved Virginia Class Attack Submarines (Replacements for Virginia class)	19	58	59	3.1	3.1	3.0	3.3
DDG-51 Flight III Arleigh Burke Class Destroyers	27	45	52	1.7	1.9	1.7	1.9
DDG(X) Destroyers (Replacements for Arleigh Burke class)	37	68	85	1.8	2.3	1.9	2.6
Littoral Combat Ships	9	4	5	0.5 [b]	0.5	0.5	0.5
Fast Frigates (Modified LCSs)	20	12	12	0.6	0.6	n.a.	0.6
LCS(X)s (Replacements for LCSs)	38	17	20	0.4 [b]	0.5	0.5	0.5
LHA-6 Amphibious Assault Ships	7	26	28	3.7	3.9	3.8	4.1
LX(R)s (Replacements for amphibious dock landing ships)	11	17	21	1.5	1.9	1.5	1.9
LPD-17 Replacements	4	8	11	2.1	2.6	2.3	2.7
T-AO(X) Oilers	17	8	10	0.5	0.5	0.5	0.6

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

Notes: The costs in this table exclude funding for research and development.

Unlike Table 1, this table excludes 1 DDG-51 Flight IIA destroyer, 1 LPD-17 amphibious ship, and 29 support ships of various types.

CVN = nuclear-powered aircraft carrier; DDG and DDG(X) = guided missile destroyer; LCS = littoral combat ship; LHA = amphibious assault ship; LPD = amphibious transport dock; LX(R) = dock landing ship replacement; T-AO(X) = oiler; n.a. = not applicable.

a. In CBO's and the Navy's estimates for aircraft carriers, total costs per class include remaining funding for the CVN-78 and CVN-79 but exclude some funding for the carrier the Navy plans to purchase in 2043 because that money would not be budgeted until 2046 or later. CBO's and the Navy's estimates of the average cost per ship exclude the remaining funding for the CVN-78 and CVN-79 but include all funding for the 2043 carrier.

b. The Navy's estimate for the LCSs is $463 million per ship; its estimate for the LCS(X) is $441 million each. Those costs exclude the cost of LCS mission packages, which CBO also excluded from its estimates.

That does not mean that all of the cost risk has been eliminated, but CBO estimates that the remaining risk of cost growth would be less than $100 million for the ship. (CBO thus no longer expects the $500 million in cost growth it had estimated for last year's report.)

The next carrier after the CVN-78 will be the CVN-79, the *John F. Kennedy*. Funding for that ship began in 2007, the Congress officially authorized its construction in 2013, and appropriations for it are expected to be complete by 2018. The Navy estimates that the ship will cost $11.5 billion in nominal dollars and $10.6 billion in 2015 dollars. The Navy's selected acquisition report on the CVN-79 states that "the Navy and shipbuilder have made fundamental changes in the manner in which the CVN 79 will be built to incorporate lessons learned from CVN 78 and eliminate key contributors to cost performance challenges realized in the construction of

CVN 78."[20] Although CBO expects the Navy to achieve a considerable cost reduction in the CVN-79 compared with the CVN-78, CBO's estimates are somewhat higher than the Navy's. Specifically, CBO estimates that the cost of the ship will be $11.9 billion in nominal dollars and $11.3 billion in 2015 dollars, about 4 percent more than the Navy's estimate.

The Navy estimates an average cost of $11.3 billion for the 6 carriers in the 2016 shipbuilding plan, the CVN-80 through CVN-85. CBO's estimate is $12.3 billion per ship. Both estimates are substantially lower for the 2016 plan than they were for 2015. The Navy's current estimate incorporates the effects of efforts to reduce costs for the CVN-79 and successive ships in the class. CBO's estimate is based on the Navy's estimate for the final cost of the CVN-78, which reduced the estimated cost of succeeding ships in the class. CBO's estimate is still above the Navy's, however, because CBO projects smaller reductions in price than the Navy predicts and because CBO anticipates real cost growth in the naval shipbuilding industry.

Submarines

Under the 2016 shipbuilding plan, submarines would consume the lion's share of shipbuilding funds over the next 20 years (see Table 6). The Navy currently operates 14 Ohio class ballistic missile submarines (SSBNs), 4 Ohio class guided missile submarines (SSGNs) modified from the SSBN version, and 54 attack submarines (SSNs) of several classes. Over the next three decades, the Navy plans to buy 12 new SSBNs, starting in 2021. It also plans to buy 45 new SSNs, including 26 Virginia class submarines (mostly at an average rate of 1.5 per year through 2033) and 19 submarines that are based on a redesigned and improved Virginia class (production is set to begin in 2034). The Navy does not plan to replace the 4 SSGNs it will retire in the mid-to-late 2020s.

Ohio Replacement Ballistic Missile Submarines. SSBNs, which carry Trident ballistic missiles, constitute the sea-based leg of the United States' strategic triad for nuclear deterrence. (The other two legs are land-based intercontinental ballistic missiles and manned strategic bombers.) The design, cost, and capabilities of the 12 Ohio Replacement submarines in the 2016 shipbuilding plan are among the most significant uncertainties in the Navy's and CBO's analyses of the cost of future shipbuilding. Under the 2016 plan, the first Ohio Replacement submarine—sometimes called the SSBN(X)—would be purchased in 2021, although advance procurement funding would be needed starting in 2017 for items with long lead times. A second submarine would be purchased in 2024, followed by 1 per year from 2026 to 2035 (see Figure 3 on page 9).[21]

The Navy currently estimates the cost of the first Ohio Replacement submarine at $12.1 billion in 2015 dollars, and it estimates an average cost for follow-on ships of $5.7 billion (the Navy has stated an objective of reducing that cost to $5.6 billion).[22] The implied total cost for the 12 submarines is $75 billion, or an average individual cost of $6.2 billion (see Table 5).

The Navy's estimate represents a 12 percent reduction in the cost per thousand tons for the first Ohio Replacement submarine compared with the first Virginia class submarine—an improvement that would affect costs for the entire new class of ballistic missile submarines. The main reason for those purported improved costs by weight for the Ohio Replacement is that the Navy will recycle, to the extent possible, the design, technology, and components used for the Virginia class. Furthermore, because ballistic missile submarines (such as the Ohio Replacement) tend to be larger and less densely built ships than attack submarines (like the Virginia class), they will be easier to build and therefore less expensive per thousand tons, the Navy asserts.

However, the historical record for the lead ships of new classes of submarines in the 1970s and 1980s provides little evidence that ballistic missile submarines are cheaper by weight to build than attack submarines (see Figure 9).

20. Defense Acquisition Management Information Retrieval, *Selected Acquisition Report: CVN 78 Gerald R. Ford Class Nuclear Aircraft Carrier, as of FY 2016 President's Budget* (Department of the Navy, December 2014), p. 29.

21. More information appears in Ronald O'Rourke, *Navy SSBN(X) Ballistic Missile Submarine Program: Background and Issues for Congress*, Report for Congress R41129 (Congressional Research Service, July 31, 2014). See also the testimony of Eric J. Labs, Senior Analyst for Naval Forces and Weapons, Congressional Budget Office, before the Subcommittee on Seapower and Expeditionary Forces of the House Committee on Armed Services, *The Long-Term Outlook for the U.S. Navy's Fleet* (January 20, 2010), www.cbo.gov/publication/41886.

22. That figure was stated in a briefing by the Navy to the staff of the House Committee on Armed Services, CBO, and the Congressional Research Service (February 28, 2011). The Navy's estimates, expressed in 2010 dollars, were $5.6 billion for the average follow-on submarine, with an objective of reducing that cost to $4.9 billion.

Table 6.

Total Shipbuilding Costs, by Major Category, 1986 to 2045

	Historical				CBO's Estimates Under the Navy's 2016 Plan			
	1986-1995	1996-2005	2006-2015	1986-2015	2016-2025	2026-2035	2036-2045	2016-2045
	Average Annual Costs (Billions of 2015 dollars)							
New-Ship Construction								
Aircraft carriers	2.4	1.1	2.0	1.8	2.3	2.4	2.7	2.4
Submarines	5.2	3.0	4.4	4.2	7.7	9.2	5.4	7.5
Surface combatants	7.1	4.8	4.2	5.4	5.4	5.0	7.1	5.8
Amphibious ships	1.3	1.7	1.6	1.6	1.7	1.9	2.3	2.0
Logistics and support ships	1.5	0.5	0.7	0.9	1.1	0.7	0.3	0.7
Subtotal	17.6	11.1	12.9	13.9	18.2	19.2	17.8	18.4
Refueling of Nuclear-Powered Carriers and Submarines[a]	0.4	1.0	1.3	0.9	1.4	1.0	0.7	1.0
Other Items	1.1	1.2	0.7	1.0	1.2	0.6	0.6	0.8
Total	**19.1**	**13.2**	**15.0**	**15.8**	**20.7**	**20.8**	**19.0**	**20.2**
	Percentage of Average Annual Costs							
New-Ship Construction								
Aircraft carriers	13	8	13	11	11	11	14	12
Submarines	27	23	29	27	37	44	29	37
Surface combatants	37	36	28	34	26	24	37	29
Amphibious ships	7	13	11	10	8	9	12	10
Logistics and support ships	8	4	5	6	6	4	1	4
Subtotal	92	84	86	88	88	92	93	91
Refueling of Nuclear-Powered Carriers and Submarines[a]	2	8	9	6	7	5	4	5
Other Items	6	9	5	6	5	3	3	4
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Congressional Budget Office.

Note: Costs exclude funds for refueling nuclear-powered aircraft carriers and for ship conversions, construction of ships that are not part of the Navy's battle force (such as oceanographic survey ships) and training ships, outfitting and postdelivery (including the purchase of smaller tools and pieces of equipment that are needed to operate a ship but not necessarily provided by the manufacturing shipyard as part of ship construction), and smaller items. Costs for the mission packages for littoral combat ships, which are not funded in the Navy's shipbuilding accounts, also are excluded.

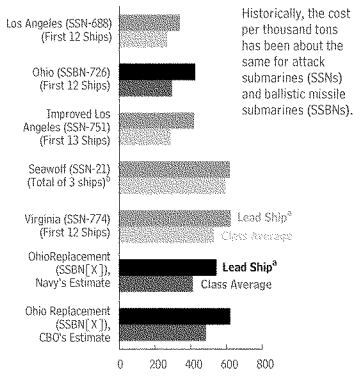
a. CBO's estimates under the Navy's 2016 plan reflect only the costs of refueling aircraft carriers. Historically, the refueling of nuclear-powered submarines also was included in the Navy's shipbuilding accounts, but in 2010, the Navy transferred that funding to other accounts.

The first Ohio class submarine was more expensive than the lead ships of the two classes of attack submarines built during the same period—the Los Angeles and the Improved Los Angeles. (The design of the Improved Los Angeles included the addition of 12 vertical launch system cells.) In addition, the average cost by weight of the first 12 or 13 ships of the Ohio, Los Angeles, and Improved Los Angeles classes was virtually identical. By the 1990s, the cost of lead ships for submarines had grown substantially. The first Virginia class submarine, which was ordered in 1998, cost about the same per thousand tons as the first Seawolf submarine, even though the Seawolf is 20 percent larger and was built nine years earlier.

Using data from the Virginia class submarine program, CBO estimates that the first Ohio Replacement submarine will cost $13.2 billion in 2015 dollars. Estimating

Figure 9.

Cost per Thousand Tons for Various Classes of Submarine, Lead Ship and Class Average



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

Notes: Cost per thousand tons of Condition A-1 weight, which is analogous to lightship displacement (the weight of the ship without its crew, materiel, weapons, fuel, or other liquids) for surface ships.

SSBN = ballistic missile submarine; SSN = attack submarine.

a. Data exclude costs for plans, which include nonrecurring engineering and detail design.

b. Although 29 Seawolf class submarines were planned, only 3 were built.

the cost of the first submarine of a class with an entirely new design is particularly difficult because of uncertainty about how much the Navy will spend on nonrecurring engineering and detail design. All told, 12 Ohio Replacement submarines would cost $88 billion, in CBO's estimation, or an average of $7.3 billion each—$1.1 billion more per submarine than the Navy's estimate. That average includes the $13.2 billion estimated cost of the lead submarine and a $6.8 billion average estimated cost for the 2nd through 12th submarines. Research and development would cost between $10 billion and $15 billion, for a total program cost of $98 billion to $103 billion, CBO estimates.

Overall, the Navy expects a 22 percent improvement in the cost-to-weight relationship of the Ohio Replacement class compared with the first 12 submarines in the Virginia class. Given the history of submarine construction, however, CBO is less optimistic that the Navy will realize as large an improvement in the cost-to-weight relationship of the Ohio Replacement class compared with the Virginia class. CBO estimates a 9 percent improvement, based in part on projected savings attributable to the concurrent production of the Ohio Replacement and Virginia class submarines.

As the Navy develops its acquisition strategy, costs for the Ohio Replacement could decline. For example, if lawmakers authorized and the Navy used a block-buy strategy to purchase a group of submarines over a specified period (effectively promising a steady stream of work for the shipyard to achieve better prices for those submarines, as it does for some other ship types)—and if that action also authorized the Navy to purchase submarines' components and materials in batches—the savings could be considerable.[23] Similarly, if the Congress funded the purchase of the Ohio Replacement submarines through the National Sea-Based Deterrence Fund, which was established in the fiscal year 2015 National Defense Authorization Act, the Navy could potentially save several hundred million dollars per submarine by purchasing components and materials for several submarines at the same time.[24] A disadvantage of that acquisition strategy is that if the Congress decided not to build all of the submarines for which the Navy purchased some materials, those materials might go unused.

Attack Submarines. The 2016 shipbuilding plan calls for the Navy to buy 26 Virginia class attack submarines. Between 2016 and 2033, those purchases would occur at a rate of 1 or 2 per year. In 2034, the Navy would switch to an improved Virginia class submarine but continue to build at the same rate. With such a procurement

23. More information on block-buy and multiyear procurement authority acquisition strategies is in Ronald O'Rourke and Moshe Schwartz, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, Report to Congress R41909 (Congressional Research Service, September 24, 2015).

24. That fund, like the National Sealift Defense Fund, would probably operate outside of many of DoD's acquisition regulations but it would allow the Navy to make a single purchase of components and materials for a group of submarines. The potential cost savings are not included in either the Navy's or CBO's estimates.

schedule, the attack submarine force would remain at or above the Navy's goal of 48 submarines through 2024 but would then fall to 41 to 47 submarines for the 2025–2041 period before reaching or exceeding 48 submarines again beginning in 2042—seven years later than under the 2015 plan (see Figure 4 on page 10).

For the entirety of the Virginia class under the 2016 shipbuilding plan, the Navy's and CBO's estimates are quite similar: The Navy estimates that the total cost of purchasing 26 of the submarines between 2016 and 2033 would be about $74 billion; CBO estimates that cost to be $76 billion.

The Navy expects to begin purchasing the Improved Virginia class submarine in 2034. The service's recent shipbuilding plans call for continuous changes to the current design to create a new class of submarine that incorporates significant technological upgrades in systems and capabilities. CBO assumed as well that the Improved Virginias would incorporate changes that were sufficient to make the submarines a new class, although not with a wholly new design. On the basis of that assumption, both CBO and the Navy estimate that the average Improved Virginia class attack submarine would cost $3.1 billion.

Although the Navy's plan does not include submarines to replace the 4 existing Ohio class guided missile submarines when they are retired in the 2020s, the service expects to lengthen the hull of future Virginia class submarines to insert the Virginia payload module (VPM). The VPM would contain four large-diameter payload tubes, each of which could carry seven Tomahawk missiles. That change would increase the submerged displacement of the submarine—the weight of the water it displaces—by nearly 30 percent and would increase the number of the Virginia class submarine's vertical-launch weapons from 12 to 40 (in addition to the approximately 25 weapons in the torpedo room). The Navy estimates that 20 Virginia class submarines equipped with the additional payload modules would provide a "near equivalent" to the strike capability of the existing force of 4 SSGNs. In his 2016 budget, the President proposed spending $700 million between 2015 and 2019 for research and development on the VPM and for modifying the design of the Virginia class submarine. The Navy's 2016 plan calls for building only 15 Virginias with the VPM, beginning in 2019. (The 2015 plan had 20 Virginias with the VPM.) Both the Navy's and CBO's estimates of costs reflect that change. Neither the Navy nor CBO assumes that the Improved Virginia class will include the missile module.

Large Surface Combatants

The Navy's 2016 plan incorporates the purchase of the same types of destroyers as the 2015 plan. The service restarted production of DDG-51 Flight IIA destroyers in 2010 and purchased 10 ships through 2015 (in addition to the 62 ships that had already been purchased when production ceased in 2005). The Navy plans to purchase 1 more DDG-51 Flight IIA in 2016. Beginning in 2016 and continuing through 2029, the Navy plans to purchase 27 DDG-51s with an upgraded design, a configuration known as Flight III (see Table 5 on page 22). In 2030, the Navy would start buying 37 DDG(X)s, a not-yet-designed destroyer intended to replace the DDG-51 class.

The Navy also is pursuing two other strategies to boost its inventory of large surface combatants. One is to modernize 11 of its 22 Ticonderoga class cruisers and thereby extend their service in the fleet through 2038. (The other 11 would remain in the fleet through the end of their service life but would not require as much modernization to remain effective.) If the Navy does not modernize those ships, all of its cruisers would be retired by 2028. The other critical strategy is to keep all DDG-51 Flight IIAs and subsequent destroyers serving in the fleet for 40 years. The class originally was designed to serve for 30 years, but the Navy has gradually increased the planned service life—first to 35 years and then, in the 2009 shipbuilding plan, to 40 years—of Flight IIA and Flight III ships. However, 12 of the last 13 classes of destroyers and cruisers have been retired after serving for 30 years or less. Indeed, in recent years, Spruance class destroyers and some Ticonderoga class cruisers have been retired after serving 25 years or less. The Navy retired all of those ships for various reasons: They had reached the end of their useful service life, they became too expensive to maintain toward the end of their service life, or they no longer had the combat capabilities needed to meet existing threats and modernization was not considered cost-effective.[25] If the DDG-51 class met the same fate, additional ship purchases would be needed to achieve the Navy's inventory goal.

Taken together, the intended ship purchases, cruiser modernization, and extended service life for destroyers would allow the Navy to meet or exceed its inventory

25. See the testimony of Eric J. Labs, Senior Analyst, Congressional Budget Office, before the Subcommittee on Seapower and Expeditionary Forces of the House Committee on Armed Services, *The Navy's Surface Combatant Programs* (July 31, 2008), www.cbo.gov/publication/20065.

goal of 88 large surface combatants through 2033; although it would fall 6 ships short in the following decade (see Figure 4 on page 10).

DDG-51 Flight IIA Destroyers. The Navy's existing force of 62 DDG-51 destroyers was built in three primary configurations. The first 28 ships, designated Flight I or II, did not include hangars for embarking helicopters, which are important in countering enemy submarines and attacks by small boats, along with other missions. The next 34, designated Flight IIA, were equipped with hangars that could carry two helicopters or several ship-launched unmanned aerial vehicles.[26] In the Navy's 2016 plan, 1 new DDG-51, purchased in 2016 (in addition to 10 that were purchased between 2010 and 2015 but that are not yet in the fleet), would use the Flight IIA configuration but also incorporate the latest ballistic missile defense capabilities.[27]

DDG-51 Flight III Destroyers. The Navy's strategy for meeting the combatant commanders' goal that future ballistic missile defense capabilities exceed those provided by existing DDG-51s—and for replacing 11 Ticonderoga class cruisers when they are retired in the 2020s—is to substantially modify the design of the DDG-51 Flight IIA destroyer, creating a Flight III configuration.[28] That change would incorporate the new Air and Missile Defense Radar (AMDR), now under development, which will be larger and more capable than the radar on current DDG-51s. The effective operation of the AMDR in the new Flight III configuration, however, will require an increase in the ships' capacity to generate electrical power and their ability to cool major systems.[29]

With those changes and associated increases in the ships' displacement, CBO expects that the average cost per ship over the entire production run would be $1.9 billion in 2015 dollars, or about 15 percent more than the Navy's estimate of $1.7 billion. Costs could be higher or lower than CBO's estimate, however, depending on the eventual cost and complexity of the AMDR and the associated changes in the ship's design to integrate the new radar.

DDG(X) Future Guided Missile Destroyers. Like the Navy's 2015 shipbuilding plan, the current plan includes a future class of destroyers that is intended to replace the DDG-51 Flight I and II ships when they are retired in the late 2020s and 2030s.[30] The Navy's 2016 plan described the ship as a "mid-sized future surface combatant," but it does not provide further specification.[31] CBO has adopted a generic DDG(X) designation, implying an unknown design.

Under the 2016 plan, production of the DDG(X) would start in 2030, which would make that ship a successor to the DDG-51 Flight III. The Navy says that it would buy 37 DDG(X)s at an average cost of $1.8 billion, or about $100 million more than the cost of DDG-51 Flight III ships. Those estimates imply that the DDG(X)'s capabilities would represent a modest improvement over the DDG-51 Flight III or, if capabilities were significantly improved, that the DDG(X) would be smaller than the DDG-51 Flight III.

CBO expects that the DDG(X) will have a largely new design but will be about the same size as the DDG-51 Flight III, which would be consistent with the concept of

26. For a detailed discussion of the differences between the DDG-51 flights, see Norman Polmar, *The Naval Institute Guide to the Ships and Aircraft of the U.S. Fleet*, 19th ed. (Naval Institute Press, 2013), pp. 140–145.

27. The Navy has announced that eventually all existing DDG-51s will have improved ballistic missile defense capabilities. As of the end of fiscal year 2015, those improvements were funded for up to 35 destroyers. More discussion is in Ronald O'Rourke, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, Report for Congress RL32109 (Congressional Research Service, September 22, 2015).

28. Combatant commanders—the four-star generals or admirals who head the regional commands—oversee all U.S. military operations within their areas of geographic responsibility.

29. More information is in Ronald O'Rourke, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, Report for Congress RL33745 (Congressional Research Service, September 25, 2015), and *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, Report for Congress RL32109 (Congressional Research Service, September 22, 2015). Press reports indicate that some Navy officials do not agree with the DDG-51 Flight III strategy and would prefer to build Flight IIAs a little longer while designing an entirely new destroyer that would allow for new, more capable, potentially larger weapons and increased capabilities in the future. See Christopher P. Cavas, "U.S. Navy Weighs Halving LCS Order," *Defense News* (March 17, 2013), http://tinyurl.com/kbey7qp.

30. Those retirement dates are based on the Navy's assumption that all DDG-51 Flight IIAs will be modernized midway through their 40-year service life.

31. Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2016* (March 2015), http://tinyurl.com/ocrqtfc. This description did not appear in previous shipbuilding plans.

a large surface combatant. CBO projects the average cost of the DDG(X) at $2.3 billion, roughly 30 percent more than the Navy's projection. Over the 2016–2045 period, CBO estimates, the Navy would have to spend $85 billion for the DDG(X) portion of the shipbuilding program—$17 billion more than the Navy's estimate of $68 billion. That amount represents almost one-third of the overall difference of $58 billion between the Navy's and CBO's estimates of the cost of the 2016 shipbuilding plan as a whole (see Appendix B). The great uncertainty about the ultimate size and capabilities of the DDG(X) suggests that the true cost could be substantially different from either the Navy's or CBO's estimate.

Littoral Combat Ships and Fast Frigates

Under the 2016 plan, the Navy envisions building a force of 52 small surface combatants consisting of littoral combat ships and improved LCSs—the latter designated as fast frigates—by 2025. The first LCS was authorized in 2005, and the Navy already has 23 either in its fleet or under construction—split nearly evenly between the two designs built by two contractors. Because those ships are assumed to have a service life of 25 years, the Navy would need to begin procuring their replacements in 2030. Therefore, the Navy plans to purchase 9 more LCSs through 2018 and then 20 fast frigates between 2019 and 2025 to complete its initial force of 52 ships. In 2030, the Navy would begin purchasing 38 next-generation ships, called LCS(X)s, to replace the first-generation LCSs as they retire. The Navy's plan does not indicate a replacement for the fast frigate, although the purchase schedule for the first generation suggests that the last 6 of those LCS(X)s should be replacements for the fast frigates.

The LCS differs from past and present U.S. warships in that its production program is divided into two components—the sea frame (the ship itself) and mission packages (the main combat systems). The sea frame is being designed and built so that mission packages can be switched onto or off of a given ship over time as the ship's mission changes. Currently, the Navy expects to use three types of mission package—one each for countering mines, submarines, and fast-moving small boats. It also expects that the LCS will be able to perform maritime security operations (such as sanctions enforcement, counterpiracy operations, and engagement with friendly navies) while equipped with any of those mission packages. In all, by 2025 the service plans to buy 64 mission packages for the 52 ships.[32] The Navy has not announced the anticipated effects of restructuring the program into its LCS and fast frigate components on the number or type of mission packages that it plans to purchase. In time, the Navy may also develop and purchase other types of mission packages.[33]

In the 2016 FYDP, the Navy estimates an average cost of about $437 million (in 2015 dollars) per LCS over the next three years. That figure is well below the cost cap of $515 million per ship (adjusted for inflation to 2015 dollars) that the Congress set for the LCS program.[34] The Navy estimates the average cost of the fast frigates at $590 million each, although the ships' final design and capabilities have not been determined. CBO estimates the cost of the fast frigates at $610 million per ship.

Under the 2016 plan, the Navy also would purchase 38 LCS(X)s beginning in 2030. Both the Navy and CBO assumed that the LCS(X)s would have a design similar to that of the LCSs being built today rather than that of the improved LCSs that are designated as fast frigates. The Navy's cost estimate for an LCS(X) is $441 million, essentially the same as the current cost of LCSs. CBO estimates that the average cost of the LCS(X) would be higher, about $516 million per ship, largely reflecting the real cost growth in the shipbuilding industry. However, if the LCS(X) was built to meet or exceed the capabilities of the fast frigate, it would cost more than either the Navy or CBO now estimate.

Amphibious Warfare Ships

The Navy's inventory goal for amphibious warfare ships is 34. That proposed force would consist of 11 LHA or LHD amphibious assault ships, 12 LPD amphibious transport docks, and 11 replacements for the Navy's LSD dock landing ships. The 2016 plan calls for buying 7 LHA-6s, at a rate of 1 every four or seven years, to

32. The Navy presumably will reduce the number of mission modules it purchases for the LCS, but it had not done so by the time of the President's 2016 budget submission.

33. More detail is in Ronald O'Rourke, *Navy Littoral Combat Ship (LCS)/Frigate Program: Background and Issues for Congress*, Report for Congress RL33741 (Congressional Research Service, September 23, 2015).

34. The 2010 National Defense Authorization Act, which set the LCS cost cap for ships purchased in or after fiscal year 2010, permits the Secretary of the Navy to waive compliance with the cap if doing so is considered in "the best interest of the United States," if the ship is "affordable, within the context of the annual naval vessel construction plan," or in other specific circumstances.

replace LHD-1 class amphibious assault ships as they are retired.[35] The plan calls for the purchase of 11 LX(R)s (the replacement for LSDs), the first in 2020, and then 1 per year between 2022 and 2031 to replace existing dock landing ships in the LSD-41 and LSD-49 classes. Under the 2016 plan, the LX(R) would be completed three years earlier than under the 2015 plan. Under the 2016 plan, the Navy also would start replacing the LPD-17 class with a new class, buying 4 ships between 2040 and 2045.

The Navy intends to keep the existing class of LHD-1 amphibious assault ships in service for 43 to 45 years. That expectation, which was stated in the three most recent shipbuilding plans, differs from the 40-year service life identified in the 2012 plan, which is the expected service life the Navy uses for amphibious warfare ships generally. With the procurement schedule and service life as described in the 2016 plan, the number of amphibious warfare ships would be at or above the goal of 34 for about two-thirds of the 30-year period covered by the plan (see Figure 4 on page 10). After 2016, the number of such ships would never fall short of the goal by more than 2 ships.

The Navy estimates that the LHA-6 class amphibious assault ships will cost $3.7 billion each. CBO's estimate is slightly higher at $3.9 billion. Both CBO and the Navy assumed that the LHA-6 class ship authorized for 2017 and all subsequent amphibious assault ships would include well decks—necessitating some redesign of the LHA-6 class and therefore additional costs. (A well deck is a large floodable area in the stern of an amphibious warfare ship that allows direct launching of amphibious vehicles and craft.) The costs are included in the estimates both of the Navy and of CBO.

35. There is a seven-year gap between a purchase in 2017 and the next one, in 2024. After that, however, ships in the LHA class are to be purchased at the rate of 1 every four years.

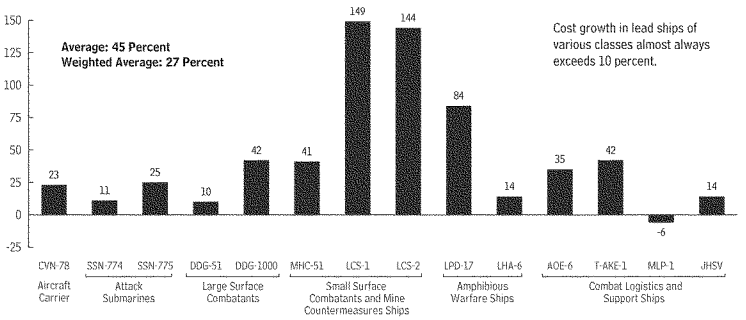
The Navy estimates an average cost of $1.5 billion per ship for the LX(R); the first of the class is expected to cost about $1.6 billion. The design of the LX(R) is to be based on the hull of the LPD-17, which is much larger than existing LSDs. An LPD-17 ordered today would cost about $2.1 billion. Thus, the Navy's estimate for the first ship of the class appears optimistic in light of cost growth in lead ships over the past 30 years (see Figure 10). To achieve its cost goal for the LX(R), the Navy plans to alter the design of those ships and change the manner in which it buys them. First, the LX(R) variant of the LPD-17 would need to have substantially less capability than the LPD-17 class. Second, the Navy plans to use a competitive process for procurement, which would probably include asking the Congress to give it multiyear authority or block-buy authority to purchase ships—or at least their materials—in batches of 5 to 10.[36] Such authority would be similar to that provided for the Arleigh Burke class destroyers, Virginia class attack submarines, and LCSs. The shipyards competing to build the LX(R) would almost certainly incorporate the benefits of such contracts into their bids.

On the basis of the limited information available, CBO estimates the cost of the LX(R) at $1.9 billion per ship, on average. The agency used the existing LPD-17 hull as the starting point for its estimate and then adjusted the ship's size to reflect the reduced capability it expects for the LX(R). CBO's estimate also accounts for the use of multiyear or block-buy procurement authority in a potentially competitive environment.

36. Although multiyear procurement and block-buy authority are broadly similar as acquisition strategies, block-buy authority is not regulated in statute, is more flexible in that there is less oversight by the Congress, and is less likely to carry cancellation penalties. Multiyear procurement authority allows the Navy to buy materials in large quantities for the ships covered under a given contract. Block-buy authority would require separate authorization to purchase materials for more than one ship at a time. That authority is called authorizing economic order quantity.

Figure 10.

Cost Growth in Lead Ships, 1985 to 2015



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

Notes: For most ships, CBO calculated cost growth using the first and last mentions of a ship in the books that accompany each year's budget: *Justification of Estimates, Shipbuilding and Conversion, Navy*. For AOE-6, MHC-51, JHSV, and DDG-51, CBO relied on Navy information papers provided to CBO for the final estimates and the Budget Appendixes for the years those ships were authorized.

AOE = fast combat support ship; CVN = nuclear-powered aircraft carrier; DDG = guided missile destroyer; JHSV = joint high speed vessel; LCS = littoral combat ship; LHA = amphibious assault ship; LPD = amphibious transport dock; MHC = coastal mine hunter; MLP = mobile landing platform; SSN = attack submarine; T-AKE = ammunition cargo ship.

Appendix A: How CBO Estimates the Cost of New Ships

For this report, the Congressional Budget Office projected the costs of the Navy's proposed new-ship purchases by first analyzing the cost per thousand tons for analogous, previously built ships. The resulting figures were then adjusted to account for the percentage of the cost attributable to *rate*, the production efficiencies that are made possible when several ships of the same type are built at a given shipyard, and those that arise from *learning*, the gains in efficiency that accrue over the duration of a ship's production as shipyard workers gain familiarity with a particular ship model. CBO also accounted for the effect of the Navy's acquisition strategy for purchasing new ships, specifically, whether the service can reduce spending by purchasing in quantity. Last, CBO's estimates (all in constant 2015 dollars) incorporated the assumption that growth in the costs of labor and materials for the shipbuilding industry would continue to outpace that in the economy as a whole, as has been the case for the past several decades.

Projecting the Size of Future Ships

To estimate the cost of a future ship, CBO first uses data from the Navy to estimate the ship's size, which traditionally is measured as displacement—the weight of the water it displaces. At this step, CBO determines the size by *full-load displacement* for surface ships and by *submerged displacement* for submarines; that is, the weight displaced by the ships with their contents—crew, stores, ammunition, fuel, and other liquids. If such data are not available (perhaps because the ship is projected to be built in 20 years and the Navy does not specify ship designs that far in advance), CBO makes its estimate based on the sizes of existing ships of the same type that perform the same missions.

For example, the Navy has described the DDG(X), a guided missile destroyer, as a future "midsized" surface combatant, although it has not yet designed the ship. The Navy estimates that the cost of a DDG(X) will be close to that of a large surface combatant—in this case, a modified version of the DDG-51 Flight III destroyer. A fully loaded midsized surface combatant displaces between 6,000 and 9,000 tons; a large surface combatant in the Navy today displaces 9,000 to 10,000 tons. (The new Zumwalt class DDG-1000 destroyers will displace 15,000 tons once completed.) CBO's estimate of the cost of the DDG(X) incorporates an assumption that, like current the DDG-51 Flight III, the new ship would displace 10,000 tons. Once the full size of the ship is determined, CBO estimates the *lightship displacement* for surface ships or the *A-1 weight* for submarines—both reasonable measures of the weight of the mostly empty vessel—without a crew, stores, ammunition, fuel, or other liquids.

The Relationship Between Weight and Cost

After estimating a ship's size, CBO calculates the cost per thousand tons, using historical data from an analogous class of ship (see Table A-1). A primary advantage of CBO's use of analogous ships and cost-to-weight comparisons in the development of estimates is that doing so is more straightforward than projecting costs on the basis of supposition; similar ships have already been built and their cost-to-weight ratios are already documented. The primary disadvantage of this approach is that, because the data are historical, they will not capture potential improvements in manufacturing or other efficiencies that come with new approaches to manufacturing or changes in technology that could lower a ship's cost per ton. (However, that disadvantage may not have much practical effect: CBO has not identified any examples of new-generation ships that proved to be less expensive per ton than earlier ships of the same type.) Another disadvantage

Table A-1.

Ship Analogues for Estimating Cost-to-Weight Relationships

	Ship Class
Aircraft Carriers	Ford (CVN-78)
Ballistic Missile Submarines	Virginia (SSN-774)
Attack Submarines	Virginia (SSN-774)
Large Surface Combatants	Arleigh Burke (DDG-51)
Small Surface Combatants	Freedom (LCS-1) Independence (LCS-2)
Large Amphibious Ships	America (LHA-6)
Small Amphibious Ships	San Antonio (LPD-17)

Source: Congressional Budget Office.

is that sometimes there is no good historical analogue, recent or distant, to use as the basis of a cost projection for a new ship with an innovative design. In rare instances, CBO may start with the Navy's estimate and then apply a more generic factor for the likely increase in cost above the amount in the Navy's current plan. The object is to track cost growth as the shipbuilding program evolves; such factors are derived empirically from historical data.[1]

As a rule, CBO tries to find the most comparable recent ship as a model for its cost-to-weight estimates. It would not be appropriate or useful to use an aircraft carrier as the analogue for a submarine: They are different vessels with different missions and designs, and so their cost-to-weight ratios are not comparable.

1. Several researchers have examined the historical cost growth of weapon systems. See, for example, David L. McNicol and Linda Wu, *Evidence on the Effect of DoD Acquisition Policy and Process on Cost Growth of Major Defense Acquisition Programs*, IDA Paper P-5126 (Institute for Defense Analyses, 2014), www.acq.osd.mil/parca/docs/ida-p5126.pdf (826 KB); Obaid Younossi and others, *Is Weapon System Cost Growth Increasing? A Quantitative Assessment of Completed and Ongoing Programs* (prepared by the RAND Corporation for the United States Air Force, 2007), www.rand.org/pubs/monographs/MG588.html; and Mark V. Arena and others, *Historical Cost Growth of Completed Weapon System Programs* (prepared by the RAND Corporation for the United States Air Force, 2006), www.rand.org/pubs/technical_reports/TR343.html.

For example, CBO identified the current Virginia class submarine as the most logical analogue for a new ballistic missile submarine. Specifically, CBO used the cost per thousand tons of A-1 weight of the Virginia class submarine to estimate the cost of the SSBN(X)—also often called the Ohio Replacement submarine—as though it would be built in 2015. On the basis of the Navy's estimate that the new submarine would be about two and a half times the size of the current Virginia class submarine, CBO estimated that the total cost of the new vessel would be about two and half times that of a Virginia at this point in the cost-estimating process. The agency did not use the historical cost of the original Ohio class submarine as the basis of its estimate because the Ohio was first built in the 1970s, too long ago to be useful. Even if adjusted for inflation, that basis would yield a cost for the SSBN(X) that is only slightly higher than the Virginia today, despite the large difference in size.

Adjusting for Rate, Learning, and Acquisition Strategy

After establishing its preliminary estimate of how much a new ship would cost in 2015, CBO applied factors associated with rate, learning, and, as appropriate, the Navy's acquisition strategy to the entire proposed shipbuilding program. Although described here separately, those factors are applied simultaneously in the cost-estimating process. The result was an estimate of the cost of building new ships, before accounting for future economic conditions in the industry.

When more than one ship is purchased in a given year, the cost per ship is less than it would be for a single ship, largely because the fixed overhead costs of ship construction at a shipyard would be shared by more ships. That difference is the rate effect: It is less expensive per ship to produce two ships than to build one, and four ships are less expensive to build per ship than two—as long as the shipyard has the production facilities and workforce to accommodate the larger volume of work. Historically, the rate effect varies by ship type. For example, building two attack submarines rather than one in a year reduces the cost of both by 10 percent; for surface combatants, the rate effect is closer to 20 percent.

At the same time, as more ships of the same type are built in sequence, the shipyard learns how to build those ships

more and more efficiently. The cost of the second ship in a production run is less than the first, the fifth ship more so, and the ninth ship is cheaper to build than the fifth. That effect represents the learning curve in production and, based on historical evidence, the slope of that learning curve varies by ship type. In addition, unlike the rate effect, which always provides a reduction in cost when more than one ship is built in the same shipyard, the reduction in cost that comes from learning levels off as more and more ships are built; eventually, learning becomes effectively exhausted. Generally, the effects of the learning curve have the smallest influence of all factors in CBO's methods for estimating shipbuilding costs.

CBO's cost estimates also incorporate the effects of the ship acquisition strategy, when applicable. For example, DDG-51 Arleigh Burke class destroyers are usually purchased under a multiyear procurement contract. Such a contract commits the government to purchase a certain number of ships in exchange for a price that is less than if those ships were purchased under a series of individual contracts because the shipyard can better plan its labor force and its purchases of inputs over a longer period. If the government does not purchase the agreed number of ships in the multiyear contract, it pays a substantial penalty to the shipbuilder.

Adjusting for Cost Growth in the Shipbuilding Industry

In the final step of the process, CBO adjusts the estimate to account for the consistently faster growth in prices paid for labor and materials in the shipbuilding industry than in the rest of the U.S. economy. The earlier part of the process established how much a ship would cost to build today, given current economic conditions and including adjustments for rate, learning, and acquisition strategy. But because the ship will be built in the future, CBO adjusts its constant-dollar estimates for new ships by means of a factor that is derived from the difference between historical inflation in the shipbuilding industry and general inflation in the economy as a whole. CBO regards that difference as real cost growth in the shipbuilding industry. (For more discussion, see Box 2 in the main text.)

An Example: Projecting the Cost of Virginia Class Attack Submarines

Between 2016 and 2033, the Navy plans to purchase 26 Virginia class attack submarines at a rate of 2 per year in most years through 2025 and then 1 per year for the rest of the period. Using the methods described above, CBO estimated a total cost (in 2015 dollars) of $76 billion, or about $3.0 billion per submarine. (The Navy's estimate was slightly lower: $74 billion, or about $2.9 billion each.)

The Virginia class is the closest analogue to the future submarines included in the Navy's current shipbuilding report. The Navy has a lengthy history of Virginia purchases: Production began in 1998; 12 Virginia submarines currently serve in the fleet and 10 more are in various stages of construction. To arrive at its cost projections, CBO started with the actual cost of $6.0 billion for the first Virginia class submarine. CBO then subtracted from that total the $2.3 billion that the Navy spent for nonrecurring engineering and detailed design, because those onetime costs are reflected solely in the expense of building the first submarine; they do not carry over to subsequent vessels.

On the basis of cost data for that lead ship plus another 21 submarines that have been completed or authorized thus far, CBO estimated a learning effect of 95 percent: As successive ships are built, the cost of a ship twice as far in the production sequence is 95 percent that of the ship to which it is being compared. So, for example, costs drop by 5 percent from the second ship to the fourth, by another 5 percent from the fourth to the eighth, and so on. Learning tends to level out because the distance to the next doubling increases; 8 more ships must be built to reach the 16th ship and thus to achieve an additional 5 percent decline in costs. CBO applied the 95 percent learning effect going forward from the 22nd submarine (the one most recently authorized) so that the next 5 percent reduction would occur at the 22nd submarine in the Navy's plan—the 44th in the Virginia class. CBO estimated the cost of that submarine to be $2.9 billion, before applying the rate effect.

At the same time CBO applied the learning effect to the Virginia class estimates, it applied the rate effect where appropriate. When submarines are purchased at a rate of two per year (a practice that began in 2011 and that is anticipated to continue in most years through 2025 under the Navy's plan), the cost per submarine is

reduced by the 10 percent; that reduction is added to the reduction attributable to the learning effect.

In addition, in 2019 the Navy will start including what is called the Virginia payload module in most of its new Virginia class submarines. To account for the cost of redesign, CBO added 10 percent, starting in 2019, to the estimate of the cost for most submarines. The two planned for 2025 would be the 39th and 40th in the class and both would include the new payload module. The position in the production sequence from the 22nd to the 40th is not quite double, so the learning effect was set at 4.3 percent rather than a full 5 percent.[2] Applying both a 4.3 percent learning effect and a 10 percent rate effect to the 40th submarine, CBO arrived at an estimate of $2.8 billion in constant 2015 dollars for that ship.

In the final step, CBO applied a factor to account for the difference between general inflation in the U.S. economy and inflation specific to the shipbuilding industry. That real growth would increase by 13 percent the cost of submarines purchased in 2025. With all of those adjustments, CBO estimates the cost of the 40th submarine to be $3.2 billion.

2. For more discussion on procedures for estimating and applying learning curves see Matthew S. Goldberg and Anduin E. Touw, *Statistical Methods for Learning Curves and Cost Analysis* (Institute for Operations Research and the Management Sciences, 2003).



Appendix B: The Difference Between the Navy's and CBO's Estimates for the Cost of New Ships

Each year, the Navy provides estimates of the costs of building each class of ship in its 30-year shipbuilding plan. The Congressional Budget Office also produces annual estimates. Table B-1 compares the two sets of figures for the five most recent 30-year plans.

Table B-1.

Percentage Difference in the Navy's and CBO's Estimates of Shipbuilding Costs, by Program

Percentage of Total Cost Difference

	2012 Plan	2013 Plan	2014 Plan	2015 Plan	2016 Plan
CVN-78 Gerald R. Ford Class Aircraft Carriers	18	13	3	3	9
Ohio Replacement Ballistic Missile Submarines	15	13	12	20	22
Virginia Class Attack Submarines	1	1	-1	3	3
Improved Virginia Class Attack Submarines (Replacements for Virginia class)	3	4	-3	8	2
DDG-51 Arleigh Burke Class Destroyers					
Flight IIA	3	0	0	0	0
Flight III	-7	11	7	11	12
DDG(X) Destroyers (Replacements for Arleigh Burke class)	41	34	58	38	29
Littoral Combat Ships	1	3	4	5	2
Fast Frigates (Modified LCSs)	n.a.	n.a.	n.a.	n.a.	0
LCS(X)s (Replacements for LCSs)	5	4	7	0	5
LHA-6 Amphibious Assault Ships	7	5	5	3	3
LX(R)s (Replacements for amphibious dock landing ships)	5	4	4	5	3
LPD-17 Replacements	n.a.	n.a.	n.a.	n.a.	5
T-AO(X) Oilers	0	0	1	1	3
Other	8	7	4	4	2
Total	**100**	**100**	**100**	**100**	**100**
Memorandum:					
Difference in Billions of Dollars[a]	74	94	76	66	58

Source: Congressional Budget Office.

Notes: Numbers reflect the percentage that each ship program contributes to the total cost difference between CBO's and the Navy's estimates for each plan: Positive values indicate instances in which CBO's estimate is higher; negative values, instances in which the Navy's is higher.

CVN = nuclear-powered aircraft carrier; DDG and DDG(X) = guided missile destroyer; LCS = littoral combat ship; LHA = amphibious assault ship; LPD = amphibious transport dock; LX(R) = dock landing ship replacement; T-AO(X) = oiler; n.a. = not applicable.

a. For each plan, the difference is expressed as a percentage in constant dollars from the preceding year: The value for the 2012 plan is calculated in 2011 dollars; the value for the 2016 plan is calculated in 2015 dollars.

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About This Document

This testimony reprises the Congressional Budget Office's report, *An Analysis of the Navy's Fiscal Year 2016 Shipbuilding Plan*, which was released on October 29, 2015, and prepared as required by the National Defense Authorization Act for Fiscal Year 2012 (Public Law 112-81). In accordance with CBO's mandate to provide objective, impartial analysis, the report makes no recommendations.

Eric J. Labs of CBO's National Security Division prepared the report with guidance from Matthew Goldberg and David Mosher. Raymond Hall of CBO's Budget Analysis Division produced the cost estimates with guidance from Sarah Jennings. Bernard Kempinski of CBO provided comments on the report, as did independent naval analyst Norman Polmar. (The assistance of external reviewers implies no responsibility for the final product, which rests solely with CBO.)

Keith Hall, Jeffrey Kling, John Skeen, and Robert Sunshine reviewed the report; Kate Kelly edited it; Jeanine Rees prepared it for publication; and Bernard Kempinski produced the ship illustrations.

Electronic versions of this testimony and the report are available on CBO's Web site (www.cbo.gov/publication/50981 and www.cbo.gov/publication/50926, respectively).

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TESTIMONY

Statement of

Ronald O'Rourke
Specialist in Naval Affairs

Before

House Armed Services Committee
Seapower and Projection Forces Subcommittee

Hearing on

Acquisition Efficiency and the Future Navy Force

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Chairman Forbes, Ranking Member Courtney, distinguished members of the subcommittee, thank you for the opportunity to appear before you today to discuss acquisition efficiency and the future Navy force. You asked that I testify on how contracting mechanisms like multiyear procurement (MYP) and block buy contracting (BBC) can reduce the procurement costs of Navy ships, and on the use of incremental funding in Navy shipbuilding. These are topics that I have been following in my CRS reports since 2002.[1]

Some Key Points Up Front

Some key points that can be made up front include the following:

- MYP, which has been used more extensively in Navy shipbuilding programs in recent years, can reduce the unit procurement costs of ships by roughly 10%, compared to unit procurement costs under the standard or default Department of Defense (DOD) approach of annual contracting.
- BBC, which has been used in two Navy shipbuilding programs, can reduce the unit procurement costs of ships by amounts comparable to those of MYP, if the authority granted for using BBC explicitly includes authority for making economic order quantity (EOQ) purchases of components. If the authority granted for using BBC does not explicitly include authority for making EOQ purchases, then the savings from BBC will be less—in the range of roughly 5%. EOQ authority comes automatically with MYP authority, but must be explicitly included in legislation granting BBC authority.
- BBC, unlike MYP, can be used at the outset of a shipbuilding program, starting with the lead ship in the class. MYP, in contrast, cannot be used until the lead ship has completed construction. Thus, for a class of ships that is procured at a rate of one ship per year and in which each ship takes five years to build, BBC can be a contracting option starting with the first ship in the class, and MYP can become a contracting option starting with the fifth or sixth ship in the class. This difference is due to the requirement under the statute governing MYP (10 U.S.C. 2306b) that a program must demonstrate design stability to qualify for MYP. In a shipbuilding program, design stability is typically demonstrated by completing the construction of the lead ship in the class.
- MYP contracts and block buy contracts can be awarded competitively. The law governing MYP requires MYP contracts to be fixed price contracts. BBC contracts can also be fixed price contracts.
- Some shipbuilding programs that have not employed MYP or BBC have been able to reduce their unit procurement costs by a few percent by making combined purchases of components for multiple ships in the class. Specifically, some ships funded in the past through the National Defense Sealift Fund (NDSF) have had their unit procurement costs reduced through combined purchases of components. Ohio replacement program (ORP) ballistic missile submarines (SSBN[X]s) funded through the National Sea-Based Deterrence Fund (NSBDF) might similarly have their unit procurement costs reduced

[1] See:

-- CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz (first published in July 2011 and most recently updated on November 6, 2015);

-- CRS Report RL32776, *Navy Ship Procurement: Alternative Funding Approaches—Background and Options for Congress*, by Ronald O'Rourke (first published in February 2005 and archived in June 2007); and

-- CRS Report RL31404, *Defense Procurement: Full Funding Policy—Background, Issues, and Options for Congress*, by Ronald O'Rourke and Stephen Daggett (first published in May 2002 and archived in June 2007).

through combined purchases of components, even if the ORP program does not employ MYP or BBC. For shipbuilding programs that do not employ MYP or BBC, and which are not funded through NDSF or NSBDF, authority to make combined purchases of materials and components can be granted through specific legislation.

- From a congressional perspective, tradeoffs in making greater use of MYP, BBC, and combined purchases of materials and components include the following:
  - reduced congressional control over year-to-year spending, and tying the hands of future Congresses;
  - reduced flexibility for making changes in Navy shipbuilding programs in response to unforeseen changes in strategic or budgetary circumstances (which can cause any needed funding reductions to fall more heavily on programs not covered by MYP or BBC contracts);
  - a potential need to shift funding from later fiscal years to earlier fiscal years to fund EOQ purchases of components;
  - the risk of having to make penalty payments to shipbuilders if multiyear contracts need to be terminated due unavailability of funds needed for the continuation of the contracts; and
  - the risk that materials and components purchased for ships to be procured in future years might go to waste if those ships are not eventually procured.
- Several Navy shipbuilding programs can be viewed as candidates for using MYP, BBC, or combined purchases of materials and components. In considering whether to grant authority for using MYP, BBC, or combined purchases of materials and components, Congress may weigh the potential savings of these measures against the tradeoffs listed above.
- Incremental funding, which has been used more extensively in certain Navy shipbuilding programs in recent years, can help mitigate budget "spikes" associated with the procurement of very expensive ships that are procured at a rate of less than one per year, such as aircraft carriers and LHA-type amphibious assault ships. Using incremental funding distributes the cost of a ship across multiple years, but as a general matter does not materially change the total procurement cost of the ship. Mitigating budget spikes, however, might reduce the need for the Navy to shift the procurement of other items to years before and after the spike. Since such shifts can increase costs for those other programs by disrupting their procurement schedules, using incremental funding in a shipbuilding program might help avoid cost increases to other programs. This would not be a savings, but rather an avoided cost increase.

Contracting Mechanisms and Funding Approaches

In discussing MYP, BBC, and incremental funding, it can be helpful to distinguish contracting mechanisms from funding approaches. The two are often mixed together in discussions of DOD acquisition, sometimes leading to confusion. Stated briefly:

- **Funding approaches** are ways that Congress can appropriate funding for weapon procurement programs. Examples of funding approaches include traditional full funding (the standard or default DOD approach), incremental funding, and advance appropriations. Any of these funding approaches might make use of advance procurement

(AP) funding.[2] As a general matter, funding approaches do not materially change the total procurement cost of a ship.

- **Contracting mechanisms** are ways for DOD to contract for the procurement of weapons systems, once funding for those systems has been appropriated by Congress. Examples of contracting mechanisms include annual contracting (the standard or default DOD approach), MYP, and BBC. Contracting mechanisms can materially change the total procurement cost of a ship.

The use of a particular funding approach in a defense acquisition program does not dictate the use of a particular contracting mechanism. Defense acquisition programs consequently can be implemented using various combinations of funding approaches and contracting mechanisms. Most DOD weapon acquisition programs use a combination of traditional full funding and annual contracting. A few programs, particularly certain Navy shipbuilding programs, use incremental funding as their funding approach. A limited number of DOD programs use MYP as their contracting approach, and to date two Navy shipbuilding programs have used BBC as their contracting approach. The situation is summarized in **Table 1**.

Table 1. Contracting mechanisms and funding approaches

		Funding approaches		
		Full funding	**Incremental funding**	**Advance appropriations**
Contracting mechanisms	**Annual contracting**	Most programs	A few programs (e.g., CVNs, LHAs, DDG-1000s)	
	MYP	Selected programs		
	Block buy contracting	Virginia class (units 1-4) and Littoral Combat Ship (units 5-24)		

Source: Table prepared by CRS.

Notes: Advance procurement (AP) can be used with any of the funding approaches. As a general matter, funding approaches do not materially change the total procurement cost of a ship. (By mitigating budgets spikes, however, incremental funding might prevent disruptions to other programs.) Contracting approaches can materially change the total procurement cost of a ship. Funding a ship inside or outside the procurement title of the DOD appropriation act can affect the application of the full funding policy, and thus how funds can be used for purposes such as making combined purchases of components for multiple ships in a class.

For additional background information on MYP, and BBC, see **Appendix A**.

For additional background information on full funding, incremental funding, and advance appropriations, see **Appendix B**

For a general summary of some lessons learned in Navy shipbuilding, see **Appendix C**.

[2] AP funding is provided in one or more years prior to the year of procurement of a weapon system for the procurement of long-leadtime components—components with long construction times. Such components must be funded prior to the procurement of the remainder of the weapon system if they are to be ready for installation in the weapon system at the appropriate point in the construction process. AP funding is a permitted exception to the full funding provision. AP funding is not to be confused with advance appropriations.

Increased Use of Incremental Funding, MYP, and BBC in Navy Shipbuilding

With congressional approval, the Navy in recent years has made increased use of incremental funding its shipbuilding programs. Incremental funding is now the standard funding approach for aircraft carriers and LHA-type amphibious assault ships. Aircraft carriers are now being funded with six-year incremental funding, and amphibious assault ships are typically funded with two-year incremental funding (aka split funding). Incremental funding has also been used on rare occasions to fund other types of ships, such as the three Zumwalt (DDG-1000) class destroyers, which were each funded with split funding.

Also with congressional approval, Navy has made significant use in recent years of MYP and BBC in its shipbuilding (and aircraft acquisition) programs. Among other things, the Navy in recent years has used MYP or BBC for all three of its year-to-year shipbuilding programs—the Virginia-class attack submarine program, the DDG-51 destroyer program, and the Littoral Combat Ship program. These three programs account for a significant share of the Navy's shipbuilding effort: Of the 48 new-construction ships in the Navy's FY2016 five-year (FY2016-FY2020) shipbuilding plan, these three programs account for 34, or about 71%. Savings from the use of MYP recently have, among other things, helped Congress and the Navy to convert and a nine-ship buy of DDG-51 class destroyers in FY2013-FY2017 into a 10-ship buy, and a nine-ship buy of Virginia-class attack submarines in FY2014-FY2018 into a 10-ship buy.

The Navy's increasing use of MYP and BBC in recent years amounts to a significant change—some might say a quiet revolution—in Navy ship and aircraft acquisition. In an interview published on January 13, 2014, Sean Stackley, the Assistant Secretary of the Navy for Research, Development, and Acquisition (i.e., the Navy's acquisition executive), stated:

> What the industrial base clamors for is stability, so they can plan, invest, train their work force. It [multiyear contracting] gives them the ability in working with say, the Street [Wall Street], to better predict their own performance, then meet expectations in the same fashion we try to meet our expectations with the Hill.
>
> It's emblematic of stability that we've got more multiyear programs in the Department of the Navy than the rest of the Department of Defense combined. We've been able to harvest from that significant savings, and that has been key to solving some of our budget problems. It's allowed us in certain cases to put the savings right back into other programs tied to requirements.[3]

New Opportunities for Using MYP, BBC, Combined Purchases, and Incremental Funding

Several Navy shipbuilding programs can be viewed as candidates for using MYP, BBC, or combined purchases of materials and components. In considering whether to grant authority for using MYP, BBC, or combined purchases of materials and components, Congress may weigh the potential savings of these measures against the tradeoffs listed earlier. Below are brief discussions of individual Navy shipbuilding programs.

[3] "Interview: Sean Stackley, US Navy's Acquisition Chief," *Defense News*, January 13, 2014: 22.

Ohio Replacement Ballistic Missile Submarine Program[4]

BBC and MYP

BBC is an option for reducing the unit procurement costs of the first several Ohio replacement program ballistic missile submarines (SSBN[X]s), and both MYP and BBC are options for reducing the unit procurement costs of the latter ships in the class. If these contracting mechanisms were used across all 12 boats in the class, and if doing so reduced their unit procurement costs by about 10%, the effect would be to get a bit more than one of the 12 planned boats in the class for "free," compared to procuring them with annual contracting.

Combined Purchases of Materials and Components

Based on the precedent of ships funded through the National Defense Sealift Fund (NDSF), Ohio replacement boats funded through the National Sea-Based Deterrence Fund (NSBDF) and procured with annual contracting might be candidates for having their unit procurement costs reduced by a few percent through combined purchases of materials and components. As stated in the CRS report on the Ohio replacement program:

> the National Defense Sealift Fund is located in a part of the DOD budget that is outside the procurement title of the annual DOD appropriations act. Consequently, ships whose construction is funded through the NDSF are not subject to the DOD full funding policy in the same way as are ships and other DOD procurement programs that are funded through the procurement title of the annual DOD appropriations act.
>
> For NDSF-funded ships, what this has meant is that although Congress in a given year would nominally fund the construction of an individual ship of a certain class, the Navy in practice could allocate that amount across multiple ships in that class. This is what happened with both the NDSF-funded Lewis and Clark (TAKE-1) class dry cargo ships and, before that, an NDSF-funded class of DOD sealift ships called Large, Medium-Speed Roll-on/Roll-off (LMSR) ships. In both cases, the result was that although ships in these two programs were each nominally fully funded in a single year, they in fact had their construction financed with funds from amounts that were nominally appropriated in other fiscal years for other ships in the class.
>
> The Navy's ability to use NDSF funds in this manner has permitted the Navy to, among other things, marginally reduce the procurement cost of ships funded through the NDSF by batch-ordering certain components of multiple ships in a shipbuilding program before some of the ships in question were fully funded—something that the Navy cannot do with a shipbuilding program funded through the Navy's shipbuilding account unless the Navy receives approval from Congress to execute the program through a multiyear procurement (MYP) contract.
>
> If the National Sea-Based Deterrence Fund is located outside the procurement title of the annual DOD appropriations act, the Navy might be able to do something somewhat similar in using funds appropriated for the procurement of Ohio replacement boats.[5]

Section 1022 of the FY2016 National Defense Authorization Act (S. 1356) would amend the provision establishing the NSBDF (10 U.S.C. 2218a) by, among other things, adding a new subsection stating that

> The Secretary of the Navy may use funds deposited in the Fund to enter into contracts known as 'economic order quantity contracts' with private shipyards and other commercial or government

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[4] This section includes material adapted from CRS Report R41129, *Navy Ohio Replacement (SSBN[X]) Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke.

[5] CRS Report R41129, *Navy Ohio Replacement (SSBN[X]) Ballistic Missile Submarine Program: Background and Issues for Congress*, by Ronald O'Rourke, section entitled "Potential Implications of NSBDF on Funding Available for Other Programs."

> entities to achieve economic efficiencies based on production economies for major components or subsystems. The authority under this subsection extends to the procurement of parts, components, and systems (including weapon systems) common with and required for other nuclear powered vessels under joint economic order quantity contracts.

This new subsection would provide explicit authority to make combined purchases of major components and subsystems for Ohio replacement boats funded through the NSBDF, regardless of where in the DOD appropriations act the NSBDF is located. It would also permit such purchases to include components and materials not only for Ohio replacement boats, but for other nuclear-powered ships, such as Virginia-class attack submarines and Gerald R. Ford-class aircraft carriers. Combining material and component purchases across classes might reduce costs beyond what could be accomplished through combined material and component purchases that are confined to individual ship classes.

Partial Batch Building

As one means of reducing the procurement cost of the Ohio replacement boats, the Navy is considering a partial batch-build approach for building the boats. Under this approach, instead of building the boats in serial fashion, portions of several boats would be built together, in batch form, so as to maximize economies of scale in the production of those portions. Under this approach, the boats would still be finished and enter service one at a time as currently scheduled, but aspects of their construction would be undertaken in batch fashion rather than serial fashion. Implementing a partial batch-building approach for building the boats might be facilitated by

- using an MYP contract whose built-in EOQ authority might be expanded to cover not just batch-ordering of selected long leadtime components, but also batch-building of sections of the ships; or
- using a block buy contract that included an added EOQ authority of similar scope; or
- locating the NSBDF outside the procurement title of the DOD appropriations act and using funds in that account for the construction of Ohio replacement boats in a manner somewhat similar to how the Navy has used funds in the NDSF to batch-order components for ships acquired through the NDSF.

Joint-Class Block Buy Contract

The Navy is investigating the possibility of using a single, joint-class block buy contract that would cover both Ohio replacement boats and Virginia class boats. Such a contract, which could be viewed as precedent-setting in its scope, could offer savings beyond what would be possible using separate MYP or block buy contracts for the two submarine programs. A March 2014 GAO report stated that if the Navy decides to propose such a contract, it would develop a legislative proposal in 2017.[6] The Navy reportedly plans to finalize its acquisition strategy for the Ohio replacement program, including the issue of the contracting approach to be used, in the fall of 2016 as part of DOD's Milestone B decision for the program.[7]

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[6] Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapons Programs*, GAO-14-340SP, March 2014, p. 141.

[7] Lee Hudson, "Navy SSBN(X) Acquisition Strategy Will Not Be Finalized Until Fall 2016," *Inside the Navy*, September 8, 2014.

Incremental Funding

Another option for the Ohio replacement program would be to stretch out the schedule for procuring SSBN(X)s and make greater use of split funding (i.e., two-year incremental funding) in procuring them.[8] This option would not reduce the total procurement cost of the Ohio replacement program—to the contrary, it might increase the program's total procurement cost somewhat by reducing production learning curve benefits in the Ohio replacement program.[9] This option could, however, reduce the impact of the Ohio replacement program on the amount of funding available for the procurement of other Navy ships in certain individual years. This might reduce the amount of disruption that the Ohio replacement program causes to other shipbuilding programs in those years, which in turn might avoid certain disruption-induced cost increases for those other programs. The annual funding requirements for the Ohio replacement program might be further spread out by funding some of the SSBN(X)s with three- or four-year incremental funding.

Table 2 shows the Navy's currently planned schedule for procuring 12 SSBN(X)s and a notional alternative schedule that would start two years earlier and end two years later than the Navy's currently planned schedule, so as to provide more opportunities for using incremental funding. Although the initial ship in the alternative schedule would be procured in FY2019, it could be executed as it if were funded in FY2021. Subsequent ships in the alternative schedule that are funded earlier than they would be under the Navy's currently planned schedule could also be executed as if they were funded in the year called for under the Navy's currently planned schedule. Congress in the past has funded the procurement of ships whose construction was executed as if they had been procured in later fiscal years.[10] The ability to stretch the end of the procurement schedule by two years, to FY2035, could depend on the Navy's ability to carefully husband the use of the nuclear fuel cores on the last two Ohio-class SSBNs, so as to extend the service lives of these two ships by one or two years. Alternatively, Congress could grant the Navy the authority to begin construction on the 11th boat a year before its nominal year of procurement, and the 12th boat two years prior to its nominal year of procurement.

[8] Under split funding, a boat's procurement cost is divided into two parts, or increments. The first increment would be provided in the fiscal year that the boat is procured, and the second would be provided the following fiscal year.

[9] Procuring one SSBN(X) every two years rather than at the Navy's planned rate of one per year could result in a loss of learning at the shipyard in moving from production of one SSBN to the next.

[10] Congress funded the procurement of two aircraft carriers (CVNs 72 and 73) in FY1983, and another two (CVNs 74 and 75) in FY1988. Although CVN-73 was funded in FY1983, it was built on a schedule consistent with a carrier funded in FY1985; although CVN-75 was funded in FY1988, it was built on a schedule consistent with a carrier funded in FY1990 or FY1991.

Table 2. Navy SSBN(X) Procurement Schedule and a Notional Alternative Schedule

Fiscal year	Navy's Schedule	Boat might be particularly suitable for 2-, 3-, or 4-year incremental funding	Notional alternative schedule	Boat might be particularly suitable for 2-, 3-, or 4-year incremental funding
2019			1	X
2020				
2021	1	X	1	X
2022				
2023			1	X
2024	1	X		
2025			1	X
2026	1		1	
2027	1		1	
2028	1		1	
2029	1		1	
2030	1		1	
2031	1		1	X
2032	1			
2033	1	X	1	X
2034	1	X		
2035	1	X	1	X
2036				
2037			1	X
Total	**12**		**12**	

Source: Navy's current plan is taken from the Navy's FY2015 budget submission. Potential alternative plan prepared by CRS.

Notes: Notional alternative schedule could depend on Navy's ability to carefully husband the use of the nuclear fuel cores on the last two Ohio-class SSBNs, so as to extend the service lives of these two ships by one or two years. Alternatively, Congress could grant the Navy the authority to begin construction on the 11th boat a year before its nominal year of procurement, and the 12th boat two years prior to its nominal year of procurement. Under Navy's schedule, the boat to be procured in FY2033 might be particularly suitable for 4-year incremental funding, and boat to be procured in FY2034 might be particularly suitable for 3- or 4-year incremental funding.

Virginia-Class Attack Submarine Program

The Virginia-class program used BBC to reduce the unit procurement costs of the first four boats in the program,[11] and MYP to reduce the unit procurement costs of most of the subsequent boats in the class. The current Virginia-class MYP contract extends through FY2018. The multiyear contract anticipated for Virginia-class boats to be procured in FY2019-FY2023 can be another Virginia-class MYP contract, or possibly a joint-class block buy contract with the Ohio replacement program (see previous section). The authority for making cross-class joint purchases of major components and subsystems for Ohio replacement boats and "other nuclear powered vessels" that would be provided by Section 1022 of the FY2016 National Defense Authorization Act (S. 1356; see above section on Ohio replacement program) might enable some additional savings under another Virginia-class MYP.

[11] The BBC contract for the first four Virginia-class boats was the first contract of its type. In this sense, BBC can be said to have been invented with this contract.

Gerald R. Ford (CVN-78) Class Aircraft Carrier Program

In previous years, the CRS report on the Gerald R. Ford (CVN-78) class aircraft carrier program[12] presented an option for reducing the procurement costs of CVN-79 and CVN-80 through a two-ship block buy contract broadly similar to the two-ship block buys that Congress approved for the Nimitz (CVN-68) class aircraft carriers CVN-72 and CVN-73 in FY1983, and the Nimitz-class aircraft carriers CVN-74 and CVN-75 in FY1988. Congress has not chosen to pursue a two-ship block buy contract for CVN-79 and CVN-80.

A new option would be to reduce the procurement costs of CVN-80 and CVN-81 through a two-ship block buy contract covering those two ships. A reduced-scope version of that option would be to employ a combined purchase of materials and components for CVN-80 and CVN-81. The current version of the CRS report on the CVN-78 program provides additional discussion of this reduced-scope option for CVN-80 and CVN-81.

The authority for making cross-class joint purchases of major components and subsystems for Ohio replacement boats and "other nuclear powered vessels" that would be provided by Section 1022 of the FY2016 National Defense Authorization Act (S. 1356; see above section on Ohio replacement program) might help reduce the cost of CVN-78 class ships.

DDG-51 Destroyer Program

The DDG-51 program in recent years has used MYP to reduce DDG-51 unit procurement costs. The current DDG-51 MYP contract extends through FY2017. An MYP contract for DDG-51s to be procured in FY2018-FY2022 could continue to reduce DDG-51 unit procurement costs relative to costs that would be experienced under a return to annual contracting. As discussed in testimony to the full committee last year, the DDG-51 program is using Profit Related to Offers (PRO) bidding (i.e., competition for profit) among the two DDG-51 builders to further reduce costs.[13]

Littoral Combat Ship (LCS) Program

The LCS program has used a pair of 10-ship block buy contracts (one with each LCS builder) to procure ships 5 through 24 in the program. The contract began in FY2010, and ship 24 is the first of three LCSs requested for FY2016. At a February 25, 2015, hearing on Department of the Navy acquisition programs

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[12] CRS Report RS20643, *Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress*, by Ronald O'Rourke.

[13] As stated in Statement of Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service, Before the House Armed Services Committee on Case Studies in DOD Acquisition: Finding What Works, June 24, 2014, p. 7:

> When the end of the Cold War led to a reduction in the annual procurement rate of Arleigh Burke (DDG-51) class Aegis destroyers, the Navy judged that the new, lower rate was insufficient to sustain a meaningful competition between the two DDG-51 builders (General Dynamics/Bath Iron Works and Huntington Ingalls Industries/Ingalls Shipbuilding) for the right to build each year's DDG-51s. The Navy, however, found a way to maintain competition in the DDG-51 program by using Profit Related to Offers (PRO) bidding, and has used PRO bidding in the DDG-51 almost every year since FY1996. Under PRO bidding, the Navy allocates individual DDG-51s to the two yards (over time, each yard receives roughly half of the ships), and the yard that submits the lower bid for the ships that it has been allocated receives a higher profit margin. The approach is referred to as competition for profit rather than for quantity, and can be considered a successful example of how to continue employing competition in a procurement program when the program's annual procurement rate is not deemed sufficient to sustain a meaningful competition for quantity.

For an article discussing PRO bidding in the DDG-51 program, see Sydney J. Freedberg Jr., "Can Navy Afford Next-Gen DDG-51 Destroyer, Packard Award Or Not?" *Breaking Defense*, November 12, 2012.

before this subcommittee, Department of the Navy officials testified that the Navy plans to extend the current block buy contracts to include the 25th and 26th ships in the program (i.e., the second and third of the three ships requested for procurement in FY2016), and "use the competitive pricing from the block buy [contracts] to obtain option prices" for those two ships.[14] The Navy has not yet announced an acquisition strategy for ships 27-32 in the program (i.e., the six ships scheduled for procurement in FY2017 and FY2018), or for the final 20 ships in the program—ships 33-52—which are to be procured starting in FY2019 and which are to be built to a modified design.

New block buy contracts are options for both ships 27-32 and ships 33-52. MYP might be an option for ships 27-32, if the design of these ships is not changed substantially from that of ships 5-24. MYP might also be an option for the final ships in the program, after the modified design introduced with ship 33 has demonstrated stability through the construction of ship 33.

LHA-6 Class Amphibious Assault Ship Program

As mentioned earlier, LHA-type ships have been procured in recent years using split funding. The next two LHA-6 class ships are scheduled for procurement in FY2017 and FY2024. One option would be to accelerate the procurement of the second of these two ships to an earlier year (such as FY2021 or FY2022) and then procure the two ships together under a two-ship block buy contract broadly similar to the two-ship block buys for aircraft carriers discussed earlier. A reduced-scope version of that option would be to employ a combined purchase of materials and components for the two ships, broadly similar to the reduced-scope option discussed earlier for CVN-80 and CVN-81.

LX(R) Amphibious Ship Program

The design of the LX(R) is to be based on the design of the San Antonio (LPD-17) class amphibious ship. BBC is an option for the initial ships in the LX(R) amphibious ship program, and BBC and MYP would be options for later ships in the program.

Huntington Ingalls Industries (HII) is the builder of LPD-17s, the 12th of which is requested for procurement in FY2016. As discussed in the CRS report on the LX(R) program,[15] if construction of the initial LX(R)s is awarded to HII, then accelerating the procurement of the lead ship in the LX(R) class from FY2020 to FY2019 or FY2018 might reduce unit procurement costs of LX(R)s by reducing the loss of production learning curve benefits that would occur between the 12th LPD-17 and the first LX(R).

TAO(X) Oiler Program

The design of the TAO(X) has not yet been determined, but could be based on an existing design for a Navy auxiliary ship, a military sealift ship, or a commercial cargo ship. As discussed in the CRS report on the TAO(X) program,[16] BBC is an option for the initial ships in the TAO(X) oiler program, and BBC and MYP would be options for later ships in the program. As also discussed in the CRS report on the TAO(X) program, if TAO(X)s are funded through the NDSF, unit procurement costs could be reduced through combined purchases of components, even if BBC or MYP is not used.

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[14] Statement of the Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development and Acquisition) and Vice Admiral Joseph P. Mulloy, Deputy Chief of Naval Operations for Integration of Capabilities and Resources and Lieutenant General Kenneth J. Glueck, Jr., Deputy Commandant, Combat Development and Integration & Commanding General, Marine Corps Combat Development Command, Before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee on Department of the Navy Seapower and Projection Forces Capabilities, February 25, 2015, p. 11.

[15] CRS Report R43543, *Navy LX(R) Amphibious Ship Program: Background and Issues for Congress*, by Ronald O'Rourke.

[16] CRS Report R43546, *Navy TAO(X) Oiler Shipbuilding Program: Background and Issues for Congress*, by Ronald O'Rourke.

As mentioned earlier, in considering whether to grant authority for using MYP, BBC, or combined purchases of materials and components, Congress may weigh the potential savings of these measures against the tradeoffs listed earlier.

Mr. Chairman, this concludes my statement. Thank you again for the opportunity to testify, and I will be pleased to respond to any questions the subcommittee may have.

Appendix A. Background information on MYP and BBC

This appendix provides basic background information on MYP and BBC.[17]

Multiyear Procurement (MYP)

MYP in Brief

What is MYP, and how does it differ from annual contracting? MYP, also known as multiyear contracting, is an alternative to the standard or default DOD approach of annual contracting. Under annual contracting, DOD uses one or more contracts for each year's worth of procurement of a given kind of item. Under MYP, DOD instead uses a single contract for two to five years' worth of procurement of a given kind of item, without having to exercise a contract option for each year after the first year. DOD needs congressional approval for each use of MYP.

To illustrate the basic difference between MYP and annual contracting, consider a hypothetical DOD program to procure 20 single-engine aircraft of a certain kind over the five-year period FY2015-FY2019, at a rate of four aircraft per year:

- **Under annual contracting**, DOD would issue one or more contracts for each year's procurement of four aircraft. After Congress funds the procurement of the first four aircraft in FY2015, DOD would issue one or more contracts (or exercise a contract option) for those four aircraft. The next year, after Congress funds the procurement of the next four aircraft in FY2015, DOD would issue one or more contracts (or exercise a contract option) for those four aircraft, and so on.
- **Under MYP**, DOD would issue one contract covering all 20 aircraft to be procured during the five-year period FY2015-FY2019. DOD would award this contract in FY2015, at the beginning of the five-year period, following congressional approval to use MYP for the program, and congressional appropriation of the FY2015 funding for the program. To continue the implementation of the contract over the next four years, DOD would request the FY2016 funding for the program as part of DOD's proposed FY2016 budget, the FY2017 funding as part of DOD's proposed FY2017 budget, and so on.

Potential Savings Under MYP

How much can MYP save? Compared with estimated costs under annual contracting, estimated savings for programs being proposed for MYP have ranged from less than 5% to more than 15%, depending on the particulars of the program in question, with many estimates falling in the range of 5% to 10%. In practice, actual savings from using MYP rather than annual contracting can be difficult to observe or verify because of cost growth during the execution of the contract that was caused by developments independent of the use of MYP rather than annual contracting.

A February 2012 briefing by the Cost Assessment and Program Evaluation (CAPE) office within the Office of the Secretary of Defense (OSD) states that "MYP savings analysis is difficult due to the lack of actual costs on the alternative acquisition path, i.e., the path not taken."[18] The briefing states that CAPE

[17] Material in this appendix is adapted from CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke and Moshe Schwartz.

[18] Slide 10 from briefing entitled "Multiyear Procurement: A CAPE Perspective," given at DOD cost analysis symposium, February 15-17, 2012, posted at InsideDefense.com (subscription required) May 14, 2012.

up to that point had assessed MYP savings for four aircraft procurement programs—F/A-18E/F strike fighters, H-60 helicopters, V-22 tilt-rotor aircraft, and CH-47F helicopters—and that CAPE's assessed savings ranged from 2% to 8%.[19]

A 2008 Government Accountability Office (GAO) report stated that

> DOD does not have a formal mechanism for tracking multiyear results against original expectations and makes few efforts to validate whether actual savings were achieved by multiyear procurement. It does not maintain comprehensive central records and historical information that could be used to enhance oversight and knowledge about multiyear performance to inform and improve future multiyear procurement (MYP) candidates. DOD and defense research centers officials said it is difficult to assess results because of the lack of historical information on multiyear contracts, comparable annual costs, and the dynamic acquisition environment.[20]

How does MYP potentially save money? Compared to annual contracting, using MYP can in principle reduce the cost of the weapons being procured in two primary ways:

- **Contractor optimization of workforce and production facilities.** An MYP contract gives the contractor (e.g., an airplane manufacturer or shipbuilder) confidence that a multiyear stream of business of a known volume will very likely materialize. This confidence can permit the contractor to make investments in the firm's workforce and production facilities that are intended to optimize the facility for the production of the items being procured under the contract. Such investments can include payments for retaining or training workers, or for building, expanding, or modernizing production facilities. Under annual contracting, the manufacturer might not have enough confidence about its future stream of business to make these kinds of investments, or might be unable to convince its parent firm to finance them.
- **Economic order quantity (EOQ) purchases of selected long-leadtime components.** Under an MYP contract, DOD is permitted to bring forward selected key components of the items to be procured under the contract and to purchase the components in batch form during the first year or two of the contract. In the hypothetical example introduced earlier, using MYP could permit DOD to purchase, say, the 20 engines for the 20 aircraft in the first year or two of the five-year contract. Procuring selected components in this manner under an MYP contract is called an economic order quantity (EOQ) purchase.[21] EOQ purchases can reduce the procurement cost of the weapons being procured under the MYP contract by allowing the manufacturers of components to take maximum advantage of production economies of scale that are possible with batch orders.[22]

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[19] Slide 12 from briefing entitled "Multiyear Procurement: A CAPE Perspective," given at DOD cost analysis symposium, February 15-17, 2012, posted at InsideDefense.com (subscription required) May 14, 2012. Slide 12 also stated that these assessed savings were based on comparing CAPE's estimate of what the programs would cost under annual contracting (which the briefing refers to as single-year procurement or SYP) to the contractor's MYP proposal.

[20] Government Accountability Office, *Defense Acquisitions[:] DOD's Practices and Processes for Multiyear Procurement Should Be Improved*, GAO-08-298, February 2008, p. 3.

[21] The term EOQ is occasionally used in discussions of defense acquisition, somewhat loosely, to refer to any high-quantity or batch order of items, even those that do not take place under MYP or BBC. As a general matter, however, EOQs as described here occur only within MYP and block buy contracts.

[22] A 2008 Government Accountability Office (GAO) report on multiyear contracting lists five areas of savings, most of which are covered in the two general areas of savings outlined above. One of GAO's five areas of savings—limited engineering changes due to design stability—can also occur in programs that use annual contracting. The GAO report states:

> Multiyear procurement can potentially save money and improve the defense industrial base by permitting the more efficient use of a contractor's resources. Multiyear contracts are expected to achieve lower unit costs compared to annual contracts through one or more of the following sources: (1) purchase of parts and

(continued...)

What gives the contractor confidence that the multiyear stream of business will materialize? At least two things give the contractor confidence that DOD will not terminate an MYP contract and that the multiyear stream of business consequently will materialize:

- For a program to qualify for MYP, DOD must certify, among other things, that the minimum need for the items to be purchased is expected to remain substantially unchanged during the contract in terms of production rate, procurement rate, and total quantities.
- Perhaps more important to the contractor, MYP contracts include a cancellation penalty intended to reimburse a contractor for costs that the contractor has incurred (i.e., investments the contractor has made) in anticipation of the work covered under the MYP contract. The undesirability of paying a cancellation penalty acts as a disincentive for the government against canceling the contract. (And if the contract is canceled, the cancellation penalty helps to make the contractor whole.)[23]

Permanent Statute Governing MYP

Is there a permanent statute governing MYP contracting? There is a permanent statute governing MYP contracting—10 U.S.C. 2306b. The statute was created by Section 909 of the FY1982 Department of Defense Authorization Act (S. 815/P.L. 97-86 of December 1, 1981), revised and reorganized by Section 1022 of the Federal Acquisition Streamlining Act of 1994 (S. 1587/P.L. 103-355 of October 13, 1994), and further amended on several occasions since. DOD's use of MYP contracting is further governed by DOD acquisition regulations.

Under this statute, what criteria must a program meet to qualify for MYP? 10 U.S.C. 2306b(a) states that to qualify for MYP, a program must meet several criteria, including the following.

- **Substantial savings.** DOD must estimate that using an MYP contract would result in "substantial savings" compared with using annual contracting.
- **Realistic cost estimates.** DOD's estimates of the cost of the MYP contract and the anticipated savings must be realistic.
- **Stable need for the items.** DOD must expect that its minimum need for the items will remain substantially unchanged during the contract in terms of production rate, procurement rate, and total quantities.

(...continued)

materials in economic order quantities (EOQ), (2) improved production processes and efficiencies, (3) better utilized industrial facilities, (4) limited engineering changes due to design stability during the multiyear period, and (5) cost avoidance by reducing the burden of placing and administering annual contracts. Multiyear procurement also offers opportunities to enhance the industrial base by providing defense contractors a longer and more stable time horizon for planning and investing in production and by attracting subcontractors, vendors, and suppliers. However, multiyear procurement also entails certain risks that must be balanced against potential benefits, such as the increased costs to the government should the multiyear contract be changed or canceled and decreased annual budget flexibility for the program and across DOD's portfolio of weapon systems. Additionally, multiyear contracts often require greater budgetary authority in the earlier years of the procurement to economically buy parts and materials for multiple years of production than under a series of annual buys.

Government Accountability Office, *Defense Acquisitions[:] DOD's Practices and Processes for Multiyear Procurement Should Be Improved*, GAO-08-298, February 2008, pp. 4-5.

[23] Annual contracts can also include cancellation penalties.

- **Stable design for the items.** The design for the items to be acquired must be stable, and the technical risks associated with the items must not be excessive.

Section 811 of the FY2008 National Defense Authorization Act (H.R. 4986/P.L. 110-181 of January 28, 2008) amended 10 U.S.C. 2306b to require the Secretary of Defense to certify in writing, by no later than March 1 of the year in which DOD requests MYP authority for a program, that these and certain other criteria have been met. It also requires that the Secretary provide the congressional defense committees with the basis for this determination, as well as a cost analysis performed by DOD's office of Cost Assessment and Program Evaluation (CAPE) that supports the findings.[24] Section 811 further amended 10 U.S.C. 2306b to require the following:

- **Sufficient prior deliveries to determine whether estimated unit costs are realistic.** A sufficient number of the type of item to be acquired under the proposed MYP contract must have been delivered under previous contracts at or within the most current estimates of the program acquisition unit cost or procurement unit cost to determine whether current estimates of such unit costs are realistic.
- **No Nunn-McCurdy critical cost growth breaches within the last five years.** The system being proposed for an MYP contract must not have experienced within five years of the anticipated award date of the MYP contract a critical cost growth breach as defined under the Nunn-McCurdy act (10 U.S.C. 2433).[25]
- **Fixed-price type contract.** The proposed MYP contract must be a fixed-price type contract.[26]

What is meant by "substantial savings"? The meaning of "substantial savings" is open to interpretation and might depend on the circumstances of the program in question. In practice, estimated savings of at least 5% might be judged substantial, and estimated savings in the range of 10% (or more) are more likely to be judged substantial. The amount of savings required under 10 U.S.C. 2306b to qualify has changed over time; the requirement for "substantial savings" was established by Section 808(a)(2) of the FY1991 National Defense Authorization Act (H.R. 4739/P.L. 101-510 of November 5, 1990), which amended 10 U.S.C. 2306b in this regard.[27]

What is meant by "stable design"? The term "stable design" is generally understood to mean that the design for the items to be procured is not expected to change substantially during the period of the contract. Having a stable design is generally demonstrated by having already built at least a few items to that design (or in the case of a shipbuilding program, at least one ship to that design) and concluding, through testing and operation of those items, that the design does not require any substantial changes during the period of the contract.

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[24] §811 states that the cost analysis is to be performed by DOD's Cost Analysis Improvement Group (CAIG). In a subsequent DOD reorganization, CAIG was made part of CAPE.

[25] For more on the Nunn-McCurdy provision, see CRS Report R41293, *The Nunn-McCurdy Act: Background, Analysis, and Issues for Congress*, by Moshe Schwartz.

[26] The requirement for using a fixed price contract is now codified at 10 U.S.C. 2306b, subsection (i)(3)(F).

[27] For a discussion of the evolution of the savings requirement under 10 U.S.C. 2306b, including a figure graphically summarizing the legislative history of the requirement, see Government Accountability Office, *Defense Acquisitions[:] DOD's Practices and Processes for Multiyear Procurement Should Be Improved*, GAO-08-298, February 2008, pp. 21-22, including Figure 3 on p. 22.

Potential Consequences of Not Fully Funding an MYP Contract

What happens if Congress does not provide the annual funding requested by DOD to continue the implementation of the contract? If Congress does not provide the funding requested by DOD to continue the implementation of an MYP contract, DOD would be required to renegotiate, suspend, or terminate the contract. Terminating the contract could require the government to pay a cancellation penalty to the contractor. Renegotiating or suspending the contract could also have a financial impact.

Effect on Flexibility for Making Procurement Changes

What effect does using MYP have on flexibility for making procurement changes? A principal potential disadvantage of using MYP is that it can reduce Congress's and DOD's flexibility for making changes (especially reductions) in procurement programs in future years in response to changing strategic or budgetary circumstances, at least without incurring cancellation penalties. In general, the greater the portion of DOD's procurement account that is executed under MYP contracts, the greater the potential loss of flexibility. The use of MYP for executing some portion of the DOD procurement account means that if policymakers in future years decide to reduce procurement spending below previously planned levels, the spending reduction might fall more heavily on procurement programs that do not use MYP, which in turn might result in a less-than-optimally balanced DOD procurement effort.

Congressional Approval

How does Congress approve the use of MYP? Congress approves the use of MYP on a case-by-case basis, typically in response to requests by DOD.[28] Congressional approval for MYP contracts with a value of more than $500 million must occur in two places: an annual DOD appropriations act[29] and an act other than the annual DOD appropriations act.[30]

In annual DOD appropriations acts, the provision permitting the use of MYP for one or more defense acquisition programs is typically included in the title containing general provisions, which typically is Title VIII.

An annual defense authorization act is usually the act other than an appropriations act in which provisions granting authority for using MYP contracting on individual defense acquisition programs are included. Such provisions typically occur in Title I of the defense authorization act, the title covering procurement programs.

Provisions in which Congress approves the use of MYP for a particular defense acquisition program may include specific conditions for that program in addition to the requirements and conditions of 10 U.S.C. 2306b.

How often is MYP used? MYP is used for a limited number of DOD acquisition programs. Annual DOD appropriations acts since FY1990 typically (but not always) have approved the use of MYP for one or a few DOD programs each year.

A February 2012 briefing by the Cost Assessment and Program Evaluation (CAPE) office within the Office of the Secretary of Defense (OSD) shows that the total dollar value of DOD MYP contracts has remained more or less stable between FY2000 and FY2012 at roughly $7 billion to $13 billion per year.

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[28] The Anti-Deficiency Act (31 U.S.C. 1341) prohibits the making of contracts in advance of appropriations. A multiple-year commitment may be made when authorized by Congress by entering into a firm commitment for one year and making the government's liability for future years contingent on funds becoming available.

[29] 10 U.S.C. 2306b, subsection (l)(3).

[30] 10 U.S.C. 2306b, subsection (i)(1).

The briefing shows that since the total size of DOD's procurement budget has increased during this period, the portion of DOD's total procurement budget accounted for by programs using MYP contracts has declined from about 17% in FY2000 to less than 8% in FY2012.[31] The briefing also shows that the Navy makes more use of MYP contracts than does the Army or Air Force, and that the Air Force made very little use of MYP in FY2010-FY2012.[32]

A 2008 Government Accountability Office (GAO) report stated:

> Although DOD had been entering into multiyear contracts on a limited basis prior to the 1980s, the Department of Defense Authorization Act, [for fiscal year] 1982,[33] codified the authority for DOD to procure on a multiyear basis major weapon systems that meet certain criteria. Since that time, DOD has annually submitted various weapon systems as multiyear procurement candidates for congressional authorization. Over the past 25 years, Congress has authorized the use of multiyear procurement for approximately 140 acquisition programs, including some systems approved more than once.[34]

Block Buy Contracting (BBC)

BBC in Brief

What is BBC, and how does it compare to MYP? BBC is similar to MYP in that it permits DOD to use a single contract for more than one year's worth of procurement of a given kind of item without having to exercise a contract option for each year after the first year.[35] BBC is also similar to MYP in that DOD needs congressional approval for each use of BBC.

BBC differs from MYP in the following ways:

- There is no permanent statute governing the use of BBC.
- There is no requirement that BBC be approved in both a DOD appropriations act and an act other than a DOD appropriations act.
- Programs being considered for BBC do not need to meet any legal criteria to qualify for BBC because there is no permanent statute governing the use of BBC that establishes such criteria.
- A BBC contract can cover more than five years of planned procurements. The BBC contracts currently being used by the Navy for procuring Littoral Combat Ships (LCSs), for example, cover a period of seven years (FY2010-FY2016).

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[31] Slide 4 from briefing entitled "Multiyear Procurement: A CAPE Perspective," given at DOD cost analysis symposium, February 15-17, 2012, posted at InsideDefense.com (subscription required) May 14, 2012.

[32] Slide 5 from briefing entitled "Multiyear Procurement: A CAPE Perspective," given at DOD cost analysis symposium, February 15-17, 2012, posted at InsideDefense.com (subscription required) May 14, 2012.

[33] S. 815/P.L. 97-86 of December 1, 1981, §909.

[34] Government Accountability Office, *Defense Acquisitions[:] DOD's Practices and Processes for Multiyear Procurement Should Be Improved*, GAO-08-298, February 2008, p. 5.

[35] Using the hypothetical example introduced earlier involving the procurement of 20 aircraft over the five-year period FY2013-FY2017, DOD would follow the same general path as it would under MYP: DOD would issue one contract covering all 20 aircraft in FY2013, at the beginning of the five-year period, following congressional approval to use BBC for the program, and congressional appropriation of the FY2013 funding for the program. To continue the implementation of the contract over the next four years, DOD would request the FY2014 funding for the program as part of DOD's proposed FY2014 budget, the FY2015 funding as part of DOD's proposed FY2015 budget, and so on.

- Economic order quantity (EOQ) authority does not come automatically as part of BBC authority because there is no permanent statute governing the use of BBC that includes EOQ authority as an automatic feature. To provide EOQ authority as part of a BBC contract, the provision granting authority for using BBC in a program may need to state explicitly that the authority to use BBC includes the authority to use EOQ.
- BBC contracts are less likely to include cancellation penalties.

Given the one key similarity between BBC and MYP (the use of a single contract for more than one year's worth of procurement), and the various differences between BBC and MYP, BBC might be thought of as a less formal stepchild of MYP.

When and why was BBC invented? BBC was invented by Section 121(b) of the FY1998 National Defense Authorization Act (H.R. 1119/P.L. 105-85 of November 18, 1997), which granted the Navy the authority to use a single contract for the procurement of the first four Virginia (SSN-774) class attack submarines. The four boats were scheduled to be procured during the five-year period FY1998-FY2002 in annual quantities of 1-1-0-1-1. Congress provided the authority granted in Section 121(b) at least in part to reduce the combined procurement cost of the four submarines. Using MYP was not an option for the Virginia-class program at that time because the Navy had not even begun, let alone finished, construction of the first Virginia-class submarine, and consequently could not demonstrate that it had a stable design for the program.

When Section 121(b) was enacted, there was no name for the contracting authority it provided. The term block buy contracting came into use later, when observers needed a term to refer to the kind of contracting authority that Congress authorized in Section 121(b).

Potential Savings Under BBC

How much can BBC save, compared with MYP? BBC can reduce the unit procurement costs of ships by amounts comparable to those of MYP, if the authority granted for using BBC explicitly includes authority for making economic order quantity (EOQ) purchases of components. If the authority granted for using BBC does not explicitly include authority for making EOQ purchases, then the savings from BBC will be less. Potential savings under BBC might also be less than those under MYP if the BBC contract does not include a cancellation penalty, or includes one that is more limited than typically found in an MYP contract, because this might give the contractor less confidence than would be the case under an MYP contract that the future stream of business will materialize as planned, which in turn might reduce the amount of money the contractor invests to optimize its workforce and production facilities for producing the items to be procured under the contract.

Frequency of Use of BBC

How frequently has BBC been used? Since its use at the start of the Virginia-class program, BBC has been used very rarely. The Navy did not use it again in a shipbuilding program until December 2010, when it awarded two block buy contracts, each covering 10 LCSs to be procured over the six-year period FY2010-FY2015, to the two LCS builders.[36] A third example, arguably, is the Air Force's KC-46 aerial refueling tanker program, which is employing a fixed price incentive fee (FPIF) development contract

[36] For further discussion, see CRS Report RL33741, *Navy Littoral Combat Ship (LCS)/Frigate Program: Background and Issues for Congress*, by Ronald O'Rourke.

that includes a "back end" commitment to procure certain minimum numbers of KC-46s in certain fiscal years.[37]

Using BBC Rather than MYP

When might BBC be suitable as an alternative to MYP? BBC might be particularly suitable as an alternative to MYP in cases where using a multiyear contract can reduce costs, but the program in question cannot meet all the statutory criteria needed to qualify for MYP. As shown in the case of the first four Virginia-class boats, this can occur at or near the start of a procurement program, when design stability has not been demonstrated through the production of at least a few of the items to be procured (or, for a shipbuilding program, at least one ship).

MYP and BBC vs. Contracts with Options

What's the difference between an MYP or block buy contract and a contract with options? The military services sometimes use contracts with options to procure multiple copies of an item that are procured over a period of several years. The Navy, for example, used a contract with options to procure Lewis and Clark (TAKE-1) class dry cargo ships that were procured over a period of several years. A contract with options can be viewed as somewhat similar to an MYP or block buy contract in that a single contract is used to procure several years' worth of procurement of a given kind of item.

There is, however, a key difference between an MYP or block buy contract and a contract with options: In a contract with options, the service is under no obligation to exercise any of the options, and a service can choose to not exercise an option without having to make a penalty payment to the contractor. In contrast, in an MYP or block buy contract, the service is under an obligation to continue implementing the contract beyond the first year, provided that Congress appropriates the necessary funds. If the service chooses to terminate an MYP or block buy contract, and does so as a termination for government convenience rather than as a termination for contractor default, then the contractor can, under the contract's termination for convenience clause, seek a payment from the government for cost incurred for work that is complete or in process at the time of termination, and may include the cost of some of the investments made in anticipation of the MYP or block buy contract being fully implemented. The contractor can do this even if the MYP or block buy contract does not elsewhere include a provision for a cancellation penalty.[38]

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[37] For more on the KC-46 program, see CRS Report RL34398, *Air Force KC-46A Tanker Aircraft Program*, by Jeremiah Gertler.

[38] Source: Telephone discussion with Elliott Branch, Deputy Assistant Secretary of the Navy for Acquisition & Procurement, October 3, 2011, and email from Navy Office of legislative Affairs, October 11, 2011. Under the termination for convenience clause, the contractor can submit a settlement proposal to the service, which would become the basis for a negotiation between the contractor and the service on the amount of the payment.

Appendix B. Background information on funding approaches

This appendix provides back background information on full funding, incremental funding, and advance appropriations.[39]

Full Funding Policy

General Description

Most Navy ships procured since the late 1950s have been funded in accordance with the full funding policy. Before then, many Navy ships were procured with incremental funding.

For DOD procurement programs, the full funding policy requires the entire procurement cost of a usable end item (such as a Navy ship) to be funded in the year in which the item is procured. The policy applies not just to Navy ships, but to all weapons and equipment that DOD procures through the procurement title of the annual DOD appropriations act.

In general, the full funding policy means that DOD cannot contract for the construction of a new weapon or piece of equipment until funding for the entire cost of that item has been approved by Congress. Sufficient funding must be available for a complete, usable end item before a contract can be let for the construction of that item. Under traditional full funding, no portion of a usable end item's procurement cost is funded in a year after the year in which the item is procured.

Congress imposed the full funding policy on DOD in the 1950s to make the total procurement costs of DOD weapons and equipment more visible and thereby enhance Congress's ability to understand and track these costs. Congress's intent in imposing the policy was to strengthen discipline in DOD budgeting and improve Congress's ability to control DOD spending and carry out its oversight of DOD activities. Understanding total costs and how previously appropriated funds are used are key components of Congress's oversight capability.

The full funding policy is consistent with two basic laws regarding government expenditures—the Antideficiency Act of 1870, as amended, and the Adequacy of Appropriations Act of 1861. Regulations governing the full funding policy are found in Office of Management and Budget (OMB) Circular A-11 and DOD Directive 7000.14-R, which provide guidelines on budget formulation. OMB Circular A-11 states, among other things, that

> Good budgeting requires that appropriations for the full costs of asset acquisition be enacted in advance to help ensure that all costs and benefits are fully taken into account at the time decisions are made to provide resources. Full funding with regular appropriations in the budget year also leads to tradeoffs within the budget year with spending for other capital assets and with spending for purposes other than capital assets. Full funding increases the opportunity to use performance-based fixed price contracts, allows for more efficient work planning and management of the capital project (or investment), and increases the accountability for the achievement of the baseline goals.
>
> When full funding is not followed and capital projects (or investments) or useful segments are funded in increments, without certainty if or when future funding will be available, the result is sometimes poor planning, acquisition of assets not fully justified, higher acquisition costs,

[39] Material in this appendix is adapted from CRS Report RL32776, *Navy Ship Procurement: Alternative Funding Approaches—Background and Options for Congress*, by Ronald O'Rourke.

cancellation of major investments, the loss of sunk costs, or inadequate funding to maintain and operate the assets.[40]

Support for the full funding policy has been periodically reaffirmed over the years by Congress, the Government Accountability Office (GAO), and DOD.[41]

Advance Procurement (AP) Payments Under Full Funding

The executive branch regulations that implement the full funding policy for DOD procurement programs permit two circumstances under which advance procurement (AP) "down payments" on a usable end item can be provided in one or more years prior to the item's year of procurement:[42]

- AP funding may be used to pay for long-lead items—components of a usable end item that have long manufacturing lead times—if needed to ensure that these items will be ready for installation into the end item at the appropriate point in the end item's construction process.
- AP funding may also be used to pay for economic order quantity (EOQ) procurement of a set of long-lead items for a set of weapons being acquired under a multiyear procurement (MYP) arrangement.

"One Decision for One Pot of Money"

Although some DOD weapons and equipment are procured with AP funding provided in prior years, most DOD procurement items are funded through a single decision by Congress to provide the entire cost of the item in the item's year of procurement. For this reason, the full funding policy for DOD procurement programs can be described in simplified terms as "one decision for one pot of money."[43]

Incremental Funding

General Description

In spite of the existence of the full funding policy, some Navy and DOD ships, particularly aircraft carriers and LHA-type amphibious assault ships, have been procured in recent years with incremental funding. Prior to the imposition of the full funding policy in the 1950s, however, much of DOD weapon procurement was accomplished through incremental funding.

Under incremental funding, a weapon's cost is divided into two or more annual portions, or increments, that can reflect the need to make annual progress payments to the contractor as the weapon is built.

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[40] OMB Circular A-11 (July 2003), Appendix J, Section C, Principle 1 (of four principles for financing capital assets).

[41] For a detailed discussion of the origins, rationale, and governing regulations of the full funding policy, as well as examples of where Congress, GAO, and DOD have affirmed their support for the policy, see Appendix A of CRS Report RL31404, *Defense Procurement: Full Funding Policy - Background, Issues, and Options for Congress*.

[42] Note that the funding discussed here is advance *procurement* funding, which is not to be confused with the alternate funding approach called advance *appropriations*, discussed later.

[43] When Congress approves AP funding for an item, it does so through a funding decision for that year that is separate from the decision that Congress subsequently makes, in the item's year of procurement, to fund the remainder of the item's procurement cost. Items procured with AP funding thus involve two or more funding decisions from Congress—one or more decisions to approve AP funding in one or more years prior to the year of procurement, plus a final decision, in the item's year of procurement, to fund the remainder of the item's procurement cost. A decision by Congress to approve AP funding for an item does not create an obligation on the part of Congress to approve the remainder of the item's procurement cost in some future year, but it usually indicates that Congress anticipates doing so.

Congress then approves each year's increment as part of its action on that year's budget. Under incremental funding, DOD can contract for the construction of a weapon after Congress approves only the initial increment of its cost, and completion of the weapon is dependent on the approval of the remaining increments in future years by that Congress or future Congresses. A key feature of incremental funding is that a portion of the ship's cost is provided in one or more years beyond the item's year of procurement.

"Multiple Decisions for Multiple Pots of Money"

Since incremental funding divides the procurement cost of an end item into two or more annual increments, and since Congress typically approves one of these increments each year, incremental funding can be described in simplified terms as "multiple decisions for multiple pots of money."

Advance Appropriations

General Description

Advance appropriations have not been used in Navy ship procurement, but have been used by other executive branch agencies to fund various programs.[44] Advance appropriations is an alternate form of full funding that is permitted under executive branch budget regulations. As a funding approach, it can be viewed as lying somewhere between traditional full funding and incremental funding. Advance appropriations is not to be confused with advance procurement (AP) funding that can occur under traditional full funding.

Under advance appropriations, as under traditional full funding, Congress makes a one-time decision to fund the entire procurement cost of an end item. That cost, however, can then be divided into two or more annual increments, as under incremental funding, that are assigned to (in budget terminology, "scored in") two or more fiscal years.[45]

In contrast to incremental funding, under which Congress must take a positive action each year to approve each year's funding increment, under advance appropriations, Congress, following its initial decision to fund the item, would need to take a positive action to cancel or modify an annual funding increment in a future-year budget. In this sense, advance appropriations can be thought of as a legislatively locked in form of incremental funding: the future-year funding increments will occur unless Congress takes action to stop them.

OMB Circular A-11 allows for the use of advance appropriations to help finance capital assets under certain circumstances:

> Regular appropriations for the full funding of a capital project or a useful segment (or investment) of a capital project in the budget year are preferred. If this results in spikes that, in the judgment of OMB, cannot be accommodated by the agency or the Congress, a combination of regular and

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[44] Use of advance appropriations in the federal budget is summarized in the appendix volume of each year's U.S. government budget.

[45] Advance appropriations can also be used to fund the entire cost of an item and have that entire cost assigned to a single future fiscal year.

OMB Circular A-11 defines advance appropriations as appropriations that are enacted normally in the current year; scored after the budget year (e.g., in each of one, two, or more later years, depending on the language); and available for obligation in the year scored and subsequent years if specified in the language.

> (OMB Circular A-11 (July 2003 version), Appendix J (Principles of Budgeting for Capital Asset Acquisitions), Section E (Glossary).)

advance appropriations that together provide full funding for a capital project or a useful segment or an investment should be proposed in the budget.

Explanation: Principle 1 (Full Funding) is met as long as a combination of regular and advance appropriations provide budget authority sufficient to complete the capital project or useful segment or investment. Full funding in the budget year with regular appropriations alone is preferred because it leads to tradeoffs within the budget year with spending for other capital assets and with spending for purposes other than capital assets. In contrast, full funding for a capital project (investment) over several years with regular appropriations for the first year and advance appropriations for subsequent years may bias tradeoffs in the budget year in favor of the proposed asset because with advance appropriations the full cost of the asset is not included in the budget year. Advance appropriations, because they are scored in the year they become available for obligation, may constrain the budget authority and outlays available for regular appropriations of that year.

If, however, the lumpiness caused by regular appropriations cannot be accommodated within an agency or Appropriations Subcommittee, advance appropriations can ameliorate that problem while still providing that all of the budget authority is enacted in advance for the capital project (investment) or useful segment. The latter helps ensure that agencies develop appropriate plans and budgets and that all costs and benefits are identified prior to providing resources. In addition, amounts of advance appropriations can be matched to funding requirements for completing natural components of the useful segment. Advance appropriations have the same benefits as regular appropriations for improved planning, management, and accountability of the project (investment).[46]

"One Decision for Multiple Pots of Money"

Because advance appropriations involves a one-time decision by Congress to approve the entire procurement cost of the end item, which can then be divided into two or more increments that are assigned to two or more fiscal years, advance appropriations can be described in simplified terms as "one decision for multiple pots of money."

Navy Advocacy in 2001

In 2001, some Navy officials advocated the use of advance appropriations for Navy ship procurement, noting at that time that this funding approach is used by several federal agencies other than DOD.[47]

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[46] OMB Circular A-11 (July 2003), Appendix J, Section C, Principle 2 (of four principles for financing capital assets). Italics as in the original.

[47] Source: Slides for May 3, 2001 Navy briefing to CRS, *Advance Appropriations for Navy Shipbuilding*, pages 19-21. The Navy also argued that current law, contrary to some assertions, does not prohibit the use of advance appropriations. Specifically, the Navy argued that:

> —31 USC 1341, [the] "Anti-Deficiency Act," prohibits writing a contract which "involves the government in a contract or obligation for the payment of money before an appropriation is made *unless authorized by law*."
>
> —10 USC 2306b [the provision covering multi-year procurement contracts] allows [DOD and certain other federal agencies] to enter into multi-year contracts for the purchase of weapon systems, as long as [there is] "a reasonable expectation that throughout the contemplated contract period the head of the agency will request funding for the contract at the level required to avoid contract cancellation."
>
> —31 USC 1105 [a provision relating to the contents of the federal budget and its submission to Congress] requires that [the executive branch] identify in advance of need future appropriations that will have to be approved in order to complete the contract. These advance appropriations have to be specifically approved by Congress to allow [the executive branch] to obligate the government in advance of receipt of funds. (Slides for May 3, 2001 Navy briefing to CRS, *Advance Appropriations for Navy Shipbuilding*, page 16. Emphasis as on the briefing slide.)

Although use of advance appropriations for Navy ship procurement was supported by some Navy officials and some Members of Congress,[48] the Navy in 2001 apparently did not receive approval from the Office of Management and Budget (OMB) to use the approach for ship procurement, and did not officially propose its use as part of its FY2002 budget submission to Congress.[49] Congress in 2001 did not adopt advance appropriations as a mechanism for funding Navy ships. The House Appropriations Committee, in its report (H.Rept. 107-298 of November 19, 2001) on the FY2002 defense appropriations bill (H.R. 3338), stated that it was

> dismayed that the Navy continues to advocate the use of alternative financing mechanisms to artificially increase shipbuilding rates, such as advanced appropriations, or incremental funding of ships, which only serve to decrease cost visibility and accountability on these important programs. In attempting to establish advanced appropriations as a legitimate budgeting technique, those Navy advocates of such practices would actually decrease the flexibility of future Administrations and Congresses to make rational capital budgeting decisions with regard to shipbuilding programs. Accordingly, the Committee bill includes a new general provision (section 8150) which prohibits the Defense Department from budgeting for shipbuilding programs on the basis of advanced appropriations.[50]

The general provision mentioned above (Section 8150) was not included in the final version of the bill that was passed by Congress and signed into law (H.R. 3338/P.L. 107-117 of January 10, 2002).

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[48] Christian Bohmfalk, "O'Keefe: Advance Appropriations, If Used Correctly, Could Help Navy," *Inside the Navy*, November 26, 2001; Christian Bohmfalk, "Stevens Promotes Advance Appropriations To Boost Ship Production," *Inside the Navy*, September 10, 2001; Mike McCarthy, "CNO Advocates Advance Funding of Ships," *Defense Week*, July 16, 2001, p. 2; Christian Bohmfalk, "Senior Navy Leaders Describe Benefits of Advance Appropriations," *Inside the Navy*, April 16, 2001; Christopher J. Castelli, "Congress Weighs Using 'Advance Appropriations' For Shipbuilding," *Inside the Navy*, April 9, 2001; Dale Eisman, "Plan Would Boost Navy Shipbuilding," *Norfolk Virginian-Pilot*, April 5, 2001.

[49] Dale Eisman, "White House Rejects Proposal To Stretch Shipbuilding Funds," *Norfolk Virginian-Pilot*, September 6, 2001; Christian Bohmfalk, "Advance Appropriations, Not Part of FY-02 Request, May Resurface," *Inside the Navy*, July 16, 2001.

[50] H.Rept. 107-298, p. 119.

Appendix C. A Summary of Some Shipbuilding Lessons Learned

Measures for efficiently executing Navy shipbuilding programs are not limited to MYP, BBC, and combined purchases of materials and components. A more general summary of lessons learned for Navy shipbuilding, reflecting comments made repeatedly by various sources over the years, includes the following:[51]

- **Get the operational requirements for the program right up front.** Manage risk by not trying to do too much in the program, and perhaps seek a so-called 70%-to-80% solution (i.e., a design that is intended to provide 70%-80% of desired capabilities). Achieve a realistic balance up front between requirements and estimated costs.
- **Impose cost discipline up front.** Use realistic price estimates, and consider not only development and procurement costs, but life-cycle operation and support (O&S) costs.
- **Employ competition** where possible in the awarding of design and construction contracts;
- **Use a contract type that is appropriate for the amount of risk involved**, and structure its terms to align incentives with desired outcomes.
- **Minimize design/construction concurrency** by developing the design to a high level of completion before starting construction and by resisting changes in requirements (and consequent design changes) during construction.
- **Properly supervise construction work.** Maintain an adequate number of properly trained Supervisor of Shipbuilding (SUPSHIP) personnel.
- **Provide stability for industry**, in part by using, where possible, MYP or BBC.
- **Maintain a capable government acquisition workforce** that understands what it is buying, as well as the above points.

Identifying these lessons is not the hard part—most if not all these points have been cited for years. The hard part is living up to them without letting circumstances lead program-execution efforts away from these guidelines.

[51] Material in this appendix is adapted from Statement of Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service, Before the House Armed Services Committee on Case Studies in DOD Acquisition: Finding What Works, June 24, 2014, pp. 8-9.

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