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OPTIONS AND CONSIDERATIONS FOR ACHIEVING A 355–SHIP NAVY

HEARINGS

BEFORE THE

SUBCOMMITTEE ON SEAPOWER

OF THE

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

ONE HUNDRED FIFTEENTH CONGRESS

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INDUSTRY PERSPECTIVES ON OPTIONS AND CONSIDERATIONS FOR ACHIEVING A 355–SHIP NAVY

WEDNESDAY, MAY 24, 2017

UNITED STATES SENATE,
SUBCOMMITTEE ON SEAPOWER,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

The subcommittee met, pursuant to notice, at 9:34 a.m. in Room SR–232A, Russell Senate Office Building, Senator Roger Wicker (chairman of the subcommittee) presiding.

Committee Members present: Senators Wicker, Tillis, Sullivan, Hirono, Shaheen, Blumenthal, Kaine, and King.

OPENING STATEMENT OF SENATOR ROGER WICKER

Senator WICKER. This hearing of the Seapower Subcommittee will come to order.

The Senate Armed Services Subcommittee on Seapower convenes today to receive testimony on industry perspectives and options and considerations for achieving a 355-ship Navy.

We welcome our three witnesses who are leaders in our shipbuilding industry: Mr. Brian Cuccias, Executive Vice President of Huntington Ingalls Industries and President of Ingalls Shipbuilding, representing America's largest shipbuilder with nearly 37,000 employees and with shipyards in Mississippi and Virginia; also, Mr. John Casey, Executive Vice President of General Dynamics Marine Group, which includes 25,000 employees, with shipyards in California, Connecticut, Maine, and Rhode Island; and Mr. Matthew Paxton, President of the Shipbuilders Council of America, a national trade association representing U.S. shipbuilders, ship repairers, and the shipyard supplier base with members in 34 States.

Gentlemen, our subcommittee is grateful to you for agreeing to testify today. Your expertise and counsel will be invaluable today and in the future as we consider options for increasing the size of our fleet.

We have long argued that the United States Navy's dominant maritime position would not be possible without the unique skills, capabilities, and capacities across the maritime industrial base. So thank you for all you do.

Now more than ever, a strong Navy and Marine Corps are central to our Nation's ability to deter adversaries, assure our allies, and defend our national interests. Our sailors and marines are at the forefront of our rebalance to Asia, ongoing operations against

the Islamic State, responses to a resurgent Russia, and efforts to deter rogue states such as Iran and North Korea.

Yesterday, this subcommittee held a classified roundtable discussion with Navy leaders to discuss current readiness challenges, emerging threats, and the requirements underpinning the 355-ship force structure objective that was established in December of last year. It is clear that our current fleet of 275 ships is insufficient to address the security challenges we face today and that we anticipate in the future.

Even with recent shipbuilding increases, many of which were initiated by this subcommittee, the fleet would have peaked at 313 ships in 2025 under the Navy's 2017 30-year shipbuilding plan. We look forward to receiving the Navy's updated 30-year shipbuilding plan, which by law should have accompanied the budget submitted yesterday. We would like to receive that as soon as possible and expect it to contain the recommended path to achieving the 355-ship requirement. We want to help and we want to lead in this regard.

This morning, I would like to hear from our witnesses on what I consider four key issues.

First, industrial base readiness to increase production. Last week, the Chief of Naval Operations released a white paper entitled "The Future Navy" which identified 29 additional ships that could be procured over the next 7 years, or roughly four additional ships per year. This document states hot production lines can do more economically. I would like to hear your assessments of your companies' readiness, including vendors and subcontractors, to increase production in line with this Navy document, or potentially faster.

Second, the importance of stable and predictable workload. Shipbuilding requires a long-term commitment. For example, it takes millions of man-hours over 3 to 4 years to build each destroyer and about 5 years to build each fast attack submarine. I would like to hear your views on the importance of a national commitment and budgetary certainty to enable sound decision-making and efficient planning to align our workforce with the anticipated workload.

Third, options to improve efficiency and cost effectiveness. While this subcommittee will continue to exercise its oversight responsibilities on each shipbuilding program, there are certain authorities to save time and money that only Congress can authorize. In addition, I recognize companies of all sizes across the supply chain will need to invest in facilities, equipment, and workforce to meet higher demand if we are to get this done. I am interested in your recommendations on what the subcommittee can do this year to enable the companies you represent to reduce unit cost and deliver ships the Navy needs and deliver them faster.

Finally, best practices to ensure success. Similar to the *Reagan* buildup, in which 91 ships were added to the fleet between 1980 and 1987, to reach 355 ships will be an increase of 80 ships compared to today's fleet. So with our witnesses' considerable experience in all facets of shipbuilding, I hope you will describe those best practices that are absolutely essential to get right as we grow the Navy.

In closing, let me say that I am open to all options to meet the Navy's 355-ship objective as soon as possible. This will be a historic undertaking, depending on assumptions such as such a buildup would take more than 25 years or as few as 8 years. So help us out there.

In any case, the new construction options we will discuss today are critical. However, I believe we must also look at other options such as extending the service lives of existing ships and reactivating decommissioned ships. This committee will continue to explore these options and more in the coming weeks.

With that in mind, I turn to our ranking member, Senator Hirono, who had very major surgery only 1 week ago today and in an amazing way was back voting on the floor and helping us with this subcommittee. So the amazing Mazie Hirono is recognized for her remarks.

STATEMENT OF SENATOR MAZIE HIRONO

Senator HIRONO. Thank you very much, Mr. Chairman. I would like to join you in thanking our witnesses for being here with us this morning to discuss how we can get to the goal of a 355-ship Navy.

I think we need to be very realistic in the short-term and in the long-term of ways that we can get to this goal. Of course, in Hawaii we understand the threats our country faces and the Navy's role in confronting them. This is particularly true at a time when four out of five of our country's most pressing national security challenges are present in the Pacific theater.

The growing importance of the Indo-Asia-Pacific region is a primary driver of the Navy's goal to increase the number of ships in its fleet from 308 to 355. But after 2 decades of restructuring the shipbuilding industry to support a much smaller fleet, meeting this goal presents a unique set of challenges, particularly in how to pay for the construction and the maintenance of a significantly larger fleet.

Earlier this year, I attended the graduation ceremony for the apprenticeship program at Pearl Harbor Navy Shipyard, which plays a critical role in keeping our Navy fit to fight. Any plan to expand the size of our Navy must provide a simultaneous commitment to continuing shipyard modernization, funding maintenance availability, and developing a skilled workforce to maintain the fleet.

Because her diving certifications have expired, the USS *Boise* is tied up at a pier and will be unable to operate until the Navy overhauls and inspects the boat. The current Navy plan is to fund planning and design in fiscal year 2018 and conduct the overhaul sometime in fiscal year 2019, which means the boat will have sat idle for roughly 2 years before the maintenance begins. It makes little sense for combatant commanders to be asking for more attack submarine deployments while we have a $1 billion submarine tied up at a pier for lack of maintenance.

I am also looking forward to hearing more about impediments to expanding our shipbuilding industry and what our partners can and should do to help in this effort. This testimony that you provide today will be crucial as we try to understand the context with-

in which the Navy has made budgetary decisions for the 2018 budget and future years defense program.

Thank you again, Mr. Chairman, for conducting this hearing. I look forward to the testimony.

Senator WICKER. Thank you, Senator Hirono.

We will begin our testimony at this point with Mr. Cuccias. Thank you, sir, for being here.

STATEMENT OF BRIAN J. CUCCIAS, EXECUTIVE VICE PRESIDENT, HUNTINGTON INGALLS INDUSTRIES AND PRESIDENT, INGALLS SHIPBUILDING

Mr. CUCCIAS. Well, thank you, Chairman Wicker, Ranking Member Hirono, distinguished members of the Seapower Subcommittee. Good morning. My name is Brian Cuccias, and I am honored to address you today, along with my colleagues, on how the shipbuilding industry can help the Navy and the Nation achieve a 355-ship Navy.

Chairman Wicker, I greatly appreciate the attention you are devoting to this critical national initiative.

I would like to thank the subcommittee for its longstanding support for shipbuilding and the Navy and Marine Corps team.

I plan to limit my oral remarks to a brief summary and ask that my written testimony be submitted for the record.

Senator WICKER. Without objection.

Mr. CUCCIAS. I am here today representing Huntington Ingalls Industries which operates two of the Nation's major shipyards; Ingalls Shipbuilding, of which I am President; and Newport News Shipbuilding. Newport News has been building ships for 131 years; Ingalls for nearly 80 years. We also operate Continental Maritime, a small repair yard in San Diego.

Together, we have built more than 2,800 ships, submarines, vessels, including 70 percent of the Navy's fleet of warships. Our three yards employ more than 30,000 shipbuilders. We are the largest employer in the State of Mississippi and the largest industrial employer in the State of Virginia. Supporting the work at these yards are roughly 5,000 suppliers from virtually all 50 States.

We appreciated Chairman McCain's recommendations in January contained in Restoring American Power. This document, coupled with several other studies, including the Navy's own force structure assessment, provides a compelling rationale for increasing the size of the Navy. We are proud to partner with the Navy and Congress in providing the United States with the fleet it needs.

Turning now to the tools and resources industry needs to carry out an accelerated military shipbuilding plan, I will offer several recommendations for your consideration.

First and foremost, leveraging successful platforms on current hot production lines will provide the fastest results. I would note that many of the proposals in Chairman McCain's paper, such as compressing deliveries on *Ford* aircraft carriers to 4 years, building DDGs on 9-month centers, increasing submarine production, and accelerating the LXR program, are all efforts that we ourselves would recommend and are ready now to execute.

In my view, it is a best practice to keep current production lines hot, utilizing existing designs. When the production line is stopped and subsequently restarted, we traditionally experience significant cost as a result of loss of shipbuilder learning. In the 5-year break in production in the DDG program, the first ship in the restart resulted in a labor premium of over 20 percent.

With your help and support, we have kept the LPD line at Ingalls hot and hope to continue to building amphibious ships for the Marine Corps without a break in production. We assumed the benefits of zero production. Costs are coming down in this program, and we are in a position to deliver more capability to the Marines at the program of record cost if we do not break the hot production line.

Second, I cannot underestimate the importance of a steady and predictable funding and a stable shipbuilding plan. Continuing resolutions can impact our business significantly, not only causing delays in meeting milestones but increasing costs. Unpredictable funding is hard for shipbuilders to manage, but it is even more difficult for our suppliers, two-thirds of which are small businesses. A clear and consistent demand signal would go a long way in promoting a healthy, efficient, and productive industrial and supplier base.

Perhaps one of the most impactful tools are procurement strategies such as block buys and multiyear procurement authority. Multiyear procurements provide a demand signal to industry which stabilizes not only the work at our shipyard but also in our suppliers' facilities.

Furthermore, a predictable demand from the government allows us and our suppliers to make facility and human capital investments and process improvements that ultimately will enable us to build ships faster and more affordably.

We encourage Congress to make the broadest use of multi-ship block buy contracts, particularly for mature programs, including amphibious warships, destroyers, aircraft carriers, and submarines. The savings from a multi-ship procurement alone could be as much as $1 billion for amphibious warships and $1.5 billion for aircraft carriers. A multi-ship buy of carriers would not only reduce the cost of these ships but also help stabilize the industrial base that would benefit the overall shipbuilding industry.

Third, I recommend that Congress authorize and fund new ship construction on optimum intervals. This would allow us to deploy our workforce as effectively as possible. For example, the LHA program of record currently has a 7-year gap between LHA–8, which we are now building, and LHA–9. This production break would require us to drastically reduce our LHA workforce, then having to ramp up and retrain a workforce 7 years later. The interval between 3 and 4 years for these ships would enable us to operate most efficiently and return our skilled workforce as well as our supplier base.

Finally, we must invest in infrastructure improvements in our shipyard and our supplier facilities. At Huntington Ingalls, we will invest in $1.5 billion in our shipyards to make sure we are ready to build the future fleet. At Ingalls alone, we are investing hundreds of millions of dollars in recapitalization of the shipyard. We

call it the shipyard of the future. This effort has been strongly supported by not only the corporation but also the State of Mississippi. We need the Federal Government to be a strong partner as well.

These efforts will help accelerate the delivery of our ships to our Navy and Coast Guard, save taxpayer dollars, stabilize the industrial base, preserve American jobs, and improve the security of our great Nation.

Thank you and I look forward to your questions.

[The prepared statement of Mr. Cuccias follows:]

PREPARED STATEMENT BY BRIAN CUCCIAS

Chairman Wicker, Ranking Member Hirono and distinguished members of the Seapower Subcommittee, thank you for inviting me to appear before you to discuss the state of military shipbuilding and share our ideas on how we increase the size of the U.S. Navy's fleet to 355 ships as efficiently and effectively as possible.

I am here today representing Huntington Ingalls Industries, which operates two of our nation's major shipyards: Ingalls Shipbuilding, of which I am the president, and Newport News Shipbuilding, where my colleague Matt Mulherin will soon turn over the reins to Jennifer Boykin. We also own and operate Continental Maritime, a small repair yard in San Diego.

Today I will discuss the investments and improvements we are making at our shipyards to accelerate and make more cost-effective our military shipbuilding efforts. I will also discuss what we recommend are best practices and the tools and resources to fully meet an accelerated shipbuilding plan, including leveraging hot production lines and employing multi-ship procurement strategies.

Newport News has been building ships for 131 years, and Ingalls for over 79 years. Together, we have built more than 70 percent of the Navy's fleet of warships. Our yards employ more than 30,000 shipbuilders, including more than 5,000 engineers and designers. We are the largest employer in the State of Mississippi and the largest industrial employer in the State of Virginia. Supporting the work at both yards are roughly 5,000 suppliers from all 50 states. Throughout our company, we have more than 1,000 employees with 40 years or more with the company; we honor them with the title of Master Shipbuilder.

We build ships that last for decades. In February, we authenticated the keel of the destroyer Frank E. Petersen Jr. (DDG 121). That ship will be still be in service in 2050. At Newport News, the aircraft carrier *Gerald R. Ford* recently successfully completed builder's sea trails. She will be in service until nearly 2070.

We appreciate the widespread support for increasing the size of the Navy's fleet, and we look forward to participating in the dialogue on the best way to do this. We especially appreciate Chairman McCain's recommendations in January contained in "Restoring American Power." This document—coupled with numerous other studies, including the Navy's own Force Structure Assessment—provides a compelling rationale for increasing the size of the Navy. As a partner with the Navy and Congress on providing the nation with the fleet it needs, we are always looking for ways to provide more buying power for our customer.

Before I discuss ways to accelerate our Navy's drive to 355-ships, let me tell you a bit about our industry. Building warships is hard work. These are unbelievably complex machines—challenging to design and challenging to build. We used to measure complexity and capability of a ship by the tons of steel required to build it. While steel still matters, the requirement for life-cycle cost-savings through crew-size reduction and for increased lethality of these weapons systems increases the complexity of the design. For instance, *Ford* contains 10 million feet of electrical cable and 4 million feet of fiber optic cable—a 200 percent increase in the amount of cable over USS *Abraham Lincoln* when she was commissioned in 1989.

Unlike many other Department of Defense acquisition programs, we don't build prototypes, test articles or construct low-rate initial production runs before producing the first ship in a class. The first ship in a class is the prototype; it is commissioned and sent into harm's way and is expected to serve for between 30 and 50 years, depending on the ship class. The idea of not having a prototype is part of the issue with why a first-of-class ship has cost challenges built into the effort. Also unlike many other programs, the construction of one ship will span years and cover multiple budget submissions and legislative cycles.

Shipbuilding is largely outdoor work. Although I will talk later about ways we are providing cover for our shipbuilders, we build ships outdoors, in the heat, cold, sun, wind, rain and snow.

As I mentioned earlier, we are supported by roughly 5,000 suppliers in all 50 states. Our supplier base has seen significant changes as the size of the fleet has decreased.

For nuclear shipbuilding, during the 20-year period between 1977 and 1996, Electric Boat, Newport News and the industrial base delivered almost 90 nuclear ships in the *Ohio-, Los Angeles-, Seawolf-* and *Nimitz*-class programs. The industrial base population during that time was in excess of 17,000 suppliers between both Electric Boat and Newport News. Critical suppliers decreased 27 percent over the years as suppliers left the submarine industry due to low-rate production. Ownership changes and corporate consolidations caused further contraction of the industrial base by an additional 16 percent. For example, major suppliers that left the industrial base during this time included General Electric and Westinghouse, resulting in the components they had provided becoming single-sourced. Overall, the outcome of low-rate production and lead time to enter our marketplace resulted in a reduction in competition and an increase in the number of single- and sole-source acquisitions, which now account for approximately 65 percent of total spend at Newport News. After the major contraction described above, approximately 3,000 suppliers remain to support submarine and CVN programs as first-tier suppliers.

Qualifying to be a supplier is a difficult process. Depending on the commodity, it may take up to 36 months. That is a big burden on some of these small businesses. This is why creating sufficient volume and exercising early contractual authorization and advance procurement funding is necessary to grow the supplier base, and not just for traditional long-lead time components; that effort needs to expand to critical components and commodities that today are controlling the build rate of submarines and carriers alike. Many of our suppliers are small businesses and can only make decisions to invest in people, plant and tooling when they are awarded a purchase order. We need to consider how we can make commitments to suppliers early enough to ensure material readiness and availability when construction schedules demand it.

With questions about the industry's ability to support an increase in shipbuilding, both Newport News and Ingalls have undertaken an extensive inventory of our suppliers and assessed their ability to ramp up their capacity. We have engaged many of our key suppliers to assess their ability to respond to an increase in production.

The fortunes of related industries also impact our suppliers, and an increase in demand from the oil and gas industry may stretch our supply base. Although some low to moderate risk remains, I am convinced that our suppliers will be able to meet the forecasted Navy demand.

Next I would like to address ways to accelerate getting ships to the fleet. We view this as a team effort with our customer, our suppliers and Congress. First I will discuss efforts we are undertaking at our yards, and then I would like to suggest ways that Congress can help us.

Huntington Ingalls Industries has made significant capital improvements across the two yards, and we are investing $1.5 billion over five years in improving our facilities. At Ingalls, we are continuing a set of improvements we refer to as the "Shipyard of the Future" that covers all aspects of shipbuilding, including infrastructure upgrades, process improvements and continuous investment in our workforce. The funds are being provided by a combination of corporate, state and Navy investment.

These initiatives include an improved line of robotics; assembly halls that will facilitate the modular construction of future ships, reducing the time it takes to build those ships; areas and tools that protect our most precious asset, the people of the workforce, to keep them from the elements and give them the ability to be most efficient; as well as the addition of a new dry dock that will replace the current dock that is more than 30 years old with greater displacement, which will provide for increased flexibility and outfitting, allowing for greater completion rates prior to launch.

At Newport News, we are investing nearly $1 billion dollars to build facilities that provide the capability to build the new class of ballistic missile submarines, the *Columbia*-class. We are also investing in facilities to further drive costs out of *Virginia*-class submarines and *Ford*-class carriers with added automation and bringing work indoors, under cover and out of the weather. Additionally, with the help of additional funds from Congress, we are investing in a range of process improvements that we call Design for Affordability (DFA). On the *Virginia*-class submarine program, DFA initiatives have returned $5 for every $1 invested. Given the longer time between construction starts, we expect savings of about $2 for every $1 invested on the *Ford*-class.

Some examples of DFA initiatives that will benefit the *Ford*-class include the implementation of Integrated Digital Shipbuilding (IDS), which saves money by elimi-

nating the need for traditional paper construction drawings by putting a robust, three-dimensional and data-enhanced product model in the hands of the shipbuilders on the deckplate. Our goal is for CVN 80, the third ship in the *Ford*-class, to be a paperless ship. Other DFA initiatives include the use of improved coatings and increasing the size and completeness of "superlifts" to eliminate smaller erection lifts.

On the *Ford*-class, we have also been aggressive in applying lessons learned from CVN 78 to drive costs down on CVN 79, including modifying more than 7,000 items to increase production efficiency and reviewing more than 25,000 recommendations from our shipbuilders. As a result, we have signed a contract on CVN 79 that commits to an 18 percent reduction in man-hours from CVN 78.

Along with our partners at Electric Boat, we have leveraged lessons learned from continuous production and made significant investment in technology, manufacturing techniques and facilities to support aggressive *Virginia*-class submarine cost and schedule reductions. A good example of this is the design and construction of a Supplemental Module Outfitting Facility (SMOF), a covered facility designed for continuous production of VCS bow sections to support a two-per-year VCS construction build rate with reduced man-hours. This facility has significantly contributed to program cost-reductions and the ability to reduce VCS construction time spans from greater than 84 months to less than 66 months.

At Ingalls, in addition to the Shipyard of the Future infrastructure improvements already discussed, we are taking steps to make design choices that improve producibility, streamline our equipment packaging and improve our overall process flow throughout the yard. These efforts are paying off, and I am proud to tell you that right now Ingalls is over 1 million man-hours ahead of schedule across all our ship classes.

Additional investments aside, both yards are relentlessly looking to exploit opportunities for process improvements. We constantly look to move work "upstream" and away from the waterfront. If you've visited our shipyards, you may have heard about the 1–3–8 rule. Consider work done inside a shop, with adequate lighting, ventilation and easy access to tools and materials as costing one "unit" of work. The same work, done in an assembled module, where one of our shipbuilders is working outside, and perhaps working above their head, may cost three "units." Work done on a nearly complete ship, where our shipbuilders have to climb up ladders, often with their tools, and work in increasingly confined spaces and integrate their work with other teams on the ship costs eight times what it would cost in a shop.

We are also investing in our workforce. The skills required are many and varied, and mastery does not occur overnight. We have master craftsmen who are machinists, electricians, welders, pipefitters, crane operators, fabricators and experts at a host of other technical skills. We also employ naval architects, structural engineers, designers, test engineers and a variety of other professionals. It takes three to five years to hire someone off the street, then train and develop him or her into a journeyman-level employee, and it takes an average of eight years to develop a fully certified nuclear pipefitter.

We operate apprentice schools at both shipyards. These nationally recognized schools, with highly competitive application processes, provide us with well-trained, professional shipbuilders who go on to become leaders in the shops and on the waterfront. Several of our vice presidents are Apprentice School graduates. In addition to continuous training, the company has invested in health centers for our employees and their families, and we are now undertaking an effort to increase our employees' financial literacy.

Congress has been very supportive of the shipbuilding industry, but let me suggest ways that we can work better together. All these suggestions will have two things in common: stability and predictability—in design and requirements, in funding, and in schedule.

Maintaining a stable design and stable requirements on short and predictable construction centers provides us a foundation to make the process improvements I spoke about earlier. As I said, building a complex warship is a multi-year endeavor. Although it is difficult, we try to replicate the benefits you would expect from an assembly line as much as possible. My goal is to have one of my teams finish performing a set task on one ship and then move immediately to perform the same task on the next ship. This is really where we see savings. This practice also allows for innovation to come from our shipbuilders. When they are allowed to repeatedly perform the same task, not only do they get really good at it, they figure out ways to do it better.

Stability and predictability in funding allows us and our suppliers to properly plan and make long-range hiring plans. At Newport News, we are still feeling the effect of decisions made as a result of sequestration after the passage of the Budget

Control Act. Until Congress acted forcefully, the Navy had proposed delaying the refueling and complex overhaul of the aircraft carrier USS *George Washington*. This delay was one of the major factors in the difficult decision to lay off 1,500 Newport News shipbuilders in 2015 and 2016. Newport News is now hiring shipbuilders as work begins to climb back up—what we call "green labor," new shipbuilders lacking experience, where training is very expensive.

Along with a stable design, the intervals at which we begin construction, what we refer to as centers, have to be set correctly to let us optimize the learning I just discussed. We were pleased that Chairman McCain, in "Restoring American Power," recommended accelerating production of the *Ford*-class aircraft carriers to four-year centers to support an increase to 12 CVNs. If the construction intervals get too long, it is like we are starting at square one again. For instance, the optimal production rate for *LHA*-class amphibious ships is between three and four years, depending on some variables. Presently, the program of record reflects a break in production between LHAs 8 and 9 of 7 years, which would result in a cost increase of as much as $700 million above the optimal build plan. In another example, we experienced a five-year break in production in the *Arleigh Burke*-class destroyer program between DDGs 110 and 113, which resulted in a vessel labor cost increase of more than 20 percent for the first ship in the restart. These disruptions to the optimal build interval ripple through the industry down to our suppliers, many of whom are not as well situated as Ingalls to weather the ups and downs.

I strongly believe that the fastest results can come from leveraging successful platforms on current hot production lines. We commend the Navy's decision in 2014 to use the existing LPD 17 hull form for the LX(R), which will replace the *LSD*-class amphibious dock landing ships scheduled to retire in the coming years. However, we also recommend that the concept of commonality be taken even further to best optimize efficiency, affordability and capability. Specifically, rather than continuing with a new design for LX(R) within the "walls" of the LPD hull, we can leverage our hot production line and supply chain and offer the Navy a variant of the existing LPD design that satisfies the aggressive cost targets of the LX(R) program while delivering more capability and survivability to the fleet at a significantly faster pace than the current program. As much as 10–15 percent material savings can be realized across the LX(R) program by purchasing respective blocks of at least five ships each under a multi-year procurement (MYP) approach. In the aggregate, continuing production with LPD 30 in fiscal year 2018, coupled with successive MYP contracts for the balance of ships, may yield savings greater than $1 billion across an 11-ship LX(R) program. Additionally, we can deliver five LX(R)s to the Navy and Marine Corps in the same timeframe that the current plan would deliver two, helping to reduce the shortfall in amphibious warships against the stated force requirement of 38 ships.

Multi-ship procurements, whether a formal MYP or a block-buy, are a proven way to reduce the price of ships. The Navy took advantage of these tools on both *Virginia*-class submarines and *Arleigh Burke*-class destroyers. In addition to the LX(R) program mentioned above, expanding multi-ship procurements to other ship classes makes sense.

This is important to remember when we consider procuring an icebreaker for the U.S. Coast Guard. We are looking forward to participating in that competition, but we hope it will be a production run of at least three ships. Given the amount of design, engineering, planning, hiring and learning that goes into a new ship class, contracting for just a single ship puts us and our suppliers in a tough spot.

The most efficient approach to lower the cost of the *Ford*-class and meet the goal of an increased CVN fleet size is also to employ a multi-ship procurement strategy and construct these ships at three-year intervals. This approach would maximize the material procurement savings benefit through economic order quantities procurement and provide labor efficiencies to enable rapid acquisition of a 12-ship CVN fleet. This three-ship approach would save at least $1.5 billion, not including additional savings that could be achieved from government-furnished equipment. As part of its Integrated Enterprise Plan, we commend the Navy's efforts to explore the prospect of material economic order quantity purchasing across carrier and submarine programs.

In closing, let me reiterate that I appreciate the opportunity to address you today. The size and capability of a nation's Navy has long been a measure of that nation's strength, both to deter foes that would do us harm as well as assure friends that stand with us. We are partners with Congress, the Navy and our supply chain in building the fleet the nation needs at a price it can afford. We will continue to provide solutions and identify ways to increase productivity and lower costs.

Senator WICKER. Thank you.

Mr. Casey, you are recognized.

STATEMENT OF JOHN P. CASEY, EXECUTIVE VICE PRESIDENT, MARINE SYSTEMS, GENERAL DYNAMICS

Mr. CASEY. Chairman Wicker, Ranking Member Hirono, members of the committee, thanks a lot for this invitation to testify today and for the committee's long history of support for shipbuilding programs.

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

Ranking Member Hirono, I wish you a speedy recovery. It is quite remarkable to see you here today and happy that you made it.

So at General Dynamics Marine Systems is organized as three autonomous shipyards. Bath Iron Works builds Navy destroyers. Electric Boat, submarines. NASSCO builds Navy auxiliary ships as well as commercial vessels. We have facilities in nine States: Maine, Rhode Island, Connecticut, Virginia, Georgia, Florida, California, Washington, and Hawaii. As you stated, we have about 25,000 people, a paltry sum compared to my partner here.

So our initial conclusion right up front here is, yes, we can scale up. We do agree that hot production lines are a smart way to go, along with the planned expansion necessary to build *Columbia.*

We are working closely with the Navy in Newport News on this integrated enterprise plan. That includes an analysis and evaluation of our 5,000 vendors that support the nuclear industrial base across all 50 States.

So let me just talk a little bit of history here. I think Brian and I have both been in the business about 4 decades. So I thought it would be useful to think back about where we came from.

The first decade of those four, we were building one SSBN and three SSNs collectively across the industry. It is about five times the number of ships we built in the last decade, so to speak, in terms of displacement tons of ships being built.

Along came the *Seawolf* program viewed as the future of the fast attacks, and it was originally a 30-ship program and it was canceled in January of 1992. Groton and Quonset went from about 18,000 shipyard folks, not counting the engineers, down to about 25,000. No fun for me. A lot of my friends and neighbors had to be laid off along the way. Our supply base went from about 9,000 to 3,000 after being in a peak in the Cold War of about 17,000.

So coming from where we have been in the last 10 to 20 years to where we have to go just to meet the Navy's current fiscal year 2017 shipbuilding plan goes back to three times the past decade or so. So we were at five times down to the 20 years. Now we go back up to three times. So it is probably not quite a little over half of where we were. That is driven partially by the *Virginia* payload module 84-foot hull section, along with the *Columbia,* which I think we all would agree is the Nation's highest priority at this point in time.

So there are three areas that require close attention with this growth, and we do not take any of those lightly and we pay close attention.

So first is facilities and capital equipment. Both companies have expansion plans, and at the end of that, EB would be expecting to be able to deliver one SSBN and two VPM SSNs, *Virginia* payload module fast attacks, per year.

The labor resources need to be increased. We have unique skills, as everybody I think understands. But probably what is not well understood is we have hired 10,000 people since 2011. We have done that by developing partnerships with the United States Department of Labor, the Rhode Island and Connecticut governors, technical community colleges, technical high schools, and we have internal active learning centers that support that.

We have also re-engineered the hiring process. What used to take 163 days will be at 45 days by the end of the year. Frankly, the only hiccup we have had in the hiring is getting security clearances processed, which is a government-controlled process that has been difficult to work through.

Senator WICKER. Now, say that again because I am kind of slow.

Mr. CASEY. When you come to work in the nuclear industry to work in the shipyard in most locations, you require a security clearance. Those are granted by the government. So we make application for those, and we would like it to take a few weeks. It has been taking months to process an interim clearance, let alone a permanent clearance. So that slows our ability to get people into the workforce. We have had some of our Representatives and so forth try to deal with the agencies in the government that make that happen.

Senator WICKER. So is it getting better or worse?

Mr. CASEY. I think it is getting better but not by a lot.

Then the third and equally important, which you asked about, is the supplier capability and capacity. So we believe we have to expand the number of suppliers, the processes in which they are qualified, and the capacity of each of those vendors. We would propose early, non-recurring funding of those vendors. The EOQ, economic order quantity, process has been very supportive and needs to continue and the advanced procurement process as well.

So those three things are what we would propose.

We would also internally program for longer lead times and particularly on the qualified critical suppliers and/or to qualify new critical suppliers. We say we have 5,000 suppliers. That is a real number. In reality, there is about 150 critical suppliers based on the size of what they build, the complexity of what they build, or the cost of what they build.

We work closely with Matt and his Shipbuilding Council of America, along with the American Shipbuilders Suppliers Association, the Marine Machinery Association, the Submarine Industrial Base Council, and the Aircraft Carrier Industrial Base Council, to make sure we are touching the suppliers in every way we can to make sure they understand what is coming and what activity is necessary.

So we just talked about the Navy's 2017 plan. Let us think about how does that compare to the 355-ship plan.

So, first off, if there are going to be 355 ships, we believe efforts need to start immediately like in fiscal year 2018, not in 2019, not in 2020. It needs to start immediately.

We also want to confirm what is the objective. I mean, we get to 355 by when? If we are going to get there by the middle of the 2030s, by the middle of the 2040s, or at some other point in time makes a big difference in terms of the capacity that is required. We are evaluating right now two scenarios: three submarines per year and four submarines per year, including *Columbia*.

Industry has a challenge of its own and a responsibility. With certainty of volume and predictable returns, we have to make investment decisions. We have to decide when and how much to scale the workforce, and we have to time our material procurement.

What can we hope the government will support? As Brian said, multiyear and block procurement contracting authority, various capital incentives which exist to help make sure that the investments that are acquired are not negative to our earnings and cash for a decade in the future. Those things have all been done in the past: accelerated depreciation, accelerated cash, GOCO facilities, special fixtures and features, and recovery commitments, if you will, if programs get canceled.

So we would like to propose and we are evaluating in our industrial enterprise work $400 million of funding starting in 2018, the first increment in 2018, $150 million, to make sure we can get vendors up on the step, qualify new vendors, and get us back in the place where we have more people to choose from basically. We think the acceleration of advanced procurement and economic order quantity on the block V ships, which we know we are going to build, we know when we are going to build them, will help get the industrial base jump-started. It will help the vendors get into the mode of producing at higher levels. We also think authorization of production spares can support that.

So to wrap up on the submarine side, we are ready to accelerate this historical precedence for what has been asked to be done. We understand the challenges associated with that, and we take them very seriously. It is not something we take lightly.

Although I was asked to focus on submarines, I think it is important just to talk a little bit about the surface side of General Dynamics starting with Bath Iron Works. We understand the plan would be four DDGs per year split between Bath and Ingalls. Frankly, in the decade of 1994 to 2004, we were at two destroyers, two DDG 51 destroyers, at Bath. So we believe the existing facilities that Bath has are adequate. We got to focus on training. Frankly, going to two DDGs per year at Bath would avoid what otherwise is going to be an employment reduction. So it is not so much we are concerned about having to hire a lot. We got to try to make sure we maintain stability there by one to two DDG 51s per year.

At NASSCO, we understand the challenge to be three more ESBs, the expeditionary support bases, two T–AO's per year beyond the one today. Frankly, NASSCO is very similar to Bath. In order to get back to where we were last year, we would require that kind of volume on the Navy side. Last year, we delivered six commercial tankers out of NASSCO, probably a record certainly for that shipyard and maybe for any shipyard. But those contracts are wrapped up. The very last one of those eight tankers is at sea

today as we speak undergoing trials. It should be back sometime today before the day is over.

So, Chairman Wicker, Ranking Member Hirono, and members, that concludes my summary of my comments of my written testimony. I would be glad to take any questions and help in any way I can in this process.

[The prepared statement of Mr. Casey follows:]

PREPARED STATEMENT BY JOHN P. CASEY

Chairman Wicker, Ranking Member Hirono, members of the Seapower Subcommittee, thank you for your invitation to testify today and for the committee's long history of support for United States Navy shipbuilding.

Following a brief introduction of the General Dynamics Marine Systems shipyards, this testimony will address the issues requested in your invitation letter, specifically, the ability of our shipyards to support increased shipbuilding demand with a focus on the Submarine Industrial Base. The Submarine Industrial Base has unique challenges which will be discussed in detail.

INTRODUCTION TO GENERAL DYNAMICS MARINE SYSTEMS SHIPYARDS

The General Dynamics Marine Systems business segment includes three major business units: Bath Iron Works, Electric Boat, and NASSCO. Bath Iron Works operates one full-service shipyard in Bath, Maine, plus several fabrication and engineering facilities in the surrounding area. Electric Boat operates a full-service shipyard in Groton, Connecticut, a submarine module fabrication facility in North Kingstown, Rhode Island, and an engineering and design facility in New London, Connecticut. Electric Boat also has employees located in Honolulu, Hawaii; Washington, DC; and the submarine homeports in Kings Bay, Georgia; Pearl Harbor, Hawaii; Portsmouth, Maine; Bangor, Washington; Bremerton, Washington; and Norfolk, Virginia. NASSCO operates one full-service shipyard in San Diego, California, and four repair shipyards in Norfolk, Virginia; Portsmouth, Virginia; Mayport, Florida; and Bremerton, Washington. Combined, these shipyards employ more than 25,000 people. The group designs, builds, repairs and supports submarines, surface combatants, auxiliary ships for the United States Navy, and commercial ships for the U.S. Jones-Act commercial market.

BATH IRON WORKS

Bath Iron Works (BIW), located on the Kennebec River in Bath, Maine, since 1884, delivered its first ship to the United States Navy in 1893. Since then, BIW has delivered 256 military ships. BIW is the lead designer for both classes of U.S. Navy destroyers that are currently in production—the DDG 51 and the DDG 1000-class destroyers. BIW's Planning Yard activities sustain 77 percent of the Navy's active surface combatant fleet, offering a full range of surface combatant engineering, design, production support, and lifecycle support services. BIW is Maine's largest single-site private employer with over 5,800 highly skilled engineers, designers, and shipbuilders who, on average, have over 17 years of ship design and construction experience.

ELECTRIC BOAT

Electric Boat, headquartered in Groton, Connecticut, has been designing, building, and repairing submarines for the U.S. Navy since 1899. Starting with the first nuclear submarine, the USS *Nautilus,* Electric Boat has designed and built the lead ship for 17 of the 20 U.S. nuclear submarine classes, and has delivered a total of 103 nuclear submarines to the U.S. Navy from the Groton shipyard. Electric Boat employs 15,200 engineers, designers, and tradespeople focused on the design, construction, repair and lifecycle support of nuclear submarines. Electric Boat is currently building *Virginia*-class submarines and designing the lead ship of the *Columbia* Program, the next SSBN.

NASSCO

NASSCO's primary facility, located in San Diego, California, has designed, built and delivered 134 new ocean-going vessels (Navy and commercial) over the last 57 years. This facility is the only remaining private, full-service shipyard on the West Coast designing, building, and repairing large vessels for the U.S. Navy and com-

mercial Jones-Act customers. NASSCO is the largest industrial manufacturer in San Diego, employing 3,100 engineers, designers, and skilled shipbuilding craftspeople, plus 300 long-term, on-site subcontractor partners supporting the shipyard. NASSCO is currently building expeditionary sea bases and cargo ships for commercial customers. NASSCO also has a presence in four Navy homeports where its 700 employees and 300 subcontractor partners conduct surface ship repair for the U.S. Navy.

INTRODUCTION

General Dynamics Marine Systems supports the efforts of the Administration and the Congress to build a larger fleet for the U.S. Navy. It is our belief that the Nation's shipbuilding industrial base can scale-up hot production lines for existing ships and mobilize additional resources to accomplish the significant challenge of achieving the 355-ship Navy as quickly as possible.

This testimony will discuss what the General Dynamics shipyards must do to support the current U.S. Navy 30-year Shipbuilding Plan and what additional effort is required if more ships and submarines were to be authorized by the Congress to achieve the new fleet levels identified in the December 2016 U.S. Navy Force Structure Assessment. General Dynamics cannot speak for Newport News Shipbuilding on this subject except to note where both companies have been working closely together on an Integrated Enterprise Plan focused on co-production of both *Virginia* and *Columbia*-class submarines and carriers where appropriate (e.g., common suppliers etc.) and associated impacts to facility plans, trade resource plans, and supply base.

The Nuclear Submarine Industrial Base, which includes Electric Boat, Newport News Shipbuilding, and over 5,000 highly specialized suppliers in all 50 states, provides material and components for these national assets. Supporting a plan to achieve a 355-ship Navy will be the most challenging for the nuclear submarine enterprise. Much of the shipyard and industrial base capacity was eliminated following the steep drop-off in submarine production that occurred with the cancellation of the *Seawolf* Program in 1992. The entire submarine industrial base at all levels of the supply chain will likely need to recapitalize some portion of its facilities, workforce, and supply chain just to support the current plan to build the *Columbia*-class SSBN program, while concurrently building *Virginia*-class SSNs. Additional SSN procurement will require industry to expand its plans and associated investment beyond the level today. After discussing the Submarine Industrial Base, this testimony will conclude with a brief review of the capability of our two surface ship construction shipyards, Bath Iron Works in Bath, Maine and NASSCO in San Diego, California, to support new prospective scenarios of increased shipbuilding demand, leveraging the work recently completed by the Congressional Budget Office (CBO).

SUBMARINE INDUSTRIAL BASE

HISTORICAL PERSPECTIVE

The production of a new class of SSBNs to support the Navy's strategic deterrent mission has occurred only twice before in our shipbuilding history. The "41 for Freedom" SSBNs were constructed by four shipyards over the 9-year period from 1957 to 1966. These submarines were replaced by 18 *Ohio*-class SSBNs, all built by Electric Boat over a 23-year period from 1974 to 1997. The lead ship USS *Ohio* (SSBN726) was delivered in 1981 and subsequent ships of that class joined the fleet at a rate of one ship-per-year in steady state continuous production. During this period of *Ohio*-class construction, Electric Boat also delivered 33 *Los Angeles*-class SSNs. The first EB delivery of a *Los Angeles*-class SSN was the USS *Philadelphia* (SSN690) in 1977 and the last was the USS *Columbia* (SSN771) in August 1995, an average rate of 1.7 SSN deliveries per year. The combined rate of submarine deliveries from Electric Boat was 2.7 submarines per year. During the same period, Newport News also delivered 29 *Los Angeles*-class SSNs. The lead ship USS *Los Angeles* (SSN688) was delivered in 1976 and their last ship USS *Cheyenne* (SSN773) was delivered in 1996, with an average rate of 1.5 SSNs per year. The combined capability of the two nuclear submarine shipyards and the associated 17,000 suppliers delivered 4.2 submarines per year consisting of one SSBN and 3.2 SSNs per year.

Therefore, as you can see, the last time the industry built a class of SSBNs, we also delivered more than three SSNs per year. In fact, over the period from 1977 to 1996, our submarine enterprise delivered 65 SSNs and 17 SSBNs for about 770,000 tons of submarine displacement. However, the industry has been away from these levels of production for some time.

The most recent 20 years, from 1997 to 2016, has been a very different story. The follow-on SSN to the *Los Angeles*-class SSN was the *Seawolf* Program. Originally a 30-ship program, it started construction in 1989, the year the Berlin Wall came down. That program was cancelled in January 1992 with the plan to only complete construction of the lead ship, USS *Seawolf* (SSN21). Funding for the second *Seawolf* submarine was restored by the Congress and construction began later that year in September. The program was later restored to three *Seawolf*-class SSNs by the Congress with $700 million appropriated in November 1995 as a bridge to the follow-on *Virginia*-class SSN, which was to start construction in 1998 after a period of design development. The lack of stability on the *Seawolf* Program is one thing people still remember when they make investment decisions in new facilities and workforce development. The backlog in submarine work in 1989 was 32 (19 at EB and 13 at NNS), and by 1997, the backlog was three (all EB).

During the course of the 1990's, the submarine industrial base "rationalized" its facilities, skilled workforce, and unique supply base to survive in a period of very low rate submarine production. There were five years in the 1990's when no SSNs were authorized (fiscal year 2092, fiscal year 2093, fiscal year 2094, fiscal year 2095 and fiscal year 2097). For example, Electric Boat had four final assembly positions dedicated to the *Los Angeles*-class construction program and two final assembly positions dedicated to the *Ohio*-class construction program. Upon completion of the *Los Angeles*-class build program, the *Los Angeles*-class assembly positions were mothballed, reducing the Groton shipyard's final assembly capability to two positions. The skilled trade workforce at the Groton shipyard was reduced from over 12,000 at peak demand in the early 1980's to about 1,500 by the time *Virginia*-class started construction in 1998. Quonset Point peaked at 6,000 skilled workers and its workforce was reduced to less than 1,000 over the same period. Furthermore, the supply base started the 1990's with 9,000 suppliers (Cold War peak was 17,000) and was reduced to 3,000 suppliers by the end of that decade.

Electric Boat had several off-site fabrication and assembly locations (e.g., Charleston, SC at 400K sq.ft of facilities and Avenel, NJ at 400K sq.ft), as well as significant laydown and warehouse capacity in and around Groton, CT and at Quonset Point (which was 2.2 million sq.ft of facilities during the previous peak). This expanded footprint and capacity available during the previous peak construction period was eliminated during the decline to low rate production. Similarly, NNS had offsite machining and fabrication facilities in Asheville, NC and Greeneville, TN, both of which were shuttered as shipbuilding demand declined. During this period of decreased build rate and low volume, work was moved from shipyard satellite facilities and the supply base back to the Shipbuilder to maintain critical skills as we adjusted to average build rates of *Virginia*-class SSN per year at each shipyard (low point in year 1999).

The last 20 years from 1997 to 2016 marks a period of low rate production for the submarine enterprise, where 16 SSNs and one SSBN were delivered, for a total tonnage of 150,000 tons of combined submarine displacement. This represents a reduction of 80 percent from the prior 20-year period when we delivered 4.2 submarines per year.

TODAY'S SUBMARINE ENTERPRISE CAPABILITY

The *Virginia*-class SSN started construction in 1998 and was initially procured at a rate of one SSN per year. The Shipbuilders implemented a co-production team agreement in 1997 to effectively share the production at SSN per year with one SSN delivery from each shipyard every two years on an alternating basis. This approach was sufficient to maintain the requisite critical skills at both shipyards for nuclear submarine construction and delivery.

The *Virginia*-class SSN production rate doubled starting in 2011 and has continued at that rate ever since. The Submarine Industrial Base has facilitized over the last five years to support this step change in demand from one SSN per year to two SSNs per year. These submarines have been procured over the last 18 years under one block buy contract (i.e., Block I, four ships fiscal year 1998 to fiscal year 2002), followed by three separate multi-year contracts (Blocks II, III, IV, 24 ships, fiscal year 2003 to fiscal year 2018), which provided stability in the acquisition process and encouraged private investment across the entire submarine value chain. The successes in cost reduction and the dramatically reduced production cycle times that we achieved in this program would have been impossible without the committee's support for multi-year procurement.

We are currently under contract to build 15 Block III and IV *Virginia*-class submarines, and the President's fiscal year 2018 budget is expected to request your authorization for the final two Block IV submarines in that multi-year procurement

(i.e., fiscal year 2014 to fiscal year 2018). The Shipbuilders urge the Committee to continue its support of multi-year authority for this program in all subsequent blocks of *Virginia*-class.

Key facilities were added at both shipyards to support the increased production rate from one SSN per year to two SSNs per year. A CAPEX incentive feature in the Block III contract supported corporate capital investment required for two *Virginia*-class SSNs per year. A total of 27 projects between the two shipbuilders were completed for a total of $258 million in capital investment, which supported all facility asset categories, including capital equipment, module construction facilities, transportation equipment, and final assembly, test and launch facilities. For example, Quonset Point added a $50 million module fabrication facility in 2012, and in 2013, we added a $24 million coatings facility with two specialized coatings cells as part of Electric Boat's overall capital investment plan.

Today, each shipyard has two submarine final assembly positions for a total of four positions at the enterprise level that are dedicated to deliver one *Virginia*-class SSN per year from each shipyard. The waterfront organizations at each shipyard have modules from five different *Virginia*-class SSNs in various states of final assembly and test. *Virginia*-class SSN delivery at one per year from each waterfront is just starting to be demonstrated. At Electric Boat, the delivery of the Colorado (SSN788) later this summer will demonstrate the shift in waterfront cadence from one SSN delivery every two years to one SSN delivery every year.

The facilitization that has occurred to date at both nuclear shipyards supports continuation of the *Virginia*-class construction program which is in steady state production at two submarines per year for the foreseeable future.

SUPPORTING THE INCREASED DEMAND ASSOCIATED WITH THE NAVY'S FISCAL YEAR 2017 SHIPBUILDING PLAN

The Navy's 30-year shipbuilding plan, issued in July 2016, is summarized in the figure below for the period that covers the *Columbia* authorization years. The submarine enterprise at all levels of the value chain has been working hard to develop facility and workforce development master plans and establish associated investment plans to support this plan of record.

We have been told by the Navy that we should be prepared to execute a plan that would add a second *Virginia*-class SSN with *Virginia* Payload Module (VPM) in fiscal year 2021, so Block V is expected to be a 10-ship block rather than 9 ships. This would keep *Virginia*-class SSN procurement at two SSNs per year through fiscal year 2023 with three submarine authorizations in fiscal year 2021 (two VCS and one *Columbia*).

There are two major new demand drivers in this plan of record. The first is the *Virginia* Payload Module (VPM) which is an 84' hull section with four centerline large-diameter tubes that is inserted into the class design for additional payload capability. The VPM will provide additional payload capacity in each *Virginia*-class submarine to partially offset the loss in payload capacity from the four *Ohio*-class SSGNs that will begin to come out of service starting in 2026. This configuration of the *Virginia*-class SSN is planned for all subsequent *Virginia*-class SSNs starting in 2019 (ship two of that year). The VPM will increase the volume of work at the shipyards and in the supply base by about 28 percent based on displacement.

The second major demand driver is the *Columbia*-class SSBN construction program which is expected to be for 12 submarines and will reach steady state production starting with the fiscal year 2026 ship authorization. Each *Columbia*-class SSBN is more than double the displacement of a *Virginia*-class SSN. The *Columbia* construction program begins in fiscal year 2021, two years after the *Virginia* Block V fiscal year 2019 award.

The figure below illustrates the challenge in the submarine industrial base. Delivered nuclear submarine capability on an annual basis as measured by submerged displacement is plotted for different demand scenarios. As the chart illustrates, the major inflection points since the beginning of the *Virginia*-class SSN program are captured on the x-axis. The transition to two *Virginia*-class SSNs per year (doubling of demand) is occurring from 2016 to 2023. This is followed by a brief three-year period of increased demand at 28 percent for VPM. In the steady state, the annual demand jumps to double or triple, depending on the procurement rate of *Virginia*-class SSNs, either two *Virginia*-class SSNs per year or three, as noted in the figure below.

GROWTH IN SUBMARINE TONNAGE PER YEAR—DELIVERED SUBMARINE CAPABILITY

Over the next 20-year period that starts in 2017, the Submarine Industrial Base is expected to deliver 32 SSNs, 16 with the VPM configuration, and the first 8 *Co-*

lumbia-class SSBNs based on the Navy's fiscal year 2017 30-year Navy Shipbuilding Plan. The increase in demand, just to support the Navy's fiscal year 2017 Shipbuilding Plan of Record, is three times the level of the last 20 years that ended in 2016 (an increase of greater than 200 percent), with a projected 454,000 tons of delivered submarine displacement. In this plan of record scenario, *Virginia*-class procurement would drop to one SSN per year starting in 2026 when the *Columbia* is expected to reach steady state production at one SSBN per year. At this point, the production rate for the submarine enterprise is two submarines per year, one SSBN and one SSN (with VPM).

The two nuclear submarine shipbuilders, Electric Boat and Newport News Shipbuilding, have been working an Integrated Enterprise Plan (IEP) to address the impacts to each company's skilled workforce, facilities, and supply base of this new shipbuilding era marked by the generational increase in demand of multi-class construction.

The two companies signed a team agreement in March 2015 to co-produce the *Columbia*-class SSBN and amended that agreement in February 2016 to be consistent with the Navy's Submarine Unified Build Strategy (SUBS). The approach maintains a plant focus for major module construction between the *Columbia* and *Virginia*-class submarines (e.g., Newport News builds bows for both programs, Electric Boat builds missile compartments for both programs, etc.).

There are three major resource areas that affect the Shipbuilders' ability to increase nuclear submarine production:

- Shipyard facilities and capital equipment
- Skilled shipyard trade and support labor resources
- Supply base capability and capacity

FACILITIES AND CAPITAL EQUIPMENT

Shipyard facilities and capital equipment under the current co-production plan for SSNs and SSBNs (i.e., the Navy's SUBS–E Plan) consists of the combined assets of the two nuclear shipbuilders, including hull fabrication facilities, modular manufacturing and outfitting facilities, final assembly, test and launch facilities, transportation assets, and post launch facilities.

Each shipyard has developed a Facility Master Plan that adds assets to support *Virginia* Payload Module construction or *Columbia*-class construction. Under the plan of record scenario, both companies are expanding shipyard module construction and final assembly capabilities and adding module transportation assets to support the build plans of both programs at the required levels. For example, at Electric Boat, we will be adding additional hull fabrication facilities and tooling to support the increased demand associated with the Block V *Virginia* Payload Module. Module fabrication and outfitting facilities are being added to the Quonset Point footprint starting next year. The current plan adds up to 575,000 square feet of new facilities to support the plan of record. Newport News Shipbuilding is also adding facilities to its shipyard to support the increased volume associated with multi-program construction of bows and sterns, among other modules.

Electric Boat and Newport News Shipbuilding are both working to expand final assembly capabilities to support increased combined throughput of submarine deliveries. As in the past, Electric Boat is evaluating whether to maintain separate facilities for SSN and SSBN final assembly and launch. The two final assembly and launch facilities on the Groton waterfront would be capable of delivering one SSBN per year (from a new South Yard facility with two final assembly positions) and up to two SSNs per year (from the existing North Yard facility that will be modified for VPM). Supporting this plan requires an investment that is currently estimated to be greater than $1.5 billion over the next 10 years.

In a similar fashion, Newport News is modifying its Modular Outfitting Facility (MOF) to place into service two additional final assembly positions, bringing its total shipyard capacity to four final assembly positions. This configuration will support a higher throughput of *Virginia*-class deliveries with VPM.

LABOR RESOURCES

Shipyard labor resources include the skilled trades needed to fabricate, build and outfit major modules, perform assembly, test and launch of submarines, and associated support organizations that include planning, material procurement, inspection, quality assurance, and ship certification. Since there is no commercial equivalency for Naval nuclear submarine shipbuilding, these trade resources cannot be easily acquired in large numbers from other industries. Rather, these shipyard resources must be acquired and developed over time to ensure the unique knowledge and know-how associated with nuclear submarine shipbuilding is passed on to the next

generation of shipbuilders. The mechanisms of knowledge transfer require sufficient lead time to create the proficient, skilled craftsmen in each key trade including welding, electrical, machining, shipfitting, pipe welding, painting, and carpentry, which are among the largest trades that would need to grow to support increased demand. These trades will need to be hired in the numbers required to support the increased workload. Both shipyards have scalable processes in place to acquire, train, and develop the skilled workforce they need to build nuclear ships. These processes and associated training facilities need to be expanded to support the increased demand. As with the shipyards, the same limiting factors associated with facilities, workforce, and supply chain also limit the submarine unique first tier suppliers and sub-tiers in the industrial base for which there is no commercial equivalency.

Electric Boat has reengineered hiring to improve recruiting, streamline processes, and reduce the time to recruit new talent in order to appeal to the next generation of prospective shipyard workers. At Electric Boat, the time from application to start has been reduced from 163 days to 60 days with the goal of getting to 45 days by the end of this year. Electric Boat has increased hiring since 2011 when *Virginia*-class construction increased from one ship per year to two ships per year. Quonset Point has hired over 3,200 people since 2011, and Groton has hired about 3,300.

Electric Boat has established partnerships with the Department of Labor, State Governors, and their respective workforce development organizations to implement pipeline programs aimed at acquiring and training the requisite number of people in the skilled trades we need in submarine construction. Electric Boat has also established partnerships with area technical community colleges that are currently sized to support training for over 3,000 tradesmen per year and embedded maritime trade curriculum into eight area career and technical education (CTE) schools in Rhode Island. This year, Electric Boat reinstituted apprentice programs in Groton for skilled trades and draftsmen, and plans to kick off an apprentice program at Quonset Point next year. Electric Boat also increased the effectiveness of internal training programs through active learning centers that provide training aids and mock-ups that deliver more hands-on learning. These active learning centers are designed to appeal to how people learn today and have reduced the time to develop proficiency for new hires on basic skills, as well as teach advanced skills. Lastly, Electric Boat's operations supervision and leadership programs, which draw on area colleges for content and instruction, have also been improved to increase volume and throughput.

We provide our demand signals for skilled trades to our community partners to support future growth and offer competitive employment opportunities at the end of the line, which is a win-win for all involved.

SUPPLY BASE CAPABILITY AND CAPACITY

The supply base is the third resource that will need to be expanded to meet the increased demand over the next 20 years. During the OHIO, 688 and SEAWOLF construction programs, there were over 17,000 suppliers supporting submarine construction programs. That resource base was "rationalized" during submarine low rate production over the last 20 years. The current submarine industrial base reflects about 5,000 suppliers, of which about 3,000 are currently active (i.e., orders placed within the last 5 years), 80 percent of which are single or sole source (based on $). It will take roughly 20 years to build the 12 *Columbia*-class submarines that starts construction in fiscal year 2021. The shipyards are expanding strategic sourcing of appropriate non-core products (e.g., decks, tanks, etc.) in order to focus on core work at each shipyard facility (e.g., module outfitting and assembly). Strategic sourcing will move demand into the supply base where capacity may exist or where it can be developed more easily. This approach could offer the potential for cost savings by competition or shifting work to lower cost work centers throughout the country. Each shipyard has a process to assess their current supply base capacity and capability and to determine where it would be most advantageous to perform work in the supply base.

Today, the Shipbuilders have approximately 147 critical suppliers based on contract value, part complexity, and current risk profile. Some of the suppliers are common between the two Shipbuilders and GFE prime contractors, making it more difficult to meet the demand challenges ahead of us. In response, the Shipbuilders have engaged the Tier-1 suppliers (i.e. survey and visits), and made additional inquiries of the second and third tier suppliers, to ascertain capacity and capability shortfalls with the advancing build-rate increase. The Shipbuilders anticipate the information gleaned from these inquiries to be the first step toward identifying critical capacity shortages at the Tier-1 suppliers, as well as pinch-points at the second

and third tiers. The Shipbuilders further anticipate that much of the capacity shortfall will reside in the second and third tiers (e.g., ball valve castings & forgings for bodies, pump housings, motor bearings, etc.) and will require expansion of both the number of critical suppliers as well as select process capacity (e.g., non-destructive testing) within existing suppliers. In addition, the increase may offer opportunities, in some cases, to create new Tier-1 suppliers, thereby gaining additional resiliency and creating competition for critical components to further reduce material costs.

Achieving the increased rate of production and reducing the cost of submarines will require the Shipbuilders to rely on the supply base for more non-core products such as structural fabrication, sheet metal, machining, electrical, and standard parts. The supply base must be made ready to execute work with submarine-specific requirements at a rate and volume that they are not currently prepared to perform. Preparing the supply base to execute increased demand requires early non-recurring funding to support cross-program construction readiness and EOQ funding to procure material in a manner that does not hold up existing ship construction schedules should problems arise in supplier qualification programs. This requires longer lead times (estimates of three years to create a new qualified, critical supplier) than the current funding profile supports.

The Extended Enterprise initiative is an enabler to support higher demand in the nuclear ship enterprise. In the past, insufficient supplier and shipbuilder capacity and readiness have been some of the most significant contributing factors for lead ship overruns and cost growths in major shipbuilding programs. CBO reported in its analysis of the Navy's fiscal year 2017 shipbuilding plan that cost growth in lead ships almost always exceeds 10 percent and has averaged 45 percent (27 percent weighted average) for the most recent ships. Being prepared via this funded effort will result in cost mitigation and/or cost avoidance.

Funding of $400 million over a 3-year period starting in 2018 is required for supplier base development. This funding is needed to "prime the pump", help identify pinch points in the supply chain (which are more likely to be in the sub-tier supply base), and establish capacity and capability ahead of the significant increase in VCS (with VPM) *Columbia* and CVN demand. Additionally, the investment is needed at an important inflection point in history. Signals from the President indicate that the unprecedented investment planned in infrastructure projects in the United States will require U.S. materials, effectively creating competition for material in non-traditional markets, where early movers will have advantages. Competition will also be heightened for skilled labor, making key elements of the investment request represented in this document even more time critical.

We need to rely on market principles to allow suppliers, the shipyards and GFE material providers to sort through the complicated demand equation across the multiple ship programs. Supplier development funding previously mentioned would support non-recurring efforts which are needed to place increased orders for material in multiple market spaces. Examples would include valves, build-to-print fabrication work, commodities, specialty material, engineering components, etc. We are engaging our marine industry associations to help foster innovative approaches that could reduce costs and gain efficiency for this increased volume. We have active efforts with the following key associations:

- Shipbuilding Council of America (SCA)
- American Shipbuilders Suppliers Association (ASSA)
- Marine Machinery Association (MMA)
- Submarine Industrial Base Council (SIBC)
- Aircraft Carrier Industrial Base Council (ACIBC)

These associations have existing infrastructure and memberships that can reach out to suppliers in all 50 states, at all levels of the supply chain, including first tier and sub-tiers. By partnering with Department of Labor, we can create programs that support workforce development and encourage investment in facilities and infrastructure. This is a "Buy American" initiative which the entire Congress and Administration should be able to agree on.

SUPPORTING THE NAVY'S 355–SHIP NAVY IN THE SUBMARINE ENTERPRISE

Based on the Navy's force structure assessment issued in December 2016, the SSN force level would be increased from 48 SSNs to 66 SSNs, an increase of 38 percent. Efforts to step-up production to support increased SSN deliveries would need to begin immediately due to the long lead time that is required to add capacity and capability at the two nuclear submarine shipyards and the associated unique supply base. We have looked at two scenarios of increased SSN demand that are within the historical precedence of one SSBN per year and up to three SSNs per year. Below are two scenarios to help bracket the discussion.

The first scenario would maintain *Virginia*-class procurement at two SSNs per year during the entire 15-year period of *Columbia*-class SSBN authorizations (i.e., fiscal year 2021 to fiscal year 2035). This scenario effectively adds 10 *Virginia*-class SSNs to the Navy 30-year shipbuilding plan (which includes the second *Virginia*-class SSN in fiscal year 2021). Under this scenario, the Navy would reach its force level goal of 66 SSN in three decades by the mid 2040's. Scenario one reflects three submarines per year in the steady state starting in fiscal year 2026 which would consists of two SSNs and one SSBN per year. Over the next 20-year period that starts in 2017, the Submarine Industrial Base would be expected to deliver 39 SSNs, 24 with the VPM configuration, and the first 8 *Columbia*-class SSBNs. That level of submarine construction is 3.5 times the level of the last 20 years that ended in 2016 (an increase of greater than 250 percent), and includes a projected 525,000 tons of delivered submarine displacement.

The second scenario would increase the rate of SSN procurement starting in fiscal year 2020 to three *Virginia*-class SSNs per year. fiscal year 2020 would allow two-year advance procurement (AP) to be programmed into the fiscal year 2018 budget should the Congress elect to begin as soon as possible. Under this scenario, the Navy would reach its force structure target one decade earlier in the mid 2030's. The figure below illustrates the two scenarios. Scenario two reflects four submarines per year in the steady state starting in fiscal year 2026 which would consist of three SSNs and one SSBN per year. Over the next 20-year period that starts in 2017, the Submarine Industrial Base would be expected to deliver 50 SSNs, 35 would include the VPM configuration, and the first 8 *Columbia*-class SSBNs. That level of submarine construction is 4.2 times the level of the last 20 years that ended in 2016 (increase of greater than 320 percent), and includes a projected 636,000 tons of delivered submarine displacement.

Cummulative Effect of Submarine Deliveries over 20-Year Period

GOVERNMENT COMMITMENT

Supporting the 355-ship Navy will require Industry to add capability and capacity across the entire Navy Shipbuilding value chain. Industry will need to make investment decisions for additional capital spend starting now in order to meet a step change in demand that would begin in fiscal year 2019 or fiscal year 2020. For the submarine enterprise, the step change was already envisioned and investment plans that embraced a growth trajectory were already being formulated. Increasing demand by adding additional submarines will require scaling facility and workforce development plans to operate at a higher rate of production. The nuclear shipyards would also look to increase material procurement proportionally to the increased demand. In some cases, the shipyard facilities may be constrained with existing capacity and may look to source additional work in the supply base where capacity exists or where there are competitive business advantages to be realized. Creating additional capacity in the supply base will require non-recurring investment in supplier qualification, facilities, capital equipment and workforce training and development.

Industry is more likely to increase investment in new capability and capacity if there is certainty that the Navy will proceed with a stable shipbuilding plan. Positive signals of commitment from the Government must go beyond a published 30-year Navy Shipbuilding Plan and line items in the Future Years Defense Plan (FYDP) and should include:

- Multi-year contracting for Block procurement which provides stability in the industrial base and encourages investment in facilities and workforce development
- Funding for supplier development to support training, qualification, and facilitization efforts—Electric Boat and Newport News have recommended to the Navy funding of $400 million over a 3-year period starting in 2018 to support supplier development for the Submarine Industrial Base as part of an Integrated Enterprise Plan Extended Enterprise initiative
- Acceleration of Advance Procurement and/or Economic Order Quantities (EOQ) procurement from fiscal year 2019 to fiscal year 2018 for *Virginia* Block V
- Government incentives for construction readiness and facilities / special tooling for shipyard and supplier facilities, which help cash flow capital investment ahead of construction contract awards
- Procurement of additional production back-up (PBU) material to help ensure a ready supply of material to mitigate construction schedule risk

SUBMARINE INDUSTRIAL BASE SUMMARY

The Submarine Industrial Base stands ready to expand the scope of effort required to support increased submarine procurement if the nation has determined it

needs additional submarines. Supporting three SSNs per year plus one SSBN per year is within historical precedence. The *Columbia*-class SSBN Program is the Navy's top development priority and, as the Chief of Naval Operations has stated, it is "foundational to the security of the Nation". Supporting increased SSN demand beyond the Navy's fiscal year 2017 Shipbuilding Plan can be supported by scaling-up already existing master plans in shipyard facilities and workforce development. The nuclear shipyards will need to expand efforts to place work into the supply base, perhaps beyond proportionally increased levels due to constraints at shipyard facilities. Enabling the supply base to expand its support of increased submarine procurement will require additional non-recurring funding for supplier development and facilitization where submarine-unique capability at the required level may not exist anymore. It will take up to three years in some cases to develop and qualify new suppliers and/or new capabilities which in some cases will require qualification hardware to be built and tested. This non-recurring effort must begin now in the fiscal year 2018 budget. The Shipbuilders urge a minimum of $150 million in fiscal year 2018 to support development of new capacity and capability in the supply base. In addition, increasing the level of material procurement for *Virginia*-class Block V and *Columbia*-class will establish a strong signal of Government commitment to industry to encourage additional investment in new capability, capacity, facilities, capital equipment, and workforce development that will need to be in place to support increasing levels of demand that are up to four times the level over the last 20 years.

SURFACE SHIP SUMMARY

So far, this testimony has focused on the Submarine Industrial Base, but the General Dynamics Marine Systems portfolio also includes surface ship construction. Unlike Electric Boat, Bath Iron Works and NASSCO are able to support increased demand without a significant increase in resources.

BATH IRON WORKS

Bath Iron Works is well positioned to support the Administration's announced goal of increasing the size of the Navy fleet to 355 ships. For BIW that would mean increasing the total current procurement rate of two DDG 51s per year to as many as four DDGs per year, allocated equally between BIW and HII. This is the same rate that the surface combatant industrial base sustained over the first decade of full rate production of the DDG 51-class (1989 to 1999). Over this period, BIW was awarded two construction contracts per year and from 1994 to 2004 sustained an average delivery rate of two ships per year. Since then, the Navy's procurement rate has declined to only two ships per year and, although BIW adjusted to this lower volume, the company continued to invest in facility modernization.

No significant capital investment in new facilities is required to accommodate delivering two DDGs per year. However, additional funding will be required to train future shipbuilders and maintain equipment. Current hiring and training processes support the projected need, and have proven to be successful in the recent past. BIW has invested significantly in its training programs since 2014 with the restart of the DDG 51 program and given these investments and the current market in Maine, there is little concern of meeting the increase in resources required under the projected plans.

A predictable and sustainable Navy workload is essential to justify expanding hiring/training programs. BIW would need the Navy's commitment that the Navy's plan will not change before it would proceed with additional hiring and training to support increased production.

BIW's supply chain is prepared to support a procurement rate increase of up to four DDG 51s per year for the DDG 51 Program. BIW has long-term purchasing agreements in place for all major equipment and material for the DDG 51 Program. These agreements provide for material lead time and pricing, and are not constrained by the number of ships ordered in a year. BIW confirmed with all of its critical suppliers that they can support this increased procurement rate.

BIW is prepared to ramp up for increased production and looks forward to working with the Navy in support of increased surface combatant demand.

NASSCO

NASSCO builds Combat Logistics Force ships, strategic sealift and other support ships like the Expeditionary Sea Base (ESB). NASSCO is currently building ESB 4 and 5, the last of these ships currently programmed. NASSCO is designing the Navy Fleet Replacement Oiler (*T–AO 205*-class) and construction will commence on

the lead ship in September 2018. The Navy currently plans a production rate of one ship per year for the balance of a 17-ship class.

The Navy's Force Structure Assessment calls for three additional ESBs. Additionally, NASSCO has been asked by the Navy and the Congressional Budget Office (CBO) to evaluate its ability to increase the production rate of T–AOs to two ships per year. NASSCO has the capacity to build three more ESBs at a rate of one ship per year while building two T–AOs per year. The most cost effective funding profile requires funding ESB 6 in fiscal year 2018 and the following ships in subsequent fiscal years to avoid increased cost resulting from a break in the production line. The most cost effective funding profile to enable a production rate of two T–AO ships per year requires funding an additional long lead time equipment set beginning in fiscal year 2019 and an additional ship each year beginning in fiscal year 2020.

NASSCO must now reduce its employment levels due to completion of a series of commercial programs which resulted in the delivery of six ships in 2016. The proposed increase in Navy shipbuilding stabilizes NASSCO's workload and workforce to levels that were readily demonstrated over the last several years.

Some moderate investment in the NASSCO shipyard will be needed to reach this level of production. The recent CBO report on the costs of building a 355-ship Navy accurately summarized NASSCO's ability to reach the above production rate stating, "building more . . . combat logistics and support ships would be the least problematic for the shipyards."

As NASSCO builds ships to commercial standards, its supplier base is robust, flexible and fully capable of supporting increased production of both ESBs and T–AOs.

I would like to thank the committee for the opportunity to speak this morning and I am ready to answer your questions.

Senator WICKER. Thank you, Mr. Casey.

Mr. Paxton?

STATEMENT OF MATTHEW P. PAXTON, PRESIDENT, SHIPBUILDERS COUNCIL OF AMERICA

Mr. PAXTON. Thank you. On behalf of the Shipbuilders Council of America, I would like to thank Chairman Wicker, Ranking Member Hirono, and members of the Seapower Subcommittee for the opportunity to provide industry perspectives on the domestic shipyard's capacity and capability to build a 355-ship Navy.

I would ask that my full written testimony be submitted for the record.

Senator WICKER. Without objection.

Mr. PAXTON. To meet the demand for increased vessel construction, while sustaining the vessels we currently have, will require U.S. shipyards to expand their workforces and improve their infrastructure in varying degrees depending on ship type and ship mix, a requirement our Nation's shipyards are eager to meet. But first, in order to build these ships in as timely and affordable manner as possible, stable and robust funding is necessary to sustain those industrial capabilities which support Navy shipbuilding and ship maintenance and modernization.

Congress must find a way to remove the defense spending caps set in place by the 2011 Budget Control Act. In recent years, Congress has worked around sequestration with short-term deals. However, without a long-term solution, uncertainty continues regarding the specific effects of sequestration in 2018 through 2021. Although it is difficult to determine the exact impacts going forward, 5 years of budgetary reductions, of funding restrictions have already led to furloughs, deferred maintenance, delayed recapitalization programs, and increased deployment times. A sustained in-

vestment in our naval fleet requires the threat of sequestration be permanently eliminated.

In addition, Congress and this subcommittee can support the use of acquisition strategies to provide funding stability and enhance cost reduction. Alternative funding approaches such as advanced procurement, incremental or split funding, and bock buy contracting already in use in naval shipbuilding can help increase stability and affordability in building a 355-ship Navy.

Through the use of advanced procurement, Congress provides upfront funding for the purchase of long lead time material and components and provides the balance of ship funding in the subsequent year. For the shipbuilding industry and the critical supplier base, this creates an early financial commitment which enhances job security, allows for strategic planning, hiring and training, as well as encourages capital investment.

Incremental or split funding, where cost is divided into two or more annual increments, allows for Navy ships to be procured while avoiding or mitigating budget spikes and major fluctuations in year-to-year budget totals. Incremental funding would also allow construction to start on a large number of ships in a given year so as to achieve better production economies.

Beyond that, Congress can consider block buys of ships. Block buy contracting permits the Department of Defense to use a single contract for more than 1 year's worth of procurement of a given kind of ship without having to exercise contract options for each year after the initial procurement year. Purchasing ships through block buy contracting enables shipyards to leverage hot production lines and streamline the acquisition process for these shipyards.

The selection or combination of these type of strategies will signal to U.S. shipbuilding and repair industry and the critical supplier chain that Congress is committed to building a 355-ship Navy and our industry is ready to respond accordingly.

Beyond providing for the building of the naval fleet, there must also be provision to fund the tail, the maintenance of the current and new ships entering the fleet. Target fleet size cannot be reached if existing ships are not maintained to their full service lives. Maintenance has been deferred in the last few years because of across-the-boards budget cuts. Investment in building ships must be complemented by the investment to maintain those ships to their full life expectancy.

Long term there needs to be a workforce expansion, and some shipyards will need to reconfigure or expand production lines. This can and will be done if adequate, stable budgets and procurement plans are established and sustained for the long term. Funding predictability and sustainability will allow the industry to invest in facilities and more effectively grow its skilled workforce. The development of that critical workforce will take time and a concerted effort in a partnership between industry and the Federal Government.

In conclusion, the U.S. shipyard industry is certainly up to the task of building a 355-ship Navy and has the expertise, the capability, the critical capacity, and the unmatched skilled workforce to build these national assets. Meeting the Navy's goal of a much larger fleet will require sustained investment by Congress and the

Navy's partnership with the defense industrial base that can further attract and retain a highly skilled workforce.

Again, I would like to thank the subcommittee for inviting me to testify alongside such distinguished witnesses. As a representative of our Nation's private shipyards, I can say with confidence and certainty that our domestic shipyards and skilled workers are ready, willing, and able to build and maintain the Navy's future fleet. Thank you, sir.

[The prepared statement of Mr. Paxton follows:]

PREPARED STATEMENT BY MATTHEW O. PAXTON

On behalf of the Shipbuilders Council of America (SCA), I would like to thank Chairman Wicker, Ranking Member Hirono and members of the Seapower Subcommittee for the opportunity to provide industry perspectives on the domestic shipyard industry's capacity and capability to achieve a 355-ship Navy.

I am Matthew Paxton, President of the Shipbuilders Council of America, the largest national trade association representing the U.S. shipyard industry. The SCA has been in existence since 1920 and represents 85 member shipyard facilities and 99 industry partner member companies that are part of the vital supply chain that make up the shipyard industrial base.

SCA member shipyards are located along the eastern seaboard, the Gulf coast, Great Lakes, on the inland river system, West Coast, Alaska and Hawaii and constitute the shipyard industrial base that builds, repairs, maintains and modernizes U.S. Navy ships and craft, U.S. Coast Guard vessels of all sizes, numerous Army vessels, as well as vessels for other U.S. Government agencies. In addition, SCA member shipyards build, repair and maintain America's commercial fleet of 40,000 vessels that operate along our coastline, inland waterways and between Alaska, Hawaii and Puerto Rico. The nearly 100 partner members of the SCA represent a significant portion of the vast supplier industrial base that provide goods and services to support commercial and government shipbuilding and ship repair in the United States.

My testimony this morning will focus primarily on the capability and capacity of the domestic shipyard industry to build and maintain a 355-ship Navy. The shipyard membership of this trade association builds the Navy's fleet of aircraft carriers, surface combatants, submarines, amphibious vessels and support ships. To be clear, the trade association advocates for policies and budgets that support our members' combined interests and refrains from promoting specific platforms or mixes of ships.

In December 2016, the Navy released a new force structure assessment (FSA) that called for a fleet of 355 ships—substantially larger than the current fleet of 275 ships and also larger than the Navy's previously stated goal of 308 ships. To increase the Navy's Fleet to 355 ships, a substantial and sustained investment is required in both procurement and readiness. However, let me be clear: building and sustaining the larger required Fleet is achievable and our industry stands ready to help achieve that important national security objective.

To meet the demand for increased vessel construction while sustaining the vessels we currently have will require U.S. shipyards to expand their work forces and improve their infrastructure in varying degrees depending on ship type and ship mix—a requirement our Nation's shipyards are eager to meet. But first, in order to build these ships in as timely and affordable manner as possible, stable and robust funding is necessary to sustain those industrial capabilities which support Navy shipbuilding and ship maintenance and modernization.

First, Congress must find a way to remove the defense spending caps set in place by the 2011 Budget Control Act, which enacted the 10-year slate of reductions known as sequestration. In recent years, Congress has worked around sequestration with short-term deals, however, without a long-term solution uncertainty continues regarding the specific effects of sequestration in fiscal years 2018 through 2021. Although it is difficult to determine exact impacts going forward, five years of restrictions and reductions have already led to furloughs, deferred maintenance, delayed recapitalization and modernization programs, and increased deployment times. The easiest or least harmful of the reductions have already been made. Any cuts going forward will have incrementally more of an impact and will be more difficult to reverse causing further strain to the readiness of the Fleet. A sustained investment in our Naval Fleet requires as an essential precondition that the threat of sequestration be permanently eliminated.

In addition to eliminating sequestration, Congress can support the use of acquisition strategies to provide stability and enhance cost reduction rather than requiring the entire procurement cost of a ship to be funded in one fiscal year. Alternative funding approaches such as advance procurement, incremental or split funding and block buy contracting—all already in use in Navy shipbuilding—can help increase stability and affordability in Navy shipbuilding.

Through the use of advanced procurement, Congress provides upfront funding for the purchase of long-lead time ship material and components and provides the balance of ship funding in the subsequent fiscal year. For the shipbuilding industry and the supplier base this creates an early financial commitment which enhances job security, allows for strategic planning, training, hiring as well as encourages capital investment. Additionally, advance procurement can reduce the total construction cost of ships through improved sequencing or year-to-year balancing of shipyard construction work and the purchase of batch items that can be manufactured in a more efficient and economic manner.

Incremental or split funding, where cost is divided into two or more annual increments, allows for expensive items, such as large Navy ships, to be procured while avoiding or mitigating budget "spikes" and major fluctuations in year-to-year budget totals. Incremental funding would also allow construction to start on a larger number of ships in a given year so as to achieve better production economies. An added benefit often not considered is a reduction in the amount of unobligated balances associated with DOD procurement programs.

Beyond that, Congress can consider block buys of ships. Block buy contracting permits the Department of Defense to use a single contract for more than one year's worth of procurement of a given kind of ship without having to exercise contract options for each year after the initial procurement year. This is currently how *Virginia*-class submarines are procured, and during the Reagan years the Federal Government twice purchased two aircraft carriers at once. Purchasing ships through block buy contracting enables shipyards to leverage "hot" production lines—those assembling current ships —and streamline the acquisition process for these vessels. We cannot get to or sustain the target fleet size if we do not maintain the ships we already have to their expected service life while simultaneously building new ships.

The selection or combination of these types of strategies will signal to the U.S. shipbuilding and repair industry that Congress is committed to building a 355-ship Navy and our industry is ready to respond accordingly.

Beyond providing for the building of a 355-ship Navy, there must also be provision to fund the "tail," the maintenance of the current and new ships entering the fleet. Target fleet size cannot be reached if existing ships are not maintained to their full service lives, while building those new ships. Maintenance has been deferred in the last few years because of across-the-board budget cuts. As a result of the wars in Afghanistan and Iraq, combined with commitments in Asia and other priorities, have lengthened ship deployments to eight to 11 months. This in turn has stretched the Navy's maintenance budget and kept families apart far longer than the Navy wants. The risk the Navy takes on when it has less than full operations and maintenance funding means accepting less readiness across the whole of the Navy, less capacity to surge in crisis or wartime, and preventing ships and submarines from reaching the end of their service lives. Any investment in building ships must be complemented by the investment to maintain those ships to their full life expectancy.

The domestic shipyard industry certainly has the capability and know-how to build and maintain a 355-ship Navy. The Maritime Administration determined in a recent study on the Economic Benefits of the U.S. Shipyard Industry that there are nearly 110,000 skilled men and women in the Nation's private shipyards building, repairing and maintaining America's military and commercial fleets.[1] The report found the U.S. shipbuilding industry supports nearly 400,000 jobs across the country and generates $25.1 billion in income and $37.3 billion worth of goods and services each year. In fact, the MARAD report found that the shipyard industry creates direct and induced employment in every State and Congressional District and each job in the private shipbuilding and repairing industry supports another 2.6 jobs nationally.

This data confirms the significant economic impact of this manufacturing sector, but also that the skilled workforce and industrial base exists domestically to build these ships. Long-term, there needs to be a workforce expansion and some shipyards will need to reconfigure or expand production lines. This can and will be done as

[1] "Economic Importance of the U.S. Shipbuilding and Repairing Industry". Maritime Administration (MARAD), November 2015.

required to meet the need if adequate, stable budgets and procurement plans are established and sustained for the long-term. Funding predictability and sustainability will allow industry to invest in facilities and more effectively grow its skilled workforce. The development of that critical workforce will take time and a concerted effort in a partnership between industry and the Federal Government.

U.S. shipyards pride themselves on implementing state of the art training and apprenticeship programs to develop skilled men and women that can cut, weld, and bend steel and aluminum and who can design, build and maintain the best Navy in the world. However, the shipbuilding industry, like so many other manufacturing sectors, faces an aging workforce. Attracting and retaining the next generation shipyard worker for an industry career is critical. Working together with the Navy, and local and state resources, our association is committed to building a robust training and development pipeline for skilled shipyard workers. In addition to repealing sequestration and stabilizing funding the continued development of a skilled workforce also needs to be included in our national maritime strategy.

A critical part of maintaining and growing the workforce and industrial base to build a 355-ship Navy is the strong support of the Jones Act. The Jones Act ensures a commercial shipbuilding industry and supplier chain exists domestically which also supports Navy shipbuilding and reduces costs. There is strong bipartisan support for this law, however, we must be vigilant that the law is consistently enforced and not eroded by administrative rulemaking. A recent decision by the Department of Homeland Security to not revoke a series of letter rulings that have allowed foreign-built and foreign crewed offshore supply vessels to operate in violation of the Jones Act has created uncertainty and resulted in numerous new U.S. vessel construction contracts to be cancelled. I raise this issue as an example of how a decision by an agency to not properly enforce the Jones Act can have such an adverse impact on commercial shipbuilding that reverberates throughout the entire shipyard industrial base.

The U.S. Navy has always and continues to support the Jones Act because of its national security benefits. A strong commercial shipyard base and a strong cadre of skilled mariners is crucial to fulfilling the Navy's role in maintaining a forward presence in the world's sea lanes and trouble spots. In a recent study, the independent Government Accountability Office (GAO) put it this way: "the military strategy of the United States relies on the use of commercial U.S.-flag ships and crews and the availability of a shipyard industry base to support national defense needs."

Additionally, while the Department of Homeland Security falls under the oversight of another Senate Committee, we must remember that another key component of the National Fleet is the United States Coast Guard. Shipyard capacity is required for the Service's desperately needed fleet modernization of its entire fleet from inland aids to navigation vessels to cutters of all sizes to icebreakers.

In conclusion, the U.S. shipyard industry is certainly up to the task of building a 355-ship Navy and has the expertise, the capability, the critical capacity and the unmatched skilled workforce to build these national assets. Meeting the Navy's goal of a 355-ship fleet and securing America's naval dominance for the decades ahead will require sustained investment by Congress and Navy's partnership with a defense industrial base that can further attract and retain a highly-skilled workforce with critical skill sets. Again, I would like to thank this Subcommittee for inviting me to testify alongside such distinguished witnesses. As a representative of our nation's private shipyards, I can say, with confidence and certainty, that our domestic shipyards and skilled workers are ready, willing and able to build and maintain the Navy's 355-ship Fleet.

Senator WICKER. Thank you very much.

I am going to ask the clerk to do 6-minute rounds, if we can do that. I will start off. There are five of us here. I want to try to be a little less formal, much as we were yesterday down in the SCIF. So if someone wants to interject, we will do it that way and have more of a roundtable approach. If it gets out of hand, I will be surprised.

Mr. Casey and Mr. Cuccias, I am sure you agree but let me get you in the record with Mr. Paxton's statement about sequestration. Could we possibly embark on this ambitious undertaking unless we lift sequestration? Mr. Cuccias?

Mr. CUCCIAS. Well, I think sequestration actually puts instability into the marketplace. It is hard to plan. It is hard to predict. The overhaul on Washington was impacted and we had to lay off hundreds of workers to just, at a later point, go back and hire and retrain.

So if the Nation really wants to build the Navy, it has to create stability, and the Budget Control Act and sequestration actually impact that greatly because you cannot invest. The vendors will not hire, and the supply chain is actually the critical path to build a ship. If the ship already exists, without the vendor and the supply base to provide the product and to hire the resources they need to build, ships will not come on time. They need 18 months and sometimes 2 years' advance notice before you want to start actually the shipyard to build a ship to actually signal the supply base to hire, to train, and to build. Sequestration does not put stability in that. It actually harms it. It harms the vendors to lay offs and rehire, and it harms the shipbuilders as well.

Senator WICKER. Mr. Casey?

Mr. CASEY. I believe that a constrained shipbuilding and R&D accounts, the operational accounts insofar as maintenance is concerned, will preclude the Nation from achieving 355 ships.

Senator WICKER. Okay. I believe you said, Mr. Casey, that we need to start in fiscal year 2018. Was that your testimony?

Mr. CASEY. Yes, sir.

Senator WICKER. If you will, if each of you would tell us if we want to get started realistically with this, what do you need in the next NDAA to get this started?

Mr. CASEY. We would propose to start the $400 million which is necessary to jump-start the supply chain, if you will. I agree with Brian's statements that the critical path on the ship at the beginning is to get the pieces and parts you need in place.

On the existing *Virginia*-class program, we accelerated advanced procurement monies to buy materials, and it allowed us to accelerate 2 million hours of construction work, eliminate 2 years from the construction cycle, and do it for 2 million less hours. So 2 years less, 2 million less hours, and we accelerated into the first half of the construction cycle. So we ultimately took an 84/87-month ship and got it down to about 66 months, largely on the basis of getting the material at the dock the day we were ready to start construction.

So we would propose to start that $400 million with $150 million in this fiscal year 2018's authorization act.

Senator WICKER. Is there anything else?

Mr. CASEY. I think we have laid out in detail what we can do to build on the *Virginia* program that exists today and to put monies in place that will cause the industrial base to become stressed—the supply chain, if you will, to become stressed—before we get to the point of trying to get to three or four submarines per year. If we can stress them today by authorizing them to start building pieces and parts that we know we intend to use, we think that will go a long way toward supporting the program to get to 355 ships.

Senator WICKER. Can you elaborate on what you were saying in your testimony about accelerated depreciation?

Mr. CASEY. That is more on our capital investments. If we are to make a capital investment on any given program and the program does not start for 5 years and we do not really get into the meaningful production until 5 years later, your investment is somewhat stranded.

Senator WICKER. So you are going to need a change in tax policy.

Mr. CASEY. No, sir. I do not believe a tax policy is necessary. All six of the suggestions that we have made in my testimony have been used by the Navy in the past. Those are methodologies that exist in the current FAR as I understand it.

Senator WICKER. Okay.

Mr. Cuccias, anything else?

Mr. CUCCIAS. I would say the ideal was a multi-ship procurement. For example, two carriers, if they were bought together, would significantly take the cost of carriers. But also I think it would significantly stabilize the overall industrial base because of the breadth of the supplies. Multi-ship LPDs, multi-ship destroyers—that would be the best condition.

But a fallback position is you have to have advanced procurement. If you do not have AP for the procurement, the GFE equipment is not even bought, let alone the material that the shipyards buy. You have to prime the pump. You have to get the supply chain lead time in advance or when you make the decision, the lead time strikes when the procurement lead time starts. AP must be in there. Ideally it is a multi-ship procurement I believe, to answer the question.

Senator WICKER. Mr. Paxton, anything to add there?

Mr. PAXTON. Yes, sir. Just authorize these type of acquisition strategies. I think they are important. Buying a ship all in 1 year is difficult, huge budget swings, and we need to mitigate those spikes. If we are going to go to building 12 ships a year or more, if we do not have these acquisition strategies like advanced procurement, multi-contract, block buys, it will be hard to see how you would do it.

The last thing, sir, I would say this committee can always encourage the Navy—not require, but encourage the Navy—to get requirements stable and consistent. Let us build things when we are ready to go. Encourage the Navy to get programs set and locked in.

Senator WICKER. Senator Hirono?

Senator HIRONO. Thank you, Mr. Chairman.

I think all of you testified that you liked the idea of the multiyear procurement contracts and also the multi-ship block grant contracts. Is that correct? All of you liked that.

Now, is there not an underlying statutory basis for the—is it the multiyear procurement method, or is it the multi-ship procurement that has an underlying legislation?

Mr. CUCCIAS. I would certainly like to take that question for the record.

My response was more on how to produce ships more efficiently, more affordably, and so my response was if that was available, shipbuilders and the supply chain I believe can produce ships at a better value to the taxpayer and in a more efficient, faster manner.

In terms of the policy that is behind it, I was addressing that more in the most efficient way to produce the products.

Senator HIRONO. My understanding is that one of these methods of procurement has a statutory basis for it. So the questions I have were whether both of them should have some sort of statutory basis so that you have a clear path as to what is required in order for us to have these kinds of contracts. But I will check on that.

Mr. CASEY. Ma'am, I think if I can help with that, as I understand it, both the destroyers the Navy builds and the submarines they build today are multiyear, multi-ship contracts. So they are 5-year contracts, in the case of submarines, two per year; in the case of destroyers, two per year split between two yards. So the Navy I believe is granted the authority by the Congress to put multiple ships under contract, and it takes multiple years to build those ships. I think that is what you question is, but I am not 100 percent sure I understood it.

Senator HIRONO. I just want to make sure that if we need to look at the statutory basis for us going forward with these two kinds of contracts that you all agree are good, then I will explore that.

Mr. Casey, I was curious to know when you mentioned that since 2011 you have hired 10,000 people and that you have reduced, if I heard you correctly, the hiring process time frame from 165 days to 45 days. That is a significant shortening of the time frame. So what was shortened that you managed to do this?

Mr. CASEY. We have taken an approach in the human resources department that does the personnel hiring, and they are handling that department like a lean six sigma challenge. In other words, each phase of the hiring process is laid out on a process flow map, and all the hours, if you will, days where we were not productive we did not believe then gleaned out of that process. So there was a detailed process review, led by Mora Dunn, who runs our human resource department, new to Electric Boat, frankly from another part of General Dynamics. She has just done an outstanding job at looking at H.R. more like a production person would look at operations.

Senator HIRONO. I commend you for that because that was something that you did internally. You were able to effect a shortening of the time frame for when you would be able to hire the needed workers. That is great.

Then in addition, I think there was some concern about the clearances that the government needs to provide and that there may be some issues around that, which I know the chairman has also asked you about. So that is another part of the whole process that we could be possibly of some assistance with.

Thank you.

I am glad that you all mentioned the importance of the thousands of suppliers that you all rely upon. I was particularly interested, Mr. Casey, when you said that of the 5,000-plus suppliers that you deal with, many of whom are small businesses, that there are 150 who are critical suppliers. That would be the same for you, Mr. Cuccias?

Mr. CUCCIAS. Yes.

Senator HIRONO. So out of the thousands that you work with, there are a number who are deemed critical, crucial, and maybe

there is some way that we can stabilize the funding and the—well, stabilize would be a good way so that these critical suppliers have something that they can count on in terms of the funding. So is that something that we should be working on in a separate fashion to facilitate?

Mr. CUCCIAS. Senator, I think it gets back to stabilizing the industry, and the multiyear and block buys actually do that.

Obviously, multiyear and block buy will do a couple things. One, for the critical suppliers, it gives them stability. Every supplier is critical if you need the part. So the whole industrial chain is really important.

I think actually it will bring other vendors in. It will actually create a more healthy supply base, hiring across the country. It will actually be an entry point I think for other companies and businesses to maybe get into the market where you are not so tied to single soul source vendors where they are all so critical. The BCA and sequestration actually helps cause that limiting of suppliers exiting in the market. The opposite, providing stability creates more vendors that would create stability and more vendors would come in the marketplace.

Senator HIRONO. We do have bipartisan support for eliminating the sequestration, but we have not quite been able to achieve that and we have kind of kicked the can——

Senator WICKER. Well, we just do not have the bipartisan votes. [Laughter.]

Senator HIRONO. Or a bipartisan agreement on how the heck we should do it.

I know that we have a maintenance backlog, and a recent RAND report indicated that public shipyards resourcing suggested more maintenance work could be transferred to the private yards to address the backlog. Do your yards have the capacity to take on more maintenance availabilities?

Mr. CASEY. Yes, ma'am. Right now, for example, at Electric Boat, they are doing the Montpelier maintenance work which will wrap up roughly at the end of this year. It is another example of—we are out to bid in competition with Newport News right now for the *Boise.* I think that was mentioned as being laid up. That is exactly right. We are in competition for that ship right now.

Electric Boat actually requires that kind of volume of work to avoid having to reduce its workforce while we have the sight of *Columbia* in our eyes. *Columbia* is a vision in the future. If we do not have some interim work between what we are doing today in the repair world and what we need to do when we start *Columbia,* we will actually be reducing people not hiring. So it is a difficult dilemma to have as a company to be in, but that is where we find ourselves.

So that is why the *Boise* is an important availability to Electric Boat. I appreciate the committee's support on moving any other work that exceeds the other shipyard capacity in the nuclear world.

Of course, on the surface ships, virtually all the work is done in the private industry. So it is a different kind of issue there, but nevertheless, we definitely have the capacity. We are way short in Norfolk—we have a couple repair yards down there—of repair work

relative to the capability of the port. We are also, as I just pointed out, short in the submarine business.

Senator HIRONO. Mr. Chairman, if I could just have Mr. Cuccias answer yes or no as to their capacity to do maintenance work.

Mr. CUCCIAS. Newport News does have the ability to do maintenance work on both carriers. Lincoln was just redelivered in May, and *George Washington* is now under contract planning. We have contracts of *Columbus* and *Helena.* We have submarine overhaul work as well. From the surface side, it really depends on the yard's loading in terms of a new construction balance. Certainly we have the capability where Ramage is being overhauled at Ingalls at the moment. That job is going quite well. I believe we will be ahead of schedule. So I think both facilities have ability to do overhaul and repair.

Senator HIRONO. Thank you, Mr. Chairman.

Senator WICKER. Senator Tillis?

Senator TILLIS. Thank you, Mr. Chair.

Senator Hirono, it is great to see you back.

I had one quick question for Mr. Casey. We were talking about clearances. I chair the Personnel Subcommittee. We are dealing with clearance issues in that capacity. What specific recommendations would you have on things that we could do to expedite the process from our end?

Mr. CASEY. Senator, I am not an expert on the criteria that the government uses to grant these clearances. My view as an individual citizen of the country is that there is some basic criteria that could be established by the various agencies that oversee this to make sure people are at least granted interim clearances on a more immediate basis. Then if there is a more detailed review of somebody's history or record, that that could be done in parallel.

The other thing we are trying to do internally, frankly, is shrink down the areas in the shipyard that require these clearances. That is something we are working closely with the Navy on. We have been somewhat successful. But as a ship is getting near completion and you have a live reactor core inside a ship, the rules are pretty tight. Those are the areas where we absolutely have to have people.

It is, frankly, difficult to sit in a production meeting, which I still do—since that is where I came from and I still like to sit in those once in a while—and have the general foreman or the foreman say, I am short 10 people and I know I have got 300 people that are waiting for their clearances right outside the gate ready to come to work.

The down side effect of that is sometimes people get impatient. So we have gone to a lot of trouble to get somebody interviewed, get them hired, get them into the sort of queue and then having to say, well, I have got to wait 4 or 5, 6 months, then I am going to find something else to do to support my family. So any efforts, sir, that you could do on that would be hugely helpful.

Senator TILLIS. Well, with people that are in that lane within the organization, it would be good to get back with our office to talk about specific points that they think could be improved in terms of the process.

I have a broad question for all of you. I think I heard we need longer lead times. We need the certainty of volume. We need to

fund the tail. If not a block buy, at least advanced procurement. I have only been in politics for about 12 years. So I did not follow this at a detailed level at the Senate level until 2 years ago. But the last time I would have heard any of these things being said about policies coming out of Capitol Hill, disco and leisure suits were still popular. It has been a very long time.

When is the last time you have been able to go back to your businesses and your industries and feel like you had the certainty to ramp up your supply chains to get the resources and the supply chains in place? How long ago has it been since you have really been able to do that as an industry?

Mr. CASEY. I think, frankly—and I will stick with the submarine part of the business, since that is where I came from, for now even though the other two are equally important—when we went to two submarines per year, originally the plan was to do that in 2001. It never happened until 2011. So there was a 10-year change in policy I think is what you are describing, 10 years of we are on path A in our vision, but in reality we are living on path B. So finally, when we got to the point of the block III ships where we went from one per year to two per year, in the middle of that block to block IV where we had 10 ships authorized over 5 years, then there was some confidence that we know what we are dealing with.

Senator TILLIS. You take a look at the way the world has changed since then. It is amazing that we have got ourselves caught in this rut.

Do you all as an industry or as the businesses represented—have you done any analysis in terms of the inherent cost multiplier for the way that we are acquiring in this case ships, but weapons systems in general, how much more we are having to pay for it because of the lack of certainty and as a result, the lack of optimization, just the inherent inefficiencies that we need to pay for?

Mr. CUCCIAS. I think it is significant. When you look at a single ship buy, a procurement versus multiyear, when I just look at some of the data, it would be in real then-year term dollars much greater than 10 percent. I have seen some 20. I have seen some vendors provide 20 percent reductions in then-year. So it is the real then-year cost without escalation that you get today. So I think there are significant volumes. When vendors in the communities, both government and shipyard provided products—when they get a demand signal that structures multiple years, they get to plan their facility.

Senator TILLIS. It would not surprise me if we are paying 25 to 30 percent premiums based on lack of an optimized supply chain. I used to run a supply chain optimization practice at PriceWaterhouse, and the inherent inefficiencies in here, the multiplier that we could get out of more ships built sooner is something that we have to go from bipartisan discussion about the Budget Control Act and about the things we are talking about here to bipartisan results.

Senator WICKER. What sort of assurances could you give us about that if you crunched the numbers a little better?

Senator TILLIS. Let me see if could answer it from a consultant's perspective. You should be able to give us quite a bit of assurances. If we can give you a 10-year tail or a 5-year planning horizon that

we are willing to commit to, I know very well that you can optimize in double-digit numbers based on the baseline numbers that we have today and current budgeting practices.

Senator WICKER. What do you say to that?

Mr. CASEY. Senators, on the latest block buy, we documented $200 million unit cost reduction just for the volume, $200 million as a result of getting down to 66 months. So there are $400 million, which got us to $2 billion per copy lower than they had previously been as measured, I think, in fiscal year 2010 dollars. So the kind of numbers you are talking about are exactly the targets we should have, but not only are they targets, they are contractual commitments on the current block buy——

Senator TILLIS. What you need is the certainty out of this institution that what we say this year is what we mean next year. That is not what we are delivering today. There is no way that any business of your size and scope can go on these 3- to 5-year, 10-year horizons and get an update from us every 6 months to a year. It just will not happen.

Thank you, Mr. Chair.

Senator WICKER. Thank you, Senator Tillis.

Senator Kaine?

Senator KAINE. Thanks to our witnesses.

You have all touched on this in your testimony, but I just want to make sure that I ask you specifically. Last week, the CNO, Admiral Richardson, released a white paper titled "The Future Navy," and his conclusion was this, that today's industrial base has the capacity to construct 29 more ships over the next 7 years than our current plan. Do you generally agree with that assessment that that is about the magnitude of the additional production we could generate under the current capacity?

Mr. CUCCIAS. When I looked at the capacity, Senator, in principle we can support the demand. Depending on how it goes from the plan to the authorization of awarding contracts and to the shipbuilders, the LHA may have to move to a 4-year center. But other than that, we have the capacity to deliver all of it from both Newport News and Ingalls.

Senator KAINE. The other witnesses?

Mr. CASEY. Agreed, Senator. I just read that document last night, as a matter of fact. He is very general about what specifically he is talking, if that were 29 submarines or 29 of a blend of submarines, LHAs, aircraft carriers, et cetera. It is a little bit difficult to understand what the mix of the 29 is, but I am very confident, depending on the Navy's mix that is in that analysis. We have sort of an open book with the Navy. They understand the ins and outs of our businesses much more intimately than most relationships I think. So I am sure that came from information that we in part provided.

Senator WICKER. Based on the Navy's mix, how much more would that cost the taxpayers?

Mr. CASEY. The 29 ships?

Senator WICKER. Yes.

Mr. CASEY. I cannot answer that. I do not know what the mix is ultimately.

Mr. PAXTON. Yes, Senator. I get to represent the entire industry.

There is that capacity out there, and we think probably 29 is not the top number. We could probably go farther than that. But it goes to what Mr. Casey said about ship mix and ship type. But certainly there is excess capacity that can be reconfigured, can be utilized to meet the 29 and do better.

Senator KAINE. Let me ask a question about ship mix. I was at a brief at DARPA recently, and I do not want to get too much into it because it was in a classified setting. But the staff was briefing me on some thoughts about different visions of future fleet architecture.

If we embark on an aggressive build plan of the kind we are discussing here, which results in the hot production lines that you guys say is best—and I agree with you on that—how difficult is it to incorporate new ship designs if there is a decision that the architecture needs to be dramatically different than we have been predicting recently?

Mr. CASEY. I think there is a big difference between serial production and introduction of new technology and new designs. I can tell you during the period of low rate production, we canceled the *Seawolf,* but we also designed and built the *Virginia* virtually on time, only about 3 months late for the schedule that was created 10 years earlier. We designed and built on time and under cost the SSGN modification to the existing Tridents to make them capable of being strike vessels without having ballistic missiles aboard. We redesigned the third *Seawolf* to become the *Jimmy Carter,* which was basically written on the back of a "while you were out" pad as a concept, and 8 to 10 years later, it was at sea performing its mission.

So we have had a string of successes. I think if you are a business that has a very tight integration between your design, your supply chain, and your construction, you are more able to adapt.

The Navy on submarines, for whatever reason—I am not sure—has not introduced so much on other classes of ships as a design/build process, assuming these were all the people that are involved in planning the ship, buying parts for the ship, estimating the cost of the ship, or part of the design function. They are authorized to do their work during the design. So when you develop a manufacturing and assembly plan, everybody is signed up for it from the guy that has got to weld the joints on the boat to the people who have to estimate the cost of the boat, the people who have to buy the material for the boat.

That is different than the historic concept design that turns in detailed design. You throw two shipbuilders and say go tell me how much it is going to cost because there is a whole different phasing that is required.

So I believe that was the secret sauce that allowed those three kinds of ships to be built basically in a very narrow window without disrupting normal processes.

Senator KAINE. Thank you.

Mr. Cuccias, let me ask you this. I visited the apprentice school in Newport News. You had a wonderful program last year. I mean, you also have a wonderful program at Ingalls. These schools are a pretty big investment at a time when there is a lot of pressure to

keep the cost down. Talk about the business case for operating these schools.

Mr. CUCCIAS. We take a lot of pride in building the finest ships in the world. But I think we also produce the finest workers in the world. I think we produce—our trained workforce is paramount in terms of being in the business. I do not know if there is a business case. You need a qualified worker. You need a trained worker. We provide great training for them. I think it has been one of the key ingredients to allow us to attain and retain the skills that you need into an overall industry outside of the United States across the board. It is not really a heavy industry marketplace anymore. So we have to kind of create our own. The marketplace does not really allow that.

We have gotten very good at it. The Newport News apprentice school I think is really the gold standard. We have emulated a lot of that in Pascagoula and we have a fine maritime academy there as well. I just think it is what we think—we call it the fundamentals—I would call the business. It is hire, training, and retaining employees. So we do not look at it as a business case. We look at it as a smart investment to keep, quote, the talent that you need to build the future fleet.

Senator KAINE. Let me just say, Mr. Chair, if I could, one last point. I am on the HELP Committee and one of the goals of Chairman Alexander and Ranking Member Murray is to rewrite the Higher Ed Act during this term in Congress. One of my main goals in working on that is to make sure we define higher education broadly enough to include career and technical apprenticeship programs. Mr. Casey, you testified a bit about the wide range of kinds of training opportunities you use at General Dynamics. I just want to make sure that we give these programs the same elevation as we are thinking about them in higher education. So I would encourage your industry to pay attention to what we are doing on the HELP side when we get into the Higher Ed Act rewrite because there may be some things we can do as a part of that legislation that would be helpful in creating the workforce that you would need to do this scaled-up production.

Thank you, Mr. Chair.

Senator WICKER. Thank you, Senator Kaine.

Senator King?

Senator KING. Thank you, Mr. Chairman.

Just to follow up on that discussion, is it fair to say, gentlemen, you both testified—or all three of you testified that the industry base, in terms of physical assets, is ready to go? It would not take a huge amount of capital investment to scale up to meet these new requirements. Is it fair to say that the obstacle, if it is one, is workforce and development of a new workforce? I know in Bath, we are having a lot of retirements, and I suspect that is true in all of the shipbuilding industry. People are starting to age out and a very large turnover, which implies additional training. Mr. Cuccias, what do you see?

Mr. CUCCIAS. From the vendor—I will go from vendor. Then I will talk to the shipyards. So from the vendor community, I think the basic infrastructure of the vendor base—a lot of that exists. The talent does not exist in terms of hiring up. So from particular

components, if you go to a vendor and say how come I cannot get my product because another program basically took your lead time spot, and there is not enough volume for them to hire up to meet a higher demand.

Senator WICKER. So you are making Mr. Kaine's point really. Are you not?

Mr. CUCCIAS. Yes, sir. I think you see that across the marketplace. Depending on certain product lines, they may have to have some other facility investments depending on terms of rate of production and what that requires. The most near-term critical point is the labor force and sending the right signal to hire and train the labor market.

Senator WICKER. Mr. King's first statement about the infrastructure pretty much being where it needs to be—do you all of you agree with that?

Mr. CASEY. I agree with that on the surface ship side of the equation for certain. I do not believe—I mean, we are making an investment at NASSCO right now mostly for efficiency purposes, not to be able to have the capacity that is necessary. I believe Bath is in a similar situation. They have adequate facilities to perform this side of the work.

In the case of the *Columbia* program, that is not the case. There is no infrastructure required to build that program, and that is what we are all trying to figure out what the right path ahead to do that is.

So the fast attack submarines—basically the infrastructure is in place for the existing model of fast attack submarines. The infrastructure we need to build the *Virginia* payload module with the processes we use today—in fact, I invite you all to get up to Electric Boat and take a look at the process of building these quad packs for the *Columbia,* a very, very different process than what was used in the past. There is a very similar concept that we have developed for the *Virginia* payload module to put those four vertical missile tubes in.

But outside of *Columbia,* I agree with you, Senator, that basically the physical resources at the shipyards that we need to continue is——

Senator KING. Do you agree then that the challenge is in workforce?

Mr. CASEY. Yes. I mean, I think even though we are fairly stable at Bath right now, when we complete the DDG–1000-class, which will be in 2019, we have a significant dropoff. But in parallel with that there is somewhat of a bifurcation in the longevity of the people in the yard. So there is a lot of entry level or newer people less than 10 years, and a lot of people who have been there more than 30 years. So as the more senior people retire, we have to hire and replace them. Absolutely. So that can always be a challenge, and when we hire new people to replace more senior people, we need to get them through a training process.

Mr. PAXTON. Senator King, I would say industry-wide, the single biggest challenge is going to be workforce development. CBO estimates over the next 5 to 10 years the seven yards building naval assets will have to increase the workforce by 40 percent. That is a real number. That takes a real concerted effort.

I agree, Senator Kaine, with your legislation. We supported that as a trade association. We really do need this technical education to be thought of as a 4-year degree just as well.

The last thing I would say on that, sir, is we have a lot of veterans that do not know enough about our industry. What we have tried to do as a trade association is a concept called the Military to Maritime. We held an event down in Norfolk where the Virginia Governor came down, and we have done this now in Houston and Jacksonville and New Orleans. What we are trying to do is raise the awareness of the veterans for the shipbuilding industry, obviously. That is what I care about. But it is also ship operators. It is folks working on all sorts of craft that ply our waterway systems. So we want to get our veterans in there. They are highly skilled and highly trained, and they can help in the industry.

Senator KING. Two general points out of this, Mr. Chairman. I think clearly this is an issue. This workforce is an issue here in this subcommittee. This an issue across our economy. I am hearing it from virtually every employer in Maine. The problem is a trained and qualified workforce. So we really got to think hard about that I think in the Congress.

The other issue that you have touched on is the whole issue of clearances. I keep hearing that in other areas, and that just may be a matter of enough people to do the clearance work, enough people to do the processing in the FBI or Homeland Security or wherever it is. I think we have got to attend to that because that is a bottleneck. I know of people applying in some of our security agencies or the State Department. They are waiting more than a year and a half for their clearances, some of whom I know have given up, and the government has lost qualified, good, capable people because the clearance process was just so cumbersome and slow.

A final question. I am a little confused by two things, a combination of two things. We have been talking about a 355-ship Navy. That is what everybody is looking at. Part of that implies more DDGs, which is something I know something about, talking about four a year. I look at the budget that was submitted yesterday, and it shows two a year out to 2022. Which is it? Is the administration's proposal, the 355-ship Navy or is this a preliminary budget? Any ideas on that inconsistency?

Mr. CASEY. I certainly do not want to try to speak on behalf of the administration, but the only comment I would make is that I think the emphasis this year by DOD is supposed to be readiness and they have not really come through a detailed plan. But I can tell you from industry's point of view, if we want to get to 355, we need to start sooner rather than later. That is for sure.

Senator KING. That is what bothers me about this budget is it shows two a year all the way out into 2022, and we are not going to get to 355 in any kind of a decent time horizon if we do not start until later than that.

Thank you, Mr. Chairman.

Senator WICKER. Senator Shaheen?

Senator SHAHEEN. Thank you, Mr. Chairman.

Thank you all for being here.

I want to follow up on the workforce issue because I certainly agree with the comments of both Senators Kaine and King that

this is a huge issue, and you all have acknowledged that. It is an issue I hear everywhere I go in New Hampshire. Is the reality not that it is not just about workers having the training that they need, but we have a workforce in this country that is aging out and we are not producing enough new workers for the jobs that we need in the future? All of the statistics and the analyses that I have seen suggests that. Is that something that you all—Mr. Paxton, you are nodding your head. Is that something that you have seen as well?

Mr. PAXTON. Yes, Senator. Like a lot of manufacturing sectors, the shipyard industry is facing an aging workforce. But on top of that, we are facing the reality that we need to ramp up quickly. So we are seeing it in our area as well.

What we do also see, though, is we are generational. If you have somebody who has worked in a shipyard, you will find a daughter or a son or a nephew or cousin will know about it and will enter.

It gets back to also legislation that tries to emphasize in our community colleges, our technical schools that this is a good option and educating that as opposed to getting a 4-year degree.

Senator SHAHEEN. Are immigrant works not also important as we look at how we are going to fill our workforce needs? I was down at Austal for a christening of an LCS ship down there, and one of the things that I noticed and they talked about were the number of immigrants who were working in that yard and doing very good work. But is this not one of the other answers to our workforce challenges in the future? Anybody.

Mr. CASEY. I am not sure where that question is headed, but I know we have a challenge in the nuclear part of the business because everybody has to be a U.S. citizen. So that might be a unique challenge to the nuclear part of the business. The shipyard we have in San Diego certainly has a lot of people that are properly vetted and work in that shipyard.

Senator SHAHEEN. I am assuming that everybody who works in the shipyard who may be an immigrant and many who are U.S. citizens who have immigrated to this country are properly vetted. Otherwise they would not be hired.

Mr. CASEY. About 60 percent of NASSCO's workforce are considered minorities, if you will, and that is largely based upon their proximity to Mexico and so forth. So all those folks that come into NASSCO every day legally and they are vetted accordingly are fantastic additions. They have got a great work ethic, and we would not be where we are today without them.

Senator SHAHEEN. So that is going to be an important role as we think about how we fill the workforce needs that we have in the future. Would you all agree with that?

Mr. CASEY. Locally, true.

Senator SHAHEEN. Mr. Paxton, I want to—we have all talked about the workforce challenges, the budgetary challenges as we think about how we get our budgetary house in order. But I noticed in your testimony that you also talked about a recent decision by the Department of Homeland Security to not revoke a series of letter rulings that have allowed foreign-built and foreign crude supply vessels to operate in violation of the Jones Act, and that that has created uncertainty. Can you talk about both what happened there

and why that is a problem? Are there other unintended consequences from decisions that are made that are affecting our ability to do this ramp-up that we would like to do?

Mr. PAXTON. Thank you, Senator.

Yes, real briefly. We had a situation where CBP—they had the situation in 2009, but waited 8 years and issued a series of revocations of letter rulings that were made ex parte to individual foreign companies to operate on the offshore oil patch in the Gulf of Mexico. Why this is particularly troubling is you do not know who got it, how they got it, and how they are operating out there.

So what happened was over a series of years, we found out there were several foreign operators who pay either zero tax or 5 percent tax versus our operators who are fully U.S.-owned, U.S.-crewed, and U.S.-built paying in the 38.5 percent tax range.

If we are talking "buy America, hire America," this is the quintessential "buy America, hire America" situation. Unfortunately, CBP pulled those letter ruling revocations back. It was really a shot in the gut for an industry who——

Senator SHAHEEN. Can I just ask you when this happened?

Mr. PAXTON. This happened just last month.

Right now, the Gulf of Mexico is experiencing a low price of oil. We have a lot of work boats, highly complicated, large boats, that are tied up. This would have really put about 30 boats to work. It would have put a lot of mariners to work. So it was frustrating.

As a trade association, we work on a policy level, and one of our policy levels is rule of law. If it is the law, let us enforce it. We say the Jones Act is an important law. We should enforce that. The Jones Act on the Gulf coast is an example of why that law works. It applied to offshore oil and gas, and because it applied to offshore oil and gas, when 3,800 rigs were operating offshore, the industry stepped up and built for the offshore oil sector. Guess what happened. We ended up being a net exporter of a half a billion dollars a year in vessels being sold internationally because we dominated that market because that market was here under the Jones Act.

So not to belabor the point too much, Senator, but it was a real disappointment. We are working with this administration, again, going back to their policy of "buy America, hire America." How this could happen? There seems to be a little bit of work that needs to be done to understand it a little bit better. But it is an important aspect of our industry, and this was an unfortunate situation.

Senator SHAHEEN. Thank you.

Thank you, Mr. Chairman. My time is out.

Senator WICKER. Thank you, Senator Shaheen.

Senator Sullivan and then Senator Blumenthal.

Senator SULLIVAN. Thank you, Mr. Chairman.

Gentlemen, thank you for your testimony.

I want to talk about icebreakers. I do not know if anyone else has raised the topic yet.

Senator WICKER. We were waiting for you, but we are glad you got here.

Senator SULLIVAN. Well, I saw Senator King was here. So I thought maybe he had.

So you may have seen the President Trump's Coast Guard speech. He talked about the need for icebreakers. A number of us

on the committee, very bipartisan, have focused on this. President Obama talked about it, you know, in terms of our kind of competitiveness for the growing strategic importance of the Arctic region of the world. Russia now has 40 icebreakers, building 13 more, some of which are nuclear powered. We have two. One is broken. They are in a horrible state of disrepair. Shameful in my view to put men and women in the U.S. military with a uniform of the U.S. military on ships like this. If you have ever seen them, you would, I guarantee, agree with me.

Senator King had the very eloquent statement saying the icebreakers are the highways of the Arctic. The Russians have super highways, and we have dirt roads with potholes, something like that. But it was well stated. It was very well stated.

So we have a bit of a frustrating issue that we have to deal with here which is kind of the hot potato between the Coast Guard and the Navy. Whenever the topic comes up, nobody seems to want to own it, and we will have to deal with that.

But there is also this discussion, kind of this conventional wisdom out there that comes I think mostly from the Coast Guard that if we do get the funding to build an icebreaker, it will take $1 billion and 10 years to build. You know, every time I hear that I am like, my gosh, we put a man on the moon inside of 10 years. We cannot build one icebreaker inside of 10 years?

So I have kind of looked around the world, and the Fins are very interested. You know, they say they can build heavy icebreakers for $250 million. Singapore has a similar kind of gauge in what their industrial capacity is able to do.

So what is the deal with icebreakers? Do you agree that it should take 10 years and a billion dollars to build one medium or heavy icebreaker? If not, what are we doing wrong? Why does it look like our industrial base has no capacity when there are other countries in the world that seem to be on this, can do it in 2 to 3 years, a quarter of million dollars. We are saying 10 years, a billion. What do we need to learn here about this? It is a very frustrating topic because nobody seems to have the right answers.

Mr. CASEY. Senator, there have been I think it is five different shipyards that are in the middle of detailed studies to produce the very icebreakers that you are talking about.

Relative to the cost and the time it takes to build them, it is largely, at this stage, driven by the requirements that are determined to be necessary. So when you are looking at the cost of any ship, we like to think about it in terms of ISSR, the inherent cost of the design, if you will, the requirements. What would you like to have as part of that icebreaker? There is medium weight. There is heavy weight. There is nuclear power. There is diesel power. There are thicknesses of ice that it has to travel through. All those things can determine the cost.

We are actually teamed at NASSCO with a branch, if you will, of some of those foreign companies that have built many, many icebreakers to make sure we can come up with one of the best concepts as part of the design studies.

So the numbers that you are using I cannot comment on specifically because we are not sure of the source or what the requirements used——

Senator SULLIVAN. Should it take 10 years and $1 billion?

Mr. CASEY. We would like for it not to.

Senator SULLIVAN. So would we. But you do not know the answer to that?

Mr. CASEY. I do not because it depends on when the funding is authorized, when the design is complete. Do you do design and advanced procurement before you start construction? There are a lot of different ways to measure that. I think you could probably come up with a scenario. Obviously, the Coast Guard did. They are our direct customer on this, and we do not think it is a great thing to be alienating them right now. But we will develop for them the best, fastest, cheapest icebreaker that can be built within the constraints of the design criteria that they establish.

Senator WICKER. Are the designs unrealistic? Are they asking too much in terms of requirements?

Mr. CASEY. I think they are very open-ended at this point. I think they are very general at this point.

Senator SULLIVAN. Would it make sense to go to the Fins and just say——

Mr. CASEY. No.

Senator SULLIVAN. No?

[Laughter.]

Senator SULLIVAN. Well, that is a rhetorical question, as you can imagine. But, I mean, I am very supportive of our industrial base, but if the industrial base takes 10 years to be able to do something that really should not—let us face it. It should not take 10 years to build an icebreaker. I do not know if that is our problem or the Coast Guard's problem. But it would be helpful if you guys had suggestions on how to make it so we do not need to go to Singapore or Finland and say, well, you guys seem to know how to do this much better, much cheaper, much more efficiently than our own industrial base. I do not think that is where anyone wants to go, but at a certain point, 10 years is kind of a crazy idea that we cannot do anything in that amount of time.

Anyone else have a thought?

Mr. CUCCIAS. Senator, I think something that the Coast Guard is doing that is quite smart is they are involving industry early in the requirements definition. We all have seen designs take longer and construction take longer, and it is where the requirements were poorly defined and construction was started, and the design was not finished. To bring the industry in, the shipbuilders in to ask for their ideas—and industry is involved then in terms of the world standards for icebreaking. I was at Avondale when Healy was designed and built, the last icebreaker in this country.

But we have brought in members from all around the world to find out what the best ideas are. For the Coast Guard to be asking industry what are your ideas, what do you think, and then how much will this cost with this idea, to have those discussions now I think is extremely healthy, and I think it will actually take the Coast Guard to a good place.

Senator SULLIVAN. Thank you.

Thank you, Mr. Chairman.

Mr. PAXTON. Senator, I will just add that it is a good thing that we have five shipyards competing for this. It shows that we do

have an industrial base that can meet the challenge of building hopefully not one—we need to build six or more, and you can get the economies of scale in.

Senator WICKER. Hear, hear.

Senator Blumenthal?

Senator BLUMENTHAL. Thanks, Senator Wicker.

I want to begin by agreeing with my colleagues about the need for skilled training and sort of mention the elephant in the room, which is that we see a 10 percent increase in our defense budget and a cut in skill training funding in the Labor Department. I have said at Electric Boat, when I visited, and to the countless workers in the supply chain that they are as essential to our national security as the men and women who serve, and two of my sons have served recently in uniform. I believe passionately that we must do more to invest in them. But cutting the budget for skill training is not the way to do it. I am not asking you to go outside the mission of your being here today to be critical of the Trump budget, but I think we need to invest more, not less in that kind of training activity. I associate myself with all the remarks that have been made to that effect.

I am very happy that the Navy has heeded the calls from many of us for an additional submarine in 2021. I believe that the investment of more than $5 billion in two *Virginia* attack submarines, including $1.9 billion in advanced procurement is also welcomed.

I am concerned that this advanced procurement will be inadequate to advance the total advanced procurement for those years. I am going to be advocating an additional $200 million, and I wonder if you could comment on that, Mr. Casey.

Mr. CASEY. We appreciate your support, Senator, in every way. What you just described is certainly going to be—the benefits of that we are going to lay out in detail and provide to all the members on the various committees that evaluate those sorts of changes to the proposed budget. So we concur with that number. We think there is a rationale to do so.

Frankly, when we started up this block IV that we are in the middle of right now, I think we have realized very quickly that we did not sort of get out of the gate as soon as we could have. We actually had some material shortages when we started construction that made it more difficult to achieve the goals that we are setting for ourselves. The sooner we get that material on our dock, the sooner we can go back to that 2, 2, 2, you know, 2 years earlier, 2 million less hours per ship, and that is the key too, is having the advanced procurement money 2 years before you actually need to start construction of the ship.

Senator BLUMENTHAL. That $200 million can be a real force multiplier or leverage point to diminish costs in the future.

Mr. CASEY. It also helps the supply chain ready themselves for this increased volume in the long run. The more we can kind of task them early, the better off I think we will all be.

Senator BLUMENTHAL. The more support you can give us in detail, the better, obviously. I know that you will.

The same applies to I think the $150 million that you mentioned for fiscal year 2018 because I agree totally, and I will be a strong

advocate for it. I am hopeful that members of the subcommittee will agree as well.

I want to talk for the moment about maintenance, which is the less glamorous side of what you do, but equally important and cost effective because as much as we are building new submarines and I think the addition of a second submarine in 2021 shows how deeply the Navy—and I think we all should agree—believe that submarines and their stealth and strength are unexcelled as a weapons platform.

But maintenance is extremely important, and to go back to the USS *Boise,* which is now tied up pier side unable to submerge, I have written to advocate that that work in fact be accelerated which would, as you pointed out earlier, not only be good for our national security but also for the industrial base at Electric Boat because it would fill a lull or a gap and thereby enable us to sustain that workforce.

Perhaps you can talk a little bit more about the capacity of Electric Boat to do that work in a private shipyard so it does not have to be done later in a public shipyard and how it would sustain that industrial base.

Mr. CASEY. Well, the *Boise* would be a natural follow-on to the Montpelier that is undergoing maintenance today at Electric Boat, which is scheduled to finish roughly at the end of this year. We are in the process of responding to a request for proposal from the Navy which is due, I believe, in mid June on the *Boise.* We will be submitting that proposal, and as soon as the Navy can act on that and authorize planning and procurement of materials necessary to conduct the availability, we would be ready to go.

You stated it quite eloquently and accurately that that will fill our workload gap should we win that competition on the *Boise.* So we appreciate your support in that regard, Senator.

Senator BLUMENTHAL. Well, I raised this issue yesterday in a similar subcommittee meeting. It was a closed setting, so I am not at liberty to discuss it. But I believe it really should be a priority for the Navy because to have one of our submarines unable to submerge and potentially missing deployments I think would be very regrettable. In addition, it would be helpful to Electric Boat in sustaining the industrial base. So thank you.

Thank you, Mr. Chairman.

Senator WICKER. Mr. Casey, you discussed this, and I do not think we followed up with a question. When we hear about the 355-ship requirement, which is budget informed, realistically how quickly could we get there, and what do you understand from the Navy as to how quickly they would like to get there?

Mr. CASEY. Senator, I am privy to alternatives that get us there in the mid 2030s or the mid 2040s. As you point out, that is budget-driven. It all starts with a commitment I think from the government and the desires to be budgeted and there to be certainty into what needs to be done so the process can start. So the sooner we start, the sooner we can get there, but it largely depends on the rate at which we are expected to perform. That is what determines our capacity. I am not sure if that is clear enough of an answer, but that is how I see it.

Senator WICKER. Anyone else want to help us with that?

Mr. CUCCIAS. The 355 includes a lot of platforms. So really, I can only speak for the platforms that we provide. Carriers right now are on 5-year, 6-year centers. They can go to 3-year centers. LPDs are not on any center right now and they can go to a 1-year center. The DDGs can go faster than 1-year centers than two a year. LHA is right now on 7-year centers. LHAs can go to a 3- to 4-year center. So all the increased volumes in terms of the ships that we provide, we can produce those at a much faster rate.

Senator WICKER. Can you put a price tag on what you just said?

Mr. CUCCIAS. Not right now.

Senator WICKER. Do you think you could back to us on the record with a guesstimate?

Mr. CUCCIAS. Yes, sir.

Senator WICKER. What are we learning from our partner nations in terms of how they are building ships, and what are we learning from our adversaries that might be helpful to this committee or this Congress?

Mr. PAXTON. Mr. Chairman, I would say one thing that we have learned—and it is kind of in the reverse—is what we do not want to repeat is some of the examples we have seen in shipbuilding in Britain and shipbuilding in Canada and Australia where they really atrophied their industrial base. We do not want to ever get there. So it is kind of the reverse of your question on what we have seen. But it is an important cautionary tale because there are things that this Congress can do policy-wise that could really harm our industrial base and harm our supplier chain. So we want to avoid those things and do better, especially if we are going to build up a larger Navy.

The only other thing I would say—and this is not in my area, but I know we benchmark ourselves against international shipyards and try to do better and learn from them. So we are taking in best practices and trying to implement those in how we build.

Senator WICKER. Can any of you tell us what the Russians are doing right, wrong, what the Chinese are doing right or wrong?

Mr. CASEY. No, I cannot.

Mr. CUCCIAS. No, sir, I do not have that insight.

Senator WICKER. Senator Hirono?

Senator HIRONO. Mr. Chairman, I just wanted to note that as a very strong supporter of the Jones Act, not only is the Jones Act important to maintaining our industrial base, but it is a very important part of national security. We need those Jones Act ships. So thank you very much, Mr. Paxton, for going into a little bit of these letter rulings, which concern me very much. Mr. Chairman, I intend to follow up on what we can do to clear things up.

Mr. PAXTON. Thank you, Senator. I appreciate that.

Senator WICKER. Gentlemen, before I turn to Senator King again, I want to put in the record at this point an article by Jerry Hendrix and Robert S. O'Brien dated April 13, 2017 from Politico, "How Trump Can Build a 350 Ship Navy." It advocates, among other things bringing some ships out of mothballs. So we will put that in the record, without objection, at this point.

[The information follows:]

Please see Appendix A.

Senator WICKER. Comment about that, Mr. Cuccias—well, actually all three of you. Is there anything to be said for this? Obviously, we put ships in mothballs rather than scuttle them for some reason. What role might your yards have in making this sort of concept a reality? Is there any there there?

Mr. CUCCIAS. Well, Senator, I have not read the article. I am not really familiar with it. So it is hard to comment on it.

I know on refurbishment, there are life cycles on just the operating the plans. There are the logistic chains that should be considered. There is the operational cost part that has to be considered. Without more insight to the article, it is hard to comment more than that.

Senator WICKER. All right.

Mr. CASEY. Senator, I would only say that the Navy had begun a working group to look at the cruisers in particular, and I think there was an amphib or two in the pile where they have called industry in to talk about developing a program that would allow those ships to be brought back into service.

Senator WICKER. Is this ongoing—this working group ongoing?

Mr. CASEY. Yes. It is run by the Naval Sea Systems Command, the Program Executive Office. I do not think we have met in the last couple of months, as far as I know, but they are in discussions about how to do that efficiently.

Senator WICKER. But conceptually your company might be able to participate in such a——

Mr. CASEY. Well over half of NASSCO's business is repair business. You know, Electric Boat is doing submarines a little bit, and Bath is pretty much totally focused on construction. But NASSCO—about 50 percent of what they do is repair largely out of the Norfolk area. So NASSCO will definitely look at the details of that to see where we might add value.

Senator WICKER. I just think we ought to be looking at all alternatives and thinking outside the box. That is why I was asking about our international partners and competitors.

Mr. Paxton, any thoughts there?

Mr. PAXTON. No, Mr. Chairman.

The only other comment I would make is I know recently we did refurbish some vessels for foreign sale I believe to Japan, and the comment made by Navy officers were those vessels looked great when they came back on line and were ready to go. So we have the capability and capacity to do it, and we make them look really good when we are done. So if it is an option, our industry is there to do it.

Senator WICKER. Senator King?

Senator KING. No questions.

Senator WICKER. Well, if the witnesses will bear with us for a moment.

Thank you very, very much. I think this has been most helpful, and we had great participation from some seven members of the subcommittee. That is unusual and outstanding. I think it reflects the level of interest that this subcommittee has in the subject matter.

We will leave the record open for some 5 days so people can ask questions on the record.

This subcommittee hearing is adjourned with the thanks of the membership.

[Whereupon, at 11:06 a.m., the Subcommittee adjourned.]

APPENDIX A

POLITICOMAGAZINE

How Trump Can Build a 350-Ship Navy

The president promised to restore America's strength on the high seas. Here's how he can actually do it.

By JERRY HENDRIX and ROBERT C. O'BRIEN

April 13, 2017

AP Photo

WAR ROOM

Capt. Jerry Hendrix, USN (ret) (@JerryHendrixII) is a retired U.S. Navy captain and award-winning naval historian. Hendrix is senior fellow and director of the Defense Strategies and Assessments Program at the Center for a New American Security.

Robert C. O'Brien (@robertcobrien) is a partner at Larson O'Brien LLP. He served as a U.S. representative to the United Nations General Assembly. O'Brien was also a senior adviser to Govs. Scott Walker and Mitt Romney and Sen. Ted Cruz during their presidential campaigns. His book While America Slept: Restoring American Leadership to a World in Crisis *was released in September.*

When President Donald Trump wanted to send a message to North Korea, he did it the old-fashioned way: by sending the USS *Carl Vinson*—a *Nimitz*-class aircraft carrier that holds a crew of 5,200 people and bristles with some 65 or so fixed-wing aircraft and helicopters—steaming toward the Korean Peninsula.

An aircraft carrier is the ultimate expression of American power, a floating military base whose arrival inspires fear in our enemies and heartens our allies. The Vinson, along with its strike group of two destroyers and one cruiser, certainly caused top officials in Beijing and Pyongyang to sit up and notice. North Korea called the deployment "outrageous," while China expressed "concern." If both countries' leaders didn't understand how serious Trump is about stopping North Korea's race toward nuclear-tipped missiles, they get it now.

This is exactly why America has a Navy—and exactly why it's so important that we rebuild it after years of atrophy as a result of the war on terrorism and budget constraints under President Barack Obama. Unfortunately, the Navy is no longer large enough to remain persistently forward-deployed to uphold international law or fully protect the nation's interests. Set aside security threats like North Korea—the entire international economic system, nearly wholly dependent upon huge container ships, is nearing its fracture point. Once broken, this system, based upon a loose maritime law consensus that is enforced by American naval might, will be difficult to reestablish.

The shrinking Navy has led to a slow deterioration of the nation's shipbuilding industrial base. Shipyards require steel-workers, welders, pipefitters, electricians, heating and air conditioning technicians and industrial managers, all well-paying jobs, but as shipyards and suppliers have closed and consolidated, many of those jobs and skills have been lost. The waning of America's shipbuilding capacity is not just an economic issue; it damages our national security.

This is why Trump's promise in September 2016 in Philadelphia to "build a Navy of 350 surface ships and submarines," as well as his more recent commitment in Newport News, Virginia, to a "12 carrier Navy," is so important. If he succeeds, he will join Theodore Roosevelt and Ronald Reagan as the presidents who have shaped the world and America through their commitment to the Navy.

Trump has set out to do nothing less than reverse the slide in naval power that was a hallmark of the Obama administration's timid foreign policy. Rebuilding the Navy is the cornerstone of a "peace through strength" posture that will deter America's adversaries and reassure her friends. It will have the added benefit, as experience has demonstrated, of growing the American economy through the addition of thousands of well-paying blue-collar jobs.

And jobs aren't the only economic benefit the Navy provides. Upholding the international trading system benefits all Americans. Unfortunately, in recent years, China, Russia, Iran and North Korea have been challenging time-honored maritime norms of free trade and free navigation and threatening the United States and its allies with expansive territorial claims in the East China Sea, South China Sea, Korean Peninsula, Strait of Hormuz and the Black Sea. Moreover, China's People's Liberation Army Navy is developing bases as far away as Africa, and Russian subs are patrolling at levels not seen since the Cold War. China is engaged in the biggest shipbuilding program by an emerging power since Kaiser Wilhelm II built Germany's Kriegsmarine fleet that, in part, precipitated World War I. (The United States simply doesn't have enough ships to sustain a serious response. Even the Vinson strike group is symbolic of the

problem. In the past, a carrier would be escorted by two cruisers, two guided missile destroyers, two anti-submarine warfare destroyers and two escort frigates. Today, the Navy mustered only three ships—highly capable ones, but three nonetheless—to escort the *Vinson*.)

The president's plan is designed to address these concerns, but it won't be easy. Dramatically growing the fleet will require presidential-level leadership and significant investment. Adding 75 ships to the fleet will be a challenge both from an industrial perspective (the nation does not have as many shipyards as it once did) and from a fiscal perspective (since the president is dealing with a deficit that doubled under his predecessor).

The Navy's uniformed leadership has stated that it may take as long as 25 years to reach the president's goal, a time frame that makes sense only if we accept modest increases in production of present classes of ships. It's an unacceptably slow schedule, given the depth of the crisis—and it reflects a shipbuilding plan that is very similar to the one floated by the Obama administration. America needs a bigger Navy yesterday, not a quarter-century into the future. We believe Trump can reach his goal of a highly capable 350-ship fleet by the end of his second term if bold action is taken now. With a little creativity, some political elbow grease and good old-fashioned American ingenuity, here's how he can do it.

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We begin with a broad accounting of where we stand. Today's fleet stands at 275 ships, up slightly from the 271 ships in 2015, but nowhere near the post-World War II average of 740 ships. The good news is that the Navy is scheduled in the next eight years to take delivery of 80 new ships already under contract including two carriers, 17 *Arleigh Burke*-class Aegis destroyers and 16 *Virginia* class fast-attack submarines—all front-line warships. The bad news is that over the same period, the Navy has scheduled 49 of its ships for decommissioning. These ships include five *Ticonderoga*-class Aegis cruisers and 21 *Los Angeles*-class fast attack submarines—again, all key components of the Navy's wartime force. Taken together, these numbers add up to a net increase of 31 ships in the force over the next eight years—still 44 ships short of the president's and his commanders' requirement of 350 warships.

The USS Carl Vinson, a Navy aircraft Carrier, approaches to join an annual joint military exercise between South Korea and the United States in Busan, South Korea, in mid-March. | AP

The USS *Carl Vinson*, a Navy aircraft Carrier, approaches to join an annual joint military exercise between South Korea and the United States in Busan, South Korea, in mid-March. | AP

The number 350 is critical. The regional combatant commanders have identified 18 maritime regions around the world that require persistent American naval presence to protect the United States' national interests. If one of these regions is "gapped" of U.S. naval presence, then international norms, such as free navigation, fall into disuse and are challenged by local actors. To be sure, not all of these regions demand an aircraft carrier. *Arleigh Burke*-class destroyers seem to work best in the Baltic and Black Seas, for instance, while amphibious ships are in demand in the African Gulf of Guinea, but, as a rule, it takes five ships to keep one forward-deployed: one arriving home, one in the yards for maintenance, one working up toward deployment, one deployed and one transiting home. Taking all of these factors into consideration, we arrive at a minimum number of 350 ships to maintain stability in the global maritime commons.

So how to get to 350? The first step should be a review of the ships scheduled to be decommissioned in order to determine their true condition. The five oldest cruisers in the force have been in the water for 30 years and are scheduled to be transferred to the "mothballed" Ready Reserve fleet at 35 years, but overhauls, refitting and service life extension programs could conservatively add five to 10 years to their lives. This work would have to begin immediately and would not be inexpensive—estimates range as high as $300 million per ship—but this option must be explored. Similarly, the Navy is looking to retire nine of its 14 mine counter measure ships over the next eight years. These ships fill a critical warfighting niche and

were supposed to be relieved by littoral combat ships (LCS), but the mine-hunting systems that were to be installed on the LCS have not matured as expected, creating a strategic hole in the Navy's spectrum of capabilities. The mine countermeasure ships are generally seen to be in good condition. Taken together, the service-life extensions of the cruisers and mine sweepers would add 14 platforms to the Navy's ship count, decreasing the gap between the current plan and a 350-ship fleet from 44 to 30 ships.

Another option is to take a page from Reagan's book and find capable ships in the nation's "ghost," or Ready Reserve, fleet. The ghost fleet is a collection of ships kept in wartime reserve. Decommissioned and preserved, they sit in the water in various strategic locations around the country ready to be called upon in a national emergency.

Currently, there are 11 *Oliver Hazard Perry*-class frigates that are deemed too old and expensive to maintain by the Navy but are highly desired by allied navies such as Turkey, Taiwan and Egypt. These proven frigates could be refitted and equipped with modern anti-surface and anti-air missiles to get them back into the fleet and allow them to contribute to presence and escort missions. This is precisely what our allies have done when they have purchased the *Perry*-class frigates from us at a fraction of the cost of building a new warship.

Additionally, there are three *Ticonderoga*-class Aegis cruisers that were decommissioned with 10 years of hull-life left in them. Each ship was scheduled to be scrapped by the Obama administration, but that decision can be immediately reversed. For an investment of $550 million each, an eighth of the price of a new cruiser, these warships could be upgraded with new vertical launch systems and returned to the fleet with 122 VLS tubes stocked with a variety of missiles, including the Tomahawk land attack missiles that struck Syria last week. Only the Russian Navy's *Kirov*-class cruisers exceed the firepower of the *Ticonderogas*. To leave three of America's most lethal surface combatant on the sidelines makes no sense in today's dangerous world.

There are also two recently mothballed amphibious assault ships that should be inspected and considered for further service. With new technology such as rail guns, lasers, UAVs, Osprey tilt wing aircraft and F-35Bs, the big decks and welldecks of the amphibs could provide the Navy with many interesting opportunities. Each of these ships would also come with a maintenance and readiness bill, but again, retrofitting them would still be cheaper and faster than building new ships.

If half of the ghost fleet's *Perrys*, *Ticonderogas* and amphibs can be returned to active service with new capabilities and an extended ship life, they would represent eight additional ships in the fleet by the end of the president's first term. So America would need to build just 22 new ships to reach 350.

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This leads us to the topic of new construction. Presently the conversation within the Navy centers around taking the "warm" *Ford* (carrier), *Burke* (destroyer), *Virginia* (attack sub) and *San Antonio* (amphib) production lines and turning them "hot" by ramping them up to full capacity. While this step would have the result of improving the overall combat capabilities of the fleet, it would also add an average of $10 billion per year to the acquisitions budget of an already strained budget while yielding only an average of four additional ships per year.

While the Pentagon budget was increased by $54 billion in the president's recent budget submission, the Navy can expect to receive only about a third of this amount. Most of those funds must go toward maintenance and readiness shortfalls left over from the Obama administration's neglect. So, unfortunately, few dollars in the current budget proposal are left for building the new warships the president wants and America needs.

In our view, new or additional acquisition dollars should be spent on the 12th carrier announced by the president; on submarines, where the Navy is facing a real numbers crisis; and on small surface combatants (frigates and offshore patrol vessels), where China is racing ahead of the United States.

The Navy should continue building its highly capable *Arleigh Burke*-class destroyers, but at the current rate. Whereas two additional destroyers (the Navy already has 64 and is headed toward 80 by 2024) would cost $3.6 billion, that same money could purchase two robust frigates based upon the Italian and French FREMM class design; two 65-meter offshore patrol vessels, such as the *Ambassador*-class ships manufactured in the United States for Egypt; and two Joint High Speed Vessels modified with new surface-to-surface missiles to serve as fast missile attack ships. One benefit of the FREMM class frigate, the most robust of the Navy's frigate options, is that it could be built under license at the Marinette, Wisconsin, shipyard very soon after that yard finishes the current run of the *Freedom*-class LCS. The *Freedom*-class LCS consortium includes the FREMM's Italian manufacturer, which owns the Marinette yard.

This diverse acquisition program represents an approach that embraces carriers, naval aviation, guided-missile destroyers, subs and small surface combatants and missile boats, so that we can confront our adversaries at every level. It would allow the Navy to position squadrons of offshore patrol vessels and missile boats in the contested waters of the western Pacific, Mediterranean, Arabian and Baltic Seas, where they are urgently needed.

It's a fiscally conservative approach that would also free up the resorces to meet the president's strategic goal of adding a 12th carrier to the fleet. The additional carrier is crucial, as the United States has found itself without a carrier in the Mediterranean and other key theaters on several occasions over the past two years. At present, the Navy will not see a 12-carrier navy for 19 years, and, then, only by speeding up by the build time for new carriers by a year. What many people do not know is that the dry dock at Newport News, where the carriers are built, can actually hold two super carriers. So we recommend building two carriers at once—just as the Reagan administration did in the 1980s, when it procured the USS *Abraham Lincoln* and the USS *George Washington* simultaneously. This would cost more than the current plan, but buying the ships concurrently would also allow the government to negotiate a discount. And it would get Trump his 12th carrier into production by the end of his second term, should he be reelected.

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So, what about the jobs? All of this activity will reenergize the nation's shipbuilding and repair industrial base in a manner not seen since the height of the Cold War. Navy shipyards in Norfolk, Bremerton, Pearl Harbor and Portsmouth will be engaged in service life extensions. Mothballed ships will flow into Philadelphia, San Diego and along the Gulf Coast and come back to life. New ships will come together in Wisconsin, Alabama, Louisiana and Oregon and even along the banks of the Mississippi and Ohio rivers, just as they did during World War II, driving a renaissance in American shipbuilding and bringing much-needed well-paying jobs to the nation's heartland.

There will naturally be other expenses to be calculated beyond shipbuilding. Naval aviation will require another 225 aircraft to make up the current strike-fighter shortfall and man the 11th air wing once the 12th carrier comes on line, and there better be some long-range unmanned tanking and strike capacity in that air wing as well. The president has already talked about buying additional squadrons of Boeing's proposed upgraded Block 3 Super Hornets. The additional carrier would allow the Navy to do so without significantly cutting into its F-35C buy from Lockheed. Additional ships will also require additional maintenance and readiness dollars. More sailors will also be needed. The last time the Navy had 350 ships, it had just shy of 400,000 personnel in its ranks. Today it has 323,000 sailors. Even with new unmanned

technologies, the Navy will need more men and women in its ranks, and American sailors do not come cheap. On the very positive side for our sailors, more ships means shorter deployments and more opportunity for advancement and command.

OK, you might be asking: What's all this going to cost? The Navy's budget for fiscal year 2016 came in at $160 billion, a modest 1.5 percent increase over the previous administration's submission. This budget is well short of the type of investment necessary to return the Navy to its full strength of 350 ships while also addressing significant readiness and maintenance shortfalls. To accomplish these goals, we recommend an average ship procurement budget increase of $7 billion per year over the next eight years. That would fund the shipbuilding program proposed here, including the purchase of an additional carrier, and cover the initial *Ohio*-class ballistic missile submarine replacement. We also recommend an average increase in aviation procurement of $3.5 billion over the next eight years to address the strike fighter shortfall and reintroduce a robust long-range strike capability in the carrier air wing. These new ships and aircraft will necessitate a change in the Navy's Operations and Maintenance budget, which should rise from its present $48.4 billion to $57 billion. Increased personnel costs must be factored in as well, netting an $8.2-billion-per-year increase by the end of Trump's second term. Overall, the Navy budget we propose would rise from $160 billion to just over $190 billion by fiscal year 2024.

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We expect the criticism of our plan to be fierce and furious. Deficit hawks on the right and those on the left who would rather spend more on domestic programs will complain about the precipitous rise in defense spending suggested within this proposal. They fail to grasp, however, the threats America faces today—from a rising China to a resurgent Russia to dangerous smaller players such as Iran. In the end, history teaches us that it is far less expensive to deter a war than to fight one, a lesson that has repeated itself since the Roman era. We also note that this naval budget would not increase the overall defense budget above the post-World War II average of 4 percent of annual GDP.

Some will say that investments in older ships is lost money in an age of anti-access/area denial weapons, but 90 percent of naval operations is preventing the outbreak of war through the consistent demonstration of peacetime presence and American resolve. Older frigates, which our allies operate for 20 years after we decommission them, new frigates and offshore patrol vessels are sufficient for this purpose. Moreover, they will all field more firepower than the Navy's current small surface combatant, the LCS.

Others will argue that the Navy will be best served by a new "clean sheet" designed frigate, or even by pursuing an evolution of the LCS. Unfortunately, the two LCS designs have suffered through a series of engineering malfunctions and structural design flaws and are also considered to be too under-armed to be credible in combat situations. In general, American ship designs over the past generation have failed due to their built-in complexity and high cost. The Navy's newest ship, the Zumwalt DDG 1000, has experienced early issues and has been limited to a class of merely three ships. It is even unclear whether the Navy will purchase the costly high-tech ammunition for which its naval guns were designed.

It will be pointed out that our diverse shipbuilding plan would result in the Navy having four classes of small combatants in the fleet for a period of time (*Freedom* Class, *Independence* Class, *Perry* Class, and potentially FREMM class), which will bring additional parts, training and maintenance complexity to the fleet. Some of these issues could be mitigated by basing classes together geographically. However, at this point, numbers matter, and the key goal must remain the 350-ship fleet.

Some naysayers will claim that missile-laden high-speed vessels and offshore patrol vessels are too vulnerable to enemy attack. We reply that these ships are an inexpensive way to complicate the calculations of our competitors and project American power while reassuring allies. Indeed, China and Russia are themselves building new classes of missile craft and offshore patrol vessels for presence and sea control missions in key regions such as the Arctic, South China Sea and Taiwan Strait. To all of these critics, we say: As each day passes without a shipbuilding plan that reflects the president's priorities, Trump is missing a chance to make a strong start on significantly increasing the size of the fleet. Very soon it will be too late to influence this year's budget cycle. Ships take two to five years to build, and ships included in next year's budget will possibly not hit the water until after the next inauguration. The time to act is now.

We expect Trump to announce his pick for secretary of the Navy soon. We urge the Senate to quickly confirm him and his team so that they can get to work. And we encourage the new SECNAV and Defense Secretary James Mattis to act boldly to execute a shipbuilding plan that will make good on the president's promises today, not tomorrow. The Navy requires the ships, our sailors deserve them, and the American people need the jobs and improved defense industrial base this program will bring.

OPTIONS AND CONSIDERATIONS FOR ACHIEVING A 355–SHIP NAVY FROM NAVAL ANALYSTS

TUESDAY, JULY 25, 2017

UNITED STATES SENATE,
SUBCOMMITTEE ON SEAPOWER,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

The subcommittee met, pursuant to notice, at 3:12 p.m. in Room SR–222, Russell Senate Office Building, Senator Roger F. Wicker (chairman of the subcommittee) presiding.

Committee Members present: Senators Wicker, Rounds, Shaheen, Kaine, and King.

OPENING STATEMENT OF SENATOR ROGER F. WICKER

Senator WICKER. The Senate Armed Services Subcommittee on Seapower convenes this afternoon to receive testimony from prominent naval analysts on achieving the 355-ship Navy.

We welcome our four witnesses: Dr. Eric Labs, Senior Analyst for Naval Forces and Weapons at the Congressional Budget Office; Mr. Ronald O'Rourke, Specialist in Naval Affairs at the Congressional Research Service; Dr. Jerry Hendrix, Senior Fellow and Director of the Defense Strategies and Assessments Program at the Center for a New American Security; and Mr. Bryan Clark, Senior Fellow at the Center for Strategic and Budgetary Assessments.

Our subcommittee is grateful for these witnesses appearing before us. Their thoughtful analysis will be most helpful as we consider options for increasing the size and enhancing the capability of our Navy.

Today's hearing represents another step in this subcommittee's effort to examine the Navy's 355-ship requirement. We have received a classified briefing on the requirement, heard from shipbuilders and suppliers, held a shipbuilding hearing with Navy officials, and received testimony from Reagan administration officials last week. Our actions this year will set a firm foundation for an intelligent and responsible expansion of the fleet in the future.

To that end, I would note the bipartisan SHIPS Act legislation which would codify the Navy's requirement for 355 ships as U.S. policy. The full committee has adopted the SHIPS Act into the fiscal year 2018 NDAA, and our House counterparts have done the same and gotten it passed by the entire House of Representatives.

The seapower title also authorizes additional funding for five ships above the administration's budget request while maintaining effective cost control measures on existing programs.

Each of our witnesses has made important contributions toward analyzing Navy force structure, including the Navy's 355-ship requirement.

Dr. Labs' annual analysis of the Navy's 30-year shipbuilding plan is really anticipated and widely read. His special report this April, which projected costs and time frames to achieve a 355-ship Navy, is particularly relevant. In this report, he found that 2035 is the earliest date upon which a 355-ship fleet could be achieved. That is 18 years from now. His report estimates that reaching 355 ships would require doubling the historical spending on shipbuilding to about $33 billion per year for a number of years. In comparison, the Navy's budget request included about $20 billion for shipbuilding in fiscal year 2018.

He also found the Navy would need 19,000 more sailors to man these extra ships, $15 billion more for associated aircraft, and also that annual fleet operating costs would increase by 67 percent, or $38 billion, compared to today's fleet.

My understanding is that his analysis did not consider the effects of extending service lives for existing ships or reactivating decommissioned ships.

Mr. O'Rourke's government service as a naval analyst began in 1984 during our last naval buildup. His frequent reports on specific shipbuilding programs, as well as broader naval issues are read closely by this subcommittee, by government and industry leaders, by our allies and partners, and by our competitors. His latest Navy force structure report published last month highlights the Navy's proposed mix of ships within the 355-ship requirement. He determined that the Navy would need to add at least 57 ships over the 30-year shipbuilding plan to achieve and maintain a 355-ship fleet. This effort would require a minimum increase of $4.6 billion in the annual shipbuilding budget unless the service lives of existing ships are extended beyond currently planned figures and/or retired ships are reactivated.

As a retired Navy captain and highly regarded analyst, Dr. Hendrix is intimately familiar with Navy capability gaps and modernization needs. He has written many compelling reports and articles, including one which I have previously entered into the record entitled "How Trump Can Build a 350-Ship Navy," co-authored with Robert C. O'Brien for Politico. In this article, he asserts that a 350-ship fleet could be attained as early as 2024 by increasing the Navy's top line budget, roughly $20 billion, cumulative over the next 8 years. To achieve this timeline, he proposes several out-of-the-box actions, including service life extensions, reactivating decommissioned ships, and building foreign designs in U.S. shipyards.

Finally, as a retired Navy commander and top aide to a former Chief of Naval Operations and prominent analyst, Mr. Clark has been assessing and making recommendations on Navy force structure needs for over a decade. As with all the witnesses, his body of work is an excellent resource for this subcommittee. Today I would like to focus on his congressionally directed future fleet ar-

chitecture study called "Restoring American Seapower." His study calls for a 382-ship Navy by 2030, a figure which would cost an additional $4 billion to $5 billion for shipbuilding every year. The study's in-depth analysis of capabilities, platforms, and operating concepts and posture were compelling, and I hope to see many of these recommendations implemented.

The subcommittee is interested in the views of these four witnesses on the options and considerations for achieving a 355-ship Navy. Specifically, I hope our witnesses discuss what factors are driving the need for a bigger Navy, the right mix of ships for our future fleet, timelines and costs for achieving the Navy's requirement, innovative options to grow the fleet, including extending service lives and reactivating decommissioned ships, the additional support necessary to generate and maintain the fleet buildup, including personnel, aircraft, weapons, other equipment and maintenance, and finally, actionable items that this subcommittee should consider to lay a firm foundation for a fleet buildup. I look forward to our witnesses' testimony.

I have spoken to Senator Hirono on the floor. Her statement will be included at this point in the record.

[The prepared statement of Senator Hirono follows:]

PREPARED STATEMENT BY SENATOR MAZIE K. HIRONO

Thank you, Mr. Chairman.

I join the Chairman in welcoming our witnesses to the hearing this afternoon.

Over the past weeks, we've held hearings on the Chief of Naval Operation's new Force Structure Assessment to increase the Naval fleet to 355 ships.

That would amount to an increase of some 80 ships from the current fleet inventory.

Last week's witnesses were former Reagan Administration officials who talked about President Reagan's expansion of the Navy that increased the fleet by roughly 70 ships by the end of the 1980s.

We will need to understand what worked then and why, and how the situation we face today may be different from the early 1980s.

One major difference is the change in the fiscal environment.

In 1983, when the Reagan Administration added two aircraft carriers to the Navy budget, the Administration increased the Navy topline unilaterally to account for that addition, with no offset elsewhere in DOD or other domestic programs.

Today we would not be able to take such actions, since increases above the budget caps identified in the Budget Control Act would be automatically offset.

In lay person's terms, for every dollar we would add to the Defense budget, there would be an equal amount removed by sequestration, unless we find agreement to change the law or repeal the caps.

Ultimately, if we do not act to amend or replace the Budget Control Act, we could end up cutting, not increasing, the size of the Navy.

And that cutting would not be done with a scalpel, but rather the meat cleaver that is sequestration.

That is not an acceptable option. As we know, to a certain degree our industrial base and military are still recovering from 2013 sequester impacts.

I look forward to working with the Chairman, members of this Committee and other Senate colleagues to balance the needs of our military with critical domestic programs.

We look forward to hearing your testimony this afternoon.

Thank you, Mr. Chairman.

Senator WICKER. We will begin with testimony by Dr. Labs. Sir, you are recognized with the thanks of the subcommittee.

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

Dr. LABS. Thank you, Mr. Chairman. Chairman Wicker, Senator Hirono, and members of the subcommittee, it is a pleasure to be here today to discuss the Navy's proposal to build a 355-ship fleet.

Mr. Chairman, with your permission, I would like to summarize my statement for the record and have it entered, without objection, if I may.

Senator WICKER. Without objection, it will be entered at this point.

Dr. LABS. My written testimony focuses on the costs of force structure and implications for industry of building a 355-ship fleet over 15, 20, 25, or 30 years. It is based on the recently released CBO report titled "Costs of Building a 355-Ship Navy." In my remarks today, I will focus on the key points of that report.

Building a 355-ship fleet, as outlined in the Navy's December 2016 force structure assessment, will require a substantial investment of time and money. Even so, the Navy will not be able to reach that fleet of 355 ships for 18 years using new ship construction. I would like to note here that it is possible to build a larger fleet sooner than that, but the Navy's force goal of 355 is actually based on a specific set of goals for the major combat components of the fleet: 12 aircraft carriers, 12 ballistic missile submarines, 66 attack submarines, 156 large and small surface combatants, 38 amphibious ships, and numerous logistics and support ships. If those goals were relaxed or the Navy determined it could keep ships in service longer than previously planned, then it would be possible to reach a fleet of 355-ships much sooner than 2035.

To build a larger fleet would require increasing the shipbuilding budget substantially. CBO estimates that it would cost $26.6 billion per year over 30 years to buy the approximately 330 new ships needed to meet and sustain the Navy's force goals. That is about a 60 percent increase in the average shipbuilding budgets of $16 billion over the past 30 years or even the $17 billion of the past 5 years.

Critically, however, how fast the fleet is built up has a significant effect on shipbuilding budgets over the next decade. The 15-year buildup, for example, would need shipbuilding budgets that range from about $20 billion to as much as $35 billion per year over the next 10 years. In contrast, the budgets of the 30-year buildup range from $20 billion to $28 billion over the next 10 years.

In addition to new ship construction costs, CBO estimated that it would require an extra $15 billion in aircraft to outfit the additional ships with their aviation detachments and, in the case of a 12th aircraft carrier, the additional air wing.

A larger fleet of 355 ships will also require larger numbers of sailors and civilians, along with higher operation support and maintenance budgets. Compared with today's fleet of 275 ships, a 355-ship Navy will need approximately 19,000 more sailors to crew those ships and another 29,000 military and civilian personnel in various support roles. Annual operating and support costs would average $75 billion over the next 30 years compared to $56 billion for today's fleet.

Similar to the new ship construction costs, operation and support costs are rising faster than inflation. Thus, in real terms, that is, adjusting to remove the effects of inflation, O&S budgets will steadily increase over time as new ships are added to the fleet and the year-over-year real growth of operating and supporting that fleet requires appropriating more money.

Finally, let me spend a few moments on the shipbuilding industrial base. All the Navy's new ship construction is performed by five large and two smaller yards. Enlarging the fleet to 355 ships would place a higher demand on the shipbuilding services of the seven yards, as well as on the extensive base of parts and components vendors. Under different time frames for building a larger fleet, average annual shipbuilding rates over the next 10 years would increase 12 to 15 ships per year. To meet that demand, all seven yards would need to increase their workforces, and several would need to make improvements to their physical plant. CBO estimates that the workforces across those yards would need to increase by about 40 percent over the next 5 to 10 years. Managing the growth and training of those new workforces, while maintaining the current standard of quality and efficiency, would represent the most significant challenge that the industry would face.

In addition, industry and Navy sources indicate that as much as $4 billion would be needed to be invested in the physical infrastructure of the shipyards to achieve the higher production rates of the 15- or 20-year buildups. Much less investment would be needed if the time horizon is 25 or 30 years.

However, certain sectors face greater obstacles in constructing more ships faster than others. Without going into too much detail here, increased submarine and carrier construction posed the largest challenges to industry, submarines in particular, while surface combatant and amphibious ship construction much less so. In short, building the fleet more quickly would pose much greater but not insurmountable challenges to the shipbuilding industry.

Thank you, Mr. Chairman, and I am happy to answer any questions the subcommittee may have.

[The prepared statement of Dr. Labs follows:]

Congressional Budget Office

Testimony

Costs of Building a 355-Ship Navy

Eric J. Labs
Senior Analyst for Naval Forces and Weapons

Before the Subcommittee on Seapower of the Senate Committee on Armed Services

July 25, 2017

This document is embargoed until it is delivered at 2:30 p.m. (EDT) on July 25, 2017. 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 in this testimony are expressed in constant 2017 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.

Numbers in the text and tables may not add up to totals because of rounding.

Chairman Wicker, Senator Hirono, and Members of the Subcommittee, thank you for the opportunity to testify on the Navy's goal of building a 355-ship fleet, as outlined in its 2016 force structure assessment. My submitted statement today reprises the Congressional Budget Office's report titled *Costs of Building a 355-Ship Navy*, which was released on April 24, 2017.[1]

Summary

In December 2016, the Navy released a new force structure assessment (FSA) that called for a fleet of 355 ships—substantially larger than the current fleet of 275 ships and also larger than the Navy's previously stated goal of 308 ships.[2] In response to a request from the Subcommittee on Seapower and Projection Forces of the House Committee on Armed Services, the Congressional Budget Office has estimated the costs of achieving the Navy's objective within 15, 20, 25, or 30 years. As part of its analysis of those alternatives, the agency assessed the implications of building and operating a 355-ship fleet, including the number of ship purchases that would be necessary, prospective inventory levels, personnel requirements, and effects on the shipbuilding industry.

To enlarge the Navy to 355 ships would require a substantial investment of both money and time. CBO estimates that the earliest the Navy could achieve its goal of a 355-ship fleet would be in 2035, or in about 18 years, provided that it received sufficient funding. However, the cost to build and operate a 355-ship fleet would average $102 billion per year (in 2017 dollars) through 2047, CBO estimates, or more than one-third greater than the amount appropriated for fiscal year 2016 for today's 275-ship fleet. On average under CBO's alternatives, shipbuilding costs would be at their highest point over the next 10 years, while operating costs would be highest between 2037 and 2047, once the fleet numbered 355 ships.

Shipbuilding Costs

CBO estimates that, over the next 30 years, meeting the 355-ship objective would cost the Navy an average of about $26.6 billion (in 2017 dollars) annually for ship construction, which is more than 60 percent above the average amount the Congress has appropriated for that purpose over the past 30 years and 40 percent more than the amount appropriated for 2016. By comparison, CBO estimates that the Navy's 2017 shipbuilding plan—which is based in part on the 308-ship goal outlined in the service's 2014 FSA—would cost an average of $21.2 billion per year to implement over the next 30 years. However, the Navy's 2017 shipbuilding plan would fall short of the 308-ship force goal in 22 of the next 30 years.[3]

To establish a 355-ship fleet, the Navy would need to purchase around 329 new ships over 30 years, compared with the 254 ships that would be purchased under the Navy's 2017 shipbuilding plan (see Table 1).[4] In particular, over the next five years, the Navy would purchase about 12 ships per year under CBO's alternatives compared with about 8 per year under the Navy's 2017 plan.[5] Over the next 30 years, buying additional fixed-wing aircraft and helicopters to outfit the additional 63 ships would require $15 billion more than the Navy would spend on aircraft under its existing plan. Those costs do not reflect the additional weapons or unmanned systems that the Navy would need to purchase to arm the new ships or

1. See Congressional Budget Office, *Costs of Building a 355-Ship Navy* (April 2017), www.cbo.gov/publication/52632.

2. See Department of the Navy, Executive Summary, *2016 Navy Force Structure Assessment (FSA)* (December 15, 2016), http://tinyurl.com/zgdk5o7. The 2016 FSA does not describe the annual ship purchases or costs needed to reach 355 ships. Such information presumably would be forthcoming when the Navy releases its next long-term shipbuilding plan. For further discussion, see Ronald O'Rourke, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress,* Report for Congress RL32665 (Congressional Research Service, February 2, 2017).

   The Navy's previously stated goal of 308 ships was described in a 2014 update to its 2012 force structure assessment, which CBO refers to in this testimony as the 2014 FSA.

3. See Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2017 Shipbuilding Plan* (February 2017), www.cbo.gov/publication/52324. That report estimated that the Navy's 2017 shipbuilding plan would cost $20.7 billion per year in 2016 dollars. Adjusting that figure for inflation yields a cost of $21.2 billion in 2017 dollars. See also Department of the Navy, *Report to Congress: Force Structure Assessment* (February 2015).

4. See Department of the Navy, *Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2017* (July 2016), https://news.usni.org/2016/07/12/20627.

5. According to recent press reports, an internal Navy memorandum lays out an accelerated shipbuilding plan that would purchase an average of about 12 ships per year over the next five years. See Lee Hudson, "Proposed Navy Shipbuilding Plan Adds 23 Ships in Five Years," *Inside the Navy* (April 10, 2017), http://tinyurl.com/nxkvpwc. The accelerated shipbuilding plan most closely resembles CBO's 20-year buildup over the first five years.

Table 1.

Implications of Building a 355-Ship Fleet Under CBO's Four Alternatives Compared With the Navy's 2017 Shipbuilding Plan

	355-Ship Fleet[a]	The Navy's 2017 Shipbuilding Plan[b]
	Purchases	
Combat Ships		
Aircraft carriers	10	6
Ballistic missile submarines	12	12
Attack submarines	60 to 63	44
Large surface combatants	90 to 91	66
Small surface combatants[c]	68	58
Amphibious warfare ships	30	23
Subtotal	271 to 273	209
Combat Logistics and Support Ships	57	45
Total	328 to 330	254
	Costs (Billions of 2017 dollars)	
Total Shipbuilding Cost Over 30 Years	794 to 801	637
Average Annual Cost	26.5 to 26.7	21.2
New-Ship Construction	766 to 773	580
Average Cost per Ship[d]	2.3	2.3
Increase in Annual Operation and Support Costs by 2047 Compared With Today's Fleet	About 38	About 23
	Personnel	
Increase in Sailors Assigned to Ships Compared With Today's Fleet	About 19,000[e]	About 6,000[f]
Increase in Total Military and Civilian Personnel Compared With Today's Fleet	About 48,000[e]	About 14,000[f]
	Year All Force Goals for a 355-Ship Fleet Are Met Under CBO's Alternatives	
15-Year Buildup	2035[g]	n.a.
20-Year Buildup	2037	n.a.
25-Year Buildup	2042	n.a.
30-Year Buildup	2047	n.a.

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

n.a. = not applicable.

a. The ranges in this column reflect differences among CBO's paths to building a 355-ship fleet in four time frames—15, 20, 25, and 30 years.

b. The Navy's 2017 shipbuilding plan is based in part on a 308-ship force goal, which was described in a 2014 update to the 2012 force structure assessment. The 2017 plan, however, falls short of the 308-ship force goal in 22 of the 30 years covered by the plan.

c. Under the 2017 plan, the Navy would have 40 small surface combatants in service after 2029. However, because each of those ships is expected to be in service for 25 years, the Navy would begin buying replacements in 2030.

d. Average ship costs are calculated using new-ship construction amounts only.

e. The additional personnel is based on the number of sailors when the fleet would reach 355 ships.

f. The additional personnel is based on the number of sailors when the fleet would reach 308 ships.

g. With the exception of attack submarines, the fleet reaches all force goals in 2032.

the cost of improvements to the shipyards that would be needed to build ships at higher rates. (The effects on the shipbuilding industry of establishing a larger Navy are discussed in more detail below.)

Operating Costs

In addition to the costs of building 329 new ships, a larger fleet would cost more to operate: More ships would require more sailors; recruiting and training those sailors would require more civilian and military positions onshore; additional ships would lead to larger maintenance budgets; and those extra ships and crews would consume more fuel and supplies, during both training exercises and deployments. According to CBO's analysis, by 2047, the annual cost in 2017 dollars of operating the Navy's 355-ship fleet—regardless of whether the buildup took 15 or 30 years—would be about $38 billion (or 67 percent) more than the $56 billion the fleet of 275 ships costs annually to operate today. CBO's projection of the steep increase in operating costs by 2047 results both from having a larger fleet and from the expectation that operation and support costs would grow faster than general inflation in the economy. Under the smaller buildup proposed in the Navy's 2017 shipbuilding plan, annual costs would also rise by 2047, by about $23 billion.

Total Costs

CBO estimates that the cost to build, crew, and operate a 355-ship fleet would average $102 billion per year through 2047. That amount would be 13 percent more than the $90 billion needed to build and operate the fleet envisioned in the Navy's 2017 shipbuilding plan.

Effects of Reaching 355 Ships More Quickly

CBO analyzed four alternatives that would expand the fleet to 355 ships over different time frames: 15, 20, 25, and 30 years. Under each alternative, construction of the additional ships would begin in 2018. The major difference among those alternatives is the timing of when the fleet would reach 355 ships and, thus, when the money to build, crew, and operate those fleets would need to be appropriated. Exactly when the fleet reached the 355-ship goal would not have a significant effect on total 30-year costs in real (inflation-adjusted) terms. For example, buying more ships earlier in the 15-year time frame would mean that those ships would be slightly less expensive to build (because ships would be constructed at more efficient rates and the real cost growth in the shipbuilding industry would be lower than in later years); but establishing a larger fleet earlier would lead to higher operating costs.[6] In addition, in comparison with the 30-year buildup, shipbuilding budgets would need to be significantly higher in the 2020s for the 15-year alternative. Finally, building the fleet more quickly would pose much greater, but not insurmountable, challenges for the shipbuilding industry.

How Does the Navy's New 355-Ship Goal Compare With Earlier Plans?

In general, the 2016 FSA maintains what the Navy calls a balanced fleet. It does not substantially change the relative proportion of the different major components of the battle force: aircraft carriers, submarines, surface combatants, amphibious ships, and combat logistics and support ships. That composition has varied little since 1990 (see Figure 1). The major difference between the Navy's 355-ship goal and its prior 308-ship goal is one of scale. The new goal represents an increase of 15 percent over the Navy's previous FSA and an increase of nearly 30 percent over the current fleet of 275 ships. The composition of the 355-ship fleet would be roughly the same as today's fleet, which proportionately has slightly fewer surface combatants and more combat logistics and support ships than are called for in the 2016 FSA. Compared with an across-the-board percentage increase relative to the 2014 FSA, the new goal would increase the number of attack submarines slightly and reduce the number of small surface combatants. Because the goal for ballistic missile submarines is determined in part by a separate process that analyzes the requirements for all U.S. strategic nuclear forces, the number of ballistic missile submarines was unchanged in the 2016 FSA, effectively reducing their percentage of the fleet relative to the 2014 FSA and today's fleet.

How Quickly Might the Navy Reach Its New 355-Ship Goal?

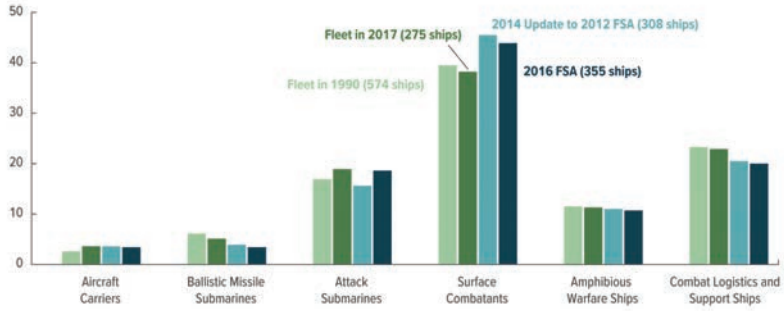
CBO projected notional ship construction schedules that would allow the Navy to achieve a fleet of 355 ships in 20, 25, or 30 years, but it would fall short of that goal in 15 years (see Figure 2). Specifically, meeting the objective of 66 attack submarines in 15 years is not realistic because the capacity of the submarine-building industry is limited. Consequently, the 15-year buildup would yield just 346 ships by 2032, including 56 attack

6. For a discussion of real cost growth in naval shipbuilding, see Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2017 Shipbuilding Plan* (February 2017), p. 17, www.cbo.gov/publication/52324.

Figure 1.

Composition of the Fleet by Ship Type, Historically and Under Recent Force Structure Assessments

Percent



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

FSA = force structure assessment.

submarines. Under the 15-year alternative, the Navy would reach its 355-ship goal for all ship types by 2035. (See the supplemental tables on CBO's website for a year-by-year list of purchases and inventories by ship type.) Under the 20-year buildup, the Navy would achieve its 355-ship goal in 2037. That goal would be reached in 2042 under the 25-year alternative and in 2047 under the 30-year plan. For those three alternatives, the force goals for each ship type would be met within the stated time frame.

How Many Ships Would the Navy Need to Build to Meet Its Goal and How Much Would They Cost?

The total number of ships the Navy would need to purchase to establish and maintain a 355-ship fleet is nearly the same for all four alternatives: 328 to 330 ships. That represents an average construction rate of 11 ships per year over 30 years, although annual rates would differ substantially depending on how quickly the Navy tried to reach its goal. The costs of implementing those plans would average about $26.6 billion per year for ship construction over the entire 30-year period. Compared with the last buildup of the Navy—the Reagan Administration's drive to have a 600-ship Navy in the 1980s—a plan to build a 355-ship fleet would buy fewer ships. However, because the average price of constructing a Navy ship—and the capabilities on those ships—has risen since then, even after removing the effects of inflation, average shipbuilding budgets would need to be almost as high.[7]

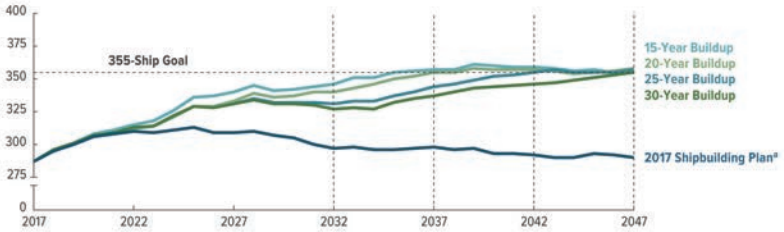
In developing alternative shipbuilding plans, CBO used existing ship designs and production lines for the first 10 years. But because the Navy is not specific about the design of the ships it plans to purchase beyond 2027, CBO made its own assumptions about the size and capabilities of those ships, which are consistent with those the agency made in its analysis of the Navy's 2017 shipbuilding plan.[8]

7. Between 1982 and 1988, the Navy purchased an average of 18.4 ships per year at an average annual cost of $28.9 billion in 2017 dollars.

8. For example, CBO assumed that in the latter part of the 2020s the Navy would need to design an all-new large surface combatant as well as a new small surface combatant that was similar in size to the retired Oliver Hazard Perry class frigate. See Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2017 Shipbuilding Plan* (February 2017), pp. 29–30, www.cbo.gov/publication/52324. Some senior Navy officials have also argued that to increase the size of the fleet, the Navy

Figure 2.

Annual Inventory of Battle Force Ships Under CBO's Four Alternatives



Source: Congressional Budget Office.

a. The Navy's 2017 shipbuilding plan is based in part on a 308-ship force goal, which was described in a 2014 update to the 2012 force structure assessment. The 2017 plan, however, falls short of the 308-ship force goal in 22 of the 30 years covered by the plan.

Although overall shipbuilding costs would be similar among the alternatives, the timing of those purchases—and thus shipbuilding costs—would vary (see Figure 3). In the first five years, ship purchases would increase from a little more than 8 per year under the Navy's 2017 shipbuilding plan to more than 12 per year under the alternatives. In the mid-2020s, the 15-year buildup, which would entail buying an average of nearly 15 ships per year, would incur the highest costs. The 30-year buildup, the alternative with the lowest costs in that period, would buy 11 ships per year. Shipbuilding budgets in the 2020s would need to be commensurately large: The 15-year buildup would require average shipbuilding budgets of $33 billion per year, compared with $26 billion annually for the 30-year buildup.[9]

Beyond the 2020s, however, ship purchases and shipbuilding costs under all of the alternatives would be more closely aligned, although some variation would remain. By the final five-year period, 2043 to 2047, ship purchases and costs would be about the same under the alternatives to maintain the fleet at 355 ships beyond 2047. Ship purchases would average 11 per year, and shipbuilding costs would average a little more than $26 billion per year across all four alternative plans.

How Would a Larger Fleet Affect Manpower Requirements and Operating Costs?

A larger fleet would require more sailors to crew the additional ships and more personnel (both military and civilian) to support those sailors. Today, the Navy employs about 106,000 men and women to operate the combat ships in its 275-ship fleet and incurs about $23 billion per year in direct operation and support costs. That is the amount of money needed to pay

should use existing ship designs, at least in the near term. See Sydney J. Freedberg, "Build More Ships, But Not New Designs: CNO Richardson on McCain Plan," *Breaking Defense.com* (January 17, 2017), http://tinyurl.com/gmsxhp3. In considering longer-term plans, others envision a future fleet composed of several types of ships that are quite different from those the Navy plans to buy. See Megan Eckstein and Sam LaGrone, "Trio of Studies Predict the U.S. Navy Fleet of 2030," *USNI News* (February 14, 2017), http://tinyurl.com/hv3t77h; and Senator John McCain, *Restoring American Power: Recommendations for the FY 2018–FY 2022 Defense Budget*, https://tinyurl.com/gt8o4cq.

9. CBO estimates the cost of ships on the basis of the relationship between weight and cost of analogous existing ships. The resulting amount is then adjusted for factors such as the 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 the production run. CBO also incorporates into its estimates a projection that labor and material costs would continue to grow faster in the naval shipbuilding industry than in the economy as a whole, as they have for the past several decades. For more detail, see Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2017 Shipbuilding Plan* (February 2017), pp. 33–36, www.cbo.gov/publication/52324.

Figure 3.

Average Annual Ship Purchases and Costs of Building a 355-Ship Fleet Under CBO's Four Alternatives and the Navy's 2017 Shipbuilding Plan

Source: Congressional Budget Office.

a. The Navy's 2017 shipbuilding plan is based in part on a 308-ship force goal, which was described in a 2014 update to the 2012 force structure assessment. The 2017 plan, however, falls short of the 308-ship force goal in 22 of the 30 years covered by the plan.

the crews, to buy fuel and supplies, and to repair and maintain the ships. The Navy's combat logistics and support ships employ another 7,600 military and civilian personnel. (Other operation and support expenses, such as indirect costs—which include operating the combat logistics and support ships—and overhead costs, are discussed below.) When the Navy designs and builds new classes of ships, it endeavors to reduce the size of the crews of those new ships to reduce operating costs. However, even if all new ship classes had smaller crews than their predecessors, increasing the fleet to 355 ships—a nearly 30 percent increase over today's fleet—would require more personnel.[10]

According to CBO's estimates, the combat ships of a 355-ship fleet would need crews totaling about 125,000 sailors, an increase of 18 percent over today's Navy (see Figure 4). The larger fleet would incur annual direct operation and support costs of about $27 billion. (The combat logistics and support ships that the Navy would include in that larger fleet would require crews of about

10. The Navy's efforts to design ships that require smaller crews have met with mixed results. The new Ford class aircraft carrier

7,400 military and civilian personnel.) Since the 15-year buildup would reach 355 ships by 2035, its operation and support costs would be the highest among the four alternatives, primarily because it would require operating a larger fleet for a longer period of time than the other three. Conversely, the 30-year buildup would cost the least to operate over the entire period because it would not reach 355 ships until 2047, employing fewer sailors overall throughout the period. However, across the alternatives, the differences in costs (which are discussed in more detail in the next section) are relatively small.

What Would Be the Total Average Annual Costs of a 355-Ship Fleet?

Altogether over the 30-year period, the total amount of money the Navy would spend to build up and operate a fleet of 355 ships is about the same across the four alternatives—approximately $102 billion per year, including costs both for ship procurement and for operation and support (see Figure 5). Ship procurement for each alternative would average about $26.6 billion per year between 2018 and 2047. Operation and support costs would average another $75.3 billion per year over the 30-year period. Those totals include direct, indirect, and overhead operating costs. (Direct costs are described above. Indirect costs include expenditures for various support units and organizations that are necessary for combat units to fight effectively. Overhead costs refer to expenditures for various functions that also support combat units, such as recruiting, training, acquisition offices, maintenance, and medical care.)[11] Those totals exclude the costs of aircraft, weapons, and unmanned systems in the average annual totals. However, each of those categories would be about the same under each alternative but higher than they would be under the 2017 shipbuilding plan. The marginal additional costs for purchasing the aircraft needed to equip the airwing that would fly off the additional aircraft carrier and the helicopters that would be carried by the additional surface combatants would total about $15 billion over 30 years, CBO estimates.[12] CBO did not calculate the marginal costs of additional weapons and unmanned systems needed to arm a larger fleet. Those costs could vary considerably depending on how the Navy employed new weapons and unmanned systems in the future.

Overall, total costs through 2047 for the most expensive alternative—the 15-year buildup—would be $3.1 trillion, or $80 billion (3 percent) more than the least expensive alternative, the 30-year buildup. Procurement and operating costs under the four alternatives would total $300 billion to $400 billion more than under the Navy's 2017 shipbuilding plan.

What Would Be the Implications for the Shipbuilding Industry?

All of the Navy's new-ship construction is performed by five large and two smaller private shipyards. Two of the large shipyards are owned by Huntington Ingalls Industries: Ingalls Shipbuilding, which builds large surface combatants and amphibious warfare ships for the Navy, as well as the national security cutter for the Coast Guard; and Newport News Shipbuilding, which builds nuclear-powered aircraft carriers and submarines. (Newport News also refuels those aircraft carriers at the midpoint of their service life, when the reactors typically run out of nuclear fuel.) General Dynamics owns the other three large shipyards: Bath Iron Works, which builds large surface combatants; Electric Boat, which builds nuclear-powered submarines; and National Steel

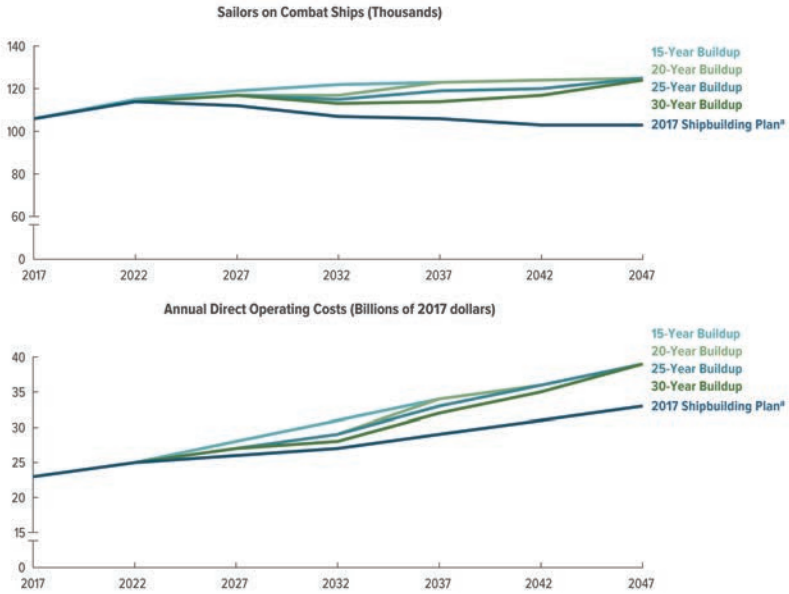
requires 660 fewer crew members than its predecessor, the Nimitz class, a reduction of about 20 percent—although that number may change once the ship is fully tested and operational. The littoral combat ships have small crews, but as a result, they require more support from the Navy's shore-based infrastructure. The new DDG-1000 Zumwalt class destroyer has a crew that is about half the size of a DDG-51Arleigh Burke class destroyer, but it will require years of operation at sea to determine whether a smaller crew can operate and maintain the ship—which is physically 50 percent larger than a DDG-51—as well as a larger crew could. By contrast, the new Columbia class ballistic missile submarine will have only four fewer crew members than the Ohio class it will replace.

11. For operation and support costs, CBO categorized every line item in the Department of Defense's (DoD's) five-year future years defense program, or FYDP, into major combat units, support units, or administrative and overhead organizations. Costs that directly pay for a combat unit, such as an infantry brigade or aircraft carrier, are direct costs. Organizations that support those major combat units, such as intelligence, maintenance, or transport units represent the indirect costs of supporting combat. Finally, administrative or overhead costs include organizations that DoD needs to sustain and support its forces over the long run, such as recruiting and medical organizations that provide health care to active-duty soldiers, reservists, and retirees, and their families. For more detail, see Congressional Budget Office, *The U.S. Military's Force Structure: A Primer* (July 2016), pp. 8–9, www.cbo.gov/publication/51535.

12. The 2016 FSA would increase the number of carriers from 11 to 12 and the number of large surface combatants from 88 to 104.

Figure 4.

Number of Sailors Required to Crew a 355-Ship Fleet and Annual Operating Costs, 2017 to 2047



Source: Congressional Budget Office.

Direct operating costs represent the amount of funding needed to pay crews, buy fuel and supplies, and repair and maintain the combat ships of the Navy's fleet. CBO counts the costs for the combat logistics and support ships as indirect costs and, therefore, their crews and costs are excluded from this figure.

a. The Navy's 2017 shipbuilding plan is based in part on a 308-ship force goal, which was described in a 2014 update to the 2012 force structure assessment. The 2017 plan, however, falls short of the 308-ship force goal in 22 of the 30 years covered by the plan.

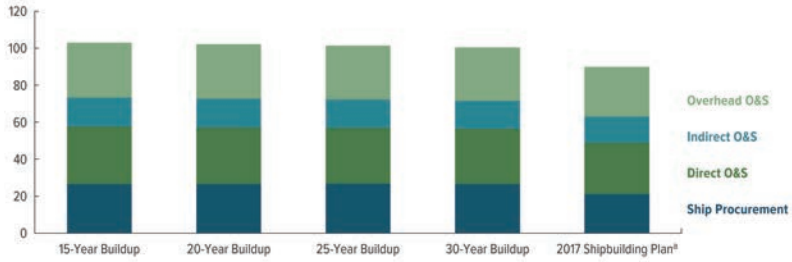
and Shipbuilding Company—better known by its acronym, NASSCO—which builds various types of combat logistics and support ships. The two smaller shipyards are Fincantieri Marinette Marine, which builds the steel monohull variant of the littoral combat ship (with Lockheed Martin as the prime integrator and provider of the combat systems); and Austal USA, which builds the aluminum trimaran version of the littoral combat ship as well as the expeditionary fast transport, which until recently was known as the joint high speed vessel—a fast ferry that the Navy uses for intratheater transport.

Enlarging the fleet to 355 ships would place a higher demand on the shipbuilding services of those seven (and possibly other) shipyards. Over the past decade, the Navy

Figure 5.

Average Annual Ship Construction and Operation and Support Costs for a 355-Ship Fleet Under CBO's Four Alternatives and the Navy's 2017 Shipbuilding Plan

Billions of 2017 Dollars



Source: Congressional Budget Office.

Overhead costs refer to expenditures for various functions that also support combat units, such as recruiting, training, acquisition offices, maintenance, and medical care. Indirect operating costs include expenditures for various support units and organizations that are necessary for combat units to fight effectively. Direct operating costs represent the amount of money needed to pay crews, buy fuel and supplies, and repair and maintain the Navy's combat ships. (CBO counts the costs for the combat logistics and support ships as indirect costs.)

O&S = operation and support.

a. The Navy's 2017 shipbuilding plan is based in part on a 308-ship force goal, which was described in a 2014 update to the 2012 force structure assessment. The 2017 plan, however, falls short of the 308-ship force goal in 22 of the 30 years covered by the plan.

has purchased an average of 8.3 ships per year. Under the four alternatives, average annual shipbuilding rates over the next 10 years would increase to 12 to 15 ships per year. To meet that demand, all seven shipyards would need to increase their workforces and several would need to make improvements to their infrastructure in order to build ships at a faster rate. However, certain sectors face greater obstacles in constructing ships at faster rates than others: Building more submarines to meet the goals of the 2016 force structure assessment would pose the greatest challenge to the shipbuilding industry. Increasing the number of aircraft carriers and surface combatants would pose a small to moderate challenge to builders of those vessels. Finally, building more amphibious ships and combat logistics and support ships would be the least problematic for the shipyards. The workforces across those yards would need to increase by about 40 percent over the next 5 to 10 years. Managing the growth and training of those new workforces while maintaining the current standard of quality and efficiency would represent the most significant industrywide challenge. In addition, industry and Navy sources indicate that as much as $4 billion would need to be invested in the physical infrastructure of the shipyards to achieve the higher production rates required under the 15-year and 20-year buildups. Less investment would be needed for the 25-year or 30-year buildups.

Submarines

The Navy's 2017 shipbuilding plan already posed a considerable challenge to the submarine-building industry. Currently, the Navy purchases 2 Virginia class attack submarines (SSNs) per year. In 2019, the Navy plans to enlarge the ships by about 30 percent by inserting what the service calls the Virginia payload module (a new section to carry additional missiles or unmanned systems) in each new SSN. The Navy is also starting the new Columbia class ballistic missile submarine (SSBN), with design work and the procurement of items with long lead times occurring between 2017 and 2020. Full construction of the first Columbia, which is two and a half times larger than a Virginia, is slated to begin in

2021. Thus, under the Navy's 2017 plan, the workload in the submarine-building yards was already expected to double with the Columbia class, even though the Navy would reduce purchases of Virginia class submarines to 1 per year in each year it purchased a new SSBN.

Although the Navy and the submarine industry have been planning for this increase in production for several years, the first Columbia SSBN will be the most technically challenging lead ship the Navy will build over the next 20 years. Maintaining SSN production at 2 submarines per year or increasing to 3 or 4 per year while the Navy is building the Columbia class would require a substantial increase in the workforces at both Electric Boat and Newport News as well as substantial investment in their infrastructure over the next 5 to 10 years. Notably, the investment required to maintain a production rate of 2 SSNs per year would be a fraction of that needed to build 3 or 4 SSNs per year while building the new SSBN at the same time.

Of the four alternatives, the 15-year buildup would present the greatest challenge. CBO's analysis of that quick buildup is based on the assumption that the industry would continue building 2 SSNs per year through 2022, ramp up to 3 per year from 2022 through 2024, and then increase further to 4 per year from 2025 through 2028. (Under the Navy's plan for the Columbia class, the first ship would be ordered in 2021, but the second SSBN would not be ordered until 2024 and the third not until 2026.) Even with that aggressive building schedule, the Navy would not meet its goal of 66 attack submarines until 2035. Such a steep increase in construction has two advantages: The Navy would meet its goal of 66 SSNs more quickly, and the unit costs of the submarines could be reduced by spreading the shipyards' fixed overhead costs among more ships. One disadvantage of such a steep increase in SSN construction is that the need to train the large number of new employees could lead to production inefficiencies, such as correcting work that was not done properly the first time (called rework), schedule delays, and potentially increased costs. Another disadvantage would be that by 2031 an equally steep decline in submarine construction would occur with the procurement rate falling back to 1 per year, if the Navy did not want to increase the size of the force above 66 SSNs.

None of the other three alternatives would necessitate building 4 SSNs per year to meet the goal of 66 attack submarines in the stated time frame. The 20-year buildup would require the Navy to purchase 3 submarines per year from 2022 through 2031 (with the exception of 2024 when only 2 would be purchased). The 25-year buildup would increase SSN construction to 3 per year in 2026 for six years. And the 30-year buildup would build two SSNs per year except in 2029 and 2031, when 3 ships would be ordered in those years, and in 2034, when 1 ship would be ordered as the start of a new class of SSNs.

Aircraft Carriers

To achieve the Navy's goal of a 12-carrier force, construction of those ships would have to move from today's rate of 1 every five years (called five-year centers) to 1 every three years (or three-year centers). Once the carrier force reached 12, however, the Navy could build carriers on four-year centers to maintain that level over the long-term. Under the 15-year buildup, the Navy would need to move to three-year centers after 2018, when it plans to order the next aircraft carrier. For the other alternatives, CBO used a transition period of four-year centers initially and then three-year centers. Thus, under both the 20-year and 25-year buildups, the Navy would purchase 1 carrier in 2018, 1 in 2022, and then 1 every three years thereafter. For the 30-year buildup, the Navy would purchase 1 carrier per year in 2018, 2022, and 2026, and then 1 every three years.

Moving from five-year centers to three would most likely result in more efficient carrier production and, potentially, slightly reduced costs for the ships. Initially, faster carrier production would require a larger workforce and a modest expansion of the infrastructure at Newport News. But with faster production and a larger workforce, the shipyard's average worker would have to perform fewer types of tasks, although with greater frequency, thereby enhancing efficiency. Also, three-year centers could make it easier for the Navy to purchase materials for more than 1 ship at a time, potentially generating other savings that would result from bulk purchases of materials.[13] However, because it was unclear how much savings would be possible by moving to three-year centers, CBO did not incorporate those savings into its estimates.

13. A RAND report came to similar conclusions. See John F. Schank and others, *Modernizing the U.S. Aircraft Carrier Fleet: Accelerating CVN 21 Production Versus Mid-Life Refueling* (RAND Corporation, 2005), http://www.rand.org/pubs/monographs/MG289.html.

Surface Combatants

In the four alternatives, the most ambitious program for surface combatants would be to build 4 large surface combatants per year (2 in each shipyard) and 4 small surface combatants per year (also 2 in each yard). For both Ingalls and Bath, as well as Marinette Marine and Austal USA, that would double the number of ships that they are currently authorized to build annually. For both Ingalls and Bath, producing 2 large surface combatants per year would require those shipyards to enlarge their workforces slightly and make some modest improvements in their infrastructure. (Each yard has underused infrastructure capacity because they are producing only 1 large surface combatant per year.) For Austal and Marinette, both yards were producing 2 small surface combatants (littoral combat ships) per year from 2012 to 2014, and then 3 ships were split between the two yards in 2015 and 2016. Thus, building 4 small surface combatants a year would simply return the production rate of those ships to the point that it was from 2012 to 2014.

Amphibious Warfare Ships

Ingalls Shipbuilding is the only producer of both large and small amphibious warfare ships, although other yards could produce those ships if it was necessary or cost-effective to do so. As is the case with builders of small surface combatants, Ingalls's amphibious warfare ship lines have excess capacity. Currently, the Navy is purchasing large deck amphibious assault ships (LHAs) on four-year centers; however, Ingalls's facilities are optimized to build LHAs on three-year centers. Moreover, under the Navy's 2017 plan, there would be a seven-year gap after the next ship is ordered in 2017. In addition, the small deck amphibious warfare ships—amphibious transport docks (LPD-17s) and the future replacement for dock landing ships (LX-Rs)—are being built at a rate of one every two years, sometimes less frequently. Building 1 of those ships every year would result in more efficient production without requiring an expansion of Ingalls's workforce or facilities. Building LHAs on three-year centers and 1 LPD or LX-R per year or every two years would meet the Navy's goal of having 38 amphibious warfare ships by 2025 under all four alternatives.

Combat Logistics and Support Ships

Over the past 20 years, NASSCO has won all contracts to build the Navy's oilers, dry cargo ships, and other large support ships, such as expeditionary sea bases (formerly called afloat forward staging bases) or expeditionary transfer docks (formerly called mobile landing platforms). Building those ships at a rate of 1 or 2 per year, which is all that would be required under the four alternatives, is consistent with NASSCO's production in the recent past. Compared with the work it would likely receive under the Navy's 2017 shipbuilding plan, NASSCO would need to enlarge its workforce and would probably need some modest investment in its infrastructure. But the increase in the workforce would be similar to (or less than) an increase NASSCO underwent between 2014 and 2015.

This testimony reprises the Congressional Budget Office's report *Costs of Building a 355-Ship Navy*, which was released on April 24, 2017. The report was prepared at the request of the Chairman and Ranking Member of the Subcommittee on Seapower and Projection Forces of the House Committee on Armed Services. In keeping with CBO's mandate to provide objective, impartial analysis, the report makes no recommendations.

Eric J. Labs wrote the report with guidance from David Mosher and Edward Keating. Raymond Hall produced the ship cost estimates with guidance from Sarah Jennings. Emily Stern of CBO provided comments on the report, as did Mandy Smithberger of the Project on Government Oversight and Bryan Clark of the Center for Strategic and Budgetary Assessments. (The assistance of external reviewers implies no responsibility for the final product, which rests solely with CBO.)

Wendy Edelberg and Jeffrey Kling reviewed the report on which this testimony is based, Loretta Lettner edited it, and Jorge Salazar prepared it for publication. Electronic versions of this testimony and the report are available on CBO's website (www.cbo.gov/publication/52911 and www.cbo.gov/publication/52632, respectively).

Senator WICKER. Thank you, Dr. Labs.
Mr. O'Rourke?

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

Mr. O'ROURKE. Chairman Wicker, Ranking Member Hirono, distinguished members of the subcommittee, thank you for the opportunity to appear before you today to discuss options and considerations for achieving a 355-ship Navy.

Mr. Chairman, with your permission, I would like to submit my written statement for the record and summarize it here briefly.

Senator WICKER. Without objection, it will be submitted and accepted.

Mr. O'ROURKE. Navy force structure and shipbuilding has been a central focus of my work at CRS since 1984. As you noted, Mr. Chairman, I worked on these issues during the Reagan era naval buildup. I remember that period quite well.

Increased shipbuilding for achieving the 355-ship fleet would have a substantial cost on the order of billions of dollars per year. On the other hand, there would be some potential economies in that effort. For one thing, increasing annual shipbuilding rates can reduce costs due to improved economies of scale. Doubling rates for ships that are procured every year, for example, might reduce their cost by roughly 10 percent. Increasing rates, moreover, can increase opportunities for using competition to restrain costs. In addition, using multiyear procurement or block buy contracting can reduce costs by about 5 percent without economic order quantity purchases and by about 10 percent with EOQ purchases. The Navy in recent years has made extensive use of multiyear contracting in its shipbuilding programs, saving billions of dollars that have been used to procure additional ships.

Finally, cross-program purchases of common materials and components such as those authorized under the National Sea-based Deterrence Fund can reduce costs further at the margin, becoming the latest element of what might be viewed as a quiet revolution in recent years in Navy ship funding and contracting practices.

Construction rates cannot be markedly increased overnight. Even so, Congress has the option of fully funding additional ships in the near term, starting as early as fiscal year 2018 with the understanding that those additional ships would not begin construction until the industrial base is ready to build them.

Fully funding additional ships in the near term could send a signal of commitment to industry and a signal of deterrence to potential adversaries such as China.

The option of fully funding additional ships as early as fiscal year 2018 includes even nuclear-powered ships such as attack submarines for which there has been no prior year advanced procurement funding. Congress has done this in the past.

Unmanned vehicles can expand Navy capabilities. Beyond a certain point, however, they will not be able to serve as substitutes for manned ships and aircraft. So beyond a certain point, they cannot act as a general reason for not procuring ships and aircraft in needed numbers.

Discussions of how to get to a force of 66 attack submarines can obscure a serious prior issue, which is how to address the dip or valley in the attack submarine force level that is projected to start in the 2020s. China has taken note of this projected valley.

In addition to procuring additional *Virginia*-class boats, there are some supplemental options for mitigating the valley. The Navy is now exploring the possibility of increasing the service lives of certain existing surface ships, particularly DDG–51s, which could make it possible to defer the procurement of some new destroyers, permitting that funding and industrial capacity to instead be used for building other ships. Extending DDG–51 service lives could involve increasing funding for maintaining and modernizing them with the funding increases perhaps starting right away.

The Navy is also exploring the possibility of reactivating recently retired ships, particularly *Oliver Hazard Perry*-class frigates. The technical feasibility and potential cost effectiveness of this option is not clear. At a minimum, however, exploring it can be viewed as a matter of due diligence.

The industrial base in general appears capable of taking on the additional shipbuilding to achieve the 355-ship fleet. Ramping up to higher rates would require additional tooling at shipyards and supplier firms, and additional workers would need to be hired and trained. So production could not jump to higher rates overnight. Some parts of the industrial base, such as the submarine portion, could face more challenges than others in ramping up to higher rates.

Finally, building the additional ships that would be needed to achieve the 355-ship fleet could create thousands of additional manufacturing and other jobs at shipyards, at supplier firms, and elsewhere in the economy.

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 follows:]

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TESTIMONY

Statement of

Ronald O'Rourke
Specialist in Naval Affairs

Before

Committee on Armed Services
Subcommittee on SeaPower
U.S. Senate

Hearing on

Options and Considerations for Achieving a 355-Ship Navy

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Chairman Wicker, Ranking Member Hirono, distinguished members of the subcommittee, thank you for the opportunity to appear before you today to discuss options and considerations for achieving a 355-ship Navy.

Navy force structure and shipbuilding has been a central focus of my work as a CRS analyst on naval issues for the past 33 years. I worked on these issues closely for Congress during the Reagan-era naval buildup of the 1980s and I remember that period quite well; I am working on them closely for Congress now, in connection with the 355-ship plan; and I worked on them closely for Congress in all the years in between. Of the various witnesses that have testified before this subcommittee at its hearings this year on the 355-ship plan, I might be the only one about which all of that can be said.

My CRS overview report on Navy force structure and shipbuilding, which is updated periodically, provides an overview of the 355-ship force-level goal and various issues for Congress arising from it.[1] The summary of that report is reprinted in this statement as **Appendix A**. Rather than repeating at length what is in that report, this statement provides some additional analytical observations.

For additional reference, this statement presents a summary of some acquisition lessons learned for Navy shipbuilding (**Appendix B**), some considerations relating to warranties in shipbuilding and other defense acquisition (**Appendix C**), and a discussion of minimizing cost growth and minimizing end cost in shipbuilding and other defense acquisition (**Appendix D**).

355-Ship Plan Is Based on 2016 Defense Strategy

It is important to note at the outset that the Navy's 355-ship force-level goal, which was released in December 2016, is the product of a Force Structure Assessment (FSA) done by the Navy in 2016, based on the U.S. defense strategy of 2016, meaning the Obama Administration's defense strategy. The Trump Administration is currently conducting a defense strategy review. If that review leads to one or more changes in U.S. defense strategy—a not-insignificant possibility, particularly given current debate about the future U.S. role the world[2]—the Navy would have an opportunity to conduct a new FSA based on the newly revised strategy, which could lead to changes in the size and composition of the Navy's force-level goal.

A Possible New Shift in Chinese Shipbuilding Could Affect Required Numbers of U.S. Navy Ships

In connection with the possibility of a new FSA reflecting a newly revised defense strategy, China may have decided in recent months (i.e., in the time since the last FSA) to increase its role on the world stage, perhaps in part in reaction to a perception, correct or not, that the United States is reducing its role on the world stage. Such a decision by China could affect its naval modernization effort, which over the last quarter century has tended to focus more on improving the quality of its naval platforms more than it has on increasing total numbers of platforms.[3] Pursuing a larger role on the world stage could lead China to shift to a naval modernization effort that, while maintaining a focus on improving quality, also focuses on

[1] CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke

[2] For further discussion regarding the future U.S. role in the world, see CRS Report R44891, *U.S. Role in the World: Background and Issues for Congress*, by Ronald O'Rourke and Michael Moodie.

[3] For additional discussion on China's naval modernization effort, see CRS Report RL33153, *China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress*, by Ronald O'Rourke.

increasing total numbers of platforms. Put differently, while China until recently may have been aiming at developing a regionally powerful Navy with an added capability for conducting occasional, limited, or tightly focused naval operations in more distant waters, it might have recently decided to pursue a more ambitious goal of developing a navy with more extensive capabilities for global operations.[4] Such a development could have potentially significant implications for required numbers of U.S. Navy ships.

As one possible indication of a possible shift of this kind in China's naval modernization effort, China reportedly is now finishing work on a new nuclear submarine construction facility that will be the world's largest. Reportedly, this facility includes a 430,000-square-foot assembly hall with two parallel production lines, and is large enough to build four nuclear-powered attack submarines (SSNs) simultaneously. This facility will be on top of China's ongoing production elsewhere of non-nuclear-powered submarines. What is going to happen to China's submarine force after this new nuclear submarine facility goes into production, which reportedly will happen later this year?[5]

China is not the only competitor country whose military modernization efforts could affect required numbers of U.S. Navy ships. Russia is another country of concern in this regard, because of its submarine force and its increased naval activities in the waters around Europe, as discussed below in the section on the option of additional forward homeporting in the Mediterranean. Required numbers of U.S. Navy ships can also be affected by developments in Iranian and North Korean military capabilities. Among all these countries, however, China arguably is of the most concern in this regard, because of the scale of its military forces, the pace and breadth of its naval modernization effort, its ability to continue financing that effort, and the increasingly global scope of its naval operations.

Some Recent Comments from Navy Officials Suggest Hedging on 355-Ship Plan

It can also be noted that while the Navy in general continues to support the 355-ship force-level plan, certain comments from Navy officials in recent months (particularly since the release in mid-March of the Administration's FY2018 budget outline) can be interpreted as hedging somewhat on the plan.[6] Observers detected similar hedging in remarks made by Secretary of the Navy nominee Richard Spencer at his July 11, 2017, confirmation hearing.[7] This apparent hedging appears due to a combination of at least three factors:

- growing Navy interest in how the Navy's future fleet architecture might be changed by unmanned vehicles (particularly very large ones that might be launched from a pier) and by other new technologies;

[4] See, for example, Ryan Martinson and Katsuya Yamamoto, "How China's Navy Is Preparing to Fight in the 'Far Seas'," *National Interest*, July 18, 2017.

[5] See Jeffrey Lin and P. W. Singer, "China Is Building the World's Largest Nuclear Submarine Facility," *Popular Science*, May 1, 2017. See also Lyle J. Goldstein, "China Prepares to Ramp Up its Shipbuilding Process," *National Interest*, April 2, 2017.

[6] See, for example, pages 4-5 and pages 8-9 of *The Future Navy*, a May 17, 2017, white paper from the Chief of Naval Operations. The document is posted at: https://news.usni.org/2017/05/17/document-chief-of-naval-operations-white-paper-the-future-navy. See also Connor O'Brien, "New Navy Vision Coming 'In the Next Few Weeks,' CNO Says," *Politico Defense Whiteboard*, April 27, 2017; and Megan Eckstein, "Moran: Navy Needs As Much As $150B Extra to 'Jump-Start' Path to 355 Ships; Would Buy Mostly DDGs, SSNs, Carriers," *USNI News*, March 22, 2017.

[7] See, for example, Sydney J. Freedberg Jr., "SecNav Nominee Spencer Soft-Pedals Trump's 355-Ship Navy, Touts Robots," *Breaking Defense*, July 11, 2017; David B. Larter, "A 355-Ship Navy? We'll See, Says Trump's Navy Secretary Pick," *Defense News*, July 13, 2017.

- uncertainty about whether future Navy budgets will be sufficient to achieve and maintain a 355-ship fleet; and
- the time (20 years or more) that would be needed to achieve all elements of the 355-ship force structure (particularly the 12-ship aircraft carrier force and the 66-boat attack submarine force), and how this timeline compares to rates of improvement in the naval capabilities of competitor countries, particularly China.

Potential Economies in an Increased Navy Shipbuilding Effort

Although the increased shipbuilding effort that would be needed to achieve the Navy's 355-ship force-level goal would have a substantial cost (see **Appendix A**), there would also be some potential economies in that effort:

- Increasing annual procurement rates for ships can reduce their unit procurement costs due to improved production economies of scale. Doubling the rate of procurement from one ship per year to two ships per year, or from two ships per year to four ships per year, for example, might reduce unit procurement costs by roughly 10 percent. Unit procurement costs for aircraft carriers and large-deck amphibious assault ships, which are procured at a rate of one ship every few years, can be reduced by procuring these ships at more-frequent intervals.
- Increasing annual procurement rates for ships can also increase opportunities for reducing unit procurement costs through use of competition for quantity in the awarding of shipbuilding contracts. In instances where competition for quantity is still not possible, the Navy, as in the DDG-51 program, can use Profit Related to Offers (PRO) bidding (i.e., competition for profit rather than quantity) to generate bargaining leverage for the government.[8]
- Compared to using annual contracting, using multiyear contracting in the form of multiyear procurement (MYP) or block buy contracting can reduce unit procurement costs by about five percent without use of Economic Order Quantity (EOQ) purchases of selected components, and by about ten percent with use of EOQ purchases. The Navy in recent years has made extensive use of multiyear contracting in procuring attack submarines, destroyers, LCSs, and oilers.[9]
- Cross-program purchases of common materials and components, such as those authorized for nuclear-powered ships under the statute governing the National Sea-Based Deterrence Fund, can further reduce ship procurement costs at the margin. Such purchases, if pursued, have a potential for becoming a third element of what might be viewed as a quiet revolution in recent years in Navy ship funding and contracting practices.[10]

[8] For more on PRO bidding, see 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, and Sydney J. Freedberg Jr., "Can Navy Afford Next-Gen DDG-51 Destroyer, Packard Award Or Not?" *Breaking Defense*, November 12, 2012.

[9] For additional discussion, 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.

[10] The first two elements would be increased use of incremental funding for procuring aircraft carriers and amphibious assault ships (which can prevent funding spikes that might force uneconomic disruptions to other Navy programs) and increased use of multiyear contracting.

Potential Economies in Coast Guard Shipbuilding Might Indirectly Benefit Navy Shipbuilding

Potential economies in Coast Guard shipbuilding might indirectly permit a bit of additional Navy shipbuilding, because such economies could permit the Coast Guard to fund more of its shipbuilding effort through its own acquisition account and thereby reduce the need for using the SCN account as an additional source of funding for Coast Guard shipbuilding. As noted in other CRS testimony and reports,[11] although the Navy for years has made extensive use of multiyear contracting to reduce ship procurement costs, the Coast Guard to date has made no use of multiyear contracting in its shipbuilding (or other) acquisition efforts.

CRS in previous testimony and reports has estimated that using multiyear contracting in the Coast Guard's 25-ship Offshore Patrol Cutter (OPC) program might reduce the total acquisition cost of those 25 ships by roughly $1 billion, and that using multiyear contracting in the Coast Guard's polar icebreaker program could reduce the cost of a three-ship heavy polar icebreaker acquisition by roughly $200 million. These programs represent a once-in-a-generation opportunity for achieving savings of these magnitudes in Coast Guard shipbuilding. Navy expertise in using multiyear contracting can be used to assist the Coast Guard in using such contracts, and the Navy is providing such assistance in the case of the polar icebreaker program.[12]

Congress Has the Option of Fully Funding Additional Ships in the Near Term, As Early as FY2018

Construction rates for major Navy ships cannot be markedly increased overnight—shipyards and supplier firms would need time to increase tooling and to hire and train the new workers that would be needed to handle the additional work. Even so, Congress has the option of fully funding additional ships in the near term—starting as early as FY2018—with the understanding that those additional ships would not begin construction until the industrial base is ready to accept the additional work, which could be years from now. Fully funding ships in the near term could send a near-term signal of commitment to industry, and a near-term signal of deterrence to potential adversaries, particularly China.

The option of fully funding additional ships as early as FY2018 includes nuclear-powered ships, such as attack submarines, for which there has been no prior-year advance procurement (AP) funding. As discussed in the CRS report on the Virginia-class attack submarine program,[13] although attack submarines

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[11] See, CRS Testimony TE10004, *The Status of Coast Guard Cutter Acquisition Programs*, by Ronald O'Rourke, CRS Report R42567, *Coast Guard Cutter Procurement: Background and Issues for Congress*, by Ronald O'Rourke, and CRS Report R42567, *Coast Guard Cutter Procurement: Background and Issues for Congress*, by Ronald O'Rourke.

[12] In connection with this issue, it can be noted that on three occasions in recent years—in 2002, 2006, and 2013—Navy and Coast Guard leaders have signed a joint National Fleet Policy Statement to provide (as stated in the 2013 edition) "direction and guidance for our Services to achieve commonality and interoperability for 21st century maritime and naval operations." The document states that "This Policy is particularly important in light of: significantly constrained fiscal resources; the growing costs of acquiring, training, and maintaining technologically advanced forces; and the complexity and lethality of national security threats and challenges confronting the Nation in and from the maritime domain." It states further that "This Policy enables Navy and Coast Guard forces to effectively and efficiently support each other while identifying specific methods and measurements, avoid redundancies and achieve economies of scale to maximize our Nation's investment of increasingly scarce resources." (*The National Fleet, A Joint Untied States Navy and United States Coast Guard Policy Statement*, undated but issued in 2013. Accessed July 17, 2017, at: https://www.uscg.mil/seniorleadership/DOCS/National%20Fleet%20Policy%20-%20signed%2025Jun13.pdf .

[13] See Appendix B of CRS Report RL32418, *Navy Virginia (SSN-774) Class Attack Submarine Procurement: Background and* (continued...)

are normally procured with two years of AP funding, Congress can fund the procurement of an SSN without prior-year AP funding (an option might be referred to as single-year fully funding or point-blank funding), or with only one year of AP funding.

Single-year full funding has been used in the past by Congress to procure nuclear-powered ships for which no prior-year AP funding had been provided. Specifically, Congress used single-year full funding in FY1980 to procure the nuclear-powered aircraft carrier CVN-71, and again in FY1988 to procure the CVNs 74 and 75. In the case of the FY1988 procurement, under the Administration's proposed FY1988 budget, CVNs 74 and 75 were to be procured in FY1990 and FY1993, respectively, and the FY1988 budget was to make the initial AP payment for CVN-74. Congress, in acting on the FY1988 budget, decided to accelerate the procurement of both ships to FY1988, and fully funded the two ships that year at a combined cost of $6.325 billion. The ships entered service in 1995 and 1998, respectively.

The existence in both FY1980 and FY1988 of a spare set of Nimitz-class reactor components was not what made it possible for Congress to fund CVNs 71, 74, and 75 with single-year full funding; it simply permitted the ships to be built more quickly. What made it possible for Congress to fund the carriers with single-year full funding was Congress's constitutional authority to appropriate funding for that purpose.

Funding the procurement of an SSN with no AP funding or one year of AP funding would not materially change the way the SSN would be built—the process would still encompass about two years of advance work on long-leadtime components, and an additional five or six years of construction work on the ship itself. The outlay rate for the SSN could be slower, as outlays for construction of the ship itself would begin at least one or two years later than normal, and the interval between the recorded year of full funding and the year that the ship enters service would be longer than normal.

Congress in the past has funded the procurement of certain ships in the knowledge that those ships would not begin construction for some time and consequently would take longer to enter service than a ship of that kind would normally require. When Congress procured two nuclear-powered aircraft carriers (CVNs 72 and 73) in FY1983, and another two (CVNs 74 and 75) in FY1988, it did so in both cases in the knowledge that the second ship in each case would not begin construction until some time after the first.

The Value of Surprise

If competitor countries, particularly China, continue to reduce the U.S. margin of military superiority, policymakers may need to consider placing increased emphasis on finding opportunities for surprising China and other competitor countries with capabilities that are *not* reflected in the 355-ship plan. The aim would be to enhance deterrence of China and other competitor countries by suddenly unveiling new capabilities, not previously spoken about in public, at carefully selected moments, so as to throw off competitor calculations and reduce their confidence about success in confronting U.S. Navy forces.

Such actions could assist in managing any increased risk of a failure of deterrence during the projected valley in U.S. attack submarine force levels (see discussion below), or more generally, risks associated with the extended period during which the Navy will be well short of 355 ships. Surprises might take the form of suddenly revealed new weapons, or suddenly revealed multiple squadrons of large unmanned surface or underwater vehicles.

Competitor countries sometimes surprise U.S. observers with new military capabilities that those observers did not expect (or did not expect to see until some later time). But this is a game that can be played both ways, and doing so might take on greater importance in a situation of reduced U.S. military

(...continued)

Issues for Congress, by Ronald O'Rourke.

superiority. Surprises, of course, can also be destabilizing, so care would need to be exercised to ensure that unveiling an unexpected capability would have the effect of enhancing deterrence rather than weakening or undermining it.

The Potential—and Limits—of Unmanned Vehicles

There is much interest in the potential for using unmanned vehicles (UVs) of various kinds to expand Navy capabilities, and in the possibility that a significant application of UVs could lead to a new fleet architecture. UVs were featured prominently in the three fleet architecture studies required by Section 1067 of the FY2016 National Defense Authorization Act (S. 1356/P.L. 114-92 of November 25, 2015).[14] This interest is warranted, particularly given developments with large surface and underwater UVs that could be launched from a pier. At the same time, it can be noted that while UVs have significant potential for performing various missions—potential that is likely not yet fully understood—there will be limits to what UVs can do relative to manned platforms, and that beyond a certain point, UVs will not be able to serve as substitutes for manned ships and aircraft, and therefore as a general reason or argument for not procuring ships and aircraft in needed numbers.

Addressing the Projected Valley in Attack Submarines

Discussion of the attack submarine portion of the 355-ship plan has tended to focus on how soon the Navy can increase the size of the attack submarine force to 66 boats, the number called for in the 355-ship plan. This focus has tended to obscure another issue that will come first, which is how to address the dip or valley in the attack submarine force level that is projected to occur during the period FY2025-FY2036, reaching a minimum of 41 boats in FY2029. I first called attention to this projected valley in 1995 and have been testifying, reporting, and speaking about it every year since. For several years now, I have been concerned that this valley, in addition to potentially causing a period of increased operational strain on the attack submarine force, could also lead to a period of weakened conventional deterrence against potential adversaries, particularly China.

It is now apparent that China has taken note of the valley. The November 2014 edition of a Chinese military journal, for example, includes an article with a passage that translates as follows:

> ... in 2028, the [U.S. Navy] force of nuclear attack submarines will fall from the current number of 55 down to 41 boats. Some are concerned about whether this force level can meet the requirements of the Asia-Pacific rebalance."[15]

As discussed in the CRS report on the Virginia-class attack submarine program, the Navy has been exploring options for mitigating the projected valley since at least 2006. Notional options for mitigating the valley include (but are not necessarily limited to) the following:

- shifting planned maintenance periods on SSNs where possible from the valley years to years before or after the valley years, so as to maximize the fraction of the SSN force that is available for operation during the valley years;
- extending the service lives of a few of the youngest Los Angeles (SSN-688) class SSNs from the currently planned notional figure of 33 years to 36 or 37 years (a figure achieved

[14] For excerpts from these studies, see Appendix F of CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

[15] Lyle Goldstein, "Evolution of Chinese Power Projection Capabilities," presentation to Center for a New American Security (CNAS) roundtable discussion, September 29, 2016, slide 7 of 41.

by at least three earlier Los Angeles-class boats), so that those boats can continue serving further into the valley years;

- performing a nuclear refueling on a few of the youngest Los Angeles (SSN-688) class boats, for the purpose of permitting those boats to operate for a few more years, so as to help fill in the valley; and
- procuring additional Virginia-class boats in the near term, meaning early enough so that they could enter service prior to or during the valley years.

Roadmap for Achieving Three Things in Cruiser-Destroyer Force

The Navy in coming years will have many DDG-51 class destroyers—the two DDG-51s requested for FY2018, for example, are to be the 78th and 79th ships in the class. DDG-51s are highly capable ships, and the Navy is reducing their procurement costs through use of multiyear procurement and PRO bidding. DDG-51 unit procurement costs could be reduced further by increasing the DDG-51 procurement rate from two ships per year to three or four ships per year, which is something that might be done to achieve and maintain the force of 104 cruisers and destroyers included in the 355-ship plan.

The Navy is not, however, taking steps to significantly reduce the operation and support (O&S) costs of DDG-51s, which could lock much of the future fleet into substantial annual O&S costs, potentially reducing options for future Navy leaders to fund other priorities in coming years within a Navy budget of a given size. More generally, as discussed in the CRS report on destroyer procurement,[16] the Navy does not have an announced roadmap for accomplishing three things in the cruiser-destroyer force:

- restoring ship growth margins;[17]
- introducing large numbers of ships with integrated electric drive systems or other technologies that could provide ample electrical power for supporting future electrically powered weapons; and
- introducing technologies (such as those for substantially reducing ship crew size) for substantially reducing ship operating and support (O&S) costs.

The Navy's pre-2008 plan to procure DDG-1000 destroyers and then CG(X) cruisers based on the DDG-1000 hull design represented the Navy's roadmap at the time for restoring growth margins, and for introducing into the cruiser-destroyer force significant numbers of ships with integrated electric drive systems and technologies for substantially reducing ship crew sizes. The ending of the DDG-1000 and CG(X) programs in favor of continued procurement of DDG-51s leaves the Navy without an announced roadmap to do these things, because the Flight III DDG-51 will not feature a fully restored growth margin, will not be equipped with an integrated electric drive system or other technologies that could provide ample electrical power for supporting future

[16] CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.

[17] Growth margins refer to a ship's capacity for accommodating over its service life new equipment that is larger or heavier than the older equipment it replaces, or which requires more electrical power or cooling capacity than the older equipment it replaces. Key measures of a ship's growth margin include available space, additional weight-carrying capacity, ability to accept resulting changes in the ship's vertical center of gravity, available electrical power, and available cooling capacity. Growth margin can also refer to a ship's ability to accept an increase in crew size due to changes in equipment or other causes.

electrically powered weapons, and will not incorporate features for substantially reducing ship crew size or for otherwise reducing ship O&S costs substantially below that of Flight IIA DDG-51s.

One option for addressing this issue would be to further modify the DDG-51 design. Another would be to initiate a program to design a new cruiser or destroyer class.

Opportunity to Create a Firm Analytical Foundation for Small Surface Combatant Acquisition

As discussed over the years in the CRS report on the LCS/Frigate program,[18] much of the controversy in that program over the years might be viewed as a consequence of the program's weak analytical foundation. The Navy's current effort to define a new frigate can be viewed as the third attempt in the last 15 years to create a firm analytical foundation for the Navy's small surface combatant acquisition efforts. Creating such a foundation involves providing analytically rigorous answers to three questions before committing to a particular acquisition:

- What capability gaps need to be addressed?
- What is the best general approach for addressing those gaps? (For example, should these gaps be addressed with a new ship? A new aircraft? An unmanned vehicle? Something else? In years past, this was sometimes referred to as an analysis of multiple concepts, though it can also be called an analysis of alternatives.)
- For the best general approach identified above, what are the key performance parameters (KPPs)?

Industrial Base Ability for Taking on Additional Shipbuilding Work

Navy and industry officials have stated that, in general, the shipbuilding industrial base has the ability to take on the additional shipbuilding work needed to achieve and maintain a 355-ship fleet, and that building toward the 355-ship goal sooner rather than later would be facilitated by ramping up production of existing ship designs rather than developing and then starting production of new designs.

Ramping up to higher rates of shipbuilding, Navy and industry officials have stated, would require additional tooling and equipment at some shipyards and some supplier firms. Additional production and supervisory workers would need to be hired and trained at shipyards and supplier firms. Depending on their specialties, newly hired workers could be initially less productive per unit of time worked than more experienced workers. Given the time needed to increase tooling and to hire and train new workers, some amount of time would be needed to ramp up to higher shipbuilding rates—production could not jump to higher rates overnight.[19] Some parts of the shipbuilding industrial base, such as the submarine construction industrial base, could face more challenges than others in ramping up to the higher production rates required to build the various parts of the 355-ship fleet.

[18] See earlier editions of CRS Report RL33741, *Navy Littoral Combat Ship/Frigate (LCS/FF) Program: Background and Issues for Congress*, by Ronald O'Rourke.

[19] For further discussion regarding the challenges of expanding shipyard workforces, see Mike Stone, "Missing from Trump's Grand Navy Plan: Skilled Workers to Build the Fleet," Reuters, March 17, 2017; and James Bach, "Massive Navy Expansion May Be Easier Said Than Done for U.S. Shipbuilders," Washington Business Journal, March 3, 2017.

Employment Impact of Additional Shipbuilding Work

Depending on the number of additional ships per year that might be added to the Navy's shipbuilding effort, building the additional ships that would be needed to achieve and maintain the 355-ship fleet could create thousands of additional manufacturing and other jobs at shipyards, associated supplier firms, and elsewhere in the U.S. economy.

Consistent with U.S. law, the seven shipyards that build most of the Navy's major ships are all located in the United States. As of 2016, these seven yards reportedly employed a total of more than 66,000 people. Production workers account for a sizeable fraction of that figure. Some of the production workers are assigned to projects other than building Navy ships.[20] (The remaining employees at the yards include designers and engineers, management and supervisory staff, and administrative and support staff.) Navy shipbuilding additionally supports thousands of manufacturing and other jobs at hundreds of supplier firms located throughout the United States. (Some states have more of these firms, while others have fewer of them.)

Shipbuilding can also have broader effects on the U.S. economy. A 2015 Maritime Administration (MARAD) report states, "Considering the indirect and induced impacts, each direct job in the shipbuilding and repairing industry is associated with another 2.6 jobs in other parts of the US economy; each dollar of direct labor income and GDP in the shipbuilding and repairing industry is associated with another $1.74 in labor income and $2.49 in GDP, respectively, in other parts of the US economy."[21]

A March 2017 press report states, "Based on a 2015 economic impact study, the Shipbuilders Council of America [a trade association for U.S. shipbuilders and associated supplier firms] believes that a 355-ship Navy could add more than 50,000 jobs nationwide."[22] The 2015 economic impact study referred to in that quote might be the 2015 MARAD study discussed in the previous paragraph. An estimate of more than 50,000 additional jobs nationwide might be viewed as a higher-end estimate; other estimates might be lower. A June 14, 2017, press report states: "The shipbuilding industry will need to add between 18,000 and 25,000 jobs to build to a 350-ship Navy, according to Matthew Paxton, president of the Shipbuilders Council of America, a trade association representing the shipbuilding industrial base. Including indirect jobs like suppliers, the ramp-up may require a boost of 50,000 workers."[23]

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[20] For example, at Huntington Ingalls Industries (HII)/Newport News Shipbuilding, a sizeable fraction of the production workforce is assigned to mid-life nuclear refueling overhauls of existing aircraft carriers. At HII/Ingalls, some production workers are assigned to building national Security Cutters (NSCs) for the Coast Guard. At General Dynamics/National Steel and Shipbuilding Company (GD/NASSCO), some production workers may be assigned to the production of commercial cargo ships.

[21] Maritime Administration (MARAD), *The Economic Importance of the U.S. Shipbuilding and Repairing Industry*, November 2015, pp. E-3, E-4, For another perspective on the issue of the impact of shipbuilding on the broader economy, see Edward G. Keating et al, *The Economic Consequences of Investing in Shipbuilding, Case Studies in the United States and Sweden*, RAND Corporation, Santa Monica, CA, 2015 (Report RR-1036), 69 pp.

[22] Yasmin Tadjdeh, "Navy Shipbuilders Prepared for Proposed Fleet Buildup," *National Defense*, March 2017. Similarly, another press report states: "The Navy envisioned by Trump could create more than 50,000 jobs, the Shipbuilders Council of America, a trade group representing U.S. shipbuilders, repairers and suppliers, told Reuters." (Mike Stone, "Missing from Trump's Grand Navy Plan: Skilled Workers to Build the Fleet," *Reuters*, March 17, 2017.)

[23] Jaqueline Klimas, "Growing Shipbuilding Workforce Seen As Major Challenge for Trump's Navy Buildup," *Politico*, June 14, 2017.

Extending Service Lives of Existing Ships and Reactivating Retired Ships

As one possible option for increasing the size of the Navy beyond or more quickly than what could be accomplished solely through increased rates of construction of new ships, Navy officials state that they are exploring options for increasing the service lives of certain existing surface ships, particularly DDG-51 class destroyers.[24] Extending DDG-51 service lives could make it possible to defer, for a period of years, the procurement of some number of destroyers that would otherwise need to be procured in the nearer term to achieve and maintain the 104-ship cruiser-destroyer force included in the 355-ship plan. The funding and industrial base capacity that would have been used for these destroyers in the nearer term could instead be used for funding and building other types of ships included in the 355-ship plan, such as frigates and amphibious ships. Extending the service lives of DDG-51s could involve increasing funding for maintaining and modernizing these ships, with the increases perhaps starting right away.[25] Even with extended DDG-51 service lives, maintaining a force of 104 cruisers and destroyers would eventually involve procuring replacement ships for the extended DDG-51s.

As a second possible option for increasing the size of the Navy—particularly in the nearer term, before increased rates of construction of new ships could produce significant results—Navy officials state that they are also exploring options for reactivating recently retired conventional surface ships, particularly Oliver Hazard Perry (FFG-7) class frigates.[26] The technical feasibility and potential cost effectiveness of these options, however, is currently not clear.[27] It may be possible to do something creative with the FFG-7 class ships.[28] Exploring options for reactivating recently retired ships can be viewed, at a minimum, as a matter of due diligence.

Option of Additional Forward Homeporting in Mediterranean

During the Cold War, the waters around Europe constituted one of three major operating hubs for the U.S. Navy, along with the Indian Ocean/Persian Gulf region and the Western Pacific. Following the end of the Cold War, U.S. Navy operations around Europe were significantly reduced, and major Navy forward-deployed operations were focused primarily on the two remaining hubs. Now, with more recent changes in the international security environment,[29] including increased Russian naval activity around Europe and

[24] Megan Eckstein, "NAVSEA: Extending Surface Ship Service Lives Could Speed Up 355-Ship Buildup By 10-15 Years," *USNI News*, June 1, 2017; Sam LaGrone, "CNO: Navy 'Taking a Hard Look' at Bringing Back Oliver Hazard Perry Frigates, DDG Life Extensions as Options to Build Out 355 Ship Fleet," *USNI News*, June 13, 2017; Richard Abott, "Navy Looking At Bringing Back Perry Frigates, Life Extension, Networking For Larger Fleet," *Defense Daily*, June 15, 2017; Sam LaGrone, "CNO Richardson: Perry Frigates Only Inactive Hulls Navy Considering Returning to Active Fleet; DDG Life Extension Study Underway," *USNI News*, June 16, 2017.

[25] See, for example, "Richard Abott, "NAVSEA Chief Says Increased Maintenance Funds Will Help Reach 355-Ship Fleet Faster," *Defense Daily*, June 2, 2017.

[26] See footnote 24, and also Lee Hudson, "CNO Considers Modernizing Oliver Hazard Perry-Class Frigates," *Inside the Navy*, June 19, 2017.

[27] See, for example, For a discussion of some past ship reactivations, see Steven Wills, "Of Mothballs and Modernizations," *Real Clear Defense*, June 16, 2017.

[28] See, for example, Tony Butera and Dale Rielage, "Innovate to Return Perry Frigates Faster & Better," *U.S. Naval Institute Proceedings*, June 2017.

[29] For a discussion of the changing international security environment, see CRS Report R43838, *A Shift in the International Security Environment: Potential Implications for Defense—Issues for Congress*, by Ronald O'Rourke.

instability and conflict in North Africa and Syria, the European theater, and particularly Mediterranean, is re-emerging as a third major operating hub for the Navy, putting upward pressure on Navy force-level requirements. For example, increasing by eight the number of Navy ships that are continuously forward deployed in the Mediterranean and sourcing that additional deployment from ships that are homeported on the U.S. East Coast could increase the Navy's force structure requirement (other things held equal) by about 42 ships.[30]

One option for managing this upward pressure on Navy force-structure requirements—that is, for increasing Navy ship deployments to the Mediterranean while minimizing reductions to Navy operations in the other two operating hubs—would be to homeport additional Navy ships in the Mediterranean. Forward homeporting additional Navy ships in the Mediterranean could substantially reduce the number of additional ships the Navy would need to support a larger forward-deployed presence there. Returning to the example cited in the previous paragraph, forward homeporting seven surface ships in the Mediterranean (and accounting for the fact that those seven ships would require periodic maintenance) could reduce from about 42 to about 14 the additional number of ships that would be needed to support eight additional forward-deployed ships in the Mediterranean.[31]

It is well known that the U.S. Navy has forward-homeported a carrier group in Japan since the early 1970s. What is less well-remembered is that the Navy in the early 1970s was also pursuing a plan for homeporting a carrier group in Greece, at the port of Piraeus, near Athens. The initial surface combatants for that group, in fact, were sent to Greece. Following a military coup in Greece, however, the United States canceled the plan to homeport a carrier group in Greece. If the coup had not occurred, the United States today might have a carrier group homeported in Greece, as it does in Japan.

Additional Navy ships homeported in the Mediterranean could be of various types, and need not amount to a carrier strike group. And Greece is not the only potential option for forward-homeporting Navy ships in the Mediterranean—other possibilities, at least in theory, include Spain (which homeports four U.S. Navy destroyers at Rota), Italy (which homeports a Navy command ship at Gaeta), and France. Some observers have also suggested Haifa, Israel, as a possible homeporting location.

Forward homeporting is an option that has been discussed in previous CRS reports[32] and in reports from the Congressional Budget Office (CBO).[33] Aside from substantially reducing the number of ships needed to support a given level of forward-deployed presence, forward homeporting offers other potential benefits. Although it can substantially reduce the number of ships needed to support a given level of

[30] Source: CRS calculation based on Navy stationkeeping multipliers provided by the Navy to CRS and CBO on December 15, 2015. A stationkeeping multiplier is the number of ships of a certain kind that are needed to keep one ship of that kind on station in an overseas operating area. The calculation here is based on an additional continuous presence of a carrier strike group (CSG) consisting of one aircraft carrier and three surface combatants, an amphibious ready group (ARG) consisting of three amphibious ships, and one attack submarine.

[31] Source: CRS calculation based on Navy stationkeeping multipliers provided by the Navy to CRS and CBO on December 15, 2015. As noted in footnote 30, in the notional example here, the additional forward-deployed presence in the Mediterranean includes one aircraft carrier, three surface combatants, three amphibious ships, and one attack submarine. In the calculation here, one carrier, three surface combatants, and three amphibious ships would be forward homeported in the Mediterranean, while the attack submarine presence would continue to be sourced from submarines homeported on the U.S. East Coast. (The Navy does not currently homeport any attack submarines outside U.S. territory.)

[32] See, for example, CRS Report RS21338, *Navy Ship Deployments: New Approaches—Background and Issues for Congress*, by Ronald O'Rourke.

[33] See, for example, Congressional Budget Office, *Preserving the Navy's Forward Presence With a Smaller Fleet*, March 2015, 29 pp.

forward-deployed presence, forward homeporting does not substantially change the number of ships needed for warfighting. In addition, forward homeporting also poses certain challenges, costs, and risks.[34]

Chairman Wicker, 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.

[34] For a discussion of the benefits, challenges, costs, and risks of forward homeporting, see pp. 8-10 of CRS Report R44635, *Navy Force Structure: A Bigger Fleet? Background and Issues for Congress*, by Ronald O'Rourke.

Appendix A. Summary of CRS Overview Report on Navy Force Structure and Shipbuilding Plans

This appendix reprints the summary of my CRS overview report on Navy force structure and shipbuilding.[35] The text of the summary is as follows:

> The current and planned size and composition of the Navy, the rate of Navy ship procurement, and the prospective affordability of the Navy's shipbuilding plans have been oversight matters for the congressional defense committees for many years. The Navy's proposed FY2018 budget, as amended on May 24, 2017, requests the procurement of nine new ships, including one Gerald R. Ford (CVN-78) class aircraft carrier, two Virginia-class attack submarines, two DDG-51 class destroyers, two Littoral Combat Ships (LCSs), one TAO-205 class oiler, and one towing, salvage, and rescue ship.
>
> On December 15, 2016, the Navy released a new force-structure goal that calls for achieving and maintaining a fleet of 355 ships of certain types and numbers. Key points about this new 355-ship force-level goal include the following:
>
> -- The 355-ship force-level goal is the result of a Force Structure Assessment (FSA) conducted by the Navy in 2016. The Navy conducts an FSA every few years, as circumstances require, to determine its force-structure goal.
>
> -- The new 355-ship force-level goal replaces a 308-ship force-level goal that the Navy released in March 2015. The actual size of the Navy in recent years has generally been between 270 and 290 ships.
>
> -- The figure of 355 ships appears close to an objective of building toward a fleet of 350 ships that was announced by the Trump campaign organization during the 2016 presidential election campaign. The 355-ship goal, however, reflects the national security strategy and national military strategy that were in place in 2016 (i.e., the Obama Administration's national security strategy and national military strategy).
>
> -- Compared to the previous 308-ship force-level goal, the new 355-ship force-level goal includes 47 additional ships, or about 15% more ships. More than 47 ships, however, would need to be added to the Navy's 30-year shipbuilding plan to achieve and maintain the Navy's 355-ship fleet, unless the Navy extends the service lives of existing ships beyond currently planned figures and/or reactivates recently retired ships:
>
> -- CRS estimates that 57 to 67 ships would need to be added to the Navy's FY2017 30-year (FY2017-FY2046) shipbuilding plan to achieve the Navy's 355-ship fleet and maintain it through the end of the 30-year period (i.e., through FY2046).
>
> -- The Congressional Budget Office (CBO) estimates that 73 to 77 ships would need to be added to the Navy's FY2018 30-year (FY2018-FY2047) shipbuilding plan to achieve the Navy's 355-ship fleet and maintain it not only through the end of the 30-year period (i.e., through FY2047), but another 10 years beyond the end of the 30-year period (i.e., through FY2057).
>
> -- Even with increased shipbuilding rates, achieving certain parts of the 355-ship force-level goal could take many years. CBO estimates that the earliest the Navy could achieve all elements of the 355-ship fleet would be 2035. Extending the service lives of existing ships and/or reactivating retired ships could accelerate the attainment of certain parts of the 355-ship force structure.

[35] CRS Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

- Procuring the additional ships needed to achieve and maintain the Navy's 355-ship fleet would require several billion dollars per year in additional shipbuilding funds:
  - CRS estimates that procuring the 57 to 67 ships that would need to be added to the Navy's FY2017 30-year shipbuilding plan to achieve the Navy's 355-ship fleet and maintain it through FY2046 would notionally cost an average of roughly $4.6 billion to $5.1 billion per year in additional shipbuilding funds over the 30-year period, using today's shipbuilding costs.
  - CBO estimates that procuring the 73 to 77 ships that would need to be added to the Navy's FY2018 30-year shipbuilding plan to achieve the Navy's 355-ship fleet and maintain it through FY2057 would cost, in constant FY2017 dollars, an average of $5.4 billion per year in additional shipbuilding funds over the 30-year period.
- The above additional shipbuilding funds are only a fraction of the total costs that would be needed to achieve and maintain the Navy's 355-ship fleet instead of the Navy's previously envisaged 308-ship fleet. CBO estimates that, adding together both shipbuilding costs and ship operation and support (O&S) costs, the Navy's 355-ship fleet would cost an average of about $11 billion to $23 billion more per year in constant FY2017 dollars than the Navy's previously envisaged 308-ship fleet. This figure does not include additional costs for manned aircraft, unmanned systems, and weapons.
- If defense spending in coming years is not increased above the caps established in the Budget Control Act of 2011, or BCA (S. 365/P.L. 112-25 of August 2, 2011), as amended, achieving and maintaining a 355-ship fleet could require reducing funding levels for other DOD programs.
- Navy officials have stated that, in general, the shipbuilding industrial base has the ability to take on the additional shipbuilding work needed to achieve and maintain a 355-ship fleet, and that building toward the 355-ship goal sooner rather than later would be facilitated by ramping up production of existing ship designs rather than developing and then starting production of new designs.
- Depending on the number of additional ships per year that might be added to the Navy's shipbuilding effort, building the additional ships that would be needed to achieve and maintain the 355-ship fleet could create thousands of additional manufacturing (and other) jobs at shipyards, associated supplier firms, and elsewhere in the U.S. economy.
- Navy officials have indicated that, prior to embarking on a fleet expansion, they would first like to see additional funding provided for overhaul and repair work to improve the readiness of existing Navy ships, particularly conventionally powered surface ships, and for mitigating other shortfalls in Navy readiness.

Appendix B. A Summary of Some Acquisition Lessons Learned for Navy Shipbuilding

A general summary of lessons learned in Navy shipbuilding, reflecting comments made repeatedly by various sources over the years, includes the following:

- **At the outset, get the operational requirements for the program right.** Properly identify the program's operational requirements at the outset. Manage risk by not trying to do too much in terms of the program's operational requirements, and perhaps seek a so-called 70%-to-80% solution (i.e., a design that is intended to provide 70%-80% of desired or ideal capabilities). Achieve a realistic balance up front between operational requirements, risks, 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, multiyear procurement (MYP) or block buy contracting.
- **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.

Appendix C. Some Considerations Relating to Warranties in Shipbuilding and Other Defense Acquisition

In discussions of Navy (and also Coast Guard) shipbuilding, one question that sometimes arises is whether including a warranty in a shipbuilding contract is preferable to not including one.

Including a warranty in a shipbuilding contract (or a contract for building some other kind of defense end item), while potentially valuable, might not always be preferable to not including one—it depends on the circumstances of the acquisition, and it is not necessarily a valid criticism of an acquisition program to state that it is using a contract that does not include a warranty (or a weaker form of a warranty rather than a stronger one).

Including a warranty generally shifts to the contractor the risk of having to pay for fixing problems with earlier work. Although that in itself could be deemed desirable from the government's standpoint, a contractor negotiating a contract that will have a warranty will incorporate that risk into its price, and depending on how much the contractor might charge for doing that, it is possible that the government could wind up paying more in total for acquiring the item (including fixing problems with earlier work on that item) than it would have under a contract without a warranty.

When a warranty is not included in the contract and the government pays later on to fix problems with earlier work, those payments can be very visible, which can invite critical comments from observers. But that does not mean that including a warranty in the contract somehow frees the government from paying to fix problems with earlier work. In a contract that includes a warranty, the government will indeed pay something to fix problems with earlier work—but it will make the payment in the less-visible (but still very real) form of the up-front charge for including the warranty, and that charge might be more than what it would have cost the government, under a contract without a warranty, to pay later on for fixing those problems.

From a cost standpoint, including a warranty in the contract might or might not be preferable, depending on the risk that there will be problems with earlier work that need fixing, the potential cost of fixing such problems, and the cost of including the warranty in the contract. The point is that the goal of *avoiding highly visible payments* for fixing problems with earlier work and the goal of *minimizing the cost* to the government of fixing problems with earlier work are separate and different goals, and that pursuing the first goal can sometimes work against achieving the second goal.[36]

The Department of Defense's guide on the use of warranties states:

> Federal Acquisition Regulation (FAR) 46.7 states that "the use of warranties is not mandatory." However, if the benefits to be derived from the warranty are commensurate with the cost of the warranty, the CO [contracting officer] should consider placing it in the contract. In determining whether a warranty is appropriate for a specific acquisition, FAR Subpart 46.703 requires the CO

[36] It can also be noted that the country's two largest builders of Navy ships—General Dynamics (GD) and Huntington Ingalls Industries (HII)—derive about 60% and 96%, respectively, of their revenues from U.S. government work. (See General Dynamics, *2016 Annual Report*, page 9 of Form 10-K [PDF page 15 of 88]) and Huntington Ingalls Industries, *2016 Annual Report*, page 5 of Form 10-K [PDF page 19 of 134]). These two shipbuilders operate the only U.S. shipyards currently capable of building several major types of Navy ships, including submarines, aircraft carriers, large surface combatants, and amphibious ships. Thus, even if a warranty in a shipbuilding contract with one of these firms were to somehow mean that the government did not have pay under the terms of that contract—either up front or later on—for fixing problems with earlier work done under that contract, there would still be a question as to whether the government would nevertheless wind up eventually paying much of that cost as part of the price of one or more future contracts the government may have that firm.

to consider the nature and use of the supplies and services, the cost, the administration and enforcement, trade practices, and reduced requirements. The rationale for using a warranty should be documented in the contract file....

In determining the value of a warranty, a CBA [cost-benefit analysis] is used to measure the life cycle costs of the system with and without the warranty. A CBA is required to determine if the warranty will be cost beneficial. CBA is an economic analysis, which basically compares the Life Cycle Costs (LCC) of the system with and without the warranty to determine if warranty coverage will improve the LCCs. In general, five key factors will drive the results of the CBA: cost of the warranty + cost of warranty administration + compatibility with total program efforts + cost of overlap with Contractor support + intangible savings. Effective warranties integrate reliability, maintainability, supportability, availability, and life-cycle costs. Decision factors that must be evaluated include the state of the weapon system technology, the size of the warranted population, the likelihood that field performance requirements can be achieved, and the warranty period of performance.[37]

[37] Department of Defense, *Department of Defense Warranty Guide*, Version 1.0, September 2009, accessed July 13, 2017, at: www.acq.osd.mil/dpap/pdi/.../departmentofdefensewarrantyguide[1].doc.

Appendix D. Some Considerations Relating to Avoiding Procurement Cost Growth vs. Minimizing Procurement Costs

This appendix presents some considerations relating to avoiding procurement cost growth vs. minimizing procurement costs in shipbuilding and other defense acquisition.[38]

The affordability challenge posed by the Navy's 355-ship force-level goal can reinforce the strong oversight focus on preventing or minimizing procurement cost growth in Navy shipbuilding programs, which is one expression of a strong oversight focus on preventing or minimizing cost growth in DOD acquisition programs in general. This oversight focus may reflect in part an assumption that avoiding or minimizing procurement cost growth is always synonymous with minimizing procurement cost. It is important to note, however, that as paradoxical as it may seem, avoiding or minimizing procurement cost growth is *not* always synonymous with minimizing procurement cost, and that a sustained, singular focus on avoiding or minimizing procurement cost growth might sometimes lead to *higher* procurement costs for the government.

How could this be? Consider the example of a design for the lead ship of a new class of Navy ships. The construction cost of this new design is uncertain, but is estimated to be likely somewhere between Point A (a minimum possible figure) and Point D (a maximum possible figure). (Point D, in other words, would represent a cost estimate with a 100% confidence factor, meaning there is a 100% chance that the cost would come in at or below that level.) If the Navy wanted to avoid cost growth on this ship, it could simply set the ship's procurement cost at Point D. Industry would likely be happy with this arrangement, and there likely would be no cost growth on the ship.

The alternative strategy open to the Navy is to set the ship's target procurement cost at some figure between Points A and D—call it Point B—and then use that more challenging target cost to place pressure on industry to sharpen its pencils so as to find ways to produce the ship at that lower cost. (Navy officials sometimes refer to this as "pressurizing" industry.) In this example, it might turn out that industry efforts to reduce production costs are not successful enough to build the ship at the Point B cost. As a result, the ship experiences one or more rounds of procurement cost growth, and the ship's procurement cost rises over time from Point B to some higher figure—call it Point C.

Now, here is the rub: Point C, in spite of incorporating one or more rounds of cost growth, *might nevertheless turn out to be lower than Point D*, because Point C reflected efforts by the shipbuilder to find ways to reduce production costs that the shipbuilder might have put less energy into pursuing if the Navy had simply set the ship's procurement cost initially at Point D.

Setting the ship's cost at Point D, in other words, may eliminate the risk of cost growth on the ship, but does so at the expense of creating a risk of the government paying more for the ship than was actually necessary. DOD could avoid cost growth on new procurement programs starting tomorrow by simply setting costs for those programs at each program's equivalent of Point D. But as a result of this strategy,

[38] 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. 15-16; and Statement of Ronald O'Rourke, Specialist in Naval Affairs, Congressional Research Service, before the House Armed Services Committee Subcommittee on Seapower and Projection Forces on the Navy's FY2014 30-Year Shipbuilding Plan, October 23, 2013, pp. 4-5.

DOD could well wind up leaving money on the table in some instances—of not, in other words, minimizing procurement costs.

DOD does not have to set a cost precisely at Point D to create a potential risk in this regard. A risk of leaving money on the table, for example, is a possible downside of requiring DOD to budget for its acquisition programs at something like an 80 percent confidence factor—an approach that some observers have recommended—because a cost at the 80 percent confidence factor is a cost that is likely fairly close to Point D.

Procurement cost growth is often embarrassing for DOD and industry, and can damage their credibility in connection with future procurement efforts. Procurement cost growth can also disrupt congressional budgeting by requiring additional appropriations to pay for something Congress thought it had fully funded in a prior year. For this reason, there is a legitimate public policy value to pursuing a goal of having less rather than more procurement cost growth.

Procurement cost growth, however, can sometimes be in part the result of DOD efforts to use lower initial cost targets as a means of pressuring industry to reduce production costs—efforts that, notwithstanding the cost growth, might be partially successful. A sustained, singular focus on avoiding or minimizing cost growth, and of punishing DOD for all instances of cost growth, could discourage DOD from using lower initial cost targets as a means of pressurizing industry, which could deprive DOD of a tool for controlling procurement costs.

The point here is not to excuse away cost growth, because cost growth can occur in a program for reasons other than DOD's attempt to pressurize industry. Nor is the point to abandon the goal of seeking lower rather than higher procurement cost growth, because, as noted above, there is a legitimate public policy value in pursuing this goal. The point, rather, is to recognize that this goal is not always synonymous with minimizing procurement cost, and that a possibility of some amount of cost growth might be expected as part of an optimal government strategy for minimizing procurement cost. Recognizing that the goals of seeking lower rather than higher cost growth and of minimizing procurement cost can sometimes be in tension with one another can lead to an approach that takes both goals into consideration. In contrast, an approach that is instead characterized by a sustained, singular focus on avoiding and minimizing cost growth may appear virtuous, but in the end may wind up costing the government more.

Senator WICKER. Thank you very much, Mr. O'Rourke.
Dr. Hendrix, you are recognized.

STATEMENT OF DR. JERRY HENDRIX, SENIOR FELLOW AND DIRECTOR OF THE DEFENSE STRATEGIES AND ASSESSMENTS PROGRAM AT THE CENTER FOR A NEW AMERICAN SECURITY

Dr. HENDRIX. Thank you, sir. Chairman Wicker, thank you for your invitation to address the topic on how the Navy might reach its stated requirement of 355 ships as quickly, economically, and efficiently as possible.

I wish to ask for permission to submit my extended written statement for the record while I summarize my remarks.

Senator WICKER. Without objection.

Dr. HENDRIX. Thank you, sir.

Today I will present a series of options that my friend and frequent co-author, Robert O'Brien, and I have suggested as providing ready paths to 355 ships. It is important to note that none of the ideas that follow are radical and that each has been used in the past, to include most recently during the Reagan administration's campaign to bring the Cold War to a successful conclusion.

First, it is important to note that the number, 355, as enunciated by the Navy is not arbitrary, but rather represents a minimum number of ships required to provide persistent presence in the 18 maritime regions of the world identified by combatant commanders where the United States has strong national interests.

Second, it is just as important to note that the time frame associated with the buildup to 355 ships is as critical as the raw number itself. Both China and Russia have taken advantage of the United States' recent strategic focus on counterterrorism campaigns in Afghanistan and Iraq to assume challenging profiles on the high seas. To head a future crisis off, the U.S. Navy must expand rapidly enough to convince others that eventual military victory at sea is not even remotely possible. To accomplish this goal, the Navy must reach the 355-ship range within 10 years.

Many tend to focus on new ship construction as the primary path to battle force growth at sea. For instance, in January, the Navy developed an accelerated shipbuilding plan that effectively took warm *Virginia*-class, *Burke*-class, LX(R), and oiler ships and turned their production lines from warm to hot, adding 29 additional ships over and above those contained within the current 30-year shipbuilding plan. However, this approach, limited as it is by the capacity of current programs, only achieves a ship count in the mid-330s. However, there are in fact other paths to 355 ships within the time frame discussed.

It is to the Nation's advantage that the Navy is scheduled to take delivery of 80 new ships of varying classes between now and the end of fiscal year 2024. Given the current battle force count of 276 ships, these new ships alone would allow the fleet to reach 355 ships. Unfortunately, during the same period, the Navy plans to decommission 49 ships from service. These factors combined result in a net 31-ship increase to 307 ships. However, if a portion of the ships scheduled for decommissioning, for instance the five *Ticonderoga*-class cruisers or the nine mine countermeasure ships, could be kept in service for another 5 to 10 years through service life extension programs, we could have a battle force of 321 ships by the end of fiscal year 2024.

Another option for rapid growth can be found in the ready reserve, or ghost fleet. Famously during the administration of Ronald Reagan, four *Iowa*-class battleships were moved from the reserve fleet to the active fleet as Reagan built towards a 600-ship Navy. Currently there are 10 retention assets in the reserve fleet, to include a conventionally powered aircraft carrier, three light amphibious carriers, and five amphibious platform docks. There are also 11 *Perry*-class frigates currently designated for foreign military sales. If 12 of the 21 ships described were returned to the active fleet within 5 years of initiating reactivation, this would leave a gap of 23 ships to achieve the 355-ship goal.

This brings us back to the original discussion of new ship construction. Of course, new construction will have to be part of the Navy's buildup. The places in the inventory where the Navy needs additional investment are fast attack submarines, which will fall to a population of 41 boats from its Cold War high of 102 by 2029, and multi-mission frigates, which have declined from 115 ships in 1987 to 0 today. Multi-mission frigates, as described by the recent requirements document from the Navy, will be critical to the Navy maintaining its persistent presence across the global maritime commons, as well as restoring a capacity to conduct anti-surface, antisubmarine, and convoy escort missions in support of military operations across the globe. Some care should be given to an ice-hardened design or variant that would allow for operations in the Arctic.

The Navy needs a robust new multi-mission frigate design, perhaps based on a proven foreign design such as the robust European FREMM or an ongoing program here in the United States such as the national security cutter currently being built for the Coast Guard. To be clear, there is neither the time nor the need to consider a new clean sheet design for a frigate, which the Navy needs a fair number of. Selecting a mature design could allow the Navy to take delivery of a new frigate within a 5 to 6-year period, depending on which design is selected. Such ships would provide naval presence in those areas of the world that are on the fringes of our interests but also where law and order are most likely to be challenged. While perceived as strong, the global system of self-governance is actually quite fragile and is in need of constant attention that only a Navy of 355 ships can provide.

Efficiencies can be found in the production of these ships by pursuing authorization for multiyear block buys of vessels. Such actions would provide stability to shipbuilders and downstream parts suppliers, stabilizing or expanding good paying jobs and strengthening the Nation's defense industrial base.

While shipbuilding is the focus of this hearing, I would be remiss if I did not take a moment to bring to your attention the importance of getting the right capabilities balance back into the air wings of our aircraft carriers. Ensuring that the mission tanker, an unmanned aircraft designated as the MQ–25 Stingray, is designed to meet certain key mission-enabling requirements, such as being able to fully tank two F–35 Charlies at 500 to 600 miles from the carrier, will be one of the major decisions of the next year. A bad decision could lessen the relevance of the carrier and hence weaken American sea power.

Senator WICKER. Let me stop you right there.

Dr. HENDRIX. Yes, sir.

Senator WICKER. Who is making that decision, and how is it going?

Dr. HENDRIX. Sir, the requirements document is in development, and ultimately that decision will be made by Navy leadership, secretary level.

Senator WICKER. Go ahead. Well, thank you for letting me interrupt there.

Dr. HENDRIX. Thank you, sir.

I have presented some options with regard to service life extensions for current ships in the fleet and returning ships to active service from the ready reserve fleet. I also recommend increased production of submarines and small combatants in order to grow the capabilities in anti-surface, antisubmarine, and convoy escort in which we are woefully short.

In closing, let me once again thank you for the honor of addressing you today. John Adams described the Navy as the shield of the republic. May it always be large enough to remain so.

[The prepared statement of Dr. Hendrix follows:]

PREPARED STATEMENT BY DR. JERRY HENDRIX, PHD

Chairman Wicker, Senator Hirono, and distinguished members of the Seapower Subcommittee, thank you for extending the honor of addressing the topic of how the Navy might reach its stated requirement of 355 ships as quickly, economically and efficiently as possible.

Today I will present a series of options that many people, to include my friend and frequent co-author Robert O'Brien, have suggested as providing ready paths to 355 ships. It is important to note that none of the ideas that follow are radical and that each of them has been used in the past, to include most recently during the Reagan administration's campaign to bring the Cold War to a successful conclusion.

First it is important to note that the numbers three hundred and fifty, first proposed by President Trump in Philadelphia on 7 September 2016, and three hundred and fifty-five, as enunciated by the Navy on 14 December of last year, are not arbitrary, but rather represent the minimum number of ships required to provide persistent presence in the eighteen maritime regions of the world (North Atlantic, Caribbean, South Atlantic, Gulf of Guinea, Arctic, Baltic Sea, Western Mediterranean, Eastern Mediterranean, Black Sea, Red Sea, Gulf of Oman, Arabian Gulf, Indian Ocean, South China Sea, East China Sea, Northern Pacific Basin, South West Pacific, South East Pacific), as identified by Combatant Commanders, where the United States has strong national interests. I must add that increasingly we must consider the Arctic as a region where we have increasing interests and plan additions to our fleet architecture accordingly. We must remember that in March of 2014, former Chief of Naval Operations, Admiral Jonathan Greenert stated before the House Armed Services Committee that to fully meet CoCom requirements would take a Navy comprised of 450 ships. Based upon current maintenance-training-deployment rotational models as well as the distances associated with these regions, the number of 355 ships has been determined to be the minimum number required to meet Combatant Commander demands with no room to spare.

Second, it is just as important to note that the time frame associated with the build-up to 355 ships is equal in consequence as the raw number itself. Both China and Russia have taken advantage of the United States' recent strategic focus on counter-terrorism campaigns in Afghanistan and Iraq to take challenging profiles on the high seas. Russia has invested in a new generation of highly capable platforms, such as the new *Yasen*-class fast attack submarine, and China is pursuing a maritime strategy that combines outright territorial acquisition with a rapid expansion and modernization of its fleet.

China also faces a series of economic and demographic challenges which are forcing the Communist Party's leadership to rush achieve its re-emergence as a great power quickly before it becomes consumed with internal issues deriving from its one-child policy and rapidly aging population. It also has a near total dependence on imported national resources to include energy and vital ores. These factors

incentivize the People's Liberation Army-Navy to achieve dominance and a destabilizing sphere of influence in the Western Pacific within a 2025 to 2030 timeframe. To head a future crisis off, the U.S. Navy must expand rapidly enough to effectively deter China from thinking that eventual military victory at sea is even remotely possible. To accomplish this goal, the Navy must reach 350 to 355 ships as swiftly as possible.

Many tend to focus on new ship construction as the primary path to battle force growth at sea. For instance, in January the Navy developed an accelerated ship building plan that effectively took "warm" *Virginia, Burke, LX(R),* and oiler class ships and turned them "hot", adding 29 additional ships over and above the current 30-year plan. However, this approach, limited as it is by the capacity of current programs, only achieves a ship count in the mid-330s. Additionally, these ships, with the exception of the new oilers, are expensive platforms, ranging from $1.6 billion to $2.7 billion each. A build-up plan centered on these units will be, of necessity, very expensive. However, there are, in fact, other paths to 355 ships within the timeframe discussed.

It is to the nation's advantage that the Navy is scheduled to take delivery of 80 new ships of varying classes between now and the end of fiscal year 2024. Given the current battle force count of 276 ships, these new ships alone would allow the fleet to reach 355 ships. Unfortunately, during that same period the Navy plans to decommission 49 ships, many of whom were built during the Reagan administration build up during the 1980s, from service. These factors combined result in a net 31 ship increase in the size of the fleet to 307 ships, but still 48 ships short of the Navy's goal. However, if a portion of the ships scheduled for decommissioning, for instance the five *Ticonderoga*-class cruisers or the nine Mine Counter Measure ships, could be kept in service for another five or ten years through a Service Life Extension Program that could cost as much as $300 million per cruiser and $50 million per mine countermeasure ship, then the fleet could be expanded commensurately. Such actions are not inexpensive, but they would be much cheaper than funding entirely new platforms and in the end could result in a battle force of 321 ships by the end of fiscal year 2024.

Another option for rapid growth can be found in the ready reserve or "ghost fleet." Famously, during the administration of Ronald Reagan, four *Iowa*-class battleships were moved from the reserve fleet to the active fleet as Reagan built towards a "600-ship Navy." Currently there are ten "retention assets" in the reserve fleet, to include a conventionally powered super carrier, three light amphibious carriers, and five amphibious platform docks. There are also eleven *Perry*-class frigates currently designated for foreign military sales. These frigates will be transferred to partner navies that will refurbish them and get another 10 to 20 years of service from them. There are also three of the first flight of *Ticonderoga*-class cruisers, built with dual Mk-26 launchers fore and aft rather than the vertical launch system tubes that later ships came with, that are scheduled for scrapping. These ships were retired early and have ten fewer years at sea that the Ticonderoga's that remain in the fleet. Investments required to return ships like these to the fleet would be much more expensive than Service Life Extension Programs, perhaps $120 million for the Perrys and $550 million for the Ticonderogas, to return them to service. While costly, these investments are significantly less than new construction of ships with similar warfare characteristics. If only half of these ships, say 12 of the 23 ships described, could be returned to the active fleet within five years of initiating re-activation, leaving a gap of 23 additional ships to achieve the goal of 355.

This brings us back to the original discussion of new ship construction. Of course, new construction will have to be part of the Navy's build-up. However, the choices in this regard need to be both efficient and effective. While the idea of taking current "warm" production lines and turning them "hot" is a responsible approach, policy makers should recognize that there are many "warm" production lines and should make wise choices as to which lines should receive additional investments and which ones represent capabilities the Navy has in sufficient numbers. For instance, the average number of large surface combatants, air and ballistic missile defense *Ticonderoga*-class cruisers and *Burke*-class destroyers, has hovered around 82 ships over the last two decades, but is projected to rise to 100 under the most recent 30-year shipbuilding plan and then hold at that level until 2028. The current two-per-year production schedule should be sufficient to maintain American overmatch in the large surface combatant category for the foreseeable future.

The places in the inventory where the Navy does need additional investment are fast attack submarines, which will fall to a population of 41 boats from its Cold War high of 102 by 2029 and multi-mission frigates, which have declined from 115 ships in 1987 to zero today. Submarines are the silent sentinels of the deep and are in constant demand around the world. The forthcoming *Virginia*-class fast attack

boats, which will come with the addition of payload modules, bring additional long range striking power that will be critical in taking on new anti-access/area denial systems presently emerging. Multi-mission frigates, as described by the recent requirements document from the Navy and are not be confused with the present single-mission Littoral Combat Ships, will be critical to the Navy maintaining its persistent presence across the global maritime commons as well as restoring a capacity to conduct anti-surface, anti-submarine and convoy escort missions in support of military operations across the globe. I am somewhat concerned about certain aspects of the requirements document issued by the Navy, specifically its mention of a 3,000 mile range at 16 knots, which seems too short, and its recommendation that the ship have a 3–D air search radar, which seemed expensive and not necessary given the number or large Aegis equipped surface combatant. Some care should be given to an ice-hardened design or variant that would allow for operations in the Arctic ocean.

The Navy needs a robust new multi-mission frigate design, perhaps based upon a proven foreign design such as the European FREMM or an ongoing stable domestic program such as the National Security Cutter currently being built for the Coast Guard. To be clear, there is neither the time nor the need to consider a new "clean sheet" design for a frigate, which the Navy needs a fair number of. Selecting a mature design could allow the Navy to take delivery of a new frigate within a five-to-six-year period, depending on which design is selected. Standard fleet mixes would suggest a requirement for as many as 70 multi-mission frigates but certainly no less than 50. The multi-mission frigate will be a critical enabling element of the 355-ship Navy.

The Navy should also consider commissioning a class of smaller combatants, either a 200 foot, offshore patrol vessels similar to the *Ambassador*-class ships built in the United States for Egypt or extending production of the Joint High Speed Vessel and then equipping them with batteries of missiles. The Navy should also consider, from a strategic standpoint, whether it has a vested interest in possessing an icebreaking capability within its force in order to assure access to the arctic region, where the nation has vested interests. Such ships would provide naval presence in those areas of the world that are on the fringes of our interests, but also where law and order are most likely to be challenged and fray. While perceived as strong, the global system of self-governance is actually quite fragile and is in need of constant attention that only a Navy of 355 ships can provide.

Efficiencies can be found in the production of these ships by pursuing authorization for multi-year block-buys of vessels. Such actions would provide stability to shipbuilders and down-stream parts suppliers, stabilizing or expanding good paying jobs and strengthening the Defense Industrial Base. In fact, this entire plan as described would strengthen the Defense Industrial Base. As a historian I can tell you that it has been since Eisenhower, and before that the administrations of the two Roosevelts, that the Defense Industrial Base has been properly viewed as a national security asset and managed properly.

Current ships in the Navy's inventory should have their service life extensions performed at the four Navy shipyards at Norfolk, Bremerton, Pearl Harbor and Portsmouth-Kittery. Ghost fleet ships being returned to the active inventory could be brought aboard in large civilian yards in Philadelphia, San Diego, Portland, OR and numerous yards along the Gulf Coast. New frigates and offshore patrol vessels could be constructed in Wisconsin, Alabama, Louisiana and Oregon through partnerships and licensing agreements. All would recreate well-paying jobs in the manufacturing and industrial sectors.

Expeditious decisions to increase submarine production and to select a frigate design would allow the Navy to move swiftly into procurement and subsequent delivery. Frigates procured before the close of the present decade would enter the fleet in the early years of the next. Smaller platforms, to include offshore patrol vessels or Joint High Speed Vessels could come quicker. While I am not sure we can make up the additional 23 ships required in the plan I have outlined prior to the end of Fiscal Year 2024, we could get close, and that would send a strong message to those nations who would make themselves our enemies that they should not risk war with the United States today, tomorrow of for the foreseeable future.

While shipbuilding is the focus of this hearing, I would be remiss if I did not take a moment to bring to your attention the importance of getting the right capabilities balance back into the air wings of our aircraft carriers. The super carrier is the centerpiece of American naval power, but the average unrefueled striking range of that air wing has fallen from just over 900 miles in the early 1990s to just under 500 miles today. While the addition of the longer ranged stealth Joint Strike Fighter helps, there is a requirement for a mission tanker capable of extending the range of the current mix of F–35C and FA–18 Super Hornets that will be the critical en-

abler of the air wing in anti-access/area denial environments. Ensuring that the mission tanker, an unmanned aircraft designated as a MQ–25 Stingray, is designed to meet certain key mission enabling requirements such as being able to fully tank two F–35C's at 500 to 600 nautical miles from the carrier, will be one of the major decisions of the next year. A bad decision could lessen the relevance of the carrier and hence American sea power.

Congress has an oversight and authorizing role in all of these decisions. The Constitution made it clear that while the Congress has the authority to raise an Army, it must maintain the nation's Navy. There is a need for a Navy comprised of at least 355 ships and the nation has discovered that we are late in servicing that need. The current fleet of 276 ships is insufficient to uphold the nation's interests around the world and rising challenges from China and Russia will not allow us to take our time in reaching our goal. I have presented some options with regard to service life extensions for current ships in the fleet and returning ships to active service from the ready reserve fleet. I would ask the question with regard to the ready reserve that if we do not plan to use them now under the present circumstances, when would we use them? With regard to new construction, I recommend increased production of submarines and small combatants in order to grow capacities in anti-surface, anti-submarine and convoy escort capabilities in which we are woefully short. Such an approach would fully engage and expand the nation's naval Defense Industrial Base and strengthen our economy.

In closing, let me once again thank you for the honor of addressing you today. As a dairy farmer from Indiana who had the privilege of serving 26 years in our Navy, it is profoundly humbling to address this body and contribute to your deliberations. John Adams described the Navy as the Shield of the Republic. May it always be large enough to remain so.

Senator WICKER. Thank you, Dr. Hendrix.

Mr. Clark. Mr. Clark, I bet you have a prepared statement that you would like entered into the record.

STATEMENT OF BRYAN CLARK, SENIOR FELLOW, CENTER FOR STRATEGIC AND BUDGETARY ASSESSMENTS

Mr. CLARK. I would, yes. Could I have that entered in the record, and I will just summarize here?

Senator WICKER. Without objection. Does any member object?

[No response.]

Senator WICKER. Hearing none, it will be accepted.

Mr. CLARK. I will summarize it here then.

Chairman Wicker, Senator Hirono, thank you very much for inviting us to testify here today on the ability of the U.S. Navy to reach a 355-ship fleet and methods to get there more quickly.

The Navy today is in transition. Each class that the Navy is building right now is undergoing a change from a current variant to a new variant or an entirely new class that is more capable than its predecessor.

At the same time, we are in transition in our strategy for the United States. We are encountering the intensification of great-power competition with countries like China and Russia. We are reviewing our national defense strategy right now to look at how to balance those needs to address those great powers with requirements to address missions like counterinsurgency and counterterrorism. Also we are facing new approaches that great-power competitors are using against us like gray zone warfare of informationized warfare as China practices it.

Although in our analysis of the requirements to address those future strategic missions in our study we found that we needed a 382-ship Navy, in reality that is only 340 battle force ships in terms of what the Navy would count itself. So a 340-ship fleet compared to what the Navy is saying they need is a 355-ship fleet. I

would argue that that is about the same. If you look at the requirements that we each came up with, they are very similar. So there is very little difference between what we at CSBA came up with and what the Navy came up with in the overall requirements.

That is important, though, because that future fleet needs to be bigger regardless.

Senator WICKER. What accounts for the larger number?

Mr. CLARK. So the larger number is a number of patrol ships that we recommend the Navy buy that they would not currently count under their battle force ship counting rules.

Senator WICKER. Thank you.

Mr. CLARK. The fleet needs to be larger, and it needs to be in about this 355-ship range, though, regardless to address the need to tackle today's readiness crisis in the fleet, which results from a mismatch between supply and demand for naval forces. We also need a bigger fleet to address growing requirements in new regions that have been quiet for the last 25 years since the end of the Cold War, places like the Mediterranean, northern Atlantic, Europe, also the South China Sea. So we have increased the presence that we need of naval forces in those regions, which has put a demand on the Navy that exceeds what its supply is able to give. That leads directly to the readiness crisis that you hear naval leaders talk about today.

The future fleet, though, will need to be as capable or more capable than the current fleet. So to address the fact that we have great-power competitors that have long-range sensors and weapons and the advent of the kinds of capabilities in their militaries that we have in our own and have used for decades here, we are going to have to have a fleet that is just as capable as the one we have today but probably even more capable with the use of new capabilities and sensors and weapons, electronic warfare, and unmanned systems.

That is going to drive what the fleet architecture looks like. We will not be able to go to a fleet that is less capable than the one today in an effort to buy it more cheaply or more quickly. We are going to have to think of ways to be able to build a fleet that is as capable as the ships that we have now.

So one example of that is the advent of gray zone warfare. If we are going to address the actions of a country like China in the South China Sea, we could send ships there to respond to what they are doing against the Philippines and Japanese, but we would encounter the fact that they have long-range sensors and weapons they can use to threaten our naval forces. Our naval forces would then need to be able to survive and persist in that environment and fight or else we are going to be forced to conduct attacks on the Chinese mainland to degrade their sensors and weapons ashore. That requires us to have a more capable fleet that is able to survive that environment without those highly escalatory attacks ashore.

This more capable fleet is going to have to be built out of the one we have today, and it is probably going to have to rely on new construction to a greater degree than bringing ships out of retirement or in adding lower-end ships that would be less capable.

A perfect example of that is this discussion about the new frigate. So the frigate that the Navy is looking to build, based on the request for information that recently came out, could have a wide range of capabilities. It could be everything from what the existing LCS brings, which is a modest amount of offensive capability with relatively low survivability, or it could be a highly capable frigate that is able to do air defense for itself and others, as well as conduct offensive operations. We would argue that the more capable frigate is more representative of what we need in the future security environment because of the ability of great powers like China and Russia to threaten our naval forces at sea and force us into this dilemma of either protecting our naval forces where they are or attacking the Chinese or Russian systems ashore and escalating what could be a gray zone confrontation into a major war. Obviously, we are not going to want to do that. So that deters us from taking those actions, and it can degrade the security assurances we provide to countries that are now facing Chinese and Russian aggression.

Now, with regard to the overall fleet mix, what that argues is that we need more of a big/small mix in the fleet rather than a high/low mix in the fleet. Some of the discussion we have heard talks about bringing ships out of retirement or buying additional numbers of smaller, less expensive combatants to grow the fleet to 355 more quickly. Those ships that we would bring in, though, would not be capable of defending themselves and being able to conduct offensive actions in some of these highly contested areas like the South China Sea or East China Sea or the Baltic. They would then become liabilities rather than assets in these regions and force us to do something to protect them in turn.

So the big/small fleet would, instead, be large ships and small ships, but both having similar capabilities but with different capacities. So, for example, cruisers and destroyers are larger ships that are capable of defending themselves and other ships and long-range offensive attacks against enemy ships and targets ashore. But a frigate and even a small missile craft could do the same thing as the destroyer, but just at a smaller scale. Those ships would be able to defend themselves in those kinds of environments as well and would be assets rather than liabilities.

To more quickly get to this 355-ship fleet of highly capable ships, a number of options have been discussed: multiyear procurement, using concepts like the Sea-Based Deterrence Fund where we can provide funding in one year that could be applied to some future years procurement, other options for funding ships more flexibly than we are today. Those are options to increase ship production and to be able to do it more efficiently and perhaps save money as we have found with multiyear procurements that usually give us a savings of 10 percent per ship. We can also ramp up production of existing ships within the shipbuilding industrial base, as the Navy has described with their recent paper talking about an increase of 29 ships over the next 7 years.

The cost of that future fleet, though, will be much higher than the fleet of today. We estimated in our study that a Navy of about 350 ships will require about 15 to 20 percent more procurement funding and about that same amount of additional operations and

maintenance funding in the out-years. But a decision on how much exactly to spend and how big a Navy to reach can be changed over the course of time, but if we do not start now trying to grow the fleet, we will not have those options down the road to decide exactly how big it needs to be. So I would argue at this point we do not necessarily need to come up with a plan to get to 355 exactly starting today, but we need to start moving in that direction so that we have the option to be able to eventually get to 355 tomorrow.

If we fail to grow the Navy with the highly capable ships that will be necessary to operate in the kinds of environments they are going to face, we are going to undermine the security assurances we provide to our allies, and that will affect the U.S. position in the world and it will have dilatory effects on our economy and our relationships with our allies and partners.

Thank you very much, and I am looking forward to your questions.

[The prepared statement of Mr. Clark follows:]

CSBA
Center for Strategic and Budgetary Assessments

TESTIMONY

STATEMENT BEFORE THE SENATE ARMED SERVICES COMMITTEE SUBCOMMITTEE ON SEAPOWER ON Options and Considerations for Achieving a 355-ship Navy

July 25, 2017

Statement by Bryan Clark
Senior Fellow, Center for Strategic and Budgetary Assessments

Chairman Wicker, Ranking Member Hirono, and distinguished members of the committee: thank you for inviting me to testify today on options and considerations for achieving a 355-ship Navy. This topic is important and timely. The U.S. Navy is at a crossroads, with each major ship type undergoing a transition over the next several years. After delays in construction and testing, the first *Ford*-class aircraft carrier and *Zumwalt*-class destroyer are finally joining the fleet. Programs for the *Virginia*-class submarine, *Burke*-class destroyer, *San Antonio*-class amphibious transport dock, and Littoral Combat Ship (LCS) are all starting new variants. The *Columbia*-class ballistic missile submarine (SSBN) is in development. And the Navy is fielding a host of new unmanned air, surface, and undersea vehicles and systems.

These changes come as the United States faces security challenges it has not encountered since the end of the Cold War. Great power competitors such as China and Russia improved their military capabilities over the last two decades and now appear willing to challenge the international order. They are likely to soon replace transnational terrorism as the primary concern of U.S. military planners. At the same time, regional powers such as Iran and North Korea will continue to develop new capabilities, including nuclear weapons, and exploit their advantageous locations to cause outsized effects.

To address the changing strategic environment, the Navy increased its force structure requirement earlier this year to 355 ships from the previous level of 308 ships.[1] Today's fleet of 276 ships, however, falls far short of both metrics. The approximately 80 additional vessels the Navy needs to build are the highly capable warships, described

[1] U.S. Department of the Navy, "Secretary of the Navy Announces Need for 355-ship Navy," *Navy News Service*, December 12, 2016, available at: http://www.navy.mil/submit/display.asp?story_id=98160.

above, that will enter the fleet over the next decade. These ships will be more expensive than their predecessors, and despite the desire of the Administration and some in Congress to increase defense spending, Pentagon budgets remain capped by 2011 Budget Control Act and 2015 Bipartisan Budget Act. The DoD will either need relief from budget caps and more funding to expand the fleet or accept that it will not be able to keep up with its great power competitors.

A larger fleet is needed for the United States to exert influence and project power in regions where U.S. and allied security interests are again being challenged, such as the North Atlantic, Eastern Mediterranean, South China Sea, and Indian Ocean. These areas were relatively peaceful since the end of the Cold War and the U.S. Navy only maintained a token presence in them. That has changed with the resurgence of Russia and expansion of China's overseas interests.

The 355-ship is also needed to address the Navy's readiness crisis, in which half the Navy's strike-fighters are unable to fly and the fleet's surge capacity is only a third of what it was before the BCA.[2] Ships and aircraft are breaking down because they don't have enough time, or predictable times, for maintenance in port. Since 2000, the fleet shrank by 20 percent, but the number of ships deployed overseas remained about the same at about 100. The Navy has kept up with demand by basing more ships overseas and deploying ships longer and more frequently from the continental United States (CONUS). For example, in 2000, less than 10 percent of deployments were more than 6 months; today they all are.[3]

And finally, the Navy and Marine Corps need a larger fleet to implement their new concepts for distributed operations, electromagnetic warfare, expeditionary advance basing, and littoral operations in a contested environment. These new ways of fighting will be essential to deterring competitors like Russia and China, who rely on their ability to contest the air and waters in their near abroad to coerce their neighbors and slow or stop U.S. intervention.

A larger Navy, however, is not enough. The 355-ship fleet will need to be equipped with new weapons, sensors, and unmanned systems to implement new Navy and Marine Corps operational concepts. Without the reach and lethality of new payloads, a larger fleet would not be able to survive and fight in contested areas long enough to defeat or delay enemy aggression against U.S. allies. Most importantly, autonomous and unmanned vehicles offer the ability to disaggregate sensors, weapons, and operators to improve the ability of U.S. naval forces to find and attack the enemy first and avoid enemy counterattacks. They will be an increasingly important component of the future fleet.

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[2] Sydney Freedberg, "Fix Readiness First, Shipbuilding Second: Navy to Trump," *Breaking Defense*, January 11, 2017, available at http://breakingdefense.com/2017/01/fix-readiness-first-shipbuilding-second-navy-to-trump/.

[3] Data from CSBA's analysis of fleet deployment was obtained through a Freedom of Information Act request from the Navy Times and, additionally, from Daniel Whiteneck, Michael Price, Neil Jenkins, and Peter Schwartz, The Navy at a Tipping Point: Maritime Dominance at Stake? (Alexandria, VA: Center for Naval Analysis, 2010). See also, Congressional Budget Office (CBO), Preserving the Navy's Forward Presence with a Smaller Fleet (Washington, DC: CBO, March 2015), p. 9.

Fleet architecture and the surface combatant mix

To address the increasing demand for naval forces and intensifying competition with China and Russia, the Congress directed in the 2016 NDAA that the Navy conduct three studies to assess its required fleet architecture in the 2030 timeframe. CSBA conducted one of those studies, and determined that the Navy needed about 340 battle force ships to support U.S. security interests in the 2030s. We also assessed the Navy needed about 42 smaller patrol vessels that would not fall under current Navy ship counting rules.[4]

Although it was developed using a different approach than the Navy's force structure assessment (FSA), the CSBA fleet architecture, shown in Figure 1 below, is very close to the Navy's requirement.

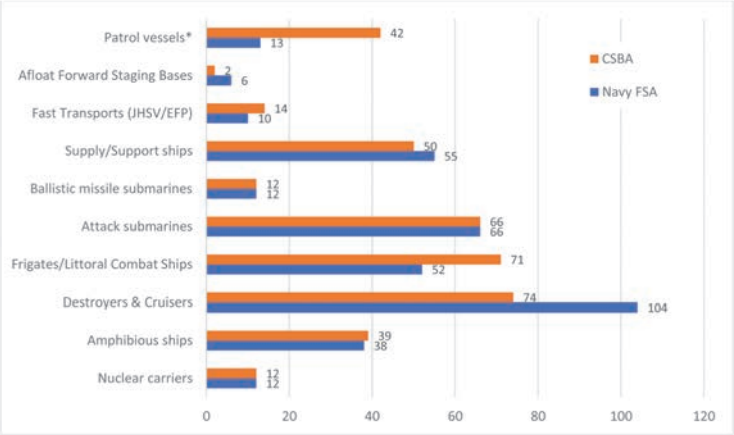

Figure 1: The Navy's force structure requirement compared to the proposed CSBA fleet architecture

The main difference between the two fleets is the rebalancing of surface combatants in the CSBA fleet toward a nearly equal mix of large surface combatants (guided missile cruisers (CG) and destroyers (DDG)) and small surface combatants, (guided missile frigates (FFG), LCS, Patrol Coastal (PC) ships, and mine countermeasure ships (MCM)). This difference results largely from the CSBA fleet's use of FFGs for some anti-submarine

[4] Bryan Clark, Peter Haynes, Bryan McGrath, Craig Hooper, Jesse Sloman, and Tim Walton, *Restoring American Seapower: A New Fleet Architecture for the United States Navy.* (Washington, DC: Center for Strategic and Budgetary Assessments, 2017), p. 110; Secretary of the Navy, General Guidance for The Classification of Naval Vessels and Battle Force Ship Counting Procedures, SECNAVINST 5030.8C (Washington, DC: Department of the Navy, June 14, 2016), p. 2.

warfare (ASW), surface warfare (SUW), and air and missile defense (AMD) missions that the Navy assigns to large surface combatants.

The Navy is currently evaluating the requirements for a FFG that will succeed the LCS as its primary small surface combatant. The request for information (RFI) recently issued by the Navy for industry input sets a low bar for the minimum capabilities needed in the new ship.[5] Although the RFI allows for a wide range of possible FFG proposals, it establishes a capability hierarchy that could support development of a less expensive and less capable ship that does not meet the Navy's needs.

The FFG RFI designates capabilities for SUW and self-defense as the highest priority, and ASW systems as the second priority. Capabilities for AMD, such as a vertical launch system (VLS), are not a priority, but respondents are asked to address whether a VLS magazine could be included in the FFG, and of what size. This approach leaves open the question of whether the FFG will be able to host VLS-launched weapons, such as the SM-2 and SM-6 multi-mission interceptors, or Tomahawk land attack missile (TLAM).

The future FFG, however, will need capabilities to conduct ASW and AMD. The Navy's stated requirement of 104 large surface combatants is based on requirements for carrier strike group (CSG) protection and ballistic missile defense (BMD) stations.[6] This leaves no CGs or DDGs for other operations such as escorting logistics or noncombatants ships. Moreover, the Navy's shipbuilding plan, shown Figure 2 below, will fall short of the required number of large surface combatants.[7] Small combatants such as FFGs will need to support escort missions for logistics and noncombatant ship, or even of CSGs in some situations. To be effective escorts, they will need to protect against submarine, ship, and air attack.

The Navy's shortfall in small surface combatants is also concerning. As Figure 2 shows, the Navy only has about half the 52 small surface combatants it says are required. As a result, CGs and DDGs are often used for lower-end missions such as maritime security and training exercises. This will improve as more LCS enter the fleet, but they will not be able to conduct AMD to protect noncombatant ships.

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[5] Department of the Navy, "RFI: FFG(X) - US Navy Guided Missile Frigate Replacement Program," *FedBizOps*, July 10, 2017, available at https://www.fbo.gov/index?s=opportunity&mode=form&id=cdf24447b8015337e910d330a87518c6&tab=core&_cview=0.

[6] 60 large surface combatants are needed to protect the Navy's required 12 CSGs based on 5 large surface combatants per CSG per U.S. Department of the Navy, "OPNAV Instruction 3501.316B: Policy For Baseline Composition and Basic Mission Capabilities of Major Afloat Navy and Naval Groups", October 21, 2010, available at https://doni.daps.dla.mil/Directives/03000%20Naval%20Operations%20and%20Readiness/03-500%20Training%20and%20Readiness%20Services/3501.316B.pdf. Assuming the Optimized Fleet Response Plan (OFRP) of one 7-month deployment per 36-month cycle, 5 large surface combatants are needed for each CG or DDG on a BMD station. The Navy maintains 10-15 BMD stations at any given time in the Mediterranean, Persian Gulf, and Western Pacific supported by a combination of forward-based and CONUS-based ships. With 2 forward-based ships or 5 CONUS-based ships needed to support each station, between 40 and 75 large surface combatants could be required for BMD operations.

[7] Chief of Naval Operations (CNO), Report to Congress on the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2017 (Washington, DC: Department of the Navy, July 2016), p. 7.

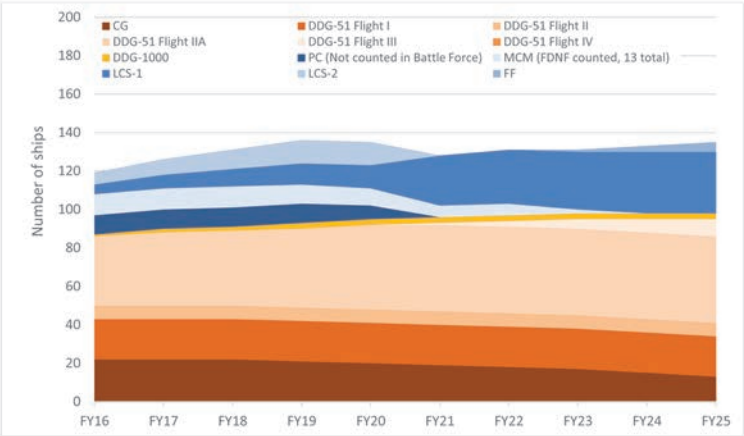

Figure 2: The Navy's planned inventory of surface combatants

Building the 355-ship fleet

Achieving the larger, more capable fleet the Navy needs will cost more money. We estimate the CSBA fleet architecture of about 340 ships would cost about 15–20 percent more to build, operate, man, and sustain than the Navy's current plans, which are still based on the 308-ship requirement. The Congressional Budget Office (CBO) estimates the Navy's planned 355-ship fleet would cost about 25 percent more to build and 16 percent more to operate and support than its current 308-ship plan.[8]

The CSBA fleet architecture and Navy force structure requirement grow today's 276-ship fleet by increasing the number of ships already under construction or planned to start in the next few years. The shipbuilding industrial base could reach the objective number for each ship type in the 355-ship fleet by the late 2030s, but additional investment will likely be needed in shipyards and their suppliers to support increased production. The Navy recently announced that, with appropriate funding, the shipbuilding industrial base could begin construction of up to 29 additional ships over the next seven years.[9]

The fleet's expansion will need to consist of highly-capable warships equipped with improving weapons, sensors, and unmanned systems. These ships, such as those in

[8] CBO estimates the 355-ship fleet would cost on average $26.6 billion per year to build; see Eric Labs, "Costs of Building a 355-Ship Navy," (Washington, DC: Congressional Budget Office, April 2017), p. 2. CSBA estimated its 340-ship fleet would cost an average of $23.3 billion per year to build.
[9] Sean Stackley, "U.S. Navy Accelerated Fleet Plan," (Washington, DC: U.S. Department of the Navy, February 9, 2017), available at https://www.blumenthal.senate.gov/imo/media/doc/U.S.%20Navy%20Accelerated%20Fleet%20Plan.pdf.

production or starting during the next several years, are required for concepts that could allow naval forces to defend themselves and fight in highly contested environments like the East and South China Seas or Norwegian and Baltic Seas. Operating in these forward areas will be essential for naval forces to provide conventional deterrence and support military competition with other great powers.

Several analysts have proposed alternative approaches to increase the size of the fleet other than stepped-up production of current and planned ships. Although some elements of these proposals have merit, they result in a less-capable fleet that will not be effective in great power competitions.

"Big-Small" instead of "Hi-Low"

Some analysts have proposed the Navy pursue a "Hi-Low" mix to grow the fleet. In this approach, the Navy would build more ships with lower survivability, fewer missions, and less-capable sensors, combat systems, and electronic countermeasures. LCS was an example of this approach. These low-end ships would conduct less stressing missions such as training, maritime security, and humanitarian assistance, freeing up high-end nuclear aircraft carriers (CVN), amphibious ships, SSNs, and large surface combatants for deterrence missions.

The Hi-Low concept worked during and immediately following the Cold War, when only a few large national militaries fielded sophisticated anti-ship weapons. Today, insurgent and terrorist groups around the world are armed with anti-ship cruise missiles (ASCM) and air defenses, which they have used against U.S. and partner forces.[10] Low-end ships would be at risk from surprise attack wherever they go.

Moreover, the Navy needs every ship to be able to defend itself and support offensive operations in contested environments. After the Cold War, the potential for an eventual U.S. response was enough to dissuade regional powers like Russia, China, or Iran from aggression against U.S. allies. Each of those competitors now fields long-range sensor and weapon networks that can attack their neighbors hundreds of miles away and protect their ground forces mounting an incursion or invasion. The same long-range sensors and weapons can threaten U.S. forces attempting to intervene on behalf of an ally under attack.[11] To persist in these environments and deter aggression, the U.S. fleet needs to be able to defeat sophisticated anti-ship cruise and ballistic missiles or the sensors supporting them. Low-end ships could become liabilities in such a scenario,

[10] Sam LaGrone, "CNO Richardson: USS Mason 'Appears to Have Come Under Attack'," *USNI News*, October 16, 2016, available at https://news.usni.org/2016/10/15/cno-richardson-uss-mason-attacked-cruise-missiles-off-yemen.
[11] See Office of Naval Intelligence (ONI), The PLA Navy: New Capabilities and Missions for the 21st Century (Washington, DC: ONI, April 9, 2015), pp. 13–25, available at http://www.oni.navy.mil/Portals/12/Intel%20agencies/China_Media/2015_PLA_NAVY_PUB_Print.pdf?ver=2015-12-02-081247-687; and Office of the Secretary of Defense (OSD), Military and Security Developments Involving the People's Republic of China 2016, Annual Report to Congress (Washington, DC: DoD, 2016), pp. 22–29, available at http://www.defense.gov/Portals/1/Documents/pubs/2016%20China%20Military%20Power%20Report.pdf; also see Office of Naval Intelligence, "Iran's Naval Forces," (Washington, DC: ONI, March 1, 2017).

rather than assets.

But every ship cannot be a dreadnought. To be affordable, the fleet will need to include some less-expensive ships The Navy also needs small surface combatants to enable proportional responses to low-intensity "gray-zone" aggression by Chinese civilian and paramilitary forces in places like the South China Sea. For example, deploying a CSG or amphibious ready group (ARG) to support Japanese or Philippine efforts to resist illegal fishing or island-building would far exceed what is needed and could cause a backlash among U.S. allies who perceive the move as too escalatory.

Instead of a Hi-Low mix in the future fleet, the Navy needs a Big-Small mix. Each ship needs to be able to defend itself long enough to expend its offensive weapons against the enemy. This requires AMD systems, strike and anti-ship weapons, and capable sensors. Small, less expensive ships such as FFGs or patrol vessels could be equipped with these capabilities, but would have less capacity than larger combatants like DDGs.

Manned, not unmanned

Another option to grow the fleet is to increase its number of unmanned vehicles and systems. In theory, unmanned systems could extend the reach and capacity of individual manned platforms, enabling a smaller number of manned ships to cover the same area as a larger fleet. For example, unmanned undersea vehicles (UUV) could conduct intelligence-gathering operations to reduce the demand on manned submarines; unmanned surface vehicles (USV) could provide additional magazine capacity to surface combatants to keep them on the battle line longer; and unmanned air vehicles like the MQ-4C *Triton* can conduct surveillance that today is done by manned P-8 *Poseidon* aircraft.

Unmanned systems should be part of the future Navy and an increasing portion of the fleet. The CSBA fleet architecture, for example, identified the need for 40 extra-large UUVs and USVs, hundreds of smaller unmanned vehicles, and thousands of unmanned acoustic or electronic sensors. These unmanned systems will be needed to enable new operational concepts to deter and defeat aggression. In concert with manned platforms, unmanned vehicles could provide additional sensor and weapons reach and capacity that enable U.S. forces to attack the enemy more effectively first and last longer in the fight.

Except for surveillance and reconnaissance missions, however, unmanned vehicles are unlikely to completely replace manned platforms in naval operations during the near to mid-term. The importance of deterrence and crisis response as naval missions requires that naval forces be deployed forward in areas of potential confrontation and conflict where they can intervene against aggression. This will place them in proximity to potential adversary forces as well as civilian vessels conducting lawful activities like fishing, shipping or research. Although technically possible, in peacetime unmanned vehicles and systems would likely not be allowed to defend themselves from tampering or attack. Regardless of the sophistication in a vehicle's autonomy, its sensors will be

constrained by cost or the space, weight, and power available. The vehicle could easily misinterpret curiosity or inadvertent contact as an attack and respond with force against unarmed civilians.

Another challenge involved in replacing combatant ships with armed unmanned vehicles is positive control over weapons. Long-range satellite communications are likely to be jammed or degraded during heightened tensions or conflict in contested areas where naval forces need to operate to deter or respond to aggression. This could restrict communication with unmanned vehicles to line-of-sight datalinks that are harder to detect and jam, but will limit how far from a manned platform an autonomous vehicle could conduct weapons operations. The future fleet is more likely to include manned-unmanned teams than unmanned autonomous formations.

Life extension, not reactivation

Bringing the "Ghost Fleet" out of retirement sounds like quick, cheap way to expand the fleet. In part, that is why it exists. In practice, however, reactivating retired warships will take time, money, and manpower from the current fleet without providing significant warfighting capability. This may be an appropriate approach during a wartime mobilization, but is not appropriate in peacetime.

Reactivated ships will require tens of millions of dollars in maintenance to be made operational and sea-worthy. They will also require millions of dollars' worth of combat system upgrades. As mentioned above, naval forces will need to survive and fight in highly contested environments to deter or respond to aggression by great powers Russia and China or regional powers like Iran. Without new capabilities, reactivated ships like the first five *Ticonderoga*-class CGs or *Perry*-class FFGs will not have the self-defense capability to persist in areas like the South or East China Seas at acceptable risk during periods of heightened or conflict. And as demonstrated by ASCM attacks by Houthi rebels against the USS *Mason* and a United Arab Emirates High Speed Vessel, areas outside the most contested regions are not hazard-free.[12]

Even with more funding, reactivation will take years. Each ship would need to be inspected and work packages developed to bring them back to operating condition and upgrade them with appropriate defensive and offensive capabilities. The ships would then need to be worked into the schedules of civilian shipyards that maintain the rest of the surface fleet. To allow current operational plans to continue, reactivated ships will need to wait for gaps when shipyards are available.

And finally, newly-reactivated ships will need crews. Compared to the approximately 100 sailors that operate an LCS, a FFG or CG will require 150-200 sailors. The ex-USS *Kitty Hawk* aircraft carrier would require about 2,500 sailors. The Navy already has manpower shortfalls, particularly in the surface fleet. Adding new ships without more

[12] Tom Finn and Hadeel Al Sayegh, "UAE says Houthi attack on ship in shipping lane was 'act of terrorism'," *Reuters*, October 4, 2016, available at http://www.reuters.com/article/us-emirates-security-idUSKCN1242DB.

sailors will further stress the already strained personnel system.[13] Moreover, some retired ships, such as *Kitty Hawk*, have obsolete conventional steam propulsion plants no longer used in the U.S. Navy. The Navy would need to reestablish specialists to operate and maintain these systems.

Instead of bringing old ships out of mothballs, the Navy should consider keeping some ships in operation beyond their planned retirement dates. These ships are in better, or at least better-known, condition than their retired counterparts and have received combat systems upgrades. They also have trained and experienced crews.

For example, the Navy is conducting a phased modernization of the oldest 11 CGs, which will keep them viable into the 2030s. These modernizations should focus on hull, mechanical, and electrical (HM&E) and equipping CGs with datalinks, passive sensors and electromagnetic warfare countermeasures, rather than upgrading their radars or giving them BMD capability. This will enable them to better defend themselves, reduce their risk of counterdetection, and employ their large VLS capacity to support attacks with other networked surface combatants.

The Navy could take a similar approach with some of its 11 amphibious landing docks (LSD), which will be replaced with the new L(X)R amphibious ship starting in the 2020s. The Navy could conduct a life-extending modernization period on some LSDs instead of retiring them so they could be used for lower-end training, maritime security, and humanitarian assistance missions. They could then help address the gap in small surface combatants shown in Figure 2.

Submarines are a key Navy shortfall. Today the fleet has about 52 SSNs, compared to a requirement of 66. The inventory will decrease over the next decade as *Los Angeles*-class SSNs retire. In some years of the Reagan-era naval buildup, SSNs were built at rates of up to 4 per year, whereas now two new *Virginia*-class SSNs are built each year. The Navy is addressing the SSN shortfall in part by extending the lives of some SSNs with remaining nuclear fuel. These efforts should continue and expand as appropriate.[14]

Conclusion

Today's Navy emphasizes efficiency over effectiveness. This was a rational reaction to the presumed end of great power competition with the fall of the Soviet Union. In the decades that followed, the U.S. Navy developed a process to affordably maintain a continuous presence of deployed forces that could not stop aggression by regional powers. They could, however, support an eventual response by follow-on forces as was

[13] Mark D. Faram, "Sea duty shortages: Why the Navy is offering rare extensions for thousands of first-term sailors," *Navy Times*, February 5, 2017, available at https://www.navytimes.com/articles/sea-duty-extensions-for-first-time-sailors.
[14] Megan Eckstein, "Navy Finds Urgency In Staving Off A Sub Shortfall Decades In The Making," *USNI News*, available at https://news.usni.org/2016/03/08/navy-finds-urgency-in-staving-off-a-sub-shortfall-decades-in-the-making; The Navy also plans to build an additional SSN during some years of the coming decade, see Megan Eckstein, "Navy Adds Second Attack Sub to 2021 Plans; Considering 3 SSNs in Future Years," *USNI News*, May 24, 2017, available at https://news.usni.org/2017/05/24/navy-adds-second-attack-sub-to-2021-plans-considering-3-ssns-in-future-years.

done in Kosovo, Iraq, and Libya.

This approach to conventional deterrence will not likely work against great power competitors, who will have much greater military capabilities than past regional adversaries and probably seek a quick, decisive victory over their adversaries. Efforts to reverse the results of aggression after the fact would require a much larger conflict and would likely have global consequences that would create international pressure to reach a quick settlement.

To be deterred, aggressors must be presented with the possibility that their goals will be denied or that the immediate costs to pursue them will be prohibitively high. This will require capable ships equipped with higher capacity defenses, more effective offensive weapons, and improved capabilities to fight in the electromagnetic spectrum. It will also require a larger fleet, as regions such as Northern Europe, the Eastern Mediterranean, and Indian Ocean become hot spots for great power competition and confrontation.

The Navy's 355-ship requirement and CSBA's proposed fleet architecture emphasize effectiveness over efficiency. Built on new operating concepts the Navy is already pursuing, a larger more capable fleet offers the prospect of protecting and sustaining America's security and prosperity, as well as that of our friends and allies around the world, in the decades ahead. Deterring great power war demands the readiness to contest and win it—and a fleet that supports this approach.

About the Center for Strategic and Budgetary Assessments

The Center for Strategic and Budgetary Assessments (CSBA) is an independent, nonpartisan policy research institute established to promote innovative thinking and debate about national security strategy and investment options. CSBA's analysis focuses on key questions related to existing and emerging threats to U.S. national security, and its goal is to enable policymakers to make informed decisions on matters of strategy, security policy, and resource allocation.

Senator WICKER. Well, thank you for four excellent examples of testimony.

Mr. Clark, you say we first need to get started with the first year. I could not agree more. So I noted in my little statement that not only have we put the Wicker-Whitman SHIPS language in both NDAA bills, but we have authorized additional funding for five ships above the administration's budget request while maintaining cost control measures.

Is that a good start for the first year?

Mr. CLARK. Yes, sir. That is exactly the kinds of start we need to have, start adding additional ships now drawing upon the industrial base that we have and the additional capacity that is available and start moving in that direction as opposed to try to bite it all off at once.

Senator WICKER. I think I heard you say that getting to the 355 ships solves not only a modernization problem, but it solves a readiness problem.

Mr. CLARK. Yes.

Senator WICKER. Okay. Help us on that because we have been told that there is a competition between readiness and getting to the fleet size we need.

Mr. CLARK. Right. So fundamentally readiness comes down to supply versus demand. So today the demand for naval forces exceeds what the supply can deliver using the current readiness processes, the fleet response plan that the Navy uses to generate ready forces. So to be able to meet the COCOM's demands, what they have been doing is short-circuiting that process and sending ships out with not as much maintenance or not as much training to be able to meet the combatant commander requirements.

Also, because they are being deployed on short notice without a lot of ability to schedule, they are having to reschedule maintenance and do maintenance at the last minute, which is more expensive and less efficient. So maintenance that needs to get done on ships is being deferred until some future date when they become available.

So all those things are happening today, but it is fundamentally because the fleet is too small for the demands being placed on it. So in the near term, we need to be thinking about maybe saying no to some of these deployments to be able to shift money into procurement of ships to solve the problem that we are going to have tomorrow.

Senator WICKER. Dr. Hendrix, does that make sense?

Dr. HENDRIX. Absolutely. Sir, one of the things that we have noted is that as we have fallen from 400 ships to 350 to 300, now to 276, is that we are still attempting to forward deploy the same number of ships. So I think today it is 104 ships are out to sea. The problem is that when you a deployment cycle where it takes four ships to keep one forward deployed, the assumption is that 25 percent of the fleet will be in maintenance in some sort of a yard capacity with workmen working on it. But when you are still trying to do 100 forward, but you only have 276, then you have to shorten up the cycle somewhere, and the cost payer now has been in maintenance and readiness because you cannot shorten the training cycle working them up and you do not want to shorten the deployed cycle, nor do you want to decrease the number of ships forward. So it has been in maintenance and readiness that the fleet has taken time out of the schedule, and that is why we see ships going out that, quite frankly, do not look that they are adequately prepared and the maintenance records are showing that the material readiness of the fleet has been falling off.

Senator WICKER. Dr. Hendrix, let me ask you about something you said on page 2 of your prepared statement. You said it on the record also. You mentioned the People's Liberation Army/Navy, the

fact that we have more or less incentivized them to try to achieve dominance in destabilizing a sphere of influence in the western Pacific. You say that the Navy needs to reach 350 or 355 as swiftly as possible to effectively deter them from thinking that this is even possible.

Dr. HENDRIX. Yes, sir.

Senator WICKER. If we sent out the clear signal this year and next year that we are going to do this and that we are going to put the money where it is needed and we are serious about it in the long run, what actions do you think the Chinese Army/Navy would take that would indicate we have actually convinced them that military victory at sea is not remotely possible?

Dr. HENDRIX. Sir, one of the things you look at—you know, great-power competition is an attitudinal function of the way that states interact with each other. States begin to build momentum towards certain ideas, certain perceptions that take a life of their own over time, and as the U.S. Navy has declined and as our strategic focus has shifted ashore and to Iraq and Afghanistan, this has created a condition where China believes there is an opportunity to grow and compete and create their own sphere of influence essentially in the western Pacific. By coming out strong both with our buildup as well as with our language and with posturing ourselves through exercises, forward deployment, and by meeting them on some of these issues that they are raising, such as freedom of navigation operations on these artificial creations that they made in the South China Sea, then you convince them today and then the day after that that a wartime challenge against the United States will not be successful. This is part of the ongoing competition amongst nations.

What you might expect them to see is a change in their posture, the change in their language as they begin to see an exercise of greater numbers of ships in the area, the forward presence, and the fact that we are taking a more aggressive form, for instance, doing FONOPS. They are operating in a normal military mode as opposed to just an innocent passage profile. Those types of things convince them that this is not a competition that they are going to be able to win with us as we come on and be more strong and steadfast.

Senator WICKER. That actually worked in the 1980s, did it not, with a different adversary.

Dr. HENDRIX. Yes, sir, both in some of the Black Sea operations and the Baltic Sea operations that we had against the Soviet Union where we actually had ships rub up against each other out there, had an action of actually demonstrating to the Soviet Union that the United States was not going to back down.

Senator WICKER. Thank you. There will be more questions.

Senator Kaine, you are recognized, sir.

Senator KAINE. Again, thank you to the witnesses.

Just two items that I would like to ask about.

First, we had some wonderful testimony last week, and I want to read it with some precision here. Secretary Lehman was with us last week, and we were talking about the Navy buildup of ships during the Reagan era. He said something, and this was the quote. Quote: 90 percent of the deterrent power of this buildup could be

achieved in the first year. He said it was achieved in the first year and we could do it again.

I think what he meant by that—and I went back and forth with him a little bit—is in the first year we started strong, and the other side, in that case the Soviet Union, really believed we would continue. It was a long buildup, but there was a dramatic start and no doubt that we would pursue it.

Not only did we have the 355-ship amendment as part of the bill that came out of this committee to the floor, but we also had a let us get rid of sequester.

If we continue to have budgetary challenges, sequester, threats of shutdown, CR, et cetera, even if we say we are going to do 355, we are not exactly sending the kind of clear message we need. Would you agree that how we overall handle the budgetary issues going forward is part of what makes that impression that the investment we are on is likely to be carried through? That is for all of you.

Mr. CLARK. For me I would argue that is definitely the case. Our adversaries, our competitors look at our budgetary situation and see that as a weakness or a vulnerability that we have and are looking to exploit it in how they coerce their neighbors. So part of this gray zone effort of China and Russia is going to their neighbors and saying you do not seem to have the kind of support from the United States or the United States cannot lend you the kind of security assurances that you would need. Maybe you should just go along with us.

Senator KAINE. Other thoughts?

Mr. O'ROURKE. The importance of signal sending is precisely why I talk in both my written statement and in my opening remarks about the option that Congress has for fully funding ships in the near term, starting as early as fiscal year 2018, even if those ships will not be ready for production until sometime down the road. The signal sending to competitor countries, particularly China, that can be accomplished by that is potentially substantial, and it is one of the reasons I emphasized it in my testimony. One of the things I pointed out is that you can even do this with nuclear-powered ships, such as attack submarines, for which there has been no prior year advance procurement funding. I also pointed out that Congress in fact has done this in the past. They have fully funded ships upfront, including nuclear-powered ships for which there was no prior year AP funding.

Senator KAINE. Thank you.

Please, Dr. Labs.

Dr. LABS. I would agree with what Mr. O'Rourke said and the other panelists. If you think about great-power politics and deterrence, a lot of it is a signaling game, and those signals take many different forms. It is not just one. So the amount of money that you want to spend on a particular set of programs such as shipbuilding is going to be a signal. So if you increase that shipbuilding, you are sending a signal. The amount of money that you spend on the defense budget overall will be another signal. The things that you say and how you then operate those forces is yet a third signal. We can keep iterating through that. So all of this becomes signals. So your overall approach to your defense budget, your overall approach to

your shipbuilding budget, and everything else is all going to play into the game of great-power politics and have the role and bringing up deterrence to be effective.

Senator KAINE. Let me ask a second question that has bedeviled the committee a little bit. Being from Virginia, carriers are something I know a little bit about. We have had many a hearing in this committee where we have looked at the cost overruns on the Ford that was just commissioned, which is a wonderful, wonderful piece of technology.

The cost overruns were driven heavily by not just a new design but also new technologies that were put as part of the design. So it is one thing to redesign the hull and so many aspects of that carrier. It is another thing to put in a new kind of arresting gear mechanism, new kind of a catapult mechanism.

So what advice—if we were going to try to dramatically build up with some new platforms, what advice would you give to us about the way to incorporate new designs and new technologies into new designs? Is it sort of a phasing concept? Dr. Hendrix, it looks like you want to jump in on that one.

Dr. HENDRIX. Yes, sir. I think there is a historical lesson to be learned from the development of the Aegis Mark 7 system, which was build a little, test a lot, the idea of building in the iterative process so that you really fully mature things as they come through time. We knew in the 1990s—and I remember this quite distinctly as a junior officer—that we were going to take a significant risk with the *Ford*-class design by the fact that we were going to ask to incorporate at a minimum three major system redesigns in one platform, which is something that we had not done probably since the 1950s when the technology was much more rudimentary, for instance, when we did the *Washington*-class ballistic missile submarine.

We made some bets, and quite frankly, some of those bets have paid off. Some have not. So the Ford is coming along somewhat slowly. Had we made a decision, for instance, to only incorporate one new aspect of design, perhaps the EMALS, aircraft launch system, on the first one and then incorporate the second one on the second in the class, that that would have been a bit more iterative. But I think one of the major lessons learned is to kind of look back at Admiral Wayne Meyer and the lessons that he taught us on developing the Aegis system.

Senator KAINE. Please, Mr. O'Rourke. If I can, Mr. Chair. I am a little bit over.

Mr. O'ROURKE. I would like to build on what you just heard with some additional comments.

In terms of the cost growth of the carrier, the specific question—Eric and I have talked about this over the years, and I think it is our view that the cost growth stemmed primarily from the fact that the original estimate was just unrealistically low. The Navy knew that at the time. They assigned a fairly low confidence factor to that estimate. So we should not be surprised that the cost of that ship wound up being higher than what that earlier estimate was.

But building on the lessons that you just heard, in my own written statement, I have a summary of generalized lessons learned for shipbuilding that have accumulated over the years. These are

things that a lot of people have mentioned over and over again that get to the broader issue that you are raising with your question. This is what I would say. There are eight or nine things here.

First is to, at the outset, get the operational requirements for the program right. Understand what you are trying to do. As Jerry said, do not try necessarily to do too much with any one program.

Secondly, impose cost discipline upfront, and that includes using realistic cost estimates rather than optimistic ones.

Employ competition where possible.

Use a contract type that is appropriate for the amount of risk involved.

Minimize design-construction concurrency, which is one of the oldest lessons in shipbuilding.

Properly supervise the construction work with an adequate number of properly trained supervisors of shipbuilding personnel.

Provide stability for the industry, where possible, by using multiyear procurement or block buy contracting.

Maintain a capable government acquisition workforce that understands what it is buying so that it can act as a force for doing all these other things.

These lessons are not new. They are actually very old. The problem is not identifying them. The problem or the challenge is living up to them without letting circumstances lead program execution efforts to drift away from them over time.

Senator KAINE. I am over my time, but I very much appreciate that.

Thank you, Mr. Chair.

Senator WICKER. Thank you, Senator Kaine.

Senator King?

Senator KING. Thank you, Mr. Chair.

Just to follow up a concrete case, as you may know, in the national defense bill, there is a 15-ship multiyear procurement for the Flight III DDG. Representing Maine, Bath Iron Works is somewhat concerned that it is not fully matured and one has not been built yet, and we are talking about a block buy and a fixed price contract.

Mr. Hendrix, it seems to me in learning the lessons of the original Aegis and also of the carrier, is this an area of concern?

Dr. HENDRIX. It is an area of concern, sir. However, the Block 3 variant of the Burke is built on an existing infrastructure that is well understood so far as power capacity, air conditioning, propulsion systems, and so on. There are some modifications that will come in with that. Most of the advancement, of course, is in the radar systems, some of the advanced sensors. So while we realize that it is a stretch to move from Flight II to Flight III, there should be a level of confidence that can be done with some sense of what the actual cost would be associated with it in order to move forward. I just drove over the bridge there to look down and see the Zumwalts being built and BIW building the Burkes. Confidence in that yard is high traditionally. We would hope that we see that bid come in soon.

Senator KING. So really it comes down to a factual determination of how much change is there in the design and how that will im-

pact the rest of the ship. That is a kind of detail that really has to be resolved between the Navy and the yards.

Dr. LABS. One of the ways I would have answered Senator Kaine's question relates directly to yours, which is the difference between the DDG–1000 and then the Flight III *Arleigh Burke.* The DDG–1000 was going to have 10 brand new technologies and all new design. It has proven to be a very expensive ship taking a very long time to build before we get it operational. We are still quite some ways away before we have truly an effective combat unit there.

The Flight III *Burke* is doing an evolutionary change to the *Arleigh Burke*-class, not unlike what we did with the Flight IIA compared to the Flight I and II. So you have a higher degree of confidence that you are going to be able to make that system work even though there are going to be kinks to work out. There always is in any new shipbuilding program. But an evolutionary approach is going to allow you to get those ships into the fleet faster, new technologies into the fleet faster than you would if you tried some sort of all new, clean slate design where you are putting everything in at once, and you are going to have to spend a long time figuring out how to build it and how to make it work.

Senator KING. But again, it comes down to a factual determination of how much is evolutionary and how much is significant change that is yet not finalized.

Dr. LABS. Yes, sir.

Senator KING. By the way, I discovered firsthand a defect in the design of the *George Washington*-class aircraft carrier. I spent some time on the aircraft carrier, and I was very excited that I was staying in the admiral's quarters. That was the good news. The bad news is I learned the admiral's quarters were right under the catapult. So because they were doing night operations, that was a problem. But it was not a very serious one.

Reactivation. There has been a lot of discussion. We have had it come up several times. Give me your thoughts. We do not have to go all the way down the panel. Is it feasible to reactivate mothballed ships, or is that a waste of time and money? I mean, if we have got a perfectly functioning hull, is that a place to start, or should we not go down that road, again thinking about the fact that the 355-ship Navy will cost somewhere on the order of $8 billion a year incrementally over the current shipbuilding budget. So would this be a cost-saver? Would it be more trouble than it is worth? I would like your thoughts. Mr. O'Rourke, what do you think?

Dr. LABS. Briefly, I think that not unlike what you just said before, that is going to come down to a factual determination on a hull-by-hull, ship-by-ship basis. So there may be situations where some of the ships are in good enough condition. The problem is that when the Navy knows they are going to retire a ship, they stop investing in the ship. They stop maintaining it well and efficiently. So there are going to be investments that are going to need to be made just to bring the ship back up to the condition that we would have liked it to be. Then you are going to have to decade whether you need to upgrade and improve the combat systems aboard those

same ships that you are reactivating. So all of that is going to take time, money and effort.

Senator KING. The cost would be of shoehorning a modern combat system into an old hull.

Dr. LABS. That is exactly right. So some ships are going to be able to do that. If we take the five *Ticonderoga*-class cruisers, the first five, there was an original plan when the Navy was doing the cruiser modernization that they would take those five ships, they would spend a healthy amount of money to upgrade them, including installing VLS cells in them. For various reasons, that never came to pass mostly for budgetary reasons. But that is the type of thing that could be done. But you are going to have to evaluate that to see whether it is worth the time and the effort compared to how long it would take you to bring new units into the fleet.

Senator KING. Yes, sir. Dr. Hendrix?

Dr. HENDRIX. Yes, sir. The one thing about that—and there are I think three existing of those first five hulls. They have 10 years less of sea life on them because they have been parked for most of the last decade. It is not going to be inexpensive to make that investment. In fact, the total of doing the three ships is going to be well over a billion, maybe south of $2 billion to do the three ships. However, the cost of one new cruiser, to build it from keel up, would be in excess of $2 billion, certainly close to $3 billion. The idea—you know, what is that tradeoff? Also, those platforms will not last as long once we make that investment. But the hope is that by then we have ramped up the infrastructure that we will be building new ships to replace it. It buys us 10 years, but it gets us three hulls with some spy and some VLS on them.

Senator KING. Has there been a study of this option per se? In other words, how many hulls are out there? How many could be renovated? I think it would be helpful to the committee to have some data on this.

Senator WICKER. I think it would b very helpful. Mr. O'Rourke has his hand up.

Mr. O'ROURKE. Yes. I mean, the Navy is actually doing that study right now. As a matter of due diligence, they need to explore that so that they can answer this question and say, yes, we looked at and it either did or did not make sense.

When you look at these older ships, there are really two issues. One is the age and condition of the ship. Some of these ships are not as young as the committee may have heard a week ago. For example, the Navy is looking in particular at these *Perry*-class frigates. Those frigates are almost 30 and 31 years old.

Senator KING. I remember when they were being built in Bath.

Mr. O'ROURKE. Exactly.

Senator KING. In the 1980s.

Mr. O'ROURKE. That is right. They all served to the end of their expected service lives. The youngest ones are 25 or 26. So they have only a handful of years.

But it is not just a matter of age and condition. It is a matter of why are you bringing them back. If you were to bring them back, could they actually do something that needs to be done. We are not just chasing numbers for their own sake. You do not just bring ships back to bring them back and put a mark on a chalkboard.

You are doing it because you believe that that ship in its reactivated capacity can actually do something of value to the Navy that is worth the cost that you put into it.

So you have to, first, look at the condition of the ship and say can you even bring that thing back. But then you have to ask yourself why and what missions could it perform. There may be something creative here we can do with the *Perry*-class frigates or some of the other ships that are in the inactive fleet. There were about 48 of them in the inactive fleet as of last September. But that is what you would need to look at. The Navy is doing that study, and I think they owe the answer back to you in the coming weeks and months.

Senator KING. Thank you.

Senator WICKER. Mr. Clark?

Mr. CLARK. A better approach might be to think about keeping some ships in operation longer rather than reactivating old ones that have a kind of unknown material condition. We have a number of LSDs or amphibious landing docks that are getting ready to retire over the next decade. Some of those can be kept in service longer and so some of the lower end missions that you might use a frigate for. It would cost less to do that than it would be to pull a ship out of retirement.

Senator KING. Life extension as opposed to renovation.

Mr. CLARK. Right. We have done that with—amphibious ships in particular have been a common choice to do life extensions on and get more use out of them to do a different set of missions than they were originally designed to accomplish. So that may be a better option than trying to start up with something that is an unknown quantity.

Senator WICKER. Dr. Hendrix, you wanted to add another brief comment.

Dr. HENDRIX. I would make just a note that the *Perry*-class are some of the most sought after ships for sale to our allies and partners who refurbish them and then make them last anywhere from 10 to 20 years after that. The idea of—surely there is a value there. The types of missions they probably would be most appropriately used is the way that our allies and partners do, which is doing coastal patrol, convoy escorts, some ASUW type missions, not in the highly contested environments but in more permissive environments where international security and laws need to be upheld. So that would be the appropriate place for that type of a ship.

Senator WICKER. In fact, this committee put a business case analysis requirement in the fiscal year 2018 NDAA to look at reactivation options. So in response to this, if it stays in the law and is signed by the President, the Navy will be required to provide us with these details in the coming months.

Thank you, Senator King.

Senator Shaheen?

Senator SHAHEEN. Thank you, Mr. Chairman.

Senator King, I am surprised to hear the catapult kept you up. I thought, as governor, you learned to sleep through anything.

[Laughter.]

Senator SHAHEEN. I just wanted to follow up a little bit on the questioning around the *Perry*-class frigates because, as you know,

Admiral Richardson stated last month that the Navy is considering the possibility of bringing those back. You indicated, Mr. O'Rourke, that there is a study underway to take a look at that. But do we have currently the need, as you described, Dr. Hendrix, to use those ships in a way that would free up other ships to do other operations? Is that a realistic idea that we can do that, and do we have any idea what it would take to modernize them?

Dr. HENDRIX. Ma'am, there are some estimates out there on what the cost would be, anywhere from $80,000 million to upwards of $180 million per ship to bring the Perry's back and do the modernization. Those are some of the numbers that I have been provided. Actually, our colleagues probably have better estimates on that than I do.

However, the types of missions where they might be used, you know, things in the Mediterranean, things in like the Gulf of Guinea, some of these areas where we are providing offshore security patrols and so on, those are the types of arenas that we would see this. This is not what I would look at as front line for something like the South China Sea, but some of the areas in Mediterranean patrol and so on that the Perry's would most be appropriately. Those would relieve other ships, new ships, more highly capable ships to be able to be targeted at other areas of more challenging arenas.

Senator SHAHEEN. Thank you.

Do you want to add anything to that, Mr. O'Rourke?

Mr. O'ROURKE. There is one other mission that comes to mind. In part of my testimony, I try to raise awareness of the national fleet policy, which is the statement signed by the Coast Guard and Navy leaders to coordinate their policies and optimize our investment in sea power at a national level. The Coast Guard will tell you that they do not have enough platforms to prosecute the majority of the intelligence reports they get out of the southern sector of inbound, seaborne illegal drug importation. They know it is happening. They have the intelligence. They do not have the platforms to act on it.

Senator KING. 75 percent.

Mr. O'ROURKE. That is right. When those ships land in the United States and those drugs get dispersed, it is a lot more expensive to stop the drugs at that point than it would have been to stop the ship at sea.

So one possible mission, a low impact mission for a Navy ship, if you wanted to see whether something might make sense from a mission standpoint, would be to bring them back to supplement the platforms that the Coast Guard has for intercepting drugs in the Caribbean region or also in the Pacific off the coast of California. They would still be Navy ships. They would still operate with Navy crews, but they would have Coast Guard law enforcement detachments on them. The Coast Guard might welcome an opportunity to improve its drug interdiction capability because when we took the *Perry*-class frigates out of service, the Coast Guard noted that and they expressed disappointment with the fact that they were losing access to those platforms as one of the set of assets for conducting that mission. So that is one mission you could bring them back for.

By the way, you could even perform that mission to some degree with naval reservists on 2-week duties because they are just going out of Florida doing that thing and coming back.

Dr. LABS. Senator, could I add one thing to the Perry discussion? Several years ago, Ron and I put this question to the Director of Naval Surface Warfare at the time because I was exploring an option about extending the lives of the *Perry*-class frigates and along the lines of the way the Australians improved and modernized those ships. At that time, the Navy said that they had looked at this issue and they found—I cannot remember all the details, but they looked at this issue and said largely because of the material condition of the ships, they did not think it was either smart or cost effective to do so. So when the Navy reports back on this current look here, it is certainly something that should be looked at carefully. I personally will be curious to see how it compares to what we were told several years ago along those same lines.

Senator SHAHEEN. So define more clearly what you mean by the material makeup of the ships.

Dr. LABS. Well, it has been 3 or 4 years I think since we had that conversation, but there were specific issues relating to the material condition of the hull, that it was getting very thin so it was going to be very expensive or very difficult to sort of improve it so that you get enough a life expectancy out of the ship to make the investment worthwhile. There would be issues related to improving the combat and the sensors on the ships to make them more—because you want something that is good. If you are going to bring it back and spend money on it, you do not want to just keep it for 2 years. You would like to keep it for, I would think, 5-plus years. You are going to need to improve sort of the actual combat capabilities of the ship as well.

Mr. O'ROURKE. The ships are old. Their plumbing gets old. So if you want to bring them back, you start looking at ripping out their insides. That is why a low impact mission like sending them down to the Caribbean might be more within the realm of feasibility.

There is one more limitation on those ships. They are weight-limited. In the latter years of their service, they got very close to their weight limit and you could hardly put anything new on them without having to find something else to take off. Again, if you were just doing it for this drug operation, you might not have to worry about putting too much new heavy equipment onto the ship, and it could be easier to manage from that regard as well.

Mr. CLARK. Senator, if I may, one thing I will add on this discussion about lower end missions is today the Navy is not doing very many of those missions. Since 2013, since sequestration basically, the Navy has not been conducting a lot of these patrol missions in Southern Command, in the Mediterranean, and elsewhere. So we would be bringing these ships back into service to do a mission that the Navy has kind of walked away from and left to allies or the Coast Guard. It would be complementary but not necessarily relieving a larger combatant ship to do——

Senator WICKER. So it is not really part of the requirement that the leadership is giving us. Is that your point?

Mr. CLARK. Yes, sir.

Mr. O'ROURKE. It is part of the national requirement but not the Navy's specific requirement.

Senator SHAHEEN. Can I ask one more question, Mr. Chairman?

Senator WICKER. Certainly.

Senator SHAHEEN. I know my time is over.

Senator WICKER. Well, we all went over.

Senator SHAHEEN. Mr. Labs, in your report you talk about the costs to improvements to the shipyard that are needed to build ships at higher rates. When you talk about those improvements, are you talking about infrastructure improvements, additional workforce? What specifically?

Dr. LABS. I divide that into sort of two different sections. So you will definitely need to increase the size of your workforce. As indicated in the report, if you want to build up to some of the levels that I discussed, a 40 percent increase in work forces.

But when I talk about the cost of the physical plant, the upwards perhaps of $4 billion, depending on how fast you want to build up the fleet, that is physical plant. So that is going to be things like pier spaces. Most of that is associated with the submarine industry. So the lion's share of that $4 billion, upwards of $3 billion, would be needed to improve the physical plant of the two submarine yards so that they can produce attack submarines at rates of three per year, in addition to the forthcoming *Columbia*-class.

Mr. O'ROURKE. Can I add one quick addendum, and it relates to submarines, which is one of the options for mitigating this valley in the attack submarine force that we are projected to go to would be to extend the service lives of some of the existing *Los Angeles*-class submarines, the youngest ones, not by very far, just by 3 or 4 years. So a 33-year submarine would instead serve to 36 or 37 years. We have had at least three *Los Angeles*-class attack submarines that have been extended to that age, and if you could take the youngest 688s and do that same extension, they could help fill in the front half of that valley. You would do that with extra maintenance performed on those ships. That is maintenance that would be performed at the naval shipyards.

Now, to the extent that they are running up against capacity, you would then want to think about having investments made at the naval shipyards to take better care of the 688's, to extend their lives a few years to help fill in the front part of the valley. Like I said in my opening statement, China has taken note of that valley, and we now can see that in their own naval literature.

Senator SHAHEEN. Well, you bring up something that I think is very important that I know and Senator King have been working on because we have the Portsmouth Naval Shipyard between our States, and that is the importance of making those investments so that the shipyard can do the maintenance that is required on the *Los Angeles*-class and on the other subs that are being created because that is absolutely critical if we are going to keep them so that they are seaworthy.

Senator WICKER. Mr. O'Rourke, how old are these younger *LA*-class submarines that you are proposing——

Mr. O'ROURKE. The very youngest one—I guess it is the Cheyenne that came off the line last—under a 33-year life, it would exit service in 2029. That is the year that we hit the bottom of the val-

ley. So that ship and the sister ships that came just before it—if you can get them 3 or 4 years over to the right by extending their service lives that much, they help fill in that downward slope on the front half of the valley.

Again, we have already operated at least three of our 688's—the hull numbers were 698, 699, and 700—to those ages. So if you baby these ships and take good care of them, then in some cases at least it might be possible to do that. I am not talking a large number of these. It is a handful, but a handful could make a difference in helping to fill in this part of that valley.

I am concerned about that valley because, as we go through it, it not only puts a greater operational strain on our attack submarine force to do all those missions with fewer boats, it can also, in the eyes of competitor countries, be taken as a signal of reduced conventional deterrence. In other words, there is a greater risk of war as we go through that period if we do not pay attention to this issue.

Senator WICKER. Before I recognize Senator Rounds, let me just observe that the future Secretary of the Navy is sitting three rows behind you gentlemen. He seems to be listening very intently to all of this.

Senator Rounds?

Senator ROUNDS. Thank you, Mr. Chairman.

I am going to follow up on this a little bit more because I like the idea of going to a 355-ship Navy, but I have also got a concern that once you have got it, you have got to take care of it. I am just curious. How do we talk about adding more ships and more boats when at the current time we have got attack submarines like the USS *Boise* sitting at dock rather than being in depot and we have got two more besides that one as I understand it right now that we cannot get to at this stage of the game? We can have all we want, but if we not taking care of the stuff we have got and if we do not have a plan in place to get them back in and operational, it is just like not having them at all.

My question—Mr. O'Rourke, I will direct this to you and you can redirect it if you need to. What are we doing about the backlog on depot work right now? What is our plan so that if we do increase the number that we are going to have, what are we going to do to increase the capabilities of more depot work to keep those in a sustained position on an active basis rather than sitting at dock?

Mr. O'ROURKE. The Navy has testified they are trying to dig themselves out of that hole right now. The emphasis had been on getting out a maintenance hole that they fell into over a period of years with the conventional surface ships. But as you noted, they have got a problem now with the submarines as well. They just have to spend the time and the money to develop the workforce and invest in the capital plant needed to work their way out of that.

But there is something else you can do as well, which is to pay attention to the operation and support, the O&S costs of the ships that we are building. We are building a lot of DDG–51's for the future fleet. Now, those are great ships. They have a lot of capability, and the success of that program, as indicated in the testimony from a week ago, is reflected in, among other things, the fact that we

have been procuring that ship for so long. The two DDG–51's in this year's budget are to be the 78th and 79th ships in the class. That is an amazing number of ships, and it is testimony to how capable and well respected that design is.

But the one thing we have not done with that design all through this period is take major steps to have a significant reduction in its O&S costs. So if you are going to flood the future fleet with a lot of DDG–51's and you are not taking steps to reduce your O&S costs, you will lock the future fleet into a situation of unavoidable, relatively high O&S costs, which can really tie the hands of future leaders in terms of their ability to pursue other program priorities with whatever budgets they may have in the future because they have inherited a very large number of ships that we have not taken steps in a major way to reduce their O&S costs.

Senator ROUNDS. Let us just take a look at the actual boats that you have got that are at dock right now. You have got them there. This is the third one of these Seapower Subcommittees in which we have brought this up. We recognize that they have a hole that they are in. At what point will we have a discussion about what we are doing to get out the hole? How do we address that when we are talking about adding more ships to our inventory? But I did not hear anything. I do not see anything yet. Maybe there is something that I am not aware of in which we are actually proposing to increase our capability to maintain this increased number that we are talking about. You got to include that.

Mr. O'ROURKE. The Navy has started this effort maybe 3 or 4 years ago to start digging out of the hole, but it will take years to get out of it with the surface ships at least because you have to wait for all the different ships to rotate into their maintenance availabilities over a several year cycle. So we are in the midst of that right now. It costs money. There is no way around it. But if you do not do it, you have what is called a fester factor where, because you did not invest in maintenance at one point, it becomes an even greater requirement down the road. You fall behind like you would if you are not making your credit card payments.

Senator ROUNDS. I really do not mean to beat a dead horse, but I guess I am going to try it one more time. If it has been 3 years and we actually have nuclear attack submarines that are sitting at dock and we still do not have a plan in place to get out or at least there is not a plan that we have heard yet, it seems to me that that is one area where we could actually have three more attack subs operational if we had the depot work being done in an expedited fashion or at least in some fashion if we have known about it for 3 years. Would you agree with me on that?

Mr. O'ROURKE. I agree. There is no magic to this. You just have to spend the time and money to do it.

Senator ROUNDS. Let me add one more. I like the idea of having the additional carrier. With that also comes THE reason for having the carrier and that is the air group that comes with it. What is the plan in place, as we add the carrier, to actually acquire, maintain appropriately, and operate the air carrier group that would go with that additional carrier? I know I am over, but I would like to have that.

Mr. O'ROURKE. Just very quickly, the Navy study that talked about building the additional 29 ships also talked about building 342 additional aircraft. A big chunk of that 342 can go toward forming up the additional air wing that would eventually be needed for the 12th carrier. But we do not get to a 12th carrier on a sustained basis until about 2030 or later. So there is a little bit of time between now and then to form up that air wing.

Senator ROUNDS. Presuming that we are doing that, though, we are looking at—F–35's I am assuming would be the aircraft of choice in this case?

Dr. LABS. In some ways you can build both. You can build the F/A–18's and the F–35's. In my report and in my opening statement, we estimate that you are going to need the additional aircraft for the additional surface combatants and the additional air wing. The air wing is driving this cost. It is going to cost about an extra $15 billion. But Mr. O'Rourke is correct. That carrier does not show up until about 2030. So you can lay those aircraft in over the next 10 years, and then you are going to have a fully equipped air wing by the time that comes around.

Senator ROUNDS. That is acquisition cost only that you are talking about.

Dr. LABS. That is acquisition cost only.

Senator ROUNDS. Right now, the F–35—we are expecting that there is an additional operating cost during its lifetime of an additional 70 percent, somewhere in that neighborhood?

Dr. LABS. That is right. So for the rest of the fleet, in terms of the estimates that CBO produced in terms of the operation and support costs, that includes the entire fleet. So that would include the cost of that additional aircraft carrier, as well as the additional air wing.

I completely agree with you. Without having the specific answer to the three submarines that are tied up at the pier, the estimates that we produced in this report incorporate the fact that you are going to have to support, operate, and maintain this fleet and this budget over a long period of time. Given the nature of sort of that industry, where its costs are rising faster than inflation, the budgets are going to go up and they are going to need to be appropriated if you want to maintain and operate that fleet effectively.

Senator ROUNDS. Mr. Chairman, I do not mean to go on. To me this is really important because I do believe that we need to increase the size of the Navy, but I just really want to have the data upfront in terms of getting it right so that we are not coming back in asking afterwards why did we not think about the added costs or, in this particular case, the costs of keeping a nuclear submarine operational rather than having it sitting at dock. I guess this is now the time that we ought to be asking the question.

Senator WICKER. I would note for the record that our crack staff would like it known that the NDAA report requires a plan for addressing how the backlog is eliminated as the fleet grows. The Navy owes us a report on this topic within the coming months.

Thank you, Senator Rounds.

Which of the four of you is most eager to talk about the new request for information on the new frigate?

[A show of hands.]

Senator WICKER. Yes. You did not hit your bell, Dr. Hendrix. So Mr. Clark gets to go first. What do you think of the new RFI and does it move us in the right direction? We will start with you and let anybody——

Mr. CLARK. I do not think it does move us in the right direction.

Senator WICKER. You do not.

Mr. CLARK. I do not. I think what it does is it opens up the aperture too much in terms of what the future frigate could be. It makes it seem like it could be anything from a ship that is only able to do surface warfare and ISR missions in support of distributed lethality, the Navy's new surface concept. It could be anything from that, which is a relatively low-end ship or less capable ship, all the way up to a frigate that can do air defense for another ship and do antisubmarine warfare.

I think the Navy needs to, instead of opening a wide aperture and seeing what comes in, make some choices about what they need this ship to do. It is needs to be a more capable ship that is able to do multiple missions. So it needs to do antisubmarine warfare and air defense and surface warfare, all three of them, all at about the same time. So it needs to be a multi-mission ship and not something that is a single-mission or a dual-mission ship like the RFI implies.

Senator WICKER. Dr. Hendrix?

Dr. HENDRIX. Yes, sir. Thank you for the question on this because the RFI I found generally to be good. However, there are a couple of troubling points within it. Probably the one that leapt out at me the most was the requirement within it for a 3,000 nautical mile range at 16 knots. Given the reserve fuel requirements, because we never run the ships all the way down to 0, we always to keep fuel for ballast and emergencies, that would actually limit that ship to have to at least to take one refueling for even a transatlantic convoy escort. It would seem to me that any type of ship that is built and it is written into the document needs to be able to do anti-surface warfare, antisubmarine warfare, and convoy escort that it ought to be able to do convoy escort without having to peel off and hit the tanker on the way over. So it struck me that something in the 4,500 to 6,000 mile range ought to be sort of a walking-in-the-door minimum, and the higher the better in order for it to give the most independent steaming out of it.

The other aspect of it as well—and then this is an area where I disagree with my friend, Mr. Clark—is I am a little concerned about the emphasis on the air defense factor in this. I believe that the ship should provide self-air defense, but we, as has already been testified to, have been buying excess capacity of air defense in the *Burke*-class for a number of years. Where we have a real deficit is anti-surface and antisubmarine warfare.

Anytime that you cause a ship or require a ship to be good at all things, you are going to drive up the cost factor on this. I think there is a certain sweet spot on costs that if you exceed that—and by that, I look generally in the $700 million to $850 million range per unit—by adding in air defense capability, certainly we start edging over a billion dollar per copy. At that point in time we will find ourselves in an argument which is to the extent of should we not just buy some more Burkes. We really need something that we

can buy in high enough numbers that we can drive up that portion of the fleet.

We talk about the need for 52 small surface combatants. Currently we consider the LCS to be part of that 52. I actually think that number is higher, that you need something in the 70 to 75 range on small surface combatants to be able to fill out the requirements from the combatant commanders around the world. I would like to see this be a robust ASW, anti-surface, design with a 6,000 mile range. I think that that is a good starting point.

Senator WICKER. Mr. O'Rourke?

Mr. O'ROURKE. This is what I will say. This is going to be our third attempt in the last 15 years to try and get right the issue of smalls surface combatant procurement. When we started the LCS program in the 2000 to 2003 time frame, the Navy did not do all the homework in my view that it needed to do to provide a firm analytical foundation for the program, and the weakness in that analytical foundation in my view that I have argued for many years now is a principal reason behind many of the difficulties that the LCS program experienced in subsequent years.

The Navy had a chance to firm up that analytical foundation when the program was restructured in 2014, but this time not so much due to the Navy's fault but rather to OSD, they missed a second opportunity to create a firm analytical foundation for what they were doing.

So this is the Navy's third bite at the apple to put a proper, robust analytical foundation to explain to itself and others what kind of ship it wants to buy. It needs to be able to answer three questions and not just with opinions or subjective judgments but with strong, robust numbers. That is, first, what are your capability gaps that you are trying to address? Second, what is the best general approach for filling those gaps? Should it be a big ship, a small ship, a plane, something else, some combination? Third, when you pick that best general approach, whether it is a ship or something else, then what are some of the key attributes that the ship should have?

This is what the Navy did not do in all three instances in the two prior attempts. They have a chance to get it right again this time. It is their third chance. If they do not put a firm analytical foundation under this effort, there will be a risk of this effort also experiencing difficulties in execution in the years ahead.

Dr. LABS. Senator?

Senator WICKER. Dr. Labs?

Dr. LABS. One last point to that because that was an excellent set of comments, and I do not have too much original to add to that. I would associate myself with what Mr. Clark said about it would be good that there would be more specificity in the RFI. Without getting into a recommendation of what that specificity ought to be—CBO does not make recommendations, but the more specificity you have, the more you can zero in and get that ship designed and faster. You can get a better cost estimate based on what the specifications are going to be. You want to get down a path where you want to be careful about not trying to do things too much on the cheap. I agree with Dr. Hendrix that you do not want to find yourself in a debate whether you should be buying Arleigh

Burkes or a really expensive frigate. But at the same time, if you can design a ship that has a great deal of capability and you can get may be two for one, two frigates for the price of one *Arleigh Burke*-class, then you are starting to get somewhere with what you are trying to achieve in terms of building a larger fleet in a timely manner.

Senator WICKER. Dr. Hendrix says you can swap two for six on destroyers. Do you agree with that? Have I characterized your——

Dr. HENDRIX. Sir, in that case what I was talking about was for one destroyer, you could look at a couple frigates. You could also look at a couple offshore patrol vessels or missile boats by perhaps converting a joint high-speed vessel and uploading it with missiles. Given that cost range, that you could pack six smaller combatants in for the cost of one Burke. Yes, sir.

Senator WICKER. Well, we could go on.

Dr. Hendrix and Mr. Clark, do you think Dr. Labs is overly pessimistic about getting this done?

Dr. HENDRIX. I have always found him to be an ebullient personality, sir. However, his fiscal caution is noted, and we have had difficulties in the past. So the fact is it is going to be a big lift to be able to do this with regard to getting the money in the right place, as has been ascertained by the last couple years of budgeting.

Senator WICKER. Are you heartened that he says we can do it 18 years?

Dr. HENDRIX. Sir, of course, I think that that has to be done a lot quicker. I think that given the threat environment, that we have to bring it down. Again, I take a different innovative approach by looking at the reserve fleet and SLEPing, whereas Dr. Labs tends to focus on new construction.

Senator WICKER. Who wants to make a last comment? No one.

Gentlemen, thank you for your excellent testimony and thought provoking. We look forward to visiting with you in the future. I appreciate your help today.

[Whereupon, at 4:36 p.m., the Committee adjourned.]

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