Navy Ford (CVN-78) Class Aircraft Carrier Program: Background and Issues for Congress

Ronald O'Rourke
Specialist in Naval Affairs

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Summary

CVN-78, CVN-79, and CVN-80 are the first three ships in the Navy's new Gerald R. Ford (CVN-78) class of nuclear-powered aircraft carriers (CVNs).

CVN-78 was procured in FY2008 and was funded with congressionally authorized four-year incremental funding in FY2008-FY2011. The Navy's proposed FY2012 budget estimates the ship's procurement cost at $11,531.0 million (i.e., about $11.5 billion) in then-year dollars. The Navy's proposed FY2011 budget requested $1,731.3 million in procurement funding as the final increment to complete this estimated procurement cost; the FY2011 Department of Defense and Full-Year Continuing Appropriations Act (H.R. 1473/P.L. 112-10 of April 15, 2011) reduced this request by $9.3 million.

CVN-79 is scheduled for procurement in FY2013, and has received advance procurement funding since FY2007. The Navy's proposed FY2012 budget estimates the ship's procurement cost at $10,253.0 million (i.e., about $10.3 billion) in then-year dollars and requests $554.8 million in advance procurement funding for the ship.

On July 11, 2011, it was reported that the Navy, as a potential measure for reducing near-term funding requirements, is considering the option of deferring the scheduled procurement of CVN-79 by two years, to FY2015. This option, if implemented, might substantially reduce FY2013 and FY2014 funding requirements for CVN-79. It could also increase the total procurement costs of CVN-79 and certain Virginia-class attack submarines, and have implications for the aircraft carrier industrial base and future aircraft carrier force levels.

CVN-80 is scheduled for procurement in FY2018, with advance procurement funding scheduled to begin in FY2014. The Navy's proposed FY2012 budget estimates the ship's procurement cost at $13,494.9 million (i.e., about $13.5 billion) in then-year dollars.

Oversight issues for Congress for the CVN-78 program include the potential for cost growth and technical and design issues that were raised in a December 2010 report from the Department of Defense (DOD) Director of Operational Test and Evaluation (DOT&E).

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Introduction

This report provides background information and potential oversight issues for Congress on the Gerald R. Ford (CVN-78) class aircraft carrier program. Oversight issues for Congress for the CVN-78 program include the potential for cost growth and technical and design issues that were raised in a December 2010 report from the Department of Defense (DOD) Director of Operational Test and Evaluation (DOT&E). Congress's decisions on the CVN-78 program could substantially affect Navy capabilities and funding requirements and the shipbuilding industrial base.

Background

The Navy's Aircraft Carrier Force

The Navy's aircraft carrier force consists of 11 nuclear-powered ships—the one-of-a-kind *Enterprise* (CVN-65), which entered service in 1961, and 10 Nimitz-class ships (CVNs 68 through 77) that entered service between 1975 and 2009. The most recently commissioned carrier, the *George H. W. Bush* (CVN-77), the final Nimitz-class ship, was procured in FY2001 and commissioned into service on January 10, 2009.[1] CVN-77 replaced the *Kitty Hawk* (CV-63), which was the Navy's last remaining conventionally powered carrier.[2]

Aircraft Carrier Construction Industrial Base

All U.S. aircraft carriers procured since FY1958 have been built by Newport News Shipbuilding (NNS), of Newport News, VA, a shipyard that is part of Huntington Ingalls Industries (HII). HII was previously owned by Northrop Grumman, during which time it was known as Northrop Grumman Shipbuilding (NGSB). NNS is the only U.S. shipyard that can build large-deck, nuclear-powered aircraft carriers. The aircraft carrier construction industrial base also includes hundreds of subcontractors and suppliers in dozens of states.

Gerald R. Ford (CVN-78) Class Program

The Gerald R. Ford (CVN-78) class carrier design (**Figure 1**) is the successor to the Nimitz-class carrier design.[3] The Ford-class design uses the basic Nimitz-class hull form but incorporates

[1] Congress approved $4,053.7 million in FY2001 procurement funding to complete CVN-77's then-estimated total procurement cost of $4,974.9 million. Section 122 of the FY1998 defense authorization act (H.R. 1119/P.L. 105-85 of November 18, 1997) limited the ship's procurement cost to $4.6 billion, plus adjustments for inflation and other factors. The Navy testified in 2006 that with these permitted adjustments, the cost cap stood at $5.357 billion. The Navy also testified that CVN-77's estimated construction cost had increased to $6.057 billion, or $700 million above the adjusted cost cap. Consequently, the Navy in 2006 requested that Congress increase the cost cap to $6.057 billion. Congress approved this request: Section 123 of the FY2007 defense authorization act (H.R. 5122/P.L. 109-364 of October 17, 2006), increased the cost cap for CVN-77 to $6.057 billion.

[2] The *Kitty Hawk* was decommissioned on January 31, 2009.

[3] The CVN-78 class was earlier known as the CVN-21 class, which meant nuclear-powered aircraft carrier for the 21st century.

several improvements, including features permitting the ship to generate substantially more aircraft sorties per day, more electrical power for supporting ship systems, and features permitting the ship to be operated by several hundred fewer sailors than a Nimitz-class ship, significantly reducing life-cycle operating and support (O&S) costs.

Navy plans call for procuring at least three Ford-class carriers—CVN-78, CVN-79, and CVN-80.

Figure 1. Navy Illustration of CVN-78

Source: Navy image accessed at http://www.navy.mil/management/photodb/photos/060630-N-0000X-001.jpg on April 20, 2011.

CVN-78

CVN-78, which was named for President Gerald R. Ford in 2007,[4] was procured in FY2008 and was funded with congressionally authorized four-year incremental funding in FY2008-FY2011.[5] The Navy's proposed FY2012 budget estimates the ship's procurement cost at $11,531.0 million (i.e., about $11.5 billion) in then-year dollars. The Navy's proposed FY2011 budget requested $1,731.3 million in procurement funding as the final increment to complete this estimated

[4] Section 1012 of the FY2007 defense authorization act (H.R. 5122/P.L. 109-364 of October 17, 2006) expressed the sense of the Congress that CVN-78 should be named for President Gerald R. Ford. On January 16, 2007, the Navy announced that CVN-78 would be so named. CVN-78 and other carriers built to the same design will consequently be referred to as Ford (CVN-78) class carriers. For further discussion of Navy ship names, see CRS Report RS22478, *Navy Ship Names: Background for Congress*, by Ronald O'Rourke.

[5] Section 121 of the FY2007 John Warner National Defense Authorization Act (H.R. 5122/P.L. 109-364 of October 17, 2006) granted the Navy the authority to use four-year incremental funding for CVN-78, CVN-79, and CVN-80.

procurement cost; the FY2011 Department of Defense and Full-Year Continuing Appropriations Act (H.R. 1473/P.L. 112-10 of April 15, 2011) reduced this request by $9.3 million.

CVN-78 is scheduled to enter service as the replacement for *Enterprise* (CVN-65). The Navy projects that there will be a 33-month period between the scheduled decommissioning of *Enterprise* in November 2012 and the scheduled commissioning of CVN-78 in September 2015. During this 33-month period, the Navy's carrier force is to temporarily decline from 11 ships to 10 ships. Since 10 USC 5062(b) requires the Navy to maintain a force of at least 11 operational carriers, the Navy asked Congress for a temporary waiver of 10 USC 5062(b) to accommodate the 33-month period between the scheduled decommissioning of *Enterprise* and the scheduled commissioning of CVN-78. Section 1023 of the FY2010 National Defense Authorization Act (H.R. 2647/P.L. 111-84 of October 28, 2009) authorizes the waiver and required the Secretary of Defense to submit a report on the operational risk of temporarily reducing the size of the carrier force.

CVN-79

CVN-79, which was named for President John F. Kennedy on May 29, 2011,[6] is scheduled for procurement in FY2013, and has received advance procurement (AP) funding since FY2007. The Navy's proposed FY2012 budget estimates the ship's procurement cost at $10,253.0 million (i.e., about $10.3 billion) in then-year dollars and requests $554.8 million in AP funding for the ship.

On April 6, 2009, Secretary of Defense Robert Gates announced a number of recommendations he was making to the President for the FY2010 defense budget submission. One of these was to shift procurement of carriers to five-year intervals. This recommendation, which was included in the FY2010 defense budget submission, deferred the scheduled procurement of CVN-79 from FY2012 to FY2013. Gates stated in his April 9, 2009, address that shifting carrier procurement to five-year intervals would put carrier procurement on "a more fiscally sustainable path."[7] For further discussion, see **Appendix A** and **Appendix B**.

On July 11, 2011, it was reported that the Navy, as a potential measure for reducing near-term funding requirements, is considering the option of deferring the scheduled procurement of CVN-79 by two years, to FY2015.[8] This option, if implemented, might

- substantially reduce FY2013 and FY2014 funding requirements for CVN-79;
- increase the total procurement cost of CVN-79, potentially by hundreds of millions of dollars;
- increase the procurement costs of Virginia-class attack submarines being built at NNS over the next few years; and

[6] See "Navy Names Next Aircraft Carrier USS John F. Kennedy," *Navy News Service*, May 29, 2011, accessed online on June 1, 2011 at http://www.navy.mil/search/display.asp?story_id=60686. See also Peter Frost, "U.S. Navy's Next Aircraft Carrier Will Be Named After The Late John F. Kennedy," *Newport News Daily Press*, May 30, 2011. CVN-79 is the second ship to be named for President John F. Kennedy. The first, CV-67, was the last conventionally powered carrier procured for the Navy. CV-67 was procured in FY1963, entered service in 1968, and was decommissioned in 2007.

[7] Source: Statement of Secretary of Defense Robert Gates, at April 6, 2009, news conference on his recommendations for the FY2010 defense budget.

[8] Christopher P. Cavas, "U.S. May Delay Next Carrier," *Defense News*, July 11, 2011: 1.

- have implications for the aircraft carrier industrial base and future aircraft carrier force levels.

CVN-80

CVN-80 is scheduled for procurement in FY2018, with advance procurement funding scheduled to begin in FY2014. The Navy's proposed FY2012 budget estimates the ship's procurement cost at $13,494.9 million (i.e., about $13.5 billion) in then-year dollars. Secretary of Defense Gates' April 2009 recommendation to shift carrier procurement to five-year intervals (see above discussion of CVN-79) deferred the procurement of CVN-80 from FY2016 to FY2018.

Procurement Funding

Table 1 shows procurement funding for CVNs 78, 79, and 80 through FY2016. Each ship is being procured with several years of advance procurement (AP) funding, followed by four-year incremental procurement funding of the remainder of the ship's cost.[9] The funding profile for CVN-78, for example, includes AP funding in FY2001-FY2007, followed by four years of incremental procurement funding in FY2008-FY2011.

The figures shown for FY2011 in **Table 1** are the requested figures for FY2011 as presented in the FY2012 budget submission. The FY2011 Department of Defense and Full-Year Continuing Appropriations Act (H.R. 1473/P.L. 112-10 of April 15, 2011), which was enacted after the submission of the proposed FY2012 budget, reduced the Navy's request for FY2011 procurement funding for CVN-78 by $9.3 million, and fully funded the Navy's request for FY2011 advance procurement funding for CVN-79.

[9] As noted in footnote 5, Section 121 of the FY2007 defense authorization act (H.R. 5122/P.L. 109-364 of October 17, 2006) granted the Navy the authority to use four-year incremental funding for CVN-78, CVN-79, and CVN-80.

Table 1. Procurement Funding for CVNs 78, 79, and 80 Through FY2016

(Millions of then-year dollars, rounded to nearest tenth)

FY	CVN-78	CVN-79	CVN-80	Total
FY01	21.7 (AP)	0	0	21.7
FY02	135.3 (AP)	0	0	135.3
FY03	395.5 (AP)	0	0	395.5
FY04	1,162.9 (AP)	0	0	1,162.9
FY05	623.1 (AP)	0	0	623.1
FY06	618.9 (AP)	0	0	618.9
FY07	735.8 (AP)	52.8 (AP)	0	788.6
FY08	2,685.0	123.5 (AP)	0	2,808.6
FY09	2,684.6	1,210.6 (AP)	0	3,895.1
FY10	737.0	482.9 (AP)	0	1,219.9
FY11 (requested)[a]	1,731.3	908.3 (AP)	0	2,639.6
FY12 (requested)	0	554.8 (AP)	0	554.8
FY13 (projected)	0	1,942.4	0	1,942.4
FY14 (projected)	0	1,920.3	228.1 (AP)	2,148.4
FY15 (projected)	0	2,030.9	1,514.9 (AP)	3,545.8
FY16 (projected)	0	1,026.5	1,476.5 (AP)	2,503.0

Source: FY2009-FY2012Navy budget submissions.

Notes: Figures may not add due to rounding. "AP" is advance procurement funding.

a. The figures shown for FY2011 are the requested figures for FY2011 as presented in the FY2012 budget submission. The FY2011 Department of Defense and Full-Year Continuing Appropriations Act (H.R. 1473/P.L. 112-10 of April 15, 2011), which was enacted after the submission of the proposed FY2012 budget, reduced the Navy's request for FY2011 procurement funding for CVN-78 by $9.3 million, and fully funded the Navy's request for FY2011 advance procurement funding for CVN-79.

Increase in Estimated Unit Procurement Costs

As shown in **Table 2**, the estimated procurement costs of CVNs 78, 79, and 80 in the FY2011 budget submission are 10.3%, 11.5%, and 25.9% higher, respectively, in then-year dollars than those in the FY2009 budget submission.[10] **Table 2** also shows that the estimated procurement

[10] CBO in 2008 and the Government Accountability Office (GAO) in 2007 questioned the accuracy of the Navy's cost estimate for CVN-78. CBO reported in June 2008 that it estimated that CVN-78 would cost $11.2 billion in constant FY2009 dollars, or about $900 million more than the Navy's estimate of $10.3 billion in constant FY2009 dollars, and that if "CVN-78 experienced cost growth similar to that of other lead ships that the Navy has purchased in the past 10 years, costs could be much higher still." CBO also reported that, although the Navy publicly expressed confidence in its cost estimate for CVN-78, the Navy had assigned a confidence level of less than 50% to its estimate, meaning that the Navy believed there was more than a 50% chance that the estimate would be exceeded. (Congressional Budget Office, *Resource Implications of the Navy's Fiscal Year 2009 Shipbuilding Plan*, June 9, 2008, p. 20.) GAO reported in August 2007 that:

> Costs for CVN 78 will likely exceed the budget for several reasons. First, the Navy's cost estimate, which underpins the budget, is optimistic. For example, the Navy assumes that CVN 78 will be built with fewer labor hours than were needed for the previous two carriers. Second, the Navy's target cost for ship construction may not be achievable. The shipbuilder's initial cost estimate for construction was 22 percent higher than the Navy's cost target, which was based on the budget. Although the Navy and the shipbuilder are working on ways to reduce costs, the actual costs to build the ship will likely increase above the Navy's target. Third, the Navy's ability to manage

(continued...)

costs of CVNs 79 and 80 in the FY2012 budget are 1.5% and 0.1% lower, respectively, than those in the FY2011 budget.

Table 2. Estimated Procurement Costs of CVNs 78, 79, and 80

(As shown in FY2009-FY2012 budgets, in millions of then-year dollars)

Budget	CVN-78		CVN-79		CVN-80	
	Estimated procurement cost	Scheduled fiscal year of procurement	Estimated procurement cost	Scheduled fiscal year of procurement	Estimated procurement cost	Scheduled fiscal year of procurement
FY09 budget	10,457.9	FY08	9,191.6	FY12	10,716.8	FY16
FY10 budget	10,845.8	FY08	n/a[a]	FY13[b]	n/a[a]	FY18[b]
FY11 budget	11,531.0	FY08	10,413.1	FY13	13,577.0	FY18
FY12 budget	11,531.0	FY08	10,253.0	FY13	13,494.9	FY18
% change:						
FY09 budget to FY10 budget	+3.7		n/a		n/a	
FY10 budget to FY11 budget	+6.3		n/a		n/a	
FY11 budget to FY12 budget	No change		- 1.5		- 0.1	
FY09 budget to FY12 budget	+10.3		+11.5		+25.9	

Source: FY2009, FY2010, and FY2011Navy budget submissions.

a. n/a means not available; the FY2010 budget submission did not show estimated procurement costs for CVNs 79 and 80.

b. The FY2010 budget submission did not show scheduled years of procurement for CVNs 79 and 80; the dates shown here for the FY2010 budget submission are inferred from the shift to five-year intervals for procuring carriers that was announced by Secretary of Defense Gates in his April 6, 2009, news conference regarding recommendations for the FY2010 defense budget.

The increases in the estimated procurement costs of CVNs 78, 79, and 80 since the FY2009 budget submission have at least four potential causes:

- one additional year of inflation being incorporated into the cost of CVN-79 as a result of its scheduled procurement being deferred from FY2012 to FY2013, and

(...continued)

issues that affect cost suffers from insufficient cost surveillance. Without effective cost surveillance, the Navy will not be able to identify early signs of cost growth and take necessary corrective action.

(Government Accountability Office, Defense Acquisitions[:] Navy Faces Challenges Constructing the Aircraft Carrier Gerald R. Ford within Budget, GAO-07-866, August 2007, summary page. See also Government Accountability Office, Defense Acquisitions[:] Realistic Business Cases Needed to Execute Navy Shipbuilding Programs, Statement of Paul L. Francis, Director, Acquisition and Sourcing Management Team, Testimony Before the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, House of Representatives, July 24, 2007 (GAO-07-943T), p. 15.)

two years of additional inflation being incorporated into the cost of CVN-80 as a result of its scheduled procurement being deferred from FY2016 to FY2018;

- increases in projected annual rates of inflation;
- higher estimates of real (i.e., inflation-adjusted) material costs, real labor rates, or labor hours (given a certain position on the production learning curve) for building CVN-78 class carriers; and
- increased costs due to loss of learning and reduced spreading of fixed overhead costs resulting from shifting to five-year intervals for procuring carriers.

Procurement Cost Cap

Section 122 of the FY2007 John Warner National Defense Authorization Act (H.R. 5122/P.L. 109-364 of October 17, 2006) established a procurement cost cap for CVN-78 of $10.5 billion, plus adjustments for inflation and other factors, and a procurement cost cap for subsequent Ford-class carriers of $8.1 billion each, plus adjustments for inflation and other factors. The conference report (H.Rept. 109-702 of September 29, 2006) on P.L. 109-364 discusses Section 122 on pages 551-552.

The Navy on February 19, 2010, notified the congressional defense committees that, after making permitted adjustments in the cost cap for inflation and other factors, the estimated cost of CVN-78 was $224 million below the cost cap for that ship.[11] The Navy on April 19, 2010, informed CRS and the Congressional Budget Office (CBO) that, after making permitted adjustments in the cost cap for inflation and other factors, the estimated costs of CVN-79 and CVN-80 each were several hundred million dollars below the cost cap for those ships.[12]

Issues for Congress

Oversight issues for Congress for the CVN-78 program include technical risk and the potential for cost growth on CVNs 78, 79, and 80, and technical and design issues for CVN-78 class carriers that were raised in a December 2010 report from the Department of Defense (DOD) Director of Operational Test and Evaluation (DOT&E).

Potential for Cost Growth

One oversight issue for Congress for the CVN-78 program concerns potential for cost growth on CVNs 78, 79, and 80. One possible source of cost growth in CVN-78 are new technologies that are being developed for the ship, particularly the electromagnetic aircraft launch system (EMALS)—an electromagnetic (as opposed to the traditional steam-powered) aircraft catapult. Problems in developing EMALS or other technologies could delay the ship's completion and increase its development and/or procurement cost.

[11] Source: Letter dated February 19, 2010, from Secretary of the Navy Ray Mabus to the chairmen of the House and Senate Armed Services committees and the Defense subcommittees of the House and Senate Appropriations Committees. Copy of letter provided by the Navy to CRS and the Congressional Budget Office (CBO) on April 19, 2010.

[12] Source: April 19, 2010, Navy briefing on the CVN-78 program to CRS and CBO.

December 31, 2010, Selected Acquisition Report (SAR)

Regarding a contract that NNS has with the Navy for detailed design and construction work on CVN-78—a contract that accounts for a portion of the ship's total cost—the December 31, 2010, Selected Acquisition Report (SAR) for the CVN-78 program, which was released in mid-April 2011, states: "The [CVN-78] Program Manager's (PM) Estimate At Completion (EAC) [for the contract] increased from $5,295.5M to $5,723.5M reflecting unfavorable contractor material and labor performance." This statement would appear to suggest a potential for $428 million in cost growth on CVN-78. The December 31, 2010, SAR for the program also states that the contract has a current target price of $5,161.3 million. Compared to this figure, the EAC figure of $5,723.5 million would appear to suggest a potential for $562.2 million in cost growth, which would equate to about 10.9% cost growth. At a May 3, 2011, briefing on the CVN-78 program for CRS and CBO, officials from the CVN-78 program office stated that the EAC figure in the SAR reflected information available at the time the SAR was being compiled, and that the Navy is working to reduce the EAC figure.

April 18, 2011, News Report

An April 18, 2011, news report stated that the EMALS program office

> has completed work on six [EMALS] generators scheduled to be delivered to the shipyard soon, but it will likely have to make changes after they are installed on the aircraft carrier since integration testing is ongoing, according to officials from Huntington Ingalls Industries.
>
> HII representatives told reporters at a Navy League conference here on April 12 that so far EMALS is on track to be installed on the Gerald Ford (CVN-78) which the company is building on schedule at Newport News, VA. They also said they are confident that the generators will not need extensive changes because the Navy has already put them through component testing.[13]

March 9, 2011, Hearing

At a March 9, 2011, hearing on Navy shipbuilding issues before the Seapower and Projection Forces subcommittee of the House Armed Services Committee, the following exchange occurred between Representative Akin, the chairman of the subcommittee, and Sean Stackley, the Assistant Secretary of the Navy for Research, Development, and Acquisition (i.e., the Navy's acquisition executive):

> REPRESENTATIVE AKIN:
>
> … one of the things we've been paying attention to is the EMALS systems on new carrier and that has to be built into the hull and everything, and I gather the timeline on that is pretty tight. How is that going and do you see any problems with that or not?

[13] Cid Standifer, "EMALS Set To Deliver 6 Generators To HII; May Require Changes Later," *Inside the Navy*, April 18, 2011.

STACKLEY:

Yes, sir. We have—we have been managing EMALS to the smallest detail. We are very concerned about two years ago that the program was not on track. We placed basically—we have replaced the management team as well as ensure that the program is properly funded both to complete its development and also to support in-yard- need-dates for the CVN-78.

Today—today, we are at a point in system development that we have turned over to the shipyard which referred to as the green book which takes all the testing that's been conducted up at Lakehurst where we have a full-scale model in the ground that we've used to launch aircraft. So we've developed the test requirements, turned over that green book to Newport News on schedule so that they can continue to build the CVN-78 to support the test program.

On the production side, we are carefully watching each of the components that need to be delivered to Newport News. We have two in particular. Two motor generator sets out of 12 that have very limited float on in-yard-need-date, but we don't see difficulties right now in terms of meeting that and all the other components have float on the order of four to six months.

So, tight, yes, closing manage [sic: closely managed], yes. I think the risk is acceptable absolutely. We have to yet to complete the STD testing that we, as I described, we launched aircraft off the Lakehurst system in December. They really do stress it and to drive learning early on and coming out of that. In fact, we have uncovered some dynamics associated between the system and the aircraft's performance that we've taken a pause to work on more on the software side of correcting that issue so that we can ...

AKIN:

Software in order to change the amount of force relative to distance that the system develops or ... ?

STACKLEY:

No, Sir. The – what's beautiful about the EMALS is it's very scalable in terms of you dial in the load that you're putting on it and what you want for speed when at the end of the runway and the EMALS will do the rest. What we discovered in moving away from a dead load to an F-18 is: EMALS is a long – it's a number of linear motors that are in series and then a hand off from linear motor to linear motor as the aircraft is accelerating. There's a slight gap. And that can be tuned in terms of the way you ramp up the load and where you drop it off to minimize that gap so it's not perceptible to the pilot.

So it's an example what were not able to pick up in dead load testing which put a pilot on aircraft and that's a report I received back until we docked in to that to figure out what the best way to mitigate that so that it's not a problem.

So the test program—bottom line is the test program is frankly in good shape. It is a fairly exhaustive test program. We did take a pause because we did not while we were working on these changes or corrections coming out of the live aircraft testing. We did not want to have a standing army on the test side that was performing inefficiently, so we took a pause; we're

coming back with corrections and picking back up the system functional demonstration this month.[14]

A June 27, 2011, press report states:

> Flight tests of the U.S. Navy's new electromagnetic aircraft launch system (EMALS) resumed in late May after a five-month hiatus, and two more aircraft types have now passed their initial launch tests.
>
> The program's maiden launches were accomplished in mid-December when an F/A-18E Super Hornet strike fighter from Air Test and Evaluation Squadron 23 (VX-23) made four takeoffs from the Navy's catapult test center at Lakehurst, N.J. But the tests revealed the need to fine-tune the software that controls the system's motors and better control the miniscule timing gaps between when the motors are energized and turned off.
>
> "The linear motors fire sequentially as you go down the catapult track," said Capt. James Donnelly, the Navy's program man-ager for EMALS. "Only three are energized at a time. They turn on, turn off. As each one energizes, a force is exerted on the aircraft, and the timing needed to be fine-tuned." Flight tests with the F/A-18E resumed May 25, and "the launches validated the software changes," Donnelly said.
>
> The Super Hornet made 14 launches using the revamped software, followed by 12 launches on June 1 and 2 with a T-45C Goshawk training jet from VX-23.
>
> A C-2A Carrier Onboard Delivery aircraft from VX-20 made a further series of 12 launches on June 8 and 9.
>
> The Super Hornet will return in July to Lakehurst for another series of launches using a variety of stores, or weapons, mount-ed under the wings and on the aircraft. Later in the summer, an E-2D Advanced Hawkeye airborne command-and-control aircraft will begin launch tests, Donnelly said.
>
> The multiple launches are used to test a variety of weights on the aircraft, he said, and to validate the EMALS system and improve reliability. The aircraft are also tested at various launch speeds.
>
> Reliability of the EMALS system is "improving," Donnelly said.
>
> "We have more and more launches without any [warning] lights that come on, anything we annotate in launch logs," he said during a June 23 interview.
>
> "A lot of corrections" were made during the early stages of the program's flight testing, Donnelly said.
>
> "We're doing much less of that. We had very few issues in the May and June launches."...
>
> Despite the five-month pause in the test schedule, production and delivery of EMALS components is proceeding for the Gerald R. Ford, under construction at Huntington Ingalls Industries' Newport News, Va., shipyard. "No impact to the ship [construction] schedule," Donnelly said. "We're meeting our required in-yard dates. We started deliveries in May, and we're delivering a lot of equipment this month, including most of the motor generators—the

[14] Source: Transcript of hearing.

components that many folks were most concerned about schedule-wise." Asked about the program's budget performance, Donnelly noted that production elements are being procured under a fixed-price contract—"no ups and extras there," he said—but he declined to provide test budget figures.

"We're constantly looking at the testing budget, so that's under discussion," he said. "The bottom line is, we'll continue testing," he said. "Our focus is to ensure the catapult is as reliable as possible as when we deliver and the ship gets underway with sailors aboard."[15]

March 2011 GAO Report

The Government Accountability office (GAO) reported the following in March 2011 regarding the status of the CVN-78 program, including the potential for cost growth:

Technology Maturity

Seven of the CVN 21 program's 13 current critical technologies have not been demonstrated in a realistic, at-sea environment. Of these technologies, EMALS, the advanced arresting gear, and dual band radar present the greatest risk to the ship's cost and schedule. Program officials stated that EMALS development has been one of the primary drivers of CVN 78 cost increases. Problems have occurred in EMALS testing which could result in more design changes later in the program. Testing uncovered a crack in the motor, which has already resulted in several design changes; and in January 2010, a motor controller software error caused damage to the EMALS hardware. Both fixes have successfully been retested. The program completed the first four

F/A-18E launches in December 2010. The advanced arresting gear is nearing maturity and has completed extended reliability testing. However, delays in land-based testing with simulated and live aircraft could lead to late delivery. The Navy finalized a fixed-price production contract for EMALS and the advanced arresting gear in June 2010. Although the Navy continues to pay design and testing costs, any EMALS changes identified during development will be incorporated into the production units at no cost to the government. The dual band radar, which includes the volume search and multifunction radars, is being developed by the DDG 1000 destroyer program and is also nearing maturity. However, as a part of a program restructuring, the DDG 1000 eliminated the volume search radar from the program. According to Navy officials, radar development has not been affected, but CVN 78 will now be the first ship to operate with this radar. Radar equipment will be delivered for installation and testing beginning September 2011 for the multifunction radar and in January 2012 for the volume search radar.

Design Maturity

In September 2008, CVN 78 began production with only 76 percent of its three-dimensional product model complete. The three-dimensional product model was completed by November 2009, but the contractor is currently making design changes to prevent electrical cable routing from interfering with other design features. As EMALS and other systems complete testing, additional design changes may be necessary.

[15] Christopher P. Cavas, "U.S. Navy Resumes EMALS Tests," *Defense News*, June 27, 2011: 19. Material in brackets as in original.

Production Maturity

The Navy awarded the CVN 78 construction contract in September 2008. Construction of approximately 65 percent of the ship's structural units is complete. These units account for about 19 percent of the ship's total production hours. As of July 2010, construction of the hull in dry dock was behind schedule because of late material deliveries from suppliers.

Other Program Issues

In 2010, the CVN 21 program shifted from a 4- to 5-year build cycle, which could increase program costs. According to program officials, the shipbuilder projects that this change will increase costs by 9 to 15 percent due to the loss of learning and effect on the supplier base, among other inefficiencies. The Navy disagrees with this assessment and reported to Congress that the shift will have minimal negative consequences. The dual band radar also presents cost risks for the program. Program officials are considering buying the radar for both CVN 79 and CVN 80 at the same time, in order to reduce the risks associated with the production line being idle for up to 5 years. However, this strategy could lead to increased costs if changes identified during at-sea testing on CVN 78 need to be incorporated into the already-procured systems for the two follow-on ships.

Program Office Comments

In commenting on a draft of this assessment, the Navy generally concurred with this assessment. Officials stated the program is addressing the technology and construction challenges for a successful September 2015 delivery, and that CVN 79 is on track to award a construction contract by the first quarter fiscal year 2013. The Navy stated that while the change from a 4- to 5-year build cycle will increase the unit cost of the CVN 78 class carrier, it facilitates a reduced average yearly funding requirement over a longer period of time. The Navy also provided technical comments, which were incorporated as appropriate.[16]

June 2011 CBO Report

A June 2011 CBO report on the potential cost of the Navy's FY2011 30-year shipbuilding plan states (with costs expressed on constant FY2011 dollars):

> The Navy's projected cost of the lead ship of the CVN-78 class grew by 10 percent between the President's 2008 and 2012 budget requests. The Navy's budget now projects the lead ship's cost to be about $12.0 billion (about what CBO estimated in its analysis of the Navy's 2009 plan). However, further increases appear likely. According to the Selected Acquisition Report for the CVN-78 program, the program manager is currently estimating an additional $600 million in cost overruns above the budgeted amount. In addition, the lead ship of the CVN-78 class is only about 23 percent complete, and cost growth in shipbuilding programs typically occurs when a ship is more than half finished—particularly in the later stages of construction, when all of a ship's systems must be installed and integrated. Therefore, greater cost growth in the lead ship appears likely, which would signal higher costs for subsequent ships in the class as well.
>
> To estimate the cost of the lead ship of the CVN-78 class, CBO used the actual costs of the previous carrier—the CVN-77—and then adjusted them for higher costs for government-

[16] Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-11-233SP, March 2011, p. 55.

> furnished equipment and for more than $3 billion in costs for nonrecurring engineering and detail design (the plans, drawings, and other one-time items associated with the first ship of a new class). As a result, CBO estimates that the lead CVN-78 will cost about $12.9 billion once it is completed. Subsequent ships of the class will not require as much funding for one-time items, although they will incur the higher costs for government-furnished equipment. Altogether, CBO estimates the average cost of the six carriers in the [FY]2012 [30-year shipbuilding] plan at $12.1 billion, whereas the Navy estimates their average cost at $10.3 billion (see Table 3). CBO's estimate for all carriers under the 2012 plan is lower than the estimate for the 2011 plan primarily because... the projected gap between inflation in the economy overall and long-run shipbuilding inflation has narrowed.
>
> There are several reasons to believe that the final cost of the CVN-78 could be even higher than CBO's estimate. First, most lead ships built in the past 20 years have experienced cost growth of more than 40 percent. (CBO's estimate for the lead CVN-78 accounts for some but not all of that historical cost growth.) Second, Navy officials have told CBO that they have budgeted to the 40th percentile of possible cost outcomes. That is, there is a 60 percent probability that the final cost of the CVN-78 will exceed the service's estimate and only a 40 percent probability that the final cost will be less than that estimate. Third, a number of critical technologies that are supposed to be incorporated into the ship, such as a new electromagnetic catapult system for launching aircraft, remain under development. Difficulties in completing their development could arise and increase costs, which would also affect the costs for subsequent ships of the class.[17]

Technical and Design Issues—December 2010 DOT&E Report

A December 2010 report on various DOD acquisition programs from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2010—stated, in its section on the CVN-78 program, that

> The CVN 78 program continues to have challenges with F-35 Joint Strike Fighter (JSF) integration. The thermal footprint from the main engine exhaust, shipboard noise levels, and information technology requirements need work. Design changes may be required for the jet blast deflectors, and active cooling may be required in the flight deck just forward of the jet blast deflector….
>
> Numerous integrated warfare system items are of concern, including:
>
> - The ship-self-defense combat systems on aircraft carriers have historically had reliability and weapon system integration shortcomings. While the Navy has made efforts, it has not yet developed a detailed plan to address these concerns on CVN 78.
>
> - The Navy lags in developing a new anti-ship ballistic missile target and in obtaining a capability to launch four simultaneous supersonic sea-skimming targets. Both are required to assess effectiveness of ship self-defense….
>
> EMALS experienced two notable hardware/software incidents that caused test delays at the SFD [System Functional Design] test site at Lakehurst [NJ]. One incident involved an un-commanded armature retraction due to a software anomaly in the asset protection module. The second anomaly involved the loss of an encoder from the catapult armature during a dead-load test. Both anomalies have been resolved. EMALS has started performance

[17] Congressional Budget Office, *An Analysis of the Navy's Fiscal Year 2012 Shipbuilding Plan*, June 2011, pp. 13-14.

> verification with dead loads at the SFD site, and [the] AAG [Advanced Arresting Gear] is nearing the start of Jet Car Track Site dead load testing. Required In Yard Date (RIYD) for these systems continues to drive the development schedule; however, to date development and testing remains on track.[18]

At a May 3, 2011, briefing on the CVN-78 program for CRS and CBO, officials from the office overseeing the EMALS development effort stated that the issues concerning EMALS that are raised in the final paragraph cited above occurred in FY2010 and FY2011 and do not change the change the Navy's earlier-cited testimony at the March 9, 2011, hearing (see "March 9, 2011, Hearing" in "Potential for Cost Growth").

Legislative Activity for FY2012

FY2012 Funding Request

As shown in **Table 1**, the Navy's proposed FY2012 budget requests $554.8 million in advance procurement (AP) funding for CVN-79.

FY2012 National Defense Authorization Bill (H.R. 1540/S. 1253)

House (Committee Report)

The House Armed Services Committee, in its report (H.Rept. 112-78 of May 17, 2011) on H.R. 1540, recommends approving the Navy's FY2012 request for advance procurement (AP) funding for CVN-79 (page 345). Page 33 of the report states:

> CVN-78 is the lead ship of the Ford-class of aircraft carriers. The committee was critical when the Navy changed construction starts of these carriers from 4-year to 5-year centers. The committee encourages the Secretary of the Navy to keep these aircraft carriers on 5-year centers at the most, with fiscal year 2013 being the first year of detail design and construction funding for CVN-79. The committee believes one key to success in this program will be to minimize changes from ship to ship in the class. (page 33)

Section 221 of H.R. 1540 as reported by the committee states:

> SEC. 221. DESIGNATION OF ELECTROMAGNETIC AIRCRAFT LAUNCH SYSTEM DEVELOPMENT AND PROCUREMENT PROGRAM AS MAJOR SUBPROGRAM.
>
> Not later than 30 days after the date of the enactment of this Act, the Secretary of Defense shall designate the electromagnetic aircraft launch development and procurement program as a major subprogram of the CVN-78 Ford-class aircraft carrier major defense acquisition program, in accordance with section 2430a of title 10, United States Code.

Regarding section 221, the committee's report states:

[18] Director, Operational Test and Evaluation, *FY 2010 Annual Report*, December 2010, p. 112.

> This section would direct the Secretary of Defense to designate the Electromagnetic Aircraft Launch System (EMALS) as a major subprogram of the CVN-78 Ford-class aircraft carrier major defense acquisition program within 30 days after the date of enactment of this Act. A major subprogram is defined in section 2430a of title 10, United States Code.
>
> The committee is aware that EMALS is progressing through its land-based testing. However, earlier problems in development have reduced almost all schedule margin in order to make the date the equipment must be in the shipyard for installation in the first ship of the class. The committee acknowledges elevating EMALS to a major subprogram will provide the proper oversight to this critical system as it continues its development and production. (Page 93)

House (Floor Consideration)

On May 25, 2011, as part of its consideration of H.R. 1540, the House agreed by voice vote to H.Amdt. 301, the text of which is as follows:

> SEC. 127. FORD-CLASS AIRCRAFT CARRIER PROCUREMENT.
>
> (a) In General.—Subject to the availability of appropriations for such purpose, the Secretary of the Navy may enter into multiyear contracts for the start of major construction of the Ford-class aircraft carriers designated CVN 79 and CVN 80 and for the construction of major components, modules, or other structures related to such carriers.
>
> (b) Requirements.—In carrying out this section, the Secretary of the Navy may—
>
> (1) enter into contracts under subsection (a) in a manner that the Secretary determines will result in the lowest cost to the United States given the variability of shipyard industrial capacity and other factors; and
>
> (2) enter into contracts with the prime contractor chosen for major fabrication and construction of the vessels or directly with other contractors to supply materiel and equipments for the construction of the vessels in such a manner as to reduce cost to the United States of such materiel and equipments by purchasing in economic order quantities.
>
> (c) Condition for Out-Year Contract Payments.—A contract entered into under subsection (a) shall provide that any obligation of the United States to make a payment under the contract for a fiscal year after fiscal year 2012 is subject to the availability of appropriations for that purpose for such later fiscal year.
>
> (d) Other Authority.—Section 121(a) of the John Warner National Defense Authorization Act for Fiscal Year 2007 (P.L. 109-364; 120 Stat. 2104) is amended by striking "three fiscal years" and inserting "four fiscal years".

Regarding subsection (d) above, as mentioned earlier (see footnote 5), Section 121 of the FY2007 John Warner National Defense Authorization Act (H.R. 5122/P.L. 109-364 of October 17, 2006) granted the Navy the authority to use four-year incremental funding for CVN-78, CVN-79, and CVN-80. Subsection (d) above would change that authority to permit the use of five-year incremental funding. Since DOD plans to procure CVN-79 in FY2013 and CVN-80 in FY2018, procuring the two ships in those years using five-year incremental funding would result in a continuous stream of carrier procurement funding from FY2013 through FY2022.

Senate

S. 1253 as reported by the Senate Armed Services Committee (S.Rept. 112-26 of June 22, 2011) recommends approving the Navy's FY2012 request for advance procurement (AP) funding for CVN-79. (See Section 4101 of the bill as reported by the committee. In the printed version of the bill as reported by the committee, the relevant table within this section appears on page 606.)

FY2012 DOD Appropriations Bill (H.R. 2219)

House

The House Appropriations Committee, in its report (H.Rept. 112-110 of June 16, 2011) on H.R. 2219, recommends approving the Navy's FY2012 request for advance procurement (AP) funding for CVN-79 (page 153).

Appendix A. Earlier Oversight Issue: Shift to Five-Year Intervals: A More Fiscally Sustainable Path?

On April 6, 2009, Secretary of Defense Robert Gates announced a number of recommendations he was making to the President for the FY2010 defense budget submission. One of these was to shift procurement of carriers to five-year intervals. This recommendation, which was included in the FY2010 defense budget submission, deferred the scheduled procurement of CVN-79 from FY2012 to FY2013, and the scheduled procurement of CVN-80 from FY2016 to FY2018.

Gates stated in his April 9, 2009, address that shifting carrier procurement to five-year intervals would put carrier procurement on "a more fiscally sustainable path."[19] This was interpreted as meaning that shifting to five-year intervals (compared to a combination of four- and five-year intervals in previous Navy 30-year shipbuilding plans) would reduce the average amount of funding required each year for procuring carriers.

As a simplified notional example, if carriers are assumed to cost $10 billion each, then shifting from a four-year interval to a five-year interval would reduce the average amount of carrier procurement funding needed each year from $2.5 billion to $2.0 billion, a reduction of $500 million per year.

This simplified notional example, however, assumes that shifting from four- to five-year intervals does not by itself cause an increase in the real (i.e., inflation-adjusted) procurement cost of the carriers. Increasing the procurement interval could by itself cause an increase in the real procurement cost of the carriers by reducing learning-curve benefits (i.e., causing a loss of learning) from one carrier to the next, and by reducing the spreading of fixed overhead costs at the Newport News shipyard and at supplier firms. A real increase in carrier procurement costs due to such effects would offset at least some of the reduction in the average amount of carrier procurement funding needed each year that would result from shifting to five-year intervals.

Shifting to five-year intervals for procuring carriers could also increase the costs of other Navy ship programs. NGSB's Newport News shipyard performs mid-life nuclear refueling complex overhauls (RCOHs) on Nimitz-class carriers, and jointly builds Virginia-class nuclear-powered attack submarines along with another shipyard (General Dynamics' Electric Boat Division). In addition, vendors that make nuclear-propulsion components for carriers make analogous components for nuclear-powered submarines. A reduced spreading of fixed costs at NGSB's Newport News yard and at nuclear-propulsion component vendors due to the shift to five-year intervals for carrier procurement might thus also increase costs for Nimitz-class RCOHs and Virginia-class submarines. Increases in costs for these programs would further offset the reduction in the average amount of carrier procurement funding needed each year that would result from shifting to five-year intervals for carrier procurement.

Potential key oversight questions for Congress included the following:

[19] Source: Statement of Secretary of Defense Robert Gates, at April 6, 2009, news conference on his recommendations for the FY2010 defense budget.

- How much of the increase since the FY2009 budget submission in the estimated procurement costs of CVNs 78, 79, and 80 (see **Table 2**) is due to the shift to five-year intervals for procuring carriers?
- How do potential increases in the costs of CVN-78 class aircraft carriers, Nimitz-class RCOHs, and Virginia-class submarines caused by the shift to five-year intervals for procuring carriers affect the calculation of the net change in average annual funding requirements that results from shifting carrier procurement to five-year intervals?

May 2009 Northrop Grumman Shipbuilding Statement

A May 2009 Northrop Grumman Shipbuilding statement on the cost impact of shifting to five-year intervals for procuring carriers states:

> One element of the announcement by the Secretary of Defense last week was to shift from four (4) years to five (5) years between construction start for each new Ford Class carrier. Past Northrop Grumman Shipbuilding experience with carrier new construction has shown that the optimum time between carrier construction is less than 4 years. This allows the most efficient flow of the work force from one ship to the next, and facilitates a learning curve for carriers. Moving to five (5) year intervals between starts will require the shipyard to sub-optimize manning level sequencing and result in added trade training, loss of learning, and added startup costs.
>
> Increasing the time between carrier construction can have a large impact on the supplier base, driving cost increases of 5-10 percent, or higher in some cases, above normal escalation. Material costs of suppliers who provide similar components to other Navy programs currently under contract will also experience cost growth. Some equipment suppliers can be expected to exit the market as a result of the additional year with the expense of component requalification being realized.
>
> Finally, the decrease in production labor volume on an annual basis, created by the increase in the time interval between carrier construction starts will increase the cost to other programs in the yard. This applies to work already under contract, namely Virginia class submarines (VCS) Block 2 and Block 3, and CVN 78 predominately; and for future work not yet under contract, namely Carrier RCOH's, CVN79 and follow-on Ford class carrier construction, and later Blocks of VCS. The impact to work already under contract is expected to be in the range of $100M of cost growth. We also expect cost increases for future contracts yet to be priced. Conservative projections of the shipbuilder cost impact to CVN 79 and CVN80 for the one year delay will be on the order of a 9-15 percent cost increase.[20]

[20] Northrop Grumman Shipbuilding statement dated May 1, 2009, entitled "NGSB Statement Regarding Extending the Time Interval between New Build Starts For the Ford Class of Aircraft Carriers," provided to CRS by Northrop Grumman.

March 2010 GAO Report

A March 2010 GAO report stated that if carrier procurement were shifted to five-year intervals, "the fabrication start date for CVN 80 will be delayed by 2 years, which will increase the amount of shipyard overhead costs paid under the CVN 79 contract."[21]

March 2010 Navy Report Required by Section 126

Section 126 of the FY2010 defense authorization act (H.R. 2647/P.L. 111-84 of October 28, 2009) required the Secretary of the Navy to submit a report to the congressional defense committees on the effects of using a five-year interval for the construction of Ford-class aircraft carriers. The conference report (H.Rept. 111-288 of October 7, 2009) on H.R. 2647/P.L. 111-84 stated the following regarding Section 126:

> The conferees note that a 5-year interval for aircraft carrier construction, as proposed by the Secretary of Defense, may be the appropriate course of action for the Department of the Navy. However, the conferees are concerned that this decision may not have been made following a rigorous cost-benefit analysis. Therefore, the conferees expect that the Secretary of the Navy will take no further action to preclude the ability of the Secretary to award a construction contract for CVN–79 in fiscal year 2012 or the aircraft carrier designated CVN–80 in fiscal year 2016, consistent with the Annual Long-Range Plan for Construction of Naval Vessels for Fiscal Year 2009, until he completes the required assessment and fully informs the congressional defense committees of any such a decision. (Page 680)

The Navy submitted the report on March 4, 2010.[22] The report states, among other things, that

- "It is reasonable to assume that some vendor base inefficiencies, in addition to inflation may occur by increasing CVN build intervals to five years."
- "While a five-year interval between carrier construction starts will result in potential inefficiencies and gaps for specific carrier construction trade skills, the Navy plans to closely manage the transition to 5-year centers to minimize the impact of this change on training of individuals required to support ship construction."
- "The Navy estimated that a four-year build interval would maximize the opportunity to achieve labor efficiencies due to learning. A five-year build interval reduces this opportunity; however, the overall impact for loss of learning associated with a shift to five-year centers is manageable through Advance Procurement and Advance Construction."
- "The Navy assessed the NIMITZ Class cost returns for shipbuilder labor and material and GFE to determine the correlation between these cost elements and the number of years between carrier awards. The Navy estimates that impact to Basic Construction is around 1.0% for CVN 79 and CVN 80."

[21] Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-10-388SP, March 2010, p. 54.

[22] This is the date of the cover letters to the congressional recipients. The report itself has a cover date of February 2010.

- "The change to five-year build intervals results in an overhead decrease in direct labor workload for aircraft carrier construction, thereby causing the overhead rates to increase proportionately. The Navy estimates the construction portion increase is less than 1% each for CVN 78, CVN 79 and CVN 80."
- "The impact of changing the interval between carrier awards to the VIRGINIA Class submarine current Block II and Block III contracts is estimated to be $30-50 million per hull."[23]

The report does not provide an overall dollar calculation of how much of the increase since the FY2009 budget submission in the estimated procurement costs of CVNs 78, 79, and 80 is due to the shift to five-year intervals for procuring carriers. Virginia-class submarines are scheduled to be procured at a rate of two ships per year starting FY2011. If the cost increase of $30 million to $50 million for each Virginia-class boat cited in the Navy's report holds for Virginia-class boats procured in FY2011 and subsequent years, then the shift to five-year intervals for procuring carriers would increase Virginia-class procurement costs by $60 million to $100 million per year. For the text of the Navy's report, see **Appendix B**.

June 30, 2010, Selected Acquisition Report (SAR)

The Department of Defense's (DOD's) June 30, 2010, Selected Acquisition Report (SAR) for the CVN-78 program states that the estimated increase in Ford-class procurement costs resulting from shifting to five-year intervals for procuring carriers is $1,798.0 million in then-year dollars, consisting of $521.0 million for CVN-79 and $1,277.0 million for CVN-80.[24] The June 30, 2010, SAR states that these two figures are a "clarification" of figures presented in the December 31, 2009, SAR. The December 31, 2009, SAR estimated the increase at $4,131.2 million in then-year dollars, consisting of $1,131.4 million for CVN-79 and $2,999.8 million CVN-80, but also stated that these figures were "overstated, and will be corrected in the June 2010 SAR."[25] The difference between the June 30, 2010, SAR, and the December 31, 2009, SAR regarding the estimated increase in procurement costs resulting from shifting to five-year intervals for procuring carriers (i.e., $4,131.2 million minus $1,798.0 million) is $2,333.2 million. The June 30, 2010, SAR re-attributes a net total of $2,333.2 million in estimated cost increases to factors other than shifting to five-year intervals for procuring carriers, and reports total estimated procurement costs for CVN-79 and CVN-80 that are the same as those reported in the December 31, 2009, SAR. Neither the June 30, 2010, SAR nor the December 31, 2009, SAR shows an estimated increase in the procurement cost for CVN-78 resulting from shifting to five-year intervals for procuring carriers. The figures in the June 30, 2010, SAR are consistent with the Navy-provided figures presented in **Table A-1**.

Navy Data Provided to CRS and CBO on June 24, 2010

On April 19, 2010, following a Navy briefing to CRS and CBO on the CVN-78 program, CRS asked the Navy to provide the procurement costs of CVNs 78, 79, and 80 in constant FY2011

[23] Department of the Navy, *Report to Congress on Effects of Five-year Build Intervals for Force Class Aircraft Carriers*, February 2010, 5 pp. Copy provided to CRS by Navy Office of legislative Affairs on April 8, 2010.

[24] Department of Defense, *Selected Acquisition Report (SAR), CVN-78*, As of June 30, 2010, p. 26.

[25] Department of Defense, *Selected Acquisition Report (SAR), CVN-78*, As of December 31, 2009, pp. 4 and 25.

dollars as in the proposed FY2011 budget, and what these costs would have been in the proposed FY2011 budget if there had been no shift to five-year intervals for carrier procurement (i.e., if CVN-79 were procured in FY2012 and CVN-80 were procured in FY2016). The Navy provided the figures (in both then-year and constant FY2011 dollars) to CRS and CBO on June 24, 2010. **Table A-1** shows the figures.

Table A-1. Cost Impact of Shifting to Five-year Intervals

(Millions of dollars, rounded to nearest tenth)

	CVN-78	CVN-79	CVN-80
Then-year dollars			
Cost in FY2011 budget	11,531.0	10,413.1	13,577.0
What the figure would have been in FY2011 budget if there had been no shift to five-year intervals	11,531.0	9,892.1	12,300.0
Difference (dollars)	0	521.0	1,277.0
Difference (%)	0	5.3%	10.4%
Constant FY2011 dollars			
Cost in FY2011 budget	11,875.9	9,742.3	11,628.5
What the figure would have been in FY2011 budget if there had been no shift to five-year intervals	11,875.9	9,396.7	10,872.2
Difference (dollars)	0	345.6	756.3
Difference (%)	0	3.7%	7.0%

Source: Briefing slide entitled "CVN 78 Class CBO/CRS Data Request," dated June 24, 2010, and provided as an attachment to a Navy information paper dated May 19, 2010. The May 19, 2010, information paper and the June 24, 2010, attachment were provided to CRS and CBO on June 24, 2010.

Notes: In the scenario assuming there had been no shift to five-year intervals for carrier procurement, CVN-79 would be procured in FY2012 and CVN-80 would be procured in FY2016. The Navy converted then-year dollars to constant FY2011 dollars using a January 2010 SCN (i.e., shipbuilding budget) deflator. FY2011 budget figures for CVN-80 reflect a CVN-78 program estimate pending official approval from the Naval Sea Systems Command (NAVSEA).

Appendix B. Text of Navy Report on Effects of Shifting to Five-Year Intervals

The following is the text of the Navy's report on the effects of shifting to five-year intervals for procuring carriers.[26]

I . REPORT REQUIREMENTS

Section 126 of the National Defense Authorization Act for Fiscal Year 2010, P.L. 111-84, (hereinafter "Section 126") requires that a report be submitted to Congress no later than February 1, 2010 assessing the effects of using a five-year interval for the construction of Gerald R. Ford Class aircraft carriers. The assessment shall include impacts with respect to four specified areas resulting from this change in acquisition strategy. This report fulfills the Navy's reporting obligation pursuant to Section 126. The language of this section is as follows:

"Not later than February 1, 2010, the Secretary of the Navy shall submit to the congressional defense committees a report on the effects of using a five-year interval for the construction of FORD Class aircraft carriers. The report shall include, at a minimum, an assessment of the effects of such five-year interval on the following:

(1) With respect to the supplier base-

(A) the viability of the base, including suppliers exiting the market or other potential reductions in competition; and

(B) cost increases to the Ford Class aircraft carrier program.

(2) Training of individuals in trades related to ship construction.

(3) Loss of expertise associated with ship construction.

(4) The costs of—

(A) any additional technical support or production planning associated with the start of construction;

(B) material and labor;

(C) overhead; and

(D) other ship construction programs, including the costs of existing and future contracts."

II. ASSESSMENT DISCUSSION

On April 6, 2009, Secretary of Defense announced within a Defense Budget Recommendation Statement that the Navy's CVN 21 aircraft carrier program (Ford Class)

[26] Department of the Navy, *Report to Congress on Effects of Five-year Build Intervals for Force Class Aircraft Carriers*, February 2010, 5 pp. The cover letters sent with the report are dated March 4, 2010. Copy of report provided to CRS by Navy Office of legislative Affairs on April 8, 2010.

would shift from a four-year to a five-year build cycle, thereby placing the program on a more fiscally sustainable path. This will result in 10 aircraft carriers after 2040. The five-year build cycle allows for a balance between carrier build-rate and inventory, and a more effective use of overall Shipbuilding and Conversion, Navy funding between carrier programs and other ship, submarine, support, and amphibious ship recapitalization plans.

1. IMPACT TO SUPPLIER BASE

It has been the Navy's experience that longstanding aircraft carrier suppliers have generally responded to ship construction schedule shifts and extended workload gaps without widespread disruption or loss of continuity for critical products from most vendors. For example, the interval between procurement of CVN 77 and CVN 78 was originally planned to be five years, but grew to seven years. There was no significant impact on the shipbuilder's procurement of components to support ship construction.

In addition, for a 2009 Navy-funded RAND Corporation study, RAND sought comments from 46 major suppliers regarding the impact of moving the CVN 79 award date to Fiscal Year 2013. The suppliers chosen were those deemed critical to aircraft carrier construction by the shipbuilder. The majority of the 18 major suppliers who responded indicated that less than 20% of their total annual revenues were from aircraft carrier construction, and nearly all responding vendors indicated they provide services to other Navy ship platforms including submarines, surface combatants, and aircraft carrier Refueling and Complex Overhauls (RCOH). It is reasonable to assume that some vendor base inefficiencies, in addition to inflation may occur by increasing CVN build intervals to five years. Efforts by the Navy to drive cross-platform commonality of parts and proactively manage obsolescence also mitigate the risk of economic dependence. As a result, economic dependence on Ford Class aircraft carrier order frequency for the majority of the vendor industrial base is projected to be low. The Navy plans to continue to closely manage this industrial base to minimize impacts and costs.

2-3. IMPACT TO TRAINING AND EXPERTISE

The construction start of the Ford Class coincides with an overall ramp-up in shipyard production efforts in the Fiscal Year 2010-Fiscal Year 2013 timeframe due to an increase to two per year VIRGINIA Class submarines, more consistent carrier build frequencies, sustained NIMITZ Class RCOH program, and the start of CVN 65 inactivation. While a five-year interval between carrier construction starts will result in potential inefficiencies and gaps for specific carrier construction trade skills, the Navy plans to closely manage the transition to 5- year centers to minimize the impact of this change on training of individuals required to support ship construction.

The Navy estimated that a four-year build interval would maximize the opportunity to achieve labor efficiencies due to learning. A five-year build interval reduces this opportunity; however, the overall impact for loss of learning associated with a shift to five-year centers is manageable through Advance Procurement and Advance Construction.

4. COST IMPACTS

There are three primary sources of cost impact associated with increasing the intervals between carrier construction starts - inflation, inefficiencies, and overhead impacts. The effects of these are addressed in paragraphs 4A, 4B, and 4C for CVN 79 and CVN 80. For other work at the shipyard, the collective impacts of the three sources are provided in paragraph 4D.

A. Cost of any Additional Technical Support or Production Planning Associated with the Start of Construction

Since CVN 79 advance planning and procurement commenced prior to the five-year build interval decision, CVN 79 technical support and production planning will be adjusted for the five-year interval. The Construction Preparation contract will be extended by one year to meet the construction award shift from Fiscal Year 2012 to Fiscal Year 2013. With the exception of costs associated with an additional year of planning amounting to about 1%, there should be no other fiscal implications with this extension.

B. Cost of Material and Labor

A five-year build interval imposes one additional year of inflation on the CVN 79 and two additional years on CVN 80. The Navy estimates a 3% impact on the Basic Construction Cost and Government Furnished Equipment (GFE) for CVN 79 and an 8% impact to CVN 80. This inflation impact will be addressed in the budget request for these two ships.

The Navy assessed the NIMITZ Class cost returns for shipbuilder labor and material and GFE to determine the correlation between these cost elements and the number of years between carrier awards. The Navy estimates that impact to Basic Construction is around 1.0% for CVN 79 and CVN 80.

C. Cost of Overhead

Overhead rates (percentage of direct labor) at the shipbuilder and major suppliers are directly correlated to the projected direct labor workload. The change to five-year build intervals results in an overall decrease in direct labor workload for aircraft carrier construction, thereby causing the overhead rates to increase proportionally. The Navy estimates the construction portion increase is less than 1% each for CVN 78, CVN 79 and CVN 80. The Navy will be working with the shipbuilder on managing overhead in the shipyard.

D. Costs of Other Ship Construction Programs, Including the Costs of Existing and Future Contracts

The impact of changing the interval between carrier awards to the VIRGINIA Class submarine current Block II and Block III contracts is estimated to be $30-50 million per hull. The increase in costs is associated with workload reallocatjon in the shipbuilding industrial base.

III. REPORT SUMMARY

This report, as required by Section 126 of P.L. 111-84, assesses the impacts resulting from the shift of the acquisition schedule to five-year intervals for Ford Class aircraft carriers. A review of available information indicates there will be a minimal impact on the supplier base if closely managed. Since the shipyard has ample opportunity to plan for five-year intervals, any impacts to worker training or trade skill inefficiencies, and workload planning is assessed to be manageable.

The change from a four-year to a five-year build interval will result in a unit cost increase to the Ford Class carriers that have funding requirements in the Future Years Defense Program. The Navy is continuing to refine the estimated impacts and will adjust future budget submissions. These increases are due primarily to inflation, inefficiencies, and overhead adjustments that will be factored into the overall budget request for each ship. Despite the inflation adjusted costs per ship, the change in build interval allows carrier annual funding requirements to be spread over longer periods of time, maintains a steady state 11 carrier

force structure until after 2040, and facilitates a reduced average annual aircraft carrier funding requirement.

Author Contact Information

Ronald O'Rourke
Specialist in Naval Affairs
rorourke@crs.loc.gov, 7-7610