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

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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 is being funded with congressionally authorized four-year incremental funding in FY2008-FY2011. The Navy's proposed FY2011 budget estimates the ship's procurement cost at $11,531.0 million (i.e., about $11.5 billion) in then-year dollars, and requests $1,731.3 million in procurement funding as the final increment to complete this estimated procurement cost.

CVN-79 is scheduled for procurement in FY2013, and has received advance procurement funding since FY2007. The Navy's proposed FY2011 budget estimates the ship's procurement cost at $10,413.1 million (i.e., about $10.4 billion) in then-year dollars and requests $908.3 million in advance procurement funding for the ship.

CVN-80 is scheduled for procurement in FY2018, with advance procurement funding scheduled to begin in FY2014. The Navy's proposed FY2011 budget estimates the ship's procurement cost at $13,577.0 million (i.e., about $13.6 billion) in then-year dollars.

On April 6, 2009, Secretary of Defense Robert Gates announced a number of recommendations he was making for the FY2010 defense budget. One of these was to shift procurement of carriers to five-year intervals. This recommendation effectively deferred the scheduled procurement of CVN-79 from FY2012 to FY2013, and the scheduled procurement of CVN-80 from FY2016 to FY2018. Secretary of Defense Robert Gates stated on April 6, 2009, that shifting carrier procurement to five-year intervals would put carrier procurement on "a more fiscally sustainable path."

Potential oversight issues for Congress for FY2011 for the CVN-78 program include the following:

- Did shifting carrier procurement to five-year intervals put carrier procurement on a more fiscally sustainable path?
- Where do the estimated procurement costs of CVNs 78, 79, and 80 stand in relation to the unit procurement cost caps for the CVN-78 program that were established by Section 122 of the FY2007 defense authorization act (H.R. 5122/P.L. 109-364 of October 17, 2006)?
- What is the likelihood that the estimated procurement costs of CVNs 78, 79, and 80 will increase from the estimates shown in the FY2011 budget?

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- What is the likelihood that the estimated procurement costs of CVNs 78, 79, and 80 will increase from the estimates shown in the FY2011 budget?

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

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) and 10 Nimitz-class ships (CVNs 68 through 77). 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.[2] CVN-77 replaced the Kitty Hawk (CV-63), which was the Navy's last remaining conventionally powered carrier.[3]

Aircraft Carrier Construction Industrial Base

All U.S. aircraft carriers procured since FY1958 have been built by the Newport News, VA, shipyard that forms part of Northrop Grumman Shipbuilding (NGSB). NGSB's Newport News yard 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 is the successor to the Nimitz-class carrier design.[4] Compared to the Nimitz-class design, the Ford-class design will incorporate several improvements, including an ability to generate substantially more aircraft sorties per day 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 costs. Navy plans call for procuring at least three Ford-class carriers—CVN-78, CVN-79, and CVN-80.

CVN-78

CVN-78, which was named in 2007 for president Gerald R. Ford,[5] was procured in FY2008 and is being funded with congressionally authorized four-year incremental funding in FY2008-

[2] 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.

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

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

[5] 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.

FY2011.[6] The Navy's proposed FY2011 budget estimates the ship's procurement cost at $11,531.0 million (i.e., about $11.5 billion) in then-year dollars, and requests $1,731.3 million in procurement funding as the final increment to complete this estimated procurement cost.

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 defense authorization act (H.R. 2647/P.L. 111-84 of October 28, 2009) authorizes the waiver and requires 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 is scheduled for procurement in FY2013, and has received advance procurement funding since FY2007. The Navy's proposed FY2011 budget estimates the ship's procurement cost at $10,413.1 million (i.e., about $10.4 billion) in then-year dollars and requests $908.3 million in advance procurement funding for the ship.

In the FY2009 budget, CVN-79 was scheduled to be procured in FY2012. On April 6, 2009, Secretary of Defense Robert Gates announced a number of recommendations he was making for the FY2010 defense budget. One of these was to shift procurement of carriers to five-year intervals. Since CVN-78 was procured in FY2008, this recommendation effectively deferred the scheduled procurement of CVN-79 from FY2012 to FY2013. Secretary of Defense Robert Gates stated that shifting carrier procurement to five-year intervals would put carrier procurement on "a more fiscally sustainable path."[7]

CVN-80

CVN-80 is scheduled for procurement in FY2018, with advance procurement funding scheduled to begin in FY2014. The Navy's proposed FY2011 budget estimates the ship's procurement cost at $13,577.0 million (i.e., about $13.6 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) effectively deferred the procurement of CVN-80 from FY2016 to FY2018.

[6] The use of four-year incremental funding is consistent with Section 121 of the FY2007 defense authorization act (H.R. 5122/P.L. 109-364 of October 17, 2006), which granted the Navy the authority to use four-year incremental funding for CVN-78, CVN-79, and CVN-80.

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

Procurement Funding

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

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

Millions of then-year dollars, rounded to nearest tenth – figures may not add due to rounding)

FY	CVN-78	CVN-79	CVN-80	Total
FY01	21.7	0	0	21.7
FY02	135.5	0	0	135.5
FY03	395.5	0	0	395.5
FY04	1,162.9	0	0	1,162.9
FY05	623.1	0	0	623.1
FY06	618.9	0	0	618.9
FY07	735.8	52.8	0	788.6
FY08	2,685.0	123.5	0	2,808.5
FY09	2,684.6	1,210.6	0	3,895.2
FY10	737.0	482.9	0	1,219.9
FY11 (requested)	1,731.3	908.3	0	2,639.6
FY12 (projected)	0	494.8	0	494.8
FY13 (projected)	0	2,418.3	0	2,418.3
FY14 (projected)	0	3,158.5	228.1	3,386.6
FY15 (projected)	0	760.7	1,523.8	2,284.5

Source: FY2009, FY2010, and FY2011Navy budget submissions.

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%, 13.3%, and 26.7% higher, respectively, than those in the FY2009 budget submission.

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

As shown in FY2009, FY2010, and FY2011 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
% increase:						
FY09 budget to FY10 budget	3.7		n/a		n/a	
FY10 budget to FY11 budget	6.3		n/a		n/a	
FY09 budget to FY11 budget	10.3		13.3		26.7	

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 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;
- 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 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.

Issues for Congress

Potential oversight issues for Congress for FY2011 for the CVN-78 program include the following:

- Did shifting carrier procurement to five-year intervals put carrier procurement on a more fiscally sustainable path?
- Where do the estimated procurement costs of CVNs 78, 79, and 80 stand in relation to the unit procurement cost caps for the CVN-78 program that were established by Section 122 of the FY2007 defense authorization act (H.R. 5122/P.L. 109-364 of October 17, 2006)?
- What is the likelihood that the estimated procurement cost of CVN-78, CVN-79, or CVN-80 will increase from the estimates shown in the FY2011 budget?

Each of these issues is discussed below.

Shift to Five-Year Intervals: A More Fiscally Sustainable Path?

As mentioned earlier, when Secretary of Defense Gates announced on April 6, 2009, that he was recommending that carrier procurement be shifted to five-year intervals, he stated that this would put carrier procurement on "a more fiscally sustainable path." This was interpreted as meaning that shifting to five-year intervals (compared to a previous combination of four- and five-year intervals in 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 procurement cost of the carriers. Increasing the procurement interval could by itself increase the procurement cost of the carriers by causing reduced learning-curve benefits (i.e., 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. An 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.

The Navy in July 2009 estimated on a preliminary basis that increasing the carrier procurement interval to five years could increase the procurement cost of each Virginia-class submarine by $20 million to $50 million. The Navy stated:

> The Navy is currently assessing the impact of the proposed shift to 5 year centers for CVN construction, however in general the cost per ship would increase due to workload reallocation at the Northrop Grumman Shipbuilding (NGSB) facility in Newport News, VA. The increased cost per ship, is due to overhead reallocation for labor and materials, includes impacts to the shipbuilder's cost as well as the cost impact on Government Furnished Equipment. The actual cost increase of each ship varies, and is being evaluated as part of FY11 budget deliberations. The preliminary expected impact to individual Virginia Class submarines varies between $20M and $50M per hull across the program.[8]

Since Navy plans call for procuring two Virginia-class submarines per year starting in FY2011, the increase for the Virginia-class program might, on this basis, be $40 million to $100 million per year in FY2011 and subsequent years.

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

[8] Navy information paper dated July 15, 2009, on the subject "5 Year Centers for CVN, Impact on VIRGINIA Class," provided to CRS by Navy Office of Legislative Affairs.

> CVN 79 and CVN80 for the one year delay will be on the order of a 9-15 percent cost increase.[9]

Potential key oversight questions for Congress for FY2011 include the following:

- 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?

Section 126 of the FY2010 defense authorization act (H.R. 2647/P.L. 111-84 of October 28, 2009) requires 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 text of Section 126 is as follows:

> SEC. 126. FORD-CLASS AIRCRAFT CARRIER REPORT.
>
> 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.

[9] 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.

Regarding Section 126, the conference report (H.Rept. 111-288 of October 7, 2009) on H.R. 2647/P.L. 111-84 states:

> *Ford-class aircraft carrier report (sec. 126)*
>
> The House bill contained a provision (sec. 122) that would require the Secretary of the Navy to make an assessment of the cost of shifting to 5-year intervals for the construction of aircraft carriers, including the effect of such shifting of that interval on other programs. The House bill would have placed a limitation on the use of any funds for the aircraft carrier, designated CVN–79, for shifting to a 5-year interval.
>
> The Senate amendment contained no similar provision.
>
> The Senate recedes with an amendment that would remove the limitation on the use of funds for CVN–79.
>
> 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)

Estimated Procurement Costs in Relation to Procurement Cost Cap

A second potential oversight issue for Congress for the CVN-78 program concerns where the estimated procurement costs of CVNs 78, 79, and 80 as shown in the FY2011 budget stand in relation to the unit procurement cost caps for the CVN-78 program that were established by Section 122 of the FY2007 defense authorization act (H.R. 5122/P.L. 109-364 of October 17, 2006). As mentioned earlier (see "Procurement Cost Cap" in the "Background" section), the cost caps established by Section 122 can be adjusted upward to take into account inflation and other factors.

Potential for Additional Growth in Estimated Procurement Costs

A third potential oversight issue for Congress for the CVN-78 program concerns the likelihood that the estimated procurement costs of CVNs 78, 79, or 80 will increase from the estimates shown in the FY2011 budget. One possible source of additional cost growth in CVN-78 is 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. GAO reported in March 2009 that:

> Nine of the CVN 21 program's 14 critical technologies are not yet fully mature. Of these technologies, EMALS, the advanced arresting gear, and the dual band radar present the greatest risk to the ship's cost and schedule. Problems during EMALS development have already resulted in cost growth and schedule delays. In order to meet CVN 78's delivery date, the Navy adopted a strategy that will test, produce, and ultimately install EMALS with

> a high degree of concurrency. In September 2008, the contractor completed the first round of high-cycle testing, gaining confidence in the performance of the generator—a source of past problems. Contractor-led integrated land-based system testing will not be complete until the end of fiscal year 2011—2-years later than estimated in December 2007. Assuming no further delays, EMALS will not demonstrate full performance of a shipboard ready system until at least 7 months after installation on CVN 78 has begun. The advanced arresting gear has completed early verification tests that proved the system's concept. Integrated land-based testing with both simulated and live aircraft has slipped by one year since last year's assessment and is now scheduled for 2010. The Navy recently postponed delivery of the arresting gear to the shipyard. Consequently, the shipbuilder will not install the gear prior to laying the flight deck—a less optimal and more costly approach to building the ship. The dual band radar—which includes the volume search and multifunction radars—is being developed as part of the DDG 1000 program. While the multifunction radar has been tested at sea, considerable testing remains for the volume search radar. Land-based tests of the volume search radar prototype will not be completed until May 2009—2 years later than planned. Upcoming land-based tests will be conducted at a lower voltage than needed to meet requirements—and without the radome (the radar's composite shield). Full power output will not be tested on a complete system until 2012. Tests of carrier-specific functionality will not conclude until shortly before shipyard delivery in 2013 leaving little time to resolve problems before ship installation....
>
> The program has faced challenges in maintaining its design schedule due to delays in the receipt of technical information on EMALS and the advanced arresting gear; however, the Navy believes this issue has been largely resolved. The shipbuilder anticipates changes to CVN 78's design based on the results of EMALS testing....
>
> A February 2008 program assessment recommended a number of changes to the EMALS program to improve performance. The Navy re-planned the test program and changed the management approach. The CVN 21 program office is now responsible for overseeing EMALS production and ship integration, rather than the Naval Air Systems Command. In addition, EMALS will no longer be provided as government-purchased equipment. Instead, the shipbuilder will purchase EMALS, giving it a more direct role in managing the integration on CVN 78. The cost impact of this change has not been finalized.[10]

Navy officials testified on April 1, 2009, that they were reviewing the EMALS situation and that "We do not see that it will have an impact on the actual schedule of the carrier at this point in time."[11] On April 16, 2009, it was reported that the Navy had decided, based on its review of the situation, to continue with the plan to build CVN-78 with EMALS.[12]

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[10] Government Accountability Office, *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-09-326SP, March 2009, pp. 68.

[11] They stated that "We're looking at all options. There has been cost growth to the EMALS system. We're looking at—at the total cost of acquisition and life cycle for EMALS and steam [catapults]. We're looking at schedule and what does—does that do if we went back to steam [catapults] on CVN-78. What would that do to schedules? We're in the process of getting information from industry so that we can make an informed decision and we've had independent technical looks at it within the department." They also stated that "The technology itself is not new, but it's the application in the aircraft carrier [that's new]. And so there is a lot of rigor we want to go through for component testing so that we understand the reliability of the components as well as system testing. We are in the component testing phase right now. We have seen minor issues in testing which we've been able to resolve. But there is some concurrency with the schedules [for EMALS development and CVN-78 construction] and that's one of the things we want to evaluate going forward. Is the [EMALS] development schedule still ongoing? How do we—how do we mitigate the risk to this carrier schedule so that that does (inaudible). Right now, we don't see an impact to the carrier schedule." The Navy officials testified that they were waiting to receive an estimate from Northrop Grumman Newport News on the potential cost impact of shifting to steam catapults for CVN-78. They stated that: "Right now, Mr. (continued...)

The EMALS development effort was the subject of a July 16, 2009, hearing before the Seapower and Expeditionary Forces subcommittee of the House Armed Services Committee. Materials from this hearing are presented in the **Appendix**.

Legislative Activity for FY2011

The Navy's proposed FY2011 budget was submitted to Congress on February 1, 2010. The budget requests $1,731.3 million in procurement funding for CVN-78 and $908.3 million in advance procurement funding for CVN-79.

(...continued)

Chairman, the plan is—is to go to EMALS, or to continue with Electromagnetic Aircraft Launching System. That's going to be briefed to the CNO and the acting secretary here in the next week to 10 days." (Source: Transcript of spoken testimony of Allison Stiller, Deputy Assistant Secretary of the Navy [Ship Programs], and [for the final quote] Vice Admiral Bernard McCullough, Deputy Chief of Naval Operations for Integration of Capabilities and Resources, at an April 1, 2009, hearing on Navy shipbuilding before the Defense subcommittee of the House Appropriations Committee. The comments by Stiller and McCullough came in response to questions on the EMALS issue posed by Representative John Murtha, the subcommittee chairman.)

For press reports during this period discussing the EMALS issue, see Peter Frost, "Questions Swirl About New Aircraft Catapult Systems For Next Carrier," *DailyPress.com* (Newport News, VA), March 31, 2009; Emelie Rutherford and Geoff Fein, "Navy Exploring Impact of Switching From EMALS To Steam Catapults For CVN-78," *Defense Daily*, April 2, 2009: 7-8; Rebekah Gordon, "Navy Examining Impacts of Switching to Steam Catapult on CVN-78," *Inside the Navy*, April 6, 2009; and Christopher P. Cavas, "Next-Gen Carrier Launch System Could Be Shelved," *DefenseNews.com*, April 6, 2009.

[12] A Navy spokesman stated: "This decision is based on completion of an extensive review of the EMALS program, which included consideration of many significant factors and represents a balance between cost, schedule, technical performance, and consideration of the risks to each." (Andrew Tilghman, "Navy to Press on With EMALS," *NavyTimes,com*, April 16, 2009.) Another Navy spokesman stated: "To ensure the program delivers on schedule, while limiting cost growth, the Navy is entering into detailed, fixed-price contract negotiations for procurement of production-level equipment while implementing additional risk management efforts associated with completion of development testing, production planning, installation and test." (Geoff Fein, "Navy Stands By EMALS As Aircraft Launch System For CVN-78," *Defense Daily*, April 17, 2009: 3-4.)

Appendix. July 16, 2009, Hearing on EMALS

This appendix presents materials from a July 16, 2009, hearing on the EMALS development effort before the Seapower and Expeditionary Forces subcommittee of the House Armed Services Committee.

Chairman's Opening Statement

The text of the opening statement of Representative Gene Taylor, the ranking member of the subcommittee, is as follows:

> The subcommittee will come to order.
>
> Today the subcommittee meets in open session to receive testimony from officials of the United States Navy on the current status of the Electromagnetic Aircraft Launch System, or EMALS. The EMALS system is an electromagnetic catapult designed for use on the Ford-class aircraft carriers. If the system delivers its full promised capability, the Ford-class carriers will have a catapult system which is far superior to the steam catapults of the Nimitz-class. The operational advantages are increased launch envelopes, that is, the ability to launch both heavier and lighter aircraft than steam catapaults, higher sortie rates, reduced weight, reduced mechanical complexity, reduced maintenance, and reduced carrier manning.
>
> Unfortunately, what brings us together today is that the development of this program is so far behind schedule that it threatens the delivery date for the USS Ford. For the record, I would like to briefly summarize the history of this program and the current status:
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> EMALS was a core capability in the design of the next generation aircraft carrier, which the Navy called "CVN 21" for "21th century" technology, and which eventually became the USS Ford (CVN 78) class. In 1999 the Navy entered into technology demonstration contracts with two different contractors; General Atomics and Northrop Grumman Marine Systems to develop prototypes for an electromagnetic catapult. By 2004 the Navy down-selected to the system proposed by General Atomics and entered into a System Design and Development contract, or SDD contract, to build a full scale, ship representative prototype at the Navy test facility in Lakehurst, New Jersey. That prototype was contracted to be completed in time for testing to begin in 2007, testing was to have concluded after two years and presumably the lessons learned from the test program would influence the final production system which would be shipped to the carrier construction yard for erection into the ship. It is now July 2009 and full scale testing has yet to begin at the Lakehurst facility. The Navy is now faced with almost complete concurrency of testing and production of the first ship-set if they are to meet the in-yard deliver dates to keep the USS Ford on schedule. There are a number of sub-systems to the complete EMALS system and each subsystem has different in-yard deliver dates, but some of those dates are as early as the summer of 2011, and to meet those dates the production of the components or at least the ordering of the material for the components must begin now—before full scale testing of the prototype system has begun. To be fair, some testing has already occurred. The High Cycle Test for the Energy Storage System is well underway, as is the Highly Accelerated Life Cycle Testing of the launch motor segments. Those tests have identified some minor redesign issues which can be incorporated into the production components. But until a full scale catapult launch from the prototype occurs, questions will remain on the systems overall performance.
>
> I have been briefed, as I believe other Members of this subcommittee have been briefed, that the issues in completing and delivering the SDD components were a result of the contractor's

inexperience managing a major production effort. I find that answer unsettling because it is the Navy's responsibility to oversee what their contractors are doing and to identify problems before they are problems. I will note that a little over a year and a half ago, the contractor did put in place an entirely new management and engineering team, hiring away proven production engineers from both General Dynamics and Northrop Grumman. This new team seems to have righted the ship, but that ship is still in very dangerous seas.

So what we have is a program that is so essential to the carrier that if it does not work, the nation has paid billions of dollars for an unusable ship. If the system is delayed, the carrier is automatically delayed. And every day of delay will push the cost of that carrier higher.

This is the first in what I intend to be a series of hearings on this program over the next few years. This is too important to not have close congressional oversight. I intend to continue close oversight of this program until it is delivered, installed, tested, and certified for launching naval aircraft off the deck of the USS Ford.

Our witnesses today are:

- VADM David Architzel, Principle Deputy to Assistant Secretary Stackley
- CAPT Randy Mahr, Program Manager for EMALS
- CAPT Brian Antonio, Program Manager, Ford Class Aircraft Carrier

VADM Architzel is representing the Assistant Secretary as the senior acquisition executive who is ultimately responsible for all Navy and Marine Corps acquisition programs. CAPT Mahr, is the official whose only responsibility is this program. CAPT Antonio is responsible for building the entire carrier—he obviously has an interest in the success of EMALS.

This year's National Defense Authorization Act directs the Secretary of the Navy to keep CAPT Mahr in his position until the completion of the system development testing and the successful production of the first ship-set of components. That means the CAPT, who has been selected to the rank of Rear Admiral, will be in place for another few years and will have the opportunity to visit with us again on this subject.

I would now like to call on my friend from Missouri, the Ranking Member of this subcommittee, the Honorable Todd Akin for any opening remarks he may wish to make.

Ranking Member's Opening Statement

The text of the opening statement of Representative Todd Akin, the ranking member of the subcommittee, is as follows:

Thank you, Mr. Chairman, and welcome to our witnesses. We appreciate your willingness to appear before us today. As the Chairman has indicated, the Electromagnetic Launch System, known as EMALS, is a critical part of the military's largest and most expensive ship, the next generation aircraft carrier. The EMALS system is important because of the capability it delivers to the Gerald R. Ford-class carrier, allowing our Navy to increase its sortie generation rate and the carrier to launch both heavier and lighter aircraft, in more operating conditions, than is currently possible. This is a significant attribute, because the first of these carriers will be in service until at least 2065, and in order to maintain its relevance, the carrier will need to be able to launch F-35s, UAVs, and whatever else we may develop in the meantime.

Additionally, EMALS is important because the schedule delays and cost growth experienced by the system have put the construction and cost of the carrier in jeopardy. As this subcommittee has noted on multiple occasions, the scale of our investment in aircraft carrier construction means that even small increases in cost have the potential to break the bank. Other shipbuilding programs have recently seen cost growth of close to 200 percent. If the carrier grows by even 10 percent, the impact is in the billions of dollars per vessel. Simply put, the EMALS program has no room for error. It must deliver on time, or put the carrier at risk. To get there, the EMALS program must engage in con-current development and production of the first ship set—a practice we know well from past experience is highly risky.

But there is some good news. The contractor has been holding to schedule since the beginning of the year and has agreed to a fixed price production contract. The Assistant Secretary of the Navy for Research, Development, and Acquisition got personally involved and conducted an in-depth review of the program. Secretary Stackley has elected to proceed with the effort, a decision that I agree with, but has taken several steps to strengthen the management of the program. One of these steps includes lengthening the tour of the current program manager, CAPT Mahr, who is with us today. I have often noted that one of the first lessons I learned during my time at IBM, is that for any project to succeed, you need to have one person who is in charge. CAPT Mahr, this subcommittee has heard many good things about you, and your colleague CAPT Brian Antonio, the CVN 21 Program Manager. But we will be holding you to a very high standard. This is your baby and you must deliver. The consequences for the rest of naval shipbuilding are too great to tolerate anything less.

In conclusion, I am interested in learning more today about the contract you are putting in place with the EMALS contractor for the production ship set, and the activities required to conclude system development and minimize risk to the CVN 21 program going forward. Thank you again for being here. I look forward to your testimony.

Navy Statement

Chairman Taylor, Ranking Member Akin, and distinguished members of the Subcommittee, thank you for the opportunity to appear before you today to report on the development of the Electromagnetic Aircraft Launch System (EMALS) for Gerald R. Ford (CVN 78) class aircraft carriers and the Department's plan ahead for this effort.

Steam catapults will continue to deliver the minimum required aircraft launching capability and remain the launching system on the NIMITZ-class aircraft carrier for the next fifty years. However, the steam catapult system limits the full potential of the inherent improved capability of the FORD-class aircraft carrier. As modern aircraft, including the Joint Strike Fighter, grow heavier and require higher launching end speeds, and the maintenance man-hours required to maintain the readiness of the steam catapult increases, it is imperative that the Navy continue development of a launching system with reduced manning and increased operational availability. In response to meeting this future need, EMALS is being developed for the CVN 78 class to replace the steam catapult system. EMALS design requirements support the CVN 78 sortie generation rate Key Performance Parameter (KPP) through increased reliability and system capability. It provides a higher energy launch capability as well as an expanded launch envelope to support future airwing capabilities. EMALS is also projected to reduce shipboard manning requirements, improve aircraft launching system maintainability, and provide better control and more efficient application of acceleration forces throughout the aircraft launch cycle.

EMALS development began with a competitive prototyping effort between General Atomics (GA) and Northrop Grumman Marine Systems in 1999. The Navy down-selected to the GA

design in 2004 following completion of approximately 1500 launch demonstration events conducted on both competing systems. Based on the successful prototype testing, the Navy awarded the EMALS System Development and Demonstration (SDD) contract to GA in 2005, which is scheduled to complete in early 2012.

The EMALS program is currently executing the test portions of the SDD phase and procuring long lead time material as it begins production of the CVN 78 ship set. Near term events such as successful completion of High Cycle Test (HCT) Phase I and commencement of High Cycle Test (HCT) Phase II, Highly Accelerated Life Testing (HALT), as well as start of commissioning testing for System Functional Demonstration (SFD), will validate the system design and enable transition into production. HCT II testing of a complete power train, with the exception of the launch motor, is ongoing at the GA Tupelo, Mississippi site. HALT testing of the launch motor is taking place at the Naval Air Warfare Center test site in Lakehurst, NJ. Production Readiness Reviews (PRRs) are currently ongoing to support release of EMALS subsystem components for production. Baseline drawing packages are projected to complete by the end of FY 2009. Full scale, full length testing of EMALS, including the launch of manned aircraft, is scheduled to begin at Lakehurst during the summer of 2010.

Concurrent with testing, EMALS manufacturing and production efforts began in December 2007 with the first Long Lead Time material procurements to support CVN 78 required in yard delivery dates and will continue through 2014 for delivery of all CVN 78 ship set components. The Navy has placed an undefinitized contract action (UCA) with a not to exceed value with General Atomics leading to an Advanced Acquisition Fixed Price contract for the remaining ship set material. Definitization of this contract is targeted for later this year. The Navy's and GA's support for a fixed price contract reflects our collective confidence in the EMALS' technology maturity and capability. The contract will be based on the EMALS performance specification and Procurement Data Packages. Specific component production release will be tied to Production Readiness Reviews and successful completion of specific test events. The Production Integrated Master Schedule shows the program will meet CVN 78 production required in yard delivery dates.

As EMALS progressed through SDD tests and began the transition to production, schedule delays and cost overruns were experienced. A series of actions aimed at improving management of the EMALS prime and subcontractors were taken by the Navy. In late 2007, Navy leadership initiated a three-month independent and in-depth Production Assessment Review (PAR). The PAR provided specific recommendations for processes and leadership improvements, which are being implemented. Most recently, senior Navy leadership conducted a detailed assessment of the viability of continuing with EMALS or reverting to a legacy steam catapult system for CVN 78 based on indications that schedule and cost performance was declining. After an extensive review, the Navy re-confirmed it's commitment to EMALS as the CVN 78-class aircraft launching system, while implementing additional actions to improve performance and mitigate risk.

The production contract will ensure rigorous management and oversight. In April 2004, the Under Secretary of Defense (Acquisition, Technology and Logistics) (USD(AT&L)) established a critical technology Integrated Product Team (IPT) to maintain oversight of all CVN 78 critical technologies, including EMALS development. Additionally, the Navy has implemented two detailed reviews to identify needed improvements to support better schedule and cost performance while completing technical efforts. The review of the PAR in 2008 provided a thorough assessment of GA's ability to transition from development to production and to support the CVN 78 production schedule. The Navy aggressively implemented many of the PAR recommendations including leadership changes, new program and technical governance processes, increased involvement of the shipbuilder and a revised test program to mitigate production schedule risks. A three-star Executive

Committee, which includes the OPNAV resource sponsor, Commanders of the Naval Sea Systems Command and Naval Air Systems Command, and the Principal Military Deputy for ASN RDA meet quarterly for program reviews and to provide oversight of EMALS development. Most importantly, direct responsibility for EMALS is being executed by the NAVAIR program manager for Aircraft Launch & Recovery Equipment (ALRE), who reports to PEO TACAIR and COMNAVAIR to support delivery of this new program within cost and schedule.

Issues with cost and schedule performance have created overlaps between production component manufacturing and system level testing. Cost and schedule performance have not been where they need to be. Recognizing this, the Navy has taken steps to better define needed testing, improved management oversight, insisted on near term definitization of the DCA into a fixed price contract, and increased funding to the program to cover anticipated growth. With system level testing ongoing the potential for additional cost increases and schedule delays remain. However, the Navy is putting additional oversight in place to maximize performance and minimize the likelihood of overruns. Given the advantages that EMALS is projected to afford the next generation of aircraft carriers, these actions are essential for providing the fleet what it needs.

Component, subsystem, and system testing is identifying technical issues, retiring technical risk, and demonstrating the capability of the EMALS. Key to the Navy's strategy is having a management team in place both within the Navy and at its prime contractor that is aggressively attacking these issues and retiring risks on a schedule that supports ship construction. We are working hard towards these ends. The management focus, review processes and oversight that the Navy is employing are mitigating future EMALS SDD phase technical, cost and schedule risks. The Navy will leverage management processes established during the SDD phase by building upon these lessons learned during system production and ship integration, including the extensive involvement of the shipbuilder in the production and integration process. A rigorous process exists for incorporating the results of upcoming testing in the production baseline which will mitigate cost and schedule risks of concurrency between the SDD and production phases. The Navy has also taken steps to include, as mentioned previously, the use of fixed price contracting where appropriate, to control EMALS cost and schedule variances during the subsystem production phase.

Mr. Chairman, the Navy understands the concerns you and your subcommittee have expressed, and is aggressively working to improve performance. We are implementing your recommendations to breakout EMALS cost and performance data for separate review by Congress, and to provide stability in the program's key technical and management teams. The Department is committed to delivering CVN 78 with EMALS on time and on budget. EMALS will enable current and future generations of Naval Aviators to perform their missions more safely, efficiently and effectively. I thank you for the opportunity to testify and look forward to answering your questions.[13]

[13] Statement of Vice Admiral David Architzel, USN, Principal Military Deputy, Research, Development and Acquisition, and Captain Randy Mahr, USN, Program Manager for Aircraft Launching and Recovery Equipment (ALRE) and Captain Brian Antonio, USN, Program Manager for Future Aircraft Carrier, Before the Seapower and Expeditionary Warfare [sic: Forces] Subcommittee of the House Armed Services Committee [Hearing] On Electromagnetic Aircraft Launch System (EMALS}, July 16, 2009, 43 pp.

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