Navy LPD-17 Amphibious Ship Procurement: Background, Issues, and Options for Congress

Ronald O'Rourke
Specialist in Naval Affairs

June 23, 2011

Congressional Research Service
7-5700
www.crs.gov
RL34476

CRS Report for Congress
Prepared for Members and Committees of Congress
c11173008

Summary

The Navy's proposed FY2012 budget requests funding for the procurement of an 11th San Antonio (LPD-17) class amphibious ship. The Navy intends this ship to be the final ship in the class. The ship has received $184.0 million in prior-year advance procurement (AP) funding, and the Navy's proposed FY2012 budget requests the remaining $1,847.4 million needed to complete the ship's estimated procurement cost of $2,031.4 million.

The Navy plans to begin procuring a new class of amphibious ship called the LSD(X) in FY2017. Some observers have suggested using the LPD-17 design as the basis for the LSD(X). Navy officials do not stress this option and instead appear more interested in developing an all-new design for the LSD(X). If a decision were made to use the LPD-17 design as the basis for the LSD(X), then procuring a 12th LPD-17 in FY2014 or FY2015 would help keep the LPD-17 production line open until the procurement of the first LSD(X) in FY2017, which in turn might help reduce LSD(X) production costs.

Issues for Congress include whether to approve, reject, or modify the Navy's proposed funding request for the 11th LPD-17, whether to encourage or direct the Navy to use the LPD-17 design as the basis for the design of the LSD(X), and—particularly if the LPD-17 design is used as the basis for the LSD(X)—whether to fund the procurement of a 12th LPD-17 in FY2014 or FY2015.

Contents

Figures

Tables

Appendixes

Contacts

Introduction

This report provides background information and issues for Congress on the San Antonio (LPD-17) class amphibious ship program. The Navy's proposed FY2012 budget requests funding for the procurement of an 11th San Antonio (LPD-17) class amphibious ship. The Navy intends this ship to be the final ship in the class.

Issues for Congress include whether to approve, reject, or modify the Navy's proposed funding request for the 11th LPD-17, whether to encourage or direct the Navy to use the LPD-17 design as the basis for the design of the LSD(X) class of amphibious ships that the Navy wants to begin procuring in FY2017, and—particularly if the LPD-17 design is used as the basis for the LSD(X)—whether to fund the procurement of a 12th LPD-17 in FY2014 or FY2015. Congress's decisions on these issues will affect, among other things, Navy and Marine Corps funding requirements and capabilities, and the shipbuilding industrial base.

Background

Amphibious Ships in General[1]

Roles and Missions of Amphibious Ships

The primary function of Navy amphibious ships is to lift (i.e., transport) U.S. Marines and their equipment and supplies to distant operating areas, and enable Marines to conduct expeditionary operations ashore in those areas. Although amphibious ships are designed to support Marine landings against opposing military forces, they are also used for operations in permissive or benign situations where there are no opposing forces. Due to their large storage spaces and their ability to use helicopters and landing craft to transfer people, equipment, and supplies from ship to shore without need for port facilities,[2] amphibious ships are potentially useful for a range of non-combat and combat operations.[3]

[1] Navy amphibious ships can be divided into two main groups—the so-called "big-deck" amphibious assault ships, designated LHA and LHD, which look like medium-sized aircraft carriers, and the smaller (but still sizeable) amphibious ships designated LSD or LPD, which are sometimes called "small-deck" amphibious ships.

U.S. Navy amphibious ships have designations starting with the letter L, as in amphibious *l*anding. LHA can be translated as landing ship, helicopter-capable, assault. LHD can be translated as landing ship, helicopter-capable, well deck. LSD can be translated as landing ship, well deck. LPD can be translated as landing ship, helicopter platform, well deck. Whether noted in the designation or not, all these ships have well decks.

The LHAs and LHDs have large flight decks and hangar decks for embarking and operating numerous helicopters and VTOL fixed-wing aircraft, while the LSDs and LPDs have much smaller flight decks and hangar decks for embarking and operating smaller numbers of helicopters. The LHAs and LHDs, as bigger ships, in general can individually embark more Marines and equipment than the LSDs and LPDs.

[2] Amphibious ships have berthing spaces for Marines; storage space for their wheeled vehicles, their other combat equipment, and their supplies; flight decks and hangar decks for their helicopters and vertical take-off and landing (VTOL) fixed-wing aircraft; and well decks for storing and launching their landing craft. (A well deck is a large, garage-like space in the stern of the ship. It can be flooded with water so that landing craft can leave or return to the ship. Access to the well deck is protected by a large stern gate that is somewhat like a garage door.)

[3] Amphibious ships and their embarked Marine forces can be used for launching and conducting humanitarian-assistance and disaster-response (HA/DR) operations; peacetime engagement and partnership-building activities, such (continued...)

On any given day, some of the Navy's amphibious ships, like some of the Navy's other ships, are forward-deployed to various overseas operating areas. Forward-deployed U.S. Navy amphibious ships are often organized into three-ship formations called amphibious ready groups (ARGs).[4] On average, two or perhaps three ARGs might be forward-deployed at any given time. Amphibious ships are also sometimes forward-deployed on an individual basis to certain lower-threat operating areas, particularly for conducting peacetime engagement activities with foreign countries or for responding to smaller-scale contingencies.

Amphibious Lift Goal

Although the Navy's planned 313-ship fleet, first presented to Congress in February 2006, called for a 31-ship amphibious force that includes 10 LPD-17s, Navy and Marine Corps officials subsequently agreed that a 33-ship amphibious force that includes 11 LPD-17s would be needed to minimally meet the Marine Corps' goal of having an amphibious ship force with enough combined capacity to lift the assault echelons (AEs) of two Marine Expeditionary Brigades (MEBs). A 33-ship force would include 15 amphibious ships for each MEB, plus three additional ships to account for 10% to 15% of the amphibious ship force being in overhaul at any given time.

Marine Corps and Navy officials also agree that a 38-ship amphibious force would more fully meet the Marine Corps' 2.0 MEB AE amphibious lift requirement. Such a force would include 17 amphibious ships for each MEB, plus four additional ships to account for 10% to 15% of the amphibious ship force being in overhaul at any given time. Although a 38-ship force would more fully meet the Marine Corps' lift requirement, the Navy and Marine Corps have agreed to accept the operational risks associated with having a 33-ship force rather than a 38-ship force.

For further discussion of the amphibious lift goal, see **Appendix A**.

(...continued)

as exercises; other nation-building operations, such as reconstruction operations; operations to train, advise, and assist foreign military forces; peace-enforcement operations; non-combatant evacuation operations (NEOs); maritime-security operations, such as anti-piracy operations; smaller-scale strike and counter-terrorism operations; and larger-scale ground combat operations. Amphibious ships and their embarked Marine forces can also be used for maintaining forward-deployed naval presence for purposes of deterrence, reassurance, and maintaining regional stability.

Although the Marines have not conducted a large-scale amphibious assault against opposing military forces since the Korean War, Marine Corps officials state that there have been about 85 U.S. amphibious operations of other kinds between 1990 and April 2008. (Source for the figure of about 85 amphibious operations between 1990 and April 2008: Marine Corps briefing to CRS on April 25, 2008.) In addition, presenting the potential for conducting an amphibious landing can generate tactical benefits, even if the landing is not carried out. During the 1991 Persian Gulf War, for example, the potential for conducting an amphibious landing by a force of about 17,000 Marines embarked on amphibious ships in the Persian Gulf tied down several Iraqi divisions in coastal-defense positions. Those Iraqi divisions' positions were not available for use against U.S.-coalition ground forces moving north from Saudi Arabia. (See CRS Report 91-421, *Persian Gulf War: Defense Policy Implications for Congress*, coordinated by Ronald O'Rourke, p. 41. [May 15, 1991; out of print and available directly from the report coordinator.])

[4] An ARG notionally includes three amphibious ships—one LHA or LHD, one LSD, and one LPD. These three amphibious ships, which are referred to as an amphibious ready group (ARG), together can embark a Marine expeditionary unit (MEU) consisting of about 2,200 Marines, their aircraft, their landing craft, their combat equipment, and about 15 days worth of supplies. ARGs can operate in conjunction with carrier strike groups (CSGs) to form larger naval task forces.

Current and Projected Force of Amphibious Ships

As of the end of FY2010, the Navy's amphibious force included the following 31 ships:

- **8 Wasp (LHD-1) class ships**, each displacing about 40,500 tons;
- **2 Tarawa (LHA-1) class ships**, each displacing about 40,000 tons;
- **5 San Antonio (LPD-17) class ships**, each displacing about 26,000 tons;
- **4 Austin (LPD-4) class ships**, each displacing about 17,000 tons; and
- **12 Whidbey Island/Harpers Ferry (LSD-41/49) class ships**, each displacing about 16,000 tons.

Table 1 shows the projected total number of amphibious ships under the Navy's 30-year (FY2011-FY2040) shipbuilding plan.

Table 1. Projected Number of Amphibious Ships, FY2012-FY2041

Under Navy's 30-year (FY2012-FY2041) shipbuilding plan

FY	Number of ships	FY	Number of ships	FY	Number of ships
2012	30	2022	34	2032	32
2013	30	2023	36	2033	32
2014	30	2024	36	2034	33
2015	30	2025	36	2035	31
2016	31	2026	36	2036	30
2017	33	2027	36	2037	30
2018	33	2028	36	2038	29
2019	33	2029	35	2039	30
2020	33	2030	33	2040	30
2021	34	2031	34	2041	30

Source: Navy FY2012 30-year (FY2012-FY2041) shipbuilding plan, provided by Navy to CRS and the Congressional Budget office (CBO) on May 24, 2011.

LPD-17 Program

Program Origin

The Navy initiated the LPD-17 program in the 1990s to provide replacement ships for the Navy's aging Austin (LPD-4) class amphibious ships, which entered service between 1965 and 1971, and three other, older classes of amphibious ships that have already been removed from Navy service.

Figure 1. LPD-17 Class Amphibious Ship

Source: Navy file photo accessed at http://www.navy.mil/management/photodb/photos/050429-O-0000X-001.jpg on April 20, 2011.

Construction Shipyards

LPD-17s have been built primarily by the Avondale shipyard near New Orleans, LA, and the Ingalls shipyard near Pascagoula, MS, that form part of Huntington Ingalls Industries (HII).[5] HII was previously owned by Northrop Grumman, during which time it was called Northrop Grumman Shipbuilding (NGSB).

Procurement History

As shown in **Table 2**, the first LPD-17 was procured in FY1996, and a total of 10 have been procured through FY2011. As of the end of FY2010, the first five had entered service.

[5] Portions of LPD-17s are built at a fabrication facility at Gulfport, MS, that is also owned by Northrop. Northrop subcontracted portions of some early LPD-17s to a shipyard in Texas operated by Signal International (http://www.signalint.com), and more recently has subcontracted portions of LPD-24 (i.e., the eighth LPD-17) to General Dynamics' Bath Iron Works shipyard of Bath, ME. Parts of LPD-24 are also being built at Newport News Shipbuilding, of Newport News, VA, another yard currently owned by Northrop. (See Peter Frost, "Labor Market, Schedule Forces Outsourcing of Work," *Newport News Daily Press*, April 1, 2008; Holbrook Mohr, "Northrop Gets LPD Help From General Dynamics," *NavyTimes.com*, April 1, 2008; and Geoff Fein, "Northrop Grumman Awards Bath Iron Works Construction Work On LPD-24," *Defense Daily*, April 2, 2008.)

Table 2. LPD-17 Procurement, FY1996-FY2011

96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11
1	0	0	1	2	0	0	1	1	1	1	0	1	1	0	0

Cost Growth, Schedule Delays, and Construction Problems

The LPD-17 program has experienced considerable cost growth, schedule delays, and construction problems, particularly on the earlier ships in the program. The first ship in the program experienced cost growth of about 70%, and later ships in the program were substantially more expensive to build than originally estimated. The design and construction of the first ship were delayed by about two years. Delays in building the first ships were a primary reason for the FY2001-FY2002 hiatus in LPD-17 procurement shown in **Table 2**. The first and second ships were delivered to the Navy in incomplete form, and numerous construction problems were identified on the first two ships. There have been recurrent reports of construction problems on in-service LPD-17s. The Navy has been working to overcome these problems and is reporting success in these efforts. For additional details, see **Appendix B** and **Appendix C**.

Option of Using LPD-17 Design as Basis for LSD(X)

The Navy plans to begin procuring a new class of amphibious ship called the LSD(X) in FY2017. LSD(X)s are to replace the Navy's 12 aging Whidbey Island/Harpers Ferry (LSD-41/49) class amphibious ships. Some observers have suggested using the LPD-17 design as the basis for the LSD(X). Navy officials do not stress this option and instead appear more interested in developing an all-new design for the LSD(X). If a decision were made to use the LPD-17 design as the basis for the LSD(X), then procuring a 12th LPD-17 in FY2014 or FY2015 would help keep the LPD-17 production line open until the procurement of the first LSD(X) in FY2017, which in turn might help reduce LSD(X) production costs.

FY2012 Funding Request

The Navy's proposed FY2012 budget requests funding for the procurement of an 11th San Antonio (LPD-17) class amphibious ship. The Navy intends this ship to be the final ship in the class. The ship has received $184.0 million in prior-year advance procurement (AP) funding, and the Navy's proposed FY2012 budget requests the remaining $1,847.4 million needed to complete the ship's estimated procurement cost of $2,031.4 million.

Issues for Congress

Issues for Congress include

- whether to approve, reject, or modify the Navy's proposed funding request for the 11th LPD-17;
- whether to encourage or direct the Navy to use the LPD-17 design as the basis for the design of the LSD(X); and
- whether to fund the procurement of a 12th LPD-17 in FY2014 or FY2015, particularly if the LPD-17 design is used as the basis for the LSD(X).

Supporters of using the LPD-17 design as the basis for the LSD(X) could argue that doing so could substantially reduce LSD(X) design costs by avoiding the need for creating an all-new design for the LSD(X), and help constrain LSD(X) production costs and risks by taking advantage of the LPD-17 production learning curve, particularly if a 12th LPD-17 were procured in FY2014 or FY2015 so as to keep the LPD-17 production line open until the scheduled start of LSD(X) production in FY2017. An amphibious force with 12 LPD-17s and 10 LSD(X)s, they could argue, would be able to meet the 2.0 MEB (AE) amphibious lift goal as well as would an amphibious force with 11 LPD-17s and 11 LSD(X)s. An LSD(X) based on the LPD-17 design, they could argue, could have its features optimized so that a force with 12 LPD-17s and 10 LSD(X)s would meet the goal. The production-cost and production-risk advantages of taking advantage of the existing LPD-17 production learning curve, they could argue, outweigh the potential cost-reduction advantages of staging a competition between shipyards for the right to build LSD(X)s.

Skeptics of using the LPD-17 design as the basis for the LSD(X) could argue that it is too early to know whether an LPD-17-based LSD(X) would be a good approach, because operational requirements for the LSD(X) have not yet been determined. They could argue that an LPD-17-based LSD(X) could be bigger and more expensive to procure and operate than what the Navy needs, and that while a brand-new LSD(X) design would likely have higher design costs than an LPD-17-based design, an all-new LSD(X) design might be smaller and less expensive to procure and operate than an LPD-17-based design, eventually offsetting its higher initial design cost. They could argue that an all-new LSD(X) design could more comprehensively incorporate newer technologies, including technologies for reducing crew size, than could an LPD-17 based design. They could also argue that competition is an important mechanism for restraining shipbuilding costs, and that it would be easier for the Navy to stage an effective competition between shipbuilders for the right to build an all-new LSD(X) design than an LPD-17-based design, because no shipbuilder would have a significant cost advantage going into the bidding for an all-new LSD(X) design by virtue of having previously built LPD-17s.

At a May 6, 2010, hearing on Navy shipbuilding programs before the Seapower subcommittee of the Senate Armed Services Committee, the following exchange occurred between Senator Kay Hagan and Sean Stackley, the Navy's acquisition executive (i.e., the Assistant Secretary of the Navy [Research, Development and Acquisition]):

> SENATOR HAGAN:
>
> The 2011-2015 shipbuilding plan calls for procuring the 11th and the final of the San Antonio class landing platform dock amphibious ship in 2012.
>
> In 2017, the 30-year shipbuilding plan calls for the start of procurement of a replacement for aging landing ship dock amphibious ships.
>
> Secretary Stackley, or all of you, can the LPD 17 design be used for the basis of the LSD replacement? And would the procurement of a 12th LPD 17 in 2014 or 2015 support keeping the production line open while transitioning to the start of the LSD replacement?
>
> STACKLEY:
>
> Yes, ma'am. Let me—let me start that. In general terms, the Navy would look for reuse of design and common hull forms to improve affordability of any new program.

> The timing for the LSD(X), I mentioned in my opening remarks is ahead of need.[6] The LSD 41 and 49 class do not exit the service until the mid-2020s. We look at concerns with the industrial base, so we have pulled that replacement program as early as we can without pushing some other requirement out that's, frankly, more urgent on a schedule basis.
>
> So we have the LSD(X) just outside of the FYDP. And this year and next year we are going through the definition of the requirements to determine exactly what is the lift fingerprint that the replacement ship has to provide, and does that, in fact, line up with an LPD 17 hull form?
>
> If it turns out that the LPD 17 is more capability than what the LSD(X) is, then we have to do the affordability and trades review to balance off what's the cost of a new start versus the cost of re-use. And affordability and capability requirements and schedules are all going to be brought to the table in that—in that review and, frankly, that debate.[7]

Legislative Activity For FY2012

FY2012 Funding Request

The Navy's proposed FY2012 budget requests funding for the procurement of an 11th San Antonio (LPD-17) class amphibious ship. The Navy intends this ship to be the final ship in the class. The ship has received $184.0 million in prior-year advance procurement (AP) funding, and the Navy's proposed FY2012 budget requests the remaining $1,847.4 million needed to complete the ship's estimated procurement cost of $2,031.4 million.

FY2012 National Defense Authorization Bill (H.R. 1540)

House

The House Armed Services Committee, in its report (H.Rept. 112-78 of May 17, 2011) on H.R. 1540, recommends approval of the Navy's request for FY2012 procurement funding for the LPD-17 program (page 346). The report states:

> The committee received testimony that the Marine Corps' requirement for amphibious ships is 38 ships, but that the number of ships that are absolutely necessary with acceptable risk is 33. The committee encourages the Secretary of the Navy to continue pursuing a minimum of 33 amphibious ships. (Page 34)

[6] Stackley here is stating that, given the ages of the LSD-41/49 class ships, the currently scheduled procurement date of FY2017 for the first LSD(X) is years earlier than what would be nominally be needed to provide a timely replacement for the first of the retiring LSD-41/49 class ships.

[7] Source: Transcript of hearing.

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 reducing by $14 million the Navy's FY2012 request for procurement funding for the LPD-17 program, with the reduction being for "Excess ECO funding." (Pages 153-154) ECO may be a reference to engineering change orders.

Appendix A. Additional Information on Amphibious Lift Goal

This appendix presents additional background information on the amphibious lift goal.[8]

Expressed in Terms of MEBs

The Marine Corps' goal for amphibious lift is to have a force of amphibious ships with enough combined lift capacity to simultaneously land the assault echelons (AEs) of two Marine Expeditionary Brigades (MEBs), or 2.0 MEB AEs for short. This goal, Marine Corps officials state, reflects responsibilities assigned to Marine Corps forces in U.S. regional war plans.

A MEB is a Marine air-ground task force (MAGTF) of 14,484 Marines and their equipment and supplies. The AE of a MEB is the initial part of the MEB to go ashore. The remaining part that goes ashore later is called the assault follow-on echelon (AFOE). Marine Corps doctrine calls for the AE to go ashore from amphibious ships, and for the AFOE to go ashore from less-survivable sealift (i.e., cargo-type) ships controlled by the Military Sealift Command (MSC). The AE of a MEB includes 10,055 of the MEB's Marines, plus equipment and supplies for these 10,055 Marines.

The amphibious lift goal as approved by the Secretary of Defense has changed numerous times since the Korean War, reflecting changes in strategic or budgetary circumstances. One such change occurred in 1991, as the Cold War was ending.[9] The most recent change occurred in 2006, when the goal was reduced from 2.5 MEB AEs to 2.0 MEB AEs. **Table A-1** shows amphibious lift goals since 1980.

Table A-1. Amphibious Lift Goals Since 1980

Year	Goal	Troops[a]
1980	1.15 MEFs[b]	66,252
1981	1 MEF AE + 1 MEB	53,240
1982	1 MEF AE + 1 MEB AE	46,810
1991	2.5 MEB AEs	33,793
2006	2.0 MEB AEs	23,016

Sources: For list of amphibious lift goals prior to 2006: Matthew T. Robinson, *Integrated Amphibious Operations Update Study, (DoN Liftt 2+)—A Short History of the Amphibious Lift Requirement*, Center for Naval Analyses, Alexandria (VA), CRM D0005882.A3/Final, July 2002, p. 2 (Table 2). For troop levels associated with each lift goal: Marine Corps data provided to CRS on May 2, 2008.

a. Troop totals shown include a Navy Support Element (NSE) consisting of Navy units that help to move the Marines' equipment and supplies from ship to shore. In the case of the 2006 goal for 2.0 MEB AEs, the total of 23,016 troops includes an NSE of 2,906 Navy personnel.

[8] Unless otherwise noted, information in this section is based on a briefing from Marine Corps officials to CRS on April 25, 2008, and on Marine Corps point papers provided to CRS in association with this briefing.

[9] Key events marking the end of the Cold War include fall of the Berlin Wall in November 1989 and the disintegration of the Soviet Union in December 1991.

b. MEF stands for Marine Expeditionary Force—a Marine air-ground task force with more than twice as many troops as a MEB.

In discussions of the current 2.0 MEB AE amphibious lift goal, the "AE" part is often dropped for convenience, even though the current requirement still relates to MEB AEs rather than complete MEBs.

Marine Corps officials state that the 2006 reduction in the amphibious lift goal to 2.0 MEB AEs is acceptable because the Navy and Marine Corps also plan to field a new squadron of 14 next-generation maritime prepositioning force ships called the Maritime Prepositioning Force of the Future, or MPF(F). The planned 14-ship MPF(F) squadron, which is to include three modified LHA/LHD-type ships and 11 sealift (i.e., cargo-transport) ships, is to have a capability for putting an additional MEB ashore. Unlike the amphibious ship force, the MPF(F) squadron is not intended as assault shipping—the sealift ships in the MPF(F) squadron have less survivability and self-defense capability than the Navy's amphibious ships, and are therefore considered unsuitable for use in forcible-entry operations. MPF(F) ships, however, are in general less expensive to procure than amphibious ships, and they are designed to remain prepositioned at sea in a theater of interest for long periods of time before returning the port for maintenance. Together, the Navy's amphibious ship force and the MPF(F) squadron are to provide a total of 3.0 MEB AEs of lift, or 30,165 troops.

Translated into Numbers of Amphibious Ships

The Marine Corps states the 2.0 MEB AE amphibious lift goal translates into a requirement for a force of 33 amphibious ships, including

- 11 LHAs/LHDs,
- 11 LSD-41/49 class ships, and
- 11 LPD-17s.

In explaining how the requirement for 2.0 MEB AEs translates into this 33-ship requirement, the Marine Corps states the following:

- Given the lift capabilities of the Navy's current amphibious ships, each MEB AE would require 19 operational amphibious ships to lift: 6 LHAs/LHDs, 7 LSD-41/49s, and 6 LPD-17s.
- To arrive at a more fiscally constrained goal, the Marine Corps reduced the above 19-ship total to 17 operational ships: 5 LHAs/LHDs, 7 LSD-41/49s, and 5 LPD-17s. This 17-ship force requires about 11% of the MEB AE's vehicles to be shifted to the AFOE, which creates a degree of operational risk. This 17-ship force was presented to Navy officials in mid-2007.
- To arrive at a still-more fiscally constrained goal, Navy and Marine Corps officials in mid-2007 agreed to reduce the 17-ship total to 15 operational ships—5 of each kind. This 15-ship force requires about 20% of the MEB AE's vehicles and about 12% of its cargo to be shifted to the AFOE, which creates an additional degree of operational risk.

The Marine Corps testified in April 2008 that:

> Each MEB AE requires seventeen amphibious warfare ships.... However, given current fiscal constraints, *the Navy and Marine Corps have agreed to assume a degree of operational risk by limiting the assault echelon of each MEB by using only fifteen ships per MEB....* [10]

Table A-2 shows the five elements of the amphibious lift footprint, and how limiting each MEB AE to 17 or 15 operational ships results in some of the MEB AE's vehicles and cargo being shifted to the AFOE.

Table A-2. MEB AE Lift Elements

	Operational ships per MEB AE			% of lift element shifted to AFOE	
Lift element	19 ships (full MEB AE)	17 ships (somewhat fiscally constrained)	15 ships (more fiscally constrained)	with 17 ships per MEB AE	with 15 ships per MEB AE
Troop berthing	10,055	10,055	10,055	—	—
Vehicle storage space (square feet)	352,340	312,601	281,694	11.3%	20.1%
Cargo storage (cubic feet)	553,009	553,009	486,638	—	12.0%
VTOL aircraft operating spots	254	254	254	—	—
LCAC operating spots	24	24	24	—	—

Source: Table prepared by CRS based on Marine Corps data provided by telephone to CRS on April 29, 2008.

Notes: VTOL means vertical takeoff and landing. LCAC means air-cushioned landing craft.

Using 15 operational ships per MEB AE, providing lift for 2.0 MEB AEs would require 30 operational ships: 10 LHAs/LHDs, 10 LSD-41/49s, and 10 LPD-17s. The Marine Corps states that, in light of ship maintenance requirements, maintaining a force of 30 operational ships (i.e., ships not in maintenance) would require having an additional 15% in total inventory, meaning a total of 34.5 ships (11.5 of each kind) for 2.0 MEB AEs. The figure of 34.5 ships, the Marine Corps states, was then rounded down to 33 ships (11 of each kind).[11]

Table A-3 shows the total number of amphibious ships that the Marine Corps states would be needed to lift 2.0 MEBs (the current goal), 2.5 MEBs (the goal from 1991 to 2006), and 3.0 MEBs (the broader current goal currently being met through a combination of amphibious and MPF[F] ships), using 15, 17, or 19 operational ships per MEB AE, and including an additional

[10] Statement of Lieutenant General James F. Amos, Deputy Commandant of the marine Corps (Combat Development and Integration), Before the Senate Armed Services Committee Subcommittee on Seapower, Concerning Shipbuilding and Force Structure on April 08, 2008, pp. 6-7. Italics as in the original.

[11] As shown in **Appendix A**, the Marine Corps alternatively has stated that in light of ship maintenance requirements, maintaining a force of 30 operational ships would require having an additional 10% in total inventory, meaning a total of 33 ships (11 of each kind).

allowance to account for ships in maintenance. The first column shows the current 33-ship requirement for 2.0 MEB AEs using 15 operational ships per MEB.

Table A-3. Ships Required for Various Potential Lift Goals

(including allowance for ships in overhaul)

	2.0 MEB AEs			2.5 MEB AEs			3.0 MEB AEs		
Operational ships per MEB AE[a]	**15**	**17**	**19**	**15**	**17**	**19**	**15**	**17**	**19**
LHA/LHD[a]	11	11	13	14	14	17	17	17	20
LSD-41/49[a]	11	13	15	14	16	19	16	20	23
LPD-17[a]	11	13	13	14	16	16	16	20	20
Total[a]	**33**	**37**	**41**	**42**	**46**	**52**	**49**	**57**	**63**

Source: Table prepared by CRS based on Marine Corps data provided to CRS on May 1, 2008.

a. Required numbers of ships shown include additional allowance to account for ships in maintenance, so as to support 15, 17, or 19 operational ships per MEB AE.

Table A-3 shows a total of 37 amphibious ships would be needed to meet the 2.0 MEB AE using 17 amphibious ships per MEB. In April 2009 testimony to Congress, the Navy revised this figure to 38 ships, including 17 ships for each MEB plus four (rather than three) additional ships to account for 10% to 15% of the amphibious ship force being in overhaul at any given time.[12]

Marine Corps Testimony in 2008

Regarding the amphibious lift goal, the Marine Corps testified in April 2008 as follows:

> Shipbuilding Requirements
>
> Based on strategic guidance, in the last several years the Navy and Marine Corps have accepted risk in our Nation's forcible entry capacity, and reduced amphibious lift from 3.0 MEB assault echelon (AE) to 2.0 MEB AE. In the budgetary arena, the value of amphibious ships is too often assessed exclusively in terms of forcible entry—discounting their demonstrated usefulness across the range of operations and the clear imperative for Marines embarked aboard amphibious ships to meet Phase 0 demands. The ability to transition between those two strategic goalposts, and to respond to every mission-tasking in between, will rely on a strong Navy-Marine Corps Team and the amphibious ships that facilitate our bond. The Navy and Marine Corps have worked diligently to determine the minimum number of amphibious ships necessary to satisfy the Nation's needs.
>
> The Marine Corps' contribution to the Nation's forcible entry requirement is a single, simultaneously-employed two MEB assault capability—as part of a seabased MEF. Although not a part of the MEF AE, a third reinforcing MEB is required and will be provided through MPF(F) shipping. Each MEB AE requires seventeen amphibious warfare ships—resulting in an overall ship requirement for thirty-four amphibious warfare ships.

[12] Statement of Vice Admiral Bernard J. McCullough, Deputy Chief of Naval Operations for Integration of Capabilities and Resources, and Ms. Allison Stiller, Deputy Assistant Secretary of the Navy (Ship Programs), before the Subcommittee on Defense of the House Appropriations Committee [hearing] on Shipbuilding, April 1, 2009, p. 7. See also McCullough's spoken testimony at the hearing.

However, given current fiscal constraints, *the Navy and Marine Corps have agreed to assume a degree of operational risk by limiting the assault echelon of each MEB by using only fifteen ships per MEB*—in other words, a Battle Force that provides thirty "operationally available" amphibious warfare ships.

Amphibious Ships

In that thirty-ship Battle Force, ten aviation-capable big deck ships (LHA / LHD / LHA(R)), ten LPD 17 class ships, and ten LSD class ships are required to accommodate the MAGTF [Marine Air-Ground Task Force] capabilities. In order to meet a thirty-ship availability rate—based on a CNO-approved maintenance factor of ten percent—a minimum of eleven ships of each of the current types of amphibious ships are required—for a total of thirty-three ships. The CNO has concurred with this requirement for thirty-three amphibious warfare ships, which provide the "backbone" of our maritime capability—giving us the ability to meet the demands of harsh environments across the spectrum of conflict.

The LPD 17 San Antonio class of amphibious warfare ships represents the Department of the Navy's commitment to a modern expeditionary power projection fleet enabling our naval force to operate across the spectrum of warfare. The LPD 17 class replaces four classes of older ships—LKA, LST, LSD 36, LPD 4—and will have a forty-year expected service life. It is imperative that eleven of these ships be built to meet the minimum of ten necessary for the 2.0 MEB AE amphibious lift requirement. Procurement of the tenth and eleventh LPDs remains a priority.[13]

[13] Statement of Lieutenant General James F. Amos, Deputy Commandant of the Marine Corps (Combat Development and Integration), before the Senate Armed Services Committee Subcommittee on Seapower, Concerning Shipbuilding and Force Structure, April 8, 2008, pp. 6-7. Italics as in the original.

Appendix B. May 25, 2011, Navy Testimony on LPD-17 Program

This appendix presents an excerpt on the LPD-17 program from the Navy's prepared statement for a May 25, 2011, hearing on Navy shipbuilding programs before the Seapower subcommittee of the Senate Armed Services Committee. For further discussion of LPD-17 class construction problems, see **Appendix C**. The text of the excerpt is as follows:

> The SAN ANTONIO Class LPD (LPD 17) has a 40-year expected service life and serves as the replacement for four classes of older ships: the LKA, LST, LSD 36, and the LPD 4. Lessons learned from the effort to resolve material reliability concerns identified in the early ships of the class are being applied to ships currently under construction. Quality continues to improve with each ship delivered as the Navy continues to work closely with the shipbuilder to address cost, schedule, and performance issues. Five ships have been delivered, and four more ships are under construction. The construction contract for the 10th ship was recently awarded and the eleventh and final LPD is planned for procurement in FY 2012.
>
> Ships of the class have deployed seven times including two ships that are currently on deployment. USS SAN ANTONIO (LPD 17) has deployed once (2008), USS NEW ORLEANS LPD 18 has completed two successful overseas deployments (2009 and 2010). USS MESA VERDE (LPD 19) has also completed two successful overseas deployments. Today, LPD 19 is again deployed overseas; and USS GREEN BAY (LPD 20) is in the middle of her first overseas deployment. LPD 18 and USS NEW YORK (LPD 21) are fully operational, conducting local operations in their homeport areas. LPD 17 is completing her major post- deployment repair availability prior to next sea trials.
>
> In February of this year, LPD 21 successfully passed an inspection by the Navy's Board of Inspection and Survey (INSURV) to support the Final Contract Trials. The President of INSURV remarked that LPD 21 was the best LPD 17 Class ship they had seen and that lessons learned from the first ships of the class were clearly being implemented.
>
> The Navy and Industry have made significant progress in correcting early class design and construction issues on the LPD 17 Class. Early ships of the LPD 17 Class were delivered to the Navy with pipe welding quality, engine alignment problems, inadequate lube oil cleanliness and bearing wear which led to unplanned engine repairs and overhauls. These material issues, combined with an optimized sized crew and a reliance on computer-based vice classroom training, led to decreased reliability and operational availability of the class.
>
> The above issues, as well as inadequate initial reliability of the ships computer network and some of the engine and ship control systems led the Navy and DoD independent operational testing organizations to rate the ships as not operationally suitable during the initial operational testing conducted in 2007-2008. Follow-on Test and Evaluation (FOT&E), which commenced in July 2010 and runs through FY 2012, is being conducted by the Navy's Commander, Operational Test & Evaluation Force and the Marine Corps Operational Test and Evaluation Activity to confirm adequate corrective actions have been taken.
>
> Over the last couple of years, the shipbuilder (Northrop Grumman Shipbuilding (NGSB), now Huntington Ingalls Industries, (HII)) has implemented several initiatives to address the quality issues associated with ship construction and delivery.

The shipbuilder significantly revised their welding, quality and production processes to improve quality and ensure consistency across all of their shipbuilding facilities. Their workforce was re-trained and re-certified to the updated process. The Navy and HII have improved the oil flushing procedures to get all the contaminants out of the ship's lube oil system and improvements to the lube oil filters and strainers have been developed to better remove any contaminants that might be introduced through normal operation of the engines. These more stringent flushing procedures are being used on all ships in the class and the improved filters and strainers are planned for installation on all ships in the class. Additionally, the shipyard has taken several steps to ensure pipe sections are maintained in a clean condition from fabrication in the pipe shop to installation on the ship including a new cleaning process in the pipe shop and improved pipe capping procedures to prevent contaminants from entering the pipe during shipping and installation onboard the ship. The Navy has also significantly improved its lube oil sampling and analysis process. This process has been incorporated into the ship construction process. The shipbuilder is responsible for the overall quality of the ship. To manage quality, the shipbuilder utilizes a Quality Management System (QMS) comprising of Quality Control (ensuring the correct product requirements, manufacturing processes, etc.) and Quality Assurance (focused on end product quality and conformance).

The Ship Wide Area Network (SWAN) design, which was based upon 1990's Asynchronous Transfer Mode (ATM) technology, experienced multiple failures resulting in failover monitoring, maintainability, and supportability issues. The ATM-based SWAN is being replaced by current Gigabit Ethernet technology hardware and software. Today, this "Gig-E" SWAN is installed on LPD 17, 18 and 21 with no reported failures to date. LPD 19 and 20 will receive this upgrade in FY 2012; and the baseline for LPD 22 and follow ships has been updated to include the Gig-E SWAN. Initial system reliability issues with the engine controls, ship controls, and interior communications systems have been addressed through major software upgrades to each system, as well as the replacement of critical obsolete parts with more rugged, current technology hardware.

Government oversight by the Navy's Supervisor of Shipbuilding, Gulf Coast (SSGC) has been revamped with an increase in overall SSGC manning by 21 percent from 2005 through the end of 2010, including an intensive focus on critical waterfront Quality Assurance (QA) billets. All Government QA weld inspectors were required to undergo re-training and re-certification in critical process areas, and QA oversight was increased across all phases of production. Within the last 18 months, the QA organization has been restructured to include more surveillance of in process work and compliance with formal ship construction procedures. A revamped training program has been implemented, providing an "apprentice to subject matter expert" career roadmap for QA specialists. SSGC has implemented a process of "critical process pulse audits" to ensure HII maintains production quality across the critical shipbuilding areas of structure, pipe, electrical, and coatings. Navy critical process metrics have been aligned with the shipbuilder to better assess performance trends leading to earlier identification of issues when they arise.

In addition, Commander, Naval Sea Systems Command (NAVSEA) sent teams of QA experts to assess SSGC ability to provide QA oversight and HII's production quality in Spring 2009, July 2010 and January 2011. The NAVSEA audits confirmed initial improvement by both SSGC and HII. The focus going forward, and a key element of the critical process pulse audits, is ensuring sustainment of that performance.

The Navy is also strengthening the LPD 17 Class crew training by establishing more traditional shore-based schoolhouses for critical systems that will result in a blended philosophy of classroom, on-ship, and computer-based training rather than solely relying on the previously emphasized computer-based shipboard training.

The Ship Manning Document (SMD) was recently approved, increasing the LPD 17 Class crew size to 381 from the original "optimized" manning level of 360.

The LPD 17 Class System Sustainability Strike Team, made up of personnel from the Fleet, the Navy regional maintenance centers, the shipbuilder, the Supervisor of Shipbuilding, the class planning yard, and the Navy Warfare Centers was established in FY 2009. The Strike Team has focused resources on developing and prioritizing correction plans addressing system design, production/quality, operations and maintenance issues identified in recent test/evaluation reports, as well as those discovered during normal shipboard operations. Lessons learned from this effort are being incorporated in the ship construction process.

Quality and reliability problems seen on the early ships of the class are being systematically addressed by the shipbuilder and the Navy. Additionally, the Fleet has recognized the need for additional manning for each ship and training for the crews, which is being implemented. The above-listed corrections and improvements are already being realized in the later ships of the class, as evidenced by LPD 21's recent success during Final Contract Trials. The Navy recently discovered quality problems with repairs on various ships during Fleet maintenance availabilities. We are addressing these issues by providing additional government oversight to ensure strict compliance with all required maintenance and repair specifications and holding the contractor accountable to provide quality.[14]

[14] Statement of the Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development and Acquisition), and Vice Admiral Kevin McCoy, Commander, Naval Sea Systems Command, and Captain William J. Galilnis, Supervisor of Shipbuilding (SUPSHIP) Gulf Coast, before the Subcommittee on Seapower of the Senate Armed Services Committee on Navy Shipbuilding, May 25, 2011, pp. 9-11.

Appendix C. LPD-17 Cost Growth and Construction Problems

This appendix, along with **Appendix B**, provides details on cost growth and construction problems in the LPD-17 program.

Cost Growth

The Congressional Budget Office (CBO) testified in July 2007 that the first LPD-17 experienced cost growth of about 70% and is, on a per-ton basis, the most expensive amphibious ship ever built for the Navy.[15] When LPD-17 procurement began, follow-on ships in the class were estimated to cost roughly $750 million each. Estimated procurement costs for the follow-on ships subsequently grew to figures between about $1,200 million and about $1,500 million. The Navy estimates the procurement cost of the 11th ship at $2,040.6 million.

A relatively small portion of the cost growth in the program since its inception is attributable to the decision to reduce the program's sustaining procurement rate from two ships per year to one ship per year. Most of the program's cost growth is attributable to other causes.[16]

Construction Problems[17]

Developments in 2005-2007

The first LPD-17, which was procured in FY1996, encountered a roughly two-year delay in design and construction. It was presented to the Navy for acceptance in late June 2005. A Navy

[15] CBO Testimony, Statement of J. Michael Gilmore, Assistant Director for National Security, and Eric J. Labs, Senior Analyst, [on] The Navy's 2008 Shipbuilding Plan and Key Ship Programs, before the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, U.S. House of Representatives, July 24, 2007, pp. 13 and 20. CBO reiterated in March 2008 testimony and a June 2008 report that the first LPD-17 is, on a per-ton basis, the most expensive amphibious ship ever built for the Navy. (See CBO Testimony, Statement of Eric J. Labs, Senior Analyst, [on] Current and Projected Navy Shipbuilding Programs, before the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, U.S. House of Representatives, March 14, 2008, p. 27; and Congressional Budget Office, *Resource Implications of the Navy's Fiscal Year 2009 Shipbuilding Plan*, June 9, 2008, p. 31.

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

[17] For an article surveying construction problems on the lead ship in the class, and Navy efforts to fix these problems, see Corinne Reilly, "Shipshape? The San Antonio, Finally, Almost Is There," *Norfolk Virginian-Pilot*, February 27, 2011.

inspection of the ship conducted June 27-July 1, 2005, found numerous construction deficiencies.[18]

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

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

The Navy accepted delivery of LPD-19 with about 45,000 hours of construction work remaining to be done on the ship. This equated to about 0.4% of the total hours needed to build the ship.

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

- It permitted the fleet to begin sooner the process of evaluating LPD-17 through operational use so as to identify problems with the LPD-17 class design that need to be fixed in follow-on LPD-17s.
- It avoided further delays in giving the LPD-17's crew an opportunity to conduct post-delivery tests and trial events that are intended to identify construction (as opposed to class design) problems with LPD-17 itself.
- It permitted LPD-17 to leave the shipyard sooner and thereby mitigated schedule and cost impacts on other ships being built at the shipyard (other LPD-17s, LHD-8, and DDG-51s) that would have resulted from having LPD-17 remain in the shipyard longer.
- It reduced the cost of the remaining construction work to be done on LPD-17 because the work in question could be performed by repair shipyards that charge lower rates for their work than the construction shipyard.

Of the approximately $160 million in post-delivery work performed on LPD-17, $108 million was for the 1.1 million hours of construction work remaining to complete the ship. (The rest was for post-shakedown and other work that normally occurs after a ship is completed and delivered to the Navy.) This $160 million in work was funded through the post-delivery part of the outfitting/post-delivery (OF/PD) line item in the Shipbuilding and Conversion, Navy (SCN) account. Because OF/DP costs are not included in ship end cost, the reported end cost of LPD-17 will understate the ship's actual construction cost by $108 million.

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

The Government Accountability Office (GAO) testified in July 2007 that:

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

> The Navy moved forward with ambitious schedules for constructing LPD 17 and [the Littoral Combat Ship] despite significant challenges in stabilizing the designs for these ships. As a result, construction work has been performed out of sequence and significant rework has been required, disrupting the optimal construction sequence and application of lessons learned for follow-on vessels in these programs.
>
> In the LPD 17 program, the Navy's reliance on an immature design tool led to problems that affected all aspects of the lead ship's design. Without a stable design, work was often delayed from early in the building cycle to later, during integration of the hull. Shipbuilders stated that doing the work at this stage could cost up to five times the original cost. The lead ship in the LPD class was delivered to the warfighter incomplete and with numerous mechanical failures, resulting in a lower than promised level of capability. These problems continue today—2 years after the Navy accepted delivery of LPD 17. Recent sea trials of the ship revealed problems with LPD 17's steering system, reverse osmosis units, shipwide area computing network, and electrical system, among other deficiencies. Navy inspectors noted that 138 of 943 ship spaces remained unfinished and identified a number of safety concerns related to personnel, equipment, ammunition, navigation, and flight activities. To date, the Navy has invested over $1.75 billion constructing LPD 17.[19]

LPD-17 was commissioned into service on January 14, 2006. In April 2007, it was reported that the first LPD-17 had thousands of construction deficiencies.[20] In late June and early July 2007, it was reported that Secretary of the Navy Donald Winter had sent a letter to the chairman and chief executive officer of Northrop Grumman, Ronald Sugar, dated June 22, 2007, expressing deep concerns about NGSS's performance, particularly in connection with the LPD-17 program. According to these news reports, Winter's letter contained the following statements among others, although not necessarily in the order shown below:

- "I am deeply concerned about Northrop Grumman Ship Systems' (NGSS) ability to recover in the aftermath of Hurricane Katrina, particularly in regard to construction of LPD 17 Class vessels."
- "I am equally concerned about NGSS' ability to construct and deliver ships that conform to the quality standards maintained by the Navy and that adhere to the cost and schedule commitments agreed upon at the outset by both NGSS and the Navy."
- "... even prior to Katrina [NGSS's performance] was marginal, resulting in significant cost overruns that forces the Navy to take delivery of the LPD-17 with numerous outstanding deficiencies.... "
- "NGSS' inefficiency and mismanagement of LPD 17 put the Navy in an untenable position."

[19] 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. 10.

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

- "By taking delivery of ships with serious quality problems, the Fleet has suffered unacceptable delays in obtaining deployable assets. Twenty-three months after commissioning of LPD 17, the Navy still does not have a mission-capable ship."
- "These delays create further problems as work must be completed or redone by other shipyards that are not as familiar with the ship's design."
- "The Navy also took delivery of LPD-18 (USS New Orleans) in an incomplete fashion, albeit more complete than LPD-17."
- "... persistent shortcomings at the NGSS yards are troubling and causing me not only grave concern about the LPD program, but also the LHA and DDG-1000 programs."
- "The Navy does not wish to find itself in the same situation [with other ships that] it faces with LPD 17 & 18."
- "It is imperative that NGSS deliver future ships devoid of significant quality problems and that it meet its cost and schedule obligations."
- One press report stated: "'Continued, focused management' is necessary to successfully deliver the remainder of the class, according to Winter."
- "[Navy acquisition executive] Dr. [Delores] Etter will be closely monitoring metrics with NGSS and the acquisition team as we move forward."[21]

Sugar reportedly sent a reply letter to Winter dated June 29, 2007. According to one press report, Sugar stated in the letter: "I share your concern regarding the need to fully recover and improve our shipyards, and produce completed LPD 17 class vessels of the highest quality with increasing efficiency.... Irrespective of Hurricane Katrina, Northrop has much work to do to meet the needs of the U.S. Navy."[22] Another press report stated:

> Northrop Grumman Corp (NOC) has "much more work to do" to improve its performance on Navy ships, but problems with a $13.6-billion amphibious ship program were not solely the contractor's making, Chief Executive Ron Sugar said in a June 29 letter.
>
> "The original acquisition strategy was changed after contract award, there was funding instability, limited early funding for critical vendor information, and the 'integrated' Navy/contractor design team produced constant design churn and thousands of design changes," Sugar wrote, responding to a tersely worded letter from Navy Secretary Donald Winter.
>
> Northrop "certainly had performance problems," but the unprecedented effects of Hurricane Katrina, which severely damaged Northrop's three shipyards in the Gulf region in August 2005, "only served to greatly exacerbate the situation...."

[21] Sources for these reported passages from the June 22 letter: Louis Hansen, "Navy Ship $840 Million Over Budget And Still Unfinished," *Norfolk Virginian-Pilot*, June 30, 2007; Tony Capaccio, "Northrop Grumman Criticized For 'Mismanagement' By U.S. Navy, *Bloomberg News*, July 2, 2007; Geoff Fein, "Navy To Monitor Work At Northrop Grumman Gulf Coast Shipyards, Official Says," *Defense Daily*, July 5, 2007; Christopher P. Cavas, "U.S. Navy Furious Over LPD-17," *DefenseNews.com*, July 9, 2007. *InsideDefense.com* on July 9, 2007, posted on the subscribers-only portion of its website a copy of what it says is the June 22 letter.

[22] Christopher P. Cavas, "U.S. Navy Furious Over LPD-17," *DefenseNews.com*, July 9, 2007.

> Sugar said he shared Winter's concerns and vowed that Northrop would invest, train and manage its operations to produce Navy ships of the highest quality with increasing efficiency. "Irrespective of Hurricane Katrina, Northrop has much more work to do to meet the needs of the U.S. Navy."
>
> "We are not happy with this history," Sugar added in the letter obtained by Reuters, "but we are incorporating the lessons from this experience into our operational plans going forward for new ships in the design, planning and production stages."
>
> He noted that Navy recently praised Northrop's work on a destroyer that was damaged by Hurricane Katrina, and termed it "one of the best ships ever delivered."
>
> Sugar said Northrop officials had given the Navy a list of efforts under way to improve training, quality, processes, productivity and facilities at the Gulf Coast shipyards. He promised "substantial investment," but gave no details.
>
> He said Northrop was aggressively reworking schedules for delivery of all ships affected by the hurricane. "We know we must do our part," Sugar said.[23]

After working to overcome construction problems, Navy officials in late 2007 stated that they were "cautiously optimistic" that the LPD-17 construction effort is stabilizing. A December 24, 2007, press report stated:

> As the Navy gears up for the first deployment of the new San Antonio-class amphibious transport dock slated for next year, a senior service shipbuilding official is "cautiously optimistic" the once-beleaguered program is on track....
>
> On Dec. 15, the Navy commissioned the third ship, the Mesa Verde, in Panama City, Fla. It was the first ship in the class to be delivered without significant problems.
>
> The San Antonio class faced difficulties beginning in late 1998, when the initial construction contract was awarded to Avondale Industries in New Orleans. Avondale beat out Litton Ingalls Shipbuilding primarily because it planned to use a new computer program to design the ships—the first time a Navy ship was designed entirety using computer tools. But the computer systems didn't work, the Navy kept making design changes, costs escalated and major delays ensued.
>
> Litton Ingalls bought Avondale in 1999, its owners mistakenly thinking they could fix the program, and in late 2000 the shipyards were acquired by Northrop Grumman.
>
> Meanwhile, a succession of service program managers and acquisition executives struggled to hold down the design changes and manage costs, which have more than doubled from the $750 million per ship the Navy forecast in the late 1990s.
>
> All those problems and more affected the first two ships of the class. The San Antonio was delivered, incomplete, in mid-2005. The Navy accepted the ship knowing it had numerous construction defects, many of which would need to be fixed at extra costs after the shipyard's obligation period ended. The next ship, the New Orleans, was delivered in December 2007, also with incomplete spaces. To make things more challenging, Hurricane Katrina had wreaked havoc on the New Orleans-based Avondale shipyard in 2005.

[23] Andrea Shalal-Esa, "Northrop Says Katrina Exacerbated Ship Problems," *Reuters*, July 10, 2007.

> Nevertheless, construction on the Mesa Verde, the third new ship, went more smoothly. The Mesa Verde was built at Northrop Grumman's Ingalls shipyard in Pascagoula, Miss....
>
> The Mesa Verde "sets a new standard for the LPD class as far as being a complete ship," Capt. Beth Dexter, the Navy's supervisor of shipbuilding in Pascagoula, told Military Times in September. "My Navy team is proud to present it."
>
> Robert Work, a naval analyst at the Center for Strategic and Budgetary Assessments in Washington, said it looks like the LPD 17 program is pulling away from its "checkered past." He said it appears the program is "getting back on track" and that it will be exciting to see the first ship as it enters the fleet.
>
> American shipbuilders have historically had difficulties with lead ships, he said....
>
> Stiller told Navy Times that after Hurricane Katrina the Navy re-established new milestones to measure the new ships' progress. So far, each ship under construction is meeting these marks, she said.
>
> "I believe we are turning the corner," Stiller said. In 2008, she said, she hopes the service and industry will be able to "not just meet but beat" these milestones.[24]

Developments in 2008

In August 2008, it was reported that the maiden deployment of LPD-17 was delayed by two days due to problems with a hydraulic system that controls the stern gate used to gain access to the ship's well deck.[25]

In August 2008, it was also reported that:

> Just under two years after the amphibious transport dock New Orleans [LPD-18] was delivered incomplete, the amphib still can't perform the central mission for which it was designed: Carrying Marines, their gear and their vehicles into battle, according to a recent report by the Navy's Board of Inspection and Survey, or InSurv.
>
> The San Diego-based New Orleans was "degraded" in its "ability to conduct sustained combat operations," and has a slew of other problems, according to the inspection, conducted Aug. 11-15. The report, obtained by *Navy Times*, paints the picture of a ship not only troubled by the same technical problems as its older sibling, the first-in-class gator San Antonio, but also with many of its own.
>
> "The ship cannot support embarked troops, cargo or landing craft," the report said. Navy engineers found "serious materials deficiencies in the well deck and vehicle stowage areas"; the well deck's ventilation fans didn't work; the vehicle ramps were inoperative; and berthing for Marines and the ships' crew was found to be unsatisfactory.

[24] Zachary M. Peterson, "Troubled Amphib Program Appears On Track," *NavyTimes.com*, December 24, 2007. See also Dan Taylor, "Contract Awarded For Ninth LPD-17 As NGC Addresses Concerns," *Inside the Navy*, January 7, 2008; and Christopher P. Cavas, "Third Time Could Be the Charm for LPD Program," *Defense News*, September 10, 2007.

[25] Andrew Scutro, "Mechanical Failure Keeps Troubled Amphib At Pier," *NavyTimes.com*, August 26, 2008; Matthew Jones, "Troubled Ship's Departure Is Delayed By Gate Problem," *Norfolk Virginian-Pilot*, August 27, 2008; Dan Taylor, "After Delayed Start, Questions Abound on LPD-17s First Deployment," *September 1, 2008.*

> Moreover, the ship's propulsion system was unreliable, causing a 10-hour delay before it could put to sea for its final contract trials. Much of its communications equipment didn't work. And when the ship tried to test its Rolling Airframe Missile launchers, both of them fired just one missile at their targets and then lost power, forcing crews to reset their computer systems.
>
> The New Orleans InSurv arrived just as the Norfolk, Va.-based San Antonio [LPD-17] is preparing to make its maiden deployment this week. That ship was delivered three years ago, also incomplete. Like the San Antonio, the New Orleans' electrical system had ship-wide problems, according to Navy inspectors: "Significant electrical and electronic cable plant installation deficiencies exist," Navy inspectors wrote, including "dead-ended cables, cables improperly bundled and banded, cables exceeding nesting capacity, inadequate packing of cables at watertight penetrations."
>
> The findings make for a total of three ships with widespread electrical problems that were built at Northrop Grumman's shipyards along the Gulf Coast: the first two San Antonios and the amphibious assault ship Makin Island [LHD-8]. Northrop Grumman announced earlier this year that it had to delay the delivery of the Makin Island by six months to fix its wiring problems. The company agreed to bear the roughly $360 million cost.
>
> Margaret Mitchell-Jones, a spokeswoman for Northrop Grumman, said the company did not comment on ships it has already delivered to the Navy, but in a written statement Tuesday, she said the San Antonio class was constantly improving:
>
> "While we don't comment on the capabilities of commissioned ships, we can say that with each LPD, we continue to make significant improvements in all areas and this includes the electrical systems. The latest LPD, Green Bay, will be delivered this week to the U.S. Navy and, from a material and systems standpoint, was more complete than any other LPD at acceptance trials. This is a testament to the benefits of series ship production and our ability to come down the learning curve resulting in greater efficiencies."[26]

In September 2008, it was reported that:

> After facing a bevy of negative survey results for the first two LPD-17-class ships, the Navy appears to be headed in the right direction, moving away from incomplete work and into serial production, a Navy official said.
>
> Earlier this year, the USS New Orleans (LPD-18) came under fire for a poor showing by the Navy's Board of Inspection and Survey (InSurv). Last year, the USS San Antonio (LPD-17), the lead ship of the new class of ambitious ships, suffered numerous issues with its InSurv report.
>
> The Navy took delivery of both the San Antonio and the New Orleans with a significant amount of work left to complete.
>
> About three years ago, the Navy was facing challenges with the construction schedule for LPD-17.

[26] Philip Ewing, "InSurv: LPD 18's Ability Degraded," *NavyTimes.com*, August 30, 2008. See also Philip Ewing and Andrew Scutro, "U.S. Navy Inspectors Pan 2nd LPD-17 Ship," *Defense News*, September 1, 2008: 1, 8; "More Issues For LPD Program," *Defense Daily*, September 2, 2008; and Steve Liewer, "Troubles In Port, At Sea Weigh Down Navy Ship," *San Diego Union-Trubune*, October 1, 2008: 1.

> Eventually, the Navy was forced to take delivery of the ship early because they had no money to complete the work, Allison Stiller, deputy assistant secretary of the Navy ships, told *Defense Daily* in a recent interview.
>
> "With LPD-18, we knew we were going to be in a similar situation financially ... that we were going to have to take delivery with a lot less incomplete," she said, although not nearly to the extent of LPD-17.
>
> As the Navy and Northrop Grumman [NOC] Ship Systems began work on the USS Mesa Verde (LPD-19), they began to believe that this ship, too, would have to be delivered incomplete.
>
> But the combined effort of the shipyard and the Navy helped deliver a completed ship, she added.
>
> LPD-19 wrapped up her shock trials, and the Navy is now compiling the date from the tests, Stiller added.
>
> "We saw what we expected to see. There were no surprises from the shock trial," she said.
>
> The USS Green Bay (LPD-20) was just delivered, and the follow-on ships are looking good, Stiller noted.
>
> Stiller acknowledges there were concerns about delivering finished LPDs. Until the Mesa Verde, Northrop Grumman had not delivered a completed LPD.
>
> "Certainly there are still challenges in getting the ship delivered, but we are in serial production," she said. "The yard is working hard at it. The ships are delivering. [We are] seeing reduced trial cards on everyone of them. That's the trend you want to see. It's good news to get into serial production, no doubt about it."[27]

In October 2008, it was reported that:

> The U.S. Navy's third and fourth San Antonio-class amphibious transport docks show a distinct improvement over the troubled first two ships in the class, inspectors have found. According to reports by the Navy's Board of Inspection and Survey, the third ship, Mesa Verde [LPD-19], was much more complete than its earlier siblings when it was accepted by the Navy Sept. 27, 2007.
>
> And in their report on the fourth ship, Green Bay [LPD-20], inspectors included something never seen before in an inspection report (referred to as an InSurv) about an LPD 17-class ship—a compliment.
>
> "Green Bay was found to be a highly capable and well built ship," they wrote. "The main spaces fit, finish and cleanliness were [satisfactory.]" To be sure, each InSurv still found many problems aboard each ship, and it concluded Mesa Verde was "degraded in its ability to conduct sustained combat operations," as was New Orleans. Overall, however, the two inspections seemed to reinforce statements by the Navy and shipbuilder Northrop Grumman that the San Antonio class is gradually improving after its initial misfires, according to a veteran skipper who examined the documents.

[27] Geoff Fein, "Navy Seeing Improvements In LHD, LPD-Class Ships, Official Says," *Defense Daily*, September 23, 2008: 1-2. Ellipsis and brackets as in original.

> The reports showed that overall build quality on Mesa Verde and Green Bay was much improved over San Antonio and New Orleans, and neither amphib seemed to have experienced as many problems with shipwide networks or electrical systems as the first two.
>
> Neither new ship had major problems with their propulsion systems, as the first two did. Other major problems from the San Antonio and New Orleans—including incomplete berthing spaces, broken gear in the galleys and medical spaces, and nonfunctioning weapons—didn't reoccur in Mesa Verde or Green Bay. Meanwhile, years of work have helped transform San Antonio from one of the Navy's most infamous ships into a fully functional member of the fleet, the ship's captain said.
>
> In a conference call with reporters Oct. 6, Cmdr. Kurt Kastner said San Antonio has had no major problems since it sailed in August from Norfolk as part of the Iwo Jima Expeditionary Strike Group.[28]

In November 2008, it was reported that:

> The troubled amphibious transport dock San Antonio—in the middle of its first deployment—has been forced to undergo two weeks of maintenance in Bahrain due to leaks in its lube oil piping system, Navy officials said.
>
> "They had a scheduled port visit," said Lt. Nate Christensen, spokesman for 5th Fleet in Bahrain. "They're in port for two weeks for a maintenance availability on some lube oil deficiencies. It's related to the diesel generators."
>
> Pat Dolan, a spokeswoman at Naval Sea Systems Command, confirmed that the problem involved leaks in the system.
>
> The yard period began earlier this week, although the exact day was unavailable.[29]

It was also reported in November 2008 that:

> The leaks were discovered while the ship was conducting maritime security operations in the Persian Gulf, according to U.S. Naval Forces Central Command spokesman Lt. Nathan Christensen....
>
> The leaks were first discovered Oct. 9 and a second incident on Oct. 17 prompted the need for a thorough inspection, Lt. Clay Doss, a Navy spokesman at the Pentagon told *ITN* [*Inside the Navy*] Nov. 6.
>
> "We are confident this issue is limited to LPD-17 only," Doss said.[30]

Later in November 2008, it was reported that:

> Experts who have examined the photos of major oil leaks aboard the amphibious transport dock San Antonio are calling the workmanship on the new amphib "sloppy," "unacceptable"

[28] Philip Ewing, "For LPDs, 3rd And 4th Time's The Charm," *Defense News*, October 13, 2008: 3. See also Andrew Scutro, "Photos Show Extent of Oil Leaks on LPD 17," *NavyTimes.com*, November 12, 2008.

[29] Andrew Scutro, "San Antonio Laid Up in Bahrain," *NavyTimes.com*, November 6, 2008.

[30] Zachary M. Peterson, "First-Of-Class LPD-17 Pierside in Bahrain For Unexpected Repairs," *Inside the Navy*, November 10, 2008. See also Mark Thompson, "The Navy's Floating Fiasco," *Time*, November 12, 2008.

and "criminal." One former chief engineer said any other CHENG [Chief of Engineering] in the Navy would be "thankful this wasn't their ship."

But it is someone's ship, and despite the finger-pointing, experts say the Navy has a serious problem on its hands....

"The secretary has been briefed on the issue and has been getting periodic extended updates about the progress of the repairs," said Capt. Beci Brenton, spokeswoman for Navy Secretary Donald Winter.

While the brass is watching and the shipbuilder defends its work and promises to make fixes, one question remains: How was this allowed to happen? And are other problems lurking?

"I'm fuming"

Margaret Mitchell-Jones, spokeswoman for shipbuilder Northrop Grumman, defended the contractor's performance and said the company is taking "corrective actions."

"The quality of our work is something we take very seriously, and we have a rigorous program in place that includes inspecting and evaluating our work to ensure it adheres to the Navy's requirements," she said in a statement. "When issues arise, we aggressively address them in an immediate and methodical way. Upon hearing there may be a problem with lube oil leaks on LPD 17, we immediately responded with technical staff to assist in the Navy's efforts and began our own in-house critique."

She added that "we are proactively conducting a comprehensive review of our procedures, processes and policies surrounding the LPD-class ships currently under construction at our Gulf Coast shipyards. This effort includes the implementation of short-term corrective actions until, aligned with our customer, we fully determine the cause and need for any long-term corrective actions to ensure conformance and reinforce the commitment to quality we have in our work. We have invited and welcomed Navy participation throughout our own internal review process."

On Capitol Hill, lawmakers also are taking notice. Josh Holly, a spokesman for the Republican side of the House Armed Services Committee, said members "continue to follow [San Antonio's] challenges. The seapower subcommittee is aware of the most recent issues, although the Navy has not briefed us yet."

Rep. Joe Sestak, D-Pa., a former vice admiral, said after viewing the photos: "It looks like more of a systemic problem from when it was built."

"The ones who suffer are the bluejackets," said Sestak, a member of the House Armed Services Committee and former top warfare requirements and programs officer for the Navy.

Naval analyst and author Norman Polmar put it more bluntly.

"It's criminal. It's criminal that the Navy accepted this ship," he said. "And this is two and a half years after the Navy accepted the ship. It's bad enough that it was delivered this way."

Polmar said he thinks the San Antonio should be towed back to the shipyard.

"As a taxpayer and as a naval analyst," he said, "I'm fuming."...

Who's to blame?

Those familiar with the situation do not blame the crew or Navy engineers for the problem, comparing it with the discovery of a flaw in your car's chassis during a road trip: You may have topped off the oil and filled the gas tank before you left, they say, but you can't be expected to examine work completed long ago, when the car was built at the auto plant.

Even those responsible for ensuring the material condition of the fleet—the ultracritical Board of Inspection and Survey—do so under certain assumptions, one Navy source said.

"Even InSurv wouldn't have found faulty welds," the Navy source said.

Cmdr. Jensin Sommer, a spokeswoman for 2nd Fleet, said her command "certifies units for deployment and for integrated training with carrier and expeditionary strike groups so they're ready for integrated operations."

"That's a different type of readiness than material condition," she added.

Pat Dolan, spokeswoman for Naval Sea Systems Command, said naval engineers declined a request to explain the damage because they refused to comment on photos that had not been officially released.

The photos were posted on a blog and later authenticated by Dolan.

She did say that when the ship pulled into Bahrain, it was greeted by a crew of more than 30 engineers, pipefitters and welders flown to Bahrain from the U.S.

As of Nov. 13, there were no initial cost estimates and no available progress reports. "We're still looking at mid- to late November for the repairs to be completed," Dolan said.

She added that engineers are conducting a "root-cause analysis" and the repair and ship crews are fixing the flaws, noting "some that require replacing whole sections of pipe."

Earlier, Dolan said the oil leaks had not posed a danger to sailors working near them.

Other problems lurking?

Naval experts and engineers familiar with the San Antonio's history are concerned that if these welding problems went undiscovered until now, what other problems are waiting to pop up?

Jan van Tol, a retired captain who commanded the amphibious assault ship Essex, said he had deployments during his career commanding three ships that were interrupted by major breakdowns, and that it's not unusual to have technical experts come aboard.

But the size of the repair team and the nature of this casualty is notable, he said.

"It surprises me to see oil leaking from such major points. I associate leaks with moving parts," he said. "What's unusual is the sheer number of people who are going out to address what appears to be a wider-ranging problem."

Van Tol said he thinks any such flaw—if detected—would have prevented the ship's deployment. So how did the ship get as far as it did?

"Are these systemic problems in one or more of the ship's systems and physical plant? If they are, that goes to the question of craftsmanship and why did the Navy accept the ship?

Are there ship-wide problems of a similar nature of poor craftsmanship and quality assurance? Who made the decisions to allow it to reach this point?" he said. "It raises the question of supervision and oversight, both at the shipyard and on the Navy's side."

He won't go as far as other critics, but he did say the situation "certainly doesn't look good."

"It's imperative to take a harsh, harsh look at how they got to this place. The Navy really needs to learn some harsh lessons," he said.

Those lessons may soon be in the syllabus.

Sestak, the former three-star, has called for a hard look at the defense acquisition process since his arrival in Congress in 2007. He believes the problems aboard the San Antonio are a symptom of a larger institutional breakdown among the defense industry, the Pentagon and Congress.

As a former commander in the fleet, he said he finds it hard to believe that the San Antonio could have been allowed to deploy if anyone knew these breakdowns were imminent.

"I expected to be handed machines of war that had a certain level of readiness I then had to maintain. At times there were unexpected problems. Something could break. But I never expected to deploy with a machine of war, particularly a relatively new one, that had systemic problems that would take weeks at a time [to fix]," said Sestak, who commanded the George Washington Carrier Strike Group.

"When it's something that appears systemic to the construction of the machine of war, we're giving short shrift to our warriors out there."

He said operators preparing for deployment care about how the ship and the crew perform; it's not their job to inspect welds. Quality construction is supposed to be a given, something certified long before the ship is ever put into action.

In pre-deployment certifications, "they're not looking inside the welds. They're looking at how it's operating at that moment," he said.

Sestak said the LPD 17 class is just one weapon system among many with major problems.

"I'd like to go back to 'What are the institutional processes that permitted this to happen?' That is where I'd like to go back to the sources and find out how this can be done better," he said. "I have proposed that we should have hearings on acquisition reform in the new session, with LPD 17 part of that."

For Polmar, the naval analyst, the Navy's experience with the San Antonio is a scandal worthy of investigation. He compares it to the infamous Air Force tanker deal that sent an Air Force civilian and an industry executive to jail.

Besides the money and shoddy product, Polmar said putting such a problematic ship to sea put sailors' lives at risk.

"It's as big in some respects as the tanker deal because it's difficult to get to the truth of this," he said. "It's difficult to find out who accepted the ship. People went to jail and were fined in the tanker deal, and that's the minimum of what should happen here."

What's particularly shocking, he said, are the repeated problems in such a new product.

> "We're talking about a warship," he said. "You can see how the oil is leaking through those welds. You may see that on a ship that is 20 or 30 years old, not a ship that's two or three years old."
>
> One naval historian, who asked not to be named because of his affiliations, was asked to think of another surface Navy program this problematic.
>
> "The only thing I'd compare it to are [the littoral combat ship] and DDG 1000," he said. "It just seems like the Navy can't get it right anymore."[31]

It was also reported later in November 2008 that:

> Navy Secretary Donald Winter said Monday [November 17] he "continues to be unsatisfied" with the performance of the amphibious transport dock San Antonio, which has been sidelined by emergency repairs since Oct. 31.
>
> But after a speech in which he described the need for accountability and a "culture of quality" for Navy acquisitions and its private-sector vendors, Winter did not commit to new changes or penalties for problems with the San Antonio and its follow-on siblings.
>
> "I continue to be unsatisfied with the performance there," Winter said. "We are continuing to look at it. It's a matter I'll be spending some time on over the next few weeks. We'll adopt an appropriate course of action ahead."[32]

Still later in November 2008, it was reported that:

> As the Navy continues to examine problems with the lube oil system on the USS San Antonio (LPD-17), the service is taking steps to ensure there are no similar issues with the remainder of the class of amphibious ships.
>
> A team of 30 maintenance personnel from Norfolk Naval Shipyard Mid Atlantic Regional Maintenance Center is in Bahrain, handling the repair work, which is focused on the main propulsion lube oil system, Capt. Bill Galinis, program manager LPD-17, told *Defense Daily* in a recent interview.
>
> Galinis said initial inspections found a couple of issues.
>
> One problem was improperly installed or missing pipe hangers. A second issue were welds that Galinis noted "were on the lower side of the acceptable criteria."
>
> In some cases, those welds didn't pass a visual inspection, he added.
>
> "Those items combined resulted in some cracked welds that we found. We believe it was fatigue failure," he added. "A lot of that analysis is still ongoing."
>
> As of earlier this week, repairs to the San Antonio were 50 percent complete and the work was expected to be wrapped up by mid to late November.

[31] Andrew Scutro, "Gator Oil Leaks: What Went Wrong?" *NavyTimes.com*, November 17, 2008. Bracketed material as in the original. Gator, as in alligator, is an informal term for an amphibious ship.

[32] Philip Ewing, "Winter Remains Unsatisfied With LPD 17," *NavyTimes.com*, November 17, 2008.

The main propulsion lube oil system problem on LPD-17 has led to a class-wide review, a Navy source told *Defense Daily*. That review includes inspection of the weld quality and an examination of whether the number of pipe supports on LPD-18, -19, and -20 are sufficient.

"We are doing engineering analysis and shipboard inspections," the source said. "That includes visual, radiological and dye penetration."

The lube oil leaks occurred in the forward and aft machinery space, the source said.

The inspections take place in two groups, one focusing on the welds and the other on the pipe hangers, Galinis said.

Weld inspections in one of two machinery rooms have been completed on LPD-18, Galinis added.

The results of that inspection show the welds are good, he noted.

"The ship is underway right now. When she pulls back in here ... we'll do the second machinery room," Galinis said. "We also just completed the pipe hanger inspection, so we have a list of pipe hangers we need to add."

The pipe hanger work likely will get done before LPD-18's deployment next year, he added.

The inspections are not limited to the ships, however. Galinis added the Navy is also looking at the weld inspection techniques used in the shipyards. "We are doing that from a training aspect, looking at the weld criteria that is applied when you do a visual inspection ... how that's applied to ensure there is uniformity."

"[We are] also taking an opportunity to go back and look at the processes that are in place in the shipyard, all the way from how the pipe is fabricated in the pipe shop and weld joints that are installed, and how the welding is done, to installation on the ship and the way the pipe gets 'hangered' on the ship," Galinis said.

"If you follow that trend all the way, from material receipt, through the fabrication of pipe details, to the installation of the pipe on the ship, to the testing of the pipe and inspection of the welds and the installation of the system, if you follow that process all the way through, there are things along the way here that we certainly can improve on," he added. "And we are taking that opportunity to do this."

Northrop Grumman [NOC] Ship Systems said the quality of its work is something the company takes very seriously.

"We have a rigorous program in place that includes inspecting and evaluating our work to ensure it adheres to the Navy's requirements. When issues arise, we aggressively address them in an immediate and methodical way," Margaret Mitchell-Jones, a Northrop Grumman Shipbuilding spokeswoman, told *Defense Daily*. "Upon hearing there may be a problem with lube oil leaks on LPD-17, we immediately responded with technical staff to assist in the Navy's efforts and began our own in-house critique. We have put our best people in place to assist our customer and we are proactively conducting a comprehensive review of our procedures, processes and policies surrounding the LPD-class ships currently under construction at our Gulf Coast shipyards."

Those efforts include the implementation of short-term corrective actions until, aligned with the Navy, Northrop Grumman determines the cause and need for any long-term corrective

> actions to ensure conformance and reinforce the commitment to quality the company has in its work, Mitchell-Jones added.
>
> "We have invited and welcomed Navy participation throughout our own internal review process."
>
> Northrop Grumman builds the San Antonio-class amphibious ships at both its Pascagoula, Miss., and New Orleans shipyards.
>
> The fourth ship of the class, LPD-20, was just delivered, Galinis said.
>
> LPD-21 through -25 are under construction, with LPD-22 and -24 being built at Pascagoula and LPD-21, -23, and -25 being built in New Orleans.
>
> The Navy just received funding for LPD-26 in the FY '09 defense bill. "We are in the process of putting together the RFP documents," Galinis said.
>
> Lessons learned from the lube oil leak on LPD-17 have been rolled into LDP-21, he added.
>
> Currently, LPD-21 is about to begin the process where its lube oil system is flushed, Galinis said.
>
> "Obviously lessons learned from [LPD]-17 were immediately applied to [LPD]-21 because that piping system, although it is installed and fully built, hasn't been completed with all the ... insulation, so it was very easy to take what we were seeing on [LPD]-17 and go back and look at [LPD]-21 ... look at the welds, look at where the pipe hangers are ... and in some cases, quite frankly even now, not all the pipe hangers are installed. So we are kind of still in that process."
>
> For the ships that have already been delivered, Galinis said there is a big focus on LPD-18, which is out on the West Coast and will deploy next year. LPD-19 is currently going through her (Post Shakedown Availability PSA) in Norfolk, Va., at BAE Systems. "We will do a weld and hanger inspection on her during the current PSA period she is in," Galinis said.
>
> The Navy is doing an inspection right now on LPD-20. Earlier this month, she was going through an engineering certification with her crew, Galinis said. "We didn't want to get into the machinery spaces while she was going through that inspection."
>
> That certification wrapped up last week, so the Navy is now going through the inspection on her, he added. "So far the results look pretty good, but we are still in that process."[33]

It was subsequently reported in November 2008 that:

> While it might appear that the Navy's San Antonio-class program is fraught with problems, the Navy and industry team have been able to drastically reduce the number of inspection trial cards and put in place construction practices to cut down on installation work and on cost, according to a Navy official.

[33] Geoff Fein, "Navy Making Sure LPD-17 Lube Oil Leak Problem Doesn't Spread To Rest of Class," *Defense Daily*, November 20, 2008: 1-3. Ellipses and material in brackets as in the original.

When the USS San Antonio (LPD-17) wrapped up her trials, the Navy's Board of Inspection and Survey (INSURV) wrote up just over 16,000 trial cards, Capt. Bill Galinis, LPD-17 program manager, told *Defense Daily* in a recent interview.

In April 2007, LPD-17 went into BAE Systems' repair facility in Norfolk, Va., to fix the problems found by the inspection.

The cost of Post Shakedown Authority (PSA) for the USS San Antonio was $36 million....

When the USS New Orleans (LPD-18) finished her trials earlier this year, the INSURV board wrote up just under 14,000 trial cards, Galinis noted.

"When we delivered the ships, they were not quite finished," he said of both the San Antonio and New Orleans.

"When we got to [LPD]-19, that's where we saw the big down shift. We had a little bit more than a 50 percent reduction from hull 2 to hull 3, and that was a step increase for us," Galinis said. "Same thing on Part 1 cards, where you went from 740 cards to 257 ... better than a 50 percent decrease from the second to third ship."

Part 1 cards note deficiencies that would affect a mission area of the ship, such as defensive systems, the ability to get underway and embark Marines, Galinis said.

Part 2 cards are material deficiencies that would not necessarily degrade a mission area, he added.

By the time the USS Mesa Verde (LPD-20) underwent her INSURV inspection, the amount of Part 1 cards decreased almost 90 percent, Galinis said.

"That's a real credit to the builder and the Navy team that's down there on site, where literally we go through and prepare a ship to go through the trial process," Galinis said.

The first trial is conducted by the Navy's Supervisor of Ships (SUPSHIP). Galinis said they take the INSURV reports from the previous inspections and start from there.

"As we go through the test sequence, we are looking at these deficiencies and making sure we are rolling those lessons in," he said. "The shipyard has a process where they do that, and the SUPSHIP does that as well."

But it's difficult to roll in those lessons learned. That's because two different yards are building the LPD-17 class: Northrop Grumman [NOC] Ship Systems Pascagoula, Miss., facility and the company's shipyard in New Orleans.

"Across the class, you don't get true learning because we are building ships in alternate facilities," Galinis said. "Although there is some part of the workforce that moves back and forth across the two shipyards."

Another issue has been that the lessons learned from LPD-17 and -18 have been rolled into the follow-on ships out of sequence, Galinis said.

"On [LPD]-19 and -20, a lot of these lessons learned were cut in... out of sequence. In other words, if you had to plan how you do the work, some of the changes as a result of some of these earlier INSURV trials were rolled into these follow ships probably not at the optimum time, if you had an opportunity to really plan it out," he said. "That's because if you take a

look at how the ships stack up on top of one another, they were just that close in the construction sequence."

Not being able to cut that work in, in sequence, affects not only the number of changes that can be cut in but also what it cost to do that work, Galinis added.

That also affects the end cost of this ship in some cases because it takes more man hours to do that. Galinis said it is the three, two, one rule.

"What would take you an hour to do in a unit would take you two hours to do when you stack that on, and when the ship goes into the water that task would take you three hours to do," he said. "So you can see as a ship gets closer to delivery it gets more expensive to do the same amount of work, because you close the ship down and are working in a much more confined space ... and it's more difficult to do the work.

"That's why when I say we are cutting corrections in, out of sequence here, you don't generally get as much learning and the same leverage," Galinis added.

What people will start to see on the USS New York (LPD-21) and the follow ships, however, is that a lot of this work is being done in sequence, Galinis said. "So we are able to sort of pan that in, and certainly with [LPD-] 22 and follow-on you will see even more of that."

The other thing the Navy and Northrop Grumman have been able to do on these ships is to increase the amount of pre-outfit on the units, Galinis said.

There are 210 units on a LPD-17-class ship. Those units are built in modules. What the Navy would like to try to do is get as much pre-outfitting done as they possibly can.

"By installing piping systems, equipment, some machinery units, ventilation, electrical components, things of that nature ... on the earlier ships pre-outfitting has probably been in the 70 percent range. We are moving up into the 90 percent, or even better, on these later ships," Galinis said. "Going back to that three-two-one rule, we are doing a lot more of that work on the front end of the construction process at a lower cost. As we start to stack those units, there is less installation work to do on the back end.

"The lessons learned in the items that were identified on the previous ships, that work is being done more efficiently, in sequence on [LPD-] 21 and follow, and we are also able, on [LPD-] 22 and follow, to pull that back further and include that as part of the pre-outfitting work that we do. We are increasing that amount of work as well."[34]

A November 2008 press report stated:

Pentagon acquisition czar John Young last week criticized the welds on the Northrop Grumman-built San Antonio (LPD-17), but said it remains to be seen if current problems with the ship lie with the builder or with the Navy.

The first-of-class amphibious transport dock ship San Antonio hit a snag recently during its much-anticipated first deployment. The ship is pierside in Manama, Bahrain, where leaks in the lube oil piping system are being investigated and ultimately repaired. "All the vessels of the class are being reinspected," Young said in a Nov. 20 breakfast meeting with reporters in

[34] Geoff Fein, "Lessons Learned From INSURV Inspections Lead To Improvements On San Antonio-Class," *Defense Daily*, November 21, 2008: 3-5. Ellipses and bracketed material as in the original.

Washington. “I think the Navy is doing the prudent thing to go back and look through the class.”

Yet, Allison Stiller, the deputy assistant secretary of the Navy for shipbuilding, told Inside the Navy Nov. 12 that the service believes the problems with the San Antonio are exclusive to that ship.

“Right now the issues that we’re experiencing on the lead ship [LPD-17], we believe are isolated to the lead ship,” Stiller said in an interview in her Pentagon office.

“We’re still getting the data, but the indications are this is limited to the lead ship and, again, it’s pipe hangers, welds or a combination, and we have to come through that analysis to understand what the problem is,” she added.

Young noted last week that the investigation is not complete and he does yet know the extent of the lube oil piping system problem.

“In the lube oil area, the Navy is still doing an investigation,” he said. “The initial results of this are somewhat concerning, and that is both industry and the Navy may have inspected these welds to a lesser standard than the Navy called for.”

Moreover, the acquisition chief argued Northrop Grumman, the shipbuilder, had higher-than-normal defect rates on some of the ship’s welds, which could in turn have led to the current problems.

“In the past, the company had defect rates over 30 percent or higher on high-temperature, high-pressure welding and even on rather simple drain pipe welding,” Young said. “None of those are the lube oil system, which I don’t know if we had excessive defect rates there.”

If the leaks are found to be the result of inadequate inspections by industry, and in turn, the Navy, the taxpayer should not foot the bill, Young argued.

“The government should not be paying under cost-plus contracts, in any area of product delivery, for poor standard of performance where we have to pay extra cost to have it re-done,” he said. “I think the defect rates on some of those high-temperature, high-pressure welds, drain-pipe welds were excessive and the government needs to find a different way to do business with industry in any sector where we get something that’s totally anomalous to what would be reasonable commercial practice.”

Northrop has launched its own investigation into the problem, the company’s president of shipbuilding told ITN [Inside the Navy] last week.

“When we first heard of the specific set of issues on LPD-17, we immediately set up our own investigation, our own team, to try to understand what are the issues to the best of our ability to figure out. What are our processes, where are the gaps in our processes, do we have them, have we already addressed them?” Mike Petters said in a Nov. 17 interview in Newport News, VA.

“We have worked cooperatively with the Navy, and we’re providing whatever assistance they’re asking for,” he added. “I don’t think we’re actually doing any of the repairs ourselves. We have had people there to assist in some of the fact finding and to help diagnose what’s going on.”

> The shipyard is "conducting briefings and reviews throughout all Gulf Coast facilities of Northrop Grumman Shipbuilding to include all quality inspectors, pipewelders, and pipefitters," a company spokeswoman said Nov. 20.
>
> Moreover, Northrop is taking other measures to ensure its processes are working right, including:
>
> —Performing a comprehensive review of all documentation from LPD-17, focusing specifically on pipe and weld design, quality inspection requirements and procedures as well as procedural compliance to design specifications;
>
> —inspecting the piping system to verify the necessary support hangers have been installed; and
>
> —performing inspections—in conjunction with the Navy—of the pipe systems on LPD-20 to ensure all weld standards are compliant before the ship leaves the yard in New Orleans.[35]

Developments in 2009

An August 2009 news report stated that: "The program manager for amphibious assault ships pledged a 'redoubling of efforts' in quality assurance of new LPD-17 amphibious assault ships after the lead ship in the class suffered a series of setbacks ranging from welding deficiencies to a delayed first deployment."[36]

A December 2009 report from the Department of Defense Director of Operational Test & Evaluation (DOT&E) provided the following assessment of the LPD-17 program:

> The following are DOT&E's observations and assessments based on testing completed to date:
>
> • LPD-17 is able to meet its amphibious lift requirements for landing force vehicles, cargo, personnel, fuel, hangar space, well-deck capacity, and flight-deck landing areas.
>
> • Reliability problems related to well deck ramps, ventilation, bridge crane, and Cargo Ammunition Magazine (CAM) elevators detracts from mission accomplishment and reduces amphibious warfare suitability.
>
> • The engineering plant, as designed, is effective and met its mobility (speed, endurance) requirements.
>
> • Reliability problems associated with the Engineering Control System (ECS), including frequent failures and high false alarm rates, and the electrical distribution system, including unexplained loss of service generators and the uncommanded opening of breakers, revealed shortfalls in manning and training to support sustained manual operation of the plant.
>
> • The Navy's Board of Inspection and Survey (INSURV) identified similar deficiencies in identical areas (propulsion, auxiliaries, electrical, damage control, deck) during both

[35] Zachary M. Peterson (with additional reporting by Rebekah Gordon), Young: Navy Should Not Pay For Poor Craftsmanship On LPD-17 Ships," *Inside the Navy*, November 24, 2008.

[36] Dan Taylor, "Graham: 'Redoubling of Efforts' To Avoid Repeat of LPD-17 Problems," *Inside the Navy*, August 24, 2009.

acceptance and final contract trials across all four of the first ships of the class. Catastrophic casualties recorded prior to the Full Ship Shock Trial in LPD-19 and during LPD-17's deployment revealed serious fabrication and production deficiencies in the main lube oil service system.

• The ship is capable of supporting Command, Control, Communications, Computers, and Intelligence requirements in an ESG [expeditionary strike group] environment; however, reliability problems with the SWAN and the Interior Voice Communications System degrade command and control and are single points of failure during operations.

• The Navy still needs to validate critical Information Exchange Requirements and pursue a formal Information Support Plan to support a Joint Interoperability Certification.

• The LPD-17 exhibited difficulty defending itself against several widely proliferated threats, primarily due to:

—Persistent SSDS Mk 2-based system engineering deficiencies

—The ship's RAM system provided the only hard kill capability, preventing layered air defense

—Problems associated with SPS-48E and SPQ-9B radar performance against certain Anti-Ship Cruise Missile attack profiles

—Degraded situational awareness due to Mk 46 Gun Weapon System console configuration

• LPD-17 failed to satisfy its reliability requirement during the first five hours of an amphibious assault and its total ship availability requirement during IOT&E.

• The survivability of the San Antonio class ships appear to be improved over the LPD class ships they will replace. However, problems encountered with critical systems during testing (particularly with the electrical distribution, chilled water, SWAN, and ECS) and difficulty recovering mission capability may offset some of the survivability improvements and have highlighted serious reliability shortcomings.[37]

Developments in 2010

An early January 2010 news report stated:

> The amphibious transport dock New York has suffered a mechanical failure and can't get underway, Navy Times has learned. Engineers are investigating whether the ship's problems will affect its San Antonio-class siblings, several of which have struggled since joining the fleet.
>
> Inspectors discovered problems with the bearings on the New York's diesel engines during an assessment while the ship was at sea, but it was able to return to its dock at Naval Station

[37] Department of Defense, *Director, Operational Test and Evaluation FY 2009 Annual Report*, December 2009, p. 150. See also Dan Taylor, "DOT&E: 'Extensive List of Deficiencies' On LPD-17 Class Needs Action," *Inside the Navy*, February 1, 2010.

> Norfolk, Va., under its own power, said Lt. Cmdr. Herb Josey, a spokesman for Naval Surface Force Atlantic.
>
> Bearings hold a ship's engines and vital propulsion gear in place. The broken ones aboard the New York are still under warranty and will be repaired by its builder, Northrop Grumman, Josey said.
>
> Northrop Grumman spokeswoman Margaret Mitchell-Jones issued this statement: "Northrop Grumman is supporting the Navy in their analysis of this situation, however we defer any additional comment on commissioned ships to the Navy."
>
> The New York—which enjoys international fame for the 7.5 tons of steel from the wreckage of the World Trade Center built into its bow stem—was commissioned with national fanfare Nov. 7 in its namesake city. Since then it has been doing at-sea tests and inspections, including the week-long "diesel baseline assessment" that revealed its failed bearings, Josey said....
>
> New York sailors told Navy Times in November before the ship's commissioning they were working out their own bugs in their new ship; for example, New York's helmsmen had gotten used to piloting it manually because its fiber-optic control network tended to blink out.[38]

Later in January 2010, it was reported that:

> A fresh set of problems with the long-troubled LPD 17 San Antonio-class amphibious ships has side-lined two of the vessels, led the U.S. Navy and its largest shipbuilder into a passionate game of finger-pointing, and raised questions about Northrop Grumman's ability to deliver quality work and the Navy's ability to carry out proper shipyard oversight.
>
> The larger issues are coming from two core problems discovered aboard the LPD 17s, five of which are in service with four still to come.
>
> Of more immediate importance is a problem that, left untreated, could wreck the four large diesel engines that drive the ships. The problem is not new but, having once thought a solution was at hand, the Navy and Northrop are once again trying to figure out why a fix hasn't been found.
>
> Another issue, affecting all the ships in the class and other ships built at Northrop's Gulf Coast ship-yards, could—unless it's fixed—shorten the service lives of all the ships. But how and why that problem arose could drive closer to the competence of Northrop and the Navy's inspectors to properly inspect weld work.
>
> The Lube Oil Problem
>
> Engineers are trying to figure out how debris—"contaminants" in engineer-speak—is getting into lube oil in the large diesel engines that drive the ships. The contaminants cause excessive wear on bearings that support a crankshaft at the bottom of each engine. If the problem isn't treated, the crankshaft will be thrown out of line and the engine could suffer serious damage or even be wrecked.

[38] Philip Ewing, "LPD Machinery Issue Could Affect Other Ships," *NavyTimes.com*, January 7, 2010.

The problem isn't new, the Navy said, and showed up about a year ago in the third and fourth ships of the class.

"We thought we had it licked," Jay Stefany, the Navy's program manager for the LPD 17 program, told reporters Jan. 21. "And that's where we were until right before Christmas." That's when the newest ship in the class, the USS New York (LPD 21), reported a bent crankshaft in one of the four diesel engines that drive the ship. Engineers found that the shaft was thrown out of alignment by scratches being made in the inner ring of the nine bearings that support the shaft—scratches that caused enough of a difference in the thickness of the bearings to make the shaft wobble. The scratches are caused by particles too small to see—much of them between 20 and 40 microns wide, or about .00118 of an inch, according to Stefany.

Such particles are found in all engines, but there are unofficial reports that the particles causing the latest problems are coming from shipyard work: slag from welding waste and grit from sand blasting.

The problems on the New York showed up in late November, after the ship returned to its base at Norfolk, Va. The ship, commissioned on Nov. 7 during an emotional and highly publicized ceremony at New York City, was widely proclaimed by Northrop as one of the best ships it had ever built, particularly because of its symbolism of the Sept. 11, 2001, terrorist attacks on the World Trade Center—steel from which was used in forging the ship's prow.

Stefany said the problems were a recurrence of similar issues discovered about a year ago on the Mesa Verde (LPD 19) and Green Bay (LPD 20).

"The ships were down for a number of months," he said, and stainless steel shavings were discovered in the lube oil. The problem was not with the Colt-Pielstick PC2.5 STC engines made by Fairbanks Morse Engine, he said, but changes were made in the piping between the engine and a strainer meant to catch contaminants. A new process to flush out the engines was also created and made standard. The ships subsequently reported no problems. The two earlier ships of the class, San Antonio (LPD 17) and New Orleans (LPD 18), also reported their engines were fine.

More Examinations

But with the new problems on the New York, the ships were examined again. Three of the ships were OK, but the San Antonio found contaminants in three of the four engines. The amphib is now at a shipyard in Norfolk awaiting repairs. The New York is also at Norfolk, where repairs are being made to the crankshaft bearings. Replacement of the bent crankshaft, however, will have to wait for a more extensive shipyard period this spring.

Engineers working for the Naval Sea Systems Command (NAVSEA), Northrop Grumman and Fairbanks Morse are deeply perplexed by the problem, and a design review meeting is to begin Jan. 26 in New Orleans, bringing together all the principals along with the fleet to discover the cause and come up with a permanent solution.

The fleet also is looking into the problem. Early in December, Adm. John Harvey, com-mander of Fleet Forces Command, ordered Rear Adm. Michelle Howard, commander of Expeditionary Strike Group Two, to begin a Manual of the Judge Advocate General investigation, or JAGMAN, of the problem. The effort reportedly is being led by NAVSEA's Rear Adm. Tom Eccles, the Navy's chief engineer. The investigation is focused primarily on the San Antonio and not the New York, which has yet to transfer to fleet operational control.

The lube oil problem is the latest embarrassment to hit the LPD 17 program, which has suffered a string of well-publicized snags and setbacks almost since the initial construction contract was awarded in 1998. Workmanship problems and bad luck have followed some of the ships even after they entered service—on its long-delayed first deployment in fall 2008, the San Antonio was forced to remain at Bahrain for more than a month to repair weld leaks in the main propulsion lube oil system.

The vexing lube oil problem on the ships is causing nerves to be frayed all around. The engines themselves are slightly modified versions of a tried-and-true model that is in wide use on ships and ashore, and has powered the Navy's LSD 41 Whidbey Island-class amphibious ships since the 1980s. Unsubstantiated charges range from shipyard sloppiness by Northrop Grumman or smaller yards that carry out overhauls to inadequate training of sailors who oversee the operation of the automated engine rooms. There is also the possibility that the fixes identified a year ago simply haven't all been made, said one key engineer.

"Replacing that section of piping from the filter to the intake, that was the main fix," said Lee Graeber, vice president of engineering at Fairbanks Morse and a former NAVSEA en-gineer. That effort, he said, "is still going on." And while "dirty lube oil is still the prime suspect for the bearing failures," Graeber feels the bent shaft "was due to engine operation while the bearing on that engine was failing or in the process of failing." Turning off the engine, he said, would avoid such damage.

Contaminants are found in all diesel engines, Graeber said. "They can be created by the combustion process in the engine itself—part of the lube oil filter process is to wash them out. Normally a diesel plant would have several lube oil purifiers that would take these out, and that also is being investigated—whether there are enough purifiers and they are of sufficient size and capacity." Virtually everything having to do with the engine and the design of the oil lubrication system will be examined at the design review, sources said, including design, welding, con-struction and maintenance procedures and other equipment.

"They're trying to figure out what's wrong with the damn system," said one exasperated official. "Everybody could raise their hand." And while the New York is undergoing repairs, work on the San Antonio is on hold pend-ing conclusion of the JAGMAN investigation.

The Weld Problem

A more widespread problem that came to light during the 2008 Bahrain repairs on the San Antonio has to do with substandard welds on pipe joints on ships delivered by Northrop's Gulf Coast yards at Avondale, New Orleans, and Ingalls, Pascagoula, Miss. The thickness of many welds, Stefany said, is too thin, meeting commercial but not military specifications. A design that featured too few hangars that hold pipes in place led to exces-sive vibration of the pipes on the San Antonio, causing the welds to fail.

The welds would not have failed were there enough hangars, Stefany pointed out. Changes were made to the ship's design and more hangars were added in all the ships. The next ship to be commissioned, the San Diego (LPD 22), will "have the right hangaring from the beginning," he said.

As a result of the problems, all Navy ships under construction at Northrop Grumman were reinspected for weld problems.

"We found a higher-than-expected failure rate on quality of the thickness of the welds," Stefany said. The issue was not that, properly hangared, the welds would soon fail in service. Rather, Stefany said, the welds are "critical for shock survivability and for service life. You

> need [the thicker weld] dimensions to guarantee that." As a result, he said, a ship de-signed for a service life of 40 years might only make it to 30.
>
> "It's not as catastrophic [as the lube oil problem] but we're working it," Stefany said. "It's not as in-your-face as the engines are—basically it's just putting more welding material on."
>
> Throughout the summer of 2009, Northrop Grumman and the Supervisor of Shipbuilding (SUPSHIP) at Pascagoula reinspected all welds on all ships. All pipe welders were de-certified and forced to go through retraining, Stefany said. "At the same time we retrained the shipbuilders, we retrained the SUPSHIP guys," he added. Delivery of the destroyer Dewey was delayed so fixes could be made, and Northrop sent a contingent of engineers to California aboard the new assault ship Makin Island to ensure the quality of repair work and carry out repairs if needed.
>
> While pipe weld problems were found on all the Navy ships under construction at Ingalls and Avondale, the Coast Guard's National Security Cutters (NSC) being built at Ingalls apparently evaded the worst of the issue.
>
> "The Coast Guard has not experienced any significant piping issues on its National Security Cutters," spokeswoman Laura Williams said Jan. 22. Some "piping discrepancies" were found and corrected on the second NSC, she said, adding that the first NSC, the Bertholf, "has not experienced any problems, but we are finishing follow up welding inspections to make sure any potential discrepancies are addressed." The ability of Northrop Grumman and SU-SHIP to properly carry out weld inspections has also come into question because of the pipe weld problem. Reversing a chronic shortage of oversight personnel has been a major pledge of Navy officials over the past three years.
>
> "Last year we saw a marked improvement in the ability of SUPSHIP to hire people," said a Navy official. "But we're going to have is-sues that come to light. The issues we're talking about go back long before we were able to hire people."[39]

It was also reported at this time that:

> The Navy's top civilian acquisition official said he was confident in shipbuilder Northrop Grumman's "commitment to delivering quality ships to the Navy" even after the Navy announced last week that all Northrop's warships built on the Gulf Coast were being re-inspected for faulty welds.
>
> "In the rare instance where an issue like this arises, the Navy and industry have always worked together toward a quick and effective resolution. This remains the case today," said Sean Stackley, the assistant secretary of the Navy for research, development and acquisition, in a statement released Monday.
>
> "At no time did the weaknesses that were discovered endanger the safety of the crews, and the Navy has determined that existing welds are satisfactory for current ship operation. We have worked hard to ensure all ships meet or exceed fleet standards, and are reliable and

[39] Christopher P. Cavas, "'We Thought We Had It Licked,'" *Defense News*, January 25, 2010: 1,8. Material in brackets as in original. See also Philip Ewing, "Widespread Problems On LPDs, Other Ships: U.S. Navy," *DefenseNews.com*, January 21, 2010; Dan Taylor, "Engine Issues Sideline Two LPD-17s; Bad Pipe Welds Prompt Northrop," *Inside the Navy*, January 25, 2010; and Peter Frost, "Navy Reports Widespread Problems On Northrop's Gulf Coast-Built Ships," *Newport News (VA) Daily Press*, January 22, 2010.

> combat ready assets. Plans are in place for inspections and required repairs to all affected ships during their normal industrial availabilities, with many already in progress."
>
> Stackley's statement was the first public comment from the Navy Department's leadership on the Jan. 21 announcement by Naval Sea Systems Command about the weld problems. Last week, a spokeswoman for Navy Secretary Ray Mabus referred questions to Stackley's office.
>
> Still, Stackley's statement did not answer the pressing questions raised by NavSea's announcement: How many warships—including destroyers and small- and large-deck amphibs—are potentially affected by the faulty welds? How or why did Navy inspectors sign off on out-of-spec welds that were discovered later on? How many of Northrop's welders and inspectors, and Navy inspectors, had to be decertified and recertified to work on ships after the problems were discovered? Who will pay for repairs?
>
> A spokesman for Stackley and a spokesman for NavSea's Supervisor of Shipbuilding both deferred those questions to NavSea. Navy Times has asked for answers and for comment from NavSea's senior leadership, but had not received a response by Monday morning.
>
> NavSea spokeswoman Monica McCoy did issue a statement Friday [January 22] about related problems with the San Antonio class of amphibious ships, blaming them in part on high labor turnover caused by the aftermath of Hurricane Katrina. Northrop Grumman also has blamed hurricane-caused worker problems for the heavy re-work necessary aboard the amphibious assault ship Makin Island.[40]

On July 1, 2010, the Navy released a 62-page report on its investigation of diesel engine and related maintenance and quality assurance issues on the *San Antonio* (LPD-17). The Navy released the document to reporters who had requested it through the Freedom of Information Act. The Navy provided a copy of the report to CRS on July 2, 2010. The report is dated January 10, 2010, and includes at the end an additional six-page "final endorsement" memorandum dated May 20, 2010. The final endorsement memorandum states in part:

> The investigation identified inadequate workmanship combined with a lack of quality control during new construction as the major causes of the damage. The investigation further identified shortcomings in ship design, systems integration, training, and ship's force management of critical engineering programs.…
>
> Numerous unacceptable conditions coalesced aboard USS SAN ANTONIO to produce the ship's significant engineering problems. Inadequate Government oversight during the construction process failed to prevent or identify as a problem the lack of cleanliness and quality assurance that resulted in contamination of closed systems. Material challenges with this ship and other ships of the class continue to negatively impact Fleet operations. Failures in the acquisition process, maintenance, training, and execution of shipboard programs all share in the responsibility for these engineering casualties…..
>
> COMVAVSEASYSCOM [Commander, Naval Sea Systems Command] has taken action… to remedy the matters under his cognizance, including change to system design, process improvement, greater government oversight during construction, and consideration of a contractual remedy with the builder. USS SAN ANTONIO, its ISIC [Immediate Superior in Command] (Amphibious Squadron SIX), and COMNAVSURFLANT [Commander, Naval

[40] Philip Ewing, "Navy, Northrop Working On Faulty Welds," *NavyTimes.com*, January 25, 2010.

> Surface Force Atlantic] have also begun taking action to correct deficiencies under their cognizance.[41]

A July 1, 2010, press report states:

> Although New York has at least been able to get underway using three of its four main diesel engines, San Antonio is laid up in a Norfolk, Va. dry dock until August or September. Engineers not only are repairing its lube oil systems, they're attempting a first-of-its kind repair job on a bent crankshaft, cutting their way through the ship's decks to get to its machinery spaces….
>
> Margaret Mitchell-Jones, a spokeswoman for Northrop Grumman, issued a written statement:
>
> "The report's findings support many of the findings from the industry/Navy technical team investigation into the bearing damage on the LPD main propulsion diesel engines this spring, resulting in a corrective action plan with recommended actions which are already in process. Northrop Grumman has aggressively prosecuted the issues and we are focused on corrective actions and moving forward."
>
> Rear Adm. Dave Thomas, commander of Naval Surface Force Atlantic, told reporters it was too early to tell how San Antonio's repairs would affect deployments for the rest of the fleet. He also said engineers were using the lessons of San Antonio to make repairs to the lube oil systems in the rest of the ships in the class.
>
> Thomas deferred questions about the report's recommendation for "a bottom up, top down review of [the Supervisor of Shipbuilding's] Gulf Coast quality control process," to Naval Sea Systems Command. A spokeswoman for NAVSEA had no response Thursday.[42]

A July 6, 2010, press report states:

> The Navy has full confidence in the Supervisors of Shipbuilding (SUPSHIPs), a NAVSEA spokeswoman says following the release of the JAGMAN report on LPD-17 last week.
>
> "SUPSHIP Gulf Coast (SSGC) identified a number of deficient welds on piping systems produced by Northrop Grumman Shipbuilding (NGSB) on LPD-17 after her delivery, and on other classes of ships in the Gulf Coast." While all shipbuilding defects identified are required to be corrected, the Navy has also formally requested Northrop Grumman Shipbuilding (NGSB) address and correct their process problems associated with each specific defect, the spokeswoman adds. "The Navy continues to closely monitor the progress being made by NGSB. NGSB is correcting their affected welding processes and SSGC has increased surveillances of welding and other critical processes."…

[41] Department of the Navy, final endorsement memorandum dated May 20, 2010, from Commander, U.S. Fleet Forces Command to Commander, Naval Sea Systems Command and Commander, Naval Surface Force Atlantic, on Command Investigation of Diesel Engine and Related Maintenance and Quality Assurance Issues Aboard USS San Antonio (LPD 17), paragraphs 1, 3, and 4. See also Geoff Fein, "Numerous Failures Led To MDEP Issues On LPD-17," *Defense Daily*, July 2, 1010; Corinne Reilly, "Report: Navy Shares The Blame For San Antonio's Defects," *Norfolk Virginian-Pilot*, July 2, 1010; Dan Taylor, "Navy Investigation: LPD-17 Problems Hamper Overall Fleet Readiness," *Inside the Navy*, July 5, 2010.

[42] Philip Ewing, "Navy: Widespread Faults Caused LPD 17 Woes," NavyTimes.com, July 1, 2010. Bracketed material as in original. A list of news releases posted by Northrop Grumman at http://www.irconnect.com/noc/press/index2.html, when accessed on July 7, 2010, did not show a news release dated on or about July 1, 2010, matching the Northrop statement mentioned in the article.

> "The SUPSHIPs have further strengthened government oversight by way of increased shipbuilder process compliance evaluations and audits of the shipbuilders' Quality Management System as added assurance that the final shipbuilding product is compliant to contract requirements," the NAVSEA spokeswoman says.[43]

On July 28, 2010, the Navy testified that the fourth LPD-17 class ship, *Green Bay* (LPD-20), had experienced problems with engine contaminants. Vice Admiral Kevin McCoy, the Commander of the Naval Sea Systems Command (NAVSEA), stated that:

> Earlier this spring Green Bay entered a post shake down availability following—following new construction trials. During that time frame, we elected to install system modifications that we determined coming out of the—the San Antonio investigation and other issues with main propulsion diesel engines on LP[D]-17 class.
>
> We changed the filtering system. We also did some piping changes between the final strainer and the engine to eliminate socket welds, and install butt welds so that we—we didn't have possibly contaminants and—and—and—and hideout places for contaminants in the system.
>
> Towards the—we also did a number of piping inspections and piping repairs due to inadequate fillet welds during the new construction process. Towards the end of that PSA—post-shakedown availability—we determined significant foreign material in the steering system that had fouled the rams (ph) and caused galling—or the steering ram (ph). And we had to go cut the deck and replace the ram (ph) which made that PSA go long, which pushed the downstream schedule.
>
> That has been repaired. The ship has been back out. Completed final contract trials last week. And we expect the ship to take its place in a regular fleet rotation from there on, sir.[44]

An October 1, 2010, press report stated:

> The troubles of the USS San Antonio, first of a large class of amphibious transport ships, haven't quite come to an end yet; the Navy and its engineers are continuing to find and fix a host of problems plaguing the 25,000-ton ship.
>
> Earlier this year, engineers searching for the cause of vibrations in the drive train discovered that imperfections in the way the ship's engines and main reduction gears were installed were threatening to eventually wreck the vessel.
>
> "The foundation bolts were not properly aligned or tightened. The main reduction gear was not properly installed and checked out," Adm. John Harvey, commander of Fleet Forces Command, said in a Sept. 20 interview at his headquarters in Norfolk, Va.
>
> "There was vibration of the entire diesel which was reflected through the crankshaft, down to the couplings with the reduction gear, to the shaft," Harvey said. "And you're trying to figure out where this thing …" he said, pausing. "Over time on that ship we had tremendous alignment problems within the drive train and within the diesel."

[43] "No Problem With SUPSHIPS" and "…Getting Tougher," [consecutive short news items], *Defense Daily*, July 6, 2010, pp. 2-3.

[44] Source: Transcript of July 28, 2010, hearing on Navy surface fleet readiness before the Readiness subcommittee and the Seapower and Expeditionary Forces subcommittee of the House Armed Services Committee. Indications of phonetic spelling (ph) of heard words as in the transcript. See also Dan Taylor, "Official: Engine Contaminants Found in Amphibious Ship Green Bay," *Inside the Navy*, August 2, 1020.

The problems are being fixed, along with other issues on the San Antonio, during a shipyard period in Norfolk that has grown from a planned four or five months to eleven or more, and risen in cost from about $5 million to $39 million. The final bill will be higher still, when all the work is factored in.

Harvey, who is charged with getting the Navy's ships ready for sea, last fall ordered a Judge Advocate General (JAGMAN) investigation into the situation aboard the San Antonio, prompted by continuing problems with the engines. The report, completed in January, concluded a host of issues contributed to problems on the ship, including inadequate workmanship, poor quality control during construction, shortcomings in the ship's design, and problems with the crew's management of engineering troubles. Even before the JAGMAN, problems had come to light involving bad electrical wiring installation, poor welds, and microscopic crud getting into the lubrication oil system of the ship's diesel engines.

The latest problems to be revealed came to light after the investigation.

The San Antonio entered Earl Industries' shipyard in Norfolk in December for a scheduled overhaul.

"We went to ground zero with the ship" in an effort to get at the root of the problems, Harvey said.

"Every time we think we get to a point where we think that problem is solved, we find some deeper one," he added with exasperation.

Naval Sea Systems Command is continuing to work to fix the ship.

"We wanted to try and get over the hump of incremental discovery," Rear Adm. Jim McManamon, NAVSEA's vice commander of the surface warfare directorate, said in a Sept. 30 phone interview. "To do it right, we're taking a very deliberate approach to really go after each of these bolts."

Each engine contained 126 "fitted" bolts—shaped to fit individual holes—and two longer bolts, McManamon said. All the bolts on each of the San Antonio's four main engines were removed, inspected and replaced, he said, along with 32 bolts on each of the two main reduction gears, which transfer power from the diesels to the propeller shafts.

"We're doing the full Monty on it," he said.

The bolts don't have to be off by much to cause a problem.

"We're talking about thousandths of an inch here," said John Hartranft, NAVSEA's director of the combustion engines branch. "We're dealing with very tight tolerances," he said, yet enough to allow the engine block to move or flex.

Similar problems have been found on the second ship in the class, the New Orleans, and to a lesser extent on the third ship, the Mesa Verde. The bolts on the fourth ship, the Green Bay, were "much better," McManamon said, and about four bolts needed replacement on the New York, the fifth ship.

The New Orleans will enter a shipyard at its homeport of San Diego in early November, for a planned 12-week overhaul. McManamon hopes the work can be done in that time, although he acknowledged it may take longer.

> Meanwhile, the San Antonio moved Sept. 10 from the shipyard at Earl to the main base at Norfolk, although the repairs are not yet complete. NAVSEA hopes to begin machinery trials in November, but with the coming holidays the overhaul isn't expected to be complete until after the first of the new year.
>
> Harvey was at a loss to explain how the problems came to be on the San Antonio, built by Northrop Grumman's shipyards at Avondale, La., and Pascagoula, Miss., and delivered to the Navy in August 2005 after a protracted and troubled fitting-out period.
>
> "I know they can build good ships; they can do it," he said.
>
> That engines could be installed improperly is "incomprehensible," he said. "A, that it would pass an internal quality check that way, and then B, that it would pass through the Navy's quality control that way."
>
> "I think we were so focused on getting that ship into service," he said of the frustrations of getting the ship completed, "that we rolled over a lot of issues."[45]

An October 2, 2010, press report stated:

> The latest round of repairs aboard the Norfolk-based amphibious ship San Antonio will run the Navy at least $39 million, far more than the $7 million officials originally estimated, the service said Friday.
>
> The San Antonio, commissioned in 2005, has been under continuous repair since December [2009].
>
> The work initially was slated to wrap up by May [2010]. That's now been pushed back to spring 2011, when the ship is scheduled for sea trials, said Chris Johnson, a spokesman for Naval Sea Systems Command in Washington.
>
> "The reason we've lengthened that time is that we want to make sure we're finding all the root causes behind the problems before we send her back out to sea again," Johnson said. "We want to be sure we get this right."…
>
> The Navy has declined to disclose how much it has spent fixing the ship since its commissioning.[46]

An October 11, 2010, press report stated that, according to the officer who heads the Navy's amphibious warfare branch, 16 of 30 material problems found on LPD-17 class ships have been solved, and the Navy is working to solve the other 14. According to the report, the officer said that "investigators found the problems arose in part because the Navy has planned to rely on contractors who provided commercial off-the-shelf equipment for training, but given financial pressures, funding for the training was cut." The officer, according to the report, said that the Navy plans to have the needed training schools and classes fully implemented by 2014.[47]

An October 14, 2010, press report stated:

---

[45] Christopher P. Cavas, "More Engine Woes Found With LPD-17," *NavyTimes.com*, September 30, 2010.

[46] Corinne Reilly, "Repair Bill For Navy's Troubled San Antonio Swells To $39M," *Norfolk Virginian-Pilot*, October 2, 2010.

[47] "Under Control," *Inside the Navy*, October 11, 2010.

The amphibious transport ship San Antonio, sidelined all year for repairs to the engineering plant, will miss a scheduled deployment next year in order to complete the work, Fleet Forces Command said in a statement released late Thursday [October 13].

San Antonio's sister ship, Mesa Verde, which returned in August from a seven-month, 35,000-mile deployment to the Persian Gulf, will take the San Antonio's place and deploy next summer with the Bataan Amphibious Ready Group, USFF said.

Problems have plagued the San Antonio since the ship was delivered in August 2005 from Northrop Grumman Shipbuilding. Although similar issues have, to varying degrees, affected follow-on ships in the class, the San Antonio, first in its class, has consistently been a problem ship—a fact the Navy acknowledged when it accepted the vessel after a prolonged fitting-out period.

The Navy and Northrop have long grown exasperated in trying to manage and deal with the ship's problems, which have included poor electrical wiring installations, bad welds, a dysfunctional engine control system and faulty hydraulics in the stern door.

A persistent problem cropped up on all the ships of the class with contaminants in the engine lube-oil system. Earlier this year, while the San Antonio was undergoing an overhaul at Earl Industries in Norfolk, Va., engineers investigating the root cause of vibrations in the drive train—the engines, reduction gears and propeller shafts that drive the ship—discovered that bolts in the foundations of the diesel engines and the main reduction gears were improperly installed. If not fixed, officials said, the vibrations could eventually wreck the propulsion system.

Over the ship's career, Navy inspectors also have cited the crew for poor maintenance procedures, and criticized training programs for insufficient instructions on how to operate the ship's systems.

Last fall, Adm. John Harvey, head of Fleet Forces Command, ordered a Judge Advocate General investigation, known as a JAGMAN, to be carried out to get to the root of the San Antonio's problems. The investigation, completed in January, concluded that a host of issues contributed to problems on the ship, including inadequate workmanship, poor quality control during construction, shortcomings in the ship's design, and problems with the crew's management of engineering troubles.

The ship completed her only fleet deployment in March 2009. The overhaul at Norfolk begun early this year was expected to take about four or five months and cost $5 million.

But largely due to the engine foundation problems, the work is now expected to take about 11 months and the cost has risen to at least $39 million, according to the Naval Sea Systems Command. The final bill will be higher when all the work is factored in.

But Harvey and NAVSEA seem determined to fix as many problems as possible during the current work package.

"We went to ground zero with the ship," Harvey said in September.

"We wanted to try and get over the hump of incremental discovery," Rear Adm. Jim McManamon, NAVSEA's vice commander of the surface warfare directorate, said Sept. 30 during a phone interview. "To do it right, we're taking a very deliberate approach."

> The Navy is working "to ensure that USS San Antonio returns to the fleet as a fully operational and deployable platform, and that the Navy has given her crew the proper tools and training necessary to use San Antonio to its fullest capability," USFF said in the statement.
>
> "San Antonio will deploy when it is operationally sound and ready to go," Harvey said in the statement.
>
> Navy officials said they were not aware of any new problems that have caused the ship to miss next year's deployment. Rather, they say, the delay is due to the year-long overhaul.
>
> Even though the repair work is continuing, the ship moved Sept. 10 from the shipyard to Naval Station Norfolk, Va., where she remains. NAVSEA officials expect the work to be finished about mid-January, after which the ship will need to go through a lengthy period of recertifications and crew training to return her to operational effectiveness.
>
> Mesa Verde is the third ship in the San Antonio class, and is considered by the Navy and Northrop to have been delivered in much better shape than the San Antonio and the second ship, New Orleans. Commissioned in late 2007, she carried out a cruise to South America before conducting a full deployment with the Nassau Amphibious Ready Group that began in January with disaster relief work in earthquake-stricken Haiti.[48]

An October 28, 2010, press report states:

> Northrop Grumman Corp.'s $1.68 billion amphibious warship, designed to transport Marines close to shore, wouldn't be effective in combat and couldn't operate reliably after being hit by enemy fire, according to the Department of Defense's top testing official.
>
> The San Antonio-class vessel's critical systems, such as electrical distribution, ship-wide fiber optics and voice-communications networks, aren't reliable, according to Michael Gilmore, the Defense Department's director of operational test and evaluation. The ship's armaments can't effectively defend against the most modern anti-ship weapons, Gilmore said.
>
> The ship is capable of operating "in a benign environment," Gilmore said in an e-mail to Bloomberg News outlining the unclassified summary of a classified report sent to Congress in June. The vessel is "not effective, suitable and not survivable in a combat situation," he said….
>
> Northrop spokesman Randy Belote referred questions about the department's test report to the Navy, which said it's aware of the reported deficiencies and is making corrections that will be tested next year.
>
> "The majority of corrective actions have been implemented across the class and other corrections are in process," Navy spokeswoman Lieutenant Callie Ferrari said in an e-mail. "It would be inappropriate to comment on the specifics."…
>
> "Survivability" for the San Antonio means the degree to which the vessel "is able to avoid or withstand" an attack "without sustaining an impairment" of its ability to accomplish a combat mission, [Gilmore] said.

[48] Christopher P. Cavas, "Amphib San Antonio To Skip Scheduled Deployment," NavyTimes.com, October 14, 2010.

> His conclusion that the San Antonio is "not survivable" doesn't mean, however, that the hull and structure can't withstand a blow from an anti-ship missile due to inherent weaknesses, Gilmore said. In fact, the Northrop ship's hull construction is "improved" in comparison with the four classes of ships it will replace, he said.…
>
> Gilmore's conclusions are based on an assessment of data compiled in combat testing the Navy completed late last year, "previous reports and raw modeling data," the Navy said in a quarterly program report.
>
> Gilmore's office in August told Pentagon officials the vessel demonstrated "poor reliability with critical equipment and control systems," and an "inability to defend itself against a variety of threats."
>
> Navy test data indicated the vessels demonstrated an inability to "maintain or rapidly recover mission capability" after being hit by "the variety of weapons likely to be encountered," the testing office said.
>
> Raytheon Co. is a subcontractor providing electronics, a fiber-optics network and an anti-missile system the testing office concluded had "persistent engineering deficiencies."[49]

A November 1, 2010, press report stated:

> The U.S. Navy insists it is "well into the process" of correcting what a recently leaked Pentagon evaluation bluntly characterized as the combat ineffectiveness of its new class of amphibious ships.
>
> Moreover, it insists, the entire San Antonio class of amphibious transport dock ships is "warfare capable."…
>
> "The details of the study are classified," said Cheryl Irwin, a [DOD] spokeswoman. "However, we have said that this ship is more survivable than the one it is replacing." The Navy acknowledged the issues, but only circumspectly. Navy spokeswoman Lt. Callie Ferrari told Bloomberg that "the majority of corrective actions … are in process.
>
> The day after that [news] report [i.e., the October 28, 2010, press report cited above] was published, the Navy softened that response. "The Navy is taking the necessary steps to implement required actions across the LPD-17 class to improve the ships' survivability in a combat situation," Lt. Courtney Hillson said.
>
> Hillson said the classification of the Pentagon report makes it "inappropriate to comment on specifics." At the same time, she defended the ships' current fighting capability.
>
> "The San Antonio-class amphibious transport dock ships are warfare-capable ships," Hillson said.[50]

A November 15, 2010, press report quotes the Chief of Naval Operations as stating that "taking delivery of [LPD-17] without it being fully complete probably was not helpful," and that "the

[49] Tony Capaccio, "Northrop Navy Ships 'Not Survivable' in Combat, Official Says," *Bloomberg News*, October 28, 2010.

[50] William H. McMichael, "Under Fire, U.S. Navy Says LPD-17s 'Warfare Capable,'" *Defense News*, November 1, 2010: 16.

focus on quality as the ship is being built needs to be more intense than it was." The article also states that Roughead was impressed with the capabilities of the class when he visited LPD-19.[51]

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 LPD-17 program, that

> LPD-17 is capable of conducting amphibious operations in a benign environment but is not operationally effective, suitable, or survivable in a hostile environment.
>
> Chronic reliability problems associated with critical ship systems across the spectrum of mission areas reduce overall ship suitability and jeopardize mission accomplishment.…
>
> LPD-17 has not yet demonstrated adequate reliability and availability of critical ship systems, including:
>
> - Control Systems – SWAN [Shipboard Wide Area Network], Interior Voice Communications System (IVCS), and Engineering Control System (ECS).
> - Support equipment – Cargo Ammunition Magazine elevators, vehicular ramps, main propulsion diesel engines, electrical distribution system, and steering system.
> - Combat systems – SPQ-9B horizon search radar, the Mk 46 Gun Weapon System (GWS), and the Magazine Signature Control System.
>
> The following LPD-17 self-defense systems did not demonstrate adequate reliability: Mk 46 GWS, SSDS [Ship Self-Defense System] Mk 2, SPQ-9B, and SPS 48 [radar]/CEC [Cooperative Engagement Capability].
>
> The Navy's Board of Inspection and Survey [INSURV] identified similar deficiencies in identical areas during both acceptance and final contract trials across all four of the first ships in the class. Severe casualties recorded prior to the Full Ship Shock Trial in LPD-19 and during LPD-17's deployment revealed serious fabrication and production deficiencies.
>
> The ship has not yet demonstrated an adequate Command, Control, Communications, Computers, and Intelligence [C4I] capability.…
>
> The design of the San Antonio class ships have numerous survivability improvements compared to the LPD class ships they will replace. However, problems encountered with critical systems during testing, as well as difficulties in recovering mission capability, have offset some of the survivability design improvements and have highlighted the impact of serious reliability shortcomings.
>
> PRA [Probability of Raid Annihilation] test bed events and the Self-Defense Test Ship events revealed several combat systems deficiencies and underscored several previously known deficiencies.[52]

[51] Dan Taylor, "Roughead: Taking Delivery Of Unfinished LPD-17 Was 'Not Gelpful,'" *Inside the Navy*, November 15, 2010.

[52] Director, Operational Test and Evaluation, *FY 2010 Annual Report*, December 2010, pp. 149-150.

Developments in 2011

A Navy point paper on the LPD-17 class that the Navy provided to a reporter on February 10, 2011, states:

- The LPD 17 Class of ships has met or exceeded all key performance parameter objectives outlined in the LPD 17 Class Operational Requirements Document (ORD) with the exception of one information exchange requirement that still needs to be validated.

- The first three ships of the class have successfully completed their maiden deployments, meeting not only their anticipated operational requirements but also responding to emergent missions requests.

- DOT&E found the LPD 17 Class "not operationally effective, suitable, or survivable in a hostile environment"; and its report identified three major issues – reliability, self defense, and recoverability. The Program Office has completed its review of operational test reports by the Navy's Commander, Operational Test and Evaluation Force (COMOPTEVFOR) and DOT&E, developed corrective active action plans, and has resolved or is in process of resolving the deficiencies cited.

Reliability

- The LPD 17 Class operational evaluation was conducted with a legacy Asynchronous Transfer Mode (ATM) version of the Ship Wide Area Network (SWAN) and an early version of the Engineering Control System (ECS). The first two ships of the class have received the upgraded GIG-E SWAN; and no issues have been cited since installation. Upgrades to LPDs 19 and 20 are scheduled for completion by the end of 2012. All remaining LPD 17 Class ships in construction will include the SWAN upgrade. New ECS software to correct observed deficiencies and provide additional built-in test/monitoring capabilities has been installed on all LPD 17 class ships.

- Main engine reliability issues have been observed on four of the first five LPD 17 Class ships. The root cause of those issues can be traced back to lube oil cleanliness. Poor initial system cleanliness led to steering reliability issues. A major redesign of the lube oil filtration system was completed in early 2010. Damaged bearings and lube oil piping segments have been replaced on all affected ships. New filters and modified strainers have been or will be installed on all delivered ships, as individual schedules permit. New flushing procedures have been developed and implemented; LPD 22 and follow ships will all be delivered with the new designs and components.

- Interior/Exterior Communications (IVCS) components demonstrated unreliability and could not support high volume traffic; and the Uninterruptible Power Supply (UPS) batteries failed prematurely resulting in total power loss for vital components. The IVCS software has been upgraded; and new batteries, along with revised preventive maintenance procedures, have been installed on all LPD 17 Class ships. Additionally, a new UPS monitoring system is being implemented across the class.

Self-Defense

- While specific deficiencies noted by DOT&E are classified, the two primary mission areas addressed were air warfare and surface warfare. Air warfare system performance observed during LPD 17's operational evaluation has been subsequently improved. Mast interference with the SPS 48 air search radar has been significantly reduced through the

installation of radar shrouds on all LPD 17 Class ships. The implementation of new hardware and software on LPD 20 and follow ships has corrected SPQ-9B surface search reliability issues. Back-fits are planned for LPDs 17-19, as their schedules permit.

- The current gun systems onboard LPD 17 Class ships meets the stated surface warfare requirements outlined in the LPD 17 Class ORD. Software installations to increase operator situational awareness are being developed for future implementation.

Recoverability

- Recoverability refers to the ability of a ship and its crew to prevent loss and restore mission essential functions given a casualty from accidents or threat weapon effects. Systems that directly impact recoverability include UPS, SWAN, ECS, damage control equipment, shipboard damage control features and crew training. Ship system issues and associated resolutions have been identified in the preceding paragraphs. Additional isolation valves in the chill water system are planned for installation on all LPD 17 class ships; and fire detection system software deficiencies have been identified and corrected across the class to improve the ship's recoverability.

Follow-On Test & Evaluation (FOT&E)

- FOT&E, which commenced in July 2010, is being conducted by the Navy's COMOPTEVFOR and the Marine Corps Operational Test and Evaluation Activity (MCOTEA) under DOT&E oversight to confirm these corrective actions resolve the problems noted by DOT&E. The evaluation is scheduled to run through the end of 2011.[53]

At a March 1, 2011, hearing on the Department of the Navy's proposed FY2012 budget before the House Armed Services Committee, Admiral Gary Roughead, the Chief of Naval Operations, stated the following as part of a response to a question concerning the Navy's amphibious ships:

> I do believe that we are through the woods on the LPD-17 quality issues. We have worked that very hard. And—and I'm pleased with how those ships are now starting to perform. But it's – it's also a lesson to be learned that you don't take ships before they're finished and that you really make sure that you're leaning on the quality early on in the construction process.[54]

In its prepared statement for a March 9, 2011, hearing on Navy shipbuilding programs before the Seapower and Projection Forces subcommittee of the House Armed Services Committee, the Navy stated the following regarding the LPD-17 program:

> Lessons learned from the effort to resolve material reliability concerns identified in the early ships of the class are being applied to ships currently under construction. Quality continues to improve with each ship delivered as the Navy continues to work closely with the shipbuilder to address cost, schedule, and performance issues.[55]

[53] Source: Navy point paper provided to Michael Fabey of *Aerospace Daily & Defense Report* on February 10, 2011 and used here with his permission. For an article based on this point paper, see Michael Fabey, "U.S. Navy Defends LPD-17 Against Tester Criticism," *Aerospace Daily & Defense Report*, February 14, 2011, page 8.

[54] Source: Transcript of hearing.

[55] Statement of The Honorable Sean J. Stackley, Assistant Secretary of the Navy (Research, Development and Acquisition), and Vice Admiral John Terence Blake, Deputy Chief of Naval Operations For Integration of Capabilities (continued...)

An April 15, 2011, press report states:

> The U.S. Navy's most problem-plagued ship has a whole new set of issues, the service said - bad documentation of the work being done to fix it.
>
> The San Antonio (LPD 17), first of a class of large amphibious transport dock ships, has been under repair at Norfolk, Va., for over a year, with much of the work being done by the Earl Industries shipyard. The work was expanded from its original scope to include a comprehensive effort to fix a wide range of fundamental problems with the ship, which has never been considered fully operational since her delivery in July 2005.
>
> Now, said Naval Sea Systems Command (NAVSEA), audits of the work being done on the ship's four main propulsion diesels revealed "unacceptable, improper documentation in the overhaul reports" by Earl and Fairbanks Morse, makers of the Colt Pielstick diesel engines.
>
> "There were missing reports; reports with data indicating out-of-specification conditions without indication of what repairs were performed; and reports with missing data or inconsistent data," NAVSEA said in a statement. "This kind of performance fails to meet the maintenance standards we expect for ship repair by our contractors and their subcontractors."
>
> A Navy investigation is ongoing to check the work and see if any material deficiencies exist.
>
> "So far there is no indication of a material problem but the investigation is continuing," said NAVSEA spokesman Chris Johnson.
>
> The ship is scheduled to get underway from Norfolk for sea trials in late April, Johnson said April 15, but so far the investigation has not affected the trials schedule.
>
> Personnel actions also appear to be underway as a result of the improper documentation. NAVSEA declined to comment, saying it would violate privacy policies.[56]

Another April 15, 2011, press report states:

> The Navy said Thursday it has launched a new investigation into engine repairs aboard the Norfolk-based ship San Antonio after recent audits uncovered serious problems with records kept by private contractors who overhauled the engines….
>
> So far, officials said, there is no indication that the latest round of engine work wasn't done properly, or that more fixes are needed. Instead, the problem is the Navy can't tell based on documents - documents the civilian contractors are required to provide - what work was done and what wasn't….
>
> The Navy said the two contractors responsible are Earl Industries, the prime contractor, and Fairbanks Morse, the engine manufacturer.

(...continued)

and Resources, and Lieutenant General George J. Flynn, Deputy Commandant, Combat Development and Integration & Commanding General, Marine Corps Combat Development Command, Before the Subcommittee on Seapower and Projection Forces of the House Armed Services Committee [Hearing] on Navy Shipbuilding Acquisition Programs and Budget Requirements of the Navy's Shipbuilding and Construction Plan, March 9, 2011, p. 8.

[56] Christopher P. Cavas, "New Problem Hits LPD 17: Bad Work Documentation," *DefenseNews.com*, April 15, 2011.

> In a sign of how seriously the Navy is taking the documentation problems, Naval Sea Systems Command, which is responsible for developing and delivering ships, is performing independent checks on the San Antonio's engines.
>
> What's more, at least one top official has been removed at Norfolk Ship Support Activity, the Navy command that oversees ship repairs done by contractors. Thomas J. Murphy, who had been its civilian executive director since 2004, was replaced this week.
>
> A source outside the Navy said other civilian officials at the command were also removed; the Navy wouldn't confirm that, saying it would violate privacy rights….
>
> Though work to overhaul the diesels was ongoing as recently as last month, the Navy has said the ship was nearly ready and would go to sea for performance tests by the end of this month.
>
> That timeline is still on track, according to Fleet Forces Command.
>
> The Navy said it is fully investigating what it described as the contractors' failure to coherently document the engine repairs. The Navy "is holding the contractors accountable," the service's statement said.
>
> The investigation also will look at whether insufficient government oversight played a role, the Navy added.
>
> Murphy, the ousted Norfolk Ship Support Activity director, declined to comment.
>
> In a written statement, Earl Industries President Jerry Miller stressed that the problems the Navy has uncovered so far relate only to record-keeping and reports, not to the quality of his company's repair work. Like the Navy, Miller said all recent checks on the engines suggest they're ready for sea tests.
>
> Miller noted that Earl Industries recently completed similar engine repairs on one of the San Antonio's sister ships, the Mesa Verde, which left for an overseas deployment ahead of schedule last month.
>
> "We are confident that San Antonio's upcoming sea trials will be equally successful and prove the quality of the complex overhaul work we've accomplished on all systems to correct the (San Antonio) class issues," he said.
>
> Fairbanks Morse said in a statement that it is cooperating with the Navy's investigation. "We are committed to resolving the matter in a satisfactory manner," the statement said.[57]

An April 20, 2011, press report states:

> The Navy has suspended the oversight authority of the local command responsible for supervising ship repairs done by private contractors.
>
> The command, called Norfolk Ship Support Activity, has headquarters at Norfolk Naval Station. Staffed by both sailors and civilians, it oversees all maintenance work done by private companies on Navy surface ships in the mid-Atlantic region.

[57] Corinne Reilly, "Investigation Puts Troubled Ship Back Under The Gun," *Norfolk Virginian-Pilot*, April 15, 2011: 1.

> By suspending the command's oversight authority—formally known as its "technical warrant"—the Navy essentially is saying it no longer trusts Norfolk Ship Support Activity to make sure work by contractors is being done properly….
>
> In response to further inquiries from The Pilot, the Naval Sea Systems Command said Tuesday [April 19] that Norfolk Ship Support Activity's oversight authority had been suspended. A senior Naval Sea Systems Command officer has been sent to "perform technical authority oversight duties until confidence is restored," the Naval Sea Systems Command said in a written statement….
>
> In addition to suspending the command's authority, the Navy has removed at least one top official. Thomas J. Murphy, who had been the command's civilian executive director since 2004, was replaced last week. Sources outside the Navy said several other officials at the command were also removed; the Navy has declined to confirm that, saying it would violate privacy rights.
>
> Officials at the Naval Sea Systems Command couldn't say what will be required of Norfolk Ship Support Activity to restore its oversight authority, or how long it might take; that won't be known until the investigation is completed. Officials weren't aware of any other instances in recent history in which the Navy has suspended a command's maintenance oversight authority.
>
> In light of what's happening at the command, the Navy said, it is reviewing quality assurance practices and procedures at all regional maintenance centers.[58]

A May 27, 2011, press report stated:

> "We're getting back to where we should be," the captain of the long-troubled amphibious ship USS San Antonio (LPD 17) told reporters May 26. "I believe all the major repairs have been fixed."
>
> The San Antonio was pulled from service nearly two years ago in an effort to rectify problems that have plagued the ship since its delivery in August 2005. In that time, a Navy inspector general investigation delved into the causes of the problems.
>
> Additional issues emerged during the repairs, including the discovery that the engines and main reduction gears were improperly installed, and the repair period was extended multiple times.
>
> Fixing the ship became a top priority for U.S. Fleet Forces Command and received the personal attention of its commander, Adm. John Harvey. Stuck in a shipyard, the San Antonio missed a scheduled deployment, and the fleet has had to adjust to the ship's absence.
>
> "We were essentially a shore command for two years," Cmdr. Thomas Kait said during a press conference aboard the San Antonio after its return to Norfolk, Va., from 10 days of engineering trials.
>
> "The engines ran beautifully," he said. "They did fantastic. It was truly incredible to feel the ship vibrate under her own power at sea."

[58] Corinne Reilly, "Navy Suspends Command's Ship-Repair Oversight," *Norfolk Virginian-Pilot*, April 20, 2011: B1.

A second series of trials still lies ahead for the ship, followed by at least 10 months of training before it can deploy again, Kait said. "We look forward to going out again and driving the ship as she was meant to be."

The post-sea trials press conference was itself unusual and highlighted the Navy leadership's concern over the ship's performance. Reporters on the ship, however, were asked not to talk to crew members about the ship's condition or performance.

A day earlier in Washington, some of the service's senior leaders were again grilled by Congress about why the ship was accepted from shipbuilder Northrop Grumman in 2005, despite knowledge of numerous construction deficiencies.

"Were we obligated to take delivery of the early LPD 17s?" asked Sen. Jack Reed, D-R.I., at a Senate seapower subcommittee shipbuilding hearing.

"We were not compelled to take delivery," Sean Stackley, the Navy's top acquisition official, said.

"There was a confluence of events," he admitted, responding to congressional questions on the program he and other officials have been asked dozens of times since 2005. "It was a conscious decision."

All five of the first ships in the class had material problems to varying degrees, acknowledged Vice Adm. Kevin McCoy, head of the Naval Sea Systems Command, although problems with the more recent ships have been less severe than the first-of-class San Antonio.

Although more recent problems have been discovered on the ships, including grit in the lube oil system and poor welds, "all the other stuff greatly improved from the first" ship, McCoy said. "And, in fact, we had a highly successful final contract trial just earlier this spring on the New York that received lots of praise from" Navy inspectors.

McCoy noted that in the week prior to the hearing, all five ships of the class were at sea, including two on deployment.

Pressed by Sen. Roger Wicker, R-Miss., about a government inspector's assertion that the ships were not yet survivable in combat, McCoy declined to argue.

"If you look at the issues that they identified, I don't take issue with the issues," he said. "We were in the middle of grit in lube oil in just about all our ships that we were dealing with, so there was a mobility issue."

But McCoy was hopeful that problem has been solved.

"I'll knock on wood here," he said, but "I think that one's behind us."[59]

A June 20, 2011, press report stated:

It's been a rough road for the San Antonio. But it's starting to look a lot smoother.

[59] Christopher P. Cavas, "LPD 17 Repairs Nearly Complete," *DefenseNews.com*, May 27, 2011. See also Carlo Munoz, "Navy Wraps Up First Half of Two-Stage Sea Trial For San Antonio-Class Ships," *Defense Daily*, May 27, 2011: 6-7; Bill Sizemore, "Overhauled San Antonio Deemed Fit For Duty," *Norfolk Virginian-Pilot*, May 27, 2011.

On June 15, the U.S. Navy ship returned to Naval Station Norfolk, Va., following nine days of sea trials — the second of two phases to test repairs after the ship was taken offline nearly two years ago.

The verdict: It works. Just like it's supposed to.

"San Antonio has made that transition from a ship that was needing a lot of help on the maintenance front [to] the level all my ships are at when they've passed through this phase," said Capt. Mark Scovill, commander of Amphibious Squadron 8, who was interviewed as the ship approached Norfolk. "We know we've gotta prove to everybody out there that we're ready to proceed. And that's what we aim to do.

"We're gonna knock their socks off," Scovill said. "I can guarantee you that."...

After a short maintenance availability to fix minor discrepancies discovered during the sea trials and an additional independent self-train-ing underway period slated for July, San Antonio will be ready to begin predeployment work-ups Aug. 1, leaders said....

The ship's chief engineer for the past six months said, with conviction, that [earlier] mechanical and electrical problems have been fixed. "This ship has come a long way in the last few months," said Lt. Cmdr. William Pikul. "We've maxed out every engine, every shaft rpm, every item that we've got on board. And we're coming back in still on all four engines, still on ship's power, and we're ready to get back underway again next month." The first set of sea trials, held in late May, validated the diesel engines, testing their ability to power up and operate free of excess vibration....

This set of trials focused on combat systems and operating with amphibious craft in the ship's well deck.

"All tested out 'sat' [satisfactory]," said Cmdr. Neil Koprowski, executive officer. He said the ship also was maneuvered much more stressfully than during the first set of trials.[60]

Author Contact Information

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

[60] William H. McMichael, "LPD 17 Back On Course," *Defense News*, June 20, 2011: 28. See also William H. McMichael, "Crew: Amphib San Antonio Finally Fixed," *NavyTimes.com*, June 15, 2011.