

ARCHIVED REPORT

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LHD-1 Wasp Class

Outlook

- LHD-8 *Makin Island* commissioned in October 2009
- No more LHD class ships to be funded
- LHD-8 is test bed for advanced technologies to be employed in later classes
- Future strength of amphibious warfare fleet uncertain, as defense reviews reconsider force structure

Orientation

Description. A large-deck multipurpose amphibious assault ship.

Status. In service.

Sponsor

United States Department of Defense
Naval Sea Systems Command (NAVSEA)
1333 Isaac Hull Ave, SE
Washington Navy Yard, DC 20376-1080
USA
Tel: + 1 (202) 781-0000

Total Produced. Eight ships of this class have been completed.

Pennant List

<u>Number & Name</u>	<u>Shipyard</u>	<u>Launch</u>	<u>Commissioning</u>	<u>Fleet</u>
LHD-1 <i>Wasp</i>	Ingalls Shipbuilding	8/4/1987	7/29/1989	Atlantic
LHD-2 <i>Essex</i>	Ingalls Shipbuilding	1/4/1991	10/17/1992	Pacific
LHD-3 <i>Kearsarge</i>	Ingalls Shipbuilding	3/26/1992	10/16/1993	Atlantic
LHD-4 <i>Boxer</i>	Ingalls Shipbuilding	8/13/1993	2/11/1995	Pacific
LHD-5 <i>Bataan</i>	Ingalls Shipbuilding	3/15/1996	9/20/1997	Atlantic
LHD-6 <i>Bonhomme Richard</i>	Ingalls Shipbuilding	3/14/1997	8/15/1998	Pacific
LHD-7 <i>Iwo Jima</i>	Ingalls Shipbuilding	3/21/2000	4/6/2001	Atlantic
LHD-8 <i>Makin Island</i>	Ingalls Shipbuilding	8/6/2006	10/2009	Pacific

Mission. The mission of these ships is to enable the Navy and Marine Corps team to act as the central feature of a Navy Amphibious Ready Group (ARG) tasked with deploying and supporting a Marine Expeditionary Unit. In a secondary role, using AV-8B

Harrier aircraft and anti-submarine warfare helicopters, these ships perform sea control and limited power projection missions.

Price Range. The unit cost of an LHD class ship has been estimated at between \$1.2 billion and \$1.6 billion.

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Contractors

Prime

Northrop Grumman Shipbuilding (Gulf Coast Shipyards)	http://www.sb.northropgrumman.com , 1000 Access Rd, PO Box 149, Pascagoula, MS 39568-0149 United States, Tel: + 1 (228) 935-1122, Fax: + 1 (228) 935-1126, Email: info@ngc.com , Prime
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Subcontractor

Aerojet-General Corp	http://www.aerojet.com , PO Box 13222, Sacramento, CA 95813 United States, Tel: + 1 (916) 355-4000, Fax: + 1 (916) 351-8667, Email: comment@aerojet.com (SLQ-25 NIXIE)
Baldt Inc	http://www.baldt.com , 6th & Butler Sts, Chester, PA 19013 United States, Tel: + 1 (610) 447-5200, Fax: + 1 (610) 874-8599, Email: info@baldt.com (Anchor Chain & Hardware)
Brown Brothers & Co Ltd	The Sales Department, Broughton Rd, Edinburgh, EH7 4LF United Kingdom (Stabilizers)
CF Power Systems Group	1000 Prospect Hill Rd, Windsor, CT 06095-1521 United States (Main Boiler)
DC Fabricators Inc	http://www.dcfab.com/ , 801 W Front St, Florence, NJ 08518 United States, Tel: + 1 (609) 499-3000, Fax: + 1 (609) 499-4214 (Main Condenser)
DRS Technical Services	http://www.drs.com , 825 Greenbrier Cir, Chesapeake, VA 23320 United States, Tel: + 1 (757) 819-0700 (Display)
Duramax Marine LLC	17990 Great Lakes Pkwy, Hiram, OH 44234 United States, Tel: + 1 (440) 834-5400, Fax: + 1 (440) 834-4950 (Shaft Sealing)
Fairmount Automation Inc	http://www.fairmountautomation.com/ , 4621 West Chester Pike, Newtown Square, PA 19703 United States, Tel: + 1 (610) 356-9840, Fax: + 1 5(610) 356-9841 (Ruggedized Controls)
Flight Safety And Communications Group	115 Emily St, Carleton Place, K7C 4J5 Ontario, Canada (Air Traffic Control)
Jered LLC	http://www.jered.com , 103 Shipyard Dr, Brunswick, GA 31520 United States, Tel: + 1 (912) 262-2000, Fax: + 1 (912) 262-2051 (Deck Edge Elevator)
L-3 Communications - Communication Systems - East	http://www.l-3com.com/cs-east/ , 1 Federal St, Camden, NJ 08103 United States, Tel: + 1 (856) 338-3000, Fax: + 1 (856) 338-3345 (Communications Systems)
Northrop Grumman Electronic Systems	http://www.es.northropgrumman.com , 1580-A W Nursery Rd, Linthicum, MD 21090 United States, Tel: + 1 (800) 443-9219, Email: ES_Communications@ngc.com (Turbine & Reduction Gear)
Northrop Grumman Norden Systems	http://www.es.northropgrumman.com , 10 Norden Pl, Norwalk, CT 06856 United States, Tel: + 1 (203) 852-5000, Fax: + 1 (203) 852-7698, Email: ES_Communications@ngc.com (SYS-1 IADT)
Raytheon Co	http://www.raytheon.com , 870 Winter St, Waltham, MA 02451-1449 United States, Tel: + 1 (781) 522-3000, Fax: + 1 (781) 860-2520 (SPS-49 Radar; SLQ-32 ECM)
Raytheon Network Centric Systems, Integrated Communications Systems	http://www.raytheon.com/businesses/rncs/index.html , 1801 Hughes Dr, Fullerton, CA 92834 United States, Tel: + 1 (714) 446-4305, Fax: + 1 (714) 446-4314 (SPS-52C Radar; Mk 23 TAS)

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Warren Pumps	220 Bridges Ave, Warren, MA 01083 United States (Main Condenser Circulating Pump)
Weidlinger Assoc	http://www.wai.com/ , 2525 Michigan Ave, Bergamot Station D2-3, Santa Monica, CA 90404-4042 United States, Tel: + 1 (310) 998-9154, Fax: + 1 (310) 998-9254 (Damage-Resistant Structures)

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Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Length (overall)	257.3 m	844 ft
Length (waterline)	240.2 m	788 ft
Beam (overall)	42.7 m	140.1 ft
Beam (waterline)	32.3 m	106 ft
Draft	8.1 m	26.7 ft
Flight deck	249.7 x 32.3 m	819 x 106 ft
Elevators	15.3 x 13.7 m	50 x 45 ft
Cargo area volume	3,087 cu m	101,000 cu ft
Vehicle area volume	2,127 sq m	22,000 sq ft
Well deck	81.4 m x 15.3 m	267.0 x 50.0 ft
Displacement		
Full load	41,180 tonnes	40,530 tons
Light	26,210 tonnes	25,800 tons
Performance		
Speed	45 kmph	24 kt
Range	18,500 km at 37 kmph	10,000 nm at 20 kt
Crew	104 officers, 1,004 enlisted	
Marine detachment	1,687	
Embarked troops, surge capacity	Up to about 1,900	
Armament – Missiles		
AAW	NATO SeaSparrow	2x 8
AAW/ASuW	RAM Mk 31	2
Armament – Guns		
CIWS	Mk 15 Phalanx 20mm	2
Machine guns	.50 caliber	4
	25mm	3-4
Aircraft		
VSTOL	AV-8B Harrier 11	6-8
Helicopters	CH-53D/E Sea Stallion, CH-46E Sea Knight, SH-60B Seahawk, UH-1W Huey, AH-1W Sea Cobra	42 - Sea Knight 6 - ASW
Electronics – Radars		
3-D Air search	SPS-48E	1
2-D Air search	SPS-49(V)9	1
Surface search	SPS-67	1
Fire control	Mk 23 TAS	1
Armament – Missiles		
	<u>Type</u>	<u>Quantity</u>

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	<u>Type</u>	<u>Quantity</u>
Electronics – Electronic Warfare		
ESM/ECM	SLQ-32(V)3	2
Decoy launchers	Mk 36 SRBOC	2x 3
Expendable decoys	SSQ-95 AEB	
Floating decoys	SLQ-49	2x 8
Chaff buoys	SLQ-39	
Torpedo decoys	SLQ-25 NIXIE	1
EO tracker	Xybion SPS-2000	1
Electronics – Communications		
Satcom	WSC-3	2
TACAN	URN-25	1
Command and control	NTDS	
	SYS-1	
Machinery		
Steam boilers	Combustion engineering	2
Propulsion engines	Westinghouse steam turbines	2x 35,000 shp (sust.)
Propellers	Fixed pitch	2
Power generation off steam power	Turbo-alternators	5x 2,000 kW
Secondary power source	Diesel engines, generators	2x 2,000 kW

Design Features. The design of the LHD-1 Wasp class differs from that of the LHA-1 Tarawa class in several key respects. Although the Tarawa class has operated up to 20 AV-8B Harrier aircraft, the Wasp class is the first amphibious assault ship specifically configured to support that vertical/short takeoff and landing fixed-wing aircraft. The ship can carry up to three LCAC landing craft, eight Harriers, and about 30 helicopters in its well deck. The helicopters can include the CH-53E Super Stallion for heavy lift, the CH-53D Sea Stallion for minesweeping, the CH-46E Sea Knight for marine assault, the UH-1N Huey utility, the AH-1T Sea Cobra gunship, and, for anti-submarine warfare, the SH-60B Seahawk LAMPS. Nine landing spots are available on the deck for the helicopters.

The Wasp class has a longer (98.1 m) but narrower (15.2 m) docking well. The well's height has been reduced to 8.5 meters to give it a tighter fit and reduce the possibility of damage during amphibious operations. The well fits alternately up to 12 LCM(6)s, six LCM(8)s, or two LCUs. Six cargo elevators and increased cargo-handling facilities are included.

Amphibious vehicles, guns, and trucks, as well as trailers and forklifts, can be loaded aboard landing craft through the stern docking gates. They resemble those of an LSD/LPD class ship, with the lower gate being similar to that of the LSD-41 and the upper gate resembling that of an LPD. The aft elevator has been moved from the stern position of the LHA-1 to the starboard side after-section of the flight deck. Both side elevators fold for Panama Canal passage. They are the largest folding elevators in the U.S. Navy. The ship can also fully maintain all embarked aircraft.

Because the LHD ships plan to operate farther out to sea than the LHA, they do not have any guns for shore bombardment, whereas the Tarawas carry three 5-inch L54 Mk 45 guns. Instead, the LHD carries two eight-cell NATO SeaSparrow Surface Missile System launchers and two Mk 23 target acquisition systems, with an automatic Identification Friend or Foe (IFF) capability. In addition, two or three Mk 15 Phalanx terminal defense systems are mounted against threats from low-flying aircraft and close-in enemy vessels. These guns are being replaced or supplemented to a varying degree by the Rolling Airframe Missile (RAM) Mk 31 surface-to-air missile (SAM). The exact fits of these and the Phalanxes are determined case by case. Three or four 25mm cannon and four .50-caliber machine guns are also included, totaling between seven and eight mounts, depending on the ship.

The electronics systems include an SPS-48E three-dimensional air search radar, SPS-49 air search radar, SPS-64 surface search radar, SLQ-32(V)3 electronic warfare system, two Mk 36 SRBOC countermeasures launchers, and the SLQ-25 NIXIE acoustic torpedo decoy. The LHD ship's command, control, and communications facilities differ slightly from those aboard the LHA.

Provisions for sprinklers, Halon, and other firefighting systems are built in. Each LHD has another damage control feature that is relatively new to U.S. Navy warships: positive pressurization of interior spaces. The air within the ship can be maintained at a higher pressure than the outside atmosphere to keep out most chemical and biological agents as well as airborne nuclear fallout.

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In one way, the LHD class marked a return to the traditional U.S. Navy practice of using steam propulsion. Most of the U.S. Navy's newer warships are powered by gas turbines. Instead, the LHD, like the LHA, relies on a steam propulsion plant. This arrangement includes two 600-pound-per-square-inch Combustion Engineering boilers powering two Westinghouse turbines rated at 52.2 kW, which in turn operate two screws.

The ship's major medical facilities include four main and two emergency medical operating rooms, three dental operating rooms, X-ray rooms, a blood bank, laboratories, and patient wards. In addition, three battle dressing stations are located on the ship.

Operational Characteristics. Modern U.S. Navy amphibious assault ships are called on to perform as primary landing ships for assault operations of U.S. Navy and Marine Corps expeditionary units. These ships use Landing Craft, Air-Cushioned (LCAC), conventional landing craft and helicopters to move Marine assault forces ashore.

LHDs embark, transport, deploy, command, and fully support all elements of a 2.5-battalion Marine Expeditionary Unit (MEU), inserting forces ashore via helicopters, landing craft, and amphibious vehicles. The world's largest amphibious ship class, the Wasp class, is the first specifically designed to employ LCACs and to carry a squadron of Harrier II (AV-8B) short takeoff vertical landing (STOVL) jets for operational support. LHDs are fully equipped with command and control systems for flagship command duty. Their top speed is 22 knots, with an operating range of 9,500 nautical miles at a transit speed of 18 knots.

As the center of a Navy multimission, Amphibious Ready Group, an LHD is fully capable of both conducting and supporting amphibious assaults, advance force and special-purpose operations, and noncombatant evacuation and other humanitarian missions. For this reason, the well deck plays a key role in the ship's operation and tactics.

The well deck where the landing craft are situated can be flooded so that the LCACs can float in and out. Under normal operating conditions, the embarked LCAC craft will float in and out of a dry well deck. The LCACs require only a foot of water, but the well deck can drop low enough to draw in 6 to 8 feet of water as required by traditional landing craft.

A typical load is a mix of 30 helicopters and six to eight Harriers in normal operations for close air support. In the secondary role as a sea control ship, the most likely mix consists of 20 Harriers and four to six Sea Hawks. The ship's air traffic control system supports

coordinated Harrier and helicopter operations on the flight deck. The ship's assault support system synchronizes the simultaneous horizontal and vertical flow of troops, cargo, and vehicles throughout the ship for efficient and fast insertion of forces ashore via helicopters, landing craft, and amphibious vehicles.

Six cargo elevators, each with 12,000-pound capacity, transport material and supplies from cargo holds to staging areas for loading. Cargo to be loaded aboard waiting landing craft within the well deck is moved via a monorail system. This system consists of 2,900 feet of track in a six-track layout directly over the ship's vehicle storage area and well deck. Five 32-foot cargo monorail trains, each with a capacity of 6,000 pounds, carry material at speeds up to 600 feet per minute (6.8 mph) from the staging area to the landing craft in the well deck.

The ship's vehicle storage area typically accommodates five M-1 tanks, 25 light amphibious vehicles (LAVs), eight Howitzer M-198 guns, 68 military trucks (HMMWVs), 10 logistics vehicles (Dragon Wagons), 12 5-ton trucks, two water trailers, a fuel service truck, four rough-terrain forklifts, and two generator trailers. These vehicles can be loaded aboard landing craft, and the majority can be rigged for transportation to the beach by helicopter.

Off the beach, landing craft are launched and recovered through the very large stern gate that opens the 13,600-square-foot well deck to the sea. This well deck is 267 feet long and 50 feet wide, and designed specifically for the fly-in/fly-out capabilities of the LCACs. To launch and recover conventional landing craft, the ship can ballast over 15,000 tons of seawater to allow them to float into and out of the well deck.

The onboard command, control, communications, computers, and intelligence (C⁴I) systems support the ship's amphibious operations and secondary mission roles. While on the LHA, the ship's war room and flag plot are separate entities, the two comprise one facility on the LHD. This command center has many of the same features found in the combat information center aboard the CG-47 Ticonderoga class AEGIS cruisers, including two large screens that display two automated status boards, closed circuit television, the naval tactical data system, and a wide array of communications equipment. Notably, the command center has been moved inside the hull from the superstructure. Ballistic protection is provided by surrounding the C⁴I space with structural steel bulkheads, decks, and shell plate.

The SYS-1 Integrated Automatic Detection and Tracking System combines inputs from these facilities and the ship's radars to provide a constantly updated and displayed version of the tactical situation. Each LHD

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ship also has the Integrated Tactical Amphibious Warfare Data System for the command and control of amphibious operations. These facilities have been moved from the island superstructure, where they are placed aboard most LHA ships, to the hull of the LHD, reducing the possibility of battle damage.

The hospital facilities on the Wasp class were considered the most advanced and comprehensive of any combat ship when it first came out. The medical and dental facilities are capable of providing intensive medical care to 600 patients with combat- or disaster-induced injuries, while providing routine medical and dental care to all embarked ship and troop personnel.

Variants/Upgrades

The first-of-class was initially fitted with an SPS-52C radar in place of the SPS-48E. This was changed prior to the ship entering service.

LHD-8. The eighth ship of the class has gas turbine machinery. Steam is thought to be excessively labor intensive and high maintenance for today's needs, given the personnel and funding resources available. The U.S. Navy decided in 1999 that the LHD-8 would be equipped with gas turbines rather than steam. The Navy stated that the "LHD-8 shall be constructed with gas turbine propulsion and all-electric auxiliary systems, in lieu of a steam plant." It noted that the service would save anywhere from \$350 million to \$420 million over the life of the ship, compared to the then-current steam-powered design. The investment associated with the elimination of steam systems is estimated at \$50 million and should be recovered in four to five years of reduced operating expenses. Gas turbine power offers a number of tactical and operational advantages over steam turbine propulsion. It also helps reduce manpower, maintenance, and fuel costs. The performance gains are estimated to result in an overall improvement in the warfighting capabilities of the ship.

Switching from steam to gas turbine propulsion is a more complex change than it might appear. The gas turbines are substantially smaller and lighter than the set of boilers and steam turbines used previously. Losing this amount of weight low in the hull raises questions as to the stability of the ship and suggests that either compensatory ballast must be loaded or substantial internal changes made. Although a definitive answer was hard to come by, it was eventually confirmed that ballast would be installed to compensate for the weight differential incurred.

The commitment from the Navy for gas turbines was necessary as part of a process to release FY99 funds that had already been awarded to the Navy to start work on the ship. The process also included the possibility that the funds would be marked as research and development money, instead of ship procurement money, with the premise of using it to convert the existing design to gas turbines. The money was eventually granted to the Navy to proceed with the plan.

IBS Retrofit. A Sperry Marine Integrated Bridge System (IBS), which provides computerized integrated navigation, steering, and control, will be installed on the *Two Jima* and may be retrofitted on the previous vessels of the class as well.

LHA-6. This is the designation for a new class of amphibious assault ships being developed by the U.S. Navy. The construction of a new class of LHAs was prompted by the realization that the LHA-1 class was deteriorating quickly due to light construction and hard use, and that a comprehensive Service Life Extension Program (SLEP) would cost more than building replacement ships. It was determined by the Center for Naval Analyses in a "development of options" study in 1999 that conducting a SLEP on the Tarawa class amphibious ships would not be economically feasible or operationally viable. Instead, the study suggested using the LHD-8, which was beginning to win funding in Congress, as a transitional model to the LHA(R), a completely new class of vessels. Subsequently, the U.S. Navy decided that LHD-9 would be reprogrammed as the first LHA-6 class ship. This would be a plugged and kipped version of LHD-8, being some 77 feet longer and 10 feet greater in beam. The LHA-6 class is covered in a new report in this tab.

Littoral Capabilities Upgrade. In 1996, LHD-2 and LHD-4 (USS *Essex* and *Boxer*) were fitted with a new batch of communications systems and sensors designed to improve the capabilities of this ship type in the littoral combat environment. New sensors, communications equipment, and decision aids for improving performance in new mission areas were used to modify the two ARGs, under a program called C⁴ISR for the Pacific Littoral Warrior.

Phalanx/RAM Fit. Slight differences exist in the superstructures of the ships in this class, depending on their age, weaponry, and electronics fit. One such example is the presence of Phalanx versus use of the RAM Mk 31 surface-to-air missile, which, unlike the close-in weapon system (CIWS), is not installed on an elevated platform. The exact mix of Phalanxes and RAMs varies on a ship-by-ship basis, although the U.S. Navy is increasingly replacing the Phalanx with the RAMs as funds become available.

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USS Iwo Jima (LHD-7) Under Way

Source: U.S. Navy



USS Makin Island LHD-8 (note major changes to superstructure)

Source: U.S. Navy

Program Review

Background. The U.S. Navy began considering the design of a new large dock landing ship/helicopter carrier (amphibious assault) ship in the late 1970s. The Navy then perceived a vital need for a new ship of this type beginning in the early 1990s, when the LPH-2 Iwo Jima class would become 30 years old. The Navy briefly considered an LHD that would be similar to the LSD-41, and Lockheed contracted with Advanced Technology to conduct design studies for such a ship.

By the late 1970s, however, the first LHA-1 Tarawa class amphibious assault ships were in service, and the Navy decided to use this design as the baseline for a new ship.

Starting Design

Baseline design began in January 1982, and a contract was awarded to Ingalls Shipbuilding (which had built all the LHA ships) in August 1982. The contract design

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package was completed in September 1983. On April 5, 1983, the U.S. Navy awarded Ingalls a \$36.8 million contract for production of long-lead items for the class. Items funded included consoles, turbines, and diesel generators. In the late 1980s, the U.S. Navy was considering the replacement of the existing steam propulsion system with a General Electric LM2500 system. This would have been for new construction only; however, this plan was abandoned in 1990.

The U.S. Navy originally wanted 11 LHD class ships to replace the Iwo Jima class ships as they reached the 30-year point. This requirement was later reduced to seven ships of this class, and a determined effort mounted to gain those ships. The Five-Year Shipbuilding Plan, as amended, showed one additional ship being requested in FY96; this was subsequently changed to FY94. The Senate Armed Services Committee (SASC) markup included the transfer of \$600 million from the Sealift fund to the construction of the long-desired LHD-7. This was subsequently rescinded when the markup was presented to the full Senate. In its place, \$50 million was provided for long-lead procurement of the LHD-7.

This action was opposed by the U.S. Navy. Navy officials argued that the \$50 million fell far short of the sum actually required and would merely detract from other, more pressing requirements. They also argued that while LHD-7 would be a valuable asset, the most urgent amphibious lift requirement was heavy-vehicle lift capability. The LHD design could only provide a limited contribution in this area. The U.S. Navy continued to maintain that funding of LHD-7 was not required until 1999, even though delaying construction to that year would increase costs from \$700 million to \$1.2 billion. Eventually, these objections were overcome; the LHD-7 was formally funded in FY96 and the appropriate orders placed with Ingalls Shipbuilding.

Operational Debut

The operational baptism of the LHD class came much earlier than anticipated. The USS *Wasp* was diverted from her scheduled shakedown period after a major refit to take part in the Haiti operation. Instead, she spent five months operationally deployed off the coast of Haiti as the flagship of Combined Joint Task Force 120. This deployment turned out to be of considerable benefit, since the crew was able to refine its operational skills in a genuine environment and to complete the integration of the ship's new SPS-48E radar.

A further major development (which may have had substantial bearing on the U.S. Navy's reluctance to fund LHD-7 at that time) was a USAF attempt to have the LHA/LHD fleet reclassified as medium aircraft carriers to justify severe reductions in the real aircraft

carrier force. This appears to have been a maneuver in the ongoing budget battles, with very little foundation in military reality. Its main effect may have been to further U.S. Navy opposition to LHD construction, or to enhance the capabilities of the LHD.

Replacing the LHAs

The most recent developments in the program involve the re-emergence of suggestions that the Navy might buy as many as 12 of these ships, eventually replacing all of the Tarawa class ships. The Marines, led by their former commandant, Gen. Charles C. Krulak, have been quite vocal about their support for buying new LHDs instead. The argument has been that after spending upward of \$1.5 billion per ship for an upgrade/modernization, the service life is only extended by about 15 years, while the cost of an all-new LHD is about the same or lower.

Furthermore, a Service Life Extension Program still leaves the users with an aged hull that has been upgraded as far as its basic characteristics allow. An LHD can carry three LCACs; their flight decks were designed for the heavier aircraft, and their piping, command systems, power distribution, and berthing facilities are in line with the requirements of these ships' intended role. Additionally, carrying out a SLEP on the Tarawas would mean that one or two of them would be permanently out of service over a period of 10 years because of the overhaul. In other words, the Navy would be restricted in maintaining its mandated 12-strong Amphibious Ready Group force (each ARG force is made up of 2.5 Marine Expeditionary Battalions), whose lift requirement the Wasp class meets.

In June 1998, the USN said that it would allow the LHA and LHDs that were scheduled for overhaul at NASSCO's Puget Sound (Washington) facility to remain in the San Diego area instead in order to avoid disruptions for sailors and their families. This is in reference to the "seven-year-plus-two-year-option" contract NASSCO won in December 1997 for the overhaul and maintenance of the amphibious ships. The convenience factor entailed that NASSCO extend its dry dock at San Diego by about 200 feet, making it 785 feet long. The expansion was expected to take about five months, thus pushing the repair schedule that much forward.

It was also decided that the eighth ship of the series would have gas turbine propulsion in lieu of steam. Also, the shipbuilder did propose at one point to convert the LHD-7 *Iwo Jima* to gas turbine power. This was ruled out, however, because of the additional cost that would be entailed in changing the design accordingly. In May 1998, as part of the military authorization bill,

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Senator Trent Lott of Mississippi proposed that \$50 million be allocated for procurement of long-lead materials for the construction of the LHD-8.

The Navy's Program Objective Memorandum (POM) for FY00 through FY04 included no funds for an eighth ship, but full funding of \$1.357 billion was expected to be requested in FY05, when the construction of the eighth ship was to begin. The manufacturer, in the meantime, argued that delaying the start of the construction would mean having to shut down the production facilities and restart them at a later date, at an estimated additional cost of \$700 million to \$1 billion.

In May and June 1999, the U.S. Senate Appropriations Committee recommended awarding \$500 million for the eighth ship in the FY00 budget, while the Senate Armed Services Committee recommended \$375 million. The House Armed Services Committee subsequently brought the request down to a level of \$15 million, leaving a substantial gap in the requests by the different budget authorities. These differences had to be ironed out in preparation for the FY00 defense budget.

By November 1999, Congress had agreed to provide an additional \$375 million for advance procurement of the LHD-8 as part of the FY00 budget, having already granted \$45 million in the previous fiscal year. At this time, the ship's estimated cost was pegged at \$1.5-\$1.6 billion. According to the Marine Corps, the cost would escalate to \$2.5 billion if construction began in FY05. The Navy had previously scheduled advance procurement for FY04, followed by full funding in FY05. However, the magnitude of this particular program was quoted as the reason for applying incremental funding. Typically, full funding is provided for a vessel within a year or two of Congress awarding advance procurement funds.

Problems with LHD-7

Unfortunately, the LHD-7 USS *Iwo Jima* failed her initial sea trials in the Gulf of Mexico in February 2001. According to a U.S. Navy Board of Inspection and Survey report, the failure centered on the vessel's many command and control systems, but also resulted from significant incomplete work by the shipyard contractor, Ingalls Shipbuilding. The report recommended two additional sea trials: one to deal with shipyard problems, the other to deal with command and control problems. Although these failures attracted attention, it should be remembered that ships run trials to detect faults. Following rectification of the problems, the USS *Iwo Jima* was delivered on schedule to the U.S. Navy by Litton Ingalls Shipbuilding on April 6, 2001. The LHD-7 is the last conventional steam propulsion ship to have entered the U.S. Navy fleet.

Following the delivery of LHD-7, Ingalls Shipbuilding was awarded an additional \$81.3 million for the continuation of work toward the construction of the LHD-8 amphibious assault ship for the U.S. Navy. The contract modification required Ingalls to purchase materials and begin preparations for the construction of selected assemblies and subassemblies. Actual construction of ship assemblies would begin following completion of material procurement and previously funded design work. Up to that point, the U.S. Congress had appropriated a total of \$880 million in design and material procurement funding for the LHD-8. This includes \$460 million in FY01 defense appropriations measures in addition to \$420 million appropriated in FY99 and FY00. This contract made it clear that the LHD-8 was to be powered by two LM-2500R gas turbines in lieu of the steam engines in the first seven ships of the series.

In June 2001, the U.S. Navy awarded an additional \$81.3 million to Northrop Grumman Ingalls Shipbuilding for the continuation of work toward the construction of an eighth Wasp (LHD-1) class large-deck multipurpose amphibious assault ship. This was followed on October 19, 2001, by an announcement that Naval Sea Systems Command intended to award a sole-source contract for construction of one amphibious assault ship (LHD-8). This effort would also provide for spare and repair parts, crew familiarization and training, special studies and analyses, engineering and industrial services, and technical data.

And So to Nine?

To the fascination of most naval experts, in the early part of 2002 a congressional process to fund a further member of the LHD-1 Wasp class, the future LHD-9, began. At the urging of Senate Minority Leader Trent Lott, the Pentagon made last-minute adjustments in the Navy's shipbuilding plan to accommodate a sum of \$10 million in advance procurement for the previously untemplated LHD-9, using funds from the LPD-17 program. The decision was believed to relate to an ongoing debate over the replacement for the five LHA-1 Tarawa class ships. Three options were available for this requirement: additional hulls repeating LHD-8; a version of LHD-8 with an inserted hull plug to increase amphibious lift; and a new, clean paper design. The funding for LHD-9 was seen as an opening bid in favor of the first of these alternatives. This interpretation was supported by an almost immediate Navy move to have the LHD-9 funding redesignated as LHA(R) funds. Pentagon Comptroller Dov Zakheim responded by declaring that LHD-9 would be built as a member of the Wasp class and that the decision was not related to the LHA(R) issue.

LHD-1 Wasp Class

Eventually, funding for LHD-9 was transferred to the LHA(R) program.

Funding for LHD-8 was finalized by April 26, 2002. A press release issued by Lott's office on that date included a comment that "projects like LHD-8 could become as important to America's defense in the future as our large carriers have proven to be. Fighting the current war on terrorism is showing that 21st century threats may require a more mobile and much more lethal force – just like that for which LHD-8 and the other amphibious Marine Corps carriers are built. I am also actively supporting other shipbuilding construction projects such as LHD-9 and LHD-10, which will follow LHD-8 at Ingalls." This suggested that Lott, at least, envisioned the construction of an additional member of the class beyond LHD-9, apparently quite independent of any decisions made over the LHA(R) requirement.

Expanding the Roles

Consideration of expanding the roles of the LHD class ships was confirmed in April 2002, when Vice Adm. John Nathman suggested that the LHD class should be the primary operating platform for the USMC fleet of F-35 Joint Strike Fighters, rather than the aircraft carriers. This issue was apparently raised by a growing consensus that the basic LHD-8 design needed substantial enlargement if it was to meet the requirements of the LHA(R) program. Another issue related to the same series of requirements was the development of a lightweight Evolved SeaSparrow missile launch system.

The role of the LHD-1 class was further expanded in October 2002 when the LHD-3 USS *Kearsarge* was picked for modification to a mine countermeasures headquarters ship in place of the fire-damaged MCS-12 USS *Inchon*. Trials showed that the LHD-3 offered significantly greater capability than the MCS-12 in terms of helicopter operations capability and C⁴I facilities (hardly unexpected, given that LHD-3 is a significantly larger and more modern ship). Significantly, the trials showed that the size of the LHD-3 allowed the ship to be reconfigured to her new

role quickly and with minimum material alterations. This immediately raised the possibility that no permanent replacement for the MCS-12 would be selected and that LHD class ships would be assigned to the role as required.

By April 2003, the situation concerning the construction of future Wasp class ships was becoming less unclear. The stretched LHD-9 would be the first of the planned replacements for the LHA class. LHD-9 would be a 77-foot-longer and 10-foot-wider version of the basic LHD-8, and would be modified to handle later generation aircraft that could not be accommodated on the LHD-8. The new ship is scheduled to be laid down in FY07. The U.S. Navy was reserving its options for the remaining four ships of the proposed LHA(R) requirement. These developments effectively established LHA(R) as being a new program, independent of the LHD-1 Wasp class.

On February 14, 2004, Northrop Grumman Ship Systems laid down LHD-8, the ship being christened *Makin Island*. By the end of the year, fabrication of 135 of the 197 hull unit assemblies had begun, and eight of these had been erected on the construction slip. At that time, delivery of the ship was planned for May 2007. This would mark the end of the LHD-1 Wasp class program.

Makin Island was damaged when Hurricane Katrina hit the Northrop Grumman shipyard at Pascagoula, along with two DDG-51 class destroyers that were also under construction at the time. Her launch and commissioning appear to have been delayed by approximately one year to accommodate quality control problems with the ship's cabling found during pre-delivery inspections. These caused a six-month delay in the ship's completion, and the remedial cost was \$360 million, which was borne by Northrop Grumman. At that time, *Makin Island* was expected to commission in October 2009 and be in full operational service by the end of that year. In accordance with this schedule, she was commissioned on October 24, 2009, in Coronado, Calif. The commissioning ceremony was coordinated by the San Diego Council of the United States Navy League.

Related News

Makin Island Passes Sea Trials – The U.S. Navy's new amphibious assault ship *Makin Island* (LHD-8) has completed a successful acceptance sea trial in the Gulf of Mexico. During the acceptance trial, *Makin Island* performed all required sea trial evolutions for the U.S. Navy's Board of Inspection and Survey. *Makin Island* proved her operational success with the first gas turbine/electric-powered propulsion system ever used on large deck amphibious assault ships. The gas turbine engines and electric drive, a change from previous steam-powered ships, will provide significant life-cycle savings in manpower and maintenance costs over the previous ships. "This ship

LHD-1 Wasp Class

could be categorized as a first-in-class ship because of the many design changes associated with the new propulsion system," said Irwin F. Edenzon, sector vice president and general manager of Northrop Grumman Shipbuilding-Gulf Coast. *Makin Island* is scheduled for commissioning at her San Diego home port in October 2009. (Northrop Grumman 3/09)

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Funding

The U.S. Navy requested initial funding for the lead ship's construction in FY83. In FY84, the U.S. Navy asked for, and Congress approved, \$1.36 billion for LHD-1 construction. On October 31, 1983, Ingalls received a \$59.6 million long-lead material contract, followed by a \$14.4 million increment on February 5, 1984. The \$822 million contract for construction of LHD-1 was issued to Ingalls on February 28, 1984.

The Navy requested and received \$39.2 million in advance procurement funding for the LHD-2 in the FY85 budget. It requested \$1.14 billion in FY86 for the LHD-2 and \$358 million for critical long-lead parts for the LHD-3 and LHD-4. Congress cut these requests to \$1.10 billion and \$165 million, respectively. In late 1985, the U.S. Navy announced that the contract for LHD-2 would contain options for LHD-3 and LHD-4. Ingalls, Avondale Shipyards, Newport News Shipbuilding & Dry Dock, and National Steel and Shipbuilding submitted bids. Ingalls won, receiving a \$402 million contract (N00024-86-C-005) on September 11, 1986. The contract contained fixed-price options for LHD-3 and LHD-4.

No LHD procurement funds were requested in FY87. A \$232 million request for long-lead items for LHD-3 and LHD-4 was cut to \$35 million. The keel for the USS *Essex*, LHD-2, was laid in August 1987, and the USS *Wasp* was launched in September 1987. The U.S. Navy requested \$740.7 million for LHD-3 in its FY88 budget. The service planned to request \$741.1 million for LHD-4 in FY89. Ingalls received a \$378.6 million contract modification for LHD-3 construction and LHD-4 long-lead materials in November 1987. When the revised FY89 budget request was released in January 1988, the U.S. Navy had cut its request slightly, to \$737.5 million. The LHD-5 was ordered from Ingalls Shipbuilding in December 1991 and was delivered in 1997. The USS *Wasp* LHD-1 was taken into USN service on July 29, 1989. In FY93 Congress authorized the allocation of \$1.2 billion for LHD-6 but allocated only \$300 million of this sum, with the balance provided in FY94. In the FY95 SASC markup, the Senate proposed the transfer of \$600.8 million from the National Defense Sealift Fund to the construction of LHD-7. This was eventually rescinded in favor of a \$50 million allocation to long-lead procurement. Finally, \$795.4 million was allocated for building the LHD-7 in December 1995. In FY96, the Congress had already appropriated \$1.3 billion for this ship, although the Navy had not planned to request the ship until 2001. The balance of \$504.6 million in the LHD-7 account was therefore allocated to other services, but with some of it being used to procure the equipment needed for construction of the vessel. The funding was presumably pushed forward to prevent having to spend an additional several hundred million dollars to restart an idle production line.

Contracts/Orders & Options

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
CAE	N/A	May 2000 – Fuel fill control system for LHD-7.
Ingalls Shipbuilding	49.8	Aug 2000 – Advanced design of LHD-8.
Ingalls Shipbuilding	196.5	May 2001 – Advance procurement of LHD-8.
Ingalls Shipbuilding	81.3	Jun 2001 – Advance procurement of LHD-8.
Ingalls Shipbuilding	N/A	May 2002 – Design studies on upgrading LHD-8 design to meet requirements of LHA(R) program.

LHD-1 Wasp Class

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Ingalls Shipbuilding	1,370	Jun 2002 – Detail design and construction contract for LHD-8.
DRS Technologies	7.6	Oct 2002 – Motor control systems for LHD-8.
GE Turbines	N/A	Dec 2002 – Two LM-2500+ gas turbines for LHD-8.

N/A = Not Available.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1981	Feasibility studies begin
Dec	1981	Baseline design initiated
Jul	1982	Engineering design
Feb	1984	First ship ordered
May	1985	USS <i>Wasp</i> keel laid
Sep	1987	USS <i>Wasp</i> launched
Jul	1989	USS <i>Wasp</i> commissioned
May	1997	USS <i>Bonhomme Richard</i> (LHD-6) christened
May	1998	Building of an eighth ship proposed by Mississippi Senator Trent Lott
Mar	2000	USS <i>Iwo Jima</i> (LHD-7) christened
	2001	LHD-7 commissioned
FY	2000	Advance funding granted for LHD-8
May	2001	Final detail-design contract for LHD-8 awarded
Jun	2001	Advance construction contract awarded
Jan	2002	Moves made to fund LHD-9
Apr	2002	Full funding for construction of LHD-8
Feb	2004	LHD-8 laid down
Aug	2006	LHD-8 launched
Oct	2009	LHD-8 commissioned

Worldwide Distribution/Inventories

United States. Eight built.

Forecast Rationale

The *Makin Island* is very much a trials ship that will test out the systems, equipment, and design concepts intended for the LHA-6 prior to their adoption for the new class. This program of testing new systems in an existing, proven, and successful hull is a wise step, and it is unfortunate that the same approach was not adopted for other new U.S. Navy warship programs.

Currently, there is significant doubt over the evolution of the amphibious warfare fleet. Construction of the large-deck ships is already shifting to the LHA-6 America class, which eliminates the well deck in favor of enhanced aircraft and helicopter operating capability.

However, doubts are already being expressed over the wisdom of this particular configuration, not least because it blurs the distinction between the Marine Corps amphibious warfare ships and the Navy's aircraft carriers. The possibility that the well deck would be restored to LHA-7 and subsequent ships suggests that, if this route was to be adopted, the ships would bear a significant family resemblance to LHD-8.

We are restricting this forecast to the completion of the LHD-8. The LHA-6 class is covered by a separate report in this tab.

Ten-Year Outlook

With the commissioning of the LHD-8 *Makin Island* and as no more LHD class ships will be funded this report contains no forecast chart.

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