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# **U.S. AMPHIBIOUS SHIPS AND CRAFT**

**AN ILLUSTRATED DESIGN HISTORY**

**SHIP PLANS BY A. D. BAKER**

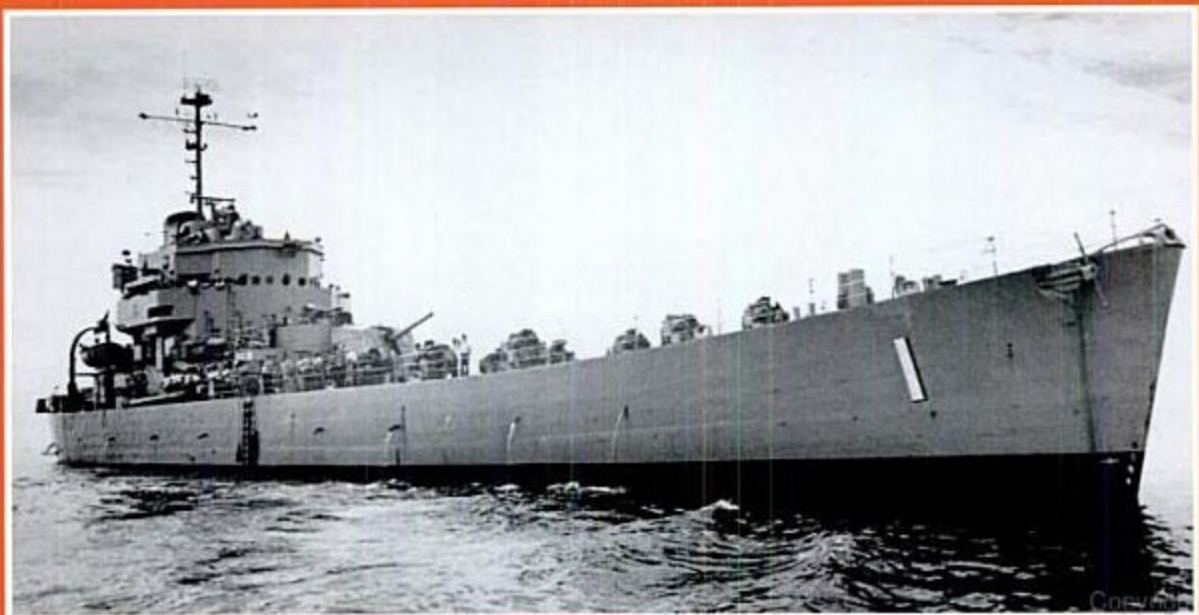
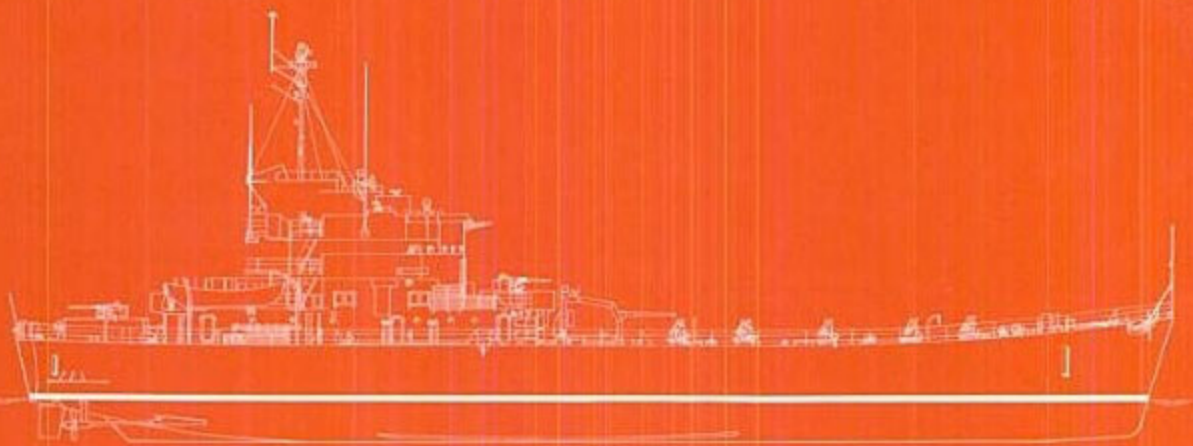


Table 11-1. The 20-kt Amphibious Force

	<i>Paul Revere</i> (APA 248)	<i>Tulare</i> (AKA 112)	<i>Charleston</i> (AKA 113)	<i>Thomaston</i> (LSD 28)
Length (ft-in)				
WL	528-0	528-0	550-0	NA
OA	564-0	564-0	575-6	510-0
Beam (ft-in)	76-0	76-0	82-0	84-0
Draft, loaded (ft-in) <sup>a</sup>	27-0	28-0	25.44 ft	19-0
Displacement (tons)				
Light	10,709	9,050	13,727	6,880
Loaded	16,838	15,970	18,648	11,270
Boilers	2 CE	2	2 CE	2 B&W
Conditions (psi/°F)	NA	NA	600/850	600/850
Power (SHP/shafts)	22,000/1	22,000/1	22,000/1	24,000/2
Speed (kt)	21	21	22	23
Radius (nm/kt)	10,000/20	10,000/20	9,600/16	13,000/10
Complement (officers/enlisted)	45/484	31/362	25/311	21/384
Capacity				
Troops <sup>d</sup>	98/1,980	18/301	15/211	29/312
Tons	1,900	4,476	5,280	2,400
Sq ft	NA	NA	32,900	10,200
Cu ft	137,678	450,000	66,100	3,500
Booms (qty-capacity) <sup>e</sup>				
70 ton	2-60	3-60	2	—
40 ton	1-30	1	2	2-50
15 ton	3-10, 2-8	6-10	8	—
5 ton	1	—	—	—
Boats				
LCM	7	9	9 <sup>h</sup>	18 <sup>i</sup>
LCVP/LCPL	15 <sup>m</sup>	11	2	4
Armament				
3-in/50	4 × II <sup>o</sup>	3 × II	4 × II	8 × II
20-mm	—	—	—	6 × II

NOTES: Dash indicates that specification is irrelevant; NA indicates relevancy but data not available.

<sup>a</sup>Draft mean if only one figure given; draft fore/aft if two figures given. Measurements are given in ft-in unless otherwise specified.

<sup>b</sup>Diesel power: four Colt-Pielstick 16PC2.5V400 in LSD 41 and LSD 49 classes.

<sup>c</sup>Diesel power: six Alco 16-251 engines.

<sup>d</sup>Officers/enlisted when two figures are listed; when only one figure is given, breakdown is unknown.

<sup>e</sup>Full load: 2,000 tons; deck areas: tank deck 12,704 sq ft, main deck 11,391 sq ft. Presumably the figure given is total usable deck area.

<sup>f</sup>Combat cargo cube was given as 4,200 cu ft in a 1969 summary of the capabilities of the new LST.

<sup>g</sup>Only quantity is listed unless capacity is different. For example, *Paul Revere* had two 60-ton booms instead of any 70-ton booms.

<sup>h</sup>Four LCM(8) and five LCM(6).

<sup>i</sup>LCM(6); alternatives are three LCU or nine LCM(8).

not roll excessively in a roadstead while unloading, might be difficult to meet in a converted merchant ship. A 6 November 1947 design report warned that mass production might be difficult, because only 20 building ways suited to so large a ship were available; the specialist wartime yards, which had built the mass of new shipping, had all shut down. The ships would be armed with the new twin 3-in/70 antiaircraft cannon, which featured in many contemporary

design studies. Not appearing in service for a decade, they then proved unsuccessful.

The 20-kt transports would be accompanied by a 20-kt LSD, which was a Priority 4 design study for FY 48. Capacity was set at three LCT or two LSM; the ship could also carry PT boats. The secretary of the navy approved a design study for a fast LSD at the same time as he approved the fast AKA. As of 1948, estimated construction cost was \$13.5 mil-

<i>Anchorage</i> (LSD 36)	<i>Whidbey Island</i> (LSD 41)	<i>Harpers Ferry</i> (LSD 49)	<i>Newport</i> (LST 1179)
534-0	580-0	579-11	522-2
562-0	609-5	609-5	561-2
84-0	84-0	84-0	69-6
20-0	19-7	19-9	5-11/17-2
8,200	11,471	11,894	4,975
13,680	15,745	16,695	8,576
2 CE	— <sup>b</sup>	—	— <sup>c</sup>
600/850	—	—	—
24,000/2	41,600/2	41,600/2	16,500/2
22	22	22	22
14,000/12	8,000/20	8,000/20	14,250/14
18/304	21/289	21/312	15/247
336	560	400	430
NA	NA	NA	500 <sup>e</sup>
15,200	13,500	16,600	17,300
1,400	5,100	50,700	3,400 <sup>f</sup>
—	1-60	—	—
2-50	—	1-30	—
—	1-20	—	2-10
—	—	—	—
9 <sup>g</sup>	10 <sup>k</sup>	4 <sup>l</sup>	—
4	3	2	4 <sup>n</sup>
4 × II	—	—	2 × II
—	2 RAM <sup>p</sup>	2 RAM <sup>q</sup>	—

<sup>j</sup>LCM(8) without mezzanine deck, or six with mezzanine deck; alternatives are 2/3 LCAC (with/without mezzanine) or 1/3 LCU (with/without mezzanine) or 50 LVT.

<sup>k</sup>LCM(8); alternatives are 4 LCAC, 3 LCU, or 64 AAV.

<sup>l</sup>LCM(8); or two LCAC or one LCU.

<sup>m</sup>Ten LCVP and five LCPL.

<sup>n</sup>Typically three LCVP and one LCPL or Seafox.

<sup>o</sup>Multiple gun mounts are indicated by Roman numbers; therefore 4 × II indicates four twin mounts.

<sup>p</sup>Plus two 25-mm, two Phalanx, and eight 0.50 caliber machine guns.

<sup>q</sup>Plus two 25-mm, two Phalanx, and eight 0.50 caliber machine guns.



A preliminary design sketch of the *Thomaston* (LSD 28)-class design, about 1953. The arrow shows the temporary mezzanine deck installed. The helicopter deck was also portable; when it was removed, the ship could carry a variety of service craft up to harbor tugs. The water barrier made it possible to carry more vehicles while retaining some landing craft capacity.

ground that they were slower and more expensive). A 7½-ton bridge crane served the covered part of the well deck. As a cost saver, air conditioning was omitted; it was restored in the last two ships of the class, however.

Eight ships of this *Thomaston* (LSD 28) class were built: LSD 28–31 under the FY 52 program, LSD 32 and 33 under the FY 54 program, and LSD 34 and 35 under the FY 55 program. Three ships were dropped from the FY 53 program (in the planning stage) to help finance the carrier *Saratoga* (CV 60). LSDs were built before AKAs or APAs because they were so versatile; in November 1948 the amphibious arm of OpNav, Op-343, pointed out that there had never been enough during World War II. During the Korean War, all available LSDs were activated. By 1952, LSDs were being justified for the FY 55 program not only for their amphibious capabilities but also for their ability to tend and transport small minesweeping boats.

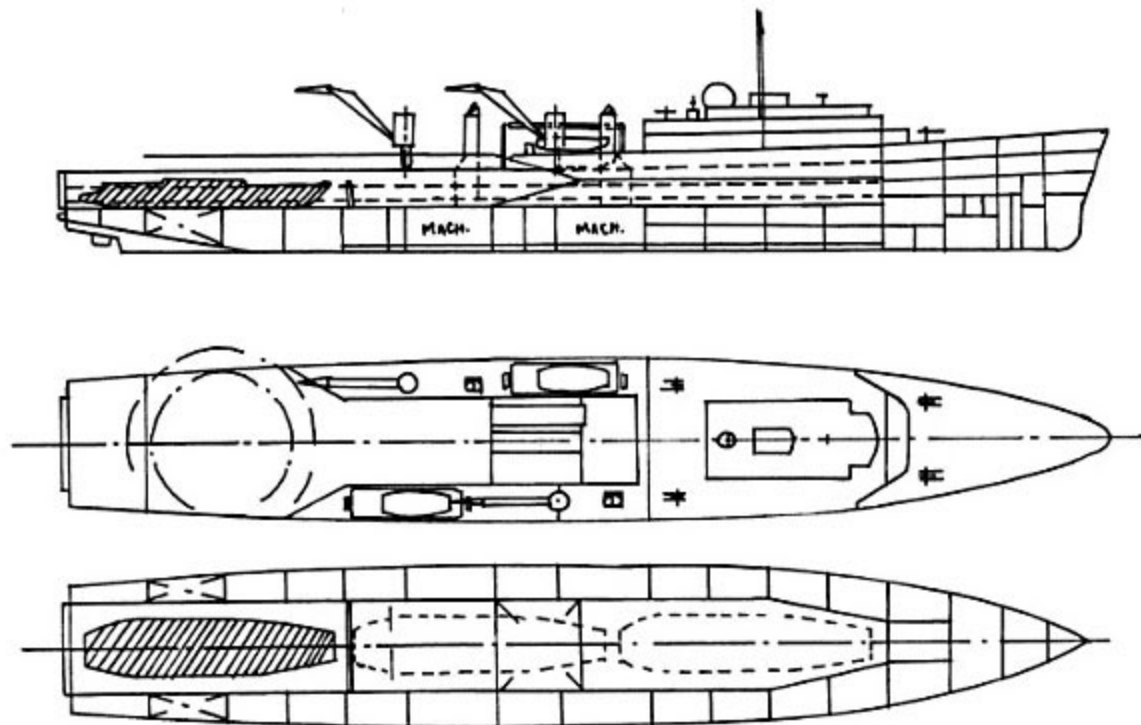
Conversely, as the fast new LSDs entered service, earlier ones became available for conversion to other purposes. For a time it seemed that they would become tenders for the new jet seaplane bomber, the P6M Seamaster; conversion of LSD 1 into AV 21

began but was stopped when the bomber was canceled. Another conversion was canceled before it began. LSD 4 was reclassified as a mine countermeasures craft mother ship (MCS 7) in 1962.

In FY 59 the navy began buying a modified well-deck ship, the LPD. No more LSDs were programmed until the mid-1960s, even though the 22 wartime-built units were wearing out. The first pair reached overage as of 30 June 1957. Long-range planners in 1955 wanted two new LSDs in the FY 57 program. In the fall of 1958 two were earmarked for transfer to Taiwan, so planners considered adding two new LSDs to the FY 61 program (in fact only one was lent). Funds were insufficient.

To stave off replacement, LSDs were modernized under the FRAM II program. A 19 December 1958 program summary showed 15 ships: 3 in FY 60, 5 in FY 61, 4 in FY 62, and 3 in FY 73.

Ultimately the World War II LSDs did have to be replaced. Five improved *Thomastons* were built as the *Anchorage* (LSD 36) class: one in FY 65, three in FY 66, and one in FY 67. The new LSDs were built under SCB projects 404.65 (LSD 36) and SCB 404.66 (the other four). Compared to the earlier class, they were considerably lengthened, from 510 to 553 ft.



A preliminary design sketch of the SCB 404.65 (*Anchorage*, LSD 36, class) LSD, about 1964. Note how the well deck could accommodate three LCU 1610s. This ship was lengthened 40 ft largely because the previous *Thomaston* class could not easily accommodate the new fast LCU; it had to be angled in the well deck to fit. Added length also added troop and cargo capacity. The 01 level was extended fore and aft for better habitability. Vertical conveyors improved cargo handling. The pilothouse was raised half a deck to improve visibility and also to improve ventilation of the forward part of the well deck; a plenum chamber occupied the half-deck void under the pilothouse. The two LCUs outlined in dashes are forward of the erectable water barrier. Boats on deck are LCM(6)s with LCPLs nested in them. The circles aft are the safety circles for a CH-53 helicopter on the ship's flight deck. The dome on the bridge is Miser (a microwave satellite relay), a projected satellite communications dish, not ultimately installed on board these ships. Crane capacity shown on the sketch was 50 tons. Dimensions of the preliminary design were 555 ft (overall) or 540 ft (waterline)  $\times$  84 ft (extreme)  $\times$  18 ft 6 in (fully loaded); full load displacement was 13,650 tons. Speed was 20 kts (24,000 SHP) as in LSD 28, and complement was 51 officers, 33 CPOs, and 709 enlisted. Armament shown is four twin 3-in/50.

The well deck was lengthened from 391 to 430 ft and it was widened by 2 ft. Light displacement increased from 6,880 to 8,600 tons in LSD 36 (8,100 tons in the others). Other changes included a tripod mast to support the new SPS-40 air search radar. The next class of LSDs, associated with the new LCAC (landing craft, air cushion), is described in Chapter 16.

The new series of fast amphibious ships inevitably included a 20-kt LST. Work began in August 1947. Such a fast LST was considered so valuable that by 1948 plans called for substituting it, if it succeeded, for six of the eight planned fast LSDs. Fast LSDs carrying landing craft were the obvious alternative to fast LSTs, if the fast LST design proved impractical. Requirements were the usual 20 kts sustained speed and 10,000 nm at 20 kts steaming radius. The ship would carry 75-ton tanks on a 300-ft tank deck (30 ft wide, with 14 ft clear overhead), with 25-ton vehicles

above on the main deck, plus troops (20 officers, 410 enlisted men). Compared to the other fast amphibious ships, armament would be quite limited (two single 3-in/50 plus pedestal-mounted machine guns).

The preliminary designers soon realized that it was hopeless to try to drive a blunt bow at high speed. Much of the usual resistance could be attributed to the very full hull, with its high prismatic coefficient (0.820). Bow doors could be a very small part of a much longer, beamier hull with more rounded bilges (beyond the doors the bilges could sweep up more steeply). This more conventional approach was rejected. Instead, the designers chose a radical alternative: the ship would have a conventional bow, with the usual blunt end with doors placed at the stern. Approaching the beach, she would turn around and, in effect, back in. The propellers could not be in their normal position at the



was characterized as a modified repeat version of the earlier ship. The 436-ft well of the earlier LSD 36 was 4 ft too short for the fourth LCAC; moreover, its forward part necked down to 24 ft. Squaring the well and extending it added 16 ft. In earlier LSDs, berthing spaces were in the wing walls. LCACs in the well deck would generate such noise and heat that this was no longer acceptable. The new LSD was therefore rearranged, with troop berthing forward of the well, thus lengthening the ship again, to at least 560 ft. In peacetime, Marines on board would live as well as the crew.

In November 1977 the ship grew another 20 ft, to 580 × 84 × 18 ft (11,006 tons). The other 20 ft of growth provided a second helicopter spot that could be used for the required storm-protected vehicle square footage, and a fixed drive-through ramp from the upper deck to the craft in the well deck. There was also a turntable, so that vehicles could be driven on board and then turned around to go onto the LCACs. Overall, the new LSD was expected to cost \$73 million more than LSD 36; displacement was 2,542 tons greater at that stage.

Cargo capacity grew from 11,983 sq ft and 2,000 cu ft to 12,800 sq ft and 5,000 cu ft. The ship could accommodate 338 marines (vs. 300 in LSD 36); under surge conditions 440 could be carried. LSD 36 had no such accommodation margin. Capacity would be 64 amphibians, compared to 39–44 in LSD

36. The ship was given 60-ton cargo cranes specifically so that she could hoist main battle tanks into and out of LCACs. She was also given hard points and space and weight provision to fit a temporary mezzanine deck.

Deletions, to save cost, included flag facilities in some ships, a helicopter hangar, provision to transfer jet fuel to helicopters, provision for airborne mine countermeasures as a secondary function, and MUTE (multiple unit for transmission elimination), a means of controlling all the ship's electronic emissions. LSD 41 did retain her air search radar and her 22-kt speed.

In July 1977 the Ship Acquisition and Improvement Panel (SAIP), in effect equivalent to the earlier SCB, approved a switch to diesel propulsion, which it reaffirmed in October 1978. Diesels would use only two-thirds as much fuel as steam or gas turbines. Power was upgraded to 33,000 (later 36,000) BHP; two medium-speed diesels on each shaft would drive controllable reversible-pitch propellers. The diesel chosen, the French-designed, U.S.-made Pielstick 16PC2.5V400, was described as a world leader, the manufacturer having accumulated over 40 million operating hours. Because the machinery was new, a land-based test site had to be built at the Naval Ship Engineering Station (NAVSES) in Philadelphia. Work began in March 1979.

