U.S.S. CURTISS

BOMB DAMAGE

Dec. 7, 1941

Pearl Harbor

Class.	Seaplane Tender (AV4)	Length (W.L.). .	508'
Launched . . .	March 1940	Beam	69'-3"
Displacement (standard). .	8625 tons	Draft (on Dec. 7) . .	19'-6"

References:

(a) C.O. CURTISS conf. ltr. to Buships, AV4/A16-3/(072), Dec. 17, 1941. (War damage report).
(b) Navy Yard, P.H., conf. Plan AV4-11/6-1: Damage Investigation, U.S.S. CURTISS.
(c) Comdt. P.H. conf. ltr. to Buships C-L11-1/S85/AV4/NY10(Y-0527), Dec. 24, 1941.
(d) C.O. CURTISS conf. ltr. to C.N.O., AV4/S88/(02), Jan. 19, 1942. (Damage control report).
(e) C.O. CURTISS conf. ltr. to Cincpac, AV4/A16-3 (071), Dec. 16, 1941.

Narrative

1. U.S.S. CURTISS was moored bow and stern at berth X22 at Pearl Harbor on the morning of December 7, 1941. The weather was clear, with visibility excellent but somewhat hampered by scattered clouds. The depth of water here is 36 feet. The ship was in Material Condition Xray.

2. Torpedo and bombing planes were observed attacking ships in the harbor and shore establishments at 0750. General Quarters was sounded at once, and all guns were in action within a few minutes. Fighter planes strafed the ship. Boilers were lit off and preparations made for getting underway.

3. Bombers unsuccessfully attacked CURTISS at 0825. Fire was opened on a submarine periscope sighted 700 yards on the starboard quarter at 0836. The submarine surfaced at 0840 and was hit in the conning tower twice by 5-inch projectiles from No. 3 gun. MONAGHAN then attacked with two depth charges. The submarine, which was of the miniature type, was later recovered for examination.

4. At 0905 CURTISS hit a plane which was pulling out of a dive over Ford Island, setting it afire. It crashed into the starboard side against the forward crane, as indicated by Photo 1. The gasoline tank exploded and the plane burned on the boat deck. Gun No. 3 was temporarily abandoned.

5. Another bombing attack was made at 0912. One bomb hit the stern mooring buoy, one fell on each side, and one hit the ship on the starboard side of the boat deck.

Bombs were released from about 300 feet in a glide at about 30 degrees to the horizontal. One plane was shot down about 1000 yards on the port bow. Another was hit squarely and disintegrated 500 yards on the port beam. Two others were reported to have crashed.

6. The direct hit pierced the boat deck at about frame 71, starboard; passed through the carpenter shop on the superstructure deck, the aviation radio repair shop on the upper deck, into and across the hangar, and detonated on the main deck. The path followed is indicated on Plate I. Structure, equipment and fixtures were destroyed within a radius of about 30 feet. Fires broke out in many places on six decks, which were not finally extinguished until 1430, though they were under control within less than half an hour. The after engine room was evacuated at 0927 because of smoke, broken steam lines and water entering from the fire-fighting operations overhead.

7. The near-misses mentioned in paragraph 5 caused no appreciable damage. The bomb which struck the mooring buoy, 50 feet astern, made small fragment holes in the counter. One detonated about 75 feet off the starboard beam. These bombs appear to have had little if any fuze delay, whereas the bomb which hit the ship travelled about 50 feet through structure before exploding.

8. The direct hit was probably by a 250-kg. general purpose bomb like the sample recovered intact from Schofield Barracks. There are indications that this type was also used on other ships at Pearl Harbor on December 7. The diameter is 12 inches, which checks with the holes in the boat and superstructure decks (Photos 3 and 4). Fragments of about 3/4-inch thickness were recovered, which correspond to parts of the case of the 250-kg. bomb. This type contains 133 pounds of T.N.T.

9. Water from fire-fighting operations accumulated until the list was 9 degrees to starboard. This was corrected by transferring fuel oil and counterflooding voids. When the fires had been extinguished, the water was removed by electric submersible and portable gasoline-engine driven pumps.

10. A wrecked OS2U-2 Navy plane is shown in Photos 11 and 12. No mention of this is made in the references.

Structural Damage

11. The path of the bomb is shown on Plate I and Photos 2, 3, 4, 6 and 7. The hole in the boat deck (Photo 3) was about a foot in diameter. In passing through the carpenter shop (Photo 4), the bomb struck a circular saw bench which deflected its trajectory, and the hole in the superstructure deck was correspondingly oval, about 12 by 24 inches. It was further deflected by glancing from the crane kingpost in the aviation radio repair shop. It left this shop at the inboard after corner (Photo 5) and entered

the hangar. The explosion was either just above or on the main deck (Photos 7 and 8) at frame 74, 10 feet to port of the centerline, and close to the bulkhead of the battery shop. The bomb had penetrated 3/4 inch of mild steel in all before it exploded. The separate thicknesses are marked on Plate I.

12. The explosion blew a hole about 8 feet in diameter in the 20-lb. plating of the main deck, as shown by Photos 7 and 8. The after bulkhead of the battery room was completely demolished. The motion picture room and the aviation instrument repair shop, which are on the upper deck directly above the battery shop, were wrecked by blast from beneath.

13. The radio transmitter room on the superstructure deck was damaged by blast, fire and fragments. There was similar damage in the handling room and ready service ammunition flat, which is suspended in the hangar beneath the boat deck, nearly directly above the explosion.

14. Blast travelled forward to rupture bulkhead 69 and entered and wrecked the supply office (Photo 6). It blew aft and out the hangar, wrecking the doors and door mullions as shown by Photos 11 and 12. The references do not state whether or not the hangar doors were closed at the time. Presumably they were open, as it does not appear from the photographs that they could have been rolled up afterwards.

15. The direct effects of the blast extended downward to the second deck, where the hole shown by Photo 9 was blown in the 12-1/2-lb. plating. The aviation engine overhaul shop on the second deck was badly damaged by blast.

Damage by Fragments

16. The fragments ranged in size from minute particles up to 4 x 4 x 3/4 inches, and caused widespread damage. The fragments were highly magnetized. This phenomenon is quite common. If steel is heated to the vicinity of the Curie point (the magnetic transformation temperature) it easily picks up magnetism under a sharp blow. Magnetism in bomb and shell fragments, and in armor plate in the vicinity of an impact, has frequently been observed.

17. Fragments penetrated up through the boat deck and down through the third deck into the engine room. Others were found on the main deck a hundred feet from the explosion. Both ammunition hoists which pass through the hangar were damaged. Photo 7 shows fairly large holes in the hoist to No. 4 gun. Those which pierced the third deck punctured a steam line in the after machinery room.

18. A considerable amount of the fragment damage can be seen in the photographs. The structural damage caused by blast previously described was of course augmented by fragments. Pipes and electrical leads were cut. Numerous fires broke out which were probably started by hot fragments.

Fires; Damage Control

19. The fires mentioned above destroyed equipment in the hangar, the upper handling room of No. 4 gun, the battery shop, motion picture projection room and the radio transmitter room.

20. Cork insulation was extensively used in CURTISS. The cork ignited and burned rapidly in the damaged area, then smouldered for some time after the flames had been extinguished. Dense acrid smoke and fumes were generated by burning cork and motion picture film which hindered firefighting and handicapped the rescue of injured personnel. At one time cork was burning in five different locations. Fire in a compartment would cause ignition of cork on the opposite sides of the bulkheads, which was especially difficult to extinguish. Burning cork caused 24 ready service cartridges to burn or explode in the handling room for No. 4 gun.

21. Fire was intense in the motion picture projection room and heated all adjacent areas. Papers and records in the supply office were set afire, though Photo 6 shows that there was no serious blaze in this space. Bedding in the crew space on the second deck also burned.

22. The damaged area was isolated as circumstances permitted. The hangar sprinkler system worked, but the risers to sprinkler systems of No. 3 and No. 4 handling rooms had been riddled by fragments above the control valves. Hoses were used for most of the firefighting. The CO_2 extinguishers were useless against these fires, though Pyrene extinguishers were helpful on burning electric cables.

23. Both power and lighting circuits in the damaged areas were cut off to prevent further fires in ruptured or damaged cables. It was necessary to use dry cell hand lanterns in the darkened compartments. These were unsatisfactory because they cannot be carried while working.

24. Water entered the aviation metal shop through a sprung hatch in the main deck. This compartment extends along the starboard side of the second deck under the hangar. The accumulated water from the hoses and sprinklers caused a list to starboard which finally reached 9 degrees, and which was dealt with as described in paragraph 9.

Comments

25. The question naturally arises as to whether this damage typifies that to be expected from the detonation of a bomb of this size within a ship structure. Probably it was less severe than would occur in most cases, due to the fact that explosion occurred in the hangar. A good deal of the blast must have escaped through the after end of the hangar where the curtain doors, even if closed, would have offered negligible resistance.

26. The belief that an explosion can be "vented" so that its damaging effects are reduced has been pretty well discredited by war experience, insofar as the normal ship doors and hatches are concerned. But there are definite indications, both from war damage and from small-scale model tests conducted by the Bureau, that explosions in large spaces (such as hangars) with large openings do not cause such a total volume of damage as in structures comprised of numerous smaller and closed compartments. The hangar on CURTISS almost certainly saved the structure forward of it from more extensive damage than it suffered, and probably the vertical effects were also less. For instance, the bomb which exploded deep in the forward structure of H.M.S. ORION was estimated to have had a 165-lb. charge. The damage caused was considerably more than one would have estimated by comparison with the damage on CURTISS.

27. The widespread damage due to fragments is well demonstrated by this case. Not the least of this is the fires which they cause. The disruption of piping, wires, ammunition supply, steam lines, etc., is out of all proportion to the actual structural damage. Important systems in unarmored parts of a ship should obviously have the best practicable individual protection, or the military effectiveness may be seriously impaired by comparatively minor attacks. Later designs have been improved; see paragraph 30.

28. The fire hazards of cork insulation have been recognized and it is not now used in new construction or repair work.* Pressed fiber glass board is used at present.

29. Miners' type head lanterns were recommended in reference (d). These are already available for issue, or will be shortly. Twenty of them have been added to the allowance list of CURTISS. Additional emergency lighting equipment which the Bureau is providing for large seaplane tenders (AV type) includes:

(a) Four battery-operated flood lanterns.
(b) Flashlight allowance increased to one for each man on board.
(c) Installation of relay-controlled hand lanterns is authorized** in selected essential locations.

30. CURTISS was designed under treaty restrictions which forbade the use of armor in auxiliaries. In CURRITUCK (AV7) and later ships of this type, the third deck is two inches thick over the middle 60 percent of the length, which covers the magazines and propulsion machinery. This would probably have stopped the fragments which entered the engine room of CURTISS. Splinter protection is also being provided for ship and fire control stations and for gun positions in all later fleet auxiliaries.

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* See Buships conf. ltrs. C-S33-6(804) of Aug. 27, 1941, and S39-1(3631) of Oct. 7, 1941.

** By Buships restricted ltr. S64-4(8660):EN28/A2-11, Jan. 8, 1942.