

U.S.S. PENNSYLVANIA

BOMB DAMAGE

Dec. 7, 1941

Pearl Harbor

Class. . . . Battleship (BB38) Length (W.L.). . . . 600'  
Launched . . . August, 1912 Beam . . . . . 106'-3"  
Displacement  
(standard). . 33100 tons

References:

- (a) C.O. PENNSYLVANIA conf. ltr. to Buships, BB38/A9/  
L11-1(06), Jan. 20, 1942 (War Damage Report).
- (b) Comdt. P.H. conf. ltr. to Buships C-L11-1/385/  
NY10(Yo49), Dec. 19, 1941.
- (c) Comdt. P.H. conf. ltr. to Buships, C-L11-1/BB38/  
NY10(Y-0201), Feb. 1, 1942.
- (d) Bureau of Ships War Damage Report No. 13 (CASSIN  
and DOWNES), dated May 28, 1942.
- (e) C.O. PENNSYLVANIA conf. ltr. to Cincpac, A16-3/  
(01535), Dec. 16, 1941 (Action Report).

Narrative

1. The events which occurred in and near No. 1 drydock at Pearl Harbor, during the Japanese air raid on the morning of December 7, 1941, are described in the Bureau of Ships War Damage Report No. 13 (CASSIN and DOWNES), reference (d). The narrative which follows deals with the action only from PENNSYLVANIA's viewpoint, and reference to the CASSIN-DOWNES report is necessary for a comprehensive understanding of the various incidents.

2. U.S.S. PENNSYLVANIA was in drydock No. 1 with the destroyers CASSIN and DOWNES. The relative positions of the ships are shown on Plate I. Repairs were being made to the strut bearings and shafting, incident to which three propellers and tail shafts had been removed. Water, air and electricity were being supplied from the Navy Yard sources.

3. The Japanese air raid commenced with dive bombing of the Air Station on Ford Island a few minutes before 0800. Torpedo planes attacked ships in the harbor almost immediately thereafter. The torpedo attack was soon finished, but high-level and dive bombing continued in varying degrees of intensity for over an hour. It is most difficult to reconstruct the times or even the sequences of events, as no individual could have more than a restricted view of the action and the accounts contain numerous contradictions.

4. Anti-aircraft batteries on PENNSYLVANIA were in action within a few minutes. Preparations were made to flood the dock as expeditiously as possible, both as a measure of protection and to permit steam to be raised and auxiliaries started. One boiler was lit off at about 0830, but could not

be forced because the heavy smoke from the cold boiler interfered too much with the anti-aircraft fire. Hits on the dock side shortly after 0900 cut off all Navy Yard services. The dock commenced to flood at about 0920, but it was after 1000 before there was enough water in it to start the generating plant and to get pressure on the fire main.

heavy smoke from the cold boiler inter-

5. Apparently no bombs fell in the vicinity until about 0906, when one section of a high-level attack dropped bombs from an altitude estimated at 10,000 to 12,000 feet. One struck the side of the dock approximately abreast frame 20 starboard. One pierced the boat deck at about frame 83 starboard and detonated on the upper deck. One was reported by reference (e) to have hit the destroyer DOWNES, but this is believed to be incorrect; see reference (d). Another, not mentioned specifically in the reports, struck near the edge of the dock to port of PENNSYLVANIA, abreast the stern of CASSIN.

6. Sporadic low-altitude strafing attacks continued until about 0930. No more bombs fell nearby, but there were about thirty machine gun hits in the shield around the main-top machine gun position. No bullets penetrated this shield.

7. Intense fires broke out on the destroyers at about 0900 and numerous explosions occurred as described in reference (d). An explosion in the starboard torpedo tubes of DOWNES\* threw a section of torpedo tube weighing between 500 and 1000 lbs. on to the forecastle of PENNSYLVANIA. Burning oil on the water entering the dock blistered the paint on the starboard bow of PENNSYLVANIA as shown by Photo 2. The fires were brought under control before they caused any serious damage to PENNSYLVANIA.

8. The bomb which struck the superstructure (boat) deck probably came, as reported, from the high-level attack, although it appears that dive-bombing was simultaneously taking place with hits being scored on the destroyers forward of PENNSYLVANIA. The trajectory was from port to starboard at an angle of approximately 13 degrees from the vertical. (Note: the bombs which struck the destroyers came at considerably greater obliquities, which supports the view that PENNSYLVANIA was not hit by the dive bombers.)

9. The hole made in the superstructure deck was 12 or 14 inches in diameter, according to reference (a) and the sketch enclosed with it. Penetration was so poor that the armor-piercing bomb used on other battleships that morning may be ruled out. It seems most probable that the hit was from a 250-kilogram general-purpose bomb such as the sample recovered intact from near Schofield Barracks. It has a diameter of 12 inches and carries 133 lbs. of explosive, and there is abundant evidence that it was used on other ships as well.

10. The bomb was stopped by the base of No. 9 gun mount, and must have rebounded inboard and aft before detonating. Maximum damage to the superstructure deck did not occur directly above the point of impact on the upper deck, but some

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\* Time given as 0941 in reference (e). This appears too late by comparison with other accounts, and probably happened before 0930. See reference (d).

distance aft. The fuse delay, if set for an interval allowing ten meters of travel between initial impact and detonation when dropped from 10,000 feet, would give enough time for the bomb to move as suggested. A good many instances of approximate ten-meter delays were observed at Pearl Harbor. ,

11. It is further reported in reference (a) that six-inch holes were found in both the superstructure and upper decks which lined up to indicate a trajectory approximately parallel to that described above and about four feet from it. These holes were ascribed to an incendiary bomb. Although the possibility cannot be definitely excluded, it is considered unlikely that incendiaries were used in any of the attacks on ships. There is no positive evidence of their use. The holes might have been made by a nose fragment of the bomb itself or by rebound, or some other cause.\*

### Structural Damage

12. The bomb pierced the superstructure deck just inside the splinter bulwark surrounding 5-inch A.A. gun No. 7, as shown on Plates I and II and Photos 3 and 4. This deck is of 20-lb. medium steel with 3 inches of wood deck planking. It then struck the base of 5-inch broadside gun No. 9 on the upper deck. The base of the mount is of cast steel, 2-1/4 inches thick, and the gun is mounted on a 2-inch wooden pad over the 20-lb. medium steel deck. Heavy framing and stanchions supporting the gun are directly beneath. This stopped the bomb. The 2-1/4-inch base must have been penetrated. The deck beneath it was dished locally about 10 inches, but not punctured. The bomb then apparently rebounded to one side and exploded.

13. The explosion blew plating upward on the superstructure deck, blew a large hole downward through the upper deck and tore out the side plating around Casemate No. 9 between these decks, as indicated on the plates and photographs. The superstructure deck appears to have fractured just abaft the splinter shield for No. 7 gun and been folded back almost as far as the crane post. Evidently the splinter shield stiffens the deck so much that comparatively little damage was caused forward of it. The after part of the foundation of 5-inch A.A. gun No. 7 was distorted. The nearby hatch (Plate II) was wrecked.

14. The large irregular hole blown in the upper deck is shown on Plate II and by Photos 6 and 7. The deck ripped along a single-riveted seam two feet from the galley bulkhead and was bent down sharply across the deck beam at frame 85.

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\* In this connection, it seems clear that about two-thirds of the planes in the flight which approached PENNSYLVANIA swerved off to attack NEVADA, which was underway in the channel. Officers in a boat going out to meet NEVADA distinctly saw a cluster of three bombs fall toward that ship, with three smaller objects trailing about 100 feet behind. Presumably these smaller objects were parts of the bomb release gear, and may account for the secondary hole on PENNSYLVANIA - though no secondary holes were found on NEVADA.

The outboard bulkhead of the casemate, with the gun shutters, was blown out from frame 79 to its end at frame 88, and the after bulkhead was distorted. Neither of these bulkheads is of ballistic steel. The inboard casemate bulkhead (galley bulkhead), however, is of 30-lb. special-treatment steel. This was deeply dished but held. The galley door O-84-1 lost two hinges as seen in Photo 6. Hatch cover and coaming O-78-1 were badly distorted. The gun shutters and bulkheads of No. 9 casemate were slightly distorted.

15. On the main deck, a hole about three square feet in area was blown in the deck and the plating was dished from frame 79 to frame 86. Stanchions were bent as shown in Photo 8, and two (not visible in the photograph) were carried away, presumably having been cut by fragments. Bulkheads in this vicinity were dished by blast as indicated on Plate III. Photo 9 illustrates the blast and fragment effects. Ventilation ducts were wrecked as far away as the Junior Officers' bunk room.

16. Blast also distorted light bulkheads and wrecked doors over a considerable area on the second deck, as shown by Plate III. Two stanchions buckled where the upper deck was dished in about 3 inches

#### Fragment Damage

17. The superstructure deck was riddled with fragments as seen in Photos 4 and 5, the holes ranging in size from 6 by 2-1/2 inches to holes about one inch in diameter. Five large fragments penetrated the nearby motor launch. Three life rafts were wrecked.

18. Fragment damage was extensive on the upper deck, Photos 6 and 7. Some fragments penetrated the 30-lb. STS galley bulkhead. About 7 large splinters struck but did not penetrate the gun. The rammer air lines to No. 7 A.A. gun and to the 5-inch A.A. loading machine were ruptured. A firemain riser (Plate II) carried away; so did the fresh water riser to the galley and the fuel oil lines from the tanks to the galley ranges. Miscellaneous lighting and non-vital circuits were severed. The degaussing cable was severed.

19. There were numerous fragment holes in the main deck and in the bulkheads surrounding the damaged area, as noted on Plate III. The general announcing system leads and miscellaneous circuits were severed. The air line to No. 9 gun carried away. Some fragments penetrated as far as the second deck, where, for instance, furniture in stateroom A was pierced.

20. The spread of fragments was not excessive in comparison with other cases where the same type of bomb was used. The S.T.S. bulkheads between casemates on the upper deck undoubtedly limited the extent of fragment damage considerably.

## Miscellaneous Damage

21. A good deal of damage occurred to galley equipment. Feed pumps and motors to the range burners were wrecked. Galley range doors, brickwork, flue and canopy were damaged. Two steam kettles, the meat slicer and the dough mixing machine were wrecked. The tile floor was damaged for a few feet inboard of the S.T.S. bulkhead. Most of this damage must have been caused by blast, but the bulkhead was apparently not ruptured and the door in it was presumably closed. The bulkhead appears to have torn away at the top, but even so it is difficult to see how so much damage occurred in the galley.

22. Fragments from the bomb which struck to starboard on the dock side punctured the ship's gasoline line in three places between frames 10 and 35, and penetrated the ship's side in eleven places between the main and upper decks forward. The holes varied from  $3/4$  inch in diameter to about  $3/4$  by  $2-1/2$  inches. No damage to the ship resulted from the bomb which hit on the dock side to port.

23. Four searchlights were damaged, having broken lenses, crushed barrels and damaged signal shutters. Forty-one windows on the bridge were shattered, either by anti-aircraft gun blast or by an explosion elsewhere, but not by the bomb which hit PENNSYLVANIA.

## Fires

24. Fires broke out on the upper, main and second decks following the bomb explosion. The worst one was in A-704 on the main deck. It was brought under control by CO<sub>2</sub> fire extinguishers, as the fire main pressure was low. The Yard water supply failed, as noted in paragraph 4. The fires on the upper and second decks were slight.

25. The oil fire in the dock surrounded the bow of PENNSYLVANIA as the dock was flooded, and burned the paint off the starboard side for about 80 feet from the stem. Paint was blistered and bitumastic melted in a dozen starboard forward compartments. Flooding of the forward magazines and gasoline stowage was commenced, but this was stopped before any ammunition was damaged.

## Discussion

26. A number of cases of action damage have now been studied in which the 250-kilogram, 12-inch bomb has been pretty well identified. Those so far examined (CURTISS, NEVADA) which compare with the case of PENNSYLVANIA, have certain features in common:

(a) The bomb travels about 36 feet (10 meters) beyond the first point of impact before exploding. In the present case the bomb would probably have traveled this distance had it not struck the gun base.

(b) The deck on which it explodes, if not armored, has a hole roughly 8 to 10 feet across blown in it.

(c) At least two decks above are likely to be ruptured and lifted upwards.

(d) A smaller hole, 4 or 5 feet across, is blown in the deck beneath, if this deck is not armored.

(e) Structural bulkheads in the vicinity will be wrecked, but the distance the damage extends horizontally is less predictable than the vertical extent of the damage.

(f) The bomb, if dropped from altitudes of about 10,000 feet or less, is stopped by between two and three inches of steel.

(g) 30-lb. S.T.S., in addition to providing good fragment protection, limits the zone of blast damage to within a few feet from the explosion.

(h) Fire follows the explosion if it occurs near combustible material within the ship.

(i) Fragment damage is extensive. The bomb fragments very well.

27. The remarks in the CASSIN-DOWNES report regarding safety precautions necessary for ships drydocked in a war zone apply equally to the PENNSYLVANIA.