Hit 24 – 5-inch Mount No. 5

From the BuShips damage report:

> 34.   Five-inch mount No. 5 was hit a glancing blow by an estimated 6-inch projectile. The 2-
> inch STS was sprung but not penetrated and minor structural damage was sustained inside the
> mount. Apparently the projectile detonated on impact. Fragments gouged both guns of 5-inch
> mount No. 7 and sprayed the starboard side of the deckhouse on the first and second
> superstructure decks between frames 93 and 100.[93]

South Dakota's action report describes the damage as follows:

> Secondary Battery Group #3
> . . . Mount 5 – Fragment gouged left gun, not serious.
> Armor sprung with minor structural damage inside mount from glancing hit.
> Mount 7 – Numerous gouges in both guns from fragments. Upper handling room damaged.[94]
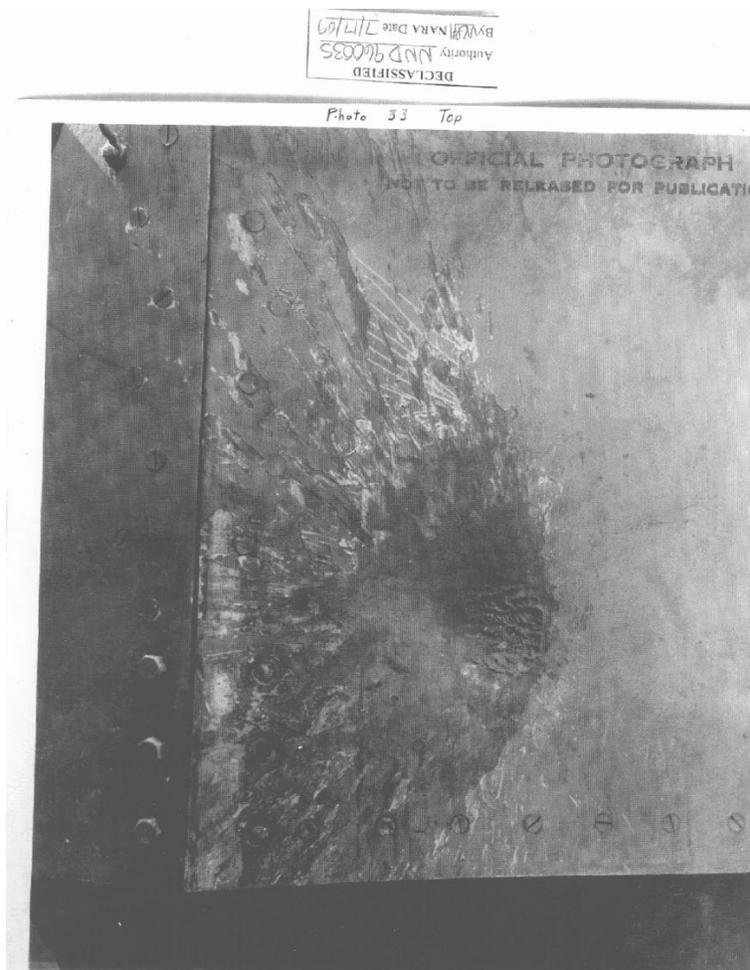
Figure 81 – Hit 24 – Damage to 5-inch Mount #5

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[93] BuShips War Damage Report # 57, page 9
[94] USS *South Dakota* Action Report, Enclosure D, page 15

Analysis of impact

There are no inconsistencies with this estimate. The timing of the hit is unknown. The shell detonated on impact indicating a nose-fuzed projectile, probably a 6-inch Type 0 HE projectile. The other possibility as the timing is not known would be a 5.5-inch Type 0 HE projectile from one of the light cruisers.

Calculating for the larger of these two possibilities: At 6,000 yards, a 6-inch shell from *Kirishima* would be traveling at about 1,700 fps and the angle of fall would be about 4 degrees. The explosive filler for this shell was 6.5 lbs or 6.5% of the total shell weight, which puts it in the category of a normal World War II HE shell. Using the five steps for Equation 1:

Step 1: $(2.576 \times 10^{-20})(D) = 2.576 \times 10^{-20} \times 6 = 1.55 \times 10^{-19}$

Step 2: $V^{5.6084} COS[2(Ob2 - 45^{\circ})] = 1,700^{5.6084} \times COS[2(45 - 45)] = 1.31 \times 10^{18}$

Step 3: $(0.156)(D) = 0.156 \times 6 = 0.94$ inches

Step 4: $1.55 \times 10^{-19} \times 1.31 \times 10^{18} = 0.20$ inches

Step 5: $T_{phe}(noADF) = 0.94 + 0.20 = 1.14$ inch thickness of STS which will result in a caliber-width hole

To find the minimum thickness of STS that ensures that no crack will be made in the plate (just a dent), we multiply $1.14 \times 1.2 = 1.37$ inches.

Note that this calculated thickness is less than the 2 inches of STS that was actually on the back of the mount. Thus, the denting with no cracks caused by this hit is consistent with a 6-inch Type 0 HE shell.

Hit 25 – Strike on Shell at Frame 109-1/2

From the BuShips damage report:

> 35.   An estimated 8-inch AP projectile hit the shell at the second deck, frame 109-1/2. The projectile pierced the shell at a seam between a 25-pound and a 50-pound STS strake, furrowed through the 20-pound STS second deck, pierced 10-pound longitudinal torpedo bulkhead No. 2 and penetrated the 12.2-inch longitudinal armor bulkhead to a depth of 7 to 8 inches at the top edge of the armor. Fragments went aft and pierced and distorted frames 109-112 and penetrated the third deck between torpedo bulkhead No. 2 and longitudinal armor bulkhead. Although the hole in the shell was above the waterline, compartments B-71-F, B-75-V, B-77-F, and B-79-F flooded as a result of this hit. This was reported by *South Dakota* to have been a 6-inch projectile, but it is not believed that a 6-inch projectile would have penetrated so much armor.[95]

South Dakota's action report only lists a five-inch entry hole at Frame 113, three feet above the waterline.[96]
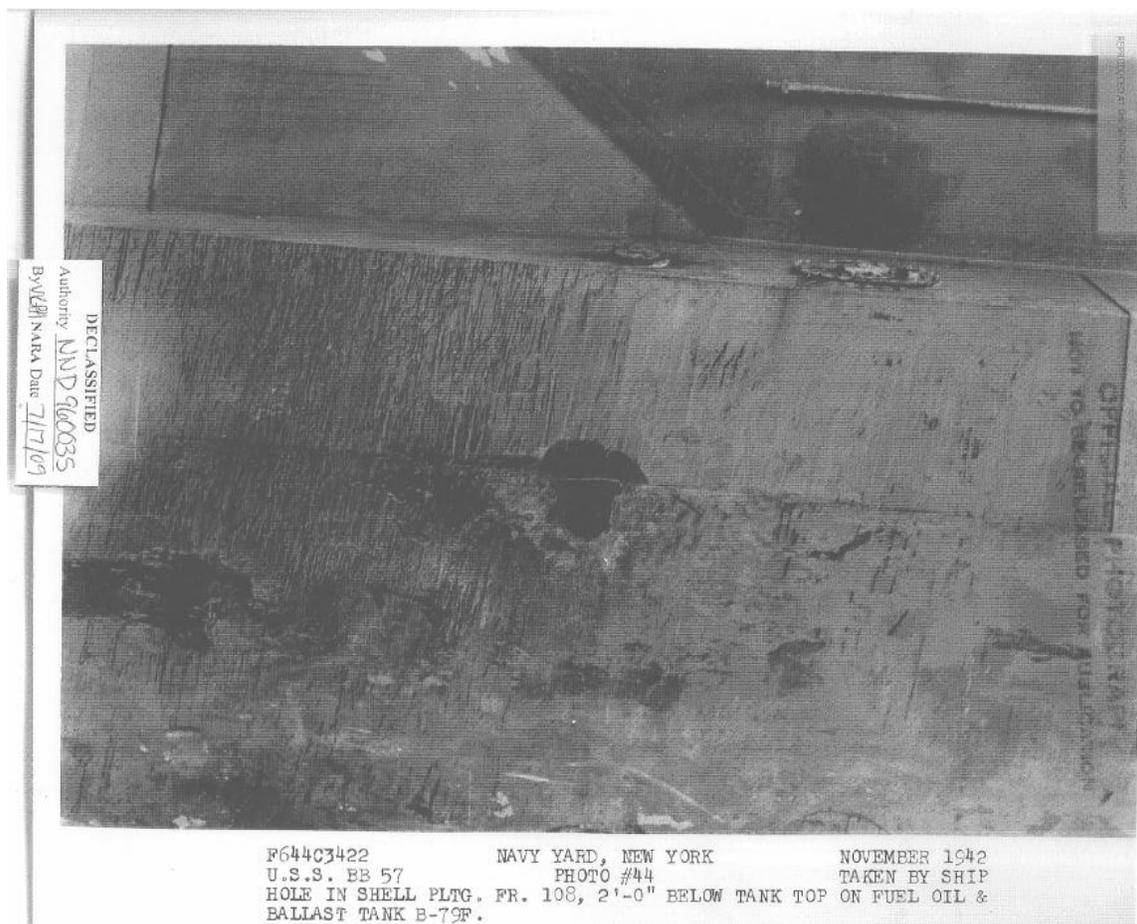
Figure 82 – Hit 25 – Impact Hole

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[95] BuShips War Damage Report # 57, page 9
[96] USS *South Dakota* Action Report, Enclosure D, page 10
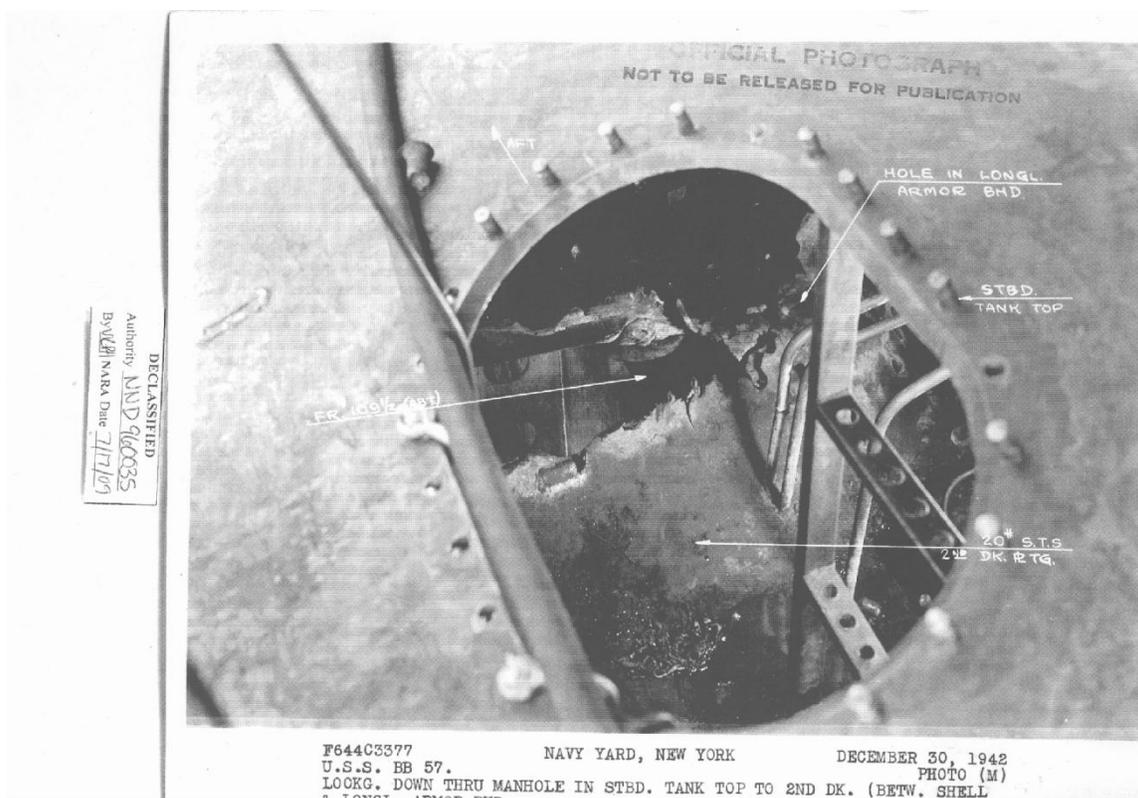
Figure 83 – Hit 25 – Damage inside Tank
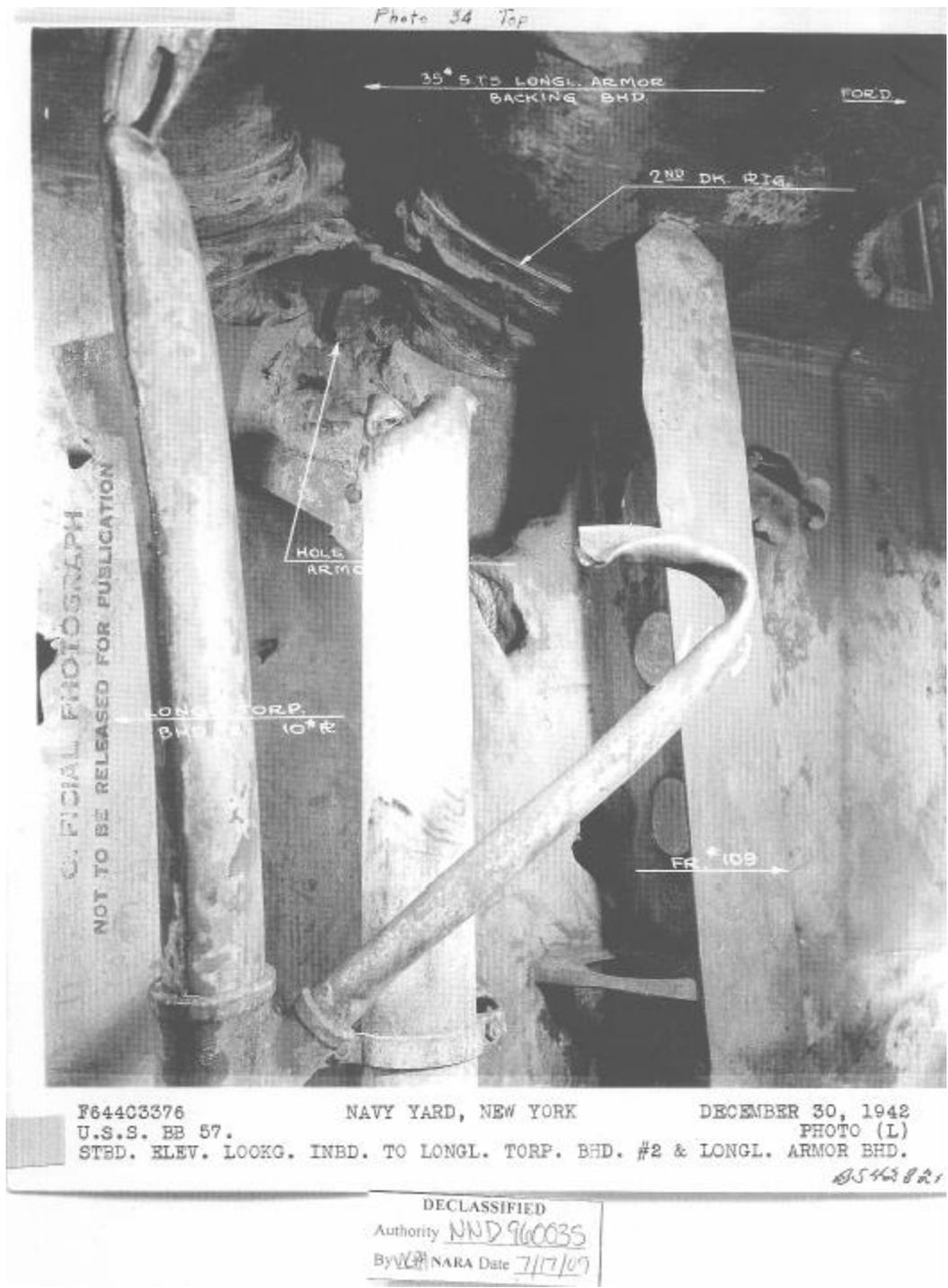
Figure 84 – Hit 25 – Damage to Main Armor Belt

Analysis of impact

There are no accurate, documented measurements for this damage. The hatch shown in Figure 83 is 26 inches long which would allow us to estimate that the hole is possibly 11 to 12 inches wide. The pipes in Figure 84 are no larger than 6-inch and this gives us a crude estimate as to the size of the pit in the plate. Only two types of projectiles would be capable of digging into the main belt as shown in this photograph and they are the 8-inch Type 91 AP and the 14-inch Type 1 AP. Based upon the size of the impact holes, this damage appears to be from the 8-inch projectile. This AP projectile ripped through the outer shell, losing its windscreen and cap head in the three prior impacts before it reached the main belt. The shell body impacted the main belt at its edge and it appears that the shell shattered at this point. If it exploded, then the explosion was probably low-order.

The hard face of the plate failed due to the close-range, high-velocity impact shock and compression force so near the edge of the hard, brittle face material, which cracked and folded back the face there like a door on its hinge, but the shell did not penetrate the back layer because, one, it broke up as it penetrated the face layer (the 8-inch Type 91 AP shell has no AP cap and had already lost its cap head), which reduced its penetration ability considerably, and, two, the armored second deck was bracing the Class "A" armor plate edge and preventing any of the back layer from being forced out of the broken projectile's path.

A 14-inch Type 1 AP projectile would have done much more damage due to its true AP cap not being removed by the thin plates this shell passed through before it reached the belt armor. Loss of the cap head would have reduced the penetration ability of the shell somewhat, but at near right-angles and at this close range, this 14-inch AP shell would still have been able to punch entirely through the belt and gouge a deep notch in the edge of the armored deck prior to slowing to a stop and exploding. None of this happened and the holes shown are too small to have been made by a 14-inch shell. The best estimate for this damage is that it was made by an 8-inch Type 91 AP shell.