RESTRICTED

INDEX NO. S-06-1

SHIP AND RELATED TARGETS

REPORTS OF DAMAGE TO JAPANESE WARSHIPS - ARTICLE I

NAGATO(BB), KATSURAGI(CV), HARUNA(BB), AOBA(CA)
ISE(BB), AMAGI(CV), RYUHO(CVL), OYODO(CL)
TONE(CA), HYUGA(BB), ASO(CV), SUZUTSUKI(DD)

U.S. NAVAL TECHNICAL MISSION TO JAPAN

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U. S. NAVAL TECHNICAL MISSION TO JAPAN
CARE OF FLEET POST OFFICE
SAN FRANCISCO, CALIFORNIA

23 December 1945

RESTRICTED

From: Chief, Naval Technical Mission to Japan.
To : Chief of Naval Operations.

Subject: Target Report - Reports of Damage to Japanese Warships.

Reference: (a)"Intelligence Targets Japan" (DNI) of 4 Sept. 1945.

1. Article 1 of the report covering Target S-06 of Fascicle S-1 of reference (a), dealing with war damage received by twelve Japanese warships, is submitted herewith.

2. The investigation and the report were accomplished by Comdr. E.C. Holtzworth, USN, assisted by Chief Dannenhauer, CSp(X) E.D., USNR.

C. G. GRIMES
Captain, USN

REPORTS OF DAMAGE TO JAPANESE WARSHIPS - ARTICLE 1

NAGATO(BB), KATSURAGI(CV), HARUNA(BB), AOBA(CA) ISE(BB), AMAGI(CV), RYUHO(CVL), OYODO(CL) TONE(CA), HYUGA(BB), ASO(CV), SUZUTSUKI(DD)

"INTELLIGENCE TARGETS JAPAN" (DNI) OF 4 SEPT. 1945

FASCICLE S-1, TARGET S-06, ARTICLE 1

DECEMBER 1945

U.S. NAVAL TECHNICAL MISSION TO JAPAN

SUMMARY

SHIP AND RELATED TARGETS

REPORTS OF DAMAGE TO JAPANESE WARSHIPS - ARTICLE 2
NAGATO (BB), KATSURAGI (CV), HARUNA (BB), AOBA (CA),
ISE (BB), AMAGI (CV), RYUHO (CVL), OYODO (CL),
TONE (CA), HYUGA (BB), ASO (CV), SUZUTSUKI (DD)

The damage to twelve Japanese warships is described in this report. The ships include battleships, carriers, cruisers, and one destroyer. All except one were damaged by bombs or rockets carried by U.S. carrier aircraft. No torpedoes were employed. This report, accordingly, gives what may be termed a representative picture of the resistance to bombing attack of various major types of Japanese warships, and also of the effectiveness of some types of U.S. bombs. (Rockets were a minor factor except possibly in the case of the destroyer.)

Japanese war vessels, in general, were well designed and constructed with respect to the major features which provide resistance to damage. Despite the fact that all except one of the ships described in this report were immobilized from lack of fuel (they were fully operational in all other respects), they resisted the effects of damage in a manner generally comparable to that of vessels of corresponding age belonging to other major naval powers. Damage control performance was poor by U.S. and British standards.

It is noteworthy that seven of the twelve ships described were sunk. Included are three battleships. All were sunk by bombs. The majority of the bombs which hit obviously were fuzed to detonate on impact or close to impact. While these did extensive topside damage, their effects were not fatal. On the other hand, some few bombs which hit just as obviously were fuzed so that detonation occurred well within the ship, and these, in general, were the direct cause of sinking. The effect of near misses which detonated on impact with the surface was not of direct importance, although in some cases fragment holes in the shell above the waterline permitted progressive flooding when other below waterline flooding put such holes under water. A few bombs, however, detonated well below the surface in close proximity to the hull. In every case where positive data could be obtained, these few bombs were found to have had serious effects.

Much evidence will be found in this report to emphasize that bombs must be fuzed to detonate well within the ship in case of hits, or well below the surface in case of close near misses, if damage resulting in sinking is to be inflicted.

TABLE OF CONTENTS

REFERENCES

Location of Targets:

Navy Technical Department, TOKYO (Fourth Section).

Available vessels now in repatriation service and in Navy yards, supplemented in three cases by divers' inspections of below water-line damage.

Ships Inspected:

NAGATO (BB), KATSURAGI (CV), HARUNA (BB), AOBA (CA), ISE (BB), AMAGI (CV), RYUHO (CVL), OYODO (CL), TONE (CA), HYUGA (BB), ASO (CV), SUZUTSUKI (DD).

Navy Yards Visited:

Kure Navy Yard (for inspection of ten ships), Yokosuka Navy Yard (for inspection of NAGATO), Sasebo Navy Yard (for inspection of SUZUTSUKI).

Japanese Personnel Who Assisted in Gathering Background Material:

Of Navy Technical Department, TOKYO, (Fourth Section):

Vice Adm. EZAKI, Vice Adm. FUKUDA, Rear Adm. KATAYAMA, Rear Adm. YAGASAKI, Capt. INAGAWA, Capt. MAKINO, Capt. OZONO.

Of Kure Navy Yard:

Capt. MATSUMOTO, Design Superintendent.

Pertinent Documents:

NavTechJap Document No. ND22-0007 - Bombing damage to warships in KURE Harbor - prepared by the Design Section of the Kure Navy Yard, reputedly in response to a request from USSBS. The document is inaccurate and incomplete with respect to numbers and locations of bomb hits. In particular, it listed the last major attack on warships at KURE as having occurred on 27 July 1945, whereas U.S. and Japanese action reports give the date as 28 July 1945.

Enclosure (A) to Article 3 of this series, "Japanese Records of Major Warship Losses", Index No. S-06-3 - complete translation of data furnished under date of 15 December 1945 by the Second Repatriation Department, Historical Survey Section, Japanese Government.

Plans of ships described - obtained at various Navy Yards. NavTechJap Report, "Characteristics of Japanese Naval Vessels, Article 1 - Surface Warship Hull Design", Index No. S-01-3, discusses the design of Japanese warships and refers specifically to important plans.

LIST OF ILLUSTRATIONS

INTRODUCTION

This is the first in a series of three reports on damage to Japanese warships, and includes accounts of the sinking or damaging of the battleships NAGATO, HARUNA, ISE, and HYUGA; the carriers KATSURAGI, AMAGI, RYUHO, and ASO; the cruisers AOBA, OYODO, and TONE; and the destroyer SUZUTSUKI.

For details regarding the procedure followed in this investigation and for basic sources of information, see the introduction to Article 2 of this series, NavTechJap Report, Index No. S-06-2.

THE REPORT

Section I - GENERAL

1. During the latter months of the war, the remnants of the Japanese Fleet were immobilized by lack of fuel oil. Most of the major units were in the vicinity of KURE, although NAGATO (BB) was still at YOKOSUKA, where she had arrived in December 1944 for overnaul and repairs. The supply of oil was so limited that major units, except CVs, had coal-burning donkey boilers installed on the weather deck to supply steam for auxiliary purposes. Almost all ships, however, retained enough oil to permit operation of at least one generator, either diesel or turbine-driven, for operation of the AA batteries. Other than lack of mobility, all ships discussed in this report, except NAGATO (BB) and ASO (CV), were fully manned and operational insofar as AA defense and damage control were concerned.

2. During July 1945, KURE and YOKOSUKA were attacked by planes from the carriers of Task Force 38. Ships at YOKOSUKA were bombed on 18 July, and at KURE on 24, 25, and 28 July. The attack on 25 July was of minor proportions because of bad weather.

3. Although action reports for all of the U.S. task groups and ships involved, covering the period of 1 July to 15 August 1945, were not available when the reporting officer departed from Washington in October, they were reasonably complete. These indicated that the majority of bombs employed were of the General-Purpose type, in 2000, 1000, and 500-pound sizes. Some few 1000-pound SAP bombs also were employed. The tail fuze usually employed* with these bombs permits a choice of the following settings: non-delay, 0.01 sec., 0.025 sec., and 0.1 sec. setting. The SAP bomb is used rarely with a nose fuze. The nose fuze for the G.P. bombs, used in conjunction with the tail fuze, can be set either at instantaneous or 0.1 sec. delay. In some of the attacks the 500-pound G.P. bombs were reported to have been equipped with VT nose fuzes. In these cases the tail fuze reportedly was set non-delay. The recently developed water-discriminating nose fuze (Mk 243) also was employed on some G.P. bombs, usually in conjunction with a tail fuze set for 0.24 sec. delay, and occasionally with the Mk 101A2 and Mk 102A2 tail fuzes. Finally, the Mk 243 water-discriminating nose fuze was reported to have been used in a very few cases with a tail fuze set for 0.04 sec. delay.

4. It appears that the rockets employed were 5-inch AR (unofficially classified as HVAR). The 5-inch rockets did not cause damage with major consequences on any of the ships discussed. The little evidence of their use has been included as a matter of general interest.

5. As a matter of convenience, the following information is given concerning the majority of bombs employed by U.S. carrier forces in the closing stages of the war:

Bomb	Diameter	TNT (Approx.)
500 pound G.P.	14.2"	270 pounds
1000 pound G.P.	18.8"	560 pounds
2000 pound G.P.	23.3"	1100 pounds
1000 pound SAP	15.1"	320 pounds

*The Mk 101A2 and Mk 102A2 tail fuzes.

Section II - NAGATO (BB) WAR DAMAGE

Plate I

NAGATO (BB-9) - Prototype of NAGATO Class

Completed	1920
Modernized	1935-36
Length (O.A.)	738 feet
Beam (max.)	111 feet (with 8 foot blisters)
Draft (full load)	31 feet
Displacement (full load)	43,355 tons
GM (full load)	8.3 feet

1. NAGATO was of British design as initially constructed. She was extensively altered during her modernization at the Yokosuka Navy Yard. She participated in many actions, the last important one being the Battle for Leyte Gulf, 25 October 1944. In this action she was a unit of the Japanese Central Force. On 24 October she was struck by three moderate-sized U.S. bombs, and also suffered minor damage from one near-miss bomb. These inflicted only superficial damage, the worst effect being the flooding of a few small compartments in the extreme bow and the destruction of a few light AA guns abaft the forward tower, and one broadside gun. She continued with the Force and participated in the action of the next day, steaming at 24 knots when under air attack. Damage to the bow apparently limited her speed to this figure.

2. As the result of the damage on 24 October, she returned to Yokosuka Navy Yard for repairs, general overhaul, and some alterations. Damage to the bow had been completely repaired by March 1945. The damage abaft the forward tower was never repaired, although all damaged structure had been removed prior to March in conjunction with the removal of the broadside battery and augmentation of the AA battery. The tops of the smokepipe and the mainmast presumably also were removed prior to March (see Figure 1). In March, the war situation having deteriorated, the Yokosuka Navy Yard was practically shut down, except for the mass production of midget submarines and suicide weapons. As a result, work on NAGATO practically came to a standstill. Her crew continued to live aboard and she remained operative, although without adequate fuel for getting underway (a coal-burning donkey boiler was installed for furnishing steam to the galley, heating, etc.). Her AA battery, of course, was only partly operative. It could not be determined to what degree NAGATO participated in air defense when YOKOSUKA was bombed on 18 July 1945.

3. Planes of Task Force 38 attacked YOKOSUKA on 18 July 1945. NAGATO was one of the targets. Action reports indicate that 1000 and 500-pound G.P. bombs were employed in conjunction with 250-pound fragmentation bombs. Although data was incomplete, some of the bombs were equipped with VT nose fuzes, others with water-discriminating nose fuzes (for maximum near miss effect), and some with standard nose fuzes (instantaneous and 0.1 sec. settings). Fuze settings of the tail fuzes were not completely reported, but at least a few bombs had "non-delay" settings. Although no rockets were reported to have been used against NAGATO, there is evidence of one 5" dud rocket hit.

4. Careful inspection of NAGATO's topside on 3 November 1945, revealed only two definite bomb hits and evidence of one dud rocket hit. The smokepipe and maintop were reported by the Assistant Design Superintendent to have been removed prior to March. This statement could not be documented, but appearance of the lower portion of the smokepipe and mainmast, as well as absence of fragment damage, are strong indications of the correctness of the statement. Nonetheless, it is possible that a third bomb hit at the top of the smokepipe or maintop, although this is considered improbable.

5. There was no evidence of any fragmentation bombs having detonated in the vicinity of NAGATO. As nearly as could be determined, there was no internal

damage or flooding. Some voids had been flooded, or partially flooded, by the Japanese with salt water prior to surrendering the ship, but the U.S. prize crew aboard reported no change in any tank soundings by 3 November. It thus appears that very little, if any, underwater damage from near miss bombs occurred.

6. One of the bombs which hit NAGATO came in from broad on the port bow with about a 45° angle of fall, indicating a low altitude of release. This bomb is referred to hereinafter as Bomb No. 1. It detonated on impact some three or four feet below and under the deck of the pilot house, and about an equal distance above the roof of the conning tower (see Figures 1 and 2 and Plate I). The pilot house was largely demolished (Figure 3). The conning tower roof plate was scarred by fragments but was otherwise undamaged and none of the instruments within appeared to be damaged. The hole in the light (1/4" M.S. and brass) deck of the pilot house was about 12 to 15 feet in diameter.

7. The major portion of the fragments from Bomb No. 1 went up through the next two higher levels. All fragments were to port of the centerline. None did any damage beyond 25 feet from the point of detonation. Fragmentation, in general, was good but not what would be expected from a fragmentation bomb. Being an unconfined detonation, blast damage, other than in the vicinity of the pilot house, was not extensive.

8. After viewing the damage, it is estimated that Bomb No. 1 could not have been larger than a 500-pound G.P., fuzed instantaneously, or at most, "non-delay." Personnel in the conning tower were reported to have been uninjured. There was no fire. Therefore, this bomb would have had little effect on fighting efficiency.

9. The other bomb which hit NAGATO, Bomb No. 2, also came in from the port bow. It pierced the 1/4" M.S. upper (or forecastle) deck, penetrating some four or five feet prior to detonation (see Figures 4 and 5 and Plate I). Point of detonation was about two feet above the main deck and on or very close to No. 3 barbette, which was deeply gouged by fragments and pitted by the heat of the detonation (unfortunately, the attempt to photograph barbette scars was unsuccessful). The turret proper and turret stool within the barbette were undamaged, and the barbette was not distorted.

10. The compartment within which detonation occurred was large and sub-divided by partition bulkheads. Blast damage was particularly severe to the overhead, of relatively light (about 1/4" M.S.) plating. It was demolished over an area about 12 feet in diameter, but the intact portion forward of the hole was arched upward some six or eight feet. Deflection extended forward about 30 feet. The main deck, two courses of high tensile steel (1" over 1/2"), was deflected downward immediately below the point of detonation some 18 inches. The upper course was not ruptured and the connection of both courses to the barbette was not ruptured. The lower course, however, was ruptured (see Figure 6) in way of a longitudinal butt.

11. There was no fire, although the deck planking on the main deck was scarred by fragments. Fragmentation was good, but not sufficiently so to be indicative of a fragmentation bomb. Damage was superficial with the exception of four light 25mm mounts on the upper deck which were rendered inoperative. After considering the damage, it is estimated that Bomb No. 2 also was a 500-pound G.P., fuzed "non-delay", or at most 0.01 sec. delay. The result on fighting efficiency was slight.

12. By reference to Photo 7 and Plate I, it will be noted that a missile struck the port quarter some four feet below the main deck. It emerged from the starboard shell somewhat higher (two feet below main deck), having struck nothing in its flight except the top of the Admiral's table on the port edge. This was gouged some two inches deep for a length of eight inches. It could have been a 5" HVAR rocket head which failed to detonate. It may have been

from some previous unreported attack, although this is unlikely as the Admiral certainly would have had his table repaired. The holes in the shell were readily patched. The sheathing on interior surfaces had not been patched. No rockets were included in the action reports available as having been employed against NAGATO, but rockets may well have been used and not reported.

13. The effects of the two bomb hits on NAGATO were reported in some detail in order to furnish a background for the reports which follow. NAGATO's two bombs had little effect on her fighting efficiency. However, they serve very well to illustrate the effects of small bombs, instantaneously or "non-delay" fuzed, on capital warships.

All of the following photographs of BB NAGATO were taken at YOKOSUKA on 9 November 1945.

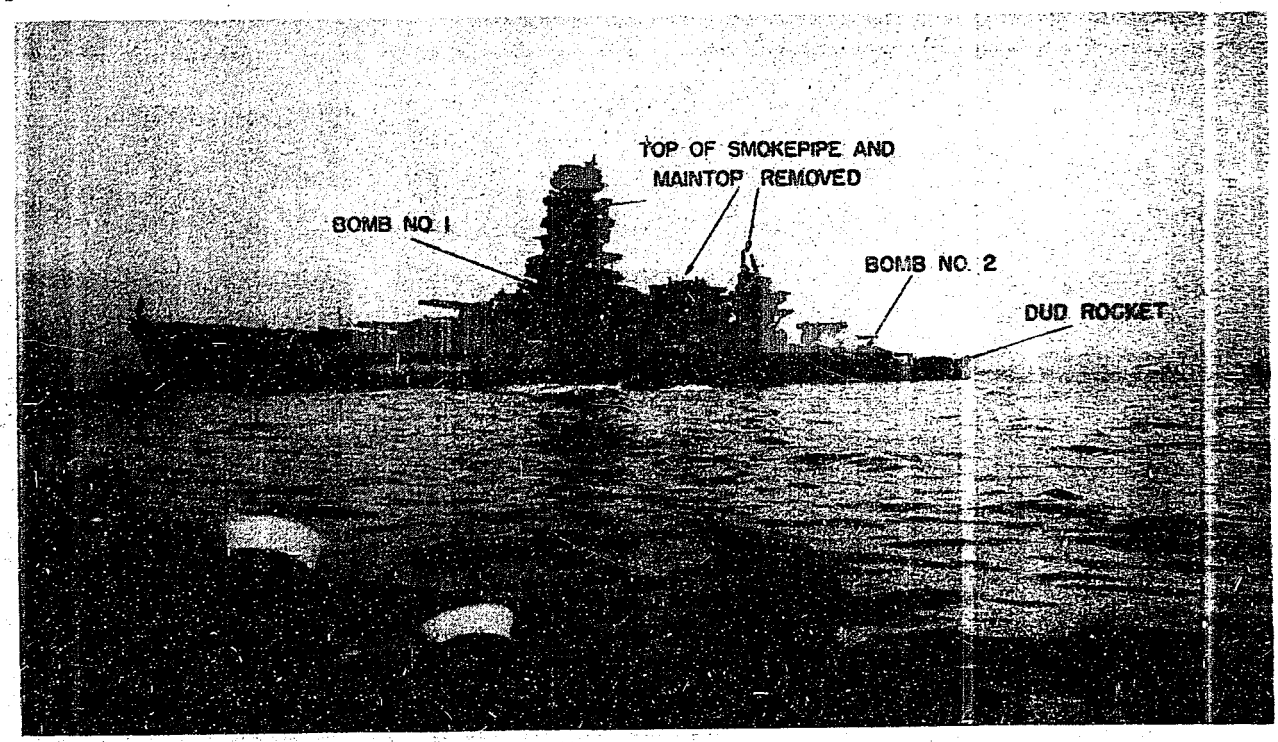


Figure 1
At anchor. Smokepipe and maintop reported removed during overhaul and repair period.

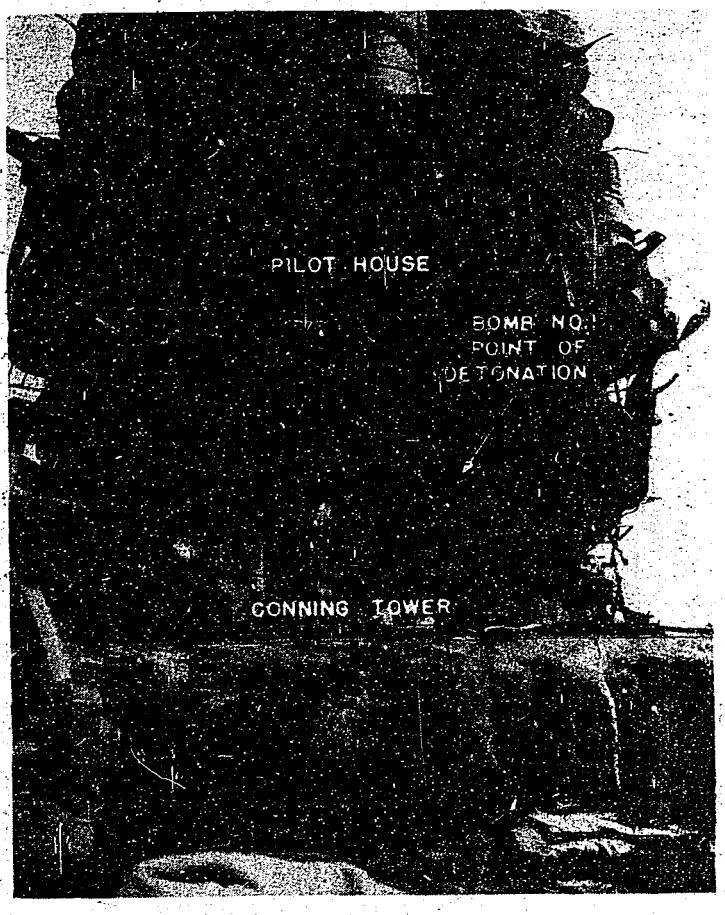


Figure 2
Looking aft from roof of No. 1 turret. Bomb No. 1, dropped from forward and from port bow, detonated upon impact. Fragmentation good, but blast damage limited. Indicative of 500-pound GP bombs, instantaneously fuzed.

Figure 3
Looking forward in pilot house, showing damage from Bomb No. 1. Most seriously damaged area from this bomb, point of detonation being immediately below the deck.

Figure 4
Looking forward on port side from roof of No. 3 turret, showing damage from Bomb No. 2. Point of detonation was close to or on barbette for No. 3 turret, about 2 feet above main deck. Super-structure deck destroyed over area some 12 feet in diameter. No fire. Also estimated to be 500-pound GP bomb, fused with slight delay. Turret undamaged, barbette scarred only.

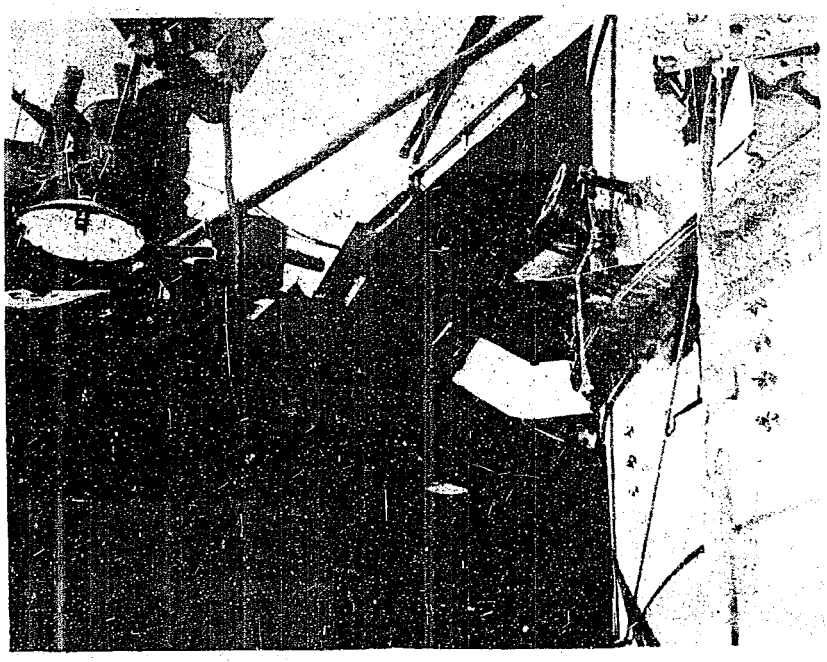


Figure 5
Looking to starboard at damage caused by Bomb No. 2. Blast extensive below superstructure (upper or forecastle) deck, arching latter some six to eight feet up for a length of 30 feet Stores placed aboard after damage.

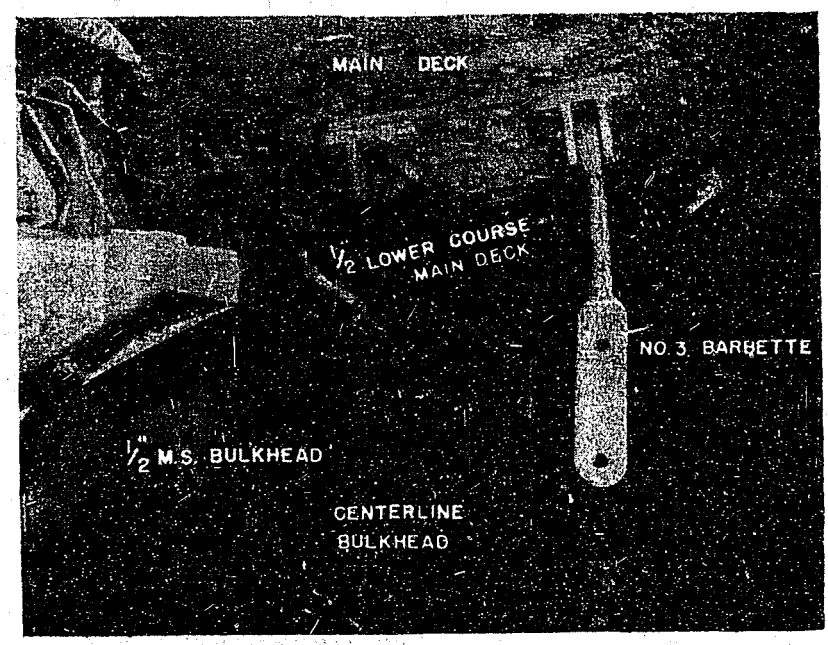


Figure 6
Looking to starboard underneath main deck. Main deck, of two courses of 1" over 1/2" H.T. steel, deflected downward about 18". Upper course not ruptured. Lower course ruptured as shown. Point of detonation about two feet above deck, adjacent to barbette.

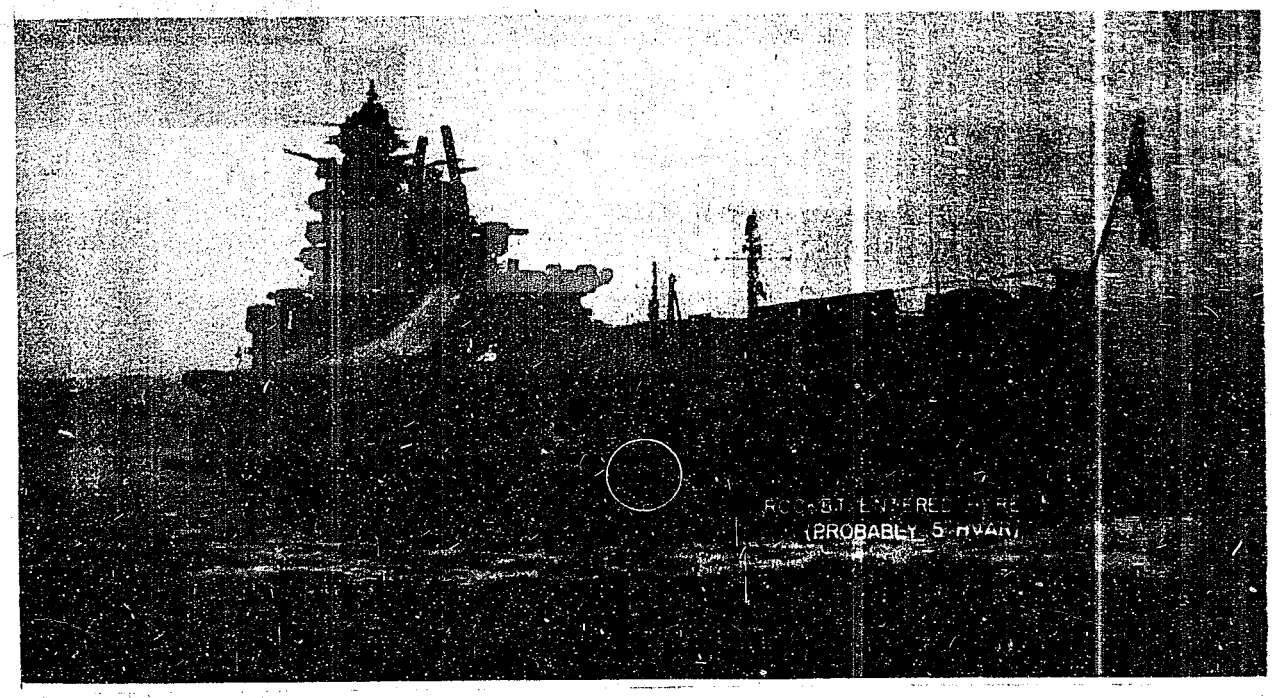


Figure 7
Probably dud 5" rocket penetrated port shell and passed completely through ship horizontally, emerging somewhat higher on starboard quarter and tearing hole in starboard shell of same size (about 10" diameter). Two holes in shell were most serious effects, although Admiral's table-top was scarred.

Section III - KATSURAGI (CV) WAR DAMAGE

Plate II

KATSURAGI (Small CV)

Completed	15 October 1944
Length (O.A.)	743 feet
(W.L.)	730 feet
Beam (W.L.)	72 feet
Flight deck width	88 feet
Draft (trial)	25.9 feet
Displacement (trial)	20,900 tons
GM (trial)	5.8 feet

1. KATSURAGI was built at the Kure Navy Yard. Although commissioned, she never participated actively in the war. The reasons given varied, but apparently no aircraft squadrons with adequate training ever became available. As the war continued into 1945, lack of fuel oil was another factor which kept her in the vicinity of KURE. Nonetheless, she was fully operational and manned, and ready for the air actions of 19 March and of late July 1945, during which she gave respectable AA performances.

2. On 19 March 1945, in the first U.S. attack against Inland Sea targets, KATSURAGI received one 5-inch rocket hit on the after port side of the flight deck. The rocket detonated on impact with the flight deck, blowing a small hole in it which was quickly repaired. There were no other effects of this hit.

3. Task Force 38, in its late July attacks, principally employed 2000, 1000, and 500-pound G.P. bombs. Some 5-inch HVAR rockets and 100-pound SAP bombs also were used. Fuzing of the bombs was not reported in detail for each attack, but the nose fuze setting for the G.P. bombs generally was 0.1 sec. with the tail fuzes set at any one of three; namely, "non-delay", 0.01 sec., and 0.025 sec. No SAP bombs or rockets inflicted any damage on KATSURAGI. Although a target for the 24 July attack, KATSURAGI escaped damage despite some uncomfortably close near misses. She apparently was not a target on 25 July.

4. On 28 July, however, she was struck by two bombs as she lay at anchor off the inlet of MITSUKO JIMA, not far from Kure Navy Yard. Attempts had been made to camouflage her by the commanding officer, but with poor results. She was fully closed up and her AA batteries were in full operation. She had no planes on board, never having operated with aircraft since completion, according to her commanding officer, who was not even an aviator (the usual practice in the Japanese Navy, as in the U.S. Navy, was to place carriers under the command of aviators).

5. The first bomb (Bomb No. 1 on Plate II) was released from starboard, in a shallow angle, striking her some three feet below the main deck (upper hanger deck) at a point about 80 feet abaft the stem. It penetrated some six to eight feet prior to detonation, which occurred about three feet above the upper half deck. The detonation blew a small hole, some 4½ feet in diameter, in the shell (Figure 8), and a large hole, approximately 15 feet in diameter, in the half deck. The majority of fragments went upwards, several large ones penetrating the flight deck (Figures 9 and 11) some 20 to 30 feet above the point of detonation. The fragments were unusually large, but not numerous. There was no fire.

6. The effects of No. 1 Bomb were almost entirely superficial, not a single gun being placed permanently out of operation. Considerations of damage lead to the conclusion that this was a 500-pound G.P. bomb, with the tail fuze set at 0.01 sec. delay.

7. The second bomb (Bomb No. 2 on Plate II) also was released from starboard, crossing the flight deck abaft the island. It struck about at the midlength of the flight deck, somewhat to port of the centerline, and penetrated some six to eight feet into the hangar prior to detonation. The effects on the flight deck were awe-inspiring. A hole 25 feet long and 25 feet wide was blown in the flight deck (Figure 14), and a corresponding section of the hangar port bulkhead also was blasted out. The entire flight deck between the two elevators, a length of about 280 feet, was raised in a huge arch (Figures 12 and 13), while a section 100 feet in length, directly over the point of detonation, was even more grotesquely distorted. Both elevators were ruined (they were in the "up" position at the time), being badly warped and lifted out of the guides. The upper hangar deck (the main or strength deck), of 1/2 inch Ducol Steel in the center, was pushed down a maximum of three feet (Figure 12) between the two elevators. Some 50 per cent of the entire flight deck, 40 per cent of the upper hangar deck, and both elevators would have required renewal prior to flight operations. There was no fire.

8. At the time of inspection, 23 November 1945, KATSURAGI was in dry dock at KURE for the bare minimum of repairs required to make her fit for repatriation service. Hull repairs for making the flight deck watertight against rain and spray were all that were accomplished. There was no evidence of the near miss damage reported by the Japanese in Article 3 of this report.

9. KATSURAGI was designed and built with completely enclosed upper and lower hangars. The upper hangar is approximately 400 feet in length, thus giving a single large compartment with no side openings such as roller curtain doors. Bomb No. 2 detonated approximately in the center of this space. There was almost no evidence of fragments, but blast was extremely severe. From Figure 12 it will be noted that the girders supporting the flight deck are quite light in weight compared with U.S. and British construction. Light transverse frames are worked every frame space (approximately one meter or 3.3 feet) with similar size intercostal longitudinals at intervals of about 1.5 meters (about 5 feet). The end connections of the transverse girders are not strongly bracketed to the side bulkheads of the hangar. The deck below is the strength deck, of 1/2 inch to 5/8 inch Ducol Steel (the modern Japanese equivalent of U.S. Tensile Steel) strongly supported. The flight deck, therefore, has little resistance to blast. Thus a bomb detonating in the hangar can be expected to deflect the flight deck upward in the gigantic, uniform arch shown in Figure 12. Unarmored flight decks on all Japanese carriers are of similar construction. The effect of bombs detonating within the hangar were almost precisely the same on RYUHO (a CVL converted from a tender: see Section VIII). Much the same phenomena apparently occurred on AMAGI (a sister of KATSURAGI) as described in Section VII.

10. Bomb No. 2 caused extensive blast damage, as described. Despite the weakness of the flight deck with respect to blast from below, such extensive damage must have been the result of a large bomb. The large areas of flight deck and port hangar bulkhead which were demolished are also strong evidence of a large bomb. In view of these factors, it is estimated that Bomb No. 2 was a 2000-pound G.P. containing approximately 1000 pounds of TNT, with a tail fuze set for 0.01 sec. delay.

All of the following photographs of the CV KATSURAGI were taken at KURE on 23 November 1945.

Figure 8
Patch over hole in starboard shell made by Bomb No. 1.

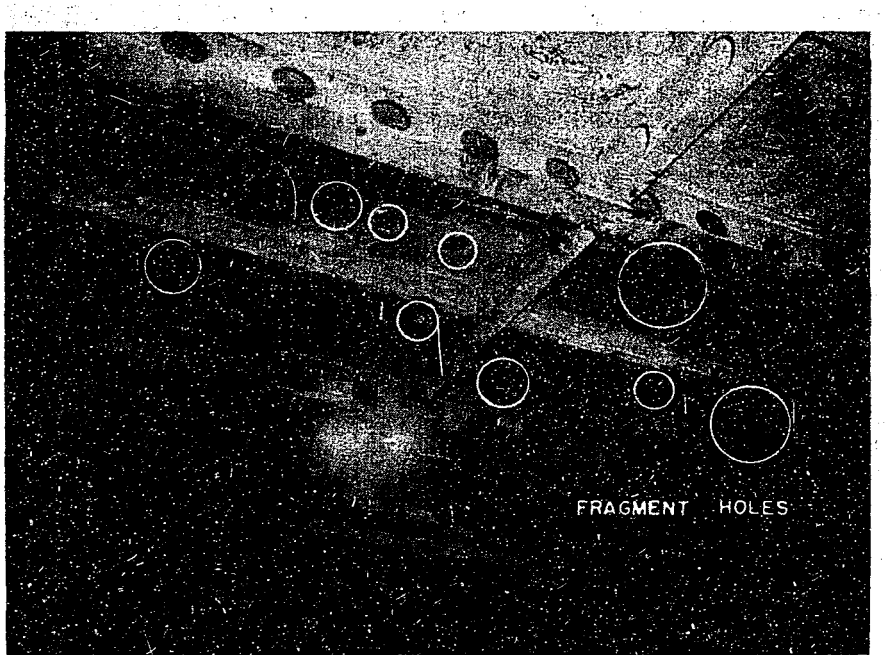


Figure 9
Looking up at fragment holes in flight deck from Bomb No. 1. Repairs in progress.

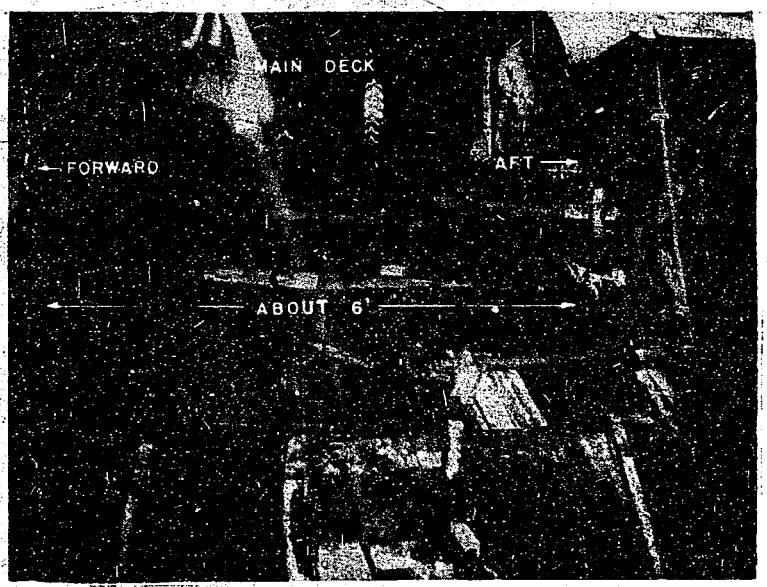


Figure 10
Temporary repairs to starboard shell to patch hole caused by Bomb No. 1. Looking outboard to starboard at shell.

Figure 11
Patches over fragment holes in flight deck caused by Bomb No. 1.

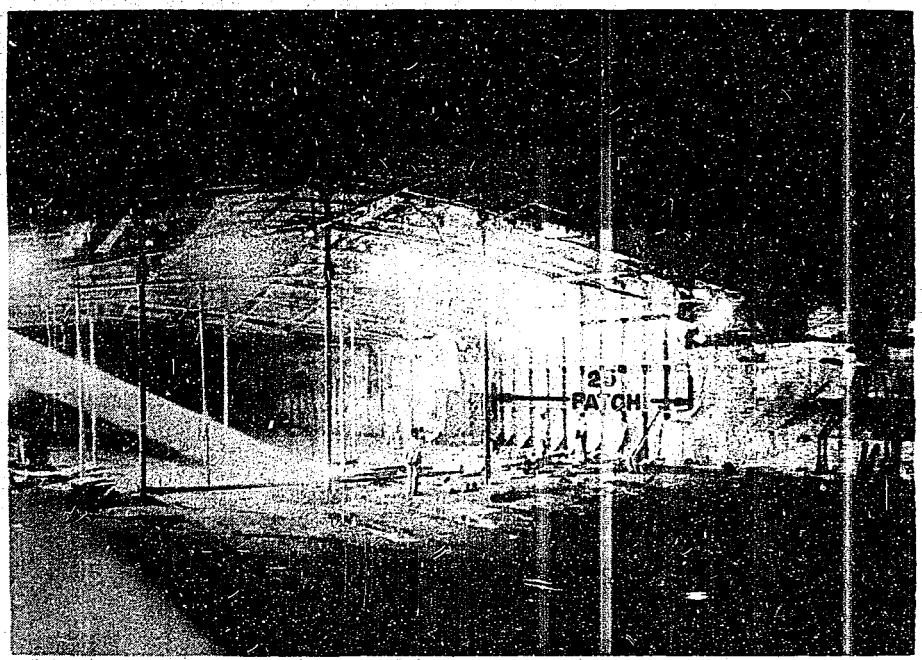


Figure 12
Damage from Bomb No. 2. Temporary repairs in progress to make flight deck watertight.

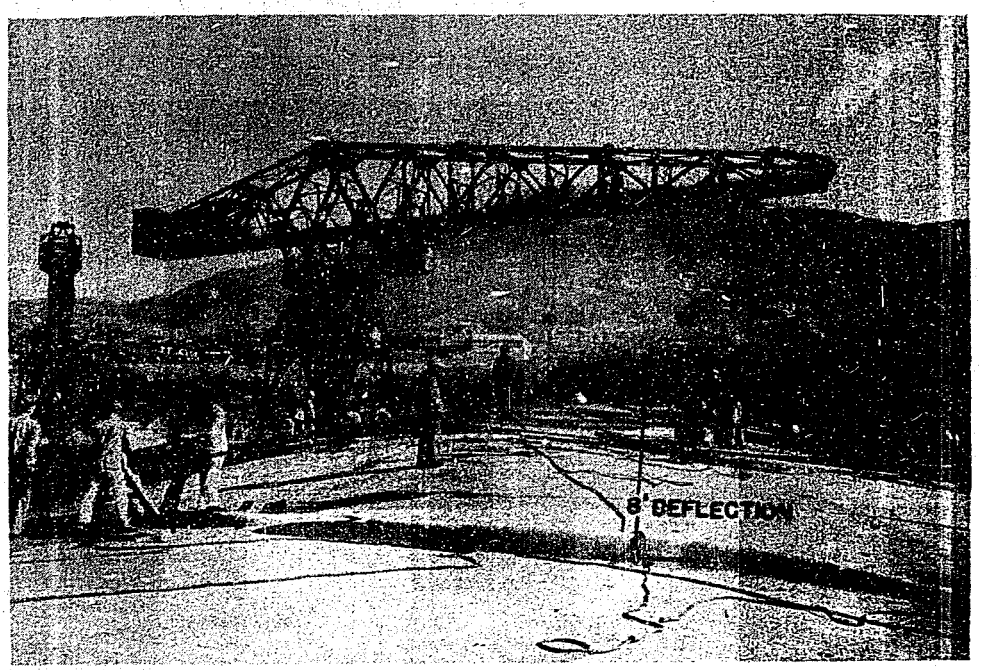


Figure 13
Damage from Bomb No. 2. Looking forward on flight deck.

Figure 14
Looking down on flight deck from island. All damage shown caused by Bomb No. 2

Section IV - HARUNA (BB) WAR DAMAGE

Plate III

HARUNA (BB-4) of the KONGO Class

Completed	1915
Modernized	1934
Length (O.A.)	704 feet
Beam (max.)	98 feet (estimated)
Draft (full load)	29 feet (estimated)
Displacement (full load)	37,000 tons (estimated)

1. HARUNA was built in JAPAN following the British design of KONGO, her prototype. She had two modernization periods, the first in 1929 and the second in 1934. Her initial design followed that of British battle cruisers of the World War I era. A conspicuous feature was the absence of a complete armored deck over the vitals. Only the magazines were provided with horizontal armor, some 4 to 5 inches in thickness.

2. She participated in many actions during the war, and received minor damage on several occasions. The last such occasion was reported to have been the Battle for Leyte Gulf, where she was struck by one or two bombs on 24 October 1944. She retired to KURE, where the damage was easily repaired. The records of this damage were lost, and oral reports were so conflicting that no reliable data can be quoted here, beyond the fact that such damage was extremely minor.

3. Suffering the common fate of all Japanese warships (except the YAMATO task group on 6 and 7 April 1945) she was immobilized by lack of fuel oil, although fully operational in other respects.

4. On 19 March 1945, the commanding officer reported one bomb hit on the stern which did little damage. This was not permanently repaired, only a 15-foot diameter hole in the main deck well aft resulting. The hole was covered with tarpaulins stretched over a wood frame.

5. On 24 July, moored off of ETA JIMA, an island a few miles south of KURE, she was attacked by planes from Task Force 38. She was again attacked on 28 July and sunk on that date. On both days aircraft employed 1000 and 500-pound G.P. bombs, with fuze settings of instantaneous, "non-delay", 0.01 sec., and 0.025 sec. Other types of bombs possibly were employed, although no hits were claimed.

6. HARUNA was inspected on 24 November 1945. The main deck aft was submerged (Figures 15 and 16). For hits abaft No. 3 turret, it has been necessary to rely on Japanese reports. Because of the large number of hits, they have been numbered from forward to aft, starting at the bow.

7. On 24 July, HARUNA received three hits, Nos. 7, 11, and 12 on Plate III. Bomb No. 7 struck the first superstructure deck (01 level) just forward and to starboard of No. 2 smokepipe. It penetrated the 01 deck, and then detonated against the main deck, a total travel of some 22 to 25 feet, indicating a delay of about 0.025 sec. Damage to the main deck could not be ascertained, but a 10 to 12-foot diameter hole was blown in the upper deck (of approximately 1/4 inch M.S.) and the 01 deck was ruptured somewhat and deflected upward. The damage was consistent with a 500-pound G.P. bomb. The starboard shell between upper and main decks was riddled by fragments. This was not, however, serious damage, although some light AA guns were destroyed.

8. Bombs Nos. 11 and 12, on 24 July, both struck on the port side of the main deck. Bomb No. 11 was abreast No. 4 turret, and Bomb No. 12 about 40 feet aft of that point. This damage could be examined only through about five feet of relatively clear water. About 75 feet of main deck on the port side was destroyed, having been blown upwards. The Japanese records indicate that these two bombs caused serious damage, blowing out the port shell above the second deck for a considerable length in way of No. 4 turret. The fuze delay cannot be accurately assessed under the circumstances, but it was at least 0.025 seconds. Some flooding occurred on 24 July which was not of extensive proportions. On 28 July, however, other bombs forward caused flooding which gave her a port list, putting the big hole on the port quarter caused by Bombs Nos. 11 and 12 under water. Progressive flooding through this hole then resulted in rapid settling to the bottom in about 45 feet of water. At least one of either Bomb 11 or 12 could hardly have been smaller than a 1000-pound G.P., and what information is available indicates that both were of the 1000-pound G.P. type.

9. On 28 July, nine additional bomb hits were scored and at least one close near miss. Bomb No. 1 (Figure 17) and Bomb No. 2 (Figure 18) were obviously 500-pound G.P., instantaneously fuzed, and caused only superficial damage, detonating on contact with the upper deck forward. Bombs No. 3 (Figure 19), No. 4, and No. 5 all struck the starboard side of the forward tower. All were instantaneously fuzed, detonating on impact. The results were negligible in

terms of sinking damage, but they obviously disrupted all forward fire-control apparatus and destroyed some AA weapons. The most remarkable thing about these bomb hits was that they started no fires.

10. Bomb No. 6 (Figure 20) detonated against the top of No. 1 smokepipe, high in the air. It also was instantaneously fuzed and did only superficial damage. Such a hit does not interfere with boiler operation to any serious extent if the wreckage is promptly cleared. Bomb No. 8 detonated on impact against the after upper corner of the after tower doing negligible damage, except to light AA weapons mounted there and disrupting after fire-control gear. Both Bombs Nos. 6 and 8 obviously were no larger than 500-pound G.P.

11. Sinking damage was caused by Bombs Nos. 9 and 10. Judging from the size of the penetrating holes (about 19½ inches in diameter) both were 1000-pound G.P. Bomb No. 9 (Figure 21) penetrated deeply, judging from the absence of upper and main-deck damage. It struck about 15 feet from the starboard shell, just aft of No. 3 turret. The shell apparently was opened only by fragments, some of which were at the waterline. Bomb No. 10, striking abreast No. 3 turret on the upper deck not more than three feet from the deck edge, penetrated deeply prior to detonation. The port shell at the waterline, including the blister, was destroyed over a fairly large area, listing HARUNA to port. This put the big hole on the port quarter from Bombs Nos. 11 and 12 under water and HARUNA settled rapidly.

12. A near miss off the starboard bow, abreast the forward turrets, contributed to the progressive flooding by virtue of fragment holes slightly above the waterline. These came under water as she settled.

13. The time of the day when HARUNA was abandoned is unknown. The attack continued into the afternoon and sometime before she settled, abandonment occurred. It seems to have been a disorderly process, at least part of which was premature. No damage control efforts were reported, and no evidence existed of efforts to restrict flooding. Casualties from the numerous topside hits were considerable, however, and these must have contributed to the decision to abandon her. It must also be remembered that morale of the crews of ships at KURE, inactive for so long a time and "sitting ducks" in July, was extremely low. In addition, damage control, as it is understood in the U.S. Navy, did not exist.

14. In summary, HARUNA was sunk from the direct effects of bombs, of which four can be reasonably well established as 1000-pound G.P., fuzed 0.025 sec. delay, which inflicted damage adjacent to or below the waterline. It is known that she sunk in a few hours. An old ship, her watertight integrity was not effective, particularly in the face of numerous personnel casualties caused by several topside hits. Disorganization of the crew undoubtedly assisted in the spread of water to undamaged spaces.

15. The underwater hull was not examined by divers. Therefore, positive information concerning close near misses is lacking.

All of the following photographs of BB HARUNA were taken at KURE on 24 November 1945.

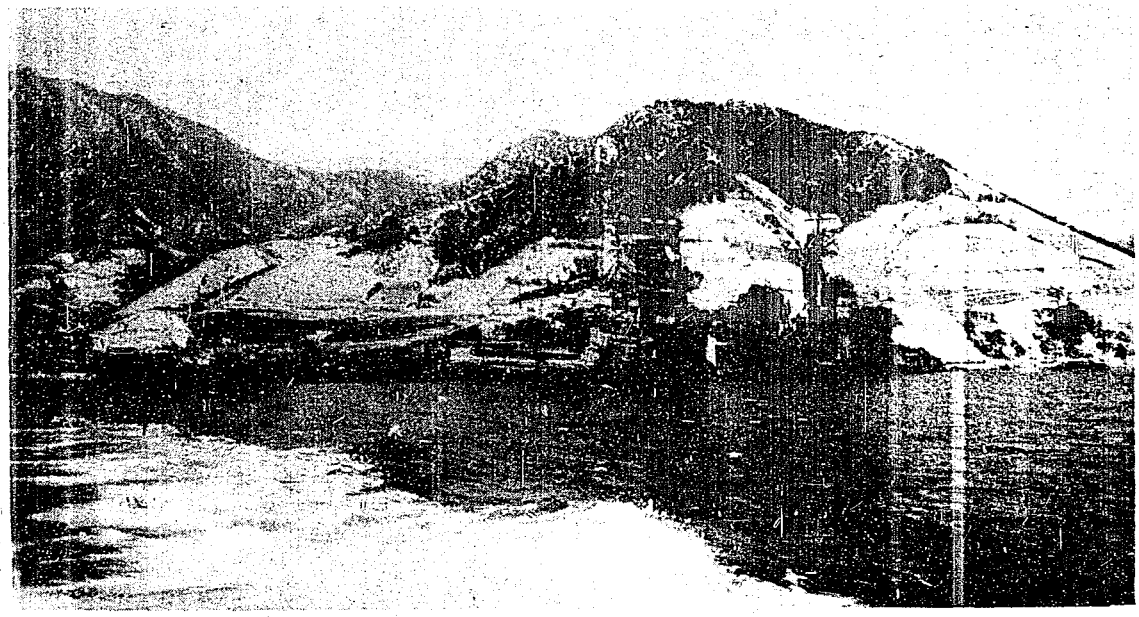


Figure 15
Looking aft along port side.

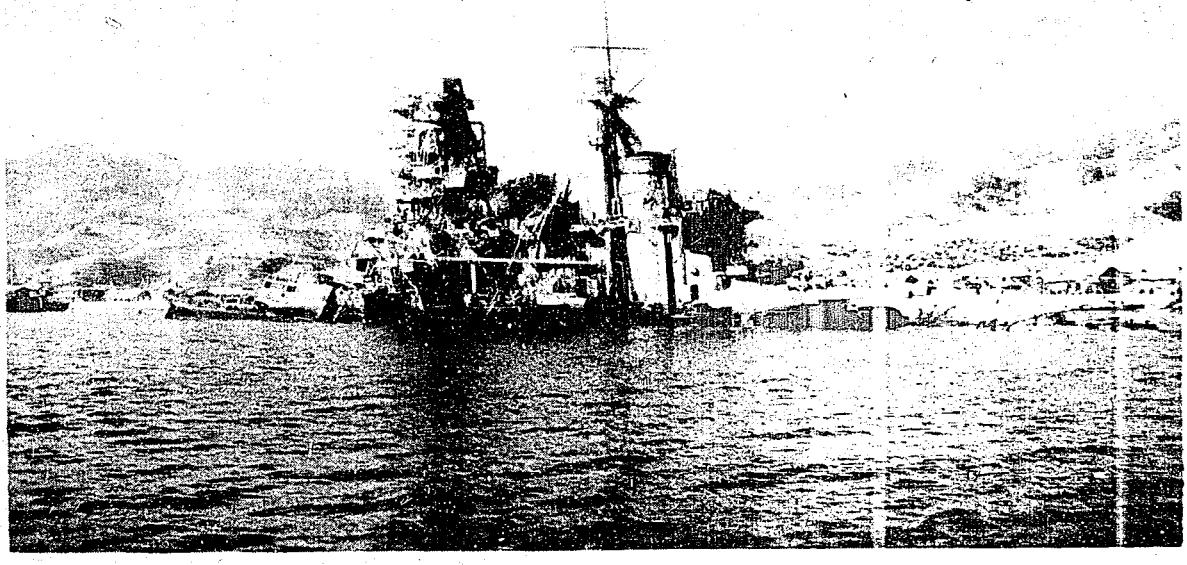


Figure 16
Looking forward along port side.

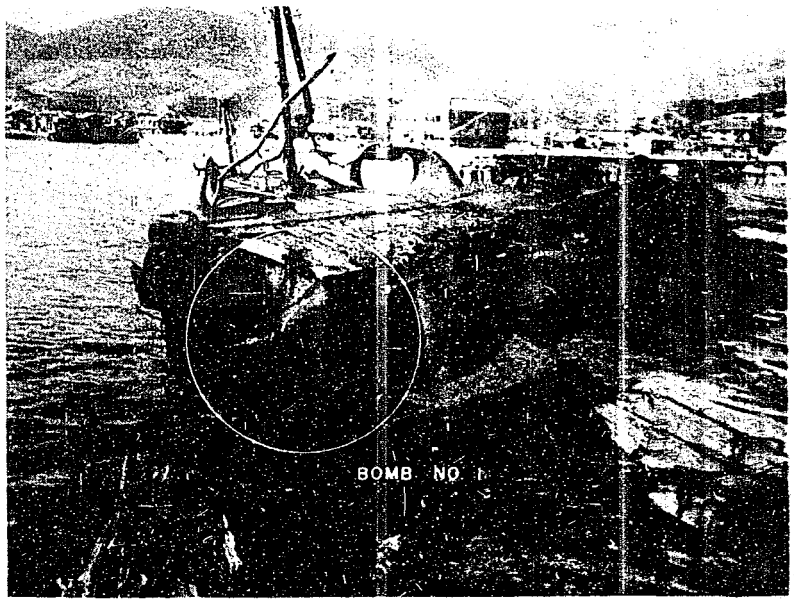


Figure 17
Bomb No. 1 struck and detonated on port hawse pipe.

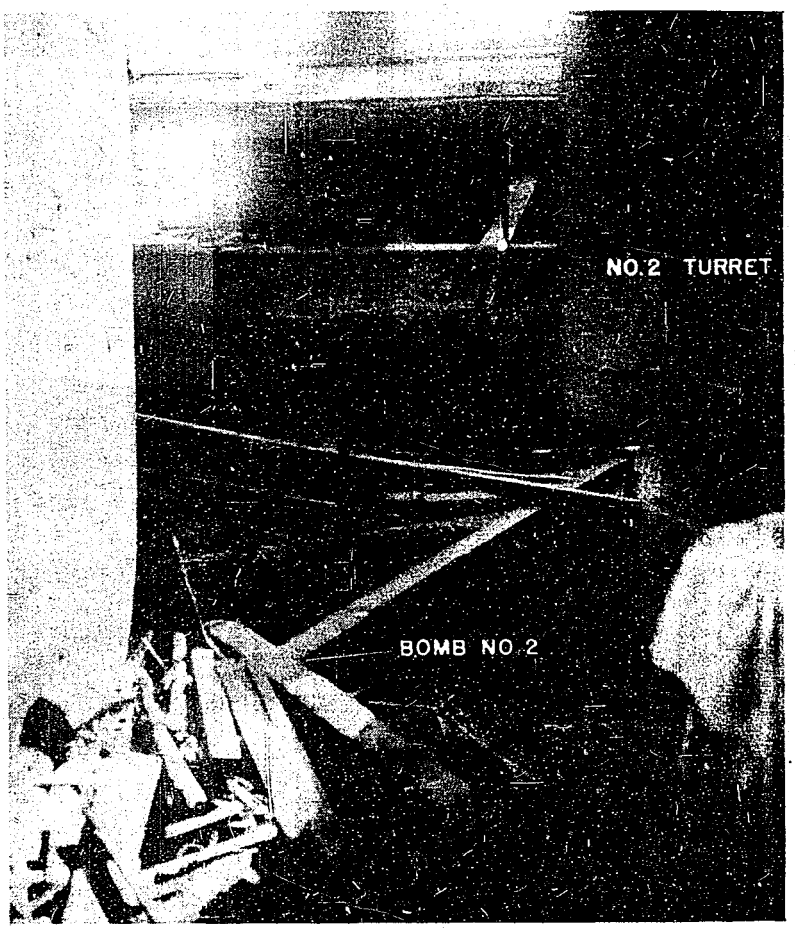


Figure 18
Damage from Bomb No. 2.

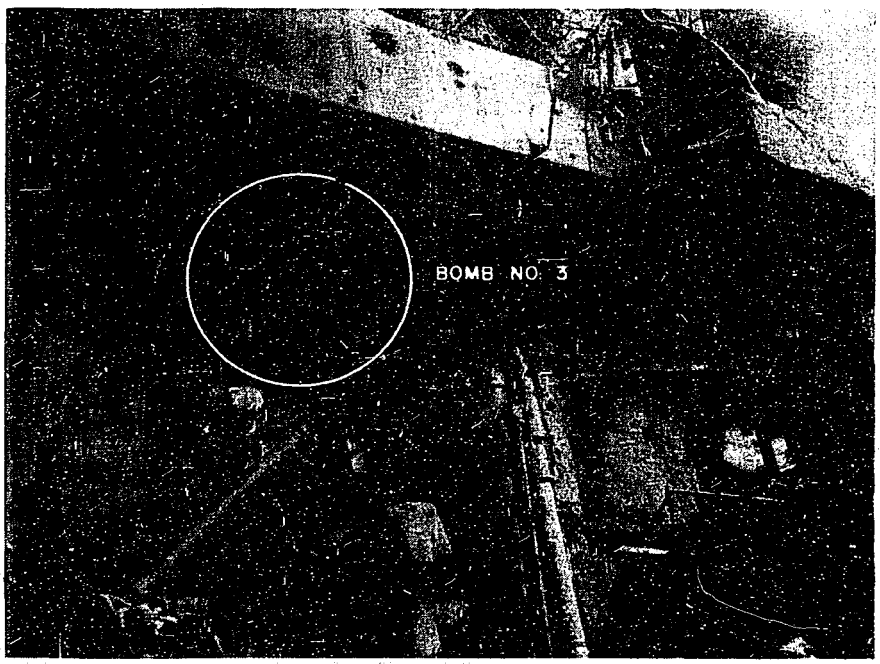


Figure 19
Damage from Bomb No. 3 – starboard side.

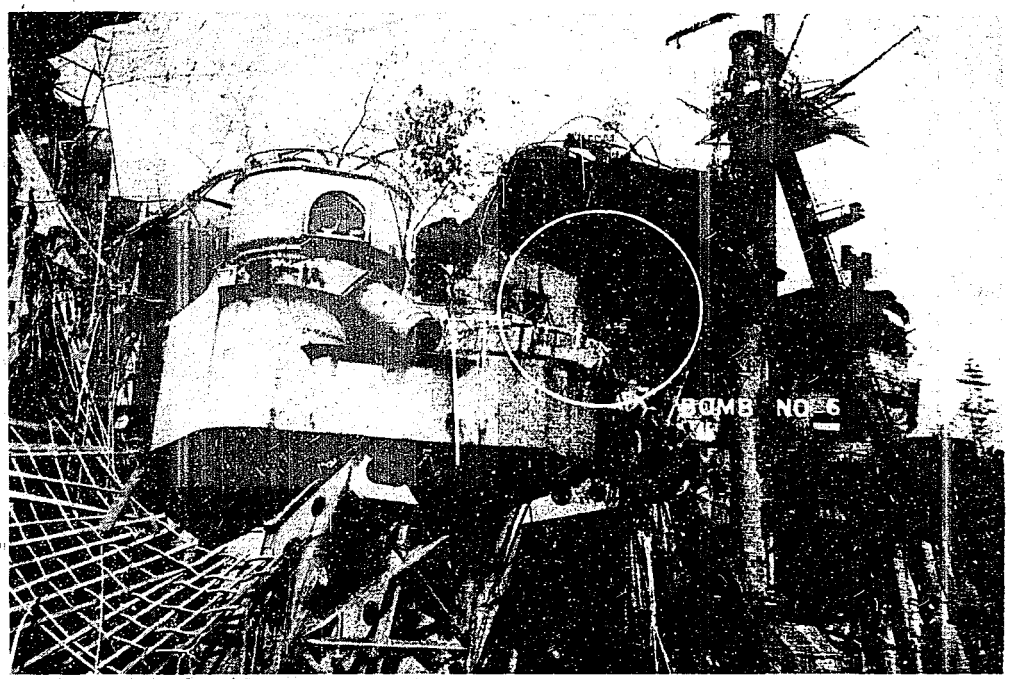


Figure 20
Damage to forward smokepipe from Bomb No. 6.

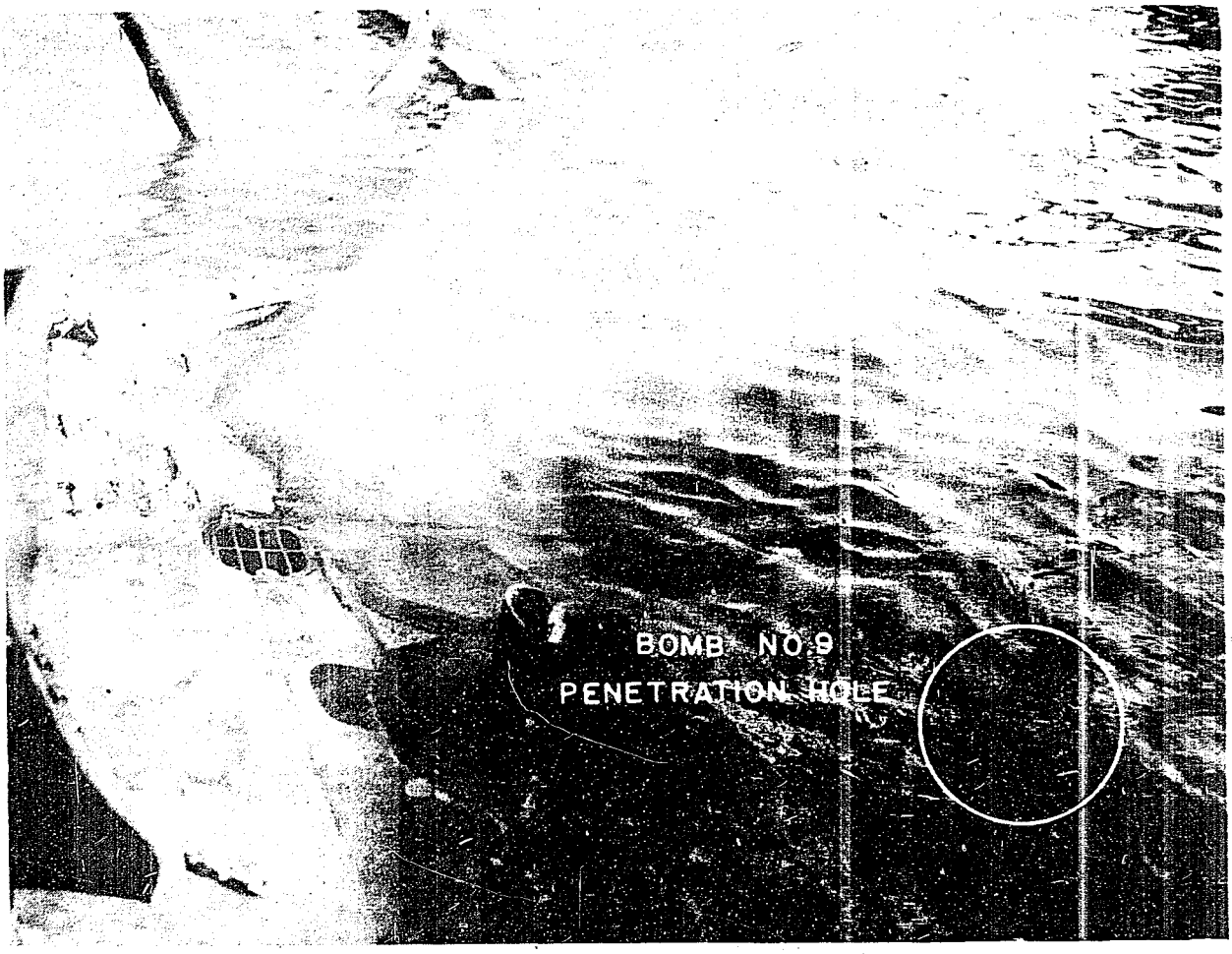


Figure 21
Bomb entry hole – 19½ inches – upper deck, aft.

Section V - AOBA (CA) WAR DAMAGE

Plate IV

AOBA (CA-3), prototype of AOBA Class

Completed	1927
Modernized	1940
Length (O.A.)	598 feet
Beam (max.)	58 feet (estimated)
Draft (full load)	20 feet (estimated)
Displacement (full load)	11,500 tons (estimated)

1. Little factual data was obtained for this ship in the way of plans or characteristics. The above figures are based on the memory of Japanese naval construction officers. AOBA was the prototype of Japan's second class of 8-inch cruisers, and was designed and built under treaty limitations for 10,000 ton cruisers. It was reported that she was lightly constructed, with little armor. Initially, she was of usual double-hull construction in way of machinery spaces and magazines, possibly somewhat similar to the U.S. PENSACOLA Class or the English HAWKINS Class. In 1940 she was fitted with blisters, primarily to permit agumentation of the AA battery, and secondarily for the installation of additional horizontal armor. It was reported that her second deck over machinery spaces was two courses of one-inch Ducol Steel. The first platform over the magazines was reported to have had three courses, the lower two of one inch and the top of one-half inch, a total thickness of 2½ inches of Ducol Steel.

2. During the war she participated in many actions, including some surface night actions in the Solomons in 1942. In the action of 11 October, 1942, she received moderate gunfire damage which required a six-week repair period at KURE.

3. In common with other Japanese warships, she was immobilized by lack of fuel oil in 1945, although operational in all other respects. She was attacked twice on 24 and 28 July 1945, by planes from Task Force 38, which employed 2000, 1000, and 500-pound G.P. bombs, fuzed with various delays of "instantaneous", "non-delay", 0.01 sec., and 0.025 sec. During the attack of 25 July, AOBA is not believed to have been a target. She was inspected on 25 November 1945 at KURE where she was lying wrecked and grounded to the southward of the Navy Yard.

4. The attack on 24 July caused serious damage, resulting in grounding; but she was not completely wrecked until 28 July. On 24 July she was struck on the port bow, well forward, by Bomb No. 1, at or close to the waterline. The damage is shown in Figures 25 and 26. It was of a misleading nature, with the shell above the point of impact being blown outward, and the shell below the waterline being deflected inboard. At this section, however, the shell has a sharp flare outward, and blast passed upward inside the ship, blowing out the shell and rupturing the second deck (Figure 26). Damage at the waterline flooded four compartments, putting her down by the head. The bomb is estimated to have been a 500-pound G.P., instantaneously fuzed.

5. AOBA received no other hits on 24 July, but a very close near miss (Bomb No. 4), abreast the after machinery spaces, caused immediate flooding of both port engine rooms. The blister was torn away for a length of some 25 to 30 feet, and the original shell was torn open over a somewhat smaller length, according to U.S. divers' reports. The detonation was well below the surface, and very close aboard, giving an effect somewhat comparable to a torpedo. The fore and aft extent of damage leads to the conclusion that this was at least a 1000-pound G.P. bomb and possibly a 2000-pound G.P., depending on the distance from the hull of the detonation. It also was fuzed with at least a 0.025 sec. delay, and may well have had the Mk 243 water discriminating nose fuze.

6. While the Japanese did not class this as fatal damage, survival obviously would have been a close thing. The centerline bulkheads in way of engine rooms were not completely watertight, the forward starboard engine room flooding completely before nightfall and after starboard engine room flooding slowly in a period of two or three days. The initial port list was heavy, and some counterflooding was accomplished, assisted by the inadvertent flooding of the starboard forward engine room. By nightfall, however, she was hard aground forward and amidships in about 22 feet of water with a 9° starboard list, due principally to the contour of the bottom.

7. What salvage or damage control measures were accomplished by 28 July are unknown. AOBA was not abandoned, however, despite the fact that no guns, except 25mm, remained in operation. On 28 July she was hit by at least four additional bombs (Nos. 2, 5, 6, and 7), and received additional minor fragment damage on the starboard side from a near miss (Bomb No. 3), which detonated on impact abreast No. 1 smokepipe.

8. Bomb No. 2 struck the main deck at the forward starboard corner of the forward deck house, making a hole about 14½ inches in diameter. The bomb penetrated the second deck, detonating above the armored first platform. The second deck was wrecked (Figure 27) over a large area, and the main deck was deflected upwards some 18 inches from side to side. The forward bulkhead of the forward pair of firerooms was badly torn, and these spaces flooded promptly. This was serious damage and typical of a bomb fuzed to penetrate and detonate within enclosed spaces. The main battery fire-control system was completely destroyed by severance of electrical cables and flooding of the plotting room, under the first platform. This bomb undoubtedly was a 500-pound G.P., fuzed 0.025 sec.

9. Bombs Nos. 5, 6, and 7 fell across the stern, practically demolishing the starboard shell, main and second decks for a length of some 80 feet. All obviously were fuzed with considerable delay, probably 0.025 sec. The penetration hole for Bomb No. 5 was found on the centerline of the main deck aft of No. 3 turret. It was 14 inches in diameter, identifying the bomb definitely as a 500-pound G.P. Nos. 6 and 7 could not be reasonably well identified, beyond the fact that they were either large bombs, or else more than two fell in this area. The appearance of the wreckage indicated only a total of three, however, i.e., Bombs Nos. 5, 6, and 7, as shown on Plate IV. The effect of these bombs was to destroy the stern, causing the wreckage to settle to the bottom.

10. She was abandoned after the hits on the stern on 28 July. Two successive typhoons in September and October flooded her completely.

11. Summarizing, AOBA was very nearly sunk, if not actually so, on 24 July by a close near miss abreast the port engine rooms which flooded them both. The centerline bulkheads not only gave her a sharp initial list (which would have been dangerous in a seaway), but later proved to be non-watertight, permitting the two starboard engine rooms to flood prior to 28 July. At least three hits on that date demolished her stern and completely wrecked her beyond reasonable salvage considerations.

12. AOBA is considered to be a classic example of the lethal effects of bombs detonating inside a vessel, or well below the water surface in case of near misses.

All of the following photographs of CA AOBA were taken at KURE on 25 November 1945.

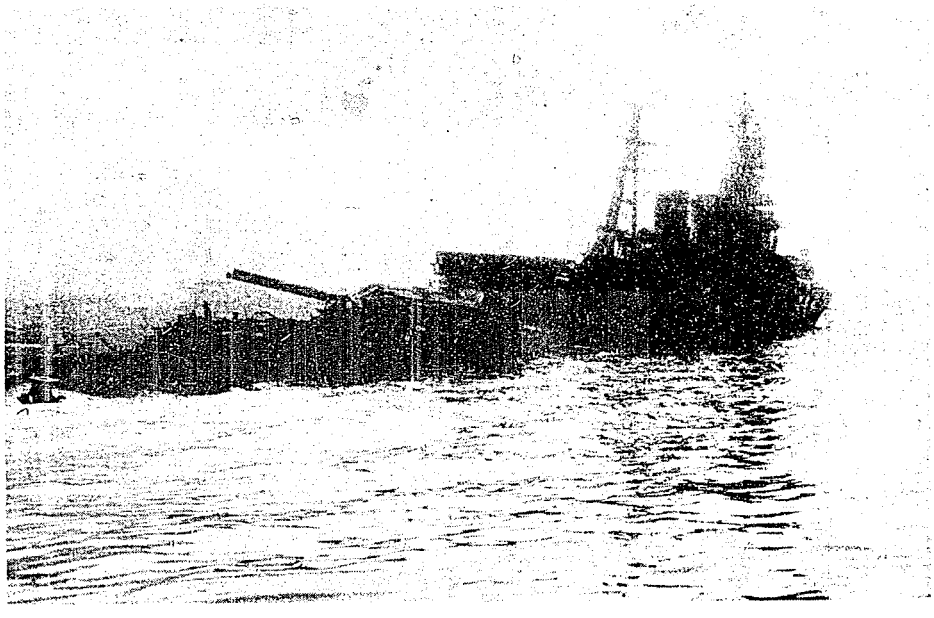


Figure 22
Looking aft from port bow.

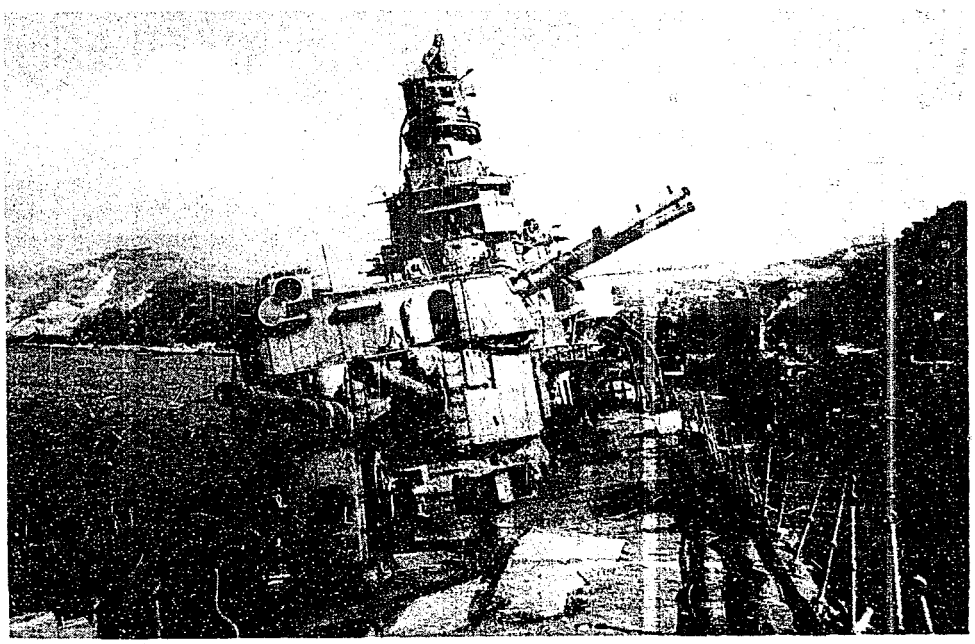


Figure 23
Looking aft from eyes of ship.

Figure 24
Looking down and forward from bridge.

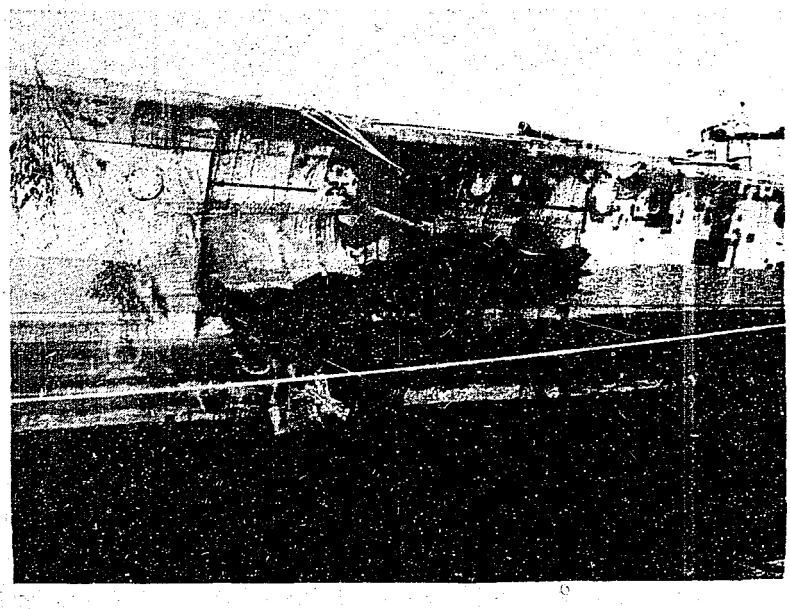


Figure 25
Hole in port shell at bow caused by Bomb No. 1.

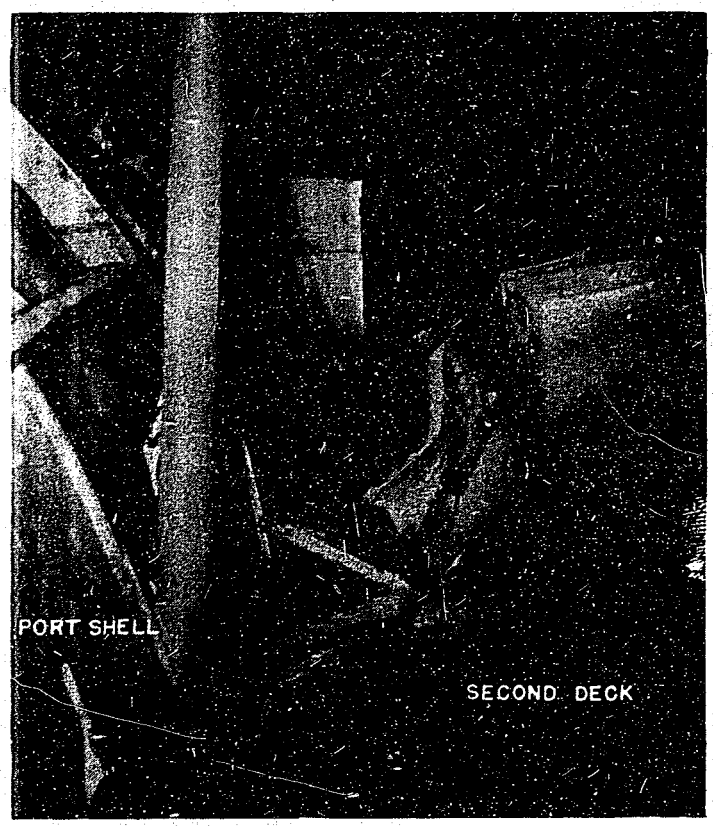


Figure 26
Looking forward and to port at damage caused by Bomb No. 1 to port shell.

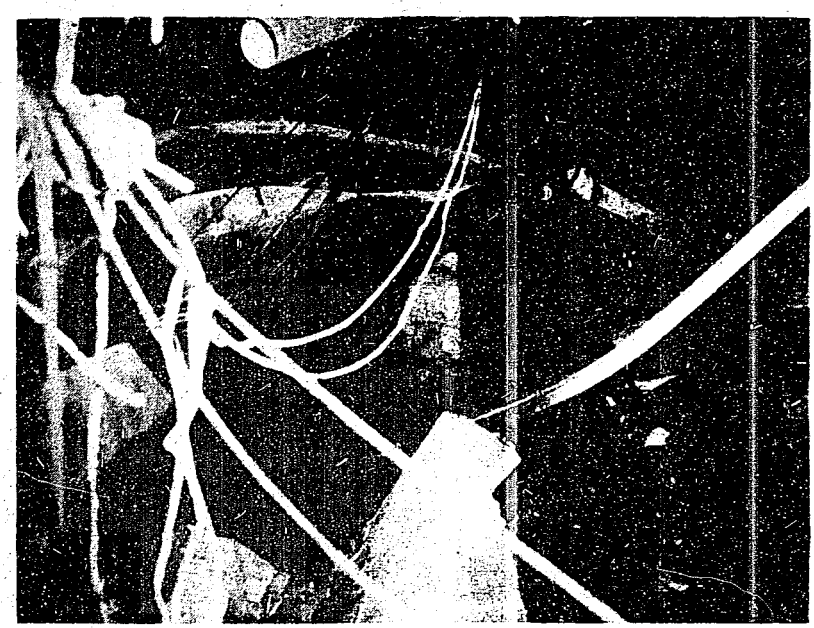


Figure 27
Looking aft and to starboard in second deck compartment at damage caused by Bomb No. 2.

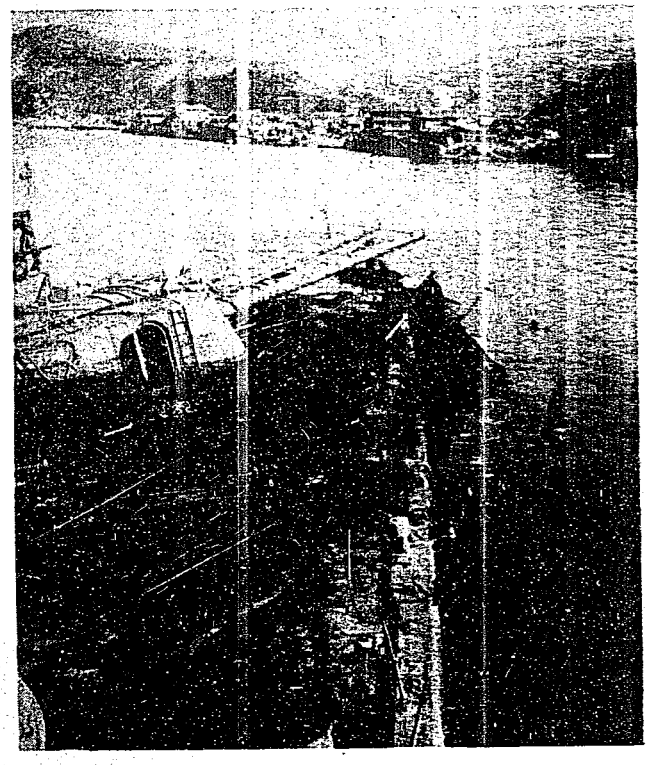


Figure 28
Looking aft at damage on port quarter.

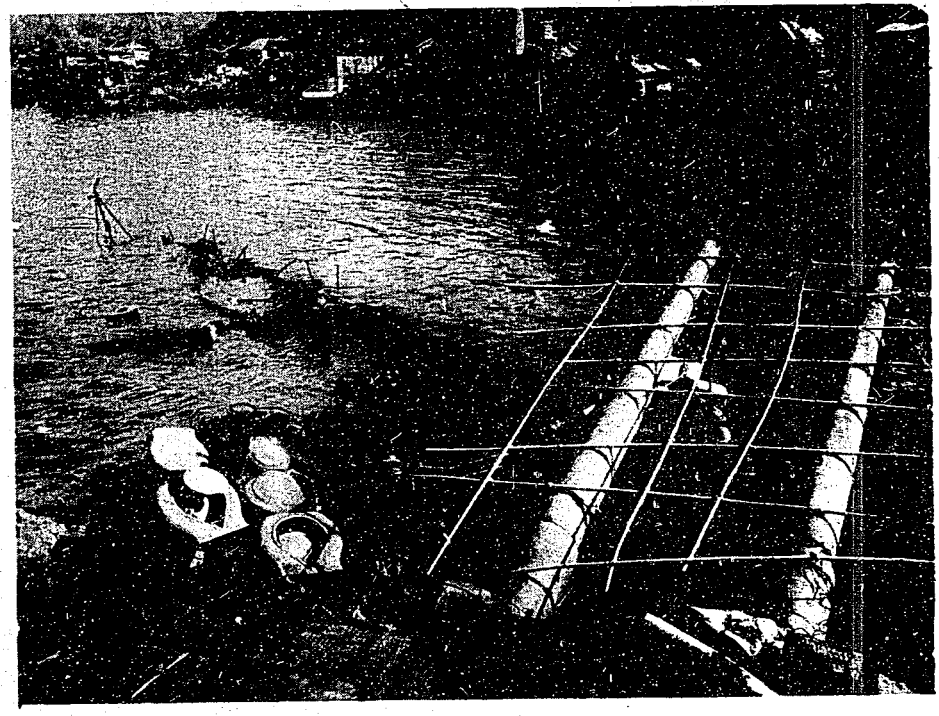


Figure 29
Looking aft at sunken after-portion of vessel.

Section VI - ISE (BB) WAR DAMAGE

Plate V

ISE (BB-7), prototype of ISE Class

Completed	1917
Modernized	1943
Length (O.A.)	715 feet
Beam (max.)	111 feet (with blisters)
Draft (full load)	30.7 feet
Displacement (full load)	40,444 tons
G.M. (full load)	9.2 feet

1. This class of BB was Japan's third finest, ranking in size, armament, and armor only after the YAMATO and NAGATO Classes. The removal of the two after 14-inch turrets, and the installation of a flying deck (this was neither a landing or flying-off deck - simply a plane-handling deck for catapult-type seaplanes) in 1943 considerably diminished her offensive power. One of the unique features was an 8 inch layer of reinforced concrete covering this deck. It was installed to partially compensate for the high weight removed with the turrets in order to prevent an excessively quick period of roll. It added little, however, to the defensive characteristics of the ship.

2. Task Force 38 attacked ISE on 24 and 28 July with 2000, 1000, and 500-pound G.P. bombs, claiming hits with all three types. Fuzing was not specified in detail, but undoubtedly the usual fuzes were employed; i.e., nose fuzes either "instantaneous" or 0.1 sec, and tail fuzes some one of "non-delay", 0.01 sec., 0.025 sec., and 0.1 sec., Mk 243 fuzes also were used.

3. On 24 July, ISE was moored close to shore off the island of ETA JIMA, to the southward of Kure Harbor. Except for immobility due to lack of fuel oil, she was fully manned and operational. Crude attempts at camouflage had been made by the crew under the direction of the commanding officer. Morale of the crew was not high. Her war record was not impressive, her last surface action having been in the Battle for Leyte Gulf in October 1944. There she had received superficial bomb damage which had been repaired at KURE. On 19 March, at KURE, one small bomb damaged the elevator on the flying deck. This damage was not repaired.

4. She was struck by many bombs on both 24 and 28 July. It was possible to spot and identify by dates (using Japanese records) all the bombs which hit forward of the mainmast tower. Aft of that point so many struck her that the total number could not be counted. These uncounted bombs were dropped on 28 July after she was abandoned. It is emphasized that ISE, as was HYUGA (see Section X), was literally deluged with bombs - a reasonable (but not necessarily accurate) estimate of the number of hits, on the conservative side, being 18. She was inspected on 26 November and U.S. divers examined her the week 2 - 9 December 1945.

5. On 24 July, Bombs Nos. 1, 4, 10, and 11 (Plate V) struck her, inflicting serious, but not necessarily fatal, damage. Of these, Nos. 1 and 11 caused extensive flooding. No. 1 struck the top of a shelf of what formerly had been a casemate recess, almost at the starboard shell abreast the forward edge of No. 1 turret. It penetrated some 20 to 25 feet prior to detonation, indicating a fuze delay of 0.025 sec. The detonation demolished the forwardmost portion of the starboard blister over an area 15 feet long and 10 feet high, well below the waterline. The forward starboard 8-inch armor plate was blown off (it was not found by divers) and the armor backing plate (5/8 inch M.S.) or shell had seams and butts opened, permitting flooding of seven or eight magazines. The detonation actually occurred within the blister, but outboard of the armor belt. No. 1 was probably a 1000-pound G.P. bomb, inasmuch as it punched a 19-inch diameter hole in the casemate shelf. Bomb No. 11 also hit

a vulnerable spot. The point of impact was the top of the starboard blister, abreast the starboard engine room. The bomb penetrated deeply to a point below the armor belt and detonated within the torpedo protection system. Divers were unable to examine accurately the damage because of the large amount of debris which covered a length of some 60 to 80 feet. The engine room was immediately flooded, as were starboard magazines for Nos. 3 and 4 turrets. From these two hits, ISE had a sharp starboard list which was never entirely removed, despite some counterflooding of port voids.

6. Bombs Nos. 4 and 10 inflicted topside damage. No. 4, an instantaneously fuzed bomb, struck the forward tower structure on the 05 level above the pilot house (Figure 32). It is believed to have been a 500-pound G.P. bomb, inasmuch as only superficial damage was caused. However, fragments cut many fire control cables serving the main battery director and AA directors. There was no fire.

7. Bomb No. 10 struck the roof plate of No. 3 turret (Figures 32, 33, and 34). The point of impact was at the juncture of the roof plate with a telescope hood (2½ inch N.C. armor) on the turret centerline. The hood was blown completely off, as were similar hoods on the left and right edges of the turret roof. The roof plate, of 6-inch N.C. armor, was not directly penetrated, but a crack starting at a horizontal bolt hole (by which the hood was secured to the roof plate) resulted in a 9-inch diameter plug being knocked out of the roof plate. The plug and large bomb fragments which passed downward through the opening for the hood wrecked the center slide and trunnions for both guns, effectively putting both guns out of operation. Large fragments also scarred both gun barrels to a depth of two inches. The bomb, either instantaneously fuzed or a high order deflagration, is believed to have been a 1000-pound G.P. judging from the diameter (about 3½ feet) of the puddled area on the roof plate and the depth of fragment scars (some were two inches deep).

8. On 28 July, ISE was still manned but only a portion of the 5-inch AA battery was operable. Light (25mm) AA weapons were operable. The main battery was almost completely inoperable (only No. 2 turret could have been fired using local control). It is not clear if she was aground, although she may have been aground forward.

9. The first bomb (No. 2 on Plate V) struck the roof plate of No. 1 turret. It also struck at the juncture of a telescope hood, in this case the left. The hood was blown off and a large fragment, passing downward through the opening in the roof plate, damaged the slide and the trunnion for the left gun. There was no penetration of the 6-inch N.C. roof plate. The puddled area on the roof was only about two feet in diameter, and fragment scars were not so deep as on No. 3 turret, leading to the conclusion that Bomb No. 2 was a 500-pound G.P., instantaneously fuzed.

10. Other bombs came in quick succession. No. 3, a dud, struck some 20 feet aft of Bomb No. 1, on the starboard edge of the casemate. It did not detonate as divers found no damage to the shell. It, however, left a 19-inch diameter penetration hole, indicating that it was a 1000-pound G.P.

11. Bomb No. 7 destroyed the top of the smokepipe. Judging from the damage and fragment effects, it too was a 500-pound G.P. instantaneously fuzed. Bomb No. 8 struck No. 6 twin 5-inch mount on the port side abreast the smokepipe, completely demolishing it. This bomb detonated on impact. There was little blast damage to surrounding structure, indicating that it was no larger than a 500-pound G.P. Bomb No. 9 struck No. 7 twin 5-inch mount, on the starboard side of the smokepipe. This mount was demolished. Blast damage to surrounding structure was enormous, indicating that it was a large bomb, at least 1000-pound G.P. It also passed through the starboard searchlight platform overhead, leaving a hole 19 inches in diameter, further identifying it as a 1000-pound G.P. bomb. The plating (1/16 inch) was too thin to initiate fuze action.

12. Bombs Nos. 5 and 6 struck the port side in way of the foremast tower (Figure 31). No. 5 blew a 15-foot diameter hole in the shell (5/8 inch M.S.) above the armor belt. It penetrated a few feet prior to detonation, as indicated by the outward projection of the torn plate edges. This damage was consistant with a 500-pound G.P. bomb, fuzed "non-delay" or 0.01 sec.

13. No. 6 bomb was a different matter. It apparently entered the water some few feet from the blister, plunging into the blister 10 to 12 feet below the waterline, where it detonated below the bottom of the armor belt. More than 60 feet of the blister was blown completely off. Exploration of the damage was impossible, but the Japanese reported immediate wide-spread internal flooding, putting ISE's bow firmly aground. This was a large bomb, possibly a 2000-pound G.P., obviously fuzed with considerable delay* (probably 0.025 sec.). It was a damaging hit, which combined with the effects of Bomb No. 1 on the 24th, would have put ISE in a precarious condition with respect to plunging by the bow, had she been at sea.

14. The remainder of the bombs all hit in the vicinity of the mainmast tower and on the flying deck. Only one of these could be tentatively segregated from the remainder (see Figure 38). This was a large bomb which hit the port quarter between the flying deck and the waterline, demolishing an enormous portion of the shell from the deck to below the waterline. It was either a 2000-pound G.P. bomb, or else several smaller bombs hit in this area. Extensive flooding resulted from this damage.

15. Several bombs hit the flying deck on the starboard side somewhat aft of the mainmast tower (see Figure 35). Some were fuzed to penetrate and some detonated on impact. As a result the flying deck was demolished over a wide area, and the damage extended down to the second deck, permitting complete flooding of second deck spaces under the flying deck.

16. Again several bombs struck the main deck just forward of the flying deck on the starboard side (Figure 35), demolishing all structure down to the second deck to starboard of the centerline. Flooding occurred throughout this area when the second deck went under.

17. Likewise, the forward port corner of the flying deck was struck by two or more small bombs which detonated on impact (Figure 37), but did no vital damage.

18. The time when ISE ceased being a unit of the Japanese Navy is unknown, but abandonment started by noon in a disorderly fashion and continued for some hours for removal of the wounded. There was little that could be done to control damage under the hail of bombs which struck her.

19. In summarizing, however, it is possible to state that ISE was sunk as the direct result of Bombs Nos. 1, 6, and 11, plus the one or more which hit the port quarter. All of these obviously were large bombs, fuzed to inflict damage deep within the ship. Others which struck on the starboard side aft contributed indirectly to sinking by destroying reserve buoyancy. As the ship settled, the after one-third of the ship was flooded through the destruction of watertight integrity on levels normally above the waterline.

20. The practice of installing telescope hoods in the roof plates of turrets presents a menace, as typified by hits Nos. 2 and 10, on turrets Nos. 1 and 3, respectively. In both cases, if the hoods had not been present, the plate would have defeated the bombs and the guns would have remained operable.

21. The absence of fire is again especially noteworthy. As noted in the summary, by U.S. standards, all Japanese ships contained a large quantity of inflammables. ISE was typical of many ships which did not burn. This matter will be discussed more fully in Section XIV.

- -

(*This bomb may well have been equipped with the Mk 243 (water discriminating) nose fuze and a longer delay tail fuze.)

All of the following photographs of BB ISE were taken at KURE on 26 November 1945.

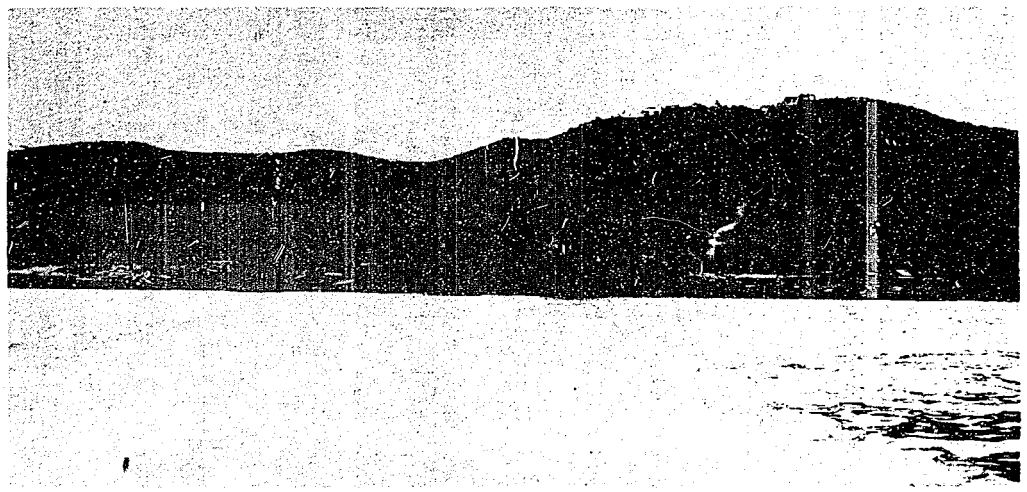


Figure 30
Approaching from starboard.

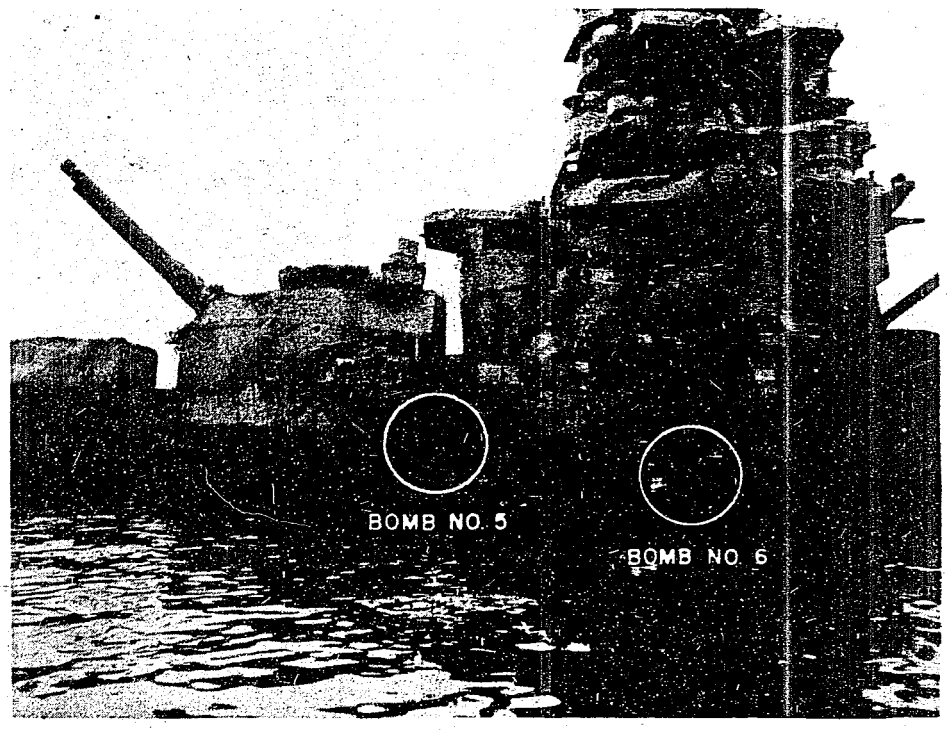


Figure 31
Impact points of Bombs No. 5 and No. 6

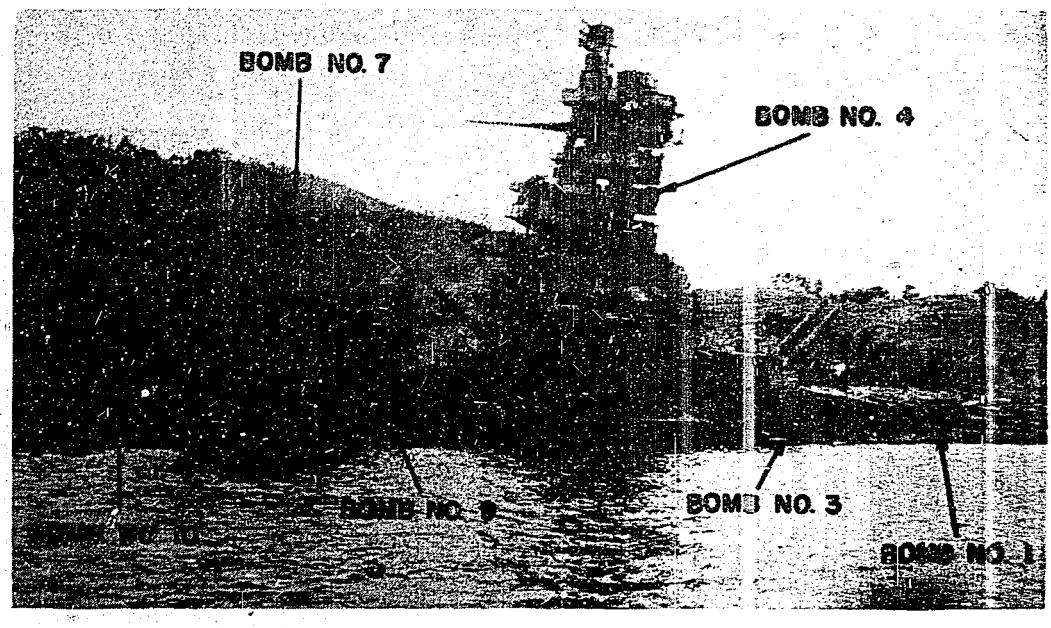


Figure 32
Starboard side.

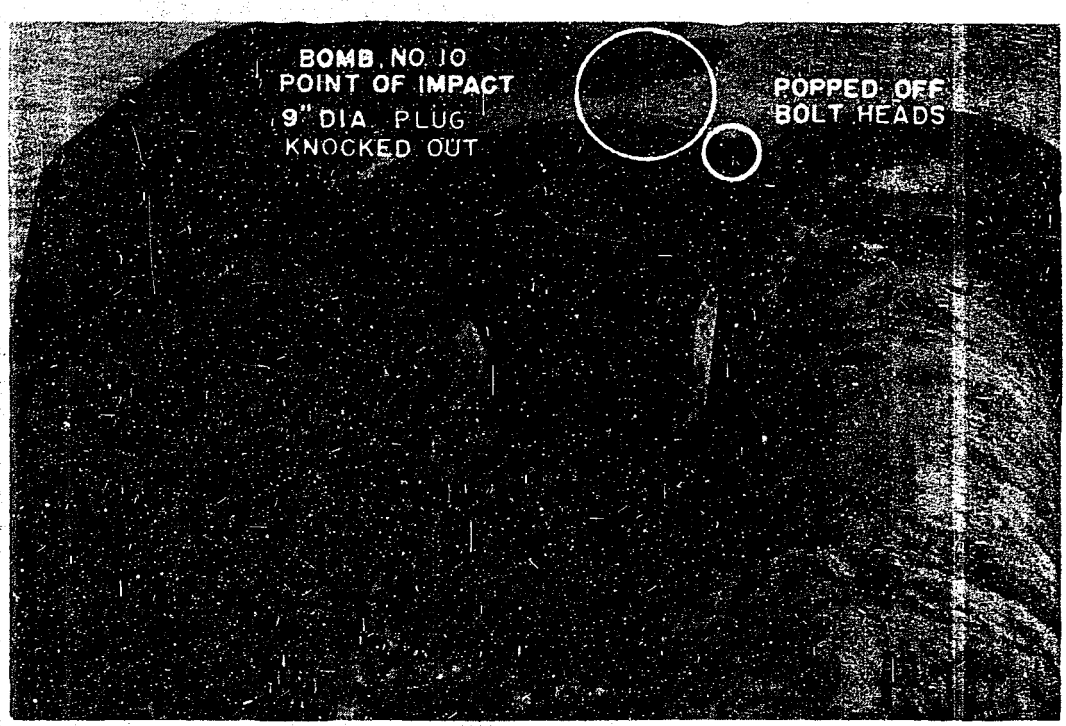


Figure 33
Damage to No. 3 Turret and Guns.

Figure 34

Turret No. 3 - opening at scarfed joint left gun port, between 6" roof plate and 12" face plate, caused by Bomb No. 10. (See Figure 33.)

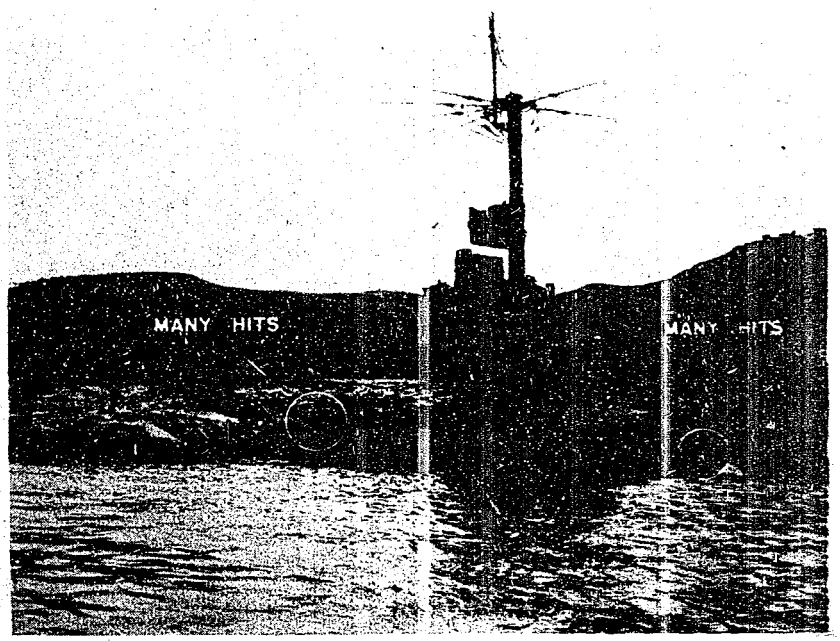


Figure 35

Looking down to port in way of mainmast.

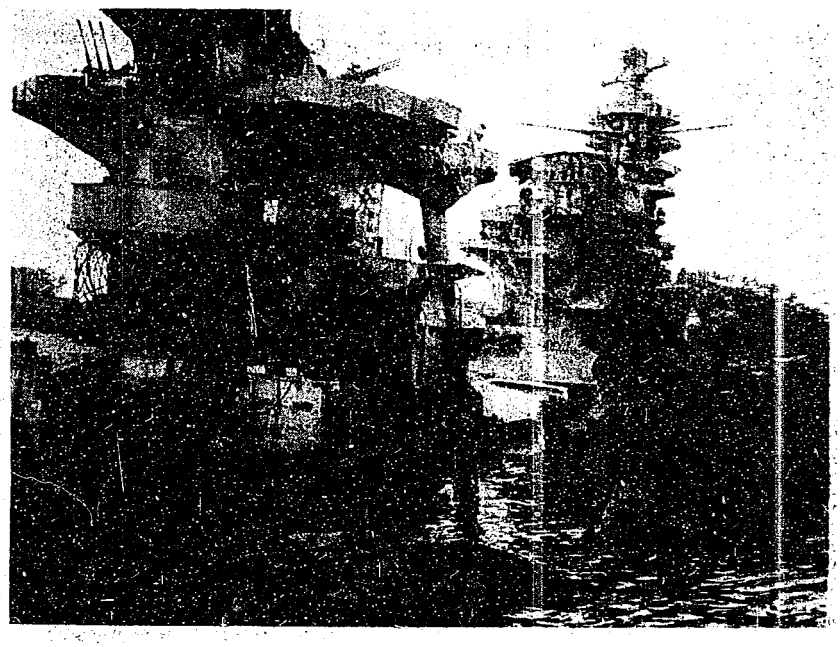


Figure 36
Looking forward on starboard side from flying deck. Many bombs struck in this area. (See Figure 35.)

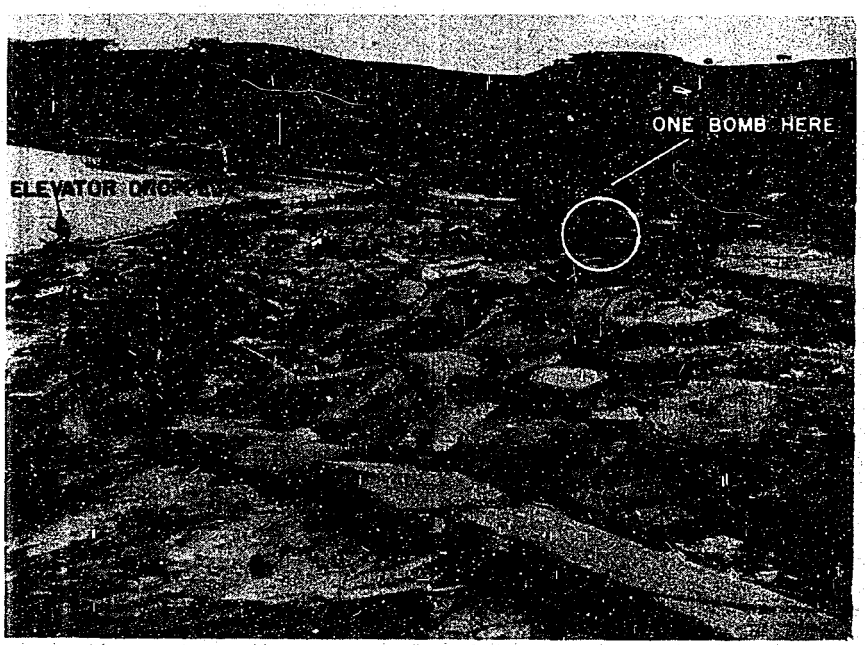


Figure 37
Looking aft on port side of flying deck.

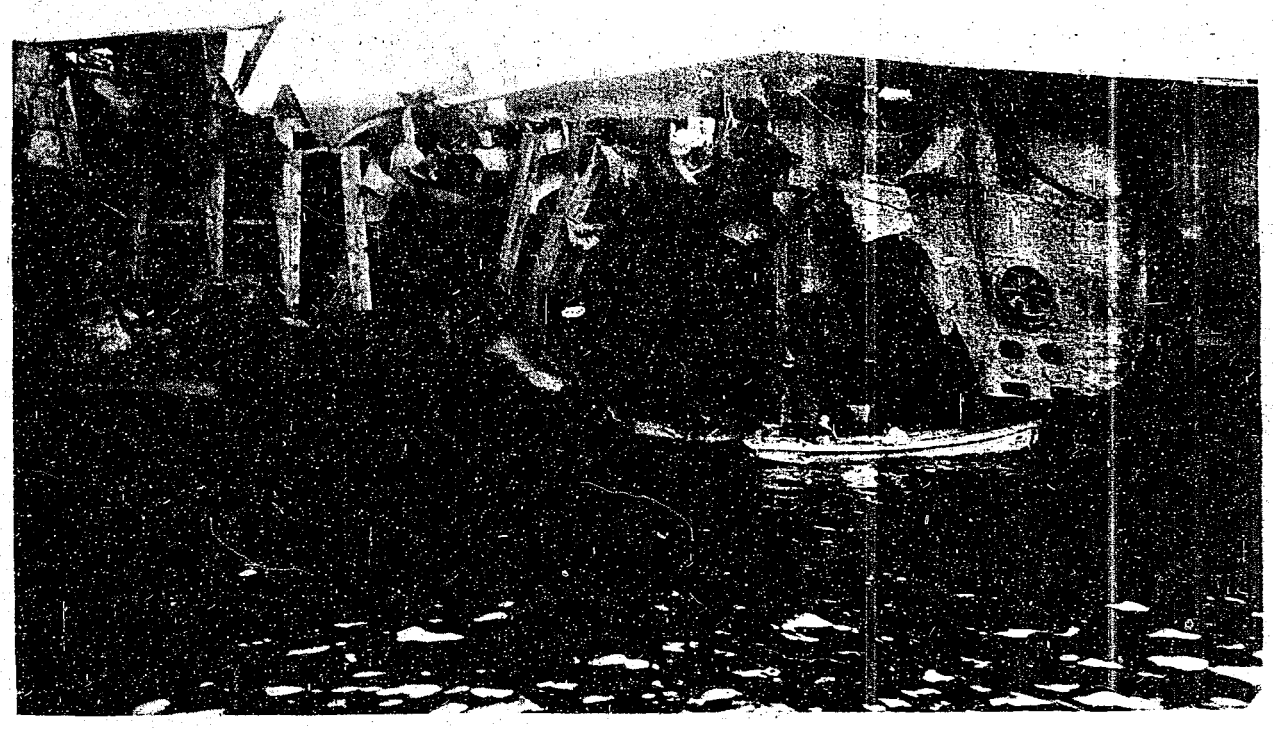


Figure 38
Looking at port quarter, well aft.

Section VII - AMAGI (CV) WAR DAMAGE

Plate VI

AMAGI (small CV), a sister of KATSURAGI (See Section III)

Completed	end of 1944 (exact date unknown)
Length (O.A.)	743 feet
(W.L.)	730 feet
Beam (W.L.)	72 feet
Flight deck width	88 feet
Draft (trial)	25.9 feet (from Katsuragi data)
Displacement (trial)	20,900 tons (from Katsuragi data)
G.M. (trial)	5.8 feet (from Katsuragi data)

1. AMAGI was reported to have been built at a private yard on the Inland Sea. For that reason, little data concerning her is available other than that she was a sister of KATSURAGI, built to the same plans. Like KATSURAGI, AMAGI never participated actively in the war. She was fully operational and manned, but immobilized from lack of fuel oil. Her crew was untrained and her commanding officer inexperienced. Her end was typical of the frustration and confusion which existed among the Japanese naval forces at KURE.

2. She was struck during the attack of 19 March by two small bombs, either 250-pound or 500-pound G.P. These damaged the after elevator, putting it out of commission, and knocked off a gun sponson located on the after starboard

quarter. The bombs detonated on impact, doing slight damage. This damage was never repaired, however.

3. As on KATSURAGI, 2000, 1000, and 500-pound G.P. bombs were employed against AMAGI. In addition, one 5-inch HVAR rocket hit the flight deck to starboard of the forward elevator.

4. On the morning of 24 July, early attacks did not score any hits. Numerous close near misses were scored, however. These were reported to have occurred off both bows. One very close aboard (Bomb No. 1), abreast the forward edge of the island, to port, opened the shell some 15 feet below the waterline and flooded the forward bomb magazine. AMAGI started listing slowly to port. This bomb, size unknown, was fuzed to detonate well below the surface.

5. Other near miss bombs to port were surface detonations, and fragments from them were reported by the Japanese to have riddled the port shell slightly above the waterline. As AMAGI listed slightly to port, the lower of these holes shipped water and progressive flooding on the lowest complete deck (corresponding to U.S. third deck) started.

6. It appears that at this point (sometime before noon) two bombs (Nos. 2 and 3) struck the flight deck. Bomb No. 2, a small bomb (see Figures 41 and 42) struck close to the starboard edge of the flight deck and penetrated some six feet into a passageway outboard of the hangar, where it detonated abaft No. 2 smokepipe. Although it was a small bomb, it severely damaged No. 2 smokepipe and blew a small hole in the starboard shell below the flight deck. Almost all traces of the damage caused by this bomb were obliterated by Bomb No. 3 which struck a few minutes later. Nonetheless, enough is known to definitely establish a hit at this location. The bomb was probably a 500-pound G.P., fuzed 0.01 second delay.

7. Bomb No. 3 struck almost on the centerline of the flight deck midway between the two elevators. It was a large bomb, fuzed for considerable delay. It penetrated to the upper hangar deck (of approximately 1/2 inch Ducol Steel), where it detonated. Travel to point of detonation was about 25 feet, indicating a delay of 0.025 seconds. The flight deck between the two elevators for a length of about 200 feet was blown up and side hangar bulkheads amidships were blown out - the damage seems to have been even more severe than on KATSURAGI. When the ship later capsized, all the wreckage fell off, including both elevator platforms. This bomb blew a 25-foot diameter hole in the upper hangar deck (see Figures 41 and 42), and fragments passed through the 5/16 inch lower hangar deck, some 15 feet below. Watertight integrity of decks and bulkheads in the amidships area was destroyed over a large area. This bomb undoubtedly was a 2000-pound G.P., fuzed with a delay of 0.025 seconds.

8. At this point the commanding officer and the crew started to abandon ship. No damage control efforts were made. AMAGI was flooding progressively and the list continued to increase.

9. Additional near misses off the port side amidships, detonating below water, caused flooding of the after port engine room, and two of the port boiler rooms. This seems to have occurred when abandonment was in progress, having been reported to the Design Section of the Kure Navy Yard by surviving engineering personnel. The action report given in Article 3 of this report listed four firerooms as flooded.

10. By nightfall AMAGI had rolled over to a 70° angle, coming to rest on the bottom (see Figures 39 and 40) with almost her entire starboard side exposed. The position of the ship precluded a diver's examination of the port side in a reasonable length of time, so the number of port near misses in unknown, as well as details of damage to the underwater hull. There is no evidence of close near misses below the waterline on the starboard side, there being only a few fragment holes in the bow area above the waterline.

11. As a matter of interest, a 5-inch HVAR rocket struck and detonated on the flight deck between the forward elevator and island (Figure 42). A hole was blown in the flight deck, of 1/4 inch M.S., about 2½ feet in diameter. The rocket seems to have had little effect on sinking the ship, although the Design Superintendent of the Kure Navy Yard gave it credit for frightening the commanding officer as it zoomed past the island, and hence hastening the decision to abandon ship. This story places the time of the hit at about noon.

12. In summary, AMAGI was lost (if that be the term to describe a partially wrecked and partially sunken ship) from the underwater effects of the near-miss bombs. Kure Navy Yard officials believed that she could have been kept afloat by more experienced and better trained personnel. This seems doubtful, however, in view of the reported (and reasonably well authenticated) extent of initial flooding. Damage from No. 3 bomb was enormous, completely wrecking the flight deck. Similar damage was inflicted on KATSURAGI (Section III) and RYUHO (Section VIII). Again there were no fires of any consequence.

All of the following photographs of CV AMAGI were taken at KURE on 28 November 1945.

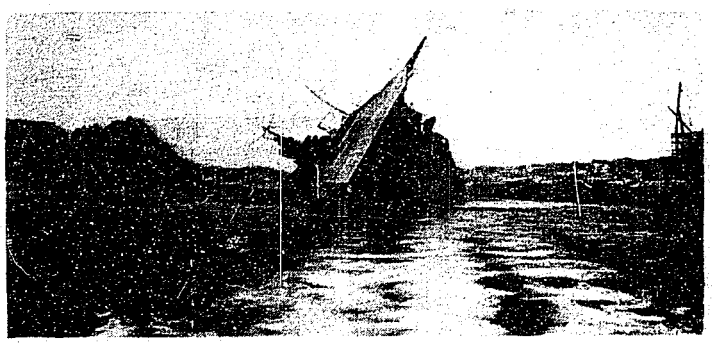


Figure 39
Capsized on 24 July.

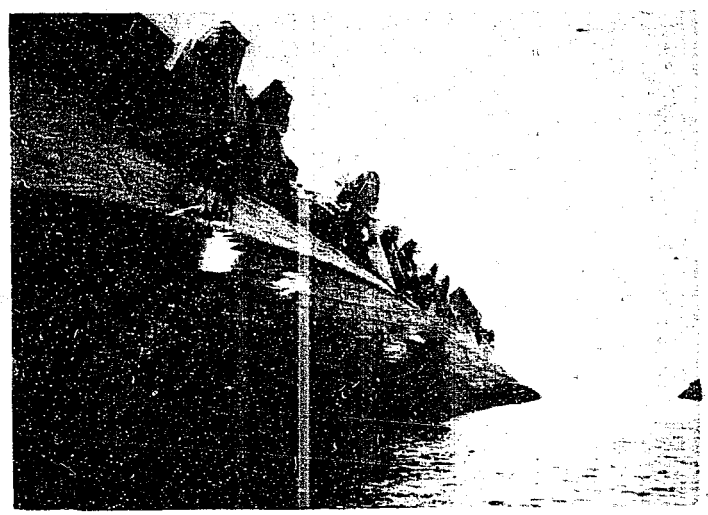


Figure 40
Starboard bottom and side, looking forward.

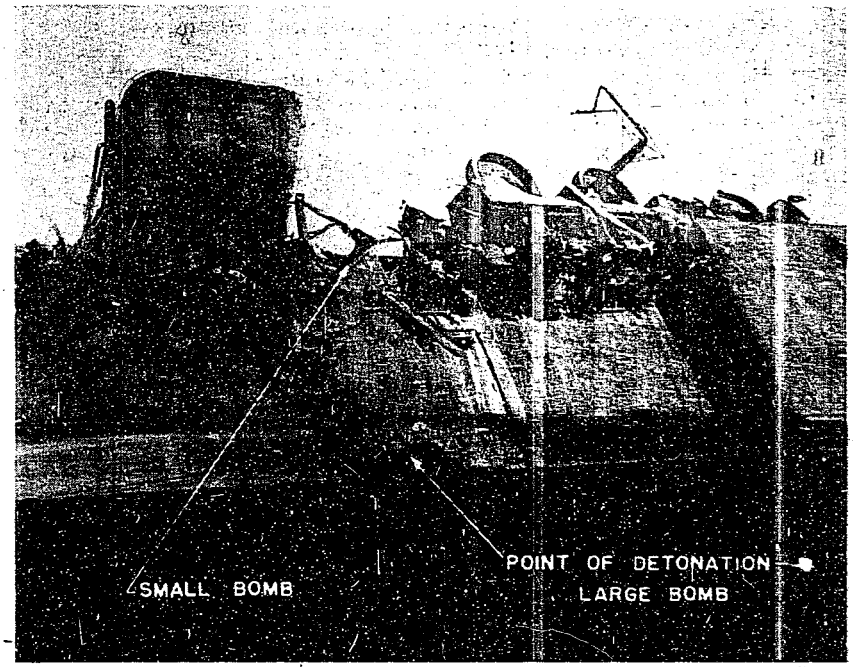


Figure 41
Damaged flight deck fallen off; upper hangar deck shown.

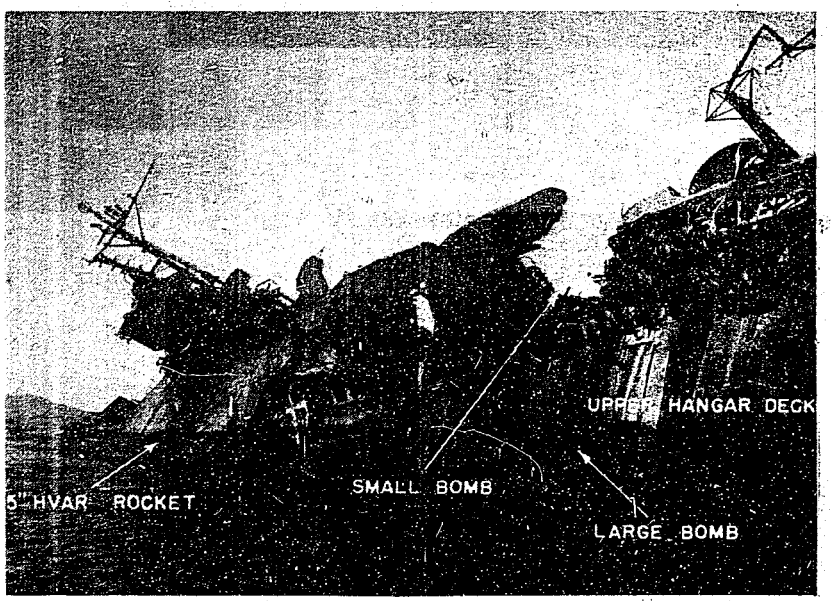


Figure 42
Looking forward along damaged flight deck and upper hangar deck.

Section VIII - RYUHO (CVL) WAR DAMAGE

Plate VII

RYUHO (CVL), converted from the Submarine Tender TAIGAI

Converted.....1942
Length (O.A.).....712 feet
Width of Flight Deck.....88 feet (estimated)
Displacement (full load).....19,200 tons (estimated)

1. RYUHO was damaged on 19 March 1945. She apparently was not a target after that date. Her story is included in this report primarily because of the damage to her flight deck, which was markedly similar to that suffered by KATSURAGI (Section III) and AMAGI (Section VII).

2. RYUHO has been classified in U.S. Navy recognition manuals throughout the war as a CVL. Actually, she was converted from a large submarine tender built in 1933-35 to merchant-ship standards. The Japanese considered her a poor ship with sub-standard watertight subdivision, longitudinal strength, and stability characteristics. She was used sparingly during the war and saw little service compared to other carriers. She had no armor. All in all, a classification of CVE would seem more appropriate.

3. On 19 March 1945, she was at anchor at Kure Naval Base. She was attacked with 1000 and 500-pound G.P. bombs and 5-inch HVAR rockets. She was fully manned and operational, although a line officer, rather than an aviator, commanded her. She had little fuel oil aboard and no planes. She was inspected on November 29, 1945, at which time she was partially manned.

4. She was struck by three bombs and two rockets. Data given by the Japanese, and listed in Article 3 of this report, confused one rocket with a bomb. Bomb No. 1 struck the starboard hangar bulkhead somewhat aft of amidships about six feet below the flight deck. It penetrated some six to eight feet prior to detonating within the hangar. It blew a hole in the flight deck about ten feet long and four feet in width. The starboard hangar bulkhead had a hole blown in it some 15 to 18 feet in length and about eight feet in height (Figure 46). The flight deck was pushed up a maximum of three feet, the total length deflected being about 50 feet. Damage was sharply localized. The bomb is indicated thus as having been a 500-pound G.P., fuzed 0.01 second delay.

5. Bomb No. 2 struck shortly after No. 1. It struck the flight deck to port of the centerline, about 80 feet forward of the after elevator. It pierced the flight deck, making a hole about 19½ inches in diameter (Figure 44), carried forward and detonated a few feet above the hangar deck. It blew a hole in the hangar deck plating (1/4 inch M.S.) about 15 to 20 feet in diameter. Blast damage to the flight deck was enormous (Figure 45). The deck was raised in the customary arch, some six feet in height, over a length of about 250 feet, between the two elevators. There was no fire. The bomb is considered definitely to have been a 1000-pound G.P., fuzed with a 0.025 second de[illegible].

6. Curiously enough, the flight deck on this ship was the strength deck. There were continuous longitudinals running its entire length, and these were somewhat deeper than the transverses, which were intercostal. A seam in the deck plating strakes was located just inboard of the third longitudinal. The seam was continuous for the entire length between elevators. This seam on the starboard side was ruptured for a length of about 150 feet. All transverses joining to No. 3 longitudinal on the inboard side had their rivets sheared, and the entire center section of the deck was lifted and settled back on top of the outboard portion (Figure 45). The two outboard strakes of the flight deck were 1/2 inch M.S., and the inboard center strakes were 1/4 and 3/8 inch M.S.

7. The net effect of Bombs Nos. 1 and 2 was to so destroy the flight deck that the longitudinal strength of the ship was gravely impaired. The Japanese considered her to be beyond repair and had recommended scrapping her, even prior to the end of the war. As a result, she was completely non-operational after 19 March.

8. Bomb No. 3 struck the after port quarter of the flight deck and plunged straight down to an aviation storeroom at the waterline level on the port quarter where it detonated. The plating at the point of impact was very thin (about six pounds) and fuze initiation at this point is considered doubtful. A hole about 19 inches in diameter was made in the flight deck, indicative of a 1000-pound G.P. bomb. The detonation occurred about 60 feet from point of impact, some eight feet from the shell. A hole some 25 feet in diameter was blown in the shell and several compartments in the vicinity were flooded. A flash fire occurred in the storerooms in the area which was extinguished by the inrush of sea water. Fuze action was certainly initiated at the hangar deck, of 3/8 inch M.S., if not at the flight deck. The fuze delay was probably 0.1 sec., with the nose fuze functioning in this case. This was a very damaging hit. Two or three such hits located in the middle half length would jeopardize such a ship. As it was, RYUHO changed trim by the stern some six feet after this hit.

9. The two rocket hits on RYUHO, while not important, are of some interest. The forward one hit a starboard gun sponson at an angle of about 30° from the vertical, and passed downward and through the turn of the bilge, causing the flooding of an empty fuel tank. It was a dud. The second struck the starboard shell about three feet above the waterline, in a shallow trajectory, and penetrated through one deck and two longitudinal bulkheads, finally detonating in the top of a starboard fireroom. Fragments ruptured the main steam line, and put the boiler out of operation. The boiler was not damaged. The main steam line could have been repaired in two days, although repairs had not been made. Fuzing of 0.015 second delay was indicated. Total travel within the ship was about 30 feet.

10. In this case again are seen the effects of flimsy construction, despite the fact that the flight deck was the strength deck. The vagaries of blast are unexplainable, but they seem to have been similar in the cases of KATSURAGI, AMAGI, and RYUHO. It is further noted that all carriers had completely enclosed hangars.

All of the following photographs of CVL RYUHO were taken at KURE on 29 November 1945.

Figure 43

At anchor. Non-operational, although manned. Damaged 19 March 1945 with three bomb hits and two rocket hits.

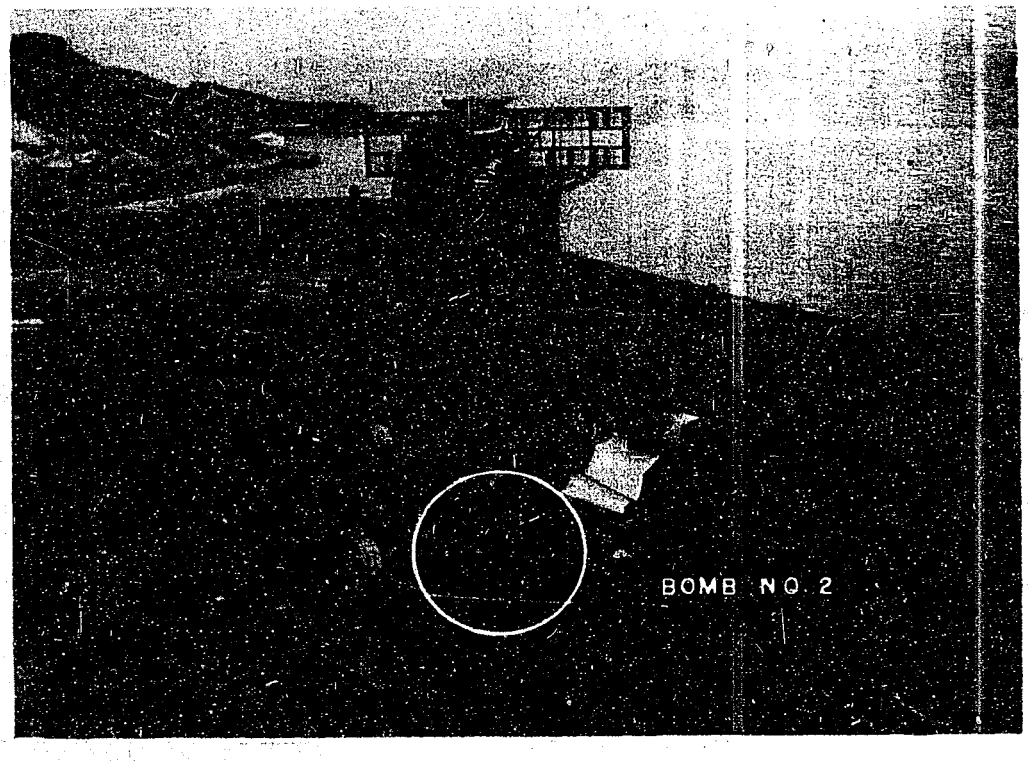


Figure 44
Bomb penetration hole (19½" diameter) in flight deck for most damaging hit (Bomb No. 2).

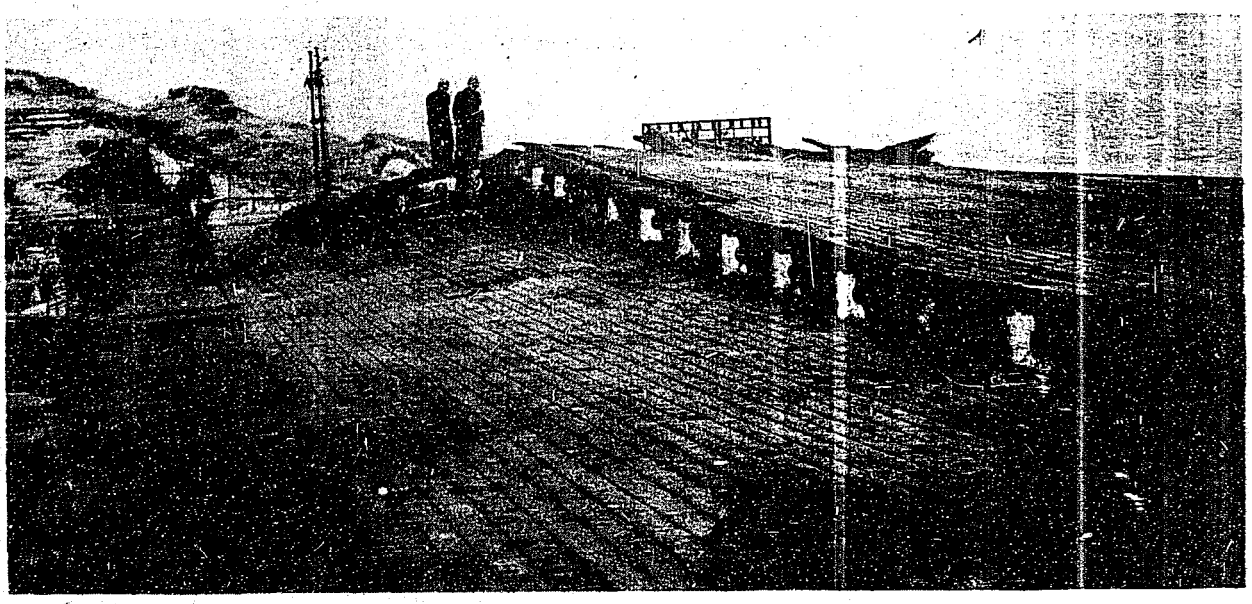


Figure 45
Damage to flight deck by Bomb No. 2.

Figure 46
Damage to starboard shell and flight deck by Bomb No. 1.

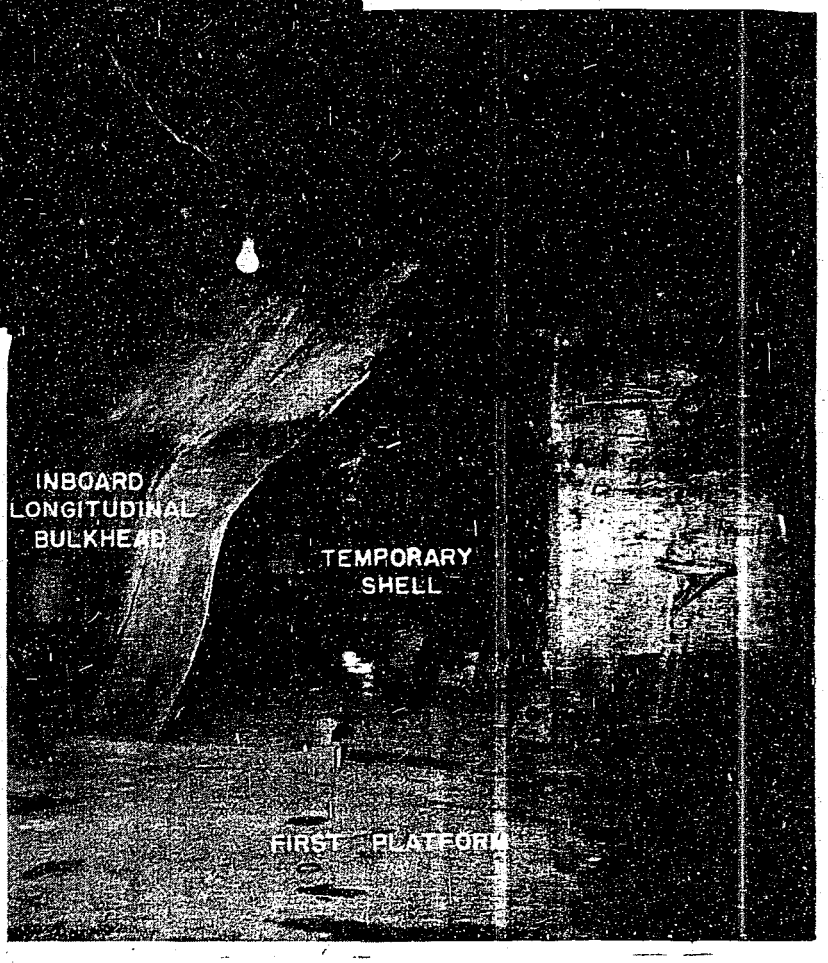


Figure 47
Damage on first platform level, at waterline, from Bomb No. 3. Looking outboard to port.

Section IX - OYODO (CL) WAR DAMAGE

Plate VIII

OYODO (CL-22) - Single ship of class

Completed	February 1943
Length (O.A.)	628 feet
Beam (max.)	54.3 feet
Draft (full load)	21.3 feet
Displacement (full load)	11,433 tons
GM (full load)	4.3 feet
GZ (full load)	3.8 feet
Range of stability (full load)	over 90°

1. OYODO was the last and latest light cruiser built by the Japanese. She was designed to be what the Japanese classed an "aircraft ship". For this reason, she had two triple 6-inch mounts forward, and a hangar and aircraft handling arrangement aft in lieu of a third main battery mount. In justice to her designers, it appears that they were dubious of the value of such a ship, but the characteristics were forced upon them by operating personnel. The designers' doubts were well justified, inasmuch as OYODO was never used to operate planes. Her chief employment was as a fleet flagship. As such she saw only limited service.

2. Her design contained a fatal defect - the presence of centerline bulkheads in the machinery spaces. The Japanese consistently used centerline bulkheads in their larger heavy cruisers where stability characteristics were such as to permit theoretically a comparatively large amount of off-center flooding. From what is known of the war record of the larger cruisers, they seem to have withstood the effects of single torpedoes in the middle body reasonably well, justifying their designers' hopes. But OYODO was too small to withstand a large amount of off-center flooding, with its obvious disadvantages, despite her designers' claim that maximum list would be limited to 15° with one engineroom and one fireroom on one side flooded. Under such conditions, reserve of statical stability would be almost zero - providing no resistance against even slight additional flooding. It is pointed out, however, that her stability characteristics were excellent for a moderate-sized cruiser, in the intact condition and without centerline bulkheads.

3. In common with other Japanese naval units in the vicinity of KURE, OYODO was almost immobilized from lack of fuel oil. Otherwise, she was completely manned and ready for action. Her crew was well-trained by Japanese standards. She was attacked by planes from Task Force 38 on both the 24th and the 28th of July. The bombs principally employed were 1000 and 500-pound G.P. types with the usual nose and tail fuzes. Although fragmentation bombs were reported to have been dropped, no hits were claimed with them. On 28 July OYODO also was the target for 5-inch HVAR rockets. In this connection, the Japanese, in the data included in Article 3 of this report, reported her seriously damaged on 19 March and sunk on 24 July. Officials at KURE knew nothing of this damage. See NavTechJap Document No. ND 22-7. Finally, the damage reported to have occurred on the port side should have been visible (the port side was almost completely exposed), on inspection. There were no signs of it.

4. OYODO was moored off the westward shore of the island of ETA JIMA, some 10 miles from Kure Naval Base, where she was sunk. She was inspected on 29 November, when she was lying at an angle of 80° from the vertical, in about 25 feet of water, with her port side exposed (Figures 48 and 49). Her position was such that it precluded a diver's examination of the damaged starboard side in a reasonable length of time. Thus the cause of her capsizing is unknown in detail, although the general picture is well-authenticated from Japanese reports.

5. On 24 July, OYODO suffered only minor damage. Two small bombs (Nos. 1 and 2), presumably 500-pound G.P., detonated on impact with the main deck well aft in the vicinity of the catapult. The holes in the main deck both were reported to have been about 3 to 4 meters (10 to 13 feet) in diameter. The upper shell strake on the extreme port quarter was riddled by fragments coming down and outboard, as determined by visual inspection. There was no fire. These bombs were instantaneously fuzed.

6. The Japanese reported four near misses off the port bow on 24 July. These apparently were some distance away as only a few fragment holes, well above the waterline in the shell, could be found as evidence. A 20-foot long indentation in the port turn of the bilge was found amidships (Figure 52). This obviously was from a near miss which detonated some 20 feet below the surface. Although maximum indentation was about 18 inches, the shell was not ruptured and all rivets appeared tight. These near misses caused negligible damage, which played no part in her capsizing on 28 July. She was not hit by rockets on 24 July.

7. On 28 July OYODO suffered several close near misses to starboard. One particularly serious one bilged the forward starboard engineroom and starboard after fireroom extensively, permitting instantaneous flooding of both spaces. Others opened the shell above and adjacent to the waterline. Counterflooding efforts were not successful. OYODO capsized to starboard in about 25 minutes.

8. During the afternoon, after OYODO was lying on her starboard side with the port shell above water, she was exposed to attack with 5-inch rockets. Two struck her as shown in Figures 50 and 51. The forward one, Figure 50, detonated on impact against a 1/2 inch Ducol Steel plate, at about the location of the waterline. A hole about two feet in diameter was blown in the plate. A noteworthy fact was the absence of interior fragment damage. A bulkhead parallel to the shell, and about three feet inboard was not attacked by a single fragment. The other rocket detonated on impact with a 3/4 inch Ducol Steel plate at a point about 20 feet aft of the forward rocket. As will be noted in Figure 51, the hole in the shell was about the same size as that caused by the forward rocket, despite the heavier plate thickness. Again there was no interior fragmentation, as evidenced by inspection of the space behind the shell.

9. Although very little detailed data could be obtained, it is certain that OYODO's rapid capsizing was due to the presence of the centerline machinery space bulkheads. The design Superintendent of the Kure Navy Yard, formerly with the Ship Construction Division of the Technical Department in TOKYO, had opposed their installation. He considered that OYODO's loss justified his point of view.

All of the following photographs of CL OYODO were taken at ETA JIMA on 29 November 1945.

Figure 48
Looking aft.

Figure 49
Looking aft along the port shell.

Figure 50
A typical 5" HVAR rocket hole in 1/2" plate. Rocket struck ship after she had capsized.

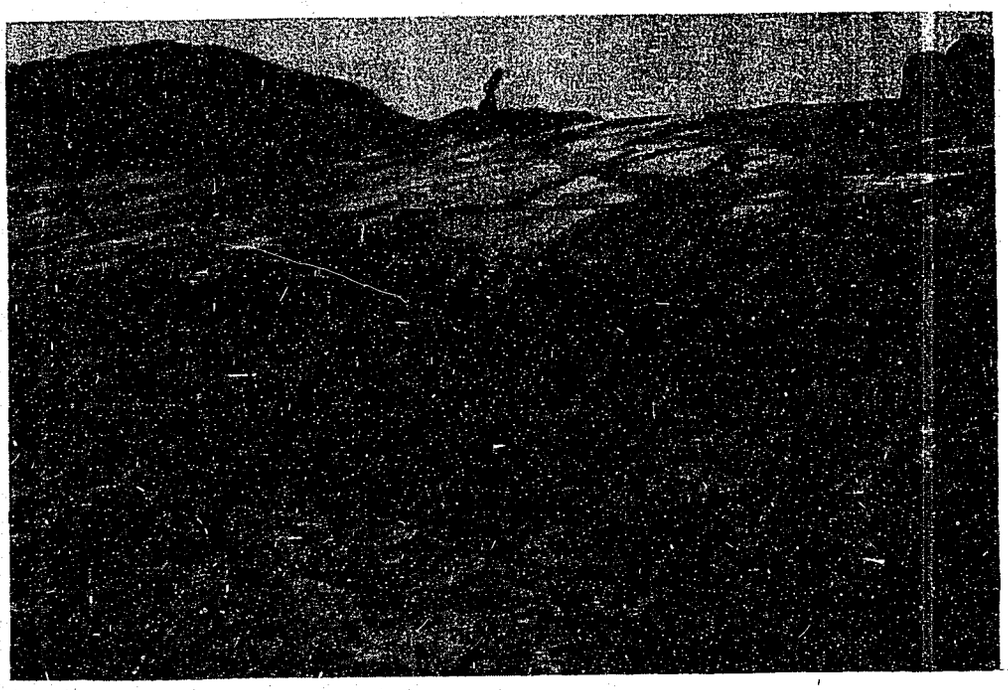


Figure 51

Second 5" HVAR rocket hit on 3/4" plating. No penetration or blast damage to longitudinal bulkhead, parallel to and three feet inboard of shell.

Figure 52

Identation in port bilge plate caused by far near-miss bomb on 24 July. Most serious identation covered length of about 20 feet. Maximum deflection was 18".

Section X - TONE (CA) WAR DAMAGE

Plate IX

TONE (CA-17), prototype of TONE Class

Completed	1938
Length (O.A.)	659 feet
Beam (max.)	63.5 feet
Draft (full load)	22.4 feet
Displacement (full load)	15,201 tons
GM (full load)	5.75 feet
GZ (full load)	4.95 feet

1. TONE was the first ship of the last class of Japanese heavy cruisers. The hull form and features were reported to have been identical with those of the MOGAMI Class. The battery arrangement was quite different, however. TONE had four twin 8-inch mounts all mounted forward, while MOGAMI had five twin 8-inch mounts, three forward and two aft. Aircraft handling arrangements with two catapults were installed aft on TONE.

2. TONE had an internal armor belt, with a blister outboard (carried void) and a layer of fuel oil tanks inboard. The depth of this underwater system was 8.5 feet, which was designed to defeat a torpedo warhead containing 200kg (440 pounds) of TNT. Tests conducted while the class was building revealed that the system was not that good. The tests later were substaniated by war experience.

3. TONE had a long and distinguished fighting career. She received damage on several occasions, but only once was it serious prior to 24 July 1945. She was hit with one submarine torpedo in June 1943, in way of the after port engine room at about the midlength of the space. The bulge was torn off for a length of about 60 feet, and the armored bulkhead was split at the joint between the upper and lower sections. Butts of both sections were opened. Only the one engineroom was flooded. Initial list was of the order of 8° to 11°. Despite delay in counterflooding, she returned to KURE under her own power with little difficulty, where repairs required about six months.

4. She was attacked at KURE on both 24 and 28 July by planes of Task Force 38. Hits were claimed with 1000-pound SAP, 1000-pound G.P. and 500-pound G.P. bombs. The fuzing was not reported in detail, but the ordinary tail fuze with settings of "non-delay", 0.01 sec., 0.025 sec., or 0.1 sec., delay, undoubtedly was used with the SAP bombs as well as with the G.P. bombs. At least one 5-inch rocket struck her, doing negligible damage. Like the other Japanese warships at KURE, TONE was virtually out of fuel oil. She was fully manned and operational, and was completely closed up and ready for action at dawn of the 24th. TONE was inspected on 29 November for topside damage, and by divers during the week of 2-9 December. At that time she was off ETA JIMA, about 15 miles from KURE.

5. There was no damage to TONE forward of the smokepipe. The Japanese reported numerous near misses off the port bow caused some flooding in that area, and put her down by the bow. Careful inspection both above and below water failed to reveal any damage whatsoever to the shell below the second deck. There were a few small fragment holes in the port shell just below the main deck, but these were so high that no flooding occurred through them.

6. Bomb No. 1 struck at the base of the smokepipe on the port side (Figures 56 and 57). This bomb completely wrecked all uptakes at the main deck level, making all boilers inoperative (note: more than two were steaming to furnish power for the battery). Judging from the damage, it was a 500-pound G.P., which detonated on impact. Sinking damage was not caused.

7. Bomb No. 2 caused very serious damage. It struck the main deck just inboard of the port deck edge, about halfway between the after port 5-inch twin and the mainmast. Divers' reports indicate clearly that it penetrated the 2½ inch C.N.C. sloping armored deck prior to detonation. The hole in the port shell was about 40 feet in length, extending from the main deck to the turn of the bilge. Extensive damage was done to the armored (second) deck, the deck being blown upward, as shown on Plate IX. The internal armor belt was blown outward. A hole about 20 feet in length was blown in the main deck. Shell seams were ripped open for a length of about 30 feet on each side of the hole. The divers inclined to the belief that a magazine explosion had occurred. There was no magazine in the vicinity, however, the closest gun mount being the after 5-inch twin, some distance away, with magazines located aft of the machinery spaces (ammunition was passed along the second deck). Both port enginerooms flooded instantly. The starboard forward engineroom and the after port fireroom flooded slowly, for reasons unknown (most probably through piping systems, although it could have been through fragment holes or leaky rivets and seams in the peripheries). The above description is based on divers' examination in comparatively clear water. It checks fairly well with the reported extent of immediate flooding.

8. It seems most unlikely that a 1000-pound G.P. bomb could have penetrated the 2½ inch deck (maximum penetration of armor is approximately 1½ inches for this bomb). On the other hand, the damage seems exorbitant for the 1000-pound SAP, with about 300 pounds of explosive. Yet it was a confined detonation, capable of widespread blast damage to surrounding structure. Accordingly, it is concluded that a 1000-pound SAP bomb, fuzed 0.025 second delay, caused the damage.

9. At this point a tug was procured and TONE was pushed ashore, bow first. While under tow, Bomb No. 3 struck the main deck aft, slightly to port of the centerline. This bomb detonated quite deep in the ship, wrecking the main and second decks (unarmored this far aft), and doing some damage to the shell which permitted extensive flooding aft. As she was well aground in mud, it was impossible for divers to examine her shell closely. The amount of wreckage on the inside of the ship precluded an interior examination deeper than about six feet below the main deck level. About all that can be said of this bomb was that it was either a 1000-pound SAP or G.P. bomb, fuzed probably with an 0.025 second delay setting.

10. At this time TONE appears to have been seriously damaged; she was flooding badly aft and through the port side into the enginerooms. Her crew, not conspicuous for damage control ability (actually they had turned in a very inept performance when torpedoed in June 1943) become panicky, as did the commanding officer. She was abandoned in a hurry as the attacks continued. The exact time she was abandoned could not be ascertained by Kure Navy Yard officials, but they believe it to have been prior to 1400. No fires occurred.

11. She was bombed again on 28 July, but apparently escaped further damage (except for a single rocket hit), as no other damage was found. The stern, however, was well submerged and difficult to examine. Although the damage aft is believed to have been caused by a single bomb (No. 3), it might well be that additional bombs struck in that vicinity.

12. The rocket hit occurred after TONE was abandoned, either on the afternoon of 24 July or on 28 July. It struck a starboard platform, outboard of Battle II, aft of the smokepipe. It detonated on impact, blowing a three-square-foot section of the platform overboard. Some fragmentation occurred but it was of minor proportions.

13. It is doubtful if TONE flooded completely for some time. It will be recalled that she was pushed aground. The two typhoons of September and October apparently finished the job, if any spaces remained dry when these occurred.

14. The Japanese considered her salvable prior to the end of the war, but now she is to be cut up for scrap. Japanese naval constructors are of the opinion that she could have survived the effects of the bombing on 24 July if she had not been ineptly handled. However, the general situation was so depressing that it is understandable that the crew could see little point in presenting themselves as targets for what must have appeared to them to be certain destruction.

15. In summary, TONE was lost from the effects of two bombs (No. 2 and 3), both of which did underwater damage. An alert crew, well-trained in damage control, probably could have kept her afloat.

All of the following photographs of CA TONE were taken at KURE on 29 November 1945.

Figure 53
Approaching from starboard bow

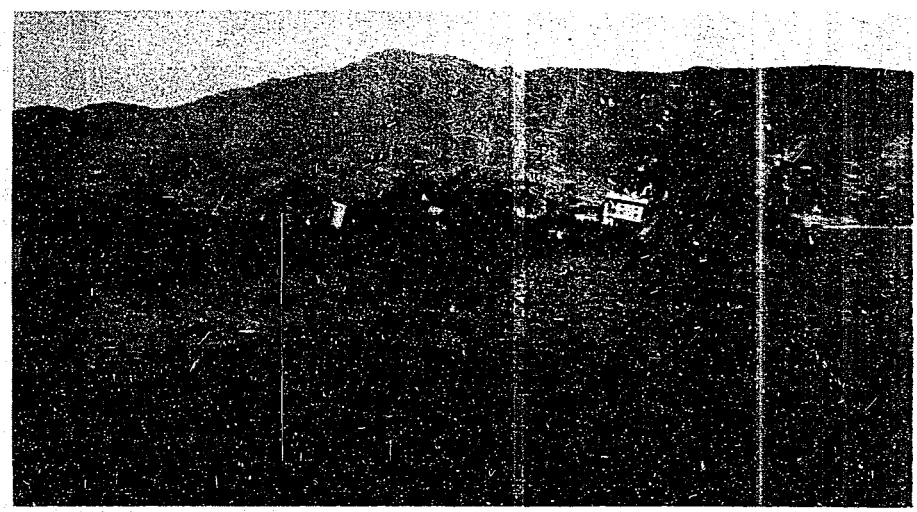


Figure 54
Was deliberately beached on 24 July, being grounded by the bow

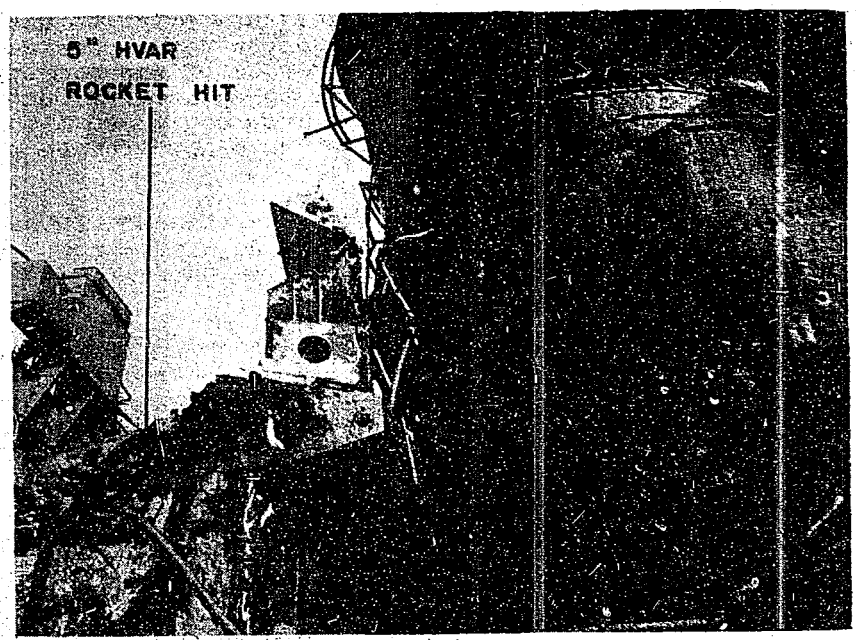


Figure 55
Hit, reported by Japanese as a rocket. Small damage identifies it as probably 5" HVAR rocket.

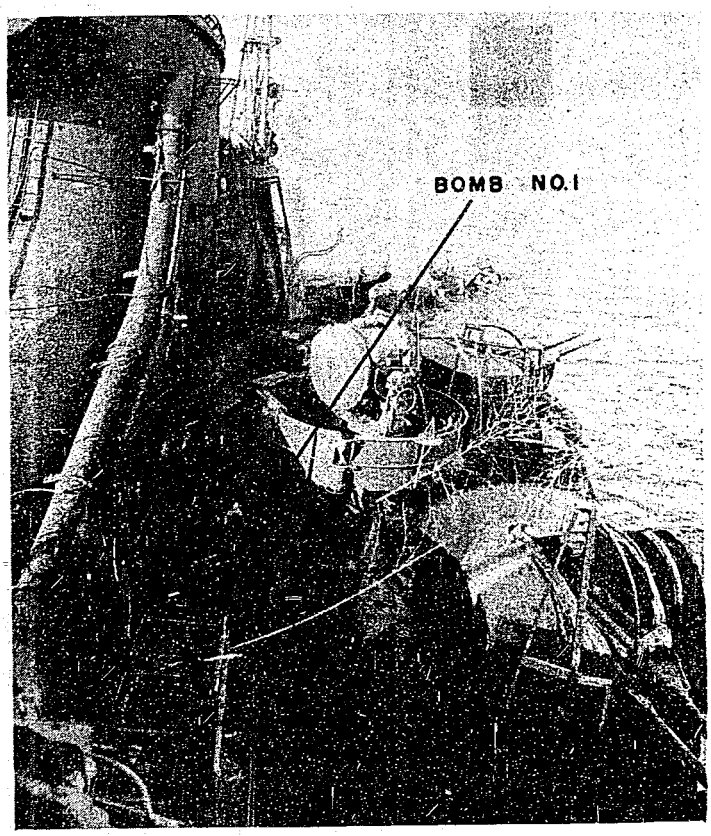


Figure 56
Path of Bomb No. 1

Figure 57
Close-up of damage to base of smokepipe caused by Bomb No. 1. Looking to starboard.

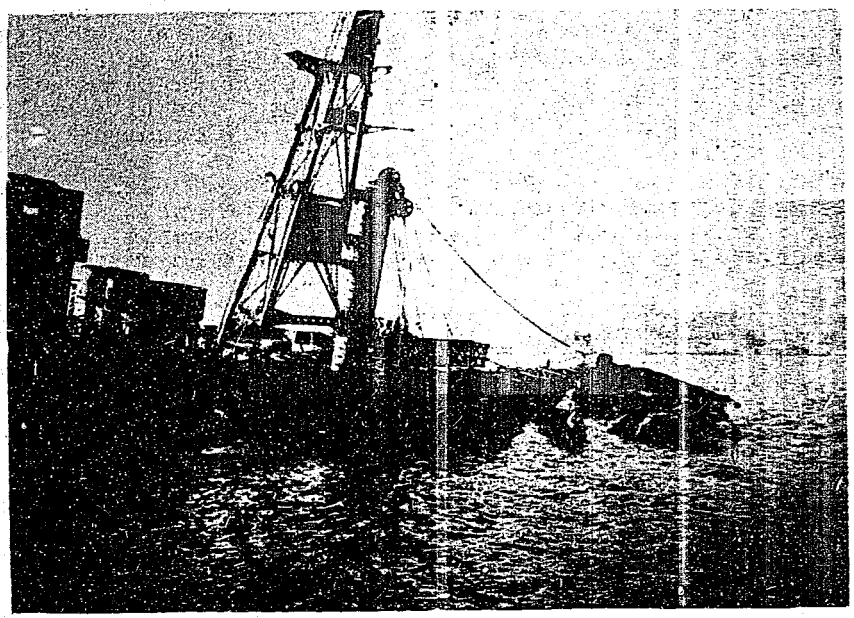


Figure 58
Large bomb, at least 1000-pound SAP, fuzed 0.01 second delay, struck deck and penetrated below second deck, where it detonated.

Section XI - HYUGA (BB) WAR DAMAGE

Plate X

HYUGA (BB-3), of the ISE Class (see Section VI)

Completed	1918
Modernized	1943-44
Length (O.A.)	715 feet
Beam (max.)	111 feet (with blisters)
Draft (full load)	30.7 feet
Displacement (full load)	40,444 tons
GM (full load)	9.2 feet

1. HYUGA was a sister of ISE and had undergone the same hybrid conversion as had ISE. HYUGA also had been with the Japanese Central Force at the Battle for Leyte Gulf, 24-26 October 1944. There she received minor bomb damage which was repaired prior to 1 March 1945. It is not clear if it was ISE or HYUGA which was repaired at Singapore, but Kure Navy Yard officers reported HYUGA did not arrive at KURE until late February, thus indicating that she was the ship which was repaired at Singapore.

2. Like other naval units at KURE, HYUGA was immobilized almost completely because of lack of fuel oil. She was moored in the lee of a small island in HIRO WAN, some 15 miles from Kure Naval Base. On 19 March she received one bomb hit (No. 8) which struck the upper deck on the port side amidships, just aft of 5-inch twin mount No. 4. This bomb detonated with almost no delay, blowing a hole in the deck some eight or nine feet in diameter and damaging the mount beyond repair (Figure 64). This damage was not repaired. It appeared to have been caused by a 500-pound G.P. bomb, "instantaneously" or "non-delay" fuzed.

3. On 24 and 28 July, HYUGA was attacked by planes from Task Force 38. However, she was sunk on 24 July in about 45 feet of water, and the attack of 28 July might be termed superfluous. The hits made on 24 July were fairly accurately recorded by the Japanese, but they made no effort to record those made on 28 July. In this report, therefore, the hits not recorded by the Japanese, and found on inspection 30 November, are assumed to have occurred on 28 July.

4. HYUGA was attacked on 24 July with 2000, 1000, and 500-pound G.P. bombs, using the usual fuzes. Hits were claimed with all three types. On that date she received eight hits and innumerable near misses (none of which did any observable damage, beyond a few fragment holes), well above the waterline.

5. On 24 July, HYUGA was closed up and ready for action. Her camouflage job had been supervised by the commanding officer. Her crew was a veteran outfit, well-trained by Japanese standards. The action is reported to have started at about 0915 and to have continued into the middle of the afternoon.

6. Bomb No. 1 struck the forecastle deck early in the action at the eyes of the ship, blowing off a small part of the deck and stem (Figure 60). It was either a 500 or 1000-pound G.P., which detonated on impact. The damage was superficial - no one was injured.

7. Bombs Nos. 3, 4, and 5 (Figure 61) all struck the foremast tower in quick succession, disrupting all fire-control equipment and starting a series of fires which never were controlled. These eventually gutted the entire tower before dying out that night. Figure 63, of the pilot house, shows a typical burned-out space. The damage from all three bombs was consistent with the 500-pound G.P. type, instantaneously fuzed.

8. Bomb No. 9 struck the upper deck some 20 feet aft of the wreckage caused by Bomb No. 8 (on 19 March). It left a 14½ inch diameter penetration hole just forward of 5-inch mount No. 6, and penetrated to the vicinity of the second deck, where it detonated, blowing a hole in the port shell above the second deck, and damaging the main deck. When HYUGA later settled, this hole came under water and permitted extensive amidships flooding. The diameter (14½ inches) of the penetration hole identifies the bomb as probably a 500-pound G.P. The depth of penetration, at least 15 feet, leads to the conclusion that this bomb was fuzed with 0.025 second delay. It was a damaging hit, which later caused serious trouble.

9. Bombs Nos. 10, 11, and 12 all struck the flying deck aft. Judging from the appearance of the damage, at least two (Nos. 11 and 12) were large bombs which penetrated deeply prior to detonation. The detonation occurred in the vicinity of the second deck, indicating at least a 0.025 second delay. The port shell was badly damaged in the vicinity of the waterline, permitting large-scale flooding. The two bombs destroyed virtually all watertight structure between the second and main decks (damage below the second deck could not be ascertained with any reliability for a length of about 100 feet) - indicative of large bombs. The hangar on the main deck was virtually destroyed. On the day of inspection, damage to the main deck could be seen through the clear water flooding the hangar. It was apparent that these two bombs caused considerable damage which started extensive flooding aft, through the port shell. It is considered that Bombs Nos. 11 and 12 were at least 1000, and more probably 2000-pound G.P. bombs. Bomb No. 10 was a small bomb, probably 500-pound G.P., which detonated on impact with the flying deck and crumbled much concrete. There was some evidence of a fourth bomb to starboard of the centerline, just forward of the elevator, but this could not be positively identified.

10. HYUGA was an old ship. As she started to settle by the stern, the crew, badly disorganized by numerous topside and below decks casualties, were powerless to stop progressive flooding through doors, hatches and bulkheads which did not prove to be watertight. By nightfall she was hard aground aft.

11. She was not abandoned. Most of the senior officers had been killed in the forward tower and command devolved upon a lieutenant. Little was done, however, except to tend the wounded in a primitive way and clear off the dead. The remnants of the crew simply existed during the following week.

12. On 28 July, HYUGA was hit by two more bombs (Nos. 6 and 7) and damaged by a close near miss (No. 2) off the starboard bow abreast No. 2 turret. Bombs Nos. 6 and 7 both hit the forward tower and detonated instantly. Bomb No. 6 (Figure 62) was probably a 1000-pound G.P., judging from the large amount of damage, while Bomb No. 7 (Figure 61) obviously was a 500-pound G.P. Brief fires were kindled which soon died from lack of material to burn. Bomb No. 2 cannot be identified as it seems to have been a surface burst, causing only fragment damage to upper works (HYUGA was aground with the waterline up to the main deck when this occurred).

13. The remnants of her crew remained aboard until 1 August 1945, when hunger and exposure drove them off. The typhoons of September and October completed the flooding of all compartments and drove her deeper into the mud. The Japanese did not believe she was worth salvaging.

14. In summary, the effects of two large bombs (Nos. 11 and 12) striking aft and detonating in the vicinity of the waterline, put her aground by the stern. Progressive flooding, greatly assisted by the effects of a third bomb (No. 9), caused her to settle forward, as well as aft, and she was hard aground by nightfall of the 24th of July.

15. The hull underwater could not be examined by divers. A large number of near misses was reported by the Japanese, but damage from these could not be verified.

All of the following photographs of BB HYUGA were taken at HIRO WAN on 30 November 1945.

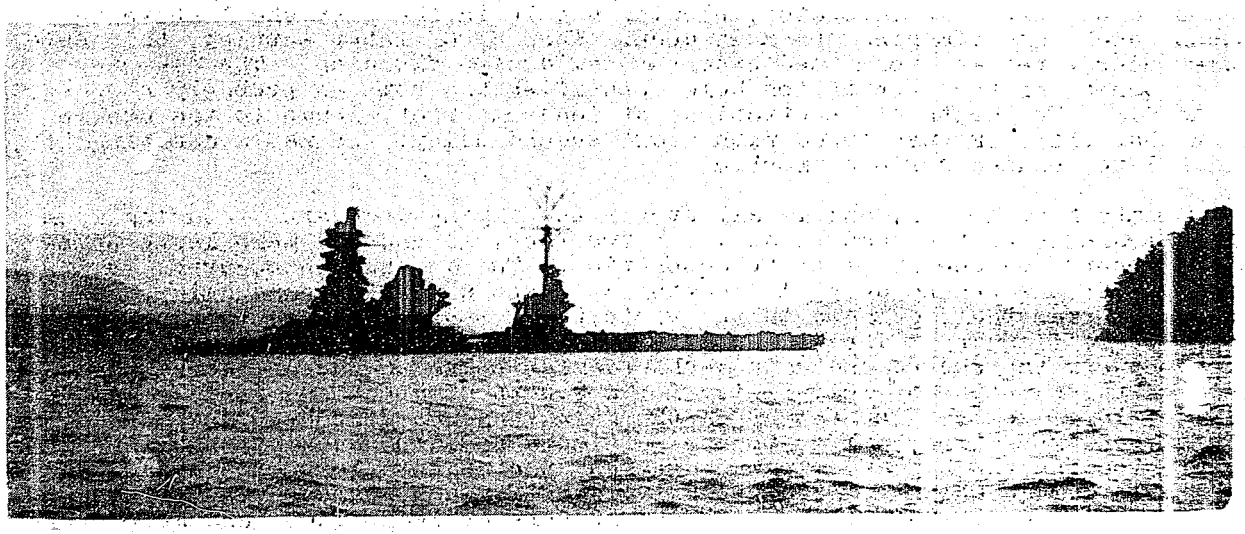


Figure 59

Sunk 24 July, but additional damage inflicted 28 July.

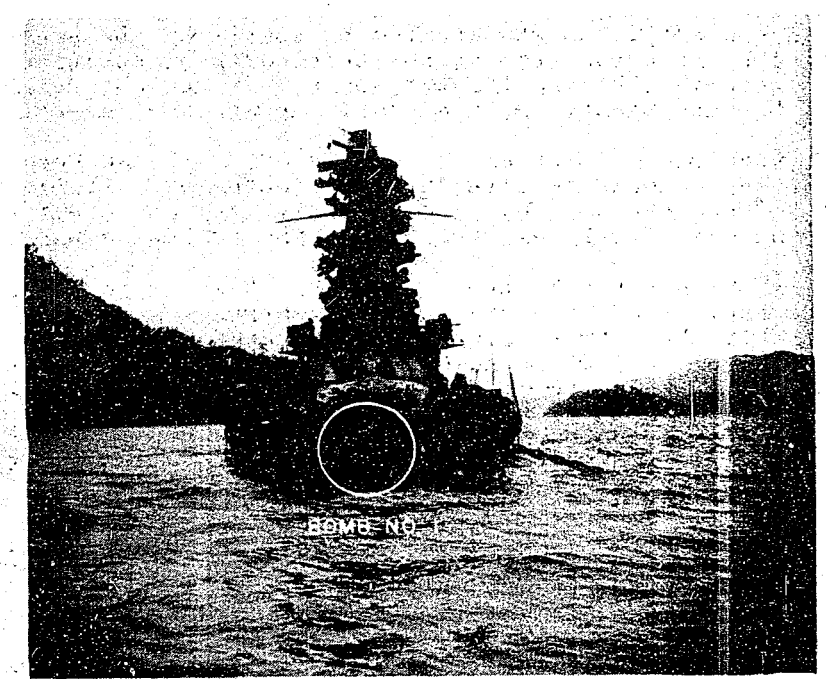


Figure 60

Bomb No. 1 instantaneously fuzed, blew off eyes of ship 24 July. Could have been either of two types of GP bombs dropped that day; viz., 500 or 1000 pounds.

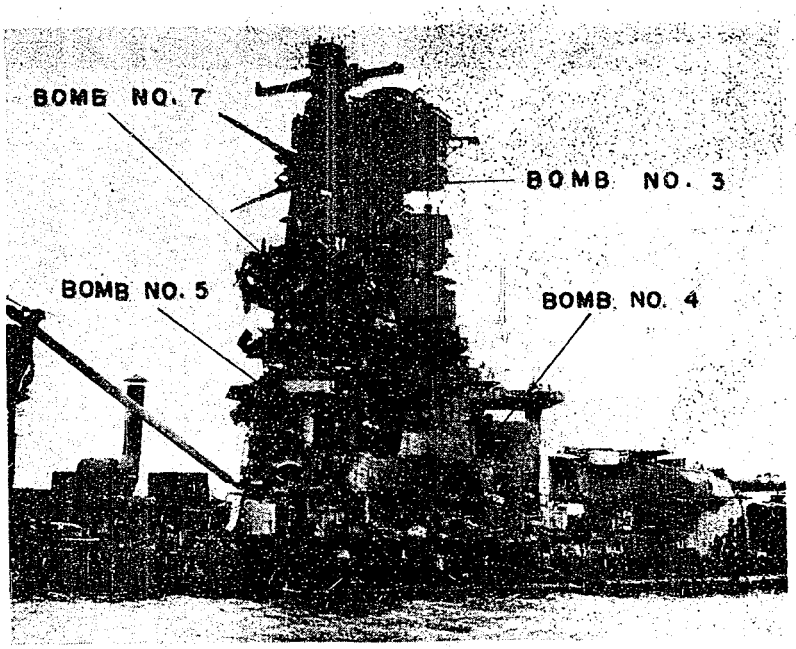


Figure 61

Showing four bomb hits on starboard side of foremast tower, 500-pound GP bombs, instantaneously fuzed. Started bad fire which gutted tower, destroying all fire control apparatus located there.

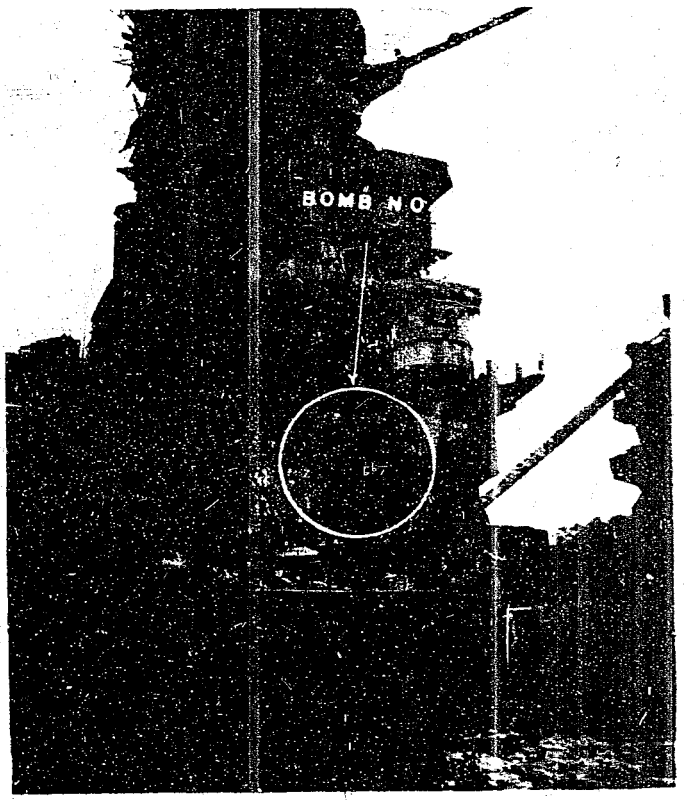


Figure 62

Port side of foremast tower, showing large GP bomb hit. Bomb probably was 1000-pound type, instantaneously fuzed.

Figure 63

Pilot house, looking forward. Completely gutted by fire.

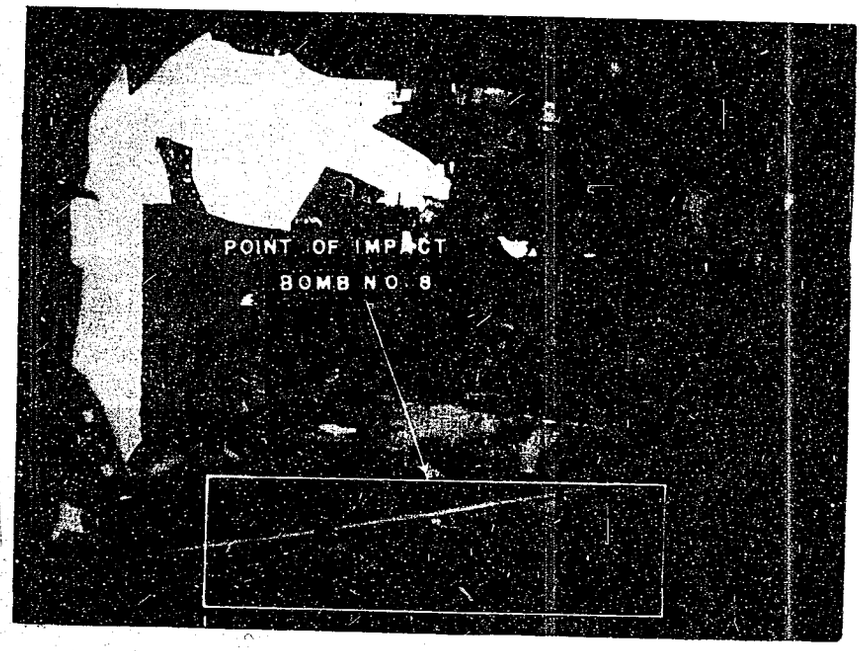


Figure 64

Looking forward on port upper deck at remains of twin 5-inch mount destroyed by Bomb No. 8. Judging from damage, appears to have been 500-pound GP bomb, instantaneously fuzed.

Figure 63

Pilot house, looking forward. Completely gutted by fire.

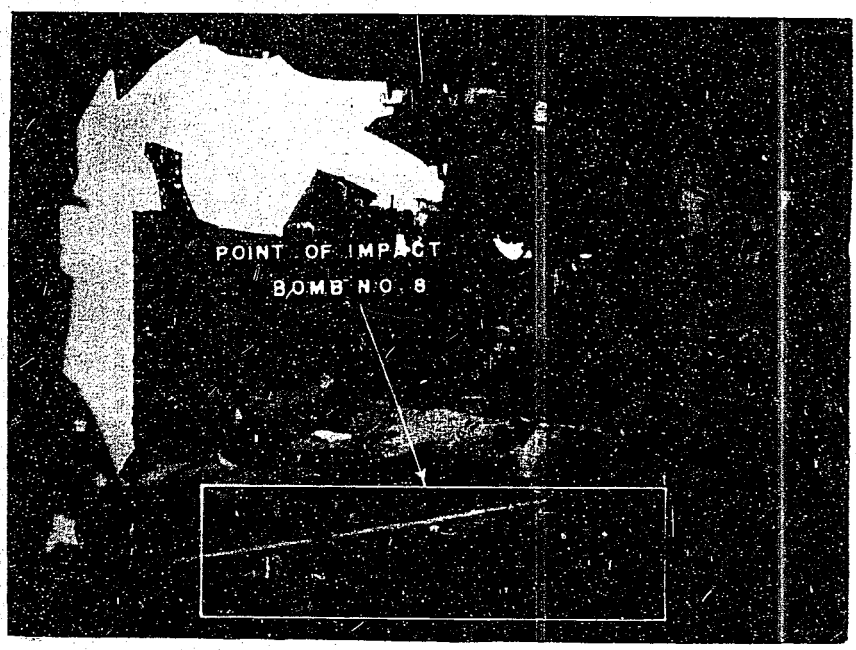


Figure 64

Looking forward on port upper deck at remains of twin 5-inch mount destroyed by Bomb No. 8. Judging from damage, appears to have been 500-pound GP bomb, instantaneously fuzed.

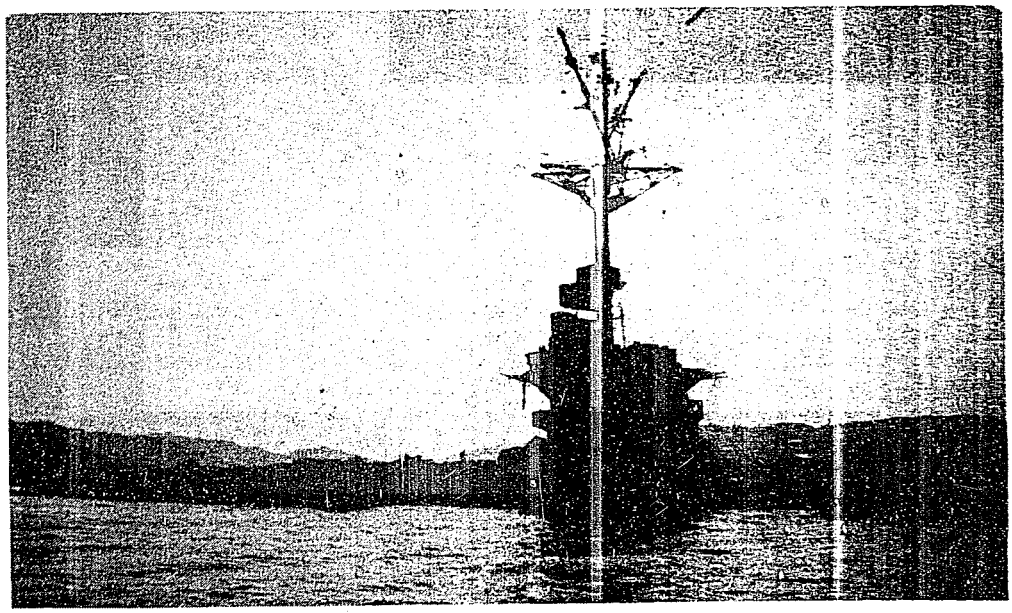


Figure 65
Looking at starboard quarter showing remains of flying deck.

Figure 66
Looking forward on port side of flying deck. This bomb was at least 1000-pound GP, 0.025 second delay fuzed. Detonated well below flying deck, destroying supports for latter and permitting general collapse. Note remnants of 8" thick concrete deck covering.

Section XII - ASO (CV) DAMAGE

Plate XI

ASO (small CV)

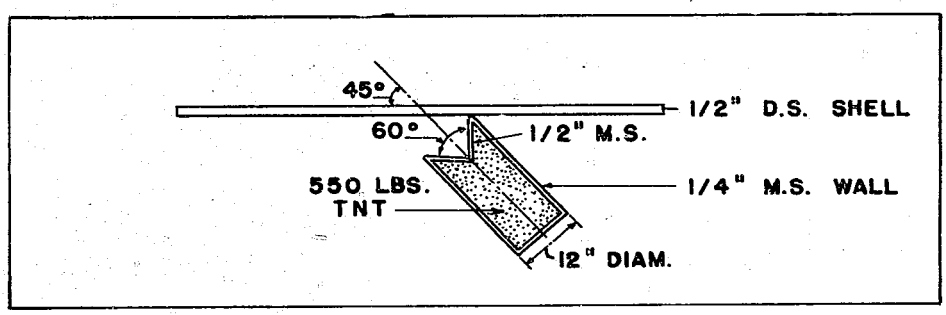
Not completed
Length (O.A.).....743 feet
(W.L.).....730 feet
Beam (W.L.).....72 feet

1. ASO was to have been a sister of KATSURAGI and AMAGI. As the Japanese war situation deteriorated in the spring of 1945, and emphasis was placed on the production of suicide weapons to repel the expected invasion, work on ASO was stopped. Early in the summer, the Japanese decided to use her as an experimental ship to determine the efficiency of various kinds of warheads (including shaped charges) to be used with KAMIKAZE planes. This decision seems to have been more at the insistence of the Japanese Army.

2. When these experiments were started, ASO was complete only to the upper hangar deck (U.S. main deck). The hangar deck plating had not been riveted except for the stringer strakes, and no hatches had been installed. The elevator wells also gaped open.

3. There is no evidence to indicate that ASO was hit by U.S. bombs or other weapons. The story of three experiments which the Japanese conducted on ASO is included in this report only as a matter of interest. She was inspected on 30 November 1945. At that time she was aground off a small island in HIRO WAN, with the main deck on the starboard side half submerged.

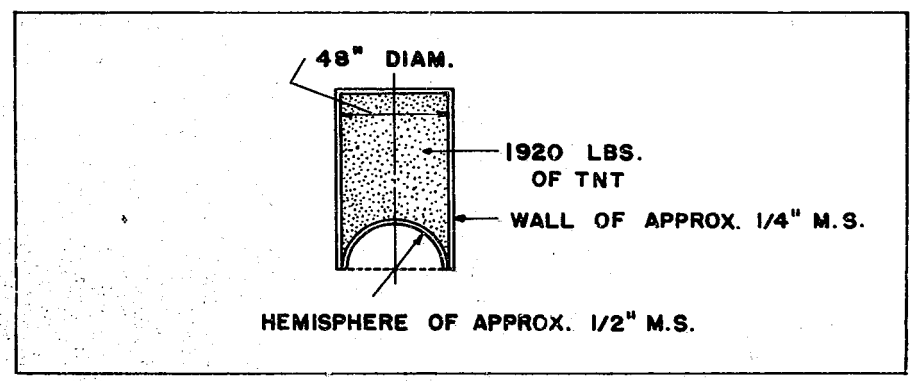
4. Test No. 1 (Figures 67 and 69) consisted of the static detonation of 250kg (550 pounds) of TNT against the port shell in way of 1/2 inch D.S. plate. The charge was cylindrical, 300mm (12 inches) in diameter, with an inverted cone angle of 60° in the nose. It was placed against the shell in such a position that the axis of the charge was at an angle of 45° to the plane of the shell plate. The arrangement is shown below.



5. The damage done is shown in Figure 69. The hole in the shell plate was about five feet square. Fragmentation effects were not impressive. There was little penetration by the blast. A few fragments did penetrate a bulkhead 14 feet inboard of the shell. The fragments were from the shell, rather than from the charge case. The Japanese were disappointed in the results. They attributed the poor results (that is, the small amount of damage) to the angle of inclination and the lack of confinement of the detonation.

6. It is difficult to conceive of a charge so large doing such small damage. Detonation of only a portion of the charge was suggested, but the Kure Design Superintendent believed that a normal high order detonation occurred.

7. Test No. 2 consisted of the static detonation of 900kg (1920 pounds) of TNT about 30 feet forward of the extreme stern. The charge had the following characteristics:



8. The charge was mounted nose down on a scaffold, and 15 feet in the air, above the deck - the distance the flight deck was to have been placed above the hangar deck. The test was to simulate a vertical dive by a KAMIKAZE into the flight deck.

9. Blast damage to the extreme end of the deck was considerable, the after 40 feet being completely blown off (Figure 67). From Plate XI it will be noted that the after end of the hangar deck is only a platform, supported by girders, so this result was not surprising. A few fragments penetrated completely through the hull, emerging from the bottom. Three after compartments in the extreme stern were flooded through these holes. The Japanese again were disappointed in the results. They attributed the comparatively small amount of damage to the lack of confinement of the detonation - it being, in effect, an air detonation 15 feet above the deck.

10. As a result of Tests Nos. 1 and 2, the Japanese naval representatives asked that an "ordinary" 250kg G.P. Bomb (containing about 250 pounds of TNT) be statically detonated in the lower hangar. This was done. The bomb was placed about 30 to 40 feet forward of the forward elevator well on the centerline and on the hangar deck. The blast did considerable damage to the main deck, some 15 feet above the lower hangar deck. The main deck was deflected upward over a length of 80 to 100 feet, with the forward elevator opening being about in the center of the damage. Maximum deflection was about two feet. Figure 68 shows the deflection of the main deck from this blast. A hole about 30 feet in diameter was blown in the lower hangar deck (of 5/16 inch M.S.).

11. Two additional tests were reported which involved much smaller charges. Details of these were unknown to the Design Superintendent. However, they did not cause any damage perceptible above the waterline, and according to the Design Superintendent had no effect on the sinking of ASO.

12. ASO was completely abandoned and neglected after the 28 July raid by Task Force 38. Apparently the Japanese did not inspect her for some months. During the interim the typhoons of September and October occurred. These were the cause of her filling with water and grounding. Although she was a target during the July raids, there was no topside evidence of any damage other than that described. Her sinking was due to the open condition of the main deck. No watertight hatches or doors had been installed, and heavy seas breaking over her undoubtedly caused her to fill with water.

13. The above data are based on the memory of the Design Superintendent of the Kure Navy Yard. He participated in the tests, having been responsible for the preparation of the necessary plans. When the Navy Yard was bombed, the Design Section was destroyed by fire. All records of the tests were reported destroyed in the fire.

All of the following photographs of CV ASO were taken at KURE on 30 November 1945.

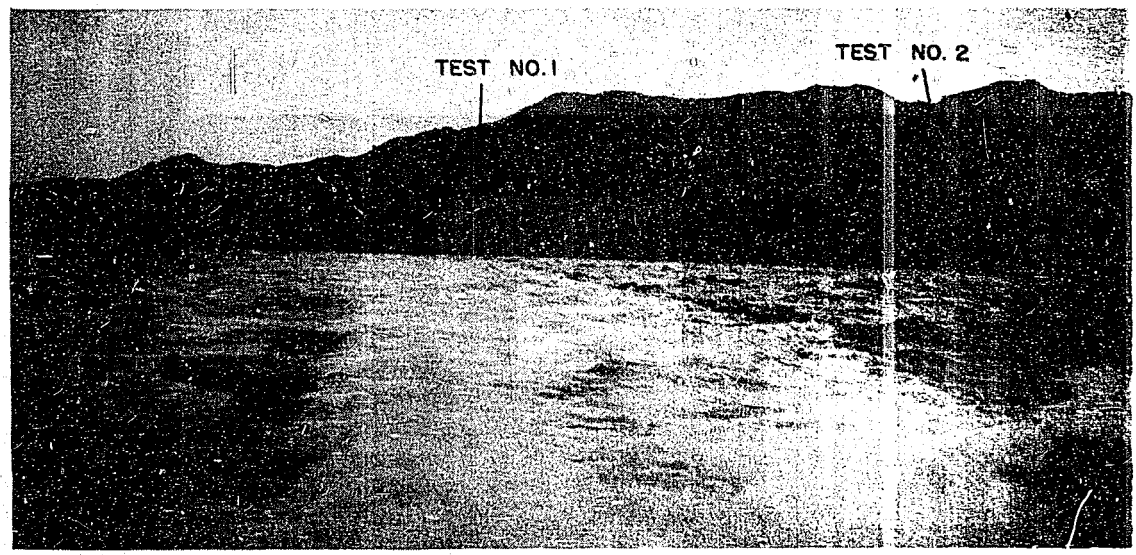


Figure 67
Sunk during early part of October. Completed only to deck of upper hangar. Typhoon was final cause of loss.

Figure 68
Note deflection of main deck from Test No. 3, a 250 kg GP bomb detonated on the lower hangar deck.

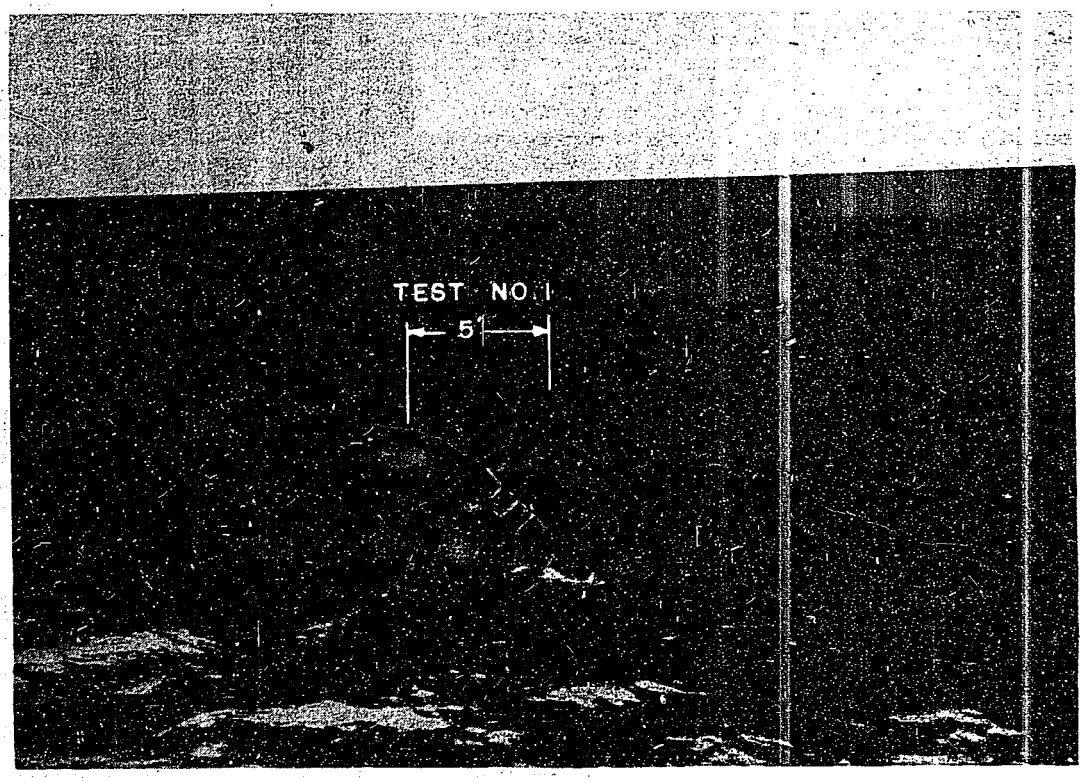


Figure 69

Hole in port shell which Japanese reported caused by 250 kg shaped charge of TNT, inclined to shell at angle of 45°.

Section XIII - SUZUTSUKI (DD) WAR DAMAGE

Plate XII

SUZUTSUKI (DD-110), TERUTSUKI Class

Completed	1942
Length (O.A.)	440 feet
(W.L.)	432 feet
Beam (W.L.)	38 feet
Draft (trial)	13.5 feet
Displacement (full load)	3894 tons
Displacement (trial)	3478 tons
GM	3.5 feet
GZ	2.2 feet
Range of stability	92°

1. SUZUTSUKI was one of the TERUTSUKI Class destroyers - the latest and largest destroyers built by the Japanese. As a matter of interest, the Japanese often referred to this class as "anti-aircraft ships".

2. SUZUTSUKI was completed in 1942. Little is known of her history except that she was badly damaged by a submarine torpedo in December 1942. She was repaired at SASEBO in 1943.

3. The damage described below was received on 7 April 1945 while SUZUTSUKI was a unit of YAMATO's screen in the action south of KYUSHU. She was struck by one bomb and reported damage from two near misses. She proceeded to SASEBO under her own power, although well down by the head. At SASEBO the emergency repairs seen in the photos were accomplished. On 5 May 1945 work was suspended to permit the Navy Yard to concentrate on the production of suicide weapons. She was removed to the small cove shown in Figure 70 and remained hidden there until the U.S. occupation. She was virtually abandoned during the interval.

4. The missile which caused the damage was a bomb. The resulting damage is consistent with that normally expected from a 500-pound G.P. bomb, fuzed to detonate instantaneously. The case was investigated because rumor had it that a mass detonation of the magazines had occurred.

5. It was immediately apparent, however, that a mass detonation had not occurred, inasmuch as the boundaries of the lower magazines were still intact. Nonetheless, the case has some interesting features which have caused it to be described here.

6. The bomb struck the starboard shell in way of No. 2 mount at about the main deck level, and appears to have detonated on impact. The main deck, of 5/16 and 3/8 inch Ducol Steel, was demolished for a length of about 25 feet, inboard almost to the centerline. (In the photos, damaged structure had been trimmed away, thus enlarging the hole). The forecastle deck was blown away over a similar area. The hole in the shell extended downward in a V-shape (similar damage has been observed on U.S. destoryers) to about three feet below the waterline. The first platform, at the waterline, had a hole about eight feet long extending inboard about three feet. The magazines are located below the first platform.

7. SUZUTSUKI had 3.9 inch twin mounts, which used fixed-case ammunition. The projectiles contained 2.1 pounds of TNT and the cartridges contained approximately 15 to 18 pounds* of a propellant similar to British Cordite. When the bomb detonated, a fire was started which must have heated circular foundation for both forward mounts (the trace of the left portion of the circular foundation for No. 2 mounts may be seen in Figure 73). Ready service rounds for both mounts were racked vertically around the interior of these mounts (see Plate XII). They were knocked to the deck, apparently by the shock of the detonation (their securing devices were very flimsy). The propellant charges undoubtedly were ignited, adding to the fire. Their ignition could have been either from fire or from fragments, or both. The projectiles, after being roasted sufficiently, detonated (probably low order) resulting in the holes in the forecastle deck shown in Figure 73. Similar holes were in the main deck inside of the circular foundation for No. 1 mount. Figure 74 shows fragment holes caused by fragments of 3.9 inch projectiles which detonated within the circular foundation. During the fire, some rounds must have behaved like rockets, a phenomenon reported several times in U.S. experience. If this occurred, it probably gave rise to the rumors that a magazine explosion had happened on SUZUTSUKI.

8. This case is markedly similar to certain experiences of U.S. warships, reported in detail in War Damage Reports issued by the Bureau of Ships.

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*Estimated. The propellant had not been weighed at the time of writing The entire round weighed 28.6 pounds.

All of the following photographs of DD SUZUTSUKI were taken at SASEBO on 4 December 1945.

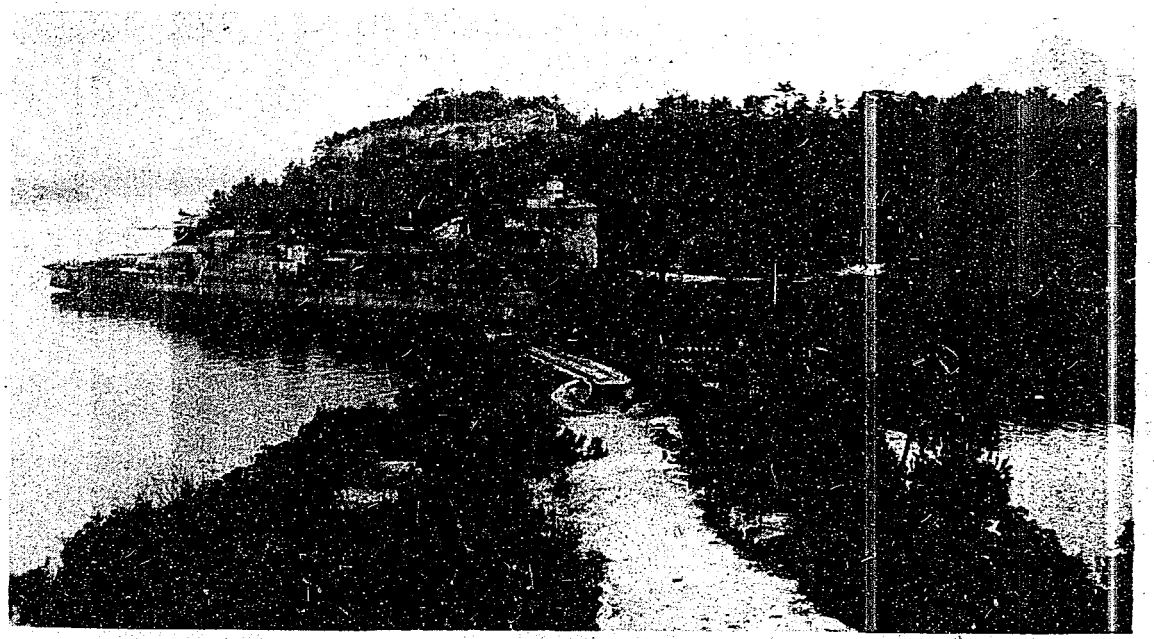

Figure 70
Looking along port side.

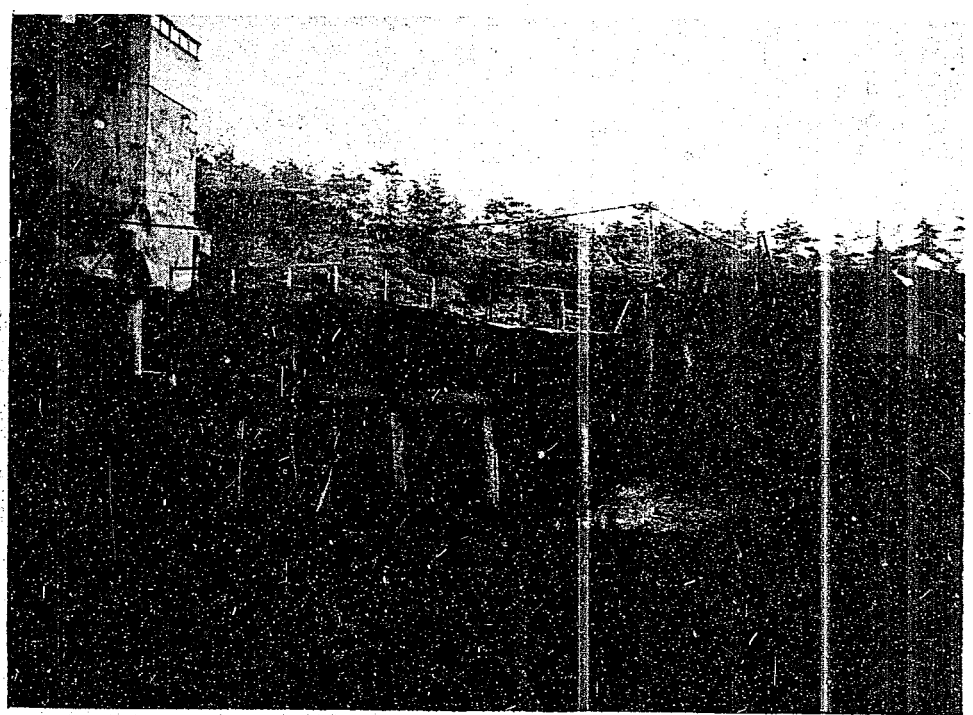

Figure 71
Damage to port bow. No. 1 and No. 2 mounts have been removed.

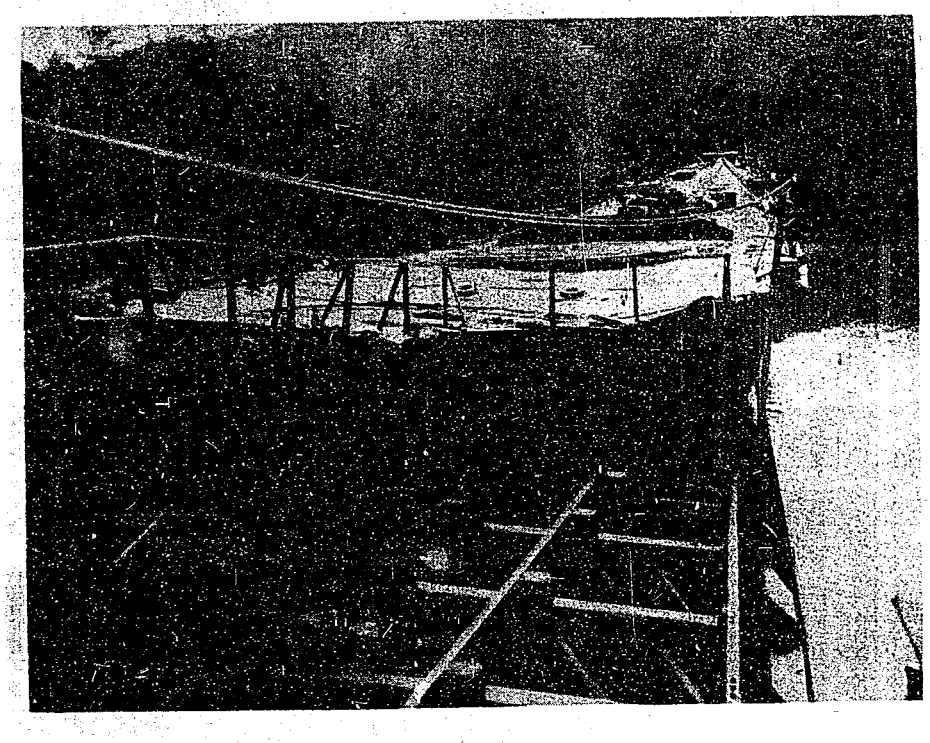

Figure 72
Looking forward. Note method of temporary bracing.

Figure 73
Looking down on forecastle deck from bridge. Note holes in deck caused by low order detonation of 3"9 projectiles.

Figure 74

Looking aft at fragment holes in circular bulkhead foundation for No. 1 mount. Presumably caused by low order detonation of 3"/9 projectiles knocked to deck by initial shock.

Section XIV - CONCLUSION

1. Oddly enough, fire was not a major factor in any of the cases discussed in this report. Evidence of only two serious fires was found. One of these was on HYUGA (BB), which had her forward tower structure completely gutted. The other case was that of SUZUTSUKI (DD), in which ready-service ammunition was consumed. The absence of large-scale conflagrations is of some interest inasmuch as the Japanese installed much material usually considered to be of a combustible nature. For example, all furniture, including office equipment, throughout all ships was constructed of wood. A large portion of the sheathing for insulation purposes in living compartments also was of wood. This material was difficult to ignite, although it was not treated with any material to make it fire-resistant.

2. The primary factor in the conspicuous absence of large-scale conflagrations undoubtedly was the shortage of fuel oil. When tanks were ruptured by bombs, they were usually empty. In addition, the Japanese normally did not carry fuel oil in outboard wing tanks in battleships, carriers, and large cruisers. They did not do this primarily to reduce the fire hazard, but because they considered outboard voids more effective against underwater attack than outboard liquid layers. This practice, however, served to substantially reduce the fire hazard. Finally, the carriers discussed in this report did not have planes, bombs, or aviation gasoline aboard. Thus, the major fire hazards of carriers were lacking.

3. The most noteworthy damage control features provided large Japanese warships were counterflooding valves in outboard voids. These were operated from remote stations on third or second decks, by reach rods equipped with universal joints*. There is almost no evidence of their use in the cases discussed, although OYODO (CL) and AMAGI (CV) capsized. AMAGI (CV) was prematurely abandoned, indicative of extremely poor damage control performance, even by Japanese Standards.

4. Age of the ships was a major factor in some of the cases discussed. This was particularly true in the cases of HARUNA (BB), AOBA (CA), ISE (BB), and HYUGA (BB). These older Japanese ships suffered from the usual defects in watertight integrity found in old ships of all navies. Progressive flooding through non-tight bulkheads, decks, doors, and hatches was an important factor in the sinking of the older ships.

5. Blast damage to the enclosed hangars of KATSURAGI (CV), AMAGI (CV), and RYUHO (CVL) was markedly similar in all three cases. The flimsiness of the flight decks and their supports greatly contributed to the extent of damage. The Japanese practice of enclosing hangars seems of dubious value, particularly on the smaller carriers without armored flight decks. This, combined with the flimsiness of the flight deck, on the carriers described herein, made the hangars peculiarly susceptible to blast. The damage to the flight decks of the three carriers is unique in the annals of war experience, to say the least.

6. The Japanese practice of putting telescope hoods in the roof plates of main battery turrets created a point of major weakness to bombing attack. The bombs which struck the roof plates of two turrets on ISE (BB) made both turrets inoperable, despite the fact that the roof plates were of more than ample thickness (6 inches) to defeat the bombs which struck them.

7. Clear evidence of penetration of an armor deck could be found in only one case, that of Bomb No. 2 which struck TONE (CA). It is empnasized that failure to penetrate was a matter of the short delay of fuzes employed rather than inability of the bombs to penetrate the armor. The horizontal armor on the ships described herein actually was very meager by U.S. standards. Longer delay fuze settings would have resulted in more underwater damage, with consequent more rapid sinking in almost every case.

8. The Japanese practice of installing centerline bulkheads in machinery spaces of all ships larger than destroyers is open to question. Centerline bulkheads undoubtedly were the cause of the capsizing of both OYODO (CL) and AMAGI (CV), despite the theoretically excellent stability characteristics of both ships. The Japanese designers admittedly placed their faith in skillful damage control efforts to overcome the adverse effects of off-center flooding. In these two instances their faith certainly was misplaced.

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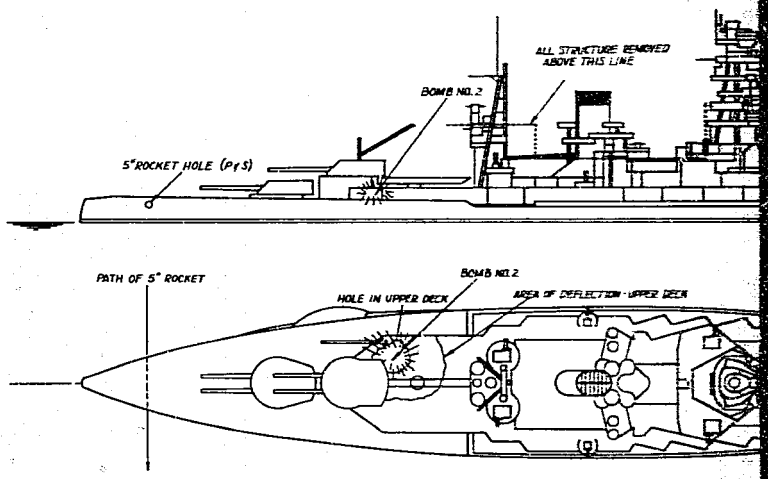
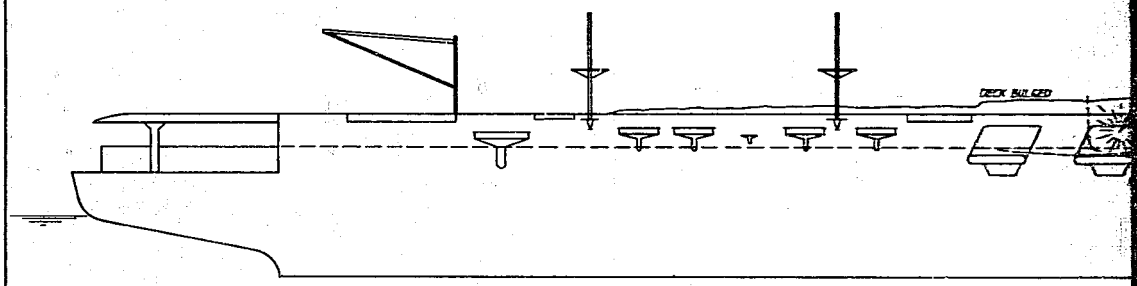
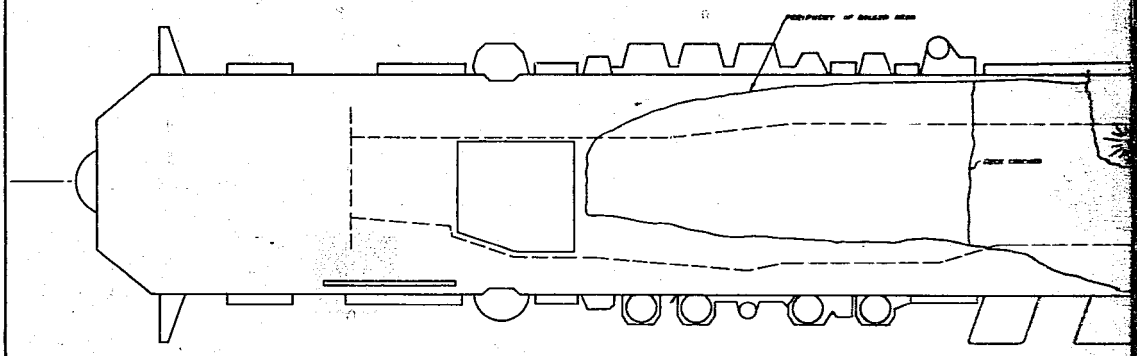
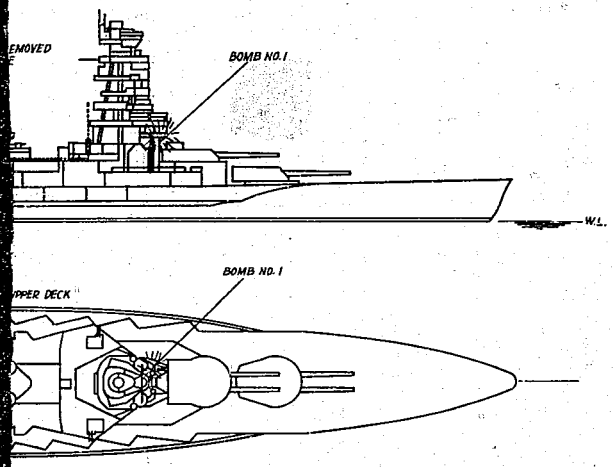
*On some of the latest Japanese ships these valves were reported to have been hydraulically operated.

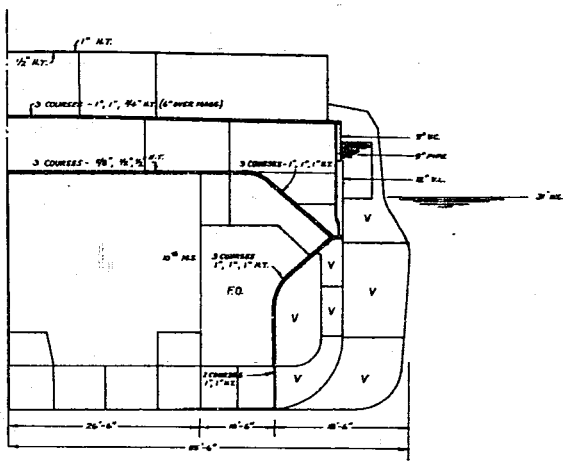

ALL STRUCTURE REMOVED
ABOVE THIS LINE
BOMB NO. 2
5"ROCKET HOLE (P & S)

PATH OF 5" ROCKET
BOMB NO.2
HOLE IN UPPER DECK
AREA OF DEFLECTION - UPPER DECK


DECK BULGED





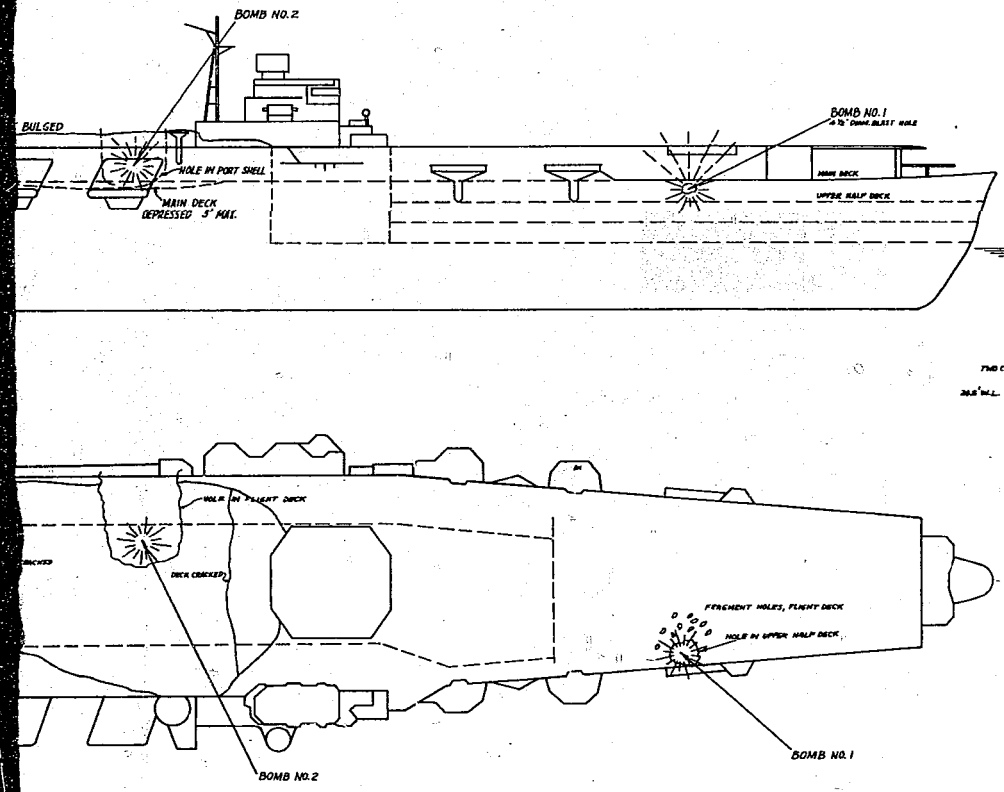


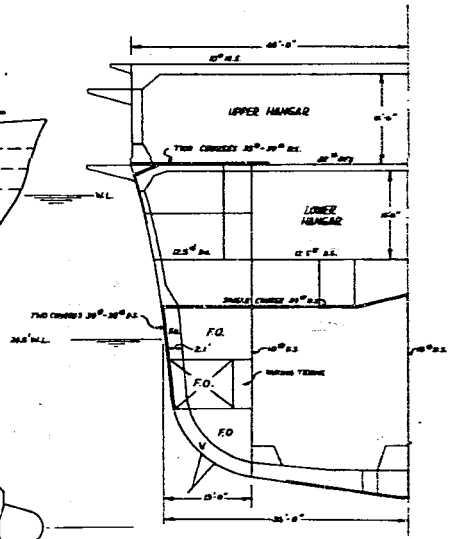
NOT TO SCALE

PLATE I 15 DEC. 1945

NAGATO (BB) DAMAGE

NAV TECH JAP TOKYO APPROVED C.C.N.



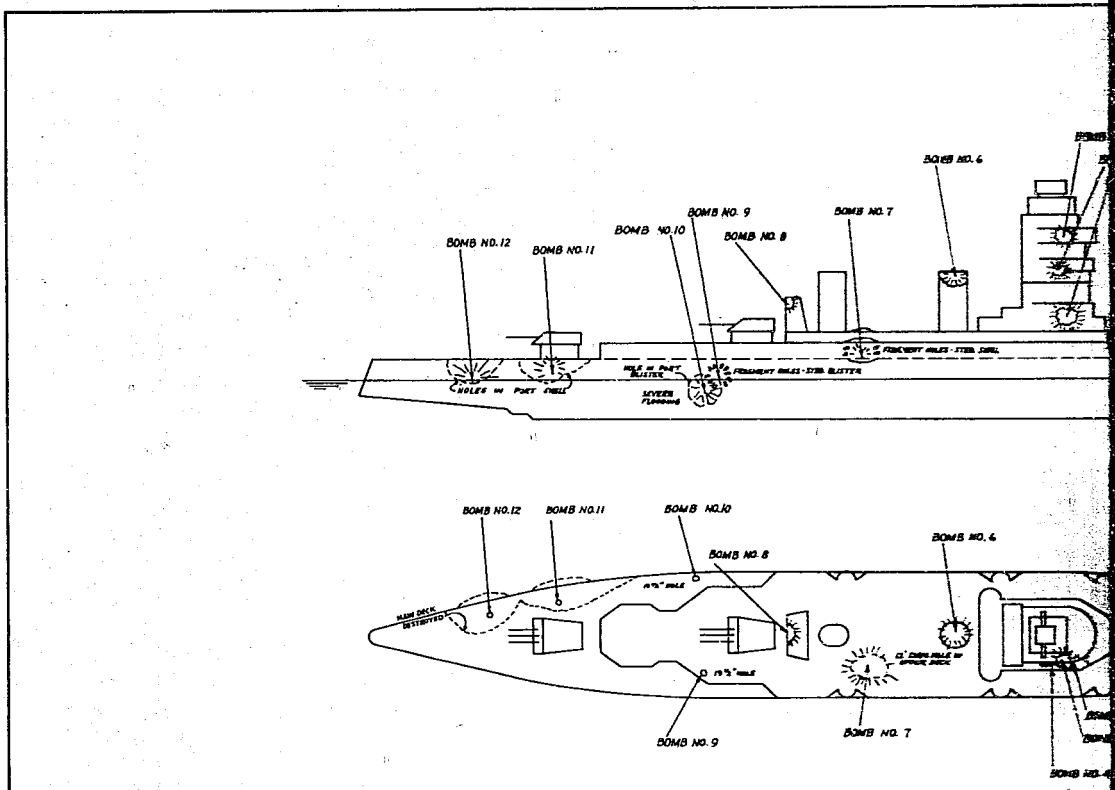


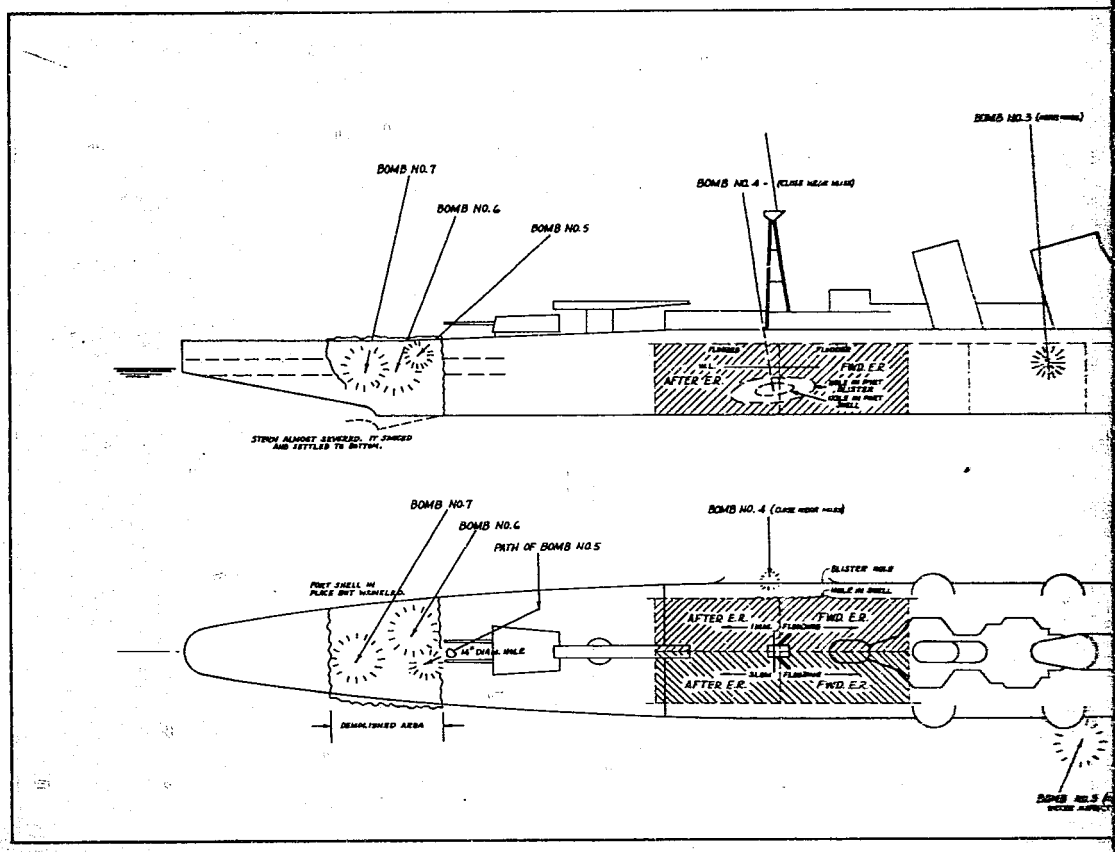
NOT TO SCALE

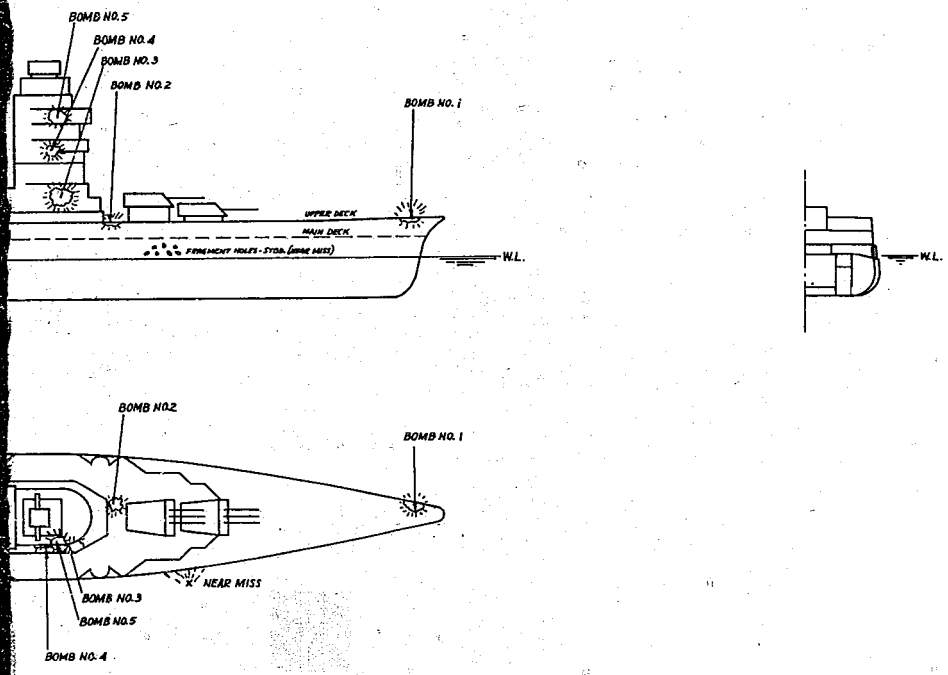
PLATE II 15 DEC. 1945

KATSURAGI (CV) DAMAGE

NAV TECH JAP TOKYO APPROVED C.C.N.


BOMB NO. 6
BOMB NO. 9
BOMB NO. 7
BOMB NO. 10
BOMB NO. 8
BOMB NO. 12
BOMB NO. 11
HOLES IN PORT SHELL
HOLE IN PORT BILGE
LOWER FLOORING
BOMB NO. 12
BOMB NO. 11
BOMB NO. 10
BOMB NO. 8
BOMB NO. 4
MAIN DECK DESTROYED
BOMB NO. 9
BOMB NO. 7


BOMB NO. 7
BOMB NO. 6
BOMB NO. 5
BOMB NO. 4 - (CLOSE NEAR MISS)
FWD. E.R.
AFTER E.R.
HOLE IN PORT BILGE
HOLE IN PORT SHELL
STERN ALMOST SEVERED. IT SINKED AND SETTLED TO BOTTOM.
BOMB NO. 7
BOMB NO. 6
PATH OF BOMB NO. 5
BOMB NO. 4 (CLOSE MISS)
PORT SHELL IN PLACE BUT WRINKLED.
14" DIAM. HOLE
BLISTER HOLE
HOLE IN SHELL
AFTER E.R.
FWD. E.R.
AFTER E.R.
FWD. E.R.
DEMOLITIONED AREA

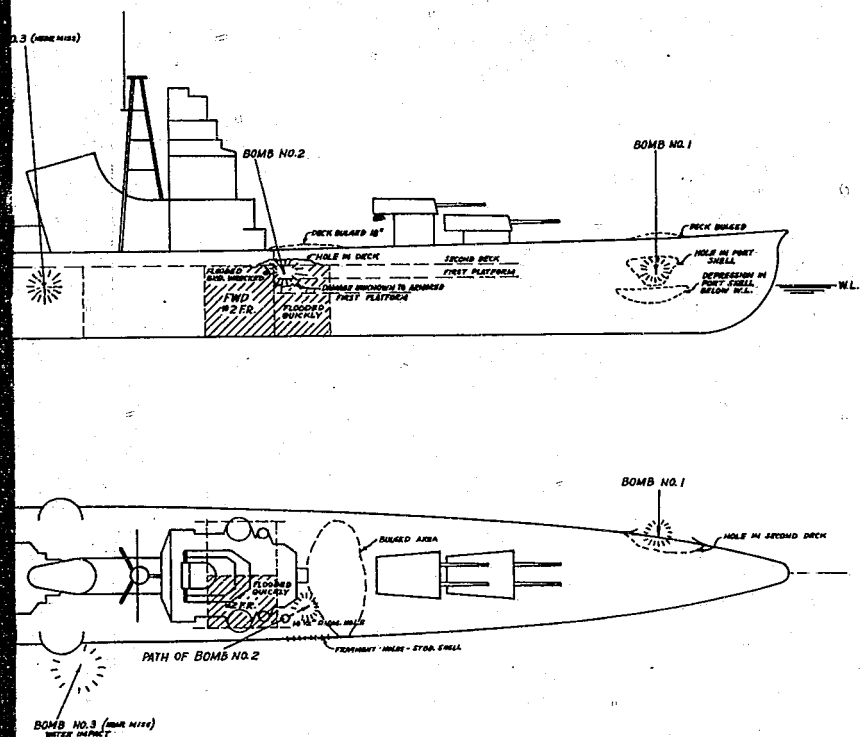


NOT TO SCALE

PLATE III 15 DEC. 1945

HARUNA (BB) DAMAGE

NAV TECH JAP TOKYO APPROVED C.C.N.



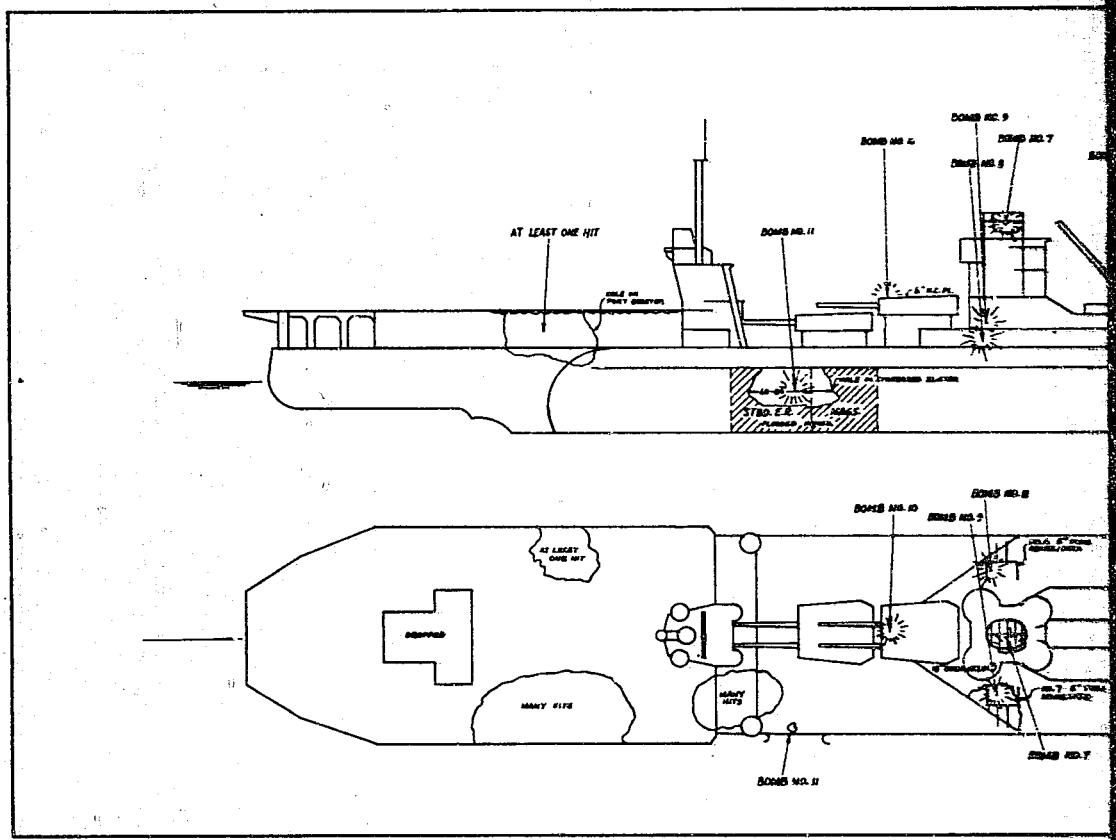
NOTES:
1. MIDSHIP SECTION NOT AVAILABLE
2. REPORTED TO HAVE BEEN DOUBLE HULL WITH KAIBOKAN (?) BLISTER.

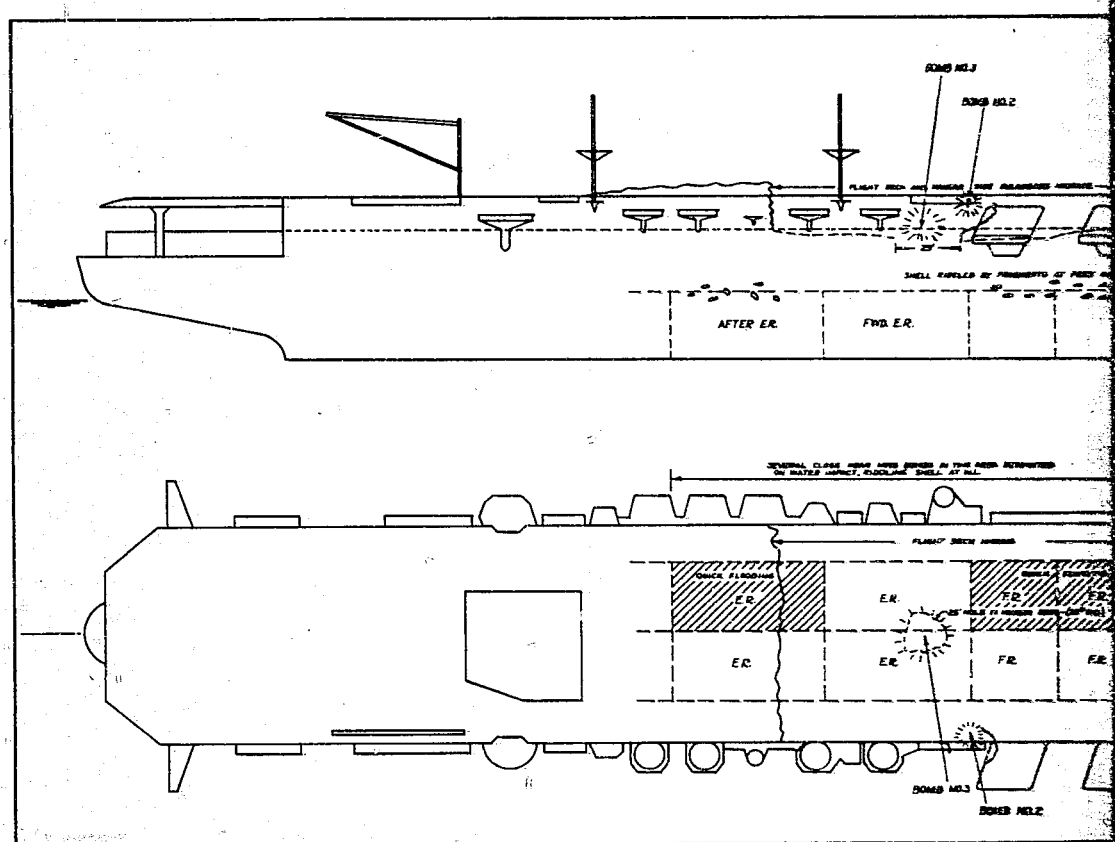
NOT TO SCALE

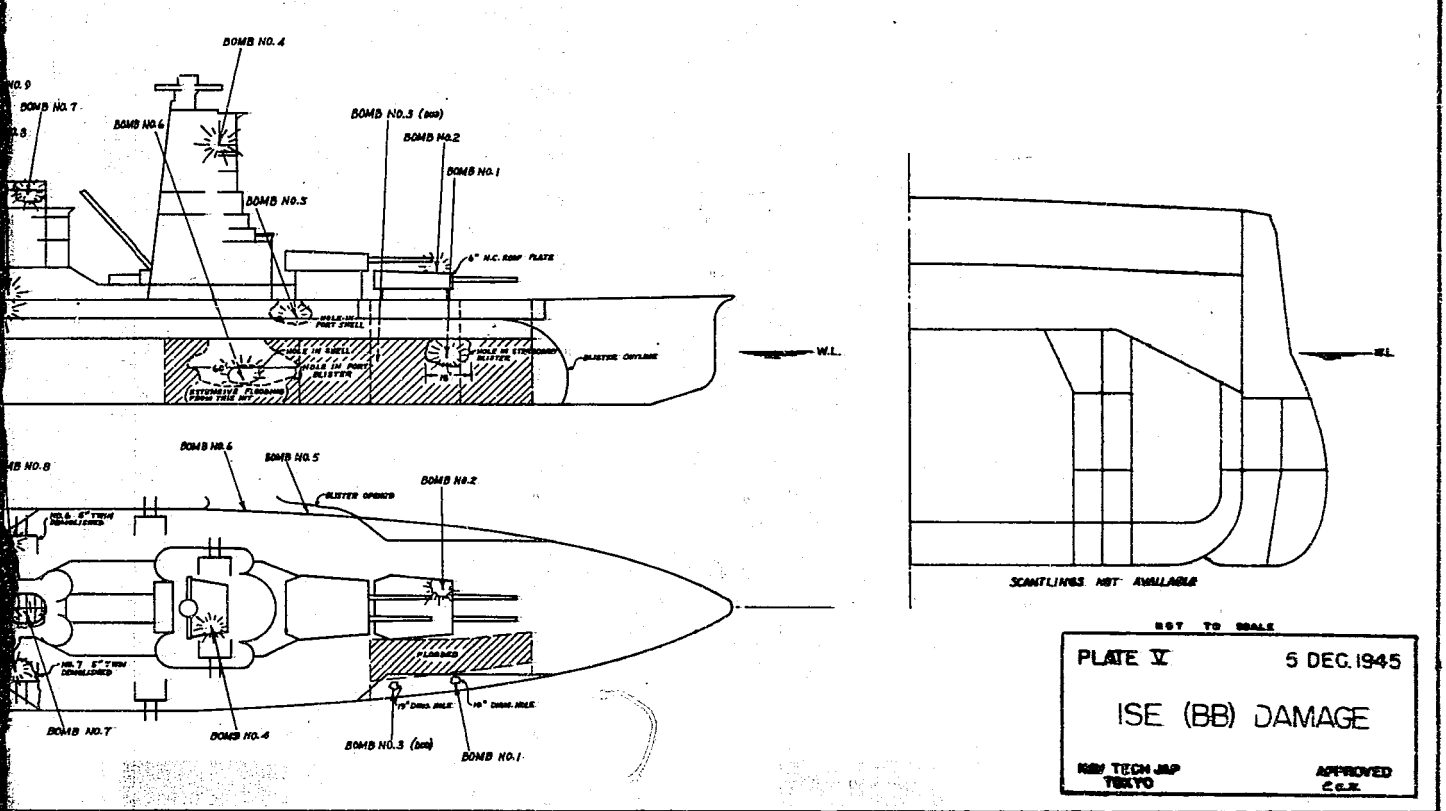
PLATE IV 15 DEC. 1945

AOBA (CA) DAMAGE

NAV TECH JAP TOKYO APPROVED C.C.N.


BOMB NO. 9
BOMB NO. 7
BOMB NO. 6
BOMB NO. 8
AT LEAST ONE HIT
BOMB NO. 11
STBD. E.R.
BOMB NO. 10
BOMB NO. 5
BOMB NO. 8
AT LEAST ONE HIT
MANY HITS
MANY HITS
BOMB NO. 7
BOMB NO. 11


BOMB NO. 3
BOMB NO. 2
AFTER E.R.
FWD. E.R.
E.R.
E.R.
E.R.
E.R.
F.R.
F.R.
BOMB NO. 3
BOMB NO. 2

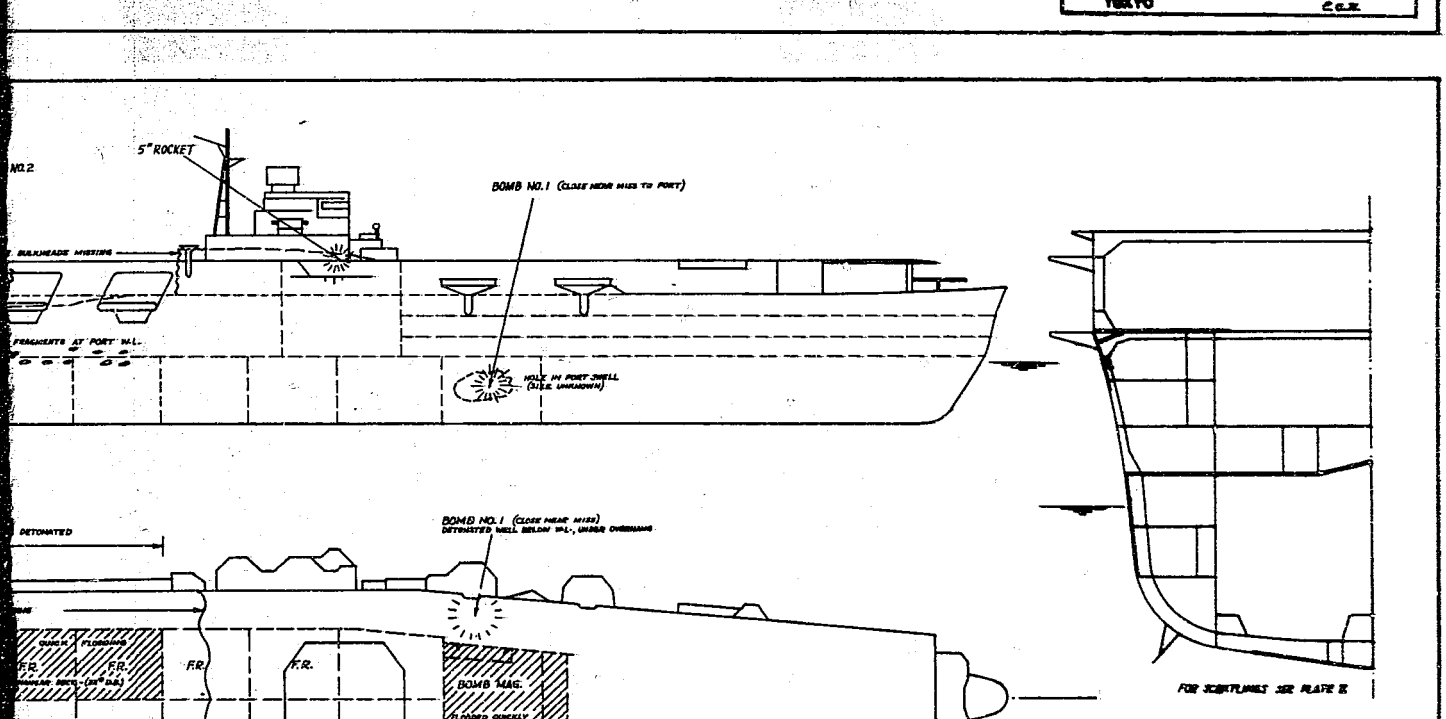


NOT TO SCALE

PLATE V — 5 DEC. 1945

ISE (BB) DAMAGE

NAV TECH JAP TOKYO — APPROVED C.C.N.

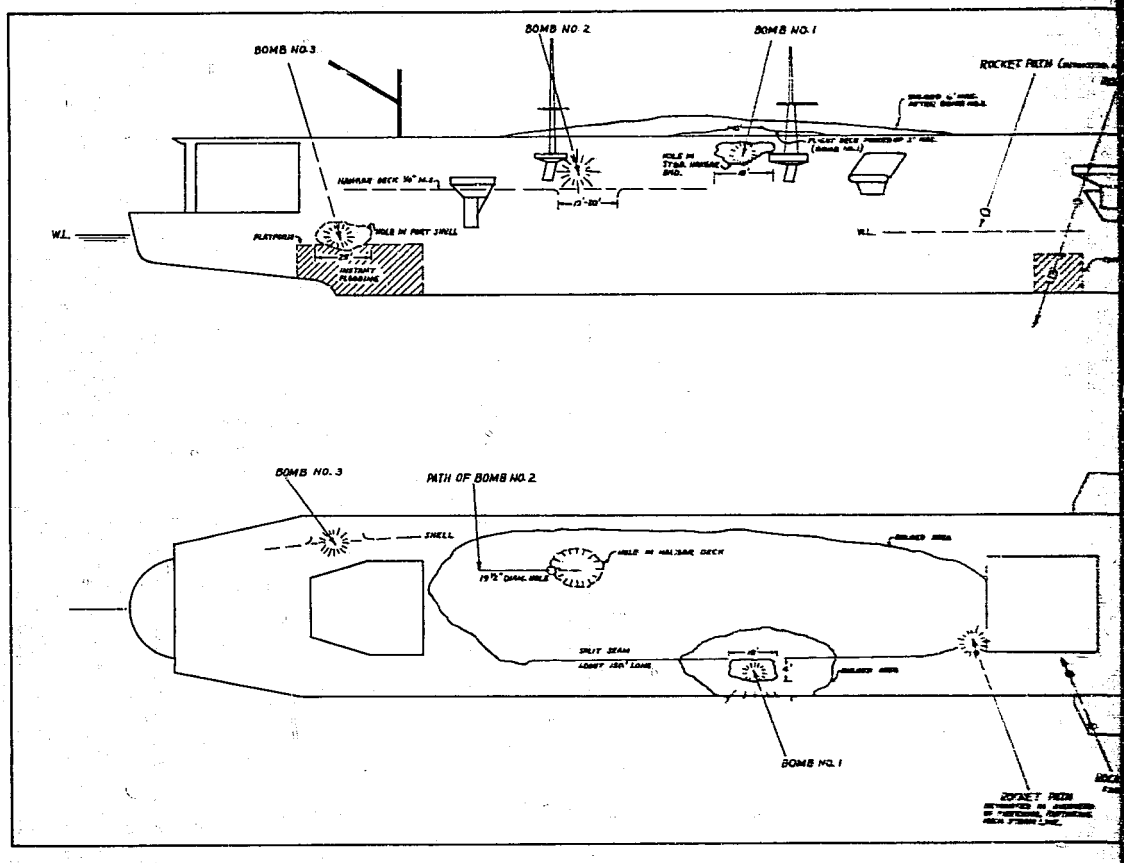


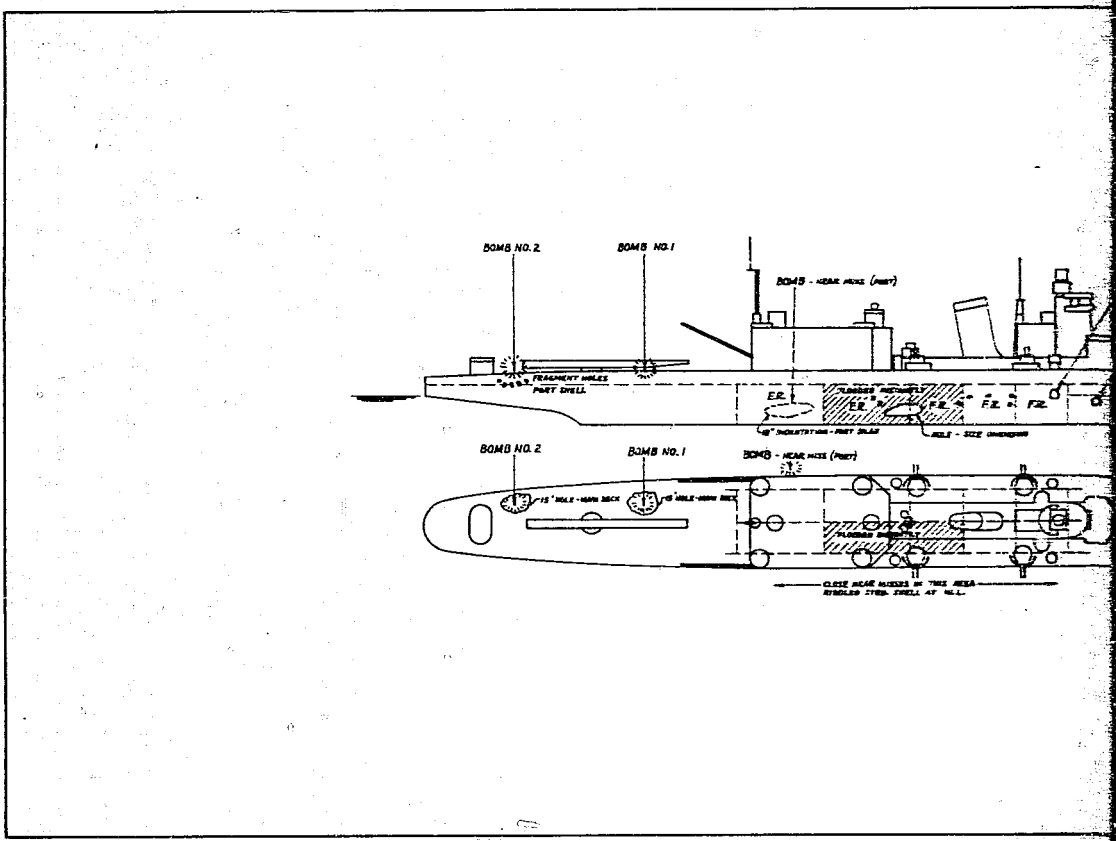
NOT TO SCALE

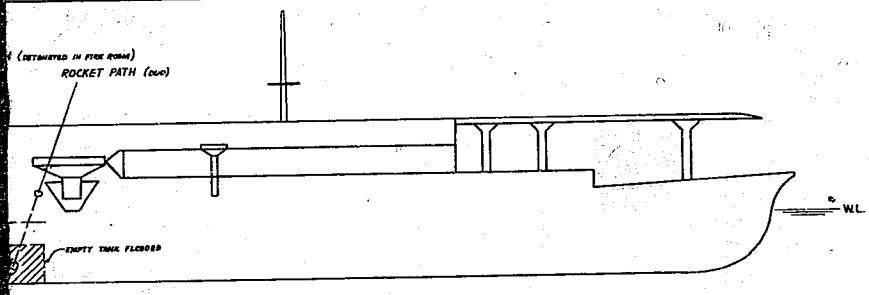
PLATE VI — 15 DEC. 1945

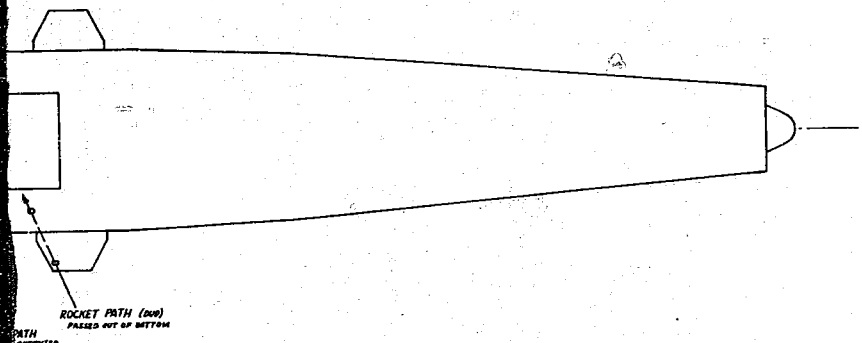
AMAGI (CV) DAMAGE

NAV TECH JAP TOKYO — APPROVED C.C.N.


BOMB NO. 3
BOMB NO. 2
BOMB NO. 1
ROCKET PATH
W.L.
PLATFORM
HOLE IN PORT SHELL
INSTANT FLOODING
HANGAR DECK
W.L.
BOMB NO. 3
PATH OF BOMB NO. 2
SHELL
HOLE IN HANGAR DECK
SPLIT SEAM
BOMB NO. 1
ROCKET PATH


BOMB NO. 2
BOMB NO. 1
BOMB - NEAR MISS (PORT)
FRAGMENT HOLES
PORT SHELL
F.R.
F.R.
F.R.
F.R.
F.R.
BOMB NO. 2
BOMB NO. 1
BOMB - NEAR MISS (PORT)
CLOSE NEAR MISSES IN THIS AREA
RIVETED STEEL SHELL AT W.L.





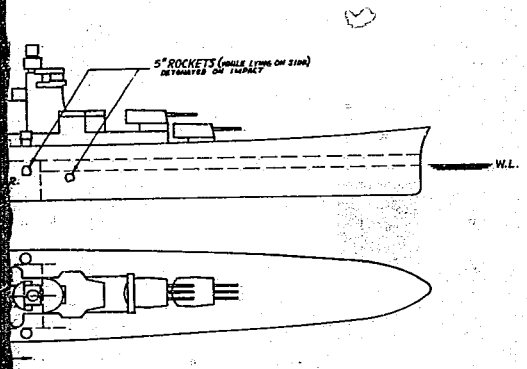
NOTES:
1. MIDSHIP SECTION NOT AVAILABLE.
2. CONVERTED FROM SUBMARINE TENDER AND INITIALLY BUILT TO MERCHANT SHIP STANDARDS.
3. FLIGHT DECK IS STRENGTH DECK.

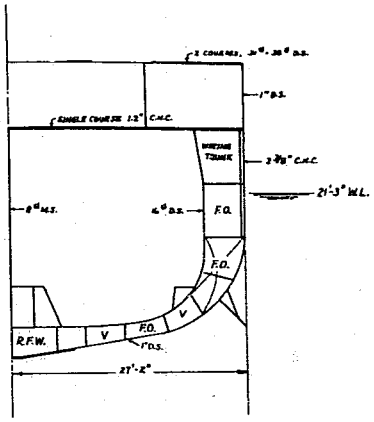
NOT TO SCALE

PLATE VII 15 DEC. 1945

RYUHO (CVL) DAMAGE

NAV TECH JAP TOKYO APPROVED C.C.S.



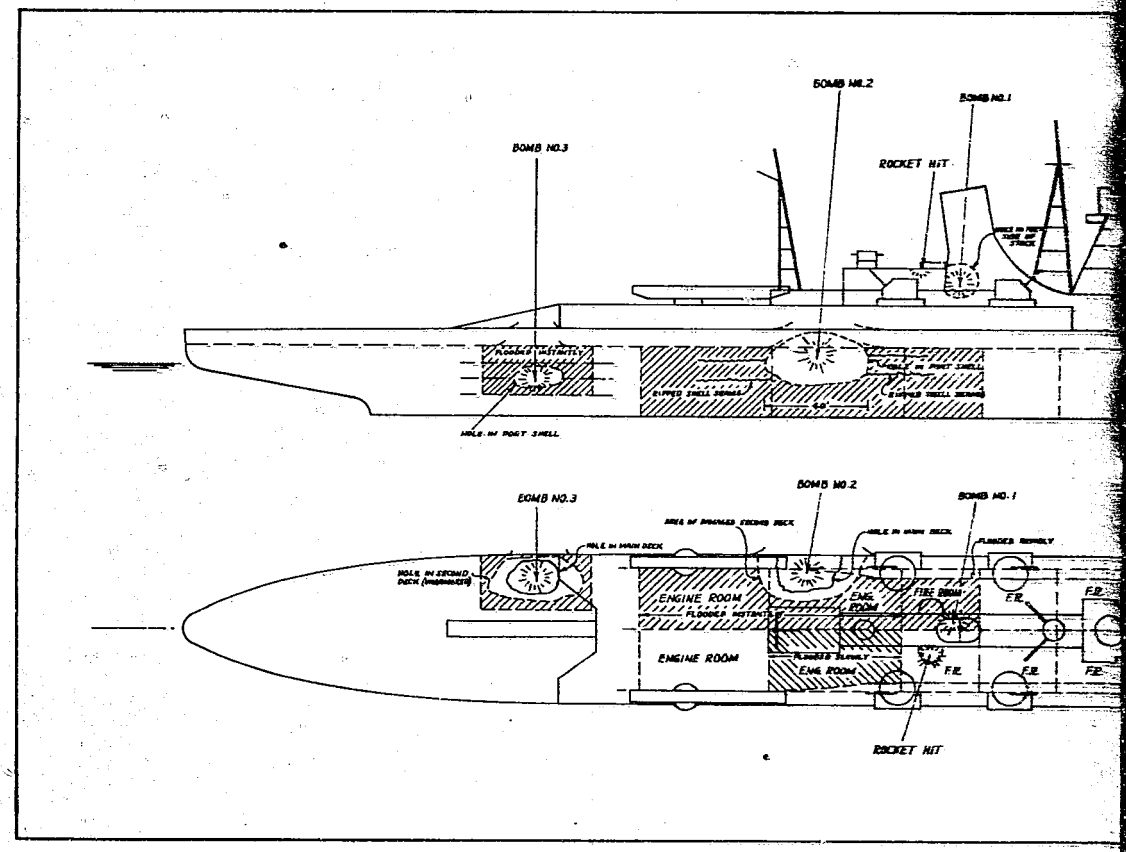


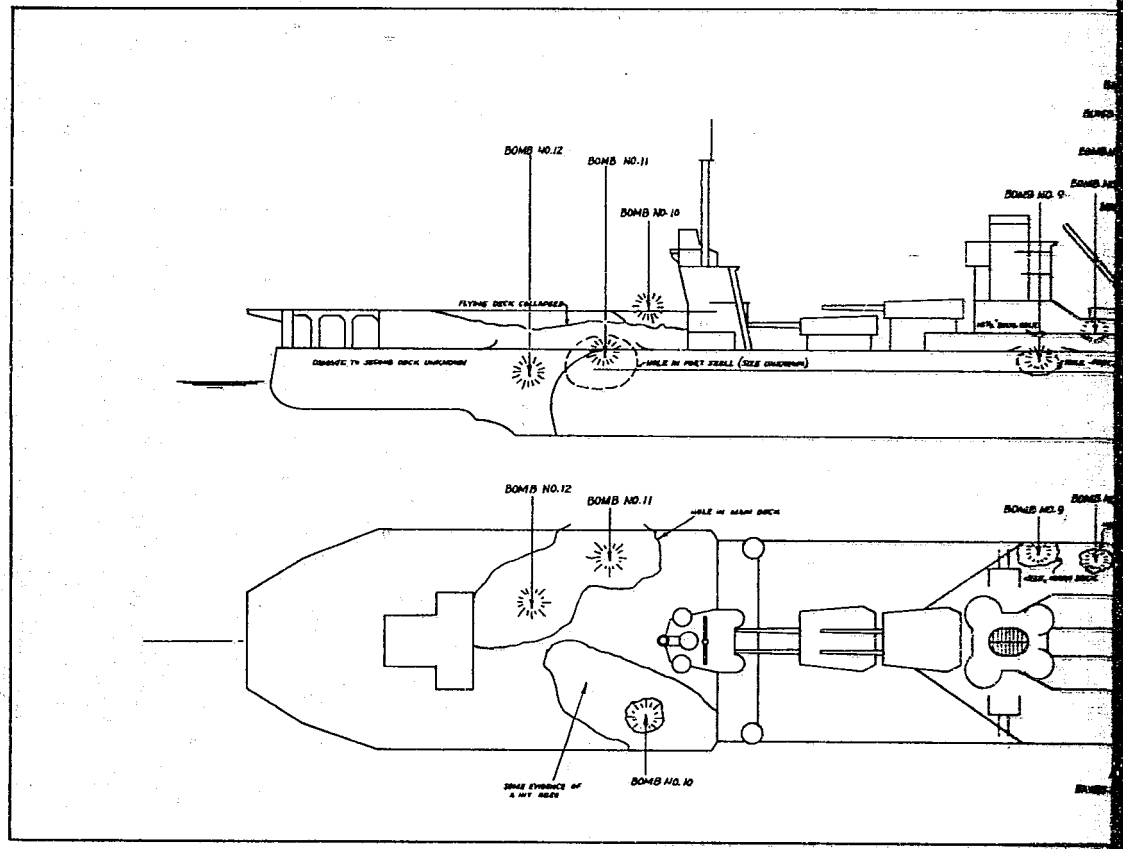
NOT TO SCALE

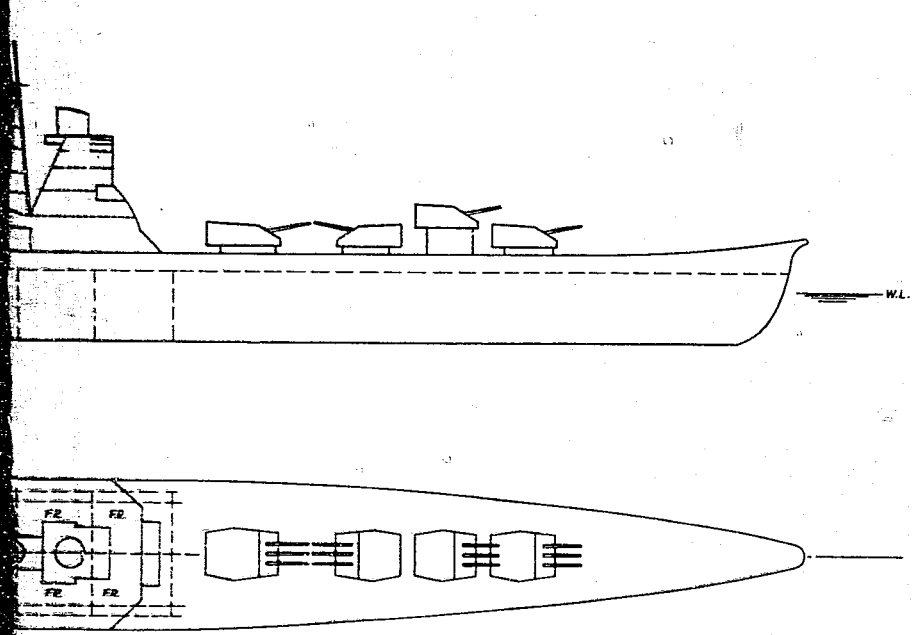
PLATE VIII 15 DEC. 1945

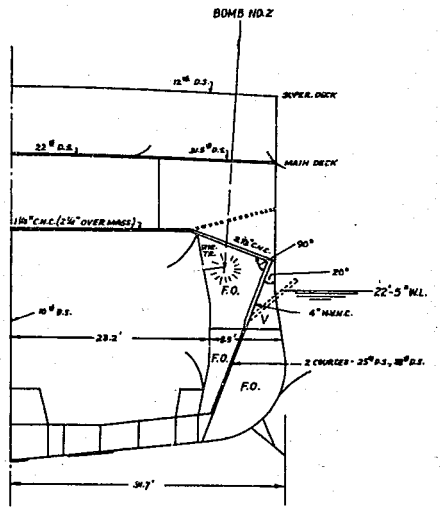
OYODO (CL) DAMAGE

NAV TECH JAP TOKYO APPROVED C.C.S.


BOMB NO.2
BOMB NO.1
BOMB NO.3
ROCKET HIT
HOLE IN PORT SHELL
BOMB NO.3
BOMB NO.2
BOMB NO.1
HOLE IN MAIN DECK
HOLE IN SECOND DECK (approximate)
ENGINE ROOM
ENG. ROOM
FIRE ROOM
F.R.
ENGINE ROOM
ENG. ROOM
F.R.
F.R.
F.R.
ROCKET HIT


BOMB NO.12
BOMB NO.11
BOMB NO.10
BOMB NO. 9
FLYING DECK COLLAPSED
HOLE IN PORT SIDE (SIZE UNKNOWN)
BOMB NO.12
BOMB NO.11
HOLE IN MAIN DECK
BOMB NO.9
BOMB NO. 10





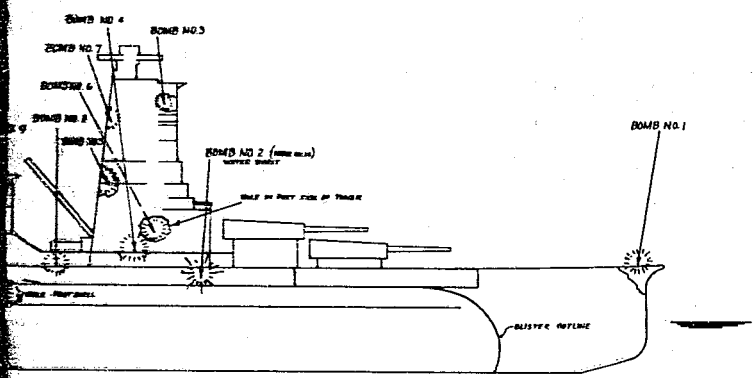
NOT TO SCALE

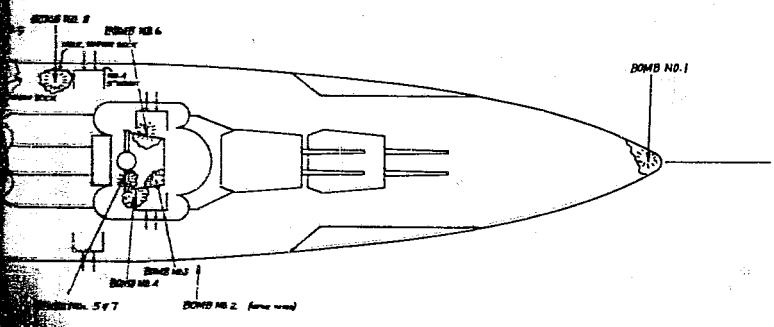
PLATE IX 15 DEC. 1945

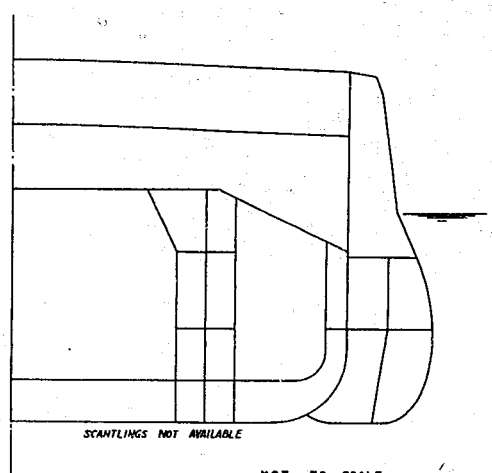
TONE (CA) DAMAGE

NAV TECH JAP TOKYO

APPROVED C.O.H.







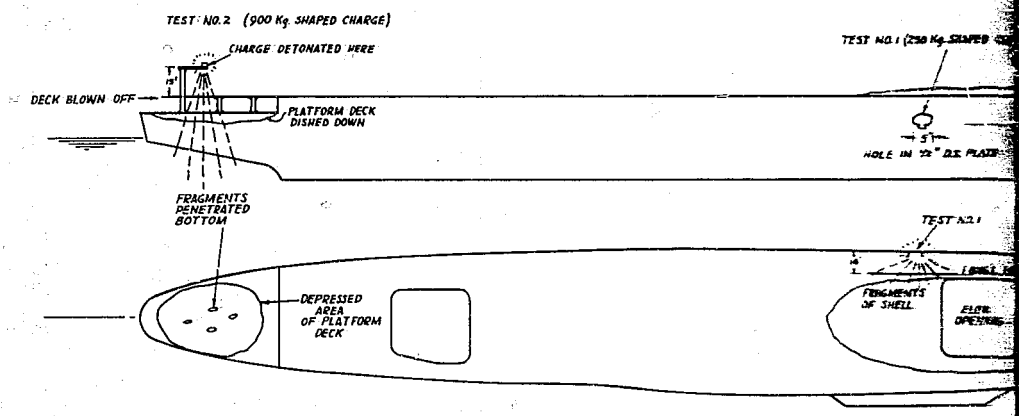
NOT TO SCALE

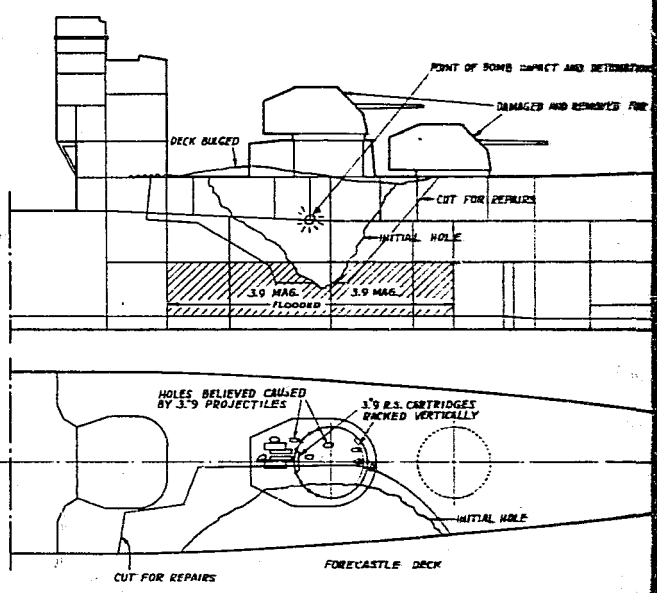
PLATE X 15 DEC. 1945

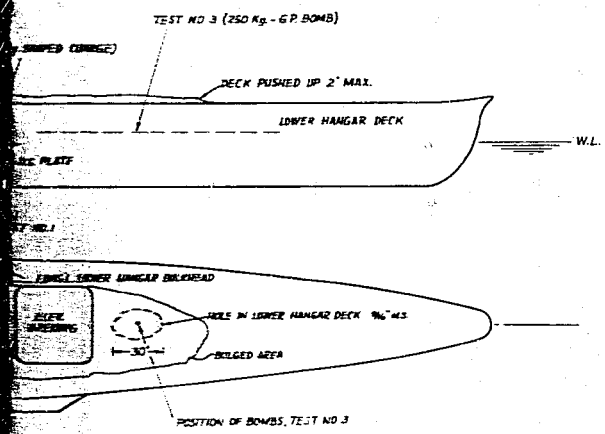
HYUGA (BB) DAMAGE

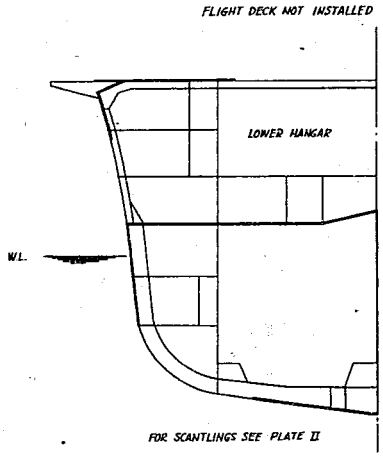
NAV TECH JAP TOKYO

APPROVED C.O.H.


TEST NO.2 (900 Kg. SHAPED CHARGE)
CHARGE DETONATED HERE
DECK BLOWN OFF
PLATFORM DECK DISHED DOWN
FRAGMENTS PENETRATED BOTTOM
DEPRESSED AREA OF PLATFORM DECK
TEST NO.1
FRAGMENTS OF SHELL


DECK BULGED
CUT FOR REPAIRS
INITIAL HOLE
3.9 MAG.
3.9 MAG.
FLOODED
HOLES BELIEVED CAUSED BY 3.9 PROJECTILES
3.9 R.S. CARTRIDGES RACKED VERTICALLY
INITIAL HOLE
CUT FOR REPAIRS
FORECASTLE DECK



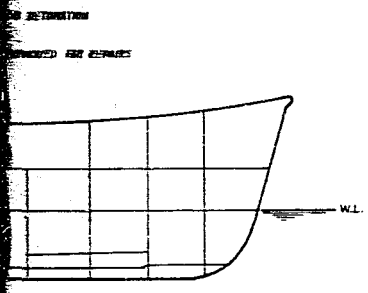


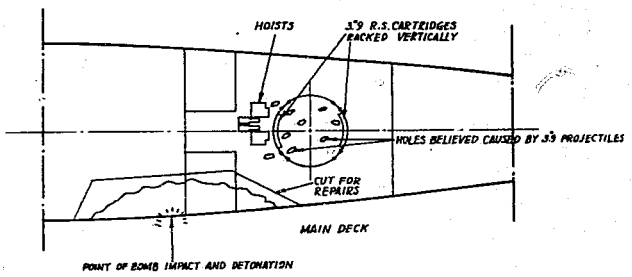
NOT TO SCALE

PLATE XI 15 DEC. 1945

ASO (CV) DAMAGE

NAV TECH JAP TOKYO APPROVED C.C.H.





NOT TO SCALE

PLATE XII 15 DEC. 1945

SUZUTSUKI (DD) DAMAGE

NAV TECH JAP TOKYO APPROVED C.C.H.