

USS NEW ORLEANS (CA32)

Torpedo Damage  
Lunga Point  
30 November 1942

Class.....Heavy Cruiser (CA32)	Length (W.L.).....578'-5/16"
Launched.....12 April 1933	Beam (W.L.).....60'-1-1/8"
Displacement.....10,000 Tons (Standard)	Draft.....23'-9" (Before Damage)

References:

- (a) C.O. NEW ORLEANS ltr. CA32/L11-1/(076) of 9 Dec. 1942.
- (b) C.O. NEW ORLEANS ltr. CA32/L11-1/(08) of 14 Jan. 1943.  
(War Damage Report - Photographs).
- (c) C.O. NEW ORLEANS ltr. CA32/L11-1/(022) of 15 February 1943 (Supplemental War Damage Report).
- (d) NYPS ltr. CA32/L11(M-21) of 8 May 1943 (War Damage Information).

CONTENTS

<u>Section</u>	<u>Page</u>
I - Summary	1
II - Narrative	2
III - Discussion	5
A. Damage Control Measures	5
B. Shock Effect	6
C. Analysis of Damage	6
D. Conclusion	8

LIST OF PHOTOGRAPHS

- | <u>No.</u> | <u>Title</u>  |
|------------|---|
| 1.         | USS NEW ORLEANS - Tulagi, about 3 December, 1942. A port list is indicated although none actually existed. The misleading impression is due to the camera angle.  |
| 2.         | USS NEW ORLEANS - Sydney, Australia, about 26 December, 1942.   |
| 3.         | USS NEW ORLEANS - Sydney, Australia, about 26 December, 1942. Draft forward about 27'-9".   |
| 4.         | USS NEW ORLEANS - Dry dock, Sydney, Australia, 3 February, 1943. Clearing away the wreckage.  |
| 5.         | USS NEW ORLEANS - Dry dock, Sydney, Australia, 3 February, 1943.  |
| 6.         | USS NEW ORLEANS - Dry dock, Sydney, Australia, 3 February 1943. Note remnants of 8" powder tanks.   |
| 7.         | USS NEW ORLEANS - Dry dock, Sydney, Australia, 3 February. Rip in "E" strake, port, at frame 53, caused by bow as it floated aft on port side. Armored bulkhead 53 apparently prevented further damage. |
| 8.         | USS NEW ORLEANS - Sydney, Australia, about 26 December, 1942. Damage to port quarter caused by bow as it floated aft.   |
| 9.         | USS NEW ORLEANS - Dry dock, Sydney, Australia, 3 February, 1943 - Damage to port inboard propeller, caused by bow as it floated aft.  |
| 10.        | USS NEW ORLEANS - Starboard longitudinal bulkhead in turret II lower handling room - looking aft. Note damage to watertight door and powder passing scuttle.  |
| 11.        | USS NEW ORLEANS - Damage to flame-proof doors of 8" powder hoist; lower handling room of turret II.   |
| 12.        | USS NEW ORLEANS - Shoring of bulkhead 48-1/2, second deck. Timber for shores was cut on island of Tulagi.   |
| 13.        | USS NEW ORLEANS - Navy Yard, Puget Sound, 8 April, 1943. Looking aft into A-310-L, first platform, port side. Damage from fire and flooding. Space has been stripped of debris.                         |

14. USS NEW ORLEANS - Starboard after side of bulkhead 40, second platform. Note deflection of bulkhead and stiffeners.
15. USS NEW ORLEANS - Hole in port shell at frame 136, caused by bow striking port quarter as it drifted aft.
16. USS NEW ORLEANS - Condition upon arrival at Navy Yard, Puget Sound.
17. USS NEW ORLEANS - In drydock at Navy Yard, Puget Sound, 8 April, 1943. Stub bow in place.
18. USS NEW ORLEANS - In drydock at Navy Yard, Puget Sound, 10 April, 1943. Stub bow partially removed.
19. Prefabricated bow for USS NEW ORLEANS in last stages of assembly on 2 April, 1943.
20. USS NEW ORLEANS after completion of repairs and alterations. Navy Yard, Puget Sound about 1 August, 1943.

#### LIST OF PLATES

<u>Plate</u>	<u>Title</u>
I	Damage, Fire and Flooding
II	Arrangement of Forward Magazines

## SECTION I - SUMMARY

1. During the night of 30 November, 1942, NEW ORLEANS was a unit of a task force which engaged a Japanese force in the action subsequently named the Battle of Lunga Point. NEW ORLEANS, firing with her main battery and steaming at 20 knots, had just started to swing to the right to avoid MINNEAPOLIS when a torpedo struck the port bow in way of turret I and detonated.
2. The torpedo detonation was followed immediately by a second and much heavier detonation. As a result, the bow, including turret I, was severed almost completely between turrets I and II. It swung out to port and tore loose, probably due to the starboard swing of the ship. It then floated aft and banged against the port side. Holes were torn in the shell at frames 53, 130 and 136 and the port inboard propeller was wrecked.
3. NEW ORLEANS proceeded, with some difficulty, to Tulagi. She remained there until 12 December with the crew making temporary repairs, clearing away wreckage and shoring bulkheads. She then sailed for Sydney, Australia, arriving on 24 December. In Sydney a temporary stub bow was fitted in dry dock. NEW ORLEANS left Sydney on 7 March and arrived at Puget Sound on 3 April after stops at Pago Pago and Pearl Harbor. All repairs have been completed together with many alterations, and NEW ORLEANS is now back in service.
4. The Bureau of Ships made a careful study of the case based largely on the reports submitted by the Commanding Officer and information obtained by an officer from the Bureau who inspected the ship at Puget Sound. It was established that the bomb and mine magazine, A-502-1/8-M, contained the 160 pound demolition charge and forty-nine 100-pound bombs and that small arms magazine A-502-M contained five 325-pound depth bombs. These magazines extended to the shell with no armor or liquid protection. The torpedo detonated in way of or adjacent to these magazines. As the result of these facts, plus other evidence discussed in more detail later in this report, this Bureau is of the opinion that the severe damage to NEW ORLEANS was the result of the combined effects of the torpedo detonation and a mass detonation of aircraft bombs and demolition charge caused by fragments produced by the torpedo. The Bureau of Ordnance concurs with this opinion.
5. Because of the serious hazard involved, the Bureau investigated the location of magazines for all heavy and light cruisers and means for improving their protection where this was required. The Bureau's experience with underwater explosion tests and in analysis of war damage indicates that a liquid layer of about four feet thickness, or an internal armored bulkhead, is sufficient to stop fragments resulting from a torpedo detonation or at least to reduce their velocity to a relatively harmless value. Where required, action has been taken to provide protection for all magazines of cruisers, either by relocating the magazines behind armor or liquid or else by creating a liquid layer outboard of the magazine.

SECTION II - NARRATIVE

(All photos - Plate I)

6. This report is based on the information contained in the references plus that obtained by an officer from the Bureau who inspected NEW ORLEANS shortly after arrival at Puget Sound. Some of the photographs were supplied by the Commanding Officer, others by the Intelligence Center, Pacific Ocean Areas and the remainder by the Navy Yard, Puget Sound. The plates were prepared by the Bureau.

7. On 30 November, 1942, a U.S. task force engaged a Japanese force off the northern coast of Guadalcanal. The U.S. force was composed of four heavy cruisers, one light cruiser and six destroyers. The cruisers were in column, spaced 1000 yards, with MINNEAPOLIS in the lead followed by NEW ORLEANS. Four of the destroyers were in column some 4000 yards ahead and slightly on the engaged (port) bow of MINNEAPOLIS. The remaining two destroyers were in column astern of the cruiser column. Force speed was 20 knots.

8. The night was intensely dark with no moon. The sky was completely covered by a heavy overcast of clouds at a ceiling of 3000 feet. Surface visibility was good. A light southeast breeze scarcely ruffled the surface of the water.

9. The best information indicates that the Japanese force consisted of eight destroyers of which six were acting as transports. Large and midget submarines are also believed to have been in the area.

10. The U.S. formation was steaming on course 300° true when action was opened by the van destroyers with a torpedo attack at about 2318. Two minutes later the MINNEAPOLIS commenced firing with her main battery. NEW ORLEANS opened fire with her main battery at 2321. The target bore about 280° relative and was about 8700 yards distant. Although the reports of MINNEAPOLIS and NEW ORLEANS disagree as to the times of the subsequent events, there is complete agreement as to the sequence. The following seems to be the most reasonable reconstruction. Some three minutes after NEW ORLEANS opened fire, MINNEAPOLIS\* was struck by two torpedoes on the port side. The latter almost instantly caught fire and burned fiercely but briefly. This was noted immediately on NEW ORLEANS and full right rudder was ordered so that MINNEAPOLIS would be passed to the latter's starboard. When the rudder was 15° right and the ship had started swinging and was some 10° to the right of the original course NEW ORLEANS was struck on the port bow, forward of frame 36, by a fairly deep running torpedo. The time of the hit, recorded by NEW ORLEANS was three minutes and 20 seconds after NEW ORLEANS had commenced firing. Although the source of the torpedoes is not definitely known, scrutiny of the action reports of the ships involved and of the various analyses prepared by the forces afloat indicates that destroyers probably fired them even though submarines were believed to be present. It appears that the torpedoes which struck MINNEAPOLIS and NEW ORLEANS were fired in the same salvo. Further, the one which struck NEW ORLEANS undoubtedly was in the water before NEW ORLEANS commenced firing. These considerations tend to substantiate that destroyers were the source of the enemy torpedoes.

\* Buships War Damage Report No. 36.

11. The torpedo detonation was followed within a few seconds by a second heavier detonation. The combined effects of both detonations were to sever the bow almost completely in the general vicinity of frame 35, just forward of turret II. The hard right turn which NEW ORLEANS was executing at the time the torpedo struck appears to have completed the rupture of all structure between turrets I and II (plate I and photos 1 to 6 inclusive show the fracture). The bow tore loose and was observed floating aft on the port side in a vertical position with the stem and some 15 feet of the forward structure above water and in an intact condition. As it passed aft along the port side it tore a hole in the shell at frame 53 well below the armor belt (photo 7) and then bumped into the shell on the port quarter punching holes and denting the side at frames 130 and 136 above the waterline (photo 8). The port inboard propeller was damaged at the same time (photo 9). The bow was observed to sink off the port quarter.

12. The detonations were accompanied by a large column of flame which was estimated to have been twice as high as the foremast. Some observers reported that the flame was dotted with incandescent particles while others stated that it was clear and bright. Unburned powder grains, small arms cartridges and 20mm rounds were reported to have been found scattered over the topside the next morning. Flame was thought to have entered turret II through the range finder ports. A fire from an unknown origin occurred in the gun chamber. There was little evidence of fire on the shell deck, although projectiles were scorched. There was definite evidence of fire in the upper handling room inasmuch as paint was brown and blistered. Bags of powder in all upper hoists and in the after car of the lower hoists were scorched. The evidence thus points to a flash fire throughout some of the spaces of turret II. Attempts to sprinkle the turret failed because of ruptured pipe lines. All personnel of turret II, including the magazines and the handling rooms, were killed either by the blast or the flash fire. The fire appears to have been almost immediately extinguished by the large column of water thrown high in the air by the detonations and which descended on and engulfed the forward portion of the vessel. There was only one burn casualty among survivors.

13. The shock of the detonations put the following equipment out of order: the forward FC radar, the TBS radio equipment, the forward master gyro and the plotting room stable vertical element. The number one main reduction gear was reported to have jumped about four inches but no misalignment developed. Some flexural vibration was reported with a maximum vertical amplitude of perhaps three to six inches at frame 95.

14. When the bow struck No. 3 propeller the impact stopped the shaft immediately. Before the throttle could be closed, however, the shaft resumed revolving and apparently operated normally at slow speeds as the throttle was closed. The shaft was locked for the subsequent journey to Sydney where the propeller was removed. At Puget Sound the shaft was pulled and the turbine and reduction gear casings lifted. No misalignment was found and only a slight discoloration of the gear teeth was noted. This was probably caused by overheating resulting from abnormally high pressures on the teeth at the moment of impact. Vacuum in No. 1 main condenser dropped to some 18 or 20 inches. Boilers salted up with salinity readings of about 300 grains. At Tulagi it was found that the main condenser header had become clogged by debris from the bow. A few condenser tubes had been ruptured

by debris and it was necessary to plug these. When this was done no further contamination of feed water occurred. Possibly the most serious engineering casualty occurred when the evaporator room flooded to a depth of two feet. The pump motors were drowned out. This prevented operation of the evaporators until these motors were rewound by the ship's force at Tulagi. During the interim feed and potable water were very short and there was no means of replenishing that used from the reserve feed tanks. Potable water tanks had, of course, been lost with the bow.

15. Bulkhead 36 remained reasonably close to its original location, but it was badly warped and torn. There was free flooding through this bulkhead throughout its vertical extent via tears in the plating and the doors, all of which were badly damaged or blown away. The waterline after damage approached 40 feet at frame 33. Water about four feet deep (to the level of the waterline) on the main deck extended back through the wardroom country to bulkhead 53. There are no watertight bulkheads on the main deck and it is surprising that flooding stopped at gastight bulkhead 53. Probably the short time the main deck was underwater prevented further infiltration. On the second deck bulkhead 40 was badly damaged and A-207-L flooded freely. Bulkhead 48-1/2 on the second deck was almost undamaged but the watertight door in it was left open after the escape of personnel and A-208-L flooded. When the door was closed by a diver the space was unwatered in 45 minutes. On the first platform bulkhead 40 was badly damaged and A-310-L flooded freely. Bulkhead 48, although badly warped, remained fairly tight and the evaporator room flooded only to a depth of two feet via the door in the bulkhead which had been distorted to the extent that the watertight seal was broken. Outboard, on both sides of the evaporator room, the brig spaces and radio III flooded back to bulkhead 53 because of open or damaged doors in bulkhead 48. These spaces were unwatered with little difficulty using submersible pumps once the doors were closed. Bulkhead 48 was subsequently shored and made completely tight. On the second platform free flooding occurred to bulkhead 45. The latter was warped but relatively intact. However, water entered A-421-M, between bulkheads 45 and 47-1/2 via the ammunition scuttles. About two feet of water leaked into central station, frames 47-1/2 to 53, via the escape scuttle to A-421-M in bulkhead 47-1/2. Fumes in central station caused four casualties. The fumes came through the scuttle from A-421-M, probably emanating from the flash fire in the lower spaces of turret II.

16. Plate I and photos 1 and 3 to 6 indicate the details of the damage at the break. It will be noted that the keel and bottom structure were relatively intact forward to frame 26. Until divers at Tulagi cut away the wreckage some 20 to 30 feet projected downward with the knuckle at frame 26. Port and starboard shell strakes above the bilge keel were peeled out and aft with the port extension being some 40 to 50 feet long. It also will be noted from photo 4 that the second platform between frames 32 and 36, A-411-M, was relatively complete. Actually the shell plating and framing back to about frame 50 had to be renewed although the temporary bow fitted at Sydney was attached at about frame 36.

17. There were no machinery derangements or power failures which would interrupt damage control efforts. Bulkhead 53 was shored on the second deck and also in No. 1 fireroom. Trim was corrected by emptying the wing fuel tanks abreast the firerooms. Fire and flushing pumps were kept on the fire main. The three remaining submersible pumps were put into A-208-L and, en route to Tulagi,

the door in bulkhead 48-1/2 to A-207-L was closed by a diver and A-208-L was pumped down to the 5" ammunition passing scuttles in bulkhead 48-1/2. The scuttles were found open (the 5" battery was in a condition of readiness to open fire at the time of damage) and were closed. A-208-L was then quickly dried.

18. NEW ORLEANS proceeded to Tulagi with difficulty because of the wreckage forward and the trim by the bow. Speed en route was only about 2 knots. MAURY (DD401) secured alongside at 0300 and assisted in holding the head up while underway and later in anchoring at Tulagi. The distance fortunately was not great and NEW ORLEANS arrived early in the morning. At Tulagi the crew camouflaged the ship and proceeded with clearing away the wreckage and making minor repairs. The evaporator room and central station were cleared of water. The engineering repairs described in paragraph 14 were made. Trees were cut for shores and bulkheads 47-1/2 on the second platform, 48 on the first platform and 48-1/2 on the second deck (photo 12) were thoroughly shored and reinforced. On 7 December repair personnel from VESTAL arrived to assist. On 10 December MORTOLAN helped and on 11 December NAVAJO furnished underwater cutting equipment and personnel. On 12 December NEW ORLEANS sailed for Sydney, Australia. On departure from Tulagi the underwater wreckage had been largely cleared away, forwardmost bulkheads were tight and shored, and the ship had been cleaned. Drafts were 27 feet 9 inches forward and 23 feet 1 inch aft. NEW ORLEANS was able to steam at about eight knots. Some difficulty was encountered with head winds and seas during the passage, but no serious trouble resulted.

19. NEW ORLEANS arrived at Cockatoo Island, Sydney Harbor on 24 December. She was placed in dry dock on 3 February where photos 3 to 7 and 9 were taken. The temporary stub bow shown in photos 16 and 17 was fitted. It was during this period that five 100-pound bombs were found in A-504-F. She was undocked on 5 March and departed Sydney on 7 March for Puget Sound.

20. The passage back was uneventful. A two day stop was made at Pago Pago and three days were spent at Pearl Harbor. NEW ORLEANS arrived at the Navy Yard, Puget Sound on 3 April. Average speed during the long passage was about 13.5 knots.

21. As shown in photo 19 the new bow for NEW ORLEANS was practically complete upon arrival. She was placed in dry dock on 8 April where the stub bow was removed and the new one attached. The job of replacing No. I turret would have involved a long delay in returning the vessel to service had not turret I from MINNEAPOLIS been made available. This was done, as were many alterations, and NEW ORLEANS returned to service early in August, 1943. Photo 20 shows NEW ORLEANS as she now is, in many respects a more efficient fighting unit than before damage was incurred.

### SECTION III - DISCUSSION

#### A. Damage Control Measures

22. The absence of major fires and an uninterrupted power supply greatly facilitated damage control efforts. A large part of the trim by the head was removed readily by emptying the wing fuel tanks abreast the firerooms. No attempt was made to counter-flood and remaining reserve buoyancy was thus augmented rather than diminished. Flooding boundaries were established quickly and, when time permitted, additional forward compartments were unwatered resulting in further important gains in reserve buoyancy and freeboard.



23. The most difficult part of the damage control job was done at Tulagi in making NEW ORLEANS seaworthy for the long journey to Sydney. In effecting temporary repairs it was necessary to overcome the handicaps of threat of constant air raids, poor living conditions and inadequate repair facilities. A noteworthy part of the job was the shoring of the various bulkheads using timbers cut by the ship's force on the island. This was also done on MINNEAPOLIS \*. Only eleven days were required to make NEW ORLEANS seaworthy, a notable achievement.

#### B. Shock Effect

24. NEW ORLEANS undoubtedly received an unusually severe shock from the explosions. Yet, resulting derangement of equipment was negligible. Of the radar equipment only the forward FC was knocked out. Shock-proofing and maintenance of NEW ORLEANS' radars were evidently excellent. Radars of other vessels have been disabled by shock under much less severe circumstances. No electrical difficulties because of shock were encountered and there were no power interruptions. Considering the violence of the explosions, which resulted in the loss of one quarter of her length, the lack of machinery and electrical difficulties is remarkable. It is clearly evident that considerable effort was expended on the myriad details of maintenance and that such effort paid dividends.

#### C. Analysis of Damage

(Plate II and Photos 1 and 4 to 6)

25. The loss of some 150 feet of the bow was more severe damage than normally would be expected from a single torpedo even if it contained an unusually large amount of explosive in the warhead \*\*. Reference (a), written prior to drydocking and examination of underwater structure, advanced the supposition that the second detonation was the result of the explosion of magazine groups I and II and the gasoline tanks, located in the hold between bulkheads 12 and 17-1/2.

26. The absence of gasoline fires and the fact that buoyancy sufficient to provide flotation for the bow section remained for an appreciable length of time (the structure forward of frame 4 projected above water in an intact condition) indicates that the gasoline tanks were not involved and probably were not ruptured. Other evidence, to be discussed below, also indicates that the torpedo struck so far aft of the tanks that it was improbable that they incurred structural damage from the torpedo detonation. The tanks, between bulkheads 12 and 17-1/2, were some 40 to 45 feet forward of the probable point of impact.

\* Buships War Damage Report No. 36.

\*\* Recent information indicates that some Japanese surface craft use 24" torpedoes with a warhead charge of about 900 lbs. Earlier in the war Japanese surface craft and submarines were believed to use 21" torpedoes with 550 lbs. of explosive. It is now believed that the Japanese 21" torpedo is fitted with a warhead containing about 660 lbs. of an explosive somewhat similar to hexa, and that this torpedo is standard for the later classes of submarines.

27. Fortunately the records of the amount and distribution of the ammunition aboard on 30 November were available. From these, Plate II was prepared. It thus was established that the bomb and mine magazine, A-502-1/8-M, contained the 160 pound demolition charge and forty-nine 100 pound bombs and that the small arms magazine, A-502-M, contained five 325 pound depth bombs. It is pointed out that these magazines extend to the shell, have no armor or liquid protection and that they contained a considerable quantity of high explosive which is susceptible to detonation by fragment penetration. In this connection the British attribute the loss of the BACV AVENGER to detonation of aircraft bombs as a result of torpedo attack. The circumstances were very similar in the case of NEW ORLEANS.

28. The evidence and this Bureau's conclusions in the NEW ORLEANS case follow:

(a) Five 100 pound bombs were found intact in A-504-F, the starboard forwardmost fuel oil tank and abaft the bomb magazine. The depth bombs were located close to the point of impact of the torpedo and it is probable that detonation of those bombs was caused by fragments from the torpedo detonation. When the depth bombs detonated, fragments from them in turn detonated most of the 100 pound bombs and blew the remainder into the oil tank or overboard.

(b) In addition, 20mm rounds which had been stowed adjacent to the bombs in A-502-1/4-M were found on the weather decks. These cartridges could not have been blown upward if the explosion had occurred in the 8" powder magazine, A-408-M, above the bomb magazine, instead of in the bomb magazine itself.

(c) It is improbable that any explosion occurred in the 8" powder magazines, even after the mass detonation of bombs. Burning of smokeless powder in confined spaces will develop pressures of destructive magnitude after an interval of time, only under certain conditions of density of loading and degree of confinement. In the case of BOISE \* about 3000 pounds of 6" powder burned without producing an explosion. In the case of NEW ORLEANS unburned 8" powder grains were reported to have been found on the upper decks. Some powder might have burned briefly in the magazines but if so it would have been quickly extinguished by the inrush of water. Further, if an explosion had occurred in the large powder magazines, A-408-M and A-411-M, between turrets I and II, the damage would have been even more severe than was actually the case. The bottom of the ship under these magazines was distorted but relatively intact as far forward as frame 30. The bomb magazines were just forward of this and the structure was bent sharply downward forward of frame 28, see photo 6. This alone is almost conclusive evidence that the bomb magazine was the center of the trouble.

(d) Study of the references and scrutiny of photo 6 indicates that the torpedo did not hit aft of frame 30 in view of the intact condition of the bottom aft of that point. One member of the crew reported that he had sighted bubbles from the torpedo and that it appeared to be headed for a point between turrets I and II. As the ship was in a right turn, it thus appears that the point of impact was within the general region bounded by frames 24 to 28. From the reports of the quantity of water thrown into the air and the damage to the keel it is

\* Buships War Damage Report No. 24.

probable that the torpedo hit some 12 to 16 feet below the waterline which would place it very close to the second platform. It has been reported that the Japanese use a standard depth setting of about 12 feet against surface targets. In any event, it is clear that the point of impact was so close to A-502-M that extensive fragmentation occurred within the boundaries of that compartment.

29. Summarizing, the evidence and the known behavior of explosives under certain conditions lead to the probability that fragments from the torpedo explosion caused the detonation of aircraft depth bombs in A-502-M. This in turn, but almost simultaneously, caused the detonation of the 100 pound bombs in A-502-1/8-M, similarly by fragment attack. The cumulative effect of the torpedo and bomb detonations severed almost all of the structure between turrets I and II and the speed and turning motion completed tearing away the remaining structure.

30. Because of the serious hazard involved and brought to light by this case, an investigation of the location of magazines for all heavy and light cruisers has been made. The Bureau's experience with underwater explosion tests and in analysis of war damage indicates that a liquid layer (if an internal armored bulkhead is not available) of about four feet thickness is sufficient to stop fragments resulting from a torpedo explosion or at least to reduce their velocity to a relatively harmless value. Accordingly, a program has been established either to provide liquid protection or to relocate magazines behind armored bulkheads for those cruisers which require improved protection against underwater attack for magazines containing high explosives and for which one solution or the other is possible. It should be noted in this connection that the NEW ORLEANS' principal magazines are located behind longitudinal armor bulkheads but the bomb magazines which gave trouble were located below these armored bulkheads, and thus contiguous to the shell plating.

#### D. Conclusions

31. NEW ORLEANS was the victim of an unusual combination of circumstances which resulted in heavy damage. Her survival speaks well for the ruggedness of her construction and the effectiveness of her crew under very trying conditions.