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BUREAU OF SHIPS GROUP

TECHNICAL INSPECTION REPORT

CONFIDENTIAL
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Classification (Cancelled) (Changed to _____)
By Authority of JOINT CHIEFS OF STAFF JCS 1750/55 DATED 15 APRIL 1949
By John L. Cayette Date 24 SEP 1953

366709

NAGATO (Ex-Jap BB)

TEST ABLE

U. S. GOVERNMENT
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Defense Document Agency
D. C. 20301

OPERATION CROSSROADS

DIRECTOR OF SHIP MATERIAL

JOINT TASK FORCE ONE

1 JAN 1965

GROUP-3
Downgraded at 12 year intervals;
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(6) OPERATION CROSSROADS.
NAGATO (EX JAP BB).
TEST ABLE [redacted]. (8)

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EX JAPANESE BATTLESHIP NAGATO

SHIP CHARACTERISTICS

Completed: November 1920

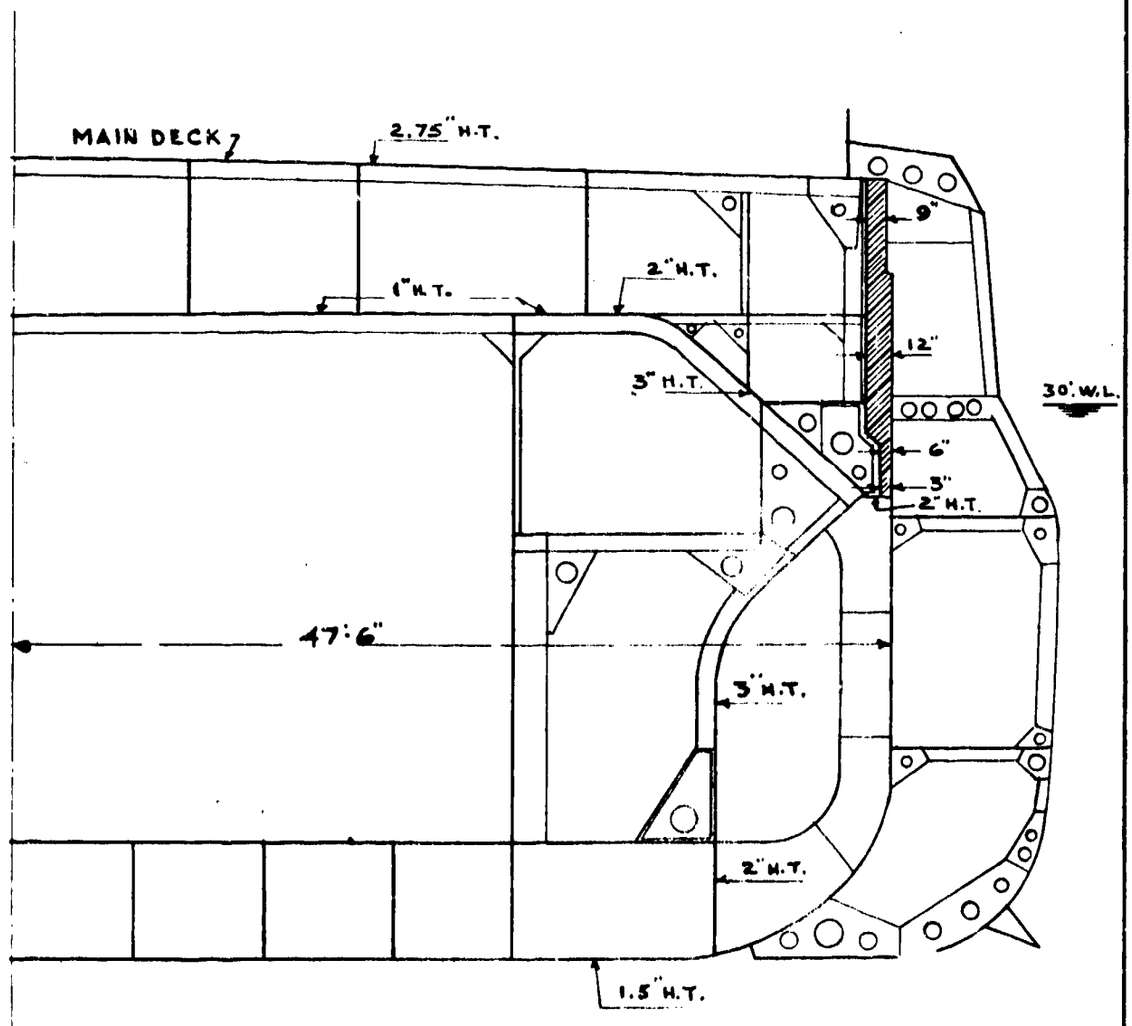
Modernized: 1935 - 36.

HULL

Length Overall: 700 feet 0 inches.
Beam (without bulges): 95 feet 0 inches.
Drafts at time of test: Fwd. 32 feet 5 inches.
Aft. 34 feet 7 inches.
Standard displacement: 34,000 tons.
Displacement at time of test: 46,150 tons.

MAIN PROPULSION PLANT

Main Engines: Four main turbine sets, one set for each shaft. Mfgd. by Westinghouse Co. Each set consists of a H.P., L.P. and astern turbine.
Reduction Gears: Four units installed in ship. Single reduction.
Main Condensers: Four units installed in ship.
Boilers: Ten units installed in ship.
Main Shafts: Four installed in ship.
Propellers: Four installed in ship.



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MIDSHIP SECTION
TEST-A

TECHNICAL INSPECTION REPORT

OVERALL SUMMARY

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

	Forward	Aft	List
Before test drafts.	32'-5"	34'-7"	1/2° starboard
After test drafts.	33'-5"	36'-1"	0°

Flooding occurred in three fuel oil tanks probably through leaky Kingston valves and in the shaft alley and engine rooms through the stern tubes.

(b) Structural damage.

HULL

Structural damage is confined to light plating in the superstructure and on the main and second decks. The main hull is undamaged. Many light non-watertight doors were torn off their hinges.

MACHINERY

No comment.

ELECTRICAL

Not observed.

(c) Other damage.

HULL

Not observed.

MACHINERY

Two ventilation blowers topside were jammed. The other machinery on this vessel was undamaged by Test A. Most all that was operable before the test has been cperated since the test.

ELECTRICAL

There was no significant electrical damage to this vessel. Minor damage was sustained by the 24" searchlights, running and anchor lights, and one announcing system reproducer.

II. Forces Evidenced and Effects Noted.

(a) Heat.

HULL

A heat wave, originating on a bearing of approximately 210 degrees relative, scorched port side paintwork and started several small fires.

MACHINERY

Paint on the exposed side of deck machinery was scorched and blistered.

ELECTRICAL

There was evidence of heat on exposed electric cables. Direction of heat blast was from port quarter. Several fires started onboard and paint was scorched on electric cables on topside. No damage to any electrical equipment from heat.

(f) Fires and explosions.

HULL

Small fires which were started in pine wood decking and in life rafts, occurred on the port weather decks and the forecastle. No explosions occurred.

MACHINERY

No evidence.

ELECTRICAL

There were no fires or explosions in the way of electrical equipment.

(c) Shock.

HULL

There are no significant results from shock. Cast ladder rungs were broken.

MACHINERY

No evidence.

ELECTRICAL

The only evidence of shock damage to electrical equipment was the breaking of the 24'' signal searchlight incandescent lamps.

(d) Pressure.

HULL

A pressure wave originated on a relative bearing of 210 degrees. This wave caused slight damage to topside structure

such as light metal bulkheads, castings, and equipment mounted on light foundations. 10 pound plate generally resisted the blast satisfactorily. The main deck aft of Turret 4 was permanently deflected downward one inch.

MACHINERY

Blast pressure jammed two ventilation blowers topside.

ELECTRICAL

There was evidence of pressure as one 1 MC loud speaker on the quarter deck aft was torn from its mounting and blown overboard, and bow and stern lights were blown overboard. Direction of the pressure blast was from the port quarter.

(e) Effects peculiar to the Atomic Bomb.

HULL

The sudden, complete exposure to heat, blast pressure and radioactivity, for all practical purposes, simultaneously, is peculiar to the atomic bomb.

MACHINERY

None.

ELECTRICAL

The effects that were noted as to heat and pressure are peculiar to the atom bomb.

III. Results of Test on Target.

(a) Effect on machinery, electrical, and ship control.

HULL

There are no known ill effects on machinery or electrical installations other than the antennae damage. All equipment and circuits that operated prior to the test functioned satisfactorily after the test. Flooding that occurred in the shaft alleys and engine rooms did not injure equipment. Ship control, other than damage to antennae and visual signalling gear, is unaffected.

MACHINERY

None.

ELECTRICAL

There was no damage to electrical, machinery, or ship control equipment.

(b) Effect on gunnery and fire control.

HULL

The vessel could have kept fighting at her maximum speed and main battery fire power except for reduction in accuracy due to the use of local control.

MACHINERY

No comment.

ELECTRICAL

No effect on gunnery or fire control.

(c) Effect on watertight integrity and stability.

HULL

Three fuel oil tanks flooded, two on the port quarter and one on the starboard side amidships. The three engine rooms

flooded to above the lower floor plates. Three of the shaft alleys were partially flooded. Other than this above flooding there was no known impairment of the watertight integrity. Stability was affected slightly and probably increased in that the added water was low in the ship.

MACHINERY

No comment.

ELECTRICAL

No effect on watertight integrity or stability from electrical damage.

(d) Effect on personnel and habitability.

HULL

Personnel exposed topside probably would have suffered from heat, blast, and radioactivity. Personnel in the engine spaces would probably have suffered from blast. These spaces have very large ventilation ducts leading almost directly to the weather deck. Habitability of spaces where completely enclosed by structure is unaffected. Habitability of the ship is reduced by the destruction of temporary refrigeration equipment installed on the weather deck which was the only stowage of perishable goods.

On each of the first four days after the test some of the ship's rats were found dead. Others were very sluggish and some were as active as before. The dead rats were found primarily on the main and 01 decks but one was found on the second deck. This indicates possible casualties to personnel in enclosed spaces.

MACHINERY

None below decks.

ELECTRICAL

There was no effect on habitability from electrical damage.

(e) Effect on fighting efficiency.

HULL

Probably the only effects on fighting efficiency would have been the results of injury to personnel. The overall poor condition of the ship and her equipment is due to the lack of preventive maintenance and overhaul and to the fact that her engineering plant sat idle for over a year.

MACHINERY

None.

ELECTRICAL

There was no effect on the fighting efficiency from electrical damage.

IV. General Summary of Observers' Impressions and Conclusions.

HULL

This vessel is structurally of heavier construction than other ships exposed to the bomb. The damage that did occur was generally of a negligible nature and had contributing factors such as lack of maintenance, rust, or previous damage.

MACHINERY

The boilers of the NAGATO were more resistant to blast pressure than those of U.S. vessels at comparable distances from the explosion.

ELECTRICAL

As there was no significant electrical damage to the ship, no impressions or conclusions were formed by the observers.

V. Preliminary Recommendations.

HULL

Necessary superstructure should have faired lines, no recesses or pockets, and be constructed of 10 pound plate or heavier.

MACHINERY

It is recommended that the construction of boilers and uptakes of the NAGATO be studied with a view to considering the desirability of incorporating some of their features into the design of our vessels in order to make them more resistant to blast pressure.

ELECTRICAL

There are no recommendations by the inspecting group.

TECHNICAL INSPECTION REPORT

SECTION I - HULL

GENERAL SUMMARY OF HULL DAMAGE

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

	Forward	Aft	List
Before test drafts.	32' 5"	34' 7"	1/2° Starboard
After test drafts.	33' 5"	36' 1"	0°

Flooding occurred in three fuel oil tanks probably through leaky Kingston valves and in the shaft alley and engine rooms through the stern tubes.

(b) Structural Damage.

Structural damage is confined to light plating in the superstructure and on the main and second decks. The main hull is undamaged. Many light non-watertight doors were torn off their hinges.

(c) Other damage.

Not observed.

II. Forces Evidenced and Effect Noted.

(a) Heat.

A heat wave, originating on a bearing of approximately 210 degrees relative, scorched port side paint work and started several small fires.

(b) Fires and Explosions.

Small fires which were started in pine wood decking and

in life rafts, occurred on the port weather decks and the forecastle. No explosions occurred.

(c) Shock.

There are no significant results from shock. Cast ladder rungs were broken.

(d) Pressure.

A pressure wave originated on a relative bearing of 210 degrees. This wave caused slight damage to topside structure such as light metal bulkheads, castings, and equipment mounted on light foundations. 10 pound plate generally resisted the blast satisfactorily. The main deck aft of Turret 4 was permanently deflected downward one inch.

(e) Effects peculiar to the Atomic Bomb.

The sudden, complete exposure to heat, blast, pressure and radioactivity, for all practical purposes, simultaneously, is peculiar to the atomic bomb.

III. Results of Test on Target.

(a) Effect on machinery, electrical, and ship control.

There are no known ill effect on machinery or electrical installations other than the antennae damage. All equipment and circuits that operated prior to the test functioned satisfactorily after the test. Flooding that occurred in the shaft alleys and engine rooms did not injure equipment. Ship control, other than damage to antennae and visual signalling gear, is unaffected.

(b) Effect on gunnery and fire control.

The vessel could have kept fighting at her maximum speed and main battery fire power except for reduction in accuracy due to the use of local control.

(c) Effect on watertight integrity and stability.

Three fuel oil tanks flooded, two on the port quarter and one on the starboard side amidships. The three enginerooms flooded to above the lower floor plates. Three of the shaft alleys were partially flooded. Other than this above flooding there was no known impairment of the watertight integrity. Stability was affected slightly and probably increased in that the added water was low in the ship.

(d) Effect on personnel and habitability.

Personnel exposed topside probably would have suffered from heat, blast, and radioactivity. Personnel in the engine spaces would probably have suffered from blast. These spaces have very large ventilation ducts leading almost directly to the weather deck. Habitability of spaces where completely enclosed by structure is unaffected. Habitability of the ship is reduced by the destruction of temporary refrigeration equipment installed on the weather deck which was the only stowage of perishable goods.

On each of the first four days after the test some of the ships rats were found dead. Others were very sluggish and some were as active as before. The dead rats were found primarily on the main and 01 decks but one was found on the second deck. This indicates possible casualties to personnel in enclosed spaces.

(e) Effect on fighting efficiency.

Probably the only effects on fighting efficiency would have been the results of injury to personnel. The overall poor condition of the ship and her equipment is due to the lack of preventive maintenance and overhaul and to the fact that her engineering plant sat idle for over a year.

IV. Summary of Observers' Impressions and Conclusions.

This vessel is structurally of heavier construction than other ships exposed to the bomb. The damage that did occur was generally of a negligible nature and had contributing factors such as lack of maintenance, rust, or previous damage.

V. Preliminary Recommendations.

Necessary superstructure should have faired lines, no recesses or pockets, and be constructed of 10 pound plate or heavier.

VI. Instructions for loading the vessel specified the following:

ITEM	LOADING
Fuel oil.	15%
Diesel oil.	15%
Ammunition.	No service ammunition.
Potable and reserve feed water.	Full load.
Salt water ballast.	Conform to Jap practice.
Gasoline.	15%

Details of the actual quantities of the various items aboard are included in Report 7, stability Inspection Report, submitted by the ship's force in accordance with "Instructions to Target Vessels for Tests and Observations by Ship's Force" issued by the Director of Ships Material. This report is available for inspection in the Bureau of Ships Crossroads Files.

DETAILED DESCRIPTION OF HULL DAMAGE

A. General Description of Hull Damage.

(a) Overall condition of vessel.

The overall condition of the vessel is only slightly changed by the test. The main deck aft of turret 4 has a one inch permanent deflection downward. Light structure and equipment exposed topside is damaged. Flooding occurred in three fuel oil tanks, the shaft alleys, and the enginerooms.

Several small fires occurred on the weather decks in pine wood decking and in liferafts. General views of the exterior are shown on pages 52 to 63 , inclusive.

(b) General areas of hull damage.

Light plating is dished in the superstructure. Wooden structures on the signal bridge and on the port upper deck amidships were demolished and the parts widely scattered. Many light weight non-watertight doors were torn off their hinges. A wooden boat on the 02 level, port side, was demolished. Ventilation ducts to the center engineroom were ruptured. A tunnel passageway, which funneled the blast, had passageway bulkhead and doors badly buckled and torn.

(c) Apparent causes of hull damage in each area.

Damage to structure is almost entirely due to blast. Heat radiation scorched paintwork and started several small fires.

(d) Principal areas of flooding with sources.

Three fuel oil tanks, two on the port quarter and one on the starboard side amidships, were flooded from unknown sources. It is believed that this flooding occurred through the tank kingston valves. The shaft alleys were partially flooded with more than normal leakage. through the stern tubes. Overflow from the shaft alleys entered the enginerooms and flooded to the lower gratings.

(e) Residual strength, buoyancy, and effect of general condition of hull on operability.

The residual strength and general condition of the hull with respect to operability is unchanged. Buoyancy has been slightly affected by the flooding.

B. Superstructure.

(a) Description of damage, giving important dimensions.

1. Bridge Area.

The after bulkhead of the forward superstructure is a flat surface unbroken by catwalks or other structure for several decks. This large panel has been dished. (photo 1816-10, page 6 .) A ladder on this surface has been bent. The wooden, temporary, signal shack on the 05 level is completely demolished (photo 1816-8, page ,) A stowage compartment on the 04 level was dished by the blast. (photo 1764-2, page .) A large bulkhead on the 03 level is dished.

Several doors, watertight and non-watertight, of lighter that 7.65 pound plating, are dished, and many light weight non-watertight doors have been torn off their hinges. Bulkheads below 10 pound plate are dished, and on one instance bulged and torn in way of a "U" shaped, covered athwartships passageway from on the 01, deck, about frame 120. (photo 1763-8, page .) Ladders in general stood up very well. Cast alloy attachments were broken by shock. Light flat plates are dished, curved surfaces have suffered less damage than flat surfaces of equal thickness. Three light audio aircraft detector horns have broken their base castings on the 010 level and fallen to the forecastle deck. (photo 1763-11, page .) The range finder, which travels around the mast on a circular track, has been dislodged from the rails. Glass and plexiglass instruments faces have been broken.

2. Midship deckhouse and stack.

The smokestack has light dishing caused by the blast. Part of the light metal fins on the after top part of the stack are of

the light metal fins on the after top part of the stack are missing (photo 1763-12, page 71 .)

3. After deck house and tower.

No visible damage occurred to the structure. Light jury rig wooden masts would have disappeared carrying the antenna with them.

(b) Causes of damage in each area.

Damage to all structure is primarily attributable to the blast.

(c) Evidence of fire in superstructure.

No fires occurred on the superstructure.

(d) Estimate of relative affectiveness against heat and blast.

1. Various plating thickness.

Structure of 10 pound plate or heavier is undamaged except in one instance. A large bulkhead with widely spaces stiffeners and a large watertight door on the 03 level of the foremast, starboard side is dished. Watertight and non-watertight doors of less that 7.65 pound plate were dished by the blast.

2. Various shaped surfaces.

Flat surfaces, in general, suffered more damage. Where 10 pound plate appears to be the critical plate thickness for permanent deformation on flat surfaces, air foil structures of five pound plate used in ventilator cowls were undamaged.

3. STS compared to MS.

No difference in effect known.

4. Aluminum structures (where fitted).

Aluminum castings used as ladder treads were vulnerable to shock. This may be partially attributable to age and electrolysis, as in general, ladder frames and bolts were of steel.

(e) Constructive criticism of superstructure design or construction, including important fittings and equipment,

No comment.

C. Turrets, Guns, and Directors.

(a) Protected mounts.

1. General condition, including operability.

Turrets 1, 3, and 4 were in condition "Z" for the test, while turret 2 was in condition "Y". The turrets were not operable before the test, but there is no damage as a result of the test that affects there operability in anyway. Armor plating, fixed and rotating structure, supporting structure under the barbettes, stools, rollers, and roller paths are free of any evidence of damage or distortion as a result of the test. All canvas gun port bucklers were ripped to shreds by the blast. Paint is lightly scorched on the exterior of the turrets and barbettes from radiated heat but there is no evidence of flame or heat having reached the interior of the turrets. Four tampions were blown out of the gun muzzles.

2. Effectiveness of installed turrets or shields.

These turrets have proven to be very effective against the effects of the atomic bomb under the conditions of the test. The fighting efficiency of the turrets is not affected.

(b) Unprotected Mounts.

All mounts other than the main battery had been removed prior to the test.

(c) Directors and rangefinders.

1. General condition, including operability if known.

The main battery range finder, which is located near the top of the foremast, has been dislodged from its track, apparently by shock or by whip of the foremast as the rangefinder is very heavy and was shielded from the blast by the fore mast. This rangefinder traveled on a track around the foremast. The equipment was inoperable before the test and no damage attributable to the test other than the derailment was found. No known damage attributable to the test occurred occurred to the directors. Generally, equipment was damaged and broken prior to the test.

2. Condition of instruments therein.

Instruments were damaged prior to the test.

(d) Constructive criticism of design or construction of mounts director, foundations and shelters.

No comment.

D. Torpedo Mounts, Depth Charge Gear.

Not applicable.

E. Weather deck.

(a) General condition of deck and causes of damage.

The weather deck, except in way of previous damage is in excellent condition. Many small fires were started in the pine wood deck covering and in several life rafts. The weather decks except aft of turret 4, had some deflection occur which almost entirely was within the elastic limits and only noticeable in that the deflections were recorded by scratch gages. Aft of turret 4 the weather deck has a permanent downward deflection of one inch.

Deck deflection gage readings are listed on pages 102 and 103.

(b) Usability of deck in damaged condition.

There is no change, due to the test, in the usability of the weather decks. (Photos 1763-10 and 1764-3, pages 72 and 73). The small fires in the wood deck covering generally covered an area of two or three square feet. A few exposed ladders were bent or had broken rungs. (Photo 1816-2, page 74).

(c) Condition of equipment and fittings.

1. Mooring and towing fittings.

No damage.

2. Boats and boat handling: liferafts.

A wooden boat stored on the 02 deck, frame 130, port, was blown upward and demolished. (Photos 1816-11, 1763-12, 1816-9, pages 70, 71, and 75). The boat boom is undamaged. Several liferafts, standard U.S. Navy issue, had small fires which started on the canvas and burned out large sections of the interior.

3. Airplane handling gear.

No damage due to the test.

4. Barriers, arresting gear, catapults.

The catapults had been removed prior to the test.

5. Temporary refrigeration equipment installed at frame 170, port, 01 deck. This equipment which was the only space for stowage of perishable foods was demolished by the blast. (Photos 1816-4, 3, and 1763-7, pages 76, 77 and 78).

6. Gas bottle stowage, stern, main deck.

Glass bottles in the stowage were cast adrift.)photo 1816-1, page 79 .)

F. Exterior Hull (above waterline)

(a) Condition of exterior hull plating and causes of damage.

There is a cracked weld in way of a pre-test patch plate at frame 300, port side, about four feet above the second deck., (photo 1851-9, page 80 .)

(b) Condition of exterior hull fittings and causes of damage.

Fittings are undamaged.

(c) Details of any impairment of sheer strake.

No impairment of the sheer strake occurred.

G. Interior Compartments (above waterline)

(a) Damage to structure and causes.

The interior compartments, where completely enclosed, suffered no damage. Underneath the previous damage to the 01 deck just forward of turret 3, light divisional bulkheads have been torn and buckled Insulation has been shaken or blown loose from the wooden securing strips. Some weather deck ventilation ducts permitted blast to enter and this ruptured a few ducts in the interior of the vessel.

(b) Damage to joiner bulkheads and causes.

The only joiner bulkhead damage occurred in the previously damaged area, as noted above

(c) Details of damage to access closures and fittings.

No known damage occurred.

(d) Condition of equipment within compartments.

Equipment within the compartments is in good condition.

(e) Evidence of fire.

None.

(f) Damage in way of piping, cables, ventilation ducts, etc.

A few ventilation ducts transmitted blast pressure from the topside to below the main deck and were ruptured.

(g) Extimate of reduction in watertight subdivision, habitability, and utility of compartments.

The habitability and usability are not seriously impaired. Ventilation duct damage could be repaired by ship's force. Watertight subdivision has no impairment due to the test, however, the pre-test condition was poor.

H. Armor Deck.

(a) Damage to armor deck and causes of damage.

No visible damage occurred.

(b) Protection afforded spaces below.

Protection was adequate.

(c) Condition around openings.

No visible damage occurred around openings in the armor deck.

(d) Condition of connections to vertical armor.

No visible damage occurred.

I. Interior compartments (below waterline).

(a,b,c,) Damage to structure, joiner bulkheads, or access closures and causes.

No known or observable damage occurred to structure joiner bulkheads, or access closures.

(d) Condition of equipment within compartments.

Equipment is undamaged even in the engineering spaces where flooding occurred and blast pressure ruptured ventilation ducts.

(e) Flooding.

There was no flooding except in the tanks and engineering spaces. See Items K and L.

(f) Damage in way of piping cables, ventilation ducts, shafts, etc.

Ventilation ducts to the center engine room were ruptured by blast.

(g) Estimate of reduction in watertight subdivision, habitability, and utility of spaces.

No reduction occurred in watertight subdivision, habitability or utility of spaces. However the airtightness of spaces is very poor as indicated by attempted air tests on various spaces prior to the test.

J. Underwater hull.

(a) Interior inspection of underwater hull.

Portions of the underwater hull that are visible from the interior have no damage as a result of the test. Opening of blister seams may have occurred. See Items K and L. There are several known pre-test defects in the underwater hull. The principal damage

is a rectangular hole approximately 10 feet long and 8 feet high at frame 90, starboard. In at least two places shell plate seams or butts, where backed up by other structural members, had openings up to one-half inch wide.

(b) Effect of damage on buoyancy, operability, maneuverability.

None.

(c) Any known or suspected damage to shafts, propellors, struts, rudder, external keels.

None.

(d) Details of impairment of keel structure.

None.

K. Tanks.

(a) Condition of tanks in area of damage.

Two fuel oil tanks on the port quarter and one on the starboard side amidships flooded. These blister tanks flooded from undetermined sources. However it is known that the condition of the Kingston valves was poor. Flooding water could have entered through these valves or through opened shell seams.

(b) Contamination of liquids.

Fuel oil tanks that flooded were not filled with oil.

(c) Damage known or suspected to torpedo defense system.

No damage other than that noted above is known. However it is possible that other damage could have occurred. The exact status of liquids in blister spaces is not known. The spaces are blown down using air pressure. Completion of pumping is estimated from reading of air pressure gages at the manifold. From the increased

draft readings, which would indicate a considerable amount of water taken on board, it is probable that other blisters have flooded.

L. Flooding.

(a) Description of major flooding areas.

Flooding occurred in two port quarter fuel oil tanks, in one starboard side amidships fuel oil tank, in three shaft alleys, and in all three engine rooms. However, the increased draft readings indicate that more flooding, although unknown, is probable.

(b) Sources of flooding.

The fuel oil tanks flooded from undetermined sources. The sources, however, probably were either leaky Kingston valves or opened seams. The shaft alleys flooded through the stern tubes. Leakage through the stern tubes was at an aggravated rate. The outboard shaft alleys overflowed through drain lines into the wing engine rooms after water covered the shaft spring bearings. When the water covered the spring bearings it was possible for progressive flooding ot occur via the lub oil return line and overflow from the starboard sump tank.

(c) List of compartments believed to have flooded slowly so as to be susceptible to damage control.

Flooding in the shaft alleys and enginerooms could have been controlled by the ship's force.

M. Ventilation (exclusive of blowers).

(a) Damage to ventilation system and causes.

In general, the cowls which are fabricated of one-eighth inch metal in airfoil shapes are undamaged (photo 1764-1, page 81 .)

Internal ducts have slight damage where blast entered cowls facing the blast. This damage extends downward about one deck to the adjacent elbow or turn. Large ventilation ducts to the center en-

gine room, of approximately 12 square foot cross section, are ruptured in the enginerooms.

Damage that occurred to ventilation systems other than in the enginerooms, has no appreciable effect on habitability. However damage to the engineroom ducts has an appreciable effect on the maintenance of working conditions for personnel.

(b) Evidence that ventilation system conducted heat, blast, fire or smoke below decks.

Ruptured ducts indicate that blast was conducted into the ship. There are no evidences that heat, fire, or smoke was conducted below decks.

(c) Evidences that ventilation system allowed progressive flooding.

None.

(d) Constructive criticism of design and construction of system.

No comment.

It was noted that in major internal control stations provisions had been made for recirculation of air within the space. Equipment for removeal of impurities and producing oxygen were present. There were no means, unless performed in the chemical containers, for cooling the air. It is believed that the equipment would function for a short period of time. (photo 494-7, page 82 .)

N. Ship Control.

(a) Damage to ship control stations and causes.

Ship control stations are undamaged. Antennae are down; signal halyards have disappeared; the temporary wooden signal booth is demolished. All damage is of a temporary or repairable nature.

(b) Constructive criticism of ship control systems.

No comment.

O. Fire Control.

(a) Damage to fire control stations and causes.

1. Directors and elevated control positions.

Equipment prior to the test was severely damaged. Any damage due to the test is indistinguishable from the prior damage except for the dislodgement of the foretop rangefinder from its track and the failure of the audio aircraft detector mountings.

2. Plat rooms and protected spaces.

No damage.

(b) List of stations having insufficient protection and estimated affect on fighting efficiency of the loss of each.

In general, secondary battery control stations are exposed, while the main battery control station is only lightly protected. Personnel is exposed control stations would probably have suffered serious casualties from blast and heat radiation.

(c) Constructive criticism of location and arrangement of stations.

No comment.

P. Ammunition Behavior.

Only small caliber ammunition was on board. This ammunition was unaffected by the test.

Q. Ammunition Handling.

(a) Condition and operability of ammunition handling devices.

No damage occurred to ammunition handling equipment.

(b) Evidence that any ammunition handling devices contributed to passing of heat, fire, blast, or flooding water.

None.

(c) Constructive criticism of design and construction of ammunition handling devices.

No comment.

R. Strength.

(a) Permanent hog or sag.

There are no evidences of deformation or movement of structure that indicate any change in the vessels pre-test condition.

(b) Shear strains in hull plating.

None.

(c) Evidences of transverse or racking strains.

None.

(d) Details of any local failures in way of structural discontinuities.

None.

(e) Evidence of panel deflection under blast.

The after side of the foremast structure is dished. Weather decks were displaced, generally within the elastic limit, as indicated by deck deflection gages.

(f) Turret, machinery, and gun foundations.

No damage.

S. Miscellaneous.

Report on General Method of Supporting Pagoda on ex-Japanese Battleship "NAGATO".

1. Summary.

The so called pagoda structure on this ship consists of the elevator column at frame 106 and the sextipolar mast with platforms cantilevering from its legs. The pagoda acts as a unit between the battle bridge and the (04) level where the tower legs penetrate the super structure at this level, loads from the tower begin flowing into the main body of the ship thru the superstructure. The conning tower is situated on the 04 level but is independent of the tower and is supported on its own stool and below decks supports. Connections between the conning tower and the superstructure are for lateral support only. The superstructure absorbs most of the direct load and the tipping movements from the pagoda and transfers them, through heavy bulkhead and framing, into the hull proper between the mid and lower decks. Provision for absorbing the balance of the direct load in the legs has been made by landing them on heavy bulkheads or heavily framed arches, which carry the load to the keel or the hull proper. The design is adequate for supporting the loads but appears to err on the score of overweight. Nagato lay 900 yards from the burst. This was outside the critical range for damage to such a heavily constructed ship. No damage of any description occurred to the pagoda structure. The impression of poor intergration of design which the ship conveys is probably due to the requirements imposed by a series of urgently needed alterations which did not permit a smooth blending of local structure into the main trunk. There are patchwork appearances in the tower generally which strengthen this impression, as does the odd mixture of welding and riveting the use of inadequate and intermittent welding on heavy plate, and by the seeming overweight of many of the members - particularly some of the platforms.

2. Conning Tower.

The conning tower is approximately 13 1/2 inches in thickness and is supported by an elliptical stool three deck levels in height between the bottom of the tower and the weather deck. This

stool is in two sections - the upper sections two decks high and is conical in form. It rests on the boat deck. The lower is a vertically section between the boat and weather decks. The construction of both sections of the stool is similar consisting of 1" thick plates stiffened with 9 1/2" x 3 1/2" Z-bars spaced generally 30" on centers inside by the stool. Stiffeners locations are occasionally shifted slightly to suit interferences from structure of equipment. Butts in the 1" plates are connected by 3/4" double riveted straps and 1 1/8" rivets spared 3" on centers. Stiffeners in the upper section are bracketed at the bottom by 30" x 1/2" plate and at the top, under the conning tower, by 24" x 18" x 1/2" plates. The lower section is bracketed similarly, top and bottom. Boundary bars, which are double at the boat deck, are 5" x 5" x 9/16" and connected by 1" rivets spaced 4 1/2" on centers. The lower section of the stool was supported, along its after face, on bulkhead 95 and by a 15 pound bulkhead, port and starboard extending forward from this bulkhead. Additional support aft of bulkhead 95 is furnished by a set of 3 - 24" x 1/2" vertical plate columns, one on the centerline of the ship and one each port and starboard approximately 7 feet off the centerline. Below the main deck, bulkhead 95 continues to the keel. The 15 pound longitudinal bulkheads continue to the middeck which is armored forward of bulkhead 95, and for 1 frame space aft of it. The 24" vertical plate columns on the after side of bulkhead 95 also continues to and rest on, the armored portion of the middeck. The conning tower tub extends to the middeck.

3. Elevator Tubes.

The 6 feet diameter elevator tube, which affords passage from the main deck to the main director level, is constructed of 2 semi-circular sections. The after section is 1/2" H.T.S. plate and the forward half is 1" H.T.S. form the top to the level above the top of the conning tower (06 level) and 2" below that.

The seams are connected with 3/4" rivets. The transverse division plate, in this tube, is located just forward of the center. It is 3/4" H.T.S. form the top to the 06 level and 1.5" H.T.S. below that level. The tube is connected to the various platforms and decks, through which it passes, with 15 pound and 20 pounds webs, brackets and bounding bars which are generally 4" x 4" x 1/2".

4. Sextipolar tower structure.

The six column tower structure rests on the main deck, which is approximately 2 3/4" thick and is built up to 3 layers of H.T.S. plating in the area upon which the tower rests. The legs of the tower rest on an imaginary circle of approximately 24 feet radius. The arrangement is symmetrical about the centerline of the ship with the forward pair at frame 96, the center pair of 106 and the after pair at frame 116. The legs of the forward and after pairs are approximately 31" outside diameter and those of the center pair are approximately 35" outside diameter. All legs are constructed of 3/8" thick semi-circular M.S. sections, seam riveted with 3/4" rivets spaces 4 1/2" on centers zigzag. Butts in the legs are connected by 3/8" qrapper plates 36" long with 3/4" rivets. The elevator tube and six legs of the tower structure are rigidly connected at the spotting bridge level, which is just above the main director platform and is the last stop of the elevator. There is one more level above the spotting bridge - the battle bridge or 012 level. The elevator column only continues to the underside of this level which is supported by cantilever beams radiating from the column. The connections between the legs of the tower and the elevator column is made by 3 methods:
(1) The semi-circular half of each leg nearest the elevatortube has been cut and flanged inward to form a U-shaped collar-open at the top-which fays against the tube. This flange is riveted with 7/8" rivets spaced about 4 1/4" on centers. (2) The cap plate, which is the central piece of the spotting platform, is 1" plate connected to the inside of the elevator tube and the legs by 3/8" thick collar angles formed to suit. (3) Tying all elements together is a tremendous wrapper plate 58" deep and 3/4" thick, except in way of the elevator door opening where the depth of the wrapper drops to 37". Photograph 2559-6, page 83, shows the wrapper plate, the elevator opening and the 4" x 4" x 1/2" angle collar fitted around the lower edge of the wrapper plate. The spotting platform and wrapper plate are connected by a 3/8" thick angle collar. The wrapper plate is formed and riveted to suit only the legs of the mast. Between the spotting bridge and the 06 level, the structure is generally cantilevered from the six legs of the tower by radial beams. In general these beams are 36" deep at the legs and have webs of 3/8" plate with flanges of 4" x 4" x 1/2" angles, doubled. At the lower levels of the structure, the platforms are supported between

the elevator column and the legs by deep girders of 3/8'' thick plate and 1/2'' thick flanges. Inter costal rings, concentric about the center of the elevator column, form additional stiffenening for the platforms. These intercostals are 12'' I-beams with 1/4'' webs and 3/8'' flanges and are spaced generally 24''. Photograph 2559-6, page 83, illustrates this construction as does photograph 2559-7, page 84, which shows the construction on the underside of the machine gun platform (07) level. Between the (06) and (03) levels, the construction is a hetrogeneous mixture of vertical webs, arches and brackets radiating from the elevator tube and tower legs; and, transverse brackets and superstructure side stiffeners. The superstructure plating in this region is generally 15 pounds, as are the webs of stiffeners, arches and brackets.

Between these levels the loads from the tower are being largely transmitted into the superstructure, and the tower itself firmly anchored into the hull proper through the superstructure. Photograph 2559-8, page 85, taken at the boat deck, 02 level, illustrates typical superstructure construction. Here the plating is 1/2'', and stiffeners 12'' x 3/8'' with 1/2'' flanges.

At the main deck the only loads left in the tower legs are perhaps 50% of the direct loads which appear to be more than adequately provided for with heavy bulkheads brackets and columns below.

Connections of legs to the decks within the superstructure enclosure were 5'' x 5'' x 9/16'' angle collars using 1'' rivets spaced 4 1/2'' on centers, zig zag. The collars were double on the boat deck and single on the weather deck and main decks. Photograph 2050-4, page 86, is taken from the mid-deck, looking through the port side access hatch in the main deck at the port forward leg of tower. The photograph shows typical construction under the weather deck, relative thickness of the main deck, the lower edge of a butt joint in the leg - top center, just under weather deck - relative sizes and types of rivets and typical ladder construction.

Photographs 2050-1 and 2050-2, pages 87 and 88, illustrates construction in way of the forward pair of tower legs between the boat and weather deck. The photographs show the port forward leg, and bulkhead 97 which is 12 1/2 pound plate approximately.

Photograph 2050-3, page 89, shows the starboard forward leg between the weather deck and the ending of the leg on the main deck just aft of bulkhead 95, which carries the loads from this pair of legs into the hull. Photographs 2050-6 and 2050-7, pages 90 and 91 show the 15 pound, 36 inch brackets forward and aft of bulkhead 95, under the main deck, which support the bulkhead in way of the leg above. Note the 20 pound columns under the brackets on the after face of the bulkhead. These columns foot in the 5'' armor of the mid-deck and line up with web stiffeners on the forward face of the 8 3/4'' armor of bulkhead 96, which is the after boundary of the forward armor box.

Photograph 925-8, page 92, shows the starboard of the outer pair of legs and the structure under the weather deck. Note the 15'' butt strap which projects about 12'' below the weather deck. The transverse beam upper right is a 12'' x 3/8'' channel riveted to a bulkhead about 12 pounds in weight. The spacing of transverse beams in this area varied from 48'' to 56''. Photograph 925-7, page 93, shows the footing of this leg on the main deck.

Direct loads from this - the center pair of legs, flow into the hull from a pair of 25 pound transverse arches located at frames 105 and 107. These arches shown in photos. 2050-8 and 2050-9, pages 94 and 95, transmit the load into two 20 pound longitudinal bulkheads, 11' - 6'' apart, running between bulkheads 103 and 117. Photograph 2050-8, page 94, looking forward at bulkhead 103, shows the transverse arches and a portion of the 36'' depth of plating above the opening, which is 48'' wide. The box like structures, at upper right and left, are 20# wireways between bulkheads 103 and 117. The shaped bracket, upper center in photograph 2050-9, page 95, supporting the cable run is 2 - # plate and is 48'' deep at the center. The deck on which these longitudinals and arches rest is 1'' H.T.S. This deck is supported in way of the longitudinals above by 3 longitudinal wireway bulkheads and short transverse bulkheads at frames 109, 113 and 119 in addition to full transverse bulkheads at 103 and 121.

Photograph 925-9, page 96, shows the connection to the starboard after leg under the weather deck. Brackets are 30''x 30'' x 3/8'' plate. Photograph 925-10, page 97, shows the base of the same leg on the main deck. Photograph 2050-10, page 98, is a view looking up inside the port after leg and shows the construction typical of all legs.

Photograph 2559-4, page 99 , shows a pair of 36" x 3/8" brackets which are part of 24" columns on the forward face of bulkhead 117 under the after port leg. This construction, starboard, which is similar ties the after pair of legs into the hull through bulkhead 117.

All legs fast in supporting structure at least adequate for transmitting imposed loading.

TECHNICAL INSPECTION REPORT

SECTION II - MACHINERY

GENERAL SUMMARY OF MACHINERY DAMAGE

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

No data taken by machinery group.

(b) Structural damage.

No comment.

(c) Other damage.

Two ventilation blowers topside were jammed. The other machinery on this vessel was undamaged by Test A. All that was operable before the test has been operated since the test.

II. Forces Evidenced and Effects Noted.

(a) Heat.

Paint on the exposed side of deck machinery was scorched and blistered.

(b) Fires and explosions.

No evidence.

(c) Shock.

No evidence.

(d) Pressure.

Blast pressure jammed two ventilation blowers topside.

(e) Effects apparently peculiar to the atom bomb.

None.

III. Effects of Damage.

(a) Effect on machinery and ship control.

None.

(b) Effect on gunnery and fire control.

No comment.

(c) Effect on water-tight integrity and stability.

No comment.

(d) Effect on personnel and habitability.

None below decks.

(e) Total effect on fighting efficiency.

None.

IV. General Summary.

The boilers of the NAGATO were more resistant to blast pressure than those of U. S. vessels at comparable distance from the explosion.

V. Preliminary Recommendation.

It is recommended that the construction of boilers and uptakes of the NAGATO be studied with a view to considering the desirability of incorporating some of their features into the design of our vessels in order to make them more resistant to blast pressure.

DETAILED DESCRIPTION OF MACHINERY DAMAGE

A. General Description of Machinery Damage.

(a) Overall condition.

There was no apparent damage to the machinery except for two ventilation blowers on the 01 level which were jammed by the blast. A number of auxiliary machinery units were operated after Test A. Boiler #7 was operated for 36 hours after Test A and showed no evidence of damage. A number of machinery units were not in an operable condition before Test A, but their condition was not changed by the test.

(b) Areas of major damage.

Not applicable.

(c) Primary cause of damage in each area of major damage.

Not applicable.

(d) Effect of target test on overall operation of machinery plant.

The target test had no effect on the operability of the machinery plant.

B. Boilers.

Undamaged. Boilers No. 1, 3, 4, 8, 9 and 10 were not operable before Test A. Boilers No. 2, 5, 6 and 7 were operable before the test and showed no evidence of damage after it. No hydrostatic tests were made, but two of the four operable boilers were steamed at designed pressure and temperature after Test A. A careful inspection of all boilers revealed no damage whatever. In view of the failures of boilers on U. S. vessels at comparable ranges during the test, the performance of these boilers is noteworthy.

NOTE: The stack was cut off by the Japanese at about the 03 level before the ship was taken over by the United States.

C. Blowers.

1. Undamaged.

2. Blowers No. 1, 2, 9 and 10 were operated at about 50% speed after Test A, and functioned normally. Blowers No. 3, 4, 5, 7, 8 and 11 were turned over by hand after Test A. They are undamaged.

3. Blowers No. 6, 12, 13, 14, 15 and 16 were not operable before the test. Their condition was not changed by the test.

D. Fuel Oil Equipment.

Undamaged. The system as a whole was not in good condition before Test A, but no additional damage was sustained.

E. Boiler Feedwater Equipment.

1. Undamaged.

2. There were 5 main and 5 auxiliary feed pumps in an operable condition before Test A. All of these were tested by steam and found operable after the test.

3. The feed discharge system was not tested except for that part required to operate boiler #7 for about 36 hours. Visual inspection however, showed no evidence of damage due to Test A.

F. Main Propulsion Machinery.

1. Undamaged.

2. Turbines No. 3 and 4 were jacked over with no evidence of damage. Turbine No. 1 was rubbing before the test and turbine No. 2 was not in use. Their condition was not changed by the test.

G. Reduction Gears:

Undamaged. The reduction gears were not opened for inspection, but there was no evidence of damage when the main engines were jacked over.

H. Shafting and Bearings:

Undamaged. All shafting and bearings were inspected. No defects were noted.

I. Lubrication System.

Undamaged. All equipment for shafts No. 1 and 2 was visually inspected. There was no evidence of damage. Most all equipment for shafts No. 3 and 4 was inspected and tested.

J. Condensers and Air Ejectors:

Undamaged. Main condensers No. 1, 2 and 4 were inspected visually. No defects were noted. Condenser No. 3 was tested. Its performance was the same as before the test.

K. Pumps:

1. Undamaged.

2. The following pumps were tested at designed loads after Test A.

(a) Feed pumps.

(b) Circulating pumps.

(c) Combined air and condensate pumps.

(d) All fire pumps.

(e) All lube oil pumps.

(f) All fuel oil pumps.

The remaining units were visually inspected and turned over by hand where possible after the test. Some pumps were in such condition before the test that they could not be turned over by hand.

L. Auxiliary Generators (Turbines and Gears).

Undamaged. Turbo-generators No. 1 and 2 operated for 36 hours after Test A. Unit No. 3 was jacked over. Unit No. 4 was inoperable before Test A. Its condition was not changed by the test.

M. Propellers.

Undamaged. The starboard and port outboard propellers were visible from the surface of the water. There was no evidence of damage. The inboard propeller was not visible from the water surface.

N. Distilling Plant.

Undamaged. Operation of both plants was satisfactory with the same capacity and quality of water as before Test A.

O. Refrigeration Plant.

The refrigerating plant was inoperable before Test A. No mechanical damage was evident after Test A.

P. Winches, Windlasses, and Capstans.

All windlasses and capstans were inoperable before Test A. One winch was in poor operating condition before Test A. No evidence of damage to any of this equipment from Test A was noted.

Q. Steering Engine.

Undamaged. A visual inspection was made. No evidence of damage was noted.

R. Elevators, Ammunition Hoists, etc.

Undamaged. Elevators, ammunition hoists, etc. were not in operable condition before Test A. Visual inspection indicates that no damage was sustained from the test.

S. Ventilation (Machinery).

All ventilation machinery operated satisfactorily after the test, except for 2 blowers on the 01 level which were jammed by blast.

T. Compressed Air Plant.

Undamaged. There was only one compressor which operated before Test A. A visual inspection indicated that compressors were not damaged during Test A.

U. Diesels (Generators and Boats).

Undamaged. The diesel engines were not working before Test A. Visual inspection indicated that no damage was sustained during the test.

V. Piping Systems.

Undamaged. Wherever possible the piping systems were tested at designed conditions after Test A. The systems that were visually inspected include: Hydraulic, gasoline, and compressed air piping. Main steam, auxiliary steam and auxiliary exhaust were checked under steam pressure and no defects appeared.

W. Miscellaneous.

No machinery under this heading was damaged by Test A.

TECHNICAL INSPECTION REPORT

SECTION III - ELECTRICAL

GENERAL SUMMARY OF ELECTRICAL DAMAGE

I. Target Condition After Test.

(a) Drafts after test;list; general areas of flooding, sources.

Not observed.

(b) Structural damage.

Not observed.

(c) Other damage.

There was no significant electrical damage to this vessel. Minor damage was sustained by the 24" searchlights, running and anchor lights, and one announcing system reproducer.

II. Forces Evidenced and Effects Noted.

(a) Heat.

There was evidence of heat on exposed electric cables. Direction of heat blast was from port quarter. Several fires started onboard and paint was scorched on electric cables on topside. No damage to any electrical equipment from heat.

(b) Fires and explosions.

There were no fires or explosions in the way of electrical equipment.

(c) Shock.

The only evidence of shock damage to electrical equipment was the breaking of the 24" signal searchlight incandescent lamps.

(d) Pressure.

There was evidence of pressure as one 1MC loud speaker on the quarter deck aft was torn from its mounting and blown overboard, and bow and stern lights were blown overboard. Direction of the pressure blast was from the port quarter.

(e) Any effects apparently peculiar to the atom bomb.

The effects that were noted as to heat and pressure are peculiar to the atom bomb.

III. Effects of Damage.

(a) Effect on propulsion and ship control.

There was no damage to electrical, machinery or ship control equipment.

(b) Effect on gunnery and fire control.

No effect on gunnery or fire control.

(c) Effect on water-tight integrity and stability.

No effect on water-tight integrity or stability from electrical damage.

(d) Effect on personnel and habitability.

There was no effect on habitability from electrical damage.

(e) Total effect on fighting efficiency.

There was no effect on the fighting efficiency from electrical damage.

IV. General Summary of Observers' Impressions and Conclusions.

As there was no significant electrical damage to the ship, no impressions or conclusions were formed by the observers.

V. Any Preliminary General or Specific Recommendations of the Inspecting Group.

There are no recommendations by the inspecting group.

DETAILED DESCRIPTION OF ELECTRICAL DAMAGE

A. General Description of Electrical Damage.

(a) Overall condition.

The general overall condition after Test A was the same as before the test. All machinery was operable and the vessel suffered only very minor electrical damage to 24" searchlights, one loudspeaker, and bow and stern anchor lights.

(b) Areas of major damage.

The areas of electrical damage were the superstructure and topside area.

(c) Primary causes of damage in each area of major damage.

There was no major damage. The minor electrical damage was caused by pressure and shock.

(d) Effect of target test on overall operation of electric plant.

There was no effect on the operation of the electric plant from Test A.

(e) Types of equipment most affected.

Two 24" incandescent type searchlights bow and stern anchor lights, blinker type signal lights, and one loud speaker.

B. Electric Propulsion Rotating Equipment.

Not Applicable.

C. Electric Propulsion Control Equipment.

Not Applicable.

D. Generators - Ships Service.

Not damaged.

E. Generators - Emergency.

Not damaged.

F. Switchboards, Distribution and Transfer Panels.

Not damaged.

G. Wiring, Wiring Equipment and Wireways.

Wiring for bow and stern anchor lights and one loud speaker was broken when that equipment was blown overboard from blast pressure.

H. Transformers.

Not damaged.

I. Submarine Propelling Batteries.

Not Applicable.

J. Portable Batteries.

Not damaged.

K. Motors, Motor Generator Sets, Motor Controllers.

Not damaged.

L. Lighting Equipment.

The bow and stern anchor lights blown overboard from blast pressure.

Two blinker signal lights mounted on the foremast structure were blown off by the blast and were demolished by the fall to the forecastle deck. These lights were mounted in groups of three on the signal yards, each light having a colored fresned lens and a solenoid operated cylindrical shutter. The weight of the assembly was obviously too great for the light strap iron supports which broke when the light was struck by the bomb blast.

M. Searchlights.

The incandescent lamps in both 24" searchlights on the signal bridge were broken from shock. The searchlights were operable when lamps were replaced.

N. Degaussing Equipment.

Not Applicable.

O. Gyro Compass Equipment.

Not damaged.

P. Sound Powered Telephones.

Not Applicable.

Q. Ship's Service Telephones.

Damaged extensively prior to test by souviner hunters.

R. Announcing Systems.

The quarter deck loud speaker was blown overboard.

S. Telegraphs.

Not damaged.

T. Indicating Systems.

Not damaged.

U. I.C. and A.C.O. Switchboards.

Not damaged.

V. F.C. Switchboard.

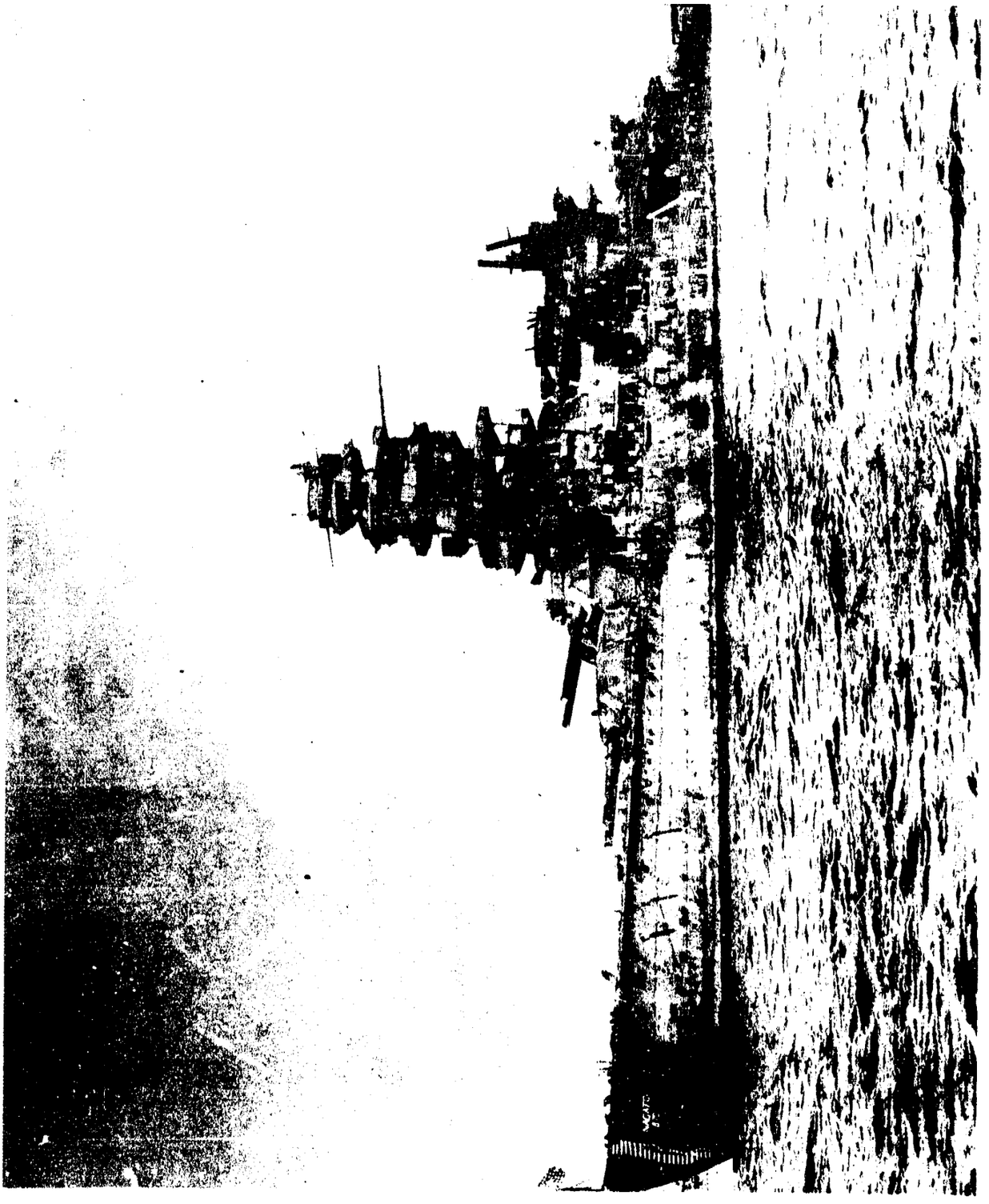
Not damaged.

SECTION IV

PHOTOGRAPHS

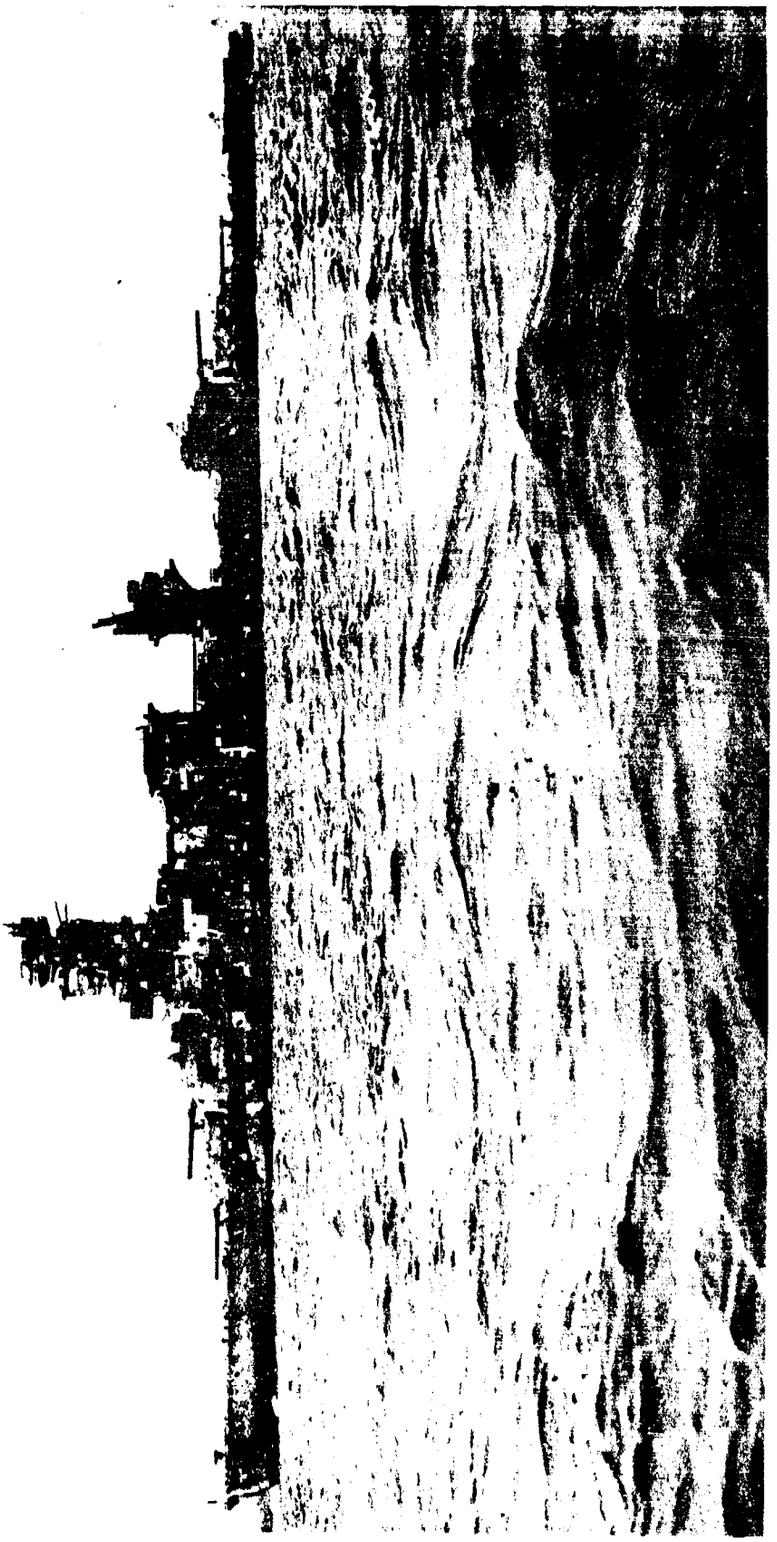
TEST ABLE

BA-CR-196-151-19. View from off port bow before Test A.

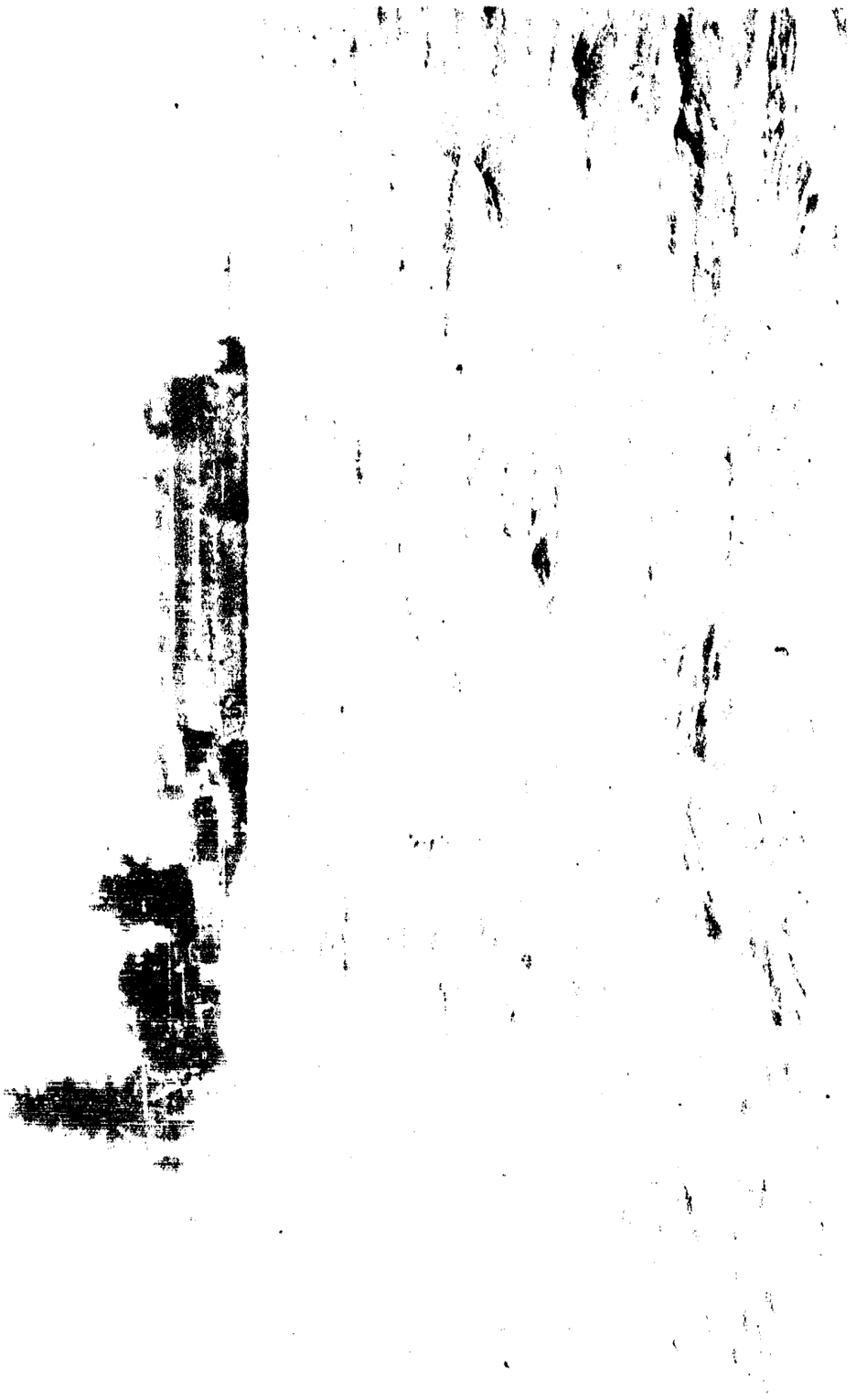


BB-CR-227-513-6. View from off port bow after Test A.

BA-CR-196-151-18. View from off port beam before Test A.

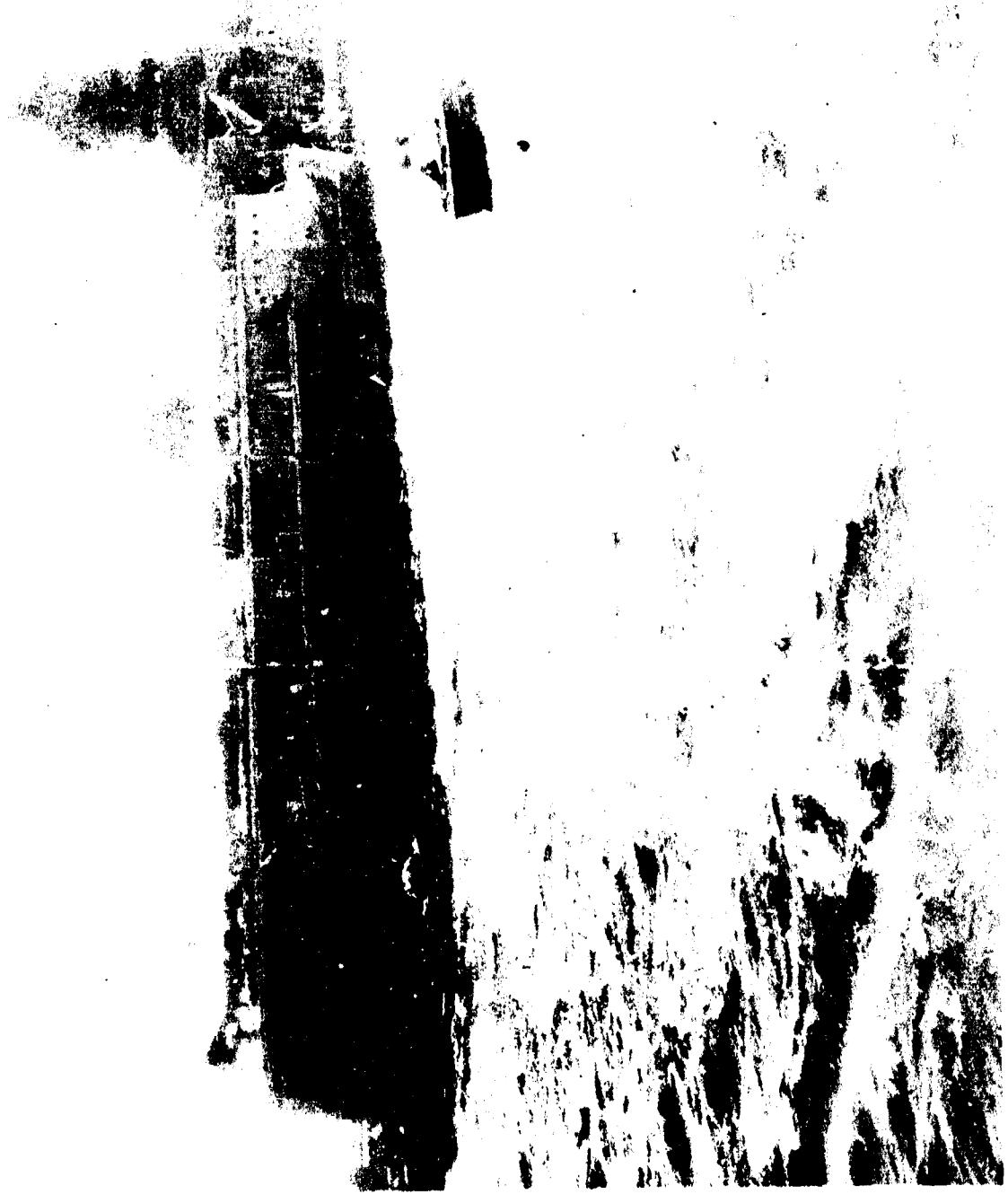


AA-CR-227-91-37. View from off port beam after Test A.



BA-CR-196-151-17. View from off port quarter before Test A.

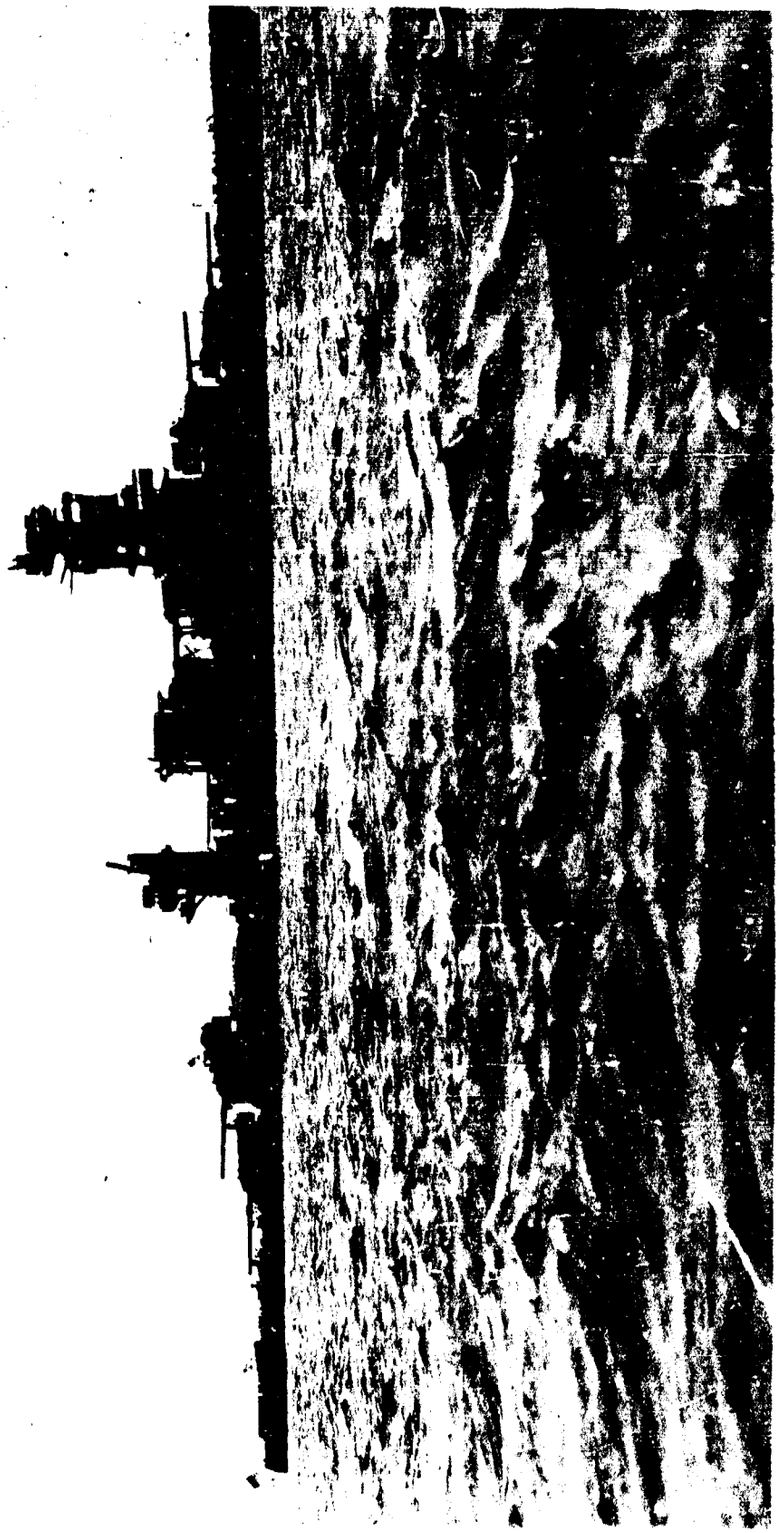
AA-CR-227-91-30. View from off port quarter after Test A.



BA-CR-196-151-22. View from off starboard quarter before Test A.

AA-CR-227-91-32. View from off starboard quarter after Test A.

BA-CR-196-151-21. View from off starboard beam before Test A.



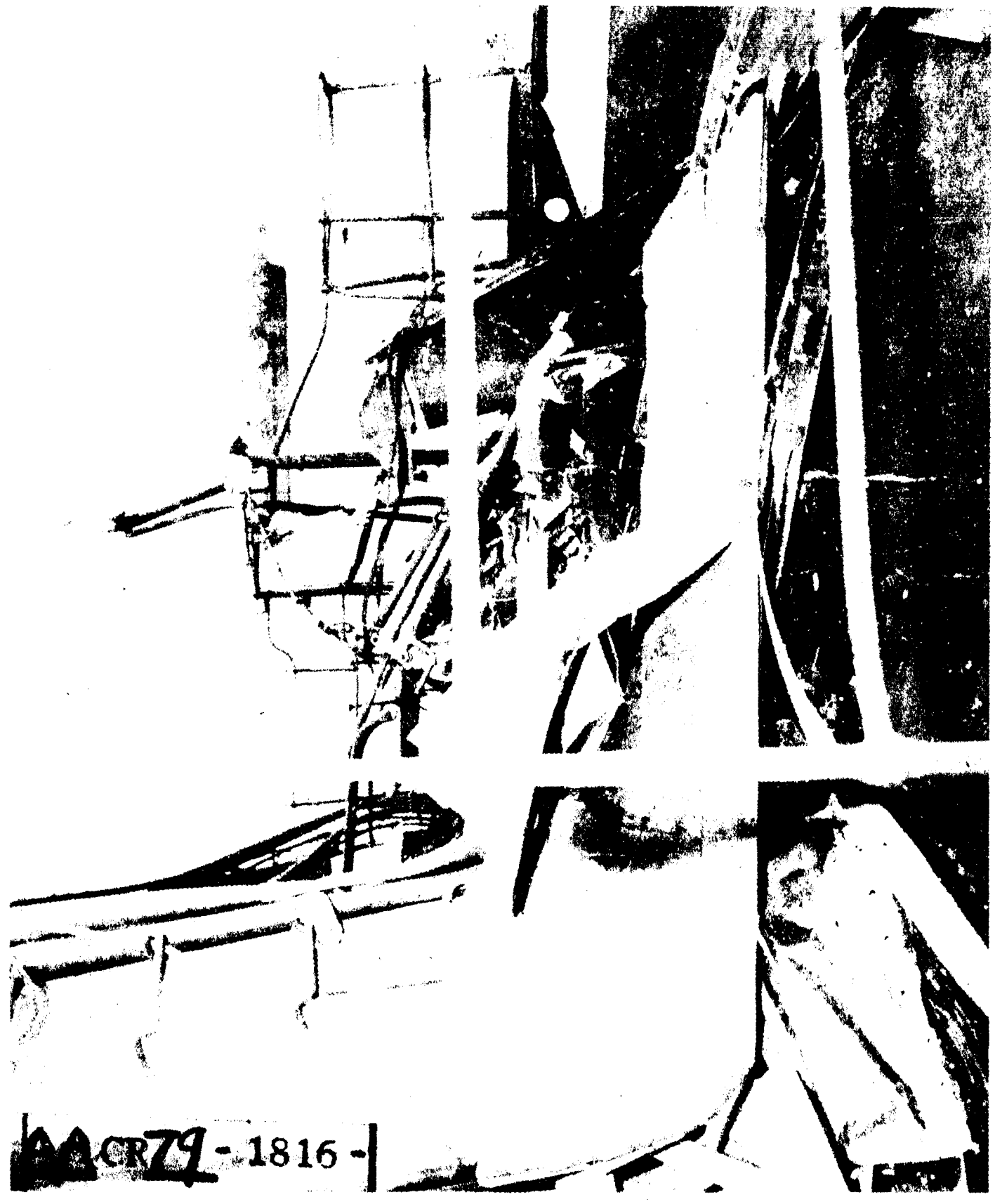
AA-CR-227-91-33. View from off starboard beam after Test A.

BA-CR-196-151-20. View from off starboard bow before Test A.

AA-CR-227-91-34. View from off starboard bow after Test A.

AA-CR-79-1816-10. Looking upward at after face of foremast structure showing light dishing of panel and bending of ladder.

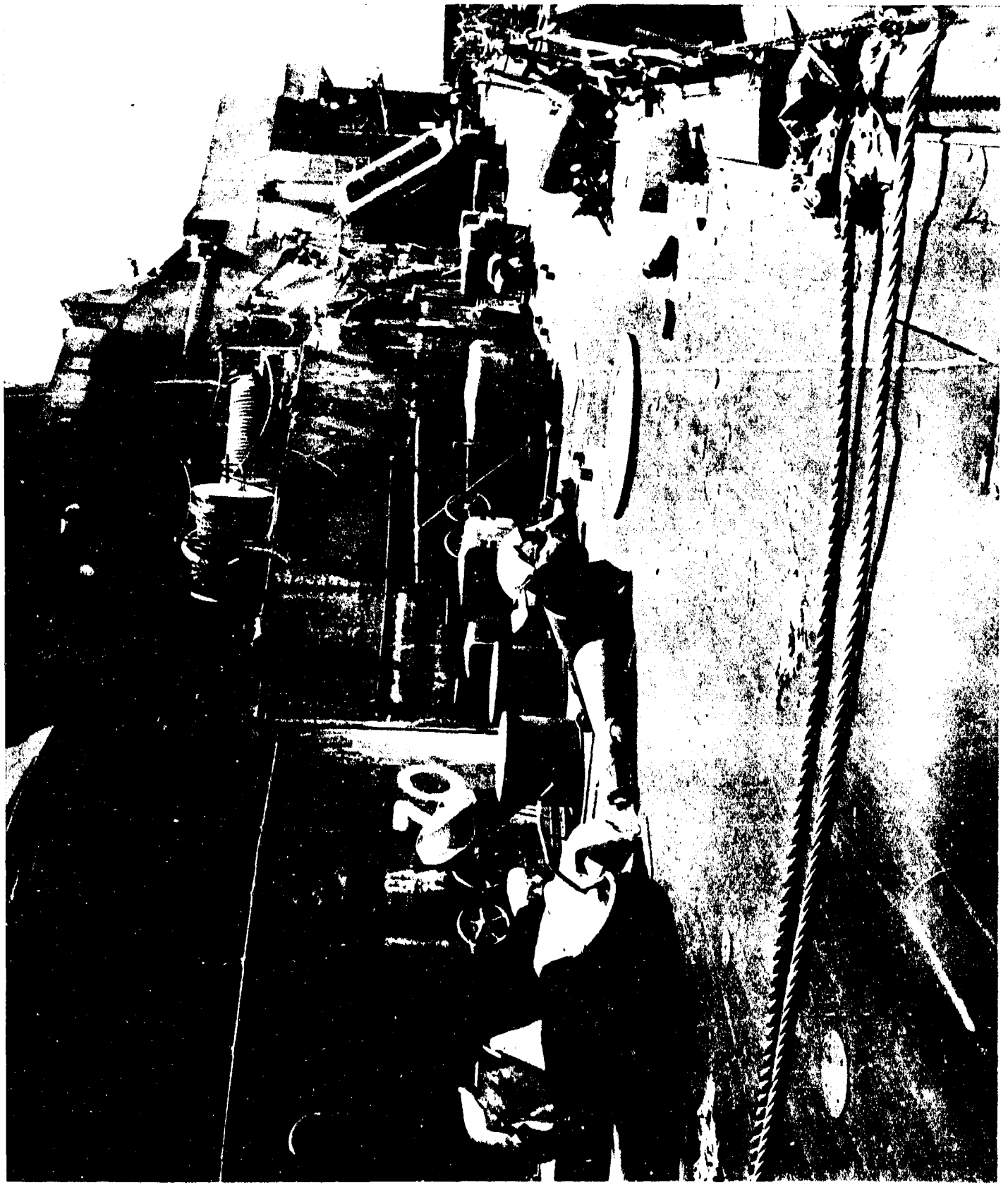
AA-CR-79-1816-7. Looking to starboard on 05 level of foremast, at wreckage of wooden signal shack.



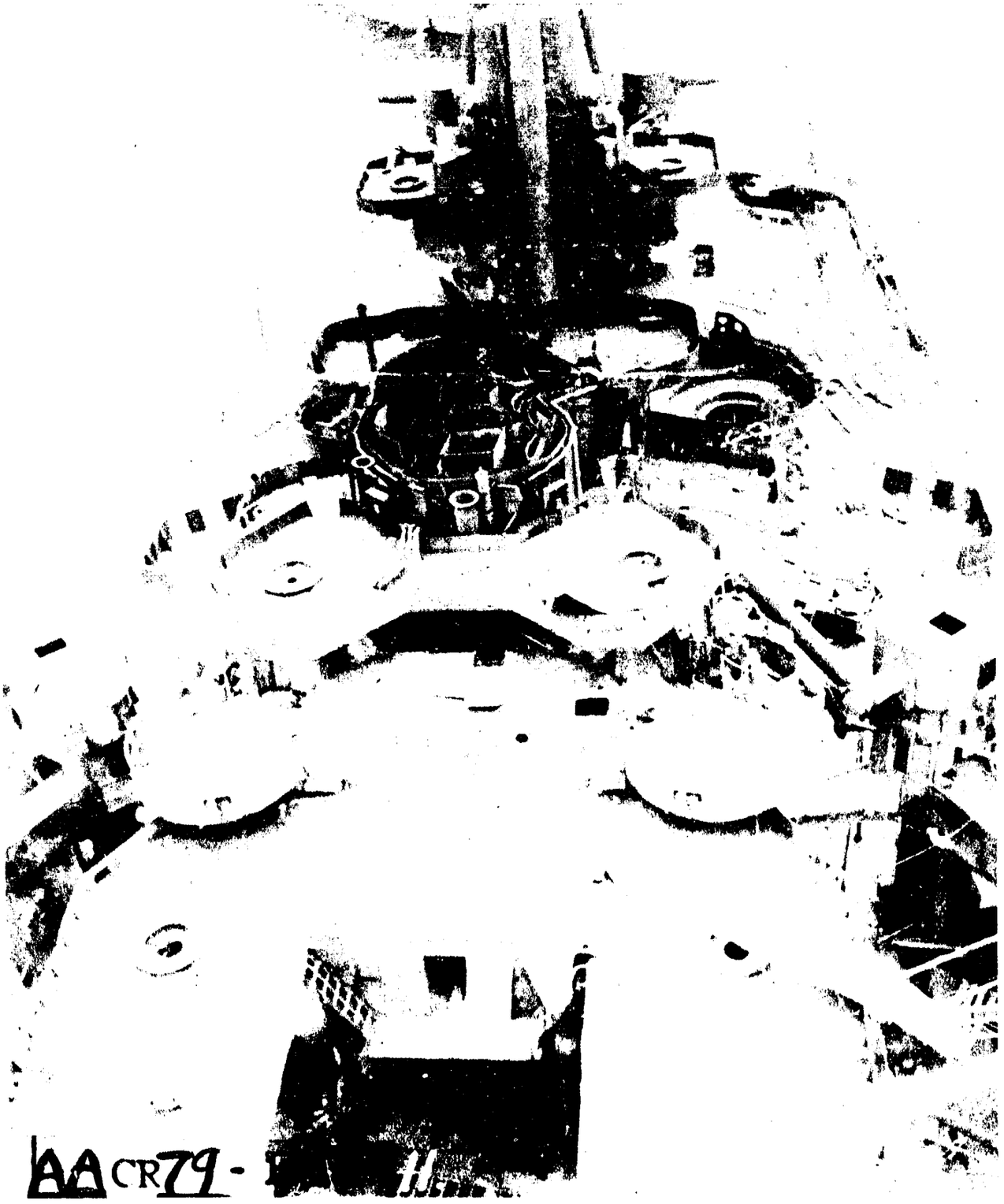
AA-CR-79-1816-8. Looking to starboard on 05 level of foremast, at wreckage of flagbag.

AA-CR-68-1764-2. Looking down on top of stowage compartment on 04 level, frame 115.

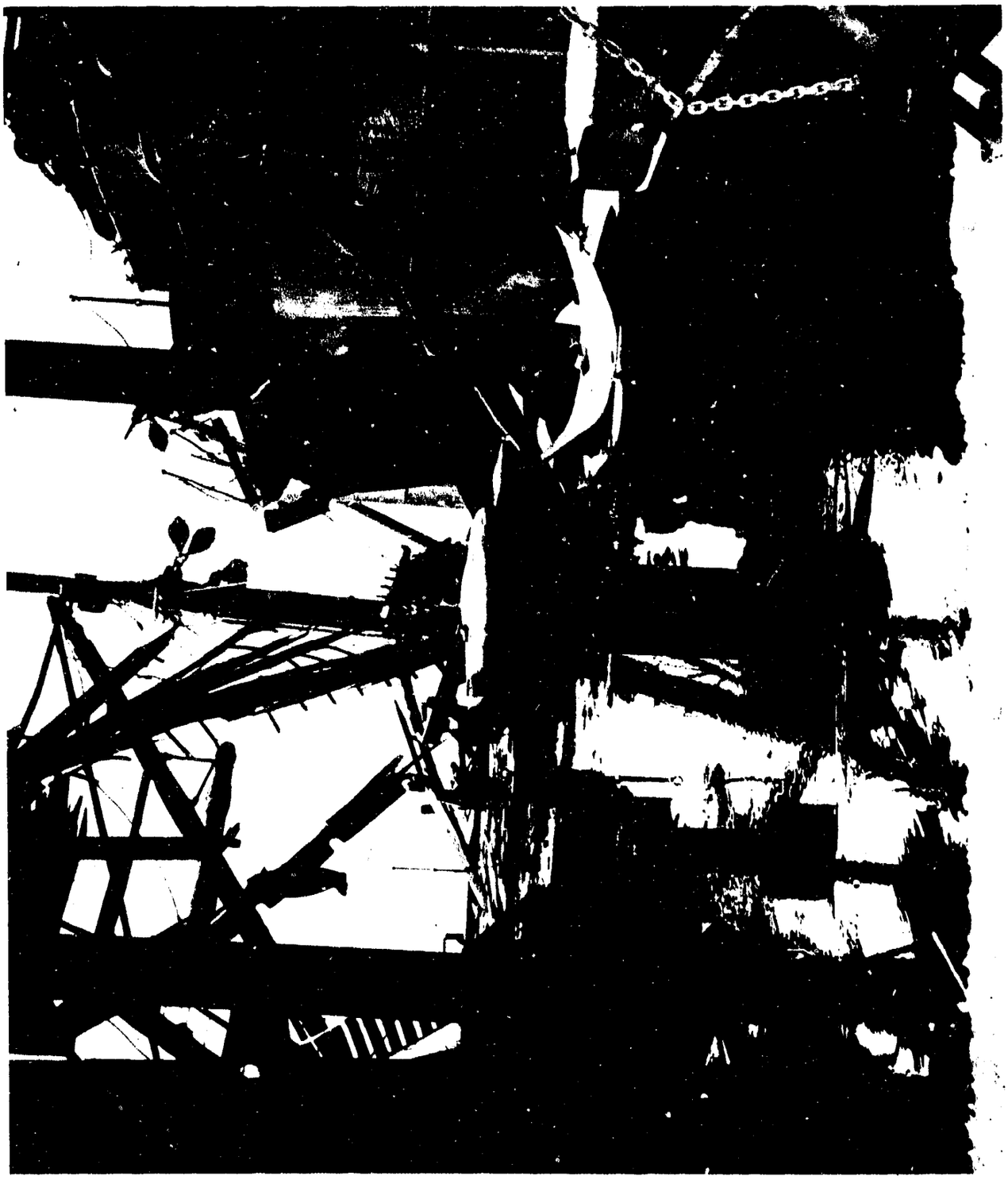
AA-CR-68-1763-8. Looking forward on starboard side, 01 deck, frame 120. Passageway turns to port just aft of doorway in background.



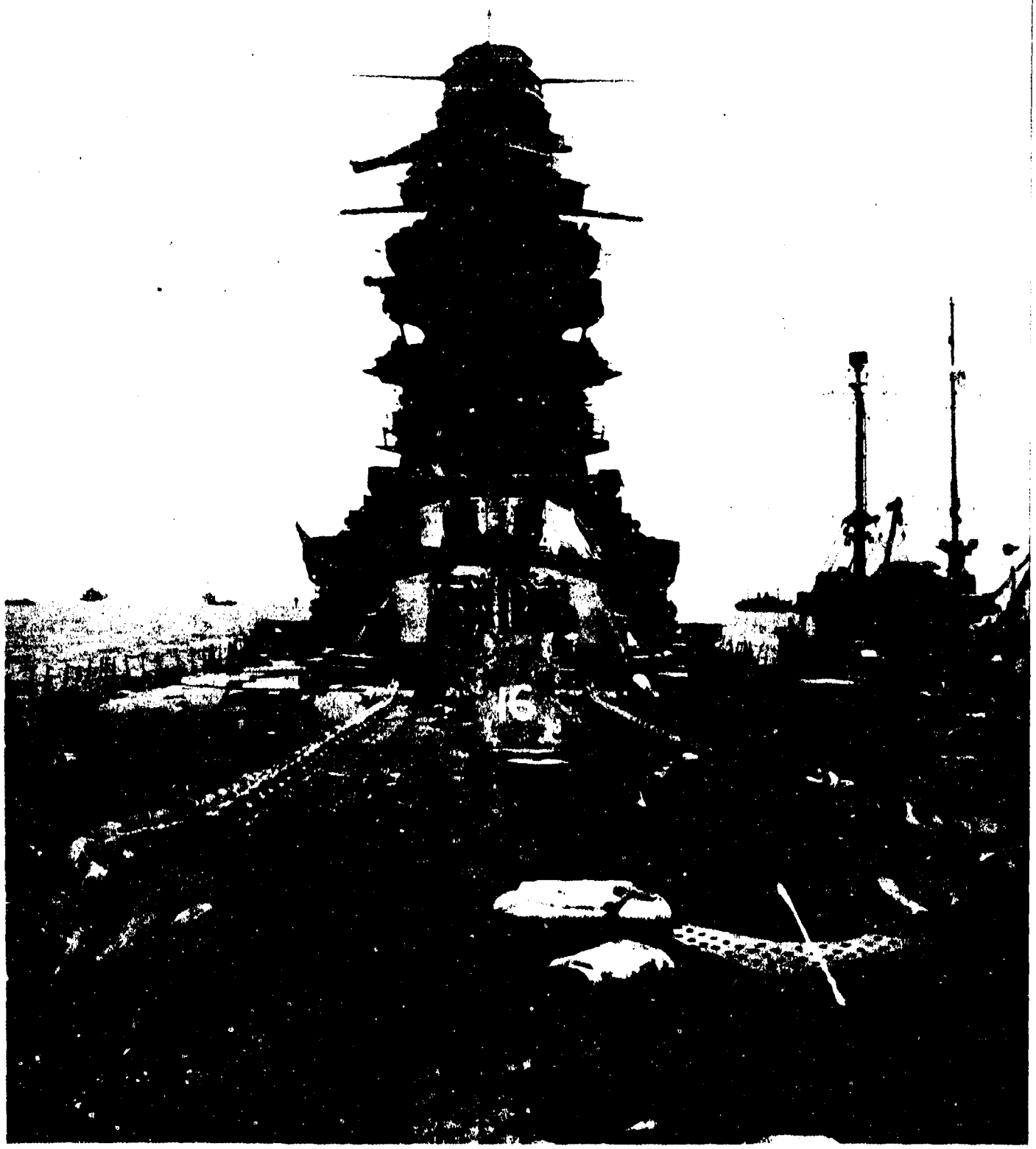
AA-CR-68-1763-11. Looking aft on port forecastle deck, frame 65. Note acoustic horns and training mechanism on deck.



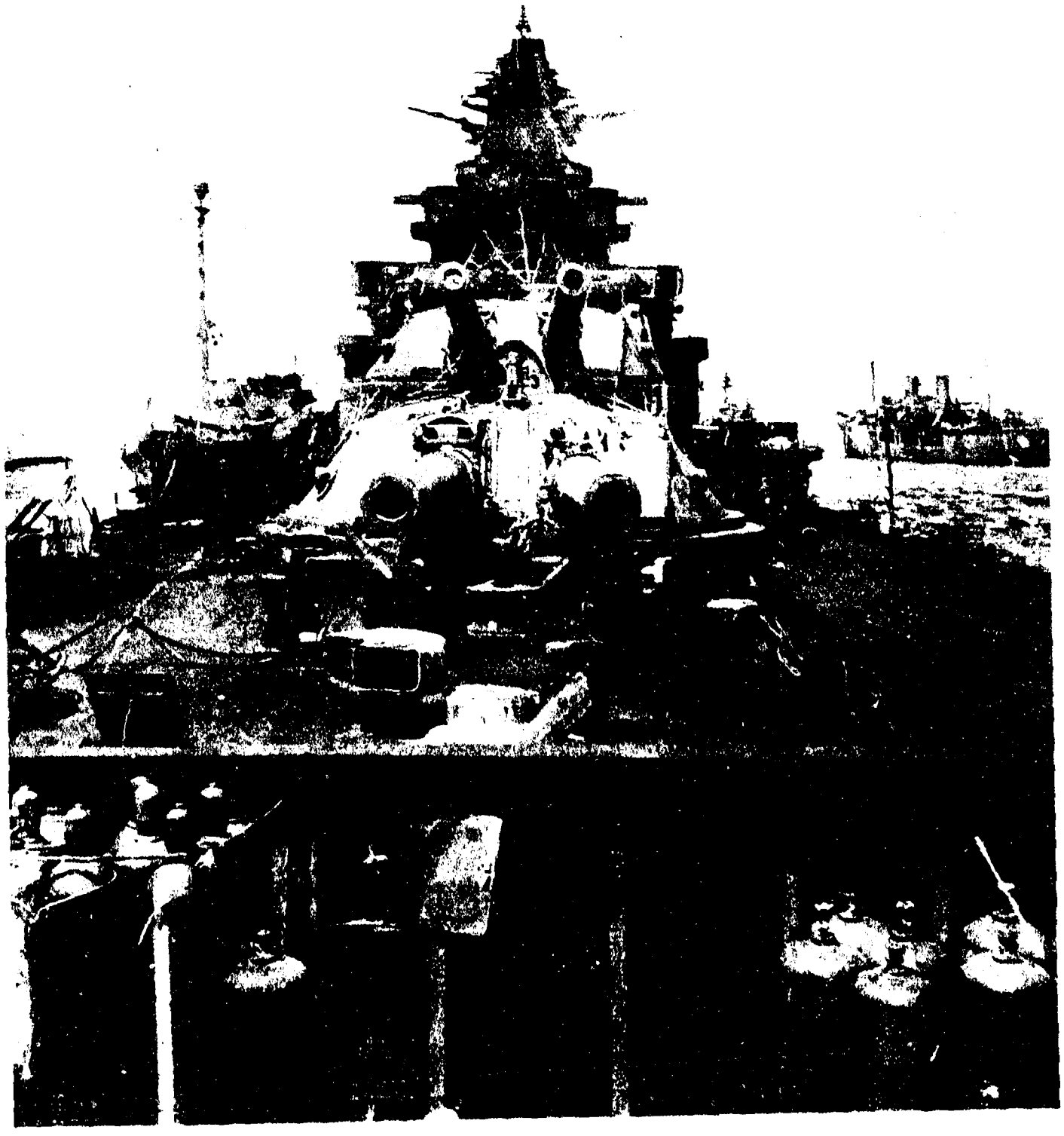
AA-CR-79-1816-11. Looking down and aft from foremast. Note that fins are missing from top of the smokestack and parts of boat on 04 deck.



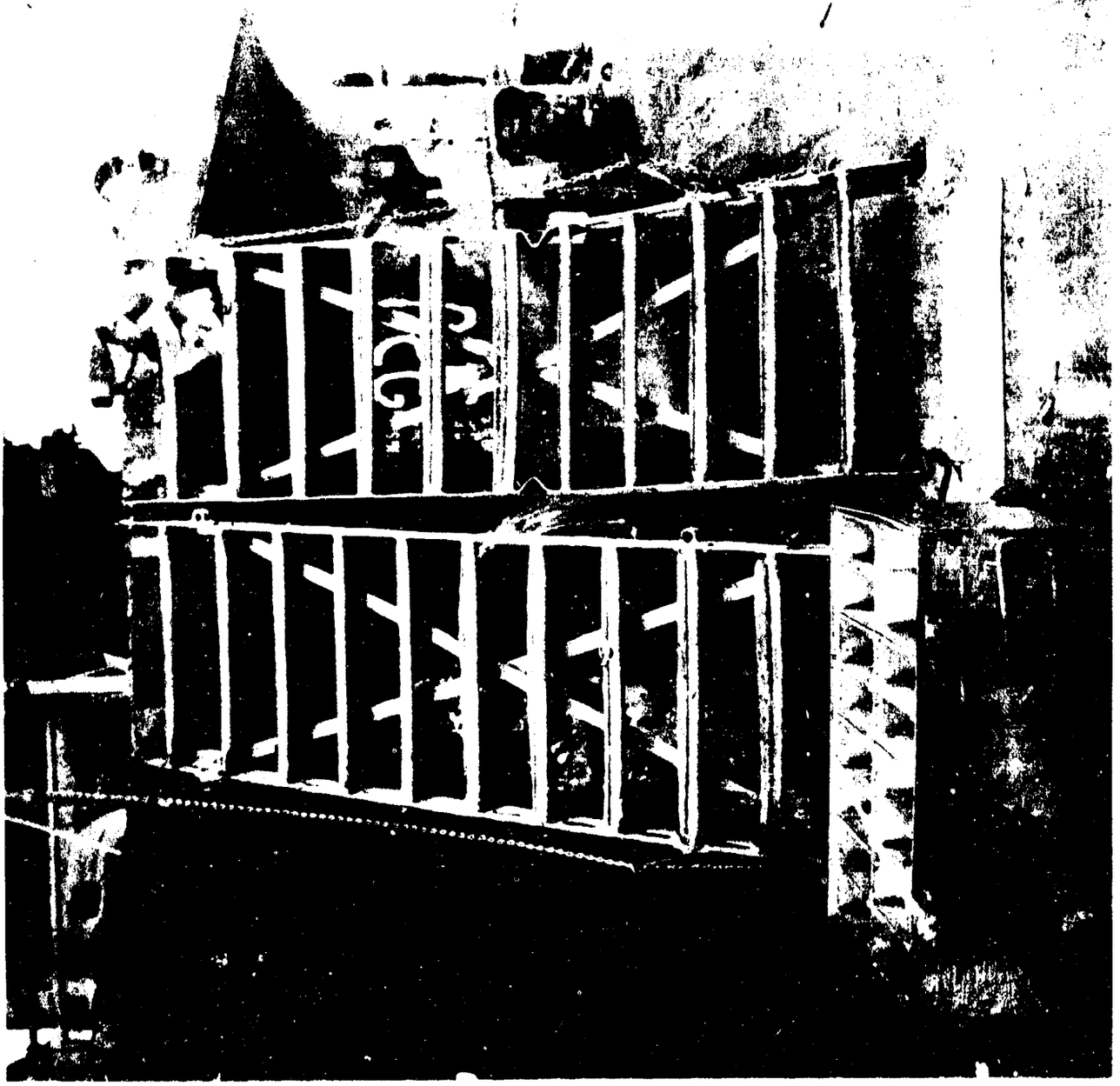
AA-CR-68-1763-12. Looking to port on 02 deck, frame 140, at oil on deck and boat stowage. Note parts of boats.



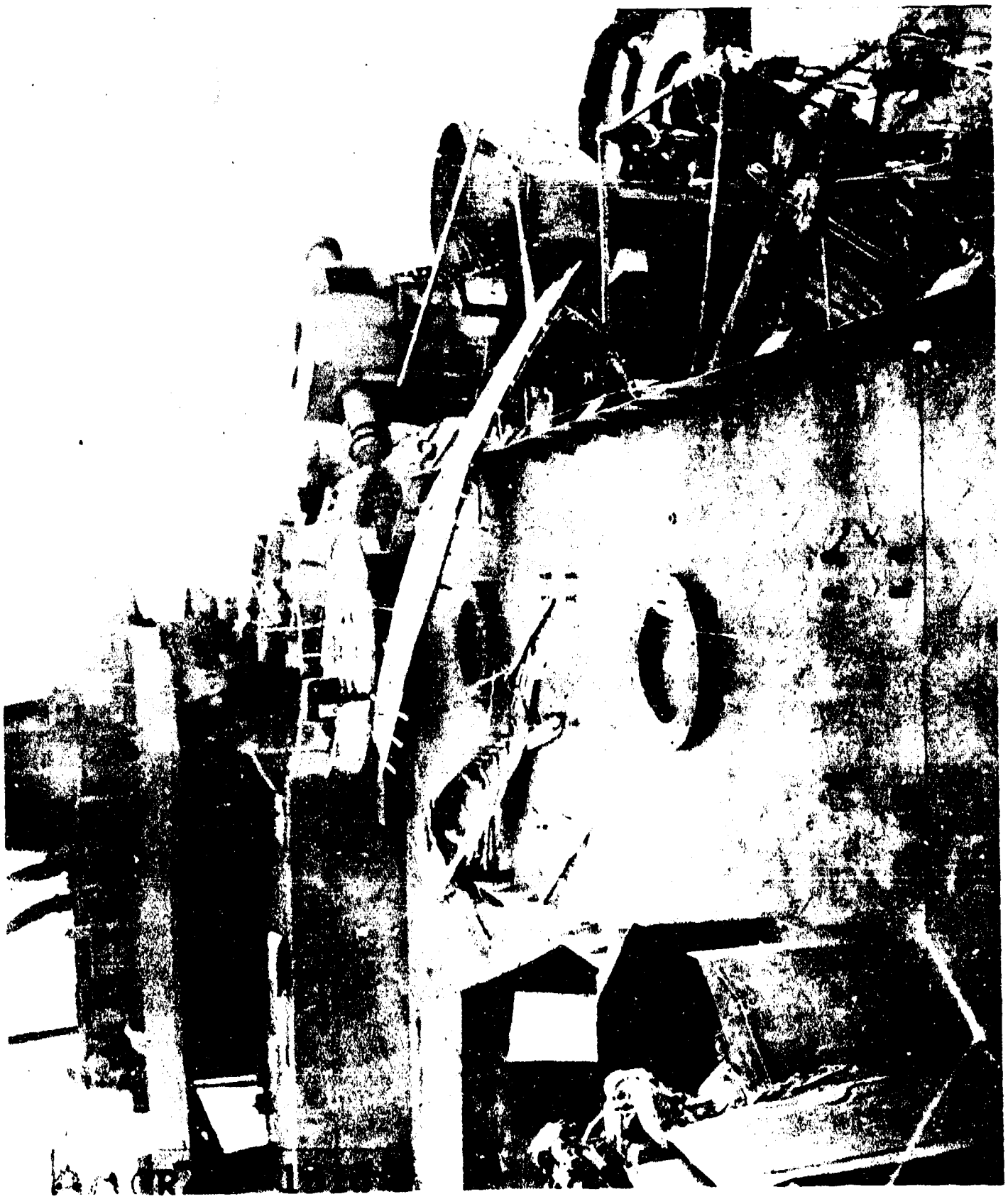
AA-CR-68-1763-10. Looking aft from forecastle.



AA-CR-68-1764-3. Looking forward from stern. Note gas stowage has been rearranged.

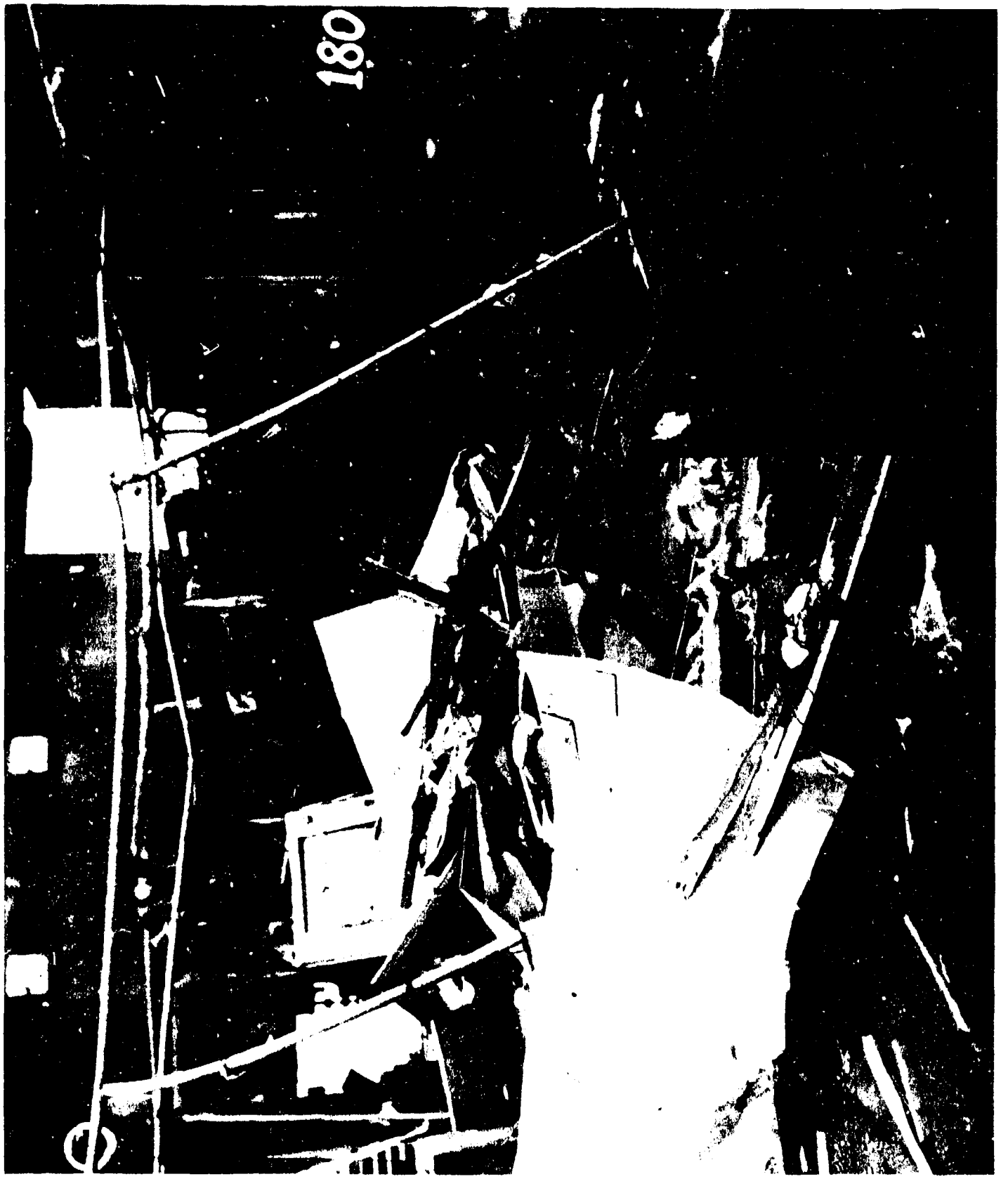


AA-CR-79-1816-2. Looking forward at buckled ladder, frame 235, main deck.

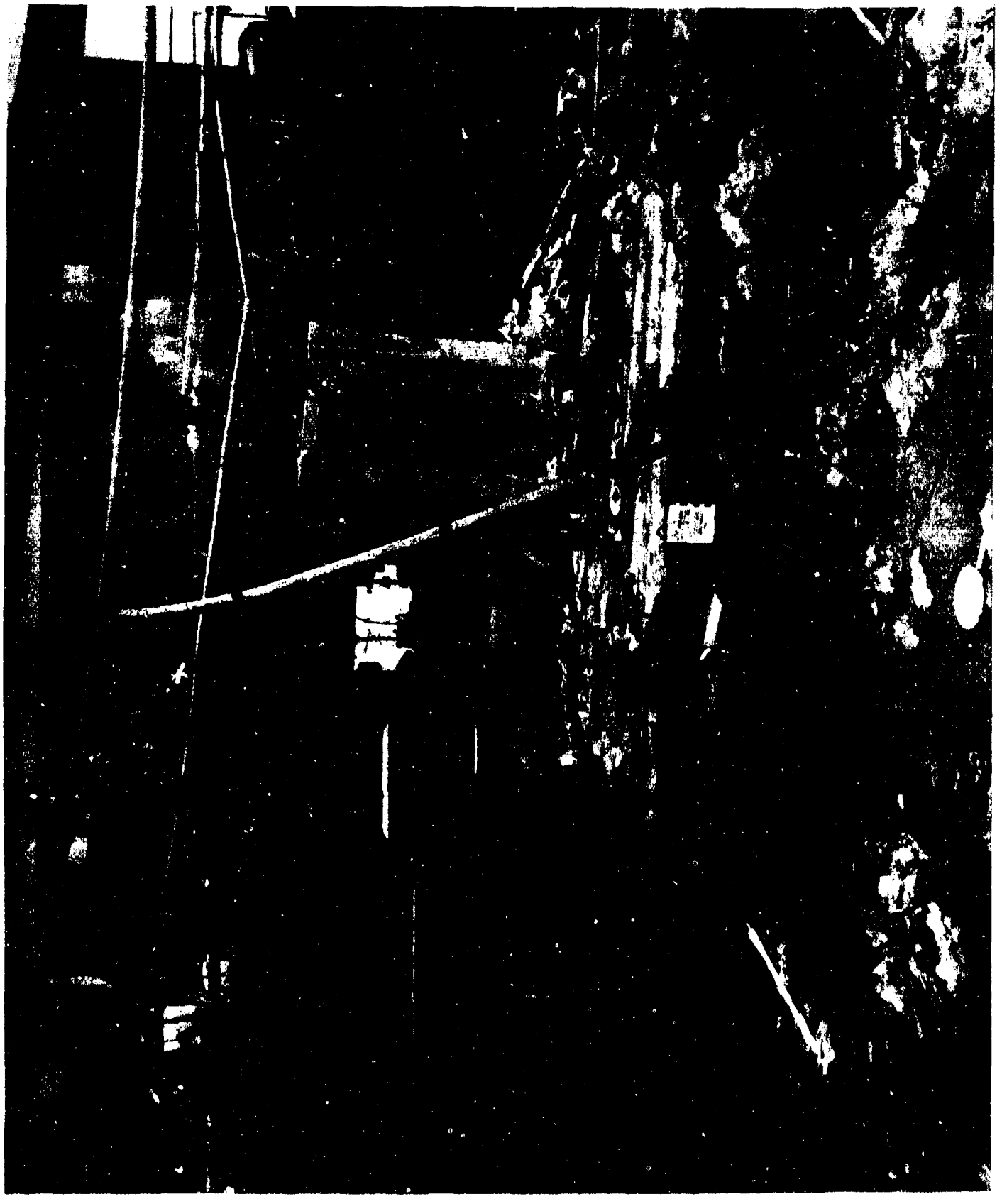


AA-CR-79-1816-9. Looking aft on port side 04 level at parts of wooden boat.

AA-CR-79-1816-4. Looking at wreckage of advanced base reefer box on port side, 01 deck, frame 170.

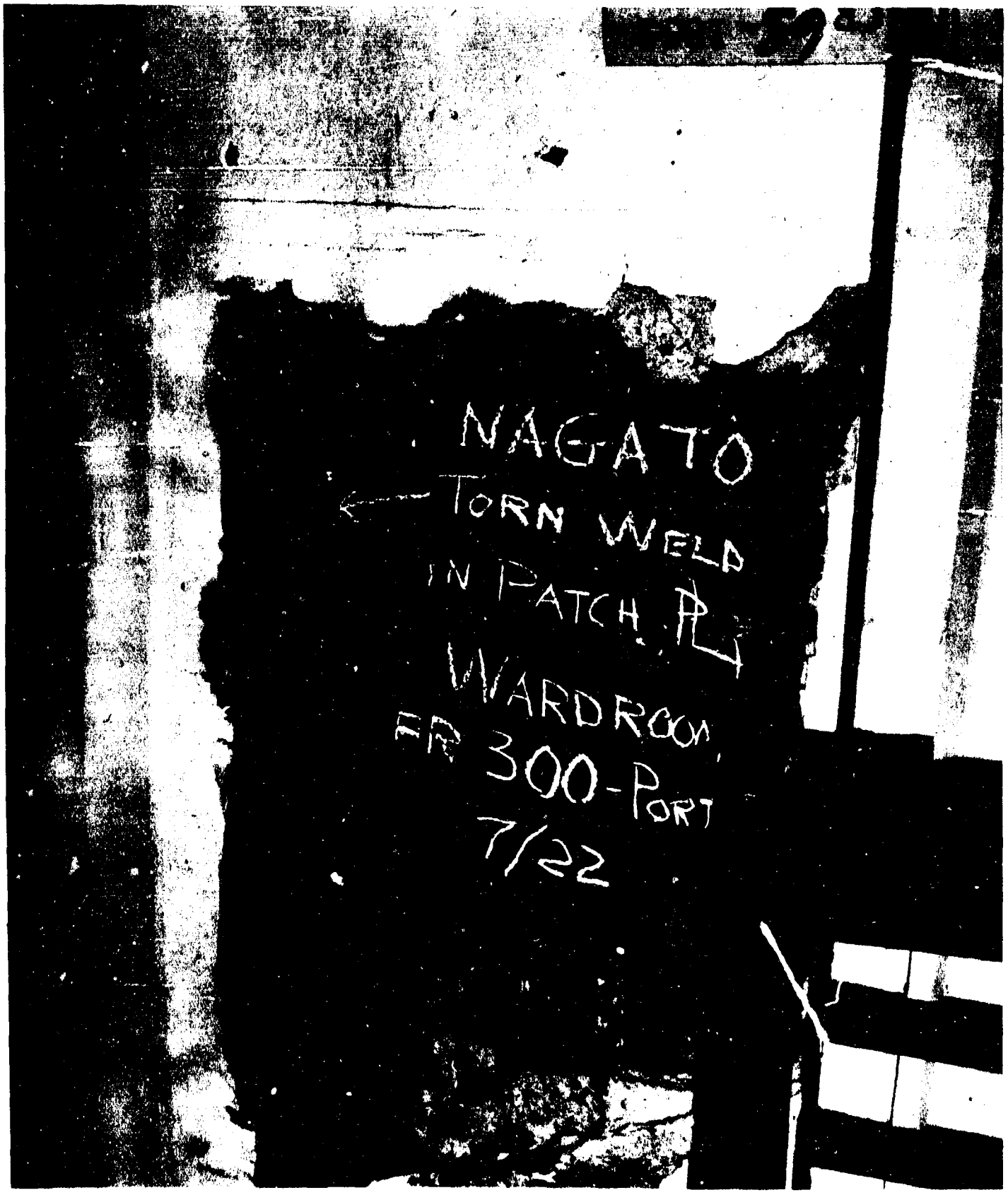


AA-CR-79-1816-3. Looking at wreckage of advanced base reefer box on port side, 01 deck, frame 170.



AA-CR-68-1763-7. Looking at wreckage of advanced base reefer box on port side, 01 deck, frame 170.

AA-CR-79-1816-1. Looking forward at gas bottle stowage on stern, main deck.

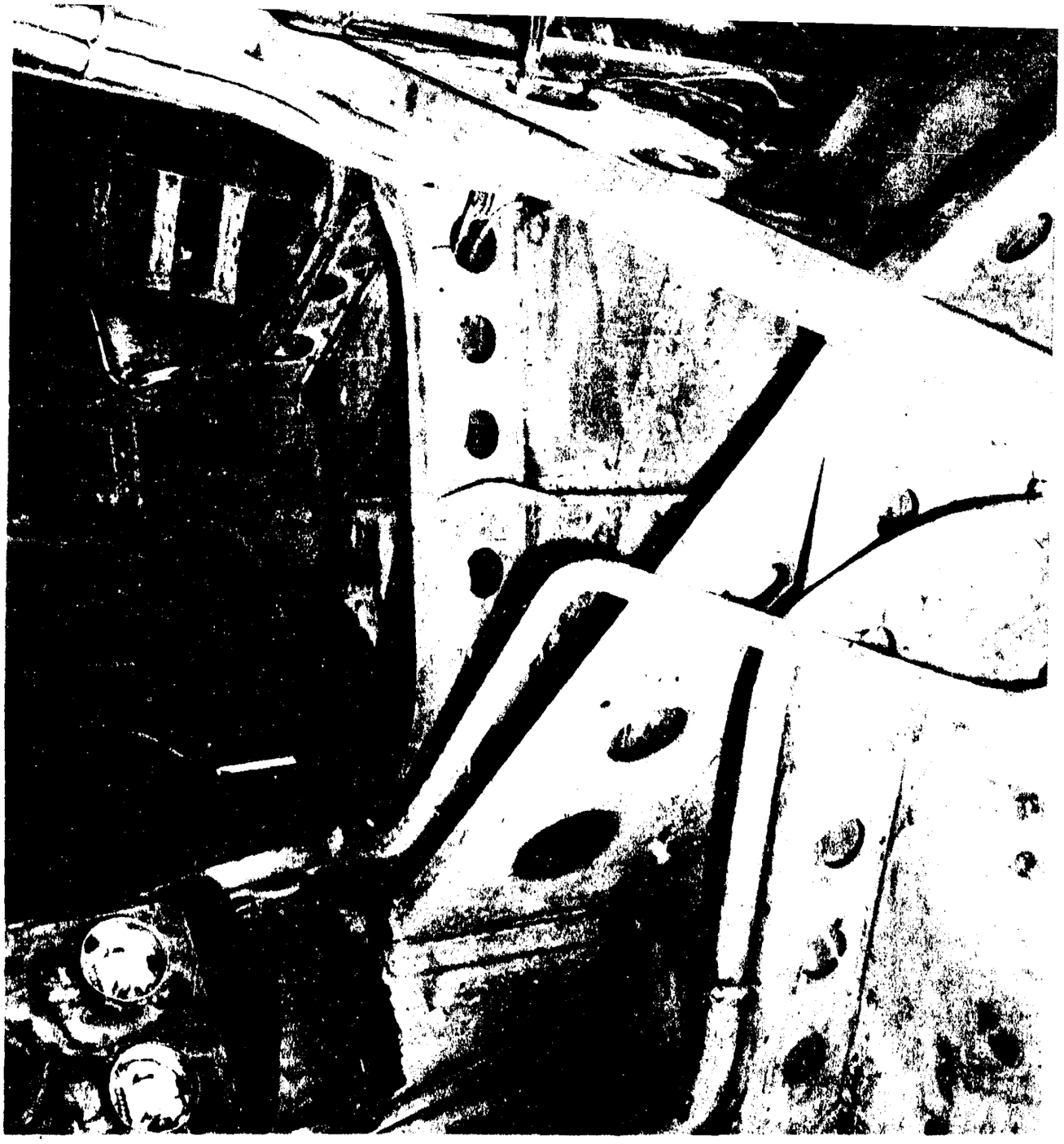


AA-CR-65-1851-9. Looking outboard at frame 300, second deck, port side at cracked weld in way of patch plate.

AA-CR-68-1764-1. Looking outboard at ventilation cowl at frame 130, starboard, 03 deck in way of open space where blast came through. Blast dislodged screen but did not blow off loose cover plate on top.

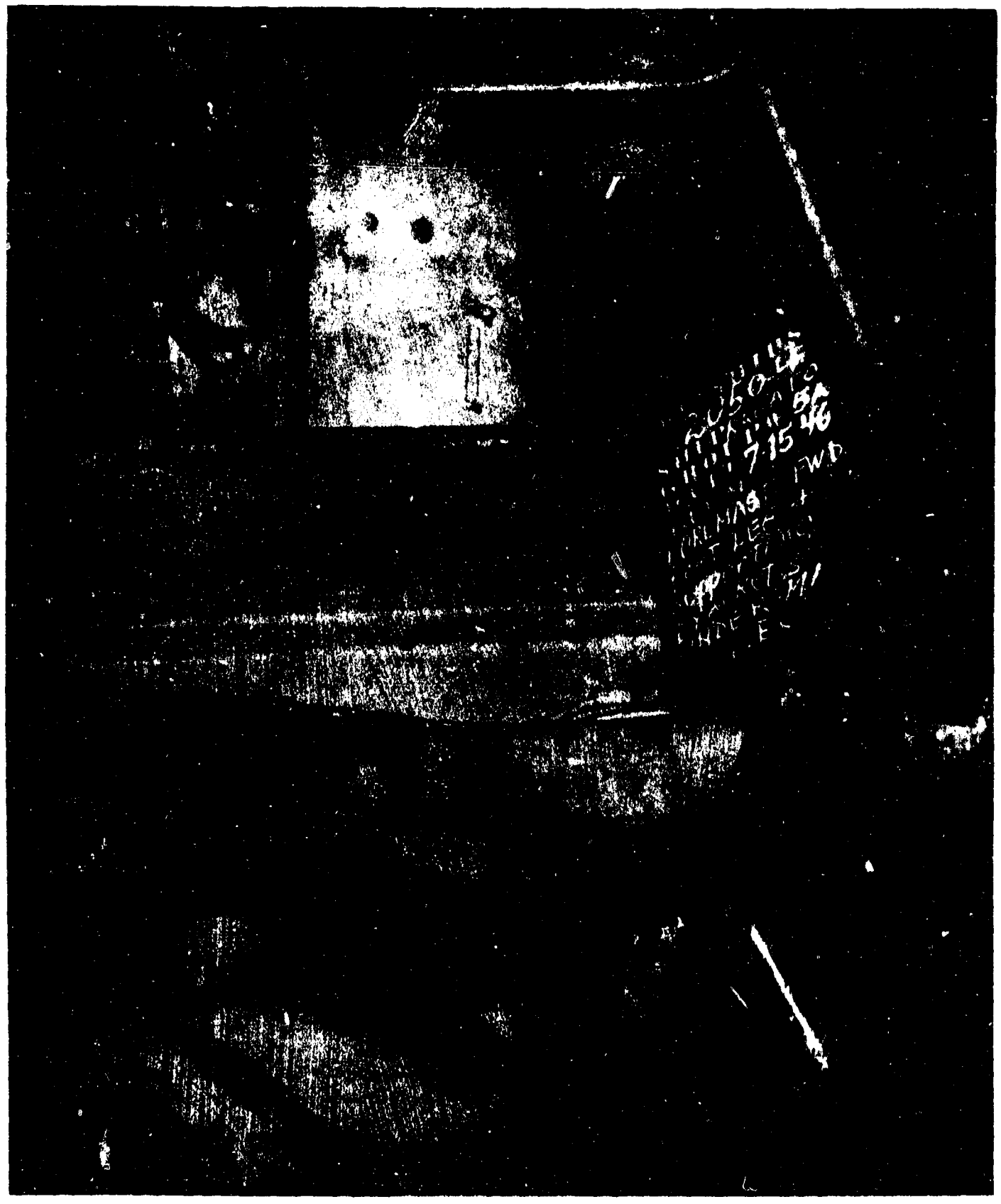
BA-CR-58-494-7. Looking at part of ventilation system for purifying recirculated air. Oxygen bottle not shown.

AA-CR-66-2559-6. Wrapper plate tying top of legs into elevator tube. Main director level.



AA-CR-66-2559-7. Machine Gun Platform. Cantilever construction.

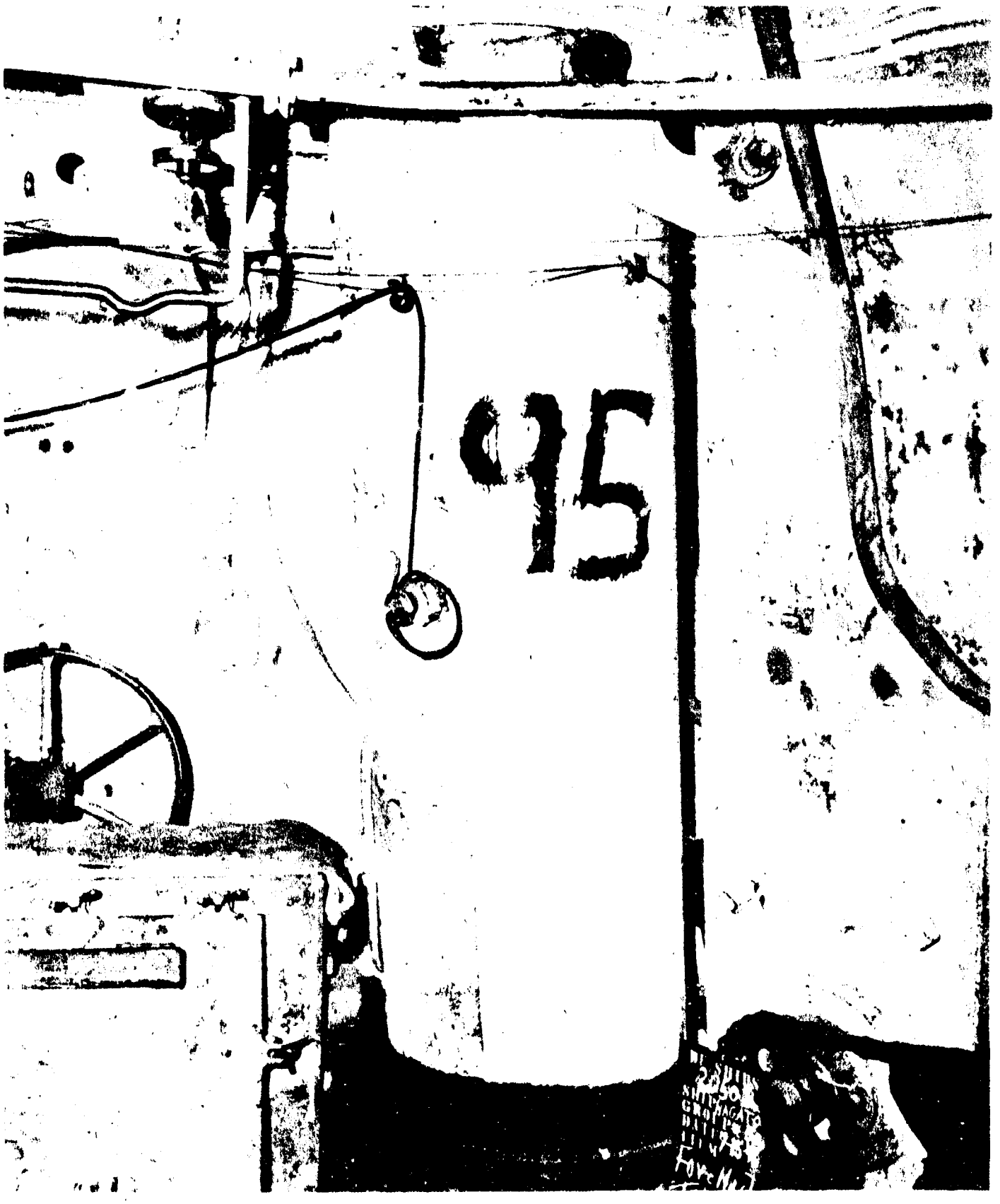
AA-CR-66-2559-8. Boat deck. Typical 20# deck house side framing.



AA-CR-66-2050-4. Underside of main deck looking forward and through hatch at port forward leg of sextipolar mast. Shows flanges of supporting brackets under deck.

AA-CR-66-2050-1. Port forward leg of sextipolar mast bulkhead 97. Weather deck looking forward.

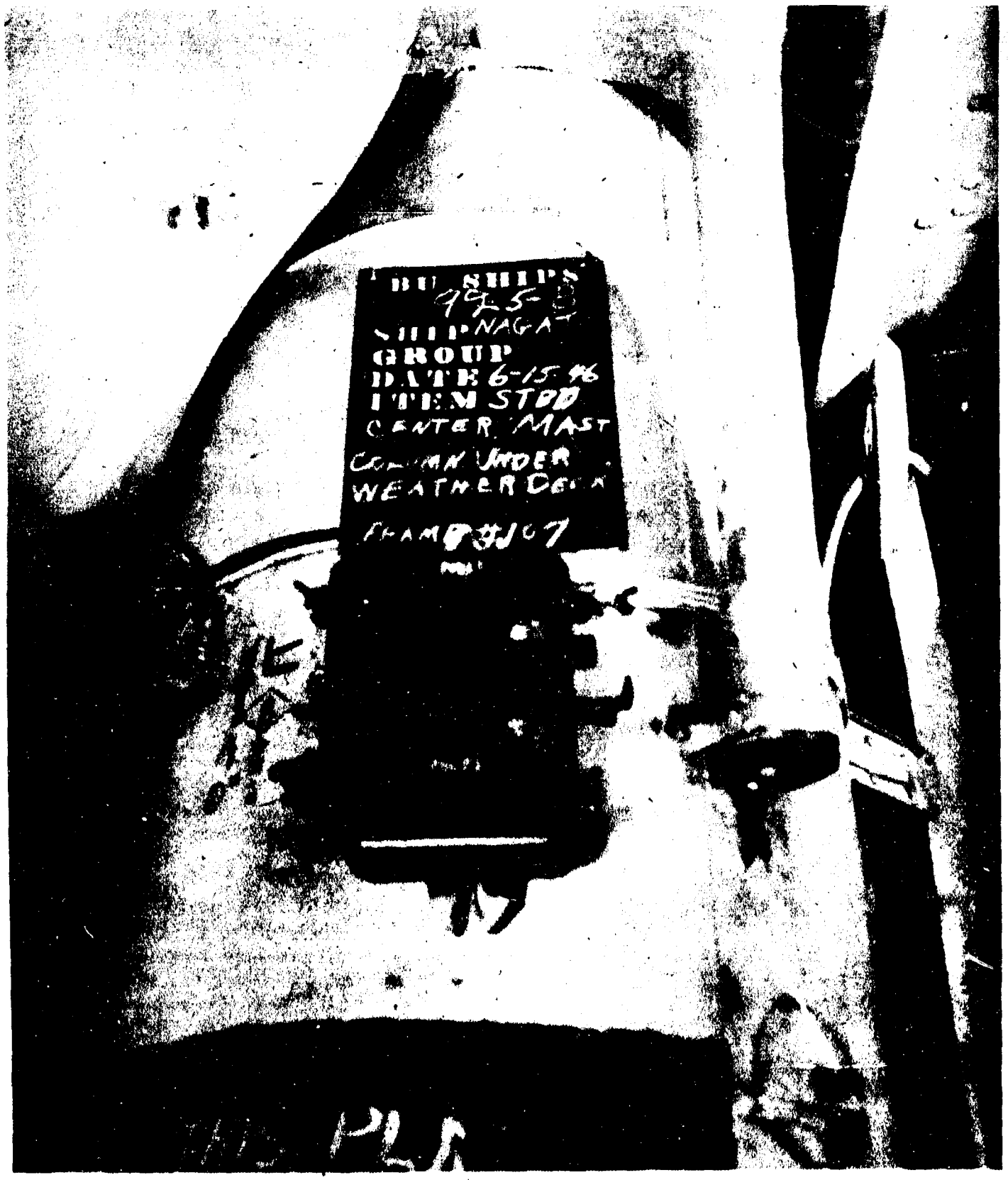
AA-CR-66-2050-2. Port forward leg of sextipolar mast bulkhead 97. Weather deck, looking inboard and aft.



AA-CR-66-2050-3. Starboard. Forward leg of sextipolar mast base. Main deck looking forward.

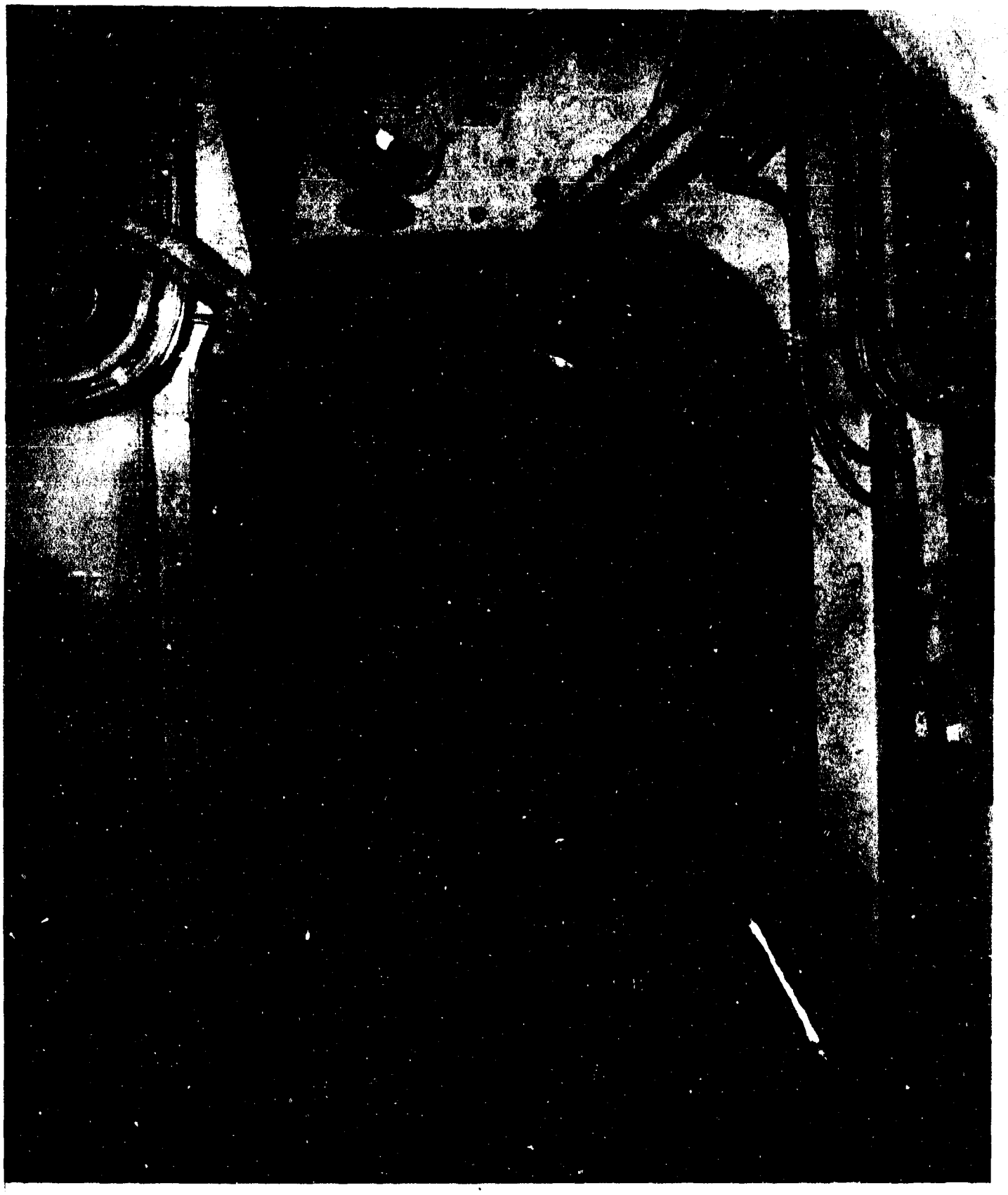
AA-CR-66-2050-6. Brackets under main deck on after face of bulkhead 95, supporting port forward leg of sextipolar mast.

AA-CR-66-2050-7. Brackets under main deck on forward face of bulkhead 95, supporting port forward leg of sextipolar mast.



BA-CR-78-925-8. Center leg, starboard side, under weather deck, sextipolar mast. Frame 107.

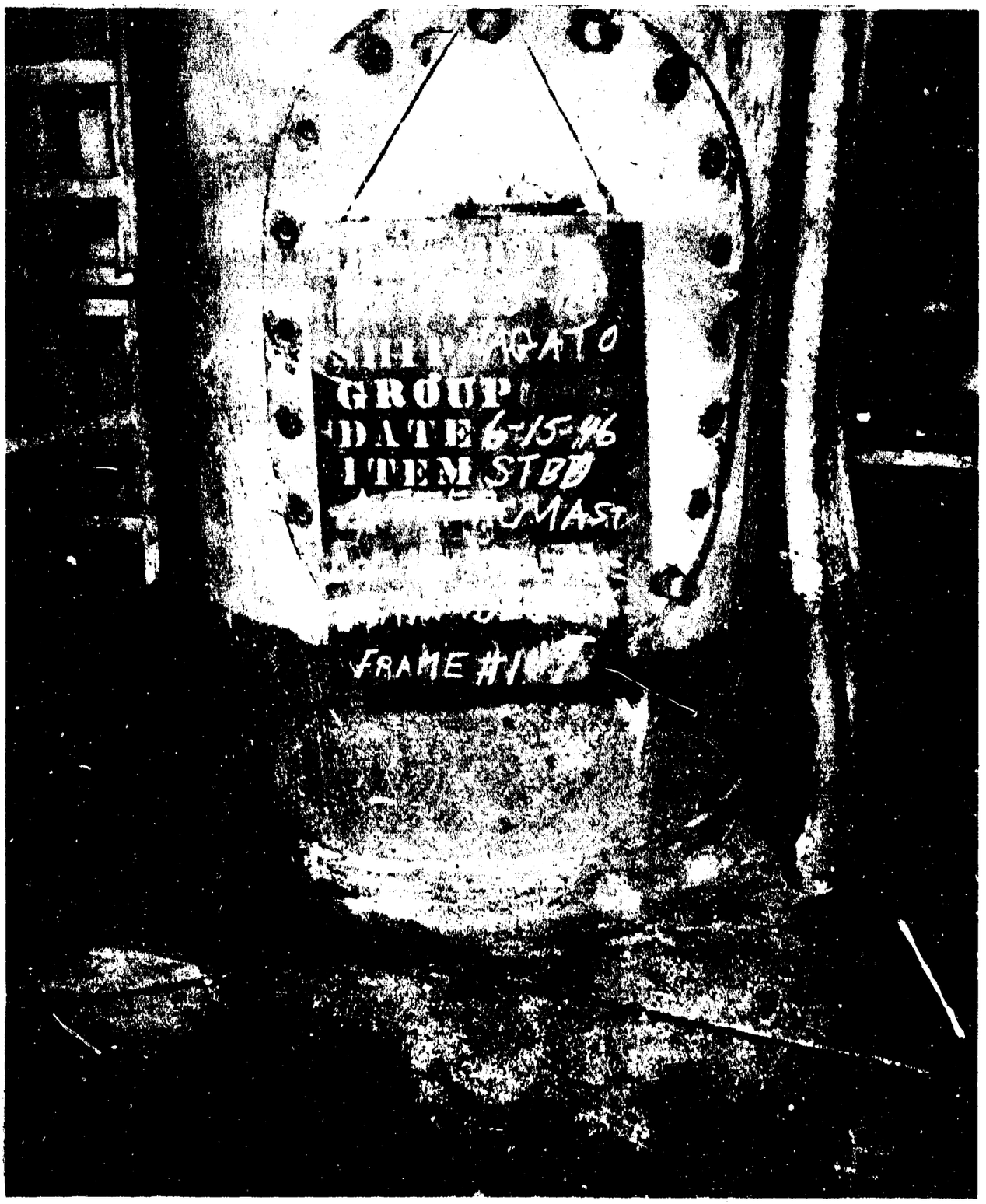
BA-CR-78-925-7. Center leg, starboard side, main deck, sextipolar mast. Base at frame 107.



AA-CR-66-2050-8. Transverse arch-frames 107 and 105 - forming support, under main deck, for middle (starboard) leg of sextipolar mast.

AA-CR-66-2050-9. Longitudinal arch construction between transverse arches 105-107.

BA-CR-78-925-9. After leg, starboard side, under weather deck, sextipolar mast. Frame 115.



BA-CR-78-925-10. After leg, starboard side, base on main deck, frame 115.

AA-CR-66-2050-10. Interior construction. Port after leg sextipolar mast - looking up from main deck.

AA-CR-66-2559-4. Third deck, bulkhead 117, support brackets for port after leg.

APPENDIX

SHIP MEASUREMENT DATA

TEST ABLE

SHIP MEASUREMENT DATA

Recordings of deflection scratch gages installed to measure movement of the weather deck are on pages 102 and 103 .

DECK DEFLECTION GAGES

SHIP NAGATO TEST A

LOCATION			MAXIMUM	MAXIMUM	PERMANENT SET		REMARKS
FR. NO.	DECK	DIST. OFF ℄	COMP.	EXP.	DISTANCE	EXP. / COMP.	
26	MAIN	CENTERLINE	NONE	0-0-1/16	NONE	NONE	NONE
39	"	"	0-0-7/16	NONE	"	"	"
39	"	PORT	0-0-3/16	"	"	"	"
39	"	STBD.	0-0-9/16	"	"	"	"
62	"	PORT	0-0-3/16	"	"	"	"
62	"	STBD.	0-0-3/16	"	"	"	"
249	2ND	PORT	0-0-7/16	"	"	"	"
249	"	STBD.	0-0-3/8	"	"	"	"
275	"	CENTERLINE	0-2-1/4	"	0-1-0	"	"
286	"	PORT	0-0-7/16	"	NONE	"	"

DECK DEFLECTION GAGES

SHIP NAGATO

TEST A

LOCATION			MAXIMUM COMP.	MAXIMUM EXP.	PERMANENT SET		REMARKS
FR. NO.	DECK	DIST. OFF ℄			DISTANCE	EXP. / COMP.	
286	2ND	STBD.	0-0-3/16	NONE	NONE	NONE	NONE
299	"	CENTERLINE	0-2-1/16	"	0-0-7/8	COMP.	"

APPENDIX

COMMANDING OFFICERS REPORT

TEST ABLE

REPORT #11

COMMANDING OFFICER'S REPORT

SECTION I

The Ex-Japanese Battleship NAGATO (B70) was anchored 400 yards to starboard of the NEVADA. Upon careful checking it was determined that the ship's draft had increased about one (1) foot and there was no list, a change of 1/2° to port from before the test. In spite of her appearance, the NAGATO is structurally sound. Her previous battle damage would not have effected her fighting efficiency. The poor condition of the ship and her equipment is due to lack of preventitive maintenance and overhaul, and to the fact that her engineering plant sat idle for over a year.

Three fuel oil tanks, two on the port quarter and one on the starboard side amidships, had flooded, probably through their Kingston valves. The three engine room bilges were filled above the lower floor plates, this water had come from the shaft alleys. The outboard shaft alleys drain into the wing enginerooms, the Center Engineroom water had come in through the lube oil return line and the starboard sump tank when the water in the starboard inboard shaft alley covered the spring bearing. There was more water in the shaft alleys than normally collects in the length of time that they were not pumped.

There was no major structural damage. Superstructure spaces made of sheet metal had their bulkheads wrinkled and many light non-watertight doors were torn off their hinges. The sides of two sheet metal vent ducts to the Center Engineroom were blown off. Three light audio aircraft detectors were broken from their mountings on the 010 level. The stack was well reinforced and hence received only slight damage. The boiler casings and uptakes are made of steel plate and were in no way damaged, nor was the boiler brickwork harmed. By scratch gage measurements, the after part of the main-deck was deflected 2-1/4 inches and took a permanent set about 1 inch below its former position. Four tompions were blown out of the gun muzzles.

All the electrical and mechanical equipment that operated before the test operated after the test. All electrical circuits were as clear as before the test. Except that the antennas were gone the electronic equipment was not further damaged. Those units that operated before, operated after the test.

The heat blast came from the port quarter of the NAGATO, searing the wooden decks and paint in direct line with it. Four life rafts nearest the blast ignited and burned and a few small fires started on the wooden decking along the port waterway forward and at several places where cordage was resting on deck. All topside personnel would probably have been killed by either the blast or the heat. It is unknown whether or not the pressure in the turrets would have done any physical harm to the men in the gun rooms and booths; however, the shock in the turrets was slight, for boxes left standing on one another; and battle lanterns were undisturbed.

There would undoubtedly have been some radiological casualties aboard, for four days after the test some of the ship's rats were found dead, some very sluggish and some as active as before. These were not caged rats, but were living in their natural habitat. The dead rats were on the main and 01 decks and one was found on the second deck. There are still some active rats aboard today. Four rats were sent to the HAVEN for study. The number of rats aboard is unknown.

The Center Engineroom, which has a very large system of ventilation ducts, had the highest recording of the Peak Pressure gauges. It was about twice that of the other gauges.

A comparison of the bearing leads from before and after the tests would indicate a slight movement of the shaft. However, this could be somewhat discounted as the second set of leads were in the bearings about ten days. The leads were placed in the high and low pressure turbine bearings of the port inboard main engine.

From the status of the machinery, there would have been no effect on the ship's propulsion or control. Steam was raised, auxiliary machinery tested, and #3 and #4 main engines turned over.

The Gunnery Department would probably have had to shift to local control until the exposed director personnel could be replaced.

The ship could have kept fighting at her maximum speed and main battery fire power except for reduction in accuracy due to use of local control and possible shock of some key personnel. As the secondary, anti-aircraft, and machine-gun batteries have been removed, any effects upon them is unobserved.

From the foregoing it can be concluded that the only casualties that would effect the fighting efficiency of the NAGATO were those that would have been received by exposed personnel. If there had been a crew aboard at the time of the test the engine room bilges would not have flooded. It is not likely that the three tanks would have flooded had they been full of fuel oil, it is more probable that the Kingston valves on these tanks were weak as other empty tanks in the same vicinity did not flood. There has been no opportunity to overhaul these Kingston valves, and United States ships do not have a comparable installation.

In comparison with the apparent damage on United States ships, it might be well to note the heavier construction of the NAGATO boilers and the reinforcement of her stack in our future construction.

Defense Special Weapons Agency
6801 Telegraph Road
Alexandria, Virginia 22310-3398

TRC

4 April 1997

MEMORANDUM TO DEFENSE TECHNICAL INFORMATION CENTER
ATTN: OMI/Mr Bill Bush

SUBJECT: Declassification of Documents

The following is a list of documents that have been declassified and the distribution statement changed to Statement A, Approved for Public Release.

XRD-41, AD-366731
XRD-42, AD-366732
XRD-40, AD-366730
XRD-39, AD-366729
XRD-38, AD-366728
XRD-34, AD-366720
XRD-13, AD-366725
XRD-8, AD-366699
XRD-5, AD-366697
XRD-6, AD-366698
XRD-21, AD-366708
XRD-27, AD-366714
XRD-22, AD-366709
XRD-26, AD-366713
XRD-28, AD-366715
XRD-29, AD-366727
XRD-36, AD-366722

If you have any questions, please call me at 703-325-1034.

Ardith Jarrett

ARDITH JARRETT
Chief, Technical Resource Center