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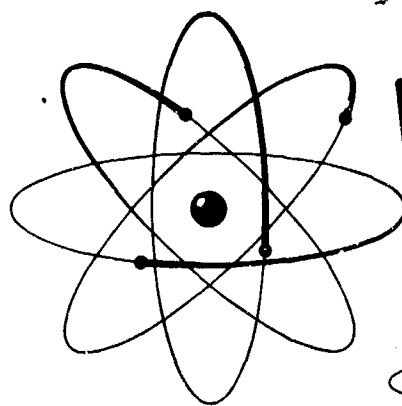
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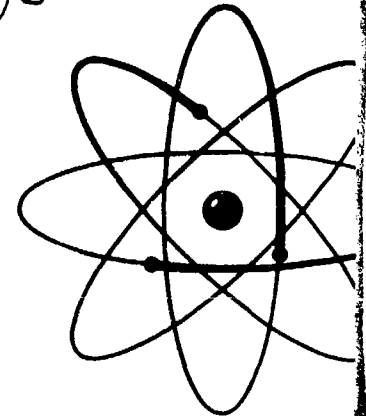
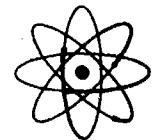
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XRD-114  
Report Number



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USAC Division of Technical Information, Oak Ridge, Tenn.

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BUREAU OF SHIPS GROUP  
TECHNICAL INSPECTION REPORT.

Classification (Confidential) changed to **CONFIDENTIAL**  
By Authority of **JOINT CHIEFS OF STAFF** JOCS ATG 100 DATED 15 APRIL 1949  
By *J. H. Bailey, Chief, AFSA* *30 June 51*

GROUP 4  
Downgraded at 3 year intervals;  
Declassified after 12 years

RESTRICTED DATA

ATOMIC ENERGY ACT OF 1946  
SPECIFIC RESTRICTED DATA CATEGORY  
USE MILITARY CLASSIFICATION

6

Operation Crossroads U.S.S APOGON (SS308)

"This information is restricted to the U.S.S. APOGON (SS308) and is to be controlled by the person in charge of the ship. Its disclosure to any other person is prohibited by law."

11 1946,

12 22 p.

14 XRD-114

SUBMITTED:

C. L. Gaasterland,  
Commander, U.S.N.

APPROVED:

*[Redacted Signature]*

F. X. Forest,  
Captain, U.S.N.

USS APOGON (SS308)

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~~CONFIDENTIAL~~ USS APOGON (SS308)

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U.S.S. APOGON (SS308)

**SHIP CHARACTERISTICS**

**Building Yard:** Portsmouth Naval Shipyard.

**Commissioned:** 16 July 1943.

**HULL**

**Heavy Hull Construction.**

**Length Overall:** 311 feet 8 inches.

**Length (between perpendiculars):** 307 feet 0 inches.

**Beam (extreme):** 27 feet 3 inches.

**Beam (molded):** 27 feet 1 3/4 inches.

**Height (lowest point of keel to top of periscope supports):** 47 feet 2 inches.

**Drafts (at time of test):** Submerged.

**Standard Displacement:** 1525 tons.

**Displacement (at time of test):** 2405 tons.

**MAIN PROPULSION PLANT**

**Main Engines:** Four Fairbanks-Morse, 9 cylinder,  
Type 38D8.

**Auxiliary Engine:** Fairbanks-Morse, 7 cylinder,  
Type 38D5.

**Main Motors and Generators:** Elliott.

**Main Storage Battery:** Exide.

**Main Controls:** Westinghouse.

**Reduction Gears:** Westinghouse.

**Diesel Electric Drive.**

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# TECHNICAL INSPECTION REPORT

## OVERALL SUMMARY

### I. Target Condition After Test.

#### (a) Draft after test; list; general areas of flooding sources.

All information has been obtained from salvage operations, which were abandoned before the ship was brought to the surface. The APOGON was submerged for Test B in 28 fathoms of water to a keel depth of approximately 100 feet at a range of approximate 850 yards from the center of the burst. After the test she was found on the bottom. All compartments were flooded or partially flooded with the possible exception of the conning tower. The forward torpedo room flooded through a hole in the pressure hull plating. The sources of flooding of the outer compartments is not definitely known. All compartments which can be blown contain some oil.

#### (b) Structural damage.

All bulkheads except that at frame 88 are known to have openings which permit the passage of air. All bulkheads were air tested and found tight immediately prior to Test B. The after torpedo room upper hatch cover and either the lower hatch cover or the hatch trunk failed. The tank top in the vicinity of Main Ballast Tank 6-B is reported to be ruptured. There is a 30" x 15" hole in the pressure hull plating between frame 30 and 31. Considerable other damage is suspected.

#### (c) Other damage.

Due to flooding and possible other damage it is extremely unlikely that any equipment could be operated. No inspection could be made of the interior of the ship.

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## II. Forces Evidenced and Effects Noted.

### (a) Heat.

Unknown.

### (b) Fires and explosions.

Unknown.

### (c) Shock.

Insufficient data for comment.

### (d) Pressure.

An ordnance torpedo, designed to operate at 600 feet, was lashed to the deck of the APOGON for Test B. When this equipment was recovered it was found to be completely crushed and collapsed. The damage to the gasket of the after torpedo room hatch (described herein under Item G), appears to have been caused by a very high and relatively sustained pressure wave.

The "Coordinator's Report on Air Blast and Water Shock in Test A and B" of 27 September 1946, indicates that the peak pressure was around 1200 lbs. per square inch. Data from a Hilliar gage submerged to 20 feet at a range of 1090 feet shows the positive phase had a duration of 1.6 milli-seconds.

### (e) Effects peculiar to the atom bomb.

None except as covered elsewhere.

## III. Effect of Damage.

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

Although no inspection has or could be made it is assumed that all machinery and equipment is completely inoperable as a result of flooding and possible other damage.

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(b) Effect on gunnery and fire control.

Probably completely inoperable.

(c) Effect on watertight integrity and stability.

Eight out of nine compartments are flooded or partially flooded. The other, the conning tower, is suspected of being in a similar condition.

(d) Effect on personnel and habitability.

It is estimated that the ship would have been lost with all hands. No habitability remains.

(e) Total effect on fighting efficiency.

Completely destroyed.

IV. General Summary of Observers' Impressions and Conclusions.

It is considered that the damage suffered would have sunk a fully manned ship despite any preventive efforts available to the crew.

V. Preliminary Recommendations.

The damage sustained is of such nature as to be extremely valuable for future design. It would be desirable that the APOGON be salvaged and repaired to such an extent that the ship can return to a shipyard for extensive and detailed examination. The time required to complete the salvage is estimated at three weeks.

The damage to the double lip "T" gasket installed on the after torpedo room hatch cover and discussed under Item G raises a question as to the suitability of this gasket design. None of the "dove tail" or solid "T" type hatch gaskets on the USS SKIPJACK (which was submerged at approximately the same range) are

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significantly damaged. Nothing is known regarding the remaining hatch covers on USS APOGON except that the hand wheels had backed off a turn or two in nearly all cases.

The reason for the severe damage of the after torpedo room hatch cover of the APOGON is not known. Depth charge tests with 300 lb. TNT charges were conducted at the time the double lip gasket was developed, and at this time the gasket and hatch cover successfully withstood peak water pressures several times those estimated to have prevailed at the range of the APOGON in Test B.

Several theories might be advanced in explanation of the severe damage to this gasket. Although the characteristics of the underwater pressure phenomena during Test B have not yet been definitely determined, the consensus indicates that the duration of high pressure for an atomic blast is several times greater than for a TNT blast. This may explain why the development tests did not produce failure under higher peak pressures.

The APOGON was submerged about 30 feet deeper than the SKIPJACK. The vertical stations of ball crusher gages show the pressures to have been somewhat more severe with increased depth. Also local peaks in the pressure distribution were caused by reflections from the bottom or other surfaces. Some phenomena similar to this may explain why damage to the APOGON in general, and to the subject hatch cover in particular, was more severe than to the SKIPJACK.

Another possible explanation of the damaged gasket is that some force acted on this particular hatch to produce rubbing or chattering which resulted in mechanically cutting the rubber between the hatch cover and the seat. Such a force could have been caused by elastic flattening of the spherical cover plate followed by vibrational deflections which caused the gasket to be rubbed back and forth rapidly between the two metal surfaces. On the other hand, the air, blown into the torpedo room during salvage operations, might have caused chattering while blowing out past the gasket. (A maximum of 40 lbs. per square inch over bottom pressure was used.

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The evidence available is not sufficient to indicate that the double lip gasket is weaker than earlier types. However, it does appear to be sufficient to justify further investigation. Therefore, inasmuch as an alteration to install double lipped "T" gaskets in all active submarines has been authorized, it is recommended that further investigation be undertaken to uncover the possible weakness or confirm the suitability of this gasket design.

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# DETAILED DESCRIPTION OF DAMAGE

## A. General Description of Damage.

### (a) Overall condition.

The ship is sunk in 28 fathoms of water. All compartments, with the possible exception of the conning tower are flooded. Salvage operations were started on 10 August 1946 and terminated on 1 September 1946 without raising the ship. If sufficient time were available the ship could undoubtedly be salvaged. All descriptions of damage contained in this report, (with the exception of that concerning the after torpedo room hatch cover) were obtained from divers' reports.

### (b) General areas of major damage.

The only known major damage is the 15" x 30" hole in the pressure hull plating between frames 30 and 31 (see Item E). There is minor denting of the main deck and superstructure in several locations throughout the length of the ship. The tank top in way of Main Ballast Tank 6-B is ruptured and all compartment bulkheads except one have leaks. All emergency vent valves (except on safety tank) leak, as do the main vent valves on Main Ballast Tanks 1 and 7. The after torpedo room hatch cover is badly damaged.

### (c) Principal areas of flooding with sources.

All compartments with the possible exception of the conning tower are flooded. The torpedo room undoubtedly flooded very rapidly through the large hole at frame 31. The remaining compartments are believed to have flooded slowly through small leaks in the hull, bulkheads or fittings, although there may be other large, undiscovered holes.

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

There is no remaining buoyancy and the ship is completely inoperable. The strength of the pressure hull around frame 31 has been seriously reduced due to the hole in the shell plating and to the surrounding dished plating.

**B. Superstructure.**

The superstructure and weather deck have been locally damaged and distorted in several locations. At present none of the known damage appears to be significant.

**C. Turrets, Guns and Directors.**

Unknown.

**D. Torpedo Tubes and Appurtenances.**

Although not conclusive, there is some evidence that the outer doors of one or more torpedo tubes in the after room are open or partially open and that there are small leaks from the interior of these tubes to the compartment. While attempting to blow the after torpedo room, one diver reported bubbles rising from the free flooding structure aft of the trim tank.

**E. Weather Deck.**

See Item B above.

**F. Exterior Hull Above the Waterline.**

On the top of the pressure hull, between frames 30 and 31 there is a hole in the pressure hull plating approximately 15" x 30". The plating immediately forward of the hole is dished down a depth of 6". The damage to frame 30, if any, is unknown. Frame 31, which consists of a "T" section outside of the hull, is not reported

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to be distorted. However, divers reported that the web of this frame is fractured immediately above the intersection of the web with the torpedo loading trunk. A sketch of the damaged area, reconstructed from divers' reports is included on Page 22. Part of frame 31 was cut away in preparation for patching the hole.

It was reported that the pressure hull plating around the hull fitting for the circulating water discharge for number two main engine was cracked.

#### G. Compartments.

The only known damage to the pressure hull is discussed under Item F.

All bulkheads except that at frame 88 are known to leak air at an appreciable rate. After blowing air into the forward engine room, or into any compartment forward of this for approximately five minutes, large bubbles emerge from the hole in the shell at frame 31. Prior to Test B all main bulkheads were tight as shown by compartment air test conducted in the target area.

On the port side of the conning tower fairwater, the after radio antenna insulator is cracked, permitting the escape of air blown into the control room. This air probably enters the trunk by way of the lower flapper valve in the antenna hull casting.

Further details of the damage to compartments and closures are not known, except in the case of the after torpedo room hatch cover which was brought to the surface.

The after torpedo room hatch cover has a standard type double lip gasket. It was left securely dogged and was further held down by two depth charge turnbuckles. Upon blowing air into the after torpedo room air bubbles appeared under the hatch cover and a diver attempted unsuccessfully to tighten it by turning the hand wheel.

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The hatch could be opened about 6 inches on the after end which permitted a diver to burn off the depth charge turn-buckles. The cover was then brought to the surface. Damage was found as follows:

a. The dished cover plate and rim are intact and undistorted.

b. The hinge arms are spread apart about  $3/4$  inch at the hinge pin. Where the arms are welded to the cover some cracking appears in the welds.

c. On the gasket, the inner lip, to an average depth of about  $1/4$  inch is almost entirely missing. It appears to have been torn out by pressure exerted from the outside. The outer lip is also torn or missing in several spots, totalling about 25% of its circumference. See photographs on Pages 18, 19 and 20.

d. The retaining ring is forced in toward the center about  $3/4$  inch for a length of about ten inches on each of two locations. Sixteen of the flathead screws holding the retaining ring are sheared off. See photograph on Page 19.

e. The lower hand wheel is moderately distorted, but the spindle, worm and gear segments are undamaged. No explanation for this particular damage is available. It could have happened when raising the hatch cover.

f. The locking dogs, pins and linkage are undamaged except as follows:

1. On the starboard dog the hole for the fulcrum pin is elongated about .010 of an inch.

2. On the after dog, the pin connecting the fork to the dog is missing and the hole for the fulcrum pin is elongated about .010 of an inch. See photograph of Page 21.

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3. On the port dog, the fulcrum pin is missing, the brackets supporting the ends of the fulcrum pin are pulled out, and the corresponding hole in the dog is elongated about .015 of an inch. See photograph on Page 20.

It is considered possible but not probable that damage to the locking dogs was caused by the air pressure (110#/sq. in.) used in attempting to blow the after torpedo room. This is 40#/sq.in. over bottom pressure.

H. Armor Decks and Miscellaneous Armor.

Not Applicable.

I. Interior Compartments (below W.1.)

Unknown.

J. Underwater Hull.

Unknown.

K. Tanks.

The safety tank is known to be intact. All main and fuel ballast tanks have appreciable leaks at or near the highest part through which air escapes when the tanks are blown. On Main Ballast Tanks 1 and 7 the main vents were left closed, and on all other main and fuel ballast tanks the emergency vents were left closed for the test. Therefore, it is assumed that the explosion damaged these closed valves or jarred them open. There is a hole in the tank top plating around the vent riser in Main Ballast Tank 6-B. Air blown into Main Ballast Tank 6-D also escapes through this hole. The diver reported this damage to the tank top as "cracked, with a hole large enough to put your hand in".

Except for blow connections fitted into the top and holes cut in the bottom of Normal Fuel Oil Tanks 6 and 7 by the divers, these tanks are believed to be intact. Nothing is known regarding any other tanks.

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L. Flooding.

With the exception of the conning tower all compartments are known to be flooded. The forward torpedo room would have flooded immediately through the large hole at frame 31. Other compartments are believed to have flooded slowly, either through leaks in the bulkheads or relatively small leaks in the shell or fittings. (All bulkheads were air tested and found tight immediately prior to Test B). It is possible, however, that other large holes exist in the pressure hull.

M. Ventilation.

Unknown.

N. Ship Control.

Unknown.

O. Fire Control.

Unknown.

P. Ammunition Behavior.

Unknown.

Q. Ammunition Handling.

Unknown.

R. Strength.

Unknown.

S. Miscellaneous.

Unknown.

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**T. Covering.**

**Unknown**

**U. Welding and Rivetting.**

**Unknown.**

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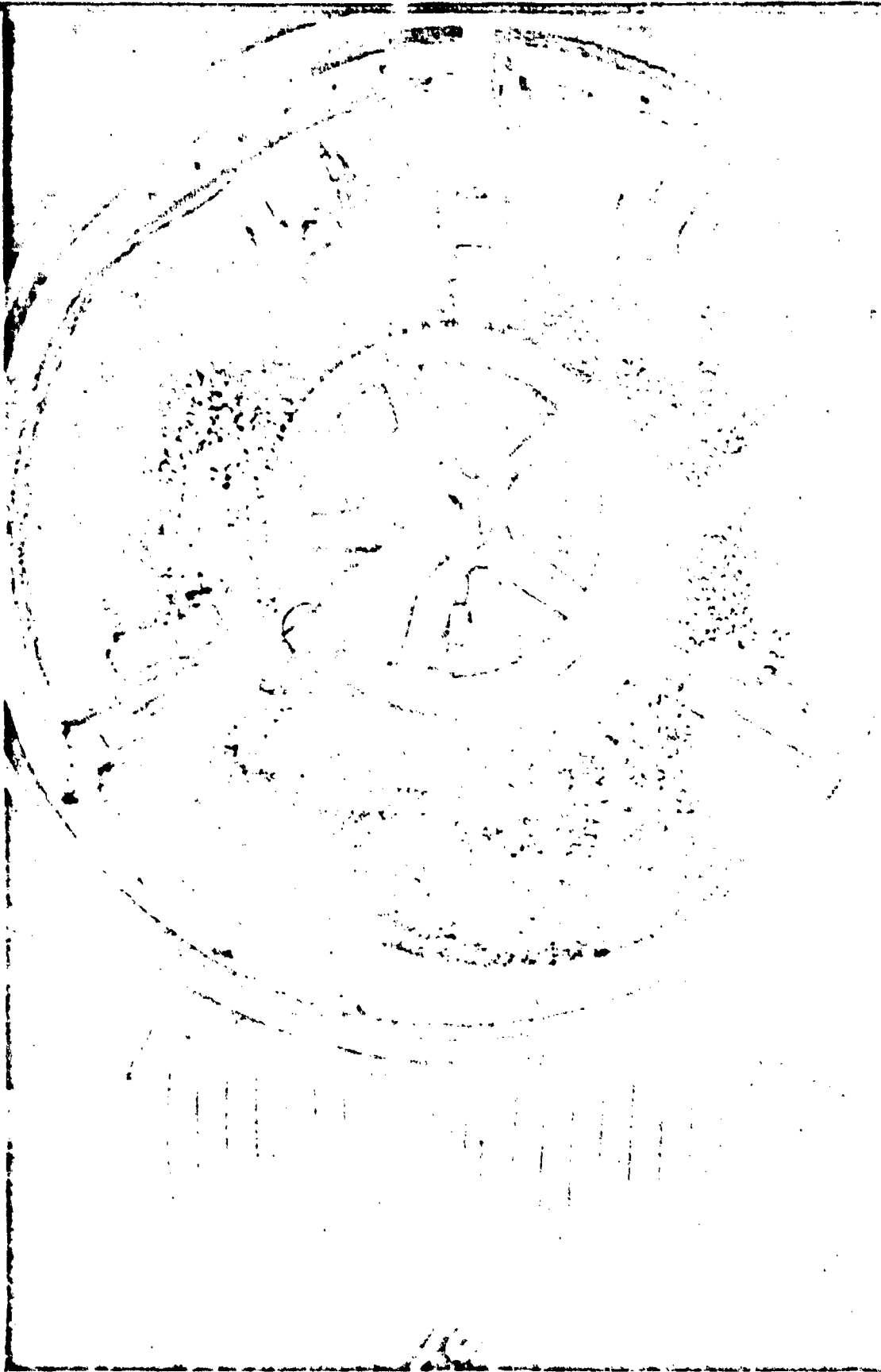
PHOTOGRAPHS

TEST BAKER

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ABCR-79-2978-10. After torpedo room hatch. General view of damage.



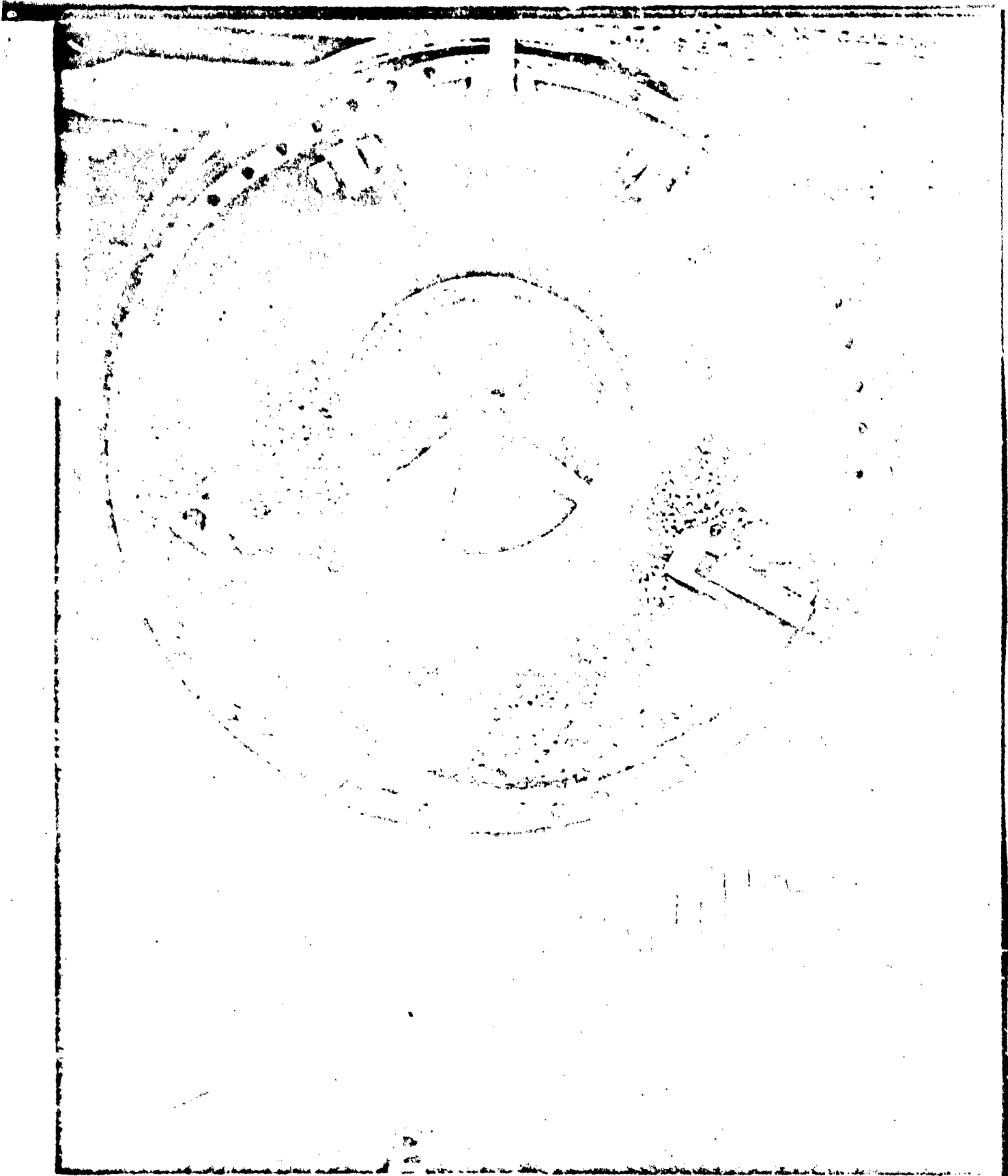
ABCR-79-2978-11. After torpedo room hatch. Detail of sector of gasket and distorted retaining ring.

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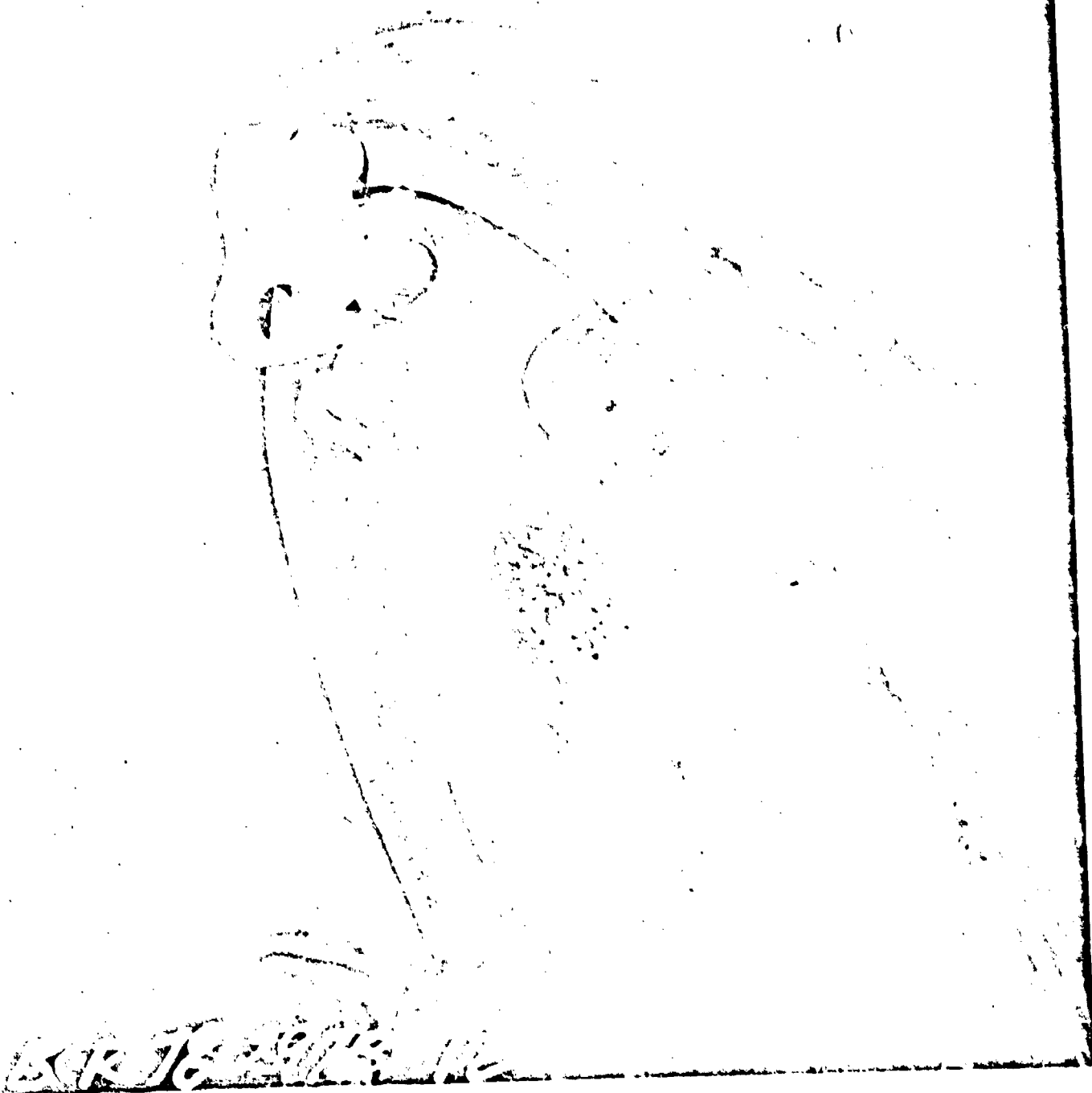
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ABCR-79-2979-2. After torpedo room hatch. General view showing damage to gasket, retaining ring and dog mechanism.

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ABCR- J-2978-12. After torpedo room hatch. Detail of after dog pin connecting dog to link missing.

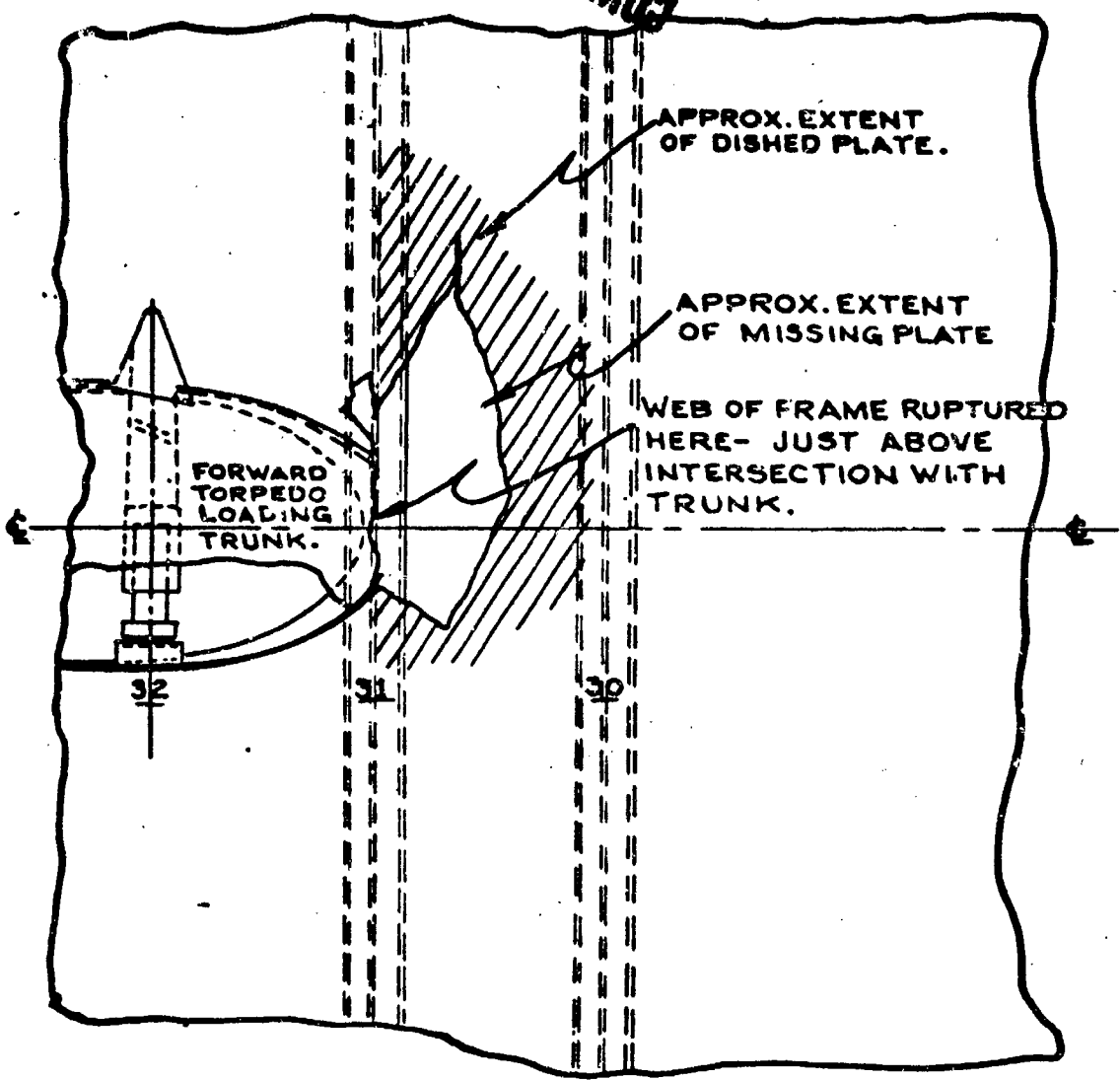
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PLAN VIEW

RUPTURE OF HULL PLATING

TEST B  
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U.S.S. APOGC N (SS-308)



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

TRC

18 April 1997

MEMORANDUM FOR DEFENSE TECHNICAL INFORMATION CENTER  
ATTENTION: OMI/Mr. William Bush (Security)

SUBJECT: Declassification of Reports

The Defense Special Weapons Agency has declassified the following reports:

/ ✓ AD-366588 <del>4</del>	XRD-203-Section 12 ✓
AD-366589 <del>4</del>	XRD-200-Section 9
AD-366590 <del>4</del>	XRD-204-Section 13
AD-366591 <del>4</del>	XRD-183
/ ✓ AD-366586 <del>4</del>	XRD-201-Section 10 ✓
/ ✓ AD-367487 <del>4</del>	XRD-131-Volume 2 <del>4</del>
/ ✓ AD-367516 <del>4</del>	XRD- <del>1</del> 143 ✓
/ ✓ AD-367493 <del>4</del>	XRD-142 <del>4</del>
AD-801410L ✓	XRD-138 ✓
AD-376831L ✓	XRD-83 ✓
AD-366759 <del>4</del>	XRD-80
/ ✓ AD-376830L <del>4</del>	XRD-79 ✓
/ ✓ AD-376828L <del>4</del>	XRD-76 ✓
/ ✓ AD-367464 <del>4</del>	XRD-106 ✓
AD-801404L ✓	XRD-105-Volume 1 <del>4</del>
/ ✓ AD-367459 <del>4</del>	XRD-100 ✓

TRC

18 April 1997

Subject: Declassification of Reports

AD-801406L ✓ XRD-114✓

In addition, all of the cited reports are now **approved for public release; distribution statement "A" now applies.**

*Arduith Jarrett*  
ARDITH JARRETT  
Chief, Technical Resource Center