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**RESTRICTED**

**THE UNITED STATES  
STRATEGIC BOMBING SURVEY**

**(Pacific)**

**Evaluation of  
Photographic Intelligence  
in the Japanese Homeland**

**PART SIX  
SHIPPING**

**PHOTOGRAPHIC INTELLIGENCE SECTION**

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Dates of Survey:  
7 October 1945 through 1 March 1946

JUNE 1946

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### FOREWORD

The United States Strategic Bombing Survey was established by the Secretary of War on 3 November 1944, pursuant to a Directive from the late President Roosevelt. Its mission was to conduct an impartial and expert study of the effects of our aerial attack on Germany, to be used in connection with air attacks on Japan and to establish a basis for evaluating the importance and potentialities of air power as an instrument of military strategy, for planning the future development of the United States armed forces, and for determining future economic policies with respect to the national defense. A summary report and some 200 supporting reports containing the findings of the Survey in Germany have been published.

On 15 August 1945, President Truman requested that the Survey conduct a similar study of the effects of all types of air attack in the war against Japan, submitting reports in duplicate to the Secretary of War and to the Secretary of the Navy. The officers of the Survey during its Japanese phase were.

Franklin D'Olier, Chairman.

Paul H. Nitze,

Henry C. Alexander, Vice-Chairmen.

Walter Wilds, Secretary.

Harry L. Bowman,

J. K. Galbraith,

Rensis Likert,

Frank A. McNamee,

Fred Searls, Jr.,

Monroe Spaght,

Dr. Louis K. Thompson,

Theodore P. Wright, Directors.

The Survey's complement provided for 300 civilians, 350 officers, and 500 enlisted men. The military segment of the organization was drawn from the Army to the extent of 60 per cent, and from the Navy to the extent of 40 per cent. Both the Army and the Navy gave the Survey all possible assistance in furnishing men, supplies, transport and information. The Survey operated from headquarters established in Tokyo early in September, 1945, with sub-headquarters in Nagoya, Osaka, Hiroshima and Nagasaki, and with mobile teams operating in other parts of Japan, the islands of the Pacific and the Asiatic mainland.

It was possible to reconstruct much of war-time Japanese military planning and execution, engagement by engagement and campaign by campaign, and to secure reasonably accurate statistics on Japan's economy and war-production, plant by plant and industry by industry. In addition, studies were conducted on Japan's overall strategic plans and the background of her entry into the war, the internal discussions and negotiations leading to her acceptance of unconditional surrender, the course of health and morale among the civilian population, the effectiveness of the Japanese civilian defense organization, and the effects of the atomic bombs. Separate reports will be issued covering each phase of the study.

The Survey interrogated more than 700 Japanese military, government and industrial officials. It also recovered and translated many documents which have not only been useful to the Survey, but will also furnish data valuable for other studies. Arrangements are being made to turn over the Survey's files to a permanent government agency where they will be available for further examination and distribution.

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Chief, G-2

PHOTOGRAPHIC INTELLIGENCE SECTION, G-2\*

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- \* Personnel from the U. S. Naval Photographic Intelligence Center gave valuable assistance to USSBS personnel in the preparation and reproduction of Photographic Intelligence Section reports.



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**I SCOPE OF REPORT****I INTRODUCTION**

a. Since the interpretation of shipping was, quite naturally, of considerably more interest to the Navy than to the Army, it was a subject of greater concentration and specialization in Navy units than in Army units, and consequently Navy reports were the principal source of photographic intelligence on shipping. For that reason this report confines itself to an evaluation of Navy reports.

b. From the early stages of the Pacific war it was apparent that accurate assembling of naval and merchant shipping intelligence was extremely important. Photography has been a major source of this intelligence. Interpreters working with shore based interpretation organizations and aboard carriers were charged with the job of reporting:

- (1) Naval and merchant ship movements
- (2) General activity within harbors, including shipbuilding and repair
- (3) Recognition features of new classes and types developed

c. The above information was issued in various forms to operational commands for tactical action and to groups in Washington and elsewhere interested in over-all military and economic aspects of shipping. It is the purpose of this report to evaluate shipping intelligence as interpreted from photographs by comparison with information presently available from Japanese sources.

**2 TYPES OF REPORTS**

a. Standardization of shipping reports was difficult because of varying conditions and practices at sea and in the field. As the war expanded to the home island, the situation was complicated by increases in ship concentrations, shipbuilding, and repair activity. In general, however, reports were of three basic types: Flash reports, General shipping reports and Special reports.

b. Flash Reports - Flash reports in the form of dispatches, were sent out whenever photographs revealed ships or ship concentrations of any significance. Interpretation was often from small scale vertical and oblique photography. Reports included name and class of each naval unit present, an estimate of total merchant ship tonnage

(operational and non-operational), and a statement as to extent of photographic coverage. These dispatches preceded the more complete studies and were issued immediately, whether or not the particular photographs justified a later shipping report.

c. General Shipping Reports - These studies were divided, for convenience, into two parts: Summary, and Detail. The Summary briefly listed naval units present in the area and gave total gross tonnage of merchant shipping, listing non-operational and operational ships separately. The detailed portion listed name and length of each Naval unit, and type, length, and gross tonnage of each merchant vessel. A separate column outlined briefly the observed activity for each ship (i.e. building, unloading, beached, etc.). Reference was made to previous coverage and, where practical, a diagram of the area was included indicating relative position of ships.

**d. Special Reports**

(1) Shipbuilding - Although the general reports mentioned the progress of a ship's construction from keel-laying to completion, it was often necessary to assemble this data into comprehensive shipbuilding studies. These reports indicated in more detail the general trend in enemy shipbuilding, and included an analysis of the yard's layout, equipment, and capabilities.

(2) Damage Assessment - Comparison of pre-strike, strike, and post-strike photography of attacked naval units made possible reports assessing the damage sustained.

(3) Target Photographs - Target Photographs and diagrams of harbor areas showing exact location of naval units were prepared and issued to carriers for pilot briefing prior to strikes.

(4) Recognition - Photographs of new classes and types, accompanied by sketch plans and profiles, were issued directly to the operating commands as well as to groups interested in the publication of recognition manuals.

(5) Mining Activity - In conjunction with the aerial mine laying program, reports were prepared which described the methods of minesweeping used, and the location and type of sunken vessels.



## II WARSHIP MOVEMENT AND IDENTIFICATION

### I INTRODUCTION

It was evident from photographic intelligence in the beginning of 1945 that most major units of the Japanese Fleet were not being groomed for action. As photographic coverage increased, it was possible to check not only the position of all units, but to record any important changes in appearance due to alterations and camouflage. Warship movement was largely confined to the smaller units. Destroyers, submarines and escort vessels moved frequently, and their changing positions and concentrations were recorded in shipping reports.

### 2 ACCURACY OF REPORTING

a. Because of the difficulty in putting Japanese data, such as logs and harbor masters' reports, in useable form it is not presently possible to make a complete check of naval unit movements. However, the specific examples presented below are believed to be an adequate basis for evaluating the work done.

b. BB-Magato. The Japanese report that the BB-Magato entered the Inland Sea on 23 November 1945 and later proceeded to the Yokosuka Naval Base for repairs. She was first sighted in photographs of Yokosuka on 17 February and subsequently reported nine times between then and the final attacks on 18 July which resulted in heavy damage.

c. CVE-Kaiyo. Though a less important ship, the CVE-Kaiyo was also frequently reported. The following reports of her movements are typical of those made on every major warship in home waters. Dates, positions, and conditions listed are from shipping reports, and have been confirmed by the Japanese.

DATE	LOCATION AND ACTIVITY
18 March 1945	Kure Harbor; anchored.
13 April	Nishinomi Shima; anchored.
28 April	Kure Harbor; heavily camouflaged.
7 May	Kure Harbor; in drydock.

28 May 1945	Beppu Wan; moored offshore (approx. 85 miles SW of Kure)
21 June	Beppu Wan; heavily camouflaged.
2 July	Beppu Wan; camouflaged, moved nearer shore.
24 July	Beppu Wan; attacked, later capsizing.

d. Warships in the Kure area

(1) The following major naval units were reported in the vicinity of Kure from carrier photography taken during the attacks of 18/19 March 1945:

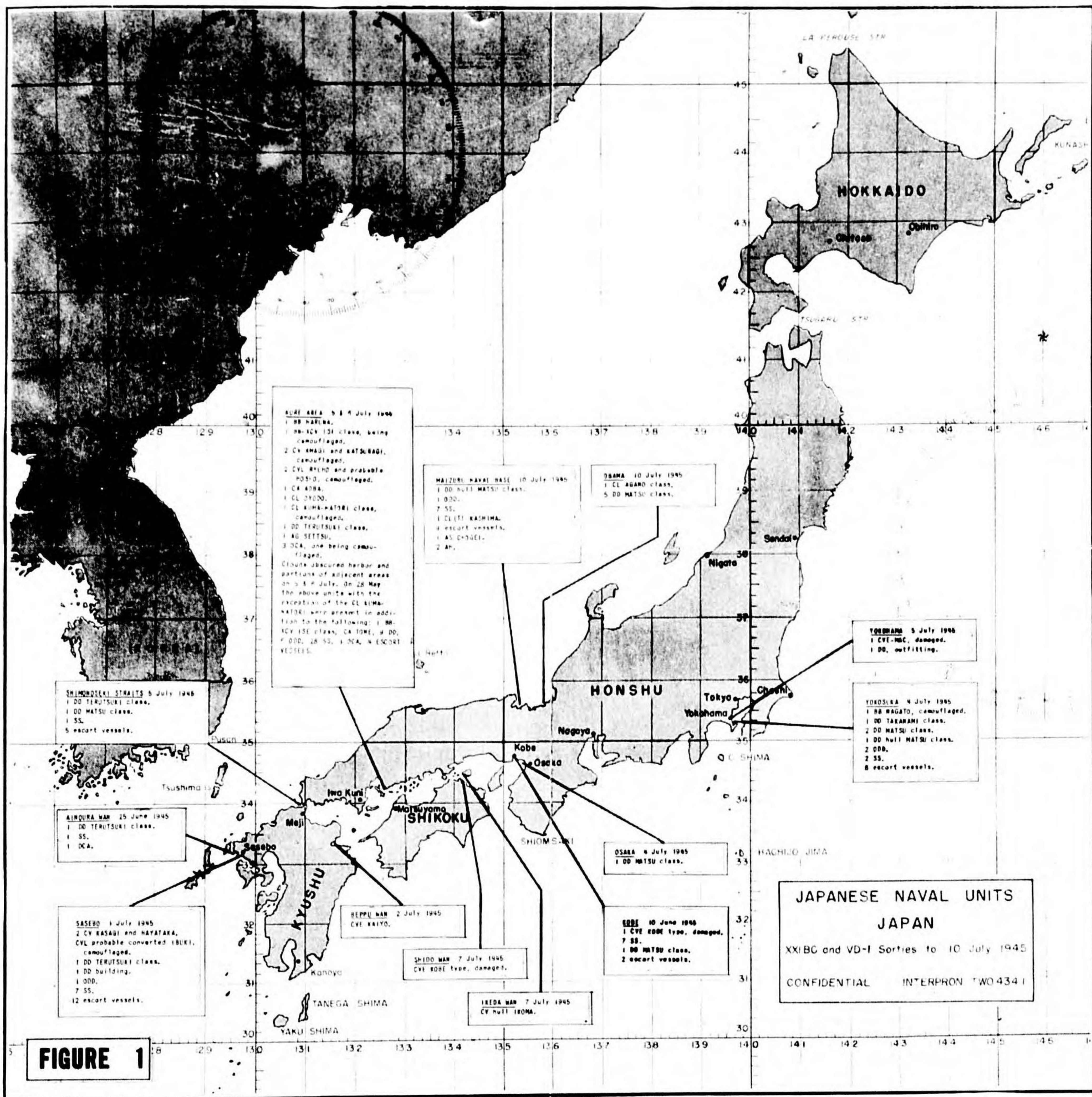
- 1 - BB-Yamato
- 1 - BB-Kongo class (later identified as Haruna)
- 2 - BB-XCV Ise and Hyuga
- 2 - CV-Unryu class (later identified as Amagi and Katsuragi)
- 1 - CV hull Unryu class (later identified as Aso)
- 1 - CVL-Ryuho
- 1 - CVE-Kaiyo
- 2 - CA-Tone and Aoba
- 1 - CL-Oyodo
- 1 - CL-Agano class

(2) The Japanese have stated that all were present at this time. Subsequently, their positions changed. Several went through extensive alterations, and all were heavily camouflaged. Except for 3 ships (BB-Yamato, CVE-Kaiyo, CL-Agano class), all remained in the vicinity of Kure. Their position and status were correctly reported as frequently as photography was secured. It was possible, therefore, during the early part of July, to prepare accurate target photographs for our carrier forces showing the exact position of all units.

e. Japanese Naval Unit Location Chart. Figure 1 is a reproduction of a chart of the Empire showing disposition of the Imperial Fleet in home waters. It is indicative of the extensive shipping intelligence gained from photography. Subsequent check revealed that all major units were correctly identified and located.



# II WARSHIP MOVEMENT AND IDENTIFICATION



## DISPOSITION OF JAPANESE NAVAL UNITS



# III MERCHANT SHIP MOVEMENT AND IDENTIFICATION

## I INTRODUCTION

a. Concentrations of merchant ships and general port activity were subject to daily fluctuations. During the closing months of the war sufficient coverage was obtained to permit a reasonably accurate estimation of this variation. Because of the strategic blockade by submarines, aerial mines and aircraft, some of the ports were extremely overloaded, and others were virtually unused. Ports such as Shimonoseki-moji, Osaka, Kobe, Hakodate, and Aomori were very active while Nagoya, Shimizu and those in the Tokyo Bay area were inactive.

## 2 METHOD OF REPORTING

a. Although methods of writing shipping reports varied considerably, all included sections in which particulars about each vessel were listed. A sample of one of these reports has been included as Table 2, to show the kind of information furnished. This particular report was based on photographic coverage of 27 February 1945 of Kobe Harbor. The J M S T (Japanese Merchant Shipping Tonnage) coding method was used to signify various merchant ship types. For instance, FTB (Fox-Tare-Baker) indicates a medium-sized freighter-transport (5500-7000 g.t.). SBL means a large stack-aft cargo vessel (4400-6700 g.t.). Except when known from other sources, tonnages were determined from a length-gross tonnage graph.

b. Whenever practical, an overlay of the harbor area, which indicated the position of all vessels, was included with the report. By comparing overlays made from different sorties, the constantly changing positions of individual ships and ship concentrations could be seen at a glance.

c. Fig 2 is a reproduction of an overlay of Kobe Harbor, locating ships as of 27 February. The letters and numbers at the ships' positions refer to Naval and Merchant vessels respectively.

## 3 ACCURACY OF REPORTING

a. Efforts were made to obtain Japanese daily records of entrance and clearance for each port. It was hoped that these could be compared with photographic intelligence reports, but unfortunately, records were generally either unavailable or inadequate. With one exception, the few records which were kept applied only to "C" (Civilian) class ships. Movement of "A" (Army) and "B" (Navy) vessels were considered a secret.

b. Yokohama is the only harbor for which comparatively accurate records of all classes of ships were kept. Records showed the exact tonnage of each vessel entering and leaving for any day. Although no mention was made of the name of the ship or the length of time she remained in port, it is possible, by careful bookkeeping, to obtain a reliable figure for the operational tonnage present on any particular day. Shipping reports indicated the amount of non-operational tonnage as well as operational, but no check was possible on non-operational shipping.

c. Table 1 shows that photographic intelligence figures are very nearly the same as those recorded by the Japanese.

DATE	REPORTED (g.t.)	ACTUAL (g.t.)
28 January 45	34,120	36,200
14 February 45	65,500	66,161

SHIP NO.	TYPE	GROSS TON'	L. O. A. FEET	REMARKS
10	FTC	1500	249	No activity
12	SBL	6670	445	Type A (Mod.) moving out of drydock
14	SBL	6670	445	Type A (Mod.) in floating drydock outfitting
16	SBL	6670	445	Alongside wharf, outfitting, near completion
18	FTB	6400	455	Probably Akiura Maru class, after hatches open, loose stores forward



### III MERCHANT SHIP MOVEMENT AND IDENTIFICATION

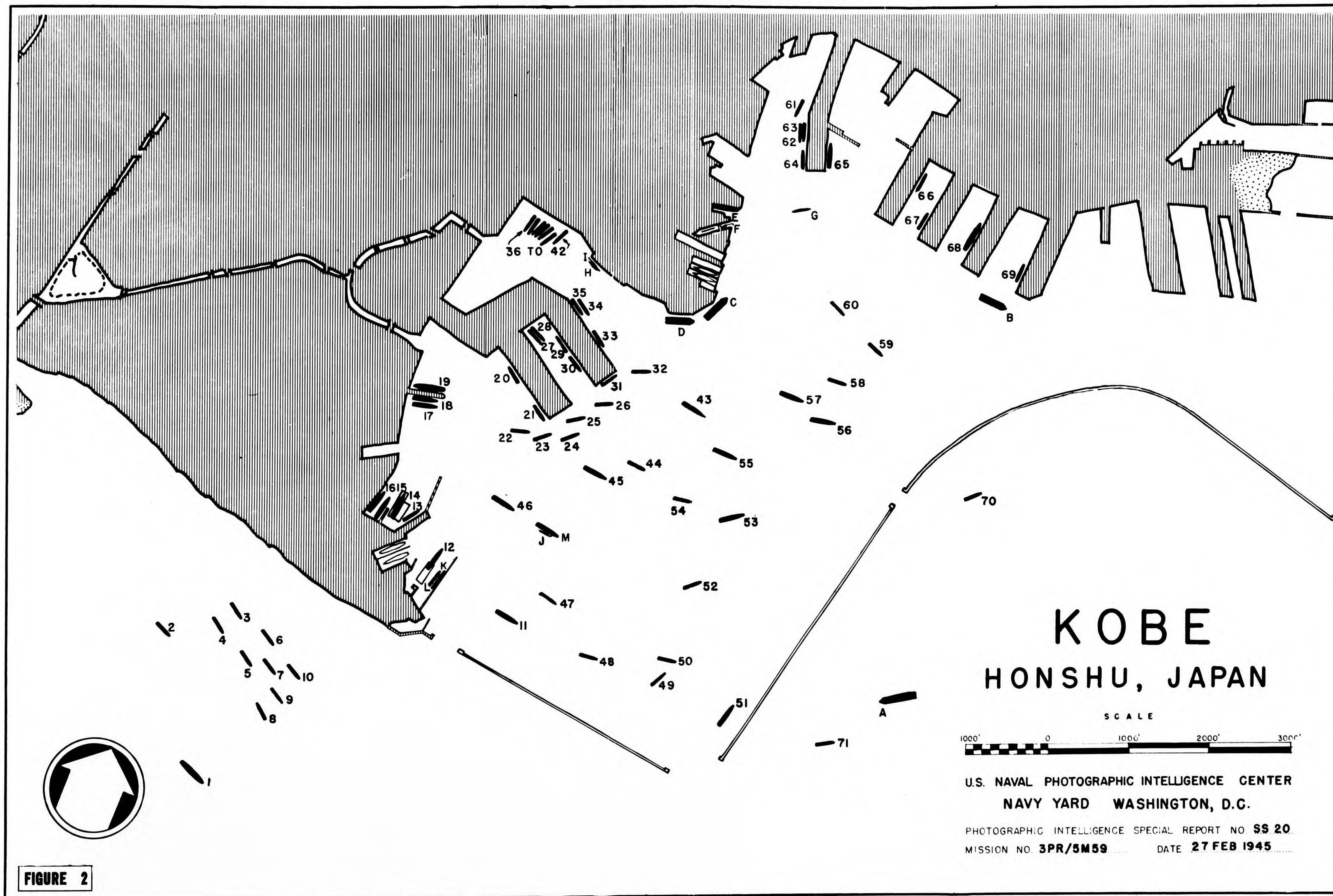


FIGURE 2

U.S. NAVAL PHOTOGRAPHIC INTELLIGENCE CENTER  
 NAVY YARD WASHINGTON, D.C.  
 PHOTOGRAPHIC INTELLIGENCE SPECIAL REPORT NO. SS 20.  
 MISSION NO. 3PR/5M59 DATE 27 FEB 1945



## IV SHIPBUILDING

### I INTRODUCTION

a. During the early part of the war little was known concerning size, facilities and production schedules of Japanese Naval Bases (i.e., Yokosuka, Kure, Sasebo, Maizuru). It was not until late fall of 1944 when high altitude photographic reconnaissance was made over these areas that much was learned. In the case of commercial shipbuilding yards, many of which constructed naval vessels, considerable information was available. These yards had been visited by Allied engineers and tourists and the pre-war layout and capabilities of many was general knowledge.

b. Although at first information gained from photographs was sketchy because of inadequate photography, it was possible during most of the last year of the war to keep adequate records and progress schedules of enemy steel ship construction and repair. Through periodic shipping reports and special shipbuilding studies photographic intelligence endeavored to furnish the following information.

- (1) Physical layout and facilities of all shipyards
- (2) Existence of new yards
- (3) Types and characteristics of naval and merchant ships under construction and outfitting
- (4) Progress of construction on particular ways, which indicated production rates for certain types
- (6) Extent and type of repair work.

c. Captured Japanese documents, such as TATSU, which have the announcements of new construction and conversion, offer a comprehensive view of their naval shipbuilding program and were consequently of great assistance. Though never up to date, these

documents did, nevertheless, form a base on which to start and helped to confirm much of the activity observed.

### 2 EVALUATION

a. As in the case of merchant ship movement, Japanese records on daily construction activity were not as complete as desired. Sufficient records, however, have been collected by the Military Supplies Division of the Survey to provide adequate evaluation of that phase of shipbuilding activity known as "progress on the ways". These records give the following information on all commercial yards.

- (1) Type and length of vessel under construction
- (2) Number of the way occupied
- (3) Date of keel laying
- (4) Date of launching
- (5) Date of final completion (after outfitting)
- (6) Percent of total completion at close of war (if still on way or outfitting).

b. The Ishikawajima Shipyard at Tokyo was chosen for comparison because the photographic coverage of this yard extended over several months and the Japanese records for the period were complete for the two ways selected. Tables 3 and 4 give chronological listings of the status of construction so that reports by photographic intelligence on ways #4 and #6 can be compared readily with the progress as reported by Japanese sources. During the period from 17 August 1944 to 2 April 1945, two cargo ships were constructed and launched at each way. An examination of these tables, and a check made of the ways of several other yards shows that the activity interpreted from photographs was consistently accurate. Photo 1 shows the yard in question as it appeared on 2 April 1945.



## IV SHIPBUILDING

## WAY NO. 4 ISHIKAWAJIMA SHIPYARD TOKYO

CONSTRUCTION PROGRESS ON WAY #4 Photographic Coverage: 1 November 1944 - 2 April 1945.

## FIRST SHIP

DATE	SOURCE	ACTIVITY
17 August 1944	Japanese Data	Keel laid for 443 foot type "A" (Mod) Cargo Vessel
1 November	P I Reports	Type "A" (Mod) 445 feet. Frames, bulkheads and shell plating in progress. Vessel 65% complete
7 November	P I Reports	Main deck complete. Vessel 75% complete estimate launching to be this day or following
15 November	Japanese Data	Launched
25 November	P I Reports	Vessel at berth "A" outfitting with superstructure being installed; 80% complete
11 December	Japanese Data	Outfitting completed
13 December 1944	P I Reports	At berth "B" apparently 100% complete
SECOND SHIP		
17 November 1944	Japanese Data	Keel laid for 443 foot type "A" (Mod) Cargo Vessel
25 November	P I Reports	Type "A" (Mod) 445 feet. Bottom plating in progress 5% complete
13 December	P I Reports	Bottom plating complete. Floors in progress. Vessel 8% complete
9 January 1945	P I Reports	Progress rapid since 13 December. Bulkheads complete up to main deck. Shell plating in place. Second deck on stern and bow through forepeak complete. Vessel 30% completed.
16 January	P I Reports	Beams and girders for main deck plating in progress. Vessel 65% complete. Launching date estimated end of January.
5 February	Japanese Data	Launched
26 April	Japanese Data	Outfitting completed
8 March	P I Reports	Way estimated empty since 6 March. Flat and vertical keel being laid for unidentified ship. No confirmation of this observation from Jap source
11 March	P I Reports	No progress
2 April 1945	P I Reports	No progress

TABLE 3



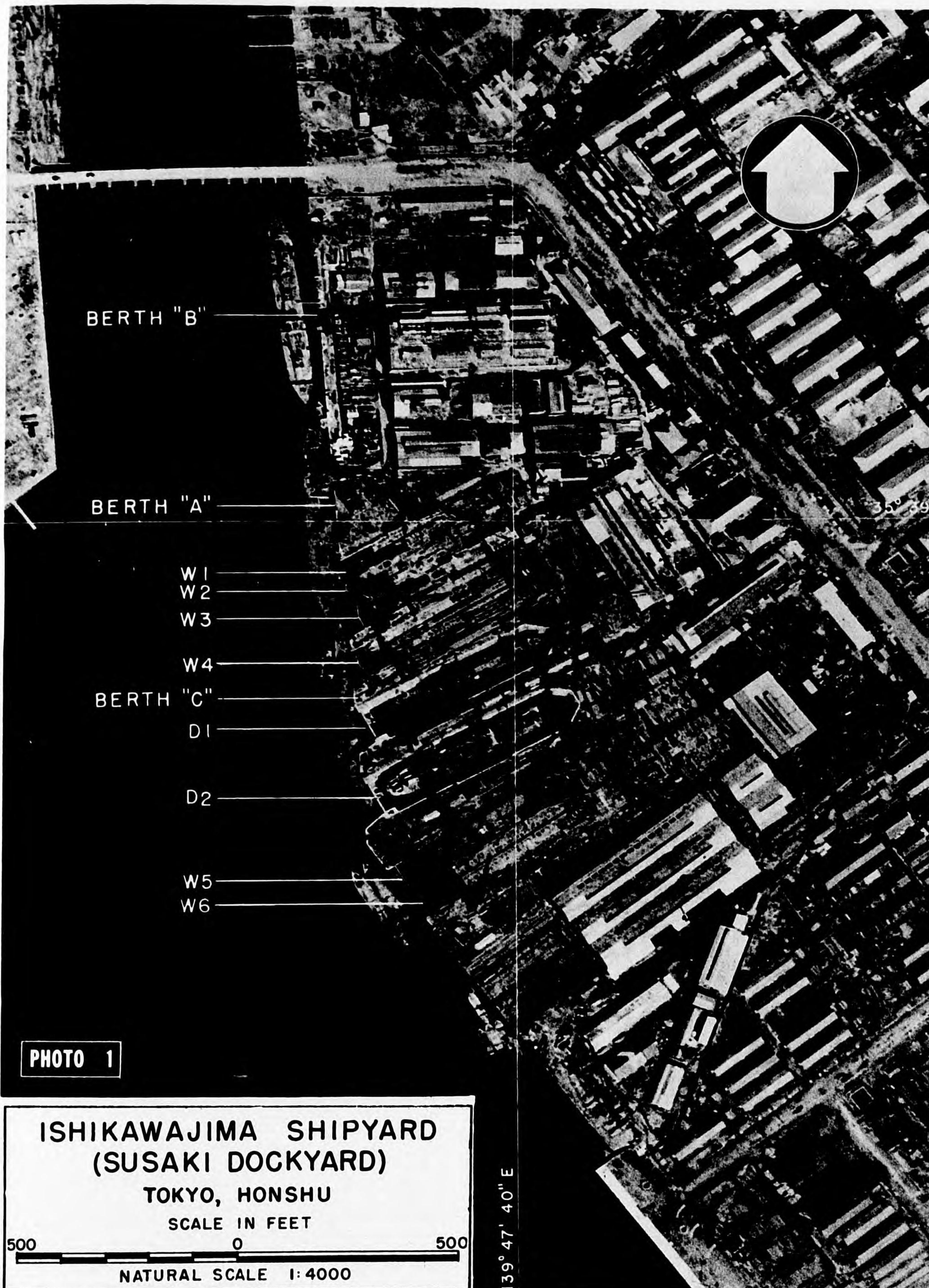
**IV SHIPBUILDING****WAY NO. 6 ISHIKAWAJIMA SHIPYARD TOKYO**CONSTRUCTION PROCESS ON WAY #6  
FIRST SHIP

Photographic Coverage: 1 November 1944 - 2 April 1945

DATE	SOURCE	ACTIVITY
12 September 1944	Japanese Data	Keel laid for 443 foot type "A" (Mod) cargo vessel
1 November	P I Reports	445 foot type "A" (Mod). Frames, bulkheads and shell in progress. Shell plating up to second deck. Vessel 45% complete.
7 November	P I Reports	Shell plating up to main deck. Second deck framed. Bow framing complete. Vessel 55% complete.
23 November	P I Reports	Main deck complete. Vessel 75% complete. Launching within a few days.
30 November	Japanese Data	Launched
13 December	P I Reports	Outfitting at Berth "A", 85% complete. Masts in place and aft deck house installed.
22 January 1945	Japanese Data	Vessel delivered; completed
<b>SECOND SHIP</b>		
2 December 1944	Japanese Data	Keel laid for 443 foot type "A" (Mod) Cargo Vessel
13 December	P I Reports	445 foot type "A" (Mod). Keel and two adjoining strakes of bottom plating laid. Vessel 2% complete.
9 January 1945	P I Reports	Bottom plating and floors in place. Tank top one sixth complete. Vessel 10% complete.
16 January	P I Reports	Tank top plating in progress and approx. one quarter complete. Vessel 11% complete.
7 March	Japanese Data	Launched
8 March	P I Reports	Mouth of way clear. Vessel probably launched end of February. Vessel outfitting at "A" with aft deck in progress; vessel 75% complete.
2 April	P I Reports	Same position as 8 March, progress slow
25 June 1945	Japanese Data	Outfitting completed.

**TABLE 4**







# V DAMAGE ASSESSMENT

## I INTRODUCTION

a. The most comprehensive damage assessment study of the war was made after the crippling raids on the remnants of the Japanese fleet on 24 and 28 July 1945. All major warships in Kure Harbor and vicinity, were attacked at this time. Prior to the attacks, target photographs and an area diagram, indicating the exact disposition of the Japanese units, were furnished to the carrier

task force. These were used both for briefing pilots and, as aids in finding the targets during the raids. Only ships observed in the latest coverage were included.

b. Photo 2 is one of five 8 x 8 target photographs (here slightly reduced in size) used in the Kure attack. A diagram of the area, Fig 3, accompanied the target photographs and showed the islands and shoreline around Kure.

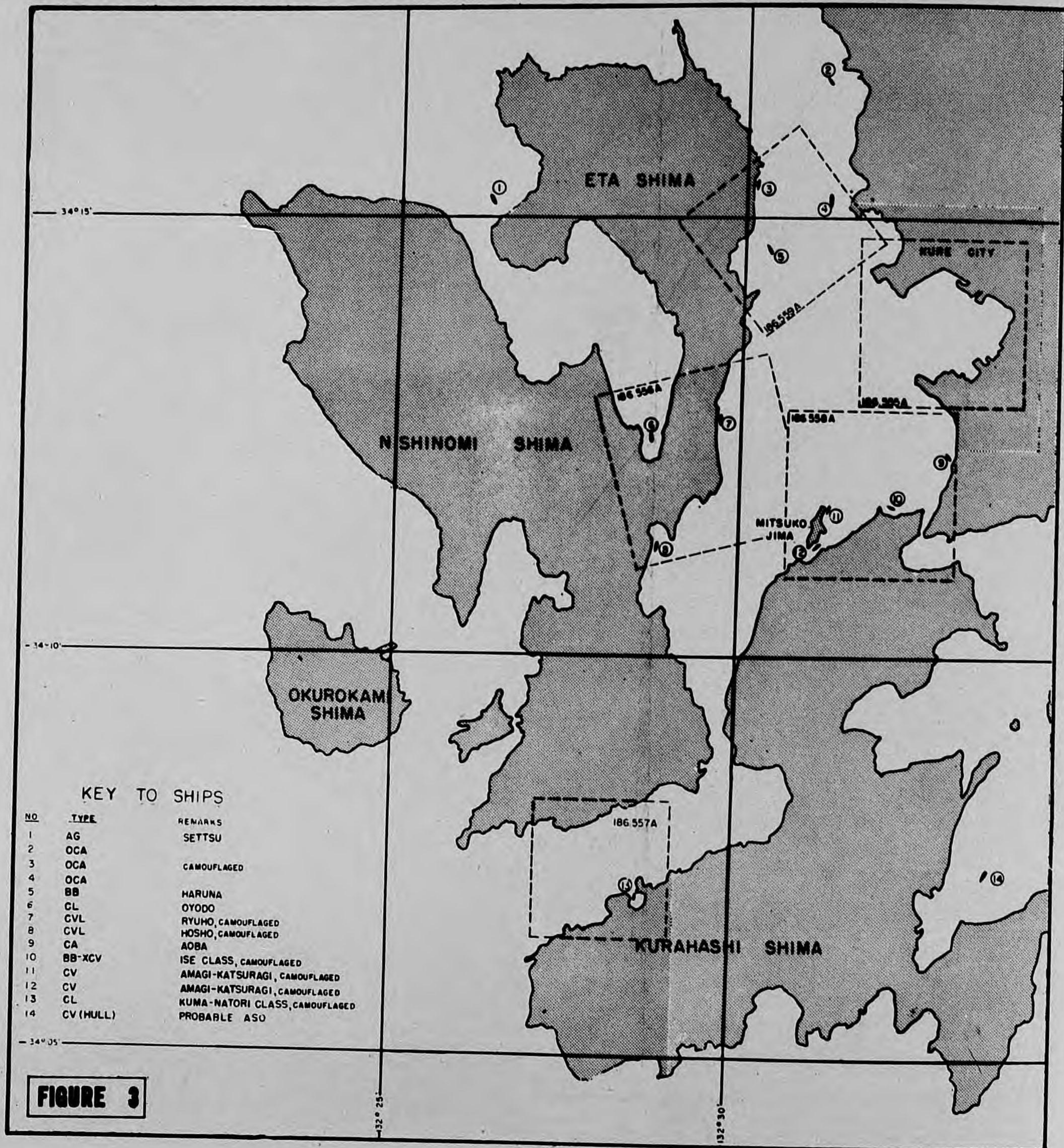


FIGURE 3



**V DAMAGE ASSESSMENT****2 EVALUATION**

a. Soon after the attack all available carrier sorties were studied and a damage assessment report prepared. The following pages present a graphic comparison of damage reported from photographs with the actual damage. They indicate that a thoroughly satisfactory report of damage can be made from a study of post-strike photography.

b. Although 3 battleships (Haruna, Ise, Hyuga), 3 carriers (Katsuragi, Amagi, Ryuho), 3 cruisers (Aoba, Tone, Oyodo), and 3 old cruisers (Iwate, Izumo, Settsu) were all damaged, it is felt that for the purpose of evaluation a comparison of four ships is sufficient. General views of these warships appear as Photos 3, 4, 5, and 6.

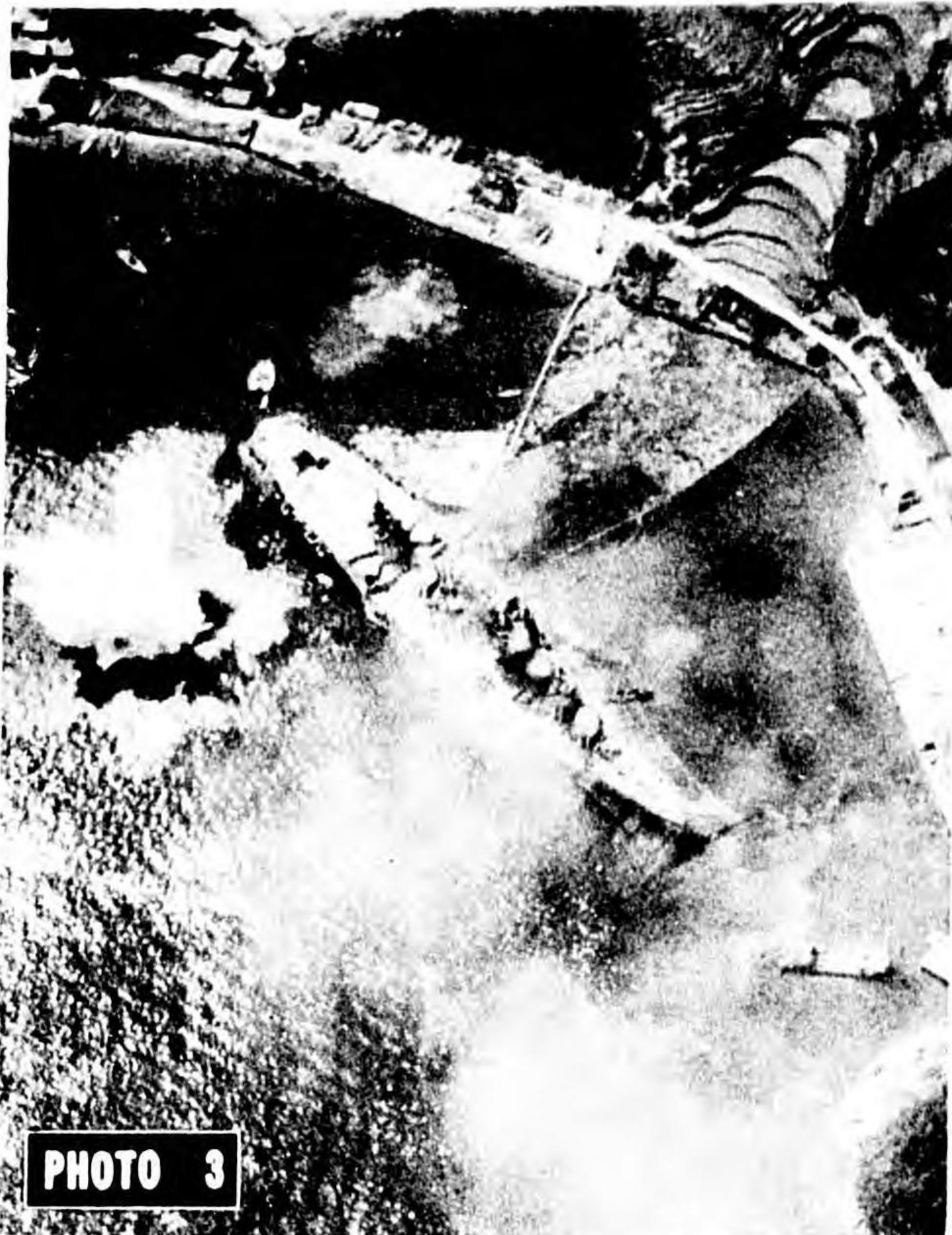
c. Detailed information on damage sustained was obtained from the Japanese Naval Headquarters by the Naval Analysis Division of the Survey and by inspection of the ships themselves. Sketches showing the location of bomb and rocket hits were furnished by Capt. MATSUMOTO of the Kure Naval Base.

d. Exhibits in the form of vectographs of each of three ships made from photographs taken during the raid have been included in an envelope attached to the last page of this report. It will be readily seen that a three dimensional view is essential in assessing damage. Exhibits are labeled, "A": CA-Aoba, "P": CV-Katsuragi, "C": CV-Amagi.





# V DAMAGE ASSESSMENT



**PHOTO 3**

BB-1SE. Oblique view taken at 1000 on 24 July. See figure 4 for a plan drawing of final damage assessment.



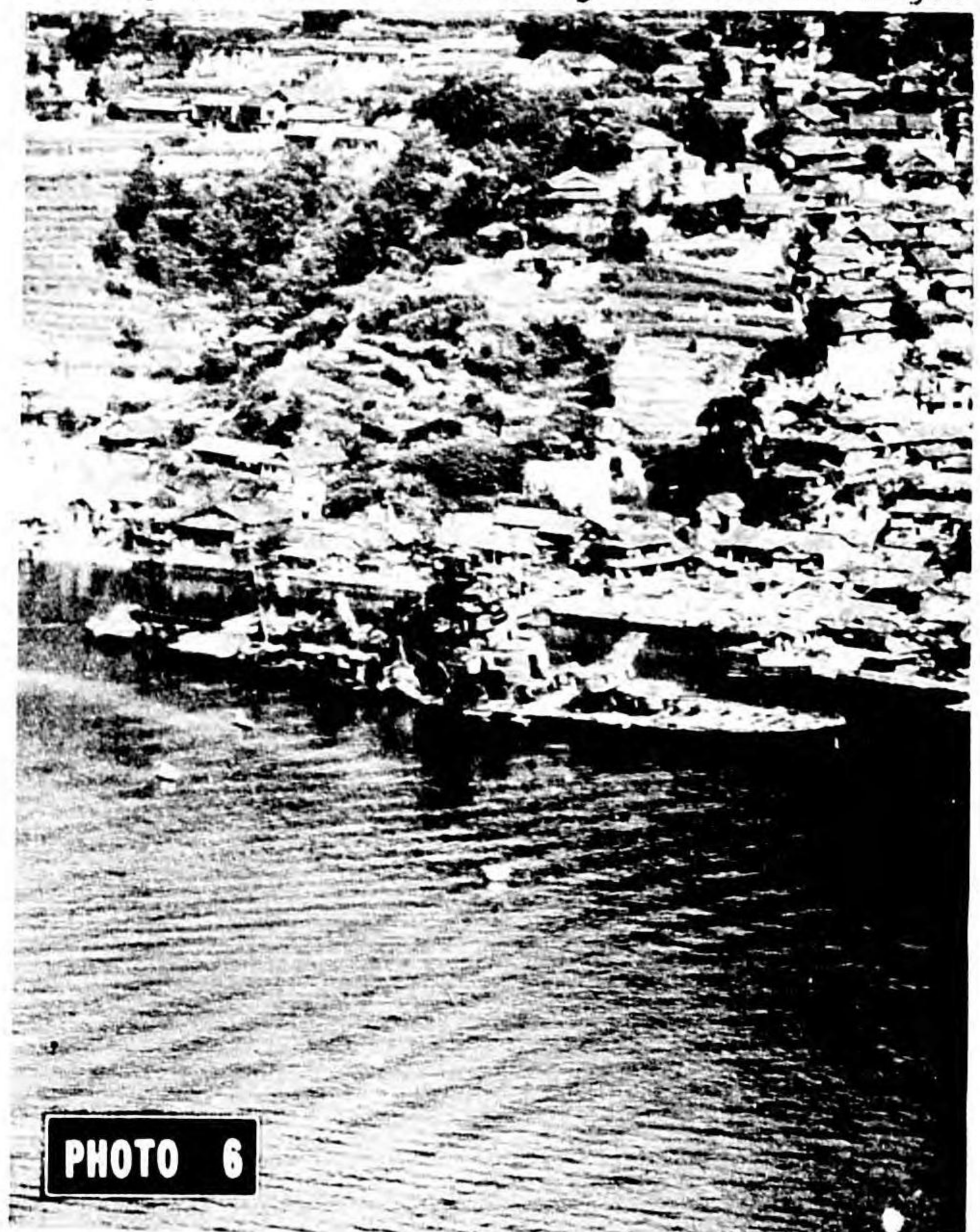
**PHOTO 4**

CV-KATSURAGI. Photograph taken during the raid of 28 July. Notice the use of structures, paths and netting for camouflage.



**PHOTO 5**

CV-AMAGI. Taken early in the morning of the second raid, this photograph shows the damage to the flight deck amidships.



**PHOTO 6**

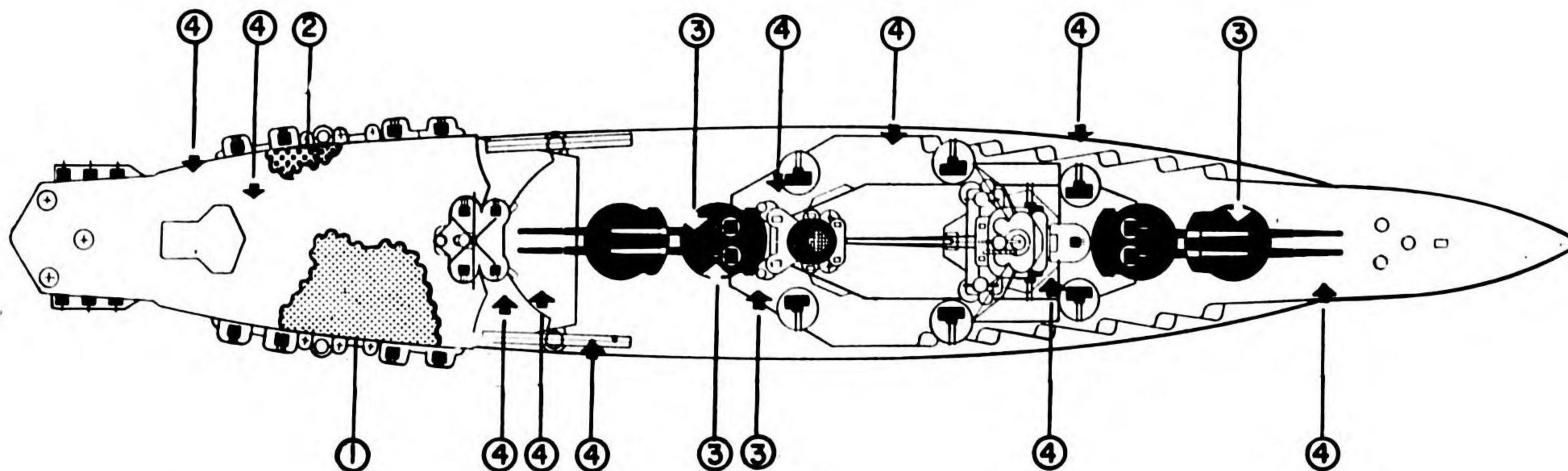
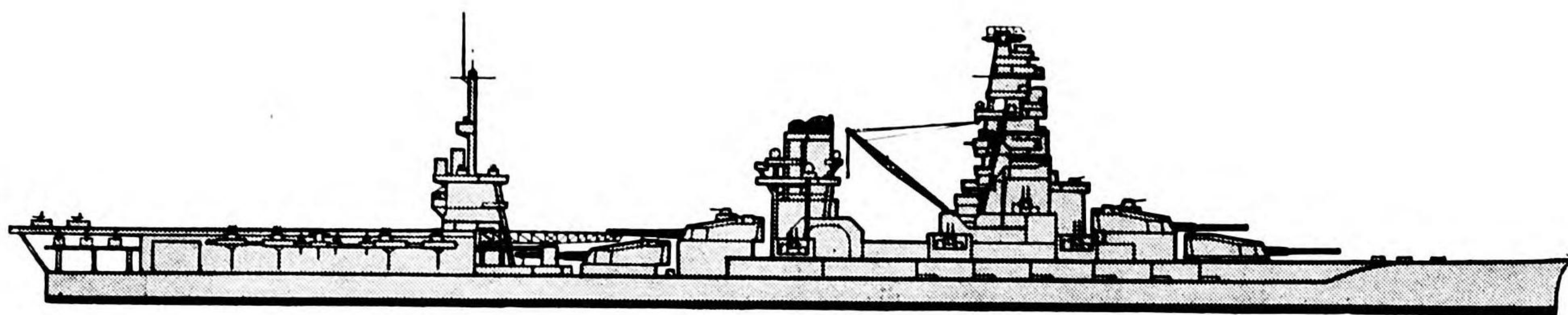
CA-AOBA. Although photographed on 15 Sept, this oblique view indicates the damage sustained. Note that fantail is broken off.



# V DAMAGE ASSESSMENT

BB-XCV 1 SE

REPORTED DAMAGE	KEY	ACTUAL DAMAGE
Ship low by the bow probably resting on bottom.		After 24 July attack ship settled by bow. Ship abandoned 1800 28 July after settling on bottom - 15° list to starboard.
Hole in staging deck extending aft of mainmast for 50 feet and from centerline starboard side of ship.	1	Report correct
20 x 20 foot hole on port side at edge of staging deck 130 feet from stern.	2	Report correct
No report	3	Direct hits on #1 & #3 turret roofs failed to penetrate 6 inch armor.
No report	4	Numerous hits on main deck
Maindeck awash		Maindeck awash at high tide
Camouflage destroyed		Report correct
No report		Serious fire below decks around #1 turret caused considerable damage.



**FIGURE 4**

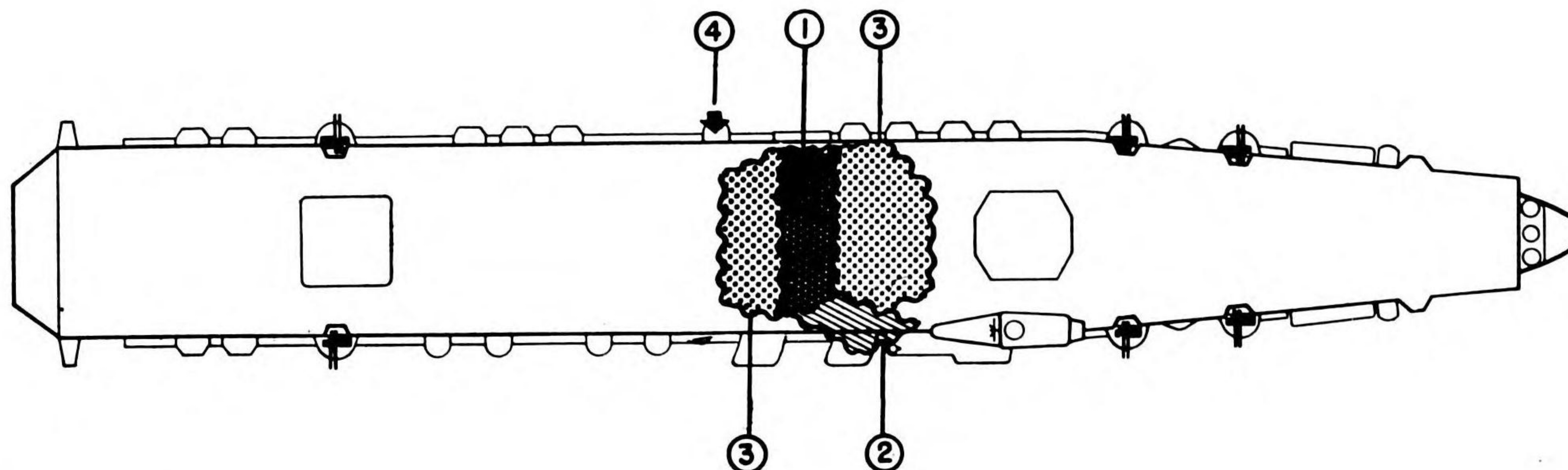
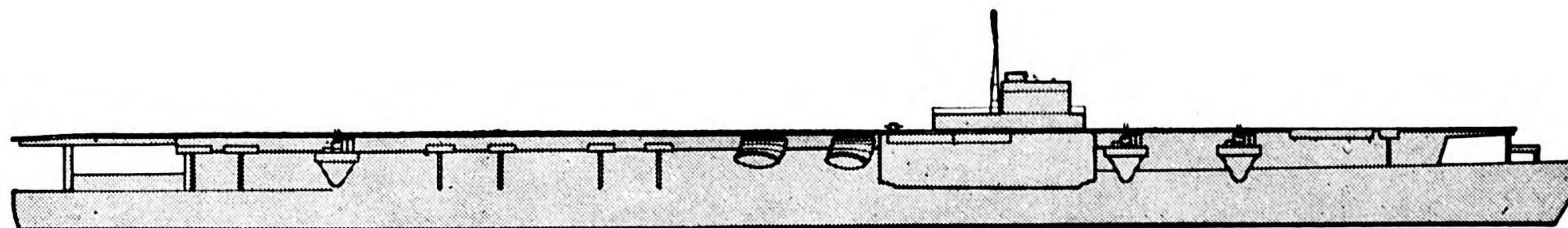
BB-XCV 1 SE



# V DAMAGE ASSESSMENT

CV - KATSURAGI

REPORTED DAMAGE	KEY	ACTUAL DAMAGE
Flight deck destroyed near stacks. Hole extends from side to side and for 35 feet fore and aft with side plating port side blown out down to hangar deck.	1	Report correct; bombs exploded in upper hangar deck.
Destroyed portion of flight deck with framing attached blown out and resting on starboard side.	2	Report correct
Flight deck buckled 50 feet forward and 30 feet aft of hole.	3	Upper deck bulged outward in every direction and much of flight deck and all elevators bent out of line.
80% of ship to shore camouflage destroyed.		Report correct.
Ship pumping water starboard bow.		Not reported.
Not reported	4	One hit on AA gun port, starboard side amidships.



**FIGURE 5**

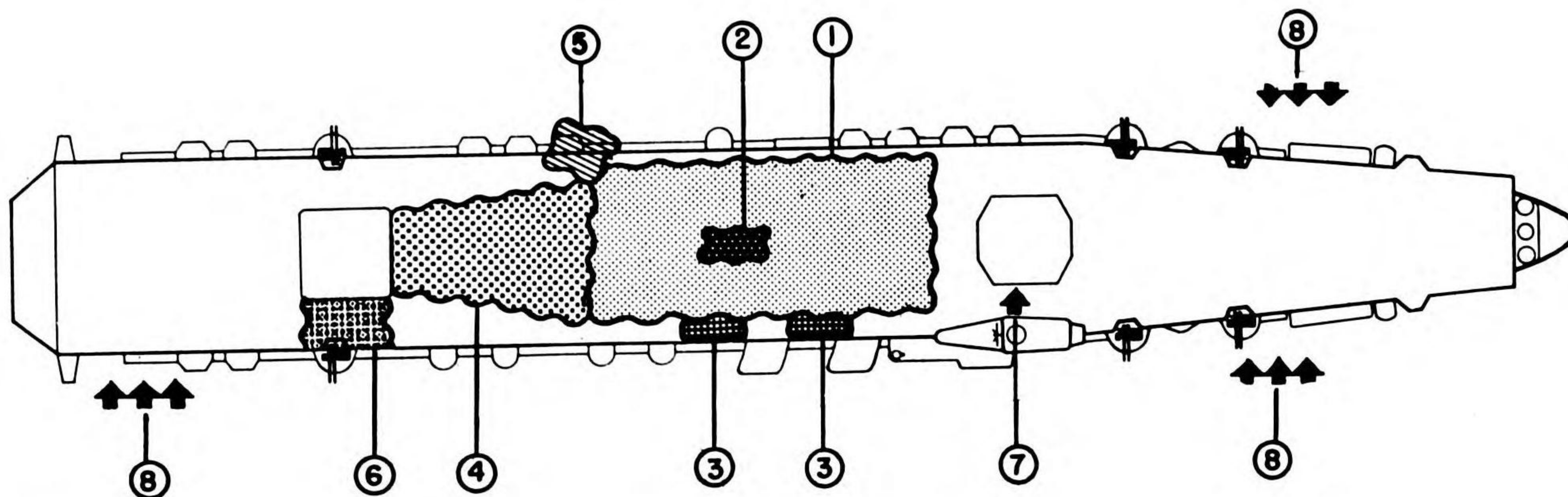
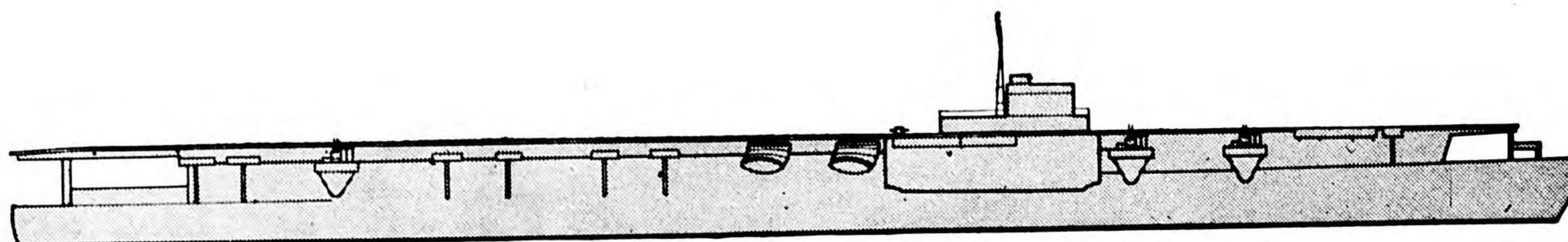
CV - KATSURAGI



# V DAMAGE ASSESSMENT

CV - AMAGI

REPORTED DAMAGE	KEY	ACTUAL DAMAGE
Hole 180 feet long in flight deck aft of island extending across ship	1	Report correct
25 x 10 foot hole through hangar deck	2	Report correct
Two 50 foot sections of side plating starboard side blown out down to hangar deck.	3	Report correct
85 feet of flight deck buckled and sagging.	4	Report correct
30 foot section of flight deck hanging over port side.	5	Report correct
Portion of flight deck between aft elevator and starboard side destroyed.	6	Report correct
Not reported	7	Rocket hit alongside island
Not reported	8	Near misses caused flooding and severe leakage



**FIGURE 6**

CV - AMAGI



# V DAMAGE ASSESSMENT

CA - A0BA

REPORTED DAMAGE	KEY	ACTUAL DAMAGE
55 feet of main deck destroyed from side to side aft of #3 turret.	1	Report correct; four or more hits on stern caused it to break off and sink.
Side plating, starboard side in damaged area torn down to waterline.	2	Report correct
Not reported	3	Direct hit on port bow
Not reported	4	Near miss port side aft of #2 stack.
Resting on bottom parallel to and 125 feet off shore.		During 24 July attack ship lost bouyancy and settled to bottom.
Not reported		Near misses caused flooding of all engine rooms.
Evidence of fire, hits not reported.	5	Four direct hits set numerous fires.

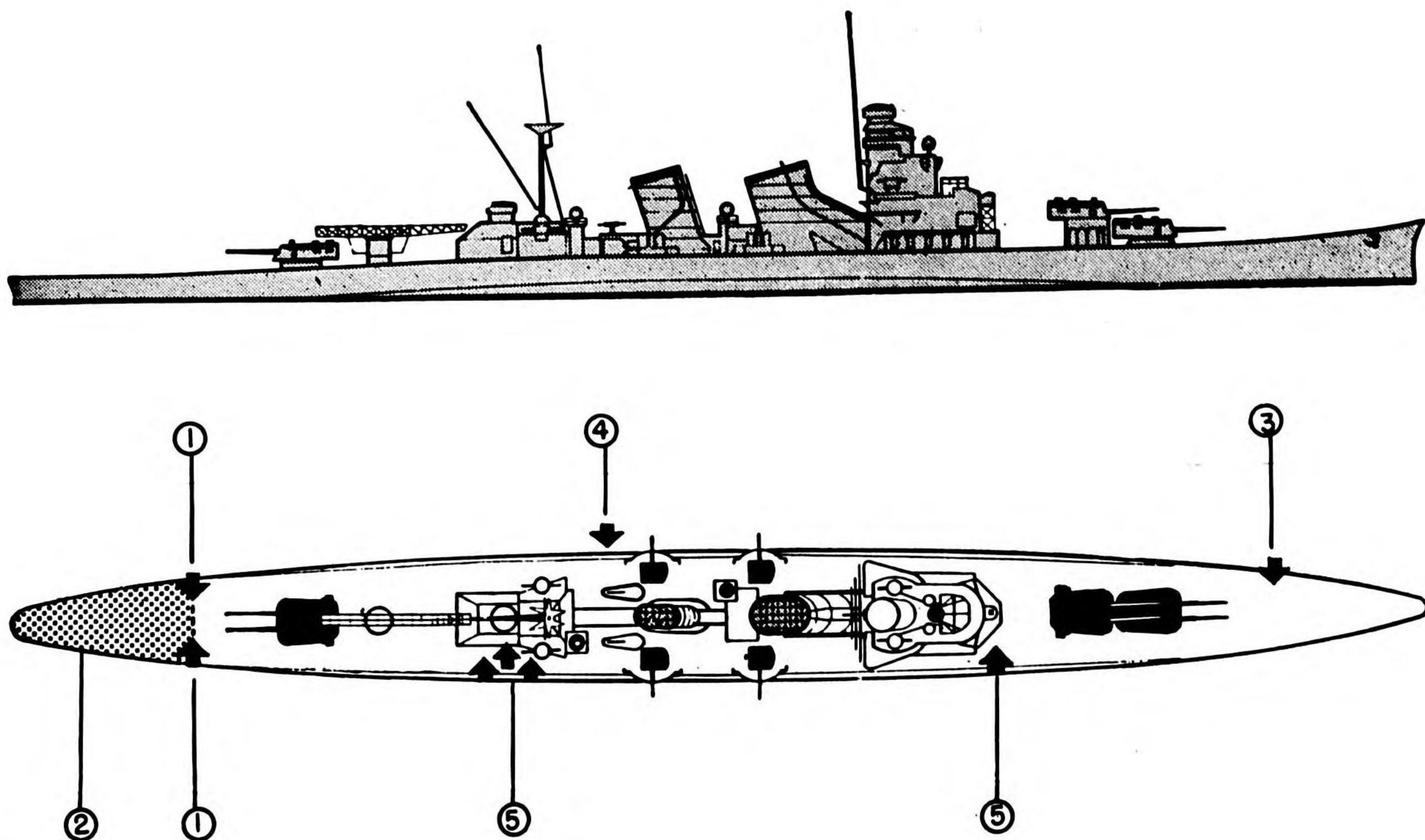


FIGURE 7

CA - A0BA



## VI CONCLUSIONS AND RECOMMENDATIONS

### 1 ACCURACY AND UTILITY

a. The accuracy of all phases of the work seems to have been well within the limits required by those using it. Specific conclusions on certain phases of the work follow.

(1) Ship movements and identification

(a) The identification of warships, classification of new types, description of new design features, and the location of fleet units, even when heavily camouflaged, was almost entirely accurate.

(b) Reports and dispatches on merchant ship movement were accurate. In addition to their tactical value these reports contributed to analyses of the relative importance of shipping routes, cargo handling capabilities of harbors, effectiveness of blockade, and other important problems. Through the development of the JMST system of coding merchant ships, speed and accuracy of this work was greatly increased and with the general use of length-tonnage graphs, it was possible for all interpreters to be consistent in the reporting of tonnage figures. Reports on merchant ship movement and concentration would have been more useful if greater emphasis had been placed on position changes of ships within harbors. The best method of emphasizing position changes is by the issuance of simple outline charts showing ship positions. This practice was followed in some instances but a shortage of manpower prevented this being adopted as a standard procedure.

(c) Universal use of a standard form for reporting shipping would have raised the general level of reporting from organizations without shipping specialists. In many cases vital information was omitted through carelessness or lack of awareness of its importance.

(d) Reports on shipping would have been more useful had they been divided into two sections, operational and non-operational, since those interested in one category are frequently not interested

in the other. The operational section should give information on all ships anchored, at a quay, unloading, loading, etc. The non-operational section should include data on ships building, outfitting, repairing, and damaged.

(2) Shipbuilding

(a) Reports on shipbuilding from keel laying to outfitting were generally accurate, although some reports slightly over-estimated the rate of progress since interpreters were influenced by similar American production rates.

(b) The check of the work on the Ishikawajima Shipyard proves conclusively that with good photography and regular coverage, an accurate check on enemy construction activity can be maintained.

(3) Damage assessment

(a) The assessment of damage was correct within reasonable limits. Major damage which resulted in crippling a ship or forcing it to lose water-tight integrity was accurately reported, as was its status, i.e., waterborne, low in the water, resting on bottom, sunk, or listing.

(b) Severe damage by internal fires and explosions, underwater damage, and direct hits which left no visible evidence were impossible to report. Near misses were frequently observed in photographs and their locations gave some indication of their damaging potentialities.

### 2 ORGANIZATION AND PROCEDURES

a. Shipping interpretation, along with most other phases of photographic intelligence, suffered from a lack of coordination with other branches of intelligence. Information which would have materially aided the interpreter was either not available to him soon enough or not available at all. At the same time a considerable part of the information obtained through photographic intelligence was not utilized. There



## VI CONCLUSIONS AND RECOMMENDATIONS

are cases in which estimated production schedules on individual shipyards were published long after photographic intelligence had indicated that the yards were completely inactive.

b. It is believed that the solution to the problem of lack of coordination, as well as to the almost equal problem of duplication of effort lies in the establishment of a central intelligence organization in which all forms of shipping intelligence can be both analyzed and synthesized. It is also believed that the main establishment of this organization should be as close to the theatre command as possible so that there can be a direct relationship between the needs for intelligence and the production of intelligence.

c. To be completely effective, this organization should supervise the production of all recognition and reference material as well as operational intelligence on shipping. Maximum available effort will thus go into rapid production of a single reliable series of shipping publications.

### 3 PERSONNEL AND TRAINING

a. In many instances officers with little or no technical education did excellent jobs in shipping interpretation. It seems reasonable, however, to assume that interpreters working in the special fields of ship recognition, construction, and damage assessment should have a good background

in the fundamentals of naval architecture, ship construction, and shipyard layout.

(1) Knowledge of naval architecture and contemporary warship and merchant ship design is most helpful in the recognition of new types. Small features in the design, often evident only during construction and outfitting give clues as to the ultimate use of the vessel.

(2) Familiarity with ship construction, materials, procedures and types of equipment used in shipbuilding and repair are essential to quick, accurate recognition of stages of construction and general activity at a yard.

(3) Thorough knowledge of shipyard layout and the sequence of operations within a yard, from the storing of steel through fabrication, erection, and launching will facilitate functional analysis of a yard and an estimation of its capabilities.

### 4 PHOTOGRAPHY

a. In general photographic coverage of Japan was adequate for shipping interpretation.

b. It is highly desirable that photography be secured at more frequent intervals than was secured during the war, and that complete port coverage of a reasonable scale be obtained.



## DESCRIPTIONS OF VECTOGRAPH EXHIBITS

## Vectograph Exhibit A - Japanese CA "Aoba"

Careful stereoscopic study of photographs similar to this three dimensional aerial view of the Japanese heavy cruiser "Aoba" revealed that 55 feet of main deck was destroyed aft of the after turret, that side plating on the starboard side in the damaged area was torn down to the water line, and that the ship was resting on the bottom.

See page 16 of this report for a plan drawing of this ship showing the damaged areas.

## Vectograph Exhibit B - Japanese CV "Katsuragi"

This aerial view of the well camouflaged Japanese aircraft carrier "Katsuragi" illustrates the value of third dimension study of shipping when assessing damage. Stereoscopic study of the photographs enabled interpreters to report correctly that the flight deck had been destroyed near the stacks, that a hole extended from side to side and for 35 feet fore and aft with side plating on the port side blown out down to the hangar deck, that the destroyed portion of the flight deck with framing attached was blown out and resting on the starboard side, and that the flight deck was buckled fifty feet forward and thirty feet aft of the hole.

See page 14 of this report for a plan drawing of this ship showing the damaged areas.

## Vectograph Exhibit C - Japanese CV "Amagi"

Stereoscopic study of the Japanese aircraft carrier "Amagi" revealed the following damage: A hole 180 feet long in the flight deck aft of the island, extending athwartship; A 25 x 10 foot hole through the hangar deck; Two 50 foot sections of side plating on the starboard side blown out down to the hangar deck; 85 feet of flight deck buckled and sagging; An 80 foot section of flight deck hanging over the port side; A portion of flight deck between the after elevator and the starboard side destroyed.

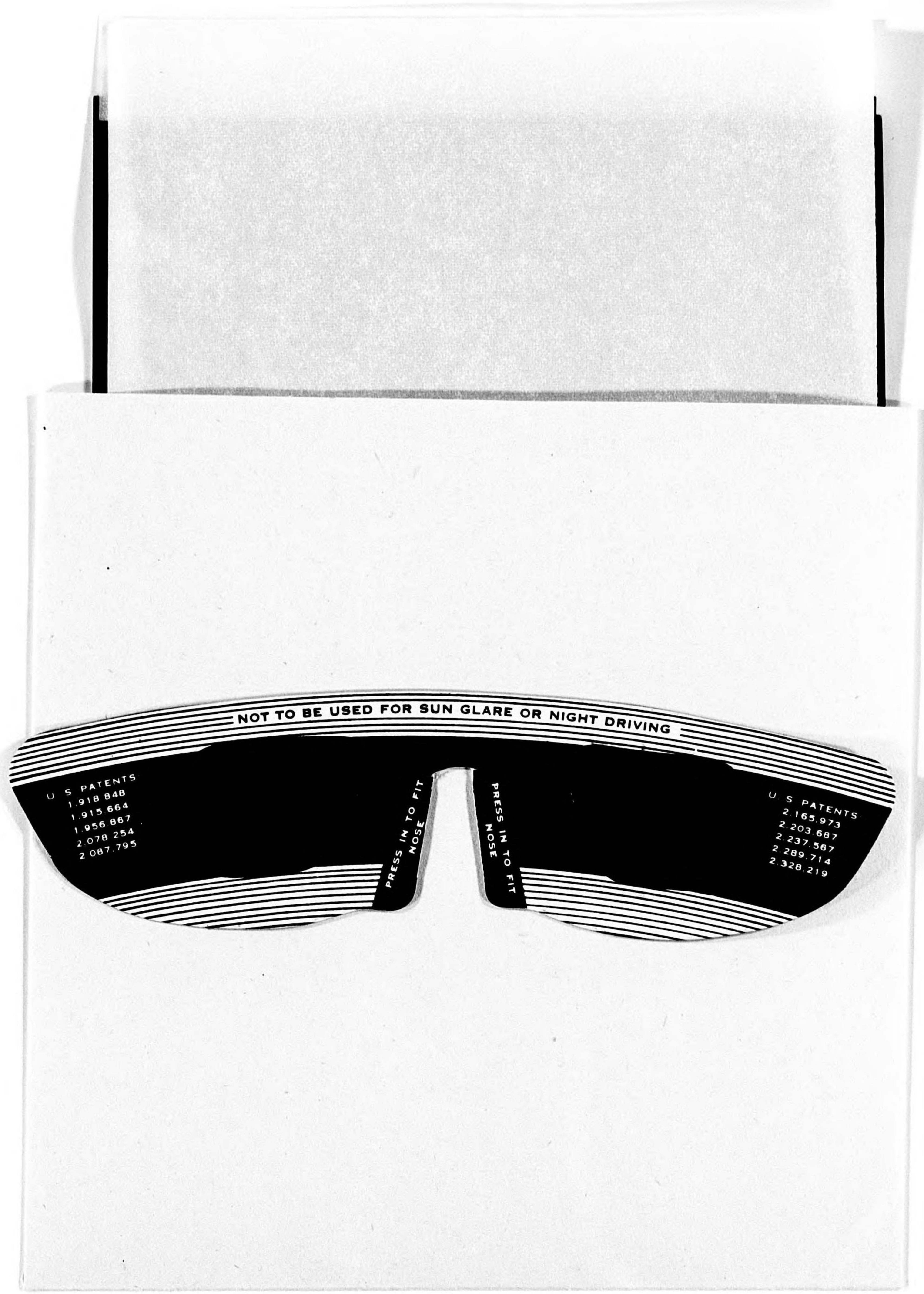
See page 15 of this report for a plan drawing of this ship showing the damaged areas.



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PHOTOGRAPHIC INTELLIGENCE — SHIPPING

# VECTOGRAPH EXHIBITS



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## UNITED STATES STRATEGIC BOMBING SURVEY

### European War

#### LIST OF REPORTS

The following list of studies is a bibliography of completed reports resulting from the German survey. Reports numbers 1, 2, and 3 can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. Permission to examine the remaining reports may be had by writing to the headquarters of the Survey at Gravelly Point, Washington 25, D. C.

- 1 The United States Strategic Bombing Survey: Summary Report (European War)
- 2 The United States Strategic Bombing Survey: Over-all Report (European War)
- 3 The Effects of Strategic Bombing on the German War Economy

#### AIRCRAFT DIVISION

(By Division and Branch)

- 4 Aircraft Division Industry Report
- 5 Inspection Visits to Various Targets (Special Report)

#### Airframes Branch

- 6 Junkers Aircraft and Aero Engine Works, Dessau, Germany
- 7 Erla Maschinenwerke G m b H, Heiterblick, Germany
- 8 A T G Maschinenbau, G m b H, Leipzig (Mockau), Germany
- 9 Gothaer Waggonfabrik, A G, Gotha, Germany
- 10 Focke Wulf Aircraft Plant, Bremen, Germany
- 11 Messerschmitt A G, Augsburg, Germany 

}	Over-all Report
	Part A
	Part B
- 12 Dornier Works, Friedrichshafen & Munich, Germany
- 13 Gerhard Fieseler Werke G m b H, Kassel, Germany
- 14 Wiener Neustaedter Flugzeugwerke, Wiener Neustadt, Austria

#### Aero Engines Branch

- 15 Bussing NAG Flugmotorenwerke G m b H, Brunswick, Germany
- 16 Mittel-Deutsche Motorenwerke G m b H, Taucha, Germany
- 17 Bavarian Motorworks Inc, Eisenach & Durrenhof, Germany
- 18 Bayerische Motorenwerke A G (BMW) Munich, Germany
- 19 Henschel Flugmotorenwerke, Kassel, Germany

#### Light Metal Branch

- 20 Light Metals Industry 

}	Part I, Aluminum of Germany
	Part II, Magnesium
- 21 Vereinigte Deutsche Metallwerke, Hildesheim, Germany
- 22 Metallgussgesellschaft G m b H, Leipzig, Germany
- 23 Aluminiumwerk G m b H, Plant No. 2, Bitterfeld, Germany
- 24 Gebrueder Giulini G m b H, Ludwigshafen, Germany
- 25 Luftschiffbau Zeppelin G m b H, Friedrichshafen on Bodensee, Germany
- 26 Wieland Werke A G, Ulm, Germany

- 27 Rudolph Rautenbach Leichtmetallgiessereien. Solingen, Germany
- 28 Lippewerke Vereinigte Aluminiumwerke A G, Lunen, Germany
- 29 Vereinigte Deutsche Metallwerke, Hedderheim, Germany
- 30 Duerener Metallwerke A G, Duren Wittenau-Berlin & Waren, Germany

#### AREA STUDIES DIVISION

- 31 Area Studies Division Report
- 32 A Detailed Study of the Effects of Area Bombing on Hamburg
- 33 A Detailed Study of the Effects of Area Bombing on Wuppertal
- 34 A Detailed Study of the Effects of Area Bombing on Dusseldorf
- 35 A Detailed Study of the Effects of Area Bombing on Solingen
- 36 A Detailed Study of the Effects of Area Bombing on Remscheid
- 37 A Detailed Study of the Effects of Area Bombing on Darmstadt
- 38 A Detailed Study of the Effects of Area Bombing on Lubeck
- 39 A Brief Study of the Effects of Area Bombing on Berlin, Augsburg, Bochum, Leipzig, Hagen, Dortmund, Oberhausen, Schweinfurt, and Bremen

#### CIVILIAN DEFENSE DIVISION

- 40 Civilian Defense Division—Final Report
- 41 Cologne Field Report
- 42 Bonn Field Report
- 43 Hanover Field Report
- 44 Hamburg Field Report—Vol I, Text; Vol II, Exhibits
- 45 Bad Oldesloe Field Report
- 46 Augsburg Field Report
- 47 Reception Areas in Bavaria, Germany

#### EQUIPMENT DIVISION

##### Electrical Branch

- 48 German Electrical Equipment Industry Report
- 49 Brown Boveri et Cie, Mannheim Kafertal, Germany

##### Optical and Precision Instrument Branch

- 50 Optical and Precision Instrument Industry Report

##### Abrasives Branch

- 51 The German Abrasive Industry
- 52 Mayer and Schmidt, Offenbach on Main, Germany

##### Anti-Friction Branch

- 53 The German Anti-Friction Bearings Industry

##### Machine Tools Branch

- 54 Machine Tools & Machinery as Capital Equipment
- 55 Machine Tool Industry in Germany
- 56 Herman Kolb Co, Cologne, Germany
- 57 Collet and Engelhard, Offenbach, Germany
- 58 Naxos Union, Frankfort on Main, Germany

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**MILITARY ANALYSIS DIVISION**

- 59 The Defeat of the German Air Force
- 60 V-Weapons (Crossbow) campaign
- 61 Air Force Rate of Operation
- 62 Weather Factors in Combat Bombardment Operations in the European Theatre
- 63 Bombing Accuracy, USAAF Heavy and Medium Bombers in the ETO
- 64 Description of RAF Bombing

**MORALE DIVISION****Medical Branch**

- 65 The Effect of Bombing on Health and Medical Care in Germany

**MUNITIONS DIVISION****Heavy Industry Branch**

- 66 The Coking Industry Report of Germany
- 67 Coking Plant Report No. 1, Sections A, B, C, & D
- 68 Gutehoffnungshuette, Oerhausen, Germany
- 69 Friedrich-Alfred Hütte, Rheinhausen, Germany
- 70 Neunkirchen Eisenwerke A G, Neunkirchen, Germany
- 71 Reichswerke Hermann Goering A G, Hallendorf, Germany
- 72 August Thyssen Huette A G, Hamborn, Germany
- 73 Friedrich Krupp A G, Borbeck Plant, Essen, Germany
- 74 Dortmund Hoerder Huettenverein, A G, Dortmund, Germany
- 75 Hoesch A G, Dortmund, Germany
- 76 Bochumer Verein fuer Gusstahlfabrikation A G, Bochum, Germany

**Motor Vehicles and Tanks Branch**

- 77 German Motor Vehicles Industry Report
- 78 Tank Industry Report
- 79 Daimler Benz A G, Unterturkheim, Germany
- 80 Renault Motor Vehicles Plant, Billancourt, Paris
- 81 Adam Opel, Russelheim, Germany
- 82 Daimler Benz-Gaggenau Works, Gaggenau, Germany
- 83 Maschinenfabrik Augsburg-Nurnberg, Nurnberg, Germany
- 84 Auto Union A G, Chemnitz and Zwickau, Germany
- 85 Henschel and Sohn, Kassel, Germany
- 86 Maybach Motor Works, Friedrichshafen, Germany
- 87 Voigtlander Maschinenfabrik A G, Plauen, Germany
- 88 Volkswagenwerke, Fallersleben, Germany
- 89 Bussing NAG, Brunswick, Germany
- 90 Muehlenbau Industrie A G (Miag) Brunswick, Germany
- 91 Friedrich Krupp Grusonwerke, Magdeburg, Germany

**Submarine Branch**

- 92 German Submarine Industry Report
- 93 Maschinenfabrik Augsburg-Nurnberg A G, Augsburg, Germany
- 94 Blohm and Voss Shipyards, Hamburg, Germany
- 95 Deutschewerke A G, Kiel, Germany
- 96 Deutsche Schiff und Maschinenbau, Bremen, Germany
- 97 Friedrich Krupp Germaniawerft, Kiel, Germany
- 98 Howaldtswerke A G, Hamburg, Germany
- 99 Submarine Assembly Shelter, Farge, Germany
- 100 Bremer Vulkan, Vegesack, Germany

**Ordnance Branch**

- 101 Ordnance Industry Report
- 102 Friedrich Krupp Grusonwerke A G, Magdeburg, Germany

- 103 Bochumer Verein fuer Gusstahlfabrikation A G, Bochum, Germany
- 104 Henschel and Sohn, Kassel, Germany
- 105 Rheinmetall-Borsig, Dusseldorf, Germany
- 106 Hermann Goering Werke, Braunschweig, Hallendorf, Germany
- 107 Hannoverische Maschinenbau, Hanover, Germany
- 108 Gusstahlfabrik Friedrich Krupp, Essen, Germany

**OIL DIVISION**

- 109 Oil Division Final Report
- 110 Oil Division Final Report, Appendix
- 111 Powder, Explosives, Special Rockets and Jet Propellants, War Gases and Smoke Acid (Ministerial Report #1)
- 112 Underground and Dispersal Plants in Greater Germany
- 113 The German Oil Industry, Ministerial Report Team 78
- 114 Ministerial Report on Chemicals

**Oil Branch**

- 115 Ammoniakwerke Merseburg G m b H, Leuna, Germany--2 appendices
- 116 Braunkohle Benzin A G, Zeitz and Bohlen, Germany
- Wintershall A G, Luetzkendorf, Germany
- 117 Ludwigshafen-Oppau Works of I G Farbenindustrie A G, Ludwigshafen, Germany
- 118 Ruhroel Hydrogenation Plant, Bottrop-Boy, Germany, Vol I, Vol II
- 119 Rhenania Ossag Mineraloelwerke A G, Harburg Refinery, Hamburg, Germany
- 120 Rhenania Ossag Mineraloelwerke A G, Grassbrook Refinery, Hamburg, Germany
- 121 Rhenania Ossag Mineraloelwerke A G, Wilhelmsburg Refinery, Hamburg, Germany
- 122 Gewerkschaft Victor, Castrop-Rauxel, Germany, Vol I & Vol II
- 123 Europaeische Tanklager und Transport A G, Hamburg, Germany
- 124 Ebano Asphalt Werke A G, Harburg Refinery, Hamburg, Germany
- 125 Meerbeck Rheinpreussen Synthetic Oil Plant--Vol I & Vol II

**Rubber Branch**

- 126 Deutsche Dunlop Gummi Co., Hanau on Main, Germany
- 127 Continental Gummiwerke, Hanover, Germany
- 128 Huels Synthetic Rubber Plant
- 129 Ministerial Report on German Rubber Industry

**Propellants Branch**

- 130 Elektro Chemiewerke, Munich, Germany
- 131 Schoenebeck Explosive Plant, Lignose Sprengstoff Werke G m b H, Bad Salzemen, Germany
- 132 Plants of Dynamit A G, Vormal, Alfred Nobel & Co, Troisdorf, Clausthal, Drummel and Duneberg, Germany
- 133 Deutsche Sprengchemie G m b H, Kraiburg, Germany

**OVERALL ECONOMIC EFFECTS DIVISION**

- 134 Overall Economic Effects Division Report
 

Gross National Product	Special papers
Kriegs Eil Berichte	which together
Herman Goering Works	comprise the
Food and Agriculture	above report

**PHYSICAL DAMAGE DIVISION**

- 135 Villacoublay Airdrome, Paris, France
- 136 Railroad Repair Yards, Malines, Belgium
- 137 Railroad Repair Yards, Louvain, Belgium
- 138 Railroad Repair Yards, Hasselt, Belgium
- 139 Railroad Repair Yards, Namur, Belgium
- 140 Submarine Pens, Brest, France



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- 141 Powder Plant, Angouleme, France  
142 Powder Plant, Bergerac, France  
143 Coking Plants, Montigny & Liege-Belgium  
144 Fort St. Blaise Verdun Group, Metz, France  
145 Gnome et Rhone, Limoges, France  
146 Michelin Tire Factory, Clermont-Ferrand, France  
147 Gnome et Rhone Aero Engine Factory, Le Mans, France  
148 Kugelfisher Bearing Ball Plant, Ebelspach, Germany  
149 Louis Breguet Aircraft Plant, Toulouse, France  
150 S. N. C. A. S. E. Aircraft Plant, Toulouse, France  
151 A. I. A. Aircraft Plant, Toulouse, France  
152 V Weapons in London  
153 City Area of Krefeld  
154 Public Air Raid Shelters in Germany  
155 Goldenberg Thermal Electric Power Station, Knapsack, Germany  
156 Brauweiler Transformer & Switching Station, Brauweiler, Germany  
157 Storage Depot, Nahbollenbach, Germany  
158 Railway and Road Bridge, Bad Munster, Germany  
159 Railway Bridge, Eller, Germany  
160 Gustloff-Werke Weimar, Weimar, Germany  
161 Henschel and Sohn G m b H, Kassel, Germany  
162 Area Survey at Pirmasens, Germany  
163 Hanomag, Hanover, Germany  
164 M A N Werke Augsburg, Augsburg, Germany  
165 Friedrich Krupp A G, Essen, Germany  
166 Erla Maschinenwerke, G m b H, Heiterblick, Germany  
167 A T G Maschinenbau G m b H, Mockau, Germany  
168 Erla Maschinenwerke G m b H, Mockau, Germany  
169 Bayerische Motorenwerke Durrerhoff, Germany  
170 Mittel-Deutsche Motorenwerke G m b H, Taucha, Germany  
171 Submarine Pens Deutsche-Werft, Hamburg, Germany  
172 Multi-Storied Structures, Hamburg, Germany  
173 Continental Gummiwerke, Hanover, Germany  
174 Kassel Marshalling Yards, Kassel, Germany  
175 Ammoniskwerke, Mersburg-leuna, Germany  
176 Brown Boveri et Cie, Mannheim, Kafertal, Germany  
177 Adam Opel A G, Russelheim, Germany  
178 Daimler-Benz A G, Unterturkheim, Germany  
179 Valentin Submarine Assembly, Farge, Germany  
180 Volkswaggonwerke, Fallersleben, Germany  
181 Railway Viaduct at Bielefeld, Germany  
182 Ship Yards Howaldtswerke, Hamburg, Germany  
183 Blohm and Voss Shipyards, Hamburg, Germany  
184 Daimler-Benz A G, Mannheim, Germany  
185 Synthetic Oil Plant, Meerbeck-Hamburg, Germany  
186 Gewerkschaft Victor, Castrop-Rauzel, Germany  
187 Klockner Humboldt Deutz, Ulm, Germany  
188 Ruhroel Hydrogenation Plant, Bettrop-Boy, Germany  
189 Neukirchen Eisenwerke A G, Neukirchen, Germany  
190 Railway Viaduct at Altenbecken, Germany  
191 Railway Viaduct at Arnsburg, Germany  
192 Deurag-Nerag Refineries, Misburg, Germany  
193 Fire Raids on German Cities  
194 I G Farbenindustrie, Ludwigshafen, Germany, Vol I & Vol II  
195 Roundhouse in Marshalling Yard, Ulm, Germany  
196 I G Farbenindustrie, Leverkusen, Germany  
197 Chemische-Werke, Huels, Germany  
198 Gremberg Marshalling Yard, Gremberg, Germany  
199 Locomotive Shops and Bridges at Hamm, Germany
- TRANSPORTATION DIVISION**
- 200 Transportation Division Report  
201 Rail Operations Over the Brenner Pass  
202 Effects of Bombing on Railroad Installations in Regensburg, Nurnberg and Munich Divisions.  
203 German Locomotive Industry During the War  
204 Wehrmacht Traffic Over the German Railroads
- UTILITIES DIVISION**
- 205 German Electric Utilities Industry Report  
206 1 to 10 in Vol I "Utilities Division Plant Reports"  
207 11 to 20 in Vol II "Utilities Division Plant Reports"  
208 21 Rheinische-Westfalische Elektrizitatswerk A G