

RESTRICTED

INDEX NO. S-95(N)

SHIP AND RELATED TARGETS

WOODS, TEXTILES, RUBBER, AND PLASTICS
USED IN JAPANESE NAVAL VESSELS

U.S. NAVAL TECHNICAL MISSION TO JAPAN

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

1 February 1946

RESTRICTED

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

Subject: Target Report - Woods, Textiles, Rubber, and Plastics
Used in Japanese Naval Vessels.

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

1. Subject report, covering Target S-95(N) of Fascicle S-1 of reference (a), is submitted herewith.
2. The investigation of the target and the target report were accomplished by Comdr. R.H. Hedgecock, USN.



C. G. GRIMES
Captain, USN

RESTRICTED

S-95(N)

**WOODS, TEXTILES, RUBBER, AND PLASTICS
USED IN JAPANESE NAVAL VESSELS**

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

FASCICLE S-1, TARGET S-95(N)

JANUARY 1946

U.S. NAVAL TECHNICAL MISSION TO JAPAN

SUMMARY

SHIP AND RELATED TARGETS

WOODS, TEXTILES, RUBBER, AND PLASTICS USED IN JAPANESE NAVAL VESSELS

Wood of many varieties was used extensively in Japanese naval vessels, and the workmanship in wood was very careful. Even on modern steel ships, wood was used for equipment such as furniture, shelving, and cabinets.

Textiles, rubber, and plastics in moderate amounts found essentially the same uses as in U.S. naval vessels.

Supply of certain types of wood became critical, but suitable substitutions were made. Near the end of the war, Japan's natural rubber supply was cut off, but she had not completely used up her stock-pile of rubber when the war ended.

Information concerning protective coatings is covered in NavTechJap Report "Japanese Navy Paints" - Index No. S-59.

TABLE OF CONTENTS

Summary	Page 1
References	Page 3
Introduction	Page 5
The Report	
Part I Wood	Page 7
Part II Textiles	Page 9
Part III Rubber and Plastics	Page 10

RESTRICTED

S-95(N)

REFERENCES

- A. Location of Target:
Navy Technical Department, TOKYO - Ship Construction, Machinery, Electrical, and Ordnance Sections.
- B. Japanese Personnel Who Were Interviewed and Who Assisted in Gathering Documents:
1. A. KATAYAMA, Former Constructor Admiral, IJN - On 15 August 1945 was in the Ship Construction Section, Navy Technical Dept.
 2. K. YADA, Former Constructor Captain, IJN - On 15 August 1945 was assistant to the Hull Superintendent at Sasebo Navy Yard.
 3. G. YAMAMOTO, Former Constructor Captain, IJN - On 15 August 1945 was the detail fittings designer, Ship Construction Section, Navy Technical Department.
 4. T. KOYAMA, Civilian Engineer - Has been a small boat designer for the Ship Construction Section, Navy Technical Dept., since 1934.
 5. K. KUDO, Former Engineering Commander, IJN - On 15 August 1945 had just completed four years in the Machinery Section, Navy Technical Department, working at engine production.
 6. Y. NAGI, Civilian Engineer - On 15 August 1945 had completed twelve years in the Machinery Section, Navy Technical Department. He worked at boiler and engine fittings and arrangement.
 7. Y. MIMURA, Civilian Radio Engineer - Presently in the Electrical Section, Navy Technical Department. Has worked for the Navy for 17 years.
 8. F. IWASHIMA, Former Ordnance Captain, IJN - On 15 August 1945 had completed six years in the Ordnance Section, Navy Technical Department, in ordnance production and experiment.
 9. T. KUBOTA, Research Chemist for Yokohama Gum Co.
 10. S. IKAI, Design Dept. of Yokohama Gum Co.
 11. S. KOI, Chief of Production for the Japan Tire Co.
 12. M. HAMANO, Chief of the Rolling Section of Japan Tire Co.
 13. S. INOUE, Chief of the Business Section of Japan Carbide Co.

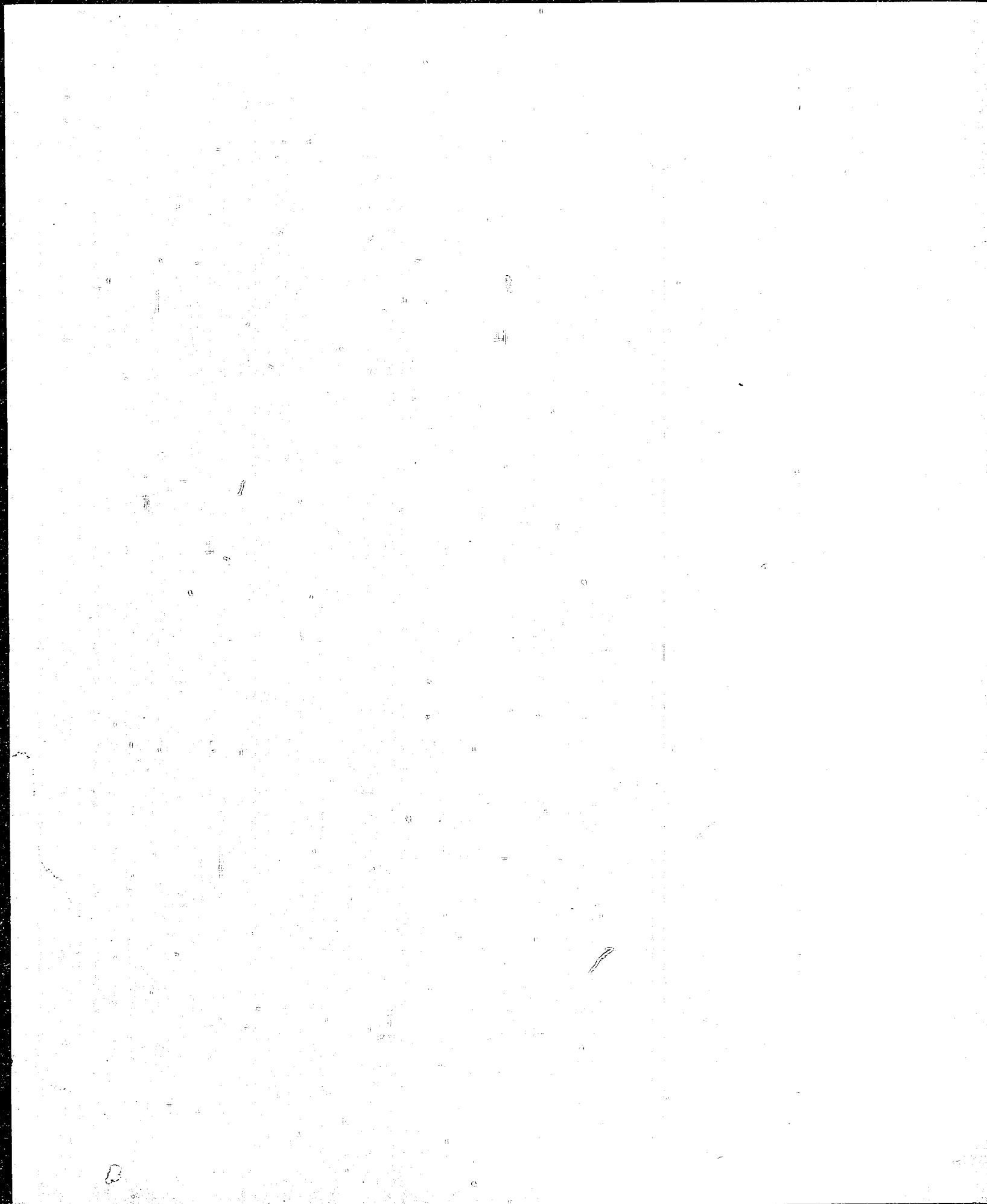
REFERENCES

A. Location of Target:

Navy Technical Department, TOKYO - Ship Construction, Machinery, Electrical, and Ordnance Sections.

B. Japanese Personnel Who Were Interviewed and Who Assisted in Gathering Documents:

1. A. KATAYAMA, Former Constructor Admiral, IJN - On 15 August 1945 was in the Ship Construction Section, Navy Technical Dept.
2. K. YADA, Former Constructor Captain, IJN - On 15 August 1945 was assistant to the Hull Superintendent at Sasebo Navy Yard.
3. G. YAMAMOTO, Former Constructor Captain, IJN - On 15 August 1945 was the detail fittings designer, Ship Construction Section, Navy Technical Department.
4. T. KOYAMA, Civilian Engineer - Has been a small boat designer for the Ship Construction Section, Navy Technical Dept., since 1934.
5. K. KUDO, Former Engineering Commander, IJN - On 15 August 1945 had just completed four years in the Machinery Section, Navy Technical Department, working at engine production.
6. Y. NAGI, Civilian Engineer - On 15 August 1945 had completed twelve years in the Machinery Section, Navy Technical Department. He worked at boiler and engine fittings and arrangement.
7. Y. MIMURA, Civilian Radio Engineer - Presently in the Electrical Section, Navy Technical Department. Has worked for the Navy for 17 years.
8. F. IWASHIMA, Former Ordnance Captain, IJN - On 15 August 1945 had completed six years in the Ordnance Section, Navy Technical Department, in ordnance production and experiment.
9. T. KUBOTA, Research Chemist for Yokohama Gum Co.
10. S. IKAI, Design Dept. of Yokohama Gum Co.
11. S. KOI, Chief of Production for the Japan Tire Co.
12. M. HAMANO, Chief of the Rolling Section of Japan Tire Co.
13. S. INOUE, Chief of the Business Section of Japan Carbide Co.

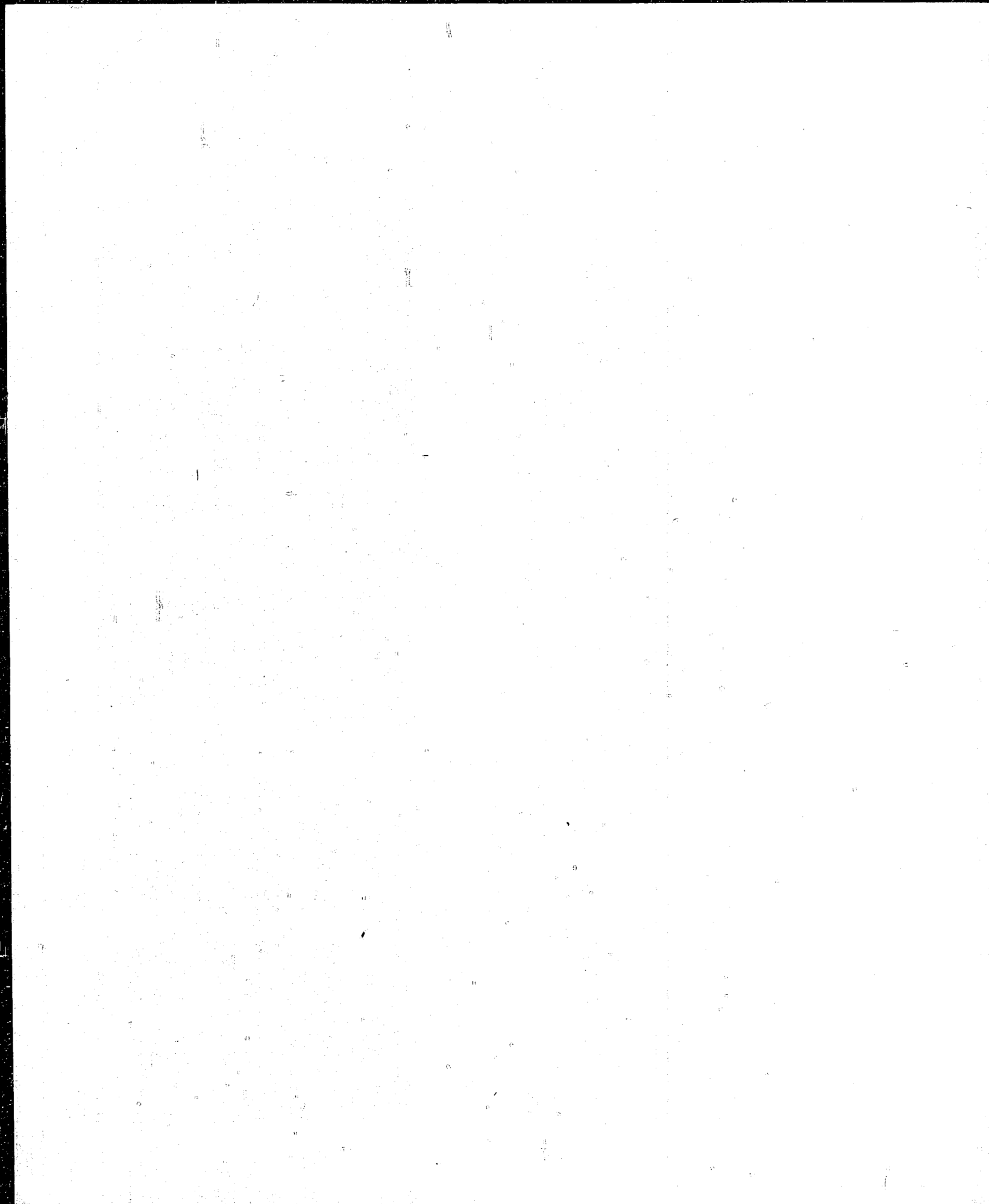


INTRODUCTION

This report on wood, textiles, rubber, and plastics used on Japanese naval vessels was prepared from information and reports from the respective design sections of the Navy Technical Department of the Navy Ministry.

The data on rubber were collected from representatives of Yokohama Gum Co., Japan Tire Co., Japan Carbide Co., and Takasago Rubber Industry.

Samples of materials discussed herein have been forwarded, as indicated, to the Bureau of Ships, Navy Department, Washington, D.C., for laboratory examination. All the samples are identified by NavTechJap Equipment No. JE 50-1394.



THE REPORT

Part I - WOOD

A. Types of Lumber Used by the Japanese for Fabrication of Various Parts of Wooden Vessels

<u>Item No.</u>	<u>Jap. Name</u>	<u>U.S. Equivalent</u>	<u>Sample</u>	<u>Use</u>
1	Keyaki	"Zelkova"	Yes	Keel, frame, stem, sternpost, longitudinals, engine bed, etc.
2	Matsu	Pine	Yes	Frame, longitudinal, knee, mast, boom.
3	Honoki	Japanese Cypress	Yes	(From Japan) shell, deck plank (from Formosa) mast, boom.
4	Sugi	Cryptomeria	Yes	Shell, deck plank, overhead of deck house.
5	Shioji		Yes	Frame, beam (small boat), overhead furniture.
6	Nara	Oak	Yes	Same usage as Keyaki, Item 1.
7	Oregon Pine	Oregon Pine	No	Longitudinals, deck plank.
8	Teak	Teak	No	Deck plank, furniture. (Procured in Siam or Burma.)
9	Sen		Yes	Making of plywood used on small boats.
10	Shina		No	Making of plywood.
11	Buna	Beech	Yes	Making of plywood, furniture.
12	Kaba	Birch	Yes	Making of plywood used on small boats.
13	Kashi	Type of Oak	No	Especially used where hardness required.

B. Plywood

1. Extent of Use - moderate amounts of plywood were used for furniture, cabinets, and heat insulation on the overhead of some compartments on steel ships. Material listed in Items 15 and 16 were used for some small boat hulls.

2. Types of Wood Used

<u>Item No.</u>	<u>Jap.Name</u>	<u>U.S. Equivalent</u>	<u>Sample</u>
14	Buna	Beech	Yes
15	Kaba	Birch	Yes
16	Sen		Yes
17	Shina		No
18	Shioji		Yes
19	Nara	Oak	Yes
20	Katsura		Yes

3. Glues Used

a. Casein Glue (Item 22) - The compounds of this glue are absorbent soy bean and lime with an added "harmony agent" of soda salt or alkali. The powder is mixed with hot or cold water to form the glue. A test piece of birch withstood a joint tensile stress of 63 kg/sq cm.

b. Urea Resin Glue (Item 23) - The compounds of this glue are urea and formalyn, with a fixing solution of 10-15% ammonium chloride. The fixing solution is mixed with the compounds (5-10% fixing solution, 90-95% compounds). This mixture is then painted on the faces of the wood to be glued. The wood is then compressed under a loading of 5-10 kg/sq cm for a period of 2-2.5 hours at a temperature of about 30°C. A test piece of birch so prepared withstood a joint tensile stress of 72 kg/sq cm. (1025 lbs/sq.in.)

c. Bakelite glue (Item 21) was also used. No sample was secured.

C. 1. Materials Used for Ship Fenders

Item 24:

- a. Matsu (Pine) (see Item 1)
- b. Keyaki (Zelkova) (see Item 2)
- c. Sugi (Cryptomeria) (see Item 4)
- d. Bamboo

2. Materials Used for Buoyant Equipment Such as Life Floats

Item 25: (No samples submitted)

- a. Cork
- b. Balsa

Part II - TEXTILES

A. Textile Items Used Aboard Japanese Ships

<u>Item No.</u>	<u>Name</u>	<u>Sample</u>	<u>Use</u>
26	Hemp Canvas	Yes	Awnings, gun and hatch covers. (Note: sample submitted is #5 grade of 8 grades)
27	Cotton Canvas	Yes	Gun and hatch covers, bags, small awnings, side screens.
28	"Terenpu"	No	Cloth chair and sofa covers.
29	Glass wool (glass cloth)	Yes	Flame proof curtains, separators for submarine batteries, covering of insulation material. (Note: Japanese believed glass yarn less than .013mm in diameter would not irritate the skin of the man installing it. Japanese glass yarn came in a diameter of .007mm)
30	Asbestos cloth	Yes	
31	Asbestos sheet	No	Heat insulation.
32	Rock wool	Yes	Insulation of living spaces, boiler casings, and pipes.
33	Silicate cotton	Yes	Same as item 32.
34	Leather cloth (artificial)	No	Chair and sofa covers.
35	Felt	No	Packing, box lining.
36	Silk cloth	Yes	Cable wrapping, insulating tape for motors and generators.
37	Cotton cloth	Yes	Insulating tape.
38	Artificial silk (rayon)	No	Cable wrapping.
39	Four samples of electric cable are submitted to show the use of textile wrapping.		

B. Use of Coated Textiles

Coated silk and coated cotton cloth were used for cable wrapping and for motor and generator insulation.

Sample Item 36 is silk cloth coated with 20% phenol and 80% bakelite. Sample Item 37 is cotton cloth coated with the same mixture as Item 36.

Common black tire tape (coated cotton) was used in the same manner as in our Navy. No sample is submitted.

Cotton canvas was coated with "Artmetal - Beton" to make it flameproof. (See Part II, D-2 of this report for flameproof treatment).

C. Fiber Used For Textiles and Cordage

Cotton	Rayon
Wool	Glass Yarn
Silk	Asbestos Yarn

Hemp
 Manila (sample Item 40)
 Sisal (form of hemp, sample Item 41)

D. Anti-Mildew and Flameproofing Treatments

1. No anti-mildew treatment was reported.
2. Flameproofing was accomplished by spraying cotton canvas with "Artmetal-Beton" is zinc powder mixed with $\text{Na}_2\text{Si}_2\text{O}_3$ (Note: A sample of "Artmetal-Beton" was submitted with NavTechJap Report-"Japanese Navy Paints"-Index No. S-59.

Part III - RUBBER AND PLASTICS

A. Development of New Natural Sources of Rubber

No information could be obtained which would indicate the development of new natural sources of rubber during this war.

B. Types of Natural or Synthetic Rubber Used

No information could be obtained which would indicate that virgin rubber stocks were ever compounded with reclaimed rubber. Synthetic rubber was used in places where it would be subject to heat or to penetration by oil. To conserve synthetic rubber, the cores of engine vibration mounts were often made of natural rubber, while the outside of the vibration mount was coated with synthetic rubber.

Following are examples of shipboard use of both natural and synthetic rubber:

<u>Item No.</u>	<u>Sample</u>	<u>Use</u>
42	Yes	Natural rubber gaskets.
43	Yes	Flexible hose of natural rubber.
44	Yes	Natural sponge rubber for cushioning.
45	Yes	Natural sheet rubber for cushioning.
46	Yes	Synthetic rubber gaskets.
47	Yes	Natural rubber shock mount.
48	Yes	Engine pedestal vibration block; has a natural rubber center covered with synthetic rubber.

- | | | |
|----|-----|---|
| 49 | Yes | Piping vibration damper to be inserted between two pipe flanges; has a natural rubber center covered with synthetic rubber. |
| 50 | Yes | Cover for piping vibration damper made as a split ring (two pieces). |
| 51 | Yes | Two pipe flanges connected with a rubber tube used to damper water pipe vibration. |

Note: Various radio and radar sets were rubber shock-mounted. Samples in Item 39 illustrate rubber covering of electrical cables.

C. Compounding of Rubber Stock, both Natural and Synthetic

1. Takasago Rubber Industry.

	Relative Composition	
	BN Rubber	Natural Rubber
Perbunan	100	100
Pale Crepe		
Sulphur	0.5	2.3
Zinc Oxide	10	10
Carbon Black	50	60
Tetramethyluramdisulfide	2.5	
Mercaptobenzothiazole		1.0
Phenyl-B-Napthylamine		2.0
Tri-cresyl-phosphate	10	
Pine Tar		5
Stearic Acid	2.5	1.5
Heat Treatment	141° x 60 min	133° x 45 min

2. Yokohama Gum Co. (Only Natural Rubber)

	Relative Composition			
	A 40° Bumper (Shore D)	B 50° Bumper (Shore D)	C 60° Bumper (Shore D)	D 70° Bumper (Shore D)
Crude rubber	100	100	100	100
Mitsui carbon Black	5	30	50.0	20.0
Acetylene black	10		10.0	
Tokaki denkyoku Carbon black				50.0
Mercaptobenzothiazole	0.20	0.2	0.3	0.3
Hexamethylene tetraline	0.30	0.3	0.3	0.3
Sulphur	2.50	2.5	2.8	2.8
Zinc oxide	4.70	5.0	10.0	5.0
Aldol naphthylamine	0.70			
Phenyl naphthylamine	0.70	1.4	2.0	2.0
Stearic acid	1.00	1.0	1.6	1.0
Hakuenka whiting		30.0		
TOTAL	125.10	170.4	177.0	189.4
Sp. Gr	1.02	1.21	1.19	1.19

3. Japan Tire Co. (Formerly Bridgestone Rubber Co.)
(Note: For samples see Items 52, 53, 54, and 55)

	Relative Composition	
	Natural Bounding Rubber - K-40 (40° Shore)	Synthetic Bounding Rubber - MS-260 (60° Shore)
FAQ smoked sheet	100	100
Chloroprene polymer		1.2
Iron chloride	1.6	
Phenyl naphthylamine	1.3	1.0
Mercaptobenzothiazole	1.3	
Pine tar	4.0	
Stearic acid	.8	
Iron oxide	10.0	5.0
Zinc oxide	15.0	5.0
Acetylene black	23.4	20.0
Sulphur	3.0	1.75
Sodium chloride		1.2
Resin		2.5
Magnesium (light calcine)		10.0
Tetra methylthureamdisulphide		1.0
Calcium sulphate anhydride		4.0
TOTAL	160.4	152.65

RESTRICTED

S-95(N)

D. - Plastics Used on Naval Equipment

<u>Item No.</u>	<u>Sample</u>	<u>Item and Use</u>
56	Yes	Flexiglass used for bridge wind screen for submarines and for depth gauges of submarines.
57	Yes	Phenol resin used for voice tube outlet, insulation plates in radio sets, etc.
58	Yes	Ebonite used for battery baths, insulation in radio equipment, exhaust pipe for submarine batteries.
59	Yes	Bakelite used for insulation in radio sets, etc.
60	Yes	A type methocryalate of German formula.
61	No	Cellophane used for wrapping material and for the inside of a flexible gasoline hose.