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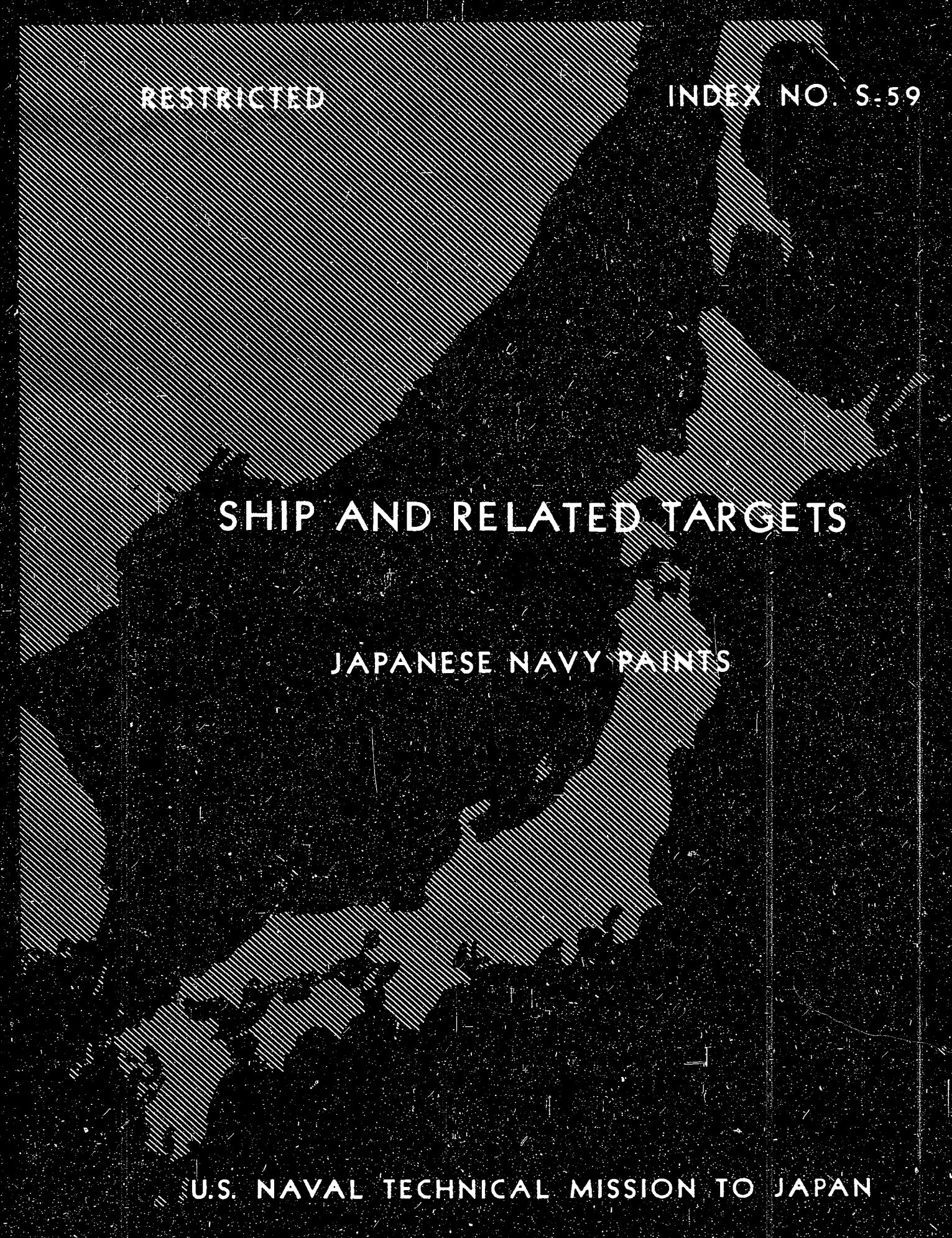
INDEX NO. S-59



SHIP AND RELATED TARGETS

JAPANESE NAVY PAINTS

U.S. NAVAL TECHNICAL MISSION TO JAPAN

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S-59

U. S. NAVAL TECHNICAL MISSION TO JAPAN
CARE OF FLEET POST OFFICE
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22 Jan. 1946

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

Subject: Target Report - Japanese Navy Paints.

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

1. Subject report, covering Target S-59 of Fascicle S-1 of reference (a), is submitted herewith.

2. The investigation of the target and the target report were accomplished by Lt. Comdr. E.F. Carlston, USNR.

C. G. GRIMES
Captain, USN

30678

JAPANESE NAVY PAINTS

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

FASCICLE S-1, TARGET S-59

JANUARY 1946

U.S. NAVAL TECHNICAL MISSION TO JAPAN

SUMMARY

SHIP AND RELATED TARGETS

JAPANESE NAVY PAINTS

The investigation of Japanese Navy paints has been accomplished by interrogation of personnel of the Japanese Navy and of several commercial paint manufacturers. Complete details of the manufacturing formulas for the various antifouling and anticorrosive paints used by the Japanese Navy have been obtained. Information has also been obtained, in the form of documents, that describes all aspects of the entire field of paints used by the Japanese Navy. In addition, the report includes a document containing detailed painting instructions for all parts of Japanese naval vessels. Many items of the report have been discussed with the object of comparing Japanese Navy with U.S. Navy painting practices.

TABLE OF CONTENTS

REFERENCES

A. Location of Target:

Navy Yard, SASEBO
Navy Yard, KURE
Navy Yard, YOKOSUKA
Chugoku Paint Company, HIROSHIMA
Nippon Yushi Company, Ltd., OSAKA
Toa Chemical Company, OSAKA
Dai Nippon Paint Company, OSAKA
Shinto Paint Company, AMAGASAKI

B. Japanese Personnel Who Assisted in Gathering Documents:

H. MIYAKAWA, Navy Yard, YOKOSUKA - Dockmaster and expert on ship paints and painting. Responsible for the preparation of book of specifications and formulas for Japanese Navy ship paints.
I. UCHIDA, Navy Yard, YOKOSUKA - Asst. Hull Superintendent.
M. TAMEHIRO, Navy Yard, KURE - Chemical Engineer and expert on ship paints and painting.

C. Japanese Personnel Interviewed:

T. MORIKAWA, Navy Yard, SASEBO - Hull Superintendent.
K. YADA, Navy Yard, SASEBO - Submarine Hull Superintendent.
T. SAKITA, Navy Yard, SASEBO - Dockmaster.
H. MIYAKAWA, Navy Yard, YOKOSUKA - Dockmaster.
I. UCHIDA, Navy Yard, YOKOSUKA.
M. TAMEHIRO, Navy Yard, KURE.
H. FURUKAWA, Navy Yard, KURE.
M. YAMAGUCHI, Kanseihonbu, TOKYO.
P. SUZUKAWA, Chugoku Paint Company, HIROSHIMA.
S. MURATA, Chugoku Paint Company, HIROSHIMA.
S. OSHIMA, Toa Chemical Company, OSAKA.
P. MIYOSHI, Nippon Yushi Company, Ltd., OSAKA.
K. TOKUDA, Dai Nippon Paint Company, OSAKA.
S. KADOKAWA, Shinto Paint Company, AMAGASAKI.

D. U.S. Personnel Interviewed:

Comdr. R. H. HEDGECOCK, USN - Responsible for interviews and paint samples obtained at Navy Yard, SASEBO. (Paint samples he collected have been shipped to the United States and have been identified with NavTechJap Equipment No. JE 10-2002 (S-59)).
Comdr. T. H. WHITE, USN - Responsible for obtaining formula for anti-sonar submarine paint at Navy Yard, YOKOSUKA.
Lt. (jg) W. KLUSS, USN - Prepared NavTechJap Report - "Camouflage of Japanese Ships and Naval Installations", Index No. X-32, and who collected a sample of No. 2 green color paint which has been shipped to the United States and identified by NavTechJap Equipment No. JE 50-1222(S-59).

LIST OF ENCLOSURES

(A) List of Japanese Equipment & Documents Shipped to the United States.

(B) Formula, Hot Venetian Antifouling Paint, Toa Chemical Company, OSAKA.

(C) Formula, Experimental Hot Plastic Paint, Chugoku Paint Company, HIROSHIMA.

(D) Formula, Takata Antifouling Paint No. 2, Navy Grade, Nippon Yushi Co., Ltd., OSAKA.

(E) Formula, Chugoku Antifouling Paint No. 2, Navy Grade, Chugoku Paint Company, HIROSHIMA.

(F) Formula, Toa Antifouling Paint No. 2, Merchant Grade, Toa Chemical Company, OSAKA.

(G) Formula, Mercury Free Antifouling Paint, Chugoku Paint Company, HIROSHIMA.

(H) Formula, Experimental Mercury Free Antifouling Paint, Shinto Paint Company, AMAGASAKI.

(I) Formula, Hot Venetian Anticorrosive No. 1, Toa Chemical Company, OSAKA.

(J) Formula, Takata Anticorrosive Paint No. 1, Nippon Yushi Company, Ltd., OSAKA.

(K) Formula, Chugoku Anticorrosive Paint No. 1, Chugoku Paint Company, HIROSHIMA.

(L) Formula, Experimental Anticorrosive Paint No. 1, Shinto Paint Company, AMAGASAKI.

(M) Formula, Antifouling Paint for Wooden Boats, Nippon Yushi Co., Ltd., OSAKA.

(N) Formula, Antifouling Paint for Wooden Boats, Toa Chemical Company, OSAKA.

(O) Formula, Neutral Color Bottomtopping Paint, Nippon Yushi Co., Ltd.

(P) Formula, Fire-Retardant Paint for Interiors.

(Q) Formula, Anti-Radar Paint.

(R) Formula, Anti-Sonar Paint.

INTRODUCTION

The subject of antifouling paints is of interest to Bureau of Ships Paint Laboratories, the Naval Research Laboratory, and the David Taylor Model Basin. The purpose of the investigation was to determine the practice of the Japanese Navy in connection with the formulation, manufacture, and use of ship-bottom paints, and to compare the Japanese Navy painting practices with the U.S. Navy painting practice.

The search for information on this subject began at Japanese Naval Headquarters by interrogation of Naval constructors and architects of the Navy Technical Department in the Nissan Building, TOKYO. Interrogation of Japanese Navy personnel at Navy Yards at YOKOSUKA, KURE, and SASEBO followed. Finally, the commercial manufacturing processes were investigated.

As a result of the above procedure, complete information on painting instructions to shipbuilders and paint manufacturing formulas was obtained.

THE REPORT

PART I - ANTIFOULING PAINT

The important part that an antifouling paint plays in the efficient operation of a fleet is well recognized by the U.S. Navy. There have been important instances where combat vessels of the U.S. Navy have had waterborne periods in excess of 24 months before docking became possible, and 18 month periods have been common. This situation was due to the rapidly expanding areas of naval operations and the inadequacy of docking facilities in those areas. The Japanese Navy, on the other hand, had a constantly decreasing area of operations, and practically no instances of long waterborne periods between dockings. Therefore, while the use of the most effective antifouling paints on U.S. Navy vessels became a necessity during the war, the use of the better types of antifouling paint became less necessary for the Japanese Navy as the war progressed.

The development of shipbottom paints for the Japanese Navy has been conducted almost exclusively by the commercial paint manufacturers. Testing of paints developed by the paint companies was conducted by several Navy Yards and Stations, and approval of commercial brands for Navy use was based on results of the Navy tests. The testing of shipbottom paints was performed in much the same manner as testing in the United States. Barges or rafts were used from which to hang painted panels in the water, and a test period from May through November was considered sufficient. The usual manner of testing was to place both standard and experimental paint on half of each side of the same panel, using duplicate panels at different places on the barge or raft. Additional reduplication of the test was obtained by similar tests at other sites. Some evidence of the existence of Navy paint laboratories doing paint formulation was found, but fire and bombs had destroyed all records of such work. The main paint laboratory, at Kure Navy Yard, was moved to HIROSHIMA as the bombing of the Navy Yard became more intense. Complete destruction of the paint laboratory occurred at HIROSHIMA when the atomic bomb was dropped. Practically all of the commercial paint factories survived the bombing raids, and at the time of the interrogations, were in operation and manufacturing as much paint as available raw materials permitted.

The Japanese standard antifouling paint formulations show little originality. Hot plastic Venetian antifouling paint, used by the Japanese Navy, closely resembles the composition known as "Moravian", which originated fifty years ago in Italy. One company has produced all of the Venetian hot plastic antifouling paint for the Japanese Navy. Interrogation of personnel of this company disclosed that the Venetian hot plastic paint was formulated to match a sample of Moravian hot plastic paint imported from Italy about twenty-five years ago. Apparently the Japanese chemists had no knowledge of the actual formula. However, the formula developed by the Toa Chemical Company of OSAKA produces a composition which seems to be an exact duplicate of the Moravian hot plastic antifouling paint, and was accepted as such by the Japanese Navy. It is claimed that the Venetian hot plastic antifouling paint has an effective life of 18 months. Manufacturing formula, as disclosed by the Toa Chemical Company, is contained in Enclosure (B). The use of Venetian hot plastic antifouling paint was originally restricted to large ships of the BB, CA, and CV types, because the scarcity of drydocks big enough to accept large ships was such that a long-life paint was considered necessary. Periodic drydocking of all other ships was maintained at intervals of six months, and therefore the Venetian hot plastic paint was considered unnecessary for them. As the war progressed, drydockings of all ships became more frequent, and the time in dock shorter; the use of hot plastic paint practically ceased. No special equipment was ever developed for the application of Venetian hot plastic paint. Melting

vats, double-walled buckets, and daubers were used in a manner similar to the application of hot bituminous compositions. Venetian hot plastic paint applied in this manner is of variable film thickness, and rough. Several statements were made by Japanese naval personnel that the Venetian hot plastic paint smooths out in active service. Whether or not it actually smooths out in service is not known, but from the physical characteristics of the material it appears doubtful that any reduction of surface roughness occurs as claimed. Experimental procedures which have been devised by U.S. Navy paint laboratories to measure flow of plastic compositions are expected to determine conclusively the flow characteristics of the Venetian hot plastic antifouling paint. Samples of the paint have been obtained and shipment has been arranged as described in Enclosure (A).

Comparison of the Venetian hot plastic paint formula with our U.S. Navy Formula 15 HP shows that rosin is common to both paints as the basic vehicle ingredient. The differences between the paints lie chiefly in the choice of plasticizers and pigments. The Venetian hot plastic is plasticized with a complex mixture of metallic soaps, and pigmented with compounds of copper, mercury, and arsenic. Formula 15 HP is plasticized with paraffin and pigmented with cuprous oxide.

Experiments were made in Japan during the war with the object of improving the physical characteristics of the standard hot plastic antifouling paint. Such work was conducted by the commercial paint manufacturers. An example of one experimental hot plastic antifouling paint formula that was submitted to the Japanese Navy for approval is described in Enclosure (C). The formula was disclosed through interrogation of personnel of the Chugoku Paint Company of HIROSHIMA. The paint was apparently never service-tested owing to the end of the war. Undoubtedly many similar formulas were developed, but no reliable records were found of such experimental work, other than the above formula.

The differences between the Japanese experimental hot plastic paint and typical experimental hot plastics developed by U.S. Navy paint laboratories may be of interest. The pigmentation of the experimental Japanese hot plastic introduces cuprous oxide as a new pigment, but still retains mercury and arsenic as of old. The vehicle contains a wax as a new ingredient and utilizes a simple mixture of metallic soaps as the plasticizer. Test of the Venetian hot plastic paint and of the experimental hot plastic paint in comparison with standard and experimental U.S. hot plastic paints is desirable.

By far the greatest use of antifouling paint by the Japanese Navy has been of the solvent-type composition. Formulas of the standard Japanese Navy grades of solvent-type antifouling paints are given in Enclosures (D) to (F). They were obtained by interrogation of personnel of the respective paint companies. The solvent-type paints are usually manufactured with high solids and heavy body, but during application additional solvent is added as necessary to obtain easy brushing consistency. Only one coat of antifouling paint is applied, and consequently thickness of applied paint films is low. A six-month life expectancy of one coat of paint is claimed for the standard Japanese Navy grades of antifouling paint. Japanese paint chemists have a good knowledge of the proper formulation of antifouling paints, and they know that the effective life of an antifouling paint is directly related to the film thickness of that paint, within reasonable limits. This is because of the wearing caused by water flow and the acceleration of corrosion and consequent film disruption caused by rapid absorption of water by thin films of paint. The necessity for the application of but one thin coat of paint is nevertheless accepted as inevitable, and no apparent effort has been made to extend the life expectancy of antifouling paint films by applying additional coats of paint. The use of the principle involved in the formulation of U.S. Navy cold plastic paints, which makes possible the application of thick films of antifouling paint in one coat, has not been adopted as a practice in Japan. With proper spray equipment, however, the standard Japanese Navy grades of anti-

fouling paint undoubtedly could be applied in thick films, and their life expectancy thereby increased. Necessity for economy in the use of materials during the war was probably a prime factor in the continuation of the practice of using minimum quantities of antifouling paint. This, coupled with the lack of urgency for better performance of antifouling compositions due to frequent drydockings and consequent opportunities for renewal of paint films, resulted in little importance being placed on improvement of antifouling paints and painting practices.

The one subject considered of sufficient importance to engage the attention of antifouling paint chemists, however, was the conservation of copper and mercury. Much effort was expended in the search for satisfactory substitutes for copper and mercury in antifouling paints, but all such experiments were disrupted by the end of the war. Wartime shortages of copper and mercury were met by simply reducing the proportions of copper and mercury pigments in the standard paint formulas and replacing them with equivalent amounts of inert iron oxide. Two formulas designed to eliminate the dependency on mercury are described in Enclosures (G) and (H). One formula, Enclosure (H), was developed at the Kyoto Imperial University, and test batches were manufactured by the Shinto Paint Company near OSAKA. By examination of the formula it is obvious that the novelty is nothing more than the substitution of powdered derris root, an insecticide, for the regular mercuric oxide pigment. By their own statement, the Japanese admitted that the idea was not a good one. The other formula, Enclosure (G), substitutes copper thiocyanate for mercuric oxide, and the paint was actually used to some extent during the last year of the war. Japanese standard antifouling paint formulas show the dependence of the Japanese paint chemist on copper, mercury, and arsenic to provide the toxic qualities required for repelling the growth of organisms. This use of combinations of copper, mercury, and arsenic represents a continuation of old practices in the pigmenting of antifouling paints, as contrasted with the discovery in the United States that inexpensive copper may be used as the only toxic pigment without the addition of the more expensive mercury and arsenic pigments. The present standard U.S. Navy antifouling paints are based on this fact, and utilize copper as the only source of toxicity. This is the most important difference between the Japanese and U.S. Navy antifouling paints.

The vehicles of the Japanese solvent-type antifouling paints are based on rosin or fortified rosin, as are also the U.S. antifouling paints. The major difference in the vehicles lies in the choice of plasticizer, which in the Japanese antifouling paints is invariable a vegetable oil of some kind. U.S. Navy antifouling paints utilize chemical rather than vegetable oil plasticizers. Samples of the Japanese solvent-type antifouling paints have been obtained and shipment to the United States arranged as described in Enclosure (A). Tests of the sample antifouling paints in comparison with the standard U.S. Navy cold plastic paint are desirable.

No special antifouling boottopping paints were regularly used. Whenever a black antifouling paint was required for boottopping, the standard red antifouling paints were modified by the addition of carbon black. The same procedure was followed with submarine paint. A special antifouling boottopping paint was available that could be readily tinted to any desired camouflage color, but it was rarely used. The formula is shown in Enclosure (O).

PART II - ANTICORROSIVE PAINTS

Closely associated with antifouling paints are anticorrosive paints. Formulas of the standard Japanese Navy anticorrosive paints are contained in Enclosures (I) to (K). They were obtained by interrogation of personnel of the respective paint companies. It is obvious that they are conventional varnish-type paints with little or no content of rust inhibitive pigments. The formula of an experimental anticorrosive to be used with experimental antifouling paint described in Enclosure (H) is shown in Enclosure (L). The use

of zinc dust in paints for seawater exposure is not considered good practice in the United States. The use of a combination of zinc dust-zinc oxide in the experimental as well as in one of the standard anticorrosives is, therefore, of interest. Samples of all of these anticorrosive paints have been obtained and shipment arranged for as described in Enclosure (A). Tests of the sample anticorrosives in comparison with the standard U.S. Navy anticorrosive are desirable.

PART III - OTHER PAINTS

In addition to covering the subject of antifouling and anticorrosive paints, this investigation has been extended to include all types of paints used on Japanese naval vessels. Most of this information can be found in the documents listed in Enclosure (A). For instance, the formula for gray exterior camouflage paint for Japanese naval vessels may be found on top of page 24, and the formulas for green exterior camouflage paint may be found on page 31, of NavTechJap Document ND 50-1226. Anticorrosive paint used for shop coat during naval construction may be found on top of page 70 of the same document. It either was made in the navy yards by mixing the pigments and boiled oil on the job, or it was purchased ready-made. The special paint called "Suboid" used this same formula, but substituted gray lead oxide for red lead.

Certain special paints are to be found in Enclosures (P), (Q), and (R), which describe fire-retardant paints and anti-radar and anti-sonar paints. For additional information on sound absorbent and anti-radar paints see NavTechJap Reports: "Japanese Naval Vessels, Own Ship's Noise," Index No. S-43, and "Japanese Anti-Radar Coverings," Index No. E-06.

ENCLOSURE (A)

LIST OF JAPANESE EQUIPMENT AND DOCUMENTS
SHIPPED TO THE UNITED STATES

1. SASEBO, JE 10-2002

Item 1	Iron-lead anticorrosive paint
Item 2	Takata anticorrosive paint No. 1
Item 3	Suboid anticorrosive paint
Item 4	Takata antifouling paint No. 2
Item 5	Hot Venetian antifouling paint
Item 6	Hot Venetian anticorrosive paint
Item 7	Fire-retardant paint vehicle
Item 8	Fire-retardant undercoat
Item 9	Fire-retardant topcoat

2. KURE, JE 22-2061

Item A	Chugoku anticorrosive paint No. 1
Item B	Chugoku antifouling paint No. 2, Navy Grade
Item C	Chugoku antifouling paint No. 2, Merchant Grade
Item D	Hot Venetian antifouling paint
Item E	Nippon Yushi anticorrosive paint, general purpose
Item F	Takata anticorrosive paint No. 1
Item G	Suboid anticorrosive paint
Item H	Shinto experimental anticorrosive paint

3. YOKOSUKA, JE 50-1222

Item A	No. 2 green camouflage paint

4. YOKOSUKA, JE 50-1223

Item I	Hot Venetian antifouling paint No. 1
Item II	Hot Venetian antifouling paint No. 2

5. KURE, JE 50-1224

Item A-1	Suboid anticorrosive paint
Item A-2	Suboid lead oxide pigment for paint Item IA.
Item B	No. 2 green camouflage paint
Item C	Hot Venetian antifouling paint
Item D	Hot Venetian anticorrosive paint
Item E	Toa No. 2 antifouling paint, Merchant Grade
Item F	Toa antifouling paint for wood
Item G	Takata anticorrosive paint No. 1
Item H	Takata antifouling paint No. 2
Item I	Takata boottopping paint
Item J	Takata antifouling paint for wood

6. TOKYO, ND 50-1225

Item A	Toso Yoryo Sho, 13 page document, which is the Japanese version of Appendix 6 to the General Specifications for Building of U.S. Naval Vessels.
Item B	English translation of Item A

ENCLOSURE (A), continued

7. TOKYO, ND 50-1226

Item A Book of paint formulas used by the Japanese Navy. Incompletely translated in text.

8. TOKYO, ND 50-1227

Item A Book of specifications and tests for paints used by the Japanese Navy. Not translated.

Note:

1. Shipments 1, 2, 3, 4, and 5, are being directed to the Naval Research Laboratory, Anacostia Station, Washington, D.C. Shipments 6, 7, and 8, are being directed to the Bureau of Ships, Washington, D.C.

2. "JE" numbers are NavTechJap Equipment Numbers; "ND" numbers are NavTechJap Document Numbers.

ENCLOSURE (B)

FORMULA
HOT VENETIAN ANTIFOULING PAINT
TOA CHEMICAL COMPANY, OSAKA

Rosin	42.0 Kg
Stearic Acid	13.7
Sodium Carbonate	1.3
Cupric Oxide	1.9
Litharge	6.5
Red Mercuric Oxide	4.0
Paris Green	10.0
Arsenious Oxide	12.6
Pine Oil	1.3
Solvent Naphtha	11.9
	105.2
YIELD	100 Kg

Process consists of first manufacturing the sodium, copper, and lead soaps of rosin and stearic acid, and then adding the toxic pigments. The solvents are added to act as a flux, some of which are lost by evaporation during the process of manufacture.

ENCLOSURE (C)

FORMULA
EXPERIMENTAL HOT PLASTIC PAINT
CHUGOKU PAINT COMPANY, HIROSHIMA

Rosin	38.0 Kg
Lead Linoleate	11.0
Zinc Oleate	5.5
Palmitic Acid	8.0
Paris Green	16.0
Cuprous Oxide	8.0
Calcium Sulphate	8.0
Chromium Oxide	1.5
Mercuric Oxide	4.0
	100
YIELD	100 Kg

ENCLOSURE (D)

FORMULA
TAKATA ANTIFOULING PAINT NO. 2, NAVY GRADE
NIPPON YUSHI CO., LTD., OSAKA

Rosin	15	Kg
Dammar Gum	5	
Linseed Oil	10	
Pine Tar	15	
Arsenious Oxide	5	
Cuprous Oxide	30	
Mercuric Oxide	6	
Iron Oxide	5	
Calcium Sulphate	10	
Alcohol	1	
Solvent Naphtha	10	
Mineral Spirits	10	
	122	
YIELD	100	Kg

Manufacturing process consists of preparing a varnish first, and then adding the pine tar and pigments. Grinding is accomplished usually by means of ball mills, but occasionally stone mills or roller mills are used.

ENCLOSURE (E)

FORMULA
CHUGOKU ANTIFOULING PAINT NO. 2, NAVY GRADE
CHUGOKU PAINT COMPANY, HIROSHIMA

Copper Resinate	33.0 Kg
Zinc Stearate	0.7
Lead Oleate	0.2
Bodied Linseed Oil	9.0
Stearic Acid	1.0
Oleic Acid	1.0
Mineral Oil	3.0
Cuprous Oxide	30.0
Mercuric Oxide	6.5
Paris Green	2.0
Iron Oxide	1.3
Silica	1.0
Solvent Naphtha	20.0
	108.7
YIELD	100 Kg.

Manufacturing process consists of first preparing copper resinate soap by boiling rosin and cuprous oxide at a ratio of 77 to 23, adding the remaining ingredients, and grinding. Cuprous oxide shown in the formula is not used to make the soap but is added as a pigment. For merchant marine grade, the cuprous oxide pigment is reduced to 20%, mercuric oxide to 3%, and iron oxide is substituted in equivalent amount.

ENCLOSURE (F)

FORMULA
TOA ANTIFOULING PAINT NO. 2, MERCHANT GRADE
TOA CHEMICAL COMPANY, OSAKA

Varnish:		
Rosin	38%	
Linseed Fatty Acids	5	
Boiled Linseed Oil	12	
Rosin Oil	10	
Solvent Naphtha	35	
Paint:		
Varnish	50	Kg
Cuprous Oxide	30	
Mercuric Oxide	5	
Iron Oxide	12	
Calcium Soap of Perilla Oil	1	
Solvent Naphtha	5	
	103	
YIELD	100	Kg

ENCLOSURE (G)

FORMULA
MERCURY FREE ANTIFOULING PAINT
CHUGOKU PAINT COMPANY, HIROSHIMA

Phenolic Modified Rosin	24.9 Kg
Boiled Linseed Oil	7.6
Litharge	1.0
Mineral Oil	2.0
Cuprous Oxide	38.1
Copper Thiocyanate	10.0
Iron Oxide	1.7
Calcium Sulphate	1.7
Solvent Naphtha	22.0
	109.0
YIELD	100 Kg

Manufacturing process consists of preparing a varnish, adding pigments and solvent, and grinding.

This paint superseded Chugoku No. 2 (Enclosure E) during the latter part of the war when mercury was scarce. Note the change from copper resinate to a phenolic modified rosin resin. Ratio of rosin to phenol in this resin is 22 to 2.9. Same resin is used in the Chugoku anticorrosive paints.

ENCLOSURE (H)

FORMULA
EXPERIMENTAL MERCURY FREE ANTIFOULING PAINT
SHINTO PAINT COMPANY, AMAGASAKI

Varnish:

Rosin	30%
Linseed Fatty Acids	13
Pine Tar	17
Solvent Naphtha	15
Mineral Spirits	25

Paint:

Varnish	485 Kg
Cuprous Oxide	184
Paris Green	8
Derris Powder	24
Venetian Red Iron Oxide	24
Calcium Carbonate	16
Barium Sulphate	64
Carbon Black	0.66
	805.66Kg

The derris powder is a mixture of derris root and zinc oxide at a ration of 1 to 3.

Above formula was developed at Kyoto Imperial University.

ENCLOSURE (I)

FORMULA
HOT VENETIAN ANTICORROSIVE NO. 1
TOA CHEMICAL COMPANY, OSAKA

Varnish:

Rosin-Dammar Resin	42.5%
Perilla Oil	14.0
Tung Oil	3.0
Zinc Oxide	0.9
Litharge	0.96
Manganese Oxide	0.56
Mineral Spirits	20.0
Solvent Naphtha	26.0
	100 (Loss 8%)

Paint:

Varnish	55	Kg
Zinc Oxide	9	
Iron Oxide	16	
Calcium Sulphate	16	
Calcium Soap of Perilla Oil	1	
Solvent Naphtha	3	
	100	
YIELD	100	Kg

The rosin-dammar resin is prepared by heating 25 parts rosin with 25 parts black dammar. Loss by heating is 7.5 parts.

ENCLOSURE (J)

FORMUALA
TAKATA ANTICORROSIVE PAINT NO. 1
NIPPON YUSHI COMPANY, LTD., OSAKA

Black Dammar Gum	10	Kg
Rosin	20	
Tung Oil	2	
Linseed Oil	8	
Zinc Dust	6	
Zinc Oxide	6	
Iron Oxide	20	
Calcium Sulphate	12	
Alcohol	1	
Mineral Spirits	15	
Solvent Naphtha	15	
	115	
YIELD	100	Kg

Manufacturing process consists of preparing a varnish, then adding pigments, and grinding.

ENCLOSURE (K)

FORMULA
CHUGOKU ANTICORROSIVE PAINT NO. 1
CHUGOKU PAINT COMPANY, HIROSHIMA

Varnish:

Rosin Modified Phenolic Resin	23.0 Kg
Ester Gum	7.0
Boiled Linseed Oil	3.9
Tung Oil, Bodied	3.0
Zinc Stearate	1.5
Lead Oleate	2.5
Mineral Oil	3.5
Solvent Naphtha	28.0
	67.8 (Loss 4.6)

Paint:

Varnish	67.8 Kg
Iron Oxide	17.0
Calcium Sulphate	11.0
Barium Sulphate	1.8
China Clay	0.7
Silica	1.2
Zinc Oxide	0.2
Litharge	0.3
	100
YIELD	100 Kg

The rosin-modified phenolic resin is same as used in Chugoku anti-fouling paint. (Enclosure (G)).

ENCLOSURE (L)

FORMULA
EXPERIMENTAL ANTICORROSIVE PAINT NO. 1
SHINTO PAINT COMPANY, AMAGASAKI

Varnish:

Rosin	25.0%
Copal Resin	13.5
Boiled Linseed Oil and Drier	16.7
Tung Oil	2.0
Mineral Spirits	27.0
Benzol	15.8
	100 %

Paint:

Varnish	730.0 Kg
Zinc Dust	97.6
Zinc Oxide	24.4
Calcium Sulphate	97.6
Venetian Red, Iron Oxide	268.4
YIELD	1218 Kg

The above formula is similar to Enclosure (I).

ENCLOSURE (M)

FORMULA
ANTIFOULING PAINT FOR WOODEN BOATS
NIPPON YUSHI CO., LTD., OSAKA

Rosin	20	Kg
Pine Tar	5	
Boiled Linseed Oil	8	
Cuprous Oxide	18	
Arsenious Oxide	5	
Iron Oxide	30	
Solvent Naphtha	11	
Mineral Spirits	11	
	108	
YIELD	100	Kg

ENCLOSURE (N)

FORMULA
ANTIFOULING PAINT FOR WOODEN BOATS
TOA CHEMICAL COMPANY, OSAKA

Varnish:

Asphalt Oil	40%
Rosin	10
Perilla Oil	6
Mineral Spirits	6
Solvent Naphtha	38
	100%

Paint:

Varnish	36	Kg
Cuprous Oxide	20	
Iron Oxide	11	
Calcium Carbonate	20	
Graphite	4	
Solvent Naphtha	9	
	100	Kg

ENCLOSURE (O)

FORMULA
NEUTRAL COLOR BOTTOMTOPPING PAINT
NIPPON YUSHI CO., LTD.

Rosin	10	Kg
Dammar Resin	5	
Tung Oil	2	
Linseed Oil	9	
Pine Tar	7	
Paris Green	16	
Yellow Iron Oxide	3	
Zinc Oxide	6	
Titanium-Barium Pigment	8	
Calcium Sulphate	16	
Carbon Black	0.3	
Iron Oxide	0.2	
Alcohol	1	
Mineral Spirits	12.5	
Solvent Naphtha	12.5	
	108.5	
YIELD	100	Kg

This paint was furnished to both Navy and Merchant Marine whenever an antifouling bottomtopping paint was required that would be readily tinted to any camouflage color desired. It was not very extensively used, and is not claimed to be a good antifouling paint. It is an attempt at combining the vehicles of the standard antifouling paint and of the standard anticorrosive paint.

ENCLOSURE (P)

FORMULA
FIRE-RETARDANT PAINT FOR INTERIORS

Undercoat:

Sodium Silicate	90%
Zinc Dust	10

Topcoat:

Sodium Silicate	70%
Zinc Oxide	30%

This paint is a water-type paint, and is not durable. No claims have been made for anything but fire resistance. No other fire retardant paints seem to have been used by the Japanese Navy.

ENCLOSURE (Q)

FORMULA
ANTI-RADAR PAINT

Lacquer Cellulose Nitrate or Acetate	50%
Graphite or Black Iron Oxide	49
Aluminum Flake Powder	1

No claims have been made for the effectiveness of this paint.

ENCLOSURE (R)

FORMULA
ANTI-SONAR PAINT

Vehicle:		
Rubber Latex	60%	
Pigment:		
Portland Cement	50	Kg
Silica	90	
Calcium Carbonate	35	
Asbestos	40	
Mica	2	
Carbon Black	1	
Black Iron Oxide	6	

Paint is prepared by adding the latex to the powder until a paste of the proper consistency is obtained. No claims have been made for the effectiveness of this paint. It was applied to several submarines in a band 3 to 5 feet wide and 8 to 10mm thick, but no results were reported.