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

26 December 1945

RESTRICTED

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

Subject: Target Report - Japanese Radio Apparatus Construction Methods.

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

1. Subject report, dealing with Target E-18 of Fascicle E-1 of reference (a), is submitted herewith.

2. The investigation of the target and the target report were accomplished by Lieut. R.C. Brooks, USNR, assisted by Lt. Comdr. T.J. Glanville, RNVR.

C. G. GRIMES
Captain, USN

JAPANESE RADIO APPARATUS CONSTRUCTION METHODS

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

FASCICLE E-1, TARGET E-18

DECEMBER 1945

U.S. NAVAL TECHNICAL MISSION TO JAPAN

RESTRICTED

SUMMARY

SUMMARY
ELECTRONICS TARGETS

JAPANESE RADIO APPARATUS CONSTRUCTION METHODS

Construction methods for Japanese military radio and similar electronic equipment in general followed the same practices as were used in commercial equipment available before the war. As the war progressed and shortages in critical materials developed, many substitutions were made where the substitutes did not impair operation of the equipment, as is indicated by the use of plywood sub-panels, wooden cabinets, and the support of all components on ebonite, glass, or porcelain. Equipment developed and manufactured before the war was well constructed, had ample meters, and many little conveniences for adjustment and calibration. Intensive work on high altitude and pressurized equipment had not reached the production stage, nor had there been any specialized work on temperature, humidity or fungus proofing.

A collection of captured documents, listed in Enclosure (A), gives in detail Japanese reports on standardization, components, etc. It is suggested that the report be read in conjunction with related NavTechJap reports listed in reference C, since items therein will aid in obtaining a complete picture of this phase of Japanese electronics.

Japanese electronics engineers in many cases realized the need for specialized construction, but because of the lack of facilities and capacities during the closing years of the war they were unable to put their ideas into practice.

TABLE OF CONTENTS

REFERENCES

A. Location of Target:

Second Naval Technical Institute, Meguro, TOKYO.

Tokyo Shibaura Denki, K.K. 72 Horikawa-Cho, KAWASAKI-Shi, Kanagawa-Ken.

Nippon Denki Co. (Formerly Sumitomo Tsushin Kogyo, K.K.) 2 Mita, Shikoku-Cho, Shiba-Ku, TOKYO and 1753 Tamagawa Mukai, Shimonumabe-Cho, KAWASAKI-Shi, Kanagawa-Ken.

B. Japanese Personnel Interviewed:

Mr. S. HAMADA, Laboratory Director, Tokyo Shibaura Denki, K.K.

Dr. Y. NIWA, Director of Engineering, Nippon Denki Co.

Mr. K. TSUBAI, Radio Engineer, Nippon Denki Co.

Dr. N. TANAKA, Radio Engineer, Nippon Denki Co.

Dr. K. KOBAYASHI, Asst. Sup't and Carrier Transmitter Engineer, Tamagawa Plant, Nippon Denki Co.

Mr. G. HAKATA, Apparatus Engineer, Nippon Denki Co.

Admiral NAWA, and Staff, Radio and Radar Section, Second Naval Technical Institute.

C. Related NavTechJap Reports:

"Power Supplies for Japanese Electronics", Index No. E-15

"Japanese Radio, Radar, and Sonar Equipment", Index No. E-17

"Japanese Electronic Equipment Construction Materials", Index No. E-19

"Japanese Insulation Materials", Index No. E-23

"Japanese Electronics - General", Index No. E-28

LIST OF ENCLOSURES

(A) List of Documents Pertaining to Radio Construction and Special Components Forwarded Through ATIS to WDC.

INTRODUCTION

From captured equipment and previous knowledge gleaned from intelligence reports, it was apparent that most Japanese radio equipment had been designed with little or no attention to insuring satisfactory operation under unusual operating conditions.

To determine just what had been done, investigations were made of representative manufacturing concerns and design laboratories, interrogations of key personnel were conducted, and samples of typical equipment were prepared for shipment to the United States for further investigations by interested laboratories.

THE REPORT

A. Special Construction for Pressurized and High Altitude Equipment.

Prior to the organization of the Second Naval Technical Institute in February 1945, the problem of special construction to meet specific operational conditions was not of prime importance. Communications from the fleet were poor, operational data did not reach the engineers, and they had no knowledge of the adequacy of the equipment in use. In the preliminary years of the war, both in the very early days in China, and in the ensuing battles with the U.S. Fleet, the equipment was adequate for the purpose, and no specific reports were returned. As the war progressed, increasing dependence on aircraft was evident, but it was only after February 1945 that concentrated effort in this field was authorized. The major effort of the Second Naval Technical Institute at this time was concentrated on airborne equipment.

Pressurizing of radar equipment to provide sea-level operation at altitudes above 20,000 feet was not considered. Prior to 1945 it had not been needed operationally, and when suicide attacks developed in the last stages of the war, this type of equipment was unnecessary. Centimeter radar for aircraft (10cm equipment) was going through the "pre-production model" stage.

For radio operation at high altitudes, no precautions were taken in the early stages of the air war to prevent arc-overs and general equipment failures which usually occurred at 15,000 to 18,000 feet. Later, at the direction of the Naval General Staff, an attempt was made to produce equipment that would operate at altitudes of 30,000 feet. This was accomplished by better insulation, greater spacing of critical components, and lower operating voltages. Since most of the equipment was for use in the two to 10 megacycle range, this was relatively easy to accomplish. Even so, there were operational difficulties on fighters because of moisture condensing on terminal strips at high altitudes. Interconnecting cables, using "Amphenol type" plugs, were taped and painted with insulating paint, and leakage paths between terminals were increased. In interrogations it was revealed that sporadic operation or complete failure would occur within 30 minutes to two hours at altitudes of 30,000 feet and above.

The general construction of most aircraft equipment was neat, compact and fairly efficient. Samples of equipment have been obtained by various Army technical intelligence agencies operating in Japan and have been shipped to TAIC at Anacostia, and to ARL at Wright Field for inspection and analysis. TAIU and ATIG were the cognizant agencies and it is suggested that their reports, which will be available in the Bureau of Aeronautics, be checked for more detailed information.

An interesting side light on naval radio development is the fact that only after February 1945 was any effort made to produce an airborne radio transmitter-receiver which could be operated on more than one channel merely by throwing a switch. This apparatus was designated the "Type P-1". It was reported to be an improvement over the former type in that two-wave selection could be had by push-button operation. Also, efforts had been made to improve the articulation. The apparatus was not placed in service.

B. Temperature, Humidity, and Fungus Proofing.

At the beginning of the war, equipment was produced in accordance with standards set for operation in Japan, China, and similar temperature zones. As the war developed and component failures were evidenced by the need for replacement parts, steps were taken to provide against breakdown. These steps were

rudimentary, but it was recognized that transformers needed protection to prevent breakdown due to moisture. As a result, an impregnating compound was developed which effectively sealed all transformers. Known as H-14, it was produced by the Hitachi Mfg. Co., and was made of brown asphalt, paulownia oil, and latex. At the same time, the interlayer insulation in the transformer windings was increased, and a better insulation for the wire used in the windings was put into production. This, it was stated, virtually eliminated transformer breakdowns as a result of humidity.

To increase protection against humidity, oiled varnished cotton tubing used for insulation of open wiring was replaced by a tubing impregnated with a plastic preparation, polyvinal chloride, produced by the Sugawara Electric Company. The preparation was reported as quite satisfactory.

Insulating paint was used over terminal strips and the soldered connections to separable plugs.

In some instances where temperature rise permitted, airtight construction utilizing tightly fitting cabinets with rubber seals were used. Where forced cooling was needed, and in some cases to insure adequate distribution of warm air to prevent condensation, small blowers were used.

According to comments made during investigations and interrogations, these precautions usually were ample. However, large quantities of aviation and ship-borne radio gear stored in damp underground caves showed marked evidence of corrosion and mold.

Comments on captured equipment, ARC-1 for example, were highly favorable as to its mechanical features. It was flatly stated, however, that production of something similar in Japan was impossible because of the lack of facilities and shortage of critical materials.

ENCLOSURE (A)

LIST OF DOCUMENTS PERTAINING TO RADIO CONSTRUCTION AND SPECIAL COMPONENTS FORWARDED THROUGH ATIS TO WDC

NavTechJap No.	ATIS No.	Subject
ND21-6061	3483	Standard radio parts
ND21-6062	3484	Standard radio parts
ND21-6064	3453	Study of special insulators
ND21-6199	3456	Deterioration of steatite cable insulators due to sea water

Additional pertinent documents are listed in NavTechJap Report "Japanese Electronics - General", Index No. E-28.